

# Radiation Oncology

Board and Certification Review

375 Questions and Explanations

2022  
edition

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# **Radiation Oncology Specialty Review and Self-Assessment**

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## Section 1

**Question 1:** A 68-year-old male received radiation therapy to the right face and neck for treatment of oropharyngeal cancer in December 2016. Chemotherapy with paclitaxel was initiated in January 2017. Five days after the initiation of chemotherapy he noticed a rash on his right neck, which was pruritic and edematous. He was diagnosed with radiation recall at the site of the original radiation therapy. Which of the following is true about radiation recall?

### Choices:

1. Radiation recall frequently occurs years after treatment with combined radiation therapy and chemotherapy
2. Only chemotherapeutic agents can trigger radiation recall
3. Radiation recall occurs in just under 50% of patients undergoing both radiation therapy and chemotherapy
4. Corticosteroids are known to have protective effects against radiation recall in treating the symptoms during chemotherapy following radiation therapy

**Answer: 4** - Corticosteroids are known to have protective effects against radiation recall in treating the symptoms during chemotherapy following radiation therapy

## Explanations:

- Radiation recall is an acute inflammatory reaction that occurs at a site that has been exposed to ionizing radiation when a chemotherapeutic agent is used within approximately two months after the original radiation therapy. It occurs in up to 6% of patients undergoing radiation treatment. These reactions are drug-specific.
- Radiation recall usually is associated with commonly used chemotherapeutic agents including anthracyclines, taxanes, and antimetabolites. Some of the chemotherapeutic agents involved are doxorubicin, docetaxel, paclitaxel, methotrexate, tamoxifen, vinblastine, hydroxyurea, and dactinomycin. Nonchemotherapeutic agents also can trigger radiation recall.
- Clinically, the most common signs and symptoms of radiation recall include maculopapular eruptions, dry desquamation, pruritus, swelling, and ulcerations at the site of the original radiation therapy.
- In general, the treatment of radiation recall symptoms is focused on local skin care and alleviation of pruritus and edema. Corticosteroids have been suggested to have some protective effects against radiation recall in treating the external symptoms during chemotherapy following radiation therapy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Therapy Induced Skin Ulcer



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**Question 2:** A 58-year-old female with a history of cT1cN0M0 invasive ductal carcinoma of the breast, ER/PR+ HER2- treated with mastectomy and sentinel lymph node biopsy with 1/4 nodes involved, followed by adjuvant chest wall irradiation with regional node irradiation, presents to the clinic with chest wall recurrence. Which of the following is the most appropriate rationale for re-irradiation with hyperthermia in this patient?

**Choices:**

1. A complete pathologic response rates range from 80% to 90% for combination of hyperthermia and radiation
2. An improvement in benefit in patients with recurrent lesions in previously irradiated areas since concurrent hyperthermia enhanced lower doses of repeat radiation therapy
3. A decreased rate of toxicity to the bone marrow
4. A more durable local control rate in patients who only received radiation



**Answer: 2** - An improvement in benefit in patients with recurrent lesions in previously irradiated areas since concurrent hyperthermia enhanced lower doses of repeat radiation therapy

### Explanations:

- The addition of hyperthermia to radiation therapy has been shown to achieve complete response rates ranging from 55% to 66%, much higher than the 16% to 47% seen with chemoradiotherapy.
- Acute toxicities associated with combined radiation therapy and hyperthermia have been reported as persistent ulceration seen in patients with prior radiation, blisters, second and third-degree burns, and infection. The addition of chemotherapy to cancer treatment increases the risk of bone marrow toxicity.
- Local control was found to be more durable with the addition of hyperthermia to radiation.
- The most significant benefit of combining hyperthermia to radiation in previously radiated patients is observed in patients with recurrent lesions in previously irradiated areas, where the dose of radiation is lowered due to prior radiation treatment and concern of toxicity to nearby normal tissues, thus showing that the synergy of hyperthermia helps the lower doses of radiation reach a higher therapeutic ratio leading to local control.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Hyperthermia for Chest Wall Recurrence



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**Question 3:** A 56-year-old female is found to have an asymptomatic thyroid nodule and is euthyroid. Fine needle biopsy shows follicles that resemble normal thyroid tissue but after excision, the tumor cells show PAX-PPAR-gamma fusion gene. What is the most probable diagnosis?

**Choices:**

1. Follicular carcinoma
2. Medullary thyroid carcinoma
3. Papillary thyroid carcinoma
4. Anaplastic thyroid carcinoma

**Answer: 1** - Follicular carcinoma

## Explanations:

- Follicular carcinoma can be difficult to distinguish from follicular adenoma with fine needle biopsy.
- Forty-nine percent of follicular carcinoma show RAS point mutations, 36% show PAX-PPAR-gamma rearrangements, and only 3% show both.
- Paired box or PAX genes are associated with several cancers including PAX-2 with optic nerve colobomas, PAX-5 with lymphoplasmacytoid lymphoma, and PAX-6 with Wilms tumor.
- Papillary thyroid cancer accounts for 80% of thyroid cancers, follicular carcinoma 10%, medullary 5%, and anaplastic 1.6%. Thyroid lymphoma can occur also, usually with a background of Hashimoto thyroiditis.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Follicular Thyroid Cancer



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**Question 4:** A 68-year-old male with a history of leptomeningeal carcinomatosis from melanoma presents with intractable nausea, vomiting, headache and blurry vision going on for the last few days. He has tried multiple analgesics for his headache and antiemetics without any relief. He is started on intravenous analgesics and antiemetics on admission. Despite higher doses of scheduled medications his symptoms do not abate. MRI of the brain shows bulky nodular central nervous system disease with significant hydrocephalus and enlargement of the third and lateral ventricles. Optic disc exam shows significant bilateral papilledema. He has limited performance status and wishes to focus on symptom control mainly at this time. Which of the following should be the next step in management?

**Choices:**

1. Relieve hydrocephalus with ventriculoperitoneal shunt and radiation
2. Systemic chemotherapy
3. Continue supportive care
4. Intrathecal chemotherapy

**Answer: 1** - Relieve hydrocephalus with ventriculoperitoneal shunt and radiation

## Explanations:

- Given significant hydrocephalus and lack of symptoms improvement with supportive care, treatment options that relieve hydrocephalus like ventriculoperitoneal shunt or radiation seem to be appropriate in this clinical scenario.
- Radiation is also important for palliation of symptoms especially in spinal involvement as it may alleviate pain. It may relieve hydrocephalus and associated symptoms and facilitate administration of intrathecal chemotherapy.
- Intrathecal chemotherapy in this setting will lead to toxic accumulation given obstructed cerebral spinal fluid flow.
- There is no known survival benefit from surgical procedures but it may improve quality of life.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Leptomeningeal Carcinomatosis



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**Question 5:** A 35-year-old male presents to the clinic for a lump below his left axilla. He first noticed it two months ago, but it has gradually been increasing in size. He has no known medical problems and takes no medications. He also denies smoking or using illicit substances. Physical examination reveals a firm growth barely palpable in the left midaxillary line. A CT of the chest reveals a 4 cm rounded growth in the chest wall muscles. Which of the following is the most appropriate next step in the management of this patient?

**Choices:**

1. Needle aspiration
2. Incisional biopsy
3. Excisional biopsy
4. Radiotherapy

**Answer: 3** - Excisional biopsy

### Explanations:

- Lesions measuring less than five centimeters undergo an excisional biopsy.
- Lesions greater than five centimeters either undergo needle aspiration or incisional biopsy.
- Radiologic evidence is not sufficient to make a confirmatory diagnosis.
- Histopathologic diagnosis is necessary to confirm the diagnosis. The size of the lesion determines the type of biopsy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Chest Wall Tumors



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**Question 6:** A 68-year old woman being treated for cervical cancer is referred to the hyperbaric oxygen treatment facility by her oncologist. She has hemorrhagic cystitis secondary to radiation treatment and her oncologist feels that hyperbaric oxygen would facilitate healing. Part of her current treatment strategy includes doxorubicin. How soon can she start hyperbaric oxygen therapy?

**Choices:**

1. Immediately
2. She must wait at least 3 days from her last dose of doxorubicin
3. She must wait 6 months
4. She is no longer a candidate for hyperbaric oxygen therapy due to doxorubicin use



**Answer: 2** - She must wait at least 3 days from her last dose of doxorubicin

### Explanations:

- Doxorubicin has a relatively short half-life of about 20 to 48 hours.
- Current recommendations state that hyperbaric therapy may be used 3 days after the last dose of doxorubicin.
- Concomitant doxorubicin and hyperbaric oxygen therapy have been shown to increase mortality in rat models. This synergy has not been studied in humans.
- Out of caution, although not proven to be harmful in humans, the combination of hyperbaric oxygen and doxorubicin is to be avoided.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Hyperbaric Contraindicated Chemotherapeutic Agents



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**Question 7:** A 65-year-old female is found to have a 4 cm left breast mass. She undergoes a biopsy, which reveals an invasive ductal carcinoma. She then undergoes a lumpectomy with sentinel node mapping. The pathology reveals that the sentinel node is negative, but the tumor is seen "on ink" at multiple margins. The tumor is ER and PR negative but HER2 positive. Which of the following is the next step?

**Choices:**

1. Start radiation therapy, followed by trastuzumab
2. Reoperate to obtain clear margins with either breast conservation or mastectomy
3. Recommend radiation therapy only 30 days after surgery
4. Start chemotherapy ASAP and follow up with radiation therapy, no further surgery is needed.

**Answer: 2** - Reoperate to obtain clear margins with either breast conservation or mastectomy

## Explanations:

- For all cancers, when the margins are positive or "on ink," the risk of recurrence is very high.
- Reoperation should be performed to obtain clear margins prior to starting radiation therapy. This may require a mastectomy in many patients if multiple margins are positive, and an adequate cosmetic outcome is unable to be achieved. Radiation may not be needed if mastectomy is performed pending final tumor size and nodal status.
- Once negative margins have been obtained, adjuvant treatments are appropriate. While radiation may be initiated in those who underwent breast-conserving therapy, usually 3-4 weeks after surgery to allow for the surgical wound to heal, radiation is generally given after adjuvant chemotherapy is completed, which is generally recommended in this case.
- Delaying radiation therapy increases the risk of death.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Breast Cancer Conservation Therapy



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**Question 8:** A 65-year-old male patient presents to the hospital with hoarseness, pain with swallowing, and earache. On examination, there is a 3 cm node palpable on the left side of the neck. On further investigations, he is found to have a squamous cell carcinoma of the right side of the laryngeal surface of the epiglottis. What is the nodal staging of this tumor?

**Choices:**

1. N1
2. N2
3. N2a
4. N2c

Answer: 4 - N2c

## Explanations:

- According to the tumor, node, metastases classification by the American Joint Committee on Cancer, N2c represents "bilateral or contralateral positive nodes, none more than 6 cm in diameter."
- Therefore, the neck staging is N2c because the node is on the contralateral side of the tumor.
- N2a is metastasis in a single ipsilateral lymph node which is more than 3 cm but not more than 6 cm at its greatest dimension.
- N2b is metastasis in multiple ipsilateral lymph nodes, but none are more than 6 cm at their greatest dimension.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Laryngeal Cancer



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**Question 9:** A 45-year-old woman presents to the otolaryngology outpatient setting with five weeks of throat discomfort. Physical examination reveals a lesion within her left tonsil and a left level III node. Cross-sectional imaging reveals a 3 cm lesion within the left tonsil and several enlarged left-sided cervical lymph nodes, the largest of which measures 4.5 cm. There is no distant metastasis. Fine needle aspiration (FNA) sampling of the neck node is p16 positive. What is the TNM staging according to the American Joint Committee on Cancer 8th edition?

**Choices:**

1. T1N2M0
2. T2N1M0
3. T2N2M0
4. T3N2M0

Answer: 2 - T2N1M0

## Explanations:

- The revised 8th edition of the TNM classification of oropharyngeal cancer splits the disease into p16 positive and p16 negative disease. This is a p16 positive case and has a primary lesion measuring between 2 to 4 cm, making it T2. The patient has ipsilateral nodes all less than 6 cm, making this N1 disease.
- p16 positive tumors tend to present in younger patients and have an improved prognosis
- Early T1/2 tonsil cancers can be managed with single modality treatment, either primary radiotherapy or transoral robotic or laser resection.
- Tonsil malignancies are best imaged with MRI of the neck, with CT scanning used for assessment of locoregional metastasis and staging.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Tonsil Cancer



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**Question 10:** Hyperbaric oxygen treatment is an accepted treatment modality for ulcerations due to radiation injury to the skin because of which of the following?

**Choices:**

1. Oxygen promotes angiogenesis and fibroplasia in the irradiated tissue at a normobaric pressure of 1 ATA
2. Hyperbaric oxygen treatment makes it possible for a steep oxygen gradient to develop within the hypoxic irradiated tissue. This steep gradient makes it possible for angiogenesis to occur, increasing the level of oxygen within the tissue
3. The accepted Marx protocol of daily hyperbaric oxygen treatment at 1.5 ATA for 10 days provides the best results to help in reactive reepithelialization of an ulceration due to radiation injury
4. Hyperbaric oxygen treatment is well tolerated by all patients, and there are no contraindications to hyperbaric oxygen treatment



**Answer: 2** - Hyperbaric oxygen treatment makes it possible for a steep oxygen gradient to develop within the hypoxic irradiated tissue. This steep gradient makes it possible for angiogenesis to occur, increasing the level of oxygen within the tissue

## Explanations:

- Skin ulcers due to radiation injury following radiation therapy for the treatment of cancer is due to a progressive fibrosis as well as thrombosis of the microvasculature of the soft tissue. A relative state of progressive hypoxia is present within the irradiated tissue. Injury to the skin due to ionizing radiation may occur in up to 6% of patients undergoing radiation therapy. The head and neck are most sensitive to ionizing radiation.
- Hyperbaric oxygen therapy (HBOT) is a recognized treatment modality for the late effects of radiation to the skin presenting as ulceration with or without necrosis. The primary mechanisms of action in treating skin ulceration due to the effects of ionizing radiation are angiogenesis and fibroplasia.
- Angiogenesis and fibroplasia occur at 2.4 ATA for 90 minutes per session, 5 days a week, over a 20 session treatment course. This is known as the MARX protocol, and it is the protocol that has been shown to provide the best results for the treatment of skin ulcerations due to radiation therapy. The absolute contraindication for HBOT is an untreated pneumothorax.
- The steep oxygen gradient created with HBOT is the main factor that eventually promotes angiogenesis and fibroplasia within the irradiated tissue.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Therapy Induced Skin Ulcer



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**Question 11:** A 67-year-old male is discussed in the head and neck interprofessional meeting. He has presented with a biopsy-proven squamous cell carcinoma (SCC) on the apex of his scalp measuring 5 cm in diameter. It had been growing over the last 6 month prior to him seeking medical help. CT imaging shows a deep lesion but that the underlying skull appears unaffected. What is the best course of action from the options stated below?

**Choices:**

1. Excise the lesion with appropriate margins and close with a rotational flap
2. Excise the lesion with appropriate margins and examine the bone below; if the bone is uninvolved close with a full-thickness skin graft
3. Excise the lesion with appropriate margins and examine the bone below; if the bone is uninvolved close with a split-thickness skin graft
4. Excise the lesion with appropriate margins and close with a free flap

**Answer: 3** - Excise the lesion with appropriate margins and examine the bone below; if the bone is uninvolved close with a split-thickness skin graft

## Explanations:

- Risk factors for SCC of the scalp include long term sun exposure, having fair skin (low Fitzpatrick skin types), chronic lesions, and immunosuppressed patients.
- The depth of invasion is an important prognostic factor for survival, with dural and brain parenchyma involvement being considered inoperable.
- Calvarial involvement requires bone to be drilled or removed. Often with large SCC scalp lesions, sentinel lymph node biopsying is done. This will help to decide on adjuvant therapy.
- Split-thickness skin grafting (STSG) would be ideal with the large defect caused here. The take rate is higher in STSG due to the graft's lower metabolic requirements. As this defect is down near to bone the vascular bed left behind the following excision will be poor, making a full-thickness skin graft more likely to fail. A dermatome is used to take donor skin from the thigh. The patients often require postoperative radiotherapy, but this requires further discussion at the interprofessional team meeting.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Scalp Reconstruction



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**Question 12:** A 65-year-old male with known GOLD stage 4 chronic obstructive pulmonary disease was diagnosed with unresectable stage 3b adenocarcinoma of the right lung. He was also diagnosed with hypertrophic pulmonary osteoarthropathy resulting in excruciating pain in both arms and elbow. What will be the medication of choice for symptom relief that has the best outcome?

**Choices:**

1. Hydrocodone
2. Bevacizumab
3. Intravenous pamidronate
4. Ibuprofen

**Answer: 3** - Intravenous pamidronate

### Explanations:

- Intravenous pamidronate and zoledronic acid have the best success rate in symptom suppression in hypertrophic pulmonary osteoarthropathy (HPOA) with bronchogenic carcinoma.
- Therapeutic response was noted regarding symptom suppression as well as radiographic resolution of periostitis in bone scan.
- HPOA lesions are typically poorly responsive to opioids.
- Although NSAIDs are helpful, typically a COX -2 inhibitor like celecoxib has better efficacy. The role of bevacizumab is still experimental.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

#### Secondary Hypertrophic Osteoarthropathy



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**Question 13:** A 65-year-old female with a history of Hashimoto thyroiditis presented with worsening dyspnea. Examination revealed a significantly enlarged thyroid gland compared to the last office visit two months ago which is firm and fixed to the surrounding structures. Diffuse large B-cell lymphoma (DLBCL) confined only to the thyroid gland, stage I E is diagnosed after all the appropriate investigations. What is the most appropriate therapy?

**Choices:**

1. Surgery
2. Chemotherapy
3. Radiation therapy
4. Combined chemoradiation therapy

**Answer: 4** - Combined chemoradiation therapy

## Explanations:

- Combined modality treatment (CMT) with chemotherapy and radiotherapy is preferred for the limited stage (I E and II E) diffuse large B-cell thyroid lymphoma. Chemotherapy regimen used is rituximab- cyclophosphamide, doxorubicin, vincristine, prednisolone (R-CHOP).
- CMT is associated with a higher five-year failure-free survival rate of 91 percent compared to 50 percent with chemotherapy alone.
- Advanced stage (III E and IV) DLBCL cannot be treated with one irradiation field; hence chemotherapy alone is used in such cases.
- Surgery is not recommended except for diagnostic biopsy due to the potential surgical risks and no additional benefit compared to chemoradiation therapy. Obstructive symptoms like dyspnea usually improve within hours of chemotherapy (R- CHOP) initiation due to the steroid (prednisolone) in the regimen.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Thyroid Lymphoma



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**Question 14:** The RTOG 98-11 trial randomized patients with locally advanced non-metastatic anal cancer to chemoradiation with 3D conformal radiation and either MMC/5FU or cisplatin/5FU. It showed an improved disease-free survival, overall survival, and colostomy-free survival in the MMC arm. What is a major criticism of this trial?

**Choices:**

1. Adherence to radiotherapy was significantly worse in the cisplatin-based group
2. The radiation dose is not considered adequate for treatment of gross disease
3. The patients were not randomized in a balanced manner
4. The cisplatin/5FU arm received induction cisplatin, and 5FU is a potential confounding variable



**Answer: 4** - The cisplatin/5FU arm received induction cisplatin, and 5FU is a potential confounding variable

## Explanations:

- The RTOG 98-11 trial randomized 644 patients with T2-T4, any N, M0 anal cancer to concurrent 5FU (1000 mg/m<sup>2</sup>), mitomycin-C (10 mg/m<sup>2</sup>) and radiation versus induction cisplatin (75 mg/m<sup>2</sup>) and 5FU (1000 mg/m<sup>2</sup>) for two cycles followed by concurrent cisplatin and 5FU at same doses. Because there were two variables in the experimental arm (both the induction chemotherapy and experimental concurrent chemotherapy regimen), this resulted in a potential confounding variable.
- Ben Josef et al. demonstrated that total treatment time correlates with colostomy failure and local failure. Therefore, it is unclear if the difference in colostomy rate in RTOG 98-11 was due to the chemotherapy regimens or the treatment time.
- The 5-year disease-free survival in RTOG 98-11 was 67.8% vs 57.8% ( $p = 0.006$ ) for the MMC vs cisplatin arms. The 5-year overall survival rates were 78.3% vs 70.7% ( $p = 0.026$ ) for the MMC vs cisplatin arms. The 5-yr colostomy-free survival rates were 71.9% vs 65% ( $p = 0.05$ ) for the MMC vs cisplatin arms.
- Standard of care for treatment of locally advanced non-metastatic anal cancer is definitive chemoradiation with MMC/5FU.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Therapy For Anal Cancer



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**Question 15:** A patient past her reproductive years has carcinoma in situ of the cervix with cone biopsy showing squamous cell carcinoma with invasion 1 mm beyond the basement membrane. There is no lymphovascular space invasion. What is the next best step?

**Choices:**

1. Treatment with external beam radiation
2. Implantation of radioactive cesium into the cervical canal
3. Simple hysterectomy
4. Simple hysterectomy with pelvic lymphadenectomy

**Answer: 3** - Simple hysterectomy

## Explanations:

- Microinvasive carcinoma of the cervix includes lesions within 3 mm of the base of the epithelium, with no confluent tongues or lymphatic or vascular invasion.
- This is a T1a lesion, and the treatment of choice is surgery. Both hysterectomy and conization are acceptable procedures.
- Lymph node dissection is not indicated as the depth of invasion is less than 3 mm, and there is no lymphovascular space invasion.
- For women who would like to maintain fertility, conization is an option with close follow-up. Those patients not suitable for surgery can be offered radiation.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Cervical Cancer



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**Question 16:** A 42-year old female presents with a 4-month history of a left-sided neck mass, that she ignored being painless. She says she is now worried, as the mass has not disappeared. She has no other symptoms. On exam, there is a 5 cm mass on the left side of the neck just below the thyroid cartilage. The nodule appears fixed to the surrounding tissues and appears to move with the act of swallowing. The clinician performed a fine needle aspiration that reveals atypical cells with intranuclear clearings. The nuclear scan suggests a cold nodule. Mutations of which gene have been linked to the development of this lesion?

**Choices:**

1. C-abl
2. RET proto-oncogene
3. HER/Neu
4. Myc

Answer: 2 - RET proto-oncogene

## Explanations:

- Papillary thyroid cancer is strongly associated with some specific rearrangements of the RET proto-oncogene. The intranuclear clearings, often referred to as "orphan Annie eye" nuclei, are a hallmark cytologic finding of papillary thyroid carcinoma.
- If possible, the assessment of the RET proto-oncogene expression should be performed in anyone having a relative with a history of medullary thyroid cancer.
- The RET proto-oncogene encodes a receptor tyrosine kinase for many cells.
- Loss of function mutation in the RET proto-oncogene has been linked to Hirschsprung disease.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Medullary Thyroid Cancer



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**Question 17:** A 40-year-old male was recently diagnosed with a mediastinal mass when he was evaluated for chest pain. CT scan showed 6 cm anterior mediastinal mass with prominent calcification. Serum alpha-fetoprotein and beta-hCG are within normal limits. The patient underwent surgical excision of the mass. Gross cut section of the mass had chalky mass with sebum like material, hair, and tooth. He was diagnosed with mediastinal nonseminoma. What treatment should be offered to this patient next?

**Choices:**

1. 4 cycles of adjuvant therapy with bleomycin, etoposide, and cisplatin
2. Radiation therapy
3. Surveillance
4. Combined chemotherapy with 3 cycles of paclitaxel, ifosfamide, and cisplatin with radiation.

**Answer: 3** - Surveillance

### Explanations:

- The patient has mature mediastinal teratoma (non-seminoma). Surgical excision is the treatment of choice and is curative.
- After excision, surveillance alone is advised for mature teratoma.
- Mature teratomas are resistant to chemotherapy, and hence there is no role for adjuvant chemotherapy.
- Mature teratomas are known to be radiotherapy resistant tumors as well.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Mediastinal Nonseminoma



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**Question 18:** A 12-year-old male presents to his provider with a 2-month history of pain in his lower right thigh. He describes the pain as "achy" in character, moderate in severity, and persistent in duration. On physical examination, there is a palpable mass in the distal right thigh. He adds that it is tender. He also exhibits a limited range of motion at the knee. Radiographs of the lower extremity reveal an osseous lesion with a radiodense matrix and a "sunburst" appearance. Local soft tissue extension is apparent. Which organ is the most common site of spread of the most likely lesion in this patient with inadequate treatment?

**Choices:**

1. Liver
2. Brain
3. Lungs
4. Adrenal glands



Answer: 3 - Lungs

## Explanations:

- Osteosarcoma is a lethal pediatric malignancy which most commonly occurs in the long bones of the lower extremity. Physical exam findings may include warmth and tenderness in the affected area, a palpable mass, and a limited range of motion when a joint is involved.
- The lungs are the most common site of extraosseous metastasis. CT imaging of the chest may reveal pulmonary nodules with density (measured in Hounsfield units) similar to that of bone due to the production of osteoid by the metastatic osteosarcoma cancer cells.
- The characteristic "sunburst" appearance of osteosarcoma seen on radiography is the result of aggressive periostitis.
- Extrapulmonary metastasis related to osteosarcoma is exceedingly rare.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Osteosarcoma



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**Question 19:** A 34-year-old male with a history of cancer of the right neck has undergone radical surgical excision of the tumor followed by chemotherapy with doxorubicin and extensive radiation therapy to the right neck and lower jaw. Six months later, he develops a right molar abscess, which requires extraction. He is sent to the regional wound care and hyperbaric center to evaluate possible hyperbaric oxygen treatment (HBOT). Which of the following is false about HBOT?

**Choices:**

1. HBOT stimulates angiogenesis and reduces fibrosis at the site injured by the ionizing radiation.
2. Marx protocol of 20 treatments at 2.4 ATM for 90 minutes daily followed by tooth extraction then 10 HBOT treatments at 2.4 ATM for 90 minutes daily is an acceptable protocol.
3. There is an increased mobilization of stem cells at the irradiated tissue site following HBOT.
4. He is not a candidate for HBOT as doxorubicin is an absolute contraindication to HBOT.

**Answer: 4** - He is not a candidate for HBOT as doxorubicin is an absolute contraindication to HBOT.

## Explanations:

- Hyperbaric oxygen treatment (HBOT) is a well-established modality for delayed radiation injuries.
- Exposure to cumulative ionizing radiation can cause delayed radiation injury to the irradiated skin site. Its main mechanism of injury is the obliteration of the microvasculature, causing tissue hypoxia with the possibility of eventual tissue necrosis and increased tissue fibrosis.
- The main beneficial effects of HBOT for delayed radiation injury to the skin are stimulation of angiogenesis to improve oxygenation, reduction of fibrosis at the irradiated site, and an increase in stem cells within the irradiated tissue.
- Regarding the use of HBOT in patients who have received ionizing radiation to the jaw, the Marx protocol prior to tooth or teeth extraction is daily sessions for 20 days before the extraction and 10 additional days.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Radiation Therapy Induced Skin Ulcer



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**Question 20:** A 62-year-old male undergoes a partial penectomy for a 2.5 cm, grade 3, squamous cell carcinoma of the penis. Pathology reveals invasion of the corpus cavernous and negative margins. On physical exam, he has matted firm 6 cm right inguinal lymph nodes. A CT scan of the chest, abdomen, and pelvis reveals right-sided inguinal adenopathy but no other metastases. What is the next step for this patient?

**Choices:**

1. Fine needle aspiration of the inguinal lymph nodes
2. Right inguinal lymph node dissection
3. Neoadjuvant chemotherapy
4. Bilateral inguinal lymph node dissection

**Answer: 3** - Neoadjuvant chemotherapy

## Explanations:

- Men with penile cancer who present with bulky, fixed inguinal nodes or pelvic lymph nodes have relatively low survival rates when treated with surgery alone and are candidates for multimodal treatment strategies.
- Neoadjuvant chemotherapy is indicated for patients with difficult to resect matted or fixed inguinal lymph nodes from metastatic penile cancer.
- The TIP regimen is the standard regimen used and consists of paclitaxel, ifosfamide, and cisplatin. This is given at 3 to 4-week intervals for 4 cycles.
- Neoadjuvant chemotherapy should reduce the size of the nodes and increase their resectability. Following chemotherapy, the patient should have bilateral inguinal lymph node dissection and pelvic lymph node dissection.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Penile Cancer



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**Question 21:** A patient is being evaluated for a nonhealing wound in an irradiated field. He had squamous cell carcinoma of the neck and received 8000 Gy of radiation along with chemotherapy 12 months ago. Which historical chemotherapy agent would be most concerning for the development of pulmonary fibrosis during a course of hyperbaric oxygen therapy?

**Choices:**

1. Adriamycin
2. Bleomycin
3. Cis-platinum
4. Doxyrubicin

Answer: 2 - Bleomycin

## Explanations:

- Bleomycin has been implicated in the development of pulmonary fibrosis in patients exposed to high oxygen tensions.
- The incidence of pulmonary fibrosis is lower with lower doses of bleomycin.
- The exact causal relationship between hyperbaric oxygen and bleomycin causing pulmonary fibrosis has not been established but it is possible that bleomycin exposure lowers the lungs' tolerance to pulmonary oxygen toxicity.
- When treating a patient with a history of bleomycin exposure with hyperbaric oxygen therapy, it is prudent to establish baseline pulmonary function and monitor closely during the treatment course for any signs of toxicity.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Hyperbaric Complications



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**Question 22:** A 72-year-old male is admitted to the medicine floors after he presented to the hospital with poor oral intake and a 25-pound (11 kg) unintentional weight loss for the past three months. Social history includes a 40 pack-year history, and he was a retired PVC factory worker. Physical examination is remarkable for hepatomegaly, and labs reveal ALT 100 IU/L, AST 110 U/L, ALP 215 U/L, and total bilirubin 3 mg/dL. Triple-phase CT shows multiple hypodense liver lesions, with some lesions becoming hyperdense after contrast is administered. Liver biopsy shows solid spindle cell proliferation and necrosis. What is the most effective treatment of this patient's liver condition?

**Choices:**

1. Tumor resection
2. Chemotherapy
3. Radiation therapy
4. Liver transplant



**Answer: 1** - Tumor resection

## Explanations:

- Resection of the tumor or complete resection is the best way to treat hepatic angiosarcoma (HAS) though only a few achieve complete resection due to the aggressive nature of the tumor.
- Effective chemotherapeutic agents have not been established for the treatment of HAS. Chemotherapy is tried in unresectable disease.
- Only a few cases have shown positive results with using 5-FU-carboplatin with doxorubicin or ifosfamide in unresectable HAS.
- Liver transplant is not recommended due to high recurrence and progression of the malignancy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Liver Angiosarcoma



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**Question 23:** A 21-year-old male presents to the clinic for a regular follow-up. He was treated for acute myeloid leukemia three years ago with chemotherapy, and complete clinical remission was achieved after three courses. Later, however, the patient relapsed within a year, and although he survived, the second remission was challenging to achieve. Which of the following is the best next step in the management of this patient?

**Choices:**

1. Gene therapy followed by treatment with anti-CD45 monoclonal antibody
2. Supporting immunotherapy with granulocyte colony-stimulating factor and platelet transfusion
3. Bone marrow transplantation followed by treatment with methotrexate
4. Treatment with gemtuzumab ozogamicin

**Answer: 3** - Bone marrow transplantation followed by treatment with methotrexate

## Explanations:

- Bone marrow transplantation is considered in a young patient with suitable family members to treat acute myeloid leukemia, and methotrexate is used intermittently to prevent graft-versus-host disease (GVHD), which is a usual complication of stem cell transplantations.
- GVHD after bone marrow transplantation has high morbidity and mortality, and it can be minimized using highly compatible or HLA identical marrow donors.
- Irradiation of bone marrow cells is done to prevent a GVHD after transplantation. The bone marrow transplantation is achieved by giving cyclophosphamide (120 mg/kg) followed by total body irradiation. After that, an intravenous transfusion of  $10^9$  unfractionated bone marrow cells per kilograms is given, which is obtained from a related family or HLA-compatible donor.
- The patient is supported with platelet transfusions and with granulocyte colony-stimulating factor (G-CSF) during the aplasia before the engraftment has occurred.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Graft Versus Host Disease



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**Question 24:** A 32-year-old multiparous lady presented with complaints of repeated spotting for the last 3 months. She had no history of oral contraceptive intake or irregular menstruation. Vaginal examination showed an irregular growth at the lower lip of the cervix. On rectal examination, no adhesion or thickening was palpated on both the left and right parametrium. Contrast computed tomography scan of the pelvis was done, revealing an irregular dense mass of  $3.5 \times 3 \times 1.5$  cm occupying the inferior lip of the cervix and posterior fornices. No pelvic extension and no regional lymphadenopathy were noted on the CT scan. A punch biopsy was taken and sent for histopathological examination. Histopathology revealed partly solid and tubulo-cystic growth pattern of neoplastic cells. The tumor cells had abundant clear cytoplasm, round nuclei, and hobnailing appearance in many cells. The nuclei showed hyperchromasia, moderate pleomorphism, and prominent nucleoli. No other organ involvement was noted. What will be the best treatment for this patient?

**Choices:**

1. Radical hysterectomy and pelvic lymphadenectomy
2. Vaginal hysterectomy
3. Radiotherapy
4. Chemotherapy and radiotherapy

**Answer: 1** - Radical hysterectomy and pelvic lymphadenectomy

## Explanations:

- In this case, the histopathological examination confirmed the diagnosis of clear cell carcinoma of the uterine cervix. Surgery is the treatment of choice for patients with early-stage carcinoma of the uterine cervix. Patients with early-stage cervical carcinoma FIGO (either stage IB or IIA) could be treated by radical hysterectomy and pelvic lymphadenectomy.
- In this case, the tumor is classified as stage IB since the tumor is strictly confined to the uterine cervix and does not extend onto the lower third of the vagina or to the pelvic wall. Moreover, no regional lymphadenopathy was noted.
- For early-stage cervical cancer, fertility-sparing surgery is a safe option. This was confirmed by a recent study that studied oncologic outcomes of fertility-sparing radical trachelectomy versus radical hysterectomy for stage IB1 cervical carcinoma in young adult women and found no statistically significant survival differences.
- For patients with stage I cervical cancer, metastasis occurs in about 18 percent of the cases. After treatment of clear cell carcinoma of the cervix, long-term follow-up is necessary to detect local and distant relapse.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Cervical Clear Cell Carcinoma



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**Question 25:** What stage is invasive cervical carcinoma by cone biopsy, the upper portion of the vagina involved by tumor, and a CT positive for periaortic and pelvic nodes?

**Choices:**

1. Ia
2. Ib
3. IIIb
4. IVb

Answer: 4 - IVb

## Explanations:

- Cervical cancer is staged clinically, but this can often miss pelvic and aortic lymph nodes in 10-40% of patients. Thus, surgical staging is recommended.
- Stage Ia disease is preclinical (i.e., microscopic). Stage 1B is a clinically visible lesion.
- Stage IVb denotes macroscopic disease spread beyond the pelvis.
- Stage III is when the lesion extends to the pelvic wall and/or also involves the lower third of the vagina. There may be associated malfunction of the kidney or hydronephrosis.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Cervical Cancer



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**Question 26:** A 65-year-old male presented with dyspnea and hypoxemic respiratory failure. He has metastatic stomach cancer with liver, lung, and bone metastases. On presentation, he is hypotensive, tachypneic, and clearly in distress. He was placed on home hospice 3 weeks ago with an expected prognosis of less than one month. Chest x-ray showed large right-sided pleural effusion and moderate left pleural effusion. His son states that he presented similarly 3 weeks ago and had had fluid removed from his right side. He felt much better post-procedure. He has a do not resuscitate order placed on the chart. The son wants to know if something can be done for his father's recurrent pleural effusion. What should he be told?

**Choices:**

1. Thoracentesis now followed by pleural catheter placement
2. Thoracentesis as needed
3. Talc pleurodesis
4. Bedside pleural catheter placement



**Answer: 2** - Thoracentesis as needed

## Explanations:

- The choice of therapy depends on the expected survival of the patient. This patient has malignant pleural effusion, and his life expectancy is less than 1 month. Therefore, it is less painful if symptomatic relief is provided by repeated thoracentesis. He may not survive long enough to require another thoracentesis since his last procedure was 3 weeks ago.
- Thoracentesis should be performed immediately if the acute respiratory failure is due to pleural effusion. Afterward, an indwelling pleural catheter can be placed if the patient has recurrent symptomatic pleural effusions, an uncorrectable underlying cause like malignancy or congestive heart failure, and the patient has expected survival of more than one month.
- Talc pleurodesis is only successful in 70% of patients with malignant pleural effusions; therefore, it is not the first choice procedure.
- A bedside pleural catheter should not be placed because it is tunneled catheter and carries the risk of a tunnel or pleural infection.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Intrapleural Catheter



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**Question 27:** A 60-year-old female underwent a modified radical mastectomy. On serial sectioning, 5.5 cm × 5 cm × 2.5 cm well-circumscribed tumor in the upper outer quadrant is found. Microscopic examination establishes the diagnosis of medullary breast carcinoma. Four lymph nodes dissected out of the specimen were metastatic. Immunohistochemically, the tumor is estrogen receptor/progesterone receptor (ER/PR) and CerbB2 negative. The work-up for the spread of breast carcinoma did not show metastases. Which of the following is the most appropriate pTNM classification of this tumor?

**Choices:**

1. pT2N1M0
2. pT2N2M0
3. pT3N2M0
4. pT3N3M0

Answer: 3 - pT3N2M0

## Explanations:

- The most widely used clinical staging system for medullary breast carcinoma is the one adopted by both the International Union for Cancer Control (UICC) and the American Joint Commission on Cancer (AJCC). It is based on the TNM system (T, tumor; N, nodes; M, metastases).
- pT3 is defined by a tumor greater than 50 mm in the greatest dimension. The tumor, in this case, measures 5.5 cm × 5 cm × 2.5 cm.
- pN2 is defined by metastases in 4 – 9 axillary lymph nodes. In this case, four lymph nodes dissected out of the specimen were metastatic.
- pM0 has no clinical or radiographic evidence of distant metastases. In this case, the work-up for the spread of breast carcinoma did not show metastases.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Medullary Breast Carcinoma



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**Question 28:** A 70-year-old white male status post radiation therapy (6600 cGy) for prostate cancer 5 years previously has developed rectal bleeding and discomfort thought to be secondary to radiation proctitis. The patient has not responded to sucralfate or sulfasalazine. What is the most appropriate next step in this patient's evaluation and treatment?

**Choices:**

1. Colonoscopy
2. Rectal biopsy
3. Hyperbaric oxygen therapy
4. Diverting colostomy

**Answer: 3** - Hyperbaric oxygen therapy

### Explanations:

- Hyperbaric oxygen therapy promotes angiogenesis and repair of damaged rectal tissue and should be used prior to any surgical intervention.
- The diagnosis of radiation proctitis is made clinically. Colonoscopy is relatively contraindicated initially as this can result in perforation. Rectal biopsy is relatively contraindicated due to the danger of causing complications such as erosion or fistula.
- Sucralfate enema can be useful for symptom relief but is not curative.
- Sulfasalazine can be used orally or per rectum.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Hyperbaric Treatment Of Radiation Proctitis



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**Question 29:** A 28-year-old female is being seen in the emergency department for a complaint of chest discomfort that began about four weeks ago. She describes the patient as intermittent nonradiating left sided parasternal heaviness. It lasts a few minutes at a time and related to exertion. Denies any shortness of breath, lower extremity edema, or abdominal pain. Her medical history includes Hodgkin lymphoma diagnosed and treated at a young age and depression. She is doing well of antidepressants and sees a therapist regularly. There is no significant cardiac history in her family. Vital signs show mild sinus tachycardia. Physical exam reveals an anxious female clenching her left side of the chest. There is no jugular venous distension. Lungs are clear to auscultation. Cardiac exam reveals a new 4/6 pansystolic murmur heard best at the apex. The abdomen is soft, non-distended, and non-tender to palpation. ECG shows sinus tachycardia with some nonspecific ST changes. The patient undergoes a cardiac cath which shows coronary artery disease. What was the recommend surveillance modality and how frequently should it have been done after treatment with radiation?

**Choices:**

1. ECG every 6 months
2. Cardiac catheterization every 6 months
3. Echocardiography in 10 years followed by 5-year intervals
4. Echocardiography in 5 years followed by 10-year intervals

**Answer: 3** - Echocardiography in 10 years followed by 5-year intervals

## Explanations:

- The American Society of Echocardiography and The European Association of Cardiovascular Imaging recommend a pre-radiation echocardiogram followed by a repeat 10 years after radiation therapy has been initiated and then every 5 years after that.
- For patients with high-risk disease such as those with prior coronary artery disease according to The American Society of Echocardiography and The European Association of Cardiovascular Imaging recommend a pre-radiation echocardiogram followed by a repeat 5 years after radiation therapy has been initiated and then every 5 years after that
- Radiation-induced coronary artery disease presents very similarly to coronary artery disease.
- Valvular disease is the next most likely structure of the heart behind the coronary arteries to be affected by radiation exposure.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Radiation Induced Coronary Artery Disease



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**Question 30:** A 42-year-old patient presents with increasing sporadic episodes of vomiting, on physical examination he presents papilledema. Neuroimaging reveals a tumor arising from the ventricular lining of the fourth ventricle; histology reveals papillary structures. Which of the following is the most common treatment for the most likely tumor in this patient?

**Choices:**

1. Chemoradiotherapy
2. Complete resection with adjuvant radiotherapy
3. Radiotherapy only
4. Symptomatic treatment and comfort measures only



**Answer: 2** - Complete resection with adjuvant radiotherapy

## Explanations:

- Patients who present with vomiting and papilledema on physical examination should raise suspicion for intracranial hypertension.
- This patient has a tumor that shows papillary structures on histology and arises from the ventricular lining which is most consistent with ependymoma.
- Treatment of ependymoma most commonly consists of total resection and adjuvant radiation.
- Chemotherapy has not demonstrated a clear benefit in the treatment of ependymoma.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Ependymoma



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**Question 31:** A 71-year-old woman undergoes unilateral mastectomy with immediate free muscle-sparing transverse rectus abdominis flap reconstruction. If the patient ultimately requires post-operative radiation therapy, what effect will this have on the reconstructed breast?

**Choices:**

1. No effect
2. Increased risk of flap loss due to vessel fibrosis
3. Poorer cosmetic outcome
4. Wound breakdown

**Answer: 3** - Poorer cosmetic outcome

## Explanations:

- Patients who receive immediate reconstruction may require adjuvant radiation. While there is an increased risk of flap fibrosis, there is no increased risk of wound complications, fat necrosis, and infection. Overall, delayed reconstruction is associated with improved cosmetic outcomes. Therefore, it is generally recommended that patients wait 12 months after radiation for autologous reconstruction.
- Ionizing radiation will cause microvascular changes and fibrosis, but will not threaten the patency of the TRAM pedicle.
- Flap fibrosis is likely to cause contraction and a poorer appearance after radiation.
- Despite radiation-induced fibrotic changes, there is no increased risk of wound complications after radiation.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

**Breast Transverse Rectus Abdominus Muscle Procedure**



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**Question 32:** A 44-year-old male patient with a prior history of glioblastoma multiforme treated with surgical excision and radiation therapy, present to your office with symptoms memory loss, headaches and drowsiness and periods of blank staring. During these periods the patient is not responsive and will usually last for 2 to 3 minutes. Symptoms started about six months after completion of the radiation therapy. Someone does an MRI scan of the brain which shows an area of a defect in the right temporal lobe with a palisading pattern of necrosis, but there is a lack of T2 flair involving the surrounding white matter. What would be reasonable options for further diagnosis of this patient's condition?

**Choices:**

1. Recommend surgical biopsy of the area for definitive diagnosis
2. FDG-PET scanning which will show increased activity in radiation necrosis, while recurrent tumor typically have decreased activity
3. The MRI scan is characteristic enough and recommends starting hyperbaric oxygen therapy to treat patient's brain tissue radiation necrosis and follow with serial MRI scanning
4. Recommend referral to a radiation oncologist to consider further palliative radiation therapy.

**Answer: 1** - Recommend surgical biopsy of the area for definitive diagnosis

## Explanations:

- When symptoms and MRI scan is not diagnostic for radiation necrosis, it is best to biopsy for definitive diagnosis and treatment.
- FDG-PET scanning will show decreased activity in radiation necrosis, while recurrent tumor typically has increased activity. The underlying pathologic process for radiation necrosis is from tissue ischemic necrosis do to endovascular breakdown.
- The MRI scan is more compatible with tumor recurrence because glioblastoma multiforme commonly has a palisading pattern. Subjecting the patient to inappropriate therapeutic trials of hyperbaric oxygen therapy would delay definitive diagnosis and treatment.
- Doing further radiation therapy could cause worsening of the patient's condition if the underlying problem is from radiation necrosis.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

[Hyperbaric Treatment Of Brain Radiation Necrosis](#)



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**Question 33:** A 67-year-old male presents to his primary care provider after noticing a swelling on the medial aspect of his thigh. According to the patient, the swelling has been increasing in size for approximately 5 months. The patient denies experiencing pain, fever, or night sweats. On exam, the swelling is a 6 cm non-fluctuant, nontender fixed nodule. Following MRI and tissue biopsy, a soft tissue sarcoma is diagnosed and later excised. The patient then undergoes a course of radiation. Seven months later, he develops a non-healing ulcer at the irradiated site. Which of the following would likely resolve the ulcer?

**Choices:**

1. Hyperbaric oxygen therapy (HBOT) at 2.0 to 2.4 ATA for 90 minutes five times per week
2. HBOT at 3.5 ATA for 2.5 hours five times per week
3. Clindamycin 300-450 mg orally three times daily for 10 days
4. Hospitalization followed by IV vancomycin twice daily for 7 days

**Answer: 1** - Hyperbaric oxygen therapy (HBOT) at 2.0 to 2.4 ATA for 90 minutes five times per week

## Explanations:

- Hyperbaric oxygen therapy (HBOT) should be initiated with daily treatments of 100% oxygen at 2.0 to 2.4 ATA for 90 minutes five times per week.
- It has been shown that approximately 80% of problem wounds resolve with HBOT.
- The risk of a patient suffering HBOT adverse effects increases if the patient is subjected to treatments lasting for more than 2 hours or to treatments where the pressure exceeds 3 atmospheres.
- While an infection could be preventing healing of the patient's ulcer, soft-tissue radionecrosis commonly results from radiation-induced small vessel loss, and the ulcer would benefit from measures that increase angiogenesis.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Hyperbaric Affects On Angiogenesis



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**Question 34:** A 65-year-old male presents with a cough and hemoptysis for four weeks. CT showed a 1.5 cm right upper lobe lesion and normal-sized lymph nodes. PET-CT showed fludeoxyglucose (FDG) uptake in the mass and right hilar lymph node. What is the next step in his care?

**Choices:**

1. Do preoperative clearance for surgery
2. Refer to oncology
3. Perform convex probe endobronchial ultrasound sampling of hilar lymph node
4. Perform convex probe endobronchial ultrasound sampling of mediastinal and hilar lymph nodes



**Answer: 4** - Perform convex probe endobronchial ultrasound sampling of mediastinal and hilar lymph nodes

### Explanations:

- This is a high-risk patient for lung cancer. According to PET-CT, he has stage IIB disease; therefore, surgery is an option.
- Before surgery, N2 and N3 diseases should be ruled out. PET showed uptake in only an N1 node, but PET has a significant false-negative rate. As per ACCP guidelines, N1 disease on PET should be confirmed with tissue biopsy.
- The sampling of a hilar lymph node will only give a diagnosis but not staging.
- Preoperative clearance is only done after ruling out metastatic and extensive disease.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Lung Cancer



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 35:** A 64-year-old male presents with a complaint of fecal incontinence that started about 6 months ago. He states he works at a wholesale store and often time at work, he feels the urge to defecate, and it's hard for him to make it to the bathroom. He experiences soiling of his underpants at least twice a week with fecal material and has started using adult diapers. Colonoscopy 2 years ago was unremarkable. His only past history includes a history of prostate cancer treated with radiation. He was deemed to be in remission. Otherwise, denies any constipation or medical co-morbidities. Rectal exam shows normal resting and squeezing tone. What is the best initial management strategy?

**Choices:**

1. Increase water and fiber intake
2. Bulking agents and trial of loperamide
3. Anorectal manometry
4. Refer for defecography

**Answer: 2** - Bulking agents and trial of loperamide

## Explanations:

- This patient has most likely radiation proctitis. Due to radiation associated possible fibrosis, there is reduced rectal reservoir which leads to the inability of the rectum to distend upon receiving fecal load from sigmoid colon. In these patients, reducing stool frequency and improving stool consistency should be the primary goal. By bulking agent, stool texture can be improved (solid) reducing the risk of liquid stool seepage. With loperamide, stool frequency can be reduced. Loperamide also has an effect of increasing the resting tone of anal sphincter further reducing the risk of incontinence.
- He does not have constipation so increasing water and fiber will not help. Fiber can actually cause worsening of incontinence.
- With normal sphincter tone upon exam and clinical history suggestive of a primary problem with rectal sensation, manometry is unlikely to add any extra information to impact management. Anal plugs have shown poor evidence in cases of incontinence and are not widely used.
- Defecography is reserved for evaluation of pelvic floor dysfunction and with isolated incontinence without constipation, unlikely to add any significant information.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Fecal Incontinence



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**Question 36:** A 65-year-old male is started on oral morphine following a pathological fracture. After 6 days he presents to the healthcare provider with complaints that he is constipated. He has been straining, and his stools are rock hard. Also, he feels that he has not had complete evacuation of his stools. It is determined that he has developed opioid-induced constipation (OIC). Of the following, which type of laxative is not recommended for treatment of OIC?

**Choices:**

1. Bulk laxative
2. Osmotic laxative
3. Emollient
4. Lubricant

Answer: 1 - Bulk laxative

## Explanations:

- Even though laxatives are an essential component of any treatment regimen, there is no consensus on which laxative to use first.
- Except for the bulk-forming laxatives, all other types of laxatives can be used as initial therapy.
- There is no evidence to date indicating that one laxative is better than a laxative from another class.
- Because opioids decrease intestinal transit time, bulk-forming laxatives may not work well. Most healthcare providers start osmotic laxatives or emollient laxatives at the same time as the opioid.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Opioid Induced Constipation



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**Question 37:** A 59-year-old female with a history of stage II breast cancer treated with radical mastectomy and radiation therapy to the left breast presents to the clinic to discuss treatment options after her specialist recommended the addition of hyperthermia to the treatment regimen. She is curious about the risks and benefit of hyperthermia. Which of the following is most accurate about the recommended treatment?

**Choices:**

1. There is no difference in local control between radiation alone versus radiation and hyperthermia
2. Local control rates ranging from 55%-66% have been reported
3. Toxicities include anemia, leukopenia, or myelosuppression
4. Higher doses of radiation are required when combined with hyperthermia compared to radiation alone

**Answer: 2** - Local control rates ranging from 55%-66% have been reported

### Explanations:

- The addition of hyperthermia to radiation therapy has been shown to achieve complete response rates ranging from 55% to 66%, much higher than the 16% to 47% seen with chemoradiotherapy.
- Hyperthermia combined with radiation permits the advantage of lower radiation doses due to its radiosensitizing properties. This is especially important in women who have received prior radiation therapy to the breast or chest wall.
- Acute toxicities associated with hyperthermia and radiation therapy have been reported as persistent ulceration seen in patients with prior radiation, blisters, second and third-degree burns, and infection.
- The ability to safely and effectively administer repeat radiation therapy is more difficult due to the toxicity associated with high cumulative radiation doses, as well as a lower likelihood of controlling a tumor that was originally resistant to prior definitive doses of radiation.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

#### Hyperthermia for Chest Wall Recurrence



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## Section 2

**Question 38:** A 54-year-old male who is HIV positive presents with bright red blood per rectum. Digital rectal examination reveals an ulcerated and friable 5.5 cm mass in the anal canal originating 2 cm from the anal verge. A biopsy confirms squamous cell carcinoma. There is no involvement of the rectum or urethra. Positron emission tomography-computed tomography (PET/CT) demonstrates a 1.2 cm left external iliac lymph node without additional metastases. What is this patient's stage according to American Joint Committee on Cancer (AJCC) Eighth edition?

### Choices:

1. T2N1bM0
2. T3N1bM0
3. T2N1aM0
4. T3N1aM0



Answer: 2 - T3N1bM0

## Explanations:

- Primary tumors larger than 5 cm that do not involve adjacent organs are classified as T3.
- American Joint Committee on Cancer (AJCC) nodal staging of anal cancer changed from the seventh to eighth edition. The N stage used to consist of N1, N2, and N3 disease, but the AJCC Eighth edition now uses N1a, N1b, and N1c to define nodal staging. External iliac lymph nodes are classified as N1b, whereas metastasis to inguinal, mesorectal, or internal iliac lymph nodes are classified as N1a. Metastases to both external iliac lymph nodes with any N1a nodes is now classified as N1c.
- Anal canal cancers are initially worked up with a digital rectal examination, anoscopy with biopsy, pelvic CT/MRI, and inguinal lymph node evaluation with biopsy of suspicious nodes. PET/CT should be considered to assist in radiation treatment planning and to evaluate for distant metastatic disease.
- Clinical presentation of anal canal cancers can include bleeding (45%), pain (30%), pruritis, perianal mass, rectal urgency, or change in stool caliber.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Radiation Therapy For Anal Cancer



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 39:** A 67-year-old female with hypertension and chronic obstructive pulmonary disease (COPD) presents to the emergency department with complaints of lower abdominal pain with associated nausea, vomiting, and anorexia over the last 48 hours. Her blood pressure is 148/90 mmHg; heart rate is 110/min, respiratory rate 18/min, and temperature 39 C (102.2 F). Physical exam reveals an elderly well-nourished female with tachycardia, bilateral expiratory wheezing, and isolated right lower quadrant abdominal pain. The electrocardiogram (EKG) shows sinus tachycardia, and the chest radiograph appears to show hyperinflation of both lungs. Initial labs show a white blood cell count of 12,000/microL, chloride 82 mmol/L, potassium 3.0 mmol/L, creatinine 1.7 mg/dL, lactic acid 3.0 mmol/L, and urinalysis is negative for nitrite or bacteria. Computed tomography of the abdomen and pelvis with oral and intravenous contrast reveals appendiceal dilation, hypervascularity, and adjacent fat stranding consistent with acute appendicitis. The patient undergoes an uneventful appendectomy. The patient is discharged two days later, and the pathology report states there is a moderately differentiated adenocarcinoma in the tip of the appendix with signet cells. What is the preferred next best step in the management of this patient?

### Choices:

1. Refer to medical oncology for systemic chemotherapy and radiation
2. No further treatment is necessary as this time as her appendectomy was curative
3. Return for surgical consultation for colonoscopy and right hemicolectomy
4. Referral to a surgical oncologist for cytoreduction and heated intraperitoneal chemotherapy

**Answer: 3** - Return for surgical consultation for colonoscopy and right hemicolectomy

## Explanations:

- Appendiceal tumors are relatively rare; however, when they do occur, adenocarcinoma is most likely to cause acute appendicitis. Neuroendocrine tumors such as carcinoids are more commonly seen and are managed differently as adenocarcinoma. Adenocarcinoma is most commonly identified postoperatively when the pathology report is available. Some adenocarcinomas have high-risk features and can be identified as such during the initial operation if they are found to spill mucin or have ruptured. Often, pathologic features such as signet cell morphology portend a worse prognosis as this is usually associated with a more aggressive tumor and often needs more than just a simple appendectomy.
- When a patient undergoes an appendectomy, and there are no other indications at the time of the initial operation that there is concern for malignancy, the diagnosis of adenocarcinoma is often revealed after the patient has been discharged. When this occurs, patients should be recalled and set up for an elective right hemicolectomy.
- Adenocarcinoma of the appendix, a rare appendiceal neoplasm with three various histopathological subtypes, is most commonly present with acute appendicitis. The standard treatment is performing a right hemicolectomy, irrespective of the tumor size and or the involvement of the lymph node basin. A right hemicolectomy is the procedure of choice with uncomplicated appendiceal adenocarcinoma in that it also allows for the removal of the draining lymph node basin as opposed to a simple appendectomy which does not treat the lymph nodes and does not allow for local-regional control. Before surgery, a complete assessment of the colon is needed with colonoscopy.
- Although referral to a surgical oncologist would be prudent, some centers do not have access to this specialist and must manage this patient on their own. Without noted appendiceal rupture, mucinous spillage, or concern for pseudomyxoma peritonei, there is no benefit for formal cytoreduction and heated intraperitoneal chemotherapy. Referral to medical oncology may also be a reasonable option, but definitive surgery and follow up thereafter would be the best option. Furthermore, there is a role for chemotherapy but not radiotherapy for this disease process.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Appendicitis



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**Question 40:** A 65-year-old male patient presents to the hospital with a 3 cm, mobile, group 2 lymph node. Fine-needle aspiration reveals squamous cell carcinoma. The physical examination and radiographic evaluation reveal no evidence of a primary site of lesion and no distant metastases. Which of the following is most likely the primary site?

**Choices:**

1. Nasopharynx
2. Floor of mouth
3. Base of tongue
4. Infrahyoid epiglottis

Answer: 3 - Base of tongue

## Explanations:

- The primary site is detected in approximately 40% of patients presenting with a metastatic upper cervical lymph node from an unknown primary site. Specifically, in the head and neck of patients who have undergone a modern evaluation with flexible fiber-optic endoscopy, CT or MRI of the head and neck, and directed biopsies.
- Approximately 40% of detected primary sites are found in the base of the tongue and 40% in the tonsillar fossa.
- With tonsillar cancer, metastasis to regional lymphatics is a frequent occurrence. Neck metastases are seen in 50% to 65% of patients. Even in patients with a clinically negative physical exam, 30% to 40% will have neck disease.
- Tonsillar squamous cell cancer also may spread to the retropharyngeal lymph nodes.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Tongue Cancer



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**Question 41:** A 75-year-old male patient presents to the clinic with complaints of diarrhea, urgency, and tenesmus. He had brachytherapy one year ago for unresectable prostate cancer. Which of the following is the best initial therapy for this patient?

**Choices:**

1. Mesalamine (5-ASA) enemas or suppositories
2. Corticosteroid enemas
3. Sucralfate enemas
4. A course of tapering oral corticosteroids

**Answer: 3** - Sucralfate enemas

### Explanations:

- Patient's history of brachytherapy for prostate cancer more than nine months ago, with the current complaints of urgency and tenesmus, points to possible chronic radiation proctitis.
- Topical sucralfate enema is the best available treatment for chronic radiation proctitis.
- Acute radiation proctitis may increase the risk of chronic radiation proctitis.
- Patients with radiation proctitis, have increased risk of secondary malignancies, mainly colorectal cancers.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Proctitis And Anusitis



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**Question 42:** A 65-year-old male presents to a clinic with complaints of lumbar pain and difficulty with urination. Detailed medical history revealed that he had lost 22 kgs of weight over a period of six months. He also reports that he often feels fatigued. On physical examination, his back is non-tender, and there is no abnormal finding on the neurologic exam. The rectal exam reveals an enlarged, nodular hard prostate with obliteration of the slit and immobile rectal mucosa in the region corresponding to the prostate. His prostate-specific antigen (PSA) is 38 ng/mL. Magnetic resonance imaging and prostate biopsy show a clinically advanced disease and a Gleason score of  $4 + 4 = 8$ . He was started on oral hormonal agents but did not show any response. The blood workup for AR-V7 was positive. What does the presence of AR-V7 (androgen receptor splice variant-7 messenger RNA) in this patient mean?

**Choices:**

1. Resistance to enzalutamide
2. Resistance to abiraterone acetate
3. Resistance to both enzalutamide and abiraterone acetate
4. Sensitivity to both enzalutamide and abiraterone acetate



**Answer: 3** - Resistance to both enzalutamide and abiraterone acetate

## Explanations:

- The finding of AR-V7 (androgen receptor splice variant-7 messenger RNA) in circulating tumor cells in patients with castrate-resistant prostate cancer indicates expected resistance to both enzalutamide and abiraterone acetate.
- Both of these drugs target the androgen receptor site. A blood test for AR-V7 is now commercially available and is currently recommended for patients who fail initial treatment with any of these oral hormonal agents. Interestingly, a positive AR-V7 blood test also suggests an enhanced response to chemotherapy.
- Earlier use of these drugs is encouraged. If there is no clinical response as evidenced by a drop in the prostate-specific antigen over the following 12 weeks, then another therapy should be substituted.
- Patients with metastatic, hormone-sensitive disease and especially those with high volume disease, benefited most from adding docetaxel chemotherapy initially along with their androgen-deprivation therapy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Prostate Cancer



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**Question 43:** A 55-year-old male presents after a 70 Gray course of radiation therapy for squamous cell carcinoma of the oral tongue with a non-healing oral lesion and exposed bone of the anterior lingual cortex of the mandible. He has stopped smoking five months before beginning his radiation therapy and is now in an alcohol treatment program, started at the same time. Which of the following is a significant risk factor for developing this complication?

**Choices:**

1. Prophylactic antibiotics were held during radiotherapy
2. Total radiation dose less than 6,000 rads (cGy)
3. A tooth extraction one month before starting radiotherapy
4. Total radiation dose greater than 7,000 rads (cGy)

**Answer: 4** - Total radiation dose greater than 7,000 rads (cGy)

## Explanations:

- Of the listed options, a radiation dose greater than 7,000 rads (cGy) is an independent risk factor for the increased incidence of osteoradionecrosis (ORN) of the mandible.
- Below 6,000 rads total exposure is unlikely to develop ORN.
- A mechanical injury such as tooth extraction can increase the incidence of ORN if done anytime within two weeks of radiotherapy and indefinitely afterward.
- ORN is an aseptic disease process. Antibiotics only have a role in established secondary bacterial infections.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Mandible Osteoradionecrosis



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**Question 44:** A 70-year-old male presents with a 3-month history of dyspnea with a recent occurrence of hemoptysis. He has a past medical history of a 40 pack-year smoking history. His vitals are stable, and his physical examination is unremarkable. CT of the chest shows a 4.3 cm spiculated mass in the left upper lobe with an enlarged hilar lymph node. The patient undergoes surgery which shows that this mass is a poorly differentiated adenocarcinoma with negative margins, hilar lymph nodes are positive, but mediastinal lymph nodes are negative. What is the most appropriate management?

**Choices:**

1. Palliative care
2. Adjuvant chemotherapy
3. Adjuvant chemoradiation
4. Adjuvant radiation

**Answer: 2** - Adjuvant chemotherapy

## Explanations:

- Treatment options for non-small-cell lung carcinoma (NSCLC) include chemotherapy, radiation, surgical resection, and combinations of these. The patient has options and should not be directed to palliative care only.
- This patient has stage II non-small cell lung cancer (NSCLC) as his mass is less than 5 cm and is localized. With stage II and stage III NSCLC, it is recommended to undergo adjuvant chemotherapy.
- Studies have not shown a survival benefit with chemoradiation for stage II NSCLC. Chemoradiation can be an option for stage III NSCLC with mediastinal lymphadenopathy.
- As this patient had negative surgical margins, it would not be recommended that he undergo only radiation.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Non Small Cell Lung Cancer



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**Question 45:** A patient with prostate cancer is planned for a course of 39 fractions. At simulation, the patient is found to have a full rectum despite counseling and the use of enemas as prescribed. How often should image verification ideally be performed for this patient?

**Choices:**

1. Once every five fractions
2. Twice per week
3. Twice daily
4. Once daily

**Answer: 4** - Once daily

## Explanations:

- Imaging verification for radiation treatment delivery traditionally has been performed once every five fractions. However, modern radiation therapy is generally more highly conformal, with limited margins for set up error. Therefore, more frequent imaging is commonly used to verify positioning before treatment delivery, particularly for targets expected to have a great deal of internal motion.
- The radiation oncologist can vary the frequency of imaging as needed for a particular course of therapy, depending on expected set-up error. Twice a week verification can be reasonable in the right clinical setting. However, it is not a typical regimen and would not be suitable for targets expected to have a great deal of inter-fraction motion, such as the prostate.
- Twice-daily imaging verification for radiation treatment delivery can be used with twice-daily treatments; expect to have a significant amount of variability between fractions. Small cell lung cancer often is treated twice daily and therefore can be verified with twice-daily imaging.
- Daily imaging verification, ideally with soft tissue visualization, such as a cone beam CT, would be prudent in a patient expected to have a high degree of internal variability, particularly for a target site such as the prostate where high doses typically are used. Rectal filling can dramatically change the prostate position and therefore should be taken into account before delivering radiation treatment day-to-day.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Therapy



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**Question 46:** What is recommended for a 49-year-old patient with Stage IA, T1c N0 M0, grade 2, ER positive, PR negative, HER2/neu negative breast cancer who underwent successful lumpectomy and chemotherapy?

**Choices:**

1. Observation
2. Endocrine therapy alone
3. Hypofractionated whole breast radiation therapy and endocrine therapy
4. Conventional dose whole breast radiation therapy and endocrine therapy



**Answer: 3** - Hypofractionated whole breast radiation therapy and endocrine therapy

## Explanations:

- Radiation therapy is recommended after lumpectomy to reduce the risk of in-breast recurrences.
- Previously hypofractionated whole breast radiation therapy was recommended for certain patients. However, recent long-term data from multiple clinical trials support the safety and efficacy of hypofractionation in most patients regardless of age, tumor grade, left or right sided breast cancer, prior chemotherapy, receptor status, and breast size.
- The American Society for Radiation Oncology (ASTRO) recently issued new clinical guidelines in March 2018 for whole breast radiation therapy to expand the patient population to be treated with a hypofractionated course of radiation therapy.
- Endocrine therapy is recommended for those with hormone receptor-positive tumors.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Therapy For Early Stage Breast Cancer



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**Question 47:** A 67-year-old woman with a history of stage I right breast cancer treated with lumpectomy and radiation therapy presents to discuss treatment options after being diagnosed with recurrence to the right breast. She is concerned about additional radiation to the breast. Her provider recommends concurrent temperature regulation therapy, which may allow the radiation amount to be reduced. Which of the following is most accurate about this therapy?

**Choices:**

1. Decreased cell permeability preventing the diffusion of nutrients into tumor cells
2. Decreased cell permeability, causing retention of sodium ions in the cell, followed by enhancing water diffusion and cell lysis
3. Increased cell permeability allowing entry of calcium ions into the cell, with the initiation of the apoptosis cascade
4. Increased cell permeability allowing increased exit of potassium ions from the cell interior, leading to cell dehydration

**Answer: 3** - Increased cell permeability allowing entry of calcium ions into the cell, with the initiation of the apoptosis cascade

## Explanations:

- Cellular alterations induced by extreme temperatures include increased cellular permeability.
- The increased cellular permeability induced by supraphysiologic temperatures increases the influx of calcium into the cell.
- Calcium is a component of the apoptotic cascade.
- Increased cytosolic calcium induces the release of mitochondrial caspases, activating apoptosis.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Hyperthermia for Chest Wall Recurrence



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**Question 48:** A 55-year-old lady presents to the office with subacute onset pain and swelling of both knees and elbows. She has a history of hypertension, hyperlipidemia, and a recent diagnosis of a lung nodule which is undergoing further diagnostic workup. On examination, both knee joints appear swollen significantly. Her fingers also have a characteristic swan neck deformity. As a part of a detailed workup, she undergoes serological studies, technetium bone scan and a PET scan which was primarily ordered to evaluate the lung nodule. Which among the following findings would best help confirm her underlying diagnosis?

**Choices:**

1. Monolayer circumferential widening of the diaphysis of both tibia
2. Symmetrical periostosis of the tibia with cortical destruction
3. Epiphyseal involvement of tibia
4. SUV of 1.3 and 1.4 in PET scan in tibial lesions with SUV of 7.2 in lung nodule

**Answer: 1** - Monolayer circumferential widening of the diaphysis of both tibia

## Explanations:

- Symmetrical bilateral involvement of appendicular skeleton with a suspicious lung nodule which is 2-[18F]fluoro-D-glucose (FDG) avid raises the likelihood of secondary hypertrophic osteoarthropathy.
- It characteristically involves shafts of tubular bones, initially limited to the diaphysis, with metaphyseal involvement only in late stages. Epiphysis involvement is seen in primary hypertrophic osteoarthropathy.
- There is an initial monolayer circumferential widening without transformation of bone shape, followed by multilayered, laminated, centripetal thickening with an irregular appearance in advanced stages.
- Symmetrical periostosis, in the absence of cortical destruction or fracture, is the hallmark of radiological findings.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Secondary Hypertrophic Osteoarthropathy



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**Question 49:** A 67-year-old man presents to the otolaryngology outpatient setting with three months of throat discomfort and progressive trismus. He is a current smoker of 40 pack-years and suffers from chronic obstructive pulmonary disease. Physical examination reveals a large lesion within his left tonsil and large bilateral cervical lymphadenopathy. Cross-sectional imaging reveals a large lesion arising from the left tonsil invading the medial pterygoid muscle and several enlarged bilateral cervical lymph nodes, the largest of which measures 5cm. There is no distant metastasis. Fine needles aspiration (FNA) sampling of the neck node is p16 negative. What is the TNM staging according to the American Joint Committee on Cancer 8th edition?

**Choices:**

1. T3N2aM0
2. T3N2cM0
3. T4aN2aM0
4. T4aN2cM0

Answer: 4 - T4aN2cM0

## Explanations:

- The revised 8th edition of the TNM classification of oropharyngeal cancer splits the disease into p16 positive and p16 negative disease. This is a p16 negative case and has a tonsil cancer invading the medial pterygoid muscle, making this T4a disease. He also has bilateral cervical nodes measuring less than 6cm and therefore has N2c nodal involvement.
- Advanced tonsillar p16 negative tonsillar cancer is usually seen in older patients who are smokers and has less favorable outcomes compared to p16 positive disease.
- Advanced tonsil cancer is typically managed with radiotherapy and either platinum-based chemotherapy cisplatin or monoclonal antibody cetuximab.
- Surgical intervention for advanced tonsillar cancer is technically very difficult, can cause significant post-operative comorbidity, and often requires postoperative chemoradiotherapy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Tonsil Cancer



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**Question 50:** A 65-year-old female presents to the office with complaints of fatigue and chest discomfort. The patient has a history of clinical T2N0M0, ypT0N0Mx moderately-differentiated invasive ductal carcinoma in the right breast, which was ER/PR/Her2neu positive, and was treated with right breast mastectomy and sentinel lymph node biopsy revealing complete pathologic response and 0/4 lymph nodes involved. The clinician suspects chest wall recurrence. She wants to discuss the reasons behind her recurrence. Which of the following increased this patient's risk of recurrence?

**Choices:**

1. Tumor size of 4 cm
2. Unifocal disease
3. Nipple involvement
4. ER-positive status



**Answer: 1** - Tumor size of 4 cm

## Explanations:

- Katz et al. found that patients with tumors greater than or equal to 4 cm or at least four involved nodes experience local recurrence rates over 20%.
- Gross multifocal/multicentric disease is more likely to lead to recurrent disease.
- Age younger than 40 and genetic predispositions to breast cancer are associated with the risk of recurrent breast cancer.
- ER-positive hormone status permits the use of selective estrogen receptor modulators, drugs whose benefits in the treatment of breast cancer outweigh their relatively low toxicity.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Hyperthermia for Chest Wall Recurrence



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**Question 51:** A 26-year-old male patient presents with complaints of pain of the left knee. Labwork demonstrates no evidence of leukocytosis. An MRI is performed and shows a T2/STIR high signal lesion centered within the physis. CT evaluation of the lungs demonstrated no evidence for metastatic disease. The patient underwent curettage and grafting. Reevaluation, after five years, showed no evidence of recurrence. Which of the following statements characterizes this neoplasm?

**Choices:**

1. There is a high association with Maffucci syndrome
2. Males are disproportionately affected when compared to women
3. Translocation between chromosomes 11 and 22 is frequently noted on cytogenetic analysis
4. Hereditary multiple exostoses a well-known risk factor for the development of these neoplasms



Photo: Contributed by Dawood Tafti, MD.

**Answer: 2** - Males are disproportionately affected when compared to women

## Explanations:

- Chondroblastomas are benign cartilage forming lesions of the epiphysis. These lesions frequently cross the physis into the metaphysis.
- Recurrence rates vary and have been reported between 8% and 35%.
- There is a male predominance in the syndrome, with a mean age of diagnosis of 27 years.
- The long bones are most frequently affected, including the proximal or distal femur and the proximal tibia.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Chondroblastoma



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**Question 52:** A patient presents with a 1.5 cm Merkel cell carcinoma in the periorbital region and no evidence of lymphadenopathy. Which treatment is definitely not indicated?

**Choices:**

1. Wide local excision
2. Neck dissection
3. Radiation therapy to the primary site
4. Chemotherapy

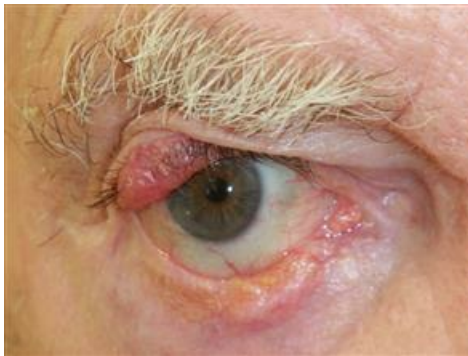


Photo: Contributed by DermNetNZ

**Answer: 4** - Chemotherapy

### Explanations:

- Chemotherapy is reserved for stage II or stage III disease.
- A wide local excision should be performed to treat this stage I cancer, and the primary site should be radiated.
- Elective treatment of the neck with neck dissection or radiation therapy is controversial.
- Mohs Micrographic Surgery (MMS) may be considered in lieu of wide-local excision if there are vital structures to be spared; adjuvant radiation is often recommend even if the tumor has been cleared with MMS.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Merkel Cell Carcinoma Of The Skin



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**Question 53:** A 54-year-old woman presents to the clinic with a one-year history of progressive swallowing difficulties. An MRI is obtained showing a T2 fat saturation hyperintense lesion as pictured. A needle biopsy is performed, which shows bubbly cells separated into lobules with fibrous septa and a myxoid stroma. Which of the following is the best initial therapy for this patient?

**Choices:**

1. Neoadjuvant radiation therapy
2. Chemotherapy
3. Conventional photon radiation
4. Highly-conformal radiotherapy

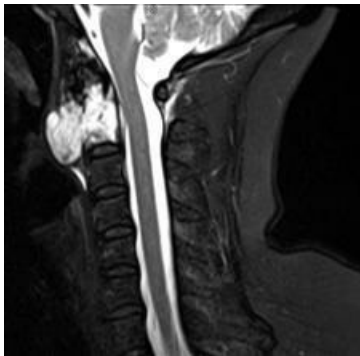


Photo: Contributed by Steven Tenny, MD, MPH, MBA and Christopher Gillis, MD.

**Answer:** 4 - Highly-conformal radiotherapy

## Explanations:

- Chordomas are relatively radioresistant which necessitates high-dose radiation including proton beam radiation or radiosurgery (highly conformal radiotherapy).
- When a needle biopsy is performed, the surgical resection should include the needle tract as chordomas can seed the needle biopsy tract.
- En bloc resection followed by high-dose radiation provides the best current long-term outcomes for chordoma treatment.
- Chordomas are slow-growing and chemotherapy is not a generally used treatment strategy. If chemotherapy is given, it is usually given as part of a clinically trial.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Chordoma



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**Question 54:** A 65-year-old farmer presents to the clinic with a lesion on his face. The patient states he is on chemotherapy for skin cancer. The clinical examination reveals a 1 cm red, slightly raised plaque on his face. The histopathology report has shown cytological atypia and dyskeratosis, limited to the basal layers of the stratum spongiosum, along with hyperkeratosis and parakeratosis. A clinical image of a similar lesion is shown. What agent is most likely the cause of this condition?

**Choices:**

1. Ipilimumab
2. Vemurafenib
3. Nivolumab
4. Trametinib



Photo: Contributed by DermNetNZ



Answer: 2 - Vemurafenib

## Explanations:

- The clinical and pathological descriptions are suggestive of a keratoacanthoma.
- Ultraviolet light, trauma, human papillomavirus (HPV), genetic factors, immune status, use of hedgehog pathway inhibitors for basal cell carcinoma (BCC), and use of BRAF inhibitors in patients with melanoma have been implicated as risk factors.
- The choices in this question are all therapy agents used for the treatment of melanoma. However, the only vemurafenib is the listed BRAF inhibitor.
- Ipilimumab is a monoclonal antibody against CTLA-4, nivolumab is a programmed cell death protein 1 (PD-1) inhibitor, and trametinib is a MEK inhibitor. All of these medications are used in the treatment of melanoma, but none of them are associated with the formation of keratoacanthomas.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Keratoacanthoma



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**Question 55:** A 69-year-old man presents to the clinic for follow up. He was recently diagnosed with renal cell carcinoma and a solitary metastatic spread to the T9 vertebral body. His primary lesion was amenable to surgical resection. With regard to the management of his metastatic vertebral lesion, he is being evaluated in detail. His clinical examination, including a detailed neurological assessment, is normal. His magnetic resonance imaging (MRI) reveals epidural spinal cord compression (ESCC) score of 1 and spinal instability neoplastic score (SINS) of 5. He is therefore planned for spine stereotactic radiosurgery (SSRS), as the primary modality of treatment. Which of the following investigations is the most appropriate way to evaluate the treatment response of the tumor at this point?

**Choices:**

1. Dynamic contrast-enhanced perfusion images
2. Positron emission tomography
3. Diffusion tensor Imaging
4. Tumor biopsy

**Answer: 1** - Dynamic contrast-enhanced perfusion images

## Explanations:

- "Spine response assessment in neurooncology group" reported criteria for the assessment of local control of spinal metastases following SSRS treatment. They published recommendations regarding treatment planning, the definition of treatment endpoint, and patient follow-up. Based on their recommendations, dynamic contrast-enhanced perfusion MR imaging (DCE-MRI) is the best available imaging modality to assess the viability of tumors after SSRS.
- The DCE-MR images are sensitive and specific for assessing treatment responses following SSRS, and changes are observed earlier than standard MRI.
- With the enhanced ability to provide high dose tumor irradiation with SSRS, even radio-resistant tumors which have been traditionally unresponsive to conventional external beam radiation therapy (cEBRT) have been successfully irradiated. Nevertheless, tumors with high-grade ESCC score may not be amenable to the delivery of adequate radiation dosage to the entire clinical target volume (CTV). In such tumors, the chances of poor tumor response to treatment are high.
- In these non-surgically managed (SSRS) patients, DCE-MRI provides an excellent idea regarding the post-SSRS viability of the lesion, thereby precluding the need for an invasive biopsy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Spinal Metastasis



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**Question 56:** A 24-year-old male presented in the emergency with the complaint of one episode of hematemesis three hours back. Previously, he had been having complaints of intermittent epigastric pain, early satiety, and constipation for the last six months. On examination, there was epigastric tenderness on deep palpation. Esophagogastroduodenoscopy was done, which showed esophageal and gastric ulcers along the lesser curvature. A mass was found in the gastric antrum. He was admitted, and colonoscopy was done, which revealed a stricture in the middle of the transverse colon and ileocecal valve. Biopsies were taken and sent for histopathology. CT scan of the abdomen with contrast demonstrated a 4 cm well-enhanced lobulated mass located in the gastric antrum and others in the duodenum loop, and pancreatic head. Diffuse lymphadenopathy was seen. Biopsy results showed nests of poorly differentiated cells that stained positive for desmin and neuron-specific enolase. Which of the following will be the best management for this tumor?

### Choices:

1. Cytoreductive surgery + hyperthermic intraperitoneal chemotherapy (P6 protocol) + radiotherapy
2. Neoadjuvant chemotherapy (P6 protocol) + aggressive surgery + radiotherapy
3. Whole abdominal radiotherapy alone
4. Palliative chemotherapy alone (P6 protocol)

**Answer: 2** - Neoadjuvant chemotherapy (P6 protocol) + aggressive surgery + radiotherapy

## Explanations:

- Primary peritoneal cancer (PMC) is subdivided into extra ovarian, primary peritoneal carcinoma, malignant mesothelioma (MPM), multicystic mesothelioma, leiomyosarcomas, leiomyomatosis peritonealis disseminata, and desmoplastic small round cells tumor. Desmoplastic round small cell tumor occurs in adolescents (median age 19 years) and 85% in Caucasians. Gerald and Rosai first described it in 1989. It is caused by t(11;22)(p13;q12) translocation. It belongs to the Ewing's sarcoma tumor family.
- The presenting symptoms are diverse and vague. Most present with non-specific symptoms like abdominal pain, distension, early satiety, anorexia, nausea, weight loss, and constipation. Imaging studies demonstrate an abdominal mass with peritoneal implants. Lymphadenopathy is common. Liver metastasis can also be present at the initial diagnosis. This tumor has aggressive features with a dismal prognosis.
- On biopsy, it presents as a small round blue cell tumor and consists of clumps, nests or sheets of small round to ovoid cells with extensive mitotic figures. It stains with three different markers delineating its multilineage origin; epithelial cytokeratin, mesenchymal desmin and vimentin, and neural neuron-specific enolase.
- In DSRCT, neo-adjuvant chemotherapy is the main approach for management. Systemic chemotherapy comprising cyclophosphamide, ifosfamide, vincristine, etoposide, doxorubicin, and mesna (P6 protocol) is done, followed by aggressive surgical excision. HIPEC is regarded as adjunctive therapy. Consolidative whole abdominal radiotherapy in the pediatric population in particular and in adults generally is essential to improve the outcome. Palliative chemotherapy is reserved for recurrence.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Peritoneal Cancer



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**Question 57:** A 52-year-old woman with a past medical history of hepatic cirrhosis secondary to alcohol use disorder presents to the hospital with a complaint of fatigue and abdominal pain. As a part of the history and physical, she states that she has been sober for over a year with the help of rehabilitation. An initial workup to evaluate her abdominal pain includes a CT of the abdomen and pelvis with intravenous contrast. The scan reveals a shrunken, nodular liver containing a single enhancing lesion measuring 5.6 cm. Laboratory analysis reveals elevated liver enzymes and total bilirubin, but her Child-Pugh score is B. CT-guided biopsy reveals hepatocellular carcinoma. Due to the size of the lesion, the patient is not considered to be a candidate for surgical resection. Percutaneous radiofrequency ablation is considered. Following ablation, the patient develops burns across her abdomen at the sites of probe entry following the ablative procedure. Which of the following interventions is most likely to have prevented this complication?

**Choices:**

1. Decreasing the target temperature of the ablation probes
2. Decreasing the power (wattage) of the ablation probes
3. Decreasing the duration (time) of each ablation
4. Larger grounding pads with improved skin contact

**Answer: 4** - Larger grounding pads with improved skin contact

## Explanations:

- Radiofrequency ablation is a relatively safe and effective method for treating hepatic tumors, whether primary (i.e., hepatocellular carcinoma) or metastatic (colorectal, amongst others).
- While generally considered safe, radiofrequency ablation is not without risk of complication, which may occur in various forms, including cutaneous thermal injury. Skin burns can occur at the point of needle entry and ground pad sites. Third-degree skin burns are rare but have been described, even leading to death.
- Skin burns used to be more common due to smaller pads, but they have become a rarity more recently due to increased pad size. Adequate pad placement with good skin contact is also a key to avoid this complication.
- Large and sometimes multiple ground pads are necessary to disperse the high amount of energy generated by RFA. They should be equidistant from the needle due to the asymmetric distribution of the electrical current. This asymmetry prevents temperature uniformity beneath the pads, causing increased heat around the edges in the pads closest to the needle. Decreasing temperature, power/wattage, or duration of the ablation will not eliminate the risk of skin burn, but they will reduce the efficacy of the procedure.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Percutaneous Radiofrequency Ablation Of Liver Tumors



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**Question 58:** A 27-year-old female patient had been complaining of hearing loss and pulsatile tinnitus in the right ear for six months. On examination, she has a significant conductive hearing loss on the right ear with a retro auricular bruit. She is noted to have excessive sweating of the hands and cervical area. Blood pressure is 130/90 mmHg with a heart rate of 110 beats per minute. There is noticeable facial flushing. Magnetic resonance imaging with intravenous contrast-enhanced shows a 4 cm enhancing lesion was extending from the jugular bulb to the middle ear with a characteristic salt-and-pepper appearance on T1 and T2 weighted images. The neurosurgeon discussed the patient's diagnosis and surgical options, and she is scheduled to have subtotal resection and adjuvant radiosurgery. Which is the next best step before the surgical procedure?

**Choices:**

1. Embolization 24 to 72 hours before surgery
2. Radiosurgery 3 to 4 weeks before surgery
3. Balloon test occlusion studies
4. 24-hour urinary collection for catecholamines and metanephrines



**Answer: 4** - 24-hour urinary collection for catecholamines and metanephrines

## Explanations:

- Up to 1 to 3% of glomus tumor cases have secretion of catecholamines. Signs and symptoms of a hormonally active tumor include labile hypertension, increased heart rate, headache, excessive sweating, tremors, as well as facial flushing; these mandate a comprehensive evaluation.
- With high enough levels of catecholamines, pheochromocytoma-like symptoms may develop, resulting in systemic effects.
- Laboratory workup (24-hour urinary collection for catecholamines and metanephrines) is mandatory for any patient undergoing a surgical approach.
- Preoperative embolization of the tumor can lead to a decrease in the duration of surgery, as well as a reduction of operative estimated blood loss. In this patient, laboratory workup is necessary before the embolizations as she is presenting symptoms of active catecholamine hormone secretion, which can complicate the embolization and surgery.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Glomus Jugulare



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**Question 59:** 74 year old male presents with a 2.5 cm nodule in the right middle lobe on chest CT. No pathologically enlarged lymph nodes were noted in the hilum or mediastinum. PET-CT was negative for distant metastatic disease. Lung nodule was PET-avid with SUV of 22. Biopsy of lung nodule demonstrated moderately differentiated adenocarcinoma. Pulmonary function test revealed a FEV1 of 50% predicted and DLCO of 40 percent predicted. What is treatment should be recommended?

**Choices:**

1. Concurrent chemoradiation
2. Pneumonectomy
3. Lobectomy
4. Stereotactic body radiation therapy

**Answer: 4** - Stereotactic body radiation therapy

### Explanations:

- Radiation therapy with concurrent chemotherapy is recommended for Stage IIIA-B non-small cell lung cancer. Radiation therapy is delivered over 6 to 7 weeks to a total dose of 60 to 70 Gy.
- If patient is a surgical candidate, lobectomy is preferred over pneumonectomy, if anatomically feasible. Wedge resection is not considered oncologic surgery and is only considered if patient is physiologically compromised.
- Stereotactic body radiation therapy (SBRT) or stereotactic ablative body radiation (SABR) is an alternative option for patients who are not surgical candidates due to high operative risk from poor cardiopulmonary function, comorbid conditions, advanced age, or if patients refuse surgery.
- 5 year survival for Stage IA (T1N0M0) is 60 to 80 percent.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

[Radiation Therapy For Early Stage Non-Small Cell Lung Cancer](#)



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**Question 60:** A 25-year-old male is being evaluated in the clinic. He presented initially with complaints of chest pain and cough. He has an anterior mediastinal mass that has elevated levels of both HCG and alpha-fetoprotein. A computed tomography scan of the chest reveals a large mass extending into the right chest. The patient was administered multimodality chemotherapy for two months. The levels of HCG and alpha-fetoprotein remain elevated. His blood pressure is 130/80 mmHg, and the pulse is 85/min. What is the next step in the management of this patient?

**Choices:**

1. Debulking surgery followed by chemotherapy
2. Further multimodality chemotherapy
3. Add radiation to the chemotherapy
4. Debulking surgery followed by a combination of radiation and chemotherapy

**Answer: 2** - Further multimodality chemotherapy

## Explanations:

- Non-seminoma is less common than seminoma. These tumors occur in the anterior mediastinum of young males.
- They grow rapidly and present earlier with metastatic disease. They may present with superior vena cava syndrome, right ventricular outflow tract obstruction, or a coarctation.
- Gynecomastia may be present. Both AFP and HCG are elevated. Once a diagnosis of a non-seminoma is obtained with a needle biopsy, treatment can be started. In a patient with a non-seminoma, multimodality chemotherapy should be initiated. If the markers fail to come down, the second round of chemotherapy should be utilized.
- Elevated markers suggest residual tumors or unresponsive tumors. These patients have a poor prognosis.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Mediastinal Nonseminoma



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**Question 61:** An 84-year-old man is being evaluated at a home visit. He was diagnosed with stage 4 bronchogenic carcinoma two months ago. He has a 60 pack-year history of smoking. He chose palliative care and has not sought chemotherapy or radiation. The patient is mostly bed-bound and peaceful. However, he tears up upon coughing blood-tinged sputum. His family is concerned about the patient being distressed. Which of the following is the most appropriate recommendation for this patient?

**Choices:**

1. Reassurance
2. Dark towels
3. Sertraline
4. Palliative radiotherapy

Answer: 2 - Dark towels

## Explanations:

- The clinical scenario describes a patient with a terminal disease, complaining of distress due to hemoptysis.
- Hemoptysis is a common cause of distress for patients with lung cancer due to the expression of blood on the hand or a white napkin.
- The appropriate recommendation for this patient is to use dark towels or absorptive sheets that would hide the red color of blood. Dark green or blue towels are commonly recommended.
- Reassuring the patient is unlikely to work. Sertraline is not the most appropriate option as there is no overt sign of depression. Palliative radiotherapy is usually employed for obstructive or painful lesions.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

End of Life Care



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**Question 62:** A 65-year-old male presents to a clinic with complaints of difficulty in maintaining the urinary stream, hesitancy, and nocturia associated with urgency. Detailed medical history revealed that he also had a few episodes of hematuria over the past several weeks. On abdominal examination, the abdomen was soft and non-tender. The findings of the digital rectal exam (DRE) are unremarkable. His prostate-specific antigen (PSA) is 16 ng/mL. Suprapubic ultrasound reveals a prostate volume of 30 ml. An ultrasound-guided biopsy shows 3+3 positive specimens with a Gleason score of 6. A bone scan was performed, which did not reveal any skeletal lesions. What is the current recommendation regarding the next best step in the management of this patient?

**Choices:**

1. Perform radical prostatectomy
2. Start him on docetaxel
3. Counsel him regarding the active surveillance of the disease
4. Do transurethral resection of prostate followed by radiation therapy



**Answer: 3** - Counsel him regarding the active surveillance of the disease

## Explanations:

- Many low-risk cases can now be followed with active surveillance. In active surveillance, patients are usually required to have regular, periodic PSA testing and at least one additional biopsy 12 to 18 months after the original diagnosis.
- Active surveillance is appropriate for men with low-grade prostate cancer (Gleason 3+3=6 or less with a PSA less than 20) and limited sized tumors. Genomic testing can be considered in these cases but maybe most helpful when the PSA is in the 10 to 20 ng/ml range, or there is increased tumor volume.
- MRI of the prostate can also be used to follow these patients and avoids the discomfort of repeated biopsies. The purpose of close observation is to identify those patients, usually about 25% of the total, who will significantly increase PSA levels, clinically progress, or upgrade to a higher Gleason score. This indicates possible conversion to a more aggressive cancer, and definitive treatment can then be offered appropriately while the vast majority are safely spared the costs, inconvenience, side effects, and complications of curative therapy.
- Definitive treatment of localized disease now includes radiation therapy (external beam and/or brachytherapy radioactive seed placement), radical prostatectomy, and cryotherapy (usually reserved for radiation therapy failures). Docetaxel is usually the chemotherapeutic agent to start with for castrate-resistant prostate cancer (CRPC).

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Prostate Cancer



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**Question 63:** A 72-year-old female is referred for evaluation at a hyperbaric facility by an oral surgeon. She is due to have multiple dental extractions from the right side of her mandible. The patient underwent radiation therapy to treat a right-sided neck cancer several years ago. The patient admits to having xerostomia, and her skin on the right side of her neck has a thickened, woody appearance. What is the primary hyperbaric oxygen physiologic effect that would apply to this patient?

**Choices:**

1. Angiogenesis stimulated by vascular epidermal growth factor
2. Antimicrobial effects caused by a decrease in intravascular carbon dioxide
3. Compression of intrinsically formed gas bubbles
4. Hyperoxygenation of the blood leading to an increase of human growth hormone

**Answer: 1** - Angiogenesis stimulated by vascular epidermal growth factor

## Explanations:

- Hyperbaric oxygen therapy is the only treatment that is available to treat the underlying lack of typical microvasculature characteristic of soft tissue radionecrosis. Hyperbaric oxygen therapy supports capillary budding by increasing the vascular epidermal growth factor (VEGF) and supports more normal fibroblast activity, which requires adequate oxygenation of the tissue.
- Obliterative endarteritis from delayed radiation injury causes hypoxia in the tissue, and the characteristic fibrotic changes. The arterioles may try to re-grow, but this proliferative endarteritis results in a disorganized telangiectatic growth of vascular tissue. It often does not provide adequate oxygenation of the tissue to maintain normal function.
- The pathology behind the soft tissue damage follows the principle that the cells that have a faster turnover rate or dividing at a faster rate have more sensitivity to the radiation and are more damaged than cells that are not undergoing division. Endothelial cells in the arterioles and capillary beds are particularly sensitive to radiation.
- Hyperbaric oxygen therapy can enhance the antimicrobial activity of the immune system. However, this action is not the result of fluctuating carbon dioxide levels, and hyperbaric treatments have no significant effect on carbon dioxide. The pathophysiology of soft tissue radionecrosis does not include intrinsic bubble formation or human growth factor. Additionally, hyperbaric oxygen therapy is not known to stimulate human growth factors.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Hyperbaric Soft Tissue Radionecrosis



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**Question 64:** A 78-year-old male miner presents to the clinic with chronic cough and worsening breathlessness for the past 2 months. A chest radiograph is suggestive of a right upper lobe mass. A CT-guided biopsy yields a diagnosis of adenocarcinoma lung. Immunohistochemistry reveals an EGFR L858R mutation. He is given osimertinib. After six months of therapy, he presents to the clinic with lower backache without any signs of bladder involvement. An x-ray of the thoracolumbar spine reveals a compression fracture at the level of L2. His corrected serum calcium level is 8.5 mg/dL. He is planned for stereotactic radiotherapy to the spine. Which of the following is the next best step in the management of this patient?

**Choices:**

1. 3D conformal radiotherapy
2. Intensity-modulated radiotherapy
3. Cone-beam computed tomography
4. Stereotactic body radiotherapy

Answer: 2 - Intensity-modulated radiotherapy

## Explanations:

- The incidence of metastatic bone disease ranges from 17%-64% in lung cancer, 65%-75% in breast cancer, 65%-90% in prostate cancer, and 70%-95% in multiple myeloma. Locoregional approaches for symptomatic palliation of bone metastases include surgery and radiotherapy. Systemic approaches include the usage of inhibitors of bone resorption, radiopharmaceutical targeted agents, endocrine approaches, and chemotherapy.
- Stereotactic body radiotherapy has emerged as an important treatment modality for the delivery of conformal radiotherapy with a higher biologically effective dose to the spinal vertebrae and surrounding paraspinal tissue. SBRT uses many more multidirectional beams than conventional opposed field radiotherapy. SBRT also allows for a visual dissection of the tumor from the adjacent normal tissues.
- Usage of new beam shaping and image guidance technologies have ensured closer proximity to the tumor while allowing greater conformal allegiance to the three-dimensional tumor outline.
- The use of an interactive image-guided approach has been made possible by the use of a multitude of technological advances such as online cone-beam computed tomography (CBCT), dynamic multi-leaf collimators (DMLC), and rapid intensity-modulated beam delivery (IMRT). The rapid IMRT approach confines the radiation beam to the target tumor while promoting a rapid dose fall-off to surrounding normal tissues.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Palliative Radiation Therapy For Bone Metastases



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**Question 65:** A 16-year-old girl is being evaluated for upward gaze palsy. CT head revealed the presence of a pineal region tumor. The endoscopic third ventriculostomy (ETV) guided biopsy revealed large, epithelioid cells with abundant PAS+ cytoplasm admixed with mature lymphocytes. CSF cytology is negative. Which of the following is the best treatment strategy for this patient?

**Choices:**

1. Surgical resection
2. Craniospinal irradiation
3. Localized radiotherapy
4. Chemotherapy combined with ventricular radiotherapy

**Answer: 4** - Chemotherapy combined with ventricular radiotherapy

## Explanations:

- The presence of large, epithelioid cells with abundant PAS+ cytoplasm admixed with lymphocytes is characteristic of a germinoma. Germinoma accounts for more than 50% of lesions in the pineal region.
- Germinoma can be localized or disseminated. Localized pure germinoma is best treated with chemotherapy combined with reduced dose ventricular radiotherapy. Craniospinal irradiation is no longer recommended for localized disease.
- Germinomas have a very good response to radiation therapy and chemotherapy and are prognostically better than non-germinomatous lesions.
- Surgery is not indicated for germinoma. Localized radiotherapy is associated with a greater risk of relapse.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Germ Cell Seminoma



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**Question 66:** A 10-year-old boy undergoes magnetic resonance imaging (MRI) for an intracranial brain tumor. The tumor is situated within the posterior fossa, in the midline of the cerebellum. It has a large cystic component and avidly enhancing nodular mural. The nodule shows a high signal on T2 weighted imaging. He also has obstructive hydrocephalus. Histology shows low cellularity with long cellular processes. Which of the following roles does radiotherapy have in the treatment of these tumors?

**Choices:**

1. No role as these tumors is not sensitive to radiotherapy.
2. Not first-line as usually curative on surgical resection, however, it can be an additional treatment for unresectable components.
3. First-line treatment in order to avoid surgery in children.
4. Standard care is surgical resection followed by radiotherapy.



**Answer: 2** - Not first-line as usually curative on surgical resection, however, it can be an additional treatment for unresectable components.

## Explanations:

- Standard treatment of pilocytic astrocytoma is complete surgical resection alone, as these tumors are usually curative on resection.
- If some tumor remains due to the difficulty in resecting, then radiotherapy may have an additional role.
- Radiotherapy of the posterior fossa in this age group often carries neurological sequelae.
- Chemotherapy has no role in the management of pilocytic astrocytoma.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Pilocytic Astrocytoma



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**Question 67:** A 55-year-old male presents to the dental surgeon with complaints of a discharging lesion on his face and a bony projection in his oral cavity. He states that the lesions have been present for the past four weeks and are getting worse. He reports severe pain and foul-smelling breath associated with the lesions. He has completed two courses of oral antibiotics but has had little symptomatic relief. He had a history of squamous cell carcinoma of the oral cavity, which was treated with resection and postoperative radiotherapy two years ago. He recently had a wisdom tooth removed from the affected side. Examination reveals a discharging sinus on his right lower cheek. A bony projection is seen in the right retromolar area. He fails to respond with antibiotics and minor debridement. He is started on a regimen involving 90 minutes of sessions in a pressurized chamber. He is reviewed after 20 sessions and has achieved good symptom resolution. What beneficial mechanism is responsible for the improvement in this patient?

**Choices:**

1. Vascular proliferation
2. Osteoclast inhibition
3. Bacterial toxicity
4. Fibroblast involution

**Answer: 1** - Vascular proliferation

## Explanations:

- This patient has presented with a discharging sinus and a painfully bony projection into the oral cavity. His history of previous head and neck irradiation and history of recent dental extraction make the diagnosis of osteoradionecrosis of the mandible, which is a delayed complication of radiation treatment. Hyperbaric oxygen therapy (HBOT) is a useful modality in the treatment of osteoradionecrosis (ORN).
- The primary pathophysiology of ORN is hypoxic bone injury. The necrosis is aseptic and hypoxic. Previous radiation injury leads to an obliterative endarteritis which leads to tissue hypoxia. This tissue can develop necrosis after subsequent trauma or surgery. HBOT aims to improve vascularity and promote healing.
- HBOT leads to the induction of vascular endothelial growth factor (VEGF), which promotes angiogenesis. Increased capillary density then improves hypoxia and enhances tissue repair.
- HBOT also stimulates fibroblasts and increases collagen formation. Though HBOT does have a bactericidal action, ORN is a primarily hypoxic insult rather than secondary to bacterial infection.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Hyperbaric Treatment Of Delayed Radiation Injury



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**Question 68:** A 48-year-old man with a history of tuberous sclerosis presents to the outpatient clinic, complaining of bilateral flank discomfort. He has had discomfort for the past six weeks. Other than the discomfort, the patient does not have any other symptoms. His physical examination is within normal limits. A thorough blood workup including CBC, BMP, urinalysis, LFTs were performed, and these came out to be within normal limits. Renal ultrasound showed a hyperechoic mass. CT scan of the kidney, ureter, and bladder was ordered, which showed a hypoattenuating area. The patient was scheduled for a percutaneous renal biopsy, which confirmed the diagnosis. Which of the following is required for diagnosing the most likely tumor in this patient?

**Choices:**

1. This requires a CT density reading of less than 0
2. This requires a CT density reading of more than -10
3. This may require thin sectioning
4. It requires thin sectioning along with a CT density reading of -10

**Answer: 4** - It requires thin sectioning along with a CT density reading of -10

## Explanations:

- A negative Hounsfield unit (HU) less than 0 does not diagnose fat. The statistical spread of density readings of lesions follows a Bell curve. A lesion is called "water density" if it falls between 0 and +10.
- Fat is diagnosed if the HU is less than -10.
- Thin sections might be needed to get a more accurate density reading on the CT scan to guard against volume averaging artifact.
- With MRI, macroscopic fat is diagnosed by a bright signal on T1 and loss of signal on fat-saturation sequences.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Renal Angiomyolipoma



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**Question 69:** A 78-year-old woman is brought to the hospital with severe left-sided low backache. She was recently diagnosed with stage 4 breast cancer, including metastasis to the L4 vertebra. She has chosen palliative care and has been using hydromorphone and acetaminophen for pain; however, it has not been helpful for this episode. She is holding her back in pain. Vital signs are significant for a heart rate of 100/min. Which of the following is the next best step in the management of this patient?

**Choices:**

1. Therapeutic chemotherapy
2. Epidural analgesia
3. IV morphine
4. Palliative radiotherapy

Answer: 3 - IV morphine

## Explanations:

- The patient has presented with a painful spinal metastasis. Palliative radiotherapy is a suitable treatment for this patient but will take time to have an effect. Morphine should be started to relieve her pain.
- The precise mechanism of action of radiotherapy in the treatment of metastasis is not known. However, it is believed that it causes tumor shrinkage and decreased inflammation.
- Another appropriate treatment might be IV corticosteroids.
- Since the patient has chosen palliative care, therapeutic chemotherapy is an inappropriate choice. Epidural analgesia may be difficult to perform for this patient and associated with more complications. Since the patient has already received two doses of a strong opioid, adding morphine would not be appropriate or helpful.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Palliative Care



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**Question 70:** A 45-year-old man is diagnosed with Hodgkin lymphoma of the mediastinum and is referred to a radiation oncologist for treatment. The patient receives thoracic radiation therapy several times in conjunction with daunorubicin chemotherapy, and his lymphoma is eventually put into remission. Twenty years later, he presents to the emergency department with crushing, substernal chest pain of 20 minutes duration. He is found to have an anterior myocardial infarction and is sent to the cath lab, where his left anterior descending artery is found to be 99% stenosed. Which of the following best describes the pathophysiology of the damage that contributed to his coronary artery disease?

**Choices:**

1. Progressive myocardial fibrosis
2. Coronary artery vasospasm
3. Endothelial cell inflammation
4. Fibrosis of the valvular endothelium



**Answer: 3** - Endothelial cell inflammation

## Explanations:

- Mediastinal Hodgkin lymphoma can be treated with radiation therapy, which can result in cardiac side effects. Among these is the more severe or earlier presentation of coronary artery disease. This can lead to the acute coronary syndrome, including myocardial infarction.
- The pathophysiology of radiation-induced atherosclerosis is the same as it is in the general population. Radiation causes inflammatory damage to the coronary vascular endothelium, which leads to fibrin and lipid-laden macrophage deposition. This causes plaque to form and stenosis to develop. Should the plaque rupture and a thrombus forms, the acute coronary syndrome will occur.
- Coronary artery vasospasm is the mechanism behind variant (prinzmetal) angina, in which the coronary arteries transiently constrict and cause angina. This is not related to radiation damage.
- Myocardial fibrosis and valvular fibrosis are other long-term effects of radiation on the heart. Myocardial fibrosis leads to restrictive cardiomyopathy and eventual heart failure. Valvular damage can lead to both regurgitation or stenosis as the valvular tissue is damaged.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Therapy Induced Cardiac Toxicity



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**Question 71:** A 54-year-old male with no significant past medical history presents to the clinic complaining of dyspnea and wheezing for 10 months duration, which has gradually worsened. He has no smoking history or significant family history. He was previously prescribed bronchodilators, but they did not help. CT scan of the chest showed a mass at the right bronchial stem. The clinician suspects it is a primary malignant carcinoma. Which of the following is the commonest morphologic variant of the most likely diagnosis?

**Choices:**

1. Adenoid cystic carcinoma
2. Giant cell carcinoma
3. Squamous cell carcinoma
4. Adenocarcinoma

**Answer: 3** - Squamous cell carcinoma

### Explanations:

- Although the trachea is lined by tall columnar ciliated epithelial cells, approximately forty-five percent of primary tracheal carcinomas belong to the squamous cell variety.
- The squamous carcinomas appear to develop from the metaplastic epithelium.
- In the early stage, tracheal tumors can be cured with surgery. Radiation is offered to people who are not surgical candidates.
- Dyspnea is the first symptom, followed by a cough and hemoptysis. Unfortunately, there are non-specific symptoms, and in most cases, the diagnosis is delayed.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Tracheal Cancer



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**Question 72:** A 45-year-old male patient was given a diversion loop sigmoidostomy for obstructive rectal carcinoma and planned for neoadjuvant chemotherapy (CT) and radiotherapy (RT) before definitive tumor resection surgery. After 20 days, the patient came with complaints of the stoma having enlarged in size by 3 inches. The patient has no other complaints and is asymptomatic, but that this new symptom is only mildly disconcerting. What should be the next course of management of this patient?

**Choices:**

1. Reassure the patient and manage conservatively
2. Change the stoma to a diversion transverse colostomy
3. Stoma revision
4. Stop neo-adjuvant chemoradiation and plan for immediate tumor resection surgery

**Answer: 1** - Reassure the patient and manage conservatively

## Explanations:

- Stoma prolapse is a common complication after stoma creation and can have varied symptomatology based on the stoma, its perfusion, and the degree of prolapse.
- A small asymptomatic prolapse without signs of obstruction or necrosis may be managed conservatively with reassurance.
- A more considerable degree of prolapse, causing trouble for the patient, not fitting in the colostomy appliance or causing symptoms of stoma obstruction or necrosis, will need surgical management.
- Surgical management using a stapler device applied directly to the prolapsed stoma at the local stomal site is effective, reducing the need for laparotomy. If found gangrenous, laparotomy with stoma creation at a different site is the only option.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Colostomy Care



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**Question 73:** A 58-year-old woman is brought to the clinic with the chief complaints of memory loss and irritability for seven months. 'She struggles to find her way home from the store. We've been living here for five years,' he says. She has no history of alcohol intake, smoking, or drug abuse. She has a history of lymphoma with brain metastases for which she received radiotherapy, two years ago. On examination, the blood pressure is 130/82 mmHg, the pulse is 60/min, and the temperature is 37.2C (99F). An MRI reveals a "soap-bubble" enhancement on T1 weighted imaging, in the frontal lobe and hippocampus, on the right side. FDG-PET reveals a hypometabolic lesion in the left frontal and hippocampal regions. What is the most appropriate treatment?

### Choices:

1. Surgical resection
2. Whole-brain radiation therapy
3. Hyperbaric O2 therapy
4. Aspiration

Answer: 3 - Hyperbaric O2 therapy

## Explanations:

- Brain radiation necrosis is an infrequent complication of radiation therapy. Lesion biopsy ultimately may be necessary to determine whether it is radiation necrosis versus tumor recurrence. It is very important to establish the diagnosis of radiation necrosis versus tumor recurrence so that the appropriate therapy may be rendered to the patient.
- Hyperbaric oxygen (HBO2) promotes tissue healing by improved angiogenesis that results in better tissue perfusion. Hyperbaric oxygen therapy also can reduce tissue edema and enhance collagen synthesis by fibroblasts which activity is crucial for the healing of damaged tissue.
- Radiation necrosis is in part caused by a coagulative and ischemic process which leads to cellular death. This is, in essence, an ischemia-reperfusion injury phenomenon. HBO2 helps to restore normal cellular functions to aid the repair of the ischemic damaged tissue. It is important to note that the angiogenesis that occurs with hyperbaric oxygen therapy produces a vascular supply to the radiation damage tissue that is more robust than the telangiectasia that sometimes occurs as a part of the radiation necrosis.
- HBO2 usually is delivered at a dose of 2 to 2.4 atmospheres absolute for 90 to 120 minutes daily and may take 20 to 30 treatments before significant angiogenesis occurs with the improvement of the neurologic symptoms. Longitudinal studies have not shown any increased incidence of tumor recurrence or cancer growth associated with hyperbaric oxygen therapy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Hyperbaric Treatment Of Brain Radiation Necrosis



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**Question 74:** A 40-year-old woman is undergoing resection of stage II type B3 thymoma that involves the left ventricle. There is some residual disease that is unable to be removed from the left ventricle. What is the next step in the management of this patient?

**Choices:**

1. Adjuvant chemotherapy
2. Postoperative radiation
3. Bone marrow transplantation
4. Immunotherapy



Answer: 2 - Postoperative radiation

## Explanations:

- In patients who have stage II tumors with macroscopic invasion into mediastinal fat or pleura, radiation therapy can be administered postoperatively.
- Several studies have shown that people who undergo incomplete thymoma resection and do not receive postoperative radiation have a high incidence of recurrence.
- A large study from Memorial Sloan-Kettering Cancer Center showed that adjuvant radiation therapy did not reduce recurrence or improve survival in stage II and III disease. However, the current practice is to administer radiation if there is any evidence of residual tumor after resection.
- Studies show that people who benefit most from postoperative radiation following surgery are (1) female patients, (2) patients with early-stage thymoma, and (3) those who do undergo surgical removal of the thymoma.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Thymoma



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## Section 3

**Question 75:** A 13-year-old boy is brought to the emergency department with severe pain in his right leg. Pain has been intermittent and presents for the last 2 weeks. The patient was given ibuprofen at home without relief of pain. His mother says that he was playing outside with his sister but did not experience any trauma or injury. His pain was attributed to “growing pains,” as the patient is at an appropriate height and weight for his age. He has not had a fever, cough, vomiting, or rash. The physical exam is significant for a firm, tender swelling of the right thigh. The radiograph of the right leg shows a multilayered periosteal reaction with an “onion peel” appearance. CT guided biopsy from the mass was done, and it showed sheets of round to oval cells with scant cytoplasm and hyperchromatic nuclei. He was treated with chemotherapy and limb-sparing surgery. His chemotherapy regimen included cyclophosphamide, doxorubicin, and vincristine with alternating cycles of ifosfamide and etoposide. In his health supervision visit in the near future, which of the following is the most appropriate periodic test for him in addition to age-appropriate health counseling, immunizations, and screening?

### Choices:

1. Bone marrow biopsy
2. Echocardiography
3. Urinalysis with cystoscopy
4. Nerve conduction study

Answer: 2 - Echocardiography

## Explanations:

- Treatment with doxorubicin can be complicated by cardiomyopathy in a dose-dependent manner and it can manifest many years after the treatment.
- Patients may require heart transplants due to anthracycline associated cardiac failure.
- Periodic screening with echocardiography is recommended in patients who received anthracycline.
- Patients should be screened with a physical examination and history on regular visits. After disease control, regular surveillance should be implemented that includes a physical exam, MRI with or without CT (both with contrast) of the primary site and chest after 24 months and annually after five years based on national comprehensive cancer network (NCCN) guideline (category 2B). Periodic screening with bone marrow biopsy is not recommended. Cyclophosphamide and ifosfamide are well-known causes of hemorrhagic cystitis. However, patients with gross hematuria and or cystitis should be evaluated further with urine studies.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Ewing Sarcoma



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**Question 76:** A 78-year-old male presents for his regular follow up of his radiation-induced coronary artery disease. He has had multiple procedures in the past including drug-eluting stent and 3 vessel CABG. He is on goal-directed medical therapy and reports compliance with the medical regimen. He has no complaints today. He is doing well. No recent anginal symptoms. There are no signs of dementia. What was the initial radiation injury that leads to a cascade of events that lead to his disease?

**Choices:**

1. Plaque formation
2. Effacement of the tunica intima of the coronary arteries
3. Clot formation
4. Inflammation

**Answer: 2** - Effacement of the tunica intima of the coronary arteries

### Explanations:

- In hours after radiation exposure, the endothelium becomes effaced.
- Inflammation follows the initial insult of endothelial damage.
- Clot formation develops as hemostatic factors are released leading to hypercoagulability.
- Plaque formation occurs years after radiation exposure.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Radiation Induced Coronary Artery Disease



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**Question 77:** A 70-year-old male presents to the emergency department with complaints of weakness and hematuria. He states that he has been experiencing multiple episodes of bloody urine for the past few days. The urine is reddish and is associated with the passage of clots. He also complains of suprapubic discomfort and urinary urgency. He has a history of prostate cancer for which he had a radical prostatectomy 3 years ago. He received multiple cycles of external beam radiation therapy post-surgery. He has been asymptomatic previously and his prostatic specific antigen levels were undetectable 6 months ago. His urine examination reveals numerous red blood cells. His urine culture is negative. Cystoscopy performed after bladder irrigation reveals diffuse mucosal erythema and numerous telangiectasia. Urine cytology fails to demonstrate the presence of any suspicious or atypical cells. He fails to respond to a regimen of oral agents and bladder irrigation. He is treated with multiple cycles of high concentration oxygen at 2.5 atm. A repeat cystoscopy after the completion of these treatments shows significant resolution of the mucosal lesions, hematuria, and his urinary symptoms. Stimulation of which of the following factors has contributed to improvement in the patient's symptoms?

**Choices:**

1. Extracellular matrix alterations
2. Submucosal fibrosis
3. Fibroblast proliferation
4. Neutrophilic infiltration

**Answer: 3** - Fibroblast proliferation

## Explanations:

- This patient has a history of prostate cancer managed by surgical resection and radiotherapy. The patient has presented with urinary urgency and hematuria. Evaluation reveals sterile, gross hematuria and mucosal erythema on cystoscopy. The most likely diagnosis is radiation-induced cystitis. Hyperbaric oxygen therapy (HBOT) is a useful modality in the treatment of radiation cystitis that is refractory to other treatments.
- HBOT increases oxygen tension in the wound and stimulates fibroblasts. Activated fibroblasts increase the synthesis of ground substance and collagen, promoting wound healing.
- Oxygen is essential for the hydroxylation of proline and lysine residues in collagen. This improves the cross-linking and formation of mature collagen. Healing of mucosal lesions is seen upon successful completion of therapy.
- HBOT also promotes angiogenesis, which helps to counteract radiation-induced cellular hypoxia. It has immunomodulatory effects and generally decreases inflammation. Chronic radiation cystitis is associated with submucosal fibrosis and small bladder volumes.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Cystitis And Hyperbaric Management



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**Question 78:** A 28-year-old male presents with progressive weakness of the lower limbs. His past medical history includes the excision of an ependymoma two years ago. He has been receiving radiotherapy postoperatively, and follow-up neuroimaging has shown no disease recurrence. For his new symptoms, magnetic resonance imaging (MRI) of the head, neck, and back is performed, which is negative for tumor recurrence, stenosis, or any new lesions. He is commenced on therapy for the likely cause of his symptoms. Which of the following is a complication of this therapy?

**Choices:**

1. Obesity and weight gain
2. Hypoglycemia
3. Acute kidney injury
4. Worsening headaches



**Answer: 1** - Obesity and weight gain

## Explanations:

- The patient is complaining of weakness following radiotherapy, and he may, therefore, be suffering from progressive myelopathy as a long-term side effect of radiotherapy. Experimental studies show the improvement of symptoms with glucocorticoids. Therefore the most widely used therapy is corticosteroids.
- One of the major side effects of glucocorticoids is obesity and weight gain, which is even more predominant in patients with myelopathy due to a decrease in physical activity.
- Glucocorticoids can cause bones to be more fragile due to osteoporosis. It is advisable to check a bone densitometry scan in any patient receiving steroids every six months to monitor bone density and receive calcium and Vitamin D supplementation.
- Worsening headaches would be seen in tumor recurrence, but this patient's MRI is negative for any new masses.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Adverse Effects Of Radiation Therapy



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**Question 79:** A 7-year-old boy is brought to the hospital by his mother. She complains that he has been having excessive thirst and urination for the past three weeks. Previously she thought that it was because of the change of weather, but now it is becoming too frequent. Of note in clinical history is that he had had previous cranial radiation due to a malignant tumor. His urine dipstick is negative for glucose, his calcium is 2.3 mmol/l (2.15- 2.55 mmol/L), and potassium is 4 mmol/L (3.5-5.3 mmol/L). Serum sodium result is 148 mmol/L (135-145 mmol/L) and serum osmolality is 300 mosm/kg (285- 295 mosm/kg). Which of the following is the next best diagnostic step?

**Choices:**

1. Growth hormone provocative testing with arginine and glucagon
2. Synacthen test
3. Insulin tolerance test
4. Water deprivation test

**Answer: 4** - Water deprivation test

## Explanations:

- Given the clinical history and exclusion of other common causes of polyuria and polydipsia including normal calcium, potassium, and negative urine dipstick for glucose, the patient is likely to have antidiuretic hormone deficiency and diabetes insipidus.
- The initial evaluation is the water deprivation test. ACTH stimulation test and triple bolus test are used for anterior pituitary function.
- Irradiation may have affected growth hormone secretion, however, there is no complaint regarding short stature.
- Pituitary pathology is a complication of childhood cranial irradiation.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Hypopituitarism



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**Question 80:** A 52-year-old female presents for followup after she underwent a unilateral left skin-sparing mastectomy and immediate autologous left breast reconstruction with DIEP free flap. The procedure was performed four months ago. She has two weeks of adjuvant chemotherapy to go. She requests nipple-areolar reconstruction on the left side. What is the most appropriate response?

**Choices:**

1. Nipple-areolar reconstruction cannot be performed at any time
2. Nipple-areolar reconstruction cannot be performed now because it is too soon after autologous reconstruction
3. Nipple-areolar reconstruction can be performed immediately
4. Nipple-areolar reconstruction can be performed once chemotherapy is complete

**Answer: 4** - Nipple-areolar reconstruction can be performed once chemotherapy is complete

### Explanations:

- Nipple-areolar reconstruction is deferred until adjuvant chemotherapy and radiation are complete. Likewise, nipple-areolar complex reconstruction is performed three months following autologous breast reconstruction (or permanent implant placement) to allow for a stable breast mound.
- Likewise, nipple-areolar complex reconstruction is performed three months following autologous breast reconstruction (or permanent implant placement) to allow for a stable breast mound.
- All breast reconstruction patients without a nipple-areolar complex should be offered nipple-areolar complex reconstruction if desired. There are proven benefits to having the nipple-areolar complex reconstructed.
- As the patient has not yet completed chemotherapy, nipple-areolar complex reconstruction should be delayed until then.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

#### Nipple Areola Reconstruction



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**Question 81:** A 63-year-old patient presented with a palpable mass in her right breast. The diagnostic mammogram showed a spiculated mass measuring 1.7 cm. Ultrasound demonstrated a hypoechoic mass measuring 1.8 cm x 1.1 cm x 0.9 cm. Biopsy revealed a well-differentiated mucinous carcinoma that was ER/PR positive and HER2/neu negative. Lumpectomy and sentinel node biopsy revealed 1.8 cm mucinous carcinoma with widely negative margins. No associated ductal carcinoma in situ or lymphovascular invasion was noted. Two sentinel nodes were negative. The oncotype score was 3. What is the treatment recommendation?

**Choices:**

1. Radiation therapy to the breast and endocrine therapy
2. Radiation therapy to the breast and nodes and endocrine therapy
3. Chemotherapy, then radiation therapy to the breast
4. Mastectomy and endocrine therapy

**Answer: 1** - Radiation therapy to the breast and endocrine therapy

## Explanations:

- Radiation therapy is recommended in the post-lumpectomy setting to decrease the risk of local recurrence.
- Whole breast radiotherapy can be delivered in a conventional fractionation schedule over 6 to 7 weeks or a hypofractionation schedule over 3 to 4 weeks.
- Hypofractionation is an option for low risk, node-negative patients with breast cancer who are 50 years or older, not getting chemotherapy, and have a separation of 25 cm or less.
- Endocrine therapy, such as anastrozole, is recommended in patients with hormone receptor-positive disease.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Radiation Therapy For Early Stage Breast Cancer



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**Question 82:** A 58-year-old woman with a past medical history of asthma presents to the hospital with a complaint of fatigue and abdominal pain. The initial workup includes a CT of the abdomen and pelvis with intravenous contrast. The scan reveals a short segment of focal wall thickening with luminal stenosis in the descending colon. Also noted are several masses in the liver. Colonoscopy with biopsy reveals colorectal adenocarcinoma. Further workup with gadolinium-enhanced MRI of the abdomen reveals multiple lesions, consistent with colorectal metastasis to the liver, measuring 1 cm, 2.5 cm, 3.5 cm, 4.5 cm, and 5 cm, respectively. Laboratory analysis reveals mild elevation of liver function tests but no frank liver failure. Her ECOG score is 0. The patient undergoes partial colectomy for resection of her primary tumor. During a follow-up visit, percutaneous radiofrequency ablation of her liver disease is recommended because she is not a surgical candidate. Which of the following aspects of the patient's disease best precludes her from surgical resection?

**Choices:**

1. The type of primary cancer
2. The number of metastatic lesions
3. The size of the metastatic lesions
4. The patient's ECOG score



**Answer: 3** - The size of the metastatic lesions

## Explanations:

- Percutaneous RFA is a tumor treatment method typically performed by an experienced interventional radiologist.
- Percutaneous RFA is a reliable primary treatment for small hepatic tumors (a single tumor measuring 5 cm or less in diameter; 3 or fewer tumors, each measuring 3 cm or less in diameter).
- Percutaneous RFA is indicated for the treatment of primary hepatocellular carcinoma as well as metastases from colorectal, breast, thyroid, and neuroendocrine cancers.
- RFA is indicated for patients with an Eastern Cooperative Oncology Group (ECOG) performance status of 0, which indicates a patient is fully functional without any performance restrictions.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

[Percutaneous Radiofrequency Ablation Of Liver Tumors](#)



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**Question 83:** A 65-year-old male patient underwent excision for a high-grade glioma followed by six months of radiation therapy. Follow-up MRI imaging three months later showed evidence of a single fluid-attenuated inverse recovery (FLAIR), suppressed and enhancing 1.5 cm lesion within the operated site. The MR spectroscopy showed low N-acetyl aspartate (NAA)/choline peak. What is the ideal management plan for the patient?

**Choices:**

1. Biopsy
2. Radiation therapy
3. Chemotherapy
4. Conservative management

**Answer: 4** - Conservative management

## Explanations:

- One of the complications of radiation therapy includes radiation necrosis within the irradiated site that can masquerade as tumor recurrence.
- Tumor necrosis will be seen as a fluid-attenuated inverse recovery (FLAIR) suppressed and enhancing lesion within the irradiated zone.
- It will have a characteristic low NAA/choline ratio in MR spectroscopy. They are benign and do not require any intervention.
- Biopsy, repeat radiation, or chemotherapy is justified only in cases of tumor recurrence. Tumor recurrence will have a choline peak in MR spectroscopy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Adverse Effects Of Radiation Therapy



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**Question 84:** A 38-year-old man is hospitalized with a 4-week history of progressive dyspnea on exertion, intermittent fever, night sweats, and cough. The patient works as an engineer in a garment factory. The patient's vitals are stable. Physical examination reveals facial edema and venous distention of her chest wall. Her neurological exam is within normal limits. Lab values include hemoglobin level of 11 mg/dl, lactate dehydrogenase level of 667 U/L, and platelet count of 170,000 per mm<sup>3</sup>. A CT scan of chest, abdomen, and pelvis reveals a 12 by 10 cm mediastinal mass compressing the superior vena cava. There is no evidence of tracheal compression or the presence of any thrombus. Which of the following next step is most appropriate in this case?

**Choices:**

1. Irradiate the mediastinal mass
2. Perform core needle biopsy of mediastinal mass
3. Put a stent in superior vena cava
4. Perform a PET scan

**Answer: 2** - Perform core needle biopsy of mediastinal mass

## Explanations:

- The first step in managing a patient with SVC syndrome who is hemodynamically stable and has a mediastinal mass is to get a tissue biopsy with a needle.
- Superior vena cava (SVC) syndrome is most common with right-sided tumors due to the anatomic location of the SVC. This patient with a large mediastinal mass, an increased lactate dehydrogenase levels, and B symptoms ( night sweats, fever, and cough ) indicate a large B-cell lymphoma. Accurate tissue diagnosis is essential before therapy is initiated.
- The majority of SVC syndromes are the result of mediastinal malignancies, primary small cell bronchogenic carcinoma. The second most commonly associated malignancy is non-Hodgkin lymphomas, followed by metastatic tumors.
- SVC syndrome is most commonly seen secondary to malignancy, although, with the increasing use of intravenous indwelling catheters, there has been a more recent rise in benign etiologies. The resulting venous congestion produces a clinical scenario relating to increased upper body venous pressures.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Superior Vena Cava Syndrome



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**Question 85:** A 60-year-old gentleman presents with severe hematochezia. He has a history of prostate cancer at the age of 51 and received radiation therapy as definitive treatment. His prostate cancer remains in remission. On anoscopy, you see a large amount of bright red blood in the rectum with clots. He stabilizes with 2 units of packed red blood cells. What is the next best step?

**Choices:**

1. Proctectomy
2. Sucralfate enemas
3. Formalin administration
4. Colonoscopy with argon beam

**Answer: 4** - Colonoscopy with argon beam

## Explanations:

- Severe bleeding due to radiation proctitis is uncommon and can be challenging to manage. There are nonoperative techniques that should be attempted before considering a proctectomy.
- Argon plasma coagulation is extremely effective in controlling radiation proctitis with associated hemorrhage.
- Care should be taken to avoid “painting” the rectal mucosa to minimize ulceration. It is suggested to treat individual telangiectasias.
- Formalin therapy and sucralfate enemas would not be useful in massive bleeding requiring blood products.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Proctitis



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**Question 86:** A 32-year-old primigravid woman with 8 weeks of gestation presents to the clinic for a recent abnormal pap smear exhibiting squamous cell atypia. The patient reports no abnormal bleeding, discharge, or pain. Her records show that on pelvic examination, a 1.5-cm cervical mass was seen on the posterior lip of the cervix. On the rectovaginal examination, both parametria and posterior fornix appear to be clear of any abnormal growth. Cervical lesion biopsy reveals a poorly differentiated adenosquamous cervical carcinoma. MRI of the abdomen and pelvis exhibits a 3.6-cm lesion, limited to the cervix, without parametrial invasion, lymphadenopathy, or hydronephrosis. The patient is diagnosed with cervical carcinoma of stage IB1, according to FIGO classification. Her eggs have been cryopreserved. Which of the following is the next best step in the management of this patient?

**Choices:**

1. Conical biopsy after the first trimester and intensity-modulated radiation therapy (IMRT) irrespective of gestational age
2. External beam cervical irradiation now and neo-adjuvant chemotherapy after 12th week
3. Radical hysterectomy and intensity-modulated radiation therapy (IMRT)
4. Pelvic lymph node dissection and conical biopsy now and Intensity-modulated radiation therapy (IMRT) in the third trimester



**Answer: 3** - Radical hysterectomy and intensity-modulated radiation therapy (IMRT)

## Explanations:

- Gynecologic cancers are especially more challenging as most of them inadvertently causes either a spontaneous abortion of a fetus due to either radical surgeries or irradiation. It's vital to be aware of patients' wishes to terminate the pregnancy or not. If she wants to continue the pregnancy, the best policy is to be observant of significant tumor progression until fetal maturity is reached and then deliver by C-section. If the progression of the disease is rapid, and the fetus is below maturity, especially if in the first trimester, abortion is required to administer either surgery or radiation.
- Irradiation or radical operative procedures will most likely make the patient infertile hence cryo-preservation is advised to have offsprings later. Fertility preserving surgeries like trachelectomy can be advised, but it will lead to abortion in 1/3rd of cases, and the prognosis is poor in such cases. Unfortunately, all pregnancies require a high dose of radiation, leading to fetal abnormalities. In grade IB1, the recommended treatment is when fertility preservation isn't concerned, are- radical hysterectomy, and EBRT with chemo. Since heavy doses of EBRT and radical Hysterectomy will eventually lead to pregnancy loss, cryopreservation is recommended.
- Chemotherapy has shown no substantial implications on fetus growth parameters, irrespective of fetal age. Hence, it should be the first line of therapy while surgical or radiotherapeutic regimens are awaited. However, only chemo-monotherapy isn't recommended in IB1 cervical cancer due to the aggressive nature of the disease.
- When irradiation is done before 12 weeks, i.e., in the first trimester, there is a high probability of having fetal malformations as it corresponds with the stage of fetal organogenesis. Hence when indicated, RT should be performed in the 2nd-3rd trimester with adequate shielding.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Effects On The Fetus



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**Question 87:** A 65-year-old male patient presents to the hospital with unilateral hearing loss. He works at the airport. He noted symptoms to be progressive for the past three months. He initially thought that the right side of his earphones was not working properly, but noticed that when answering the phone, he can only hear garbled words in his right ear. He has no known medical illnesses. He smokes half a pack of cigarettes a day and drinks occasionally. On examination, vital signs are normal. The cranial nerve exam is unremarkable except that Weber exam lateralizes to the left and bone conduction (BC) is better than air conduction (AC) on the right. The motor and sensory examinations are normal. A head MRI with contrast reveals a 1.1 cm enhancing lesion on the right vestibular nerve and a 0.5 cm enhancing lesion on the left vestibular nerve. Which of the following chromosomes is likely to be involved in this patient?

**Choices:**

1. Chromosome 9 and 12 translocation
2. Chromosome 17 duplication
3. Chromosome 22q12.2
4. Chromosome 15q11-q13

**Answer: 3** - Chromosome 22q12.2

## Explanations:

- One disorder commonly associated with bilateral acoustic tumors in neurofibromatosis type II. It is inherited through an autosomal dominant pattern.
- It is caused by mutation at chromosome 22q12.2 inactivating the NF2 gene.
- Most patients with neurofibromatosis type II present late with acoustic neuromas. These slow-growing tumors typically appear in the fifth to seventh decade of life.
- The diagnosis of an acoustic neuroma is made with a contrast magnetic resonance imaging (MRI) or a computed tomogram scan. Contrast is essential; otherwise, the non-enhanced scan can miss small tumors.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Acoustic Neuroma



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**Question 88:** A 45-year-old woman presents to the clinician with concerns that her face is getting "bigger" and "rounder" despite the fact that she is exercising regularly and restricts her diet. She also complains of fatigue and acne problems. On physical examination, her blood pressure is 159//101 mmHg, the pulse is 87 beats per minute, respirations are 17 breaths per minute, and the temperature is 98 degrees Fahrenheit. Further examination reveals facial hair, central obesity, and purple abdominal striae. She is sent to the lab for blood workup. Six days later she follows up with 24-hour urinary cortisol elevated, and suppressed cortisol with high-dose but not low-dose dexamethasone. Her plasma ACTH level is 4 pg/ml (reference value >10 pg/ml), and a computer tomography (CT) with contrast that shows an adrenal mass of 6 cm unenhanced attenuation value of 30 Hounsfield units (HUs) with heterogeneous contrast medium uptake in central areas. Which of the following is the most probable diagnosis?

**Choices:**

1. Pituitary adenoma
2. Adrenal hyperplasia
3. Adrenocortical adenoma
4. Adrenocortical carcinoma

**Answer: 4** - Adrenocortical carcinoma

## Explanations:

- This case presents a patient with Cushing syndrome produced by an adrenal tumor because the patient has abnormal overnight dexamethasone suppression test, high 24-hour urine free cortisol, a low level of adrenocorticotropic hormone (ACTH), and a computer tomography that confirms an adrenal mass.
- The objective of this case is to confirm if the adrenal tumor is benign or malignant because it has characteristics of a malignant tumor including a diameter of 6 cm, and unenhanced attenuation value of 30 (HU) with heterogeneous contrast medium uptake due to central areas that represent necrosis.
- Presence of primary adrenal malignancy is more related to mass size, as adrenocortical carcinoma represents 2% of all tumors equal to 4 cm in diameter, 6% of tumors with size between 4.1-6 cm and 25% of the tumors greater than 6 cm. On the other hand, benign adenomas comprise 65% of masses less than 4 cm and 18% of masses greater than 6 cm.
- Many studies have established a threshold of less than ten or equal Hounsfield unit (HU) in unenhanced CT for the diagnosis of a benign lesion.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Adrenal Cancer



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**Question 89:** A 65-year-old man with a family history of malignancy presents with bilateral leg swelling progressively worsening over the last six months and shoulder pain. He has a smoking history of 30 pack years. He also has complaints of anorexia, but he denies any chest pain or dyspnea. His blood pressure is 88/40 mmHg, heart rate is 110 beats/min, and respiration rate 28 breaths/min. The physical examination reveals bilateral lower limb swelling and tenderness. The patient has undergone a chest CT scan. What could be the most likely finding on the CT scan?

**Choices:**

1. Ground glass opacity
2. Normal CT scan
3. Subdiaphragmatic mass
4. Honeycomb appearance

**Answer: 3** - Subdiaphragmatic mass

### Explanations:

- The history and physical examination suggest that the patient has most likely inferior vena cava syndrome (IVCS).
- The etiology of this condition is most commonly a tumor obstruction.
- The supradiaphragmatic mass is a rare cause of IVCS.
- The mass irritates the phrenic nerve and results in referred shoulder pain.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Inferior Vena Cava Syndrome



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**Question 90:** A 72-year-old male presents to the emergency department with sudden onset seizure and confusion. For the past two weeks, he had multiple falls at home and noticed that his left leg was weaker. Past medical history includes diabetes and lung cancer. He smoked 1 pack of cigarettes per day since he was 20 and stopped seven years ago. On initial examination, he was drowsy and disoriented but able to follow commands. There were no cranial nerve deficits. Cervical lymph nodes are palpated on the neck. Manual muscle testing shows 4/5 power on the left upper and lower extremity, 5/5 on the right upper and lower extremity. There are no sensory deficits. Babinski was positive bilaterally. A CT scan was requested and was unremarkable. Cerebrospinal fluid analysis reveals mild pleocytosis, elevated protein, and normal glucose, CSF cytology revealed malignant cells. An MRI with contrast was requested, which of the following are the expected findings?

### Choices:

1. A lesion with thick, irregular margins that may enhance, central necrosis and may have an intralesional hemorrhage
2. A lesion with characteristic "concentric target sign" and perilesional edema
3. A lesion that is homogeneously enhancing, may exhibit subependymal extension and may cross the corpus callosum
4. A lesion on the leptomeninges that is enhancing, hydrocephalus, subependymal nodules/deposits, cisterns, and on the tentorium



**Answer: 4** - A lesion on the leptomeninges that is enhancing, hydrocephalus, subependymal nodules/deposits, cisterns, and on the tentorium

## Explanations:

- Leptomeningeal carcinomatosis is a late-stage and metastatic complication of various cancer types, it is classified as stage IV disease.
- Breast and lung cancer and melanoma are the most common cancer types known to cause leptomeningeal involvement.
- Diagnosis requires at least a high-quality MRI with contrast and lumbar puncture with cerebrospinal fluid studies. Rarely, it may be a presenting symptom of systemic cancer.
- Given the metastatic nature of the disease, the prognosis of leptomeningeal carcinomatosis is very poor.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Leptomeningeal Carcinomatosis



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**Question 91:** A 46-year-old woman with an H3F3A gene mutation had a curettage specimen obtained from the right distal femur epiphysis 1 year earlier. The patient just underwent a simple curettage with a bone graft and refused radiotherapy or any adjuvant treatment. What is the most likely recurrence rate for the primary tumor with this treatment approach?

**Choices:**

1. Under 10%
2. 35%
3. 70%
4. Almost 100%

Answer: 2 - 35%

## Explanations:

- Mutations within the H3F3A gene can distinguish giant cell tumor (GCT) from other entities, as they are identified in up to 96% of cases.
- A simple curettage with or without a bone graft has a recurrence rate between 27-55%.
- Many surgeons choose to replace bone graft packing of the lesion with PMMA packing due to this high recurrence rate.
- Adjuvant treatments (e.g., liquid nitrogen, phenol, and argon beam coagulation, offers an excellent recurrence-free survival, especially when paired with an intralesional curettage.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Giant Cell Tumor



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**Question 92:** A patient presents with a 3-cm adenocarcinoma in the left upper lobe. A head CT scan reveals a 2-cm mass in the parietal lobe. Additional work up for metastatic disease is negative. What is the management of this patient?

**Choices:**

1. Simultaneous radiation to the lung and cranial lesion
2. Craniotomy followed by a lobectomy
3. Lobectomy followed by a craniotomy
4. Chemotherapy and radiation therapy

**Answer: 2** - Craniotomy followed by a lobectomy

## Explanations:

- This is one scenario where metastatic disease is resected. Trials have shown that patients with adenocarcinoma and a single brain metastatic lesion can undergo craniotomy followed by a lobectomy.
- When a brain lesion is detected first, and a search for a primary lesion is negative, resection of the cranial lesion is the therapy of choice. When a brain lesion presents subsequent to a lung resection for cancer and there is not recurrence, resection of the cranial lesion is performed.
- When the brain and lung lesions are detected simultaneously and both are resectable, a craniotomy is performed first followed by a thoracotomy.
- If either the lung or cranial lesion is suspected to be unresectable, surgical therapy is directed first to the resectable lesion. Otherwise therapy by non-surgical means is recommended. This has prolonged survival.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Adenocarcinoma



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**Question 93:** A patient is referred to after cholecystectomy as the pathological report showed the incidental finding of gallbladder cancer. The full evaluation shows T2N1M0. Which of the following is not considered an adjuvant option by the current National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology?

**Choices:**

1. Chemotherapy alone for six months with single-agent gemcitabine or leucovorin-modulated 5-fluorouracil (5-FU)
2. Chemoradiation for four cycles of capecitabine plus gemcitabine followed by concurrent radiation therapy plus oral capecitabine
3. Concurrent radiotherapy plus infusional 5-FU
4. Observation

Answer: 4 - Observation

## Explanations:

- Published in the ESPAC-3 Trial with median overall survival for chemotherapy with gemcitabine or leucovorin-modulated 5- fluorouracil being 43.1 months versus 35.2 months in the observation group. This is not statistically significant.
- It was published in a single-arm SWOG-S0809 Trial with an expected mean overall survival of 35 months without a comparison group.
- This is based on adjuvant chemoradiation therapy from other gastrointestinal malignancy extrapolation data.
- Adjuvant therapy should be considered for patients with resected high-risk gallbladder cancer stage T2 or higher, lymph node, and/or margin-positive benefit confirmed median overall survival extension on meta-analysis.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Gallbladder Cancer



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**Question 94:** A 68-year-old man with a history of oral cancer status-post radiation therapy up to 6000 cGy presents to the clinic for follow up. His treatment was completed 2 years ago. Over the past 2 months, the patient has had increasing pain in his left lower jaw. Oral examination shows exposed necrotic bone in his left lower mandible. What is the most appropriate management strategy for this patient?

**Choices:**

1. Hyperbaric oxygen therapy, surgical debridement, and antimicrobial therapy
2. Hyperbaric oxygen therapy and antimicrobial therapy
3. Hyperbaric oxygen therapy and surgical debridement
4. Surgical debridement and antimicrobial therapy



**Answer: 1** - Hyperbaric oxygen therapy, surgical debridement, and antimicrobial therapy

## Explanations:

- Hyperbaric oxygen therapy is helpful in treating soft tissue radionecrosis by the improved oxygenation of the damaged tissue transiently during the treatment. After 20 to 30 treatments, angiogenesis is stimulated with the formation of new capillary beds and granulation tissue that has a more robust blood supply for wound healing.
- Hyperbaric oxygen therapy is most beneficial when used in combination with a good surgical technique which has been demonstrated by the extensive work done by Dr. Marx on osteoradionecrosis of the mandible and the development of the Marx protocol.
- Dr. Marx demonstrated the benefit of treating the patient with initial 20 to 30 hyperbaric oxygen treatments before reconstructive surgery or bone debridement of the jaw, with additional ten treatments to help the post-surgical tissue and grafts to heal with robust angiogenesis.
- It is important to treat the patient with soft tissue radionecrosis from an interprofessional approach with the hyperbaric oxygen therapy not done as isolated treatments, but in conjunction with adequate, timely surgical debridement, antimicrobial therapy for infection, and adequate nutrition.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Hyperbaric Soft Tissue Radionecrosis



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**Question 95:** There has been an explosion at a local nuclear power plant. A moderate amount of radiation exposure is reported and your hospital is receiving patients soon after. After proper decontamination, the patients are assigned to different treatment areas. Your patient is a 25-year-old male with shrapnel wounds to his trunk and abdomen. The initial ultrasound FAST exam is negative for blood in the abdomen. You are concerned about a deeper puncture wound near the umbilicus and discuss the exploration of the area in the operating room with the surgeons. They want to observe overnight given the negative FAST and urine analysis. Why is it not advised to delay the procedure?

**Choices:**

1. FAST examination is not reliable to detect blood in the abdomen
2. The cosmetic result of the wounds will be worse if you wait
3. Surgical exploration related to radiation exposure has a limited time window
4. Radiation pneumonitis

**Answer: 3** - Surgical exploration related to radiation exposure has a limited time window

## Explanations:

- Ultrasound FAST examinations have a sensitivity of 75-100 % in detecting free fluid in the abdomen.
- The cosmetic results of the wound will not be impaired with waiting 8-12 hours.
- Surgical exploration and repair is best done as soon as possible. The patient may have a decreased ability to fight infection as a result of their radiation exposure. White cells can decrease dramatically over the first few days of a moderate exposure.
- Radiation pneumonitis is an uncommon presentation after the exposure and it is unlikely to occur overnight.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Syndrome



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**Question 96:** The mother of an 8-year old boy comes to your clinic seeking information on a recent diagnosis of medulloblastoma. At diagnosis, the tumor was located within the posterior fossa, growing within the vermis of the cerebellum and invading the fourth ventricle. The neurosurgeons reported a well-tolerated surgery with near-total resection of the tumor, although she reported a post-operative residual tumor margin of 0.5 cm by MRI. His oncologist just called today with results of subgrouping and cytogenetics, stating that her child has a group 3 tumor with myc amplification. Which of these tumor characteristics predicts a high-risk stratification?

**Choices:**

1. Posterior fossa location of the tumor growing within the vermis of the cerebellum and invading the fourth ventricle
2. Age of the patient over four and less than 21 years at the time of the diagnosis with near-total resection of the tumor
3. Subgrouping into group 3 medulloblastoma with high myc expression
4. Postoperative residual tumor less than 1.5 cm by MRI without any evidence of dissemination

**Answer: 3** - Subgrouping into group 3 medulloblastoma with high myc expression

## Explanations:

- Patients with medulloblastoma are traditionally risk stratified into average-risk or high-risk groups based on age at diagnosis, the extent of postoperative residual disease, and degree of tumor metastasis at diagnosis.
- Average risk patients at the time of diagnosis are older than three years of age, have no disseminated tumor, and have near-complete tumor resection with less than 1.5 cm postoperative disease burden by MRI.
- Factors associated with poor outcome in medulloblastoma (high-risk stratification) include age less than three years old, disseminated tumor, and incomplete tumor resection with greater than 1.5 cm postoperative disease burden by MRI.
- This risk stratification has been further augmented by medulloblastoma subgrouping into as many as 11 subgroups using methylation profiling, cytogenetic aberrations, copy-number variation, and clinical outcomes. The worst prognosis befalls patients with group 3 MB with high myc expression.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Medulloblastoma



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**Question 97:** A 33-year-old man with a mediastinal seminoma measuring 7.2 cm was treated with chemotherapy and radiation. He is currently asymptomatic but smokes tobacco. He reports smoking one pack per day for the last seven years. On a follow up computed tomography (CT) scan, he has a 3.5 cm mass in the anterior mediastinum. He reports no associated symptoms and reports he feels much better since he stopped his chemotherapy regimen. What is the most appropriate way to manage the residual mass found on the CT scan?

**Choices:**

1. Follow-up in one years time to assess symptoms and progression
2. Administer a second round of chemotherapy
3. Administer a second round of radiotherapy to the mass
4. Obtain an open biopsy for tissue diagnosis

**Answer: 4** - Obtain an open biopsy for tissue diagnosis

## Explanations:

- After patients undergo treatment of their mediastinal seminoma, it is not uncommon to have a residual mass. The residual mass is not always cancer.
- The remaining mass may be a fibrotic scar, a desmoplastic reaction, or an area of necrosis.
- After treatment, residual masses in the mediastinum are usually monitored with serial CT scans if less than 3 cm in size. Masses larger than 3cm may contain residual disease in up to 30% of patients. If the mass is larger than 3cm, an open biopsy should be obtained instead of getting serial CT scans versus a positron emission tomography scan. Before starting any more chemotherapy or radiation, a tissue biopsy should be taken to determine if the mass is cancer.
- The residual mass should be further examined since it is larger than 3cm in size; this can harbor malignancy. Follow-up in one years time is not adequate. Starting chemotherapy or radiation without a tissue biopsy would be incorrect as it is first necessary to determine if this is cancer.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Mediastinal Seminoma



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**Question 98:** A 65-year-old man presents to the clinic with complaints of progressive dysphagia and a decrease in appetite for the past two months. He has observed that he had lost some weight in the past, and he has started developing dysphagia to the liquids now, which was previously only for solids. The patient is a heavy smoker and drinker for the past 30 years. Upper endoscopy of the patient was performed that revealed a 15 mm ulcerated mass close to the gastro-oesophageal junction, and biopsy report says that the mass has cells that have “salt and pepper” nuclei that exhibit molding. What is the best treatment option for this patient?

**Choices:**

1. Esophagectomy
2. Chemotherapy and radiation
3. Radiation and stenting
4. Chemotherapy only



**Answer: 4** - Chemotherapy only

## Explanations:

- A 'salt and pepper' appearance is indicative of small cell cancer. These cancers are usually not amenable to surgery as they often have spread by the time the diagnosis is made.
- The overall incidence of esophageal squamous cell carcinoma is decreasing, and the incidence of adenocarcinomas is rising rapidly, likely as an effect of lifestyle changes. Curative surgery or endoscopic resection could be offered to selected patients.
- Unfortunately, survival rates of patients with small cell cancer of the esophagus, like the lung, remain very poor.
- The treatment is usually chemotherapy. Chemotherapy and radiotherapy are only done for a selected number of cases.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Esophageal Cancer



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**Question 99:** A 60-year-old male with a history of lymphoma develops pain in the jaw, and ulceration of the mucosa following radiation treatment. He is treated with IV antibiotics, hyperbaric oxygen therapy, and surgical resection of the affected tissue, but still has symptoms. What additional therapy may benefit this patient?

**Choices:**

1. Addition of misoprostol therapy
2. Addition of pentoxifylline and tocopherol therapy
3. Addition of cisplatin and docetaxel therapy
4. Addition of rivastigmine therapy

**Answer: 2** - Addition of pentoxifylline and tocopherol therapy

### Explanations:

- Osteoradionecrosis is a possible complication of radiation therapy to the neck and jaw.
- Osteoradionecrosis results in ulceration and necrosis of the mucosa with exposed bone, inevitably leading to infection and necrotic bone. Exposed bone often leads to irritation of surrounding oral soft tissues.
- The mainstay of treatment for osteoradionecrosis is IV antibiotic therapy, hyperbaric oxygen therapy, and surgical resection of the affected tissue.
- Failed treatment of osteoradionecrosis with conventional therapy indicates the addition of pentoxifylline and tocopherol therapy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Osteoradionecrosis



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**Question 100:** A 65-year-old female comes to a clinic complaining about recent weight loss and difficulty in swallowing food. She states that she has lost over 20 pounds (9 kg) over the last three weeks and cannot seem to gain any weight no matter how much she eats. She has no heat or cold intolerance but does complain her neck feels swollen from time to time. No masses are palpable on the thyroid. Neck sonography is performed, and a midline neck mass is observed. Her family history is unremarkable, and so is her past medical history. Resection of the mass is performed, and the results are pending. Which of the following is most commonly associated with this mass?

**Choices:**

1. Anaplastic Thyroid Carcinoma
2. Hurthle cell thyroid carcinoma
3. Papillary thyroid carcinoma
4. Medullary thyroid carcinoma

**Answer: 3** - Papillary thyroid carcinoma

## Explanations:

- Papillary thyroid carcinoma is the most commonly associated cancer to thyroglossal duct cyst carcinoma, with over 80% of the cases, though it is exceedingly rare to have any malignancy in a thyroglossal duct cyst.
- Other carcinomas, such as Hurthle cell thyroid carcinoma, is less commonly associated with thyroglossal duct cyst carcinoma.
- Anaplastic thyroid carcinoma is not as frequently found as papillary thyroid carcinoma, in thyroglossal duct cyst carcinoma.
- Medullary thyroid carcinoma is not as frequently found as papillary thyroid carcinoma, in thyroglossal duct cyst carcinoma.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

[Anatomy, Head and Neck, Thyroid Thyroglossal Duct](#)



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**Question 101:** Which of the following benefits of limiting radiation doses to the surrounding abdominal viscera was demonstrated in an analysis of data from the ROTG 05-29 trial versus the RTOG 98-11?

**Choices:**

1. Grade 3+ genitourinary adverse events reduced to 78%
2. Reduced chronic nausea
3. No difference in adverse events observed
4. Grade 3+ gastrointestinal adverse events reduced to 21%

**Answer: 4** - Grade 3+ gastrointestinal adverse events reduced to 21%

## Explanations:

- The main purpose of dose constraints is to limit the acute and long-term toxicities associated with radiation to the pelvis when using intensity-modulated radiation therapy (IMRT).
- RTOG 0529 limited small and large bowel to V45 Gy 20 cc, V35 Gy 150 cc, and V30 Gy 200 cc. This resulted in acute grade 2+ gastrointestinal (GI) adverse events of 73% and acute grade 3+ GI adverse events of 21%.
- The same study limited bladder dose to V50 Gy = 5%, V40 Gy = 35%, and V35 Gy = 50%. These constraints limited acute grade 2+ genitourinary (GU) adverse events to 15% and acute grade 3+ GU adverse events to 2%.
- The overall rate of late GI grade 2+ adverse events was 10% and late GU grade 2+ adverse events was 4%.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Radiation Therapy For Anal Cancer



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**Question 102:** A 64-year-old man with recently treated hepatitis C on sustained virological response who developed cirrhosis (Childs-Pugh B) has an alpha-fetoprotein level of 300 mg/mL. An MRI identified four ring-enhancing lesions, up to 4 cm, in the liver with a characteristic hypointense area in comparison to the other parts of the liver. The patient has an ECOG score of 0 and Okuda 1, and staging did not reveal nodules or metastasis. Which of the following is most likely the initial approach in this patient?

**Choices:**

1. Consider hepatobiliary surgery referral for partial liver resection
2. Consider transplant surgery referral for orthotopic liver transplantation
3. Consider interventional radiology referral for transarterial chemoembolization
4. Consider oncology referral for sorafenib



**Answer: 3** - Consider interventional radiology referral for transarterial chemoembolization

## Explanations:

- According to the Barcelona Clinic Liver Cancer (BCLC) staging classification and treatment algorithm, the patient is an intermediate (stage B). Very early (stage 0) and early (stage A) may be considered for resection or even liver transplant with curative intent. Resectable candidates are considered early hepatocellular carcinoma (HCC) (stages less than IIIB) and liver disease Child-Pugh (stage A only).
- Transplant candidates are evaluated according to the Milan criteria. These are a single tumor less than 5 cm or two to three tumors, none exceeding 3 cm, with no vascular invasion and extrahepatic spread.
- Intermediate (stage B) asymptomatic patients with multinodular HCC may benefit from transarterial chemoembolization. This is most often used in large (greater than 5 cm) or multifocal (greater than three tumors) disease and is not suitable for local ablation with early liver disease.
- BCLC advanced (stage C) symptomatic patients with vascular invasion and extrahepatic spread with preserved liver function could be enrolled for chemotherapy. One agent used is sorafenib.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Liver Cancer



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**Question 103:** A 65-year-old male presents to a clinic with complaints of difficulty with urination and hematuria for the past 6 months. He also reports a history of weight loss and fatigue. The rectal exam reveals an enlarged, nodular hard prostate with obliteration of the slit and immobile rectal mucosa in the region corresponding to the prostate. His prostate-specific antigen (PSA) is 20 ng/mL. A biopsy of the lesion demonstrates predominantly poorly-formed, fused, or cribriform glands with a lesser component of well-formed glands. An interprofessional team of health care providers told the patient that first, he will be treated with hormone therapy agents to downsize the disease and then later offer him radiation therapy. Which of the following is a preferred treatment of choice for hormonal therapy in the management of this patient?

**Choices:**

1. Leuprolide and bicalutamide
2. Degarelix only
3. Degarelix and bicalutamide
4. Leuprolide only

Answer: 2 - Degarelix only

## Explanations:

- Hormonal therapy has been found to improve survival when combined with radiation therapy but not with radical prostatectomy for intermediate (Gleason 3 + 4 = 7) and higher-grade disease.
- The hormonal therapy is usually continued for at least one year and optimally for at least two years after radiation. One common plan is to start with either luteinizing hormone-releasing hormone (LHRH) agonists or blockers and monitor the PSA level monthly until it becomes undetectable or nadirs at which time definitive radiation therapy (cyberknife, external beam and/or brachytherapy seed implants) can be started.
- Initial therapy with leuprolide, goserelin and similar luteinizing hormone-releasing hormone (LHRH) agonists should be preceded by anti-androgen therapy, such as bicalutamide when the PSA level is greater than 10 ng/ml to prevent any clinical response to the temporary testosterone surge that typically accompanies initiation of hormonal therapy with these agents.
- This prophylactic anti-androgen therapy is not necessary with degarelix because it is a direct LHRH antagonist, and there is no testosterone surge with this drug. Thus, degarelix is currently the preferred treatment of choice in such patients.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Prostate Cancer



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**Question 104:** A 10-year-old boy was brought to the clinic by his mother. The mother states that she has noticed recent changes in the behavior of her son. His school grades are dropping, and he has been complaining of tiredness over the past few weeks. Recently he started bedwetting and experiences increased thirst and urination. Complete physical examination is unremarkable. Significant laboratory findings include fasting blood glucose 75 mg/dl, serum sodium 149 mEq/L, plasma osmolality 297 mOsm/liter, urine osmolality 280 mOsm/liter, serum TSH 0.3 mIU/L, and fT4 0.2 ng/dL. Urine osmolality did not increase after the water deprivation test. Plasma osmolality after desmopressin administration is 285 mOsm/L. MRI showed a small, homogenous mass in the suprasellar region of the brain. Tumor oncoproteins were not elevated. He subsequently underwent an endoscopic biopsy of the mass. A dual population of cells comprising of large polygonal cells with vesicular nuclei, prominent nucleoli, and distinct cell borders intermixed with small cells with coarse, dense nuclei and scant cytoplasm was detected on histological examination. Malignant cells were also detected in CSF cytology. What is the most effective treatment modality for this patient?

**Choices:**

1. Craniospinal irradiation
2. Whole ventricular radiotherapy
3. Chemotherapy followed by localized radiotherapy
4. Chemotherapy only

**Answer: 1** - Craniospinal irradiation

## Explanations:

- Diabetes insipidus is the most common presentation of germinoma involving the suprasellar region. The patient develops enuresis, polyuria, and polydipsia. Serum osmolality is greater than urine osmolality on laboratory evaluation. Desmopressin administration normalized serum osmolality.
- Abnormalities in the hypothalamic-pituitary axis cause panhypopituitarism and endocrinal insufficiency. This patient had hypothyroidism demonstrated by decreased serum TSH and free T4 levels.
- Timely diagnosis and treatment are critical because of better survival. Tumor staging with imaging and CSF cytology helps to guide the appropriate therapy. In patients with positive CSF cytology, the disseminated disease is suspected. Treatment is more aggressive with craniospinal irradiation for an effective outcome.
- Whole ventricular radiation is used in cases of localized pure germinoma.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Germ Cell Seminoma



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 105:** A 77-year-old male presents with headaches for the past two weeks. His headache is more prominent upon waking up. It is not relieved by the intake of NSAIDs. His headache has been gradually worsening for the past two days and now is graded 7/10 from the initial 3/10. On further questioning, he admits to "blinking out" a couple of times in the past two weeks. He would find himself on the floor with no recall of how he got there. He was previously diagnosed with metastatic non-small cell carcinoma, EGFR mutant, and ALK-negative. On examination, pupils were isochoric; funduscopic examination shows bilateral papilledema; there are no other cranial nerve deficits. The motor and sensory exam were normal. Babinski was positive bilaterally. Which drug has shown some promise in treating this current patient diagnosis?

**Choices:**

1. Erlotinib
2. Crizotinib
3. Dabrafenib
4. Temozolomide

Answer: 1 - Erlotinib

## Explanations:

- Most solid tumors are known to cause LC, but the most common solid tumors that involve the leptomeninges are breast, lung, and melanoma, gastrointestinal, and primary central nervous system tumors. Metastatic breast cancer is the most common etiology, followed by lung cancer (mainly small cell lung cancer), which is followed by melanoma.
- The prognosis of leptomeningeal carcinomatosis remains poor despite advances in therapy. Treatment focuses on improving neurologic deficits, quality of life, and prolonging survival while minimizing toxicity.
- There are reports of increased frequency of leptomeningeal spread in patients with positive EGFR status. Several studies have shown EGFR-mutant non-small cell lung cancer (NSCLC) response to erlotinib. There are ongoing trials of other tyrosine kinase inhibitors (TKIs) in LC from EGFR-mutant NSCLC and has shown promising results in terms of extended survival.
- Commonly, radiation is applied to bulky or symptomatic anatomical lesions, followed by IT chemotherapy. CSF flow obstruction is relieved by surgical interventions; however, surgery has a very marginal role in the management of LC.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Leptomeningeal Carcinomatosis



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**Question 106:** A patient presents with unilateral hearing loss. The symptoms were noted two months before the consultation and had been progressively getting worse. This is accompanied by tinnitus and a sense of imbalance. The patient has no known medical comorbidities. On examination, the patient is awake, alert, able to follow commands. The cranial nerve examination is within normal limits, except for sensorineural hearing loss on the left. The motor and sensory examinations were also within normal limits. The imaging studies reveal a small, well-circumscribed enhancing lesion on the left vestibular nerve. What is the expected hearing preservation rate with fractionated stereotactic radiation in this patient if he had an excellent hearing before treatment?

**Choices:**

1. Approximately 1%
2. Approximately 25%
3. Approximately 33%
4. Approximately 75%



**Answer: 4** - Approximately 75%

## Explanations:

- Most patients have hearing preservation of approximately 75% with fractionated stereotactic radiation treatment of a small acoustic neuroma.
- Hearing preservation is more likely if fractionated therapy stereotactic radiotherapy is used instead of a single dose.
- Low dose therapy likely prevents further growth of the tumor by causing obliterative endarteritis of the vessels that supply the tumor.
- Hydrocephalus is a potential complication of fractionated stereotactic radiation.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Acoustic Neuroma



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**Question 107:** A 37-year-old male smoker has just been diagnosed with a posterior fossa lesion based on the computed tomography imaging studies. Computed tomography shows a hypodense area in the right cerebellopontine angle displacing the pons and cerebellum posteromedial. The lesion appears extra-axial. What type of magnetic resonance imaging (MRI) technique is most useful to distinguish an arachnoid cyst from an epidermoid tumor?

**Choices:**

1. MRI with gadolinium
2. T2 sequence imaging
3. Diffusion-weighted imaging
4. Gradient-echo sequence

**Answer: 3** - Diffusion-weighted imaging

## Explanations:

- The epidermoid tumor shows diffuse restriction, while arachnoid cyst does not show restriction. Diffusion-weighted imaging is used to identify the presence of restriction.
- Magnetic resonance imaging findings for the epidermoid tumors and arachnoid cyst consisted of increased T2 relaxation times. Both lesions appear bright.
- Arachnoid cyst is composed of cerebrospinal fluid, while the epidermoid tumor is composed of keratin.
- Magnetic resonance imaging with gadolinium does not enhance the capsule of the epidermoid tumor nor the arachnoid cyst. Gradient-echo sequence is useful to identify degraded blood products.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Epidermoid Cancer



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 108:** A 32-year-old female presents to a clinic complaining about new-onset pigmentations on flexor surfaces of her arms, forearms, and neck. She reports pain and itching associated with the pigmentation. On examination, the spot has irregular borders with scaly outgrowths and palpable lumps. She also reports recently being diagnosed with pregnancy and is currently in her 15th week of pregnancy. Her biopsy reveals it as a nodular type of melanoma. Given her ongoing pregnancy, what should be the next appropriate step in her management?

**Choices:**

1. Get a PET-CT to assess metastasis and ask her to terminate the pregnancy as her melanoma might be dangerous to mother and child.
2. Immediately start ipilimumab and nivolumab and wait till her pregnancy is over for metastasis assessment and radiotherapy (RT).
3. Get a PET-CT to assess metastasis and immediately start her on ipilimumab and nivolumab while planning for a possible RT.
4. Get a PET and sentinel biopsy if metastasis is present ask her to abort the pregnancy for urgent radiotherapy.

**Answer: 3** - Get a PET-CT to assess metastasis and immediately start her on ipilimumab and nivolumab while planning for a possible RT.

## Explanations:

- Cancer in pregnancy is a clinical challenge, especially if aggressive, like melanoma. However, newer data suggest that if done with a tailored approach, keeping in mind patients' gestational age, cancer staging, and other co-morbidities, it's possible to treat melanoma even during pregnancy without inflicting any lasting effects on the growing fetus.
- PET/CT scans are ideally not recommended in pregnancy, however here, due to melanoma being of aggressive metastatic nature, it's clinically relevant to carry out CT scans for staging and assessing metastatic spread, since the radiation exposure is well below the threshold for causing fetal malformations. Here since the fetus is above 15 weeks, that is in the second trimester, which is far less susceptible to radiation effects. Sentinel lymph node biopsy (SLNB) has also been shown to be safe during pregnancy.
- Chemotherapy has shown no substantial implications on fetus growth parameters, irrespective of fetal age; hence it should be the first line of therapy while surgical or radiotherapeutic regimens are awaited.
- Aborting ongoing pregnancy should be the last resort, only after weighing various modalities against the possible outcomes and should be left to the patient and her partner. It requires a multidisciplinary team. Fortunately now, due to far advanced techniques of delivering radiation, unlike a few decades ago, abortion isn't recommended unless the site of radiation happens to be right above the fetus as in uterine, ovarian or cervical and vulvar pregnancies, even then various shielding methods are advised with a test run in phantom models to assess possible fetal exposure.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Effects On The Fetus



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 109:** A 48-year-old man with no past medical history is diagnosed with squamous cell carcinoma of the right anterior tongue. The tumor is approximately 3cm in diameter, and his tongue deviates slightly to the right upon protrusion. He has no palpable lymphadenopathy, and a CT scan shows neck lymph nodes with normal size and morphology. Given the presentation, select the best treatment option for this patient?

**Choices:**

1. Wide local excision of the primary lesion and adjuvant chemoradiation
2. Wide local excision of the primary lesion
3. Wide local excision of the primary lesion and Ipsilateral selective neck dissection
4. Excision of the primary lesion

**Answer: 3** - Wide local excision of the primary lesion and Ipsilateral selective neck dissection

## Explanations:

- The patient has a T2N0Mx squamous cell carcinoma of the oral tongue. Given the significant risk of occult neck metastasis with tongue carcinoma, elective right supraomohyoid neck dissection (Right levels I-III) should also be offered to the patient. Wide local excision is correct, and adjuvant chemotherapy and radiation may be recommended depending on the final pathologic diagnosis and adequacy of resection. However, concurrent ipsilateral neck dissection should be performed at the time of primary surgery.
- Given the significant risk of occult neck micrometastasis with tongue carcinoma despite no gross clinical or radiological evidence of neck lymph node involvement, elective right supraomohyoid neck dissection (Right levels I-III) should be offered to the patient. Wide local excision is correct, but concurrent ipsilateral neck dissection should be performed.
- The patient has a T2N0Mx squamous cell carcinoma of the oral tongue. Size is between 2 and 4cm (T2) and there is no clinical or radiologic evidence of lymphadenopathy (N0). However, given the significant risk of occult neck metastasis with tongue squamous cell carcinoma, elective right supraomohyoid neck dissection (Right levels I-III) should be performed at the time of surgery along with primary tumor resection.
- The patient has a T2N0Mx squamous cell carcinoma of the oral tongue. Given the significant risk of occult neck metastasis with tongue carcinoma, wide local excision of the tumor with negative margins as opposed to simple excision is recommended. Elective right supraomohyoid neck dissection (Right levels I-III) should be offered to the patient due to the risk of occult neck metastatic disease.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Tongue Cancer



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**Question 110:** A 79-year-old man is found to have a 2.5 cm nodule in the right upper lobe on chest CT. CT guided biopsy demonstrates moderately differentiated adenocarcinoma. The lung nodule is PET-avid, with an SUV of 22. PET-CT is negative for distant metastatic disease. Pulmonary function test reveals an FEV1 of 50% predicted and DLCO of 30% predicted. What is the most appropriate management strategy for this patient?

**Choices:**

1. Lobectomy
2. Chemotherapy
3. Radiation therapy with concurrent chemotherapy
4. Stereotactic body radiation therapy



**Answer: 4** - Stereotactic body radiation therapy

## Explanations:

- Stereotactic body radiation therapy (SBRT) or stereotactic ablative body radiation (SABR) is an alternative option for patients who are not surgical candidates due to high operative risk from poor cardiopulmonary function, comorbid conditions, advanced age, or if patients refuse surgery.
- The 5-year survival for stage IA (T1N0M0) is 60-80%.
- Radiation therapy with concurrent chemotherapy is recommended for Stage IIIA-B non-small cell lung cancer. Radiation therapy is delivered over 6-7 weeks to a total dose of 60-70 Gy.
- If the patient is a surgical candidate, lobectomy is preferred over pneumonectomy, if anatomically feasible. Wedge resection is not considered oncologic surgery and is only considered if the patient is physiologically compromised.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

[Radiation Therapy For Early Stage Non-Small Cell Lung Cancer](#)



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**Question 111:** A 65-year-old male presents to the clinic with complaints of burning urination and blood in his urine. He has had the symptoms for the past 4 weeks. Initially, the symptoms were mild, but the urine is now grossly bloody. He also reports urinary urgency and incontinence. He has a history of prostate carcinoma and completed external beam radiotherapy 6 months back. Physical examination reveals pallor. A urinalysis demonstrates the presence of numerous RBCs. Urine cultures are negative. A cystoscopy demonstrates extensive mucosal erythema with telangiectasias; cytology is negative for atypical cells. He fails to respond to medical management and bladder irrigation. He is treated with highly concentrated oxygen therapy administered at elevated atmospheric pressures. He reports good control of symptoms after completion of therapy. Which of the following factors is most likely responsible for the improvement in this patient's condition?

**Choices:**

1. Increased vascularization
2. Increased arteriolar obliteration
3. Increased microbial destruction
4. Increased sympathomimetic tone

**Answer: 1** - Increased vascularization

## Explanations:

- This patient has a history of prostate carcinoma and subsequent pelvic irradiation. His current symptoms of urgency, incontinence, and hematuria in the presence of normal cytology and sterile urine raise the possibility of radiation induced cystitis. The patient does not respond with conservative treatment and is managed with hyperbaric oxygen therapy (HBOT).
- HBOT is a useful treatment modality in radiation induced tissue damage. Tissue hypoxia and vascular damage is the main cause of radiation cystitis. HBOT leads to increased synthesis of vascular endothelial growth factor and increased new blood vessel formation.
- New blood vessel formation improves supply to the overlying mucosa and prevents the development of interstitial fibrosis. Increased capillary density also improves mucosal healing and leads to the resolution of symptoms.
- Several studies have shown a good response of refractory radiation cystitis to hyperbaric therapy with minimal toxicity. HBOT increased the bactericidal action of neutrophils, but this effect is not considered responsible for the improvement in this patient's condition. It will also lead to a reduction in telangiectasis and mucosal erythema through healing rather than vessel thrombosis. A direct sympathomimetic effect is not seen.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Cystitis And Hyperbaric Management



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## Section 4

**Question 112:** A 74-year-old patient presented with a palpable mass in her right breast. The diagnostic mammogram showed a spiculated mass measuring 1.2 cm. Ultrasound demonstrated a hypoechoic mass measuring 2.1 cm x 1.3 cm x 0.8 cm. Biopsy revealed a well-differentiated mucinous carcinoma that was ER/PR positive and HER2/neu negative. Lumpectomy and sentinel node biopsy revealed 1.8 cm mucinous carcinoma with widely negative margins. No associated ductal carcinoma in situ or lymphovascular invasion was noted. The clinician suggests doing radiotherapy. Which is an absolute contraindication to breast radiotherapy?

### Choices:

1. Psoriasis
2. Coronary artery disease (CAD)
3. Scleroderma
4. Chronic obstructive pulmonary disease (COPD)

Answer: 3 - Scleroderma

### Explanations:

- Radiotherapy effects on normal tissue are considered to be greater and, at times, severe in patients with active collagen vascular diseases such as scleroderma.
- Common acute side effects of breast radiotherapy include skin reactions such as erythema, itchiness, hyperpigmentation, and desquamation, as well as fatigue.
- Late effects of breast radiotherapy include cosmetic effects such as edema, fibrosis, and telangiectasia, and less commonly radiation pneumonitis, rib fracture, cardiac toxicity, and secondary malignancies.
- If breast radiotherapy is not recommended, mastectomy is often the appropriate treatment.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Radiation Therapy For Early Stage Breast Cancer



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 113:** A 65-year-old male presents to a clinic with complaints of increased urinary frequency, hesitancy, and incontinence associated with a weak stream. Detailed medical history revealed that he also had a few episodes of hematuria over the past several weeks. On abdominal examination, the abdomen was soft and non-tender. On digital rectal exam (DRE), there was a large prostate nodule with immobile overlying mucosa. Lab reports showed hemoglobin of 14 g/dL, hematocrit 39.2%, white blood cell count 9,200/mm<sup>3</sup> with a normal differential count, platelets 230,000/mm<sup>3</sup>, blood urea nitrogen 11 mg/dL, and creatinine level 1.1 mg/dL. His liver function tests (LFT) were all within a normal range. His prostate-specific antigen (PSA) was 40 ng/mL. Ultrasound pelvis showed a hypoechoic lesion in the peripheral zone of the prostate. An ultrasound-guided biopsy reveals 8/8 positive specimens with a Gleason score of 8. A bone scan was performed, which did not reveal any skeletal lesions. What is the current recommendation for the treatment for this disease?

### Choices:

1. Radiation therapy and androgen ablation
2. Androgen ablation alone
3. Brachytherapy
4. Active surveillance

**Answer: 1** - Radiation therapy and androgen ablation

## Explanations:

- The treatment of prostatic cancer is mired with many conflicts, and the reported studies are not homogeneous.
- Nevertheless, for locally advanced prostate cancer, the treatment is androgen ablation with radiation therapy.
- Radical prostatectomy is another option if the individual does not want to have radiation.
- Recently some urologists have used brachytherapy, external radiation, and hormonal therapy, but it is not known that if this regimen has any advantage over just hormone ablation and radiation therapy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Prostate Cancer



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**Question 114:** A 78-year-old man presents to the clinic with a history of stage I mandibular gingival squamous cell carcinoma treated with primary radiation therapy 18 months ago. He underwent pre-treatment dental care, and his remaining dentition is in good repair. On examination, there is a 1x1cm area of exposed bone with minimal local tissue response at the site of the primary tumor with no exposed tooth roots. He is unwilling to accept surgical intervention. What is the proposed mechanism of action of the most effective non-surgical treatment option, assuming this does not represent persistent cancer?

**Choices:**

1. Reducing the burn
2. Causing vasoconstriction
3. Reducing edema
4. Promoting angiogenesis



**Answer: 4** - Promoting angiogenesis

## Explanations:

- Delayed radiation-induced tissue damage causes a hypovascular-hypoxic-hypocellular tissue bed.
- Hyperbaric oxygen (HBO) therapy is shown to improve angiogenesis in hypoxic tissues.
- Increased neovascularity promotes tissue repair mechanisms tipping the balance towards repair rather than cellular loss.
- HBO treatments before and after dental extractions of teeth in a previously irradiated area can decrease the incidence of osteoradionecrosis, a specific example of delayed radiation-induced tissue damage.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

**Mandible Osteoradionecrosis**



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**Question 115:** A 15-year-old boy had a recurring, raised lesion at the site of an old scar on his chest from a previous bicycle accident many years ago. His mother and sister have both had similar scar-type lesions that required surgery and radiation therapy. Which radiation modality has been shown to be the most successful in treating this type of lesion?

**Choices:**

1. Electron therapy
2. Superficial x-ray therapy
3. Proton therapy
4. Brachytherapy

**Answer:** 4 - Brachytherapy

## Explanations:

- Different forms of radiation can be used to deliver dose to a superficial target in the treatment of keloids. These include electrons (less than or equal to 6 MeV), x-rays (70 to 150 kV), and iridium-192 brachytherapy with implants or surface applicators.
- In a meta-analysis systemic review of post-excisional radiation modalities, brachytherapy was demonstrated to have the lowest recurrence rate (15%) compared to EBRT (23%) and x-ray therapy (23%).
- Brachytherapy can deliver more precise radiation to treat keloids. However, the radiation dose delivery is very heterogeneous, and it could lead to increased skin toxicity.
- The modality most commonly used to treat keloids is electrons. Brachytherapy is not as widely used because all radiation centers do not have the physical radioactive source (Iridium-192) needed for brachytherapy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Therapy In The Treatment Of Keloids



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**Question 116:** A 56-year-old male presents to the clinic with new-onset urinary incontinence and back pain. He has a known history of metastatic cancer, a 45 pack-year smoking history, and uncontrolled type 2 diabetes mellitus. Magnetic resonance imaging reveals a lytic lesion in the T10 vertebral body with compression on the spinal cord. Physical examination reveals 3+ patellar reflexes bilaterally. A biopsy of the lesion in question showed renal cell carcinoma. What factor would lead to recommending against palliative radiotherapy to address his symptoms?

**Choices:**

1. Patient's smoking history
2. Patient's history of uncontrolled diabetes mellitus
3. Renal cell origin of his tumor
4. Patient's age younger than 65 years

**Answer: 3** - Renal cell origin of his tumor

### Explanations:

- Palliative radiotherapy of the spine is a useful treatment in the case of back pain and spinal cord compression in patients with metastatic lesions in the vertebrae.
- Metastatic lesions to the vertebrae can lead to spinal cord compression, resulting in loss of bowel and bladder function, weakness, numbness/sensory deficits, and hyperreflexia.
- Renal cell carcinomas are very notoriously radioresistant. The more radioresistant a tumor is, the less likely it will respond to radiation treatment.
- Smoking history, diabetes, and young patient age are not a contraindication to palliative radiation therapy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Palliation Radiation Therapy Of The Spinal Cord



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**Question 117:** A 54-year-old female presents to the hospital for an outpatient catheterization. She is thought to have radiation-induced coronary artery disease secondary to radiation exposure following right mastectomy for breast cancer. She was treated with radiation to the right mediastinum 15 years ago, and she is cancer free now. Family history is only significant for breast and ovarian cancer. What coronary artery is most likely involved?

**Choices:**

1. Left circumflex
2. Left main
3. Left anterior descending
4. Right coronary artery

**Answer: 4** - Right coronary artery

## Explanations:

- Given that the patient had right-sided radiation therapy, the most likely vessel involved is the right coronary artery (RCA). More recently studies have shown that the RCA has a higher likelihood of disease compared to the LAD correlating with higher doses of radiation being used to the right chest.
- The left main is usually more commonly involved with radiation to the left side of the chest.
- Before 1990, the left anterior descending was a commonly affected target. This was because a higher radiation dose was being used to treat both sides of the chest. It is important for providers to obtain the medical records of how the radiation therapies were administered.
- It might help discern where the disease may have the highest rate of evolving. It is important for oncologist and radiation therapist to be cognizant of the amount of radiation used, and the location of radiation therapy is being administered and documented thoroughly.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Radiation Induced Coronary Artery Disease



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**Question 118:** A 56-year-old female patient with a medical history of hypertension, diabetes mellitus, and breast cancer comes to the office with persistent back pain for the last three weeks. She first noticed the pain while moving some heavy boxes around the house. Further workup reveals the presence of mixed lytic and blastic lesions in the spine, and a diagnosis is made. She has previously received chemotherapy with high dose doxorubicin, and the decision is made to treat with the same agent. Which of the following is the preferred management to prevent complications from this treatment regimen?

**Choices:**

1. Aggressive fluid therapy
2. Tight glucose control
3. Dexrazoxane therapy with baseline cardiac imaging
4. Dose reduction of doxorubicin



**Answer: 3** - Dexrazoxane therapy with baseline cardiac imaging

## Explanations:

- Dexrazoxane is currently approved to reduce the incidence and severity of cardiomyopathy in patients with metastatic breast cancer and a cumulative dose of  $300 \text{ mg/m}^2$ . Doxorubicin is not recommended for initial treatment.
- In addition to dexrazoxane therapy, baseline cardiac imaging, along with optimization of cardiovascular status before initiation of therapy, is recommended to reduce the risk of developing cardiomyopathy.
- This drug is also used to treat extravasation of anthracyclines during infusion. It is administered via intravenous route over 1-2 hours within 6 hours of extravasation, and the course is repeated for three days. Dexrazoxane infusion should be at room temperature and one at a site remote from the extravasation.
- Aggressive fluid therapy is used to prevent tumor lysis syndrome, which is common following chemotherapy for lymphomas. Tight glucose control will not help prevent cardiac complications arising from anthracycline-based chemotherapy. Although dose reduction may reduce or delay the development of cardiomyopathy in this patient, it may lead to inadequate control of the tumor burden.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Anthracyclines



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**Question 119:** A 45-year-old man presents to the hospital with 4 weeks of dry mouth and difficulty eating following treatment for American Thyroid Association (ATA) high-risk thyroid carcinoma. Which of the following is most likely responsible for his symptoms?

**Choices:**

1. Recurrent laryngeal nerve damage following thyroidectomy
2. Radioiodine adjuvant therapy
3. Radioiodine whole body scanning
4. Metastasis to the salivary glands

**Answer: 2** - Radioiodine adjuvant therapy

## Explanations:

- Xerostomia is one of the most common side effects associated with radioiodine therapy.
- Whole-body scans require a small dose (2-5 mCi) compared to therapeutic dosing (30-150 mCi) therefore the patient's symptoms are likely to due to adjuvant therapy.
- Common complications associated with chronic hyposalivation include increased incidence of dental caries, dysgeusia (altered taste), and difficulty with mastication and deglutition.
- Damage to the recurrent laryngeal nerve is a risk factor associated with thyroidectomy. However, that would cause hoarseness, not xerostomia. Thyroid cancer really metastasizes. When it does, it typically spreads to the lymph nodes, lungs, and bone.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

**<sup>131</sup>I Sodium Iodide**



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**Question 120:** A 59-year-old male patient presents with a white lesion in his mouth. The patient had previously been diagnosed with oral squamous cell carcinoma three years ago and was treated with 2000 cGY of radiation to his head and neck. The previous cancer lesion appeared to resolve, and the patient is being asked to be evaluated for hyperbaric treatments to treat his new lesion. The patient does not have a fever or lymphadenopathy and denies any purulent discharge. What is the best option at this time?

**Choices:**

1. Treatment with hyperbaric oxygen on Marx protocol
2. Ask to have the lesion biopsied
3. Refer for additional radiation
4. Start antibiotics immediately

**Answer: 2** - Ask to have the lesion biopsied

## Explanations:

- When evaluating a problematic wound in previously radiated tissue, it is crucial to determine that the problem is from soft tissue radionecrosis and not from another cause.
- Typically, for soft tissue radionecrosis lesions to develop, the accumulative dose of radiation has been over 3000 cGy, and more commonly over 5000 cGy.
- Lesions caused by lower levels of radiation therapy would be doubtful to develop a future skin ulcer from the delayed effects of radiation therapy. More likely, the skin ulcer may represent a recurrence of skin cancer, and biopsy should be done. Initiating hyperbaric oxygen therapy without confirming the diagnosis may delay appropriate treatment. Alternatively, blindly treating with radiation could cause further unnecessary damage to a soft tissue radionecrosis lesion.
- There is no evidence that an infection is present. Therefore, antibiotics would be of little to no value at this time but could be appropriate if signs of infection develop, which can be expected in soft tissue radionecrosis lesions.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

**Hyperbaric Soft Tissue Radionecrosis**



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 121:** A 26-year-old man is involved in a motor vehicle accident and sustains a left hip fracture requiring open reduction internal fixation. He has an allergy to nonsteroidal anti-inflammatory medications. Which of the following is the most appropriate management strategy within 72 hours after surgery to prevent long-term complications in this patient?

**Choices:**

1. Radiation therapy to 7 Gy in 1 fraction
2. Radiation therapy to 30 Gy in 10 fractions
3. Radiation therapy to 5.5 Gy in 1 fraction
4. Indomethacin

**Answer: 1** - Radiation therapy to 7 Gy in 1 fraction

## Explanations:

- Radiation therapy to 7 Gy in 1 fraction is a standard postoperative dose for the prevention of heterotopic ossification (HO). It should be considered in settings with high risk for HO formation (e.g., after hip trauma or surgery).
- Radiation therapy to 30 Gy in 10 fractions is a standard palliative dose but is considered unnecessarily high for prevention of heterotopic ossification, which is usually managed with 7 or 8 Gy in a single fraction.
- In a retrospective analysis by Healy et al., the radiographic failure rate was significantly worse using 5.5 Gy postoperatively compared to the standard 7 Gy radiation dose for the prevention of heterotopic ossification.
- Nonsteroidal anti-inflammatory medications such as indomethacin or ibuprofen can be used for the prevention of heterotopic ossification but can be avoided by using radiation instead in patients with contraindications such as allergic reaction.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Therapy For Heterotopic Ossification Prophylaxis



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 122:** A 45-year-old woman presents to the clinic for follow up. She recently underwent a right modified radical mastectomy and was found to have a 2.5 cm invasive ductal carcinoma with negative margins and 4 positive lymph nodes out of 11 total removed. Which of the following best describes the benefits of comprehensive nodal irradiation in this patient?

**Choices:**

1. 20% improvement in disease-free survival but no difference in overall survival
2. 10% improvement disease-free survival but no difference in overall survival
3. 10% improvement in disease-free survival and overall survival
4. 5% improvement in disease-free survival and overall survival



**Answer: 3** - 10% improvement in disease-free survival and overall survival

### Explanations:

- For patients with node-positive breast cancer with nod positive disease, several large randomized trials have consistently demonstrated an improvement in both disease free-survival and overall survival of approximately 10%.
- A large meta-analysis of over 3,500 women enrolled in randomized trials comparing post-mastectomy radiation to no radiation demonstrated a reduction in both breast cancer recurrence and overall survival for any patient with node-positive disease. The magnitude of benefit for both recurrence and overall survival was in the range of 10-12%.
- NCCN strongly recommends PMRT for patients with 4 or more positive nodes and recommends strong consideration of PMRT in the setting of 1-3 positive nodes.
- These trials demonstrated both disease-free survival and overall survival benefit, therefore answers 1 and 2 are wrong. The benefit is >5%, so answer 4 is wrong.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Postmastectomy Breast Cancer Radiation Therapy



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 123:** A 30 year male patient from Malawi presents a history of trauma to the jaw, complaints of swelling in the area with overlying ulceration and associated paraesthesias. A radiograph of the jaw is suggestive of a radio-opaque lesion with an absence of a sunburst appearance. Biopsy from the specimen yields a fibroblastic tumor with areas of osteoid formation. He receives six cycles of MAP (methotrexate, adriamycin, and cisplatin) in the neoadjuvant setting and is planned for definitive surgical extirpation. Which of the following treatment modalities is useful in response assessment to preoperative chemotherapy in these tumors?

**Choices:**

1. Radiograph of the maxilla
2. Computed tomography scan – maxilla
3. Magnetic resonance imaging
4. Fluorodeoxyglucose (FDG)-positron emission tomography

**Answer: 4** - Fluorodeoxyglucose (FDG)-positron emission tomography

## Explanations:

- High-grade craniofacial osteosarcoma is found in older patients, as compared to conventional osteosarcomas. They have a male to female ratio of 1,7:1, and a preponderance for the mandible in the females and the maxilla in the males.
- The radiograph of the involved site may not always show the typical sunburst appearance. It may show radiolucent to radioopaque lesions depending upon the degree of calcification or osteoid formation. These tumors have been shown to have a better prognosis and are seldom associated with metastasis development.
- While surgical resection is the treatment of choice, Radiotherapy may be recommended in cases that are not amenable to complete surgical resection. The histological response to neoadjuvant treatment expressed as the percentage of necrosis has not been shown to correlate with survival. Negative surgical margins are the most important predictor of survival.
- PET-CT scanning may be advantageous and more reliable when compared to conventional CT for response assessment. The most common cause of therapeutic failure is local recurrence. The presence of metastasis portends a poor survival of less than one year only.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Osteogenic Sarcoma



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 124:** A 60-year-old man presents with dull abdominal pain for 3 weeks. The pain is located in the right upper quadrant and is not related to movement, inspiration, or food. The patient describes the severity as 4/10. Past medical history is insignificant. There is a long history of smoking. Vital signs include blood pressure 135/80 mmHg, pulse 80 beats per minute, and temperature 37.3 C (99.1 F). Physical exam is significant for mild tenderness in the right lumbar quadrant and a palpable mass in the same area. Laboratory workup is significant only for microscopic hematuria. CT scan shows a solid right renal mass with signs of necrosis and no macroscopic fat. What is the most common location of metastasis of the most probable diagnosis?

**Choices:**

1. Lungs
2. Bone
3. Liver
4. Brain

Answer: 1 - Lungs

## Explanations:

- Renal cell carcinomas (RCCs), which originate within the renal cortex, are responsible for 80% to 85% of all primary renal neoplasms.
- Nearly 30 percent of patients with renal cancer present with metastatic disease. The lung is the most common site followed by soft tissues and bone.
- Other organs where renal cancer spreads is the liver, brain and skin.
- Varicoceles on the right side should raise suspicion of a renal cell cancer.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Renal Cell Cancer



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 125:** A 45-year-old man with a history of squamous cell carcinoma of the esophagus received radiation to the esophagus and chest six months ago. Now he presents with painful swallowing and has not been able to tolerate many diets. He has experienced weight loss and dehydration. He has low-grade fever and tachycardia. Labs show hyponatremia and hypokalemia and elevated urea nitrogen and creatinine. He is given intravenous fluids, and electrolyte replacement is initiated. He undergoes an esophagogastroduodenoscopy, which shows discrete ulcers in the mid esophagus with surrounding erythema and areas of the normal-looking esophagus. Biopsies show viral inclusions. What treatment should be initiated in this patient?

**Choices:**

1. Acyclovir
2. Fluconazole
3. Gancyclovir
4. Vancomycin

**Answer:** 1 - Acyclovir

## Explanations:

- The patient has herpes esophagitis and should be treated with acyclovir.
- Infections with herpes simplex are common in immunocompromised patients.
- Herpes infection are differentiated from CMV on pathology and is important for starting treatment.
- Candida esophagitis presents as white plaques and not ulcers.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Radiation Esophagitis



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 126:** A 60-year-old male with a past medical history of HIV was seen by the primary care physician after he presented with anal pain for 6 months and associated bleeding per rectum. He is otherwise in very good health and compliant with his antiretroviral therapy. On the anal exam, there is a concern for a mass. The patient was further evaluated by anoscopy and found to have a 2.5 cm mass in the anal canal, the biopsy of which turned out to be a squamous cell carcinoma, which is poorly differentiated. Staging studies did not show any lymph node involvement or other metastasis. Which of the following is an appropriate therapy recommended for him?

**Choices:**

1. Surgery alone
2. Local radiation and followed by surgery
3. 5-FU + mitomycin with concurrent local radiation
4. 5-FU + mitomycin alone



**Answer: 3** - 5-FU + mitomycin with concurrent local radiation

### Explanations:

- 5-FU + mitomycin with concurrent local radiation is the recommended regimen for T1-T4 and N+ anal cancer.
- Concurrent chemoradiation with local radiation decreased the risk of local failure by 46% and has a better overall survival at 5 years compared to other regimens.
- Surgery alone may be an option for patients with T1 tumors less than 1 cm in size. But this approach was not compared with RT and chemoradiotherapy, which is the standard of care.
- Chemotherapy without radiation is not an appropriate therapy in localized anal cancer.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Anal Cancer



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 127:** A 74-year-old man has been diagnosed with metastatic deposits involving T12 and L1 vertebrae secondary to adenocarcinoma of the prostate. His MRI reveals grade 3 epidural spinal cord compression (ESCC). The lesion is highly radiosensitive. He is complaining of sudden onset, progressive bladder retention with perineal numbness of 5 hours' duration. The rest of his sensory and motor components of neurological examination are normal. Which of the following is the most appropriate management strategy for this patient?

**Choices:**

1. Intravenous dexamethasone
2. Immediate surgical spinal decompression
3. Immediate radiotherapy with conventional external beam radiation therapy (cEBRT)
4. Immediate radiotherapy with stereotactic radiation surgery (SRS)

**Answer: 2** - Immediate surgical spinal decompression

## Explanations:

- Any patient with large metastatic vertebral deposits and significant spinal canal compromise presenting with progressive neurological deficit (conus medullaris syndrome, in this case), requires immediate spinal decompression surgery. This is a surgical emergency.
- Duration and severity of neurological deficit are the most important prognostic indicators in such scenarios, and surgical decompression provides the quickest relief of compression of the spinal cord.
- Such surgical decompression can be achieved by the posterior approach alone, a posterolateral approach involving 360° decompression of the spinal canal with or without anterior column reconstruction [with polymethyl methacrylate (PMMA) or cage reconstruction], anterior approach alone or combined anterior-and-posterior approach. With the recent advances in technology, all the surgical goals can be achieved with posterior or posterolateral approaches only.
- Although steroids may have some role in ameliorating the neurological prognosis in cancer patients, there is no evidence supporting its role as the sole definitive treatment in these patients. Similarly, even in highly radiosensitive tumors with progressive neurological deficits, radiotherapy (cEBRT or SSRS) may not be the best approach to ensure immediate spinal canal decompression.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Spinal Metastasis



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 128:** A 76-year-old man is planned for surgical resection, with adjuvant chemotherapy and radiotherapy for a squamous cell malignancy in his anal canal. Which of the following best explains the primary benefit of the addition of mitomycin-C to 5-fluorouracil in the chemotherapy regimen?

**Choices:**

1. Reduced grade 4 and 5 toxicity
2. Reduced brain metastasis
3. Improved 5-year local control
4. Improved quality of life

**Answer: 3** - Improved 5-year local control

### Explanations:

- Clinical trials in anal cancer have demonstrated that concurrent chemotherapy and radiation yield results superior to those of radiation alone or surgery alone.
- The RTOG 87-04 trial demonstrated a benefit to chemoradiation with mitomycin-C (MMC) and 5-fluorouracil (5FU) versus chemoradiation with 5FU alone.
- This study showed an improvement in 5-year local control from 64% to 83%.
- There was also a decreased colostomy rate from 22% to 9% ( $p = 0.002$ ) with the addition of MMC to 5FU.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Radiation Therapy For Anal Cancer



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 129:** A 67-year-old man presents to his family provider with lower urinary tract symptoms that have developed over the previous 12 months. He finds that his urinary stream is not as strong as it once was, and he has to get up usually once during the night to pass urine. There is no relevant medical or surgical history. His 85-year-old father has just celebrated his 10th anniversary of radical prostatectomy for prostate cancer. Physical examination is unremarkable: he has no abnormal abdominal masses palpable, external genitalia are normal, and on the digital rectal exam (DRE), his prostate feels benign, smooth, and slightly enlarged (estimated volume 40 cc). What is the most appropriate next step in his management?

### Choices:

1. Discussion regarding urological referral with a view to laser prostatectomy for symptom control
2. Discussion regarding the pros and cons of a serum prostate-specific antigen (PSA) test
3. Referral for a multiparametric MRI scan of his prostate
4. Referral for a transrectal ultrasound-guided prostate biopsy

**Answer: 2** - Discussion regarding the pros and cons of a serum prostate-specific antigen (PSA) test

## Explanations:

- He has a positive family, which increases his risk compared to the general age-matched population and therefore requires some investigation for prostate cancer.
- He has already had a DRE, so a PSA test completes the initial investigations.
- If cancer is suspected, PSA is required for risk stratification.
- Although his symptoms are causing him some trouble, they seem relatively mild, and medical therapy in the form of alpha-blockade would be preferable to consideration of a prostatectomy if benign prostatic hypertrophy (BPH) is suspected at this stage. There is little evidence to suggest that MRI scans offer much in a population of men with a normal PSA, and this approach is not likely to be cost-effective. A prostate biopsy is only indicated if there is clinical evidence that suggests prostate cancer, namely an abnormal DRE, an elevated PSA, and an abnormal MRI scan.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Localized Prostate Cancer



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 130:** A 45-year-old female presents after screening mammography to the office. A mass is seen in the lower inner quadrant of the left breast. She reports age at menarche to be 9 years, her first child-birth at age 28 years age. She never took any oral contraceptive pills but is currently on hormone replacement therapy. Her father was diagnosed with breast cancer at age 60 with positive genetic testing for breast cancer. Diagnostic mammogram and stereotactic biopsy confirm invasive ductal carcinoma. Which of the following most adversely affected the lifetime risk of this patient to develop breast cancer?

**Choices:**

1. Early menarche
2. Hormone replacement therapy
3. Family history
4. Age at first childbirth



Answer: 3 - Family history

## Explanations:

- This patient has a strong family history of breast cancer. Male breast cancer in a first-degree relative is strongly suggestive of BRCA mutation, specifically BRCA 2. Her father was tested for genetic mutation and was positive. This patient's relative risk for breast cancer increases to  $>4$  given BRCA mutation.
- Early menarche can increase the risk of breast cancer.
- Other cancers in the family such as prostate, pancreatic cancers, or ovarian cancers in first degree relatives should also raise suspicion for BRCA mutation and prompt for genetic testing.
- Nulliparity can increase risk but not to the magnitude of possessing the BRCA1 gene. Late age at first childbirth(not early as in this case) could increase the risk for breast cancer.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

BRCA 1 and 2



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 131:** A 55-year-old female patient is being treated in a hyperbaric chamber for radiation cystitis. She has undergone 37 treatments at 2.8 atmospheres with some resolution of her symptoms, but she is stating that her "glasses are not working anymore." Upon further questioning, she explains that she is noticing a difficulty seeing distant objects when this was not an issue prior to starting hyperbaric treatments. What is the best advice for the patient at this time?

**Choices:**

1. Immediately stop all hyperbaric treatments as her eyes are permanently damaged
2. Hyperbaric associated visual changes are always related to cataract formation or progression
3. It can be attributed to changes in the corneal thickness caused by exposures to high atmospheric pressures
4. Most cases of hyperbaric myopia are reversible after completion of treatments

**Answer: 4** - Most cases of hyperbaric myopia are reversible after completion of treatments

## Explanations:

- Hyperbaric oxygen-related vision changes include hyperbaric myopia as well as cataract formation and progression.
- The mechanism for hyperbaric myopia is not fully understood, but it is thought that oxygen toxicity causes changes to the crystalline lens, hardening the lens and increasing its refractive power. The ultimate effect is a myopic shift and blurry vision reported by the patient. Most of the myopic changes are reversible after cessation of therapy.
- Many studies report the effects of hyperbaric myopia lasting from days to months. The reversal of myopia was rapid within the first few weeks and then progressed more slowly over months up to a year.
- In a particular study, patients were examined with pretreatment and follow-up refraction studies, measurement of axial length, keratometry, fundus examination, and tonometry. The results of these examinations revealed no other effects of hyperbaric oxygen therapy. They helped suggest that the myopic changes observed were due to changes within the lens rather than changes to other orbital structures.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Hyperbaric Related Myopia and Cataract Formation



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**Question 132:** An 18- year-old male patient diagnosed with high-grade osteogenic sarcoma of the femur, received neoadjuvant chemotherapy with methotrexate- adriamycin – cisplatin regimen, following which he underwent surgical resection. The resected tumor specimen showed less than 10 percent viable tumor. He was subsequently planned for chemotherapy in the adjuvant setting. Which of the following is the chemotherapeutic regimen of choice?

**Choices:**

1. Ifosfamide plus etoposide (IE)
2. Methotrexate, adriamycin, and cisplatin (MAC)
3. Methotrexate, adriamycin, cisplatin, and IE combination
4. Methotrexate, adriamycin, cisplatin, and interferon-alpha-2b

**Answer: 2** - Methotrexate, adriamycin, and cisplatin (MAC)

## Explanations:

- The European and American osteosarcoma study is a collaborative trial with the involvement of four study groups, who have come together intending to improve treatment outcomes in the study population. Patients aged less than 40 years with or without metastasis and high-grade osteosarcoma were enrolled in this trial and received standard chemotherapy in the form of methotrexate, adriamycin, and cisplatin in the adjuvant setting.
- Good response to treatment was defined as the presence of viable tumor less than 10 percent. The addition of pegylated interferon-alpha 2 b, in addition to standard chemotherapy in the good response group, was studied. The addition of pegylated interferon-alpha 2 b did not affect the disease-free survival or the overall survival.
- Presence of metastatic disease (pulmonary and non-pulmonary), axial tumor sites was identified as prognostic factors, most commonly associated with worse clinical outcomes. The histological subtypes of conventional osteoblastic and telangiectatic were associated with more favorable outcomes than the chondroblastic subtype.
- In patients who had undergone complete resection, the presence of a poor histological response to neoadjuvant chemotherapy was associated with poor outcomes. Ifosfamide and Etoposide were used in addition to the standard chemotherapy protocol in poor responders. The addition of IE failed to demonstrate an improvement in disease-free survival or overall survival. Conventional therapy with the MAC regimen has been advised as the chemotherapeutic regimen of choice in high-grade osteosarcoma.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Osteogenic Sarcoma



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**Question 133:** A 10-year-old girl presented with dull knee and thigh pain. Magnetic resonance imaging was performed and showed a lesion in the metadiaphysis area of the knee, involving soft tissue. Biopsy from the mass showed blue small round cell tumor and cytogenetic study for t(11, 22) was positive. A metastatic workup was negative. The patient received limb-sparing surgery with chemotherapy and radiotherapy according to the guideline. After twenty-five months of follow-up, complete remission was achieved. Five years later, the patient came into the emergency room with severe pallor, fatigue, and weakness. Physical exam was significant for cervical lymphadenopathy with splenomegaly. Her white blood cell count was 219200/ $\mu$ L, with 62% of peripheral blasts, 2% of neutrophils, and 26% of lymphocyte and a platelet count of 110000/mm<sup>3</sup>. Which of the following is the most appropriate next step for this patient?

**Choices:**

1. Total body irradiation
2. Adjuvant chemotherapy followed by surgery
3. Peripheral blood flow cytometry
4. Bone marrow biopsy

**Answer: 4** - Bone marrow biopsy

## Explanations:

- In this clinical vignette, this patient has 62% blast cells on the peripheral smear that is highly concerning for acute leukemia as a secondary malignancy. The most appropriate step would be a bone marrow biopsy with immunophenotyping.
- The estimated incidence of secondary malignancy (SMN) in Ewing sarcoma is 6–8%. The most commonly seen solid tumor secondary malignancy after Ewing sarcoma is osteosarcoma, followed by malignant fibrous histiocytoma. The most common (~60%) hematologic secondary malignancy is acute myeloid leukemia acute myelocytic leukemia and myelodysplastic syndrome. Another secondary hematologic malignancy including B and T-cell acute lymphocytic leukemia, Hodgkin lymphoma, non-Hodgkin lymphoma, and multiple myeloma is relatively rare in this setting.
- Bone marrow metastasis also requires bone marrow biopsy, and it is sometimes difficult to differentiate the bone marrow metastasis from acute leukemia. Immunohistophenotyping is of paramount importance.
- Before proceeding to therapy, the diagnosis should be made. The role of peripheral blood flow cytometry is limited if morphologically abnormal cells are seen on a peripheral smear (e.g., blast).

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Ewing Sarcoma



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**Question 134:** A 36-year-old man with a history of Hodgkin lymphoma presents to the hospital with left-sided chest pain that radiates to the left arm. EKG shows an ST-elevation myocardial infarction. Coronary angiography reveals varying degrees of stenosis in all cardiac arteries. He denies any family history of early cardiovascular disease or metabolic disorders. He has never smoked. His Hodgkin lymphoma was treated with high-dose radiation about four years ago. Which of the following medications is most likely to have prevented the patient's clinical condition?

**Choices:**

1. Procainamide
2. Sotalol
3. Colchicine
4. Phenobarbital



**Answer: 3** - Colchicine

### Explanations:

- Colchicine has been proposed as potential prophylaxis against RICAD due to its unique anti-inflammatory and anti-coagulant properties.
- Colchicine inhibits microtubule polymerization, mitosis, neutrophil motility, and platelet aggregation.
- Colchicine also affects the expression of adhesion molecules on endothelial cells, leukocytes, and decreases activation of thrombin-induced platelet aggregation.
- Procainamide and sotalol are anti-dysrhythmic medications without effect on coronary arterial inflammation. Phenobarbital is a sedative without specific anti-inflammatory effects.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Radiation Induced Coronary Artery Disease



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**Question 135:** A 70-year-old man with a 15-year history of type 2 diabetes mellitus presents to the clinic with complaints of urinary frequency and hematuria. A routine examination of urine is suggestive of the presence of RBCs. However, it does not report the presence of any organisms. A urine culture sensitivity is returned as sterile. The abdominal examination is suggestive of mass in the right flank. An office blood pressure recording is recorded as 200/120 mmHg. He denies any past or family history of hypertension. An ultrasound KUB is suggestive of a mass on the upper pole of the right kidney. He undergoes radical nephrectomy, which reveals papillary renal cell carcinoma. He then undergoes adjuvant treatment. Six months after the surgery, he presents with complaints of recent onset urinary incontinence and lower backache. He undergoes a bone scan, which is suggestive of multiple osteoblastic metastases. He is planned for spinal stereotactic radiotherapy. Which of the following is the most appropriate target volume for this patient therapy?

**Choices:**

1. Clinical target volume
2. Clinical target volume plus 5 mm
3. Clinical target volume plus 2 mm
4. Gross tumor volume

**Answer: 3** - Clinical target volume plus 2 mm

### Explanations:

- The incidence of metastatic bone disease ranges from 17%-64% in lung cancer, 65%-75% in breast cancer, 65%-90% in prostate cancer, and 70%-95% in multiple myeloma. Locoregional approaches for symptomatic palliation of bone metastases include surgery and radiotherapy. Systemic approaches include the usage of inhibitors of bone resorption, radiopharmaceutical targeted agents, endocrine approaches, and chemotherapy.
- Gross tumor volume defines the clinically delineated volume that can be seen, felt, and palpated. Clinical target volume encompasses the possibility of microscopic spread of the disease and includes a margin around the tumor. Lymph nodes draining the tumor can be either included within the gross tumor volume or the nodal clinical target volume.
- The planned target volume is a geometric construct that takes into consideration the organ motion and inaccuracies of the radiation planning equipment.
- The impact of SBRT on tumor control in radiotherapy naïve patients after excluding those who high-grade MSCC and mechanical instability have been studied by Yamada et al. Clinical target volume was defined as the entire vertebral body if any part of the vertebra was involved. Planning target volume consisted of the CTV in addition to a 2 mm margin. A median dose of 24 Gy (18-24 Gy) was prescribed to the 100% isodose line. The spinal cord constraint consisted of a maximum point dose of 14 Gy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

#### Palliative Radiation Therapy For Bone Metastases



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 136:** A 62-year-old man presents to the clinic for follow-up. He has a history of metastatic prostate cancer with involvement of multiple bones without any history of an adverse skeletal-related event in the past. He has been receiving monthly denosumab but had not been able to travel to the hospital for the past two months due to local travel restrictions. He is complaining of lower backache. Physical examination demonstrates a loss of sensation in the perianal region. Which of the following biomarkers best predicts long-term treatment outcomes in patients with this complication?

**Choices:**

1. Urinary C and N-telopeptides
2. T score less than 2.5 on DEXA (dual-energy x-ray absorptiometry)
3. Percentage change in SUV on FDG – PET
4. Serum Alkaline phosphatase

**Answer: 3** - Percentage change in SUV on FDG – PET

## Explanations:

- The incidence of metastatic bone disease ranges from 17%-64% in lung cancer, 65%-75% in breast cancer, 65%-90% in prostate cancer, and 70%-95% in multiple myeloma. Both external beam radiotherapy, stereotactic body radiotherapy, and radionuclides have been used to deliver radiotherapy to the affected site. Other approaches for palliation of symptoms in metastatic bone disease include pharmacological (bisphosphonates, opioids, and adjuvant analgesics) and non-pharmacological interventions (vertebroplasty, kyphoplasty).
- SBRT has been shown to provide durable control in palliation of pain due to uncomplicated skeletal metastasis. Single high dose SBRT has also been shown to prevent tumor progression and spinal cord compression attributable to direct or indirect tumor growth. Doses of 24 Gy in a single fraction have been used (even in radioresistant tumors).
- The search for novel biomarkers which would predict long-term survival after SBRT is ongoing. A percentage change in SUV on 18-FDG PET post high dose SF SBRT has been used as a predictor of long-term outcomes.
- Combinatorial approaches consisting of minimally invasive surgical approaches along with SBRT, which is based upon the success of achieving local control and preventing tumor progression with IGRT technique, are being studied.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Palliative Radiation Therapy For Bone Metastases



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 137:** A 54-year-old female patient presents with a progressive foreign body sensation in the throat for the last three years. The history of accompanying signs and symptoms, including dysphagia, anorexia, weight loss, heartburn, nausea and vomiting, and acid reflux, chest pain, is lacking. The patient occasionally drinks alcohol but denies smoking. The patient has a history of hypertension and diabetes mellitus, and she is receiving antihypertensive and antidiabetic treatment. She has no other significant medical history. Her father died at age 67 from lung cancer. Her temperature is 37.2 C (98.9F), blood pressure is 115/75 mm Hg, and the pulse is 92/min. Physical examination, including lymph node, cardiopulmonary, and abdominal examinations, is unremarkable. A chest x-ray reveals no abnormalities. A barium test revealed a stricture in the upper esophagus. What is the preferred next step in management?

**Choices:**

1. Omeprazole
2. Computed tomography scan chest with and without contrast
3. Manometry
4. Evaluation by a psychiatrist

**Answer: 2** - Computed tomography scan chest with and without contrast

## Explanations:

- Proton pump inhibitors (including omeprazole, lansoprazole) are useful for patients with typical symptoms of gastroesophageal reflux disease (GERD) who fail other medications. However, patients with features of tumor growth or other alarm symptoms should have a more definitive evaluation first.
- Computed tomography (CT) is considered an adjunct to endoscopy and barium studies and is used to study esophageal tumors. CT scan is done to study the esophageal lesion further. It will most likely show soft-tissue mass in the upper esophagus with mild inhomogeneous enhancement and no noticeable lymph node enlargement, indicating a benign growth such as hamartoma. CT scan is used to define the local extent of the tumor by showing the extent of involvement of the esophageal wall.
- Bronchoscopy is indicated for the evaluation of accessible pulmonary masses or patients with additional symptoms (e.g., hemoptysis) of an endobronchial lesion. This patient has a normal chest x-ray and possible dysphagia, making the esophageal tumor more likely than lung malignancy.
- Psychiatric evaluation is usually needed in patients with a history of behavioral or mood disorders that are not present in this patient.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Hamartoma



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 138:** A 12-year-old female presents to a clinic with a 4-month history of worsening intermittent headaches associated with dizziness. MRI shows a small mass occupying the third ventricle with areas of calcification, isointense on T1-weighted images, hyperintense on T2-weighted images. Which of the following features supports the most likely diagnosis?

**Choices:**

1. Restricted diffusion on diffusion-weighted MRI
2. Disseminated disease at diagnosis
3. Older age of presentation
4. History of type 1 multiple endocrine neoplasias



**Answer: 1** - Restricted diffusion on diffusion-weighted MRI

## Explanations:

- This patient has an intracranial ependymoma, a group of glial tumors that are derived from the radial glial cells. These tumors often show restricted diffusion on diffusion-weighted images.
- In children, older age at presentation is associated with a better prognosis. However, intracranial ependymomas are associated with poor long-term survival.
- Anaplastic ependymomas may seed to other parts of the CNS.
- Surgical resection may provide effective palliative therapy. After completion of therapy, an MRI of the brain is recommended every three to four months for three years.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Ependymoma



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 139:** A 55-year-old female has been diagnosed with lobular carcinoma in situ. What is the best option for the management of this patient?

**Choices:**

1. Modified radical mastectomy
2. Lumpectomy with axillary node dissection
3. Radiation
4. Observation

Answer: 4 - Observation

## Explanations:

- Lobular carcinoma in situ is a precursor for intraductal cancer.
- The risk of developing malignancy is about five-fold higher compared to women who do not have the diagnosis of lobular carcinoma in situ.
- After diagnosis in one breast, there is a 20% chance of cancer in the contralateral breast.
- Since lobular carcinoma in situ is non-invasive, node dissection is not required. The majority of surgeons recommend a simple mastectomy, but observation with follow-up is also a viable option.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Lobular Breast Carcinoma



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 140:** A 66-year-old patient presents to the office for evaluation of the back pain and fatigue for 6 months. The pain is dull, non-radiating, located in the lower back and 6/10 in intensity. On physical examination, conjunctival pallor is present and there is tenderness on the lower back. His bodyweight is stable without any significant change. His blood pressure is 110/70 mmHg, the temperature is afebrile, and pulse 100 bpm. What could be the most likely cause of his symptoms?

**Choices:**

1. Osteogenic sarcoma
2. Disc herniation
3. Multiple myeloma
4. Vertebral fracture

**Answer: 3** - Multiple myeloma

## Explanations:

- Multiple myeloma is the most common primary bone cancer in adults. Metastatic disease, secondary bone cancer, is even more common. It occurs predominantly in the geriatric population with a median age at diagnosis of about 70 years.
- Multiple myeloma affects five to seven people per 100,000 each year.
- Most cases are seen in between the ages of 50 and 70.
- Osteosarcoma is the second most common bone cancer overall and the most common in the pediatric age group.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Multiple Myeloma



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 141:** Which of the following is the most common neoplasm seen within the submandibular triangle?

**Choices:**

1. Adenoid cystic carcinoma
2. Adenolymphoma
3. Pleomorphic adenoma
4. Mucoepidermoid carcinoma

**Answer: 3** - Pleomorphic adenoma

## Explanations:

- Neoplasms within the submandibular triangle are diagnosed with ultrasound, computerized tomography, or magnetic resonance imaging, followed by fine-needle aspiration biopsy for confirmation. Treatment of all submandibular triangle neoplasms requires surgical resection.
- Neoplasms found within the submandibular triangle can be divided into benign and malignant masses. Pleomorphic adenoma is the overall most commonly seen neoplasm within the submandibular triangle.
- The next most common benign neoplasm to pleomorphic adenoma is adenolymphoma, also known as Warthin tumor.
- Malignant neoplasms found within the submandibular triangle include adenoid cystic carcinoma and mucoepidermoid carcinoma.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Pleomorphic Adenoma



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**Question 142:** A 67-year-old male with HIV presents with fevers, night sweats, and 20 lb (9 kg) weight loss in the past three months. His physical exam reveals inguinal lymphadenopathy. CT of the chest, abdomen, and pelvis reveals a gastric mass. Biopsy of the gastric mass reveals plasmablasts, and immunophenotype is positive for CD 19, CD 38, MUM-1, and MYC gene rearrangement is present. What is the standard of care for this tumor?

**Choices:**

1. Rituximab, cyclophosphamide, doxorubicin, vincristine, prednisone (R-CHOP)
2. Dose-adjusted rituximab, etoposide, vincristine, prednisone, cyclophosphamide, doxorubicin (da-R-EPOCH)
3. There is no current standard of care
4. Rituximab, cyclophosphamide, vincristine, prednisone (R-CVP)



**Answer: 3** - There is no current standard of care

## Explanations:

- Plasmablastic Lymphoma (PBL) is a very aggressive lymphoma that is both hard to diagnose and treat.
- There is no current standard of care for the treatment of PBL.
- da-R-EPOCH, R-CHOP, and R-CVP are the most common regimens used to treat this condition.
- da-R-EPOCH has been shown to be more effective than R-CHOP in patients with HIV-associated lymphomas. R-CHOP and R-CVP can also be used in elderly and frail patients who cannot tolerate very intensive chemotherapy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Plasmablastic Lymphoma



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**Question 143:** A 34-year-old female presents to the clinic with an insidious onset of painless swelling along the left posterior and anterior tibial diaphysis. The radiographs of the tibia demonstrated an osteolytic lesion without significant soft tissue involvement. MRI demonstrated a T1 low signal lesion. Fine needle aspiration demonstrated malignant features. Histopathology of the tumor shows an infiltrating spindle cell neoplasm. Immunohistochemistry staining was positive for cytokeratin and vimentin. Based on the provided description, which of the following represents the most common site of metastasis?

**Choices:**

1. Lungs
2. Spleen
3. Liver
4. Brain

Answer: 1 - Lungs

## Explanations:

- Adamantinoma is a rare and low-grade malignant tumor of the bone commonly occurring in the diaphyses and metaphyses of the tibia. Classical adamantinomas are characterized by easily recognizable epithelial and osteofibrous components that may be intermingled in various proportions and differentiation patterns.
- The most common sites of metastasis include the lungs and lymph nodes.
- The four main differentiating patterns of classic adamantinoma are basaloid, tubular, spindle cell, and squamous. There are two types of adamantinoma: the classical and the differentiated type, which resembles osteofibrous dysplasia. Immunohistochemically, the fibrous tissue is positive for vimentin. The epithelial cells show coexpression of keratin, EMA, vimentin, p63, and podoplanin.
- Despite advances in imaging techniques, the definitive diagnosis of adamantinoma is mainly established by histopathological examination. Extensive sampling of adamantinoma is very important, especially in the differentiated form where the epithelial component is only focally encountered.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Adamantinoma



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**Question 144:** A 45-year-old female presented to the emergency department suffering from chest pain, dyspnea, and hemoptysis. She endorsed smoking two packets per day and drinking alcohol two times a week. Her vital signs were unremarkable. CBC shows a hemoglobin level of 10 mg/dl, hematocrit level of 34%, MCV equals 95 fl, and MCH is 30 pg. Her EKG revealed normal sinus rhythm without any abnormalities. Blood chemistry tests showed low serum osmolarity and hyponatremia. Imaging studies, including a chest x-ray and chest CT scan, which were consistent with bilateral lower lobar lung nodules with deposits, appeared in the mediastinal lymph nodes. A bronchoscopic biopsy was performed, and histological findings were consistent with small cell lung cancer with metastasis to mediastinal lymph nodes and the contralateral lung in association with the syndrome of inappropriate secretion of antidiuretic hormone. Thereafter, the patient underwent intense chemotherapy accompanied by radiotherapy. A few months later, the patient came to the hospital for a follow-up CT scan that showed a severe calcification in the thoracic aorta, which was regarded as porcelain aorta. Which of the following factor plays a role in mediating this calcification?

**Choices:**

1. Smoking
2. Small cell lung cancer
3. Alcohol use disorder
4. Chest radiation

**Answer: 4** - Chest radiation

## Explanations:

- Non-atherosclerotic porcelain aorta (PA) is one of the two types of PA in which calcification takes place in the tunica media of the aortic wall in the absence of atherosclerosis.
- Multiple risk factors have been implicated in PA in literature reviews. The factors that are commonly involved in both types are a familial factor, aging, diabetes mellitus (DM), radiation, uremia, and Takayasu arteritis. Whereas, the atherosclerotic type is associated with additional factors such as hypertension, hyperlipidemia, smoking, alcohol use disorder, sedentary lifestyle, obesity, systemic lupus erythematosus (SLE), and rheumatoid arthritis (RA).
- Non-atherosclerotic porcelain aorta (PA) is induced by vascular inflammation, radiation, and uremia via triggering a metaplastic transformation of VSMCs into osteoblasts leading to the production of bone associated proteins such as alkaline phosphatase, bone sialoprotein, bone Gla protein, and bone morphogenic protein.
- Vascular inflammation induced by radiation also predisposes to PA through apoptotic bodies that arise from dead VSMCs and elastin degradation mediated by matrix metalloprotease and act as a nidus for medial calcification by sending paracrine osteogenic signals that will provoke the aortic calcium deposition as well as the collagen deposition and loss of the elastic fibers causing an arterial wall stiffness.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Porcelain Aorta



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**Question 145:** A 65-year-old woman with a past medical history of ovarian cancer presents to the hospital with right leg weakness. After the initial evaluation, she is diagnosed with lumbosacral plexopathy. She had surgical resection of her ovarian tumor followed by chemoradiation to the pelvis due to suspect local spread. Which of the following findings, if present, is most suggestive of radiation-induced plexopathy rather than infiltrative/tumor-related plexopathy in this patient?

**Choices:**

1. Presence of severe pain at the right groin and leg
2. Motor weakness in the right leg with sphincter disturbances
3. Electrophysiological findings of sensory and motor nerve involvement with chronic denervation noted on needle EMG study
4. Imaging findings with increased T2 signal but no Gadolinium enhancement of nerve roots noted on MRI

**Answer: 4** - Imaging findings with increased T2 signal but no Gadolinium enhancement of nerve roots noted on MRI

## Explanations:

- Radiation-induced plexopathy can coexist in a patient who has neoplastic lumbosacral plexopathy and has been treated with radiation therapy.
- The overall frequency of radiation-induced plexopathy (cervical, brachial, lumbosacral) in treated patients is 1.8% to 4.9%.
- An increased T 2 signal may be seen on MRI with both, but nerve enhancement is not seen with RILSP (but seen with neoplastic LSP).
- PET scans are also usually negative with radiation-induced plexopathy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Neoplastic Lumbosacral Plexopathy



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**Question 146:** An 81-year-old male patient comes into the clinic for evaluation. He has a known diagnosis for prostate cancer. His past medical history is noted for smoking, hypertension managed with medication, and osteoarthritis. His past surgical history was noted for bilateral knee replacements five years ago and transurethral resection of the prostate two months ago. His vitals are stable. He complains of intermittent blood in the urine. He undergoes brachytherapy and then shows up to the clinic one week later with a new symptom. What is the most likely symptom with his presentation?

**Choices:**

1. Abdominal distention
2. Rectal incontinence
3. Urinary obstruction
4. Orchitis



**Answer: 3** - Urinary obstruction

## Explanations:

- The concern of brachytherapy after transurethral resection of the prostate is the increased risk for urethral injury. The radiation from brachytherapy can damage the urethra in the setting of the urethra, already receiving thermal injury from the transurethral resection of the prostate.
- There is an increased risk for urinary retention for patients who have undergone transurethral resection of the prostate prior to receiving brachytherapy. The range of this occurrence increased from 0-22% to 0-85%, depending on the study.
- A prior transurethral resection of the prostate (TURP) within the past 3 months is a contraindication for brachytherapy. A TURP done more remotely is not a definite contraindication, and some studies show success with brachytherapy in post-transurethral resection of the prostate patients.
- Orchitis is not a usual symptom that patients present within the setting of brachytherapy and recent transurethral resection of the prostate.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Brachytherapy



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**Question 147:** What was the recommended large and small bowel constraint when treating anal cancer in the RTOG 0529 trial?

**Choices:**

1. V50 less than 5 cc
2. V45 less than 20 cc
3. V35 less than 195 cc
4. V30 less than 500 cc

Answer: 2 - V45 less than 20 cc

## Explanations:

- The RTOG 0529 trial was the first study to show improvement in anal cancer toxicity with intensity-modulated radiation therapy (IMRT) over conventional fields. The researchers treated participants with a dose-painted simultaneous integrated boost plan to various fractionation regimens dependent on T stage and the size of lymph nodes.
- Although the primary endpoint in RTOG 0529 (reducing grade 2+ acute gastrointestinal (GI) or genitourinary (GU) toxicity by 15% compared to RTOG 9811) was not met, there was significant sparing of grade 2+ hematologic and grade 3+ dermatologic and GI toxicity.
- RTOG 0529 limited the small and large bowel dose to V45 Gy less than 20 cc, V35 Gy less than 150 cc, and V30 Gy less than 200 cc. This resulted in acute grade 2+ GI adverse events at 73% and acute grade 3+ GI adverse events at 21%. Overall, the rate of late GI grade 2+ adverse events was 10%.
- RTOG 0529 limited the bladder dose to V50 Gy less than or equal to 5%, V40 Gy less than or equal to 35%, and V35 Gy less than or equal to 50%. This resulted in acute grade 2+ GU adverse events at 15% and acute grade 3+ GU adverse events at 2%. Overall, the rate of late GU grade 2+ adverse events was 4%.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Therapy For Anal Cancer



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**Question 148:** A 45-year-old female patient who has ongoing treatment with surgery and adjuvant radiotherapy for malignant melanoma presents with complaints of shock-like sensations running down the back of her spine and limbs whenever she takes a hot shower or goes out in the cold. The symptoms are not severe enough to affect her activities of daily living. She has no past medical history of any previous neurologic deficits of relapsing and remitting onset and workup before surgery for melanoma did not reveal any extensions in the spinal cord. She denies any history of recent upper respiratory tract infections. What is the most appropriate next step in management?

**Choices:**

1. Intravenous immunoglobulins
2. Oral prednisone
3. Intravenous methylprednisolone
4. Reassurance

Answer: 4 - Reassurance

## Explanations:

- The patient's presentation is most consistent with the Lhermitte phenomenon, which is an acute complication of head and neck irradiation. It is transient demyelinating myelopathy, which resolves almost completely following the completion of radiotherapy. Therefore reassurance is the most appropriate option for this patient.
- Acute side effects of radiotherapy generally resolve with time and will require treatment only if it has a significant impact on the activities of daily life.
- Intravenous methylprednisone and prednisone are used for the treatment of multiple sclerosis (MS) and transverse myelitis, respectively. This patient's MRI is negative for any lesions disseminated in space and time, and history is negative for any prior episodes of neurologic deficit. Lhermitte is a common presentation of MS and is the closest differential diagnosis for radiation-induced Lhermitte syndrome.
- Intravenous immunoglobulins are used for Guillain-Barre syndrome, which presents with ascending paralysis 2-4 weeks after an upper respiratory tract or gastrointestinal infection.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Adverse Effects Of Radiation Therapy



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## Section 5

**Question 149:** A 65-year-old man underwent primary chemotherapy and radiation therapy for an anterior floor of mouth squamous cell carcinoma one year ago. He underwent pre-treatment pan-mouth dental extraction and completed his treatment without incidents. Three weeks ago, he noticed a swelling of his submandibular area, and over the past week, it has begun to drain a cloudy fluid, particularly after eating. On examination, there is a pinpoint fistula in his submental area, with some granulation tissue intraorally, but no exposed bone. Palpation of his submandibular gland is painful but expresses clear saliva. He has not undergone hyperbaric oxygen (HBOT), and a biopsy of this area is negative for malignancy. What is his next best step in treatment?

### Choices:

1. Surgical resection with or without reconstruction without hyperbaric oxygen (HBOT)
2. 10 dives HBOT then surgical resection, followed by 30 dives HBOT
3. Surgical resection with or without reconstruction then 10 dives HBOT
4. 30 dives HBOT, then reassessment for surgical intervention

**Answer:** 4 - 30 dives HBOT, then reassessment for surgical intervention

## Explanations:

- The 30 hyperbaric oxygen treatments (HBOT) preceding surgery has shown to increase the odds of improved healing after surgery.
- All stage III osteoradionecrosis cases require surgical resection of necrotic, non-viable bone.
- Patients did not see meaningful improvements in outcomes with less than 30 preoperative HBOT.
- The staging with the Marx protocol is based on response to HBOT and the presence of characteristic signs and radiographic findings.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Mandible Osteoradionecrosis



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**Question 150:** A 5-year-old girl is brought to the emergency department with a history of sudden onset loss of consciousness following a headache that had been present for the past 3 days. On examination, the Glasgow coma scale (GCS) score is 10/15 (E3V2M5). An emergency CT scan of the brain has been performed, which shows obstructive hydrocephalus with a mass in the pineal region. She undergoes an emergency third ventriculostomy and biopsy of the lesion. The cerebrospinal fluid turns to be positive for placental alkaline phosphatase. The histopathology shows large epithelioid cells with abundant periodic acid–Schiff (PAS) positive cytoplasm. Which of the following is the most appropriate management strategy for this patient?

**Choices:**

1. Surgical excision
2. Radiotherapy
3. Chemotherapy
4. IV prednisolone only



Answer: 2 - Radiotherapy

## Explanations:

- The patient has a pineal region tumor with hydrocephalus.
- The cerebrospinal fluid (CSF) positivity for placental alkaline phosphatase (PLAP) and histopathological features are suggestive of germinoma.
- Germinomas are highly radiosensitive.
- Resection of germinomas is difficult due to high collagen content.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Childhood Brain Tumors



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 151:** A 40-year-old female is concerned about her screening mammogram result of BI-RADS 2. The ordering provider reviews the report and realizes BI-RADS 2 was assigned for benign breast calcifications. What is the next step in management?

**Choices:**

1. Reassure and follow-up screening exam should be done in 1 year
2. Get a 6-month follow-up to ensure stability
3. Schedule a fine needle aspiration
4. Schedule a core biopsy

**Answer: 1** - Reassure and follow-up screening exam should be done in 1 year

## Explanations:

- Benign breast calcifications do not require further workup or intervention.
- Benign breast calcifications do not require further workup or intervention. A 6-month follow-up is unnecessary and a waste of resources.
- Benign breast calcifications do not require further workup or intervention. Fine needle aspiration is unwarranted and a waste of resources. Furthermore, fine needle aspirations are not commonly performed in the setting of breast tissue sampling.
- Benign breast calcifications do not require further workup or intervention. A biopsy is unwarranted and a waste of resources. If tissue sampling were in order, a stereotactic biopsy would be the method of choice.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Benign Breast Calcifications



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 152:** Which of the following is the most common radiologic finding in postradiation sarcoma?

**Choices:**

1. Cortical bone destruction
2. Osteosclerosis
3. Osteopenia
4. Mineralized soft-tissue mass

**Answer: 1** - Cortical bone destruction

## Explanations:

- Cortical bone destruction is the most common radiologic finding seen with plain radiographs, MRI, and CT.
- If plain films are normal and there is significant pain, CT and MRI may identify more subtle changes, such as extramedullary soft-tissue mass and abnormal medullary areas.
- While ionizing radiation is the trigger for the sarcoma, other factors that increase the risk include concomitant use chemotherapeutic agents, genetic predisposition and other unknown factors.
- The most common clinical presentation of post-radiation sarcoma is the unrelenting severe pain, that also occurs at night. This pain is usually not relieved by the conventional pain medications and the prognosis for most patients is very poor.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Sarcoma



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**Question 153:** A 65-year-old woman presents to the clinic for follow up. She has a history of radiation for breast cancer that resulted in radiation-induced coronary arterial disease (RICAD). She is currently using nitroglycerin for angina and daily aspirin. Which of the following is the next best step in the management of this patient?

**Choices:**

1. Lidocaine
2. Simvastatin
3. Metoprolol
4. Hydralazine

Answer: 2 - Simvastatin

## Explanations:

- Simvastatin is a statin medication originally prescribed for familial hypercholesterolemia, but it has been shown to improve endothelial function and protect against radiation damage in animal studies.
- Simvastatin promotes vasculogenesis and increases thrombomodulin expression by a nitric oxide-dependent mechanism.
- Simvastatin decreases severity of injury from induced myocardial infarction and improves postischemic ventricular function in animal studies.
- Lidocaine is a sodium channel antagonist that is an anti-dysrhythmic medication. Metoprolol is a beta-blocker, also used for anti-dysrhythmia and hypertension. Hydralazine is an anti-hypertensive medication. These medications have not specifically been shown to have anti-inflammatory effects which would decrease progression of RICAD.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Radiation Induced Coronary Artery Disease



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**Question 154:** An 82-year-old man is brought to the hospital with breathlessness, fever, hemoptysis, and syncope. His family reports that he has been losing weight over the past few years. An x-ray order shows an enlarged cardiac shadow. An echocardiogram shows multiple linear disorganized echoes in the mitral orifice and within the left atrium in the region of the anterior mitral valve leaflet. Which of the following is to be seen on a cardiac biopsy?

**Choices:**

1. Vascular channels are irregular, anastomosing, and sinusoidal, with pleomorphic lining cells showing frequent mitotic figures.
2. Monomorphic fibroblasts that demonstrate little or no atypia and margins infiltrate into cardiac muscle.
3. Well-demarcated nodules of enlarged vacuolated cells with clear cytoplasm because of glycogen deposits.
4. Cytologically bland cell with eosinophilic cytoplasm and an oval or round nucleus and the cells are typically within a myxoid matrix, rich in mucopolysaccharide.



**Answer: 4** - Cytologically bland cell with eosinophilic cytoplasm and an oval or round nucleus and the cells are typically within a myxoid matrix, rich in mucopolysaccharide.

## Explanations:

- The echocardiogram findings of multiple linear disorganized echoes in the mitral orifice and within the left atrium in the region of the anterior mitral valve leaflet are suggestive of cardiac myxoma.
- The most common benign tumor in adults. More frequently found in the left atrium (80%), followed by the right atrium and occasionally in the ventricles.
- Histologically, the one defining characteristic is the presence of the so-called myxoma cell (or lepidic cell), a cytologically bland cell with eosinophilic cytoplasm, and an oval or round nucleus. These stellate, ovoid or plump spindle cells may occur singly or in groups. The cells are typically within a myxoid matrix, rich in mucopolysaccharides. Large thick-walled vessels are often present near the stalk or the base of the lesion.
- Due to the lack of a strong structure, embolization is common.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Cardiac Cancer



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**Question 155:** A 48-year-old female patient, nulliparous, presents to the outpatient clinic with complaints of irregular delayed menses for six months and upper abdominal pain for one week. Imaging showed a 11x8x6 cm solid mass from the right ovary with areas of hemorrhage and necrosis, compressing the right distal ureter and right external iliac vein with enlarged para-aortic nodes. Tumor markers (CA-125, CA 19-9, carcinoembryonic antigen, beta hCG, and alpha-fetoprotein) were normal, but inhibin A (141 pg/mL) and inhibin B (1261 pg/mL) were elevated. She underwent total abdominal hysterectomy with bilateral salpingo-oophorectomy, pelvic and para-aortic lymphadenectomy, infracolic omentectomy with peritoneal biopsy, and fluid cytology with endometrial biopsy. HPE showed granulosa theca cell cancer with lymph node metastases. Which of the following is the next ideal recommended treatment?

**Choices:**

1. Adjuvant chemotherapy with bleomycin, etoposide, and cisplatin
2. Adjuvant chemotherapy with cisplatin, vinblastin, and bleomycin
3. Adjuvant chemotherapy with cisplatin, doxorubicin, and cyclophosphamide
4. Adjuvant chemotherapy with paclitaxel and carboplatin

**Answer: 4** - Adjuvant chemotherapy with paclitaxel and carboplatin

## Explanations:

- This patient has FIGO Stage III granulosa cell cancer, for which the recommended treatment is complete cytoreduction followed by adjuvant chemotherapy.
- Adjuvant chemotherapy has been associated with longer progression-free survival among advanced granulosa cell tumors [FIGO stage II to IV]. Still, there is no evidence supporting an overall survival benefit.
- The most commonly used regimens are bleomycin, cisplatin, plus etoposide (BEP), or paclitaxel plus carboplatin (TC).
- For younger, fit patients BEP regime is preferred, while the TC regime is preferred for patients >40 years old due to toxicity concerns.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Granulosa Theca Cell Cancer



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**Question 156:** A 67-year-old man is being evaluated following an insidious history of altered bowel habits, pain on defecation, and weight loss over the past year. A CT pelvis is suggestive of a lesion in the proximal anal canal with bilateral external inguinal node involvement but without evidence of distant metastasis. Following the results of the EORTC 22861 study, what benefit might this patient receive following a course of combined chemo- and radiotherapy, versus radiotherapy alone?

**Choices:**

1. Improved locoregional control at 1 year
2. Improved colostomy-free interval
3. Statistically significant increase in 5-year overall survival
4. Statistically significant increase in 10-year overall survival

**Answer: 2** - Improved colostomy-free interval

## Explanations:

- Concurrent chemotherapy and radiation yield results superior to those of radiation alone or surgery alone.
- The two most prominent trials comparing radiation alone to chemoradiation include ACT I and EORTC 22861. The latter trial randomized patients with anal cancer to receive radiation therapy alone, or with adjuvant 5-fluorouracil and mitomycin-C.
- Patients had an improved colostomy-free survival rate with chemoradiation.
- Locoregional control was improved at 2 years (31% vs. 22%,  $p = 0.02$ ).

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Therapy For Anal Cancer



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 157:** An 8-year-old female is brought to the clinic by her mother with complaints of double vision, unsteady gait, weakness, and problems swallowing for 3 weeks. An MRI of the brain is ordered, and it shows a non-enhancing, low-intensity lesion at the pons. What is the next best and ideal step in the management of this patient at an experienced center?

**Choices:**

1. Stereotactic biopsy
2. Chemotherapy
3. Radiotherapy
4. Shunt placement

**Answer: 1** - Stereotactic biopsy

## Explanations:

- The patient most likely has a diffuse intrinsic pontine glioma.
- This is usually high grade and has a very poor prognosis.
- The current management recommendations are tissue diagnosis with a stereotactic biopsy at an experienced center, followed by conventional radiotherapy at doses from 54-60 Gy.
- The treatment efficacy in children has not advanced in the past several years.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Diffuse Intrinsic Pontine Glioma



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 158:** A 68-year-old man presents with a lump on the right forearm. He noticed this lump three months ago when he accidentally brushed himself against the kitchen sink. Initially, a bruise appeared on the affected area that waxed and waned till about four weeks ago, when it started growing to its current size (~4 x 5 cm). He has a history of leiomyosarcoma in the same region that was irradiated, followed by R0 resection nearly ten years ago. The mass is biopsied, and histopathology shows abnormal, pleomorphic, malignant endothelial cells. The cells stain positively for Ulex europaeus agglutinin 1, and vascular endothelial growth factor (VEGF), and negative for S-100 and HMB-45. Staging imaging does not show any evidence of metastasis, confirming a stage 1 disease. The overall performance status of the patient is between 0-1. Which of the following would be the best approach to the treatment of this patient?

**Choices:**

1. Systemic treatment with cytotoxic chemotherapy
2. Immunotherapy
3. Neoadjuvant RT followed by surgical resection.
4. Hospice care



**Answer: 3** - Neoadjuvant RT followed by surgical resection.

## Explanations:

- The goal of treatment in localized angiosarcoma is to achieve R0 resection.
- Perioperative RT helps in achieving a durable response.
- Angiosarcoma is a high-grade tumor by definition. Hence perioperative RT is indicated along with surgery for patients with localized angiosarcoma.
- Immunotherapy is still experimental in patients with angiosarcoma. Cytotoxic chemotherapy alone is not indicated for localized angiosarcoma. Hospice care is not appropriate for this patient at this point.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Angiosarcoma



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 159:** A 53-year-old female with breast carcinoma HER 2+ presents with complaints of sudden seizures in the emergency. She has complained of mild headaches and nausea for the last three weeks. She has been treated with a bilateral mastectomy and chemotherapy drugs, including carboplatin, cyclophosphamide, and doxorubicin. On examination, the patient is drowsy and disorientated but able to follow commands. The patient has left facial nerve palsy, left VI palsy, and asymmetric weakness of lower limbs. Power is 4/5, and the Babinski sign is positive bilaterally. Magnetic resonance imaging brain is done; it shows leptomeningeal enhancement, enlarged lateral ventricles, and dilatation of temporal horns bilaterally. CSF cytology shows HER 2+ tumor cells. Which is the best treatment approach?

**Choices:**

1. Surgical excision of metastatic lesion
2. Whole-brain irradiation therapy
3. Intrathecal chemotherapy with systemic trastuzumab
4. Systemic chemotherapy with intrathecal trastuzumab

**Answer: 4** - Systemic chemotherapy with intrathecal trastuzumab

## Explanations:

- Primary cancers causing metastatic infiltration of leptomeningeal layers are variable. They include extra-cranial and intra-cranial sites. Breast carcinoma is one of the most frequently sold cancer to cause carcinomatous meningitis. It occurs in the advanced stage of an aggressive tumor. So, invasive lobular breast carcinoma is the most common among breast cancers to cause this, particularly HER 2+ type. It can present with a wide variety of neurological symptoms like headaches, seizures, cranial nerve symptoms, spinal radiculopathy, cauda equina syndrome, and even like a stroke.
- The diagnosis is by cerebrospinal fluid studies and magnetic resonance imaging. Cerebrospinal fluid cytology is of vital importance in solid tumors. It holds diagnostic value as well as prognostic value. Different tumor markers can be checked, which can lead to early diagnosis. Magnetic resonance imaging study shows hydrocephalus, leptomeningeal enhancement along sulci and gyri, sub-ependymal nodules, and dilatation of the Virchow-robin spaces in carcinomatous meningitis.
- Carcinomatous meningitis from breast carcinoma is an aggressive metastatic complication with a dismal prognosis. Management of carcinomatous meningitis due to breast cancer is complex and depends on whether the patient is at high risk or low risk. Good prognostic factors include the Karnofsky performance status scale (KPS) score >60, minimal systemic disease, minimal neurological deficit, low CSF protein, and good treatment options. Poor risk patients are those with KPS score 60, neurological deficits, high systemic disease burden, normal CSF protein, and poor treatment options. Patients with low-risk disease are treated with a combination of intrathecal and systemic chemotherapy, while those with high-risk disease are managed with palliative care.
- Surgical treatment is rarely done in carcinomatous meningitis. In CNS lesion, which is single and accessible, can be removed with surgery, but in carcinomatous meningitis, only surgery is done for the Omayo catheter placement. Radiotherapy includes focal and whole-brain irradiation therapy. Focal radiotherapy is done for symptomatic management of nodular lesions, while whole-brain radiation therapy is done for linear lesions causing symptoms. Asymptomatic and symptomatic lesions in low-risk disease are treated with a combination of intrathecal and systemic chemotherapy according to ESMO-EANO guidelines. Intrathecal trastuzumab in patients with human epidermal growth factor receptor 2 positive (HER 2+) breast cancer is proving to be an effective therapy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Carcinomatous Meningitis





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**Question 160:** A 45-year-old Hispanic woman presents to the clinic with complaints of anxiety, tachycardia, diarrhea, profuse sweating, and loss of hair. She underwent surgical resection of a thyroid tumor one year ago. Her ultrasound at that time showed solid hypoechoic nodules with microcalcifications, poorly defined margins, and vascular patterns with the dominant intranodular flow. Her pathology reports confirmed follicular cells that did not have the nuclear atypia. She was then lost to follow up. She said she had to travel back to her country and was of the impression that after this surgery, she was cured of the disease. She has not seen any doctors since then. Which of the following treatments is most likely to have prevented this patient's current condition?

**Choices:**

1. Neck radiotherapy
2. Radioactive iodine-131 ablation
3. Immediate thyroid hormone replacement therapy
4. Tyrosine kinase inhibitor therapy

**Answer: 2** - Radioactive iodine-131 ablation

## Explanations:

- Follicular thyroid carcinoma with invasive characteristics is treated with total thyroidectomy, radioiodine ablation, and thyrotropin suppressing medications.
- After surgery, radioactive iodine is administered. This will destroy any residual thyroid tissue and occult cancer cells and also allow for the detection of any persistent cancer.
- A study reported a 2.1 fold increase of follicular thyroid cancer recurrence in those who did not undergo radioiodine ablation compared to those who did, which is why the standard treatment recommendation is total thyroidectomy followed by radioiodine radiation.
- Most patients require ablation with I-131 following surgery to eliminate the risk of recurrence.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Follicular Thyroid Cancer



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 161:** A 45-year-old woman presents to the clinic with new-onset urinary incontinence and back pain. She has a known history of metastatic stage IV breast cancer. MRI reveals a blastic lesion in the T10 vertebral body with compression on the spinal cord. Physical examination reveals 3+ patellar reflexes bilaterally. Palliative radiotherapy is recommended to address her symptoms. Which of the following steps is most critical to perform before initiating radiotherapy in this patient?

**Choices:**

1. Determination of the stability of the spine
2. En bloc resection of the T10 vertebral segment with fusion from T8-L2
3. 3 months of aggressive chemotherapy regimen
4. Genomic testing for BRCA1 and BRCA2 mutations

**Answer: 1** - Determination of the stability of the spine

## Explanations:

- Palliative radiotherapy of the spine is a useful treatment in the case of back pain and spinal cord compression in patients with metastatic lesions in the vertebrae.
- Metastatic lesions to the vertebrae can lead to spinal cord compression, resulting in loss of bowel and bladder function, weakness, numbness/sensory deficits, and hyperreflexia.
- Patients with metastatic lesions to the spine should be evaluated using the SINS scoring system to determine the stability of the spine, and whether surgical intervention is necessary, even when undergoing palliative radiation therapy.
- In patients with incurable metastasis, radiation therapy should not be delayed, especially in the case of spinal cord compression.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Palliation Radiation Therapy Of The Spinal Cord



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**Question 162:** A 65-year-old man presents to the clinic with complaints of intractable abdominal pain. He also complains of continuous fatigue. The detailed history reveals him to be associated with the PVC (polyvinyl chloride) pipe manufacturing industry for the last 30 years. On presentation, he is afebrile, has a pulse rate of 80 bpm, a blood pressure of 140/90 mmHg, and a respiratory rate of 12 breaths/min. The general physical examination is insignificant except for the presence of scleral icterus. The abdominal examination shows the pain to be localized to the right upper quadrant, and hepatomegaly is also noted. On auscultation, a bruit is heard in the right hypochondrium. He has a hemoglobin level of 8.6 g/dl, an MCV of 80 fl, a total leukocyte count of 5500/mm<sup>3</sup>, and a platelet count of 110,000/mm<sup>3</sup>. Liver function tests show bilirubin of 8 mg/dl and an alkaline phosphatase level of 248 IU/L. His serum alpha-fetoprotein is also raised. He has been taking a high dose of opioids but no avail. A nerve block is planned. What is the approach for administering this block?

### Choices:

1. Via anterior abdominal wall
2. Via lateral abdominal wall
3. Transaortic approach
4. Trans-intervertebral approach

**Answer: 1** - Via anterior abdominal wall

## Explanations:

- With the anterior approach, the needle is inserted through the anterior abdominal wall aimed at the region of the celiac plexus. The neurolytic agent is then injected into the antecrural space.
- The anterior approach means crossing the abdominal organs like the liver and bowel, but the procedure is well tolerated.
- In addition, with the anterior approach, the patient is more comfortable in the supine position. In other approaches, the patient is often placed in less comfortable positions.
- With the posterior approach, the needle is inserted through the paraspinal muscles into the region of the celiac plexus. Again the neurolytic agent is injected into the antecrural space.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Celiac Plexus Block



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**Question 163:** A 62-year-old female is discovered to have metastatic breast cancer that is positive for HER2 and negative for estrogen receptor (ER) and progesterone receptor (PR). Vital signs are pulse rate 75/min, blood pressure 125/72 mm Hg, respiratory rate 16/min, and temperature 98.6F (37 degrees C). The clinician wants to start her on a medication that acts on this receptor. Which of the following studies should be obtained prior to the initiation of therapy?

**Choices:**

1. Transthoracic echocardiogram
2. Spot urine protein: creatinine ratio
3. Pulmonary function testing
4. Testing for HLA: B27

**Answer: 1** - Transthoracic echocardiogram

## Explanations:

- All patients beginning therapy with trastuzumab should receive a transthoracic echocardiogram for baseline assessment of left ventricular function.
- Trastuzumab is known to cause cardiotoxicity, usually manifested as a decrease in left ventricular ejection fraction (LVEF). The exact pathogenesis of this event is unknown but may involve the decreased clearance of reactive oxygen species in cardiac myocytes.
- The major risk factor for the development of cardiotoxicity is concurrent treatment with anthracyclines; the risk of severe cardiotoxicity is three to four times higher in patients receiving both trastuzumab and anthracyclines.
- Old age and hypertension are associated with a small but significant increase in the risk of trastuzumab-induced cardiotoxicity. In clinical practice, most cases of trastuzumab-induced cardiotoxicity appear to be reversible upon discontinuation of treatment. In some patients, however, long-term echocardiographic evidence of myocardial dysfunction persists.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Trastuzumab



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**Question 164:** Which of the following describes a Brooker grade II heterotopic ossification?

**Choices:**

1. Bony ankylosis between proximal femur and pelvis
2. Exophytes in pelvis or proximal end of femur with less than 1 cm between opposing bone surfaces
3. Exophytes in pelvis or proximal end of femur with at least 1 cm between opposing bone surfaces
4. Bone islands in soft tissue around hip

**Answer: 3** - Exophytes in pelvis or proximal end of femur with at least 1 cm between opposing bone surfaces

### Explanations:

- HO is typically evaluated radiographically.
- The Booker Staging system is the most widely accepted classification system that includes 4 grades based on anteroposterior (AP) radiograph of the pelvis and hip.
- Early grade cases that are asymptomatic may be observed.
- Grades 3 and 4 are considered clinically relevant even if there is no pain or impaired mobility.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Radiation Therapy For Heterotopic Ossification Prophylaxis



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**Question 165:** A 22-year-old female presents for a diagnostic mammogram after a suspicious lesion was palpated on a routine exam. The mammogram identifies a mass concerning for malignancy. Biopsy reveals invasive ductal carcinoma. On physical examination, there is also the presence of a butterfly rash, prominent nose, malar hypoplasia, and short stature. In addition to surgical resection, what is the best treatment for this patient?

**Choices:**

1. Proton beam therapy
2. Radiation therapy
3. 5-fluorouracil therapy
4. Cyclophosphamide therapy

**Answer:** 1 - Proton beam therapy

## Explanations:

- This patient most likely has Bloom syndrome. Due to the increased risk of chromosomal breakage, radiation should be avoided in patients with Bloom.
- Proton beam therapy uses protons to deliver high energy beams to tumor cells instead of x-rays. Studies have shown higher efficacy and a better safety profile compared to traditional radiation in Bloom syndrome patients.
- If needed, lower-dosed chemotherapy may be used to treat malignancy in patients with Bloom syndrome. However, there is a higher risk of bone marrow suppression and toxicity compared to proton beam therapy.
- 5-Fluorouracil has been shown to induce higher levels of DNA fragmentation when used in Bloom syndrome patients.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Bloom Syndrome



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**Question 166:** A 48-year-old female presents to the plastic surgery department with complaints of a non-healing wound after mastectomy. She underwent radical mastectomy with axillary clearance for invasive ductal carcinoma one year back. This was followed by multiple sessions of localized radiotherapy. Her mastectomy incision, unfortunately, suffered dehiscence, and she has developed a large wound on her upper chest. She has tried multiple regimens of dressing and oral antibiotics, but the wound has failed to heal. Examination reveals a 7x5x6 cm wound on her right upper chest with clean edges and a clear base. The surrounding skin appears thickened and woody. She is started on a regimen multiple sessions involving 100% oxygen administration at 2.4 atm. She experiences a good response, and her wound heals after 30 sessions. Inhibition of which underlying pathologic process has resulted in improvement in this patient?

**Choices:**

1. Obliterative endarteritis
2. Lymphatic obstruction
3. Malignant infiltration
4. Bacterial colonization

Answer: 1 - Obliterative endarteritis

## Explanations:

- This patient has presented with a chronic non-healing wound after mastectomy. The appearance of the wound, along with a history of post-surgical radiotherapy, suggests the development of radiation-induced skin necrosis. Radiotherapy can damage soft tissues in the radiation field and contribute to poor wound healing. Tissue hypoxia is the likely mechanism for chronic radiation-induced soft tissue necrosis.
- Radiation damages the endothelial cell and causes abnormal proliferation, which results in obliterative endarteritis. This vasculopathy contributes to local tissue hypoxia and causes poor wound healing. Hyperbaric oxygen therapy (HBOT) is a useful adjunct in patients with radiation-induced skin necrosis. HBOT alleviated tissue hypoxia and promotes healing.
- HBOT results in increased expression of vascular endothelial growth factor (VEGF). VEGF promotes angiogenesis and improves the vascularity of affected tissue. Improved blood flow and tissue oxygenation are the main beneficial effects seen after HBOT.
- CommImpaired wound healing after radiotherapy is the result of impaired vascular supply. HBOT therapy usually does no improve lymphatic obstruction or target malignant cells. HBOT also reduces tissue edema and decrease inflammatory infiltrate.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Hyperbaric Soft Tissue Radionecrosis



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**Question 167:** A 49-year-old man is being evaluated for newly found lymphadenopathy. He started noticing large lymph nodes on the right side of the neck for 3 months, initially noted to be pea-sized nodes, now progressed to the size of a grape. B symptoms were reported during evaluation and included weight loss of >10 lbs in 2 months and persistent night sweats. On exam, no other adenopathy is appreciated on the exam, and 2 separate nodes, each measuring approximately 1.5 cm in size, are noted in the right neck area. There are no other positive pertinent findings on the exam. PET/CT demonstrates multiple FDG avid and enlarged lymph nodes in the mediastinum and retroperitoneum along with right cervical adenopathy. Excisional biopsy of the cervical lymph node is completed. Pathology shows anaplastic lymphoma kinase (ALK)-negative anaplastic large cell lymphoma (ALCL) with diffuse CD30 positivity. Bone marrow biopsy shows no significant marrow involvement. He is treated with 6 cycles of CHOP (cyclophosphamide, hydroxydaunorubicin, vincristine, prednisone) regimen with post-treatment PET/CT showing resolution of lymphadenopathy in the neck and retroperitoneum. However, mild activity still persists in the mediastinal area measuring about 2 cm. Which of the following is the next best step in the management of this patient?

### Choices:

1. High dose chemotherapy and autologous stem cell transplantation
2. Involved site radiation therapy
3. Continue surveillance with repeat PET/CT in 3 months
4. Rituximab consolidation every 2 months for 2 years

**Answer: 2** - Involved site radiation therapy

## Explanations:

- Based on the excellent response noted elsewhere, it is recommended to consolidate further with ISRT (involved site radiation therapy). This is similar to ISRT consolidation employed in the management of B-cell and other T-cell lymphomas.
- Radiation therapy alone has also been used as a curative modality in patients with stage I T-cell lymphomas.
- High dose chemotherapy and autologous stem cell rescue have been employed in patients with relapsed/refractory ALCL. Patients still need to be salvaged with another regimen prior to proceeding with autologous SCT.
- Since there is residual disease noted on restaging scans, surveillance alone is not acceptable in young and fit patients. ALCL is histologically negative for CD20, and therefore there is no role for rituximab.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

**ALK Negative Anaplastic Large Cell Lymphoma**



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**Question 168:** A 78-year-old man presents with a lump on his right forearm. He first noticed the lump three months ago when he accidentally brushed himself against the kitchen sink. Initially, a bruise appeared on the affected area that waxed and waned until about four weeks ago, when it started growing to its current size (4 x 5 cm). He has a history of liposarcoma in the same region that was irradiated, followed by R0 resection nearly ten years ago. The mass is biopsied, and histopathology shows abnormal, pleomorphic, malignant endothelial cells. The cells stain positively for Ulex europaeus agglutinin 1 and vascular endothelial growth factor (VEGF) and negative for S-100 and HMB-45. Staging imaging shows bilateral pulmonary nodules, confirming stage 4 disease. The overall performance status of the patient is between 1-2. Which of the following is the most appropriate treatment for this patient?

**Choices:**

1. Cytotoxic chemotherapy with gemcitabine
2. Cytotoxic chemotherapy with weekly paclitaxel
3. Cytotoxic chemotherapy with doxorubicin and ifosfamide (AIM-75 regimen)
4. Hospice care

**Answer: 2** - Cytotoxic chemotherapy with weekly paclitaxel

## Explanations:

- This patient has radiation-induced angiosarcoma. Weekly paclitaxel is well tolerated in patients with metastatic angiosarcoma.
- Although no comparative studies exist, the ANGIOTAX study has shown a response rate of up to 20% in patients with metastatic angiosarcoma in the first-line setting. It is frequently used in patients with poor performance status.
- The combination of doxorubicin and ifosfamide (AIM-75 regimen) has no statistically proven benefit over doxorubicin alone but certainly adds to the toxicity. In a patient with poor performance status, either single-agent doxorubicin is preferred, or weekly paclitaxel is well tolerated.
- Gemcitabine is clinically active in patients with angiosarcoma but is not the first line of treatment. This patient can tolerate weekly paclitaxel, and hence hospice is not appropriate at this time.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Angiosarcoma



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**Question 169:** What is the optimal treatment for a chordoma?

**Choices:**

1. Chemotherapy
2. Radiation therapy
3. Surgery and chemotherapy
4. Surgery and radiation therapy

**Answer: 4** - Surgery and radiation therapy

## Explanations:

- Chordomas are slow-growing tumors with a high local recurrence rate thus necessitating post-surgical radiation therapy.
- The slow-growing nature of chordomas makes them relatively resistant to radiation therapy requiring high-dose conformal radiation therapy such as proton beam therapy for post-resection treatment.
- Chemotherapy is uncommonly used for the treatment of chordomas as they are resistant to most current conventional chemotherapeutic agents.
- Complete en bloc resection of a chordoma with clean margins can increase 5-year survival to 65% from 50% 5-year survival for resection with positive margins.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Chordoma



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**Question 170:** A 55-year-old woman complains of neck pain and hoarse voice that has been worsening over the past several months. She also complains of weight loss. Physical examination reveals a palpable neck mass. Biopsy of the mass shows cuboidal epithelium with areas of cellular discohesiveness, increased nuclear/cytoplasmic ratio, and nuclear grooves. How should this patient be treated?

**Choices:**

1. Thyroidectomy followed by adjuvant radioactive iodine therapy only if serum thyroglobulin remains elevated post-surgery
2. Reassurance and follow up
3. Thyroidectomy only
4. Thyroidectomy followed by radioactive iodine therapy

**Answer: 4** - Thyroidectomy followed by radioactive iodine therapy

## Explanations:

- Cuboidal epithelium with areas of discohesiveness, increased nuclear/cytoplasmic ratio, and nuclear grooves are all signs of the hobnail variant of papillary thyroid carcinoma.
- The American Thyroid Association classifies the hobnail variant of papillary thyroid carcinoma as intermediate risk.
- The American Thyroid Association recommends that intermediate-risk patients be treated with thyroidectomy and adjuvant radioactive iodine therapy regardless of postoperative thyroglobulin levels.
- Thyroglobulin levels are typically used to measure disease recurrence and treatment response.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Thyroidectomy



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**Question 171:** A 65-year-old male with prostate cancer was recommended pelvic radiation as part of his treatment regimen. He was told about the potential risk of development of colovesical fistula after prostate radiation. He wants to discuss further options to minimize this risk. What is the most appropriate recommendation to mitigate this risk?

**Choices:**

1. Consider prophylactic long term antibiotic therapy
2. Avoid radiation and consider surgery
3. Consider hydrogel spacer placement
4. Rectal sucralfate enemas

**Answer: 3** - Consider hydrogel spacer placement

### Explanations:

- Hydrogel spacer is an established prophylactic procedure to prevent colonic radiation exposure, which increases the risk of a colovesical fistula.
- Hydrogel provides a cushion between the bladder, prostate, and colon wall and can be easily done by a urologist.
- Hydrogel placement is safe and effective.
- There is no role for long term antibiotic therapy. It also increases the risk of clostridium difficile infection. Rectal enemas do not prevent the formation of fistulas.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

#### Colovesicular Fistula



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**Question 172:** A 76-year-old woman presents with new-onset urinary incontinence and back pain. She has a known history of metastatic stage IV breast cancer. MRI reveals an osteoblastic lesion in the T10 vertebral body with compression on the spinal cord. Physical examination reveals 3+ patellar reflexes bilaterally. The clinician recommends palliative radiotherapy to address her symptoms. He refers to an orthopedic spine specialist, who determines that her spine is unstable, and requires stabilization. The patient is in agreement with this plan. What is the most likely consequence of palliative radiation therapy given prior to surgery rather than after it?

**Choices:**

1. Increased wound healing complications
2. Increased paraspinal fibrosis
3. Lymphedema
4. Neuropathy

**Answer: 1** - Increased wound healing complications

## Explanations:

- Metastatic lesions to the vertebrae can lead to spinal cord compression, resulting in loss of bowel and bladder function, weakness, numbness/sensory deficits, and hyperreflexia.
- Palliative radiotherapy of the spine is a useful treatment in the case of back pain and spinal cord compression in patients with metastatic lesions in the vertebrae.
- Patients with metastatic lesions to the spine should be evaluated using the spinal instability neoplastic score (SINS) scoring system to assess the stability of the spine, and whether surgical intervention is necessary.
- When comparing preoperative vs. postoperative radiation therapy, preoperative radiation requires a lower dose than postoperative radiation therapy and, therefore, is only associated with increased wound healing complications as the surgeon operates through a previously irradiated field. Fibrosis and lymphedema are more commonly a consequence of postoperative radiation therapy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Palliation Radiation Therapy Of The Spinal Cord



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**Question 173:** A 55-year-old man presents to the clinic with waxing and waning painless lymphadenopathy of one cervical lymph node. Vital signs are within normal limits. On further examination with CT scan and PET scan, a single lymph node is involved. On microscopic examination, the tumor has a nodular appearance with 4 centroblasts/HPF. Which of the following is the most appropriate initial management strategy for this patient?

**Choices:**

1. R-CHOP (rituximab, cyclophosphamide, doxorubicin, vincristine, prednisolone) with radiotherapy
2. Radiotherapy only
3. Obinutuzumab-CHOP (cyclophosphamide, doxorubicin, vincristine, prednisolone)
4. Stem cell transplant

**Answer:** 2 - Radiotherapy only

## Explanations:

- Nodular appearance with 0-5 centroblasts/HPF shows grade 1 follicular lymphoma.
- Radiotherapy is preferred in stage 1 with grade 1-3a follicular lymphoma.
- Single nodal region involvement is seen in stage 1 follicular lymphoma that may need radiotherapy.
- Patients with grade 3b follicular lymphoma are treated with aggressive regimens (such as R-CHOP; rituximab, cyclophosphamide, doxorubicin, vincristine, prednisone).

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Follicular Lymphoma



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**Question 174:** A 65-year-old woman presents to the outpatient department with complaints of fatigue and shortness of breath for the past four and a half months. The patient has a past medical history of breast cancer, diabetes mellitus, and gastroesophageal reflux disease. Her breast cancer was treated with a combination of radiation and chemotherapy and is now in remission. Her other medications include famotidine and metformin. She has never traveled outside the United States. Her blood pressure is 130/70 mmHg, the pulse is 79/min and the temperature is 98.6 F (37 C). General physical examination shows conjunctival pallor, pedal edema, and a rise in jugular venous pressure following inspiration. What is the definitive management of the patient's condition?

**Choices:**

1. Cardiac transplant
2. Myomectomy
3. Pericardiotomy
4. Pericardiectomy

Answer: 4 - Pericardiectomy

## Explanations:

- The most likely diagnosis in this scenario is radiation therapy-induced constrictive pericarditis. Studies have shown a 2% to 30% incidence of constrictive pericarditis after radiation therapy. An echocardiogram will confirm the diagnosis.
- Physical examination findings are elevated jugular venous pressure (JVP), pulsus paradoxus with greater than 10 mmHg drop in systolic blood pressure on inspiration, Kussmaul sign (lack of inspiratory drop in JVP), and pericardial knock that is an accentuated heart sound occurring earlier than S3.
- Pericardiectomy is the definitive management of chronic constrictive pericarditis, and effort should be made to remove the pericardium as much as possible. Extensive penetration of the myocardium by fibrosis and calcification is associated with poor outcomes.
- Diuretics can be used to reduce edema or elevated venous pressures before the surgery or for palliative control of symptoms in patients who are not surgical candidates.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Constrictive Pericarditis



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**Question 175:** A 68-year-old woman presents to the clinic for follow up. She has a history of ER+, PR-, HER2-, cT2N1M0, pT2N1M0 invasive ductal carcinoma of the right breast treated 4 years ago with mastectomy and axillary lymph node dissection, followed by post-mastectomy radiation to the chest wall and regional nodes. She is now suspected to have recurrent disease on imaging. An option is considered, which includes multimodality therapy, including re-irradiation along with an additional treatment that works synergistically with radiation and chemotherapy by temperature modulation to increase tumor response. Which of the following is the most appropriate time to offer this synergistic treatment?

**Choices:**

1. Twice weekly, within an hour of radiation
2. Once weekly for three hours to the treatment bed
3. Within 24 hours of radiation
4. One time prior to the start of radiation treatments

**Answer: 1** - Twice weekly, within an hour of radiation

## Explanations:

- Hyperthermia is performed within an hour of radiation therapy or chemotherapy.
- Local external hyperthermia is most beneficial when delivered twice a week after radiation therapy, for about 1 hour and at least 48 hours apart to relatively small, superficial tumors (less than or equal to 3 cm up to 5 to 6 cm) where the goal is to achieve tumor temperatures between 41 to 44 C.
- Hyperthermia has been shown in studies to inhibit the repair of radiation-induced DNA damage, increasing the cytotoxic effect of radiotherapy, as well as improve blood flow, which may increase tissue oxygenation and make cells more sensitive to RT. This makes its utility most beneficial within one hour of radiation administration.
- Local external hyperthermia is most beneficial when delivered twice a week within an hour of radiation therapy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Hyperthermia for Chest Wall Recurrence



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 176:** A 65-year-old male patient presents to the clinic with a recent onset of a persistent cough, hoarseness, fatigue, hemoptysis, and shortness of breath. The provider notices that the patient has also lost 30 pounds (14 kg) since his last visit one month ago. The patient has smoked one pack per day for the past 30 years. His blood pressure is 149/80 mmHg, pulse 85/min, respirations 19/min, and temperature 98.0 F (36.7 C). He has decreased breath sounds over the left upper lobe. The provider orders a CT scan of his chest, which confirms a 6 cm mass in the left upper lobe, centrally located. Serum studies show calcium of 9 mg/dl, sodium of 130 mEq/L, and potassium of 4.0 mEq/L. What is most likely to be observed on histopathological examination?

### Choices:

1. Intercellular bridging and keratin pearls
2. Small dark blue staining cells with scant cytoplasm
3. Solid nests of polygonal cells containing vesicular nuclei
4. Invasive glandular mucin-producing cells

**Answer: 2** - Small dark blue staining cells with scant cytoplasm

### Explanations:

- PET scanning involves use of isotopes of labeled glucose.
- Tumors with high metabolic activity take up high levels of these isotopes.
- Thus the activity is then visualized on the PET scanner.
- Oat cell is the most active malignant cancer listed so a scan will be most positive.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Small Cell Lung Cancer



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**Question 177:** A 65-year-old male is brought in with a headache and a behavioral change. The patient was alright until three months ago when he began having frequent headaches. Eventually, the headaches worsened, and he started feeling clumsy. He has a 30-pack-year smoking history, but no history of alcohol or illicit drug use. He has a history of hypercholesterolemia for which he takes statins for ten years and of mitral stenosis four years back, for which he was operated and is being medicated for atrial fibrillation. He underwent an age-appropriate cancer screen last year, which was negative. Examination reveals an agitated man with intact palmar reflex and upgoing plantar bilaterally. An ocular examination reveals papilledema. He has also had a weight loss of 8 kg (17.6 lbs) over the past three months. An MRI is ordered. What is the expected finding on the MRI scan?

**Choices:**

1. Hockey stick sign in transverse view
2. Hummingbird sign in sagittal view
3. Complex cystic mass with absent dual rim sign
4. Enlarged ventricles

**Answer: 3** - Complex cystic mass with absent dual rim sign

## Explanations:

- This patient with headache, behavioral changes, complaints of clumsiness, papilledema, significant weight loss, normal age-appropriate cancer screening, and intact palmar reflex is likely a case primary brain tumor, most likely a frontal lobe tumor.
- Headaches are the most common presenting symptom of patients with glioma. Depending on the location of the tumor in the brain, the mass effect leads to signs of brain tumors. For example, frontal lobe tumors can present with behavioral changes, while dominant temporal lobe tumors can present with receptive speech problems. Other symptoms related to mass effects include nausea, vomiting, and change in vision, Seizures are the second most common symptom of presentation. Other presenting symptoms are tingling sensations, weakness, difficulty ambulation, and in rare cases, patients can present in a comatose state due to hemorrhage within the tumor, which leads to an acute herniation syndrome.
- Primary brain tumors are most likely to be gliomas. Gliomas are of 3 types. astrocytoma, oligodendrogliomas, and ependymomas. Astrocytomas are further divided into four grades, which will determine the level of malignancy. Grade 3 and 4 are highly malignant.
- The hockey stick sign is present in Creutzfeldt-Jacob's disease, which also presents with behavioral changes. Although this too can present with headache, it would not be the primary symptom. Significant weight loss over three months points to an alternate diagnosis. Hummingbird sign is found in progressive supranuclear palsy, which presents with dementia and frequent falls. However, other parkinsonian features would also be present. Enlarged ventricles can be a physiological finding in aging or a pathological finding in normal pressure hydrocephalus. The absence of urinary symptoms, presence of weight loss, and papilledema, makes this diagnosis less likely.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Gliomas



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**Question 178:** A 60-year-old female presents with an abnormal mammogram. Screening mammogram demonstrates a 1.1 cm spiculated mass in the upper outer right breast mass confirmed on subsequent diagnostic mammogram and ultrasound. Biopsy reveals moderately differentiated ductal carcinoma, estrogen receptor (ER) positive, progesterone receptor (PR) positive, and HER2/neu negative. Lumpectomy and sentinel lymph node biopsy reveals 1.2 cm carcinoma with negative axillary nodes. Surgical margins were at least 2 mm. Radiation therapy is recommended. What is the appropriate radiation regimen?

**Choices:**

1. Whole breast and nodal irradiation
2. Partial breast irradiation
3. Nodal irradiation
4. Partial breast and nodal irradiation

**Answer: 2** - Partial breast irradiation

## Explanations:

- Based on the American society for radiation oncology (ASTRO) 2016 guidelines on partial breast irradiation, suitable candidates include age 50 years or older, T-is (low risk, low to intermediate grade), T-1 (2 cm or less), negative margins of at least 2 mm, unicentric disease, estrogen receptor (ER) positive, and negative nodes.
- Partial breast irradiation options include interstitial brachytherapy, intracavitary brachytherapy, intraoperative radiotherapy, and external beam radiation therapy.
- 80-90% of breast tumor recurrences occur at or around the lumpectomy bed.
- Nodal irradiation is recommended for high-risk node-positive breast cancer patients.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Therapy For Early Stage Breast Cancer



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**Question 179:** A 67-year-old male patient received a diversion sigmoid colostomy as a palliative procedure for metastatic carcinoma rectum. The stoma was fully functional on postoperative day 3. On postoperative day 15, the patient complained of multiple healthy-looking bowel loops protruding through the stomal orifice in the anterior abdominal wall. His vital signs are blood pressure: 108/70 mmHg, pulse rate: 84 beats per minute, respiratory rate: 19 breaths per minute, and normal temperature. The abdominal wall physical examination was unremarkable for evidence of cellulitis or purulent discharge. What would be the ideal management?

**Choices:**

1. Request an abdominal CT scan
2. Request a pelvic MRI
3. Laparotomy with stoma closure with diversion transverse colostomy
4. Laparotomy with reduction of small bowel with mesh fixation around the stoma site

**Answer: 4** - Laparotomy with reduction of small bowel with mesh fixation around the stoma site

## Explanations:

- A parastomal herniation is due to a defect in the anterior abdominal wall through the orifice created for the stoma.
- It is a severe complication related to colostomy creation and can contain either omentum or bowel and can lead to bowel incarceration or strangulation.
- It may be avoided by mesh fixation of a synthetic polypropylene mesh around the stoma during the index surgery.
- It can be treated via laparoscopic modified Sugarbaker or keyhole procedures, which are currently in use with the sandwich repair as an alternative and are found to have lesser rates of recurrence than the open parastomal hernia repair method wherein the hernia contents are reduced and mesh fixation done around the stoma. In cases where repair is not possible, re-siting the stoma to the contralateral side of the abdomen is better than another site, ipsilateral.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Colostomy Care



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**Question 180:** A 42-year old man is diagnosed with metastatic cancer of the proximal anal canal. Surgical resection of the primary lesion is planned, with adjuvant chemo- and radiotherapy. Following the results of the RTOG 98-11 trial, which regimen has been shown to give the best overall survival, disease-free survival, and colostomy-free rates?

**Choices:**

1. Induction cisplatin, following by concurrent cisplatin, 5-fluorouracil (5FU), and radiotherapy
2. Trimodal cisplatin, 5FU, and mitomycin-C (MMC), with concurrent radiotherapy
3. 5FU and MMC with concurrent radiotherapy
4. Induction cisplatin, following by concurrent cisplatin, MMC, and radiotherapy

**Answer: 3** - 5FU and MMC with concurrent radiotherapy

### Explanations:

- The RTOG 98-11 trial was a two-arm trial evaluating the utilization of cisplatin as a replacement for MMC. Induction cisplatin plus concurrent chemoradiation with cisplatin/5FU was compared to the standard of concurrent chemoradiation with 5FU/MMC.
- Results were inferior in the cisplatin/5FU arm as compared to standard chemoradiation with 5FU/MMC. The use of induction cisplatin in this study may have confounded the results, because of the delay in the completion of therapy.
- The cisplatin arm resulted in worse 5-yr OS (70.7% vs 78.3%,  $p = 0.026$ ), DFS (57.8% vs 67.8%,  $p = 0.006$ ), and colostomy-free survival (65% vs 71.9%,  $p = 0.05$ ) compared to the MMC arm.
- Chemoradiation with trimodal therapy including 5FU, MMC, and cisplatin was studied in a phase II trial, but found to be too toxic.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Radiation Therapy For Anal Cancer



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**Question 181:** A 66-year-old man presents to the clinic for evaluation. He has been recently diagnosed with advanced prostate cancer. The patient is scheduled to undergo radiotherapy for the tumor. Which of the following complications is most likely to occur following radiation for this patient?

**Choices:**

1. Osteosarcoma
2. Fibrosarcoma
3. Undifferentiated pleomorphic sarcoma
4. Ewing Sarcoma

**Answer: 3** - Undifferentiated pleomorphic sarcoma

## Explanations:

- The undifferentiated/unclassified pleomorphic sarcoma (UPS), formerly known as malignant fibrous histiocytoma, is a high-grade aggressive neoplasm probably arising from mesenchymal or fibroblastic cells, rather than histiocytes. It can affect soft tissues, bones, retroperitoneum, and metastasize to several organs.
- It develops most commonly in sites of prior radiation in adults.
- On light microscopy, UPS exhibits atypical, pleomorphic spindle cells with abundant mitotic figures that extend through the deep dermis. The tumor may display a storiform, fascicular, or sheet-like configuration. The National Comprehensive Cancer Network (NCCN) guideline defines deep tumors by the involvement of the superficial fascia and beyond. Precisely distinguishing between superficial versus deep UPS may only serve may be a prognostic indicator. Nonetheless, visualization of deep-tissue invasion and lack of solar elastosis in UPS is useful to disregard atypical fibroxanthoma.
- A complete postoperative histopathology report must mention the location of the tumor, depth of invasion, size, histologic grade, presence or absence of necrosis, excision margins status, vascular involvement, mitotic rate, type and extension of the inflammatory infiltrate, as well as the tumor, node, and metastasis (TNM) staging.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Adverse Effects Of Radiation Therapy



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**Question 182:** A 65-year-old woman with a known history of breast cancer who has undergone multiple sessions of radiation has developed resistant radiation esophagitis. The patient has been experiencing chest discomfort, dysphagia, and odynophagia. She has tried multiple therapies, including high dose proton pump inhibitors, cytoprotective agents like sucralfate, and viscous lidocaine. She also takes daily naproxen for her chronic rheumatoid arthritis, and it reduces her chest pain. She has undergone multiple endoscopies with biopsies, only showing severe esophagitis in the proximal and mid esophagus and has empirically taken fluconazole for fungal esophagitis. What is the most appropriate next step in her management?

**Choices:**

1. Repeat EGD to evaluate for herpes or CMV esophagitis
2. Trial of acyclovir
3. Add a nighttime dose of famotidine
4. Discontinue naproxen and assess response

**Answer: 4** - Discontinue naproxen and assess response

## Explanations:

- NSAIDs and aspirin products are known to worsen esophagitis.
- In nonresponding cases, the use of NSAIDs and aspirin products should be stopped.
- NSAIDs, despite the use of proton pump inhibitors, can lead to smoldering esophagitis after radiation and be symptomatic.
- Adding empiric antiviral therapy will not help as several EGD and biopsies did not show such.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Radiation Esophagitis



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**Question 183:** A patient with head and neck cancer is found to have an enlarged lymph node on the right side of the neck between the hyoid and cricoid, never the carotid chain. This node is at what level?

**Choices:**

1. I
2. III
3. V
4. II

Answer: 2 - III

## Explanations:

- Level I, by Sloan-Kettering (and other) classification, involves submental and submandibular nodes, crossing midline.
- II-IV are situated to the right and left of midline, representing internal jugular nodes. II is above hyoid (including jugulodigastric node); III is between hyoid and cricoid; IV is below cricoid.
- Level V are the posterior triangle nodes, above clavicle and beneath SCM muscle.
- Level VI are below level I, stretching across the midline in front of thyroid, the anterior jugular visceral chain.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Anatomy, Head and Neck, Lymph Nodes



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**Question 184:** An older female has routine labs drawn at the time of her physical. She has a history of hypertension and is taking hydrochlorothiazide, calcium, and vitamin D. Her physical is normal. All her labs are normal except her alkaline phosphatase is three times normal. Her Gamma-glutamyl transpeptidase is normal. A femur radiograph shows a sunburst appearance. What has she developed as a complication of her primary disease?

**Choices:**

1. Ewing sarcoma
2. Osteogenic sarcoma
3. Osteoporosis
4. Osteopetrosis

**Answer: 2** - Osteogenic sarcoma

## Explanations:

- About 1-2 percent of patients with Paget disease develop an osteogenic sarcoma.
- Most of these patients are dead within 24 months.
- Osteogenic sarcoma is primarily a disease of youth, but there is a second, smaller age peak, creating a bimodal distribution in the disease. This second peak in the elderly is due, in part, to Pagetoid malignant transformation.
- Ewing sarcoma can also present with a sunburst appearance on radiographs, but is a disease of the young and is not associated with Paget disease.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Paget Disease



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**Question 185:** A 45-year-old female presents to the clinic for the evaluation of a breast lump. It has been present for three years and has slowly grown to its present size. Mammogram shows microcalcifications. Stereotactic biopsy reveals high-grade ductal carcinoma in situ (DCIS). Pathology from lumpectomy shows high-grade ductal carcinoma in situ measuring 2 cm with comedo necrosis. The tumor was ER/PR positive. No invasive carcinoma was identified. Surgical margins were 5 mm. What is the appropriate radiation therapy recommendation?

**Choices:**

1. Whole breast irradiation
2. Partial breast irradiation
3. Whole breast and nodal irradiation
4. Nodal irradiation

**Answer: 1** - Whole breast irradiation

## Explanations:

- Breast radiotherapy reduces the risk of in-breast recurrences by at least a half.
- European Organization for Research and Treatment of Cancer (EORTC) data demonstrated a significant reduction in breast recurrences with radiation therapy with no improvement in survival.
- Hypofractionation regimen is recommended for whole breast radiotherapy.
- Consensus guidelines released by the American Society of Clinical Oncology (ASCO), the Society of Surgical Oncology (SSO), and the American Society for Radiation Oncology (ASTRO) recommend surgical margins of 2 mm for patients with diagnosed with ductal carcinoma in situ (DCIS) who receive breast-conserving surgery and whole breast radiotherapy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

[Radiation Therapy For Early Stage Breast Cancer](#)



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## Section 6

**Question 186:** A 65-year-old male presents to the urology department with complaints of increased urinary frequency and blood in the urine. He has had symptoms for the past few days. He also experiences urinary dribbling and incontinence. He has a history of abdominoperineal resection for rectal carcinoma which was followed by cycles of external beam radiation 2 years back. His examination reveals conjunctival pallor. His urine examination reveals numerous RBCs but his urine culture is negative. Cystoscopy reveals the presence of mucosal erythema with petechiae and telangiectasias. The cytological analysis fails to demonstrate atypical cells. He is initially treated with medication and bladder irrigation but experiences poor symptom relief. He has subsequently planned treatment with high concentration oxygen at 2.5 atm. Which of the following will be observed in the bladder secondary to treatment?

### Choices:

1. increased vascular endothelial growth factor
2. Inflammatory infiltrate
3. Submucosal fibrosis
4. Vascular obliteration

**Answer: 1** - increased vascular endothelial growth factor

## Explanations:

- This patient has a history of rectal carcinoma that has been treated with surgical resection and radiotherapy. He develops symptoms of urgency, incontinence, and hematuria. Cystoscopy findings, along with negative cytology and urine culture, suggest the presence of radiation cystitis. Hyperbaric oxygen therapy (HBOT) can be considered in individuals who do not respond to initial treatment.
- HBOT induces complex physiological changes in the bladder mucosa. The increased oxygenation results in higher oxygen tension in the bladder tissue. This increased tissue oxygen concentration raised the oxygen gradient between normal tissue and radiation-damaged hypoxic tissue. Higher oxygen gradients lead to increased synthesis of vascular endothelial growth factor (VEGF).
- Increased VEGF expression leads to angiogenesis and increased capillary density. Improved tissue blood flow leads to improved healing and alleviation of symptoms.
- About 20 to 30 cycles of treatment are administered, which each cycle lasting 90 minutes. HBOT reduces inflammation and prevents bladder fibrosis. Radiation vascular damage can cause vascular obliteration and fibrosis, which is responsible for the symptoms of cystitis.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Cystitis And Hyperbaric Management



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**Question 187:** A 70-year-old man has been watching an asymptomatic dark spot on his chest slowly increase in size over the last 3 years. His wife has brought him to the office for the lesion to be examined. Cutaneous examination shows a black 3 x 3 cm nodule on his right chest. He has no other raised pigmented lesions. Partial biopsy of the lesion showed Dopa and Fontana-Masson silver stains highlighting melanin and melanocytes. Melanocytes were unevenly scattered throughout the entire epidermis. What is the preferred next management?

**Choices:**

1. No additional treatment is necessary.
2. The residual tumor should be treated with radiation therapy.
3. A conservative complete excision of the residual tumor should be performed.
4. The patient should receive systemic chemotherapy with vemurafenib.

**Answer: 3** - A conservative complete excision of the residual tumor should be performed.

## Explanations:

- Conservative complete excision of a cutaneous melanoacanthoma is the treatment of choice. Therefore, a cutaneous melanoacanthoma that has been completely removed during the biopsy procedure does not require any additional treatment.
- Complete removal of a cutaneous melanoacanthoma often occurs during biopsy of the lesion. However, incomplete removal of a cutaneous melanoacanthoma can result in persistence and continued growth or recurrence of the lesion.
- Systemic antineoplastic agents have not been used in the management of cutaneous melanoacanthoma. However, topical 5-fluorouracil 5% cream was used on some of the cutaneous melanoacanthomas in a woman who had multiple tumors; it caused a burning sensation at the application sites without any significant improvement and was discontinued after 4 weeks of treatment. Vemurafenib is an oral agent approved for the treatment of BRAF V600E mutation-positive metastatic malignant melanoma. It binds selectively to and inhibits the activity of the ATP-binding site of BRAF V600E kinase. In melanomas that express BRAF V600E, tumor cell proliferation is reduced.
- Cutaneous melanoacanthoma is a benign skin tumor. Radiation therapy is a treatment modality that can be used for patients with non-operative cutaneous malignancies such as basal cell carcinoma and squamous cell carcinoma. It can also be used as adjuvant treatment in the postoperative setting of non-melanoma skin cancers, which demonstrate perineural invasion. Radiotherapy has not been used in the management of benign cutaneous melanoacanthoma.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Cutaneous Melanoacanthoma



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**Question 188:** A 17-year-old male is brought to the office for headaches for three weeks. He has daily, dull pain in the frontal area of his head that is associated with nausea and vomiting. He has some episodes of blurred vision in the right eye. Vital signs are stable. Examination reveals bilateral optic disc swelling. Motor and sensory examinations are unremarkable. The MRI shows a lesion of the frontal lobe that is well defined, of low intensity and does not enhance. Which of the following is the most likely recommended treatment for this condition?

**Choices:**

1. Chemotherapy
2. Radiotherapy
3. Third ventriculostomy or shunt placement
4. Surgery

Answer: 4 - Surgery

## Explanations:

- The patient has low-grade glioma (LGG) in the frontal lobe. In this age, LGGs are among the common brain cancers.
- Nausea, vomiting, and headache are common presentations for a brain tumor due to compression effects. Surgery is the mainstay of treatment for LGG.
- MRI shows well defined, low intensity, and no enhancement of the mass, and this is the description of low-grade glioma.
- Surgery is recommended in LGGs. Radiotherapy should be given to any patient with progressive neurologic symptoms. Chemotherapy and radiotherapy can be given in the recurrence of the tumor or post-operatively if needed rather than adjunctively.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Low Grade Gliomas



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**Question 189:** A 45-year-old healthy female has microcalcifications on mammography. A stereotactic biopsy reveals a high-grade ductal carcinoma in situ. The patient elected to undergo a lumpectomy. The pathology from lumpectomy shows a high-grade ductal carcinoma in situ measuring 2 cm with comedo necrosis with negative margins and no evidence of invasion. The tumor is ER/PR positive. What would be the most appropriate option recommended for this patient?

**Choices:**

1. Monitoring and observation
2. Radiation therapy, followed by tamoxifen for 5 years
3. Chemotherapy and radiation therapy
4. Chemotherapy, radiation therapy, and tamoxifen

**Answer: 2** - Radiation therapy, followed by tamoxifen for 5 years

## Explanations:

- Radiation therapy is recommended in patients to reduce the risk of in-breast recurrence for patients who undergo lumpectomy. .
- Tamoxifen is considered for ER/PR positive ductal carcinoma in situ to reduce the risk of local recurrence although the absolute benefit may be small. Tamoxifen is recommended for five years after the completion of radiation therapy.
- Radiation therapy can be omitted for certain patients whose risk may be small such as older women (age greater than 60 years), with low-grade tumors, small tumors (0.5 cm), unicentric disease, and the tumors excised with wide margins (>1 cm).
- Post lumpectomy mammogram should be obtained to rule out any residual microcalcifications before starting radiation.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Breast Ductal Carcinoma in Situ



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**Question 190:** A 67-year-old African American man presents with worsening of his skin rash for the past one week. It started as a flat pinkish lesion on the posterior trunk one and a half months ago. He did see several dermatologists, but the treatments were not helping. These lesions have been increasing in size and are elevated from the skin. A biopsy of the lesion showed micro abscess and hyperchromatic lymphocytes. What is the most appropriate treatment regimen for his lesions?

**Choices:**

1. Radiation
2. Systemic steroids
3. Chemotherapy
4. Topical antifungal

Answer: 1 - Radiation

## Explanations:

- This patient has Mycosis fungoides, which has the characteristic histological examination called Pautrier microabscess.
- Treatment of Cutaneous T-cell lymphoma is palliative, not curative.
- Localized lesions can be treated with UV A with psoralen (PUVA), UV B, external beam radiation, total skin radiation, topical chemotherapy, and topical retinoids.
- Cutaneous T-cell lymphoma in early stages can be confused with other benign skin lesions and thus its delay in diagnosis is very commonly seen.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

T-Cell Lymphoma



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**Question 191:** A 50-year-old man was admitted to the hospital after he presented to the emergency department with a severe headache. A CT of the head was noted to have a large 4 cm frontal mass with surrounding edema. He was started on steroids to help with symptoms. He was evaluated by neurosurgery and underwent surgical resection of the frontal mass. The pathology of the lesion turned out to be a melanoma. Further evaluation by scans did not show any other metastatic lesion. Which of the following is recommended to decrease the local recurrence at the surgical site?

**Choices:**

1. Whole-brain radiation therapy (WBRT)
2. Pembrolizumab
3. Stereotactic radiosurgery (SRS)
4. Dabrafenib and trametinib

**Answer: 3** - Stereotactic radiosurgery (SRS)

### Explanations:

- Stereotactic radiosurgery is recommended to the local surgical bed after the surgical resection of the brain metastases.
- SRS to the surgical bed decreases the local recurrence of the melanoma at the site of the surgery.
- Whole-brain radiation therapy (WBRT) is not recommended post-surgical resection of the brain metastases.
- Systemic therapy options like the pembrolizumab and BRAF and MEK inhibitors are useful for systemic control of metastatic melanoma.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

**Malignant Melanoma Metastatic To The Central Nervous System**



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**Question 192:** A 47-year-old female with a history of pathologic T1cN1a(sn) of the right breast status post-mastectomy and sentinel lymph node biopsy showing intermediate grade invasive ductal carcinoma, estrogen receptor-positive/progesterone receptor positive+/HER2neu negative and 1/4 nodes positive for malignancy, presents to the oncology clinic 6 years later with chest wall scar recurrence. She will receive re-irradiation to the breast along with supplemental therapy, which will allow a reduction in the doses of radiation to decrease normal tissue toxicity. What is a method by which this additional therapy works?

**Choices:**

1. Decreased cell permeability preventing the diffusion of nutrients into tumor cells
2. Decreased cell permeability, causing retention of sodium ions in the cell, followed by enhancing water diffusion and cell lysis
3. Increased cell permeability allowing entry of calcium ions into the cell, with the initiation of the apoptosis cascade.
4. Increased cell permeability allowing increased exit of potassium ions from the cell interior, leading to cell dehydration

**Answer: 3** - Increased cell permeability allowing entry of calcium ions into the cell, with the initiation of the apoptosis cascade.

## Explanations:

- Cellular alterations induced by extreme temperatures included increased cellular permeability.
- The increased cellular permeability induced by supraphysiologic temperatures increases the influx of calcium into the cell.
- Calcium is a component of the apoptotic cascade.
- Increased cytosolic calcium induces the release of mitochondrial caspases, activating apoptosis.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Hyperthermia for Chest Wall Recurrence



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**Question 193:** A 72-year-old woman presents for her radiotherapy appointment. Her past medical history includes endometrial cancer that was surgically removed four months ago and hypertension for which she takes lisinopril. Which of the following is known to lower the rate of local complications following pelvic radiotherapy?

**Choices:**

1. Administering preoperatively
2. Administering postoperatively
3. Administering with prophylactic antibiotic treatment
4. Regular enemas during chemoradiation treatment

**Answer: 1** - Administering preoperatively

## Explanations:

- Radiation enteritis is damage to small or large intestine secondary to radiation. Different terms like radiation colitis, radiation enteropathy, radiation mucositis, and pelvic radiation disease have been used to describe this phenomenon.
- The German rectal cancer trial showed that preoperative chemoradiation leads to lower toxicity rates as compared to the postoperative method.
- Radiation enteritis is very common; studies have reported a permanent change in bowel habits in 90% of patients that undergo pelvic radiotherapy.
- The repetitive injuries caused to the intestinal mucosa by ionizing radiation, as well as its complex mechanism of healing, are proposed to cause radiation enteritis. Exposure of normal tissues to radiation leads to the production of reactive ions that combine with intracellular water molecules to form radicals like hydroxyl and other free radicals. These radicals are deemed responsible for causing breaks in DNA and causing cell death.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Enteritis



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**Question 194:** A 33-year-old man with a 26 pack-year history of smoking presents to the clinic for a follow-up. He was diagnosed with EGFR 858R mutation-positive adenocarcinoma six months ago and was planned for targeted therapy upfront. However, he was lost to follow up. He now complains of headache, nausea, vomiting, gait difficulties, and lower backache for the past one week. Physical examination findings include external ophthalmoplegia and sensorineural hearing loss. An MRI is suggestive of linear leptomeningeal disease. Which of the following treatment modalities, if any, is most likely to improve survival in this patient?

**Choices:**

1. Whole-brain radiotherapy
2. Stereotactic radiosurgery
3. Intra-CSF pharmacotherapy through the lumbar route
4. No therapy is known to improve survival

**Answer: 4** - No therapy is known to improve survival

## Explanations:

- Tumor cells invade the leptomeninges through the hematogenous route by entering arterial and venous circulation. Endoneural, lymphatic, perineural, and lymphatic spread has been seen in lung and breast cancers. Tumor cells disseminate along with the CSF flow and seed the meningeal and ependymal surface. These cells have the propensity to colonize gravity dependant locations like the posterior fossa, basilar cistern, and lumbar cistern.
- Tumor cells invade the leptomeninges through the hematogenous route by entering arterial and venous circulation. Endoneural, lymphatic, perineural, and lymphatic spread has been seen in lung and breast cancers. Tumor cells disseminate along with the CSF flow and seed the meningeal and ependymal surface. These cells have the propensity to colonize gravity dependant locations like the posterior fossa, basilar cistern, and lumbar cistern. Leptomeningeal involvement presents with multifocal signs and symptoms. Commonly encountered symptoms include headache, nausea, vomiting, cognitive deficits, gait disturbances, cranial nerve palsies, radicular weakness, bowel symptoms, and neck pain. Imaging findings include linear and nodular leptomeningeal disease or a mixture of both. These might also demonstrate no neurological evidence of leptomeningeal metastases other than hydrocephalus.
- Intra-CSF pharmacotherapy shows poor penetration into solid tumors which are 1 to 3 mm in size. It is indicated mainly in patients with type A leptomeningeal metastases along with a significant tumor load in the cerebrospinal fluid. Administration of intra-CSF therapy may be done through repeated lumbar punctures, intraventricular catheter, and subgaleal reservoirs.
- The evidence surrounding the use of radiotherapy in this setting is lacking with no completed or ongoing randomized studies. WBRT is indicated in patients with nodular leptomeningeal disease or symptomatic linear disease or patients with known brain metastases. Retrospective studies on the use of this modality in this setting have failed to show any benefit on survival.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Palliative Radiation Therapy For Brain Metastases



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**Question 195:** A 44-year-old female is found to have a very large left breast that has been increasing in size over the past 3 months. There is a huge mass measuring 8 cm. The biopsy shows fibrous stromal proliferation with an epithelial lining. What is the most likely diagnosis?

**Choices:**

1. Intraductal carcinoma
2. Fat necrosis
3. Papilloma
4. Phyllodes tumor

**Answer:** 4 - Phyllodes tumor

## Explanations:

- Phyllodes tumors can become very large and are very fast growing.
- These fibroepithelial tumors are composed of epithelial and cellular stromal elements.
- Phyllodes are predominantly found in adult women and may increase in size within a few weeks.
- Treatment is by wide, local excision. The risk of cancer is very low.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Phyllodes Tumor Of The Breast



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**Question 196:** A 73-year-old female with a history of metastatic melanoma to the lung and liver with BRAF wild type who is currently on pembrolizumab monotherapy. Her disease has been in control for the last six months. Her husband called the oncology office and concerned about her recent behavioral changes. She was evaluated in the emergency room for concern for brain metastases, and an MRI of the brain showed about 20 lesions, which are 5 mm to 10 mm in diameter. Which of the following the ideal local therapy for the local control brain metastases?

**Choices:**

1. Surgery
2. Stereotactic radiosurgery (SRS)
3. Surgery followed by stereotactic radiosurgery (SRS)
4. Whole-brain radiation therapy (WBRT)

**Answer: 4** - Whole-brain radiation therapy (WBRT)

## Explanations:

- Due to a large number of brain metastases, whole-brain radiation therapy is the ideal local therapy to control her brain metastases and help her symptoms.
- The patient has multiple brain metastases, and her symptoms are likely related to it. The goal of WBRT is to improve neurologic deficits and surrounding edema and to prevent any further deterioration of neurologic function. Unfortunately, these patients develop cognitive decline as a long term side effect.
- Stereotactic radiosurgery is usually recommended in patients with a limited number of lesions, ideally less than 5.
- Surgery is not the ideal local therapy in a patient with a large number of metastases.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

**Malignant Melanoma Metastatic To The Central Nervous System**



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**Question 197:** A 49-year-old male presented with right iliac pain which was diagnosed with acute appendicitis. He underwent appendectomy operation without complications. Two weeks later, the pathology report of the tissue removed showed a carcinoid tumor more than 2 cm in diameter. What is the next preferred step in management?

**Choices:**

1. No more management required
2. Right hemicolectomy
3. Peptide receptor radiotherapy (PRRT)
4. Octreotide

**Answer:** 2 - Right hemicolectomy

## Explanations:

- Surgical resection is the potentially curative treatment for localized and locally advanced neuroendocrine tumor (NET)s. Tumors localized in or near the ileocecal valve and small bowel tumors greater than 2 cm, right hemicolectomy, and small intestinal resection usually performed respectively.
- For midgut NETs, surgery still the preferred management modality even in patients with small, asymptomatic tumors detected incidentally. When a surgical approach to the tumor is not possible due to tumor size, a debulking surgery is recommended.
- Appendiceal tumors less than 1 cm, simple appendectomy is usually curative, but for small intestinal NETs, less than 1 cm typical small intestinal resection is required.
- Systemic therapy aims to control symptoms caused by hormonal secretion and decrease tumor proliferation and progression, while surgery is the potentially curative treatment modality of choice for NETs.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

APUDoma



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**Question 198:** A 35-year-old patient has been diagnosed with disseminated leukemia. The clinician plans to treat with total body radiation therapy before a bone marrow transplantation in the patient. However, the patient is apprehensive about the probable systemic adverse effects following the treatment. The clinician counsels him that the adverse effect depends on the turnover of cells in the respective system. What is the upper regulatory annual limit of radiation exposure to the lens?

**Choices:**

1. 15 rem
2. 150 rem
3. 15 mrem
4. 150 mrem

Answer: 1 - 15 rem

## Explanations:

- The recommended annual limit for radiation to the lens of the eye is 15 rem (or 0.15 Sievert).
- For skin, the annual radiation dose limit is 50 rem.
- For upper extremities distal to the elbow and lower extremities distal to the knee, the annual radiation dose limit is also 50 rem (0.5 Sv).
- The whole-body dose limit is 5 rem (0.05 Sv). As is evident, a small portion of the body can obtain higher limits without pushing the whole body amount above its limit. That is, the whole body dose is not the sum, but the weighted sum of the regional anatomic limits.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Ionizing Radiation



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**Question 199:** A 25-year-old man presents to the clinic with multiple episodes of blood in the sputum and progressively worsening dyspnea on exertion. Auscultation of the chest is suggestive of reduced breath sounds in the right middle and lower lobe. Amphoric breath sounds are heard over the right mammary region. The remainder of the physical examination is normal. A chest radiograph is suggestive of a cavitating lesion in the right middle zone. A contrast CT abdomen and pelvis reveals a heterogenous hypoechoic mass lesion in the right testis with sub-centimetric right inguinal lymphadenopathy. A high-risk disease with life-threatening implications is identified. He also reports a history of lower backache for the past 3 days. Associated symptoms include paraparesis and urinary incontinence. Emergency management of the complication is being planned. Which of the following is the strongest possible risk factor for treatment failure for this patient?

**Choices:**

1. Multi-level involvement
2. Intradural spread
3. Epidural involvement
4. Cerebrospinal fluid involvement

**Answer: 3** - Epidural involvement

## Explanations:

- The incidence of metastatic bone disease ranges from 17%-64% in lung cancer, 65%-75% in breast cancer, 65%-90% in prostate cancer, and 70%-95% in multiple myeloma. Locoregional approaches for symptomatic palliation of bone metastases include surgery and radiotherapy. Systemic approaches include the usage of inhibitors of bone resorption, radiopharmaceutical targeted agents, endocrine approaches, and chemotherapy.
- Locoregional approaches for symptomatic palliation of bone metastases include surgery and radiotherapy. Systemic approaches include the use of inhibitors of bone resorption, radiopharmaceutical targeted agents, endocrine approaches, and chemotherapy.
- Surgery is favored in case of early presentation, single-level involvement, presence of a bony fragment indenting upon the spinal cord, spinal instability, and radioresistant tumors.
- The extent of postoperative epidural disease control has been identified as a major predictor of local control following SBRT. The presence of epidural disease has been identified as the major cause of treatment failure following SBRT.

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## Research Concepts:

### Palliative Radiation Therapy For Bone Metastases



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**Question 200:** A 44-year-old nulligravid woman undergoes local adjuvant radiotherapy for endometrial cancer. Two-dimension CT imaging with limited bladder volume is used to orient the positioning of the source. It is noted on follow up CT that there are multiple air gaps between the applicator and vaginal surface. Which of the following techniques is most likely associated with this issue?

**Choices:**

1. Single-channel cylinders
2. Multi-channel cylinders
3. Vaginal colpostats
4. Vaginal molds

**Answer: 1** - Single-channel cylinders

## Explanations:

- Single-channel cylinders are associated with potential air gaps during treatment for vaginal brachytherapy.
- Single-channel cylinders are limited by the vaginal introitus and can lead to air gaps if the apex of the vagina is wider than the introitus.
- Single-channel cylinders are a form of HDR that placed into the vagina only during the radiation. It is removed after the treatment is complete.
- Multi-channel cylinders allow for more precision with radiation dosing. This reduces the risk of radiating nearby organs including the rectum.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Brachytherapy



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**Question 201:** A 67-year-old man with a past medical history of hepatic cirrhosis secondary to alcohol use disorder presents to the hospital with a complaint of weight loss and abdominal pain. A CT of the abdomen and pelvis with intravenous contrast reveals a shrunken, nodular liver containing two enhancing lesions measuring 2.4 cm and 2.8 cm, respectively. Laboratory analysis reveals elevated liver enzymes and total bilirubin with a Child-Pugh score of C. CT-guided biopsy reveals hepatocellular carcinoma. Due to the degree of liver failure, the patient is not considered to be a candidate for surgical resection. He relays to the team that he simply wants to live to walk his daughter down the aisle for her wedding next year. Percutaneous radiofrequency ablation is considered. Following successful ablation, the patient experiences low-grade fever, malaise, and nausea for approximately one week before symptoms resolve spontaneously. Which of the following complications did most likely occur the patient?

**Choices:**

1. Post-ablation syndrome
2. Abscess
3. Portal vein thrombosis
4. Biloma

**Answer: 1** - Post-ablation syndrome

## Explanations:

- Radiofrequency ablation is generally considered a safe and effective treatment method for certain types of hepatic tumors, including hepatocellular carcinoma and colorectal metastasis to the liver.
- While generally considered a very safe method of hepatic tumor treatment, radiofrequency ablation is not without risk of a variety of complications.
- Post ablation syndrome is a common, self-limiting phenomenon that occurs in approximately one-third of patients following radiofrequency ablation of solid abdominal tumors, including liver tumors.
- The symptoms of post-ablation syndrome are flu-like, last approximately 7-10 days post-procedure, and include low-grade fever, delayed pain, malaise, myalgia, nausea, and vomiting

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

[Percutaneous Radiofrequency Ablation Of Liver Tumors](#)



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**Question 202:** A 50-year-old Asian-American woman is found to have a right upper lobe mass on a chest x-ray done as a part of a pneumonia workup. A chest x-ray done five years ago showed no evidence of any nodule or mass. A subsequent CT chest showed a spiculated, 2.5 cm peripheral lesion in the right upper lobe with evidence of metastasis to the ribs. The patient reports that she has never smoked. Of the following therapies, which is most likely to be used first-line in this patient?

**Choices:**

1. Erlotinib
2. Cetuximab
3. Panitumumab
4. Osimertinib

Answer: 4 - Osimertinib

## Explanations:

- Given the peripheral location of the tumor and the lack of smoking history, this patient most likely has metastatic adenocarcinoma of the lung. Mutations of KRAS and EGFR, as well as rearrangements of ALK and ROS, are found in this population of patients.
- In a young female of Asian ethnicity who is a non-smoker, EGFR mutations are the most common. They represent about 40% of cases in this population of patients.
- All the drugs above target the EGFR. Cetuximab and panitumumab are monoclonal antibodies while erlotinib and osimertinib are small molecule receptor tyrosine kinase inhibitors. Of these, only erlotinib and osimertinib have been approved in metastatic adenocarcinoma of the lung.
- Osimertinib is preferred over erlotinib as it has superior progression-free survival and remains efficacious in patients with the exon 20 (T790M) mutation of the mutation.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Lung Adenocarcinoma



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**Question 203:** A 4-month-old boy is brought to your office as a new patient for a well-child visit. His mother denies any previous significant medical history. However, she expresses concern over her belief that her son's left side of the body looks significantly larger than his contralateral side. On physical examination, you confirm her concern and also note an unusually large tongue and an umbilical hernia. His weight and height are in the 95th percentile. The rest of his physical examination is unremarkable. Which of the following is the most appropriate investigation of choice for this patient?

**Choices:**

1. Echocardiogram every 2 years
2. Abdominal ultrasound every 3 months
3. Complete blood count (CBC) and differential count, review of the peripheral smear, and bone marrow examination every year
4. Fundoscopy every 5 years

**Answer: 2** - Abdominal ultrasound every 3 months

## Explanations:

- The patient has symptoms of Beckwith-Wiedemann syndrome, which occurs in approximately 1 in 13,000 infants and is associated with genetic or epigenetic abnormalities involving chromosome 11p15.
- Beckwith-Wiedemann syndrome is characterized by macrosomia, macroglossia, hemihyperplasia, organomegaly, neonatal hypoglycemia, and abdominal wall defects such as omphalocele, diastasis recti, and umbilical hernia. Other common features include linear earlobe creases, microcephaly, advanced bone age, and absent gonads.
- Beckwith-Wiedemann syndrome is also associated with an increased risk of cancer through age 7-8 years. Hepatoblastoma and Wilms tumor are the most common.
- Children with Beckwith-Wiedemann syndrome should be screened every three months with serum a-fetoprotein levels until age four years for hepatoblastoma and complete abdominal ultrasonography every three months through age 7-8 years for Wilms tumor.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Beckwith Wiedemann Syndrome



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**Question 204:** An 80-year-old woman with stage IV NYHA class congestive heart failure is found to have a 1.5 cm spiculated nodule in the left upper lobe on chest CT. Biopsy reveals squamous cell carcinoma. PET-CT demonstrates no evidence of metastatic disease. MRI of the brain is negative for intracranial metastases. What is the most appropriate management strategy for this patient?

**Choices:**

1. Stereotactic ablative body radiation
2. Chemotherapy
3. Chemoradiation
4. Wedge resection

**Answer: 1** - Stereotactic ablative body radiation

### Explanations:

- Stereotactic ablative body radiation (SABR) or stereotactic body radiation therapy (SBRT) is recommended for patients with stage I lung cancer who are not surgical candidates or refuse surgery.
- SABR delivers high doses of radiation therapy to the lung tumor with precision and accuracy.
- SABR can be delivered in 3 to 5 fractions for peripheral lung tumors.
- Studies have shown that the 3-year local control rate is 85 to 95%.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Radiation Therapy For Early Stage Non-Small Cell Lung Cancer



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**Question 205:** A 41-year-old woman with left-sided invasive ductal carcinoma is being evaluated in the clinic. She is undergoing 3D conformal radiation to the left breast and comprehensive lymph nodes with a plan that is not meeting the dose constraints for the heart. Which of the following is most likely to increase the heart dose in this patient?

**Choices:**

1. Intensity-modulated radiation therapy
2. High tangents
3. Deep inspiratory breath-hold
4. Proton beam therapy

Answer: 2 - High tangents

## Explanations:

- Intensity-modulated radiation therapy (IMRT) allows for dose intensity modulation to conform radiation to irregularly shaped targets. It also utilizes an inverse planning algorithm which enables one to optimize target coverage to meet organ dose constraints. This technique is often utilized in cases where the heart dose is not met with 3-dimensional conformal radiotherapy.
- High tangents is a technique used to treat the high axillary region within the tangent field. It does not reduce dose to the heart.
- Deep inspiratory breath-hold is a technique in which the radiation beam is turned on during deep inspiration to create space between the chest wall and the heart. This process requires the patient to take a deep breath and hold for 20 to 30-second increments during treatment. The purpose of this technique is to reduce the radiation dose to the heart.
- Protons are charged particles with mass that deposit the majority of the dose at the end of their range creating a Bragg peak. The depth of penetration is dependent on their initial energy. Given that there is no exit dose, the normal tissue distal to beam path is maximally spared. Dosimetric studies have shown proton beam therapy can reduce dose to the heart and lungs in PMRT plans. This could potentially reduce late toxicity associated with post-mastectomy radiotherapy and is an active area of ongoing research.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Postmastectomy Breast Cancer Radiation Therapy



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**Question 206:** A post-menopausal woman presents to you after undergoing a right modified radical mastectomy revealing with a 5.1cm tumor with negative margins. The tumor was low grade and did not have lymphovascular invasion. What is the benefit of post-mastectomy radiation?

**Choices:**

1. All patients with T3N0 (T3 is > 5cm) disease should receive post-mastectomy radiation therapy as it has been associated with a survival benefit.
2. The risk of locoregional recurrence with T3N0 disease is very low and therefore NCCN does not recommend adjuvant radiation therapy in these patients.
3. Adjuvant radiation is only recommended in the setting of T3N0 with a positive margin.
4. Several pathologic features have been correlated with locoregional recurrence in patients with pathologic T3N0 disease including LVSI, tumor grade and positive margins and therefore these patients should be considered for adjuvant radiation on a case by case basis.

**Answer: 4** - Several pathologic features have been correlated with locoregional recurrence in patients with pathologic T3N0 disease including LVSI, tumor grade and positive margins and therefore these patients should be considered for adjuvant radiation on a case by case basis.

## Explanations:

- For patients with negative nodes but with a large primary tumor size of greater than 5 cm (T3) the role of PMRT is less clear.
- The risk of isolated locoregional failure was only 7% among patients with T3N0 disease treated with mastectomy alone or with adjuvant systemic therapy on five National Surgical Adjuvant Breast and Bowel Project (NSABP) chemotherapy trials. Taghian AG, Jeong J-H, Mamounas EP, et al. Low locoregional recurrence rate among node-negative breast cancer patients with tumors 5 cm or larger treated by mastectomy, with or without adjuvant systemic therapy and without radiotherapy. *J Clin Oncol.* 2006;24(24):3927-3932. doi:10.1200/JCO.2006.06.9054
- A recent SEER analysis of 568 patients who received PMRT for T3N0 breast cancer showed no improvement in overall survival compared to a case-matched control analysis. However, studies have correlated lymphovascular space invasion (LVSI), high tumor grade, close/positive margins and premenopausal status with a higher risk of local recurrence, suggesting there may be a subset of patients with pT3N0 disease that may benefit from PMRT. Yu JB, Wilson LD, Dasgupta T, Castrucci WA, Weidhaas JB. Postmastectomy radiation therapy for lymph node-negative, locally advanced breast cancer after modified radical mastectomy: Analysis of the NCI Surveillance, Epidemiology, and End Results database. *Cancer.* 2008;113(1):38-47. doi:10.1002/cncr.23512 Rowell NP. Radiotherapy to the chest wall following mastectomy for node-negative breast cancer: A systematic review. *Radiother Oncol.* 2009;91(1):23-32. doi:10.1016/j.radonc.2008.09.026 Jagsi R, Raad RA, Goldberg S, et al. Locoregional recurrence rates and prognostic factors for failure in node-negative patients treated with mastectomy: Implications for postmastectomy radiation. *Int J Radiat Oncol Biol Phys.* 2005;62(4):1035-1039. doi:10.1016/j.ijrobp.2004.12.014 Childs SK, Chen YH, Duggan MM, et al. Surgical margins and the risk of local-regional recurrence after mastectomy without radiation therapy. *Int J Radiat Oncol Biol Phys.* 2012;84(5):1133-1138. doi:10.1016/j.ijrobp.2012.02.048
- The NCCN recommends patients with tumors greater than 5 cm should be “considered” for adjuvant radiation therapy to the chest wall and regional lymph nodes, but there is insufficient evidence for it to be strongly recommended for every patient.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Postmastectomy Breast Cancer Radiation Therapy





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**Question 207:** A 30-year-old man presented to the clinician's office complaining of recurrent otitis media. He had three episodes of otitis media infections in the past 6 months. He denied any upper respiratory infections recently, or any history of immunodeficiency in the family. During the examination, there is no tenderness in his face, and tonsils appeared normal in size. Otolaryngologist shows effusion behind the right tympanic membrane. Vital signs are as the following: respiratory rate: 14/minute, the pulse rate: 90/minute, blood pressure: 125/80 mmHg, O2 saturation= 99%. The patient is a heavy smoker and eats a lot of processed food. The appropriate investigation was done, and lymphadenopathy was evident at right anterior jugular station without evidence of distal metastasis. Which of the following is the best first modality of treatment?

**Choices:**

1. Nasopharyngectomy
2. No treatment needed at this time
3. Radiotherapy
4. Chemotherapy alone

Answer: 3 - Radiotherapy

## Explanations:

- Nasopharyngeal carcinoma is a malignancy arising from the epithelium of the nasopharynx. An interplay of environmental factors, genetic structure, and Epstein-Barr virus (EBV) infection is involved in the etiology of the disease.
- This patient presented with multiple episodes of otitis media, which should increase the suspicion of obstruction of the eustachian tube. One of the causes of Eustachian tube obstruction is tumors that arise around the eustachian opening in the nasopharynx, such as nasopharyngeal carcinoma (NPC).
- The best modality of treatment for this tumor is radiotherapy. Radiation is the management of choice for the loco-regional lesion. Radiotherapy is effective in all cases except those for distant metastasis.
- NPC is highly chemo and radiosensitive. Chemotherapy alone is not the best choice, it can be used as an induction, which will lead to a better response.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Nasopharyngeal Carcinoma (NPC, Lymphoepithelioma)



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**Question 208:** A 49-year-old man with no significant past medical history presents with a lump in his neck. Thyroid ultrasound shows a 3.8 cm left thyroid nodule and multiple lymph nodes on the neck. Fine needle aspiration biopsies from both the thyroid nodule and the largest lymph node on the same side are consistent with papillary thyroid cancer. He undergoes total thyroidectomy and left modified neck dissection without any complications. Surgical pathology reveals tall cell papillary thyroid cancer. Adjuvant therapy with iodine-131 (I-131) after thyroid hormone withdrawal is recommended. The patient presents for nuclear medicine appointment and reports that he had a CT-scan 2 weeks ago during the evaluation for abdominal pain. What would be the best next step in management?

**Choices:**

1. Schedule I-131 therapy as soon as possible
2. Schedule I-131 therapy in one month
3. Recommend low-iodine diet and schedule the I-131 therapy in 2 weeks
4. Recommend low Iodine diet for at least 2 weeks and check urine iodine before scheduling I-131 therapy

**Answer: 4** - Recommend low Iodine diet for at least 2 weeks and check urine iodine before scheduling I-131 therapy

## Explanations:

- Intravenous contrast contains a high load of iodine. When the body is super-saturated with iodine, treatment with radioactive iodine would be unsuccessful or with very limited effect since thyroid cancer cells would not express the affinity to take up and trap given radioactive iodine.
- The western diet is quite rich in iodine, and to increase the effectivity of iodine treatment or whole-body scan, a low iodine diet for at least two weeks is recommended.
- When the patient has a recent history of iodinated contrast study, the best way to assess the body's iodine status is to check a 24-hour urine iodine level. A urine iodine level of =100 is ideal and shows a low iodine diet, however, most of the experts are comfortable to proceed with the treatment when urine iodine is =150 ng/dl.
- Longer periods of low iodine diet may be needed.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Iodine-131 Uptake Study



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**Question 209:** An 81-year-old man is being considered for total hip arthroplasty and prophylactic radiation to prevent heterotopic ossification (HO) after surgery. Based on the most common compartment involved in the hip, which of the following functions is most likely to be affected if HO develops after surgery?

**Choices:**

1. Spreading his legs apart
2. Bringing his legs together
3. Standing from a seated position
4. Lifting his knee while standing



**Answer: 1** - Spreading his legs apart

## Explanations:

- The compartment of the hip most involved by heterotopic ossification is the abductor compartment.
- The abductor muscles of the hip control the ability to spread one's thighs apart, which is often limited due to pain or impaired mobility in patients suffering from advanced heterotopic ossification.
- The abductor muscles are located in the lateral compartment of the thigh and include the gluteus minimus, gluteus medius, gluteus maximus, and tensor fascia lata muscles. These muscles can often be affected by heterotopic ossification after hip trauma or surgery.
- Radiation therapy is a simple and effective way to help prevent heterotopic ossification after total hip arthroplasty or other major hip surgery.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

[Radiation Therapy For Heterotopic Ossification Prophylaxis](#)



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**Question 210:** A 62-year-old male has a past medical history significant for smoking for 40 years. Three months ago, he presented to the clinic complaining of shortness of breath and wheezing, which was appreciated on examination. He was diagnosed with COPD and was started on inhaler therapy, which provided minimal response initially, but his symptoms worsened in the past 2 months, and he started to have a productive cough with fresh blood. An x-ray of the chest shows a mass defect in the trachea, and bronchial biopsy is performed. The biopsy confirms a superficial squamous cell carcinoma of the distal trachea. The clinician decides to start laser photodynamic therapy after injection with hematoporphyrin. What is the laser of choice?

**Choices:**

1. Carbon dioxide
2. Helium
3. Argon
4. Helium

Answer: 3 - Argon

### Explanations:

- An Argon laser is used for phototherapy.
- The dye is administered and then the laser is used 48 hours later.
- The major side effect of the dye is photosensitivity.
- There are several other lasers that can be used including the Nd:YAG. However, all lasers have limitations and there is always the risk of fire in the airways.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Tracheal Cancer



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**Question 211:** Which of the following describes the target volume designed to cover areas of expected motion during radiation treatment delivery?

**Choices:**

1. GTV (gross tumor volume)
2. CTV (clinical target volume)
3. ITV (internal target volume)
4. PTV (planning target volume)

**Answer: 3** - ITV (internal target volume)

### Explanations:

- The ITV or internal target volume encompasses areas of internal tumor motion during radiation treatment delivery.
- The CTV or clinical target volume encompasses areas at risk for the subclinical extension.
- The GTV or gross tumor volume encompasses areas of visible disease.
- The PTV or planning target volume encompasses a margin for expected daily set-up error.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Radiation Therapy



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 212:** An 82-year-old man presents to the clinic for follow up. He has a history of prostate cancer that has been resistant to medical treatment. The patient currently takes lisinopril and metformin. He denies any allergies to medication and had had no prior abdominal or pelvic surgeries. Brachytherapy is being considered for the patient. A brachytherapy technique is employed that would allow for outpatient management of temporarily placed sources in multiple dwell positions. Which of the following best identifies this technique of therapy?

**Choices:**

1. Low dose radiation
2. Pulse dose radiation
3. High dose radiation
4. External beam radiation

**Answer: 3** - High dose radiation

## Explanations:

- High dose radiation is an outpatient procedure.
- High dose radiation utilized sources that are placed in different dwell positions on the order of minutes.
- High dose radiation has been shown to be effective for management for prostate cancer for patients that are low risk.
- While low dose radiation and ultra-low-dose radiation are also common treatment modalities for the treatment of prostate cancer, they actually require the permanent placement of sources in the patient.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Brachytherapy



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**Question 213:** A 25-year-old woman with American Thyroid Association (ATA) high-risk thyroid carcinoma presents to the clinic for her Radioactive Iodine (RAI) dose of 150 mCi I-131. She denies recent sexual activity and is currently on oral contraceptives. Her past medical history is significant for diabetes mellitus type 1 and a family history significant for endocrine neoplasia, including first degree relatives with parathyroid adenomas and prolactinomas. Which of the following is the most appropriate test to perform prior to RAI therapy?

**Choices:**

1. Fingerstick glucose
2. Pregnancy test
3. Testing for MEN1 gene mutations
4. Testing for RET gene mutation



Answer: 2 - Pregnancy test

## Explanations:

- The ATA recommends pregnancy testing for all women of childbearing age prior to RAI therapy regardless of sexual history and contraception use.
- The only two absolute contraindications for RAI therapy are pregnancy and breastfeeding.
- Radioiodine use in pregnancy is associated with miscarriage, infantile hypothyroidism, and poor neurocognitive development.
- Mutations in MEN1 and RET are associated with subtypes of multiple endocrine neoplasia (MEN), however, these hereditary neoplastic disorders are more frequently associated with medullary thyroid carcinoma, which is not responsive to radioiodine therapy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

[131 I Sodium Iodide](#)



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**Question 214:** A 65-year-old female presents to the gastroenterology clinic with persistent rectal pain, increased stool frequency, and bleeding per rectum. She states that the symptoms have been present for the past several months. She has multiple daily episodes of loose stools that are often blood-stained. She also complains of increased urgency and occasional incontinence. The symptoms have been present for the past two months. She has a history of hysterectomy followed by external beam radiation to the pelvis, for endometrial carcinoma, two years back. She is otherwise well and reports no other symptoms. Her stool culture is a negative, and fecal assay for *Clostridium difficile* toxin is negative. She undergoes flexible sigmoidoscopy that demonstrates a pale and non-compliant rectum with mucosal ulcerations and telangiectasis. The biopsy is negative for malignancy. She fails to respond to conservative medical therapy and is planned for treatment with 100 % oxygen inhalation in a pressurized chamber. Which of the following effects will be seen in the rectal mucosa as a result of the therapy?

**Choices:**

1. Vascular involution
2. Collagen synthesis
3. Interstitial edema
4. Neutrophilic infiltration

Answer: 2 - Collagen synthesis

## Explanations:

- This patient presents with symptoms of rectal inflammation. Her previous history of pelvic irradiation and sigmoidoscopic appearance of rectal mucosal suggest the development of chronic radiation proctitis. Thus, initially managed with medical therapy, hyperbaric oxygen therapy (HBOT) can be a useful adjunct in refractory cases.
- The main pathophysiological mechanism of radiation proctitis is mucosal ischemia. HBOT is associated with increased tissue oxygenation and promotes mucosal healing. HBOT stimulates fibroblast proliferation and increases the synthesis of collagen and ground substance.
- Synthesis and deposition of mature collagen promote tissue healing and alleviates patients' symptoms. Enhanced ground substance synthesis and angiogenesis are the primary beneficial effects of HBOT in radiation proctitis.
- HBOT also decreased interstitial edema and decreases tissue inflammation. It also leads to increased oxygen free radical and has a bactericidal action.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Hyperbaric Treatment Of Radiation Proctitis



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**Question 215:** Which of the following best describes risk factors of heterotopic ossification (HO)?

**Choices:**

1. Patients with frequent septic arthritis are prone to development of HO
2. It is an autosomal recessive condition from rare genetic mutations
3. HO is most common in young males who lead very active lifestyles
4. Patients at highest risk include those with bilateral hypertrophic osteoarthritis and posttraumatic arthritis

**Answer: 4** - Patients at highest risk include those with bilateral hypertrophic osteoarthritis and posttraumatic arthritis

## Explanations:

- The three primary causes of HO can be grouped into traumatic, neurogenic and genetic etiologies.
- High-risk patients include those with bilateral hypertrophic osteoarthritis, patients with prior history of HO and those with posttraumatic arthritis characterized by hypertrophic osteophytosis.
- Patients at moderate risk include those with ankylosing spondylitis, diffuse idiopathic skeletal hyperostosis (DISH), Paget disease, or unilateral hypertrophic osteoarthritis.
- HO is twice as common in males compared to females, age over 65 years at the time of surgery, and lateral surgical approach of the hip.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

[Radiation Therapy For Heterotopic Ossification Prophylaxis](#)



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**Question 216:** A 47-year-old female visited the emergency department for bright blood in stools (> 2 months), dizziness, mild shortness of breath, constipation, and anal pain. On physical examination, she was noted to have a partially obstructing palpable mass approximately 2 cm from the anal verge. She was noted to have visible and easily accessible blood vessels on the dorsum of her hands and arms. Her labs showed a hemoglobin of 6.9 mg/dL (12.7-14.5 mg/dL). She did receive 2 pack red blood cells, and surgical oncology was consulted. An anoscopy clearly visualized a 3 cm (T2) mass, and a biopsy was performed. She was subsequently discharged. The pathology result showed HPV positive, moderately differentiated squamous cell carcinoma. The patient visited the oncology clinic, and CT scans of chest/abdomen/pelvis showed no metastatic disease and indicated a T2N0MO (Stage IIA). The patient has a past medical history of renal insufficiency and HTN and has difficulty in swallowing pills due to a hiatus hernia and severe GERD. Which one of the following is the most appropriate regimen?

### Choices:

1. 5FU/Cisplatin and radiation
2. FOLFOX
3. Mitomycin/capecitabine and radiation
4. Mitomycin/5FU and radiation

**Answer: 4** - Mitomycin/5FU and radiation

## Explanations:

- Mitomycin/5FU with radiation is the appropriate first-line regimen in this case and is the recommended regimen for T1-T4 and N+ anal cancer.
- Cisplatin is not recommended as the patient has a history of renal insufficiency. In addition, this regimen is a category 2B per NCCN guidelines in this specific case and is inferior to the Mitomycin/5-FU regimen.
- Capecitabine would have been an alternative to 5-FU, but the patient has difficulty swallowing pills, and hence capecitabine is not recommended.
- FOLFOX is considered in metastatic disease per NCCN guidelines.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Anal Cancer



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 217:** A 65-year-old male presents to a clinic with a weak urinary stream, weight loss, and fatigue. He denies any history of hematuria, suprapubic pain, or dysuria. A rectal exam is done, which reveals a 2 cm hard nodule. His prostate-specific antigen (PSA) is 16 ng/mL. A biopsy of the nodule was taken. What histological feature is most likely to be seen on the microscopy?

**Choices:**

1. Absence of a basal cell layer with increased cellular atypia
2. Presence of dysplastic cells along with peripheral basal cell layer
3. Atypical small acinar proliferation with the presence of basal cell layer
4. Hyperplastic glandular cells with the presence of the basal cell layer



**Answer: 1** - Absence of a basal cell layer with increased cellular atypia

## Explanations:

- The histological features of prostate cancer include, infiltrative glandular growth pattern, absence of a basal cell layer, atypically enlarged cell nuclei with large nucleoli, increased mitotic figures, intraluminal wispy blue mucin, pink amorphous secretions, intraluminal crystalloids, adjacent high-grade prostatic intraepithelial neoplasia (high-grade PIN), amphophilic cytoplasm.
- Absence of basal cell layer sets apart prostate carcinoma from other pre-malignant lesions like high-grade prostatic intraepithelial neoplasia (high-grade PIN), atypical small acinar proliferation (ASAP), and atypical adenomatous hyperplasia (adenosis).
- In high-grade PIN, cells will usually show very large nucleoli, but marked pleomorphism is not present. The prostatic ducts and glandular patterns appear normal with a normal peripheral basal cell layer.
- Atypical small acinar proliferation (ASAP) indicates that there are small foci of atypical prostatic glands that are suspicious for cancer, but there is insufficient overall evidence of malignancy to diagnose cancer. Atypical adenomatous hyperplasia (adenosis) is defined as a well-circumscribed nodule or lobule of small prostatic glands that are tightly packed. What sets it apart from a diagnosis of prostate cancer is the presence of basal cells and the absence of significant cytologic atypia.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Prostate Cancer



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**Question 218:** What is the correct expression unit of radiation dose?

**Choices:**

1. Gray
2. Sievert
3. Amp
4. Roentgen

Answer: 2 - Sievert

## Explanations:

- Sievert is used to measure radiation dose. It translates the absorbed exposure (in Gray) to a measure of biologic effect. That is, a physical input into a biological output.
- Gray measures radiation dose absorption.
- Roentgen measures radiation exposure.
- A Sievert equals 100 rem and a Gray equals 100 rad.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Ionizing Radiation



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**Question 219:** A 65-year-old male has been diagnosed with a parietal space-occupying lesion for which surgery was done and concurrent chemoradiotherapy was given. After 6 months he was found to have a recurrence of the lesion. The treating surgeon advised a non-invasive treatment option involving the placement of ceramic transducer arrays over the patient's head. Which phases of the cell cycle does this treatment work on?

**Choices:**

1. Metaphase only
2. Anaphase and telophase
3. Telophase only
4. Metaphase and telophase

**Answer: 4** - Metaphase and telophase

## Explanations:

- Glioblastoma multiforme is an aggressive tumor with a high recurrence rate and a PFS of 6.9 months with surgery and chemoradiotherapy.
- FDA has approved the use of TTF for treatment of recurrent GBM
- TTF involves the delivery of alternating electrical fields to the tumor by application of ceramic transducer arrays over the patient's head.
- Alternating electric fields result in disruption of the mitotic spindle during metaphase and dysregulated cytoplasmic division in telophase.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Tumor Treatment Fields In Oncology



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**Question 220:** A 52-year-old woman has a routine screening mammogram, which shows an irregular 2 cm density in the left breast. Needle biopsy shows scattered malignant cells in the stroma. There are minimal nuclear pleomorphism and no atypical mitoses. She is estrogen receptor (ER) positive and human epidermal growth factor receptor 2 (HER2) negative. Axillary nodes are negative. Chest radiograph and bone scan are negative. What is the grade and stage of this malignancy?

**Choices:**

1. Grade I, stage T1 M0 N0
2. Grade I, stage T2 M0 N1
3. Grade II, stage T3 M0 N1
4. Grade II, stage T1 M0 N1

**Answer:** 1 - Grade I, stage T1 M0 N0

## Explanations:

- Breast cancer is classified with the TNM classification system, which groups patients into 4 stage groupings based on the primary tumor size (T), the regional lymph nodes status (N), and if there is any distant metastasis (M).
- Stage 1 usually describes cancer that is 2 cm or less, with no lymph node involvement or metastatic disease.
- The prognosis of early breast cancer is quietly good. Stage 0 and stage I both have a 100 % 5-year survival rate.
- T2 cancer is 2 to 5 cm, and a T3 is greater than 5 cm. T4 cancer is of any size and may extend into the chest wall. There may also be edema of the skin, satellite skin nodules, and ulceration of the breast.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Breast Cancer



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**Question 221:** A 66-year-old woman with a history of melanoma diagnosed 5 months ago, presents to the clinic with a complaint of severe neck pain radiating to her left arm. The pain is 7/10 in intensity, which started 4 days ago and is not relieved with NSAIDs. She also complains of paresthesias in the left arm. Her husband complains that lately, he has seen her talking to herself a lot. He also reports that her sleep is disturbed, and she had one episode of loss of consciousness for few seconds 2 days ago. Otherwise, she performs individual and household work herself. On examination, she is conscious and oriented. Cranial nerves examination is normal. Left-arm has a sensory loss to sharp pain at C5 and C6 levels. No muscle weakness is noted. Reflexes are normal. The rest of the neurological exam is unremarkable. MRI brain and neck with contrast shows cranial nerve root and nodular leptomeningeal enhancement at C4-C6 levels. Lumbar puncture cytology shows malignant cells. Which of the following interventions is most likely to improve the patient's pain?

**Choices:**

1. Cervical dexamethasone injection
2. Epidural pain injection
3. Focal radiotherapy
4. Vemurafenib



**Answer: 3** - Focal radiotherapy

## Explanations:

- Melanoma is one of the most common tumors that can cause metastasis in the leptomeningeal layers of the CNS. The dissemination of malignant cells from the primary tumor to leptomeninges can occur at multiple levels, which is responsible for causing a wide array of presenting symptoms in carcinomatous meningitis (CM). Spinal cord involvement in CM can cause hypoesthesia and paresis depending upon whether sensory or motor root is affected. Spinal cord involvement can cause spinal radiculopathy.
- MRI has got diagnostic significance. MRI of the spinal cord shows linear and nodular leptomeningeal enhancements along the nerve roots, particularly along the cauda equina. MRI has another role that enhances the path of malignant cell seeding, which can be helpful for radiotherapy treatment.
- Management of a patient with carcinomatous meningitis is complex. It includes a combination of both systemic and intrathecal chemotherapy with or without radiotherapy. This combination improves clinical outcomes. Radiotherapy is more commonly used for symptomatic and palliative treatment rather than as a means for eradicating the disease. Focal radiotherapy is used in the case of nodular deposits of malignant cells in meninges. Melanomas are not uniformly radioresistant, with a significant subset displaying inherent radiosensitivity.
- Cranial irradiation is helpful in symptomatic CM by reducing focal tumor growths involving cranial nerves. The neurological deficit may not improve, but radicular pain does. The dosage used for cranial and spinal irradiation is 30 Gy in 10 daily fractions. Vemurafenib is a BRAF inhibitor administered systemically and shows a significant clinical response in patients with lepto-meningeal metastasis in melanoma patients. However, the management of symptoms like pain caused by nodular deposits of leptomeningeal metastasis is best treated with focal radiotherapy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Carcinomatous Meningitis



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**Question 222:** A 54-year-old female consults with a radiation oncologist after a recent diagnosis of invasive ductal carcinoma of the right breast. She comes into the room with an assistance dog and a white cane. She has discussed treatment options with her medical oncologist, which include a total mastectomy or the possibility of preserving part of the breast (partial mastectomy/lumpectomy) if she also received radiation therapy (RT) to the breast tissue. On physical examination, the clinician finds she underwent bilateral enucleation of both eyes, which she refers occurred at some point during her childhood but does not know the exact reason. Considering that RT can increase the risk of second treatment-associated malignancies. What additional testing would be most useful before treatment initiation given this patient's clinical picture?

**Choices:**

1. She does not require any additional testing and should be scheduled for RT simulation
2. Mutational panel for TP53 gene
3. Mutational panel for Rb gene
4. Cyclin-dependent kinase levels in peripheral blood

**Answer: 3** - Mutational panel for Rb gene

## Explanations:

- This patient is presenting a status post bilateral enucleation as a child. Besides traumatic injury. There are very few indications for bilateral enucleation in pediatrics, one being bilateral retinoblastoma, which is associated with germline mutations in the Rb gene.
- There are very few indications for bilateral enucleation in pediatrics, one being bilateral retinoblastoma, which is associated with germline mutations in the Rb gene.
- RT in a patient with Rb mutation would be highly discouraged if another option, such as total mastectomy, is possible; due to the increased risk of treatment-associated malignancies with RT such as chest-wall sarcoma.
- There would be no current role for measuring CDK levels in peripheral blood; CDK inhibitors are now therapeutic agents used in metastatic breast cancer. However, peripheral levels of CDK are not of clinical utility and were not mentioned in this article. Though mutations in TP53 are associated with Li-Fraumeni Syndrome and an increase in the risk of breast cancer, the most useful test should rule out a genetic syndrome, which also explains the patient's bilateral enucleation. There are findings on PE that should lead you to think about a concomitant genetic disorder, which could lead to a higher-than acceptable risk of second primaries if treatment with RT is initiated.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Genetics, Cancer Cell Cycle Phases



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## Section 7

**Question 223:** A 65-year-old female presents with increasing bilateral shoulder and hip weakness that has been progressing over the last three months. Her past medical history includes a diagnosis of breast cancer six months prior for which she is on chemotherapy. Vital signs are pulse rate 76/min, blood pressure 125/75 mmHg, respiratory rate 16/min, and temperature 98.6 F (37 C). Physical exam reveals reddish-purple rash around the eyelids and erythematous violaceous papules and plaques over the metacarpophalangeal joints. What is the most likely cause of her presentation?

### Choices:

1. Myasthenia gravis
2. Drug-induced erythema
3. Systemic lupus erythematosus
4. Dermatomyositis

Answer: 4 - Dermatomyositis

## Explanations:

- Paraneoplastic syndromes are rare disorders with systemic clinical manifestations from underlying malignancy due to the altered immune system. A review of the literature suggests that paraneoplastic syndrome occurs in up to 8% of cancer patients.
- Dermatomyositis is an immune-mediated disorder that occurs as a paraneoplastic syndrome in 15 percent of cases. Common malignancies associated with dermatomyositis include lung cancer, ovarian cancer, breast cancer, and some gastrointestinal tumors.
- Dermatomyositis is characterized by a heliotrope rash on the upper eyelids, Gottron papules on phalangeal joints, and an erythematous rash on the face, neck back, chest, and shoulders. It also involves muscles as inflammatory myopathy and is manifested as proximal muscle weakness and muscle tenderness.
- Management of the patients is based on the type, severity, and location of the paraneoplastic syndrome. First, therapeutic options are to treat underlying malignancy with chemotherapy, radiation, or surgery.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Paraneoplastic Syndromes



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 224:** A 72-year-old-male with an evolving lesion of the cheek is diagnosed with biopsy-proven cutaneous angiosarcoma. Which of the following is the mainstay treatment protocol?

**Choices:**

1. Surgical excision only
2. Surgical excision and radiation, plus or minus chemotherapy
3. Surgical excision and chemotherapy, plus or minus radiation
4. Chemotherapy only

**Answer: 2** - Surgical excision and radiation, plus or minus chemotherapy

## Explanations:

- Residual cutaneous angiosarcoma has been found 5 cm away from the original lesion. Therefore, even with wide surgical excision, it is possible to have residual tumor cells. Therefore, if possible, radiation should be considered in addition to surgical excision.
- The mainstay of treatment of cutaneous angiosarcoma is a combination of surgical excision with radiation. The literature shows a better outcome when both treatment modalities are used rather than one or the other. Surgery may not be appropriate though, depending on the location, size, and visibility of the tumor. Radiation therapy, on average, was delivered with megavoltage (Cobalt-60 or higher) photons or electrons with a median dose of 60 Gy and a median dose per fraction of 2.0 Gy. This applied to patients who received radiation in addition to surgery or who just received radiation. Radiation has been heavily studied and found to be an acceptable monotherapy when surgical excision is not possible. Radiation has been found to control the rate of tumor growth and in some cases, has been found to completely eradicate the tumor.
- Chemotherapeutic agents are still being studied with regards to which ones are the most efficacious for treating cutaneous angiosarcoma. Radiation therapy is well studied and has been found to control the rate of tumor growth.
- Few chemotherapeutic agents have been studied in the treatment of cutaneous angiosarcoma. The two that have been studied, docetaxel and paclitaxel, have been shown to decrease the rate of metastasis but not necessarily help in the regression of the tumor.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Skin Cancer Types



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**Question 225:** A 61-year old female with T3N0M0 squamous cell carcinoma of the anal canal completed definitive chemoradiation 6 weeks ago. She has a persistent ulcerated lesion at the location of the original bulky primary tumor. What should be recommended?

**Choices:**

1. Biopsy the lesion
2. Abdominoperineal resection
3. Nivolumab
4. Follow up in 4 weeks



**Answer: 4** - Follow up in 4 weeks

## Explanations:

- Following definitive chemoradiation for anal squamous cell carcinoma, the median time for tumor regression is 3 months, but tumors can continue to regress for up to 26 weeks based on the ACT-II study.
- Nivolumab is reserved for second-line immunotherapy for metastatic disease.
- Patients that have not experienced a complete clinical response following definitive chemoradiation may be followed up every 4 weeks up to 6 months. As long as there is no disease progression, surveillance is the most appropriate option.
- Anal biopsy after definitive chemoradiation can have high morbidity to include fistula formation and should be reserved only for progressive lesions.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Therapy For Anal Cancer



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**Question 226:** A 35-year-old female patient presented to the hospital for the evaluation of chronic headaches for the past six months. The headaches had been progressively worsening. She reported peripheral visual defects on the left side for the last few months. She had amenorrhea for the previous six months. She also had weight loss with nausea and vomiting. On examination, her blood pressure was found to be 100/60 mm Hg. Magnetic resonance imaging of the head showed a suprasellar mass measuring 3x3 cm with calcification. Her lab investigations reveal sodium of 128 mEq/L. What is the next best test to explain her symptoms and sodium level?

**Choices:**

1. Cosyntropin stimulation test
2. Urine osmolarity
3. Thyroid stimulation hormone
4. Prolactin levels

**Answer: 1** - Cosyntropin stimulation test

## Explanations:

- The symptoms of adrenal insufficiency are weight loss, generalized arthralgia, dizziness, and hypotension.
- Craniopharyngioma is associated with one or more hormonal deficiencies.
- Hyponatremia can be seen in a patient with adrenal insufficiency and hypothyroidism.
- Thyroid-stimulating hormone (TSH) is not reliable in a patient with pituitary disease. Free T4 is needed to have an adequate assessment of pituitary-related thyroid disorder.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Craniopharyngioma



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**Question 227:** A 48-year-old female was brought to the emergency department for generalized seizures. Past medical history cannot be elicited. On examination, she was drowsy, had difficulty maintaining wakefulness, and is not oriented. She has severely slurred speech and withdraws all extremities to pain. Babinski was positive bilaterally. A plain head CT was unremarkable. A brain MR with contrast was requested, which shows enhancing lesion of the leptomeninges over both cerebral convexities with subependymal nodules. There is also dilatation of the temporal horn bilaterally. Which of the following solid tumor is known to be most commonly involved in this patient's presentation?

**Choices:**

1. Gastrointestinal tumor
2. Metastatic breast cancer
3. Lung cancer
4. Melanoma

**Answer: 2** - Metastatic breast cancer

## Explanations:

- Metastatic breast cancer is cancer most commonly known to involve the leptomeninges, followed by lung cancer. These are followed by melanoma.
- Leptomeningeal carcinomatosis is an uncommon and late complication seen in 5% to 8% cases of solid tumors.
- It is usually a late complication, but less commonly, it may be a presenting sign of the underlying systemic cancer.
- Therapy has shown superior efficacy in leptomeningeal disease from breast cancer with a median survival of 5-7 months with treatment, compared to other solid tumors like melanoma and lung cancer with a median survival of approximately four months.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Leptomeningeal Carcinomatosis



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**Question 228:** A 74-year-old patient presents 25 months after completing primary chemotherapy and radiation therapy for stage 3 oropharyngeal squamous cell carcinoma. She continues to smoke. She began having pain when chewing one month ago, which has become progressively worse, and she has noticed that her teeth "do not fit together normally" anymore. She denies hemoptysis, weight loss, trismus, or neck mass. On examination, there is a palpable pseudoarthrosis in the body of her left mandible, but no exposed bone. Her remaining teeth are in good repair. After a biopsy excludes recurrent cancer, which of the following would be a component of her next step in treatment?

**Choices:**

1. 30 hyperbaric oxygen treatments
2. 10 hyperbaric oxygen treatments
3. Surgical removal of necrotic bone
4. Empiric antibiotics

**Answer:** 1 - 30 hyperbaric oxygen treatments

### Explanations:

- This patient most likely has osteoradionecrosis. Patients see the most improvement of healing and symptom relief when 30 preoperative hyperbaric oxygen (HBO) treatments are delivered.
- Surgical intervention should take place after 30 HBO treatments have been done for improved healing of the bone and improvement of symptoms.
- All cases of osteoradionecrosis of the mandible require surgical intervention with mild bony debridement as a minimum requirement. To prevent osteoradionecrosis (ORN), HBO treatments are always indicated before the surgical intervention or dental extraction in a previously irradiated area of bone.
- ORN of the mandible is primarily an aseptic disease of the bone and only requires antibiotics if an apparent secondary bacterial infection is present.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Mandible Osteoradionecrosis



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**Question 229:** A 45-year-old male patient with good health recently developed a dull, non-specific type of pain, localized to the right hypochondrium for the last 3 months. On further inquiry, he reports feeling a low-grade body temperature with some loss of appetite. Ultrasound of the liver showed a heterogeneous lesion with no specific boundary. Further radiological examination of the lesion with a computed tomography scan revealed diffuse enhancement of right liver lobe on the late arterial phase with no significant washout on the port venous phase. Biopsy of the lesion revealed diffusely large cells with dark chromatin arranged in dispersed sheats. The CD 7 and CD 20 stain are positive while chromogranin A and Hep Par 1 stains are negative. What treatment option would be selected to treat this patient?

**Choices:**

1. Somatostatin analog
2. Multikinase inhibitor sorafenib
3. Rituximab based combination chemotherapy
4. Surgical resection of the right liver lobe



**Answer: 3** - Rituximab based combination chemotherapy

### Explanations:

- The morphology of lesion on biopsy is consistent with diffuse large B cell lymphoma, not consistent with carcinoid tumors or hepatocellular carcinoma.
- The diffuse large B cell lymphoma of the liver responds in the same way as of systemic diffuse large B cell lymphoma.
- History, radiology, and histopathology are all combined to confirm a diagnosis of primary hepatic lymphoma.
- Of all other types of primary hepatic lymphoma, the diffuse large B cell lymphoma is the most common variant that other forms of primary lymphoma of the liver.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

#### Hepatic Lymphoma



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**Question 230:** A 16-year-old patient presents with increasing testicular pain of 1 months duration. On exam, a left testicular mass is identified. An orchiectomy was performed and the testicular mass is found to have a stroma that is infiltrated with numerous lymphocytes and has extensive hemorrhage and necrosis. Light microscopy reveals a diffuse sheet-like pattern of cells. Which of the following is most likely?

**Choices:**

1. Seminoma
2. Embryonal carcinoma
3. Leydig cell tumor
4. Choriocarcinoma

Answer: 1 - Seminoma

## Explanations:

- Seminoma is the most common pure germ cell tumor and is predominantly found white populations.
- Seminoma has been linked to cryptorchidism or a previous testicular cancer.
- Seminoma usually presents as enlarged masses with extensive hemorrhage and necrosis. An interstitial growth pattern or extensive fibrosis is also seen.
- The specific tumor marker for seminoma is the beta subunit of HCG.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Seminoma



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**Question 231:** A 9-year-old boy with a history of a cerebellar medulloblastoma resection followed by radiation therapy develops right-sided weakness and difficulty speaking. A contrast-enhanced MRI scan of the brain shows soap-bubble enhancement adjacent to the resection cavity, and magnetic resonance spectroscopy shows low choline, creatine, and N-acetylaspartate (NAA). He is referred for hyperbaric oxygen therapy. How can this treatment be beneficial in treating the present condition of the child?

**Choices:**

1. Promotes organized angiogenesis with improved tissue perfusion and partly increases vascular epidermal growth factor
2. Improves oxygenation in ischemic radiation necrosis tissue which results in reduced cellular activity for the repair of tissue
3. Reduces tissue edema and collagen synthesis by fibroblasts and astrocytes
4. It reduces the production of cerebrospinal fluid and thereby prevents its seepage into the tumor cavity and the necrosed parts of the brain

**Answer: 1** - Promotes organized angiogenesis with improved tissue perfusion and partly increases vascular epidermal growth factor

## Explanations:

- One of the key mechanisms of action of hyperbaric oxygen therapy is to promote the increase of vascular epidermal growth factor, which promotes capillary budding and angiogenesis.
- Another major mechanism of hyperbaric oxygen therapy is to improve tissue oxygenation by the increased transport of oxygen by the plasma in the bloodstream and also by increasing the oxygen gradient to ischemic tissue. The partial pressure of oxygen in the tissue can exceed well over 1000 mmHg.
- Hyperbaric oxygen therapy also decreases tissue edema by vasoconstriction. Additionally, it decreases neutrophil adherence to the post venule side of the capillary bed, lessening ischemia-reperfusion injury.
- With hyperbaric oxygen therapy, the angiogenesis that occurs is more organized than the disorganized vascular growth that can be seen in certain forms of radiation necrosis.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Hyperbaric Treatment Of Brain Radiation Necrosis



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**Question 232:** A 79-year-old man, 3 years status-post radiation therapy for prostate cancer, presents to the office with complaints of intermittent rectal bleeding. A flexible sigmoidoscopy reveals ulceration, friability, and telangiectasia. Which of the following is the best initial therapy for this patient?

**Choices:**

1. Vitamin A
2. Vitamin B12
3. Vitamin C
4. Vitamin E

Answer: 1 - Vitamin A

## Explanations:

- The patient's clinical presentation is most consistent with a diagnosis of radiation proctitis. In a 2009 study, oral vitamin A led to a significant reduction in the number of treatments and the time needed for the resolution of bleeding symptoms in radiation proctitis.
- Vitamin A increases fibroblast secretion of mucopolysaccharide and collagen and fibronectin synthesis, which assists in the wound healing process.
- Oral vitamin A enhances the effectiveness of formalin therapy.
- Daily supplementation of 10,000 units of vitamin A in combination with topical formalin therapy when treating CRP is a simple, effective, and well-tolerated treatment regimen.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Proctitis



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**Question 233:** A 67-year-old female presents to the clinic for sudden left eye pain. The patient denies ocular surgery or eye trauma. The patient reports that she is currently undergoing intravenous (IV) chemotherapy for adenocarcinoma of the stomach. On physical exam, she presents with diffuse hyperemia, pain, and visual impairment. The patient's sclera was biopsied, and cultures showed a gram-positive organism. Which of the following treatments should the patient be prescribed?

**Choices:**

1. Fortified topical cefazolin 50mg/mL and topical ciprofloxacin 0.3%
2. Topical Amikacin 2.5% and oral doxycycline 200mg
3. Oral Trimethoprim-sulfamethoxazole 160mg-800mg twice daily
4. Systemic trimethoprim-sulfamethoxazole (160mg/800mg twice daily) and azithromycin 500mg



**Answer: 1** - Fortified topical cefazolin 50mg/mL and topical ciprofloxacin 0.3%

## Explanations:

- The patient is undergoing chemotherapy for adenocarcinoma, for which the patient is given IV mitomycin-C. Mitomycin-C is a known risk factor for Streptococcus infections. As such, the patient has the highest risk for Streptococcus infectious scleritis. Immunocompromised patients are at risk for different pathogens that cause infectious scleritis. Reviewing the patient's medications or other treatments are necessary to find additional inciting factors.
- The patient is at risk for a non-tuberculosis Mycobacterium infection as she is on chemotherapy. However, she is at a higher risk for a Streptococcus infection because she would be receiving Mitomycin-C for adenocarcinoma.
- The patient is at risk for a Toxoplasmosis gondii infection as she is on chemotherapy.
- However, she is at a higher risk for a Streptococcus infection because she would be receiving Mitomycin-C for adenocarcinoma.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Infectious Scleritis



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**Question 234:** A 65-year-old female patient presents to the hospital with complaints of severe headaches associated with nausea and vomiting on awakening for the past few months. She also reports loss of weight and loss of appetite. She recalls having radiation therapy ten years ago for some growth, but can not precisely remember the diagnosis. On examination, she is found to have a heart rate of 100 beats/min, a blood pressure of 100/70 mmHg, respiratory rate of 20/min, and 95 % oxygen saturation on room air. Lab values, including CBC and metabolic profile, are within the normal range. CT head shows an irregular mass-like lesion, which was not present in her previous imaging four years ago. MRI revealed a 3 cm irregular mass in the left temporal lobe. Information regarding which of the following is most likely to help in establishing a diagnosis in such patients?

**Choices:**

1. Previous radiation
2. Prior surgeries
3. Family history
4. Smoking and alcohol history

**Answer: 1** - Previous radiation

## Explanations:

- Glioblastoma multiforme is the most common aggressive primary cranial nervous system tumor. Usually more common in older men and African American race.
- Studies have shown that a previous history of irradiation in early life is a risk factor for GBM. Although, in most cases, risk factors are not identified.
- It is important to take a careful history, including a prior history of irradiation, to assess for risk factors.
- No convincing evidence exists regarding associations of GBM with family history, smoking, or alcohol history.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Glioblastoma Multiforme



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**Question 235:** A 33-year-old woman presents to the clinic for follow up. She recently underwent a modified radical mastectomy for a pathologic T3N1M0 triple-negative invasive ductal carcinoma of the left breast. The tumor was completely resected with widely negative margins, and no lymphovascular invasion was present. What is the most appropriate radiotherapy dose for this patient?

**Choices:**

1. 50 Gy in 25 fractions
2. 70 Gy in 35 fractions
3. 30 Gy in 5 fractions
4. 50 Gy in 10 fractions

**Answer:** 1 - 50 Gy in 25 fractions

## Explanations:

- 50 Gy at 2 Gy per fraction for a total of 25 fractions is currently the standard of care dosing for post-mastectomy radiotherapy (PMRT). There is no evidence to suggest triple-negative breast cancer requires a higher dose of radiation.
- Hypofractionation, which involves giving a larger daily dose over a shorter period, was recently shown in a randomized setting to be equivalent to conventional PMRT at five years.
- However, the dose fractionation employed in this trial was 43.5 Gy in 15 fractions, which were compared to a standard dose of 50 Gy in 25 fractions. Longer follow up is necessary to determine long-term outcomes of this approach.
- 70 Gy in 25 fractions is higher than recommended for post-mastectomy radiotherapy to treat microscopic disease. In cases where there is a gross positive margin, a focal boost to an addition 10 to 16 Gy is performed. Dosing the chest wall to 70 Gy would significantly increase the risk of damage and toxicity to the chest wall, heart, and lungs. 30 Gy in 5 fractions is not a standard dose fractionation for post-mastectomy radiotherapy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Postmastectomy Breast Cancer Radiation Therapy



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**Question 236:** A 55-year-old male with a history of Paget disease and severe osteoarthritis presents to the emergency department with erythema, warmth, and swelling of the surgical incision. CT of the hip reveals no fluid formation. He has a history of total hip arthroplasty 4 months ago as well as resection of heterotopic ossification (HO) followed by radiation therapy (RT) 2 weeks ago. What is the most likely diagnosis?

**Choices:**

1. Wound healing complication
2. Re-development of heterotopic ossification
3. Septic arthritis
4. Psoriasis

**Answer: 1** - Wound healing complication

## Explanations:

- The clinical vignette is most consistent with wound complications following radiation therapy for heterotopic ossification.
- Treatment for HO consists of resection of the ossification followed by postoperative radiation therapy within 72 hours of surgery.
- Although the radiation given to patients is a low dose with benefits likely outweighing the potential risks, side effects can include fatigue, wound healing delays, joint swelling, and extremely low chance of secondary cancer from the radiation.
- For male patients, RT dose to the testicles is a concern as there can be a reduction in sperm count, so the use of testicular shielding during radiation is recommended.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Therapy For Heterotopic Ossification Prophylaxis



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**Question 237:** A 45-year-old male presents to the clinic having complaints of dull, persistent, mild intensity pain over the right hypochondrium. The patient reports some weight loss with an increase in the severity of the pain on movement. Radiological examination, including a computed tomography scan of the abdomen, excluded the possibility of hepatoma and cirrhosis. Furthermore, a targeted ultrasound-guided biopsy of the lesion revealed the absence of fibrosis, with an abundant cellular component. Which of the following is a poor prognostic marker for the response of this tumor to combination chemotherapy?

**Choices:**

1. Age
2. Raised beta-2 microglobulin levels
3. Low serum albumin level
4. The absence of constitutional symptoms



**Answer: 2** - Raised beta-2 microglobulin levels

## Explanations:

- Raised beta-2 microglobulin levels of  $> 3$  mg/dl is a poor prognostic marker for response to combination chemotherapy.
- Serum beta-2 microglobulin is secreted via blood cells, and its levels are directly correlated with the tumor burden.
- Presence of one pre-treatment risk factor requires to use altering combination chemotherapy, rather conventional cyclophosphamide, doxorubicin, vincristine, and prednisone (CHOP)-based regimen.
- Other predictors of poor outcomes in primary hepatic lymphoma are serum LDH  $> 10\%$  of the upper limit of the normal, presence of constitutional symptoms such as fever, myalgia, weight loss, and lastly, tumor size of  $> 7$  cm in the largest dimension.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Hepatic Lymphoma



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**Question 238:** An 82-year-old male patient reported hearing difficulty and speech recognition problems over the last year. The patient attributed these symptoms to aging and did not seek medical attention. He started experiencing a feeling of spinning of his surroundings 2 months ago. This led to a non-contrast CT scan which revealed an underlying right-sided cerebellopontine mass. MRI further solidified the CT findings. Audiometric examination revealed a severe sensorineural hearing loss in the right ear. His comorbid illnesses include heart failure, hypertension, diabetes mellitus, chronic kidney disease, and chronic obstructive pulmonary disease. Family history includes congestive heart failure in both parents. He currently lives in a nursing home. What is the most appropriate treatment option for this patient?

**Choices:**

1. Observation
2. Radiotherapy
3. Surgical resection via the retrosigmoid approach
4. Surgical resection translabyrinthine approach

Answer: 2 - Radiotherapy

## Explanations:

- Radiotherapy is suitable for elderly patients or poor surgical candidates. Tumor growth is halted successfully. However, worsening of hearing deficits and cranial neuropathies are common.
- Tumor recurrence can also occur and serial follow-up imaging should be taken routinely. Radiation-induced-tumour is also a concern in younger patients.
- Microsurgery offers a definitive solution. The goal of microsurgery is complete tumor removal as well as hearing preservation. The different surgical approaches that can be used are translabyrinthine, middle fossa and retrosigmoid approach.
- The most commonly used approach is retrosigmoid (RS) or the sub-occipital approach. This approach allows hearing preservation while providing adequate exposure.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Cerebellopontine Angle Cancer



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**Question 239:** A 20-year-old Black woman presents to the clinic for follow-up. She had her ears pierced several months ago and is concerned about a growing, non-painful lesion at the site of her piercing. On physical exam, the lesion appears to be raised, hyperpigmented, and 1.5 cm in diameter without any signs of infection. What is the most effective method of treatment for this patient?

**Choices:**

1. Surgery alone
2. Topical antibiotics
3. Surgical excision followed by radiation therapy
4. Cryotherapy

**Answer: 3** - Surgical excision followed by radiation therapy

### Explanations:

- Compared to surgery or radiation therapy alone, surgical excision followed by immediate postoperative radiation therapy has been shown to be the most effective treatment.
- Radiation is often indicated for recurrent keloids or patients with a high risk of recurrence, including marginal resections, wider spread, and unfavorable locations.
- Radiation starting on the same day after surgical removal of the keloid is most effective.
- Keloids localized on the ear were found to have the lowest rate of recurrence (12%).

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Radiation Therapy In The Treatment Of Keloids



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**Question 240:** A 33-year-old female presents to a clinic with a new breast cancer diagnosis. She is premenopausal. She has been diagnosed with invasive ductal carcinoma by core needle biopsy. The maximum size of the tumor on the core biopsy is 1cm, and the mammogram suggests a similar size. She has no palpable axillary nodes. She undergoes sentinel lymph node biopsy and lumpectomy. The lumpectomy specimen shows adequate margins. Three sentinel nodes were removed, and one was involved with a macrometastasis that did not traverse the capsule of the node. Receptors are HRT positive and PR negative. Which of the following would be the best choice for her?

**Choices:**

1. Completion of axillary node dissection and adjuvant chemotherapy
2. Adjuvant chemotherapy
3. Aromatase inhibitor therapy
4. Axillary radiation and adjuvant chemotherapy

**Answer: 2** - Adjuvant chemotherapy

## Explanations:

- The patient has early-stage breast cancer (T1, N1.) Since she has axillary involvement, she is a candidate for adjuvant chemotherapy.
- The Z0011 trial supports the idea that patients with early-stage breast cancer and minimal axillary burden do not benefit from complete axillary dissection. A ten-year follow-up trial demonstrated no increased survival in patients such as these undergoing axillary dissection after positive sentinel node biopsy.
- The cutoff for recommending axillary radiation is three positive lymph nodes (N2 disease), so there is no need for axillary radiation in this case.
- As she is premenopausal, she cannot be given aromatase inhibitors.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

[Axillary Sentinel Lymph Node Biopsy](#)



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**Question 241:** A 65-year-old male patient was diagnosed with glioblastoma multiforme and underwent surgical resection followed by chemoradiotherapy. Repeat MRI done six weeks after initiation of therapy showed the increase in size with reduced cerebral blood volume, low choline ratio Cho/NAA ratio of less than 1.48, increased lactate peak, increased lipid peak, and elevated ADC values due to cell death. On evaluation, the patient denies any new symptoms. What is the next best step in management?

**Choices:**

1. Discontinue the intensive treatment due to the progression of the disease and recommend palliative measures.
2. Continue with therapy followed by repeat imaging in 6-8 weeks.
3. Proceed with surgery again.
4. Get a PET scan to assess for progression of the disease.



**Answer: 2** - Continue with therapy followed by repeat imaging in 6-8 weeks.

## Explanations:

- Continuing with therapy followed by repeat imaging in 2 months is recommended as the imaging finding is likely a treatment-related effect called pseudoprogression. Pseudoprogression is usually asymptomatic, which is the case in this scenario.
- Pseudoprogression is a phenomenon that is usually seen four to six weeks after the completion of chemoradiotherapy.
- Pseudoprogression is a treatment-related effect with imaging findings similar to tumor progression. It usually occurs within three months of completion of chemoradiation in glioblastoma patients.
- Distinguishing between pseudoprogression due to treatment and true progression of the disease is important to avoid inappropriate discontinuation of treatment in patients.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

**Glioblastoma Multiforme**



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**Question 242:** A 51-year-old woman presents to the clinic with a skin rash on her left breast. The rash gradually appeared around four weeks ago. She has itching and mild pain but denied other symptoms. She has a ten pack-year smoking history and drinks three beers every day. On examination, there is erythematous, scaly rash, with some yellowish oozing, but no palpable mass or skin dimpling is noted. The axillary examination is unremarkable. Mammogram and ultrasound do not show any abnormality. Biopsy of the lesion confirms large ovoid cells with clear cytoplasm. What is the most appropriate initial management strategy for this patient?

### Choices:

1. Whole breast radiation therapy
2. Simple mastectomy with complete lymph node dissection
3. Tamoxifen therapy
4. Resection of the nipple-areola complex with central lumpectomy followed by radiation therapy

**Answer: 4** - Resection of the nipple-areola complex with central lumpectomy followed by radiation therapy

## Explanations:

- This patient has an eczematous rash over the nipple and areola, along with multiple risk factors of breast cancer. The rash could be an inflammatory dermatosis, infection, or allergic reaction, but it is important to rule out Paget disease of the breast (PDB), which could be an indicator of underlying breast parenchymal neoplasm. While the biopsy confirms the PDB, there is no palpable mass in the breast or axilla and no mammographic abnormality. In such cases, still, there is approximately 12-15% chance that there is some occult breast parenchymal disease present either ductal carcinoma in situ (DCIS) or invasive ductal cancer. MRI may be considered to proceed further, but the high false-positive rate is a limitation. So, MRI should be performed only in the facilities when the MRI-guided biopsy is can be taken to confirm the underlying malignant process. In any case, surgery is indicated.
- Breast conservative therapy (BCT), i.e., resection of nipple-areola complex with central lumpectomy, followed by whole breast radiating therapy (BT), is the best choice for such cases.
- Several retrospective studies have shown that simple mastectomy and BCT followed by RT have comparable results in terms of successful salvage, rate of local recurrence, and distant disease-free survival time.
- Radiation therapy alone is not a suitable option for this patient. Simple mastectomy, along with sentinel lymph node biopsy, is a suitable option in such cases. Complete lymph node dissection is not indicated unless lymph node biopsy confirms the metastases. Selective estrogen receptor stimulators (SERMs) like tamoxifen or aromatase inhibitors can be chosen individually indicated for specific breast neoplasm, but their use alone does not show any role in the treatment of Paget disease of the breast.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Mammary Paget Disease



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**Question 243:** A 66-year-old man is being evaluated for weight loss, back pain, and chronic cough. A chest x-ray reveals a 4 cm spiculated nodule in the left upper lobe. The patient denies any smoking history but did work as a uranium miner for nearly thirty years. Which of the following is most likely responsible for the patient's disease?

**Choices:**

1. Uranium
2. Radon gas
3. Xenon
4. Gamma radiation

Answer: 2 - Radon gas

## Explanations:

- Uranium mines have a high level of radon gas.
- Radon gas increases the likelihood of developing a lung carcinoma.
- Radon is made of alpha particles that can settle on alveoli tissue after being inhaled and cause cellular damage over time.
- Uranium exposure would have had cutaneous symptoms. Xenon is made of beta particles and would have had more systemic symptoms. Gamma radiation is usually a result of nuclear detonation.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Syndrome



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**Question 244:** A 65-year-old man undergoes a prostate biopsy showing a Gleason score of 4+5=9 prostate cancer. His prostate-specific antigen (PSA) is 35 ng/mL. Magnetic resonance imaging (MRI) of the prostate shows extracapsular extension and seminal vesicle invasion. His bone scan for metastasis is negative. Computed tomography (CT) scan reveals enlarged obturator and periaortic lymph nodes. What is the clinical-stage of tumor in this patient?

**Choices:**

1. T2bN1M0
2. T2cN1M0
3. T3bN1M1a
4. T3bN1M1b

Answer: 3 - T3bN1M1a

## Explanations:

- If regional lymph nodes, which in this case are iliac and obturator lymph nodes, are positive, then it is N1 disease.
- In the case of prostate cancer, M1a means that cancer has spread to the regional lymph nodes. M1b indicates that the tumor has spread to the bones, whereas M1c means it has spread to another organ of the body either with or without the involvement of the bones.
- T3b tumor invades seminal vesicle(s).
- An extracapsular extension is T3a disease. T2b tumor involves more than half of one lobe but not both lobes. T2c tumor involves both lobes of the prostate.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Prostate Cancer



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**Question 245:** A 68-year-old man with a past medical history of tobacco use disorder presents for evaluation of worsening cough and shortness of breath. He reports a chronic "smoker's" cough for multiple years, which has been worsening over the last few months even though he quit smoking two years ago. He also reports exertional dyspnea, fatigue, and unintentional weight loss over the last few months. Computed tomography (CT) of the chest with intravenous contrast reveals a 6 cm spiculated mass in the right upper lobe of the lung. The tumor is encircling the mediastinal structures, and discrete lymph nodes from the primary tumor cannot be identified. According to the American College of Chest Physicians (ACCP), this patient's malignancy is classified as which of the following?

**Choices:**

1. Group A disease
2. Group B disease
3. Group C disease
4. Group D disease



**Answer: 1** - Group A disease

## Explanations:

- The American College of Chest Physicians (ACCP) has proposed grouping patients based on tumor extent and lymph node involvement. This patient has group A disease which consists of patients with bulky tumors encircling or invading mediastinal structures such that remote lymph nodes cannot be distinguished from the primary tumor.
- Mediastinal invasion is implied in patients with group A disease and lymph node sampling is not required for staging.
- Tissue diagnosis from the primary tumor suffices to identify and stage the malignancy.
- Although CT is not the appropriate staging modality, it helps the clinician select the site for tissue biopsy. In other words, based on these groups, further staging via noninvasive or invasive methods is planned.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Lung Cancer



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**Question 246:** A 69-year-old woman presents with a palpable mass in the left breast. Mammography shows a relatively well-circumscribed lobulated mass in the right upper portion of the left breast. Ultrasonography reveals a well-defined, oval, isoechoic solid mass with a small cystic component measuring approximately 4 cm in the left breast. The examination does not reveal lymph nodes in the axilla or supraclavicular region. An excisional biopsy is performed. Microscopic evaluation reveals nests of cells floating in lakes of mucin partitioned by delicate fibrous septa containing capillary blood vessels. The cell clusters are variable in size and shape with an occasional tubular arrangement. Immunohistochemical studies show positive immunostaining of tumor cells for estrogen and progesterone receptors. HER2 is not amplified. She chooses to undergo a lumpectomy. Which of the following management steps are most appropriate?

**Choices:**

1. Radiation therapy to breast and axilla alone
2. Surveillance
3. Radiation therapy and aromatase inhibitor
4. Chemotherapy, radiation therapy, and aromatase inhibitor

**Answer: 3** - Radiation therapy and aromatase inhibitor

## Explanations:

- Based on the histology, the patient most likely has mucinous carcinoma of the breast. Mucinous carcinoma has a good prognosis.
- Preferable adjuvant treatment after surgery for lymph node-negative mucinous breast carcinoma is hormonal therapy instead of chemotherapy.
- After the lumpectomy, radiation therapy is strongly recommended.
- The role of chemotherapy is limited in early stage mucinous carcinoma of the breast. But can be used in patients with lymph node-positive disease.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Mucinous Breast Carcinoma



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**Question 247:** A 63-year-old female is being evaluated after a routine screening mammogram. It shows a spiculated mass measuring 1.1 cm in her left breast. Ultrasound demonstrates a hypoechoic mass measuring 1.0 x 1.1 x 0.9 cm. Biopsy reveals a well-differentiated invasive ductal carcinoma that is ER/PR positive and HER2/neu negative. Lumpectomy and sentinel node biopsy reveal 1.1 cm carcinoma with widely negative margins. No associated ductal carcinoma in situ or lymphovascular invasion is noted. Two sentinel nodes are negative. The Oncotype DX Test Score is 7. Anastrozole is started, and radiation therapy is planned. What is the most appropriate radiation dose for optimal radiation therapy in this patient?

**Choices:**

1. 6005 cGy
2. 5000 cGy
3. 4005 cGy
4. 3000 cGy

Answer: 3 - 4005 cGy

## Explanations:

- 4005 cGy in 15 fractions is a UK START B hypofractionation regimen.
- 4256 cGy in 16 fractions is another acceptable hypofractionation regimen, based on Whelan et al.
- The American Society for Radiation Oncology (ASTRO) recently issued new clinical guidelines in March 2018 for whole breast radiation therapy to expand the patient population to be treated with a hypofractionated course of radiation therapy.
- Previously hypofractionated whole-breast radiation therapy was recommended for certain patients. However, recent long-term data from multiple clinical trials support the safety and efficacy of hypofractionation in most patients regardless of age, tumor grade, left or right-sided breast cancer, prior chemotherapy, receptor status, and breast size.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Therapy For Early Stage Breast Cancer



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**Question 248:** A 34-year-old female presented to the emergency department after having a seizure. On examination, she has no neurological deficit and no evidence of active seizures. Brain magnetic resonance imaging was performed, and a lesion is identified on the left side. A lesion in the Sylvian fissure is identified, which opens the fissure widely. The lesion appears extra-axial and is bright on the T2 image. What is the most probable diagnosis?

**Choices:**

1. Schwannoma
2. Adenoma
3. Pearly tumor
4. Glioma

Answer: 3 - Pearly tumor

## Explanations:

- Epidermoids are more commonly found in the cerebellopontine angle, para sellar area, and Sylvian fissure. They are also called pearly tumors.
- Epidermoid tumors grow slowly from the desquamation of cells and from the breakdown of keratin.
- Epidermoid tumors can, on rare occasions, have malignant transformation.
- Gliomas are intra-axial lesions.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Epidermoid Cancer



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**Question 249:** A 59-year-old male had complaints of testicular discomfort and palpable mass for the last two years. Ultrasonography showed hypoechoic with less than one-centimeter diameter accompanied by intrinsic hypervascularization. Radical orchiectomy was done, and the diagnosis of a Leydig cell tumor was made. Computed tomography scan was done, which showed liver metastasis. What is the next step in management?

**Choices:**

1. Surgical resection of all possible sites
2. Palliative care
3. Chemotherapy
4. Radiotherapy



**Answer: 1** - Surgical resection of all possible sites

## Explanations:

- In the case of metastasis, surgical resection of all possible sites of disease should be done. (Grade 2C recommendation)
- Testicular cancer is different in that patients may have excellent survival despite metastasis, if properly managed.
- Metastasectomy and retroperitoneal lymph node dissection are important tools in the management of metastatic testicular carcinoma.
- Chemotherapy and radiotherapy have not shown many roles in the metastatic disease.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Sex Cord Stromal Testicular Tumor



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**Question 250:** A 64-year-old male presents to the clinic with complaints of fever, sore throat, and an enlarged lump in the neck one month ago. Moreover, the patient also reported an overall decrease in weight during the last 2 months. Physical examination revealed a 6cm ulcer in the posterior pharyngeal wall. An endoscopy along with biopsy was done, which revealed moderate to severe dysplastic changes. The patient underwent surgical intervention followed by cisplatin-based chemotherapy with no complications. However, today he has again presented with the complaints of painful swallowing and a sore throat. During his follow up visit, which of the following is the next preferred management in this patient?

**Choices:**

1. Computed tomography scan
2. Magnetic resonance imaging
3. Ultrasonography
4. Positron emission tomography

**Answer: 4** - Positron emission tomography

## Explanations:

- The patient in this clinical scenario most likely underwent treatment for oropharyngeal cancer. However, today he is again presenting with the complaints of sore throat and painful swallowing, which raises the suspicion of recurrence.
- The positron emission tomography scan is employed for the assessment and detection of the recurrence of the primary tumors.
- The positron emission tomography scan can also be used to identify the nodal spread of cancerous cells.
- The positron emission tomography scans evaluate cancerous cells' metabolic functioning, for example, the processing of glucose which is higher in the cancerous cells.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Oropharyngeal Squamous Cell Carcinoma



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**Question 251:** A 57-year-old female presents for evaluation of a right upper extremity mass, which has been slow growing and painful over the past 8 years. Examination reveals a tender, 3.0 x 3.0 x 2.0 cm pink, fixed, firm mass without ulceration. There is no palpable axillary lymphadenopathy, and the patient otherwise does not have any additional complaints. A biopsy is taken, and histology demonstrates tumor cells in the dermis and subcutis with abundant, eosinophilic, granular cytoplasm. The cells stain positively for S-100 and CD68. Nuclei are not pleomorphic or large, nucleoli and mitotic figures are not visible, and there is no spindling or necrosis. What is the appropriate management of this patient?

**Choices:**

1. Annual surveillance, given the indolent nature of the lesion
2. Wide local excision of the lesion with sentinel lymph node biopsy
3. Wide local excision of the lesion without sentinel lymph node biopsy
4. Chemotherapy or radiotherapy

**Answer: 3** - Wide local excision of the lesion without sentinel lymph node biopsy

## Explanations:

- This patient has a benign granular cell tumor of the skin. The diagnosis of this lesion in the skin is made on histology, and this patient's biopsy has characteristic findings of abundant, eosinophilic, granular cytoplasm with positive S-100 staining. The lesion does not have any features concerning for a malignant granular tumor, such as necrosis, pleomorphism, prominent nucleoli, high nuclear to cytoplasmic ratio, spindled cells, or mitoses. Patients with benign granular cell tumors are managed with wide local excision, and Mohs excisions are often employed to ensure clear margins. Given the lack of palpable lymph nodes, lack of malignant histologic features, and the rarity of metastasizing benign granular cell tumors, lymph node biopsy is not necessary.
- Granular cell tumors typically present on the head and neck (45%–65%, predominantly in the tongue), skin/subcutaneous tissue, and gastrointestinal tract (predominantly esophagus, stomach, duodenum), but they have also been found in the larynx, lung, breast, genitals, thyroid, and eye, among other locations. Upper extremity involvement has been reported as well, although it is rare. In each location, the tumor has a similar histologic appearance.
- Recurrence in benign lesions is only 2-8% if the tumor is removed via wide local excision with clear margins. If the margins are positive, the recurrence approaches 50%. By contrast, recurrence exceeds 40% in some studies of malignant granular cell tumors.
- Benign granular cell tumors are treated with wide local excision. Annual surveillance is not appropriate given that this patient's lesion is painful and given the question of whether benign lesions can undergo malignant transformation. Lymph node biopsies and excisions are not done routinely for benign granular tumors in the absence of palpable lymph nodes. Chemotherapy and radiotherapy have historically been reserved for metastatic or bulky disease, but they do not yet have well-defined roles in treating granular cell tumors given the lack of clinical trials and only sparse case reports of successful outcomes.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Granular Cell Tumor



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**Question 252:** A 70-year-old female presents to the clinic for an evaluation. Her symptoms include fatigue, loss of interest, and weight loss. She had a breast mammogram done recently. She takes multivitamins and metformin. Her medical history includes diabetes mellitus and anxiety. A bone scan whole-body posterior view shows the bones are without focal abnormality, the soft tissue is relatively less prominent, and there is no renal activity, though there is some bladder tracer. Which of the following is the best interpretation?

**Choices:**

1. It is a superscan, implying diffuse blastic osseous metastases
2. Renal failure
3. Flare phenomenon
4. Osteoporosis

**Answer: 1** - It is a superscan, implying diffuse blastic osseous metastases

## Explanations:

- Superscan shows intense activity in the bones on a Tc99m diphosphonate bone scan that is symmetrical. There is diminished renal and soft tissue activity. It implies diffusely increased osseous uptake due to metastatic disease (most commonly breast or prostate cancer) or metabolic bone disease, which is so intense that little or no renal excretion of the radiotracer occurs.
- Possible causes include prostatic carcinoma, breast cancer, transitional cell carcinoma, and lymphoma. Multiple myeloma can also show this pattern.
- Detection of the metastatic osseous disease most frequently occurs in the axial and proximal appendicular skeleton corresponding with sites of red marrow.
- Renal failure would show a relative increase, not a decrease in soft tissue activity. The flare phenomenon is the temporary increase in bone metastasis's prominence on bone scan in a patient receiving successful chemotherapy. Even with "more" bone metastasis, the patient is clinically improving.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Bone Scan



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**Question 253:** A 79-year-old African American male with a past medical history significant for coronary artery disease status post coronary artery bypass grafting and multiple cardiac stents, chronic stable angina, hypertension, diabetes, peripheral vascular disease, chronic kidney disease is evaluated for hematuria of 2 weeks duration. The patient denies any history of renal stones, symptoms suggestive of UTI. Vitals revealed a heart rate of 70 bpm, blood pressure of 155/86 mmHg, a temperature of 36.7, respiratory rate of 14, saturating at 97% on room air, and BMI of 23. On physical examination, the patient appears chronically ill, but not in any acute distress. Examination revealed right-sided flank tenderness. Respiratory and cardiovascular examination was essentially normal. Laboratory data revealed a white cell count of 5, hemoglobin of 10 g/dL, platelets of 210/microliter. Sodium 135 mEq/L, potassium 5 mEq/L, chloride 106 mEq/L, CO<sub>2</sub> 21mEq/L, BUN 30 mg/dL, creatinine 2.1 mg/dL, calcium 8.4 mEq/L, and albumin 3.1 mg/dL. Urinalysis revealed specific gravity of 1.010, blood ++, 30 protein, 30 RBC/HPF, and negative for WBC, nitrites, and leukocyte esterase. CT of the abdomen/pelvis revealed a 5.9 cm mass in the right kidney suspicious for clear cell renal cell carcinoma. What is the next best step?

### Choices:

1. Partial nephrectomy
2. Observation and CT scan in 3 months
3. Radiofrequency ablation and cryotherapy
4. Sunitinib



**Answer: 3** - Radiofrequency ablation and cryotherapy

### Explanations:

- The patient has stage I (T1b) for which a partial nephrectomy is recommended. But, given his age and co-morbidities, he is not a surgical candidate.
- For non-surgical candidates with T1 lesions, radiofrequency ablation and cryotherapy are recommended.
- Observation and reimaging is not an option. The patient does not qualify for chemotherapy.
- Compared to partial nephrectomy and radical nephrectomy, the rate of disease recurrence is higher in patients who undergo radiofrequency ablation and cryotherapy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Clear Cell Renal Carcinoma



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**Question 254:** A 65-year-old male presents with cough and hemoptysis. He is a longtime smoker. Chest CT shows a 3 cm spiculated nodule in the left lower lobe. Biopsy reveals squamous cell carcinoma. What is the appropriate next step in the management of this patient?

**Choices:**

1. Surgery
2. Positron emission tomography-CT
3. CT of the brain
4. Radiation therapy

**Answer: 2** - Positron emission tomography-CT

### Explanations:

- Workup begins with good history taking and physical examination.
- Staging studies include CT of the chest, abdomen, and pelvis, MRI of the brain, and positron emission tomography (PET)-CT.
- Tissue diagnosis and staging studies are crucial to help guide treatment recommendations.
- Positron emission tomography-computed tomography (PET-CT) is a nuclear medicine study that combines a PET scanner and a CT scanner to give a single superimposed image. This technique gives information on the metabolic activity in the body obtained by PET, correlating to the body anatomy obtained by CT.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

[Radiation Therapy For Early Stage Non-Small Cell Lung Cancer](#)



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**Question 255:** A 65-year-old female with a history of hypertension complained of recurrent emergency department visits because of episodes of dizziness, blurred vision, palpitations, and loss of consciousness. Her random blood glucose levels were in the range of 15 to 40 mg/dl on every visit, which improved by the administration of dextrose. She denied any medications other than amlodipine 10 mg for hypertension. She has no history of diabetes. Fasting insulin levels were 25 microU/mL and C-peptides 10 ng/mL. MRI of the abdomen showed 4 cm pancreatic mass, and the Ki-67 index was 10%. What is the best treatment modality for this patient?

**Choices:**

1. Everolimus
2. Whipple surgery
3. Octreotide
4. Peptide receptor radiotherapy (PRRT)

Answer: 2 - Whipple surgery

## Explanations:

- Pancreaticoduodenectomy or Whipple surgery and distal pancreatectomy are procedures typically used for pNETs greater than 2 cm, symptomatic disease, and low to intermediate grade.
- Surgical resection is the potentially curative treatment for localized and locally advanced NETs.
- On the other hand, surgical removal of pNETs less than 2cm in size, non-functioning, and low grade remains controversial.
- When surgical removal of the tumor is not accessible due to tumor size, a debulking surgery is recommended. Platinum-based chemotherapy is recommended following surgery in surgically excised, poorly differentiated tumors. Everolimus and octreotide are systemic therapies for more advanced NETs.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

APUDoma



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**Question 256:** Which type of breast cancer has the best prognosis?

**Choices:**

1. Paget's
2. Inflammatory breast cancer
3. Mucinous
4. Medullary

Answer: 3 - Mucinous

### Explanations:

- Mucinous is a rare type of breast cancer often seen in the 7th decade of life.
- It may present with a palpable mass with rare calcifications. Mucin production is the hallmark and is usually ER and PR positive.
- These cancers over express glycoproteins MUC 2 and MUC 6.
- Mucinous cancers have an excellent prognosis with a 80% survival at 10 years.

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### Research Concepts:

Mucinous Breast Carcinoma



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**Question 257:** A 65-year-old female patient presents to the clinic with a recent history of fatigue, a persistent cough, hoarseness, hemoptysis, and shortness of breath. The patient has also noticed that her clothes have been fitting looser, although she has not been trying to lose weight. The patient denies any illicit drug use but affirms smoking one pack per day for the past 25 years. Her blood pressure is 139/80 mmHg, pulse 77/min, respirations 17/min, and temperature 98.0 F (36.7 C). Her breath sounds are decreased over the right upper lobe. A CT scan of the chest reveals a mass in the left upper lobe. A biopsy of the mass shows nests of polygonal cells with vesicular nuclei, moderately abundant cytoplasm and prominent nucleoli, with well-defined borders. These cells are highly anaplastic and poorly differentiated. The provider recommends scheduling the patient for surgical excision. What is likely to be observed in this patient secondary to her condition?

**Choices:**

1. High serum levels of beta-hCG
2. Serum sodium of 131 mEq/L
3. Serum calcium of 12 mEq/L
4. Elevated ACTH



**Answer: 1** - High serum levels of beta-hCG

## Explanations:

- The findings in this patient are consistent with large cell carcinoma of the lung. Large cell carcinoma of the lung is associated with the secretion of the beta subunit of human chorionic gonadotropin.
- Large cell lung cancer is more of a diagnosis of exclusion. The cells belonging to this cancer will not have mucous, squamous differentiation, neuroendocrine properties, or small cell characteristics. Cells will be large with abundant amounts of cytoplasm, large nuclei, and prominent nucleoli.
- A histopathological examination of large cell carcinoma will show nests of polygonal cells with vesicular nuclei, moderately abundant cytoplasm and prominent nucleoli, with well-defined borders.
- Additionally, large cell tumor cells are highly anaplastic and poorly differentiated. Prognosis is generally poor. Large cell carcinoma tumors are poorly responsive to chemotherapy and often require surgical excision.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Non Small Cell Lung Cancer



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**Question 258:** A 68-year-old female presents with a history of bleeding via the rectum every time she has a bowel movement. She has also noticed a change in her bowel habits and feels tired all the time. A digital rectal exam reveals a 5 cm mass that is fixed to the mucosa. Biopsy reveals a lesion with dysplasia and abnormal epithelial cells. What is the most important prognostic feature of this patient's pathology?

**Choices:**

1. Nodal involvement
2. Size
3. Histology
4. Presence of symptoms

**Answer: 1** - Nodal involvement

## Explanations:

- When rectal cancer has spread to lymph nodes far from the rectum, cancer cannot be cured. Survival time is usually less than seven months.
- The rectum is about 12 to 15 centimeters in length and the prognosis of rectal cancers is dependent on nodal involvement or staging.
- Local excision of rectal cancer is not recommended, as there is a high risk of recurrence.
- Abdominal perineal resections are done for lower third rectal cancers and this means a permanent colostomy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Colon Cancer



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**Question 259:** A 72-year-old female patient presented to the emergency department by the EMS for progressive shortness of breath. Her vital signs are blood pressure 106/60 mm Hg, pulse rate 88 beats per minute, respiratory rate 27 breath per minute, and temperature 98.6 F (37 C). Her medical history is remarkable for the right breast cancer for which she underwent right modified radical mastectomy three years ago. The anterior-posterior chest x-ray is remarkable for bilaterally blunted costo-phrenic angles. Placement of indwelling pleural catheters was performed. Which of the following statements is true about intrapleural catheters (IPCs)?

**Choices:**

1. IPCs are the treatment of choice for malignant pleural effusion
2. IPCs are indicated for chylothorax secondary to lymphoma
3. IPCs should not be used in complex parapneumonic effusions
4. IPCs can be used for intrapleural chemotherapy for mesothelioma

**Answer: 3** - IPCs should not be used in complex parapneumonic effusions

## Explanations:

- IPCs are indicated for the palliative treatment and improvement of dyspnea due to a chronic pleural effusion. Malignant pleural effusions are the main indication for IPC placement only if they are associated with the respiratory compromise with document improvement of symptoms post pleural fluid removal at least on 1 prior occasion.
- IPCs are not indicated for the treatment of pleural effusion from a likely curable cause. Most lymphomas respond to therapy and hence do not warrant IPC placement. However, if the patient fails treatment and requires palliative management then an IPC can be considered.
- Despite a few case reports, there is no recommendation to treat chronic parapneumonic effusion with IPC. Video-assisted thoracoscopic surgery (VATS) should be considered.
- IPC is only for palliative treatment and not therapeutic. Intrapleural chemotherapy is not part of the mesothelioma treatment regimen at this moment.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Intrapleural Catheter



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## Section 8

**Question 260:** A 49-year-old female has undergone physical examination and mammography for a left-sided 2 cm x 3 cm breast mass. The mammography report states her BIRADS (breast imaging reporting and database system) score as 4b. Which of the following is the next most appropriate step in her management?

### Choices:

1. No further investigation is necessary as the lesion is likely to be benign
2. Ultrasound scan
3. Core biopsy
4. Excision biopsy of the mass

Answer: 3 - Core biopsy

## Explanations:

- Core biopsy is more invasive than fine-needle aspiration cytology and requires more expertise for its analysis. Either of these would be appropriate next steps in this patient.
- A core biopsy provides information about the architectural structure of tissues and the invasiveness of a tumor. Fine-needle aspirate cytology can only give information about the cells themselves. Tissue or cytological analysis of a likely malignant lesion must be carried out before excision to guide the surgeon in terms of procedure choice and appropriate margins.
- Imaging reports are standardized using a tool called BIRADS – Breast Imaging Reporting and Data System (fifth edition). This standard allows breast imaging to be described according to a certain structure as follows: density of breast tissue, presence and location of a mass or masses, calcifications, asymmetry, and any associated features. This classification system divides patients into categories 0 to 6, depending on the likelihood of malignancy in the obtained images: BIRADS 0 – insufficient or incomplete study, BIRADS 1 – normal study, BIRADS 2 – benign features, BIRADS 3 – probably benign (2% risk of malignancy), BIRADS 4 – suspicious features (divided into categories 4a, 4b, and 4c depending on the likelihood of malignancy), BIRADS 5 – probably malignant (>95% chance of malignancy), BIRADS 6 – malignant (proven malignant on tissue biopsy)
- The BIRADS system includes different classifications for masses depending on the imaging modality in question. In mammography, to be considered a mass, the lesion must be visible in two different projections, must have convex outer borders, and must be denser in the center than on the periphery.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

New Breast Mass



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**Question 261:** A 72-year-old woman is diagnosed with carcinoma of the breast, which is found to be HER2 neu positive. Due to the extent of her disease, she is planned to receive trastuzumab and radiation therapy. It is known that this combination increases the risk of adverse cardiac outcomes in the long-term. Which of the following is another factor that could increase the risk of poor cardiac outcomes in this patient?

**Choices:**

1. Female gender
2. HER2neu positive cancer
3. Hyperlipidemia
4. Autonomic dysfunction



Answer: 3 - Hyperlipidemia

## Explanations:

- Radiation therapy is, on its own, associated with adverse effects on the heart. But therapy with trastuzumab or anthracycline chemotherapy and radiation combined worsens the risk significantly. The risk can be further compounded by risk factors such as hypertension, hyperlipidemia, smoking, male gender, and prior heart disease or coronary artery disease.
- It is imperative that any patient undergoing radiation therapy that involves the chest be evaluated for the above risk factors and have medical management optimized (when possible), and smoking cessation, in particular, should be achieved. This is particularly true in patients who are simultaneously treated with cardiotoxic chemotherapeutics such as trastuzumab or anthracyclines.
- HER2neu positive breast cancer is often treated with Trastuzumab, which has cardiotoxic side effects. However, HER2neu positive cancer is not associated with increased cardiac damage.
- Female gender does not confer additional risk of adverse cardiac effects, although male gender does as it increases the risk of coronary artery disease. Autonomic dysfunction is more common in the elderly, and it can cause lightheadedness or even syncope, but it does not directly affect the heart in a negative way.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Therapy Induced Cardiac Toxicity



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**Question 262:** A 65-year-old man presents to the clinic for a follow-up visit. He has a history of cervical lymphadenopathy for five months. A diagnosis of lymphocyte-depleted classic Hodgkin lymphoma stage II (unfavorable) has been made. He has received two cycles of chemotherapy with ABVD (doxorubicin, bleomycin, vinblastine, and dacarbazine). Interim response assessment is done with a positron emission tomography scan, and a score of Deauville 5 is noted. What is the next best step in the management of this patient?

**Choices:**

1. Cervical lymph node biopsy
2. Continue chemotherapy with ABVD
3. Involved-site radiation therapy
4. Nivolumab injection

**Answer: 1** - Cervical lymph node biopsy

## Explanations:

- The Deauville criteria are used to interpret integrated positron emission tomography-computed tomography scan in patients with lymphoma during and at the end of treatment.
- Patients with a score of Deauville 5 are recommended to undergo a biopsy to confirm or exclude persistent disease.
- If the biopsy is positive, patients should be managed as a refractory disease. An individualized treatment plan is recommended.
- The high-dose therapy and autologous stem cell rescue (HDT/ASCR) is known to be the best treatment option for these patients, although it does not improve the overall survival.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Lymphocyte Depleted Hodgkin Lymphoma



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**Question 263:** A 63-year-old female is recently diagnosed with a mass in the left tonsil. Further evaluation was concerning for malignancy, and the biopsy showed p 16+ squamous cell carcinoma. The patient mentioned he wants to avoid any surgical intervention. A decision was made to start on concurrent chemoradiation. Which of the following is the major dose-limiting side effect of the most widely used regimen for radiotherapy sensitization?

**Choices:**

1. Nausea and vomiting
2. Neurotoxicity
3. Nephrotoxicity
4. Ototoxicity

**Answer: 3** - Nephrotoxicity

### Explanations:

- Cisplatin is the recommended and widely used chemotherapy medication for concurrent chemoradiation in tonsillar squamous cell carcinoma.
- Renal dysfunction is the major dose-limiting side effect associated with cisplatin.
- Ototoxicity, neurotoxicity, nausea, and vomiting are also other side effects associated with cisplatin.
- Carboplatin can be used as an alternative in patients who are not candidates for cisplatin.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Tonsil Cancer



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**Question 264:** A 55-year-old male with recently diagnosed small cell lung carcinoma presents to the clinician for a consultation. The patient is scheduled for radiation therapy. The clinician explains the possible complications of radiation therapy. New studies for the treatment of radiation esophagitis have focused predominantly on which colony-stimulating factor?

**Choices:**

1. CSF1 – macrophage colony-stimulating factor
2. CSF2 – granulocyte-macrophage colony-stimulating factors
3. CSF3 – granulocyte colony-stimulating factors
4. Synthetic – promegapoeitin

**Answer: 2** - CSF2 – granulocyte-macrophage colony-stimulating factors

## Explanations:

- Current research has been looking at the use of granulocyte-macrophage colony-stimulating factor.
- Current research has been looking at the use of honey to prevent radiation esophagitis.
- Severe cases of radiation esophagitis have been associated with genetic factors and polymorphisms.
- Genetics have been thought to play an important role in a patient who develops radiation esophagitis. Some research has correlated single-nucleotide polymorphisms of transforming growth factor b-1 to be associated with severe radiation esophagitis.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Esophagitis



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**Question 265:** A 65-year-old female presents to the clinic for evaluation of chest pain, which developed after she was involved in a low-velocity motor vehicle collision. She also reports of occasional headaches, which she attributes to old age. On routine investigation, there is an incidental finding of a 2 cm lesion in the left upper lobe on a CT scan of the chest. On biopsy, the mass proves to be lung adenocarcinoma with ipsilateral peribronchial lymphadenopathy, without evidence of contralateral or mediastinal lymphadenopathy or other sites of metastasis. Further workup reveals a 2-cm parietal lobe mass. Which of the following is the best treatment option?

**Choices:**

1. Lobectomy with systemic chemotherapy followed by craniotomy with brain tumor resection
2. Craniotomy with tumor resection and whole brain radiation followed by lobectomy and chemotherapy
3. Radiation therapy of both lung and brain lesions with concurrent systemic chemotherapy
4. Definitive chemoradiation therapy



**Answer: 2** - Craniotomy with tumor resection and whole brain radiation followed by lobectomy and chemotherapy

## Explanations:

- This patient has a T1N1M1b tumor. Without the metastatic brain disease, the pulmonary component of this disease would be considered resectable. As there is no other metastatic disease, nor contralateral nodal involvement, this patient is a candidate for definitive resection of the solitary brain metastasis and pulmonary tumor.
- The correct order would be metastatic resection first, followed by resection of the primary tumor.
- Adenocarcinoma of the lung usually evolves from the mucosal glands and represents about 40% of all lung cancers. It is the most common subtype to be diagnosed in people who have never smoked.
- Chemoradiation is indicated adjuvantly after surgical therapy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Lung Adenocarcinoma



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**Question 266:** A 35-year-old female presents with a very tender, slow-growing mass on the flexor surface of her arm. MRI imaging is shown below. A biopsy is taken, which shows a biphasic appearance with patterns of spindle cells arranged in intersecting bundles and other patterns with less cellularity and loosely arranged cells. Appropriate treatment would include which of the following?

**Choices:**

1. Limb salvage procedure
2. Marginal resection
3. Marginal resection and radiation therapy
4. Wide resection, chemotherapy, and radiation therapy

**Answer: 2** - Marginal resection

## Explanations:

- This patient presents with symptomatic Schwannoma (neurilemmoma) of the forearm. Treatment is usually observational, but symptomatic masses may be treated with marginal resection.
- Schwannomas are benign soft tissue tumors that are derived from Schwann cells. They usually arise from the periphery of nerves, known as the epineurium. They most commonly originate in large peripheral nerves of the head, neck, and flexor surfaces of the upper extremities.
- Schwannomas appear isotonic to muscle on T1-weighted imaging and hyperintense on T2-weighted imaging.
- There is a low risk of malignant transformation in benign peripheral nerve sheath tumors.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Neurilemmoma



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**Question 267:** A 38-year-old woman presents complaining of pain in her lower back for more than three months. A cystic, expansile L3 vertebral body lesion is seen on plain roentgenogram, and encroachment onto the spinal canal is detected on MRI. Detailed evaluation reveals an aggressive spinal high RANKL expressing mass. What is the most appropriate management strategy for this patient?

**Choices:**

1. Complete excision and radiotherapy
2. Curettage, radiotherapy, and zoledronate
3. Insertion of polymethylmethacrylate (PMMA), radiotherapy, and belimumab
4. Radiotherapy, transcatheter embolization, pamidronate, and denosumab

**Answer: 4** - Radiotherapy, transcatheter embolization, pamidronate, and denosumab

## Explanations:

- Aggressive spinal giant cell tumors (CTGs) are considered to be unresectable.
- Radiotherapy is recommended for the spinal, sacral, or aggressive tumors when complete excision or curettage is impractical for any functional or medical reasons.
- A trans-catheter embolization of the blood supply can be used for the unresectable GCTs (e.g., specific pelvic or sacral tumors).
- Reports show that topical or systemic bisphosphonates like zoledronate or pamidronate can be used as a novel adjuvant therapy for GCT. Bisphosphonates induce apoptosis and limit the tumor progression by targeting the osteoclast-like giant cells.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Giant Cell Tumor



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 268:** A 69-year-old patient presented with a palpable mass in her right breast. The diagnostic mammogram showed a spiculated mass measuring 1.2 cm. Ultrasound demonstrated a hypoechoic mass measuring 2.1 cm x 1.3 cm x 0.8 cm. Biopsy revealed a well-differentiated mucinous carcinoma that was ER/PR positive and HER2/neu negative. Lumpectomy and sentinel node biopsy revealed 1.8 cm mucinous carcinoma with widely negative margins. No associated ductal carcinoma in situ or lymphovascular invasion was noted. The clinician suggests doing radiotherapy. What is the most common side effect of radiation therapy to the breast?

**Choices:**

1. Skin reactions
2. Radiation pneumonitis
3. Lymphedema
4. Secondary cancers

Answer: 1 - Skin reactions

## Explanations:

- Skin reactions are the most common side effect of radiation therapy to the breast. Acute skin reactions can include pruritis, erythema, pigmentary changes, and desquamation of the skin.
- Long-term effects can lead to cosmetic changes in the breast, such as thickening of the skin, permanent pigmentation, fibrosis, and telangiectasias.
- Skincare regimens are offered during the course of radiation therapy to deter, lessen, and relieve the effects of radiation therapy.
- Skin effects from radiation therapy can be higher in patients who are larger breasted and are receiving higher doses of radiation therapy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Therapy For Early Stage Breast Cancer



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 269:** A 45-year-old female patient presents with microcalcifications on her mammogram. Stereotactic biopsy reveals high-grade ductal carcinoma in situ. Pathology from lumpectomy shows high-grade ductal carcinoma in situ measuring 2 cm with comedo necrosis. The tumor was estrogen and progesterone receptor-positive. No invasive carcinoma was identified. Surgical margins were 5 mm. What would be recommended for this patient?

**Choices:**

1. Observation
2. Radiation therapy and tamoxifen
3. Chemotherapy and radiation therapy
4. Chemotherapy, radiation therapy, and tamoxifen



**Answer: 2** - Radiation therapy and tamoxifen

### Explanations:

- Radiation therapy is generally recommended in patients to reduce the risk of in-breast recurrence.
- Tamoxifen is considered for ER/PR positive ductal carcinoma in situ (DCIS) to reduce the risk of recurrence, although the absolute benefit may be small.
- Radiation therapy can be omitted for certain patients whose risk may be small such as older women (more than 60 with low-grade tumors, small tumors less than 0.5 cm, unicentric disease, and tumors excised with wide margins more than 1 cm.
- Post lumpectomy mammogram should be obtained to rule out any residual calcifications.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Radiation Therapy For Early Stage Breast Cancer



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 270:** A 54-year-old woman with a history of squamous cell carcinoma of the lung presents the emergency department. She was treated with radiation therapy for her lung cancer. The patient states that it started after her radiation treatment. Her odynophagia has been progressive to the point where it is difficult to tolerate oral intake. During her hospital stay, she was evaluated by a healthcare provider who performed an esophagogastroduodenoscopy (EGD) that noted an erythematous and friable esophageal lining consistent with radiation esophagitis. What medication class is given prophylactically for patients suffering from radiation esophagitis?

**Choices:**

1. Antimicrobials
2. Antifungals
3. Antivirals
4. Antiemetics

Answer: 2 - Antifungals

## Explanations:

- Prophylactic antifungal therapy is indicated due to the increased risk of thrush.
- Dietary modification in the form of soft, bland diets is typically used with the removal of irritant foods such as alcohol, spicy foods, and very hot or cold food.
- Amifostine, an organic triphosphate, has been studied and shown to act as a radioprotector has been shown to improve swallowing dysfunction but had no effect on reducing rates of esophagitis in severe cases.
- NSAIDs and other non-steroidal have been studied but have not been proven effective.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Radiation Esophagitis



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**Question 271:** A 30-year-old man presents to the clinic with a small area on his chest that is itchy and raised. He got a tattoo on the location one year ago. On physical exam, the area is about one centimeter in length, elevated, hyperpigmented, and slightly erythematous without other signs of infection. Which of the following radiation prescription is most likely result in the lowest rate of recurrence for this lesion when started within 24 hours after surgery?

**Choices:**

1. 12 Gy/3fx
2. 18 Gy/3fx
3. 8 Gy/1fx
4. 60 Gy/30fx

Answer: 2 - 18 Gy/3fx

## Explanations:

- There is a keloid recurrence rate of 50% to 80% after surgery. Recurrence rate reduced to 50% with intralesional steroid therapy. Radiation therapy reduces the recurrence rate to 12% to 28%.
- Historically 3 to 4 Gy/fx for 3 to 4 fractions of radiation were given to doses of 12 to 20 Gy. However, recent Dutch meta-analysis suggests that dose is insufficient for long-term control, and should use BED of greater than 30 Gy (e.g., 13/1, 16/2, 18/3).
- Sites with high rates of recurrence (e.g., high-tension areas) should be treated with escalated dosages.
- Toxicity is still well tolerated at higher doses with BED greater than 30 Gy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Therapy In The Treatment Of Keloids



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**Question 272:** A 54-year-old woman presents to the office for her postoperative visit following left breast lumpectomy and sentinel lymph node biopsy two weeks ago. The pathology report indicates the final tumor size was 1.4 cm, and the closest margin was the anterior margin at 3 mm. The tumor is found to be both estrogen and progesterone-receptor positive. Which of the following is the most appropriate next step in the management of this patient's breast cancer?

**Choices:**

1. Return to the operating room for re-excision lumpectomy
2. Referral to medical oncology for chemotherapy recommendations
3. Referral to medical oncology for hormone therapy recommendations and radiation oncology for radiation recommendations
4. Referral to medical oncology for hormone therapy recommendations only

**Answer: 3** - Referral to medical oncology for hormone therapy recommendations and radiation oncology for radiation recommendations

## Explanations:

- The patient has early-stage breast cancer, as indicated by the final pathology. The closest margin was the anterior margin at 3 mm. Current recommendations for invasive breast cancer would suggest that this should be treated as negative margins, as there is "no tumor on ink," and the patient should proceed with adjuvant therapy as indicated.
- The tumor is estrogen and progesterone-receptor positive and, therefore, should be recommended for hormone therapy.
- The patient underwent breast-conserving surgery. As recurrence rates are unacceptably high without adjuvant radiation, she should be recommended for adjuvant radiation.
- Chemotherapy is not necessarily indicated, particularly in early-stage invasive breast cancer, which is estrogen and progesterone-receptor positive.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Breast Cancer Surgery



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**Question 273:** A 50-year-old gentleman who is a high school teacher presents to the primary care physician with the complaint of headaches 2/10 and weight loss over a 2 month period. Further evaluation by imaging of the brain showed almost 20 lesions concerning for metastatic cancer. CT of the chest, abdomen, and pelvis showed multiple lesions in the liver. The biopsy of the lesion showed a BRAF-wild type melanoma. The patient mentioned his preference to continue to teach as long as possible and would not prefer therapy that has effects on cognition. His performance status is excellent. Which of the following treatment would be recommended?

**Choices:**

1. Stereotactic radiosurgery
2. Dabrafenib and trametinib
3. Whole-brain radiotherapy
4. Ipilimumab and nivolumab



**Answer: 4** - Ipilimumab and nivolumab

## Explanations:

- Ipilimumab and nivolumab as a combination were studied in untreated brain metastases patients and showed a response rate of more than double compared to single-agent nivolumab.
- Intracranial complete responses were noted in about 17% of patients who were treated with ipilimumab and nivolumab.
- BRAF wild type tumors do not respond well to the dabrafenib and trametinib.
- Whole-brain radiotherapy causes a decrease in neurocognitive function and would not be a reasonable option for this patient. Stereotactic radiosurgery is not a practical choice for him with multiple lesions.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

**Malignant Melanoma Metastatic To The Central Nervous System**



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**Question 274:** A 43-year-old white female presents with a neck mass. She incidentally observed the mass two weeks ago while taking a shower. She denies a family history of thyroid disease. She underwent chemotherapy and radiation for a non-Hodgkin lymphoma 25 years ago. She works as a traffic sergeant and lives with her female partner. The patient denies fever, chills, change in weight, or changes in bowel habits. Currently, she is afebrile and hemodynamically stable. Physical examination reveals a 3.1 cm in diameter anterior neck mass that does not move with swallowing. Her thyroid-stimulating hormone level is 3.1 mU/L, a thyroid ultrasound reveals a  $3.2 \times 2.9$  cm hypoechoic solid right thyroid nodule with irregular margins, and right-sided cervical lymphadenopathy is confirmed by ultrasonography. Which of the following is the most likely feature of a biopsy of this neck mass?

**Choices:**

1. Secretes calcitonin
2. Psammoma bodies
3. Invades thyroid capsule and vasculature
4. Stains with Congo red

Answer: 2 - Psammoma bodies

## Explanations:

- Thyroid radiation exposure in childhood is the strongest environmental risk factor for thyroid cancer, most commonly papillary thyroid cancer (PTC).
- The two cardinal morphological features of conventional PTC are the papillae and nuclear changes.
- The papillae are composed of a central fibrovascular stalk covered by a neoplastic epithelial lining. The papillae may be long, straight, or arborizing, arranged in a parallel, regimented fashion, short and stubby, or tightly packed. The thickness and composition of the papillary stalk are variable. The stalk is usually made up of loose connective tissue and variously sized thin-walled vessels.
- PTC usually presents as an asymptomatic (painless) thyroid mass with or without enlargement of regional (cervical) lymph nodes. There may be the involvement of the recurrent laryngeal nerve, which may present as hoarseness and dysphagia. Vocal cord paralysis or tracheal compression may also be present. Nodal metastases in the lateral neck are reported in 27% of patients at presentation, most often originating from tumors in the ipsilateral thyroid lobe.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Papillary Thyroid Carcinoma



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**Question 275:** A 72-year-old man attended the otolaryngology outpatient clinic with a 3-month history of a large right-sided nodal mass, throat pain, and hoarseness. He is a life-long smoker with a history of significant chronic obstructive pulmonary disease and congestive heart failure and is capable of limited self-care. Flexible laryngoscopy accompanied with CT scan of neck and thorax revealed a large glottic mass, which extended through the thyroid cartilage and prevertebral space. Multiple bilateral lymph nodes with indistinct nodal margins are evident. What is the most appropriate management?

**Choices:**

1. Primary chemoradiotherapy
2. Laryngectomy and neck dissection with postoperative radiotherapy
3. Supportive palliative care
4. Laryngectomy and neck dissection

**Answer: 3** - Supportive palliative care

## Explanations:

- Considering the prevertebral fascia involvement, the patient is affected with T4b disease and should be treated with supportive palliative care.
- Several indications for total laryngectomy may be considered, including 1.patients with T4a glottic cancer, and 2.select cases with significant laryngeal destruction or non-functioning larynges.
- Primary chemoradiotherapy is the treatment of choice for moderately advanced glottic cancer. Previous studies have shown a higher rate of salvage surgery in T4 tumors treated with chemoradiotherapy, and therefore laryngectomy is the treatment of choice in many of these patients.
- Total laryngectomy is a major operation with a significant lifestyle change for a patient. Given these patients' other comorbidities and limited ability for self-care, he is likely not a suitable candidate for this operation.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Glottic Cancer



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**Question 276:** A 45-year-old man presents with fatigue, weight loss, and muscle weakness, and double vision at the end of the day. He has a past medical history of Hodgkin lymphoma, which was treated with mantle irradiation during childhood. He denies any fever, night sweats, shortness of breath, or chest pain. He drinks 2 to 3 glasses of wine per day and has a 30 pack-year smoking history. On examination, there is muscle weakness that improves on repeated movements. A CT scan reveals a 2 x 3 cm mass in the right lobe of the lung. Blood tests show positive antibodies against SOX1. Which of the following interventions would have reduced the risk of this complication?

**Choices:**

1. Chest physiotherapy
2. Smoking cessation
3. Moderation of alcohol use
4. Albuterol inhaler use

**Answer: 2** - Smoking cessation

## Explanations:

- The patient is presenting with secondary lung cancer years after mantle irradiation of the chest for treatment of Hodgkin lymphoma.
- Muscle weakness that improves with activity and autoantibodies against the SOX1 gene suggests Lambert-Eaton myasthenic syndrome, which is seen in lung cancers.
- The risk of secondary lung cancer is increased by 20 times if associated with smoking. Therefore, smoking cessation can reduce the risk of secondary lung malignancies in lung cancer patients.
- Alcohol use is associated with cirrhosis and subsequently, hepatocellular carcinoma. It does not affect lung cancer risk.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Adverse Effects Of Radiation Therapy



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**Question 277:** A 55-year-old woman with a past medical history of hepatic cirrhosis secondary to alcohol use disorder presents to the hospital with a complaint of fatigue and abdominal pain. As a part of the history and physical, she states that she has been sober for over a year with the help of rehabilitation. An initial workup to evaluate her abdominal pain includes a CT of the abdomen and pelvis with intravenous contrast. The scan reveals a shrunken, nodular liver containing a single enhancing lesion measuring 6.2 cm. Laboratory analysis reveals elevated liver enzymes and total bilirubin, but her Child-Pugh score is B. The patient undergoes CT-guided biopsy, the pathology for which reveals hepatocellular carcinoma. Due to the size of the lesion, the patient is not considered to be a candidate for surgical resection. The oncology team decides that despite the size of the tumor, it has a favorable location, which would likely respond well to percutaneous radiofrequency ablation. Which of the following best describes the method by which radiofrequency ablation would treat this patient's tumor?

**Choices:**

1. Direct heat-induced necrosis
2. Non-ionizing radiation-induced necrosis
3. Indirect heat-induced necrosis
4. Direct and indirect heat-induced necrosis



**Answer: 4** - Direct and indirect heat-induced necrosis

## Explanations:

- The liver is a common location for both primary and metastatic malignancies, which often result in significant morbidity and mortality. Traditional surgical resection provides excellent outcomes, but surgery is not an option for many patients due to extensive tumor burden, underlying hepatic disease, and other comorbidities. The evolution of image-guided technology has provided safe and effective alternatives for definitive and palliative treatment, including percutaneous radiofrequency ablation.
- Radiofrequency ablation equipment has three main components including needle electrodes, an electrical generator and grounding pads.
- Radiofrequency ablation is a heat-based ablation method that creates zones of coagulative necrosis through the application of heat. With RFA, an alternating current is conducted through an applicator (electrode) that acts as the cathode of a closed electrical circuit with large-surface grounding pads applied to the skin acting as the anode.
- Ions close to the electrode vibrate rapidly as they attempt to align with the alternating current, resulting in resistive tissue heating (direct heating) that is conducted into adjacent tissues (indirect heating) as a result of the high thermal gradient. The final ablation is the result of both direct heating caused by the applied energy, and indirect heating, the result of thermal diffusion into adjacent, cooler tissues.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

[Percutaneous Radiofrequency Ablation Of Liver Tumors](#)



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**Question 278:** A 75-year-old man with a history of HIV presents to the clinic with a right midline palate mass. On physical exam, the mass is non-tender, and he has bilateral cervical lymphadenopathy. Fine needle biopsy showed lymphocytes mixed with plasma cells and histiocytes. Immunophenotypic showed CD20+ B-cells. What is the most appropriate management strategy for this patient?

**Choices:**

1. Wide surgical resection with neck dissection
2. Wide surgical resection with neck dissection and adjuvant radiation
3. Wide surgical resection with neck dissection and adjuvant chemoradiation
4. Chemoradiation

Answer: 4 - Chemoradiation

## Explanations:

- The risk factors for developing Non-Hodgkin lymphoma (NHL) is multifactorial, including immunosuppression (HIV, congenital immunodeficiency, organ transplant, chemotherapy, and radiation), viral infections (EBV, HTLV-1, herpes, hepatitis C), bacterial infections (H. pylori, Lyme disease), tobacco, animal fat, obesity, hair dyes, ultraviolet radiation pesticides and occupational toxin exposure, and genetic predisposition for B-cell survival and growth.
- NHL often presents with a painless, submucosal mass without ulceration and cervical lymphadenopathy.
- NHL histopathology shows irregular lymphocytes mixed with plasma cells, histiocytes, and lymphoid follicles. (Medeiros) On immunophenotyping, there is a predominant CD20+ B-cells with T-cells positive for CD3+.
- NHL is treated with a combination of radiation and chemotherapy. Radiation was reported to be given at a range of 24-45 Gy over 16-25 fractions. NHL is most commonly treated with a standard chemotherapy regiment involving cyclophosphamide, doxorubicin, vincristine, and prednisolone (CHOP) for 8 cycles over a duration of 3 weeks.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Malignant Tumors of the Palate



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**Question 279:** A 75-year-old male presents with complaints of lower backache for the past few weeks. Comorbidities include diabetes mellitus controlled with oral hypoglycemic agents and hypertension controlled with medication. He has a history of locally advanced prostate cancer diagnosed three years back and managed with prostatectomy and bilateral orchidectomy. Clinical examination revealed tenderness in the lumbar area and no other significant findings. Lab investigations revealed serum PSA - 35 ng/ml (serum PSA done 3 months back - 20 ng/ml). Prostate-specific membrane antigen positron emission tomography-computed tomography scan revealed multiple avid lesions involving bone nodes. The further plan was discussed in a multidisciplinary meeting, and a decision was taken for chemotherapy and palliative radiation therapy. Which of the following sites should receive radiation therapy?

### Choices:

1. Prostate-specific membrane antigen avid pelvic lymph nodes
2. Prostate-specific membrane antigen avid lumbar vertebra
3. Prostate-specific membrane antigen avid lesion involving shaft of humerus
4. All prostate-specific membrane antigen avid lesions

**Answer: 2** - Prostate-specific membrane antigen avid lumbar vertebra

## Explanations:

- Palliative radiation therapy intends to provide pain relief, prevent pathological fractures and cord compression.
- Usual palliative radiation therapy fractionations are 8Gy/SF, 20Gy/5#, and 30Gy/10#.
- Palliative radiation therapy should be considered for symptomatic sites, weight-bearing sites, and lesions responsible for imminent cord compression.
- Bisphosphonates should also be considered for bone strengthening.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Palliative Radiation Therapy For Bone Metastases



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**Question 280:** A 53-year-old man was diagnosed with primary gastric mucosa-associated lymphoid tissue (MALT) lymphoma without spread to adjacent organs and no lymph node involvement via CT imaging and upper endoscopy with biopsies. The biopsies were positive for helicobacter pylori (*H. pylori*) infection. The patient had a lactate dehydrogenase level of 400 (normal 140-280) at the time of diagnosis. *H. pylori* was successfully eradicated and the patient completed radiation therapy. Subsequent upper endoscopy was unremarkable with normal biopsies from the fundus, body, incisura, and antrum. What would the clinician tell the patient regarding his prognosis on his follow up visit?

**Choices:**

1. He has a very low risk of recurrence and surveillance is not indicated
2. His risk of recurrence is low but should have repeat CT imaging in 6 months
3. He has an intermediate risk of recurrence and should undergo CT imaging in 6 months
4. He has a high risk of recurrence and should be evaluated for gastrectomy

**Answer: 3** - He has an intermediate risk of recurrence and should undergo CT imaging in 6 months

## Explanations:

- MALT-IPI index uses three independent variables to assess the prognosis of mucosa-associated lymphoid tissue (MALT) lymphoma. Age >70, Stage III & IV disease, and elevated serum lactate dehydrogenase levels are all independent risk factors for a worse prognosis.
- Patients with treated low-risk gastric lymphoma have good 5-year event-free and overall survival rates but are still recommended to undergo surveillance.
- Intermediate risk of recurrence as a 5-year overall survival rate of >90%.
- No randomized controlled trials have been performed for recommendations regarding surveillance after successfully treated gastric lymphoma. A combination of imaging and upper endoscopy is often performed at intervals of 3-12 months in the five years after treatment (with shorter intervals indicated in the first 2 years).

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Gastric Lymphoma



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**Question 281:** The normal tissue of the vagina and cervix have high relative resistance to radiation. This allows for high surface doses in patients with cervical cancer. What are the usual radiation doses of the cervix and vagina with intracavitary devices?

**Choices:**

1. 3,000 to 5,000 rads
2. 5,000 to 7,000 rads
3. 7,000 to 10,000 rads
4. 15,000-20,000 rads



**Answer:** 4 - 15,000-20,000 rads

## Explanations:

- Intracavitary devices result in doses to the vagina and cervix of 15,000 to 20,000 rad.
- The inverse square law results in much lower doses to the rectum and bladder.
- The most common side effects are nausea, vomiting, diarrhea, and premature menopause.
- Radiation cystitis and fistulas are also possible.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Radiation Therapy



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**Question 282:** A 55-year-old post-menopausal woman with ER-positive, PR-negative, HER2-negative metastatic breast cancer (status-post modified radical mastectomy followed by adjuvant chemoradiation received two years ago) presents to the clinic with complaints of yellowish discoloration of the eyes and urine for the past 15 days. She takes anastrozole. She denies any complaints of generalized itching or white discoloration of the feces. General physical examination reveals a pale, icteric, cachexic female with sensory loss in the L4 dermatome. Her T-score on the DEXA scan is -1.5. She is taking calcium supplementation. On further evaluation, she reports a history of lower backache for the past 15 days. She denies any urinary incontinence. Physical examination demonstrates loss of touch sensation in the perineal region. Which of the following best describes the target mechanism of the treatment modality of choice for this patient?

**Choices:**

1. Protein synthesis
2. DNA damage repair
3. Cell membrane damage
4. Proteasomal function

Answer: 2 - DNA damage repair

## Explanations:

- The incidence of metastatic bone disease ranges from 17%-64% in lung cancer, 65%-75% in breast cancer, 65%-90% in prostate cancer, and 70%-95% in multiple myeloma. Locoregional approaches for symptomatic palliation of bone metastases include surgery and radiotherapy. Systemic approaches include the usage of inhibitors of bone resorption, radiopharmaceutical targeted agents, endocrine approaches, and chemotherapy.
- Radiation therapy is considered the modality of choice for palliation of symptoms and prevention of recurrence. Stereotactic radiotherapy is preferred over non-informal techniques such as conventional external beam radiotherapy to reduce the amount of radiation delivered to the organs at risk. Differences in tumor radiobiology have been observed with the receipt of high dose single fraction SBRT with IGRT technique. All tumors, irrespective of their radiosensitivity, have been shown to exhibit a similar response to irradiation.
- Re-oxygenation, DNA repair, radiosensitivity, redistribution of the cell cycle, and repopulation have been described as the 5 R's of radiation therapy. A co-dependent dual-target radiation response that becomes evident at a higher radiation threshold of stereotactic irradiation has been described. It leads to a microvascular response that has been shown to interfere metabolically with the ability of the tumor cell to repair radiation-induced damage.
- Biological radiosensitizers are being explored with an aim to reduce cord-associated cumulative toxicity by bringing about a reduction in radiation dose.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Palliative Radiation Therapy For Bone Metastases



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**Question 283:** A 65-year-old male patient presents to the office with fatigue, weight loss, and bone pain. His vitals are stable. His past medical history is significant for diabetes mellitus, prostate carcinoma, hypertension, and stable angina. He is scheduled to undergo a bone scan. On interpreting a bone scan obtained 6 hours post-injection of Tc99m-MDP, a greater than normal amount of soft tissue activity diffusely is noticed. Which of the following is the most likely reason for this?

**Choices:**

1. Heart failure
2. Renal insufficiency
3. Metastatic soft tissue disease
4. Cellulitis

Answer: 2 - Renal insufficiency

## Explanations:

- Skeletal scintigraphy, commonly referred to as a bone scan (BS), is a valuable and versatile nuclear medicine tool. The examination is most commonly performed using the radiotracer Technetium-99m (Tc99m) complexed to a diphosphonate, either methylene diphosphonate (MDP) forming Tc99m-MDP or hydroxydiphosphonate (HDP) forming Tc99m-HDP. An understanding of the normal anatomic distribution of Tc99m-MDP is important for interpreting skeletal scintigraphy.
- Skeletal scintigraphy has a wide variety of indications including detection or follow-up of osseous metastases, detection of radiographically occult injury, evaluating the presence of osteomyelitis, and assessing for prosthetic hardware infection or loosening.
- Renal insufficiency is the most likely cause of this finding. Since the kidneys are not clearing the tracer sufficiently, it remains in the soft tissues. Extraosseous activity is seen in the kidneys and bladder due to the normal renal excretion of T99m-MDP. If the kidneys and bladder are not seen, this should raise suspicion of the so-called “super scan.” A super scan implies diffusely increased osseous uptake due to metastatic disease (most commonly breast or prostate cancer) or metabolic bone disease, which is so intense that little or no renal excretion of the radiotracer occurs.
- Diffuse increased uptake over the abdomen or thorax may be due to malignant ascites or pleural effusion, but that would not explain increased soft tissue uptake over the extremities. While cellulitis can cause focal soft tissue increased uptake, it should not account for diffuse uptake. While heart failure may delay delivery to the bone, extraction from blood is still high, and if the kidneys work well, soft tissue extraction is not significantly diminished. Certainly, by six hours, one shouldn't notice this.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Bone Scan



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**Question 284:** A patient is having a thoracotomy for lung cancer. The primary tumor localized in the right upper lobe is 3 centimeters. Palpation of the rest of the lung reveals two small masses, one in the right middle lobe and one in the right lower lobe. There are no regional nodes or distant metastasis. Which of the following is the correct staging of this patient?

**Choices:**

1. T4, N0, M0
2. T1, N2, M0
3. T1, N1, M1
4. T2, N0, M1

**Answer:** 1 - T4, N0, M0

## Explanations:

- T4 indicates any size of the tumor that invades the mediastinum, heart, great vessels, trachea, recurrent laryngeal nerve, esophagus, vertebral body, carina, or separate tumor nodule(s) in a different ipsilateral lobe.
- N0 indicates no regional node metastasis.
- M0 indicates no distant metastasis.
- T4 lung cancer has a poor prognosis with a 5-year survival rate of less than 5%.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Lung Cancer



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**Question 285:** A 47-year-old woman is being evaluated for a 4-month history of midsternal chest pain, usually with exertion and also worsening dyspnea on exertion for the last 2 months. The patient had a history of malignant breast cancer 13 years ago that was treated with mastectomy and radiation therapy involving the thorax. She has no family history of sudden cardiac death or heart failure. Her only medication is multivitamins. On physical examination, the patient is afebrile, blood pressure is 146/40 mmHg, pulse rate is 90/min, and respiration rate is 12/min. BMI is 26. Carotid upstrokes are rapid and accentuated with a rapid decline. A grade 3/6 high-pitched diastolic decrescendo murmur is heard to the left of the sternum at the third intercostal space. The S2 heart sound is diminished, and the apical point of maximal impulse is displaced inferiorly and laterally. No noticeable jugular venous distension (JVD), and the hepatojugular reflux is absent. EKG shows normal sinus rhythm with no acute ST/T changes with normal QRS interval on conducted beats. Which of the following is the most likely cause of the patient's symptoms?

**Choices:**

1. Restrictive cardiomyopathy
2. Aortic valve regurgitation
3. Constrictive pericarditis
4. Tricuspid regurgitation



**Answer: 2** - Aortic valve regurgitation

## Explanations:

- The symptoms of the patient's chest pain and worsening dyspnea are most likely due to aortic valve regurgitation. Physical examination is consistent with severe aortic valve regurgitation, evidenced by diastolic murmur, Corrigan pulse (rapid, accentuated upstroke with a rapid decline in carotid arteries), widened pulse pressure and displaced point of maximal pulse.
- Radiation-induced aortic valve disease is the most likely cause of aortic regurgitation in this patient. The risk of cardiotoxicity that includes valvular fibrosis and regurgitation increases with higher total radiation dose and involvement of left thorax leading to more exposure of the heart. The clinical significant aortic valve regurgitation may occur in 25% or more in cancer survivors with previous radiation to the thorax. It may occur between 10 to 25 years or more after initial radiation therapy.
- Restrictive cardiomyopathy and constrictive pericarditis may occur from previous radiation therapy but unlikely in this patient. Restrictive cardiomyopathy has signs of right-sided heart failure with elevated JVD and hepatojugular reflex, which are absent in this patient. Constrictive pericarditis usually has significant involvement of the right ventricle, causing right-sided heart failure again with signs of elevated JVD, hepatojugular reflex, and peripheral edema. Constrictive pericarditis is an early complication within weeks or months after initial radiation therapy due to acute pericardium inflammation. Restrictive pericarditis is usually a late complication after years of radiation therapy due to fibrosis of the myocardium.
- Tricuspid regurgitation also may occur from previous radiation therapy as well, however physical examination in this patient does not demonstrate signs of elevated JVD, hepatojugular reflex and large retrograde v waves. Also, a systolic murmur is usually present in severe tricuspid regurgitation not diastolic murmur.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Therapy Induced Cardiac Toxicity



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**Question 286:** A 67-year-old male with 50-year pack history of smoking comes for his initial oncology office visit. He was recently diagnosed with a tumor in one of the minor salivary glands in the oral cavity. The CT scan of the head and neck revealed a 2 cm localized tumor without extension into neighboring structures, and the biopsy of the lesion confirms it to be consistent with the most commonly encountered tumor in the minor salivary glands. The patient inquires regarding his prognosis. Which of the following is the most suitable answer from the clinician?

**Choices:**

1. The tumor usually cannot be removed through surgery because of high vascularity, and the prognosis is generally very poor.
2. The malignancy is generally slow-progressing with the 5-year survival around 75%
3. Systemic chemotherapy is the mainstay of therapy, with the prognosis depending on the response to chemotherapy.
4. This is a benign tumor and does not have a negative impact on life span.

**Answer: 2** - The malignancy is generally slow-progressing with the 5-year survival around 75%

## Explanations:

- The most prevalent malignant minor salivary gland tumor is adenoid cystic carcinoma.
- The highest incidence of malignant salivary gland tumors is found in the submandibular glands.
- Adenoid cystic carcinoma is generally well-differentiated and slow-growing, so even patients with metastatic disease may survive for years with the average 5-year survival around 75%
- Treatment is primarily surgical, but complete resection can be difficult given that it tends to grow along nerves. A delay in diagnosis and treatment is associated with poorer prognosis. Unclear surgical margins after resection of the primary tumor despite postoperative radiation therapy is the single most important risk factor for local recurrence.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Adenoid Cystic Cancer



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**Question 287:** A 39-year-old female patient presents to the clinic for follow up. She recently underwent a left modified radical mastectomy and was incidentally found to have a positive lymph node. She has decided she would like to undergo radiation to the internal mammary nodes (IMNs), given the proven survival benefit. What is the most appropriate response?

**Choices:**

1. After a mastectomy with a positive lymph node the risk of internal mammary node involvement is very high and therefore coverage of the internal mammary nodal chain is always recommended
2. A large trial from Denmark found a benefit in breast-cancer specific-survival. However, results must be interpreted with caution because this trial was not randomized
3. Large trials have consistently demonstrated an improvement in breast cancer-specific mortality with IMN irradiation in patients with a positive axillary node, and therefore it is regarded as a standard of care
4. There have been no updated studies comparing outcomes of comprehensive nodal irradiation with or without IMN coverage

**Answer: 2** - A large trial from Denmark found a benefit in breast-cancer specific-survival. However, results must be interpreted with caution because this trial was not randomized

## Explanations:

- Several studies have demonstrated an extremely low incidence of IMN nodal positivity and clinical IMN recurrence.
- Inclusion of the IMN chain within the radiation field comes at the expense of increased dose to the heart and lungs, resulting in a potentially more significant risk of long term toxicity.
- Several large trials that have evaluated the volume of elective nodal irradiation (ENI) volume to include in patients with centrally/medially located tumors, positive lymph nodes, or in node-negative patients with the high-risk disease after mastectomy. Studies from France and Denmark specifically addressed the benefit of internal mammary node irradiation (IMNI) by comparing outcomes of patients treated with the whole breast, chest wall radiation, supraclavicular and axillary apex with or without IMNI. A Dutch study allocated IMNI only to patients with the right-sided disease and omitted IMNI in left-sided disease in an attempt to spare dose to the heart. They reported a small but significant 2.5% improvement in breast cancer-specific survival for right-sided breast cancer patients allocated to IMN. A major critique of this trial is that it was not randomized (all right-sided patients received radiation therapy (RT) to IMN, whereas all left-sided patients did not).
- In contrast, a French trial randomized patients with positive axillary nodes (pN+) or central/medial tumors after mastectomy to receive radiation to the chest wall, supraclavicular lymph nodes with or without radiation to the internal mammary lymph nodes. There was no significant difference considering 10-year overall survival or disease-free survival between these two cohorts.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Postmastectomy Breast Cancer Radiation Therapy



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**Question 288:** A 72-year-old male presents with a 3-month history of tenesmus, diarrhea, and some mild fecal incontinence, which is associated with blood-stained stools. He had a screening colonoscopy performed two years prior, which only showed mild diverticulosis. He reports that he otherwise feels well, his diet is unchanged, and he has not lost any weight. His past medical history is significant for type 2 diabetes and prostate cancer. He did undergo external beam radiation therapy nine months ago. His rectal examination did not reveal any fissures or hemorrhoids. A flexible sigmoidoscopy is performed in the office, which reveals friable mucosa, edema, oozing, and ulcerations. The findings are suspicious for radiation-induced damage. Random biopsies are performed. What is most likely to be seen on the biopsy findings?

### Choices:

1. Submucosal edema with neutrophilic infiltrate, with associated serosal fibrosis
2. Non-caseating granulomas
3. Basophilic intranuclear inclusion bodies surrounded by a clear halo
4. Crypt abscesses

**Answer: 1** - Submucosal edema with neutrophilic infiltrate, with associated serosal fibrosis

## Explanations:

- The expected histopathological findings for radiation proctitis include edema, mucosal hyperemia, and ulceration of the affected tissue.
- Chronically, there is the intimal proliferation and hyaline thickening of the media of arterioles.
- Hypertrophy of rectal smooth muscle occurs, which can affect affecting compliance and defecation as the rectum's ability to distend is diminished. This is further worsened by fibrosis of the serosa.
- Crypt abscesses are associated with ulcerative colitis. Non-caseating granulomas are associated with Crohn disease, and basophilic intranuclear inclusion bodies surrounded by a clear halo are seen in cytomegalovirus colitis.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Proctitis



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**Question 289:** A 65-year-old woman with a past medical history of coronary artery disease and chronic renal failure on renal replacement therapy was undergoing a routine ultrasound abdomen and was found to have a 4x4 cm fluid-filled swelling in the tail of the pancreas. T2 weighted MRI image showed a hyperintense lesion with a uniform wall. The endoscopic ultrasound (EUS) showed no papillary projections or wall thickening. The aspirated fluid examination revealed a carcinoembryonic antigen (CEA) level of 200 ng/mL. What should be the line of management?

**Choices:**

1. Endoscopic ultrasound (EUS) guided aspiration
2. Surveillance
3. Spleen preserving distal pancreatectomy
4. Distal pancreatico-splenectomy with lymph node dissection



Answer: 2 - Surveillance

## Explanations:

- She has most likely pancreatic mucinous cystadenoma. Surveillance is an acceptable option for mucinous cystadenomas, in the absence of suspicious features such as wall thickening and papillary projections.
- MRI and EUS are complementary in assessing suspicious features of the cyst.
- Surveillance to be done once in 6 months for the first year and then annually with MRI and EUS or either alone.
- Change in patient's symptomatology or cyst characteristics warrant surgical intervention.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Pancreatic Mucinous Cystadenoma



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**Question 290:** A 58-year old male with no medical comorbidities is diagnosed with a 3.5 cm squamous cell carcinoma of the anal canal originating 1 cm from the anal verge. Positron emission tomography-computed tomography (PET/CT) shows no lymph node involvement or distant metastases. What is the recommended treatment?

**Choices:**

1. Abdominoperineal resection alone
2. Radiation alone
3. Definitive chemoradiation
4. Neoadjuvant chemoradiation followed by abdominoperineal resection

**Answer: 3** - Definitive chemoradiation

## Explanations:

- Historically, abdominoperineal resection was standard of care for anal cancers, which results in a permanent colostomy. However, abdominoperineal resection alone yields a poor overall survival rate of 50% and local recurrence rates as high as 30%.
- For tumors of the anal canal that are 2 cm or larger (T2 or higher), the standard of care is definitive chemoradiation, with surgery reserved for salvage.
- Rectal adenocarcinomas are treated with neoadjuvant chemoradiation followed by abdominoperineal resection.
- Radiation alone is an appropriate option for anal canal tumors less than 2 cm with negative nodes (T1N0) in patients who may have medical comorbidities. However, T1N0 tumors also can be managed with definitive chemoradiation.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Therapy For Anal Cancer



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**Question 291:** A 65-year-old woman presents for an evaluation. She is scheduled for a repeat total elbow arthroplasty (TEA) following a tennis injury. She has a history of a total elbow arthroplasty 3 years ago, after which she developed the formation of mature, lamellar bone in the soft tissue surrounding the elbow joint, which was resected and observed. What is the best-recommended treatment following the upcoming total elbow arthroplasty procedure?

**Choices:**

1. Radiation and chemotherapy
2. Radiation therapy with a dose of 50Gy in 5 fractions
3. Radiation therapy with a dose of 20Gy in 10 fractions starting 72 hours postoperatively
4. Radiation therapy with a dose of 7Gy in 1 fraction within 72 hours postoperatively

**Answer: 4** - Radiation therapy with a dose of 7Gy in 1 fraction within 72 hours postoperatively

## Explanations:

- The clinical vignette is most consistent with a prior history of heterotopic ossification, a risk factor for the re-development of heterotopic ossification.
- To minimize the risk of re-development of heterotopic ossification, prophylactic modalities following surgery, such as medical therapy and radiation therapy, are recommended.
- The main medical therapy is NSAIDs; however, multiple trials have shown radiation therapy to be more effective than NSAIDs.
- Radiation therapy is typically given with a dose of 7-8Gy in 1 fraction, either preoperatively within 24 hours or postoperatively within 72 hours.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Therapy For Heterotopic Ossification Prophylaxis



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**Question 292:** A 52-year-old man comes to the outpatient department with the complaint of vague right-sided headache for the past six months. On physical examination, he does not have any neurological deficits. There is a hard swelling of size 5 x 3 cm in the right parietal region. He undergoes a computed tomogram scan, which shows a right temporoparietal hemispheric mass with hyperostosis of the overlying skull, which is eroded by the mass. He undergoes craniotomy and complete excision of the lesion. The pathology report states that the Ki-67 index is 11%. What is the chance of tumor recurrence?

**Choices:**

1. 10%
2. 20%
3. 30%
4. 50%

Answer: 4 - 50%

## Explanations:

- The patient has the diagnosis of right temporoparietal meningioma.
- Meningiomas are known to occur more commonly in elderly individuals. They cause thickening of the bone, in some instances, known as hyperostosis.
- Ki-67/MIB-1 proliferation index is used to assess the prognosis of meningioma.
- The recurrence rates for tumors with Ki-67 index 0.7%, 2.1%, and 11% are 9%, 29%, and 50% respectively.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Meningioma



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**Question 293:** A 60-year-old male presents to the otolaryngology clinic with complaints of reduced taste, sticky tongue, and dental caries. He has had the symptoms for the past several months and has tried multiple medications, but has had little relief. He had a history of squamous cell carcinoma of the oral cavity for which he underwent surgical resection and neck dissection 2 years ago. His surgery was followed by multiple sessions of radiotherapy. He states that his symptoms are particularly bothersome and have affected his quality of life. It was decided to start him on treatment with 100% oxygen administered at 2.4 atm. He was seen after his 20th session and reported good symptom control. Which of the following effects would likely be seen in this patient as a result of the new treatment?

**Choices:**

1. Decreased acini proliferation
2. Increased salivary microbiota
3. Decreased salivary pH
4. Increased salivary flow rate



**Answer: 4** - Increased salivary flow rate

## Explanations:

- This patient has presented with altered taste, oral stickiness, and dental caries likely as a result of decreased salivary secretion. His history of past head and neck radiation makes post-radiation mucositis the likely diagnosis. Radiation causes soft tissue injury and causes the destruction of salivary glands, leading to troublesome xerostomia.
- Hyperbaric therapy can be a useful modality in the treatment of soft tissue radionecrosis and has been shown to demonstrate an improvement in xerostomia. Increased tissue oxygenation reverses the hypoxia-mediated damage to salivary acini caused by radiation-induced obliterative endarteritis.
- Several important effects are observed after hyperbaric therapy is administered. An increase in salivary flow is usually observed due to the proliferation of salivary acini. Increased salivary flow improves taste perception and helps to prevent dental caries.
- Hyperbaric therapy also leads to a reduction of salivary colony density of microbes such as *Streptococcus mutans*, *Lactobacillus*, and *Candida albicans*. This further helps prevent dental caries.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Hyperbaric Soft Tissue Radionecrosis



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**Question 294:** Using the American Joint Committee on Cancer classification for head and neck lymph node location, what is the level of a submental node?

**Choices:**

1. I
2. II
3. III
4. IV

Answer: 1 - I

## Explanations:

- The AJCC lymph node classification system has ten levels.
- Levels II, III, IV, and V are bilaterally symmetric.
- Levels I, VI, and VII are midline.
- Level I is submental and divided into A and B, A being medial to the anterior belly of the digastric muscle, formerly termed "submental lymph nodes" IB, more lateral, were formerly termed "submandibular lymph nodes."

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Anatomy, Head and Neck, Lymph Nodes



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**Question 295:** A 70-year-old otherwise healthy woman presents to the clinic with linear pleomorphic calcifications on screening mammography. An ultrasound-guided core needle biopsy demonstrates ductal carcinoma in situ (DCIS) in the upper outer quadrant. The patient opts for breast-conserving treatment and will undergo partial mastectomy followed with radiation. Which of the following factor is the most reliable indicator for a sentinel lymph node biopsy?

**Choices:**

1. The lesion is located in the upper outer quadrant
2. All patients with DCIS need a sentinel lymph node biopsy regardless of location
3. The patient will need biopsy since she will undergo radiation
4. The patient's age of above 65 years

**Answer: 1** - The lesion is located in the upper outer quadrant

## Explanations:

- Linear pleomorphic microcalcifications are highly suggestive of DCIS.
- DCIS is a noninvasive disease and does not warrant a sentinel lymph node biopsy.
- If there is a focus of invasion, then sentinel lymph node biopsy can be performed at a second procedure.
- Sentinel lymph node biopsy is recommended if lumpectomy is performed in the outer upper quadrant due to the disruption of lymph drainage and the inability to perform sentinel lymph node biopsy at a secondary procedure.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Breast Ductal Carcinoma in Situ



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**Question 296:** A 45-year-old male presented with progressive weakness in his legs. His neurological exam shows a grade 4 out of 5 weakness in his legs and sensory level around his umbilicus. A magnetic resonance imaging scan of the spine shows a centrally located tumor within the dorsal cord from D5-D10 levels and causing cord expansion. It has a defined border with the cord. What is the treatment of this lesion?

**Choices:**

1. Surgical excision
2. Radiotherapy
3. Chemotherapy
4. A biopsy followed by radiotherapy

**Answer: 1** - Surgical excision

## Explanations:

- The patient is having an intramedullary tumor.
- The radiological features are suggestive of ependymoma. Ependymomas often are located centrally within the spinal cord leading to symmetric expansion, occupy the whole width of the cord, and enhance diffusely with a well-defined border.
- Gross total resection is the treatment modality for ependymoma.
- Astrocytomas tend to be positioned more eccentrically, can be non-enhancing or have an enhancing nodule or large satellite cysts, and usually, do not have a well-defined border.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Intramedullary Spinal Cord Tumors



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## Section 9

**Question 297:** A 52-year-old male bus driver presents for assessment prior to a course of hyperbaric oxygen therapy for radiation cystitis. He has had no specific ocular problems in the past. Which of the following, if any, is the most appropriate pre-procedure step to perform before the hyperbaric oxygen therapy in this patient?

### Choices:

1. Ophthalmoscopy
2. Test session of hyperbaric oxygen
3. Visual acuity measurement
4. No specific evaluation



**Answer: 3** - Visual acuity measurement

## Explanations:

- All candidates for hyperbaric oxygen therapy should have a baseline visual acuity done unless they have had bilateral intraocular lens replacements. Because this man is a professional driver, it is even more important to monitor his visual acuity over time and ensure his corrected visual acuity is compatible with continuing to drive.
- A myopic shift is very common in association with a course of hyperbaric oxygen therapy, and all patients should receive a clear explanation of this potential complication, as well as an assessment of visual acuity. Baseline visual acuity assessment will help with early detection of progressive myopic shift- allowing appropriate temporary corrective spectacles to be arranged.
- Assessment of visual acuity at baseline allows the objective measurement of any change during or after treatment. Significant changes that do not resolve after treatment should have formal ocular refraction and referral to an ophthalmologist.
- Myopic shift may develop over a course of treatment but no changes are expected after a single exposure. Age is not a significant factor in the degree of myopic shift.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Hyperbaric Cataracts



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**Question 298:** A 68-year-old man presents to the clinic with one week of hematuria. He denies any dysuria, frequency, abdominal pain, or back pain. He has a history of prostate cancer treated with radiation therapy to the prostate for a total dose of 6500 cGy completed last week. What is the most appropriate time to initiate hyperbaric oxygen therapy for this patient?

**Choices:**

1. Immediately after the completion of radiation therapy
2. 1 to 3 months after radiation therapy
3. 3 to 6 months after radiation therapy
4. More than 6 months after radiation therapy

**Answer: 4** - More than 6 months after radiation therapy

## Explanations:

- Soft tissue radionecrosis refers to the delayed effects of radiation therapy, which result in tissue breakdown from the impaired blood supply radiation-damaged tissue.
- Radiation can damage capillary beds and arterioles, which lead to relative tissue hypoxia resulting in characteristic fibrosis, and these tissue changes can develop over time, remote from the time of the original radiation exposure.
- The soft tissue radionecrosis can develop 6 months to several years after the exposure.
- Prior to 6 months, the diagnosis is acute or subacute radiation injury.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

[Hyperbaric Soft Tissue Radionecrosis](#)



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 299:** A 30-year-old woman presents to the clinic for a follow-up. She was recently found to have a spiculated mass in the upper outer left breast. Her biopsy shows moderately differentiated ductal carcinoma with estrogen receptor (ER) and progesterone receptor (PR) positivity, and negative for HER2/neu. She also reports that she has not had her periods in the last two months, and yesterday her urine pregnancy test came positive. She expresses her desire to continue her pregnancy as the previous two pregnancies were spontaneously aborted. Which of the following is the most appropriate management strategy for this patient?

**Choices:**

1. PET-CT, radical mastectomy, and neo-adjuvant chemotherapy
2. Hypofractionated whole breast radiation therapy and endocrine therapy after the first trimester
3. Mastectomy and axillary staging, adjuvant chemotherapy in the second trimester, and possible adjuvant radiation and endocrine therapy postpartum
4. Recommend aborting the pregnancy for whole-body external beam irradiation and radical mastectomy

**Answer: 3** - Mastectomy and axillary staging, adjuvant chemotherapy in the second trimester, and possible adjuvant radiation and endocrine therapy postpartum

## Explanations:

- The fetus is highly susceptible to ionizing radiations during the first trimester, and if exposed to radiation above 0.5 Gy, it will develop certain malformations.
- The National Comprehensive Cancer Network recommends mastectomy and axillary staging, adjuvant chemotherapy in the second trimester, and possible adjuvant radiation and endocrine therapy postpartum
- Aborting ongoing pregnancy should be the last resort, only after weighing various modalities against the possible outcomes, and should be left to the patient and her partner.
- Chemotherapy has shown no substantial implications on fetal growth parameters, irrespective of fetal age. Hence it should be the first line of therapy while surgical or radiotherapeutic regimens are awaited. It's important to conduct a thorough obstetrical history and exam in patients of reproductive age group as pregnancy can complicate the net outcomes for both mother and fetus, especially when radiotherapy is required.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Effects On The Fetus



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**Question 300:** A 45-year-old woman presents to the clinic with new-onset urinary incontinence and back pain. She has a known history of metastatic stage IV breast cancer. MRI reveals a metastatic spine lesion with compression on the spinal cord. Physical examination reveals 3+ patellar reflexes bilaterally. Palliative radiotherapy is recommended to address her symptoms. Which of the following associated findings predicts the least benefit from this treatment?

**Choices:**

1. >50% vertebral collapse
2. Lytic lesion noted on pathology
3. Subluxation and listhesis noted at the level of the metastasis
4. Location in the semi-rigid spine (T3-T10)

**Answer: 4** - Location in the semi-rigid spine (T3-T10)

### Explanations:

- The SINS scoring system is used by spine surgeons to assess the need for surgical stabilization of metastasis to the spine, even when palliative treatment is indicated. The greater the total score across 6 categories, the more likely the patient requires surgical stabilization. The location of the lesion in the semi-rigid spine only, such as T3-T10, adds a score of 1 to the total SINS score, whereas all other criteria listed above yield a score of at least 2.
- Metastatic lesions to the vertebrae can lead to spinal cord compression, resulting in loss of bowel and bladder function, weakness, numbness/sensory deficits, and hyperreflexia.
- Patients with metastatic lesions to the spine should be evaluated using the SINS scoring system to determine the stability of the spine, and whether surgical intervention is necessary, even when undergoing palliative radiation therapy.
- A SINS score >7 total warrants a surgical consultation for metastatic spine lesions that likely cause instability.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Palliation Radiation Therapy Of The Spinal Cord



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**Question 301:** A 55-year-old man with a past medical history of type 2 diabetes mellitus, tobacco use disorder, and hypertension presents for followup. His malignant melanoma has previously been unresponsive to chemotherapy. The provider would like to start a new medication that is indicated for unresectable malignant melanoma as a solo agent. What is the mechanism of action of the most likely drug?

**Choices:**

1. mTOR inhibitor
2. Calcineurin inhibitor
3. Anti-CTLA-4 antibody
4. PD-1 antibody



**Answer: 3** - Anti-CTLA-4 antibody

### Explanations:

- When CTLA-4 is bound to B7, it prevents T cells from activating and killing other cells, such as cancer cells. Ipilimumab works by blocking CTLA-4 and therefore activating T cells to mount a response against the tumor cells.
- CTLA-4 and CD28 bind to B7 on antigen-presenting cells. CTLA-4 provides an inhibitory signal to T cells, and CD28 provides a stimulatory signal. CTLA-4 binds to B7 with greater affinity than CD28, so blocking of CTLA-4 by Ipilimumab allows T cell activation through binding of CD28 and B7.
- Ipilimumab is indicated for malignant melanoma (unresectable or metastatic) and can be used with or without other chemotherapeutic agents.
- The combination of ipilimumab and nivolumab is FDA approved for usage in certain renal cell carcinomas, colon cancers, and hepatocellular carcinomas.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Ipilimumab



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**Question 302:** A 35-year-old female patient presents to the emergency room after a fall from a ladder and is found with a right hip fracture. Before surgical stabilization, the provider counsels her on expected outcomes after radiation therapy for heterotopic ossification prophylaxis. Which of the following is the most common outcome after radiation in this setting?

**Choices:**

1. No toxicity
2. Poor wound healing
3. Arthritis
4. Secondary malignancy

Answer: 1 - No toxicity

## Explanations:

- Radiation therapy for heterotopic ossification prophylaxis is most often tolerated without toxicity, given the low doses and limited fields used in this setting.
- Radiation therapy for heterotopic ossification prophylaxis performed 24 hours before or 72 hours after, and surgical intervention typically does not result in poor wound healing.
- Late effects from prophylactic radiation for heterotopic ossification are uncommon.
- A secondary malignancy is theoretically possible after radiation for heterotopic ossification prophylaxis, but in actuality, it is exceedingly rare, according to published long-term data.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Therapy For Heterotopic Ossification Prophylaxis



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**Question 303:** Which of the following patients with papillary thyroid carcinoma has the best prognosis?

**Choices:**

1. A 65-year-old female, with a well-differentiated tumor, with invasion outside of the capsule
2. A 30-year-old male, with a well-differentiated tumor and lymph nodal metastasis found in the central compartment
3. A 48-year old male, with a poorly differentiated 2 cm tumor
4. A 40-year-old female, with a well-differentiated 2 cm tumor and distant metastasis found in the lung

**Answer: 2** - A 30-year-old male, with a well-differentiated tumor and lymph nodal metastasis found in the central compartment

## Explanations:

- Papillary thyroid carcinoma (PTC) is unique among other malignancies in that age is a significant predictor of future prognosis.
- For males younger than 45 years old, patients cannot score a cancer stage further than stage 2. A PTC with lymph node metastasis is a stage 1 PTC. Some authorities use a cut-off of 55 years.
- Further staging of PTC for young patients is contingent on metastasis. Nodal metastasis does not appear to have a significant impact on prognosis, whereas distant metastasis in other organs does affect staging.
- The degree of differentiation, size of tumors, and presence of invasions are all important prognostic factors for PTC.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Papillary Thyroid Carcinoma



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**Question 304:** A 68-year-old man presents to the clinic with hematuria for the past 3 days. He states at times he has to strain to urinate but is still passing urine. He reports that he has a history of prostate cancer and just completed a total of 7000 cGy of radiation treatment last week. What is the most appropriate time to initiate hyperbaric oxygen therapy in such circumstances?

**Choices:**

1. During radiation treatment after 3000 cGy has been completed
2. Immediately after the completion of radiation treatments
3. 2 months after radiation treatment
4. 6 months or more after radiation treatment

**Answer:** 4 - 6 months or more after radiation treatment

## Explanations:

- Delayed injuries occur more than 6 months to years after completion of radiation treatment. Prior to 6 months, the patient has acute, or subacute radiation injury and hyperbaric oxygen therapy would not be indicated.
- Delayed radiation injury is at increased risk of developing after 6500 centigray (cGy). Hyperbaric oxygen therapy can stimulate stem progenitor cells and VEGF to increase blood flow to irradiated and damaged tissue.
- Approximately one-third of patients in the United States who receive hyperbaric oxygen therapy are being treated for late effects of radiation therapy (LERT). Hyperbaric oxygen therapy is not used for acute effects of radiation.
- Hyperbaric oxygen therapy is not used in the acute setting for symptomatic patients.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Hyperbaric Treatment Of Delayed Radiation Injury



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**Question 305:** A 55-year-old female presents to the clinic with an 18-month history of left knee pain, causing a limp. Physical examination reveals a tender mass at the proximal tibia, with the patient walking with an antalgic gait. X-ray and CT of the left knee show a lesion in the proximal tibia with endosteal scalloping. Bone biopsy is performed, showing an intermediate-grade lesion with a predominantly cartilaginous matrix. What is the most appropriate treatment for this type of lesion?

**Choices:**

1. Primarily surgery, with tumors typically chemotherapy and radiotherapy resistant
2. Primarily radiotherapy
3. Primarily chemotherapy
4. A combination of surgery, chemotherapy, and radiotherapy are used in all cases



**Answer: 1** - Primarily surgery, with tumors typically chemotherapy and radiotherapy resistant

## Explanations:

- All intermediate or high-grade chondrosarcomas should be surgically excised with wide margins.
- Low-grade chondrosarcomas located in the long bones of the extremity can be managed with complete curettage, with a high chance of success.
- Chondrosarcomas are typically chemotherapy and radiotherapy resistant. The exception to this is mesenchymal chondrosarcomas, which are both chemo and radiosensitive.
- Osteosarcomas are managed primarily with surgical resection and chemotherapy. Ewing sarcomas are radiosensitive, with radiotherapy often used as part of the definitive treatment plan with surgery and chemotherapy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Primary Bone Cancer



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 306:** A 60-year-old female undergoes a hysterectomy, salpingo-oophorectomy, pelvic and aortic lymph node dissection and omentectomy for a malignant uterine neoplasm. The pathology report demonstrates a primary uterine carcinosarcoma (formerly known as a malignant mixed mesodermal tumor). Metastatic disease is noted in several lymph nodes and the omentum. Given the high-grade, metastatic, endometrial carcinoma, she underwent postsurgical adjuvant therapy with external-beam radiation to the entire pelvis. Which of the pelvic tissue is the most radiosensitive?

**Choices:**

1. Ovarian tissue
2. Vaginal tissue
3. Rectal tissue
4. Bladder tissue

Answer: 1 - Ovarian tissue

## Explanations:

- Of the pelvic tissues listed, ovarian tissue is the most radiosensitive at 2500 rads.
- The other structures can tolerate 5,000 to 20,000 rads.
- In patients who are so treated, moderate to severe intestinal complications are common and last for more than three months.
- Patients should be counseled that radiation therapy will likely result in prompt cessation of ovarian function. Premenopausal women should be made aware of the likelihood of menopausal symptoms during and after treatment.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Endometrial Cancer



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 307:** A 65-year-old male presents to a clinic with complaints of nocturia, urgency, and hesitancy for the past two months. He denies any history of hematuria, suprapubic pain, or dysuria. On a digital rectal examination, there is a small palpable nodule in the area corresponding to the prostate. Suprapubic ultrasound shows a prostate volume of 45 ml. Magnetic resonance imaging reveals a PIRADS 3 lesion. A biopsy of the lesion demonstrates predominantly poorly-formed, fused, or cribriform glands with a lesser component of well-formed glands. What is the Gleason grade group of the lesion?

**Choices:**

1. Grade group 2 (Gleason score  $3 + 4 = 7$ )
2. Grade group 3 (Gleason score  $4 + 3 = 7$ )
3. Grade group 4 (Gleason score 8)
4. Grade group 5 (Gleason scores 9 or 10)

**Answer: 2** - Grade group 3 (Gleason score  $4 + 3 = 7$ )

## Explanations:

- Grade group 3 (Gleason score  $4 + 3 = 7$ ) lesion shows predominantly poorly-formed, fused, or cribriform glands with a lesser component of well-formed glands.
- In clinical practice, group 1 is considered "low grade," Group 2 is "intermediate grade," and group 3 or higher is "high grade" disease.
- The newer classification system introduced by the world health organization (WHO) is based on clinical experience with the old Gleason scoring system. It suggests very little difference in clinical outcomes in lower Gleason score patients, but somewhat different ones in the higher grades.
- Grade group 2 (Gleason score  $3 + 4 = 7$ ) shows predominantly well-formed glands with a lesser component of poorly-formed, fused, or cribriform glands. Grade group 4 (Gleason score 8) indicates only poorly-formed/fused/cribriform glands, or predominantly well-formed glands with a lesser component lacking glands, or predominantly lacking glands with a lesser component of well-formed glands. Grade group 5 (Gleason scores 9 or 10) lesion lacks gland formation (or with necrosis) with or without poorly-formed, fused, or cribriform glands.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Prostate Cancer



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**Question 308:** A 7-year-old girl started with headaches and ataxia two weeks ago. Two days ago started with nausea and vomiting and was taken to the emergency department for evaluation. During workup was found with a large well-demarcated midline cerebellar mass with moderated hydrocephalus. Endoscopic third ventriculostomy was done this morning, and biopsy obtained. The patient was sent to the intensive care unit for close monitoring. Pathology showed an embryonal tumor with multilayered rosettes, C19MC-altered. What treatment should this patient receive after the biopsy result?

**Choices:**

1. Radiation to the brain and spine
2. Surgery and chemotherapy
3. Surgery with radiation and chemotherapy
4. Chemotherapy

**Answer: 3** - Surgery with radiation and chemotherapy

## Explanations:

- The current most effective therapy for an embryonal tumor is triple therapy, which is surgical resection plus radiation and chemotherapy.
- Gross total resection is always attempted as it provides better outcomes.
- Radiotherapy is given in the 50-60 Gy range. Chemotherapy varies with each protocol, but a combination of vincristine, cisplatin, cyclophosphamide, etoposide is common. Bevacizumab can be used to block vascular endothelial growth factor. Intrathecal methotrexate and topotecan can also be included.
- Craniospinal radiation is usually given due to the high incidence of distant metastases and leptomeningeal and spinal seeding.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Primitive Neuroectodermal Tumor



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 309:** A 20-year-old woman presents with complaints of constipation, fatigue, generalized malaise, and menstrual irregularities for the past 5 months. The patient also reports weight gain. She has a past medical history of a childhood brain tumor, which was treated with radiotherapy followed by surgical excision. On examination, delayed deep tendon reflexes are observed. What is the best next step in the management of this patient?

**Choices:**

1. CT scan of the brain
2. Thyroid function tests
3. Serum electrolytes
4. Renal function tests



**Answer: 2** - Thyroid function tests

### Explanations:

- This patient's symptoms are suggestive of hypothyroidism. Thyroid function tests should be performed in this client, as radiation to the brain can disrupt the hypothalamic-pituitary axis.
- Secondary or central hypothyroidism is labeled when the thyroid gland itself is normal, and the pathology is related to the pituitary gland or hypothalamus.
- Serum TSH level is used to screen for primary hypothyroidism in most patients.
- Central hypothyroidism is of pituitary or hypothalamic origin. TSH produced can be biologically inactive and can affect the levels of bioactive TSH, hence the diagnosis of central hypothyroidism should be based on free T4 rather than TSH.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

#### Adverse Effects Of Radiation Therapy



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**Question 310:** A 67-year-old male patient presents with bilateral tinnitus for over a year. He also has bilateral hearing loss. He is diabetic and hypertensive and lives alone. Examination of the ear reveals a right middle ear red mass that blanches with a positive pressure during pneumatic otoscopy. On the left retro auricular area, a noticeable bruit can be heard. Magnetic resonance imaging of the brain reveals bilateral tumors, the right measures 2.7 cm and the left 1.3 cm at the jugular foramen. Both have marked enhancement, and have the classic salt and pepper appearance. What is the best treatment for this patient?

**Choices:**

1. Observation
2. Bilateral surgical resection
3. Radiation alone
4. Embolization

**Answer: 3** - Radiation alone

## Explanations:

- Radiation alone can be utilized in the setting of bilateral glomus jugulare tumors and can represent an adjunct to limited surgical approaches with associated subtotal resection.
- Radiation modalities include standard fractionated radiotherapy and stereotactic radiosurgery. Standard fractionated radiotherapy requires multiple sessions while radiosurgery can be given in a single session providing focused radiation and, at the same time, sparing the vulnerable surrounding tympanic bone.
- The middle ear examination will reveal a red mass that blanches with a positive pressure during pneumatic otoscopy.
- Observation provides an excellent treatment alternative, as 65% of tumors remained stable or even regressed in size. Approximately 40% of tumors demonstrated growth at an average of 0.9 mm per year.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Glomus Jugulare



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**Question 311:** His parents bring a 5-year-old child to the emergency room with a 3-day history of painless bleeding from the rectum. Upon further inquiry, the parents explain that the child is otherwise healthy. Physical examination of the child reveals no significant abnormality. Ultrasonography is done, which demonstrates omphalomesenteric duct remnants. technetium-99m (99mTc) pertechnetate scan is in the plan. Which of the following is most likely to be the most appropriate dose in this patient?

**Choices:**

1. 10 mCi 99mTc-pertechnetate
2. 300 mCi 99mTc-sulfur colloid mixed in the juice of patient's choice
3. 20 mCi 99mTc-labeled RBCs
4. 100 mCi I-123 Meckle scan

Answer: 1 - 10 mCi <sup>99m</sup>Tc-pertechnetate

## Explanations:

- The patient most likely has a Meckel diverticulum. Meckel diverticulum is caused by the incomplete obliteration of the omphalomesenteric duct in the developing embryo. It is the most common congenital anomaly of the gastrointestinal (GI) tract.
- Meckel diverticulum is caused by the incomplete obliteration of the omphalomesenteric duct, which connects the yolk sac to the gut in the developing embryo. It provides nutrition until the placenta forms. At about seven weeks of gestation, the duct separates from the intestine. If the duct fails to partially or entirely separate and involute, it can result in an omphalomesenteric cyst, omphalomesenteric fistula that drains through the umbilicus, or a fibrous band from the diverticulum to the umbilicus, which can cause an obstruction. If there is no additional attachment, it forms into a Meckel diverticulum.
- The most sensitive test is a Meckel radionuclide scan (commonly known as Meckel scan). It is a nuclear study done by injecting technetium-99m, which is absorbed by the ectopic gastric mucosa allowing for visualization of the Meckel diverticulum. The uptake of the dye can be enhanced using cimetidine or glucagon.
- If the patient has reached adulthood without a GI bleed, the Meckel diverticulum, even if present, probably doesn't have ectopic gastric mucosa, so the NM study will be a false negative. The large majority of Meckel diverticula are not bleeding at the time of the study, so RBC labeling is inappropriate. An argument could be made that adults should not be studied with RN Meckel scans because if there is ectopic gastric mucosa present, the lesion will likely bleed and present at some point in childhood.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Meckel Diverticulum



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**Question 312:** A 65-year-old man presents with complaints of dyspnea, dry cough, and fatigue. The patient has a past medical history significant for a mediastinal tumor, for which he underwent radiation therapy 4 weeks ago. A chest x-ray today shows multiple infiltrates in the lung field surrounding the tumor. The patient has most likely developed which of the following?

**Choices:**

1. Idiopathic pulmonary fibrosis
2. Radiation pneumonitis
3. Radiation fibrosis
4. Lower respiratory tract infection

**Answer: 2** - Radiation pneumonitis

## Explanations:

- This patient has developed radiation pneumonitis.
- Early phase clinical effects of lung irradiation include congestion, cough, dyspnea, fever, and chest pain caused by radiation pneumonitis.
- Radiographic studies reveal infiltrates within the irradiated field.
- The natural course of pneumonitis is a gradual resolution of the acute phase followed by a chronic phase causing inflammation and fibrosis, which develops over months to years.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Adverse Effects Of Radiation Therapy



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**Question 313:** A 76-year-old woman presents to the clinic with new-onset urinary incontinence and back pain. She has a known history of metastatic stage IV breast cancer. MRI reveals a blastic lesion in the T10 vertebral body with compression on the spinal cord. Physical examination reveals 3+ patellar reflexes bilaterally. Palliative radiotherapy is recommended to address her symptoms. Which of the following pretreatment interventions is most likely to help avoid damage to the spinal cord with this treatment?

**Choices:**

1. Careful calculation of precise Gantry angles
2. Administration of contrast prior to the procedure
3. CT scan to evaluate all bony pathology
4. Surgical placement of spacer between the vertebral body and the spinal cord



**Answer: 1** - Careful calculation of precise Gantry angles

## Explanations:

- A careful plan should be made to apply radiation at precise Gantry angles to minimize radiation exposure to adjacent healthy tissues. This plan should be made by a radiation oncologist and confirmed with a medical physicist prior to the administration of radiation therapy to avoid exposure to surrounding organs at risk, such as the spinal cord.
- Metastatic lesions to the vertebrae can lead to spinal cord compression, resulting in loss of bowel and bladder function, weakness, numbness/sensory deficits, and hyperreflexia.
- Palliative radiotherapy of the spine is a useful treatment in the case of back pain and spinal cord compression in patients with metastatic lesions in the vertebrae.
- In patients with incurable metastasis, radiation therapy should not be delayed, especially in the case of spinal cord compression.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Palliation Radiation Therapy Of The Spinal Cord



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**Question 314:** A previously healthy 34-year-old male patient presented with left lower extremity swelling, which had been progressively worsening over the past two weeks. Computed tomography scan revealed a 6 x 4 cm soft-tissue mass in the sacrum. Magnetic resonance imaging demonstrated a well-delineated lobulated mass arising from the sacrum and extending anteriorly into the presacral space, posteriorly into the subcutaneous tissues, and superiorly into the spinal canal to the L5-S1 level. The mass was isointense relative to the spinal cord on the T1-weighted images and hyperintense on the T2-weighted images. The contrast-enhanced magnetic resonance images demonstrated enhancing soft tissue-intensity material in the mildly dilated distal inferior vena cava, left common iliac vein, and distal left common iliac vein, findings that were compatible with thrombus. The patient underwent an open biopsy of the sacral mass, which revealed a myxopapillary ependymoma (grade I). What is the optimal treatment strategy for this patient?

### Choices:

1. En bloc resection of the sacrum
2. Sacral resection followed by adjuvant chemotherapy
3. Neoadjuvant chemotherapy followed by sacral resection
4. Radiotherapy

**Answer: 1** - En bloc resection of the sacrum

## Explanations:

- Gross total resection is the optimal treatment for intradural and extradural lumbosacral myxopapillary ependymomas. If possible, en bloc resection rather than piecemeal resection is highly recommended.
- Gross total removal of myxopapillary ependymoma is associated with a better survival rate than subtotal resection.
- In the case of subtotal resection of myxopapillary ependymoma, the risk of recurrence is increased. Thus postoperative radiotherapy can be a treatment option in such a case.
- The efficacy of chemotherapy has not been established in myxopapillary ependymomas.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Myxopapillary Ependymoma



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**Question 315:** A 65-year-old man presents with a pathological lesion of the T11 vertebral body associated with some collapse. Following further investigation, he is diagnosed with metastatic follicular carcinoma of the thyroid. Based on the recommendations of the multidisciplinary tumor board in discussion with the patient, the decision is made to go ahead with surgical treatment of the primary lesion with total thyroidectomy. Non-surgical intervention for the metastatic vertebral lesion is elected with spine stereotactic radiosurgery (SSRS). Which of the following complications is associated more significantly with SSRS when compared with conventional external beam radiation therapy (cEBRT)?

**Choices:**

1. Spinal cord injury
2. Greater toxicity of organs at risk (OAR)
3. Compression fractures
4. Diarrhea

**Answer: 3** - Compression fractures

## Explanations:

- One of the major concerns following the use of high dose radiation delivery to the involved vertebra during SSRS is the occurrence of vertebral compression fractures.
- It has been reported that the risk of vertebral compression fractures following SSRS can be as high as 40%, as compared with less than 5% risk with cEBRT.
- Prophylactic vertebroplasty or kyphoplasty has been recommended in select patients at high risk for vertebral compression fractures before undergoing SSRS. Risk factors include older patients, patients with lytic lesions, vertebral malalignment, or preexisting vertebral compression fractures.
- There is no enhanced risk for the spinal cord injury (OAR) following an appropriately-planned SSRS.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Spinal Metastasis



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**Question 316:** A 65-year-old male presents to the clinic with fatigue. He reports that he felt normal until three months ago, when he started experiencing frequent fatigue. He has never had similar complaints before now. He has a 25-pack-year smoking history but has never consumed alcohol in his life. His health checkup two years ago revealed no diabetes or hypertension. He had an episode of an extremely painful rash until one week ago over his right thigh that resolved spontaneously. There has been considerable weight loss in the last three months. Examination reveals pallor on palpebral examination. Laboratory investigations reveal an ESR of 70 mm, a hemoglobin level of 10 g/dL, blood smear shows a normocytic normochromic picture, total bilirubin 1 mg/dL, and glucose levels of 210 mg/dL. His CA19-9 is also elevated. CT confirms the diagnosis, but there is no local extension or lymphadenopathy. A nerve block is planned for this patient to relieve his pain. What is a common complication of this nerve block?

**Choices:**

1. Orthostatic hypotension
2. Hypertension
3. Constipation
4. Stroke

**Answer: 1** - Orthostatic hypotension

## Explanations:

- This patient with fatigue, history of smoking, new-onset diabetes, raised ESR, migratory thrombophlebitis, and anemia is most likely a case of pancreatic adenocarcinoma of the tail. CA19-9 is a marker for pancreatic cancer, which is also elevated in this patient.
- Celiac plexus block is used in patients with pancreatic cancer to relieve their pain.
- Orthostatic hypotension is a common complication of the celiac plexus block. Constipation is not a complication of celiac plexus block; rather, the patients complain of diarrhea.
- Infection is a complication of the celiac plexus block; however, performing under sterile conditions minimizes this risk. Vascular injury of the aorta is a possible complication, but the use of CT guidance minimizes the risk of this complication.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Celiac Plexus Block



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**Question 317:** Following colonoscopy for hematochezia, a patient has an appointment with a surgical oncologist for further evaluation and recommendation regarding a 4 cm mid-rectal tumor 8 cm from the anal verge. CT imaging provided with him demonstrates liver metastases that appear resectable with no associated lymphadenopathy. However, the rectal tumor is invading into the surrounding tissue. With regards to pre-operative planning, what distinguishes this patient's cancer compared to a primary colon tumor?

**Choices:**

1. He will require a greater duration of pre-operative chemotherapy
2. He is more likely to have tumor burden necessitating radiotherapy
3. His morbidity and mortality is such that surgery is not a possibility as a result of his clinical stage, and he should undergo chemotherapy only
4. He can undergo total mesorectal excision with concomitant localized hepatectomy without need for neo-adjuvant chemotherapy



**Answer: 2** - He is more likely to have tumor burden necessitating radiotherapy

### Explanations:

- Preoperative radiotherapy, along with chemotherapy, is recommended for mid to low rectal tumors with associated hepatic metastases.
- A palliative diverting ostomy may be required for rectal cancers deemed unresectable.
- Tumor location within the rectum will dictate the surgical approach.
- Rectal cancer management is different than colon cancer.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Liver Metastasis



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**Question 318:** A 67-year-old man attends the otolaryngology outpatient clinic with a 4-month history of progressive hoarseness, throat pain, and left otalgia. He is a lifelong smoker and admits to drinking an excessive quantity of alcohol. Laryngoscopy and CT scan of neck and thorax reveal a large right-sided glottic tumor with immobile vocal cords and invasion of the paraglottic space. There is a 4cm right-sided lymphadenopathy corresponding to the middle jugular group without evidence of distant metastasis. What is the most appropriate management plan for this patient?

**Choices:**

1. Single modality radiotherapy
2. Partial laryngectomy
3. Total laryngectomy
4. Chemoradiotherapy

Answer: 4 - Chemoradiotherapy

## Explanations:

- Organ preservation chemoradiotherapy is the mainstay of the management of moderately advanced glottic cancers.
- The veterans' affairs study (1990) first noted equivalent oncological outcomes in patients with moderately advanced T3 laryngeal cancers treated with induction chemotherapy and radiotherapy compared to laryngectomy and radiotherapy.
- The radiation therapy oncology group (RTOG 91-11) further established that concurrent chemotherapy and radiotherapy had improved survival outcomes compared to induction chemotherapy and radiotherapy or single modality radiotherapy.
- Chemotherapy is associated with a higher rate of complications in patients over the age of 70 and therefore should be avoided in this group.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Glottic Cancer



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**Question 319:** A 55-year-old lady with chronic inactive hepatitis B on no daily medications was diagnosed with stage II gastric marginal zone lymphoma. The endoscopic biopsies were negative for *Helicobacter pylori* (*H. pylori*). Her stool was negative for *H. pylori* stool antigen. What is the best initial therapy option for the patient?

**Choices:**

1. Radiation therapy
2. Quadruple therapy for *Helicobacter pylori*
3. Combination of rituximab and chemotherapy
4. Surgical resection

**Answer: 1** - Radiation therapy

## Explanations:

- Stage I and II disease are considered limited-stage diseases and often do not require surgery unless there is evidence of obstruction or perforation.
- H. pylori therapy would likely not lead to disease resolution given two negative tests.
- Radiation therapy is the best initial treatment option given high response rates of stage I and II extra-nodal marginal zone lymphoma.
- Rituximab has good response rates (not as high as radiation therapy) but can lead to a reactivation of Hepatitis B.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Gastric Lymphoma



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**Question 320:** A 16-year-old boy presents with complaints of oral ulcers and dysphagia. The patient is undergoing radiotherapy for the last 2 weeks for a brain tumor. The patient states he can only eat a liquid diet. On examination, there is the presence of a white fibrinous pseudomembrane covering the ulcers. According to the World Health Organization Oral Toxicity Scale, this patient's condition can be classified as which of the following?

**Choices:**

1. Grade 1
2. Grade 2
3. Grade 3
4. Grade 4

Answer: 3 - Grade 3

## Explanations:

- Oral mucositis is a severely debilitating condition. It can occur due to radiation therapy to the head and neck, chemotherapeutic agents, high-dose chemotherapy agents, hematopoietic stem cell transplantation. It presents as erythema, edema, and ulcerations within the oral mucosa, and pain with subsequent restriction in oral intake.
- The World Health Organization Oral Toxicity Scale combines both subjective and objective measures of oral mucositis. This patient has grade 3 oral mucositis according to this scale.
- Grade 3 oral mucositis is when a patient has oral ulcers and only tolerates a liquid diet for consumption.
- Evaluating for oral mucositis is dependent upon clinical history and physical exam findings. Laboratory and radiography are not as helpful.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Oral Mucositis



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**Question 321:** A 55-year-old man is admitted to the emergency department with weakness, confusion, ataxia, sensory loss, and nystagmus. BP:85/55mmHg, PR: 120/min, RR:24/min, and temperature: normal. His past medical history is significant for lung cancer. What is the next best management?

**Choices:**

1. Electrocardiography
2. Check calcium
3. Check erythrocyte sedimentation rate
4. Check sodium



Answer: 4 - Check sodium

## Explanations:

- Precise incidence and prevalence of the paraneoplastic syndrome are unknown because of the rarity of disease; however, it can occur with any malignancy. A review of the literature suggests that paraneoplastic syndrome occurs in up to 8% of cancer patients. Neurological manifestation in the form of neuropathies is common. Males and females are affected equally.
- Lung cancers are the most common causes of paraneoplastic syndrome. Cushing syndrome: manifested as muscle weakness, weight gain, peripheral edema, centripetal fat distribution, and high blood pressure. Blood workup significant for hypokalemia elevated cortisol level and elevated ectopic adrenocorticotrophic hormone (ACTH) due to tumor cells.
- Syndrome of inappropriate antidiuretic hormone secretion (SIADH): SIADH is more frequently seen in SCLC patients due to ectopic anti-diuretic hormone (ADH) by tumor cells. Clinical manifestations vary from mild symptoms such as nausea, anorexia, fatigue, and lethargy to severe symptoms like confusion, seizures, respiratory depression, and coma. Laboratory findings are positive for hyponatremia, hyperosmolality and increased urine osmolality.
- Hypercalcemia: It is frequently associated with lung cancer, multiple myeloma, and renal cell carcinoma. Hypercalcemia is mediated by different mechanisms such as the ectopic production of the parathyroid hormone-related peptide (PTHrP) by tumor cells, local osteolytic hypercalcemia and increased excess extrarenal vitamin D. Patients manifest as generalized weakness, lethargy, nausea, vomiting, altered mental status, bradycardia, acute renal failure, hypertonia, and hypertension.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Paraneoplastic Syndromes



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**Question 322:** A 24-year-old man reports to the clinic with a complaint of vague pain in the thigh for the past two years. His father has died of leukemia, and his brother has adrenal carcinoma. His 31-years-old sister has been diagnosed to have breast carcinoma. The patient is investigated and found to have a bone tumor related to a genetic syndrome. Which of the following tumors is most likely in this patient?

**Choices:**

1. Osteosarcoma
2. Chondrosarcoma
3. Giant cell tumor
4. Ewing sarcoma

Answer: 1 - Osteosarcoma

## Explanations:

- The patient is having a familial cancer syndrome, probably Li-Fraumeni syndrome.
- It is also known as the sarcoma, breast, leukemia, and adrenal gland (SBLA) cancer syndrome.
- P53-related cancers usually include soft tissue sarcoma, osteosarcoma (bone cancer), leukemia, brain tumors, adrenocortical carcinoma (cancer of the adrenal glands), and other cancers.
- Li-Fraumeni syndrome (LFS) is an inherited autosomal dominant disorder that is usually associated with abnormalities in the tumor suppressor protein P53 gene (TP53) located on chromosome 17p13.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Li-Fraumeni Syndrome



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 323:** A 9-year-old girl started with headaches and mild ataxia, followed by nausea and vomiting last year. The parents took her to the emergency department for evaluation. During workup, a large well-demarcated paraventricular supratentorial mass with moderate hydrocephalus was found. She was operated and had an uncomplicated course and did not require a ventricular shunt. Pathology showed an embryonal tumor with multilayered rosettes, C19MC-altered. She received postoperative chemotherapy and cranial radiotherapy. Brain magnetic resonance imaging showed no evidence of disease at one-year post-treatment. Approximately three months ago, she started with urinary incontinence. What is the next step in management?

**Choices:**

1. New brain magnetic resonance imaging
2. Urology consult for urodynamic studies
3. Complete spine magnetic resonance imaging
4. Reevaluate chemotherapy regimen for side effects affecting the bladder

**Answer: 3** - Complete spine magnetic resonance imaging

## Explanations:

- Urinary incontinence probably reflects metastasis to the spine at the conus region or the distal roots. Approximately 32% of supratentorial embryonal tumors have metastases to the spine.
- Spine magnetic resonance imaging is usually required for the detection of seeding and prognosis.
- Craniospinal radiation is usually given due to the high incidence of distant metastases and leptomeningeal and spinal seeding.
- Leptomeningeal dissemination and possible extraneural metastasis correlate with the worst prognosis.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Primitive Neuroectodermal Tumor



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 324:** A 56-year-old patient who previously presented to the emergency department with abdominal pain, nausea, vomiting, indigestion, weakness, anorexia, loss of appetite, and weight loss. Physical examination demonstrates jaundice, right upper quadrant pain, and Courvoisier sign. A blood test is done which shows elevated levels of carbohydrate antigen 19-9. After the first cycle of gemcitabine plus cisplatin protocol, there is worsening acute on chronic unbearable abdominal pain despite oral oxycodone. The patient is admitted for pain control. What next step should be recommended for this patient's treatment?

**Choices:**

1. Switch chemotherapy as obviously this is considered a progression of the disease
2. Refer to radiation oncology for palliative external beam radiation therapy with a radiosensitizer
3. Add a third chemotherapy drug
4. Discharge home with an increased dose of oxycodone

**Answer: 2** - Refer to radiation oncology for palliative external beam radiation therapy with a radiosensitizer

## Explanations:

- The patient has the best evidence standard of care gemcitabine plus cisplatin by the ABC-02 study, and tumor response was assessed by RECIST criteria with imaging at 12 weeks.
- External beam radiation therapy (EBRT) with a sensitizer (5-FU) is an appropriate palliative intervention but rarely will achieve tumor control.
- PEGF regimen has similar median overall survival of 12.1 months to EBRT but with significantly more toxicities.
- Pain management by opioid should be achieved but will not affect his pain source. A celiac blockade is offered for those who can not achieve pain control with opioids and have failed palliative radiation therapy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Gallbladder Cancer



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 325:** A 65-year-old male presents with shortness of breath, weight loss, and dry cough. A chest x-ray shows an enlarged cardiac silhouette. CT of the chest was then obtained, which shows mediastinal lymphadenopathy. CT guided biopsy is performed, and the pathology reports come back positive for CD20+, Burkitt mature B cell lymphoma. What is the appropriate regimen and dosage of the monoclonal antibody?

**Choices:**

1. Rituximab 750 mg/m<sup>2</sup> with dose-adjusted etoposide, prednisolone, vincristine, cyclophosphamide, doxorubicin
2. Rituximab 1000 mg/m<sup>2</sup> on days 1 and 15
3. Rituximab 375 mg/m<sup>2</sup> once weekly for 4 doses
4. Rituximab 375 mg/m<sup>2</sup> with dose-adjusted etoposide, prednisolone, vincristine, cyclophosphamide, doxorubicin



**Answer: 4** - Rituximab 375 mg/m<sup>2</sup> with dose-adjusted etoposide, prednisolone, vincristine, cyclophosphamide, doxorubicin

## Explanations:

- Rituximab is a monoclonal antibody directed against the CD20 antigen on B-lymphocytes. It is used for the treatment of rheumatoid arthritis, granulomatosis with polyangiitis, and many malignancies. Rituximab 375 mg/m<sup>2</sup> with dose-adjusted etoposide, prednisolone, vincristine, cyclophosphamide, doxorubicin is used for Burkitt mature B cell lymphoma.
- Rituximab 375 mg/m<sup>2</sup> with cyclophosphamide, doxorubicin, vincristine, prednisone is approved for newly diagnosed diffuse large B-cell non-Hodgkin lymphoma. It has been tested as 21 days or 14-day regimen, but the 21-day regimen remains the standard first-line treatment in patients with this hematological malignancy.
- Rituximab 1000 mg/m<sup>2</sup> is mostly used in the management of rheumatoid arthritis, administered on days 1 and 15.
- Rituximab 375 mg/m<sup>2</sup> once weekly for 4 doses has been used in the management of immune thrombocytopenia (ITP) and pemphigus vulgaris. Rituximab 375 mg/m<sup>2</sup> with dose-adjusted etoposide, prednisolone, vincristine, cyclophosphamide, doxorubicin is used for Burkitt's mature B cell lymphoma.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Rituximab



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**Question 326:** A 65-year-old male presents to the clinic with a 3-month history of generalized body aches and pain in his limbs and back. He is lethargic and has lost 5 kilograms in the past 4 months. His past medical history is significant for osteosarcoma of his proximal tibia, which was diagnosed 10-years ago for which he was treated with neoadjuvant chemotherapy, surgical resection, and adjuvant chemotherapy. Physical examination does not reveal any palpable masses or localized tenderness, and neurological examination is unremarkable. What is the most appropriate diagnostic imaging modality?

**Choices:**

1. Plain film radiographs
2. CT scan of the thorax, abdomen, and pelvis
3. Bone scintigraphy
4. MRI of the spine

Answer: 3 - Bone scintigraphy

## Explanations:

- Osteosarcoma is a highly malignant osteogenic tumor that can develop in any bone, with the long bones of the lower extremity being the most common site. It characteristically develops at the metaphysis.
- The most common site for the metastatic spread is the lungs, but it can also spread to bone, liver, or brain. Metastatic spread is most commonly via the hematological route.
- The imaging modality of choice for identifying metastatic deposits in bone is whole-body scintigraphy (bone scan). Whole-body scintigraphy utilizes technetium-99m as an active agent and is used to diagnose skeletal metastases.
- Osteosarcoma with metastatic spread has a poor prognosis, with 10-year survival between 20 to 30% in patients with metastatic disease at presentation.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Primary Bone Cancer



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 327:** A 66-year-old man with a history of metastatic hepatocellular carcinoma has been found to have metastasis involving the T9 vertebra. With regard to the management of the metastatic lesion of T9, he has been offered stereotactic radiation surgery (SRS). His epidural spinal cord compression (ESCC) grade is 3 and SINScore is 6. Considering these imaging findings, he has been recommended that hybrid management involving a surgical intervention, followed by SRS is the ideal management option. Which of the following steps best describes the critical surgical intervention that is necessary in this scenario, prior to the radiation treatment?

**Choices:**

1. Posterolateral approach involving circumferential decompression, resection of posterior longitudinal ligament and thecal sac reconstitution
2. Staged posterior-cum-anterior approach to ensure complete resection of all macroscopic tumor components involving the vertebral body
3. Posterolateral approach to completely resect all the macroscopic tumor components involving the vertebral body and paraspinal masses
4. Posterior approach ensuring adequate stabilization of the vertebrae with pedicle screw-rod constructs

**Answer: 1** - Posterolateral approach involving circumferential decompression, resection of posterior longitudinal ligament and thecal sac reconstitution

## Explanations:

- In patients with radioresistant tumors and significant cord compression (high-grade ESCC – grades 2 and 3), a hybrid approach involving initial “separation surgery,” followed by stereotactic radiation surgery (SRS), is recommended.
- The rationale underlying such an approach is to ensure circumferential decompression of the spinal cord, with the removal of any tumor component encroaching upon the spinal canal significantly. This enables the delivery of adequate dose of radiation (>15Gy) to the entire clinical tumor volume (CTV) without risking the spinal cord viability.
- This surgical intervention (“separation surgery”) typically involves a posterolateral approach enabling circumferential decompression, resection of the posterior longitudinal ligament, and 360-degree reconstitution of the thecal sac.
- SINScore of 6 indicates that the spinal column is stable, and in such situations, additional stabilization of the spine may not be necessary.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Spinal Metastasis



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 328:** A patient has metastases to the liver and declines transcatheter arterial chemoembolization (TACE). What other treatment can be recommended if the patient is only willing to undergo monotherapy?

**Choices:**

1. Embolization of the tumor's feeding arteries with inert particles only (bland embolization) or with radioactive particles (radioembolization)
2. Intravenous chemotherapy with monoclonal antibodies
3. External beam radiation to the abdomen
4. Radiofrequency ablation

**Answer: 1** - Embolization of the tumor's feeding arteries with inert particles only (bland embolization) or with radioactive particles (radioembolization)

## Explanations:

- Alternatives to TACE depend on the patient's liver tumor and overall functional status and are graded based on evidence-based appropriateness by the National Comprehensive Cancer Network (NCCN).
- Other than opting for no treatment, other potential mainstream therapies accepted by the NCCN depending on the patient are IV chemotherapy (there are no immunotherapies as of yet), external beam radiation directed at the liver, embolization of the tumor's feeding arteries with inert particles only (bland embolization) or with radioactive particles (radioembolization).
- Radiofrequency or microwave ablation, unlike the therapies above, should not be used in isolation for metastatic disease from or to the liver.
- Radiofrequency ablation can be used in combination with TACE or other therapy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Hepatic Chemoembolization



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 329:** A 43-year-old female is diagnosed with Stage IA, T1cN0M0 invasive ductal carcinoma of the left breast. Screening mammogram demonstrated 1.5 cm spiculated mass in the upper outer quadrant of the left breast. This was confirmed on a diagnostic mammogram. Targeted ultrasound showed a hypoechoic mass measuring 1.5 x 1.1 x 0.8 cm. Breast biopsy revealed moderately differentiated invasive ductal carcinoma that was ER/PR positive and HER2/neu negative. Lumpectomy and sentinel node biopsy revealed 1.6 cm ductal carcinoma, grade 2, no lymphovascular invasion, and negative margins. 2 sentinel nodes were negative. She completed chemotherapy. Breast radiation therapy was recommended. Which of the following is an appropriate radiotherapy regimen for this patient?

### Choices:

1. Whole breast dose of 5000 cGy in 25 fractions with boost to lumpectomy bed for additional dose of 1000 cGy in 5 fractions with prone technique.
2. Partial breast dose 3400 cGy in 10 fractions, bid, in one week.
3. Whole breast dose of 4256 cGy in 16 fractions with boost to lumpectomy bed for additional dose of 1000 cGy in 4 fractions with prone technique.
4. Whole breast dose of 5000 cGy in 25 fractions with boost to lumpectomy bed for additional dose of 1000 cGy in 5 fractions with supine technique.



**Answer: 3** - Whole breast dose of 4256 cGy in 16 fractions with boost to lumpectomy bed for additional dose of 1000 cGy in 4 fractions with prone technique.

## Explanations:

- 4256 cGy in 16 fractions is a popular Canadian whole breast hypofractionation regimen.
- Previously hypofractionated whole-breast radiation therapy was recommended for certain patients. However, recent long-term data from multiple clinical trials support the safety and efficacy of hypofractionation in most patients regardless of age, tumor grade, left or right-sided breast cancer, prior chemotherapy, receptor status, and breast size.
- Boost to lumpectomy bed is recommended for younger patients 50 years or younger, high grade, or a positive margin.
- American Society for Radiation Oncology (ASTRO) guidelines on Accelerated Partial Breast Irradiation (APBI), updated in 2016, defined suitable candidates for partial breast irradiation for women 50 years and older.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Therapy For Early Stage Breast Cancer



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 330:** A 55-year-old male patient presents with a neck mass, which was significantly enlarged over the last couple of months. The mass proves to be malignant on fine-needle aspiration. Further evaluation with direct laryngoscopic examination, esophagoscopy, and CT scan of the neck, did not clarify any obvious mucosal lesions. What is the next preferred management?

**Choices:**

1. Surgical resection of the cricoid cartilage
2. Indirect laryngoscopy, and biopsy
3. Repeat esophagoscopy, and biopsy
4. Surgical tonsillectomy

**Answer: 4** - Surgical tonsillectomy

## Explanations:

- Chondrosarcoma does not usually present with adenopathy. Squamous cell carcinoma confined just to the vocal cord does not present with adenopathy because no lymphatic drainage of the cord occurs.
- If adenopathy is present, then the tumor has spread above or below the cord. Metastatic tumor of unknown primary is usually the last diagnosis and is possible but unlikely.
- In performing random biopsies of mucosa in patients who present with adenopathy and normal mucosa on direct inspection and laryngoscopic examination, performing a biopsy of the tonsillar mucosa results in the highest yield for determining the source of the adenopathy. The management of cervical adenopathy with unknown origin compromise of diagnostic evaluations, including direct laryngoscopy, esophagoscopy, and CT-scan. However, when the results remain unclear, it should proceed with the tissue diagnosis of the other most probable ones, including tonsils.
- Squamous cell carcinoma of the pyriform sinus has a predilection for local nodal spread, but the mucosal lesion is often evident on either laryngoscopic examination or CT scan.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Nasopharyngeal Cancer



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**Question 331:** A 4-year-old was diagnosed with a brain tumor at the age of 2 and is being seen by the provider for evaluation of constitutional symptoms. He had undergone subtotal surgical resection of the tumor, whole axis neuroradiation, and 4-drug chemotherapy. His MRI from 6 months ago showed minimal tumor burden within the posterior fossa. He has now begun to have night sweats, fevers, and weight loss over the past four months. He frequently complains of his body hurting and refuses to play games with the other kids. What is the most common site for extraneural metastases with this type of malignancy?

**Choices:**

1. Bone
2. Lymph nodes
3. Liver
4. Lungs

Answer: 1 - Bone

## Explanations:

- Extraneural metastases in pediatric medulloblastomas are an infrequent occurrence at about 7%.
- The most frequent sites of extraneural metastasis in children include bone, 78%; lymph nodes, 33%; liver, 15%; and lungs, 11%.
- The average time for development following maximal surgical resection is 20 months.
- Survival in these cases is dismal and in most cases, can be less than six months.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Medulloblastoma



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**Question 332:** A 55-year-old Jehovah witness female is seen in the outpatient department due to incidental finding of 2.2 cm x 1.9 cm homogeneous enhancing left lateral ventricle mass seen on brain magnetic resonance imaging with and without contrast during work-up for headache. There is no evidence of ventricular trapping or edema on adjacent brain parenchyma. On physical exam, the patient is neurologically intact and only complains of a frontal right-sided headache. She is recommended yearly follow up with imaging study. The patient is lost to follow-up and returns after 10 years with a severe headache and new brain magnetic resonance imaging showing similar characteristics, but now measuring 5.5 cm x 4.8 cm. Preoperative embolization is unsuccessful due to small feeders, however significant tumor blush is appreciated. What is the next best step in management?

**Choices:**

1. Stereotactic needle biopsy
2. Craniotomy for gross tumor resection
3. Craniotomy for subtotal tumor resection and adjuvant radiosurgery
4. Stereotactic radiosurgery

**Answer: 3** - Craniotomy for subtotal tumor resection and adjuvant radiosurgery

## Explanations:

- To minimize surgical risk by lower operative time, blood loss, and decreasing retraction, a safe alternative will be to undergo partial tumor resection and adjuvant radiosurgery. This way, you can obtain a diagnosis and minimize the risks of radiosurgery by lowering the tumor size below 3 cm.
- In large intraventricular meningiomas, there is an increased risk of surgical resection, especially in the dominant hemisphere. This is due to retraction and poor vascular control during resection due to the vascular structures' deep location.
- Preoperative embolization reduces blood loss during tumor debulking. If feeders can not be embolized, subtotal resection with adjuvant radiotherapy is effective for tumor control.
- Stereotactic radiosurgery is a non-invasive technique that is excellent for poor surgical candidates and deep-seated lesions in the eloquent brain. However, due if the lesion is >3 cm, there is a higher risk of causing unwanted radiation injury to the adjacent healthy brain. Stereotactic needle biopsy is often not required if imaging findings are characteristic of meningioma, and growth per year is as expected (approximately 0.1 cm per year).

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Intraventricular Meningioma



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 333:** A 45-year-old woman with small cell carcinoma lung with multiple intracranial metastases and biochemical features of hyponatremia is planned for stereotactic brain radiosurgery. Which of the following is the central criticism against the use of stereotactic radiosurgery without WBRT in the setting of multiple brain metastasis?

**Choices:**

1. Neurocognitive decline
2. Radiation-induced necrosis
3. Radiation-induced leukoencephalopathy
4. Recurrence due to micrometastatic disease



**Answer: 4** - Recurrence due to micrometastatic disease

## Explanations:

- The inability to treat multiple tumors, which might require the use of salvage stereotactic radiosurgery or targeted or intra-CSF treatment at a later date, is the central criticism that has been leveled against the use of stereotactic radiosurgery, without concomitant whole-brain radiotherapy.
- A delay of 6 months in the development of brain metastases has been shown in patients who have received whole-brain radiotherapy. This might prove to be particularly deleterious in individuals with a life expectancy of close to one year.
- The rates of leptomeningeal dissemination in those receiving stereotactic radiosurgery in addition to whole-brain radiotherapy and a comparator group receiving Stereotactic radiosurgery were found to be similar at the end of 12 months in patients with multiple tumors.
- The reduction in cognitive abilities has been pointed out to be a challenge that has necessitated the introduction of hippocampus avoidance strategies and an approach supporting the combination of HA-WBRT with memantine.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Palliative Radiation Therapy For Brain Metastases



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## Section 10

**Question 334:** A 65-year-old male patient was admitted with complaints of chest tightness. Further evaluation with EKG and troponin were unremarkable. Vital signs and physical examinations were normal. A CT angiogram of the chest was done to rule out pulmonary embolism, which revealed an anterior mediastinal mass measuring 4.5 cm in the greatest dimension. Thoracoscopic tumor resection was performed. The microscopic evaluation of the specimen was notable for the close margins of the resected tumor. What is the best course of management for this patient?

### Choices:

1. Surgery
2. Chemotherapy
3. Radiation
4. No further therapy, just wait and watch

Answer: 3 - Radiation

## Explanations:

- The majority of carcinoids in the mediastinum occur in the thymus. Most patients present with a heaviness in the chest area, and carcinoid syndrome is sporadic. The patients are usually in the 5-6 decade of life, and cancer is more common in males compared to females. Surgery is the mainstay of treatment that gives a chance for cure. Therefore complete resection should always be attempted. Induction chemotherapy is usually administered in advanced neoplasms, or locally advanced disease to achieve tumor shrinkage, increasing, thus, the chance to obtain a complete resection, unfortunately, results are variable. Radiation is the treatment of choice for resected tumors with a positive or close margin.
- Induction chemotherapy is usually administered in advanced neoplasms, or in locally advanced disease to achieve tumor shrinkage, increasing, therefore, the chance to obtain a complete resection. Chemotherapy, in this case, has no role as it is localized and was resected.
- Postoperative radiotherapy is administered in case of invasive lesions, or incomplete resections. As this patient has a margin, positive radiation is indicated.
- Non-functioning carcinoids may be linked to MEN 1 and can be large lesions. They are hard to differentiate from a thymoma. However, most carry a poor prognosis as even after surgery, recurrence is frequent.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Mediastinal Carcinoid Tumors



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 335:** After radiation therapy to the chest, a patient develops a necrotic skin ulcer, which has failed to heal with conservative medical management for the past 3 months. What is the best treatment option?

**Choices:**

1. Local excision with a skin graft
2. Hyperbaric oxygen treatment
3. Application of growth factor to wound
4. Myocutaneous flap

**Answer: 4** - Myocutaneous flap

## Explanations:

- Skin injuries ranging from erythema to full chronic wounds occur in about 95% of patients who undergo radiation therapy. Radiation induced non-healing skin ulcers can be difficult to heal.
- The areas of the body that are more susceptible to radiation injury are the skin of the face, neck, trunk, and extremities. The center of the ulcer is usually avascular and does not heal with routine medical care.
- Pandya et al. examined specimens from 27 patients with OSCC (oral squamous cell carcinoma) who received radiation therapy involving the jaw and neck. He found significant tissue atrophy and severity of dysplasia, an increased presence of fibrinous exudative necrosis, vessel wall thickening, with oropharyngeal ectasia of the salivary gland. In addition, dense fibrosis with thick fibers was a common finding of post-radiation tissue in the same patients. The best method to close them is the use of muscle flaps.
- Hyperbaric oxygen treatment has one of the most frequent applications and delays radiation injuries, with up to one-third of patients treated with HBO2 for radiation injury in the United States. Even the mechanism of injury of ionizing radiation to be mainly hypoxia and increased district fibrosis, better oxygen treatment has been shown to increase angiogenesis and therefore improving oxygenation as well as reduce fibrosis, although this effect has not been fully investigated and explained.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Therapy Induced Skin Ulcer



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**Question 336:** A 65-year-old male presents to a clinic with complaints of difficulty with urination, hematuria, nocturia, and lower back pain. He also reports a history of weight loss and fatigue. On physical examination, his back is non-tender, and there is no abnormal finding on the neurologic exam. The rectal exam reveals an enlarged, nodular hard prostate with obliteration of the slit and immobile rectal mucosa in the region corresponding to the prostate. His prostate-specific antigen (PSA) is 20 ng/mL. Magnetic resonance imaging and prostate biopsy show a clinically advanced disease and a Gleason score of  $4 + 3 = 7$ . He was started on leuprolide and bicalutamide but did not respond to the treatment. What is the next best step in the management of this patient?

**Choices:**

1. Start him on docetaxel
2. Perform radical prostatectomy
3. Increase the dose of hormonal therapy
4. Offer radiotherapy

**Answer: 1** - Start him on docetaxel

## Explanations:

- Most hormone-sensitive cancers eventually become resistant to hormonal therapy and resume growth. At this point, the disease is considered castrate-resistant prostate cancer (CRPC) and requires additional treatment, usually chemotherapy.
- Docetaxel is the standard initial chemotherapy agent used to treat CRPC with a median survival benefit of 2 to 3 months.
- About 90% of patients with CRPC will develop bony prostate cancer metastases, which can be extremely painful. Therefore, much of the therapy at this stage is directed at bones. Bisphosphonates and rank ligand inhibitors have been shown to improve quality of life and reduce pathological fractures in CRPC patients.
- Once the tumor has spread beyond the prostate, it is no longer considered curable. Only limited radiotherapy can be provided at this point. However, early use of chemotherapy has been shown to be helpful in many patients presenting with aggressive or advanced disease. Radical prostatectomy may be offered after downsizing the tumor with chemotherapy as a palliative surgical procedure only to avoid ureteral obstruction. It will not affect disease progression.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Prostate Cancer



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**Question 337:** A 54-year-old woman with a history of sarcoma of the mouth undergoes radiation therapy. Six months later, she presented to the emergency department with complaints of pain, drainage, and swelling of the jaw. After evaluation, she is given IV penicillin. The biopsy report states that there is no persistent malignancy now. Which of the following is the next best step in the management of this patient?

**Choices:**

1. Supraphysiologic supplementation of vitamin C
2. MRI of the head and neck
3. Biopsy of maxilla
4. Hyperbaric oxygen therapy



**Answer: 4** - Hyperbaric oxygen therapy

## Explanations:

- The patient has most likely suffered from osteoradionecrosis, a common complication following radiation to the head and neck, commonly occurring in the jaw.
- Hyperbaric oxygen therapy and IV antibiotics are the mainstays of treatment for osteoradionecrosis, but persistent malignancy must be first ruled out before initiating hyperbaric oxygen therapy.
- The addition of hyperbaric oxygen treatment improves the tissue response to surgical wounding and improves the patient's chances of healing after surgical resection or reconstruction of the mandible.
- Perioperative prophylactic hyperbaric oxygen treatment is recommended for patients with previous head and neck irradiation undergoing dental extractions or complete exodontia procedures again to increase the blood flow, oxygenation, and penetration of bone by antibiotics. Studies have shown a reduction from 30% to 5% incidence of osteoradionecrosis using prophylactic hyperbaric oxygen treatment.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Osteoradionecrosis



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**Question 338:** A 17-year-old male soccer player presents with right thigh pain for the past several weeks, and it is present only at night. He reports that the pain is responsive to the use of nonsteroidal anti-inflammatory drugs (NSAIDs) and has not been worsening in intensity. He denies injury or fever. An X-ray of the femur shows a radiolucent nidus with surrounding sclerosis in its neck. What is the most likely diagnosis?

**Choices:**

1. Osteoid osteoma
2. Growing pains
3. Overuse injury
4. Osteomyelitis

Answer: 1 - Osteoid osteoma

## Explanations:

- The classic history of osteoid osteoma is nocturnal pain only that is responsive to NSAIDs. These benign lesions are clear on plain radiography. Treatment is conservative, but in cases of severe pain, surgical intervention is an option, although recurrence is high.
- Growing pains are poorly understood episodes of pain that are brief and often resolve without intervention.
- An overuse injury is possible in this patient, but the pattern of exclusive nocturnal pain is unusual.
- Osteomyelitis also is a possibility, but the lack of fever and other symptoms, such as persistent or worsening pain, makes this less likely.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Antalgic Gait In Children



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**Question 339:** A 55-year-old woman presents to the clinic for a follow-up. She was recently diagnosed with advanced colorectal carcinoma, Eastern cooperative oncology group score 1 with solitary brain metastasis. She has no involvement of the hippocampus and surrounding region. She has a past medical history of ulcerative colitis, taking oral and rectal mesalazine, with a history of multiple exacerbations in the past 2 months. What is the most appropriate management strategy for this patient?

**Choices:**

1. Stereotactic radiosurgery plus whole-brain radiotherapy
2. Hippocampal avoidance whole-brain radiotherapy
3. Hippocampal avoidance whole brain radiotherapy plus memantine
4. Best supportive care

**Answer: 4** - Best supportive care

## Explanations:

- Active ulcerative colitis is considered a contraindication to radiotherapy. In addition to idiopathic inflammatory bowel disease, collagen vascular diseases such as systemic lupus erythematosus and Sjogren disease are also conditions that may preclude the use of radiotherapy.
- Stereotactic radiosurgery without WBRT has been shown to be non-inferior in patients with five to ten metastases. A minimal degree of invasiveness and fewer side effects, when compared to neurocognitive function has been positioned as the major advantages of the procedure.
- Strategies that have been used to preserve the neurocognitive function include the use of hippocampal avoidance strategies and a combination of HA-WBRT with memantine or donepezil. A randomized control trial has shown preservation of neurocognitive outcomes along with a reduced incidence of adverse effects with the use of hippocampal avoidance whole-brain radiotherapy in combination with memantine without an adverse impact on overall or progression-free survival.
- The use of intensity-modulated radiotherapy with conformal avoidance of the hippocampus and the parahippocampal region has been proposed to avoid irradiation to the stem cell niche and prevent the development of negative neurocognitive outcomes. The quantum of radiation exposure to the hippocampal stem cell niche is reduced by seven times.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Palliative Radiation Therapy For Brain Metastases



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 340:** A 77-year-old female presented to the emergency department with significant and progressive right-sided jaw pain that began a few days ago. She had undergone a tooth extraction 2 to 3 months ago. On exam, there was evidence of gingival swelling and erythema around the area of her vacated tooth. Complete blood count, complete metabolic panel, and plain radiographs of the area were unremarkable. She has a past medical history of hypertension, type 2 diabetes, and breast adenocarcinoma with bony metastases. She has been taking the following medications for the last two years: lisinopril, amlodipine, metformin, glipizide, and denosumab. Which of the following is the least likely predisposing factor for developing the etiology of the patient's jaw pain?

**Choices:**

1. Poor dentition
2. Recent tooth extraction
3. Treatment of diabetes with glipizide
4. Treatment of bony metastases with denosumab

**Answer: 3** - Treatment of diabetes with glipizide

## Explanations:

- Glipizide is a sulfonylurea. Its mechanism of action bind and thus inhibit K-ATP channels which leads to increased insulin secretion. Osteonecrosis of the jaw (ONJ) is not a known side effect of glipizide.
- Osteonecrosis of the jaw (ONJ) is a known but rare side effect of denosumab. Symptoms may include jaw pain, tooth infection, bone, gingival erosion, and toothache. Denosumab should not be initiated until dental health is optimized.
- Predisposing factors to developing osteonecrosis of the jaw include poor dentition, recent dental surgery/tooth extraction, osteoclast inhibitor therapy (denosumab, bisphosphonates), and/or concurrent antineoplastic therapy. An increased risk of being diagnosed with osteonecrosis of the jaw correlates directly to the duration of denosumab exposure.
- The risk of osteonecrosis of the jaw is considerably higher in patients with malignancy receiving denosumab than patients with osteoporosis receiving denosumab. Dental procedures are contraindicated while on denosumab for cancer therapy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Denosumab



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**Question 341:** A 16-year-old boy presents with a tender mass in his leg and a lesion in his lung. He has had general malaise for 3 months. X-ray reveals a mass with an "onion layering" pattern. What is the most likely diagnosis?

**Choices:**

1. Chondrosarcoma
2. Fibrous dysplasia
3. Ewing sarcoma
4. Myeloma



**Answer: 3** - Ewing sarcoma

## Explanations:

- Ewing sarcoma typically is seen in adults and presents with progressive and severe pain.
- It has a typical "onion peel" appearance on x-ray. The tumor may involve one or multiple areas of the chest wall and an excisional biopsy is recommended. Rib involvement is rare.
- Patients are best treated with a multimodality approach involving preoperative chemotherapy followed by surgery.
- Generally, patients with a chest wall primary have a worse prognosis than when the primary is in the long bones.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Ewing Sarcoma



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**Question 342:** A 55-year-old woman presents to the hospital with complaints of lower backache for the past 15 days associated with urinary and fecal incontinence. She has a history of metastatic triple-negative breast cancer status-post multiple lines of chemotherapy. She was recently treated with CDK 4/6 inhibitor abemaciclib. She has a sensory level at the T10 dermatome with weakness of the bilateral lower limbs. Bilateral knee and ankle jerks are exaggerated, and plantar reflexes are extensor. She has received radiotherapy for similar symptoms in the past, which provided relief. Which of the following is the strongest indication for radiotherapy for this patient?

**Choices:**

1. Presence of incident pain
2. Systemic tumor burden
3. Ademaciclib therapy
4. History of prior irradiation to the affected site

**Answer: 4** - History of prior irradiation to the affected site

## Explanations:

- The incidence of metastatic bone disease ranges from 17%-64% in lung cancer, 65%-75% in breast cancer, 65%-90% in prostate cancer, and 70%-95% in multiple myeloma. Locoregional approaches for symptomatic palliation of bone metastases include surgery and radiotherapy. Systemic approaches include the usage of inhibitors of bone resorption, radiopharmaceutical targeted agents, endocrine approaches, and chemotherapy.
- A slower rate of blood flow in the marrow with ensuing increased sinusoidal pressures and the presence of chemoattractant cytokines (stromal cell-derived factor -1) favor the localization of CXCR4 expressing tumor cells to the endothelium and their subsequent extravasation. SDF-1 also known as Pre B cell growth-stimulating factor is produced by Bone marrow stem cells and has been shown to act as a cytokine that plays a chemotactic role through its affinity for the CXCR4 on tumor cells.
- Radiotherapy is the treatment modality of choice in the case of recurrent tumors as well as recurrent disease in an area that has received prior irradiation. Stereotactic body radiotherapy is the treatment of choice in such cases.
- Previously irradiated tumors with high-risk metastatic spinal cord compression may require surgical decompression prior to irradiation. The use of intraoperative brachytherapy to enable receipt of stereotactic body radiotherapy in the postoperative setting is a subject of ongoing research.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Palliative Radiation Therapy For Bone Metastases



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 343:** A 74-year-old man with a history of total hip arthroplasty on the right 1 year ago presents to the emergency department with progressive right hip pain over 1 month. He denies any impaired mobility. X-ray of the pelvis reveals bone spurs in the right pelvis and proximal end of the right femur, with 1 cm between opposing bone surfaces. Which of the following is the most appropriate management strategy for this patient?

**Choices:**

1. Reassurance
2. Radiation therapy to 7 Gy in 1 fraction to the right hip only
3. Surgical excision, followed 2 days later by radiation to 7 Gy in 1 fraction to the right hip
4. Radiation to 7 Gy in 1 fraction to the right hip, followed 2 days later by surgical excision

**Answer: 3** - Surgical excision, followed 2 days later by radiation to 7 Gy in 1 fraction to the right hip

## Explanations:

- Clinically relevant factors for heterotopic ossification treatment include pain, impaired mobility, Brooker classification 3, or 4.
- Surgical excision is the treatment of choice for established heterotopic ossification, with adjunctive radiation for prophylaxis against future ossification.
- Postoperative radiation for the prevention of heterotopic ossification should be performed within 72 hours after surgery.
- Preoperative radiation for the prevention of heterotopic ossification should be performed within 24 hours before planned surgery.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Therapy For Heterotopic Ossification Prophylaxis



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**Question 344:** A patient who recently completed a standard course of radiation treatment for tonsil cancer (stage T2N2M0) presents to the physician because of tingling in his arms and fingers when he bends his neck for the past two weeks. On examination, he does not have any motor deficits. But Romberg's sign is positive in him. What is the best treatment in this case?

**Choices:**

1. High doses of corticosteroids with rapid taper
2. Reassurance that it should pass on its own
3. Referral for neurosurgical consultation immediately
4. Initiation of antiviral therapy for impending zoster infection

**Answer: 2** - Reassurance that it should pass on its own

## Explanations:

- Lhermitte syndrome is transient myelitis that can occur after high doses of radiation to the neck, including the spinal cord.
- This condition consists of electric shock feelings that extend down the spine when the head is flexed.
- It is usually self-limited, appearing shortly after a course of radiation and spontaneously regressing within a few weeks to months.
- Lhermitte's sign pathophysiology is related to demyelination of dorsal columns of the cervical spine, associated with radiographical demyelinating lesion and electrodiagnostic abnormalities on nerve conduction.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Lhermitte Sign



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**Question 345:** A 78-year-old male is recently diagnosed with chronic lymphocytic leukemia. The clinician calls the patient to the office to let him know the side effects of the radiation on different systems of the body. Acute radiation sickness is seen in 100% of exposed patients at what level of radiation absorption?

**Choices:**

1. 3 rad
2. 30 rad
3. 300 rad
4. 3000 rad



Answer: 4 - 3000 rad

## Explanations:

- Amputation may be necessary after doses greater than 10,000 rad.
- 3000 Rad is equivalent to 30 Gray.
- More than 90% of patients may be affected with as little as 8 Gray (800 rads).
- 5-50% of patients show at least some symptoms/signs with as little as 1-2 Gray (100-200 rads).

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Ionizing Radiation



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**Question 346:** Which of the following is associated with post-mastectomy radiotherapy for positive lymph nodes?

**Choices:**

1. 30% improvement in overall survival
2. 20% improvement in overall survival
3. 10% improvement in overall survival
4. 5% improvement in overall survival

**Answer: 3** - 10% improvement in overall survival

## Explanations:

- A large meta-analysis performed by the Early Breast Cancer Trialists' Collaborative Group (EBCTCG) pooled individual patient data from 22 randomized trials comparing mastectomy with or without adjuvant radiation therapy and found that among patients with 4 or more positive nodes, post-mastectomy radiotherapy reduced locoregional recurrence by 19% which translated into a 9% reduction in breast cancer mortality.
- Two of the largest studies included in this meta-analysis, the Danish collaborative group trials, randomized pre and post-menopausal women with high-risk breast cancer including patients with any positive axillary lymph nodes and reported overall survival with the addition of post-mastectomy radiotherapy by approximately 10%.
- An improvement of 20% to 30% in overall survival has not been reported in any large randomized trial involving post-mastectomy radiation.
- A 5% overall survival is less than what has generally been reported in phase 3 randomized trials of post-mastectomy radiation therapy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Postmastectomy Breast Cancer Radiation Therapy



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**Question 347:** A 67-year-old man with a diagnosis of malignant melanoma with BRAF V600E mutation, with metastasis to the brain who is currently on dabrafenib and trametinib. He had good control of his disease until recently when he developed a worsening headache. An MRI of the brain showed one enlarging lesion. All his other lesions were stable. His case was discussed at the multidisciplinary tumor board and recommended he receive stereotactic radiosurgery (SRS) to the brain. Which of the following would be the best next step regarding his dabrafenib and trametinib?

**Choices:**

1. Continue dabrafenib and trametinib during his stereotactic radiosurgery (SRS)
2. Stop dabrafenib with or without trametinib 3 days prior to stereotactic radiosurgery (SRS) and start them back at least a day after SRS
3. Continue dabrafenib, but stop trametinib
4. Change the therapy with dabrafenib and trametinib to a different BRAF and MEK inhibitor combination

**Answer: 2** - Stop dabrafenib with or without trametinib 3 days prior to stereotactic radiosurgery (SRS) and start them back at least a day after SRS

### Explanations:

- BRAF inhibitors are known to cause radiosensitization of normal tissues and thus an increased risk of side effects.
- Hold treatment with a BRAF with or without a MEK inhibitor for one to three days before and one day after SRS, which appears to minimize the risk of significant toxicity.
- Continuing BRAF inhibitors during SRS therapy can increase the side effect, especially of the skin and mucosa, as well as other organs.
- Changing to a different BRAF and MEK inhibitor doesn't decrease the associated toxicity with SRS.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

**Malignant Melanoma Metastatic To The Central Nervous System**



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**Question 348:** A 66-year-old woman presents to the clinic for follow up. She has 50 pack-year smoking history and chronic obstructive pulmonary disease on 2 L/min supplemental oxygen. She was recently diagnosed with right upper lobe lung adenocarcinoma. During staging workup, she is found to have oligometastatic disease involving the right adrenal gland (FDG avid 1.9 cm mass). The biopsy of lung mass is negative for driver mutations. Her Eastern Cooperative Oncology Group (ECOG) performance status is 2, and she is not considered a surgical candidate for video-assisted thoracoscopic surgery resection of primary lung tumor or open adrenalectomy. She undergoes 24-hour urine metanephrine and plasma free metanephrine evaluation, which is within normal limits. She undergoes fine-needle aspiration of the adrenal mass, confirming lung adenocarcinoma. Which of the following is the next best step in the management of this patient?

**Choices:**

1. Laparoscopic adrenalectomy with no intervention for the primary tumor
2. Osimertinib
3. Stereotactic body radiation therapy (SBRT) to lung primary and adrenal oligometastatic site
4. Test adrenal mass fine-needle aspiration specimen for driver mutations

**Answer: 3** - Stereotactic body radiation therapy (SBRT) to lung primary and adrenal oligometastatic site

## Explanations:

- Stereotactic radiation therapy is a useful non-invasive treatment option for adrenal metastasis from lung cancer with good local control with minimal morbidity. This can be followed by systemic therapy for continued control of micrometastasis and further improving survival outcomes.
- There is no data to support the benefit of metastasectomy alone while leaving the primary tumor intact.
- Since driver mutations were negative on primary tumor analysis, there is no role for osimertinib, which is currently approved in the first-line setting for stage IV EGFR mutated non-small cell lung cancers.
- Retesting metastatic sites for driver mutations is not currently a standard practice and also, is sometimes limited by the limited specimen obtained on fine-needle aspiration compared to core biopsies.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Adrenal Metastasis



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**Question 349:** A 65-year-old male is seen in the gastroenterology clinic with complaints of tenesmus and bloody stools. He has had the symptoms for the past several months. He has had 8-10 episodes of bloody stools associated with urgency. He has a history of prostatic carcinoma for which he underwent transurethral resection of the prostate followed by external beam radiation to the pelvis. He has otherwise been well. He undergoes flexible sigmoidoscopy. It reveals a pale non-compliant rectum and mucosal erosions and telangiectasia. He fails to respond to appropriate medical therapy and is treated with 100 % oxygen in a pressurized chamber. The patient improves with the new treatment. Antagonism of which pathophysiological effect occurs as a result of therapy?

**Choices:**

1. Obliterative endarteritis
2. Pseudo-membrane formation
3. Granulomatous infiltration
4. Lymphocytic inflammation



Answer: 1 - Obliterative endarteritis

## Explanations:

- This patient presents with a history of chronic rectal inflammation. His sigmoidoscopy findings and prior pelvic irradiation suggests the diagnosis of chronic radiation proctitis. Hyperbaric therapy (HBOT) can be used for treatment in refractory cases. HBOT improves the chronic mucosal ischemia that occurs as a result of radiation injury.
- Radiotherapy damages the endothelial cells and causes abnormal endothelial proliferation and obliterative endarteritis. The subsequent abnormal vessel proliferation leads to the formation of telangiectasias.
- Chronic mucosal hypoxia is responsible for symptoms of urgency and mucosal ulceration and bleeding. HBOT promotes tissue oxygenation and promotes angiogenesis. Increased capillary density improves mucosal ischemia.
- HBOT can be useful as an adjunct in the management of radiation proctitis. Improves tissue oxygenation and vascularity are the primary beneficial effects. Pseudomembrane formation is seen in *C. difficile* colitis, granulomatous inflammation is seen in Crohn's, and lymphocyte infiltration in the mucosa is seen in lymphocytic colitis.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Hyperbaric Treatment Of Radiation Proctitis



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**Question 350:** A 79-year-old man is brought to the hospital from a nursing home for respiratory distress and loss of voice. He ends up having an emergency tracheostomy. His chart indicates progressive dysphagia and loss of phonation for the past two months. Contrast-enhanced CT scan of the neck shows a large, 5 cm laryngeal tumor that has destroyed the thyroid cartilage and is involving vertebral bone as well as surrounding the left carotid artery. Multiple 2-3 cm lymph nodes are noted in bilateral levels II-IV. Biopsy confirms squamous cell carcinoma, and further imaging indicates no distant metastasis. The patient has poor performance status at baseline and is nearly entirely bedbound. What is the most appropriate treatment strategy for this patient?

**Choices:**

1. Palliative radiation or chemotherapy alone
2. Curative concurrent radiation and chemotherapy
3. Palliative maximal debulking surgery
4. Curative-intent laryngectomy and corpectomy, with likely adjuvant radiation and/or chemotherapy

**Answer: 1** - Palliative radiation or chemotherapy alone

## Explanations:

- A 5 cm laryngeal tumor that has destroyed the thyroid cartilage and is involving vertebral bone as well as surrounding the left carotid artery, multiple 2-3 cm lymph nodes are noted in bilateral levels II-IV, and no metastatic disease indicates T4bN2cM0 squamous cell carcinoma of the larynx, which is by definition inoperable.
- Patients with this level of disease burden and with the described poor performance status likely cannot undergo curative-intent therapy.
- Palliative radiation or chemotherapy ALONE are appropriate possibilities; concurrent chemotherapy and radiation significantly increase treatment toxicity, which is of special concern when treating for palliative intent in a patient with a poor prognosis and likely short-term survival.
- Even for palliation, surgery would not be considered in this case. A surgery to offer palliation (i.e., to reach deep structures and relieve symptoms) would be too extensive and dangerous.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Laryngeal Cancer



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**Question 351:** A 71-year-old woman presents to the clinic with hoarseness of voice and 20 pounds (9 kg) weight loss in the past two months. She has a 40-pack-year history of smoking. Laryngoscopy reveals a 2 cm exophytic mass emanating from the infrahyoid supraglottis and extending inferiorly to involve the true glottis, which has impaired but still preserves a small degree of mobility. Multiple, firm, immobile, 1.5-2 cm lymph nodes corresponding to levels II and III are also palpated. A contrast-enhanced CT scan of the neck shows extension of the tumor anterior into the pre-epiglottic space and inferiorly to approximately 7 cm below the true vocal cord. A biopsy confirms squamous cell carcinoma, and further imaging indicates no distant metastasis. Concurrent chemotherapy and radiation for laryngeal preservation are recommended. What lymphatic levels are most appropriate to be covered by the radiation fields in this patient?

**Choices:**

1. Bilateral levels II-III
2. Bilateral levels II-IV
3. Bilateral levels II-IV, level VI
4. No lymph nodes need be irradiated due to concurrent chemotherapy

**Answer: 3** - Bilateral levels II-IV, level VI

## Explanations:

- This patient is staged as T3N2bM0. Though the vocal cord is not fixed, there is pre-epiglottic space invasion. Of note, subglottic extension, typically defined as 5 mm below the true glottis, is not taken into account in AJCC 8th edition staging for supraglottic laryngeal cancers.
- Supraglottic laryngeal cancers are prone to nodal metastasis due to the rich lymphatic supply of the supraglottic region. Even in the absence of clinical nodal disease, levels II-IV are at high risk for involvement and failure.
- This case presents with clinical nodal metastasis in levels II and III, the most commonly involved. In addition, there is noted to be subglottic extension on CT scan, which additionally places level VI at risk of failure. Thus, not only should levels II, III (already involved, and IV (high risk of involvement even if N0) be covered by radiation fields, but also level VI.
- Radiation fields in the context of curative-intent treatment of laryngeal cancer always include more levels of nodal irradiation than are already involved. Thus, treating only the involved levels II and III is not appropriate.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Laryngeal Cancer



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 352:** A 30-year-old man presents to the clinic for follow up. He recently underwent an IR guided biopsy of a large superior mediastinal mass that shows a mediastinal seminoma. The patient has no past medical history and does not take any medications. A physical exam is within normal limits. What is the most appropriate management strategy for this patient?

**Choices:**

1. Radiotherapy only
2. Chemotherapy only
3. Chemotherapy and radiotherapy
4. Surgical resection only

**Answer: 3** - Chemotherapy and radiotherapy

## Explanations:

- Multimodality treatment with chemotherapy followed by radiation is the first line treatment for large mediastinal seminomas.
- Chemotherapy agents include cisplatin, bleomycin, and etoposide for 4-6 cycles. Intermittent pulmonary function tests need to be checked while on bleomycin.
- Multimodal treatment with chemotherapy and radiotherapy exerts much better results when combined. After completion of the regimen, a CT chest should be obtained. If the tumor responds well to the treatment and shrinks, surgical resection can be performed.
- Large mediastinal seminomas need to be treated with combo therapy of chemo and radiation. Each regimen alone does not yield the best results as the combined treatment. Surgical resection is not the primary treatment for large seminomas. More than 50% of patients have unresectable tumors. Surgery is usually reserved for small mediastinal masses in patients with no symptoms. Surgery is often associated with a high recurrence rate and must be accompanied by a form of adjuvant therapy if it is considered.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Mediastinal Seminoma



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**Question 353:** A 47-year-old man comes for a routine checkup. He has no complaints. His past medical history is significant for lymphoma in the supraclavicular and axillary regions, treated with ionizing radiation therapy 15 years ago. Post-radiotherapy, he was treated with daunorubicin and vincristine. Follow-up investigations reveal no metastases or residual disease. Family history is significant for colon cancer in his brother and chronic lymphocytic leukemia in his aunt. He has a 10-pack-year smoking history but has now quit smoking. Which of the following is the patient increased risk for developing?

**Choices:**

1. Cardiotoxicity
2. Peripheral neuropathy
3. Peptic ulcer disease
4. Thyroid cancer



Answer: 4 - Thyroid cancer

## Explanations:

- Exposure to radiation causes DNA instability due to the direct breakage of DNA or through the production of reactive oxygen species. Both DNA strand breakage and reactive oxygen species formation damage the structure and function genome.
- The patient's previous exposure to radiation caused mutagenesis within thyroid tissues, causing an increased risk for thyroid cancer. The thyroid gland uptakes radioactive iodine produced during radiation exposure, increasing the risk for future carcinogenesis to occur.
- Patients who receive ionizing radiation are at increased risk for a variety of cancers. Side effects of radiation therapy include mucositis, dry skin, fatigue, nausea, abdominal pain, weight loss, and pancytopenia.
- Vincristine has a notorious side-effect of peripheral neuropathy. In this patient with no symptoms and cessation of therapy, it is not recommended to monitor. H.pylori, alcohol, NSAIDs, and smoking are thought to cause peptic ulcer disease. Daunorubicin can cause dose dependent cardiotoxicity, but it usually resolves after cessation of therapy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Genetics, Somatic Mutation



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**Question 354:** A 25-year-old man presents to the clinic for a raised, hyperpigmented lesion at the site of an old scar on his face. Surgery with radiation is advised for the best long term control. Which of the following complications is most likely to occur in the first 7-10 days after treatment in this patient?

**Choices:**

1. Erythema and edema
2. Alopecia and atrophy
3. Telangiectasia
4. Wound dehiscence

**Answer: 1** - Erythema and edema

## Explanations:

- The most common complications of radiation for keloid treatment, with occurrences around 30%, are erythema and pigment related changes (hypopigmentation, hyperpigmentation).
- Acute complications, which can arise during radiation or seven to ten days after treatment, are related to the total dose of radiation given.
- Acute complications can manifest as erythema, edema, desquamation, ulceration, or necrosis.
- Late complications can occur weeks to months after treatment and are related to the dose of radiation given per session. These include pigmentary changes (hypopigmentation or hyperpigmentation), alopecia, atrophy, and telangiectasis. Although seen in less than 1% of cases, infection and wound dehiscence are also possible complications of keloid treatment.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Therapy In The Treatment Of Keloids



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**Question 355:** A 65-year-old male patient with a history of low-grade astrocytoma presents with fatigue and weight gain. One year ago, he had resection of the tumor and whole-brain radiation. The morning cortisol level is found to be 2.1 mcg/dl. Which of the other hormones is most likely affected secondary to whole brain radiation?

**Choices:**

1. Follicle stimulation hormone (FSH)
2. Thyroid-stimulating hormone (TSH)
3. Prolactin
4. Growth hormone

**Answer: 4** - Growth hormone

## Explanations:

- Hypopituitarism can occur after exposure of the hypothalamus or pituitary gland to radiation.
- The most sensitive hormone to radiation is growth hormone, followed by adrenocorticotrophic hormone (ACTH), prolactin, and gonadotropins.
- Acute radiation injury can cause headache, insomnia, or worsening of existing neurologic defects.
- Late radiation injury occurs after at least 4 months, usually at 8 to 24 months.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Adverse Effects Of Radiation Therapy



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**Question 356:** A 45-year-old man with a history of Hodgkin lymphoma of the mediastinum presents to the clinic for follow up. The patient receives thoracic radiation therapy several times and, his lymphoma, in conjunction with daunorubicin chemotherapy, is eventually put into remission. Within the first month after treatment, which of the following sets of cardiac symptoms is he most likely to experience as a result of his radiation therapy treatment?

**Choices:**

1. Sharp, pleuritic chest pain and hypotension
2. Crushing, substernal chest pain, and jaw pain
3. Chest pressure and sudden cardiac death
4. Syncope and peripheral edema

**Answer: 1** - Sharp, pleuritic chest pain and hypotension

## Explanations:

- Mediastinal Hodgkin lymphoma can be treated with radiation therapy and can result in cardiac side effects. Most common in the acute phase (the first few weeks after therapy) are acute pericarditis and pericardial effusion. Transient arrhythmias are also a possibility in the first year but are usually benign and often asymptomatic.
- Acute pericarditis causes sharp, pleuritic, positional chest pain, and the inflammation of the pericardium can lead to pericardial effusion. If significant, pericardial effusion can cause hypotension and cardiac tamponade, although this level of severity is less common.
- Acute coronary syndrome is a complication of coronary artery disease and can cause chest pain or pressure, jaw and left arm pain, and sudden cardiac death from ventricular arrhythmias. While radiation therapy can lead to worsening coronary artery disease, it is a late complication and does not usually manifest until 15-20 years after therapy.
- Syncope and peripheral edema are signs of reduced ejection fraction and can be due to systolic heart failure. Systolic heart failure is a very late complication as it requires the progression of fibrotic change in the myocardium through restrictive cardiomyopathy and diastolic failure before ejection fraction begins to fall.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Radiation Therapy Induced Cardiac Toxicity



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**Question 357:** A 47-year-old woman presents to the emergency department after a motorcycle accident. She is found to have multiple fractures to include the right proximal humerus and acromion, the right proximal radius, the left acetabulum, and the left proximal tibia. After surgical stabilization, which of the following sites is most likely to benefit most from single-fraction radiation therapy to prevent heterotopic ossification?

**Choices:**

1. Right shoulder
2. Right elbow
3. Left hip
4. Left knee



Answer: 3 - Left hip

## Explanations:

- Heterotopic ossification is most commonly associated with injury to the hip.
- The elbow is the second most commonly involved joint (after the hip) for heterotopic ossification, often following burns or elbow replacements.
- After trauma to a major joint, single-fraction radiation therapy to 7 Gy can be used to prevent the formation of heterotopic ossification.
- The knee is a relatively uncommon site for heterotopic ossification after trauma.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Radiation Therapy For Heterotopic Ossification Prophylaxis



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**Question 358:** A 27-year-old female presents with amenorrhea and galactorrhea for one year. The prolactin level was 180 ng/ml ( normal range 4.8-23.3). A magnetic resonance imaging of the brain shows a 0.9 cm pituitary mass. She is married and is planning to extend her family next year. Which of the following is appropriate management?

**Choices:**

1. Prepare patient for surgery
2. Radiation
3. Observation
4. Treatment with a dopamine agonist

**Answer: 4** - Treatment with a dopamine agonist

## Explanations:

- A microadenoma is less than 1 cm while a macroadenoma is 1 cm or greater. This is a functional adenoma with an elevated prolactin level.
- Medical treatment with a dopamine agonist is the first-line treatment for micro prolactinoma if the patient has symptoms of amenorrhea, breast discharge and or fertility.
- A prolactinoma may shrink with a dopamine agonist.
- Know the symptoms of hyperprolactinemia that are amenorrhea, galactorrhea, and infertility in females.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Pituitary Adenoma



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**Question 359:** A patient presents with a malignant melanoma on her shoulder. Biopsy showed it to be 1.3 mm deep. There are no palpable lymph nodes in the neck or axilla. What test should be done to determine the location of the sentinel lymph node biopsy?

**Choices:**

1. CT chest, abdomen, and pelvis with intravenous contrast
2. Ultrasound of neck and axilla
3. Lymphoscintigraphy
4. No test is needed

**Answer: 3** - Lymphoscintigraphy

### Explanations:

- Lymphoscintigraphy will show the draining sentinel lymph node in melanoma excision. CT is not indicated in this patient as it is not able to show lymphatic drainage.
- Lymphoscintigraphy should be done to determine exactly where the sentinel lymph node is draining.
- This is important in areas such as the back and shoulder as the lymphatic drainage is ambiguous and can go to either the axilla or the neck.
- Ultrasound and CT do not trace lymphatic drainage.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Melanoma Pathology



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**Question 360:** What is the rationale for using tumor markers in patients with lung cell carcinomas?

**Choices:**

1. They are good indicators of prognosis
2. They are useful screening tests
3. They are useful for diagnosis
4. They are used to monitor therapy

**Answer: 4** - They are used to monitor therapy

## Explanations:

- No useful markers are available yet for prognosis, screening, or diagnosis.
- Tumor markers used to monitor treatment include neuron-specific enolase, carcinoembryonic antigen, cytokeratin 19 fragments, squamous cell carcinoma antigen, cancer antigen CA 125, and tissue polypeptide antigen.
- However, not all labs have the ability to measure these markers, and not all lung cancers secrete them.
- Currently, imaging is the most sensitive method for monitoring therapy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Lung Cancer



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 361:** A 55-year-old male has been having complaints of testicular swelling for the past 2 years. On ultrasonography the radiologist has a strong suspicion of malignancy, although certainty could not be there. Hence radical inguinal orchiectomy was done. Histological diagnosis of sex cord-stromal tumor was made without lymphovascular invasion, cellular atypia or necrosis. The size was 7 cm. The staging was done after a full assessment and it was designated as stage I. Serum value of tumor markers is normal. What is the further course of management?

**Choices:**

1. Retroperitoneal lymph node dissection
2. Chemotherapy
3. Radiotherapy
4. Observe and follow up



**Answer:** 4 - Observe and follow up

## Explanations:

- 1 or 0 high-risk factors can be safely observed without RPLND, however long follow-ups are required. However, the only risk factor for the mentioned patient is the tumor size which is already above 5 cm.
- Risk factors include tumor size of above 5 cm, more than 3 mitoses per high-power field, positive margin, rete testes, lymphovascular invasion, cellular atypia, and necrosis.
- For stage I disease, orchiectomy alone is curative.
- Early retroperitoneal lymph node dissection (RPLND) is useful in those with two risk factors or stage IIA disease.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Sex Cord Stromal Testicular Tumor



We update eBooks quarterly and Apps daily based on user feedback. Please tap flag to report any questions that need improvement.

**Question 362:** A 58-year-old female presents to the clinic for a follow up of abnormal mammogram findings in the upper outer quadrant of the left breast. Ultrasound-guided biopsy reveals a 3 cm mass positive for invasive ductal carcinoma, grade 2, ER-positive, PR positive, Her2 negative. The patient wishes to discuss breast conservation therapy. Which of the following is the best treatment choice for this patient?

**Choices:**

1. Simple mastectomy with whole breast radiation
2. Partial mastectomy, sentinel lymph node biopsy, and whole breast radiation
3. Simple mastectomy with sentinel lymph node biopsy
4. Partial mastectomy with sentinel lymph node biopsy, no radiation

**Answer: 2** - Partial mastectomy, sentinel lymph node biopsy, and whole breast radiation

### Explanations:

- The patient has a T2 lesion and is, therefore, a candidate for breast conservation therapy.
- All patients undergoing partial mastectomy should have sentinel lymph node mapping performed for proper axillary staging.
- Breast conservation therapy has shown to have equivalent survival compared to mastectomy when combined with whole breast radiation.
- If a patient cannot undergo postoperative radiation, this is considered a contraindication to breast conservation therapy. Radiation may be omitted from patients over 70 years old who take are candidates and take adjuvant tamoxifen.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Breast Cancer Conservation Therapy



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**Question 363:** A 17-year-old man was referred due to pain on the upper part of the anterior aspect of the right leg. The patient reported that the pain started after he fell from his bicycle while training for a race one week ago. The patient mentioned that the pain is constant and interferes with his daily activity and training exercises. On examination, there was bruising on the leg, but no open wounds were observed. Palpation showed a tender mass on the anterior aspect of leg 3 cm below the tibial tuberosity. The mass was firm and non-mobile measuring approximately 3X3 cm in size. The active movement of the knee was partially restricted due to pain, but the passive movement was normal. Hip and ankle joint examinations were normal. What is the most likely radiological finding of the knee?

**Choices:**

1. A pedunculated mass directed downward away from the knee joint
2. A pedunculated mass directed upward toward knee joint
3. Lesion of low density with calcification
4. A well-defined, expansible osteolytic lesion with thin sclerotic margins

**Answer: 1** - A pedunculated mass directed downward away from the knee joint

## Explanations:

- Clinical examination findings of the patient suggest the diagnosis of osteochondroma (firm, immobile mass).
- Osteochondroma is a bony tumor that is usually asymptomatic and causes no pain.
- Trauma-induced fracture is a possible complication of osteochondroma, and it can explain the pain during joint movement and the tenderness during palpation.
- Osteochondroma appears in a conventional radiograph as a sessile or pedunculated lesion directed away from the joint.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Osteochondroma



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**Question 364:** A 47-year-old female is found to have a palpable 5 cm mass in the 9 o'clock position, 3 cm from the nipple. There is no palpable lymphadenopathy. She undergoes an ultrasound-guided core needle biopsy of the mass and is diagnosed with invasive ductal carcinoma, ER-positive, PR-positive, Her2-positive. She is scheduled for a partial mastectomy with sentinel lymph node biopsy. A preoperative breast MRI is obtained, which confirms the biopsy-proven malignancy in the breast but also shows enhancing axillary nodes with cortical thickening and loss of fatty hilum. Which of the following is the next best step in the management of this patient?

**Choices:**

1. Ultrasound-guided core needle biopsy of the enhancing node
2. Proceed with partial mastectomy and sentinel lymph node biopsy
3. Perform axillary node dissection instead of sentinel lymph node biopsy at the time of partial mastectomy
4. Perform right modified radical mastectomy

**Answer: 1** - Ultrasound-guided core needle biopsy of the enhancing node

## Explanations:

- Any suspicious axillary nodes should be evaluated with ultrasound and a FNA or core needle biopsy. Suspicious nodes can be identified on exam, mammogram, ultrasound or breast MRI. In this setting, if this patient has biopsy proven axillary node involvement, consideration should be made for neoadjuvant chemotherapy.
- If negative, a sentinel lymph node biopsy can still be performed.
- In a patient with suspicious, biopsy-proven axillary nodes, neoadjuvant chemotherapy could yield a robust or even a complete pathologic response. In those patients with a complete clinical response, a sentinel node biopsy can be offered at the time of surgery. A further mode of action, i.e., axillary lymph node dissection versus axillary radiation, should be discussed in an interprofessional meeting if the sentinel lymph node is still positive after neoadjuvant chemotherapy.
- The palpable node should be evaluated and biopsied before going to surgery to assist with the treatment plan.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Breast Lymphatics



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**Question 365:** An elderly patient presents with sudden onset of diplopia and blurry vision. On examination, upward-gaze palsy is noted along with light-near dissociation and convergence retraction nystagmus. An occlusion of branches of which artery would most likely produce the deficits described above?

**Choices:**

1. Anterior cerebral artery
2. Middle cerebral artery
3. Posterior cerebral artery
4. Anterior spinal artery



**Answer: 3** - Posterior cerebral artery

## Explanations:

- The symptoms the patient presents with are most consistent with Parinaud syndrome.
- Parinaud syndrome can be caused in elderly patients by stroke affecting cerebrovasculature to structures in the dorsal midbrain.
- The superior colliculus, along with other structures in the dorsal midbrain receive blood supply from the collicular artery and the posteromedial choroidal artery, both of which branch from the proximal posterior cerebral artery.
- Parinaud syndrome is more commonly caused by vascular problems in elderly individuals and neoplastic causes in younger individuals.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Neuroanatomy, Superior Colliculus



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**Question 366:** A 62-year-old female underwent a modified radical mastectomy. On serial sectioning, a 3.2 cm × 1.5 cm × 0.8 cm ill-defined tumor in the upper outer quadrant was found. Microscopic examination established the diagnosis of tubular breast carcinoma. Eight lymph nodes dissected out of the specimen were not metastatic. The work-up for the spread of breast carcinoma did not show metastases. Which of the following is the most appropriate clinical prognostic stage group?

**Choices:**

1. Stage 1A
2. Stage 1B
3. Stage 2A
4. Stage 2B

Answer: 3 - Stage 2A

## Explanations:

- pT2 is defined by a tumor > 20 mm in greatest dimension but =50 mm in greatest dimension. The tumor, in this case, measures 3.2 cm in greatest dimension so it is classified pT2.
- pN0: no regional lymph node metastasis is identified. In this case, eight lymph nodes dissected were not metastatic.
- M0: no clinical or radiographic evidence of distant metastases. In this case, the work-up for the spread of breast carcinoma did not show metastases.
- Stage 2A corresponds to T0N1M0 or T1N1M0 or T2N0M0 (as it is the case of this patient). Therefore, this case corresponds to stage 2A.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Tubular Breast Carcinoma



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**Question 367:** A 65-year-old female patient was diagnosed with paranasal sinus cancer (adenoid cystic cancer) and treated with surgical excision and postoperative radiotherapy (70Gy). One month after the completion of radiotherapy, she developed an acute orocutaneous fistula. What is the most appropriate management strategy in this case?

**Choices:**

1. Incision and drainage of the fistula
2. Repair with prosthetic closure
3. Repair with surgical intervention
4. Antibiotic courses

**Answer: 2** - Repair with prosthetic closure

## Explanations:

- Cutaneous fistula after radiotherapy is a therapeutic challenge. High doses (60 Gy or higher) are usually prescribed in patients with paranasal sinus cancer, and therefore, irreversible tissue damage is associated.
- Prosthetic closure is a convenient alternative to surgical repair in this patient. The aim of the treatment is to minimize infection risk and cosmetic burden associated with the fistula.
- Prosthesis could be used intraorally, extra orally, or as a combination.
- Such orocutaneous fistulas are frequently repaired with surgical intervention. But surgical repair is difficult in this case because the fistula appeared in the immediate post-therapy period.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Oral Cutaneous Fistula



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**Question 368:** A 60-year-old male patient presents with back pain for the last 3 weeks. Over the past 3 days, he has noticed progressive numbness involving both lower limbs. He has an unsteady gait and has fallen 3 to 4 times while walking over the last 2 weeks. On clinical examination, tenderness over thoracolumbar spine is elicited, and lower limb power is 4/5 extending from L2-S1 myotomes, and there is decreased pain and temperature sensation below the L2 dermatome. The bilateral lower limb reflexes are reduced, and he shows hypotonia. Radiographic exam reveals lytic lesion involving two-thirds of the T12 vertebral body, with less than 10% collapse. There were few small ill-defined lytic areas over T2, T6, and L3 vertebrae. His skeletal survey revealed multiple lytic lesions in the skull and an ill-defined lytic lesion in the proximal humerus. On detailed laboratory and radiological evaluation, diagnosis of multiple myeloma was made. What would be the next line for management of this spinal lesion presenting with neurological deficits?

### Choices:

1. Enbloc vertebrectomy
2. Spinal decompression with stabilization
3. Chemotherapy
4. Radiotherapy and corticosteroids

**Answer: 4** - Radiotherapy and corticosteroids

## Explanations:

- According to the International Myeloma working group criteria, the diagnosis of multiple myeloma requires following three criteria: the presence of more than 10% monoclonal cells in bone marrow or plasmacytoma proven on biopsy; monoclonal immunoglobulin in serum or urine, and at least one feature of myeloma-related organ dysfunction.
- Skeletal involvement occurs in 80 to 90% of multiple myeloma cases. Radiology is important in the diagnosis and characterization of the disease. Spinal cord compression is reported in up to 20% of the cases. In such patients, MRI is the imaging examination of choice.
- The patient presenting with symptoms of spinal cord compression is a medical emergency and needs prompt treatment. It can be due to the extraosseous extension of spinal cord tumor or a pathological fracture. Imaging provides vital information and differentiation between these two causes.
- Regarding treatment, radiotherapy is the choice for extraosseous tumor extension while for pathological fracture of vertebrae surgical decompression with stabilization followed by postoperative radiotherapy is recommended. Most patients will be started on high dose corticosteroids.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Lytic Bone Lesions



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**Question 369:** A 75-year-old female presents to the office with dyspnea and worsening cough for three months. She states she has lost 25 pounds (11 kg) in that time and has a remote smoking history of 20 pack years. Vital signs are stable, and on physical exam, there are decreased breath sounds in the right lower lobe. CT scan shows a large right pleural effusion with multiple nodules diffusely. Bone scan shows metastatic lesions along her lumbar spine. MRI is negative for abnormal lesions. Thoracentesis shows adenocarcinoma. What is the most appropriate management?

**Choices:**

1. Prophylactic cranial irradiation
2. Systemic chemotherapy
3. Test for activating mutations
4. Radiation to the metastatic lesion on the lumbar spine



**Answer: 3** - Test for activating mutations

## Explanations:

- It is important to identify mutations including EGFR, ALK, and ROS1 as it will help guide the treatment.
- For example, EGFR mutations will benefit from erlotinib but it is inappropriate to start it without identifying the mutation first.
- ALK translocations and ROS1 mutations will do better with crizotinib. These will be initial therapy before treatment starts.
- If mutation status is obtained after treatment is started, these agents can be started later.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Non Small Cell Lung Cancer



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**Question 370:** A 50-years-old man presented with a seven-month history of progressive nasal obstruction, watering of the eye, headache, and occasional epistaxis. On rhinoscopy, there was an irregular fleshy granular mass arising from the roof of the nasal cavity. CT scan showed that the mass extended superiorly into the ethmoidal sinuses, right frontal sinus, and sphenoid sinus and into the cranial cavity destroying the ethmoidal air cells, posterior wall of the right frontal sinus and sphenoid sinus inferiorly. The tumor also invaded the cribriform plate. Laterally, the mass destroyed the medial wall of right orbit and extended into it. We performed an intranasal biopsy with local anesthesia. Histopathological examination of the biopsy specimen coupled with immunohistochemistry confirmed the diagnosis of esthesioneuroblastoma. Physical examination of the patient did not disclose any cervical lymphadenopathy, and there were no distant metastases. What will be the optimal treatment of this patient?

**Choices:**

1. Palliative therapy
2. Chemotherapy and radiotherapy
3. Surgical resection with postoperative radiation
4. Radiotherapy

**Answer: 3** - Surgical resection with postoperative radiation

### Explanations:

- Extensive surgery, typically an open or endoscopic-assisted craniofacial resection along with postoperative radiation therapy is the optimal treatment of a locally advanced esthesioneuroblastoma as it is the case in this patient. Surgical resection combined with postoperative radiotherapy is the gold standard in the management of this tumor.
- For Kadish C esthesioneuroblastoma, as it is the case in this patient, a combined modality approach improves disease-free survival and overall survival compared with surgery or radiation alone.
- Preoperative radiation is an alternative strategy which may yield equivalent results, and induction chemotherapy, as well as concurrent postoperative chemoradiation, may improve local, regional, and distant control of esthesioneuroblastoma.
- Patients with distant disease can have palliative therapy. Chemoradiation is an approach for patients with unresectable local disease, which could subsequently improve the resectability for locally-advanced esthesioneuroblastoma.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

### Research Concepts:

Esthesioneuroblastoma



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**Question 371:** A 67-year-old patient with metastatic adenocarcinoma of the lungs presents with confusion and right-sided weakness. Brain imaging shows a two by three-centimeter lesion near his left motor strip with surrounding edema. Following the interprofessional team discussion, stereotactic radiosurgery is deemed appropriate. Which of the following statements best describes the modality used to treat his condition?

**Choices:**

1. It uses a rhodium-103 based device
2. It uses x-rays
3. It uses a spherical array via collimator helmets
4. It can be used for extracranial disease

**Answer: 3** - It uses a spherical array via collimator helmets

## Explanations:

- The Gamma Knife is approximately the size of an MRI or CT scanner. It consists of a heavily shielded vault containing 201 separate cobalt-60 sources, arranged around a hemisphere.
- It uses gamma rays.
- It uses a spherical array via collimator helmets.
- It can only be used for intracranial pathologies.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

Stereotactic Radiosurgery



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**Question 372:** A 67-year-old male patient with an acoustic neuroma presents with progressive left-sided hearing loss. Following an interprofessional team discussion, stereotactic radiosurgery is deemed appropriate. Which of the following best describes the treatment modality used to treat his condition?

**Choices:**

1. Photons are accelerated against a metal target to generate x-rays
2. Electrons are accelerated against a metal target to generate photons
3. Intensity-modulated radiation therapy can only vary the shape of the beam to limit the dose
4. It is limited to extracranial disease

**Answer: 2** - Electrons are accelerated against a metal target to generate photons

## Explanations:

- Linear accelerator radiosurgery is a procedure used to treat conditions like an acoustic neuroma. Electrons are accelerated against a metal target to generate photons (x-rays).
- Linear accelerator radiosurgery is most often used for brain metastasis.
- Intensity-modulated radiation therapy can vary the shape and the intensity of the beam to limit the dose.
- It can be used for extracranial pathology due to the mounted robotic arm which enables movement.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Stereotactic Radiosurgery



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**Question 373:** A 54-year-old female patient with metastatic adenocarcinoma of the breast is found to have three small cranial lesions. Her case was sent to an interprofessional team meeting to discuss whether she would be a candidate for stereotactic radiosurgery or surgery. Which of the following statements is most accurate about this patient's management?

**Choices:**

1. She would not be a candidate for stereotactic radiosurgery as she has multiple lesions
2. A patient with a Karnofsky score of 10 would be a more appropriate candidate than one with a score of 90
3. She is a candidate for gamma knife treatment but not CyberKnife treatment
4. She is a candidate for single or fractionated treatment, depending on lesion location



**Answer: 4** - She is a candidate for single or fractionated treatment, depending on lesion location

## Explanations:

- Three small lesions are appropriate for stereotactic radiosurgery, the radiation can be delivered at once or sequentially.
- The higher the Karnofsky score, the better the functional ability of a patient. 10 suggests a moribund patient whereas 90 suggests a patient who can perform normal activities with minor symptoms.
- She is an appropriate candidate for both gamma knife and CyberKnife treatments. Currently, no randomized trials compare the two and they are used depending on operative preference and availability. In this way, they are both appropriate.
- She is a candidate for single or fractionated treatment, depending on lesion location. Depending on the surrounding structures, (for example the optic chiasm) the dose needs to be reduced or delivered in fractionated treatments. She has three small metastatic lesions and is thus a candidate for radiosurgery following interprofessional team decision.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Stereotactic Radiosurgery



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**Question 374:** A 65-year-old patient with a primary glioma presents with left-sided weakness and seizures. There is a two by three-centimeter lesion near his right motor strip. Following an interprofessional team discussion, stereotactic radiosurgery is deemed appropriate. Which of the following statements best describes the procedure used to treat this patient?

**Choices:**

1. It is indicated for metastatic and primary tumors of the CNS only
2. Robotic radiosurgery therapy is equivalent to the gamma knife and can be used as the first-line treatment option
3. The dose in gray is the absorption of one kilojoule of radiation energy per kilogram of matter
4. It uses multiple, divergent beams of high energy x-rays, gamma rays, or protons

**Answer: 2** - Robotic radiosurgery therapy is equivalent to the gamma knife and can be used as the first-line treatment option

## Explanations:

- Stereotactic radiosurgery can also be used for vascular and functional pathologies.
- No randomized trials compare treatment modalities; treatment decisions are based on availability and physician preference.
- The dose in gray is the absorption of one joule of radiation energy per kilogram of matter.
- It uses multiple, convergent beams of high energy x-rays, gamma rays, or protons, delivered to a discrete, radiographically-defined, treatment volume.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Stereotactic Radiosurgery



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**Question 375:** A 35-year-old male with metastatic adenocarcinoma of the colon presents to the emergency department four days after receiving stereotactic radiosurgery for a left temporal lesion. He is complaining of a headache and has a raised white cell count. Which of the following statement is most accurate about the patient's condition?

**Choices:**

1. A raised white cell count means he has a CNS infection
2. He should be treated with oral antibiotics
3. Acute effects are secondary to axonal demyelination
4. Late effects are secondary to white matter tract damage

**Answer: 4** - Late effects are secondary to white matter tract damage

## Explanations:

- Infection at the pin-sites can happen post radiosurgery but in less than 5%. This patient is likely to have been given steroids for his stereotactic radiosurgery which can elevate the white cell count. Do not automatically assume infection. The most common acute side effect is a headache.
- This patient needs careful assessment, including history and examination. Headaches are common post-treatment and the raised white cell count may be secondary to steroids. Prescribing antibiotics for no indication is bad practice.
- Axonal demyelination can occur as a late effect. Acute effects are secondary to cerebral edema and the disruption of the blood-brain barrier. This includes a headache, the most common post-treatment complaint.
- Late effects are due to white matter tract damage following an injury to vascular endothelial cells, axonal demyelination, and coagulation necrosis. These are much less common with stereotactic radiosurgery versus conventional whole brain radiotherapy.

Go to the next page if you knew the correct answer, or click the link image(s) below to further research the concepts in this question (if desired).

## Research Concepts:

### Stereotactic Radiosurgery



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- Occupational Therapy Assistant
- Certified Surgical 1st Assistant
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- Advanced Trauma Support
- Cardiology
- Cardiology-Electrophysiology
- Cardiology-Failure Transplant
- Cardiology-Interventional
- Critical Care
- Dermatology
- Emergency Medicine
- Endocrinology
- Family Medicine
- Gastroenterology
- Genetics
- Geriatrics
- Hematology
- Hospice And Palliative Medicine
- Infectious Disease
- Internal Medicine
- Nephrology
- Neurology
- Neurology-Headache
- Neurodevelopmental Disabilities
- Neuromuscular Medicine
- Obesity Medicine
- Occupational Medicine
- Oncology
- Pain Medicine
- Pathology-Anatomic
- Pediatric
- Pediatric-Cardiology
- Pediatric-Child Abuse
- Pediatric-Critical Care



- Pediatric-Developmental
- Pediatric-Emergency Medicine
- Pediatric-Endocrinology
- Pediatric-Gastroenterology
- Pediatric-Hematology-Oncology
- Pediatric-Infectious Diseases
- Pediatric-Neonatal Perinatal
- Pediatric-Nephrology
- Pediatric-Neurology
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- Pediatric-Rehabilitation
- Pediatric-Rheumatology
- Physical Medicine
- Psychiatry
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- Psychiatry - Child and Adolescent
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- Radiology - Diagnostic
- Radiology - Musculoskeletal
- Radiology - Neuroradiology
- Nuclear Medicine
- Radiology - Pediatric
- Radiology - Physics and Safety
- Radiology - Vascular and Interventional
- Rheumatology
- Sleep
- SPEX
- Spinal Cord Injury
- Sports Medicine
- Cardiothoracic Surgery
- Colorectal Surgery
- Complex Surgical Oncology
- Craniofacial Surgery
- General Surgery
- Gynecologic Oncology
- Hand Surgery
- Ob/Gyn - Maternal-Fetal Medicine
- Neurosurgery
- Obstetrics and Gynecology
- Ophthalmology
- Oral And Maxillofacial Surgery
- Orthopedic Surgery

- Otolaryngology
- Pediatric Surgery
- Plastic Surgery
- Reproductive Endocrinology & Infertility
- Thoracic Surgery
- Urology
- Urology - Pediatric
- Vascular Surgery
- Toxicology
- Transplant Hepatology
- Undersea and Hyperbaric
- Radiology - Cardiac
- Radiology - Gastrointestinal
- Radiology - Breast
- Radiology - Genitourinary
- Radiology-Thoracic
- Radiology - Ultrasound
- Emergency Medicine EMS
- Compliance Physician
- Clinical Tropical Medicine
- Dermatopathology
- Dermatology-Pediatric
- Dermatologic Micrographic Surgery
- Pathology-Laboratory Medicine
- Pathology-Blood Banking Transfusion Medicine
- Pathology-Chemistry
- Pathology-Cytopathology
- Pathology-Forensics
- Pathology-Hematology
- Pathology-Microbiology
- Pathology-Molecular Genetic
- Pathology-Neuropathology
- Pathology-Pediatric
- Neurocritical Care
- Pediatric-Hospital Medicine
- Neurology - Epilepsy Medicine
- Neurology - Clinical Neurophysiology
- Wound
- Ophthalmology - Oculoplastic Surgery
- Brain Injury Medicine
- Vascular and Stroke Neurology
- Podiatry Medicine
- Podiatry Surgery
- Pelvic Medicine and Reconstructive Surgery
- Osteopathic Neuromusculoskeletal Medicine
- Neurology - Behavioral Neuropsychiatry

- Cardiology-Nuclear
- Cardiology-Echocardiography
- Cardiology-CV Computed Tomography
- Vascular Medicine
- Nutrition Medicine
- Quality Assurance and Utilization
- Facial Plastic Surgery
- Certified Hypertension Clinician
- Integrative Medicine
- Simulation In Healthcare
- Internal Medicine - MRCP UK and Ireland Part 2
- Internal Medicine - MRCP UK and Ireland Part 1
- General Surgery - MRCS Part A
- Family Medicine - MRCGP-Applied Knowledge Test
- Advanced Diabetes Management
- Spine Surgery
- COMVEX
- General Surgery - Inservice ABSITE®
- Correctional Medicine
- Pediatric - MRCPC
- Emergency Medicine - FRCEM Primary
- Certified Hypertension Specialist
- Ophthalmology - Cornea & External Eye Disease
- Ophthalmology - Glaucoma
- Ophthalmology - Neuro
- Ophthalmology - Pediatric & Strabismus
- Ophthalmology - Cataract
- UK PLAB 1
- Australian Medical Council-IMG
- Canada MCC-QE 1
- Optometry-Basic Science
- Optometry-Advanced Medical Care
- National Board Dental Examination (NBDE) Part I
- Pakistan Medical Commission NLE

### Medical Student Specialties

- USMLE Step 1
- USMLE Step 2
- USMLE Step 3
- COMLEX Level 1
- COMLEX Level 2
- COMLEX Level 3
- Ambulatory Care-Medical Student
- Neurology-Medical Student
- Family Medicine-Medical Student
- Internal Medicine-Med Student

- Ob Gyn-Medical Student
- Pediatrics-Medical Student
- Psychiatry-Medical Student
- Surgery-Medical Student
- Emergency Medicine-Med Student
- Internal Medicine Advanced-Med Student
- Indian PG Entrance Exam-NEETPG
- Dermatology-Medical Student
- Clinical Diagnosis
- Anatomy-Medical Student
- Behavioral Sci-Medical Student
- Biochemistry-Medical Student
- Embryology-Medical Student
- Genetics-Medical Student
- Histology-Medical Student
- Microbiology-Medical Student
- Neuroanatomy-Medical Student
- Path Clin Lab-Medical Student
- Pathology-Medical Student
- Pharmacology-Medical Student
- Physiology-Medical Student
- Philippine Physician Exam (PLE)
- Statistics and Healthcare Economics
- Law, Medicine, and Ethics
- Pakistan-1st Professional
- Pakistan-3rd Professional
- Pakistan-4th Professional
- Pakistan-Final Professional
- Ophthalmology-Medical Student
- Indonesia CBT Final Examination
- Nepal Medical Council Exam
- Medical Council Nigeria (MDCN)
- Allergy - Medical Student
- Anesthesiology - Medical Student
- Cardiology - Medical Student
- Critical Care-Medical Student
- Endocrinology-Medical Student
- Gastroenterology-Medical Student
- Infectious Disease-Medical Student
- Nephrology-Medical Student
- Oncology-Medical Student
- Peds-Cardiology Medical Student
- Peds-Critical Care Medical Student
- Peds-Endocrinology Med Student
- Peds-GI Medical Student
- Peds-Hem Onc-Medical Student

- Peds-ID-Medical Student
- Peds-Neonatal Medical Student
- Peds-Nephrology Medical Student
- Peds-Pulmonology Medical Student
- Physical Medicine-Medical Student
- Pulmonary-Medical Student
- Diagnostic Radiology-Medical Student
- Rheumatology-Medical Student
- Neurosurgery-Medical Student
- Orthopedic-Medical Student
- Urology-Medical Student
- Otolaryngology-Medical Student
- Cardiothoracic-Medical Student
- Plastic Surgery-Medical Student
- Vascular Surgery-Medical Student
- Caribbean Medical Licensing Exam
- Peds-Surgery Medical Student
- Peds-Neurology Medical Student
- Osteopathic Manipulation
- Hematology-Medical Student
- Hand-Medical Student
- Sports Medicine-Medical Student
- ENARM Mexico Exam
- Pakistan FCPS (Basic Science)
- Pakistan-2nd Professional

### Nurse Practitioner Specialties

- NP-Acute Adult and Gerontology
- NP-Diabetes Management
- NP-Family
- NP-Psychiatric Mental Health
- NP-Adult-Geriatric Primary Care
- NP-Midwife
- NP-Pediatric Primary Care
- NP-Emergency Medicine
- NP-Women's Health Care
- NP-Acute Care Pediatric
- NP-Neonatal
- NP-Dermatology
- NP-Addiction
- NP-Nephrology
- NP-Oncology
- NP-Orthopedic
- NP-Advanced Health Assessment
- NP-Advanced Pharmacology
- NP-Advanced Pathophysiology

- NP-Advanced Physiology
- NP-Urology
- NP-Wound, Continence, And Ostomy
- NP-Advanced Neurovascular Practitioner

### Physician Assistant Specialties

- PA-PANCE
- PA-PANRE
- PA-Cardiovascular Thoracic
- PA-Emergency Medicine
- PA-Hospital Medicine
- PA-Nephrology
- PA-Orthopedic
- PA-Pediatric
- PA-Psychiatry

### Pharmacist Specialties

- Pharmacy-Technician (PTCB)
- Pharmacy-NAPLEX Review
- Pharmacy-Ambulatory Care
- Pharmacy-Critical Care
- Pharmacy-Nutrition Support
- Pharmacy-Oncology
- Pharmacy-Pediatric
- Pharmacy-Pharmacotherapy
- Pharmacy-Psychiatric
- Pharmacy-Infectious Disease
- Pharmacy-Geriatric
- Pharmacy-Cardiac
- Pharmacy-Applied Toxicology

### Nursing Specialties

- NP-Pediatric Mental Health Specialist (PMHS)
- LPN LVN NCLEX PN-Nursing Student
- NCLEX RN-Nursing Student
- Community Health-Nursing Student
- Adult Medical Surgical RN-Nursing Student
- Maternal Newborn PN-Nursing Student
- Child Health RN-Nursing Student
- Mental Health RN-Nursing Student
- Fundamentals-Nursing Student
- Mental Health PN-Nursing Student
- Pharmacology RN-Nursing Student
- Professional Ethics-Nursing Student

- Calculations-Nursing Student
- Maternal Newborn RN-Nursing Student
- Pharmacology PN-Nursing Student
- Adult Medical Surgical PN-Nursing Student
- Child Health PN-Nursing Student
- Anatomy-Nursing Student
- Physiology-Nursing Student
- Microbiology-Nursing Student
- Nutrition-Nursing Student
- Lab and Diagnostic Testing-Nursing Student
- Elder Adult Care-Nursing Student
- Critical Care Rhythms-Nursing Student
- Pathophysiology-Nursing Student
- Health Assessment-Nursing Student
- Nurse-Addiction (CARN)
- Nurse-Administrator NE NEA
- Nurse-AIDS-HIV (ACRN AACRN)
- Nurse-Ambulatory Care
- Nurse-Perianesthesia CAPA-CPAN
- Nurse-Anticoagulation
- Nurse-Bariatric (CBN)
- Nurse-Breast Care CBCN© Review
- Nurse-Cardiovascular CVN-CVRN
- Nurse-Case Management
- Nurse-Continence Care
- Nurse-Corrections (CCHP)
- Nurse-Critical Care (CCRN)
- Nurse-Dermatology (DNC)
- Nurse-Certified Diabetes Specialist
- Nurse-Emergency Certification
- Nurse-Flight Registered (CFRN)
- Nurse-Foot-Nail Care (CFCN)
- Nurse-Gastroenterology (CGRN)
- Nurse-Gerontology (NCA)
- Nurse-Hemodialysis (CHN)
- Nurse-Hospice-Palliative CHPN
- Nurse-Hyperbaric (CHRN)
- Nurse-Infection Control (CIC)
- Nurse-Infusion (CRNI)
- Nurse-Lactation (CLA)
- Nurse-Low Risk Neonatal (LRN)
- Nurse-Maternal Newborn (MNN)
- Nurse-Medical Surgical
- Nurse-Neonatal Intensive Care
- Nurse-Nephrology (CNN)
- Nurse-Neuroscience (CNRN)

- Nurse-Occupational (COHN)
- Nurse-Oncology (OCN)
- Nurse-Operating Room (CNOR)
- Nurse-Ophthalmology (CRNO)
- Nurse-Orthopedic (ONC)
- Nurse-Otolaryngology (CORLN)
- Nurse-Pain Management (PMCN)
- Nurse-Pediatric (CPN)
- Nurse-Pediatric Critical Care
- Nurse-Pediatric Emergency CPEN
- Nurse-Pediatric Hem Onc (CPHON)
- Nurse-Inpatient Obstetric RNC
- Nurse-Plastic Surgery (CPSN)
- Nurse-Professional Development
- Nurse-Healthcare Quality
- Nurse-Progressive Care (PCCN)
- Nurse-Psychiatric Health
- Nurse-Radiologic (CRN)
- Nurse-Rehabilitation Registered
- Nurse-Risk Management (CPHRM)
- Nurse-Sexual Assault (SANE)
- Nurse-Transplant (CCTN-CCTC)
- Nurse-Transport (CTRN)
- Nurse-Urologic Registered
- Nurse-Wound Care
- Nurse-Eating Disorders (CEDRN)
- Nurse-Neonatal Transport C-NPT
- Nurse-Trauma (TCRN)
- Nurse-Emergency Pediatric Certification
- Nurse-Stroke Certified (SC-RN)
- Nurse-Wound Care and Ostomy
- Nurse-Wound, Ostomy, and Continence
- Nurse-Clinical Leader
- Nurse-Assisted Living
- Nurse-Vascular Access (VABC)
- Nurse-School (NBCSN)