1. A 2-month-old male infant had a small pit at the anterior border of the sternocleidomastoid muscle, with mucus dripping intermittently from the opening. The pit extended to the tonsillar fossa as a branchial fistula. Which of the following embryologic structure(s) is (are) involved in this anomaly?
   - A. Second pharyngeal arch
   - B. Second pharyngeal pouch and groove
   - C. Third pharyngeal pouch
   - D. Thyroglossal duct
   - E. Second pharyngeal pouch and cervical sinus

2. A 2-day old infant was born with a cleft palate. The major portion of the palate develops from which of the following embryonic structures?
   - A. Lateral palatine process
   - B. Median palatine process
   - C. Intermaxillary segment
   - D. Median nasal prominences
   - E. Frontonasal eminence

3. A 3-day-old infant has a small area of the right iris missing, and a diagnosis of coloboma of the iris is made. Which of the following is the most likely embryologic cause of the coloboma?
   - A. Failure of the retinal/choroid fissure to close
   - B. Abnormal neural crest formation
   - C. Abnormal interactions between the optic vesicle and ectoderm
   - D. Posterior chamber cavitation
   - E. Weak adhesion between the inner and outer layers of the optic vesicle

4. Early closure of the fontanelles of the infant skull can result in compression of the brain, restricting brain growth. Which of the following fontanelles is located at the junction of sagittal and coronal sutures and at what age does this fontanelle typically close?
   - A. Posterior fontanelle, which closes at about 2 years
   - B. Mastoid fontanelle, which closes at about 16 months
   - C. Lambdoid fontanelle, which closes at 8 months to 1 year
   - D. Sphenoidal fontanelle, which closes at 3 years
   - E. Anterior fontanelle, which closes at 18 months

5. A 3-year-old boy is admitted to the hospital because of a soft, anterior, midline cervical mass. When the patient is asked to protrude his tongue, the mass in the neck is observed to move upward. Which of the following is the most likely diagnosis?
   - A. A thyroglossal duct cyst
   - B. Defect in sixth pharyngeal arch
A 2-day-old infant male has a noticeable gap in his upper lip. The diagnosis is a cleft lip. Failure of fusion of which of the following structures is the most likely cause of this anomaly?

- A. Lateral nasal and maxillary prominences/processes
- B. Medial nasal prominences/processes
- C. Lateral nasal and medial nasal prominences/processes
- D. Lateral prominences/processes
- E. Maxillary prominences/processes and the intermaxillary segment

A 3-day-old male has a noticeably small mandible. A CT scan and physical examinations reveal hypoplasia of the mandible, cleft palate, and defects of the eye and ear. Abnormal development of which of the following pharyngeal arches will most likely produce such symptoms?

- A. First arch
- B. Second arch
- C. Third arch
- D. Fourth arch
- E. Sixth arch

A 5-day-old infant male has an abnormally large head. A CT scan examination reveals enlarged lateral and third ventricles but a normal-size fourth ventricle. Stenosis of the cerebral aqueduct (of Sylvius) is suspected. Which of the following conditions will be characteristic of these symptoms?

- A. Nonobstructive hydrocephalus
- B. Anencephaly
- C. Obstructive hydrocephalus
- D. Meroanencephaly
- E. Holoprosencephaly

A 3-month-old male infant has a lump in his neck. A biopsy of the lump shows it to be thymic tissue. Based on embryonic origin, which of the following additional structures is most likely to have an ectopic location?

- A. Jugulodigastric lymph node
- B. Lingual tonsil
- C. Parathyroid gland
- D. Submandibular gland
- E. Thyroid gland

A 3-month-old male is under observation in the pediatric clinic. The patient has no thymus, congenital parathyroidism, and thyroid hypoplasia. Abnormal development of which of the following pharyngeal pouches or arches will most likely produce these defects?

- A. First and second
- B. Second and third
- C. Third and fourth
- D. Fourth
- E. Fourth and sixth

Cleft lip, with or without cleft palate occurs about once in 1000 births. Which of the following is considered to be the most important causative factor in the production of this anomaly?

- A. Riboflavin deficiency
- B. Infectious disease
- C. Mutant genes
- D. Cortisone administration during pregnancy
- E. Irradiation

A 5-week-old male infant is born without a thymus or inferior parathyroid glands. Which of the following pharyngeal arches is most likely involved?

- A. First
- B. Second
- C. Third
- D. Fourth
- E. Fifth

A 5-day-old infant was born with a laryngeal defect. The greater cornu and the inferior part of the hyoid bone were absent at birth. Failure of development of which of the following embryonic structures most likely led to these defects?

- A. Maxillary prominence
- B. Mandibular prominence
- C. Second pharyngeal arch
- D. Third pharyngeal arch
- E. Fourth pharyngeal arch

A 22-year-old woman visits the outpatient clinic with a painless swelling on the right side of her neck. A CT scan examination reveals a well-defined cystic mass at the angle of the mandible, just anterior to the sternocleidomastoid muscle. What is the most likely diagnosis?

- A. Dermoid cyst
- B. Inflamed lymph node
- C. Accessory thyroid node
D. Thyroglossal duct cyst
E. Lateral cervical cyst

15 A 5-day-old infant is diagnosed with a noncommunicating hydrocephalus (Fig. 7-1). Which of the following is most likely to lead to such a condition?
A. Obstruction in the circulation of the cerebrospinal fluid
B. Excess production of cerebrospinal fluid
C. Increased size of the head
D. Disturbances in the resorption of cerebrospinal fluid
E. Failure of the neural tube to close

16 A 5-day-old infant was born with a normal Apgar score. One month later the external acoustic meatus was atretic. Which of the following conditions was the most likely cause of this defect?
A. Otic pit did not form.
B. Development of the first pharyngeal pouch was affected.
C. Meatus plug did not canalize.
D. Auricular hillocks did not develop.
E. The tubotympanic recess degenerated.

17 A 50-year-old woman complained of pain over her chin and lower lip. A few days later small vesicles appeared over the same area and soon began erupting. She was diagnosed with a dermatomal herpes zoster inflammation (shingles). Which of the following nerves was most likely responsible for the transmission of the virus in this case?
A. Auriculotemporal
B. Buccal
C. Lesser petrosal
D. Mental
E. Infraorbital

18 A 68-year-old woman is suffering from excruciating, sudden bouts of pain over the area of her midface. Laboratory studies indicate that she has tic douloureux (trigeminal neuralgia). Which ganglion is the location of the neural cell bodies of the nerve mediating the pain?
A. Geniculate
B. Trigeminal (semilunar or Gasserian)
C. Inferior glossopharyngeal
D. Otic
E. Pterygopalatine

19 A 17-year-old woman is admitted to the hospital with signs of cavernous sinus thrombosis, as revealed by radiographic and physical examinations. Thrombophlebitis in the “danger area” of the face can spread to the cavernous sinus and involve the ophthalmic branch of the trigeminal nerve. Which of the following symptoms will most likely be present during physical examination?
A. Pain in the hard palate
B. Anesthesia of the upper lip
C. Pain from the eyeball
D. Pain over the lower eyelid
E. Tingling sensation over the buccal region of the face

20 A 34-year-old man is admitted to the hospital with severe headaches, dizziness, and vomiting. Imaging studies reveal a tumor at the hypoglossal canal. Which of the following muscles will most likely be affected?
A. Geniohyoid
B. Mylohyoid
C. Palatoglossus
D. Genioglossus
E. Thyrohyoid

21 A 45-year-old female is admitted to the hospital with severe headaches, dizziness, and vomiting. Radiographic examination reveals an intracranial tumor. Upon physical examination the patient has dryness of the nasal and paranasal sinuses, loss of lacrimation,
and loss of taste from the anterior two thirds of the tongue. Which of the following structures is most likely involved with the tumor?

- A. Auriculotemporal nerve
- B. Lesser petrosal nerve
- C. Facial nerve
- D. Inferior salivatory nucleus
- E. Pterygopalatine ganglion

22. A 17-year-old female was admitted to the hospital with a high fever. Following intravenous administration of antibiotics, a routine CT scan revealed a “thoracic outlet” syndrome. Which symptom would most likely result from this syndrome?

- A. Problems with respiration because of pressure on the phrenic nerve
- B. Reduced blood flow to the thoracic wall
- C. Reduced venous return from the head and neck
- D. Numbness in the upper limb
- E. Distention of the internal jugular vein

23. A 31-year-old female is admitted to the hospital after an automobile collision. A CT scan examination reveals a large hematoma inferior to the right jugular foramen. Physical examination reveals right pupil constriction (miosis) and anhidrosis (loss of sweating) of the face. Which of the following ganglia is most likely affected by the hematoma?

- A. Submandibular
- B. Trigeminal (semilunar or Gasserian)
- C. Superior cervical
- D. Geniculate
- E. Ciliary

24. A 35-year-old male patient is admitted to the hospital with severe headaches. A CT scan evaluation reveals a tumor in the infratemporal fossa. Physical examination reveals loss of general sensation from the anterior two thirds of his tongue, but taste and salivation are intact. Which of the following nerves is most likely affected by the tumor?

- A. Lingual proximal to its junction with the chorda tympani
- B. Chorda tympani
- C. Inferior alveolar
- D. Lesser petrosal
- E. Glossopharyngeal

25. A 70-year-old man is admitted to the hospital with chronic headache and enlarged lymph nodes. A CT scan shows a tumor at the jugular foramen. Which of the following would be the most likely neurologic deficit?

- A. Loss of tongue movements
- B. Loss of facial expression
- C. Loss of sensation from the face and the scalp
- D. Loss of hearing
- E. Loss of gag reflex

26. A 40-year-old unconscious man is admitted to the emergency department after being hit in the head with a baseball. A CT scan examination reveals a fractured pterion and an epidural hematoma. Branches of which of the following arteries are most likely to be injured?

- A. External carotid
- B. Superficial temporal
- C. Maxillary
- D. Deep temporal
- E. Middle meningeal

27. An unconscious 48-year-old woman is admitted to the hospital. CT scan reveals a tumor in her brain. When she regains consciousness, her right eye is directed laterally and downward, with complete ptosis of her upper eyelid, and her pupil is dilated. Which of the following structures was most likely affected by the tumor to result in these symptoms?

- A. Oculomotor nerve
- B. Optic nerve
- C. Facial nerve
- D. Ciliary ganglion
- E. Superior cervical ganglion

28. A 55-year-old man is admitted to the hospital after an injury sustained at work in a factory. He presents with severe scalp lacerations, which were sutured. After three days the wound is inflamed, swollen, and painful. Between which tissue layers is the infection most likely located?

- A. The periosteum and bone
- B. The aponeurosis and the periosteum
- C. The dense connective tissue and the aponeurosis
- D. The dense connective tissue and the skin
- E. The dermis and the epidermis

29. A 36-year-old woman is admitted to the hospital with severe head injuries after a car crash. During neurologic examination her uvula is deviated to the right. Which nerve is most likely affected to result in this deviation?
A 22-year-old male is admitted to the emergency department and intubated. An endotracheal tube is passed through an opening between the vocal folds. What is the name of this opening?

- A. Piriform recess
- B. Vestibule
- C. Ventricle
- D. Valleeula
- E. Rima glottidis

A 55-year-old male has a complaint of left-sided maxillary tooth pain. A dental examination reveals no abnormalities of his teeth. During physical examination tapping on his right maxilla elicits sharp pain on the right side of his face. The patient reports that he has no allergies. Which of the following conditions will be the most likely diagnosis?

- A. Sphenoid sinusitis
- B. Anterior ethmoidal sinusitis
- C. Posterior ethmoidal sinusitis
- D. Maxillary sinusitis
- E. Frontal sinusitis

A 70-year-old man is admitted to the hospital with severe headaches. During physical examination he has difficulty coughing and swallowing. A CT scan shows a tumor affecting a cranial nerve. Which nerve is most likely affected?

- A. Mandibular
- B. Maxillary
- C. Glossopharyngeal
- D. Vagus
- E. Hypoglossal

A 7-year-old boy with a high fever is brought to the pediatrician. During physical examination the patient complains of pain in his ear. His throat appears red and inflamed, confirming the diagnosis of pharyngitis. Which of the following structures provided a pathway for the infection to spread to the tympanic cavity (middle ear)?

- A. Choanae
- B. Internal acoustic meatus
- C. External acoustic meatus
- D. Pharyngotympanic tube
- E. Pharyngeal recess

A 33-year-old woman is unconscious when she is admitted to the hospital after she fell, hitting her head. The physician in the emergency department performs a pupillary light reflex test. The integrity of which of the following nerves is being checked?

- A. Optic and facial
- B. Optic and oculomotor
- C. Maxillary and facial
- D. Ophthalmic and oculomotor
- E. Ophthalmic and facial

A 48-year-old male patient complains of diplopia (double vision). On neurologic examination he is unable to adduct his left eye and lacks a corneal reflex on the left side. Where is the most likely location of the lesion resulting in the symptoms?

- A. Inferior orbital fissure
- B. Optic canal
- C. Superior orbital fissure
- D. Foramen rotundum
- E. Foramen ovale

A 34-year-old male complains of hyperacusis (sensitivity to loud sounds). Injury to which of the following cranial nerves is responsible?

- A. Hypoglossal
- B. Facial
- C. Accessory
- D. Vagus
- E. Glossopharyngeal

A 34-year-old swimmer presents to your office with an external ear canal infection (otitis externa). The patient coughs during inspection of the external auditory meatus with a speculum. The cough results from the irritation of which nerve that innervates an area of the external auditory meatus?

- A. Vestibulocochlear
- B. Vagus
- C. Trigeminal
- D. Facial
- E. Accessory
38. A 29-year-old woman underwent a thyroidectomy. Postoperatively, the patient presented with hoarseness. Which of the following nerves was most likely injured during the operation?
- A. Internal laryngeal
- B. External laryngeal
- C. Recurrent laryngeal
- D. Superior laryngeal
- E. Glossopharyngeal

39. A 48-year-old man presents with a constricted right pupil that does not react to light. His left pupil and vision in both eyes are normal. These findings are most likely due to a lesion involving which of the following right-sided structures?
- A. Oculomotor nerve
- B. Superior cervical ganglion
- C. Nervus intermedius
- D. Edinger-Westphal nucleus
- E. Trigeminal (semilunar, Gasserian) ganglion

40. A 55-year-old woman is diagnosed with a tumor at the base of the skull, resulting in a decrease in tear production. Which of the following nerves is most likely injured?
- A. Chorda tympani
- B. Deep petrosal
- C. Greater petrosal
- D. Lesser petrosal
- E. Nasociliary

41. A 24-year-old man is admitted to the hospital after a street fight. Radiographic examination reveals an inferior (blow-out) fracture of the orbit. Orbital structures would most likely be found inferiorly in which of the following spaces?
- A. Ethmoidal sinus
- B. Frontal sinus
- C. Maxillary sinus
- D. Nasal cavity
- E. Sphenoidal sinus

42. A 35-year-old woman is hospitalized due to cavernous sinus thrombosis resulting from an infection on the face. Which of the following is the most direct route for spread of infection from the face to the cavernous sinus?
- A. Pterygoid venous plexus
- B. Superior ophthalmic vein
- C. Frontal venous plexus
- D. Basilar venous plexus
- E. Parietal emissary vein

43. A 7-year-old boy was suffering from a severe infection of the middle ear (otitis media), which spread to the mastoid air cells (mastoiditis). Surgery was required but resulted in the following: right corner of the mouth drooping, unable to close his right eye, food collection in his right oral vestibule. Which nerve was injured?
- A. Glossopharyngeal
- B. Vagus
- C. Facial
- D. Maxillary division of the trigeminal nerve
- E. Mandibular division of the trigeminal nerve

44. The arterial circle (of Willis) contributes greatly to cerebral arterial circulation when one primary artery becomes occluded by atherosclerotic disease. Which of the following vessels does not contribute to the circle?
- A. Anterior communicating artery
- B. Posterior communicating artery
- C. Middle cerebral artery
- D. Internal carotid artery
- E. Posterior cerebral artery

45. A 45-year-old woman is admitted to the hospital for severe ear pain. Physical examination reveals chronic infection of the mastoid air cells (mastoiditis). The infection can erode the thin layer of the bone between the mastoid air cells and the posterior cranial fossa and spread most commonly into which of the following venous structures?
- A. Superior sagittal sinus
- B. Inferior sagittal sinus
- C. Straight sinus
- D. Cavernous sinus
- E. Sigmoid sinus

46. A 63-year-old man with hearing loss in his left ear complains of a loss of taste and drooling from the left side of his mouth. A CT scan shows a tumor compressing the nerve entering the skull through which of the following openings?
- A. Foramen ovale
- B. Foramen rotundum
- C. Internal acoustic meatus
- D. Jugular foramen
- E. Superior orbital fissure
47 A 70-year-old man has a biopsy of a growth on his lower lip. The biopsy reveals a squamous cell carcinoma. Which lymph nodes will most likely be first involved in the spread of the cancer cells?

- A. Occipital
- B. Parotid
- C. Retropharyngeal
- D. Jugulodigastric
- E. Submental

48 A 54-year-old man is admitted to the hospital due to severe headaches. A CT examination reveals an internal carotid artery aneurysm inside the cavernous sinus. Which of the following nerves would be typically affected first?

- A. Abducens nerve
- B. Oculomotor nerve
- C. Ophthalmic nerve
- D. Maxillary nerve
- E. Trochlear nerve

49 A 24-year-old male had a third molar (wisdom tooth) extracted from his lower jaw. This resulted in the loss of general sense and taste sensation from the anterior two thirds of the tongue. This loss was most likely due to injury of which of the following nerves?

- A. Auriculotemporal
- B. Chorda tympani
- C. Lingual
- D. Mental
- E. Inferior alveolar

50 A 56-year-old woman is admitted to the hospital with rheumatoid arthritis of her temporomandibular joint (TMJ) and severe ear pain. An image from her radiographic examination is shown in Fig. 7-2. Which of the following nerves is most likely responsible for conducting the pain sensation?

- A. Facial
- B. Auriculotemporal
- C. Lesser petrosal
- D. Vestibulocochlear
- E. Chorda tympani

51 Where is the location of the postganglionic parasympathetic neuronal cell bodies that directly innervate the parotid gland?

- A. Trigeminal (semilunar Gasserian) ganglion
- B. Inferior salivatory nucleus
- C. Superior cervical ganglion
- D. Otic ganglion
- E. Submandibular ganglion

52 The arachnoid villi allow cerebrospinal fluid to pass between which two of the following spaces?

- A. Choroid plexus and subdural space
- B. Subarachnoid space and superior sagittal sinus
- C. Subdural space and cavernous sinus
- D. Superior sagittal sinus and jugular vein
- E. Epidural and subdural space

53 A 22-year-old woman is admitted to the hospital with an injury to her eye. The corneal reflex is tested and found to be present. Which of the following nerves is responsible for the afferent limb of this reflex?

- A. Frontal
- B. Lacrimal
- C. Nasociliary
- D. Oculomotor
- E. Optic

54 A 21-year-old man was brought to the emergency department because of severe epistaxis (nosebleed) from the nasal septum. This area, known as Kiesselbach’s (or Little’s) area, involves mostly anastomoses between which of the following arteries?

- A. Ascending palatine and ascending pharyngeal
- B. Posterior superior alveolar and accessory meningeal
C. Lateral branches of posterior ethmoidal and middle meningeal
D. Septal branches of the sphenopalatine and superior labial
E. Descending palatine and tonsillar branches of the pharyngeal

55. An 11-year-old boy is examined by an ENT doctor for his swollen palatine tonsils. The palatine tonsils are located between the anterior and posterior tonsillar pillars. Which of the following muscles form these pillars?
A. Levator veli palatini and tensor veli palatini
B. Palatoglossus and palatopharyngeus
C. Styloglossus and stylopharyngeus
D. Palatopharyngeus and salpingopharyngeus
E. Superior and middle pharyngeal constrictors

56. A 35-year-old female is under general anesthesia. Prior to laryngeal intubation the rima glottidis is opened by which pair of muscles?
A. Posterior cricoarytenoids
B. Lateral cricoarytenoids
C. Thyroarytenoids
D. Transverse arynoids
E. Cricothyroids

57. A 32-year-old female patient asks you what is the soft, thin ridge of tissue that she can feel running forward across the masseter muscle toward her upper lip. You reassure her that is perfectly normal. Which of the following is the most likely structure she is feeling?
A. Facial artery
B. Maxillary artery
C. Parotid duct
D. Marginal mandibular branch of facial nerve
E. Facial vein

58. A 43 year-old man is diagnosed with laryngeal carcinoma. A surgical procedure is performed and the tumor is successfully removed from the larynx. The right ansa cervical is anastomosed with the recurrent laryngeal nerve in order to reinnervate the muscles of the larynx and restore phonation. Which of the following muscles will most likely be paralyzed after this operation?
A. Sternocleidomastoid
B. Platysma
C. Sternohyoid
D. Trapezius
E. Cricothyroid

59. A 67-year-old female is admitted to the emergency department with a severe swelling on the right side of her neck. An MRI examination reveals an abscess. The abscess is surgically removed from the middle of the posterior cervical triangle on the right side. During recovery the patient notices that her shoulder droops and she can no longer raise her right hand above her head to brush her hair. Which of the following nerves has most likely been iatrogenically injured?
A. Accessory
B. Ansa cervicalis
C. Facial
D. Hypoglossal
E. Suprascapular

60. A 20-year old man is admitted to the emergency department with a stab wound in the superior region of his neck. A radiographic examination reveals that the wound has not affected any major structures. Physical examination reveals that the patient has lost sensation from the skin over the angle of the jaw. Which of the following nerves is most likely injured?
A. Supraclavicular
B. Transverse cervical
C. Great auricular
D. Greater occipital
E. Lesser occipital

61. A 6-year-old male child, whose medical history includes a complicated delivery, has a permanently tilted head posture, with the right ear near the right shoulder and the face turned upward and to the left. Which of the following muscles was most likely damaged during birth?
A. Anterior scalene
B. Omohyoid
C. Sternocleidomastoid
D. Trapezius
E. Platysma

62. A 35-year-old woman is admitted to the emergency department after a violent automobile crash. The patient’s upper airway is obstructed with blood and mucus, and a midline tracheotomy inferior to the thyroid isthmus is performed. Which of the following vessels are most likely to be present at the site of incision and will need to be cauterized?
A. Middle thyroid vein and inferior thyroid artery
B. Inferior thyroid artery and inferior thyroid vein
A 55-year-old woman is admitted to the hospital with a large mass at her thyroid gland. Ultrasound examination reveals a benign tumor. Twenty-four hours following a partial thyroidectomy, it was noted that the patient frequently aspirates fluid into her lungs. Upon examination it was determined that the area of the piriform recess above the vocal fold of the larynx was anesthetized. Which of the following nerves was most likely iatrogenically injured?

- A. External branch of the superior pharyngeal
- B. Hypoglossal
- C. Internal branch of the superior laryngeal
- D. Lingual
- E. Recurrent laryngeal

A 34-year-old woman is admitted to the hospital with a large mass in her lower anterior neck. Ultrasonic examination reveals a benign tumor of her thyroid gland. Twenty-four hours following a partial thyroidectomy, it was noted that the patient frequently aspirates fluid into her lungs. Upon examination it was determined that the area of the piriform recess above the vocal fold of the larynx was anesthetized. Which of the following nerves was most likely iatrogenically injured?

- A. External branch of the superior pharyngeal
- B. Hypoglossal
- C. Internal branch of the superior laryngeal
- D. Lingual
- E. Recurrent laryngeal

A 38-year-old man is admitted to the hospital with a large mass in his lower anterior neck. Ultrasonic examination reveals a benign tumor of his thyroid gland. Twenty-four hours following a partial thyroidectomy, it was noted that the patient could not abduct the true vocal cords due to a nerve injury during the operation. Which of the following muscles was most likely denervated?

- A. Posterior cricoarytenoid
- B. Lateral cricoarytenoid
- C. Thyroarytenoid
- D. Arytenoid
- E. Cricothyroid

A 46-year-old woman is admitted to the hospital with a large mass in her lower anterior neck. Ultrasonic examination reveals a benign tumor of her thyroid gland. During the procedure to remove the tumor the superior thyroid artery is identified and used as a landmark in order not to damage its small companion nerve. Which of the following nerves is most likely to accompany the superior thyroid artery?

- A. Cervical sympathetic trunk
- B. External branch of the superior laryngeal
- C. Inferior root of the ansa cervicalis
- D. Internal branch of the superior laryngeal
- E. Recurrent laryngeal

A 3-year-old girl ruptured her eardrum when she inserted a pencil into her external ear canal. She was urgently admitted to the emergency department. Physical examination revealed pain in her ear and a few drops of blood in the external auditory meatus. There was the concern that there might possibly have been an injury to the nerve that principally innervates the external surface of the tympanic membrane. Which of the following tests
is most likely to be performed during physical examination to check for injury to this nerve?

☐ A. Check the taste in the anterior two thirds of the tongue.
☐ B. Check the sensation to the pharynx and palate.
☐ C. Check if there is paraesthesia at the TMJ.
☐ D. Check for sensation in the larynx.
☐ E. Check for sensation in the nasal cavity.

70 A 27-year-old woman is admitted to the emergency department after she was thrown from a motor scooter. Radiographic evaluation reveals a type I Lefort fracture and comminuted fracture of the mandible and TMJ. Despite reconstructive surgery, the patient develops hyperacusis (sensitivity to loud sounds) due to facial nerve paralysis. Which of the following muscles is most likely paralyzed?

☐ A. Posterior belly of digastric
☐ B. Stapedius
☐ C. Tensor tympani
☐ D. Stylohyoid
☐ E. Cricothyroid

71 A 43-year-old man is admitted to the emergency department with a fracture of the base of the base of his skull. A thorough physical examination reveals that a number of structures have been injured, possibly including the right greater petrosal nerve. Which of the following conditions needs to be identified during physical examination to confirm the diagnosis of greater petrosal nerve injury?

☐ A. Partial dryness of the mouth due to lack of salivary secretions from the submandibular and sublingual glands
☐ B. Partial dryness of the mouth due to lack of saliva from the parotid gland
☐ C. Dryness of the right cornea due to lack of lacrimal secretion
☐ D. Loss of taste sensation from the right anterior two thirds of the tongue
☐ E. Loss of general sensation from the right anterior two thirds of the tongue

72 A 12-year-old girl is admitted to the emergency department with a middle ear infection. Physical examination reveals a long history of chronic middle ear infections that have produced a lesion in the tympanic plexus in the middle ear cavity. Since the preganglionic parasympathetic fibers that pass through the plexus have been lost, which of the following conditions will be detectable during physical examination?

☐ A. Diminished mucus in the nasal cavity
☐ B. Diminished mucus on the soft palate
☐ C. Diminished saliva production by the parotid gland
☐ D. Diminished saliva production by the submandibular and sublingual glands
☐ E. Diminished tear production by the lacrimal gland

73 A 38-year-old patient is admitted to the dental clinic with acute dental pain. The attending dentist found penetrating dental caries (tooth decay) affecting one of the mandibular molars. Which of the following nerves would the dentist need to anesthetize to remove the caries in the tooth?

☐ A. Lingual
☐ B. Inferior alveolar
☐ C. Buccal
☐ D. Mental
☐ E. Mylohyoid

74 A 59-year-old man is admitted to the emergency department with acute pain on his mandible. An MRI examination reveals an acute inflammation of the TMJ due to arthritis. Which of the following muscles will most likely be affected by the inflammatory process of the TMJ?

☐ A. Temporalis
☐ B. Medial pterygoid
☐ C. Masseter
☐ D. Lateral pterygoid
☐ E. Buccinator

75 A 56-year-old female complains of diplopia (double vision) when walking down stairs. A lesion of which of the following nerves is most likely responsible for this patient’s complaint?

☐ A. Optic
☐ B. Oculomotor
☐ C. Abducens
☐ D. Trochlear
☐ E. Frontal

76 A 43-year-old male is admitted to the hospital complaining of diplopia (double vision) when walking down stairs. During physical examination of the extraocular muscles the patient experiences diplopia, and when he is asked to turn his right eye inward toward his nose and look down, he is able to look inward but not down. Which nerve is most likely involved?
77. A 44-year-old patient is admitted to the hospital with Raynaud’s disease. A sympathetic blocking drug is administered in high doses. Which of the following conditions will be expected to occur as an adverse effect of the drug?

☐ A. Exophthalmos and dilated pupil
☐ B. Enophthalmos and dry eye
☐ C. Dry eye and inability to accommodate for reading
☐ D. Wide-open eyelids and loss of depth perception
☐ E. Ptosis and miosis

78. A 47-year-old woman is admitted to the hospital with signs of cavernous sinus thrombosis. Radiographic examination reveals a pituitary tumor involving the cavernous sinus, confirming the initial diagnosis (Fig. 7-3). During physical examination it is suspected that the right abducens nerve of the patient has been damaged by the tumor. In which direction will the physician most likely ask the patient to turn her right eye to confirm the abducens nerve damage, assuming she is unable to perform this task?

☐ A. Inward
☐ B. Outward
☐ C. Downward
☐ D. Down and out
☐ E. Down and in

79. An 8-year-old male is admitted to the hospital with a drooping right eyelid (ptosis). The initial diagnosis is Horner’s syndrome (Fig. 7-4). Which of the following additional signs on the right side would confirm the diagnosis?

☐ A. Constricted pupil
☐ B. Dry eye
☐ C. Exophthalmos
☐ D. Pale, blanched face
☐ E. Sweaty face

80. A 32-year-old woman is admitted to the hospital with headaches and dizziness. During physical examination it is noted that the patient has partial ptosis (drooping eyelid). Which of the following muscles is most likely paralyzed?

☐ A. Orbicularis oculi, lacrimal part
☐ B. Orbicularis oculi, palpebral part
☐ C. Levator palpebrae superioris
☐ D. Superior oblique
☐ E. Superior tarsal (of Müller)

81. A 16-year-old boy is admitted to the hospital with fever, confused mental state, and drowsiness. During physical examination it is noted that the boy suffers from severe acne. Radiologic examination reveals cavernous sinus thrombosis. Which of the following routes of entry to the cavernous sinus would most likely be responsible for the infection and thrombosis?

☐ A. Carotid artery
☐ B. Mastoid emissary vein
☐ C. Middle meningeal artery
☐ D. Ophthalmic vein
☐ E. Parietal emissary vein
82 A 68-year-old man is admitted to the emergency department after an acute cerebral vascular accident (stroke). Radiographic studies reveal that the primary damage was to the anterior inferior cerebellar artery, resulting in a small hemorrhage of the artery at its origin from the main trunk. Which of the following nerves will most likely be immediately affected by the hemorrhage?

- A. Optic nerve
- B. Oculomotor nerve
- C. Trochlear nerve
- D. Trigeminal nerve
- E. Abducens nerve

83 A 5-year-old boy is admitted to the hospital with otitis media. Otoscopic examination reveals a bulging and inflamed eardrum. It is decided to incise the tympanic membrane to relieve the painful pressure and allow drainage of the infection associated with otitis media. Which of the following is the best location to make an opening (myringotomy) for drainage?

- A. The anterior superior quadrant of the eardrum
- B. The posterior superior quadrant of the eardrum
- C. Directly through the site of the umbo
- D. The posterior inferior quadrant of the eardrum
- E. A vertical incision should be made in the eardrum, from the 12 o’clock position of the rim of the eardrum to the 6 o’clock position of the rim.

84 A 56-year-old man is diagnosed with an extradural tumor in the posterior cranial fossa. When the patient protruded his tongue during physical examination, the tongue deviated to the right. Which of the following muscles and nerves are most likely injured?

- A. Right hypoglossal nerve and right genioglossus
- B. Left hypoglossal nerve and left genioglossus
- C. Right hyoglossus and left styloglossus
- D. Right geniohyoid and first cervical nerve
- E. Contralateral vagus and hypoglossal nerves

85 A 62-year-old man is admitted to the hospital with blurred vision. Physical examination reveals a long history of gradual loss of his visual field. The intraocular pressure is high, and a diagnosis of glaucoma is made. Which of the following spaces first receives the aqueous humor secreted by the epithelium of the ciliary body?

- A. Anterior chamber
- B. Posterior chamber
- C. Pupil
- D. Vitreous
- E. Lacrimal sac

86 A 17-year-old woman is admitted to the hospital with tonsillitis. A tonsillectomy is performed and the patient complains postoperatively of ear pain. Which of the following nerves was most likely injured during the surgical procedure?

- A. Auriculotemporal
- B. Lesser petrosal
- C. Vagus
- D. Glossopharyngeal
- E. Chorda tympani

87 A 49-year-old woman is admitted to the hospital with headaches and dizziness. Radiographic examination reveals a tumor in the jugular canal. Upon physical examination, when the right side of the pharyngeal wall is touched with a tongue depressor, the uvula deviates to the left and the left pharyngeal wall contracts upward. When the left pharyngeal wall is touched, the response is similar. Which of the following nerves is most likely to have been injured by the tumor?

- A. Right glossopharyngeal
- B. Left glossopharyngeal
- C. Right mandibular
- D. Left hypoglossal
- E. Right vagus

88 A 45-year-old man is admitted to the emergency department with severe dyspnea. During physical examination there is swelling in the floor of his mouth and pharynx so that his airway is nearly totally occluded. In addition, there is a swelling in his lower jaw and upper neck. His physical history indicates that one of his lower molars was extracted a week ago and he had been feeling worse every day since that event. Which of the following conditions will be the most likely diagnosis?

- A. Quinsy
- B. Torus palatinus
- C. Ankyloglossia
- D. Ranula
- E. Ludwig’s angina

89 A 5-year-old girl is admitted to the hospital with an upper respiratory tract infection. During physical examination her sense of hearing appears to be poor. Her right ear is painful, and upon otoscopic examination...
tion a golden brown fluid can be observed through the tympanic membrane. Which is the most likely direct route for the spread of an infection from the upper respiratory tract to the middle ear cavity?

- A. Pharyngotympanic tube
- B. Choanae
- C. Nostrils
- D. Facial canal
- E. Internal acoustic meatus

90 A 54-year-old man is admitted to the hospital with severe pain in his nasal cavity. Radiographic examination reveals a carcinoma in his nasal cavity. In which of the following locations would the carcinoma block the hiatus of the maxillary sinus?

- A. Inferior meatus
- B. Middle meatus
- C. Superior meatus
- D. Nasopharynx
- E. Sphenoidal recess

91 A 54-year-old male is diagnosed with an aneurysm of the basilar artery close to the cavernous sinus. An anterior approach to the sella turcica through the nasal cavity is performed. Through which of the following routes is the surgeon most likely to enter the cranial cavity?

- A. Cribiform plate
- B. Cavernous sinus
- C. Frontal sinus
- D. Maxillary sinus
- E. Sphenoidal sinus

92 A 10-year-old girl is admitted to the hospital with tonsillitis. A tonsillectomy is performed and the tonsils are removed. On physical examination one week later the patient has absence of the gag reflex on the left when the posterior part of the tongue is depressed. The sensory portion of which of the following nerves was most likely injured?

- A. Facial
- B. Glossopharyngeal
- C. Mandibular
- D. Maxillary
- E. Hypoglossal

93 A 56-year-old woman has just undergone a complete thyroidectomy. After she recovers from the anesthesia a hoarseness of her voice is noted that persists for 3 weeks. Subsequent examination shows a permanently adducted vocal fold on the right side. Surgical trauma to the innervation of which of the following muscles is most likely to be responsible for the position of the right vocal fold?

- A. Aryepiglottic
- B. Posterior cricoarytenoid
- C. Thyroarytenoid
- D. Transverse arytenoids
- E. Vocalis

94 A 45-year-old man with a complaint of ear pain and difficulty hearing is diagnosed with tonsillitis. Otoscopic examination reveals fluid in the middle ear cavity. Hypertrophy of which of the following structures would be most likely to compromise the drainage of the auditory tube?

- A. Lingual tonsil
- B. Palatine tonsil
- C. Pharyngeal tonsil
- D. Superior constrictor muscle
- E. Uvula

95 While at summer camp, a 10-year-old boy develops severe pharyngitis and swollen tonsils. Infection may spread from the nasopharynx to the middle ear cavity along the derivative of which embryonic pharyngeal pouch?

- A. First
- B. Second
- C. Third
- D. Fourth
- E. Sixth

96 You wake one morning to discover that your alarm has not worked and you are running late. Desperate to get to your biochemistry lecture in time, yet unbearably hungry, you quickly throw some bread in the toaster as you get ready. Despite the toast burning a little, you eat it quickly as you rush out the door. The burnt parts of the toast scratch the roof of your mouth, leaving you with a stinging sensation there. What nerve is collecting this sensation from the hard palate?

- A. Posterior superior alveolar nerve
- B. Inferior alveolar nerve
- C. Lingual nerve
- D. Greater palatine nerve
- E. Lesser palatine nerve

97 A 32-year-old woman underwent a thyroidectomy. Two months postoperatively, it was observed that the patient had lost the ability to notice the presence of for-
eign objects in the laryngeal vestibule. Which of the following nerves was most likely injured?

☐ A. Internal laryngeal nerve
☐ B. External laryngeal nerve
☐ C. Glossopharyngeal nerve
☐ D. Hypoglossal nerve
☐ E. Recurrent laryngeal nerve

98 A 4-year-old boy suffering from ankyloglossia is brought to the speech therapist. The examining physician recommends that the child be admitted for operation by a pediatric surgeon. Which of the following surgical procedures would be most appropriate for this condition?

☐ A. Removal of pterygomandibular raphe
☐ B. Resection of the pterygoid hamulus bilaterally
☐ C. Cutting the lingual frenulum
☐ D. Repair of the palate
☐ E. Removal of the central segment of the hyoid bone

99 An 8-year-old boy was suffering from a severe infection of the right middle ear. Within the course of a week, the infection had spread to the mastoid antrum and the mastoid air cells. The organisms did not respond to antibiotics, so the surgeon decided to perform a radical mastoid operation. Following the operation, it was noticed that the boy’s face was distorted. The mouth was drawn upward to the left and he was unable to close his right eye. Saliva tended to accumulate in his right cheek and dribble from the corner of his mouth. What structure was most likely damaged during the operation?

☐ A. Mandibular nerve
☐ B. Parotid duct
☐ C. Vagus nerve
☐ D. Facial nerve
☐ E. Glossopharyngeal nerve

100 A 32-year-old man is admitted to the emergency department with visual problems. Radiographic examination reveals a tumor of the adenohypophysis (anterior pituitary gland). Physical examination reveals a loss of the lateral halves of the fields of vision of both eyes (bitemporal hemianopia or “tunnel vision”). Which of the following structures was most likely compressed by the tumor?

☐ A. Optic nerve
☐ B. Optic chiasm
☐ C. Optic tract
☐ D. Oculomotor
☐ E. Abducens nerve

101 A 32-year-old man is admitted to the hospital with severe headache and visual problems. The dilator pupillae muscle, the smooth muscle cell fibers of the superior tarsal muscle (of Müller, part of the levator palpebrae superioris), and the smooth muscle cells of the blood vessels of the ciliary body are supplied by efferent nerve fibers. Which of the following structures contains the neural cell bodies of these fibers?

☐ A. Pterygopalatine ganglion
☐ B. IML (lateral horn) C1 to C4
A 22-year-old male is admitted to the hospital after he was hit in the right eye with a frozen fish, thrown playfully by a friend while they were passing through the seafood section of the market. During physical examination considerable swelling and discoloration of the eyelids was observed. In addition, the patient could not turn his pupil laterally from forward gaze, indicating probable muscle entrapment. Which of the following bones was most likely fractured?

- A. Orbital plate of the frontal bone
- B. Lamina papyracea of the ethmoid bone
- C. Orbital plate of the maxilla
- D. Cribriform plate of the ethmoid bone
- E. Greater wing of the sphenoid bone

A 57-year-old man is admitted to the emergency department with dizziness and severe headaches. A CT scan evaluation reveals a tumor in the superior orbital fissure. Upon physical examination the patient’s eye ball is fixed in an abducted position, slightly depressed, and the pupil is dilated. In addition, the superior palpebrae are ptotic. Consensual corneal reflexes are normal. Which of the following nerves is most likely affected?

- A. Trochlear nerve
- B. Oculomotor nerve
- C. Abducens nerve and sympathetic nerve plexus accompanying the ophthalmic artery
- D. Ophthalmic nerve and short ciliary nerve
- E. Superior division of oculomotor nerve and the nasociliary nerve

An unconscious 57 year-old man is transported to the emergency department after falling from a tree. A CT scan evaluation reveals a fracture of the cribiform plate (Fig 7-5). Which of the following conditions will most likely be present during the physical examination?

- A. Entrapment of the eyeball
- B. Anosmia
- C. Hyperacusis
- D. Tinnitus
- E. Deafness

A 45-year-old woman is admitted to the hospital with a swelling on the side of her face of 2 months’ duration. Radiographic examination reveals a parotid gland tumor. An operative procedure is performed in which the tumor is removed from the parotid gland. Three months postoperatively the patient complains that her face sweats profusely when she tastes or smells food, and a diagnosis is made of Frey syndrome (gustatory sweating). Which of the following nerves was most likely injured during the procedure?

- A. Buccal
- B. Inferior alveolar
- C. Auriculotemporal
- D. Facial
- E. Lingual

A 54-year-old male is to undergo bilateral thyroidectomy. During this procedure there is the possibility of bilateral paralysis of muscles that can open the airway. If a particular nerve is injured bilaterally, there is significant risk of asphyxiation postoperatively unless the patient is intubated or the airway is opened surgically. Which of the following muscle pairs opens the airway?

- A. Cricoarytenoids
- B. Posterior cricoarytenoids
- C. Arytenoideus
- D. Thyroarytenoids
- E. Lateral cricoarytenoids
An 11-year-old boy with swollen palatine tonsils is examined by an otolaryngologist. Which of the following arteries supplies most of the blood to these tonsils and must be protected when its tonsillar branch is divided?

- A. Ascending pharyngeal
- B. Facial
- C. Lingual
- D. Descending palatine
- E. Superior thyroid

A 55-year-old man with severe ear pain visits the ENT doctor. During otoscopic examination the tympanic membrane is ruptured. Which of the following nerves is responsible for the sensory innervation of the inner surface of the tympanic membrane?

- A. Glossopharyngeal
- B. Auricular branch of facial
- C. Auricular branch of vagus
- D. Great auricular
- E. Lingual

A 45-year-old man was suffering from trigeminal neuralgia (tic douloureux). The pain was so severe that the patient had considered suicide as a way to escape the pain. Even light, gentle stimuli to the skin between the lower eyelid and the upper lip resulted in severe, agonizing pain. It was decided to lesion the nerve branch involved by injection of alcohol into the nerve. To reach the nerve, the needle will most likely need to be inserted through which of the following openings?

- A. Foramen ovale
- B. Foramen spinosum
- C. Infraorbital foramen
- D. Mandibular foramen
- E. Foramen magnum

A 32-year-old woman is undergoing a thyroidec- tomy. Two months postoperatively the patient suffers from loss of sensation within the larynx from the vocal folds upward to the entrance into the larynx, allowing for aspiration of liquids into the airway. Which of the following nerves is most likely injured?

- A. Internal laryngeal nerve
- B. External laryngeal nerve
- C. Glossopharyngeal nerve
- D. Hypoglossal nerve
- E. Recurrent laryngeal nerve

A 55-year-old man is admitted to the emergency department after slipping on wet pavement and falling. Physical examination reveals that the patient has a hematoma that formed in the danger zone of the scalp, spreading to the area of the eyelids. Which of the following layers is regarded as the “danger zone”?

- A. Loose, areolar layer
- B. Skin
- C. Galea aponeurotica
- D. Pericranium
- E. Subcutaneous layer

A 45-year-old woman is admitted to the hospital with severe headache. The patient is diagnosed with hypertension and arrhythmias. To reduce the patient’s blood pressure, massage is initiated at a pressure point located deep to the anterior border of the sternocleidomastoid muscle at the level of the superior border of the thyroid cartilage. Which of the following structures is targeted by the massage?

- A. Carotid sinus
- B. Carotid body
- C. Thyroid gland
- D. Parathyroid gland
- E. Inferior cervical ganglion

A 59-year-old painter fell from the scaffolding and was admitted to the emergency department in an unconscious condition. An emergency tracheostomy is performed and brisk arterial bleeding suddenly occurs from the midline incision over the trachea. Which of the following vessels was most likely cut accidentally?

- A. Inferior thyroid branch of thyrocervical trunk
- B. Cricothyroid branch of the superior thyroid artery
- C. Thyroidea ima artery
- D. Middle thyroid vein
- E. Jugular arch connecting the anterior jugular veins

A 21-year-old male baseball player is brought to the emergency department after feeling severe dizziness. During physical examination the patient demonstrates lack of equilibrium and memory impairment. A 3-cm wound is noted in his scalp from an injury suffered in a game several weeks earlier. A lumbar puncture does not reveal blood in the cerebrospinal fluid. Which of the following is the most likely diagnosis?

- A. The middle meningeal artery was torn, resulting in epidural hematoma.
- B. There is a fracture in the pterion with injury to the adjacent vasculature.
C. The injury resulted in the bursting of a preexisting aneurysm of the anterior communicating artery of the cerebral circle.

D. A cerebral vein is torn.

E. The cavernous sinus has a thrombus.

A 63-year-old man had his prostate gland tumor removed 2 years before his present admission to the hospital, complaining of various neurologic problems, including headache. Radiographic examination reveals that the cancer has spread from the pelvis to the posterior cranial fossa by way of the internal vertebral venous plexus (of Batson). During physical examination the patient’s right shoulder droops noticeably lower than the left, he exhibits considerable weakness in turning his head to the left, and his tongue points to the right when he attempts to protrude it directly from his mouth. There are no other significant findings. Which of the following nerves are most likely affected?

A. Right vagus, right accessory, and right hypoglossal nerves
B. Left accessory, right glossopharyngeal, right vagus, and left hypoglossal nerves
C. Left hypoglossal, right trigeminal, and left glossopharyngeal nerves
D. Right accessory and right hypoglossal nerves
E. Left facial, left accessory, right accessory, and vagus nerves

A 3-month-old male infant is admitted to the hospital because he cries continuously. During physical examination it is observed that he infant has a dry right eye. Upon the basis of imaging studies, the neuroophthalmologist diagnoses a lesion at the neural cell bodies of the preganglionic axons of the pterygopalatine ganglion. Which of the following structures contains the neural cell bodies of the preganglionic axons?

A. Superior cervical ganglion
B. Edinger-Westphal nucleus
C. Superior salivatory nucleus
D. Inferior salivatory nucleus
E. Nucleus ambiguus

A 73-year-old male patient visits the outpatient clinic with a complaint of progressive, painless loss of vision. Radiographic examination reveals thrombophlebitis of the cavernous sinus. Through which of the following structures must a thrombus pass to cause the symptoms of this patient?

A. Subarachnoid space
B. Central artery of the retina
C. Central vein of the retina
D. Optic chiasm
E. Ciliary ganglion

A 67-year-old man visits the outpatient clinic with complaints of deteriorating vision. A form of glaucoma is diagnosed in which the aqueous humor does not drain properly into the scleral venous sinus at the iridoscleral angle of the eyeball. The aqueous fluid is secreted by the epithelium of the ciliary body directly into which of the following spaces?

A. Iridoscleral angle
B. Posterior chamber
C. Pupil
D. Vitreous body
E. Lacrimal sac
A 2-month-old female infant is hospitalized with hydrocephalus. Radiographic examination reveals cerebrospinal fluid between the compressed brain and overlying bones of the skull. Which of the following conditions will most likely lead to this type of clinical picture?

- A. Lack of filtration through arachnoid granulations
- B. Occlusion of cerebral aqueduct (of Sylvius)
- C. Blockage of the foramina of Luschka
- D. Congenital absence of the foramen of Magendie
- E. Closure of the interventricular foramina of Monro

A 54-year-old man was admitted to the emergency department after he was struck by an automobile. Radiographic examination revealed a fracture through the crista galli of the anterior cranial fossa, resulting in slow, local bleeding. Which of the following is the most likely source of bleeding?

- A. Middle meningeal artery
- B. The great cerebral vein of Galen
- C. Superior sagittal sinus
- D. Straight venous dural sinus
- E. Superior ophthalmic vein

During the routine ophthalmologic exam, the globe, the retina, and the cornea of each eye are tested. Which of the following nerves must be functioning properly if the patient is to be able to turn the eye laterally (abduction) without difficulty and without upward or downward deviation?

- A. Superior division of oculomotor, ophthalmic nerve, abducens nerve
- B. Trochlear nerve, abducens nerve, nasociliary nerve
- C. Inferior division of oculomotor, trochlear, abducens
- D. Oculomotor and ophthalmic nerves
- E. Superior division of oculomotor, trochlear, and abducens nerves

A 34-year-old female is admitted to the hospital because of hoarseness for the past 3 months. Radiographic examination reveals a cancerous growth in her larynx with no evidence of metastasis. In addition, the area in which the tumor is growing is characterized by very limited lymphatic drainage. Which of the following locations is most likely to contain a tumor with these characteristics?

- A. Anterior commissure of the vocal ligaments
- B. Interarytenoid fold
- C. Laryngeal ventricle
- D. Cricothyroid ligament
- E. Middle segment of the vocal cord

A 55-year-old man is admitted to the hospital with a complaint of severe headaches. A lumbar puncture reveals traces of blood in the cerebrospinal fluid. Which of the following conditions has most likely occurred in this patient?

- A. Fracture of the pterion with vascular injury
- B. A ruptured “berry” aneurysm
- C. Leakage of branches of the middle meningeal vein within the temporal bone
- D. A tear of the cerebral vein at the entrance to the superior sagittal sinus
- E. Occlusion of the internal carotid artery by a clot generated in the left atrium

A 55-year-old man is admitted to the neurosurgical clinic for a scheduled removal of a tumor in the left jugular canal. Postoperatively, the patient has no gag reflex when the ipsilateral pharyngeal wall is stimulated, although the pharynx moved upward, and a gag reflex resulted when the right pharyngeal wall was stimulated. The uvula was deviated to the right and the left vocal cord had drifted toward the midline. Which of the following structures will contain the neural cell bodies for the motor supply of the paralyzed muscles?

- A. Nucleus solitarius
- B. Trigeminal motor nucleus
- C. Dorsal motor nucleus
- D. Nucleus ambiguus
- E. Superior or inferior ganglia of vagus

A 65-year-old man is admitted to the emergency department after his head hit the dashboard in an automobile collision. Radiographic and physical examinations reveal that the inferior alveolar nerve is injured at its origin. Which of the following muscles would most likely be paralyzed as a result?

- A. Geniohyoid
- B. Hyoglossus
- C. Mylohyoid
- D. Stylohyoid
- E. Palatoglossus

A 64-year-old man is admitted to the hospital in an unconscious condition. A CT scan examination reveals that the patient has suffered a cerebral vascular accident (stroke), with a small hematoma produced by
the superior cerebellar artery. Which of the following nerves will most likely be affected by the hematoma?

- **A.** Trochlear nerve
- **B.** Abducens nerve
- **C.** Facial nerve
- **D.** Vestibulocochlear nerve
- **E.** Glossopharyngeal nerve

**132** A 65-year-old male is admitted to the hospital three weeks after a “small bump of his head” according to his narrative. He suffered the accidental bump from a low-hanging branch while driving his tractor through the apple orchard during harvesting season. During physical examination the patient displays mental confusion and poor physical coordination. Radiographic examination reveals leakage from a cerebral vein over the right cerebral hemisphere. From what type of bleeding is the patient most likely suffering?

- **A.** Subarachnoid bleeding
- **B.** Epidural bleeding
- **C.** Intracerebral bleeding into the brain parenchyma
- **D.** Subdural bleeding
- **E.** Bleeding into the cerebral ventricular system

**133** A 27-year-old man is admitted to the hospital after a middleweight boxing match. During physical examination the strength and symmetry of strength in opening the jaws are tested. Which of the following muscles is the most important in jaw protrusion and depressing the mandible?

- **A.** Anterior portion of temporalis
- **B.** Lateral pterygoid
- **C.** Medial pterygoid
- **D.** Masseter
- **E.** Platysma

**134** A 31-year-old mother visits the pediatric outpatient clinic with her 6-month-old baby complaining that her baby is not developing quickly and has no teeth. Which of the following teeth are expected to appear first?

- **A.** Superior medial incisors at 8 to 10 months of age
- **B.** Inferior medial incisors at 6 to 8 months of age
- **C.** Superior lateral incisors at 8 to 10 months of age
- **D.** Inferior lateral incisors at 12 to 14 months of age
- **E.** First molar at 6 to 8 months of age

**135** A 56-year-old man visits the outpatient clinic with a complaint of severe headaches and ear pain. Radiographic examination reveals a tumor in the middle ear cavity, invading through the bony floor. Which of the following structures will most likely be affected?

- **A.** The cochlea and lateral semicircular canal
- **B.** The internal carotid artery
- **C.** The sigmoid venous sinus
- **D.** The internal jugular bulb
- **E.** The aditus ad antrum bulb and the facial nerve

**136** A 52-year-old man is admitted to the emergency department with a bullet wound in the infratemporal fossa. During physical examination it is observed that the patient has lost unilateral sensation of hot, cold, pain, and pressure from the front part of the tongue, but taste and salivary function are preserved. Which of the following is the most likely diagnosis?

- **A.** The facial nerve was transected distal to the origin of the chorda tympani.
- **B.** Receptors for hot, cold, pain, and pressure are absent in the patient’s tongue.
- **C.** The glossopharyngeal nerve has been injured in the pharynx.
- **D.** The superior laryngeal nerve was obviously severed by the bullet.
- **E.** The lingual nerve was injured at its origin near the foramen ovale.

**137** A 12-year-old boy is admitted to the emergency department with signs of meningitis. To determine the specific type of meningitis, it is necessary to aspirate cerebrospinal fluid with a lumbar puncture for laboratory examination. However, before performing a lumbar puncture, it must be established that the cerebrospinal fluid pressure is not elevated. What condition in the eye would indicate that cerebrospinal fluid pressure is too elevated for a lumbar puncture to be performed?

- **A.** Papilledema
- **B.** Separation of the pars optica retinae anterior to the ora serrata
- **C.** The foveal centralis exhibits hemorrhage from medial retinal branches.
- **D.** Obvious opacity of the lens
- **E.** Pitting or compression of the optic disc

**138** A 65-year-old woman is admitted to the hospital with signs of cavernous sinus thrombosis. Radiographic examination reveals an aneurysm of the internal carotid artery within the cavernous sinus. During physical examination what sign would one first expect to see?
if nerve compression has occurred within the cavernous sinus?

- A. Inability to gaze downward and medially on the affected side
- B. Complete ptosis of the superior palpebra
- C. Bilateral loss of accommodation and loss of direct pupillary reflex
- D. Ipsilateral loss of the consensual corneal reflex
- E. Ipsilateral paralysis of abduction of the pupil

A 54-year-old man is admitted to the emergency department with a fracture at the frontozygomatic suture. During physical examination the eyelid of the patient exhibits multiple lacerations and the sclera contains small fragments from his broken glasses. What site would be preferable for needle insertion to anesthetize the orbital contents and then the area of the eyelid injury?

- A. Into the sclera in the limbic region and also into the infraorbital foramen
- B. Into the lacrimal fossa and also beneath the lateral bulbar conjunctiva
- C. Into the supraorbital foramen and also into the lacrimal caruncle
- D. Through the upper eyelid deeply toward the orbital apex and also between the orbital septum and the palpebral musculature laterally
- E. Directly posteriorly through the annulus tendineus and superior orbital fissure

A 45-year-old male construction worker slips and falls on a nail protruding from a board. The nail penetrates the skin overlying the submental triangle lateral to the midline. Which of the following muscles would be the last to be penetrated?

- A. Platysma
- B. Mylohyoid
- C. Anterior belly of the digastric
- D. Geniohyoid
- E. Genioglossus

A 55-year-old woman has undergone facial surgery for the excision of a malignant parotid tumor. A week postoperatively, marked weakness is seen in the musculature of the patient's lower lip. Which of the following nerves was most likely injured during the parotidectomy?

- A. Marginal mandibular branch of facial
- B. Zygomatic branch of facial
- C. Mandibular division of the trigeminal nerve
- D. Buccal branch of facial
- E. Buccal nerve

A 15-year-old male is admitted to the emergency department with severe headache and hydrocephalus. Radiographic examination reveals a craniopharyngioma occupying the sella turcica, primarily involving the suprasellar space. Which of the following is the most likely cause of this tumor?

- A. Persistence of a small portion of the Rathke pouch
- B. Abnormal development of pars tuberalis
- C. Abnormal development of foramina of Monro
- D. Abnormal development of the alar plates that form the lateral wall of diencephalon
- E. Abnormal development of diencephalon

A 1-day-old infant presents with a telencephalic vesicle; the eyes are fused, and a single nasal chamber is present in the midline. In addition, the olfactory bulbs and tracts and the corpus callosum are hypoplastic. Which of the following is the most likely diagnosis?

- A. Holoprosencephaly
- B. Smith-Lemli-Opitz syndrome
- C. Schizencephaly
- D. Exencephaly
- E. Meningoencephalocele

A 1-day-old infant presents with meningohydroencephalocele. Which of the following bones is most commonly affected?

- A. Squamous part of temporal bone
- B. Petrous part of temporal bone
- C. Squamous part of occipital bone
- D. Sphenoid bone
- E. Ethmoid bone

A 1-day-old infant was born with the vault of the skull undeveloped, leaving the malformed brain exposed. A diagnosis of exencephaly is made. What is the embryologic cause of this condition?

- A. Toxoplasmosis infection
- B. Failure of closure of the cephalic part of the neural tube
- C. Ossification defect in the bones of the skull
- D. Caudal displacement of cerebellar structures
- E. Maternal alcohol abuse

A 6-month-old infant is admitted to the emergency department with hydrocephalus. Upon physical
examination a spina bifida cystica is noted. Radiographic examination reveals a caudal displacement of the cerebellar structures through the foramen magnum. Which of the following is the most likely diagnosis?

- A. Arnold-Chiari malformation
- B. Holoprosencephaly
- C. Smith-Lemli-Opitz syndrome
- D. Schizencephaly
- E. Exencephaly

147 A 3-month-old infant was admitted to the hospital because of the parents’ suspicion that the child was deaf. An MRI examination showed abnormal development of the membranous and bony labyrinths, leading the physician to the diagnosis of congenital deafness. Which of the following conditions can lead to congenital deafness?

- A. Infection with rubella virus
- B. Failure of the second pharyngeal arch to form
- C. Failure of the dorsal portion of first pharyngeal cleft
- D. Abnormal development of the auricular hillocks
- E. Failure of the dorsal portion of first pharyngeal cleft and second pharyngeal arch

148 A 3-month-old male infant is brought to the hospital by his parents because of white patches in his eyes. An ophthalmoscopic examination shows a congenital cataract. Which of the following conditions can cause a congenital cataract?

- A. Infection with rubella virus
- B. Choroid fissure fails to close
- C. Persistent hyaloid artery
- D. Toxoplasmosis infection
- E. Cytomegalovirus infection

149 A 1-day-old infant who exhibits absence of the ocular lens is admitted to the pediatric intensive care unit. Laboratory examination reveals a mutation in the PAX6 gene. Which of the following conditions is the most likely diagnosis?

- A. Cyclopia
- B. Coloboma
- C. Anophthalmia
- D. Aphakia and aniridia
- E. Microophthalmia

150 A 2-month-old infant presents with small and flat maxillary, temporal and zygomatic bones. In addition, the patient has anotia and a dermoid tumor in the eyeball. Which of the following conditions is the most likely diagnosis?

- A. Hemifacial microsomia
- B. Treacher Collins syndrome
- C. Robin Sequence
- D. DiGeorge syndrome
- E. Velocardiofacial syndrome

151 A 3-month-old infant is diagnosed with abnormal face, thymic hypoplasia, cleft palate, hypocalcemia, and a ventricular septal defect. Which of the following genes is defective?

- A. 22q11
- B. SONIC HEDGEHOG
- C. PAX 2
- D. PAX 6
- E. 47XXY

152 A 3-day-old male infant has a noticeably small mandible. A CT scan and physical examinations reveal hypoplasia of the mandible, underdevelopment of the bones of the face, downward-slanting palpebral fissures, defects of the lower eyelids, and deformed external ears. Abnormal development of which of the pharyngeal arches will most likely produce such symptoms?

- A. First arch
- B. Second arch
- C. Third arch
- D. Fourth arch
- E. Sixth arch

153 A 1-year-old infant is admitted to the hospital with fever. Radiographic examination reveals a sinus infection. Which of the following sinuses is present at this age?

- A. Frontal sinus
- B. Maxillary sinus
- C. Sphenoid sinus
- D. Middle ethmoidal air cells
- E. Posterior ethmoidal air cells

154 A newborn infant presents with severe brain abnormalities. The calvaria is defective and the brain is protruding from the cranium. A rudimentary brainstem and some functioning neural tissue are present. A diagnosis is made of meroencephaly. Which of the following is the most likely cause of this condition?

- A. Failure of the rostral neuropore to close in the fourth week
- B. Cytomegalovirus infection
A 55-year-old man is admitted to the emergency department with fever of 4 days’ duration. Radiographic examination reveals the presence of an infection that is spreading from the retropharyngeal space to the posterior mediastinum. Between which of the following fascial layers are the infections most likely located?

- A. Between alar and prevertebral
- B. Between alar and pretracheal
- C. Between pretracheal and prevertebral
- D. Between buccopharyngeal and alar
- E. Between buccopharyngeal and prevertebral

A 24-year-old man is admitted to the hospital after a street fight. Radiographic examination reveals an inferior blow-out fracture of the orbit. Which of the following nerves is particularly vulnerable to this type of injury?

- A. Infraorbital
- B. Supratrochlear
- C. Frontal
- D. Inferior alveolar
- E. Optic

A 67-year-old man visits the outpatient clinic with hearing problems. During physical examination a Rinne test for hearing is performed by placing a tuning fork on his head to test for bone conduction. Upon what specific point should the tuning fork be placed to test conduction?

- A. Temporal bone
- B. Frontal bone
- C. Mastoid process
- D. External occipital protuberance
- E. Vertex of the head

A 55-year-old man is admitted to the emergency department with a complaint of pain when chewing over the previous 3 months. Physical examination reveals the patient suffers from odynophagia and some hoarseness in his speech. Radiographic examination reveals a tumor at the tracheoesophageal groove. Which of the following nerves is most likely affected by the tumor?

- A. Recurrent laryngeal
- B. Internal laryngeal
- C. Vagus
- D. External laryngeal
- E. Phrenic

A 34-year-old man is admitted to the emergency department after falling off his motorbike, suffering an injury to his head. The patient has multiple lacerations in the skin over the frontal bone. Which of the following veins could most likely provide a pathway of transmission of infection from the veins of the scalp to the underlying dural venous sinuses?

- A. Supratrochlear vein
- B. Diploic veins
- C. Anterior cerebral veins
- D. Superior sagittal sinus
- E. Supraorbital vein

A 65-year-old man is admitted to the emergency department after an episode of a transient ischemic attack. Radiographic examination reveals an aneurysm in the region between the posterior cerebral artery and superior cerebellar artery. Which of the following nerves will most likely be compressed from the aneurysm?

- A. Trochlear
- B. Bducens
- C. Oculomotor
- D. Vagus
- E. Optic

A 36-year-old female racquetball player is admitted to the hospital after being struck in the orbital region. Radiographic examination reveals a blow-out fracture of the medial wall of the orbit. Physical examination also reveals that the pupil of the affected eye cannot be turned laterally. Which of the following muscles is most likely injured or trapped?

- A. Lateral rectus
- B. Medial and inferior recti
- C. Medial rectus and superior oblique
- D. Medial rectus and superior oblique
- E. Inferior rectus

A 16-year-old female volleyball player is admitted to the hospital after being hit in the eye with a ball spiked at the net. Radiographic examination reveals a blow-out fracture of the inferior wall of the orbit. Physical examination also reveals that the pupil of her eye cannot be turned upward. Which of the following muscles is (are) most likely injured?

- A. Inferior rectus and inferior oblique
- B. Medial and inferior recti
- C. Inferior oblique
A 36-year-old man is admitted to the emergency department with a painful skin rash on the dorsum of his nose. Physical examination reveals that a herpetic lesion is affecting the dorsum of the nose and the eyeball. Which of the following nerves is most likely to be responsible for transmission of the virus to the eye?

- A. Nasociliary
- B. Supratrochlear
- C. Infraorbital
- D. Posterior ethmoidal
- E. Anterior ethmoidal

A 22-year-old man is admitted to the emergency department after he was beaten up in a street fight. Radiographic examination reveals that he has suffered a forehead fracture from a blow with a club, resulting in black and swollen eyes (Fig. 7-6). Because the patient is suffering from severe pain, an anesthetic solution is ordered to be injected into his orbit. Which of the following nerves is most likely to be anesthetized?

- A. Ophthalmic
- B. Infraorbital
- C. Anterior ethmoidal
- D. Frontal
- E. Optic

A 34-year-old woman is admitted to the emergency department after her right cheekbone and bony orbit hit the dashboard in an automobile crash. Physical examination reveals that the patient has lost the ability for the affected eye to be directed downward when the pupil is in the adducted position. An MRI examination reveals a torn nerve. What is the most common location at which this nerve will be injured?

- A. As it pierces the dura of the tentorium cerebelli in the tentorial notch
- B. At the cavernous sinus
- C. At the sella turcica
- D. At the inferior orbital fissure
- E. At the superior orbital fissure

A 56-year-old woman is admitted to the hospital with eye pain. During physical examination the patient complains of excruciating pain when she performs any movement of the eye. An MRI examination reveals that the optic nerve is inflamed. What is the most likely explanation?

- A. The anular tendon (of Zinn) is inflamed.
- B. The inflammation has affected the nerves innervating the eye muscles.
- C. The muscles are contracting due to generalized inflammation.
- D. The nasociliary nerve is affected.
- E. The ophthalmic artery is constricted.

A 7-day-old infant is admitted to the pediatric intensive care unit with microphthalmia. Which of the following is the most likely cause of this condition?

- A. Infection with rubella virus
- B. Choroid fissure failed to close
- C. Persistent hyaloid artery
- D. Toxoplasmosis infection
- E. Epstein-Barr virus infection

A 2-month-old male infant is admitted to the hospital after falling from his stroller. During physical examination the infant shows signs of facial nerve injury. What is the most common place for facial nerve injury in an infant?

- A. At the stylomastoid foramen
- B. Posterior to the parotid gland
- C. Anterior to the parotid gland
- D. Proximal to the stylomastoid foramen
- E. Mandibular involvement of zygomatic and buccal branches

A 6-year-old boy is admitted to the hospital with high fever and pain over the parotid gland (Fig. 7-7). A diagnosis of parotiditis (mumps) is established, and the boy is sent back home. Which of the following nerves is responsible for painful sensations from the region of the parotid gland?

- A. Facial
- B. Auriculotemporal
170 A 55-year-old woman is admitted to the emergency department with ear pain, ringing in her ear (tinnitus), dizziness, and vertigo. Radiographic examination reveals indications of Ménière’s disease. Which of the following structures is most likely affected by the edema that is associated with Ménière’s disease?

- A. Middle ear
- B. Endolymphatic sac
- C. Semicircular canals
- D. Cochlea
- E. Helicotrema

171 A 55-year-old woman visits the outpatient clinic with a swelling in her neck. Radiographic and ultrasound examinations reveal a benign thyroid gland tumor. Three days after thyroidectomy the patient shows air bubbles in the CT of her brain. Which of the following is the most likely cause of the air bubbles in this case?

- A. Injury to inferior thyroid artery
- B. Injury to inferior and superior thyroid arteries
- C. Injury to superior thyroid artery and vein
- D. Injury to superior and middle thyroid veins
- E. Injury to superior, middle, and inferior thyroid veins

172 A 32-year-old man is admitted to the emergency department unconscious after a severe car crash. During an emergency cricothyroidostomy an artery is accidentally injured. Two days later the patient shows signs of aspiration pneumonia. Which of the following arteries was most likely injured?

- A. Superior thyroid
- B. Inferior thyroid
- C. Cricothyroid
- D. Superior laryngeal
- E. Suprahyoid

173 A 32-year-old man is admitted to the emergency department unconscious after a severe car crash. During an emergency cricothyroidostomy an artery is accidentally injured. Two days later the patient shows signs of aspiration pneumonia. Which of the following arteries was most likely injured?

- A. Superior thyroid
- B. Inferior thyroid
- C. Cricothyroid
- D. Superior laryngeal
- E. Suprahyoid

174 A 22-year-old woman is admitted to the emergency department unconscious after falling over the handlebars of her bicycle. An emergency tracheotomy is performed to insert a tracheotomy tube. What is the most common tracheal cartilage level at which a tracheotomy incision is performed?

- A. First to second
- B. Second to third
- C. Third to fourth
- D. Fourth to fifth
- E. Fifth to sixth

175 A 36-year-old woman is admitted to the hospital with severe head injuries after a car crash. During neurologic examination it is noted that her uvula is deviated to the right. Which of the following muscles is paralyzed?

- A. Left levator veli palatini
- B. Left tensor veli palatini
- C. Right levator veli palatini
- D. Right tensor veli palatini
- E. Right tensor veli palatini and left levator veli palatini

176 A 45-year-old man came to the outpatient clinic after stumbling and hitting his head on a table in a restaurant. During the neurologic examination photographs were taken of the patient’s eyes as shown in Fig. 7-8. Which of the following nerves to the left eye was most likely injured?

- A. Trochlea
- B. Abducens
- C. Oculomotor
- D. Optic
- E. Oculomotor and abducens
176 A 32-year-old woman is admitted to the hospital after losing consciousness and collapsing in the middle of the street. A neurologic examination reveals absence of the accommodation reflex of her right eye. Which of the following is most likely involved in the pathology in this patient?

- A. Superior salivatory nucleus
- B. Superior cervical ganglion
- C. Nervus intermedius
- D. Edinger-Westphal nucleus
- E. Trigeminal ganglion

177 A 32-year-old man is admitted to the hospital with nausea, vomiting, and severe headache. An MRI examination reveals an acoustic neuroma as shown in Fig. 7-9. Which of the following nerves is most likely compressed by the tumor?

- A. Facial
- B. Oculomotor
- C. Vagus
- D. Hypoglossal
- E. Abduccens

178 A 3-year-old boy is brought to the outpatient clinic with a swelling in the side of his neck. Physical examination reveals a congenital mass of tissue anterior to the superior third of the sternocleidomastoid muscle (Fig. 7-10). The swelling is asymptomatic, non-painful, and soft. Which of the following is the most likely diagnosis?

- A. Branchial cleft cyst
- B. Ruptured sternocleidomastoid muscle
- C. Lymph node inflammation
- D. Torticollis
- E. External carotid artery aneurysm

179 A 68-year-old woman visits the outpatient clinic with a complaint of chronic dizziness and headaches. Cranial and cervical angiography (Fig. 7-11) reveals an occluded vessel. Which of the following vessels is most likely occluded?

- A. External carotid
- B. Internal carotid
- C. Common carotid
- D. Vertebral
- E. Superior thyroid
A 9-year-old girl is admitted to the emergency department with a painful swelling behind her ear. An MRI examination reveals mastoiditis (Fig. 7-12). Which of the following structures is most likely to be affected by the inflammation?

- A. Transverse sinus
- B. Petrous part of the temporal bone
- C. Middle ear
- D. Occipital sinus
- E. Internal carotid artery

A 34-year-old woman is admitted to the emergency department with a painful eye. Physical examination reveals a lump in the lower eyelid that consists of debris (Fig. 7-13). A diagnosis of a chalazion is made. Which of the following structures is (are) most likely blocked by the chalazion?

- A. Lacrimal ducts
- B. Tarsal glands
- C. Sclera
- D. Pupil
- E. Nasolacrimal duct

A 45-year-old man is admitted to the hospital with breathing problems. During physical examination the patient shows signs of airway obstruction. A CT
scan examination reveals a nasal polyp obstructing the airway (Fig. 7-14). Drainage from which of the following structures is also obstructed?

- A. Sphenoid sinus
- B. Maxillary sinus
- C. Ethmoidal sinus
- D. Frontal sinus
- E. Nasolacrimal duct

183 An unconscious 54-year-old female is admitted to the hospital. A CT scan reveals a tumor in her brain, producing a tentorial herniation. When she regains consciousness, her right eye is directed laterally and downward, with complete ptosis of her upper eyelid and pupillary dilation. Which of the following lobes of the brain is affected by the tumor?

- A. Parietal
- B. Temporal
- C. Occipital
- D. Frontal
- E. Parietal and temporal

184 A newborn infant is finally delivered with forceps after a difficult delivery. Upon physical examination of the newborn a cephalohematoma is noted from rupture of small periosteal arteries. Between which of the following layers of tissue does the blood accumulate?

- A. Between skin and dense connective tissue layer
- B. Between loose connective tissue layer and galea aponeurotica
- C. Between galea aponeurotica and pericranium
- D. Between pericranium and calvaria
- E. At the subcutaneous layer

185 A 58-year-old man is admitted to the emergency department with progressive unilateral hearing loss and ringing in the affected ear (tinnitus) of 4 months’ duration. Radiographic examination reveals a tumor at the cerebellopontine angle. Which of the following nerves is most likely affected?

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

186 A 54-year-old man is admitted to the hospital with severe headaches. A CT scan reveals a tumor in his brain occupying a portion of the anterior cranial fossa. Which of the following is responsible for the sensation of pain from headache in this case?

- A. Meningeal branches of the maxillary nerve
- B. Meningeal branches of the mandibular nerve
- C. Meningeal branches of the ethmoidal nerve
- D. Tentorial nerve
- E. C2 and C3 fibers

187 A 55-year-old woman is admitted to the emergency department with chest angina. ECG examination reveals an acute myocardial infarction. A series of medications is administered to the patient, including sublingual nitroglycerin for reducing her blood pressure. Which of the following structures is most likely to be the route of absorption of this drug?

- A. Deep lingual vein
- B. Submandibular duct
- C. Sublingual duct
- D. Lingual vein
- E. Sublingual vein

188 A 35-year-old man is admitted to the hospital with severe pain in the area of his right submandibular gland. Radiographic examination reveals a tumor of the gland. An incision is made and the submandibular gland and its duct are removed. Which of the following nerves is most commonly injured in this type of procedure?

- A. Buccal
- B. Lingual
- C. Inferior alveolar
- D. Nerve to mylohyoid
- E. Glossopharyngeal
A 22-year-old man is admitted to the emergency department with a sinus infection. Radiographic examination reveals posterior ethmoidal cell infection. During physical examination the patient complains of progressive loss of vision. Which of the following structures is most likely affected?

- A. Ophthalmic artery
- B. Nasociliary nerve
- C. Anterior ethmoidal nerve
- D. Trochlear nerve
- E. Optic nerve

A 55-year-old male farmer is admitted to the emergency department after falling from the hayloft in his barn. Radiographic examination reveals a small, depressed fracture of the skull vertex and thrombosis of the superior sagittal sinus. A day later the patient loses consciousness. What is the most likely cause of his loss of consciousness?

- A. Obstruction of CSF resorption
- B. Obstruction of the cerebral aqueduct (of Sylvius)
- C. Laceration of the middle meningeal artery
- D. Fracture of the cribriform plate with CSF rhinorrhea
- E. Aneurysm of the middle cerebral artery

An 11-year-old boy visits the outpatient clinic with a history of recurrent infections of his tonsils. Which of the following lymph nodes is most likely to first become visibly enlarged during tonsillitis?

- A. Submandibular
- B. Parotid
- C. Jugulodigastric
- D. Submental
- E. Preauricular

A 45-year-old man is admitted to the emergency department with a red, painful eye. During physical examination it is noted that the conjunctiva of the affected eye is infected. Which of the following lymph node groups would be first involved if the infection spread?

- A. Submandibular
- B. Parotid
- C. Jugulodigastric
- D. Submental
- E. Preauricular

A 45-year-old woman visits the outpatient clinic with past history of dysphagia, nighttime fits of coughing, repeated chest infections, and a palpable swelling in her neck. Radiographic examination reveals the presence of a congenital pharyngeal pouch. Between which muscles is this pouch located?

- A. Between styloglossus and stylopharyngeus
- B. Between palatoglossal arch and median glossoepiglottic fold
- C. Between upper and middle pharyngeal constrictors
- D. Between the cricopharyngeal and thyropharyngeal portions of inferior pharyngeal constrictor
- E. Between the middle and inferior pharyngeal constrictors

A 5-year-old boy fell from a tree and was admitted to the emergency department unconscious. When an emergency tracheostomy was performed, profuse dark venous bleeding suddenly occurred from the midline incision over the trachea. Which of the following vessels was most likely accidentally cut?

- A. Superior thyroid vein
- B. Inferior thyroid vein
- C. Left brachiocephalic vein
- D. Middle thyroid vein
- E. Jugular arch connecting the anterior jugular veins

A 55-year-old woman visits the outpatient clinic complaining of loss of sensation in the posterior third of her tongue. Radiographic examination reveals Eagle’s syndrome, in which the styloid process and stylohyoid ligament are elongated and calcified. Which of the following nerves is most likely affected by Eagle’s syndrome in this patient?

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

A 62-year-old man visits the outpatient clinic complaining of spontaneous lacrimation during eating. Which of the following nerves has developed a lesion to cause this condition?

- A. Facial nerve proximal to the geniculate ganglion
- B. Greater petrosal nerve
- C. Lesser petrosal nerve
- D. Lacrimal nerve
- E. Chorda tympani
A 54-year-old woman is admitted to the emergency department after experiencing sudden problems with her vision for the preceding 5 days. Radiographic examination reveals that an aneurysm of one of the arteries at the base of the brain is compressing the optic chiasm. Which of the following arteries will most likely be involved?

- A. Middle cerebral
- B. Anterior communicating
- C. Anterior cerebral
- D. Superior cerebellar
- E. Posterior superior cerebellar

A 22-year-old woman visits the outpatient clinic with a sinus infection of two weeks’ duration. Physical examination reveals that the patient has focal inflammation, with mucosal edema in the inferior nasal meatus. Drainage from which of the following structures is most likely to be obstructed by this inflammation and edema?

- A. Anterior ethmoidal air cells
- B. Frontonasal duct
- C. Maxillary sinus
- D. Middle ethmoidal air cells
- E. Nasolacrimal duct

A 40-year-old woman suffers severe head trauma in a car crash. After radiographic examination she is diagnosed with a fracture of the temporal bone resulting in a lesion of the facial nerve proximal to the origin of the chorda tympani in the posterior wall of the tympanic cavity. Which of the following functions would most likely remain intact in this patient?

- A. Control of muscles in lower half of face
- B. Control of secretions by submandibular gland
- C. Taste sensation from anterior two thirds of tongue
- D. Tear production by the lacrimal gland
- E. Voluntary closure of the eyelid

Cardiac pain is referred in some cases to the mandible and the region of the TMJ. Cutaneous sensation over the angle of the mandible is normally supplied by which of the following nerves?

- A. Cervical branch of facial
- B. Great auricular nerve
- C. Mandibular branch of trigeminal nerve
- D. Mandibular branch of facial nerve
- E. Transverse cervical nerve

A 60-year-old man presents with a swelling in his neck. Physical examination and biopsy show a benign tumor in his piriform recess. The mucosa of the piriform recess must be anesthetized during the removal of the tumor. Which nerve supplies general sensation to the mucous membrane of the laryngeal vestibule and piriform recesses?

- A. External laryngeal
- B. Glossopharyngeal
- C. Hypoglossal
- D. Inferior laryngeal
- E. Internal laryngeal

A young couple hiking in a wilderness area discovered the body of a man apparently in his 20s. He appeared to have been dead a few days, but animal predation was minimal. A postmortem examination was performed by the county medical examiner, and no evidence of penetrating wounds (bullet, lacerations, etc.) was found. A plain radiograph showed a fractured hyoid bone, but the calvaria and other bones appeared to be intact. Which of the following is the most likely cause of death?

- A. Myocardial infarction (heart attack)
- B. A fall from a height that resulted in fatal internal bleeding
- C. Subdural hematoma
- D. Strangulation
- E. Ingestion of a poisonous substance

A 40-year-old woman presents with severe headaches and dizziness. An MRI reveals a brain tumor, and a biopsy confirms it as a melanoma. She dies 2 months later. Pigmented lesions are not seen on her skin or scalp at the time of diagnosis or during postmortem examination. Which of the following is the most likely source of the malignant melanoma cells?

- A. Superior sagittal sinus
- B. Sphenoidal sinus
- C. Retina of the eye
- D. Pituitary gland
- E. Thymus
ANSWERS

1. E. The child in this problem suffers from a fistula that indicates an open malformation. This implies that the defect must be due to failure of closure for both an internal and an external structure. This excludes the second pharyngeal arch and third pharyngeal pouch from being the answers alone. A branchial fistula results from failure of closure of both the second pharyngeal pouch and the cervical sinus, the cervical sinus being the consolidation of the second through fourth pharyngeal clefts, external structures. The thyroglossal duct extends from the thyroid to the tongue and failure of its closure would not result in an external defect. The second pharyngeal groove merges with the third and fourth pharyngeal grooves to form the cervical sinus. Failure of closure of the second groove alone would not present with an open fistula.

GAS 954-955; GA 492-493

2. A. The largest part of the palate is formed by the secondary palate, which is embryologically derived from the lateral palatine processes. The median palatine process gives rise to the smaller primary palate, located anteriorly. The intermaxillary segment gives rise to the middle upper lip, premaxillary part of the maxilla, and the primary palate. The median nasal prominences merge with each other and the maxillary prominences to give rise to the intermaxillary segment. The frontonasal eminence gives rise to parts of the forehead, nose, and eyes.

GAS 1047-1054; GA 533-534

3. A. A coloboma of the iris is caused by failure of the retinal fissure to close during the sixth week. Abnormal neural crest formation would lead to abnormal development of choroid, sclera, and cornea because these are derived from neural crest cells. Abnormal interaction between the optic vesicle and ectoderm would lead to abnormal development of the entire eye because a lens placode may fail to develop or develop abnormally. The iris would not be affected by abnormal development of the posterior chamber. Weak adhesion between the layers of the optic vesicle leads to congenital retinal detachment.

GAS 898-901; GA 460-461

4. E. The anterior fontanelle is located at the junction of the sagittal and coronal sutures and closes at around 18 months of age. The posterior fontanelle is located at the junction of the sagittal suture and lambdoid suture, and it closes at around 2 to 3 months. The mastoid fontanelle is located at the junction of the squamous suture and the lambdoid suture, and it closes at the end of the first year. The sphenoidal fontanelle is located at the junction of the squamous suture and the coronal suture and closes at around 2 to 3 months. There is a lambdoid suture but not a lambdoid fontanelle.

GAS 812-821; GA 430-431

5. A. Thyroglossal duct cysts occur due to retention of a remnant of the thyroglossal duct along the path followed by the descending thyroid gland during development. The path begins from the foramen cecum of the tongue and descends in the midline to the final position of the thyroid. The sixth pharyngeal arch provides origin to muscles and cartilage of the neck and would produce a midline mass connected to the tongue. A branchial cyst or fistula would not be present in the midline. The first pharyngeal arch gives rise to muscles of mastication and the malleus and incus. The third pharyngeal arch provides origin to the stylopharyngeus muscle and hyoid bone.

GAS 964 968; GA 503-504

6. E. The most common cause of cleft lip is failure of fusion of the maxillary process and the intermaxillary segment. Defects located between the lateral nasal prominences and the maxillary processes would affect the development of the nasolacrimal duct. Failure of fusion of the medial nasal prominences would produce a median cleft lip, a rare congenital anomaly. The lateral and median nasal processes both arise from the nasal placodes and do not undergo subsequent fusion. The lateral nasal prominences do not fuse with each other.

GAS 813-816; GA 429-432

7. A. The listed symptoms are typical of first arch syndrome because the first arch normally gives rise to muscles of mastication, mylohyoid, anterior belly of the digastric, tensor tympani, tensor veli palatini, malleus, and incus. Abnormal development of the second arch would affect the muscles of facial expression, the stapes, and parts of the hyoid bone. Abnormal development of the third pharyngeal arch would affect only the stylopharyngeus and parts of the hyoid bone. Abnormal development of the fourth and sixth arch would affect various muscles and cartilages of the larynx and pharynx and would not produce the hypoplastic mandible characteristic of first arch syndrome.

GAS 925; GA 456-457

8. C. Obstructive hydrocephalus, in this case resulting from obstruction of the cerebral aqueduct, refers to a condition in which flow of cerebrospinal fluid (CSF) is obstructed within the ventricular system. This leads
to pressure increasing in the CSF above the obstruction, explaining the enlarged lateral and third ventricles. Nonobstructive hydrocephalus is due to either excessive CSF production or ineffective CSF reabsorption. This would lead to enlargement of all ventricular chambers. Anencephaly, also known as ranoencephaly, is a partial absence of the brain and is due to defective closure of the anterior neuropore. Holoprosencephaly is a failure of cleavage of the forebrain and would result in a single fused ventricle.

9 C. Both the inferior parathyroid glands and the thymus are derived from the third pharyngeal pouch. Therefore, an ectopic thymus is likely to be associated with ectopic parathyroid tissue, indicating abnormal development of the third pharyngeal pouch. The lingual tonsil develops from an aggregation of lymph nodules on the tongue and is not associated with development of the thymus. The submandibular gland develops from endodermal buds in the floor of the stomodeum and is not associated with development of the thymus. The thyroid gland arises from an outpocketing of the pharynx, descending along the route of the thyroglossal duct, and it is not associated with development of the thymus. Development of the thyroglossal duct is also not associated with development of the thymus.

GAS 101, 834; GA 445

10 C. The defect is likely in the development of third and fourth pharyngeal pouches because the superior parathyroid glands are derived from the fourth pouch, whereas the inferior parathyroid glands are derived from the third pouch. In addition, the third pouch gives rise to the thymus, and the parafollicular cells of the thyroid gland are derived from the fourth pharyngeal pouch. The first pouch gives rise to the tympanic membrane and cavity. The second pouch gives rise to the palatine tonsils and tonsillar sinus. The fourth pharyngeal pouch gives rise to the superior parathyroid glands and the parafollicular cells of the thyroid gland. The fifth pharyngeal pouch contributes to the formation of the parafollicular cells of the thyroid gland.

GAS 206; GA 12, 102

13 D. The third pharyngeal arch gives rise to the greater cornu and lower part of the hyoid bone in addition to the stylopharyngeus muscle. The maxillary prominence is important in development of the cheeks and upper lip. The mandibular prominence is important in development of the mandible. The second pharyngeal arch gives rise to the lesser cornu and upper part of the hyoid bone. The fourth pharyngeal arches, while extensively involved in development of the cartilage and muscles of the larynx, play no part in the development of the hyoid bone.

GAS 803, 1034; GA 489, 504, 512-513

14 E. A lateral cervical cyst is caused by remnants of the cervical sinus and would present anterior to the sternocleidomastoid. A dermoid cyst is a cystic teratoma that often occurs near the lateral aspect of the eyebrow. A swollen lymph node is likely to present with pain. Accessory thyroid tissue is normally situated along the route of descent of the thyroglossal duct, either in the posterior tongue or along the midline of the neck. A cyst of the thyroglossal duct would be found in locations similar to where accessory thyroid tissue is found.

GAS 954, 955; GA 492-493

15 A. Noncommunicating hydrocephalus, also known as obstructive hydrocephalus, is due to an obstruction to flow of CSF within the ventricular system. Excess production of CSF or disturbed resorption of CSF gives rise to communicating or nonobstructive hydrocephalus. An increased size of the head can occur as a result of hydrocephalus but would not be a causative factor for hydrocephalus. Failure of the neural tube to close may lead to anencephaly or spina bifida, depending on the portion of the tube affected, but would not result in hydrocephalus.

GAS 101, 834; GA 445

16 C. A normal Apgar score indicates that the child appeared normal and healthy at birth, based on skin color, heart rate, reflexes, muscle tone, and breathing. An atretic external acoustic canal occurs due to failure of the meatal plug to canalize, an event that normally
occurs in late fetal life. Failure of the otic pit to form results in an absent otic vesicle and absence of the membranous labyrinth. The first pharyngeal pouch gives rise to the tympanic membrane and cavity, and abnormal development would not affect the external acoustic meatus. Failure of the auricular hillocks to develop results in failure of the external ear to develop. A degenerated tubotympanic recess would not lead to an atretic external acoustic meatus.

**GAS 796, 902-919; GA 472-474, 476**

**17 D.** The chin and lower lip area are supplied by the mental nerve, a branch of the inferior alveolar nerve, which in turn is a branch of the mandibular division of the trigeminal nerve. The auriculotemporal nerve supplies the TMJ, the temporal region, the parotid gland, and the ear. The buccal nerve is sensory to the internal surface of the cheek. The lesser petrosal nerve is a parasympathetic nerve and would not be affected by herpes zoster, a disease of the dorsal root ganglia. The infraorbital nerve provides sensory innervation to the upper lip.

**GAS 867-868, 933, 935, 1059-1060; GA 455, 483, 528**

**18 B.** The semilunar ganglion, also known as the trigeminal or Gasserian ganglion, is the location of the sensory neuron cell bodies of the trigeminal nerve. Tic douloureux is a condition in which pain occurs over the area of distribution of trigeminal nerve branches. The geniculate ganglion is found on the facial nerve and receives sensory fibers for taste and transmits preganglionic parasympathetic fibers. Inferior glossopharyngeal ganglion is part of the glossopharyngeal nerve, not the trigeminal nerve, and is not the site of the cell bodies mediating the pain. The otic ganglion, located on the mandibular division of the trigeminal nerve, contains postganglionic parasympathetic cell bodies for parotid secretion. The pterygopatine ganglion, located in the pterygopalatine fossa, also contains postganglionic parasympathetic cell bodies for lacrimation and mucosal secretion.

**GAS 850-851, 932; GA 450-451, 487**

**19 C.** The ophthalmic branch of the trigeminal nerve supplies sensory innervation to the eyeball, leading to p in upon damage. Pain in the hard palate and over eyelid and anesthesia of the upper lip would be carried by the maxillary branch of the trigeminal nerve. Paraesthesia over the buccal portion of the face would be mediated by the maxillary division of the trigeminal nerve.

**GAS 844, 852, 866-867; GA 444, 450-451, 455, 463, 465, 469, 483-484, 487**

**20 D.** A tumor at the hypoglossal canal would compress the hypoglossal nerve and affect the genioglossus, a muscle it supplies. The palatoglossus is innervated by the vagus nerve, and the thyrohyoid is innervated by the ansa cervicalis (C1 to C3). The geniohyoid is supplied by C1, which runs with the hypoglossal nerve after it passes through the hypoglossal canal, and would therefore be unaffected. The mylohyoid is supplied by the nerve to mylohyoid, a branch of the mandibular nerve of the trigeminal nerve.

**GAS 812, 822, 824-827, 848-851, 854; GA 436 437, 450-451, 494, 497, 531, 537**

**21 C.** The superior salivatory nucleus is the autonomic nucleus for the facial nerve. Parasympathetic fibers carried by the greater petrosal branch of the facial nerve are responsible for supply of the lacrimal gland and sinuses, via the pterygopalatine ganglion. The geniculate ganglion contains the cell bodies for taste from the anterior two thirds of the tongue carried by the chorda tympani branch of the facial nerve. This branch also carries the parasympathetic supply for the submandibular and sublingual salivary glands. The auriculotemporal nerve provides sensory innervation to the temporal regions of the head, the TMJ, and general sensation from the ear. The inferior salivatory nucleus provides preganglionic parasympathetic fibers carried by the glossopharyngeal nerve that synapse in the otic ganglion, providing parotid stimulation. The pterygopalatine ganglion includes fibers that innervate only lacrimation and the nasal sinuses, but not taste on the anterior two thirds of the tongue.

**GAS 807, 848-852, 863-864; GA 451, 458-459, 463, 473-474, 484, 537**

**22 D.** Thoracic outlet syndrome is characterized by the presence of a cervical rib, accessory muscles, or connective tissue bands that constrict the limited dimensions of the thoracic outlet. The cervical rib is usually located on the C7 vertebra and can impinge on the brachial plexus, resulting in loss of some feeling to the upper limb. There would be no impingement on the phrenic nerve because it leaves C3 to C5 directly parallel with the vertebral column. The syndrome does not include reduction of blood flow to the thoracic wall because of extensive anastomoses between the vessels that supply blood to the anterior thoracic wall. Venous return from the head and neck is mainly through the internal jugular vein and would not be affected because of this vein's location near the midline of the body; thus, it would not be occluded or distended.

**GAS 233; GA 6, 57-59**
23 C. The superior cervical ganglion (SCG), which is the uppermost part of the sympathetic chain, supplies sympathetic innervation to the head and neck. The usual symptoms for SCG injury are miosis and anhydrosis in the head and neck region. Postganglionic sympathetic nerves usually run alongside the arteries leading into the head and neck region. The submandibular ganglion does not carry sympathetic nerves to areas of the head and neck. The trigeminal ganglion includes only cell bodies from afferent sensory nerves from the head. The geniculate ganglion includes cell bodies for taste sensation from the anterior two thirds of the tongue, carried by the facial nerve; it also transmits parasympathetic innervation to many sections of the head and face. The ciliary ganglion provides parasympathetic innervation to the eye and also has some sympathetic fibers coursing through but not synapsing; thus, it would not account for the symptoms of the face.
GAS 45, 882, 895, 980-981; GA 190, 496

24 A. The lingual nerve joins the chorda tympani in the infratemporal fossa, and a lesion to the lingual nerve before it joins the chorda tympani would account for the loss of general sensation, with no loss to the special sense of taste and saliva production. If the chorda tympani were injured, the patient would present with a loss of taste (anterior two thirds of tongue) and a decrease in saliva production because the submandibular and sublingual salivary glands would be denervated. The inferior alveolar nerve provides sensory innervation to the mandibular teeth, but no such loss is present. The lesser petrosal nerve innervates postganglionic neurons supplying the parotid gland, but no loss of salivation is present. The glosopharyngeal nerve provides taste innervation to the posterior third of the tongue, but there is no deficit present in this patient.
GAS 937; GA 480, 484, 528-529, 532, 534

25 E. The jugular foramen is the route of exit for three nerves (glossopharyngeal, vagus, and accessory nerves) and one vein (internal jugular) from the cranial cavity. The glossopharyngeal nerve provides the sensory input for the gag reflex, whereas the vagus nerve provides the motor output. Nerve compression within this foramen would lead to a loss of both systems and thus no gag reflex. Tongue movements are supplied by the hypoglossal nerve, which exits the skull through the hypoglossal canal. The facial nerve innervates the muscles of the face and would not be affected by this injury. Loss of sensation from the face and scalp would be present only if there was involvement of the trigeminal nerve. Loss of hearing would be present with any compression of the vestibulocochlear nerve.
GAS 812, 821, 824-827, 852-853; GA 436-437

26 E. The middle meningeal artery is a branch of the maxillary artery and courses between the dura mater and skull close to the area of the pteron. Any fracture or impact trauma to this location typically results in a laceration of the middle meningeal artery resulting in an epidural hematoma. The external carotid artery ends behind the mandible by dividing into the maxillary and the superficial temporal arteries, and neither of these arteries directly affects the meninges of the brain. The deep temporal arteries do not penetrate the bony skull and thus would not contribute to an epidural hematoma.
GAS 814, 829, 845-1066; GA 459, 483, 485

27 A. An injury to the oculomotor nerve would cause the eye to point downward and laterally due to the unopposed contractions of the trochlear and abducens nerves. The oculomotor nerve also provides innervation to the levator palpebrae superioris; thus, any injury would cause complete ptosis or drooping of the eyelid. The constriction of the pupil is provided by parasympathetic nerves via the oculomotor nerve. The optic nerve is responsible only for the sensory aspect of light via the retina in the eye. The facial nerve innervates the facial muscles, including the orbicularis oculi, which supplies the blink reflex. The ciliary ganglion could be damaged in this patient, but the loss of parasympathetic supply would not adequately explain the ptosis of the eyelid. The superior cervical ganglion provides sympathetic innervation to the head and neck, but no loss of sympathetics is evident in this patient.
GAS 855, 1075; GA 450-451, 465, 469, 536

28 B. The scalp is divided into five layers: skin, dense connective tissue, aponeurosis, loose connective tissue, and periosteum. Typically, infections will be located in the loose connective tissue because of the ease with which infectious agents spread via the many veins located in this region. This area is usually referred to as the “danger zone” of the scalp mainly because scalp infections here can be transmitted into the skull via emissary veins, then via diploic veins of the bone to the cranial cavity. The periosteum and bone are almost inseparable; thus, it is not likely to find infections between these layers. The areas between the dense connective tissue and aponeurosis and between the connective tissue and the skin layers do not include connecting veins but mainly superficial veins of the head. The skin pro-
vides a very strong barrier against infections; the epidermis and dermis layers are rarely seen separated, and thus the likelihood of an infection between these areas would be rare.

GAS 797, 874-878; GA 442

29 A. An injury to the left vagus nerve would cause the uvula to become deviated to the right. This is because of the innervation of the musculus uvulae muscle that makes up the core of the uvula. If only one side is effectively innervated, contraction of the active muscle will deviate the uvula to the contralateral side of the injury (ipsilateral side of the uninjured vagus nerve). In addition, the intact levator veli palatini will pull the uvula to the intact side. The right and left hypoglossal nerves innervate the tongue muscles and would not affect the uvula. The glossopharyngeal nerve supplies sensory innervation to the oropharynx and nasopharynx, but not motor innervation to these areas.

GAS 1051; GA 62, 101, 104, 112, 191, 514

30 E. The rima glottidis is the opening between the vocal folds and the arytenoid cartilages. The piriform recess is the recess lateral to the laryngeal opening of the laryngopharynx. The vestibule is the region between the epiglottis and rima glottidis. The vestibule is the area between the true and false vocal cords. The vallecula is a bilateral recess anterior to the epiglottis in the laryngopharynx.

GAS 1004-1005; GA 512

31 D. Maxillary sinusitis is an infection of the maxillary sinus, which is located in the body of the maxillary bone. Sharp pain can be a major symptom of maxillary sinusitis. The difference between the remaining answer choices is the location of the sinus. The sphenoid sinus is located in the posterior nasopharynx. The ethmoid sinuses are located laterosuperiorly to the nasal septum. The frontal sinus is located in the frontal bone in the anterior part of the face.

GAS 797, 879, 1018, 1020, 1022; GA 487, 518, 525

32 D. The vagus nerve is responsible for sensation in the mucosa of the larynx down to the level of the vocal folds, and also motor innervation of the muscles that initiate a cough reflex and swallowing (motor). The mandibular nerve provides sensory innervation to the mouth and lower and lateral face and motor innervation to the muscles of mastication. The maxillary nerve provides only sensory innervation to the midfacial region surrounding the maxillary bone. The glossopharyngeal nerve provides sensory innervation to the pharynx and motor innervation to the stylohy-
36 B. The facial nerve innervates the stapedius muscle, which is responsible for limiting movement of the stapes, thereby reducing the intensity of the sound entering the inner ear. The hypoglossal nerve innervates tongue muscles; the accessory nerve supplies the trapezius and sternocleidomastoid muscles; the vagus does not provide any innervation for sound in the ear; and the glossopharyngeal nerve only supplies general sensation to the middle ear cavity and tympanic membrane, plus muscle innervation to the stylopharyngeus muscle. GAS 911-919; GA 474

37 B. The vagus nerve innervates a part of the external auditory meatus and, when stimulated, can trigger a cough reflex in about 20% of people. This is thought to be due to “referred sensation” from the vestibule of the ear, which is innervated by the vagus nerve. The vestibulocochlear nerve is associated only with the inner ear. The trigeminal nerve does provide some innervation to the external auditory meatus but does not affect the cough reflex as does the vagus nerve. The auricular branch of the facial nerve only provides a small amount of general sensory supply to the external ear; it is not associated with the cough reflex. GAS 814, 904, 1069; GA 472-473

38 C. The recurrent laryngeal nerve supplies most of the motor innervation to the larynx and sensation below the true vocal folds. The thyroid gland and the recurrent laryngeal nerve are in close proximity and thus the nerve is likely to be injured with a thyroidectomy. Injury to the recurrent laryngeal nerve can result in speech defects, including hoarseness. The superior laryngeal nerve has two branches: the internal laryngeal nerve innervates the mucous membranes of the larynx above the vocal folds, and the external laryngeal nerve innervates the cricothyroid muscle, which tenses the vocal folds. The glosopharyngeal nerve is supplied superiorly to the true vocal folds and would not be affected by this procedure. GAS 967; GA 503-504, 515-517

39 B. The superior cervical ganglion provides sympathetic innervation to the face and neck regions. Sympathetics travel along the branches of the internal carotid artery, and one result of stimulation of these nerves is to dilate the pupil during a sympathetic response (“flight or fight”). The oculomotor nerve would not affect the dilation of the pupil; rather, its stimulation results in the constriction (parasympathetic nerves). The nervus intermedius is the parasympathetic component to the facial nerve and affects only lacrimation of the eye. The Edinger-Westphal nucleus is the location of the cell bodies of the preganglionic parasympathetic neurons that are carried by the oculomotor nerve (not sympathetics). The trigeminal ganglion only provides sensory innervation to the face and eye but has no motor effect on the pupil. GAS 45, 882, 895, 980-981; GA 190, 496

40 C. The greater petrosal nerve, a parasympathetic branch of the facial nerve, provides innervation to the lacrimal gland of the orbit. The chorda tympani provides innervation to the submandibular and sublingual glands and also taste to the anterior two thirds of the tongue. The deep petrosal nerve provides sympathetic innervation to the blood vessels and mucous glands of the head and neck. The lesser petrosal nerve provides parasympathetic innervation to the parotid gland. The nasociliary nerve provides sensory innervation to the ethmoid sinuses and the cornea as well as innervation to the skin of the eyelids and superior nose regions. GAS 852, 917-918, 945, 1016, 1029, 1047; GA 463, 472, 487

41 C. The maxillary sinus is located inferior to the orbit. Any trauma to the inferior bony wall of the orbit will likely displace the orbital structures in the compartment to the space below the orbit (maxillary sinus). The ethmoid sinus is located superiorly and medial to the orbit, whereas the frontal sinus is located superiorly to the orbit. The nasal cavity is toward the midline and is not inferior to the orbit. The sphenoid sinus is deeper into the facial region but is not inferior to the orbit. GAS 797, 879, 1018, 1020, 1022; GA 487, 518, 525

42 B. The superior ophthalmic vein drains directly into the cavernous sinus. The danger area of the face is located in the triangular region from the lateral angle of the eye to the middle of the upper lip, near the nose, and is drained by the facial vein. The facial vein communicates directly with the cavernous sinus through the superior ophthalmic vein. The pterygoid venous plexus communicates with the cavernous sinus through the inferior ophthalmic vein, but it is not directly connected to the cavernous sinus. The basilar venous plexus connects the inferior petrosal sinuses and communicates with the internal vertebral venous plexus. The parietal emissary veins and frontal venous plexus do not communicate directly with the cavernous sinus. GAS 893, 1027; GA 467

43 C. A lesion of the facial nerve is likely to lead to the symptoms described (drooping mouth, unable to close right eye, and food collection in the oral vesti-
The facial nerve courses over the ascending ramus of the mandible because the muscles of facial expression are paralyzed. There is a bony prominence over the facial nerve located on the medial wall of the middle ear. Because of its close proximity, the facial nerve can be damaged due to otitis media. The other nerves listed are not located in close proximity to the middle ear and, if injured, would not present with the symptoms described.

GAS 855, 872, 945; GA 451, 458-459, 463, 473-474, 484, 537

44 C. The arterial circle (of Willis) receives its blood supply from the internal carotid and vertebral arteries. The actual circle is formed by the bifurcation of the basilar, posterior cerebral, posterior communicating, internal carotid, anterior cerebral, and anterior communicating arteries. The middle cerebral artery is the lateral continuation of the internal carotid artery. Although it receives its blood supply from the arterial circle (of Willis), it does not actually form any part of the circle.

GAS 837-838; GA 452

45 E. The sigmoid venous sinus empties into the internal jugular vein and drains the cranial vault. It runs along the posterior cranial fossa near the suture between the temporal and occipital bones. The superior sagittal sinus lies within the superior aspect of the longitudinal fissure, between the two cerebral hemispheres. The inferior sagittal sinus runs inferior to the superior sagittal sinus within the falx cerebri and joins the great cerebral vein (of Galen) to form the straight sinus. The straight sinus drains the great cerebral vein (of Galen) into the confluence of sinuses. The cavernous sinus is located within the middle cranial fossa and receives the ophthalmic veins, the greater petrosal sinus, and other venous vessels.

GAS 842-844; GA 445

46 C. The tumor is compressing the facial nerve, which runs through the internal acoustic meatus along with the vestibulocochlear nerve, which provides sense of taste to the anterior two thirds of the tongue via the chorda tympani and also mediates all of the facial muscles except the muscles of mastication. The mandibular branch of the trigeminal nerve courses through the foramen ovale and mediates motor to the muscles of mastication and sensory to the lower third of the face. The maxillary branch of the trigeminal passes through the foramen rotundum and is sensory to the middle third of the face. The jugular foramen has the glossopharyngeal, vagus, and accessory nerves coursing through it. Finally, the superior orbital fissure has the ophthalmic branch of the trigeminal nerve coursing through it, along with the oculomotor, trochlear, and abducens nerves.

GAS 855, 872; GA 451, 458-459, 463, 473-474, 484, 537

47 E. The submental lymph nodes drain roughly the anterior two thirds of the mouth and tongue, including the lower lips. The occipital nodes serve the inferoposterior aspect of the head. The parotid nodes lie anterior to the ear and serve the region of the lateral aspect of the eye, the parotid gland, and anterior ear. The retropharyngeal nodes lie posterior to the pharynx and drain the posterior aspect of the throat and pharynx. The jugulodigastric node is a large node posterior to the parotid gland and just below the angle of the mandible, and it receives lymph from much of the face and scalp.

GAS 872, 983-984, 1044, 1058; GA 458, 502-503

48 A. The abducens nerve would be affected first due to aneurysmal dilation of the internal carotid artery (ICA) because the nerve runs in closest proximity to the artery within the cavernous sinus. The other nerves running in the wall of the cavernous sinus are the oculomotor nerve, trochlear nerve, and both the maxillary and ophthalmic branches of the trigeminal nerve. Each of these nerves, however, courses along, or within, the lateral walls of the cavernous sinus and may not be immediately affected by an aneurysm of the ICA.

GAS 844; GA 445, 450, 452

49 C. The lingual nerve is the most likely nerve damaged because there is loss both of taste and general sensory supply to the anterior two thirds of the tongue, which is innervated by the lingual nerve, which at this point has been joined by the chorda tympani. The chorda tympani would be a likely choice; however, it carries only taste and does not mediate other general sensation to the tongue. The auriculotemporal nerve is a posterior branch of the mandibular division of the trigeminal nerve and innervates skin near the ear and temporal region. The mental nerve is the terminal branch of the inferior alveolar nerve and innervates the skin of the chin.

GAS 935; GA 480, 484, 528-529, 532, 534

50 B. The auriculotemporal nerve is a posterior branch of the mandibular division of the trigeminal nerve. It encircles the middle meningeal artery and courses medially to the TMJ and then ascends up near the auricle. Because this nerve supplies the TMJ and skin of the external auditory canal, pain from the joint can be referred to the ear as in this case. The facial nerve courses over the ascending ramus of
the mandible, passing superficial to the masseter muscle and below the TMJ through the parotid gland, and would not be involved in this problem. The lesser petrosal nerve courses through the middle cranial fossa and exits through the foramen ovale, where it joins the otic ganglion. The vestibulococlear nerve exits the cranial cavity through the internal acoustic meatus and innervates structures in the inner ear. Finally, the chorda tympani is a branch of the facial nerve and joins the mandibular division of the trigeminal nerve anterior to the TMJ. GAS 826-827, 904; GA 455, 483-485

51 D. The otic ganglion is the location of the postganglionic parasympathetic neural cell bodies innervating the parotid gland. The ganglion lies on the mandibular division of the trigeminal nerve near the foramen ovale. The trigeminal ganglion contains cell bodies for neurons innervating sensory aspects of the face. The inferior salivatory nucleus lies within the brainstem and contains preganglionic parasympathetic neurons whose axons pass within the lesser petrosal nerve to the otic ganglion for synapse in the supply of the parotid. The superior cervical ganglion has the cell bodies of postganglionic sympathetic fibers innervating sympathetic structures to the head. The submandibular ganglia contain the cell bodies of postganglionic sympathetic fibers innervating the sublingual and submandibular salivary glands. GAS 853, 864, 937; GA 484

52 B. The arachnoid villi are extensions of the arachnoid mater into the superior sagittal sinus. The villi allow for proper drainage of the CSF into the venous bloodstream from the subarachnoid space in which the CSF circulates. The villi are a crucial element in maintaining proper intracranial pressure and circulation of the CSF. GAS 101, 834; GA 445

53 C. The afferent/sensory limb of the corneal (blink) reflex is carried by the nasociliary nerve. It is a branch of the ophthalmic division of the trigeminal nerve. The frontal and lacrimal nerves provide cutaneous supply to parts of the orbit and face, but they do not innervate the cornea. The facial nerve is the efferent limb of the corneal reflex and mediates the closing of both eyes in response to irritation of the cornea. The oculomotor nerve mediates the reopening of the eyes by contraction of the levator palpebrae superioris. The optic nerve also innervates the eye for the sense of vision and is the afferent limb of the pupillary light reflex. GAS 894-897; GA 465, 469

54 D. Kiesselbach (also called Little) plexus is an anastomosis of four arteries on the anterior nasal septum. The four arteries are the anterior ethmoidal artery, sphenopalatine artery, superior labial artery, and greater palatine artery. The two largest contributors, however, are the septal branches of the sphenopalatine (from the maxillary artery) and superior labial arteries (branches of the facial artery, which in turn is a branch of the external carotid artery). GAS 813, 814, 819-820, 1016, 1018, 1020; GA 507, 520

55 B. The palatine tonsils lie in tonsillar beds with muscular (covered with mucosa) anterior and posterior pillars forming the boundaries of the bed. These pillars are formed by the palatoglossal arch, anteriorly, and the palatopharyngeal arch posteriorly. The anterior pillar, part of the palatoglossal arch, contains the palatoglossus muscle; the posterior pillar, provided by the palatopharyngeal arch, is formed by the palatopharyngeus muscle. GAS 990, 992, 993, 1051; GA 12, 504-505, 520, 532-534

56 A. The posterior cricoarytenoid muscles lie on the superoposterior aspect of the lamina of the cricoid cartilage. When these muscles contract, they cause lateral rotation (abduction) of the vocal processes of the arytenoid cartilages, thereby opening the space between the vocal folds, the rima glottidis. The lateral cricoarytenoid is involved with adducting the arytenoid cartilage and closing the rima glottidis. The thyroarytenoid muscles lie alongside either vocal ligament and are also involved in adducting the vocal folds. The transverse arytenoid muscle connects both arytenoid cartilages and also aids in closing the rima glottidis. Finally, the cricothyroid muscle is located on the anterior aspect of the cricoid cartilage and aids in elongation and tensing of the vocal folds. GAS 1006; GA 507, 513

57 C. The parotid duct, also known as the Stensen’s duct, crosses the masseter muscle transversely and extends to the oral cavity. The facial artery can be palpated in the groove anterior to the mandibular angle. The facial vein lies anterior to the artery, passing toward the angle of the lips, but does not ascend in close proximity to the masseter. All of the other vessels are located more deeply and cannot be palpated. GAS 863, 1044; GA 456-457

58 C. Because of the surgical division of the ansa cervicalis, the sternohyoideus muscle will most likely be paralyzed following this tumor resection. The ansa
cervicalis innervates the strap muscles, including the sternohyoid, sternothyroid, and omohyoid muscles. The sternocleidomastoid is innervated by the accessory nerve, the spinal accessory nerve, and would not be involved with this surgery. The platysma is located most superficially on the neck and is innervated by cervical branch of the facial nerve. The trapezius muscle is also innervated by the spinal accessory nerve and plays no role in ansa cervicalis functions. Finally, the cricothyroid muscle is innervated by the external laryngeal branch of the vagus and would not be affected by the surgery.

GAS 964, 974; GA 496-497, 531

59 A. The spinal accessory nerve passes across the posterior triangle of the neck and innervates both the trapezius muscle and the sternocleidomastoid muscle for the respective side of the body. Upon surgical division of the nerve, the patient will lose the ability to raise the respective shoulder and will demonstrate weakness in turning the head to the opposite side. The trapezius will also lose tone and the shoulder will droop. The ansa cervicalis innervates strap muscles of the neck and, if cut, would not produce drooping of the shoulder. The facial nerve does not pass through any of the triangles of the neck; however, if it were divided, paralysis would result in the muscles of facial expression. The hypoglossal nerve innervates the intrinsic muscles of the tongue, plus the genioglossus, hyoglossus, and styloglossus and, if injured, would not result in any of the patient’s symptoms. GAS 973-974; GA 37, 450-451, 94, 537.

60 C. Four nerves participate in providing cutaneous supply to the neck. The nerves are the supraclavicular, great auricular, transverse cervical, and the lesser occipital. The area over the angle of the jaw is innervated by the great auricular nerve. It ascends from spinal segments from C2 and C3 and innervates the skin over the angle of the jaw and posterior to the auricle of the ear. The transverse cervical also originates from C2-3 spinal segments but passes anteriorly to innervate the anterior and lateral aspects of the neck. The lesser occipital nerve innervates skin in the area of the back of the neck and posterior occiput. The supraclavicular nerves originate from C3-4 and innervate the more inferior aspects of the neck, the upper deltoid region, and skin inferior to the clavicles.

GAS 974-975; GA 494, 496-497

61 C. Because of its size and vulnerable position during birth, the sternocleidomastoid muscle is injured more often than other muscles of the head and neck during birth. When acting alone, the action of this muscle is to turn the head to the opposite side and bend it toward the ipsilateral shoulder. When using both muscles, the head will flex toward the chest. Therefore, the most likely muscle to have been injured here is the left sternocleidomastoid muscle.

GAS 970-971; GA 492-493

62 C. The most likely structures one would encounter while performing a midline incision below the isthmus of the thyroid gland would be the inferior thyroid vein and the thyroidea ima artery. The inferior thyroid vein drains typically to the left brachiocephalic vein, which crosses superficially, just inferior to the isthmus. The thyroidea ima artery arises from the aortic arch, vertebral artery, or other source but is not a constant structure. The middle thyroid veins drain the thyroid gland to the internal jugular vein and are superior to the incision site. The inferior thyroid arteries branch from either subclavian artery and meet the thyroid gland at an oblique angle. They would not be ligated with a midline incision. The brachiocephalic veins are inferior to the site of incision.

GAS 967; GA 503-504, 515

63 D. The recurrent laryngeal nerve is the most likely nerve damaged during the surgery because it runs in close proximity to the inferior thyroid artery and is easily injured or transected with the artery if extreme care is not exercised during operative procedures. The recurrent laryngeal nerve innervates the majority of the vocal muscles that open and close the rima glottidis, in addition to providing sensory supply to the larynx below the vocal folds. Even relatively mild trauma to the nerve can result in hoarseness. The internal branch of the superior laryngeal nerve is not in close proximity to the inferior thyroid artery and pierces the thyrohyoid membrane to enter the pharynx. The ansa cervicalis lies lateral to the site of surgery and does not innervate any structures that, if paralyzed, would cause hoarseness.

GAS 967; GA 503-504, 515-517

64 E. The vagus nerve exits the skull at the jugular foramen and is responsible for motor innervation to the smooth muscles of the trachea, bronchi, and digestive tract, in addition to the muscles of the palate, pharynx, larynx, and superior two thirds of the esophagus. The ansa cervicalis innervates the strap muscles of the neck, with the exception of the thyrohyoid muscle. The cervical sympathetic trunk does not enter into the jugular foramen; it runs behind the carotid sheath, parallel with the internal carotid artery; its carotid branch accompanies the artery into the carotid canal and carries sympathetic fibers to deep areas of the head. Damage to the
external laryngeal nerve would result in paralysis of the cricothyroid muscle, presenting as an easily fatigued voice with hoarseness. Injury to the hypoglossal nerve would result in protrusion of the tongue toward the affected side and moderate dysarthria.

GAS 203, 211-213, 217, 345, 807, 849-851, 853-854; GA 537

65 **B.** The hypoglossal nerve provides motor innervation to the muscles of the tongue, with the exception of the palatoglossus. Injury to the hypoglossal nerve would result in deviation of the tongue toward the affected side when the tongue is protruded (in this case the right side), due mainly to the unilateral contraction of left genioglossus, and moderate dysarthria. Injury to the glossopharyngeal nerve would result in loss of taste in the posterior third of the tongue and a loss of soft palate sensation and gag reflex on the affected side. The inferior alveolar nerve supplies the tissues of the chin and lower teeth. The lingual nerve conveys parasympathetic preganglionic fibers to the submandibular ganglion and general sensation and taste fibers for the anterior two thirds of the tongue. Injury to the vagus nerve would cause sagging of the soft palate, deviation of the uvula to the unaffected side, hoarseness, and difficulty in swallowing and speaking.

GAS 855, 1041, 1043-1044; GA 450-451, 494, 497, 531-537

66 **C.** During removal of the tumor, the internal branch of the superior laryngeal nerve was injured. Injury to this nerve results in loss of sensation above the vocal cords, at the entrance to the larynx, and loss of taste on the epiglottis. Loss of sensation in the laryngeal vestibule can precipitate aspiration of fluid into the larynx, trachea, and lungs. The pharyngeal nerve of the vagus supplies motor innervation to the muscles of the pharynx except the stylopharyngeus (glossopharyngeal nerve). Injury to the hypoglossal nerve would result in protrusion of the tongue toward the affected side and moderate dysarthria. The lingual nerve conveys parasympathetic preganglionic fibers to the submandibular ganglion and general sensation and taste fibers for the anterior two thirds of the tongue. The posterior laryngeal provides sensory fibers to the larynx below the vocal cords and motor fibers to all of the muscles of the larynx except for the cricothyroid.

GAS 996, 1012; GA 495, 508, 514

67 **A.** The posterior cricoarytenoids are the only muscle of the larynx that abducts the vocal cords. The remaining answer choices are muscles that act in adduction of the vocal cords.

GAS 1006; GA 507, 513

68 **B.** The external branch of the superior laryngeal nerve courses together with the superior thyroid artery for much of its route. The cervical sympathetic trunk is located more laterally and quite posteriorly to this location. The inferior root of the ansa cervicalis is located more superficially in the anterior neck. The internal branch of the superior laryngeal nerve takes a route superior to that of the external branch and the superior thyroid artery and would be unlikely to be injured in this case. The recurrent laryngeal nerve terminates inferiorly, passing into the larynx in relation to the inferior thyroid artery or its branches.

GAS 996, 1012; GA 514

69 **C.** The external surface of the tympanic membrane is innervated primarily by the auriculotemporal nerve, a branch of the mandibular division of the trigeminal nerve. Damage to this nerve would additionally result in painful movements of the TMJ because this joint receives innervation from the same nerve. Taste in the anterior two thirds of the tongue is supplied by the facial nerve and would be unaffected in this injury. The sensory innervation of the nasal cavity is supplied by the ophthalmic and maxillary divisions of the trigeminal nerve and would be unaffected by injury to the tympanic membrane. Sensory innervation to the larynx is provided by the vagus nerve, whereas the pharynx receives sensory fibers from the glossopharyngeal and vagus nerves. The palate is supplied by the maxillary divisions of the trigeminal nerve and would be unaffected by this injury.

GAS 904; GA 455, 483-485

70 **B.** Both the stapedius and tensor tympani normally function to dampen movements of the middle ear ossicles, thereby muting sound and preventing hyperacusis. The stapedius would be the source of hyperacusis in this problem because it receives its innervation from the facial nerve. The tensor tympani receives motor innervation from the mandibular division of the trigeminal nerve. The posterior belly of the digastric and the stylohyoid receive innervation from the external branch of the superior laryngeal nerve, which would not result in hyperacusis.

GAS 906, 910-911; GA 474

71 **C.** The greater petrosal nerve carries parasympathetic fibers that are involved in the innervation of the lacrimal gland, as well as the mucosal glands of the nose, palate, and pharynx. As a result, an injury to the right greater petrosal nerve would be expected to...
result in decreased lacrimal secretions for the right eye. The sublingual and submandibular glands receive their parasympathetic fibers from the facial nerve via the chorda tympani and the lingual nerve. They would be unaffected by this lesion. The parotid gland receives its parasympathetic secretory innervation from the glosopharyngeal nerve via the lesser petrosal and auriculotemporal nerves and would be unaffected. Taste to the anterior tongue is provided by the facial nerve via the chorda tympani, and general sensation to the anterior tongue is provided by the mandibular division of the trigeminal nerve via the lingual nerve.

GAS 852, 917, 918, 945, 1016, 1029-1030, 1047; GA 463, 472, 487

72 C. Parasympathetic innervation of the parotid gland is provided by axons carried by the glosopharyngeal nerve that emerge from the tympanic plexus of the middle ear as the lesser petrosal nerve. These preganglionic parasympathetic fibers terminate by synapsing in the otic ganglion, which supplies the secretory parasympathetic innervation to the parotid gland. Glandular secretions of the nasal cavity, soft palate, and lacrimal gland all receive parasympathetic innervation from the fibers of the greater petrosal nerve and would remain intact following a tympanic plexus lesion. Axons for secretory innervation to the sublingual and submandibular glands are carried by the facial nerve, then course through the chorda tympani, before synapsing in the submandibular ganglion, with postganglionic fibers eventually reaching the glands via the lingual nerve.

GAS 863-865; GA 456, 458-459, 480

73 B. The inferior alveolar branch of the mandibular division of the trigeminal nerve provides sensory innervation to the mandibular teeth and would require anesthesia to abolish painful sensation. The lingual nerve provides taste and sensation to the anterior two thirds of the tongue and carries general sensory fibers, taste fibers, and parasympathetic fibers. It does not provide sensory innervation to the teeth. The buccal nerve provides sensory innervation to the inner surface of the cheek. The mental nerve is the distal continuation of the inferior alveolar nerve as it exits the mental foramen of the mandible and does not affect the teeth. The nerve to the mylohyoid is a motor branch of the inferior alveolar nerve that supplies the mylohyoid and the anterior belly of the digastric.

GAS 937; GA 480, 483, 528

74 D. Part of the lateral pterygoid muscle has its insertion on the articular disk within the TMJ and would be most affected by the inflammation of this joint. The temporalis muscle inserts upon the coronoid process and retracts the jaw. The medial pterygoid muscle extends from the medial surface of the lateral pterygoid plate to the mandible and functions in elevation of the jaw. The masseter extends from the zygomatic arch to the lateral ramus of the mandible and elevates the jaw. The buccinator pulls back the angle of the mouth and flattens the cheek.

GAS 925, 930-931; GA 480-482, 484

75 D. The trochlear nerve innervates the superior oblique muscle, which acts to move the pupil downward and laterally. It is the only muscle that can depress the pupil when the eye is adducted. When an individual walks down stairs, this eye motion is initiated, and diplopia results if it is not functioning properly. The optic nerve provides vision, and a lesion of this nerve would not result in diplopia when an affected individual walks down stairs, but rather diminished vision or blindness. The oculomotor nerve supplies the superior, inferior, and medial rectus as well as the inferior oblique. Overall, innervation from the oculomotor nerve results in upward and inward movements of the eye, and a lesion of this nerve would not induce diplopia in an individual walking down stairs. The abducens nerve innervates the lateral rectus muscle, which abducts the eye, and damage would not induce the diplopia presented in this problem. The frontal nerve is a branch of the ophthalmic division of the trigeminal nerve and provides sensory innervation to the forehead.

GAS 848, 850-851, 855; GA 450-451, 465, 536

76 E. The superior oblique muscle turns the pupil downward from the adducted position. Inability to perform this motion, in conjunction with diplopia when walking down stairs, indicates damage to the trochlear nerve. The abducens innervates the lateral rectus, resulting in abduction of the eye. The oculomotor nerve supplies the superior, inferior, and medial rectus as well as the inferior oblique. Overall, innervation from the oculomotor nerve results in upward and downward movements of the eye. Damage to this nerve would not induce diplopia when an affected individual walks down stairs. In addition, inability to gaze downward in the adducted position does not indicate oculomotor nerve damage. In this position the oculomotor nerve would be responsible for upward movement. The nasociliary nerve is a sensory nerve originating from the ophthalmic branch of the trigeminal nerve.

GAS 888-891; GA 464, 466
77 E. Ptosis and miosis occur in response to blocking of sympathetic innervation. Ptosis (drooping of the eyelid) results from lack of innervation of the superior tarsal muscle (of Müller), and miosis (pupillary constriction) results from unopposed parasympathetic innervation of the pupil. A dilated pupil would not occur because this requires the action of the sympathetically innervated dilator pupillae. Dry eye would occur due to lacrimal gland insufficiency, but because this is mediated by parasympathetic fibers, it would remain unaffected in this case. The same holds true for the parasympathetically mediated accommodation pathway. Depth perception involves the visual pathway and is not mediated by the sympathetic system.

GAS 45, 882, 895, 980-981; GA 190, 496

78 B. The right abducens nerve innervates the right lateral rectus, which mediates outward movement (abduction) of the right eye. Inward movement is accomplished by the medial rectus, supplied by the oculomotor nerve. Downward movement in the midline is accomplished by joint activation of the superior oblique and inferior rectus muscle. Downward movement of the pupil from the adducted position is a function of the superior oblique alone, which is supplied by the trochlear nerve. Down and out motion is mediated by the combined actions of the lateral rectus and inferior rectus, which are innervated by the abducens and oculomotor nerves. Downward movement of the pupil from a forward gaze is a result of combined actions of inferior rectus and superior oblique muscles, supplied by oculomotor and trochlear nerves, respectively.

GAS 849-852, 855; GA 450, 465, 536

79 A. Horner’s syndrome involves interruption of sympathetic supply to the face. This results in ptosis (drooping eyelid) miosis (constricted pupil), and anhydrosis (lack of sweating) of the face. The eye is lubricated by the lacrimal gland, which secretes in response to parasympathetic stimulation, and would be unaffected. Exophthalmos (protrusion of the globe) is frequently caused by hyperthyroidism and is not present in Horner’s syndrome. Loss of sympathetic innervation leads to unopposed vasodilatation of the vessels to the face, leading to flushing rather than paleness.

GAS 45, 882, 895, 980-981; GA 190, 496

80 E. The superior tarsal muscle (of Müller), innervated by sympathetic, assists in elevating the eyelids and holding them up. Damage would result in partial ptosis of the eyelid. The superior oblique, innervated by the trochlear nerve, moves the pupil downward from the adducted position (for example, as when your right eye gazes down toward your left foot). To test the trochlear nerve, ask the patient to look with each eye toward the tip of the nose. The orbicularis oculi, innervated by the facial nerve, is responsible for closure of the eye. The palpebral part closes the eyelids ordinarily; the lacrimal part contracts when the eye is closed more forcibly, resulting in increased tear movement across the globe (perhaps to flow down the cheeks). Damage to the levator palpebrae superioris, innervated by the oculomotor nerve, would result in complete, rather than partial, ptosis.

GAS 878, 881, 888-889, 892; GA 461

81 D. Cavernous sinus thrombosis can often result from squeezing pimples or other infectious processes located around the danger area of the face, which includes the area of the face directly surrounding the nose. This physical pressure has the potential to move infectious agents from the pimple into the ophthalmic vein, which then carries them to the cavernous sinus. The pterygoid venous plexus and ophthalmic vein both communicate with the cavernous sinus and therefore offer a route of travel for the spread of infection, but the path provided by the superior ophthalmic vein is a more direct route. Additionally, the superior ophthalmic vein receives blood supply from the supraorbital, supra trochlear, and angular veins that supply the area around the nose and lower forehead. (Venous blood in the head can flow in either direction because these veins do not possess valves.) The emissary veins communicate between the venous sinuses and the veins of the scalp and would therefore not be involved in the spread of infection between the nose and cavernous sinus. The middle meningeal artery courses between the dura and periosteum, whereas the carotid artery, specifically the internal carotid artery, traverses through the cavernous sinus and provides origin to the ophthalmic artery. As with the middle meningeal artery, the carotid artery would not offer a route of communication between the area of infection and the cavernous sinus.

GAS 871, 877, 886, 899; GA 459

82 E. The anterior inferior cerebellar artery (AICA) is a major supplier of the anterior inferior portion of the cerebellum. Nerves located in close proximity would likely be affected by hemorrhage of this artery. The optic, oculomotor, and trochlear nerves are all associated with the midbrain region and would likely not suffer any damage with a possible hemorrhage. The trigeminal nerve is situated in the pons and is thus located too far rostrally to be affected. The abducens nerve is situated at the pontomedullary junction.
and is therefore most likely to be damaged following hemorrhage of the AICA.
GAS 837, 838; GA 452, 454

83 D. The posterior inferior quadrant of the eardrum is the only portion of the tympanic membrane that would allow for an incision with minimal or no damage to adjacent important structures. Incision in the anterior and posterior superior quadrants of the eardrum would likely damage the malleus, which is situated immediately superior and medially to the tympanic membrane. The umbo is situated in close proximity to the handle of the malleus and might be damaged during incision. A vertical incision through the eardrum would almost certainly damage the malleus of the middle ear. Damage to the malleus from surgical incision would interfere with the auditory conduction through the middle ear cavity, and this should be avoided to prevent conductive hearing loss.
GAS 904-906; GA 473, 476

84 A. The hypoglossal nerve innervates the muscles of the tongue and is therefore directly involved in alteration of shape and movement of the tongue. A lesion in this nerve would cause deviation of the tongue toward the injured side, which could be observed upon protrusion of the tongue. The genioglossus is the major muscle involved in protrusion of the tongue. The genioglossus muscles arise from the inside of the mandible and pass posteriorly to insert into the deep aspect of the tongue. When the genioglossi contract, they pull the tongue forward, and out of the mouth, in protrusion. If one genioglossus is paralyzed, it acts like a brake on one side of the tongue when the tongue is pulled forward, causing the tip of the tongue to point to the nonmoving side. The styloglossus muscle is responsible for retraction and elevation of the tongue.
GAS 1039-1041; GA 504, 530, 532-533

85 B. The posterior chamber receives ciliary body secretions first. The ciliary body produces aqueous humor and is located in the posterior chamber. Increased production of fluid from this site would cause an increase in intraocular pressure if drainage is inadequate. The iridociliary angle of the anterior chamber is the location of drainage of the aqueous humor; therefore, a blockage of drainage in this location can cause increased intraocular pressure. The pupil is the connection between the anterior and posterior chamber; a collection of fluid does not occur here, for this is simply an aperture to allow light onto the retina. The vitreous body is not directly connected to the production of aqueous humor. The lacrimal sac is the upper dilated end of the nasolacrimal duct and opens up into the inferior meatus of the nasal cavity. The nasolacrimal duct has nothing to do with increased intraocular pressure.
GAS 898-899; GA 468

86 D. The glossopharyngeal nerve mediates general somatic sensation from the pharynx, the auditory tube, and from the middle ear. Painful sensations from the pharynx, including the auditory tube, can be referred to the ear by this nerve, as in this case of tonsillectomy. The auriculotemporal nerve supplies skin of the auricle and tympanic membrane and scalp. This nerve would not be involved directly or indirectly in the operation. The lesser petrosal nerve contains preganglionic parasympathetic fibers that run in the glossopharyngeal and tympanic nerves before synapsing in the otic ganglion. The vagus nerve mediates general somatic afferent supply to the auricle and external acoustic meatus; stimulation of the meatus can trigger a gag reflex or coughing reflex. The chorda tympani mediates taste for the anterior two thirds of the tongue.
GAS 912, 996-997; GA 450-451, 484, 495-496, 508, 531, 537

87 E. A tumor of the jugular canal would likely affect the glossopharyngeal, vagus, and accessory nerves as they exit the cranium through the jugular foramen. The uvula deviates toward the unaffected side of the pharyngeal muscles because of the pull of the unopposed levator veli palatini. In this case, the uvula deviates to the left, indicating that the left palatal muscles are unaffected whereas the right muscles are not working properly. The pharyngeal wall on the left side is also drawn upward by the nonparalyzed stylopharyngeus supplied by the left glossopharyngeal nerve. The pharyngeal constrictor muscles, as well as muscles of the palate, are all innervated by the vagus nerve, except for the tensor veli palatini, which is supplied by the trigeminal nerve. The right mandibular nerve (of the mandibular division of trigeminal nerve) provides sensory innervation to the face and motor supply to the masticatory muscles and does not innervate the muscles of the pharynx. The left hypoglossal innervates the intrinsic and extrinsic muscles of the left side of the tongue. Compression or injury of this nerve would not lead to uvula deviation.
GAS 824, 826, 827; GA 436-437

88 E. An infection of the submandibular space is usually the result of a dental infection in the mandibular molar area in the floor of the mouth (Ludwig's
89 A. The auditory (eustachian or pharyngotympanic) tube is a mucosal-lined tube that provides a direct connection from the nasopharynx to the middle ear cavity. A respiratory infection can travel from the upper respiratory tract to the oropharynx or nasopharynx and then on into the middle ear via the auditory tube. The choanae are paired openings from the nasal cavity into the nasopharynx and do not connect with the auditory tube or the middle ear. The facial canal is a similar growth on the inside of the mandible. Such growths are usually benign and would not typically cause pain. A ranula is a mucocele found on the floor of the mouth, often resulting from dehydration in older individuals, with coagulation (inspissation) of salivary secretions. It can be caused by acute local trauma; however, they are usually asymptomatic. GAS 797, 1030-1060; GA 504, 524-525, 527

89 B. The maxillary sinus drains via the middle meatus, specifically the semilunar hiatus. The middle meatus and semilunar hiatus are located under the middle nasal concha. The inferior meatus drains the lacrimal secretion carried by the nasolacrimal duct, whereas the superior meatus drains the posterior ethmoidal and sphenoid sinuses. The nasopharynx and sphenoid ethmoidal recess are not situated in close proximity to the maxillary sinus and are therefore not involved in its drainage. GAS 909, 938; GA 473-475, 504-507, 520, 524

90 B. The maxillary sinus drains via the middle meatus, specifically the semilunar hiatus. The middle meatus and semilunar hiatus are located under the middle nasal concha. The inferior meatus drains the lacrimal secretion carried by the nasolacrimal duct, whereas the superior meatus drains the posterior ethmoidal and sphenoid sinuses. The nasopharynx and sphenoid ethmoidal recess are not situated in close proximity to the maxillary sinus and are therefore not involved in its drainage. GAS 1014, 1015; GA 520

91 E. The sphenoidal sinus provides the most direct access to the pituitary gland, which is situated directly above this sinus. Neither the frontal sinus nor maxillary sinus has any direct communication with the interior of the cranial vault and would therefore not allow the surgeon a potential access point to the pituitary gland. The cribriform plate could offer a point of entry into the cranium; entry at that site would lead to damage of the olfactory cells and nerve, but it would also lead to entry into the subarachnoid space, with leakage of CSF and potential meningitis. The cribriform plates are also located too far anteriorly from the pituitary gland. The cavernous sinus is situated within the cranial vault and surrounds the pituitary gland; it is not a site for surgical entrance to the cranial cavity. GAS 1019, 1020, 1022; GA 450, 504, 518-520

92 B. The gag reflex is composed of both an afferent and an efferent limb. These reflexes are mediated by the glossopharyngeal and vagus nerves, respectively. Together, the glossopharyngeal and vagus nerves are responsible for the contraction of the muscles of the pharynx involved in the gag reflex. In this case the glossopharyngeal nerve was injured when the tonsils were excised, resulting in the loss of the sensory side of the reflex. The mandibular and maxillary nerves are part of the trigeminal nerve and are thus largely associated with the sensory supply of the face, sinuses, and oral cavity. The hypoglossal nerve innervates most of the muscles of the tongue. The facial nerve is involved with taste of the anterior two thirds of the tongue; however, it does not mediate the gag reflex. GAS 997; GA 450-451, 537

93 B. The recurrent laryngeal nerve is often at risk of being damaged during a thyroidectomy. Patients who have a transected or damaged recurrent laryngeal will often present with a characteristic hoarseness following surgery. The posterior cricoarytenoid is supplied by the recurrent laryngeal and would thus be impaired following damage to the nerve. The posterior cricoarytenoid is the only muscle responsible for abduction of the vocal cords, and paralysis of this muscle would result in a permanently abducted position of the involved vocal cord. The other muscles listed are all adductors of the vocal cords, and paralysis of these would not lead to closure of the airway. GAS 967; GA 503-504, 515-517

94 C. The pharyngeal tonsil is situated in a slitlike space, the pharyngeal recess, in the nasopharynx behind the opening of the auditory (eustachian) tube, and a pharyngeal tonsil in this location can lead to blockage of the drainage of the auditory tube. The lingual tonsil is located in the posterior aspect of the tongue, whereas the palatine tonsil is contained within the tonsillar fossa between the palatoglossal and palatopharyngeal arches. An enlargement of the lingual tonsil or the palatine tonsil will
not occlude the auditory tube due to their location in the oropharynx. The superior pharyngeal constrictor would not be involved in occlusion of the auditory tube because it is located more posteriorly. The uvula is drawn upward during deglutition and prevents food from entering the nasopharynx; it does not block the auditory tube.

GAS 991-993; GA 12, 504-505, 520

95 A. Infection can spread from the nasopharynx to the middle ear by way of the auditory tube, which opens to both spaces. The first pharyngeal pouch is responsible for formation both of the auditory tube and middle ear cavity. The second pharyngeal pouch persists as the tonsillar sinus and tonsillar crypts. The third pharyngeal pouch develops into the interior parathyroid gland and thymus, whereas the fourth pharyngeal pouch forms the remainder of the parathyroid glands and the ultimobranchial body. The sixth pharyngeal pouch is not well defined and would therefore not contribute to the development of the auditory tube.

GAS 918; GA 473-475, 504-507, 520, 524

96 D. The greater palatine nerve is responsible for innervation of the hard palate, or the hard part of the roof of the mouth. The lesser palatine nerve supplies the soft palate and palatine tonsil but is not involved in supply to the hard palate. The posterior superior alveolar nerve supplies multiple structures, including posterior portions of the gums, cheeks, and the upper posterior teeth. However, it is not involved in nerve supply to the hard palate. The inferior alveolar nerve has several branches, including the mental nerve, incisive branch, mylohyoid nerve, and inferior dental branch. These nerves do not supply the roof of the mouth and thus are not involved. The lingual nerve supplies taste and general sensation to the anterior two thirds of the tongue.

GAS 943.105, 1060; GA 529, 533, 534

97 A. Damage to the internal laryngeal nerve would result in a general loss of sensation to the larynx above the vocal cords, leaving the patient with an inability to detect food or foreign objects in the laryngeal vestibule. The external laryngeal nerve and recurrent laryngeal nerve are both at risk during thyroidectomy. Damage to the recurrent laryngeal nerve would result in paralysis of all the laryngeal muscles except the cricothyroid; it would render the patient hoarse, with a loss of sensation below the vocal cords. Loss of the external laryngeal nerve would lead to paralysis of the cricothyroid muscle and vocal weakness. Injury to the hypoglossal nerve would result in weakness or paralysis of muscle movement of the tongue.

GAS 996, 1012; GA 514

98 C. Ankyloglossia (tongue-tie) is characterized by a lingual frenulum that extends all the way to the tip of the tongue. This condition can cause problems with speech, feeding, and oral hygiene as a result of the low range of motion of the tongue. Ankyloglossia can be treated surgically by cutting the lingual frenulum. None of the other procedures described would treat this condition.

GAS 1038; GA 534

99 D. Of the answer choices listed, the left facial nerve of the patient is the most likely to be damaged during the mastoidectomy. The facial nerve exits the skull via the stylomastoid foramen, just anterior to the mastoid process. A lesion of the facial nerve is likely to cause the symptoms described as a result of paralysis of the facial muscles. Depending upon the site of injury, the patient could also lose the chorda tympani branch of the facial nerve, leading to loss of taste from the anterior two thirds of the tongue ipsilaterally as well as loss of functions of the submandibular and sublingual salivary glands. The other nerves listed are not likely to be damaged during a mastoidectomy.

GAS 872; GA 436, 474

100 C. Normally the tonus of the buccinator muscle prevents the accumulation of saliva and foodstuffs in the oral vestibule. Although a lesion of the facial nerve would paralyze the other muscles listed, the buccinator is the most important muscle of the cheek.

GAS 1034-1035; GA 8, 456-457, 480, 506, 532

101 B. Compression of the optic chiasm can cause bitemporal hemianopia due to compression of nerve fibers coming from the nasal hemiretinas of both eyes. The optic chiasm is located in very close proximity above the pituitary gland. Compression of an optic nerve would cause complete blindness in the affected eye. Compression of an optic tract would cause homonymous hemianopia. Compression of the oculomotor nerve would cause the eye to deviate “out and down” (paralysis of the four extraocular muscles innervated by this nerve), ptosis (paralysis of levator palpebrae), and mydriasis (paralysis of constrictor pupillae). Compression of the abducens nerve would cause paralysis of the lateral rectus muscle, leading to medial deviation (adduction) of the eye.

GAS 1079; GA 447, 450-451
A lesion of the trochlear nerve causes weakness of downward medial gaze. As a result, patients with trochlear nerve lesions commonly have difficulty walking down stairs. The superior cerebellar artery branches from the basilar artery just before it bifurcates into the posterior cerebral arteries. The trochlear nerve emerges from the dorsal aspect of the midbrain and can easily be compressed by an aneurysm of the superior cerebellar artery as it wraps around the midbrain. Aneurysms of the other arteries mentioned are not likely to compress the trochlear nerve, and lesions of the nerves listed are not likely to cause problems walking down stairs.

A Pancoast tumor is located in the pulmonary apex, usually in the right lung. This is because inhaled gases tend to collect preferentially in the upper right lung, in part because of the manner of branching of the tertiary bronchi. These tumors can involve the sympathetic chain ganglia and cause Horner’s syndrome (slight ptosis and miosis). The other conditions listed are not likely to cause symptoms of Horner’s syndrome. Raynaud’s disease, a vascular disorder that affects the extremities, is caused by excessive tone of sympathetic vasoconstriction. Frey syndrome, a rare malady resulting from parotidectomy, is characterized by excessive facial sweating in the presence of food or when thinking about it. Bell’s palsy is characterized by a lesion of the facial nerve, with weakness or paralysis of mimetic muscles.

Quinsy is characterized by painful pus-filled inflammation of the tonsils. A lesion of the oculomotor nerve will cause the eye to remain in a “down and out” position. This is due to the actions of the unopposed lateral rectus (supplied by the abducens nerve) and the superior oblique (supplied by the trochlear nerve). The other nerves listed will not lead to the conditions described.

A lesion of the stapedius muscle. A lesion of the vestibulocochlear nerve can cause tinnitus and/or deafness. A lesion of the vestibulocochlear nerve can cause tinnitus and/or deafness.

The axons of the olfactory nerves run directly through the cribriform plate to synapse in the olfactory bulb. Damage to this plate can damage the nerve axons, causing anosmia (loss of the sense of smell). A lesion of the posterior cricoarytenoid muscle is likely to entrap the medial rectus muscle, causing an inability to gaze laterally. A fracture of the orbital plate of the frontal bone could perhaps entrap the superior oblique or superior rectus muscle, but this would be very unusual. A fracture of the orbital plate of the maxilla can entrap the inferior rectus or inferior oblique muscles, limiting upward gaze. A fracture of the cribiform plate could damage olfactory nerves and result in leakage of CSF (CSF rhinorrhea), with associated meningeal infection. A fracture of the greater wing of the sphenoid is not likely to entrap any extracranial muscles.
their function and thus are not required to maintain the airway.
GAS 1006; GA 507, 513

110  B. The palatine tonsils are highly vascular and
are primarily supplied by the tonsillar branch of the
facial artery; therefore, care is taken to preserve this
artery while performing a tonsillectomy. The palatine
tonsil also receives arterial supply from the ascending
pharyngeal, the dorsal lingual, and the lesser palatine,
but the supply from the facial artery is by far the most
significant.
GAS 990, 992, 993, 1051; GA 12, 504, 532-534

111  A. The inner surface of the tympanic mem-
brane is supplied by the glossopharyngeal nerve. The
auricular branches of the facial and vagus nerves and
the auriculotemporal branch of the trigeminal nerve
innervate the external surface of the tympanic
membrane. The great auricular nerve arises from C2 and
C3 and supplies the posterior auricle and skin over
the parotid gland. The lingual nerve does not have
anything to do with sensory supply of the tympanic
membrane.
GAS 904-906; GA 473, 476

112  C. The infraorbital branch of the maxillary di-
vision of the trigeminal nerve exits the front of the
skull below the orbit through the infraorbital fora-
men. A needle inserted into the infraorbital foramen
and directed posteriorly will pass through the fora-
men rotundum to reach the trigeminal ganglion and
the beginning of the maxillary division of the trigem-
inal nerve. The mandibular division of the trigeminal
nerve exits the skull through the foramen ovale. The
middle meningeal artery exits the temporal fossa
through the foramen spinosum to enter the cranial
cavity. The inferior alveolar branch of the mandibular
division passes into the mandibular foramen to then
descend in the jaw to supply the mandibular teeth.
The foramen magnum is where the spinal cord exits the
skull and where the spinal accessory nerve ascends into the skull after arising from the cervical
spinal cord and brainstem.
GAS 867, 886, 943, 944; GA 462, 487, 521, 528

113  A. If there is an injury to the internal laryngeal
nerve there is a loss of sensation above the vocal
cords. In this case, for internal laryngeal injury to oc-
cur, one must conclude that the operative field ex-
tended above the position of the thyroid gland to the
level of the thyrohyoid membrane. The external laryn-
geal nerve can be injured during a thyroidectomy, but
its injury would result in paralysis of the cricothyroid
muscle and weakened voice/hoarseness. Injury of the
glossopharyngeal nerve would result in more wide-
spread symptoms, including loss of sensation from
the pharynx, posterior tongue, and middle ear. Injury
to the hypoglossal nerve would cause deficits in mo-
tor activity of the tongue. Damage to the recurrent
laryngeal nerve would result in paralysis of most la-
ryngeal muscles, with possible respiratory obstruc-
tion, hoarseness, and loss of sensation below the vo-
cal cords.
GAS 996, 1012; GA 514

114  A. The loose areolar connective tissue layer is
known as the “danger zone” because hematoma can
spread easily from this layer into the skull by means
of emissary veins that pass into and through the
bones of the skull. None of the other scalp layers
listed is referred to as the “danger zone.”
GAS 874; GA 442

115  A. The carotid sinus is a baroreceptor that can
be targeted for carotid massage to decrease blood
pressure. The carotid sinus receptors are sensitive to
changes in pressure. For this reason, sustained com-
pression of the carotid sinuses can lead to uncon-
sciousness or death as the heart rate is reflexively re-
duced. The carotid body is a chemoreceptor, responsive
to the balance of oxygen and carbon dioxide. Neither
the thyroid gland nor the parathyroid gland has any-
thing to do with acute control of blood pressure due
to mechanical stimuli. The inferior cervical ganglion
fuses with the first thoracic ganglion to form the stel-
late ganglion. It gives rise to the inferior cervical car-
diac nerve and provides postganglionic sympathetic
supply to the upper limb.
GAS 959; GA 452, 498

116  C. The thyroidea ima artery supplies the thy-
roid gland and ascends in the front of the trachea;
therefore, it would be easily injured in an emergency
tracheostomy with a midline incision over the tra-
chea. The inferior thyroid branch of the thyrocervical
trunk does not run along the front of the trachea in
such a position that a midline incision could damage
it. The cricothyroid branch of the superior thyroid
artery passes across the cricothyroid ligament, well
above the site of incision. Arterial bleeding would not
result from damage to either the middle thyroid vein
or the jugular venous arch.
GAS 210, 967; GA 500-501

117  D. A torn cerebral vein often results in a rela-
tively slow-bleeding subdural hematoma. Such a
hematoma can be involved in gradual compression
of the brain, resulting in confusion, dizziness, clumsiness, and memory loss. There would be no sign of blood in the CSF because the bleeding is into the subdural space, not the subarachnoid space. This would fit the description of symptoms in this case. Middle meningeal artery rupture results in an epidural hematoma, which is much more acute and often includes a brief period of unconsciousness followed by a lucid interval and can proceed to death if the bleeding is left untreated. Fracture of the pterion also can result in an epidural hematoma because the middle meningeal artery is the adjacent vasculature mentioned. Rupture of the anterior communicating artery would result in a subarachnoid hematoma, and there would be blood in the CSF upon lumbar puncture. In a cavernous sinus thrombosis there would be cranial nerve involvement due to compression of those nerves that run through or near the cavernous sinus, including the oculomotor, trochlear, trigeminal (maxillary and mandibular divisions), and abducens nerves.

GAS 834, 845-846; GA 445

118 D. Paralysis of the right accessory and hypoglossal nerves. Drooping of the right shoulder occurs as a result of paralysis of the trapezius as a result of injury to the right accessory nerve, which supplies that muscle. Loss of the right accessory nerve would also result in weakness in turning the head to the left, a function of the right sternocleidomastoid muscle, which is supplied by this nerve. The tongue deviation to the right is due to the unopposed activity of the left tongue muscles since the right hypoglossal nerve (which innervates the right tongue muscles) is affected. The other combinations of affected cranial nerves would not produce the specific symptoms described here.

GAS 855, 1040; GA 37, 450-451, 494, 497, 531, 537

119 C. The neural cell bodies whose axons synapse in the pterygopalatine ganglion are located in the superior salivatory nucleus, which is in the pons; this nucleus provides the GVE fibers of the facial nerve for lacrimal and salivary secretion. The superior cervical ganglion is a sympathetic ganglion containing postganglionic neurons and is not concerned with the pterygopalatine ganglion, which is a parasympathetic ganglion. The Edinger-Westphal nucleus is located in the midbrain and contains the cell bodies of the GVE fibers of the oculomotor nerve, which are responsible for constriction of the pupil via synapse in the ciliary ganglion and supply to the sphincter pupillae muscle and accommodation via the ciliary muscle. The inferior salivatory nucleus is located in the medulla and gives origin to GVE fibers of the glossopharyngeal nerve to the otic ganglion for secretion of saliva from the parotid gland.

GAS 853, 883-884, 917, 944; GA 463, 487

120 B. A branch of the facial artery would be of primary concern because its branches supply the oropharynx and it is the primary source of arterial supply to the palatine tonsil. The location of the lingual artery is inferior to the oropharynx and it would be less likely to be injured in the event of a surgical procedure. The superior laryngeal artery is also located lower and would not be subject to injury by surgery in the area of the oropharynx. The ascending pharyngeal artery arises in the carotid triangle from the external carotid artery and gives rise to pharyngeal, palatine, inferior tympanic, and meningeal branches. This vessel is located inferiorly to the site of surgery. Terminal branches of the descending palatine artery could be encountered at the upper pole of the palatine tonsil, but the main stem of the vessel would not be endangered in the surgical treatment here.

GAS 990, 992, 993; GA 12, 504, 532-534

121 A. Infection in the danger area of the face can lead to cavernous sinus thrombosis because infection spreads from the nasal venous tributary to the angular vein, then on to the superior ophthalmic vein, which passes into the cavernous sinus. None of the other routes listed would be correct for drainage from the danger area of the face.

GAS 871; GA 11, 458-459, 467, 485, 491

122 C. The thrombus may pass through the central vein of the retina to reach the cavernous sinus. The patient would suffer blindness because the central vein is the only vein draining the retina and if it is occluded, blindness will ensue. The subarachnoid space would not be associated with the blindness experienced. Thrombus of the central artery would not cause cavernous sinus thrombophlebitis. The optic chiasm is a neural structure that does not transmit thrombi. The ciliary ganglion is a parasympathetic ganglion; a thrombus in the cavernous sinus would not pass through it.

GAS 899; GA 467

123 B. Aqueous humor is secreted by the ciliary body into the posterior chamber of the eye. The humor flows through the pupil into the anterior chamber and then is filtered by a trabecular meshwork, then drained by the canal of Schlemm. The pupil is the opening in the iris, which leads from the posterior
chamber to the anterior chamber. Vitreous humor, not aqueous humor, is found in the vitreous body. The lacrimal sac is involved with tears, not the secretion of aqueous humor.
GAS 898-899; GA 468

124 A. If there is CSF between the compressed brain and overlying skull bones, the problem must be a condition of communicating hydrocephalus, with inadequate drainage through the arachnoid granulations into the superior sagittal sinus. There is no evidence of obstruction of CSF flow somewhere in the ventricular system. The other choices listed are all examples of noncommunicating hydrocephalus that result from obstruction, not just overproduction or filtration problems.
GAS 101, 834; GA 445

125 C. The superior sagittal sinus would most likely be the source of the bleeding because it attaches anteriorly to the crista galli and because of the slow nature of the bleed. The middle meningeal artery would not be a good answer because its location is near the pterion on the temporal aspect of the skull but its bleeding would be profuse, not slow. The great cerebral vein (of Galen) is located posteriorly in the cranial cavity and is not in the right location for an injury of this type to disrupt it. The straight dural venous sinus is also posterior, receiving the draining of the inferior sagittal sinus and the great vein (of Galen). It drains posteriorly to the confluence of sinuses. The superior ophthalmic vein drains from the orbit to the cavernous sinus; further, it is located inferiorly to the crista galli and is not directly related to the superior sagittal sinus.
GAS 822, 842, 843, 1026 1027; GA 445

126 C. For proper movements of the eye to occur, all cranial nerves of the extraocular muscles are required (oculomotor, trochlear, and abducens nerves). The inferior division of the oculomotor innervates the inferior rectus, the medial rectus, and the inferior oblique. Lateral movement of the eye is initiated by the lateral rectus (abducens nerve), assisted thereafter by the superior oblique (trochlear nerve). The inferior rectus (inferior division of the oculomotor nerve) balances the upward deviation exerted by the superior rectus (superior division of the oculomotor nerve). The medial rectus (superior division of the oculomotor nerve) must relax to facilitate the lateral excursion. Answers A, B, and D all have branches of the trigeminal nerve, which have no role in motor movement of the eye. Finally, for answer E, the superior division innervates the superior rectus and the levator palpebrae; therefore, C is the best answer.
GAS 887-891; GA 464

127 E. The middle of the vocal cord would be the most likely location of the tumor because there is no direct lymph drainage from this region. All other locations mentioned are drained by the lymphatics. Areas above the vocal cords are drained by the superior deep cervical nodes, and areas below the vocal cords drain to the pretracheal nodes before draining into the inferior deep cervical nodes.
GAS 1011; GA 502-503

128 B. When a berry aneurysm ruptures, the blood flows into the subarachnoid space and therefore mixes with CSF; thus, blood would be present in the CSF when a lumbar puncture is performed. The pterion overlies the anterior branch of the middle meningeal vessels, and damage to these vessels would result in an epidural hematoma, with compression of the brain. Leakage of branches of the middle meningeal artery within the temporal bone would cause blood vessels within the bone to leak, without direct connection to the CSF fluid. A tear of the cerebral vein in the superior sagittal sinus would lead to a subdural hematoma, in which the blood collects in the subdural space, without entry to CSF. The occlusion of the internal carotid artery by way of clot would not lead to leakage of blood into the CSF.
GAS 840-841; GA 452

129 D. The nucleus ambiguus gives rise to efferent motor fibers of the vagus nerve, which supply the laryngeal and pharyngeal muscles. If supply to this region is interrupted, an individual loses the swallowing, cough, and gag reflexes. The nucleus solitarius is located in the brainstem and is responsible for receiving general visceral sensation and taste from the facial, glossopharyngeal, and vagus nerves. The trigeminal motor nucleus contains motor neurons that innervate muscles of mastication, the tensor tympani, tensor veli palatini, mylohyoid, and anterior belly of the digastric. The dorsal motor nucleus contains the cell bodies of preganglionic parasympathetic fibers of the vagus nerve innervating the heart muscle and smooth musculature and glands of the respiratory and intestinal tract. The superior ganglion of the vagus contains cell bodies of general somatic afferent fibers, and the inferior ganglion of the vagus is chiefly visceral afferent in function concerning sensations (with the exclusion of painful sensation) from the heart, lungs, larynx, and alimentary tract.
GAS 807, 849-851, 853-854; GA 450-451
130  C. Just before it passes into the mandible to supply the lower teeth and chin, the inferior alveolar nerve gives rise to the mylohyoid nerve, a motor nerve supplying the mylohyoid and anterior belly of the digastric. The geniohyoid muscle is innervated by motor fibers from spinal nerve C1 that run with the hypoglossal nerve. The hyoglossus muscle is innervated by the hypoglossal nerve. The stylohyoid muscle is innervated by the facial nerve. The palatoglossus muscle is innervated by the vagus nerve.
GAS 934-936; GA 480, 483, 528

131  A. The superior cerebellar artery arises near the termination of the basilar artery, passes immediately below the oculomotor nerve, and eventually winds around the cerebral peduncle, close to the trochlear nerve, as it continues on toward the upper surface of the cerebellum where it will divide into branches that anastomose with the inferior cerebellar arteries. The trochlear nerve passes between the posterior cerebral artery and the superior cerebellar artery, and therefore a hematoma of the superior cerebellar artery can easily injure the trochlear nerve, which runs alongside the internal carotid artery and then enters the orbit through the superior orbital fissure. The facial and vestibulocochlear nerves both enter the skull via the internal acoustic meatus (or internal auditory meatus) in the temporal bone and do not have an intimate relationship with the superior cerebellar artery. The glosopharyngeal nerve passes through the jugular foramen, and as it exits from the skull it passes forward between the internal jugular vein and internal carotid artery.
GAS 837, 838; GA 451-452, 454

132  D. Subdural bleeding usually results from tears in veins that cross the subdural space, between the dura and the arachnoid. This bleeding may cause a gradual increase in intracranial pressure and may result in leakage of venous blood over the right cerebral hemisphere with a variable rate of progression. A subarachnoid bleed is due to rupture of an artery into the subarachnoid space surrounding the brain, between the arachnoid membrane and the pia mater. Hydrocephalus may result if the subarachnoid bleeding or subsequent fibrosis create obstructions to CSF flow through the subarachnoid space or drainage of the CSF. Epidural bleeding results in most cases from tearing of the middle meningeal artery, and this rapidly expanding, space-occupying lesion can cause death within 12 hours. Intracerebral bleeding into the brain parenchyma is focal bleeding from a blood vessel into the brain parenchyma, most likely caused by hypertension and/or atherosclerosis. Typical symptoms include focal neurologic deficits, with abrupt onset of headache, nausea, and impairment of consciousness. Bleeding into the cerebral ventricular system may be due to trauma or hemorrhage of blood from nearby arteries, especially those related to the supply of the choroid plexus.
GAS 845-847; GA 445

133  B. The lateral pterygoid muscle is a muscle of mastication innervated by the lateral pterygoid nerve of the mandibular division of the trigeminal nerve. The lateral pterygoid acts to protrude the mandible and open the jaw. The anterior portion of temporalis is a muscle of mastication innervated by the deep temporal nerves of the mandibular division of the trigeminal nerve that elevates the mandible when contracted. The medial pterygoid muscle is a muscle of mastication innervated by the mandibular division of the trigeminal nerve that specifically assists in chewing. The platysma is a thin muscle of facial expression that lies within the superficial fascia of the neck and lower face. It is innervated by the cervical branch of the facial nerve. The platysma produces a slight wrinkling of the surface of the skin of the neck in an oblique direction, depresses the lower jaw, and draws down the lower lip and angle of the mouth.
GAS 925, 930-931; GA 480-482, 484

134  B. The order of tooth eruption is as follows: inferior medial incisors (6 to 8 months), superior medial incisors (8 to 10 months), first molar (6 to 8 months), superior lateral incisors (8 to 10 months), and finally inferior lateral incisors (12 to 14 months).
GAS 1056-1057; GA 525-529

135  D. The sigmoid sinus collects venous blood from the transverse sinuses and empties it into a small cavity known as the jugular bulb, the inferior portion of which is located beneath the bony floor of the middle ear cavity. A paraganglioma is a tumor that may originate from paraganglia cells found in the middle ear and on the jugular bulb. Tumors that originate from the jugular bulb can grow to fill the entire bulb and may effectively block blood flow to the heart from that side of the brain. Blood flow from the brain is gradually diverted toward the opposite sigmoid sinus and jugular bulb, causing the opposite venous system to expand and accommodate increased blood flow. The cochlea and lateral semicircular can-
nals are located in the inner ear and are not directly affected by such a tumor. The internal carotid artery is related to the anterior wall of the middle ear cavity and is not likely to be affected by a tumor penetrating the middle ear. The sigmoid venous sinus collects venous blood beneath the temporal bone and follows a tortuous course to the jugular foramen where it becomes continuous with the internal jugular vein at the jugular bulb. The aditus ad antrum is the entrance to the mastoid antrum, which is the common cavity in the mastoid bone into which mastoid air cells open. Below the aditus ad antrum is an elevation of hollow bone, the pyramid of the stapes, which is occupied by the stapedius muscle.

GAS 842-844; GA 445

136 E. The lingual nerve supplies sensory innervation to the mucous membrane of the anterior two thirds of the tongue, taste sensation to the anterior part of the tongue, and parasympathetic fibers to the oral salivary glands. The chorda tympani branch of the facial nerve is responsible for carrying taste fibers from the anterior two thirds of the tongue and pregan-glionc parasympathetic fibers for the submandibular ganglion. Injury to the lingual nerve at its origin before it joins with the chorda tympani, will result in loss of general sensation of the tongue, but with preservation of taste and salivary function. Injury to the glossopharyngeal nerve would result in loss of general sensory and taste fibers from the posterior third of the tongue and parasympathetic supply for the parotid gland. Injury to the superior laryngeal nerve, a branch of the vagus, would result in loss of sensation from the larynx above the vocal folds.

GAS 1040, 1043, 1045; GA 480, 484, 528-529, 532, 534

137 A. Papilledema is optic disc swelling ("edema of the papilla") that is caused by increased intracranial pressure and increased CSF pressure. If a lumbar puncture is performed in a patient with elevated CSF pressure and fluid is withdrawn from the lumbar cistern, the brain can become displaced caudally and the brainstem is pushed against the tentorial notch. This is a potentially fatal complication. Separation of the pars optica retinae anterior to the ora serrata, or retinal detachment may result in vision loss or blindness. A hemorrhage from medial retinal branches may result in damage to the fovea centralis and can result in macular degeneration. Opacity of the lens (cataracts) will cause gradual yellowing and may reduce the perception of blue colors. Cataracts typically progress slowly to cause vision loss and are potentially blinding if untreated. Compression of the optic disc, resulting from increased intrabulbar pressure, will lead to an excessive accumulation of serous fluid in the tissue space.

GAS 894; GA 468

138 E. Within the cavernous sinus the abducens nerve is in intimate contact with the internal carotid artery. Therefore, an aneurysm of the internal carotid artery could quickly cause tension or compression on the abducens nerve. This would result in ipsilateral paralysis of abduction of the pupil. Inability to gaze downward and medially would be due to the trochlear nerve, which is not in the cavernous sinus. Complete ptosis would be a result of a complete lesion in the oculomotor nerve, which is not apparent here. Bilateral loss of accommodation and loss of pupillary reflex would be the result of bilateral loss of the oculomotor nerve, which is not likely in this situation. Finally, unilateral loss of the consensual corneal reflex is a result of loss of both the ophthalmic division of the trigeminal nerve and the facial nerve supplying the afferent and efferent limbs of the reflex, respectively.

GAS 844; GA 445, 450, 452

139 D. It is necessary to anesthetize the conjunctival covering of the sclera, which is supplied by the nasociliary branch of the ophthalmic nerve. To do that, the needle should be placed through the upper eyelid deeply toward the orbital apex to infiltrate the nasociliary nerve, and also between the orbital septum and the palpebral musculature laterally to anesthetize lateral sensory supply from the lacrimal nerve and (perhaps) twigs from the maxillary nerve. The lacrimal fossa, which is occupied by the lacrimal sac portion of the nasolacrimal duct, is too medial, whereas the supraorbital foramen is above the eye. Injections into either location would not result in anesthetizing of the sclera. Answers A and E both result in puncturing of the sclera and would most likely cause further damage to the eye.

GAS 894-897; GA 465, 469

140 E. During a puncture wound as described in this case, passing up from below the chin, the nail would first pierce the platysma, then the anterior belly of the digastric, then the mylohyoid, then the geniohyoid, and finally the genioglossus.

GAS 858, 862, 954-956, 1036-1038; GA 492, 504

141 A. The anterior division of the facial nerve passes through the parotid gland and is therefore at risk during surgery of the parotid gland. Since this patient’s symptoms involved paralysis of the muscles of the lower lip, the branch of the facial nerve that supplies these muscles, the marginal mandibu-
lar branch, is the one that has suffered the iatrogenic injury.

**GAS 865; GA 456, 458-459, 480**

142 A. During embryologic development of the pituitary gland, an outgrowth from the roof of the pharynx (Rathke’s pouch) grows cephalad and comprises the anterior lobe (pars distalis) of the pituitary gland. Since this gland normally occupies the sella turcica, it is most likely a tumor derived from the Rathke’s pouch that is extending up into the sella turcica and the space just above it, the suprasellar space.

**GAS 1079; GA 446-447, 450**

143 A. In holoprosencephaly, loss of midline structures results in malformations of the brain and face. There is a single telencephalic vesicle, fused eyes, and a single nasal chamber. Also, there is often hypoplasia of the olfactory bulbs, olfactory tracts, and corpus callosum. Children with Smith-Lemli-Opitz syndrome have craniofacial and limb defects and 5% have holoprosencephaly. Schizencephaly is rare and is characterized by large clefts in the cerebral hemispheres, which in some cases cause a loss in brain tissue. Exencephaly is caused by failure of the cephalic part of the neural tube to close; therefore, the skull does not close, leaving the brain exposed. Meningoencephalocele is a deficit of the cranium involving the squamous part of the occipital bone and, in some cases, the posterior aspect of the foramen magnum. It can include the meninges if the herniation or protruding brain includes part of the ventricular system.

**GAS 812-814; GA 430-431**

144 C. Usually, deficits of the cranium involve the squamous part of the occipital bone and, in some cases, the posterior aspect of the foramen magnum. If the herniation or protruding brain includes part of the ventricular system (most likely the posterior horn of the lateral ventricles), then it is referred to as meningoencephalocele. The deficit in the squamous part of the occipital bone usually occurs at the posterior fontanelle of the skull.

**GAS 815-817, 821, 826, 827; GA 429, 434-435**

145 B. The rostral neuropore closes during the fourth week of development. If this does not occur, the forebrain primordium is abnormal and the calvaria or vault fails to develop. Toxoplasmosis infection during embryologic development leads to microcephaly, in which the brain and calvaria are small in size. These patients usually have mental retardation due to an undeveloped brain. An ossification defect in the bones of the skull is often a result of hydrocephalus. Caudal displacement of the cerebral structures would not lead to an undeveloped calvaria or vault. Maternal alcohol abuse leads to intrauterine growth restriction, causing microcephaly and mental retardation.

**GAS 812-818; GA 437**

146 B. Holoprosencephaly is caused by failure of the prosencephalon to properly divide into two cerebral hemispheres. In severe cases, this is incompatible with life, but in less severe cases such as the one presented here, babies have normal or near-normal brain development, sometimes with facial abnormalities. In this case the abnormal development of the forebrain has pushed some of the cerebellum caudally through the foramen magnum, probably due to the spina bifida cystica.

**GAS 835-846; GA 446-450**

147 A. Congenital deafness is due to a maldevelopment of the conducting system of the middle and external ear or neurosensory structures of the inner ear. Rubella infection during a critical time of ear development can lead to a malformed spiral organ (neurosensory hearing loss) or congenital fixation of the stapes, resulting in conducting hearing loss. Failure of the second pharyngeal arch to form would lead to an ear without a stapes bone. However, in congenital deafness, there is a fixation of the stapes. Failure of the dorsal portion of the first pharyngeal cleft would lead to undeveloped malleus and incus. These are not affected in congenital deafness, however. Abnormal development of the auricular hillocks does not lead to deafness but is a marker for other potential congenital anomalies.

**GAS 902, 913-919; GA 472-473, 476**

148 A. With congenital cataracts, the lens appears opaque and grayish white and blindness will result. Infection by teratogenic agents such as rubella virus (German measles) can cause congenital cataracts. This infection can affect the development of the lens, which has a critical period of development between the fourth and seventh week. Choroid fissure failure would lead to coloboma, a condition that can lead to a cleft and eye abnormalities but not congenital cataracts. A persistent hyaloid artery would not lead to a cataract but rather a freely moving, wormlike structure (as interpreted by the patient) projecting on the optic disc. Toxoplasmosis infection would lead to microcephaly and eventually mental retardation due to an undeveloped brain. Similarly, cytomegalovirus would cause microcephaly and mental retardation.

**GAS 899; GA 461, 468**
149 D. A mutation of the PAX6 gene usually results in congenital aphakia (absence of lens) and aniridia (absence of iris). Cyclopia is a condition in which there is a single eye and is usually caused by a mutation of the Sonic Hedgehog gene (SHH), leading to a loss of midline tissue and underdevelopment of the forebrain and frontonasal prominence. Coloboma occurs if the choroid fissure fails to fuse, which is usually caused by a mutation of the PAX2 gene. Anophthalmia is a disorder in which there is a complete absence of the eye. In microphthalmia, the eye is small in development, typically less than two thirds its normal size. This condition usually results from an infection such as cytomegalovirus and toxoplasmosis.

GAS 898-902; GA 461-471

150 A. In hemifacial microsomia the craniofacial anomalies that usually occur involve small and flat maxillary, temporal, and zygomatic bones. Ear and eye anomalies also occur with this syndrome. Ear abnormalities include tumors and dermoids of the eyeball. Treacher Collins syndrome is normally characterized by malar hypoplasia (caused by undeveloped zygomatic bones), mandibular hypoplasia, down-slanted palpebral fissures, lower eyelid colobomas, and malformed ears. Robin Sequence is caused by an altered first arch structure, with the development of the mandible most affected. Infants with Robin Sequence normally have micrognathia, cleft palate, and glottosplasia. DiGeorge syndrome is a severe craniofacial defect that includes velocardiofacial syndrome and conotruncal anomalies face syndrome. It is characterized by cleft palate, cardiac defects, abnormal face, thymic hypoplasia, and hypocalcemia.

GAS 813; 430-431

151 A. Abnormal face, cardiac defects, thymic hypoplasia, cleft palate, and hypocalcemia are characteristics of DiGeorge syndrome. A deletion of the long arm of chromosome 22 (22q11) causes this developmental defect. A defect of the SONIC HEDGEHOG gene (SHH) can lead to cyclopia. PAX2 and PAX6 gene mutations lead to malformations of the eye. Specifically, PAX2 mutations are responsible for coloboma, and PAX6 mutations characterize congenital aphakia and aniridia. Turner syndrome (47XXY) is characterized by webbed neck and small stature.

GAS 206; GA 102

152 A. The first pharyngeal arch, which is often associated with the mandible, is responsible for development of Meckel’s cartilage, malleus, incus, and mandible. Additionally, it is innervated by the trigeminal nerve, specifically the mandibular division that innervates the muscles of mastication. This patient presents with features characteristic of developmental defects in the first arch. The second pharyngeal arch gives rise to the stapes, styloid process, lesser cornu, Reichert’s cartilage, and the upper half of the hyoid bone. It is innervated by the facial nerve. The third pharyngeal arch is responsible for formation of the greater cornu and the lower half of the hyoid bone and is innervated by the glossopharyngeal nerve. The fourth and sixth pharyngeal arches give rise to the laryngeal cartilages, in addition to being innervated by the vagus nerve.

GAS 848-849; GA 478-483

153 B. The maxillary sinus arises late in fetal development and is the only sinus present at birth. The frontal and sphenoid sinuses often develop at approximately 2 years of age from the anterior ethmoid air cells and the posterior ethmoid air cells, respectively.

GAS 797, 879, 1018, 1020, 1022; GA 487, 518, 525

154 A. Meroencephaly often results from a failure of the rostral neuropore to close during the fourth week of development. The calvaria is absent, with a resultant extrusion of the brain from the cranium. Defects are often found along the vertebral column as well. Cytomegalovirus infection is a major cause of microcephaly, in which both the brain and cranium are drastically reduced in size. However, there is no extrusion of the brain from the cranium. The hypophyseal diverticulum is associated with the pituitary gland and usually regresses to leave only a remnant stalk. Failure of this diverticulum to develop would not be associated with meroencephaly. Neural crest cells give rise to a variety of cell types, and abnormal formation would likewise not be associated with meroencephaly.

GAS 812, 818; GA 437

155 B. The retropharyngeal space extends from the inferior aspect of the skull to the posterior mediastinum. An infection or abscess in this space could thus travel toward the posterior mediastinum. The retropharyngeal space is enclosed between the visceral fascia covering the posterior wall of the pharynx and the alar layer of the prevertebral fascia. The alar fascia is formed from bilateral anterior extensions of the prevertebral fascia. Between the alar fascia and the more posterior prevertebral fascia covering the skeletal musculature is the so-called danger space of the neck. This space is continuous superiorly to the base of the skull and continues inferiorly through the posterior mediastinum to the level of the respiratory dia-
phragm. The alar fascia is continuous with the carotid sheath and provides the posterior boundary for the retropharyngeal space. Attachments of the alar fascia to the retropharyngeal fascia result in separation of the pretracheal space from the retropharyngeal space. The prevertebral fascia invests the vertebral column and the intrinsic muscles of the back. The pretracheal fascia encloses the trachea and larynx, whereas the buccopharyngeal fascia invests the superior pharyngeal constrictor and buccinator muscles. GAS 949, 950, 985; GA 490

156 A. An inferior fracture of the orbit would likely damage the infraorbital nerve. A blow-out fracture often results in a displaced orbital wall, and in this case, the inferior wall. The infraorbital nerve leaves the skull immediately inferior to the inferior aspect of the orbit, via the infraorbital foramen. Thus, this nerve is the most likely to be damaged. The frontal nerve courses superiorly over the orbital contents before dividing into the supratrochlear and supraorbital nerves. The optic nerve is located behind the eyeball and travels posteriorly away from the orbit to enter the cranium. These nerves are therefore unlikely to be damaged.

GAS 867, 885-886, 943, 944; GA 462, 487, 521, 528

157 C. The Rinne test is often employed during physical examination to determine possible conduction hearing loss. A tuning fork is struck and placed on the mastoid process. It is then placed near the external ear until the patient can no longer detect vibrations. In a normal healthy patient the air conduction will be better than the bone conduction. The Rinne test is often used in conjunction with the Weber test to rule out sensorineural hearing loss.

GAS 1062; GA 432, 434, 436, 475, 479, 492

158 A. The right and left recurrent laryngeal nerves loop around the right subclavian artery and the arch of the aorta, respectively. These nerves then travel superiorly in the tracheoesophageal groove to the larynx. Damage to the recurrent laryngeal as a result of surgical intervention or the presence of a tumor in the tracheoesophageal groove would render the patient hoarse. This hoarseness is due to a lack of innervation by the recurrent laryngeal nerve to most of the muscles of the larynx. Damage to the internal laryngeal nerve would cause a loss of sensation above the vocal cords, in addition to a loss of taste on the epiglottis. Damage to the external laryngeal, which can occur during thyroidectomy, will result in a loss of innervation to the cricothyroid muscle, with resultant vocal weakness. Patients with this lesion will often present with a fatigued voice. The vagus nerve gives rise to the recurrent laryngeal nerves; damage to this nerve, however, would result in numerous symptoms beyond just hoarseness.

GAS 214, 966, 967, 978-979, 1013, 1014, 1072; GA 82, 101, 104, 508, 514, 516

159 B. Diploic veins are responsible for communication between the veins of the scalp and the venous sinuses of the brain. Diploic veins are situated within the layers of bone of the skull and connect the emissary veins of the scalp to the venous sinuses located between two layers of dura. The diploe are of clinical significance in that the diploic veins within this layer provide a pathway of communication between the veins of the scalp and underlying venous sinuses of the brain, by means of emissary veins. The emissary veins and diploe provide a potential vascular pathway of infection. The supratrochlear and supraorbital veins are located superficially on the scalp, immediately superior to the upper eyelid, and do not communicate directly with the venous sinuses of the brain. The anterior cerebral vein is an intracranial vein and, as such, does not maintain a direct communication with the external veins of the scalp. The superior sagittal sinus receives blood from the cerebral, diploic, and emissary veins; however, it does not provide a pathway of communication to the veins of the scalp.

GAS 842; GA 442

160 C. The oculomotor nerve passes between the posterior cerebral artery (PCA) and the superior cerebellar artery near the junction of the midbrain and pons. The optic nerve arises near the circle of Willis close to the internal carotid artery. Its location would thus prevent compression following an aneurysm at the PCA and superior cerebellar artery. Although the trochlear nerve could be compressed by the superior cerebellar artery, it would not likely be damaged by an aneurysm of the PCA. The abducens nerve is located in the pons, and the vagus is situated near the postolivary sulcus in the medulla. Neither of these nerves is likely to be compressed by the arteries mentioned here due to their more distal location.

GAS 837-838; GA 451-452

161 C. A blow-out fracture of the medial wall of the orbit would likely render the medial rectus nonfunctional by entrapment of the muscle between the edges of the cracked medial wall. The medial rectus is responsible for adduction of the eye, but in this case the muscle acts as a tether or anchor on the eyeball, preventing lateral excursion (abduction) of the eye.
There is no nerve damage here, and the muscle is not paralyzed. The lateral rectus is responsible for abduction of the eye, and the inferior rectus rotates the eyeball downward. Damage to these muscles or their nerve supply would result in an inability to move the eye laterally and inferiorly, respectively.

GAS 887-891; GA 461-467

162 A. The inferior rectus and inferior oblique muscles are entrapped in the crack between the parts of the fractured orbital floor. Normally, the superior rectus and the inferior oblique are responsible for an upward movement of the eyeball. In this case, however, the broken orbital plate of the maxilla has snared or entrapped the inferior rectus and inferior oblique muscles, causing them to act as anchors on the eyeball, preventing upward movement of the eye. The muscles are not necessarily damaged, nor is there any nerve injury in this patient. Freeing the muscles from the bone will allow free movement of the eye again, barring any other injury. Damage to the medial and inferior recti would result in a laterally and superiorly deviated eye. The inferior oblique rotates the eye upward and laterally. Damage to this muscle would therefore cause the pupil to be directed somewhat downward. Damage to the medial rectus would result in lateral deviation of the eyeball. The inferior rectus is responsible for downward movement of the eye, and damage to this muscle would result in a superiorty deviated eyeball or an inability to gaze upward symmetrically with both eyes.

GAS 886-897; GA 461-467

163 A. A herpes rash on the dorsum of the nose is known as Hutchinson's sign. This indicates that the virus is located in cell bodies of the ophthalmic division of the trigeminal nerve. This nerve branches into nasociliary, frontal, and lacrimal branches. The nasociliary nerve has direct branches that carry sensory innervation from the eye. The nasociliary nerve also gives off the ethmoidal nerves that innervate the superior nasal mucosa, in addition to providing the origin of the dorsal nasal nerve. The supratrochlear nerve is a branch of the frontal nerve and carries sensory innervation from the skin superior to the orbit. The infraorbital nerve is a branch from the maxillary division of the trigeminal nerve and carries sensory innervation from the skin of the face between the orbit and the upper lips.

GAS 894-897; GA 465, 469

164 A. Anesthetics are injected into the submuscular layer of delicate (areolar) connective tissue, the layer that contains nerves of the eyelid. This space is continuous with the "danger zone" of the scalp. A blow to the forehead can result in a "black eye," with the passage of blood into the submuscular space. Infections can, likewise, pass within this space. One can insert a needle through the upper eyelid, near the orbital margin, and then direct it deeply toward the orbital apex. The anesthetic can then infiltrate the branches of the ophthalmic nerve, including its nasociliary branch, resulting in anesthesia of the area.

GAS 879-883; GA 461-462

165 A. Paralysis of the trochlear nerve results in loss of ability for the affected eye to be directed downward when the pupil is in the adducted position (the primary action of the superior oblique muscle). The patient must tilt her head toward the opposite side to allow the two pupils to converge on an object on the floor. Paralysis of the trochlear nerve is not unusual when a patient's head has hit the dashboard in an automobile crash—the delicate nerve is easily torn where it pierces the dura of the tentorium cerebelli in the tentorial notch because the brain and brainstem move forward and backward with the force of impact (a "coup-contrecoup" injury).

GAS 850-851, 855; GA 450-451, 465, 536

166 A. The dural covering of the optic nerve is connected to the anular tendon; therefore, when there is an inflammation of the optic nerve, contractions of the recti can evoke severe pain.

GAS 894; GA 450-451, 461, 465, 468, 536

167 D. Toxoplasmosis infection is caused by the parasite Toxoplasma gondii, which is associated with undercooked meat and the feces of cats. Whereas it is a relatively common infection, once you have been exposed, you have immunity. The biggest concern is when a pregnant woman is exposed who has not been previously exposed. Congenital malformation, microphthalmia being one of the more common, can occur if the infection is passed on to the fetus.

GAS 898-902; GA 468

168 A. At the point where the facial nerve exits the stylomastoid foramen it is most susceptible to shearing forces. In the absence of a skull fracture whereby the facial nerve can be damaged within the facial canal, the nerve is most commonly injured as it exits the stylomastoid foramen. In infants, in whom the mastoid process has not yet developed, the facial nerve lies unprotected, just beneath the skin.

GAS 776, 819, 820, 821, 868, 872; GA 436, 474

169 B. The auriculotemporal nerve leads into the parotid gland, and its compression in mumps can be
associated with severe pain. The compressive effects are due in large part to the continuity of the facial capsule of the parotid gland with the tough layer of superficial investing fascia of the neck, a layer that is almost non-distensible. When the gland swells, sensory fibers for pain are triggered rapidly, and can be referred to the ear. None of the other nerves listed supply the parotid gland.

GAS 864, 867-868, 874, 875; GA 455, 483-485

**170** B. Hydrops (edema) results from accumulation of excessive fluid in the endolymphatic sac. Labyrinthine hydrops or endolymphatic hydrops is known as Ménière disease. This disease can result in hearing loss, roaring noises in the ear, and episodic dizziness (vertigo) associated with nausea and vomiting. About 10% of patients require surgical intervention for persistant, incapacitating vertigo; others are treated with diuretics, low salt intake, and reduction of stimulants like caffeine to lower the volume of body fluids and alleviate the symptoms of Ménière disease.

GAS 915, 916; GA 473-477

**171** D. The superior thyroid vein is a tributary to the internal jugular vein; it accompanies the superior thyroid artery. The middle thyroid vein is typically a short, direct tributary to the internal jugular vein. The inferior thyroid vein usually drains vertically downward to one or both brachiocephalic veins. The superior and middle thyroid veins can be torn in thyroid surgery, perhaps admitting an air bubble (due to negative pressure in the veins) that can ascend in the internal jugular vein into the skull, with injurious or lethal results.

GAS 961, 966, 967; GA 516

**172** C. The cricothyroid artery is a small branch of the superior thyroid artery. It anastomoses with the cricothyroid artery of the opposite side at the upper end of the median cricothyroid ligament, a common site for establishing an emergency airway. The cricothyroid artery can be pushed into the airway during a cricothyroidostomy. The vessel(s) can bleed directly into the trachea, bleeding that can go unnoticed by medical personnel, with potentially fatal aspiration of blood by the patient.

GAS 959, 960, 966; GA 452, 498, 516-517

**173** C. An incision at the level of the third and fourth tracheal cartilages usually results in the fewest complications during a tracheostomy. The isthmus of the thyroid gland (a richly vascular structure) is usually at the level of the second tracheal cartilage and this incision is just inferior to that. However, other vascular structures such as a thyroidea ima artery or tributaries of the external jugular veins make a tracheostomy a surgical procedure to be performed with care.

GAS 806, 1009, 1065; GA 80

**174** A. The uvula would move toward the intact right side. This is because the intact levator veli palatini would be unopposed by the opposite, paralyzed left levator veli palatini.

GAS 1051; GA 504-505, 507, 533

**175** B. If the left abducens nerve is injured, there will be a loss of function of the left lateral rectus muscle so the patient will be unable to abduct his left eye. The trochlear nerve supplies the superior oblique muscle, which if injured would cause the patient to lose the ability to turn the pupil downward when it is in the adducted position. As an example, the affected patient could not turn the pupil to look downward to the left if the right trochlear nerve were paralyzed. This deficiency can make it difficult for individuals to descend stairs if they have trochlear nerve palsy. If the oculomotor nerve were injured, the pupil would be directed “down and out” due to unopposed actions of the lateral rectus and superior oblique, which are innervated by the abducens and trochlear nerves, respectively. If the optic nerve were injured, the patient would have blindness in the affected eye. If the oculomotor and abducens nerves were injured, the patient would have only the actions of the superior oblique muscle, and the eye would be directed downward and outward from the position of forward gaze.

GAS 849-852, 855, 894-895; GA 450, 465, 536

**176** D. The accommodation reflex is performed by constriction of the pupil when trying to focus on a near object. This function is controlled by the parasympathetic nerve fibers carried in the oculomotor nerve from the Edinger-Westphal nucleus of the midbrain that synapse in the ciliary ganglion. Postganglionic axons act on the sphincter pupillae muscle to cause reduction in pupil diameter and on the ciliary muscle to cause relaxation of the suspensory ligament, allowing the lens to adopt a more spherical shape for near focusing. If there is a lack of accommodation, it means the action of the ciliary muscle is compromised. The ciliary muscle also gets parasympathetic innervation by postganglionic neurons evoked from the ciliary ganglion by GVE fibers of oculomotor nerve whose cell bodies are located in the Edinger-Westphal nucleus. The superior salivatory nucleus is involved with lacrimation and salivation, not the ciliary muscle and accommodation. The superior cervical ganglion is a sympathetic ganglion; its postgangli-
177 A. An acoustic neuroma (vestibular schwannoma or neurolemoma) is a benign tumor of the vestibulocochlear nerve, which causes compression of VII nerve. This nerve leads from the inner ear to the brain. Although many such tumors will not grow or grow very slowly, growth can in some cases result ultimately in brainstem compression (as in this example), hydrocephalus, brainstem herniation, and death. It is diagnosed on MRI with gadolinium contrast as shown. Extension of the neuma into the right internal auditory meatus can be seen on the coronal MRI (see arrow in Fig. 7-9). The exact cause of the tumor is unknown; most people with acoustic neuromas are diagnosed between the ages of 30 and 60. Due to advances in microsurgery, including intraoperative monitoring of facial and cochlear function, the risks of facial paralysis and hearing loss have been greatly reduced. Many acoustic neuromas can now be treated effectively with both surgery and targeted radiation therapy (gamma knife). The outcomes for those with small acoustic neuromas are better, whereas those with neuromas larger than 2.5 cm are likely to experience significant hearing loss postsurgery.

GAS 835; GA 450-451, 472-473, 476 537

178 A. Pharyngeal (branchial) cleft cysts are the most common congenital cause of a neck mass. They are epithelial cysts that arise anterior to the superior third of the sternocleidomastoid muscle (1) from a failure of obliteration of the second branchial cleft in embryonic development. The second arch grows caudally and, ultimately, covers the third and fourth arches. The buried clefts become ectoderm-lined cavities that normally involute. Occasionally this process is arrested and the entrapped remnant forms an epithelium-lined cyst, in some cases with a sinus tract to the overlying skin. (2) Many branchial cleft cysts are asymptomatic; others may become tender, enlarged, or inflamed as they develop abscesses that rupture, resulting in a purulent draining sinus to the skin or pharynx. Surgery is indicated in these cases.

GAS 970-971; GA 492-493

179 C. The angiograph provided clearly shows that the radiopaque medium injected into the patient did not completely fill the common carotid artery. Portions of the internal and external carotid arteries are filled above the common carotid due to “back fill” provided by the collateral circulation. However, vascular supply to the brain is still compromised in this patient, leading to her symptoms.

GAS 806, 858-859; GA 458, 491, 498

180 A. Mastoiditis is an infection of the air cells within the mastoid process of the temporal bone, often caused by untreated acute otitis media. A known complication of mastoiditis is inflammation of the transverse sinus. Necrosis of the bone due to untreated infection will often affect the transverse sinus. The petrous part of the temporal bone is unlikely to experience inflammation. Infection in the middle ear is usually the preceding event to mastoiditis rather than occurring as a result of it. The occipital sinus is located far posteriorly to the mastoid process and is unlikely to be affected. Because of its position, the internal carotid artery will not be affected by this inflammation.

GAS 907, 909; GA 474-475

181 B. A chalazion is caused by an obstructed tarsal gland of the eyelid. Swellings of the lacrimal gland usually present on the upper lateral eyelid and are not indicative of a chalazion. A chalazion is not an infection within the eye, so this excludes sclera and pupil from being the correct answers. The nasolacrimal duct runs from the medially located lacrimal sacs to the inferior meatus of the nose and would be unaffected in the case of a chalazion.

GAS 881; GA 461

182 B. The nasal polyp also involved the maxillary sinus, located immediately laterally to the nasal cavity. The sphenoid sinus, located posterosuperiorly to the nasopharynx, is unlikely to be affected by a nasal polyp. The ethmoidal sinuses, located medially to the orbit and lateral to the nasal cavity, are also unlikely to be affected by a nasal polyp, although this possibility cannot be ruled out. The frontal sinuses located superomedially to the eyes are unlikely to be affected by the nasal polyp. The frontal nasal ducts, the communication between the frontal sinus and the nasal cavity, are also unlikely to be affected.

GAS 797, 879, 1018, 1020, 1022; GA 487, 518, 525

183 C. A tumor at the cerebellopontine angle, such as an acoustic schwannoma, is most likely to affect first the vestibulocochlear nerve and then the facial nerve. This excludes the vagus, hypoglossal, glossopharyngeal, and trigeminal nerves from being the correct answers.

GAS 835; GA 472-477
D. Rupture of the periosteal arteries resulting in a cephalohematoma is defined as a collection of blood underneath the periosteum. On the head, it is located between the pericranium (periosteum of the skull) and the calvaria (skull). The galea aponeurotica, skin and areolar connective tissue are all located superficial to the site of bleeding and hematoma. GAS 830; GA 461

B. The tentorial/uncal herniation described in this case is most likely to occur as a result of a temporal lobe tumor. The uncus is part of the temporal lobe, and when enlarged, it will be compressed against the foramen magnum. This results in the symptoms manifested by damage to the nearby oculomotor nerve. The uncus is not a part of the other named lobes. GAS 824, 831; GA 444, 450

C. A tumor involving the meningeal branches of the ethmoidal nerves that originate from the ophthalmic division of the trigeminal nerve is likely to cause pain from pressure and nerve injury in the anterior cranial fossa. The maxillary and mandibular divisions of the trigeminal nerve provide sensory innervation to the middle and posterior aspects of the meninges, respectively. Spinal nerve C2 and C3 fibers do not provide meningeal innervation. The tentorial nerve, a branch of the ophthalmic division of the trigeminal nerve, supplies the tentorium and the supra-tentorial falx cerebri. GAS 833; GA 483-484

A. The deep lingual vein is located most superficially on the underside of the tongue. It is therefore the most direct route for absorption of the administered nitroglycerin. The submandibular and sublingual ducts are excretory in function and do not function to absorb a drug, such as nitroglycerin. The lingual and sublingual vein are located more deeply within the floor of the mouth and do not provide the most direct route for absorption. GAS 1042; GA 531, 534

B. The lingual nerve initially courses directly underneath the mucosa of the floor of the mouth and superficial to the submandibular gland, specifically the submandibular duct. This nerve is therefore at risk for ligation, division, or trauma during excision of the gland and duct. The lingual nerve is part of the mandibular division of the trigeminal nerve and carries fibers from the chorda tympani. These latter fibers supply taste to the anterior two thirds of the tongue and preganglionic parasympathetic axons involved in salivary gland secretion. Fibers of the trigeminal nerve supply general sensation to the anterior two thirds of the tongue. The lingual nerve passes deep both to the lateral pterygoid muscle and the ramus of the mandible and subsequently travels deep to the submandibular gland itself. The buccal nerve, also a branch of the mandibular division of the trigeminal nerve, supplies the mucosa of the cheek and is not in close proximity to the gland or duct. The inferior alveolar nerve, though close in proximity to the submandibular gland, travels deep to the lateral pterygoid muscle and later enters the mandibular canal to supply the lower teeth. The nerve to the mylohyoid, a branch of the inferior alveolar nerve, supplies the mylohyoid muscle and the anterior belly of the digastric. Neither of these nerves is at risk for damage during excision of the submandibular gland and duct. GAS 1041, 1043, 1045; GA 480, 484, 528-529, 532, 534

A. The ophthalmic artery is a branch of the internal carotid artery and provides origin to the ocular and orbital vessels, including the central artery of the retina, which supplies the retina. The central artery of the retina is an end artery that has no anastomoses with other arterial sources; therefore, occlusion of this artery will result in loss of vision. The nasociliary nerve is a branch of the ophthalmic nerve. It is the general sensory nerve for the eye and is the afferent limb of the corneal blink reflex; it has no direct effect on vision. The anterior ethmoidal nerve is a branch of the nasociliary nerve and supplies the anterior ethmoidal air cells, the nasal septum, and the lateral walls of the nasal cavity; it also supplies the skin on the bridge of the nose. The trochlear nerve is the fourth of the 12 cranial nerves and innervates the superior oblique muscle, one of the six extraocular muscles. The extraocular muscles function in the movement of the eyeball and not the perception of light. The optic nerve is the second of the 12 cranial nerves and is responsible for vision. A lesion of the optic nerve would lead to blindness; however, based on the location of the patient’s infection, the optic nerve was not affected by the loss of arterial supply. GAS 837, 838, 890, 892-893; GA 452, 485

A. CSF is mostly secreted from the choroid plexuses of the lateral, third, and fourth ventricles of the brain. The CSF enters the subarachnoid space from the fourth ventricle, via the foramina of Luschka and Magendie. The CSF then circulates in the subarachnoid space until it is finally resorbed back into the venous side of the circulation through the arachnoid granulations into the superior sagittal sinus. A thrombus of the superior sagittal sinus can lead to an obstruction of CSF (communicating hydroceph-
lusions) in which all of the ventricles of the brain are enlarged and the intracranial pressure is increased. GAS 834; GA 442-449

**191 C.** The jugulodigastric node, also known as the tonsillar lymph node, receives drainage from the tonsils, tongue, and pharynx. It is often enlarged during tonsillitis. The submandibular lymph nodes drain the back of the tongue, gums, upper lip, parts of the lower lip, and sides of the face. They drain into the deep cervical group of nodes. The parotid nodes are located superficially and deep to the parotid gland and drain aspects of the cheek, external acoustic meatus, the lateral aspects of the eyelids and posterior orbit. The submental nodes drain the tip of the tongue bilaterally, the lower lip, and floor of the mouth. Finally, the retropharyngeal lymph nodes drain the nasopharynx, nasal cavities, and auditory tubes. GAS 983, 984, 995, 1044; GA 458, 502-503

**192 B.** The preauricular lymph nodes are also known as the deep parotid nodes. They are located deep to the parotid gland and drain lymph from the posterior orbit. The submandibular nodes drain the side of the cheek and lateral aspects of the nose and lips. The superficial parotid lymph nodes lie superficially to the parotid gland and drain the lateral angles of the eyelids, aspects of the nose, and the external acoustic meatus. The jugulodigastric nodes receive drainage from all of the superior nodes of the face and also drain the tonsils. The submental lymph nodes drain the tip of the tongue and chin. GAS 872, 877, 878, 983, 984; GA 458, 502

**193 D.** The pharyngeal (Zenker) diverticulum is usually located between the cricopharyngeal and thyropharyngeal portions of the inferior pharyngeal constrictor. This is the most common site for development of a pharyngeal diverticulum due to the inherent weakness between the pharyngeal muscles in this location. Stasis of materials within this diverticulum can lead to inflammation, infection, and abscess. This site is also known as Killian’s triangle. GAS 987-989; GA 457, 504

**194 C.** The left brachiocephalic vein is the most likely vein punctured in the procedure because it extends across the trachea from the left side of the body, joining the right brachiocephalic vein to form the superior vena cava, which is located just to the right of the midline. The superior thyroid veins drain the superior aspects of the thyroid glands and join the internal jugular veins bilaterally and superiority to the site of incision. The middle thyroid veins drain the middle portions of the thyroid glands and also terminate in the internal jugular veins laterally, superior to the incision site. The inferior thyroid veins drain the inferior aspects of the thyroid glands and descend bilaterally to the trachea to join the right and left brachiocephalic veins, respectively. Finally, the jugular arch connecting the anterior jugular veins is quite superficial and is not typically a source of concern if encountered surgically. GAS 132, 206-207; GA 69, 76, 82, 95, 104, 516

**195 C.** The glossopharyngeal nerve enters the posterior oropharynx by coursing between the stylohyoid ligament and the stylopharyngeus muscle. Calcification of the stylohyoid ligament can readily affect this nerve by irritation or compression. The other nerves listed are not in close proximity to the styloid process or stylohyoid ligament. The glossopharyngeal nerve carries sensory nerve fibers from the posterior third of the tongue and the pharynx. A lesion of this nerve could cause loss of both general sensation and taste sensation from the posterior third of the tongue. GAS 987, 1032-1034; GA 489, 506-507, 530

**196 A.** There is a lesion of the facial nerve proximal to the geniculate ganglion. At the geniculate ganglion the greater petrosal nerve branches from the facial nerve and ultimately runs to the pterygopalatine ganglion where preganglionic fibers synapse on postganglionic neurons that innervate the lacrimal gland. There is a disruption of the facial nerve proximal to this branch that allows the greater petrosal nerve to be stimulated by factors that would normally stimulate the submandibular and sublingual glands. These glands are innervated via the chorda tympani that comes off the facial nerve distal to the geniculate ganglion. GAS 872; GA 451, 458-459, 463, 473-474, 484, 537

**197 B.** The anterior communicating artery, the portion of the arterial circle (of Willis), is directly superior to the optic chiasm, and an aneurysm of this artery would likely compress the chiasm, as in this patient. GAS 837-841; GA 452, 454

**198 E.** The nasolacrimal duct is the only duct that normally drains into the inferior meatus of the nose and therefore would be affected by a focal inflammation in this region. GAS 882-883, 884, 885, 1022; GA 462, 519-520

**199 D.** The greater petrosal nerve is a branch of the facial nerve that ultimately supplies the lacrimal gland. This branch comes off the facial nerve at the
geniculate ganglion proximal to the chorda tympani. The greater petrosal nerve is unlikely to be involved in a lesion of the facial nerve as described. The other listed functions of the facial nerve would be affected by the lesion.
GAS 882-884, 1069; GA 462-463

200  B. The great auricular nerve is derived from the ventral rami of the second and third cervical nerves and supplies the skin over the angle of the mandible up to the level of the TMJ.
GAS 973-975; GA 494, 496-497

201  B. The supraclavicular lymph node on the left side is associated with the thoracic duct. The thoracic duct receives lymph from below the diaphragm, including the gastrointestinal tract. Malignant cells that travel up the thoracic duct are known to involve the left supraclavicular lymph node.
GAS 138, 154, 205, 211, 215, 219-221, 372, 373, 374, 981-982; GA 12, 71, 118, 175, 503

202  E. The internal branch of the superior laryngeal nerve, often called the internal laryngeal nerve, supplies the mucosa of the larynx above the vocal folds (which includes the vestibule of the larynx) and the piriform recess. The external branch of the superior laryngeal nerve (external laryngeal nerve) is motor to the cricothyroid muscle. The inferior laryngeal nerve supplies the mucosa of the larynx below the vocal folds. The glossopharyngeal nerve supplies sensation to the posterior third of the tongue and to the pharynx. The hypoglossal nerve is motor.
GAS 996-1012; GA 514

203  D. A fractured hyoid bone is evidence of strangulation. A fall from a height and subdural hematoma would likely be accompanied by fractured bones. Whereas myocardial infarction or poison remain possibilities, the medical examiner would have a high index of suspicion for strangulation because of the fractured hyoid bone.
GAS 803, 1034; GA 489, 504, 512-513

204  C. Melanocytes in the pigmented layer of the retina are a potential source of malignant melanoma cells. The tumor spreads hematogenously directly to the brain and has a very poor prognosis. None of the other listed structures contains melanocytes.
GAS 901; GA 461, 468