A 3-year-old boy is brought to the office due to a 1-day history of fever and irritability. The mother states that the boy has been tugging at his right ear. The patient has had 2 previous episodes of acute otitis media. Temperature is 38.1 C (100.6 F). Otoscopic examination shows a perforated right tympanic membrane with erythema and purulent exudate. Cultures from the exudate yield small, oxidase-positive, gram-negative coccobacilli that grow on factor X– and factor V–supplemented media, consistent with *Haemophilus influenzae*. The patient's immunizations are up to date. Which of the following best explains this patient's susceptibility to the pathogen causing his current infection?

- A. No vaccine is effective against *H influenzae*
- B. The patient has defective cell-mediated immunity
- C. The patient has defective neutrophil function
- D. The strain responsible for this patient's disease does not produce a capsule
- E. The strain responsible for this patient's disease produces exotoxin

Proceed To Next Item

A 73-year-old woman comes to the physician complaining of progressive, severe pain and discharge from her left ear for the past 2 days. She has had type 2 diabetes for many years and has been noncompliant with her medications and follow-up appointments. On examination, moving or touching the pinna produces extreme pain. Otoscopic examination shows granulation tissue in the left ear canal with a scant amount of discharge. The tympanic membrane is clear, and there is no middle ear effusion. Initial cultures from the ear show a Gram-negative rod. Which of the following microbiological characteristics best describes the infecting organism?

- A. Comma-shaped and grows well in high pH
- B. Fast lactose fermenter
- C. Motile and oxidase positive
- D. Nonmotile and a lactose nonfermenter
- E. Requires factors V and X for growth

Proceed To Next Item

A 68-year-old man with a long history of using chewing tobacco comes to the office for follow up of squamous cell carcinoma (SCC) of the oral cavity. A month ago, the patient was diagnosed with SCC of the left lateral tongue. He underwent resection, the surgical specimen showed clear margins, and he started additional treatment. The patient recently noticed a second ulcerative lesion on the right lateral tongue. Biopsy is performed and it also shows SCC. The second tumor most likely arose from which of the following mechanisms?

- A. Chemotherapy-induced malignancy
- B. Field cancerization
- C. Hematogenous spread
- D. Immunologic privilege
- E. Impaired wound healing
- F. Lymphatic spread

Proceed To Next Item

A 26-year-old woman comes to the office due to pain in her right jaw that is deep, achy, and worse in the morning. It radiates to her temple and is associated with headaches. The patient also has neck pain and stiffness, especially on the right side. When she chews, she hears a clicking noise in her right ear. The patient is in a competitive graduate study program and has been under significant stress. Her roommate says that she has been grinding her teeth at night. Physical examination will likely reveal spasms of which of the following muscles?

- A. Buccinator
- B. Levator veli palatini
- C. Masseter
- D. Mylohyoid
- E. Omohyoid

Proceed To Next Item

A newborn girl is evaluated in the neonatal intensive care unit for difficulty breathing. The patient was born at term via spontaneous vaginal delivery. Since birth, she has had difficulty breathing with loud snoring sounds and intermittent oxygen desaturations. She has been unable to breastfeed due to her breathing problems. Breathing improves significantly when the patient is placed in a prone position. On examination, there is a small mandible, posteriorly displaced tongue, and U-shaped cleft palate. The abnormalities described represent an example of which of the following?

- A. Association
- B. Disruption
- C. Imprinting
- D. Sequence
- E. Syndrome

Proceed To Next Item

A 25-year-old woman comes to the office due to right ear pain that has worsened over the past 2 months. The pain is dull and constant and waxes and wanes. It is worse when she chews hard foods such as steak or almonds. In addition to ear pain, her ear feels stuffy and has some ringing. The patient grinds her teeth at night and previously wore a dental guard, but it broke several months ago. Ear examination is normal. Which of the following nerves is most likely responsible for this patient's ear pain?

- A. Glossopharyngeal
- B. Hypoglossal
- C. Trigeminal
- D. Vagus
- E. Vestibulocochlear

Proceed To Next Item

A 44-year-old man comes to the office for evaluation of a neck lump. The patient first noticed the lump 6 months ago while he was shaving and says that it seems to be growing in size. He has no pain, shortness of breath, cough, hoarseness, or difficulty swallowing. The patient had Hodgkin lymphoma 20 years ago, which was successfully treated with radiation therapy to his chest and neck. Physical examination shows a firm mass in the left thyroid lobe. There is no lymphadenopathy. Serum TSH level is normal. Fine-needle aspiration biopsy reveals papillary thyroid cancer. A total thyroidectomy is performed. During an attempt to ligate the inferior thyroid artery, a nervous structure in close proximity is inadvertently damaged. Which of the following was most likely injured during the surgery?

- ◯ A. Accessory nerve
- ◯ B. Ansa cervicalis
- ◯ C. Hypoglossal nerve
- ◯ D. Phrenic nerve
- ◯ E. Recurrent laryngeal nerve
- ◯ F. Superior cervical ganglion
- ◯ G. Superior laryngeal nerve

Proceed To Next Item

A 65-year-old man comes to the office with a 4-month history of persistent left ear pain that is slowly worsening. He is also having some difficulty swallowing. The patient has no chronic medical conditions but has smoked 1 pack of cigarettes per day for the last 46 years. On examination, the external auditory canal is patent and the tympanic membrane is clear with no middle ear effusion. There is an enlarged lymph node in the left anterior neck. Flexible fiberoptic laryngoscopy reveals an ulcerative mass on the posterior pharyngeal wall of the hypopharynx. Involvement of which of the following nerves is most likely responsible for this patient's ear pain?

- A. Trigeminal nerve
- B. Facial nerve
- C. Vestibulocochlear nerve
- D. Vagus nerve
- E. Hypoglossal nerve
- F. Great auricular nerve

Proceed To Next Item

A 62-year-old man comes to the office due to worsening difficulty with swallowing food over the last 3 months. He has smoked a pack of cigarettes daily for the past 45 years. On examination, there is a firm, palpable mass at the base of tongue. Cervical lymph nodes are also palpable. Which of the following histologic features is most likely to be seen on biopsy of the tongue lesion?

- A. Fibrovascular cores surrounded by squamous epithelium (18%)
- B. Glandular structures with droplets of mucin (5%)
- C. Inflammatory infiltrate with pseudohyphae (0%)
- ✓ D. Irregular nests of cells with keratinization (69%)
- E. Nodular proliferation of lymphocytic follicles (5%)

Omitted
Correct answer
D

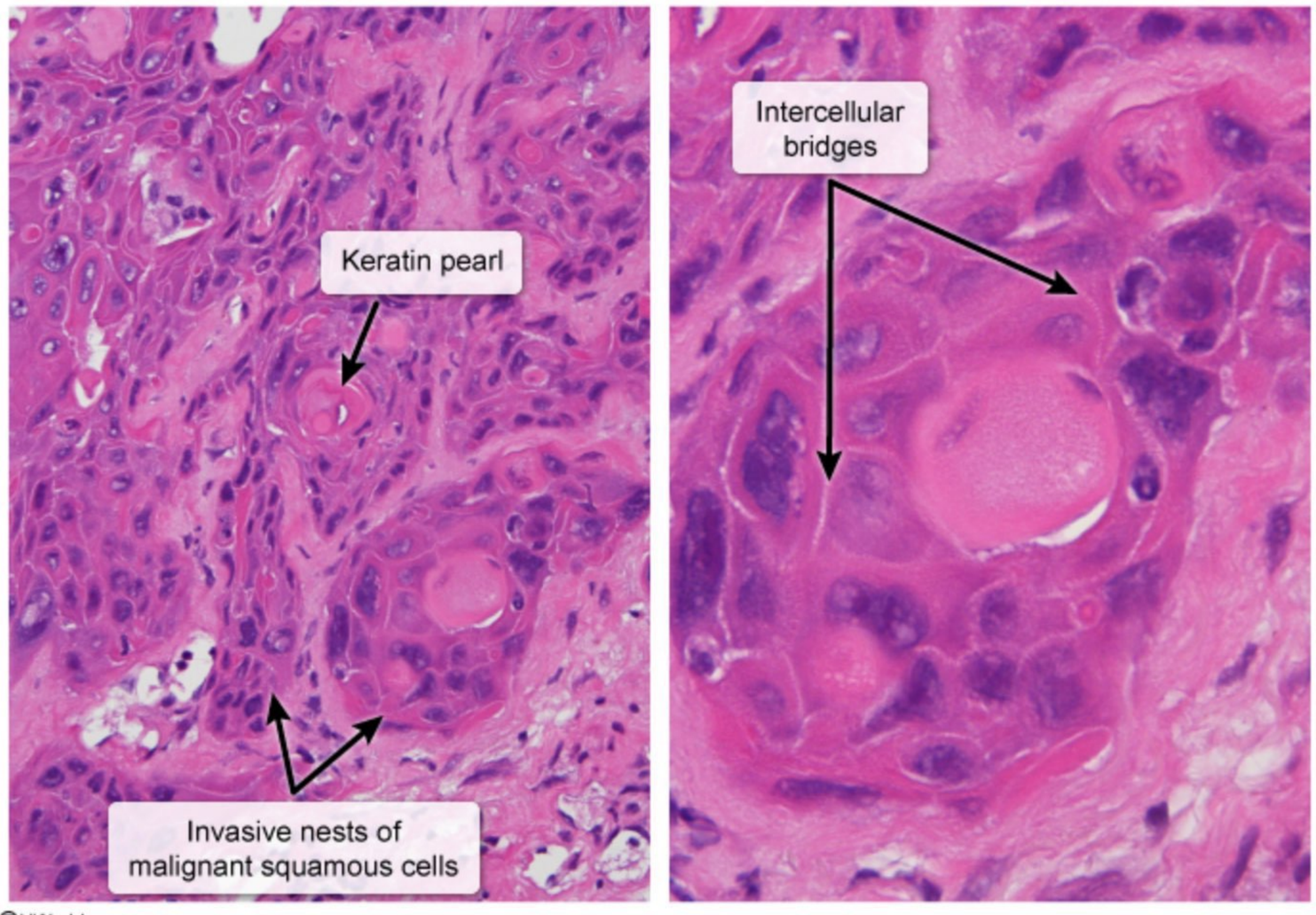
69%
Answered correctly

01 min, 46 secs
Time Spent

2023
Version

Explanation

Keratinizing squamous cell carcinoma



This patient with dysphagia, a base of tongue mass, and cervical lymphadenopathy likely has mucosal **head and neck squamous cell carcinoma** (HNSCC). HNSCC arises from the mucosa of the upper aerodigestive tract after accrual of multiple somatic mutations, often caused by the mutagens found in **tobacco**. Other risk factors for HNSCC include age >40, alcohol use, and immunocompromised status. There has also been a dramatic increase in HNSCC due to **human papillomavirus** (HPV), which may be seen in younger, nonsmoking patients

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Characteristic pathologic findings of HNSCC include nests and sheets of polygonal cells with abundant eosinophilic cytoplasm that invade the submucosa and surrounding structures; **intercellular bridges** and keratin pearls (ie, foci of **keratinization**) may be seen on light microscopy.

(Choice A) Squamous papillomas are benign tumors that have fibrovascular cores surrounded by squamous epithelium. They can occur in the mucosa of the upper aerodigestive tract but would not spread to regional lymph nodes as they are not malignant.

(Choice B) Adenocarcinomas arise due to mutation of glandular cells and often retain glandular features and some glandular functions, including the production of mucin. The mucosa of the head and neck is made of stratified squamous cells; therefore, cancers arising from this region often retain some features of squamous cells (eg, production of keratin).

(Choice C) Oral candidiasis (ie, thrush) often has an inflammatory infiltrate with pseudohyphae and can present with oral lesions. However, oral candidiasis characteristically appears as white plaques on an erythematous base throughout the mucosa. It does not form a palpable mass or cause firm cervical adenopathy.

(Choice E) Although non-Hodgkin lymphoma, such as follicular lymphoma (characterized by nodular proliferation of lymphocytic follicles), can rarely present in a tonsil, it is unlikely to occur in the base of tongue and is overall much less common than HNSCC, especially in a patient age >60 with a long history of tobacco use.

Educational objective:

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Educational objective:
Head and neck squamous cell carcinoma is likely in a patient with cervical adenopathy and a base of tongue mass, especially with a history of tobacco use. Classic histologic findings include intercellular bridges and keratin pearls.

Pathology	Ear, Nose & Throat (ENT)	Head and neck cancers
Subject	System	Topic

A 33-year-old man comes to the office due to trouble swallowing and a chronic sore throat. He has no chronic medical conditions and does not use tobacco or alcohol. Physical examination shows an enlarged, ulcerated right tonsil. Biopsy of the ulcerated lesion reveals infiltrating nests of moderately differentiated squamous cells. Immunohistochemistry is positive for p16, suggesting that the tumor is likely due to human papilloma virus. Further imaging studies for cancer staging are planned. This patient's tumor is most likely to spread first to which of the following locations?

- A. Adenoid tissue (35%)
- B. Adrenal glands (1%)
- C. Gray-white matter junction (1%)
- ✓ D. Jugular lymph nodes (56%)
- E. Lung parenchyma (4%)
- F. Vertebral bodies (1%)

Omitted
Correct answer
D

56%
Answered correctly

02 secs
Time Spent

2023
Version

Explanation

Most **carcinomas**, including head and neck squamous cell carcinoma, **spread first** from the primary site of the tumor to **regional lymph nodes** via the **lymphatics**. In this patient with a tonsillar squamous cell carcinoma,

Most **carcinomas**, including head and neck squamous cell carcinoma, **spread first** from the primary site of the tumor to **regional lymph nodes** via the **lymphatics**. In this patient with a tonsillar squamous cell carcinoma, this spread would be to the upper anterior cervical (ie, jugular) lymph nodes. Assessment of regional lymph node status is important for tumor staging based on the **TNM staging system**, which evaluates the size and characteristics of the **T**umor, regional lymph **N**ode involvement, and distant **M**etastases.

(Choice A) Similar to the tonsils, adenoid tissue is also lymphatic tissue in the head and neck that can harbor a primary site of head and neck squamous cell carcinoma. However, it is located in the nasopharynx rather than the oropharynx. The spread of cancer is typically to regional lymph nodes rather than to other mucosal sites in the head and neck.

(Choices B, C, and F) Although these are possible sites of distant cancer metastases, they are less commonly associated with metastatic head and neck cancer. Common primary sources for metastases to these sites include:

- Adrenal gland metastases: breast cancer, renal cell carcinoma, and melanoma
- Brain metastases (gray-white matter junction): lung cancer
- Vertebral body metastases: prostate cancer

However, the first site of spread of most carcinomas (including head and neck cancer) is the regional lymph nodes.

(Choice E) The lung parenchyma is the most common site for distant metastases from head and neck cancer. However, regional lymph node spread is typically seen first.

Educational objective:

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(Choice E) The lung parenchyma is the most common site for distant metastases from head and neck cancer. However, regional lymph node spread is typically seen first.

Educational objective:
Head and neck squamous cell carcinomas typically spread first to the anterior cervical (ie, jugular) lymph nodes via the lymphatics. Distant spread occurs after regional lymph node involvement.

References

- Incidence and sites of distant metastases from head and neck cancer.

Anatomy	Ear, Nose & Throat (ENT)	Lymphatic drainage
Subject	System	Topic

A 23-year-old man has 2 days of fever, cough, sore throat, and runny nose. His temperature is 38 C (100.4 F). Lung sounds are clear to auscultation. A nasopharyngeal swab is obtained. Naked viral particles are seen, and purified RNA molecules are extracted from these particles. Once introduced into human cells, the purified RNA molecules induce viral protein synthesis and viral genome replication. Which of the following is the most likely cause of this patient's symptoms?

- A. HIV (5%)
- B. Influenza virus type A (16%)
- C. Respiratory syncytial virus (6%)
- ✓ D. Rhinovirus (68%)
- E. Rotavirus (3%)

Omitted
Correct answer
D

68%
Answered correctly

01 sec
Time Spent

2023
Version

Explanation

For an RNA molecule **purified** from a virus (ie, without viral capsid or envelope) to be infectious (ie, able to induce viral protein synthesis and genome replication in the host cell) on its own, it must act as mRNA capable of using the host's intracellular machinery for translation. In other words, the purified RNA molecule must be **single-stranded** (SS) and **positive (+) sense**, or SS(+). The question describes a naked (ie, nonenveloped)

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(Choice A) HIV is a retrovirus that contains SS(+) RNA. However, viral infectivity requires the action of reverse transcriptase for integration into the host genome; purified RNA by itself cannot cause infection. In addition, HIV is enveloped, unlike the particles isolated from this patient.

(Choices B and C) Influenza A is an orthomyxovirus that contains SS(–) RNA; similarly, respiratory syncytial virus is a paramyxovirus that contains SS(–) RNA. For these viruses to replicate in a host cell, an RNA-dependent RNA polymerase must also gain entry into the host cell.

(Choice E) Rotavirus is a reovirus containing dsRNA. Its purified RNA is therefore incapable of inducing viral protein synthesis in a host cell on its own (ie, it is non-infectious). For this virus to replicate in a host cell, a specific viral RNA polymerase present in the intact virion must also gain entry into the host cell.

Educational objective:
For a purified RNA molecule to induce viral protein synthesis in a host cell, it must be able to act directly as mRNA using the host's intracellular machinery for translation. Therefore, in general, purified single-stranded positive-sense RNA can be infectious; single-stranded negative sense or double-stranded RNA is not.

Microbiology Ear, Nose & Throat (ENT) Upper respiratory tract infections

A 10-year-old girl is brought to the office due to sneezing, rhinorrhea, and nasal congestion and itching. The symptoms began 2 days ago after she arrived at a family farm for a summer vacation. The patient has spent a few days visiting the farm during previous summer seasons. She had no symptoms at her first visit 2 years ago but recalls having similar symptoms last year. She has had no respiratory symptoms while residing in another state the rest of the year. The patient has no prior medical conditions and takes no medications. On physical examination, the nasal turbinates are enlarged and bluish; clear rhinorrhea is present. Allergic response to a farm allergen is suspected. Which of the following processes most likely occurred during the first farm visit 2 years ago?

- A. Antibody receptor aggregation (24%)
- B. Complement activation (3%)
- C. Mast cell degranulation (13%)
- D. Release of interferon gamma (3%)
- ✓ E. T-lymphocyte induction (53%)

Omitted
Correct answer
E

53%
Answered correctly

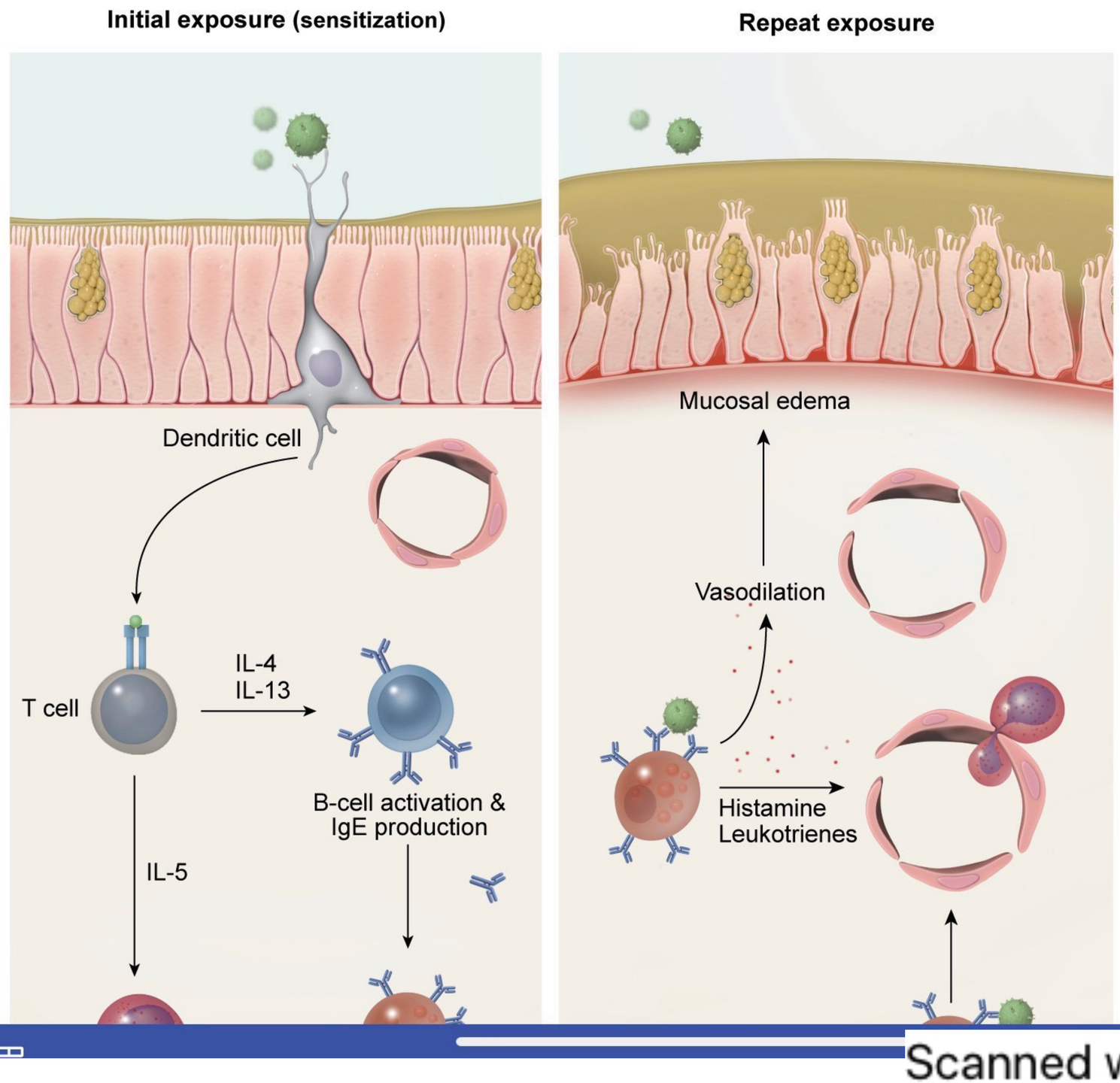
02 secs
Time Spent

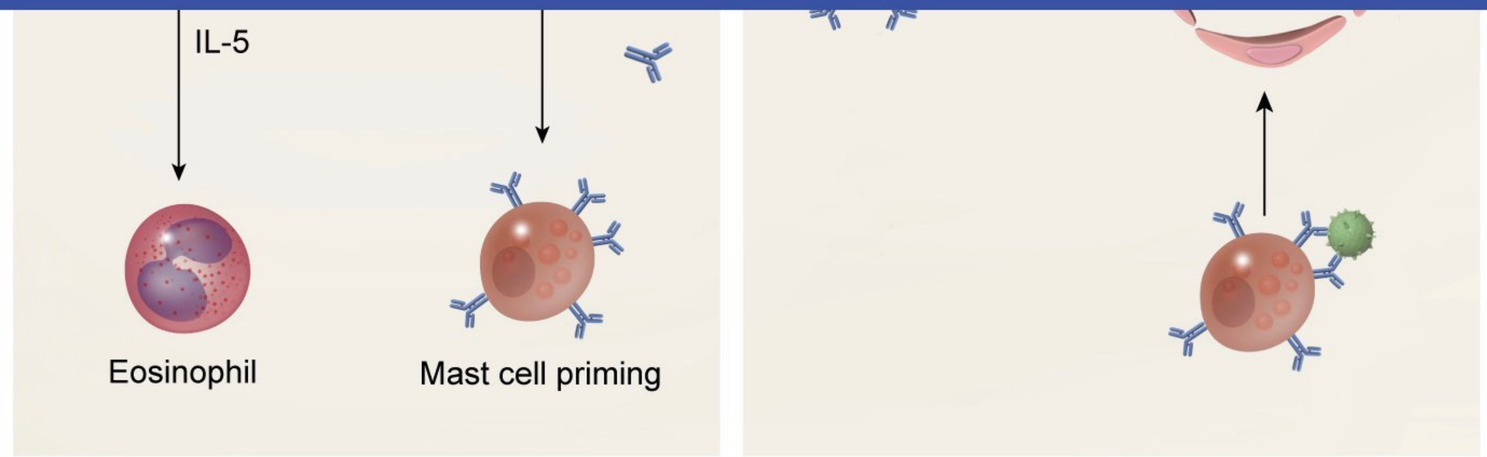
2023
Version

Explanation

Pathogenesis of allergic rhinitis

Pathogenesis of allergic rhinitis





This patient with **allergic rhinitis** (eg, location-based sneezing and rhinorrhea; bluish, congested nasal turbinates) likely became sensitized to farm allergens during her **first visit**. Allergic rhinitis is a form of type I hypersensitivity, a process that involves sensitization and elicitation phases.

Sensitization occurs when inhaled antigens penetrate the nasal epithelium and are presented on major histocompatibility complex (MHC) class II molecules, causing **activation** of naive **T-helper (Th) cells**. The release of cytokines (eg, IL-25, IL-33) from the nasal epithelium causes Th cells to differentiate into **Th2 cells** that secrete IL-4, IL-13, and other lymphokines that stimulate B cell maturation and production of **IgE antibodies**. Antigen-specific IgE antibodies then bind to the high-affinity IgE receptor on mast cells, priming the patient for an allergic response.

Repeat exposure to the inhaled antigens (eg, on subsequent visits to the farm) cross-links IgE antibodies on the surface of the mast cell, leading to IgE receptor aggregation, which causes mast cell degranulation **(Choices A and C)**. This releases histamine and other vasoactive mediators that lead to nasal inflammation, producing the allergic response. Subsequent exposure to the same antigen can lead to further allergen priming, worsening symptoms over time.

(Choice B) Complement activation occurs in type III hypersensitivity reactions, in which immune complexes

histocompatibility complex (MHC) class II molecules, causing **activation** of naive **T-helper (Th) cells**. The release of cytokines (eg, IL-25, IL-33) from the nasal epithelium causes Th cells to differentiate into **Th2 cells** that secrete IL-4, IL-13, and other lymphokines that stimulate B cell maturation and production of **IgE antibodies**. Antigen-specific IgE antibodies then bind to the high-affinity IgE receptor on mast cells, priming the patient for an allergic response.

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(Choice B) Complement activation occurs in type III hypersensitivity reactions, in which immune complexes deposit in the basement membrane of small blood vessels in the skin, kidneys, or joints, resulting in vasculitis. Complement does not play a significant role in type I hypersensitivity.

(Choice D) Interferon gamma is secreted by Th1 cells, which activates macrophages and, along with IL-2, stimulates $CD8^+$ cytotoxic cells. It inhibits, rather than enhances, the Th2 cell activity that drives type I hypersensitivity reactions (eg, allergic rhinitis).

Educational objective:
Sensitization to aeroallergens occurs when inhaled antigens induce T-helper (Th) cells to differentiate into Th2 cells. Th2 cells then promote B-cell maturation and isotype class switching to IgE.

Immunology	Ear, Nose & Throat (ENT)	Rhinitis
Subject	System	Topic

A 48-year-old woman comes to the office due to an intermittent ear discharge over the last 2 years. She has also noticed decreased hearing in the right ear recently. Past medical history is significant for obesity, hyperlipidemia, seasonal allergies, and diet-controlled diabetes mellitus. Otoscopy shows a small perforation in the right tympanic membrane and a pearly mass behind the membrane. Conduction hearing loss is noted in the right ear. The remainder of the ear, nose, and throat examination is normal. Which of the following is the most likely cause of this patient's aural mass?

- A. Cholesterol and lipid accumulation (39%)
- B. Facial nerve neuroma (10%)
- C. Malignant squamous cell neoplasm (6%)
- D. Noncaseating granuloma (5%)
- ✓ E. Squamous cell debris (37%)

Omitted
Correct answer
E

37%
Answered correctly

01 sec
Time Spent

2023
Version

Explanation

Cholesteatomas are collections of squamous cell debris that form a round, **pearly mass** behind the tympanic membrane in the middle ear. They can occur congenitally or may develop in adults as either an acquired primary lesion or secondary to infection, trauma, or surgery of the middle ear. Primary cholesteatomas are a

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Cholesteatomas most commonly cause painless otorrhea. They also can produce lytic enzymes and are often discovered when they erode through the auditory ossicles, causing conductive **hearing loss**. If a mass grows sufficiently large, it can erode into the vestibular apparatus or facial nerve, causing vertigo or facial palsies.

(Choice A) Cholesterol granulomas can form in the middle ear after hemorrhage but are much less common than cholesteatomas. They appear as bluish-black gelatinous material behind the tympanic membrane. Despite what the name implies, cholesteatomas do not contain any lipid or cholesterol components.

(Choice B) A facial nerve neuroma can grow in the middle ear as the facial nerve courses through this territory. However, it would present with unilateral facial paralysis.

(Choice C) Squamous cell carcinoma is the most common malignant tumor of the ear canal. It typically appears as an ulcerated plaque or nodule. The most common symptom is local or regional pain.

(Choice D) Granulomatous disease of the ear can occur but is uncommon and usually develops in conjunction with a systemic disease, such as sarcoidosis, granulomatosis with polyangiitis, or Langerhans cell histiocytosis.

Educational objective:
Cholesteatomas are collections of squamous cell debris that form a mass behind the tympanic membrane.

result of chronic negative pressure in the middle ear causing retraction pockets in the tympanic membrane that become cystic; as the **squamous cell debris** accumulates, a cholesteatoma is formed. Secondary cholesteatomas occur after squamous epithelium migrates to or is implanted in the middle ear ("skin in the wrong place").

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Educational objective:
Cholesteatomas are collections of squamous cell debris that form a mass behind the tympanic membrane. Cholesteatomas can be congenital or may occur as an acquired primary lesion or following infection, trauma, or surgery of the middle ear. They can cause hearing loss due to erosion into auditory ossicles.

References

A 50-year-old man comes to the office due to a lump in his neck that has been present for 4 months and is enlarging. On examination, there is a firm, nontender, nonmobile mass in the right anterior neck. Otoscopic examination shows a clear right middle ear effusion. Needle biopsy of the neck mass is consistent with regional nodal spread of squamous cell carcinoma. Which of the following is the most likely site of the primary tumor?

- A. Base of tongue (25%)
- ✓ B. Nasopharynx (43%)
- C. Parotid gland (7%)
- D. Piriform sinus (3%)
- E. Thyroid gland (5%)
- F. Vocal cord (14%)

Omitted
Correct answer
B

43%
Answered correctly

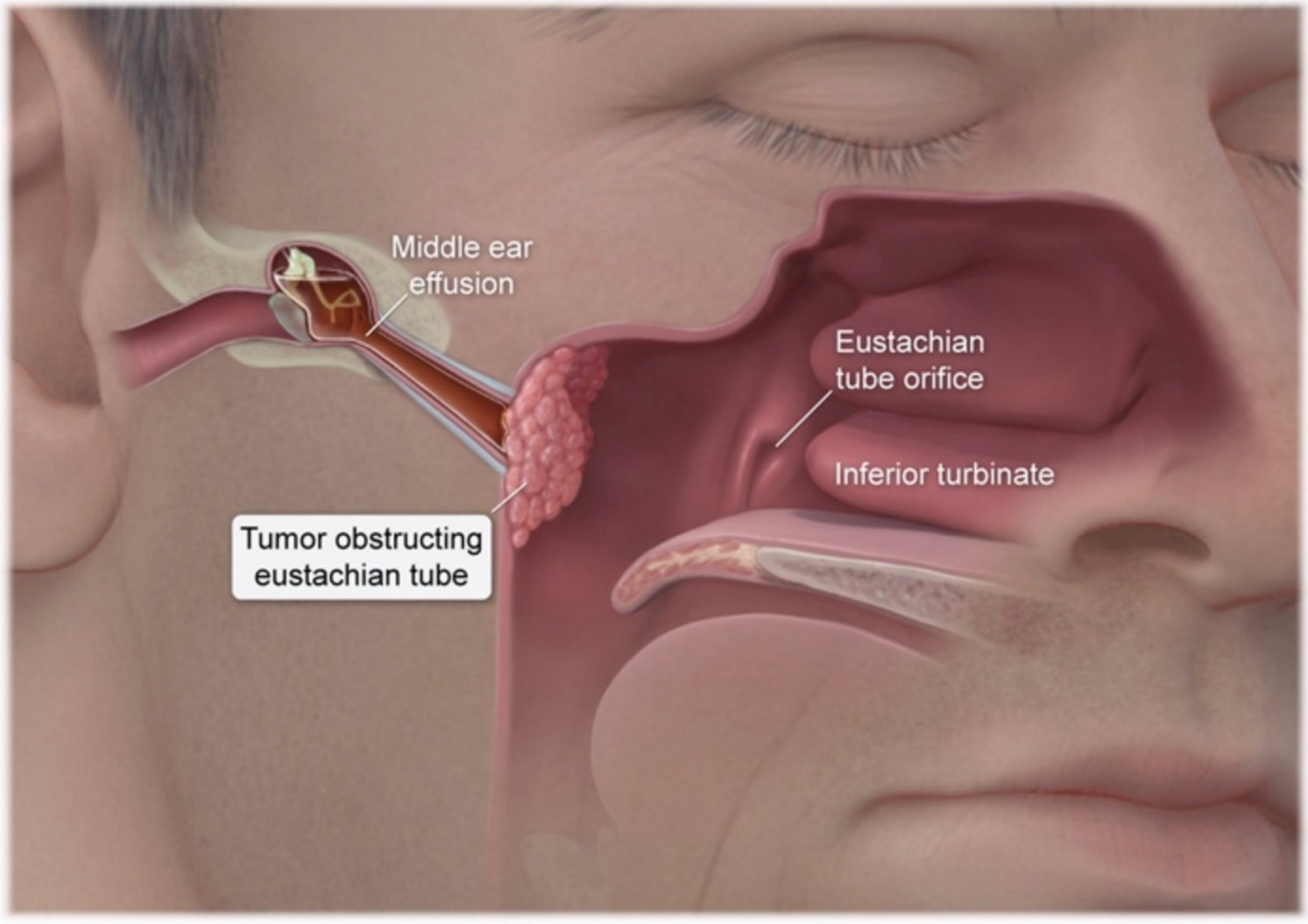
01 sec
Time Spent

2023
Version

Explanation

Middle ear effusion due to nasopharyngeal carcinoma

Middle ear effusion due to nasopharyngeal carcinoma



Squamous cell carcinoma that originates in the mucosa of the head and neck typically spreads first to the **anterior cervical lymph nodes**. An enlarged, firm cervical lymph node is often the presenting symptom of head and neck squamous cell carcinoma (HNSCC). Identification of the primary site of tumor formation is important for staging and to guide treatment strategies.

Squamous cell carcinoma that originates in the mucosa of the head and neck typically spreads first to the **anterior cervical lymph nodes**. An enlarged, firm cervical lymph node is often the presenting symptom of head and neck squamous cell carcinoma (HNSCC). Identification of the primary site of tumor formation is important for staging and to guide treatment strategies.

This patient's **unilateral middle ear effusion** suggests **obstruction** of the **eustachian tube**, which connects the middle ear space to the nasopharynx. It opens intermittently, typically during swallowing or yawning to equalize pressure in the middle ear. Failure to adequately open causes negative pressure to build within the middle ear, leading to a transudative effusion (clear, amber, or yellow). Eustachian tube dysfunction can be due to anatomic obstruction from a **mass in the nasopharynx** or, more commonly, due to functional obstruction from infections, allergic rhinitis, or irritants (eg, tobacco smoke).

(Choices A, D, and F) HNSCC can originate from the mucosa of other anatomic sites. Many sites (eg, base of tongue, piriform sinus) initially cause only vague or minor symptoms, but some may present with more specific features (eg, hoarseness in vocal cord cancer). Cancer at any of these other sites (ie, base of tongue, piriform sinus, vocal cord) would not lead to obstruction of the eustachian tube with a resultant middle ear effusion.

(Choice C) Cancer of the parotid gland may spread to the cervical lymph nodes. The superior portion of the parotid gland is near the external auditory canal of the ear, not the eustachian tube. In addition, because the parotid gland is near the skin surface, primary tumors of the parotid are typically palpable.

(Choice E) Cancer of the thyroid gland may spread to the cervical lymph nodes. However, it is very rare to have squamous cell carcinoma in the thyroid, and enlargement of the thyroid gland would not block the eustachian tube.

Educational objective:
The eustachian tube connects the middle ear to the nasopharynx. Cancer located in the nasopharynx can lead

middle ear space to the nasopharynx. It opens intermittently, typically during swallowing or yawning to equalize pressure in the middle ear. Failure to adequately open causes negative pressure to build within the middle ear, leading to a transudative effusion (clear, amber, or yellow). Eustachian tube dysfunction can be due to anatomic obstruction from a **mass in the nasopharynx** or, more commonly, due to functional obstruction from infections, allergic rhinitis, or irritants (eg, tobacco smoke).

(Choices A, D, and F) HNSCC can originate from the mucosa of other anatomic sites. Many sites (eg, base of tongue, piriform sinus) initially cause only vague or minor symptoms, but some may present with more specific features (eg, hoarseness in vocal cord cancer). Cancer at any of these other sites (ie, base of tongue, piriform sinus, vocal cord) would not lead to obstruction of the eustachian tube with a resultant middle ear effusion.

(Choice C) Cancer of the parotid gland may spread to the cervical lymph nodes. The superior portion of the parotid gland is near the external auditory canal of the ear, not the eustachian tube. In addition, because the parotid gland is near the skin surface, primary tumors of the parotid are typically palpable.

(Choice E) Cancer of the thyroid gland may spread to the cervical lymph nodes. However, it is very rare to have squamous cell carcinoma in the thyroid, and enlargement of the thyroid gland would not block the eustachian tube.

Educational objective:
The eustachian tube connects the middle ear to the nasopharynx. Cancer located in the nasopharynx can lead to obstruction of the eustachian tube, causing a middle ear effusion.

Anatomy	Ear, Nose & Throat (ENT)	Head and neck cancers
Subject	System	Topic

A 1-year-old boy is brought to the clinic for a painful mass in the neck. The parents noticed a small area of nontender swelling in the neck a month ago. Over the last few days, it has enlarged and become painful, and the patient has a fever. Examination shows a mobile, tender, fluctuant, and warm mass approximately 2 cm in diameter that is located at the right mandibular angle. There is purulent drainage from the skin surface just anterior to the right sternocleidomastoid muscle. This patient's clinical findings are most likely due to which of the following embryologic processes?

- A. Failed descent of a pharyngeal pouch structure (14%)
- B. Failed neural crest migration into a pharyngeal arch (5%)
- C. Inadequate fusion of the mandibular prominences (7%)
- ✓ D. Incomplete obliteration of a pharyngeal groove (44%)
- E. Persistence of the thyroglossal duct (27%)

Omitted
Correct answer
D

44%
Answered correctly

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2023
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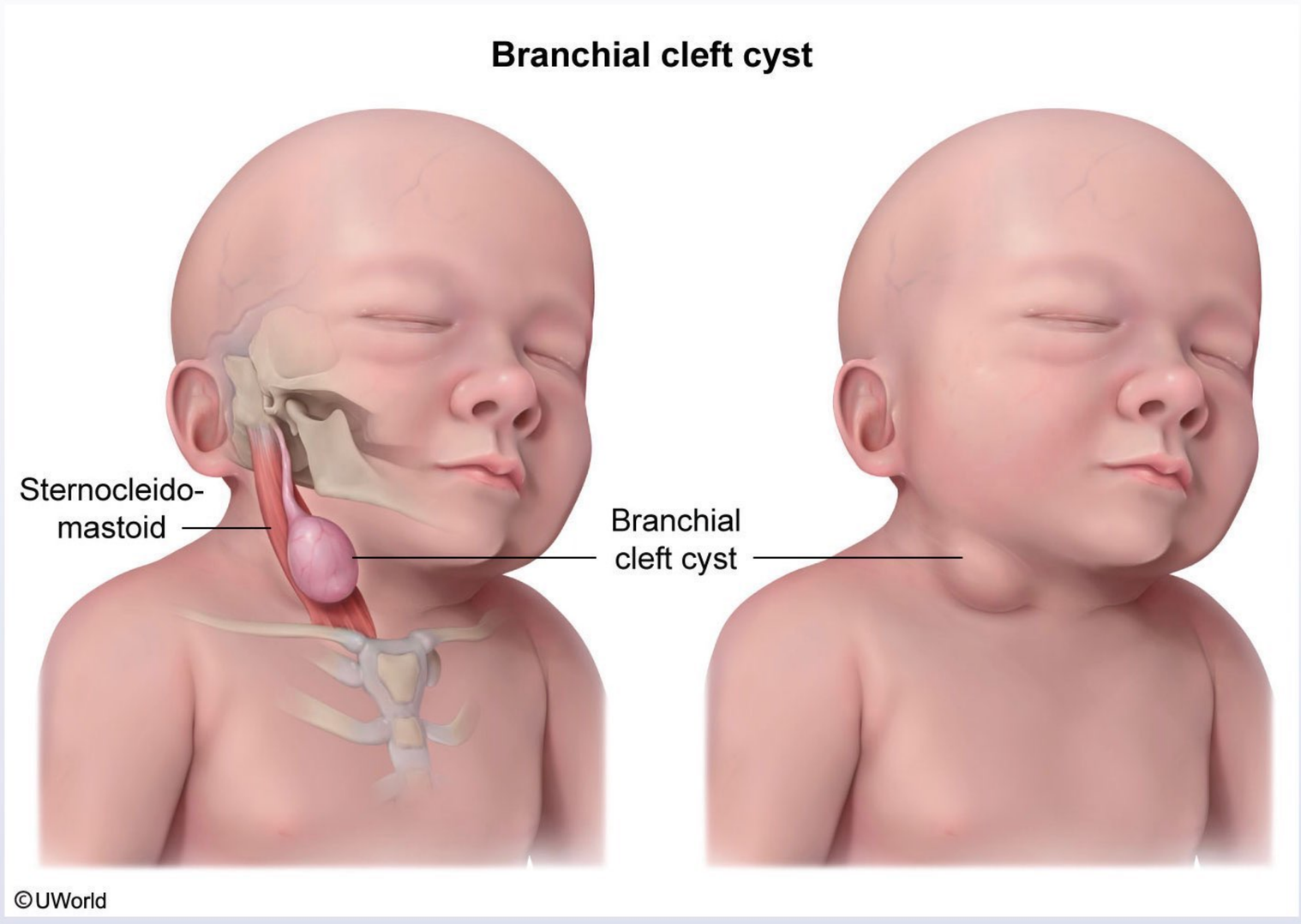
Explanation

Branchial cleft cyst



This patient's neck mass anterior to the sternocleidomastoid muscle is likely an infected **branchial cleft cyst**. This congenital anomaly is related to abnormal in utero development of the pharyngeal apparatus, an early embryologic structure comprising the following:

- Pharyngeal (or branchial) arches: Six pairs of arches are precursors to the bones, muscles, and vasculature of the face, neck, and pharynx.

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- Pharyngeal (or branchial) arches: Six pairs of arches are precursors to the bones, muscles, and vasculature of the face, neck, and pharynx.
- Pharyngeal pouches: The inner surface of the arches is lined by endoderm, and the pockets created by each arch are pouches, which differentiate into distinct fetal structures (eg, third pouch forms the thymus).
- **Pharyngeal clefts** (or grooves): The outer surface of the arches is lined by ectoderm, and the clefts are the recesses between the arches. Most clefts **obliterate**; for example, the second, third, and fourth clefts merge to form the cervical sinus, which then involutes.

Failed obliteration of a pharyngeal cleft leaves a pathologic remnant in a predictable anatomic location. This patient likely has the most common type, a second pharyngeal groove anomaly (branchial cleft cyst), which is characteristically located **anterior** to the **sternocleidomastoid muscle**. The cyst is often unrecognized until **secondary infection** leads to a tender, fluctuant mass with or without purulent drainage (ie, sinus, fistula).

(Choice A) The parathyroid glands are derivatives of the third and fourth pharyngeal pouches; failure to descend to their anatomic position leads to ectopic glands. An associated adenoma can lead to symptoms of persistent hyperparathyroidism (eg, bone disease, nephrolithiasis), not a fluctuant mass and drainage.

(Choice B) Failed neural crest cell migration to the pharyngeal arches would affect development of skeletal structures of the face and neck (eg, bone, cartilage) and would not explain a cystic mass.

(Choice C) Inadequate fusion of the mandibular prominences (derivatives of the first pharyngeal arch) is rare and affects development of the lower lip, lower jaw, and tongue, findings not seen in this patient.

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(Choice E) In utero, the thyroid gland descends from the base of the tongue to its final position down the thyroglossal duct, which then obliterates. A persistent thyroglossal duct can lead to a cyst along the path of descent that can become secondarily infected, but the cyst would be midline.

Educational objective:
Branchial cleft cysts are most often located anterior to the sternocleidomastoid muscle and result from incomplete obliteration of a pharyngeal cleft (or groove). Patients typically have a tender, fluctuant mass (due to secondary infection) with or without purulent drainage.

Embryology	Ear, Nose & Throat (ENT)	Branchial cleft cysts
Subject	System	Topic

A 42-year-old woman comes to the office due to dizziness. She has a 6-month history of episodic bouts where she experiences a spinning sensation associated with nausea and ringing in her left ear. The patient also has difficulty hearing while holding her phone to the left ear, although hearing in the right ear is normal. The dizziness improves spontaneously and she feels fine between episodes. Past medical history is notable for hypothyroidism, for which she is on thyroid replacement therapy, and endometriosis, which led to a hysterectomy at age 38. The patient works as a supermarket manager. She does not use tobacco or drink alcohol.
This patient's condition is most likely the result of which of the following pathologic processes?

- A. Demyelination in the CNS (3%)
- ✓ B. Increased volume of endolymph in the inner ear (63%)
- C. Inflammation of the vestibular labyrinth (15%)
- D. Mass lesion at the cerebellopontine angle (10%)
- E. Sclerosis of the ossicles (6%)

Omitted
Correct answer
B

63%
Answered correctly

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Time Spent

2023
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Explanation

Common causes of vertigo		

Common causes of vertigo

	Cause	Features
Ménière disease	• Increased pressure & volume of endolymph	• Recurrent vertigo • Ear fullness/pain • Unilateral hearing loss & tinnitus
BPPV	• Otoliths in semicircular canals	• Brief episodes brought on by head movement • No auditory symptoms
Vestibular neuritis (labyrinthitis)	• Inflammation of vestibular nerve (viral or postviral)	• Single episode of severe vertigo that can last for days • Termed labyrinthitis when associated with unilateral hearing loss

BPPV = benign paroxysmal positional vertigo.

This patient has classic features of **Ménière disease**, including:

- **vertigo**, the subjective sensation of spinning or motion in the absence of actual motion; commonly associated with nausea and vomiting
- unilateral **sensorineural hearing loss**, which initially completely resolves between episodes but usually worsens over time
- unilateral low-frequency **tinnitus**, often accompanied by a feeling of ear fullness

Ménière disease is a disorder of the inner ear characterized by increased volume and pressure of endolymph (**endolymphatic hydrops**) that is thought to be due to defective resorption of endolymph. The resultant distension of the endolymphatic system causes damage to the vestibular and cochlear components of the inner ear.

(Choice A) Multiple sclerosis is characterized by patchy demyelinating lesions in the CNS that are disseminated in space and time. Although this patient's symptoms are disseminated in time (ie, episodic), they are not disseminated in space because all symptoms can be explained by a single lesion impacting the inner ear. The classic triad of episodic vertigo, hearing loss, and tinnitus with aural fullness is much more consistent with Ménière disease.

(Choice C) Labyrinthitis is inflammation of the labyrinth and vestibular nerve that causes acute-onset hearing loss and vertigo, often accompanied by nausea and vomiting (if no hearing loss is present, it is called vestibular neuritis). It usually occurs in a single episode following a viral syndrome; symptoms typically last one to two days.

(Choice D) A mass lesion at the cerebellopontine angle is most commonly an acoustic neuroma (schwannoma of CN VIII). An acoustic neuroma classically presents with unilateral progressive hearing loss. Although vertigo and tinnitus could also be present, symptoms are usually persistent and progressive rather than episodic.

(Choice E) Otosclerosis is an inherited condition seen in middle age. Patients develop progressive conductive hearing loss due to bony overgrowth and fixation of the footplate of the stapes. Because it impacts the middle ear (vs inner ear in Ménière disease), vertigo does not occur.

Educational objective:
Ménière disease is characterized by episodic vertigo, sensorineural hearing loss, and tinnitus with aural fullness.

distension of the endolymphatic system causes damage to the vestibular and cochlear components of the inner ear.

(Choice A) Multiple sclerosis is characterized by patchy demyelinating lesions in the CNS that are disseminated in space and time. Although this patient's symptoms are disseminated in time (ie, episodic), they are not disseminated in space because all symptoms can be explained by a single lesion impacting the inner ear. The classic triad of episodic vertigo, hearing loss, and tinnitus with aural fullness is much more consistent with Ménière disease.

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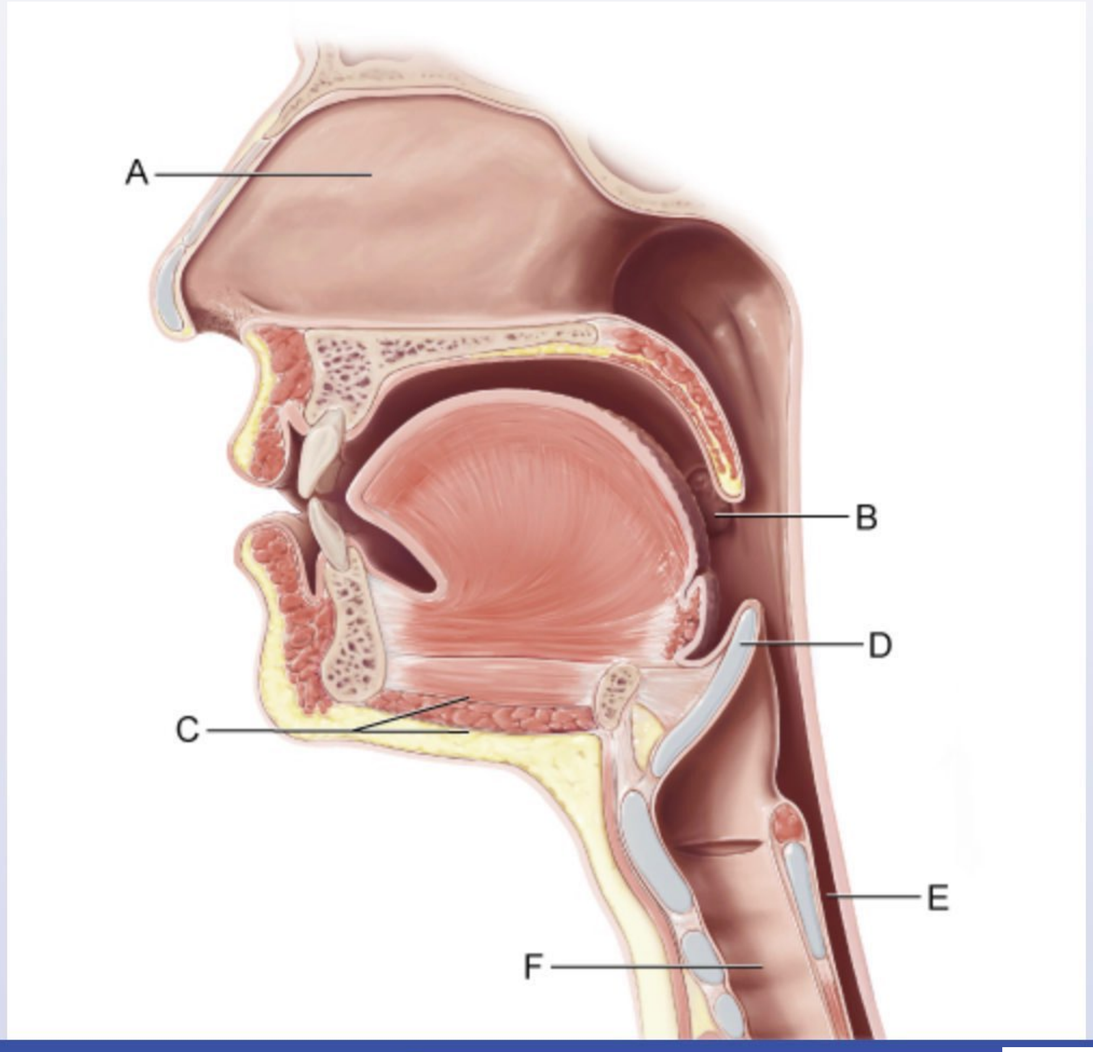
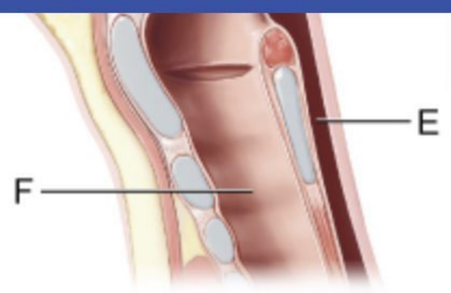
Educational objective:
Ménière disease is characterized by episodic vertigo, sensorineural hearing loss, and tinnitus with aural fullness. Its pathogenesis is related to an increased volume and pressure of endolymph in the vestibular apparatus.

References

- Endolymphatic hydrops: pathophysiology and experimental models

A 20-month old girl is brought to the emergency department for difficulty breathing. The patient has had rhinorrhea and nasal congestion for the past 2 days. She developed a cough and noisy breathing this evening. Medical history is otherwise negative. She is growing well, meeting milestones, and up-to-date on immunizations. On examination, the patient has suprasternal and intercostal retractions, inspiratory stridor, and a barking cough. Inflammation and edema of which of the following sites is most likely causing this patient's stridor?





- A. A (0%)
- B. B (10%)
- C. C (0%)
- D. D (40%)
- E. E (5%)
- ✓ F. F (42%)

Omitted
Correct answer
F

42%
Answered correctly

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Time Spent

2023
Version

Explanation

Mouth & throat anatomy