Questions

1. The hyoid bone is palpable at the level of the bifurcation of the common carotid artery. At which cervical vertebral level would one find the hyoid bone and carotid bifurcation?

2. How could an infection in the anterior triangle of the neck cause an inflammation of the pericardium (pericarditis)?

3. How could a disease of the thyroid gland cause a voice disorder in a patient?

4. A patient was given radioactive iodine to localize the thyroid tissue in a radiogram. The clinician found a large mass of thyroid tissue in the neck at the level of C6 and C7, but he also found some radioactivity in the posterior aspect of the tongue. How could there be two regions containing thyroid tissue?

5. Why would a local anesthetic deposited at the tip of each greater horn of the hyoid help prevent a patient from coughing when a bronchoscope is passed through the nasopharynx and larynx into the bronchial tree?

6. Which cranial nerve(s) are most susceptible to injury when the internal jugular vein is removed in radical neck surgery?

7. How would stimulation of the phrenic nerve produce shoulder pain in a patient?

8. How could disease in the apex of the right lung cause symptoms in the medial side of the hand?

9. How could disease in the apex of the lung cause a Horner’s Syndrome in the right eye (pupillary constriction, partial ptosis, and lack of sweating around the eye)?

10. The carotid artery can be compressed against the transverse process of a cervical vertebra at the level of the cricoid cartilage. (a) Which vertebra is at this level? (b) Would one compress the vertebral artery in this maneuver?

11. A 25-year-old woman complaining of a swelling on the front of her neck and breathlessness visited her physician. On examination, a small, solitary swelling of firm consistency was found to the left of the midline of the neck. The swelling was not attached to the skin, but moved upward on swallowing. On careful palpation, it was found to be continuous with the lower pole of the left lobe of the thyroid gland. A diagnosis of adenoma of the thyroid gland was made. From your knowledge of anatomy, explain why the tumor moved upward when the patient swallowed. What structure in the neck was being pressed on by the adenoma to cause breathlessness? Which lymph nodes would you examine for metastases if you suspected a malignant tumor?

12. A 55-year-old woman complaining of difficulty in swallowing visited her physician. She stated that she had first noticed the condition 3 months previously and that it had become progressively worse. She now found it difficult to swallow milk puddings. During the last month she had lost 28 pounds. On questioning, the patient said she felt the obstruction was at the root of the neck (i.e., just above the upper border of the manubrium sterni). On examination of the neck, a hard, fixed lump was felt deep to the anterior border of the right sternocleidomastoid muscle. The lump was considered to be a deep cervical lymph node, which was enlarged due to a secondary carcinomatous deposit. From the history, and using your anatomical knowledge, make your diagnosis.

13. A 53-year-old woman visited her physician because of a dull, aching pain in the forearm on the left side. The discomfort was made worse by exercising the arm, especially in the elevated position. The pain was relieved by rest. She noticed that her left hand was sometimes colder than the one on the right, and when held above the head, became white. When the left arm was held by the side for any length of time, the hand became blue, especially in cold weather. On examination, the radial pulse was found to be absent on the left and normal on the right. The
brachial arterial pulse was weak on the left, but normal on the right. The pulsations of the subclavian arteries were normal on both sides of the neck. It was possible to produce the color changes described by the patient by suitable positioning of the left arm. Using your knowledge of anatomy, state what possible structure or structures in the neck could produce these signs and symptoms.

14. A 22-year-old woman consulted her physician about a swelling in the anterior aspect of her neck. Although painless, she was concerned because it seemed to be slowly getting larger. Physical examination revealed that the swelling was located just inferior to her hyoid bone and that it was cystic and freely movable. The physician grasped the swelling between his first and second digits and asked the patient to open her mouth and stick out her tongue. Feeling some movement of the mass, he asked the patient to stick her tongue out as far as possible and then retract it. The physician noted a definite superior tug on the mass as the patient's tongue protruded. The swelling also moved superiorly during swallowing. Fluid was aspirated from the swelling for laboratory investigation. Diagnosis. Thyroglossal duct cyst (thyroglossal cyst). Problems. Explain the embryological basis of this cyst. Where are these cysts likely to be found? What is the anatomical basis for movement of the cyst superiorly when the patient protrudes her tongue and swallows? What would this condition be called if there had also been a midline cervical opening into the cyst?

15. A 27-year-old second-year medical student consulted her clinical instructor about a painless, plum-shaped swelling in the anterior triangle of her neck, inferior to the angle of her right mandible. As her mandibular third molar teeth ("wisdom teeth") had not erupted, she thought the swelling might be caused by a dental abscess in the submandibular triangle. She also feared that the firm swelling might be caused by a tumor of the submandibular gland or of the jugulo-omohyoid lymph node. Radiographs of her mandible showed the crown of her left third mandibular molar tooth was in contact with the posterior surface of her second molar tooth. The instructor recommended that her impacted tooth be surgically removed after consulting her physician about the swelling in her submandibular region. He stated that her impacted molar tooth was not the cause of the swelling in the lateral aspect of her neck. On examination the physician found that the swelling was caused by a painless fluctuant cyst located anterior to the superior one-third of her sternocleidomastoid muscle. Diagnosis. Branchial cyst (lateral cervical cyst). During excision of the cyst, it was discovered that a sinus tract passed superiorly from it. Problems. Explain the embryological basis of the branchial cleft cyst. Where did the sinus tract probably terminate? What nerve might be damaged during excision of this cyst? What signs would be present if this nerve were damaged? If the sinus tract had passed inferiorly, where would it probably open?

16. A 30-year-old woman complained of a swelling in the anterior part of her neck, nervousness, and loss of weight. She told her physician that her family complains that she is irritable, excitable, and cries easily. During a physical examination, a swelling was apparent on each side of her neck, inferior to the larynx. During palpation of the patient's neck from a posterior position, the physician felt an enlarged thyroid gland and noted that it moved up and down during swallowing. The following signs were also detected: protrusion of the eyes, rapid pulse, tremor of the digits, moist palms, and loss of weight. Diagnosis. Hyperthyroidism (exophthalmic goiter, Graves' disease). When the patient did not respond to medical treatment, a subtotal thyroidectomy was performed. After the operation the patient complained of hoarseness. Problems. What is the anatomical basis for the swelling moving up and down during deglutition? Because the patient's thyroid gland was enlarged, what nerves might have been compressed or displaced? If a total thyroidectomy had been done, what other endocrine glands might
inadvertently have been removed? What would result from this error? What was the probable cause of the patient's hoarseness?

**Answers**

1. C3
2. By spreading inferiorly along the carotid sheath into the thorax. The carotid artery arises from the aortic arch inferiorly, and the adventitia of the aortic arch is related to the fibrous pericardium.
3. By affecting the recurrent laryngeal nerves that ascend through the root of the neck on the posteromedial aspect of the thyroid lobes
4. The thyroid gland develops in the region of the foramen cecum in the tongue and then descends into the neck in embryogenesis.
5. It anesthetizes the internal laryngeal nerves, which innervate the laryngeal mucosa above the vocal cords.
6. IX, X, XI and XII (deep to the posterior belly of the digastric)
7. Sensory impulses would enter the spinal cord at C3, 4, 5. This is the same segmental level of the spinal cord that the supraclavicular nerves (C3, 4) stimulate when the skin over the shoulder is stimulated.
8. By stimulating the T1 segments of the brachial plexus
9. By damaging the sympathetic trunk as it crosses the neck of the 1st rib.
10. (a) C6 (Its anterior tubercle is also called the carotid tubercle.)
    (b) No, the vertebral artery has entered the C6 foramen transversarium posterior to the carotid tubercle.
11. The thyroid gland is invested by the pretracheal layer of deep cervical fascia, which binds the gland to the larynx. Thus, as the larynx moves upward on swallowing, the thyroid gland and the adenoma move upward also. Each lobe of the thyroid gland is closely related to the trachea. A localized enlargement of the gland, such as an adenoma, often presses on the trachea and partially occludes the lumen, producing dyspnea. The thyroid gland is drained mainly into the deep cervical group of lymph nodes.
12. The patient had a carcinoma of the cervical part of the esophagus. Radiological examination following the swallowing of a barium emulsion revealed the stenosis produced by the neoplasm. The growth has spread by the lymphatics to the deep cervical lymph nodes.
13. This patient is suffering from vascular insufficiency of the left arm, which is due to partial constriction of the subclavian artery. An anteroposterior radiograph of the neck revealed the presence of a complete cervical rib on the left side. The subclavian artery was found at operation to be angulated as it passed over the rib. A fusiform dilation of the artery distal to the constriction was also noted. Such a dilation is a common finding and may be the site of the formation of blood clots on the intima. Pieces of the thrombus sometimes become detached and form emboli, which may block the brachial artery or one of its branches and so further diminish the vascular supply to the hand.
14. A thyroglossal duct cyst develops from a remnant of the embryonic thyroglossal duct, which connects the thyroid gland with the base of the tongue in the embryo. Normally the thyroglossal duct atrophies and degenerates as the thyroid gland descends to its final site in the neck. Remnants of this duct may persist anywhere along the median plane of the neck between the foramen cecum of the tongue and the thyroid gland. These remnants may give rise to cysts in the tongue or neck, usually just inferior to the hyoid bone. Often the cyst is in intimate contact with the anterior part of this bone. It may be connected superiorly by a duct with the foramen cecum of the tongue, inferiorly with the pyramidal lobe or isthmus of the thyroid gland, or both. These connections explain why thyroglossal duct cysts move up and down during deglutition and when
the tongue is protruded. Sometimes a thyroglossal duct cyst develops an opening onto the surface of the neck (thyroglossal fistula). This results from erosion of cervical tissues following infection and rupture of the cyst.

15. All the conditions that came to the student's mind could have caused the swelling in the side of her neck. Branchial cysts may be derived from remnants of parts of the cervical sinus, the second branchial groove, or the second pharyngeal pouch. Although they may be associated with branchial sinuses, as in the present case, and may drain through them, these cysts often lie freely in the neck just inferior to the angle of the mandible. Branchial cysts may develop at any level in the neck, but they usually develop along the anterior border of the sternocleidomastoid muscle. The cyst usually extends deep to this muscle and involves other structures. In the present case the cyst was probably derived from a remnant of the embryonic cervical sinus. The sinus tract running superiorly from it was probably derived from the second pharyngeal pouch. It probably passed between the internal and external carotid arteries, just superior to the hypoglossal nerve and the bifurcation of the common carotid artery. Very likely it terminated in or close to the intratonsillar cleft, the adult derivative of the cavity of the second pharyngeal pouch. During the surgical excision of ascending sinuses associated with these cysts, the hypoglossal nerve may be bruised or injured, causing temporary or prolonged unilateral lingual paralysis. This would be indicated by hemiatrophy of the tongue and deviation of the tongue to the paralyzed side when it was protruded. This results from the unopposed action of the tongue muscles on the other side. If the sinus tract had passed inferiorly, it probably would have opened in the inferior third of the neck, along the anterior border of the sternocleidomastoid muscle. Branchial sinuses that open externally are derived from remnants of the second branchial groove (cleft).

16. The tongue, hyoid, and larynx rise and fall during swallowing. Because the thyroid gland is attached to the larynx by pretracheal fascia, it also moves up and down during swallowing. Physiological enlargement of the thyroid gland is commonly seen at puberty and during pregnancy; otherwise, any enlargement of the thyroid is called a goiter. In the present case the patient's goiter resulted from hyperthyroidism. The association of hyperthyroidism with protrusion of the eyes (exophthalmos) was first described by an Irish physician, R. I. Graves. For many years his name has been associated with the disease. The cause of exophthalmos is not precisely known; however, a considerable increase in the size of the orbital muscles is certainly a factor. In the surgical treatment of hyperthyroidism, part of each lobe of the thyroid is removed (subtotal thyroidectomy), thereby leaving less glandular tissue to secrete hormones. As the parathyroid glands typically lie on the posterior surface of this gland, posterior parts of the lobes are left so that these glands will not be inadvertently removed. At least one of them is essential for secretion of parathyroid hormones that maintain the normal level of calcium in the blood and body fluids. If the parathyroid glands are removed, the patient soon develops a convulsive disorder known as tetany. The signs are nervousness, twitching, and spasms in the facial and limb muscles. When the thyroid gland is being removed, there is danger that the important laryngeal nerves may be injured. Near the inferior pole of the thyroid gland, the recurrent laryngeal nerves are intimately related to the inferior thyroid arteries. The nerves may cross anterior or posterior to this artery or between its branches before ascending in or near the groove between the trachea and esophagus. Because of the close relation between the recurrent laryngeal nerves and the inferior thyroid arteries, the risk of injuring them during surgery is ever present. These nerves supply all muscles of the larynx except the cricothyroids. If one of the nerves is damaged or cut, there is likely to be a serious effect on speech (e.g., hoarseness as in the present case) or a change in the quality of the voice (e.g., a brassy sound). Some patients also have difficulty clearing their throats. Temporary paralysis of the recurrent laryngeal nerves may also result from the effect of postoperative edema on them. It must be remembered also that a
common cause of temporary hoarseness after surgery is trauma to the mucous membrane of the larynx by the endotracheal tube inserted as an airway by the anesthetist. If both nerves are severed, a very unusual occurrence, breathing will be severely impaired and speech will be difficult because the vocal folds remain partly abducted (the position of complete paralysis of the intrinsic muscles). Thus the rima glottidis is not fully open. If the nerves are compressed as a result of inflammation or the accumulation of fluid, the breathing and speech defects will normally disappear following healing and drainage of the operative site.

**Cases without printed interpretations**

- **Patient Eleanor E.** This elderly female nursing home resident aspirated some foreign substance (food) into the larynx. It induced a laryngospasm of the vocal cords. In a state of collapse she is rushed into the Emergency Department. The physician is unable to remove the aspirated debris and, with your help, immediately performs an emergency tracheostomy which re-establishes the airway. The tracheostomy is done through the upper tracheal rings superior to the isthmus of the thyroid gland.

- **Patient Shirley V.** This 46-year-old woman was thoroughly tested in the University Hospital and diagnosed as having a “goiter.” She is scheduled for surgery and you are assigned to her case. The thyroidectomy is performed by successively clamping and ligating the terminal branches of the superior and inferior thyroid arteries from the posterior to the anterior aspect of the thyroid gland. Unfortunately, the left recurrent laryngeal nerve is damaged. When you examine her the next day, her voice quality is reduced to a whisper. This persists for 4 months following the surgery, and then her voice quality gradually improves to normal over the next 2 months. Meanwhile, her metabolism has normalized.