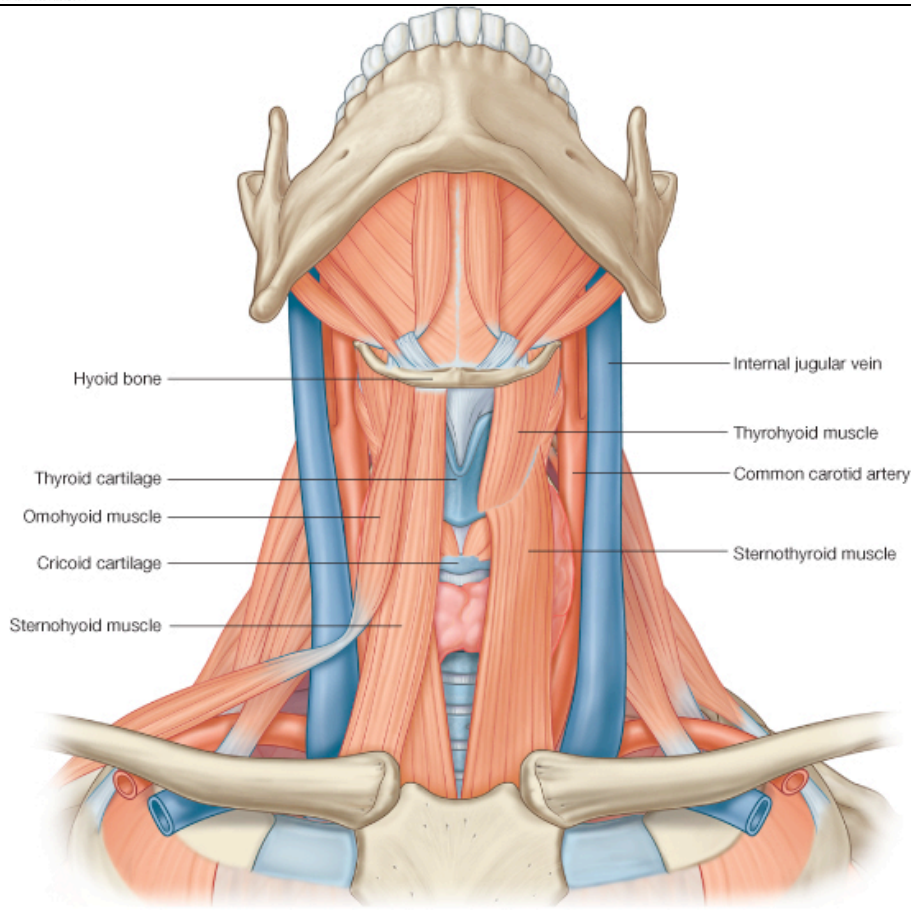
Term: FIMS Week: CBL SESSION

CBL Title: **Neck Lumps**
CBL Session Coordinators:
Coordinators' email/phone:
Key issues that may be addressed in CBL sessions:

SUGGESTED LIKELY CASES FOR DISCUSSION
Patient with a neck lump from outpatient or pre-admission clinic.
KEY POINTS FOR DISCUSSION
History: ***Examination:*** • Flexible endoscopy • Oesophagoscopies • Laryngoscopies • Bronchoscopies • Gastroscopies • Mediastinoscopies • Pan-endoscopy • +/- biopsies ***Review of pathophysiology and anatomy:*** • **Anatomy of the neck: compartments, triangles,**



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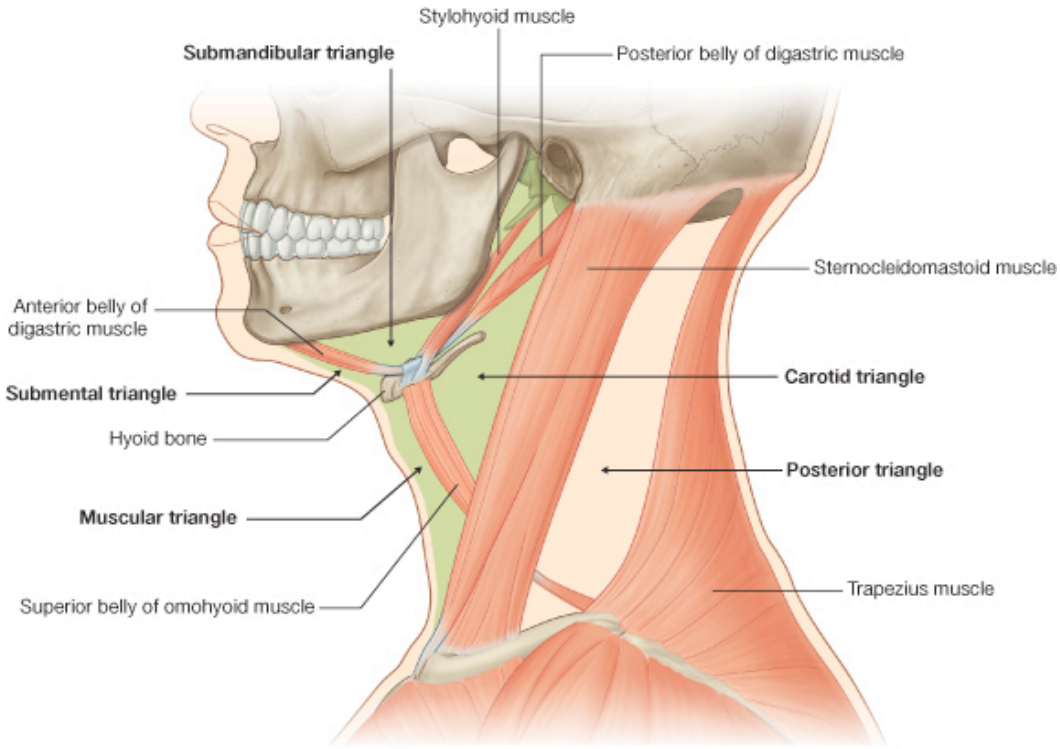

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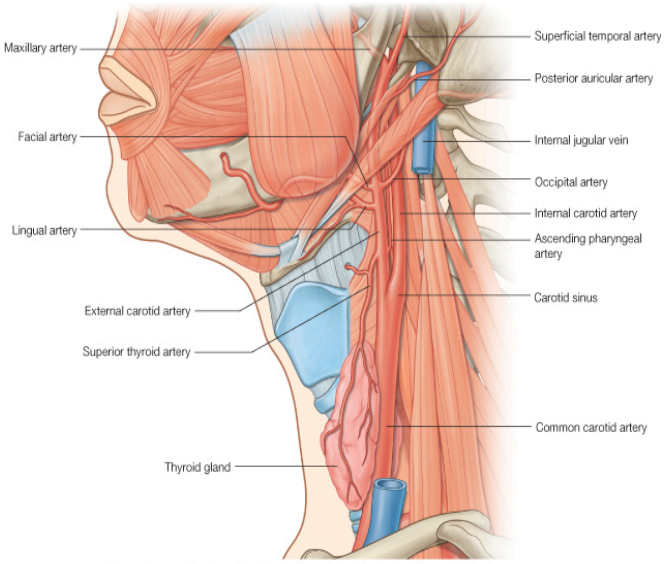
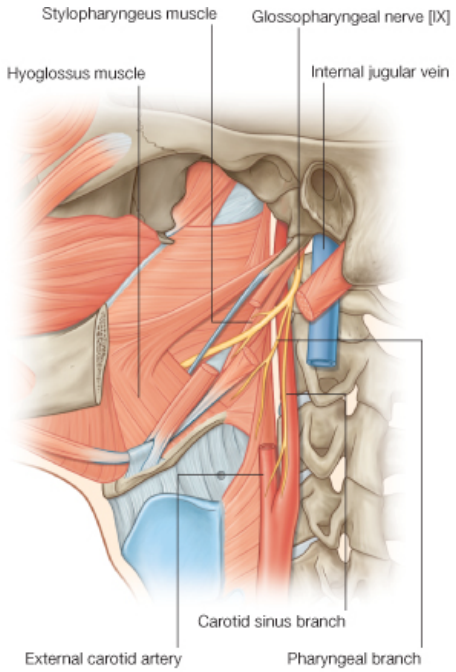
The *anterior triangle* is subdivided into the following:

- The *submandibular* triangle is outlined by the inferior border of the mandible superiorly and

the anterior and posterior bellies of the digastric muscle inferiorly;
- The submental triangle is outlined by the hyoid bone inferiorly, the anterior belly of the digastric muscle laterally, and the midline;
- The muscular triangle is outlined by the hyoid bone superiorly, the superior belly of the omohyoid muscle, and the anterior border of the sternocleidomastoid muscle laterally, and the midline;
- The carotid triangle is outlined by the superior belly of the omohyoid muscle anteroinferiorly, the stylohyoid muscle and posterior belly of the digastric superiorly, and the anterior border of the sternocleidomastoid muscle posteriorly.

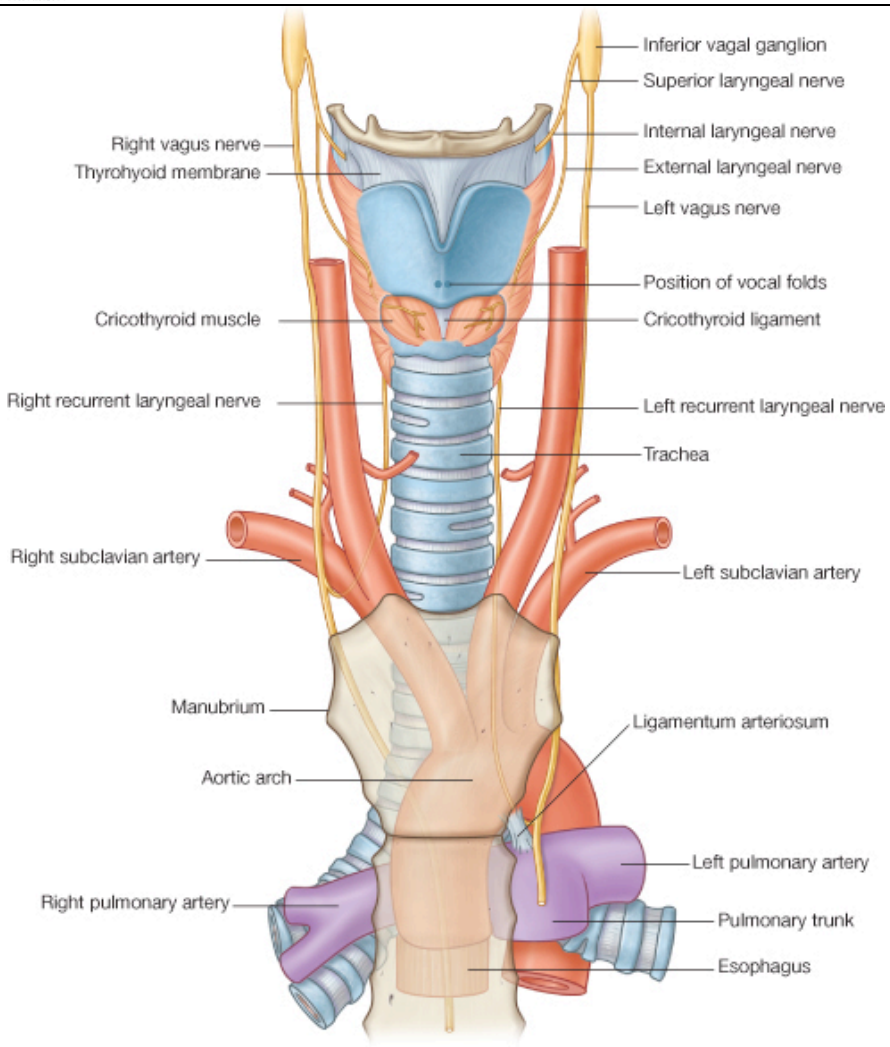
- **Contents of regional anatomy correlated to pathology**





The external laryngeal and the recurrent are the most likely to be damaged in surgery leading to inability to sing high notes or talk respectfully.

Superior laryngeal nerves
The superior laryngeal nerves originate from the inferior vagal ganglia high in the neck. On each side, they descend medial to the internal carotid artery and divide into internal and external branches just above the level of the superior horn of the hyoid bone:
- The external branch (external laryngeal nerve) descends along the lateral wall of the pharynx to supply and penetrate the inferior constrictor of the pharynx and ends by supplying the cricothyroid muscle;
- The internal branch (internal laryngeal nerve) passes anteroinferiorly to penetrate the thyrohyoid membrane-it is mainly sensory and supplies the laryngeal cavity down to the level of the vocal folds.

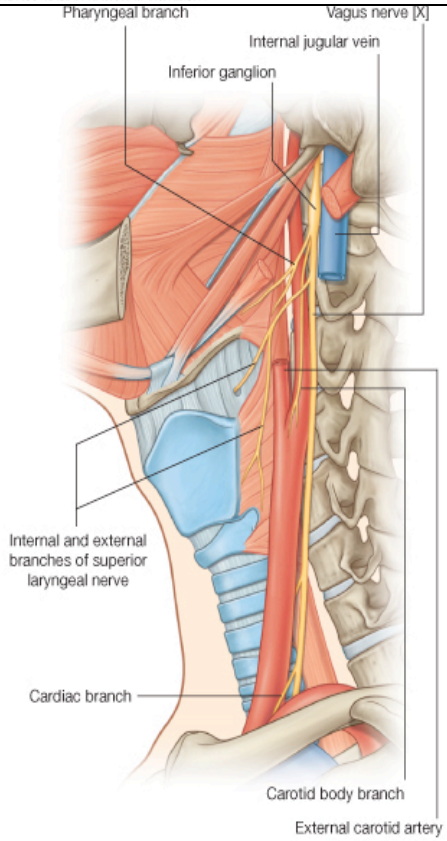


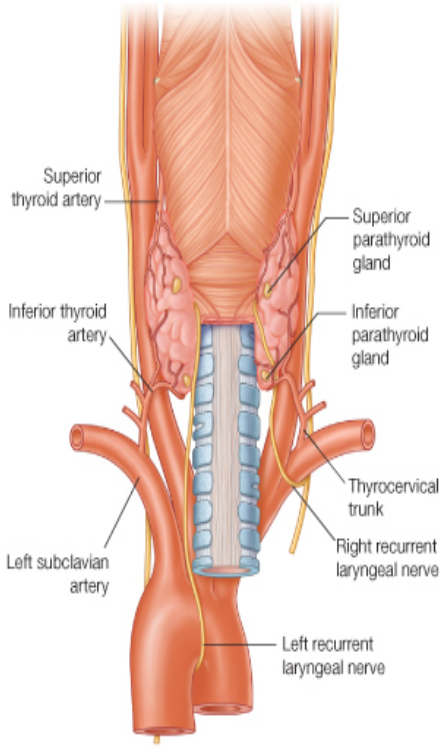
The recurrent laryngeal nerves are:

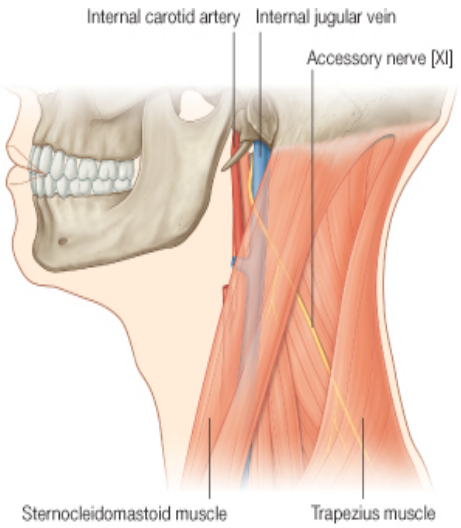
- Sensory to the laryngeal cavity below the level of the vocal folds;
- Motor to all intrinsic muscles of the larynx except for the cricothyroid.

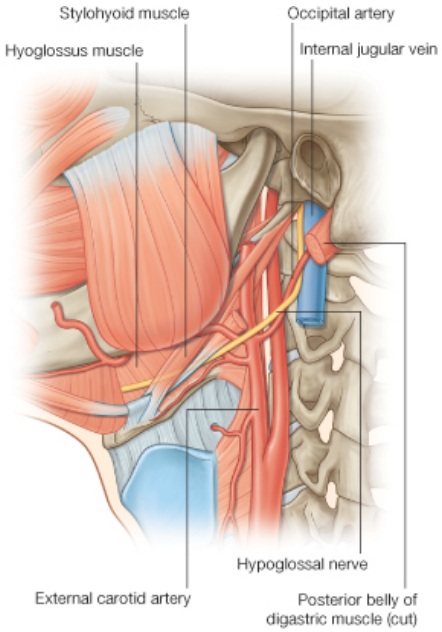
Recurrent laryngeal nerves

The thyroid gland is closely related to the recurrent laryngeal nerves. After branching from the vagus nerve [X] and looping around the subclavian artery on the right and the arch of the aorta on the left, the recurrent laryngeal nerves ascend in a groove between the trachea and esophagus They pass deep to the posteromedial surface of the lateral lobes of the thyroid gland and enter the larynx by passing deep to the lower margin of the inferior constrictor of the pharynx.









- **Vascular supplies and lymphatic drainage**

Arterial supply

Two major arteries supply the thyroid gland.

Superior thyroid artery: the first branch of the external carotid artery. It descends, passing

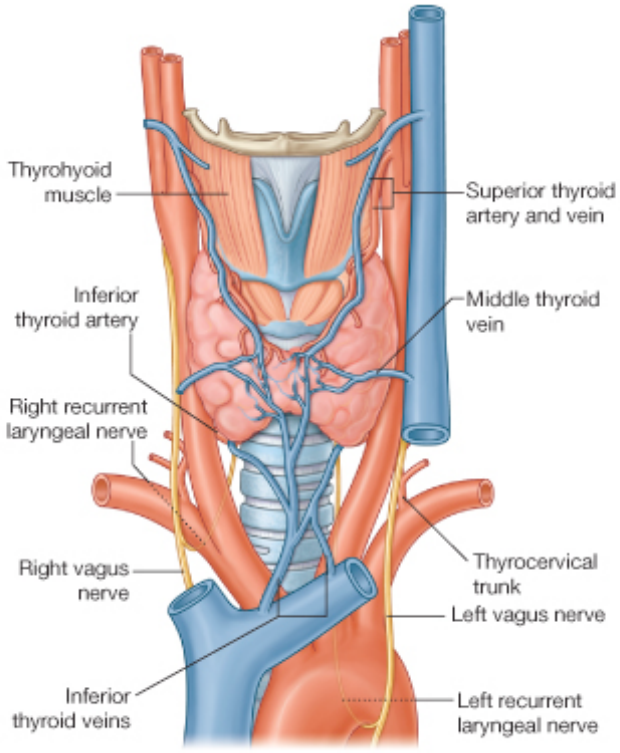
along the lateral margin of the thyrohyoid muscle, to reach the superior pole of the lateral lobe of the gland where it divides into anterior and posterior glandular branches:

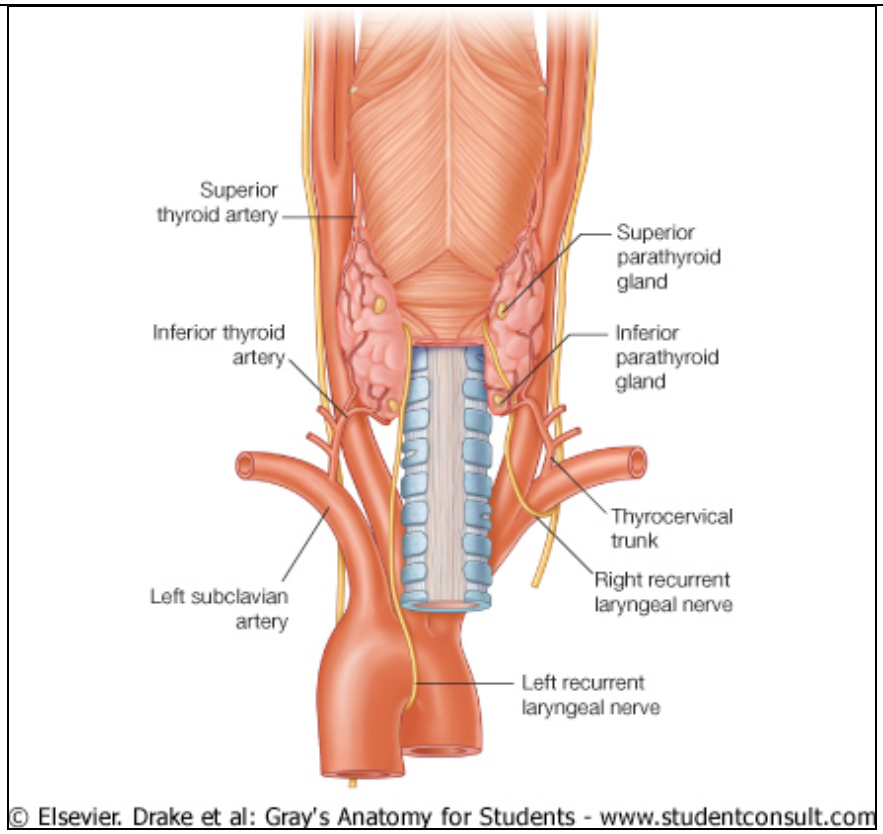
- The anterior glandular branch supplies along the superior border of the thyroid gland and anastomoses with its twin from the opposite side across the isthmus
- The posterior glandular branch passes to the posterior side of the gland and may anastomose with the inferior thyroid artery.

Inferior thyroid artery: a branch of the thyrocervical trunk, which arises from the first part of the subclavian artery. It ascends along the medial edge of the anterior scalene muscle, passes posteriorly to the carotid sheath, and reaches the inferior pole of the lateral lobe of the thyroid gland.

At the thyroid gland the inferior thyroid artery divides into an:

- Inferior branch, which supplies the lower part of the thyroid gland and anastomoses with the posterior branch of the superior thyroid artery;
- An ascending branch, which supplies the parathyroid glands.





Venous and lymphatic drainage

Three veins drain the thyroid gland

- The *superior thyroid vein* primarily drains the area supplied by the superior thyroid artery;
- The *middle and inferior thyroid* veins drain the rest of the thyroid gland.

The superior and middle thyroid veins drain into the *internal jugular vein* and the inferior thyroid veins empty into the right and left brachiocephalic veins, respectively.

Lymphatic drainage of the thyroid gland is to nodes beside the trachea (paratracheal nodes) and to deep cervical nodes inferior to the omohyoid muscle along the internal jugular vein.

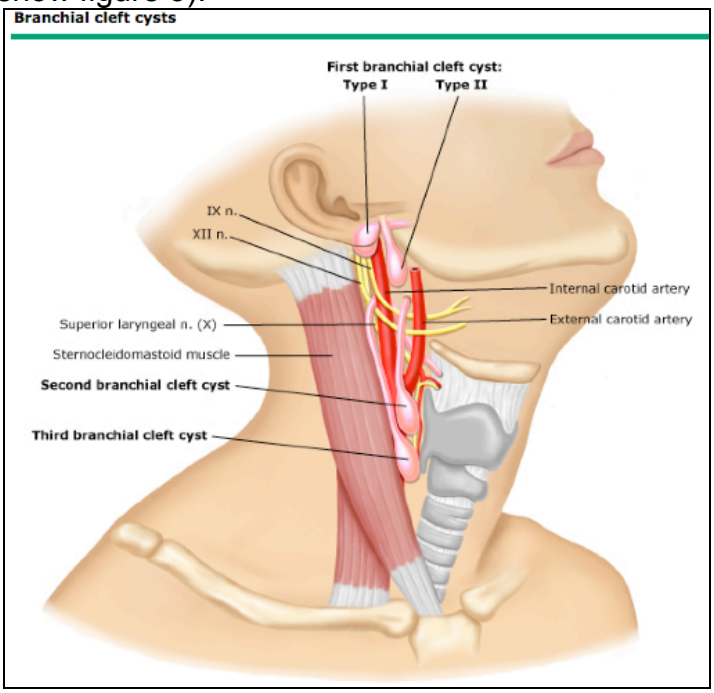
Lymphatic drainage in the head and neck

Lymph node group	Anatomic areas drained
Occipital	Posterior scalp
Postauricular	Temporal and parietal scalp
Preauricular	Anterior and temporal scalp, midface, nose, anterior ear canal and pinna, lateral conjunctivae
Parotid	Forehead and temporal scalp, midface, nose, external ear canal, middle ear, gums, parotid gland
Submandibular (submaxillary)	Cheek, nose, lips, anterior tongue, submandibular gland, buccal mucosa
Submental	Central lower lip, floor of mouth, tongue
Superficial cervical	Skin, lower larynx, lower ear canal, parotid
Superior deep cervical	Tonsil, adenoid, posterior scalp and neck, tongue, larynx, hypopharynx, thyroid, palate, nose, esophagus, paranasal sinuses, nasopharynx, other cervicofacial nodes
Inferior deep cervical	Dorsal scalp and neck, nasopharynx, superficial pectoral region of the arm, superior deep cervical

- **Pathologic classification of diseases and causation**
- **Congenital vs acquired**
- **Acquired conditions: inflammatory, infective, neoplastic, etc**

Congenital

Branchial cleft cyst — Branchial cleft cysts account for almost 20 percent of pediatric neck masses. They present in late childhood or early adulthood when cyst becomes infected. Located anterior to the sternocleidomastoid muscle. They are subdivided based on the developmental origin (show figure 3).



Type I first branchial cleft cysts are duplication anomalies of the external auditory canal and are of ectodermal origin. They pass through the parotid gland often in close proximity to the facial nerve. Type II branchial cleft cysts are more common and typically present below the angle of the mandible. They contain both ectoderm and mesoderm and pass through the parotid gland medial or lateral to the facial nerve and end either inferior to the external auditory canal or at the bony cartilaginous junction of the external auditory canal.

Second branchial cleft cysts are the *most common* type of branchial cleft anomaly. They are usually located just inferior to the angle of the mandible and anterior to the sternocleidomastoid muscle. The sinus tract of a second branchial cleft cyst will travel through the deep structures of the neck and open into the tonsillar fossa.

Third branchial cleft cysts also are located anterior to the sternocleidomastoid muscle but are typically lower in the neck than a second branchial cleft cyst. These anomalies end in the pharynx at the thyrohyoid membrane or pyriform sinus.

Recurrent infections of branchial cysts can occur, and a fistula tract to the skin may develop.

Thyroglossal duct cyst — In contrast to branchial cleft cysts, thyroglossal duct cysts present as a midline mass in the anterior neck. Thyroglossal duct cysts are usually diagnosed in childhood, but up to 40 percent may present after age 20.

Surgical treatment is the standard in the management of thyroglossal duct cyst. It includes excision of the cyst and tract which passes through the central portion of the hyoid bone to the base of tongue.

Vascular anomalies —vascular tumors and vascular malformations.
Vascular tumors are endothelial neoplasms characterized by increased cellular proliferation. The most common type is a *hemangioma*, although rare tumors (eg, hemangiopericytoma, hemangioendothelioma, and angiosarcoma) may also occur.

Hemangiomas often appear as a compressible red or bluish soft mass. An associated bruit may be present on auscultation. A full physical exam should be performed since a second hemangioma may be present in the subglottis, gastrointestinal tract, or spine.

Management of hemangiomas consists initially of watchful waiting, since the majority will resolve spontaneously and the benign tumor will not recur. Intervention of glucocorticoids or laser is necessary when the lesion is symptomatic (eg, airway compromise or bleeding).

Vascular malformations can be arterial, venous, lymphatic or a combination. Lymphatic malformations are the most likely to present as a neck mass. (See "Vascular lesions in the newborn").

On physical examination, these masses are typically soft, nontender, and compressible. The overlying skin is usually normal and the mass can be transilluminated.

Treatment (surgery involving staged procedures, sclerotherapy) is directed at preventing recurrent bleeding or infection, correcting contour deformity, and improving function.

Laryngocele — A laryngocele is a herniation of the saccule of the larynx. The herniation can be limited to internal laryngocele, or extend through the thyrohyoid membrane (external or mixed laryngocele).

Patients most often present with hoarseness, cough, and a foreign body sensation. Laryngoscopy often will demonstrate a smooth dilation at the level of the false cord, involving both the false cord and aryepiglottic fold. Managed surgically.

Ranula — A ranula is a mucocele or retention cyst arising from an obstruction in the sublingual glands in the floor of mouth.

Ranulas are often painless and slow-growing. Ranulas are managed by surgical resection of the mucocele with the sublingual gland [2].

Teratoma — Teratomas arise from pluripotential cells and contain all three germ layers.

Teratomas typically arise in the first year of life and can cause significant aerodigestive obstruction. Surgical excision is recommended [8].

Dermoid cyst — Dermoid cysts are due to entrapment of epithelium in deeper tissue, occurring either developmentally or posttrauma. Congenital lesions are usually midline, nontender, mobile, submental neck masses. They are treated by surgical excision.

Thymic cyst — Thymic cysts result from implantation of thymic tissue during its embryologic descent. As a result, they often present in a midline position. However, they can present anywhere between the angle of the mandible and the midline of the neck. Thymic cysts are managed with surgical excision

Inflammation and infection

Infectious inflammatory disorders

Reactive viral lymphadenopathy
Most common cause of cervical lymphadenopathy, especially in children post URTI caused by adenovirus, rhinovirus, or enterovirus. Epstein Barr Virus causes infectious mononucleosis and has a unique course.

Symptoms for one to two weeks; lymphadenopathy generally resolves within one to two weeks of symptom resolution. The lymphadenopathy is typically tender and located in the submandibular region or jugular chain. CT findings of lymph nodes less than 1 cm (or 1.5 cm in the upper jugulodigastric chain), oblong in shape, with no evidence of central hypodensity and a preserved vascular hilum are reassuring features.

Concerning lympadenopathy and should be followed up
Fixed firm lymphadenopathy is particularly concerning for noninfectious lymphadenopathy and should lead to referral for imaging and biopsy.
Lymphadenopathy *greater than 1 cm* in size that *persists for more than two* weeks after resolution of other viral symptoms is concerning, and should be evaluated with imaging.

Mononucleosis is often associated with neck nodes that are quite large (>2 cm) and may also occur in the posterior triangle, accompanying axillary and inguinal lymphadenopathy as well as tonsillar hypertrophy. Mononucleosis has a characteristic prodrome of fatigue, malaise, fever and severe pharyngitis.

Bacterial lymphadenopathy:
The most common organisms are Staphylococcus aureus and group A beta-Streptococcus. Patients should be treated initially with antibiotic therapy directed at these organisms. MRSA is an increasing problem and should be considered in patients who have been recently hospitalized, have an occupational exposure. Patients with a poor response to initial antibiotic therapy may require needle aspiration or incision and drainage of the abscess, with subsequent culture for bacterial diagnosis.

A few specific bacteria merit individual mention.

1. *Toxoplasma gondii* is typically acquired through ingestion of inadequately cooked meat or the ingestion of cat feces. These patients often have a prolonged course of fever, malaise, myalgias, sore throat, and cervical lymphadenopathy which can be present for weeks.
2. *Tularemia* is caused by Francisella tularensis. Transmission via rabbits is best known, but it can also be passed by ticks or contaminated water. Patients commonly present with tonsillitis/pharyngitis as well as painful lymphadenopathy. Systemic symptoms of fever, chills, fatigue and headache are common. Throat culture and serologic testing confirm the diagnosis.
3. *Brucellosis* (also called undulant, Mediterranean, or Malta fever) is caused by one of four species of Brucella, a gram negative organism, and can be acquired from one of several farm animals by direct contact or by eating the butter or milk from one of these animals.
4. *Cat-scratch* disease usually presents with submandibular and/or preauricular lymphadenopathy. Cat-scratch disease is caused by Rochalimaea henselae which is carried by felines.. Lymphadenopathy is often quite painful and accompanied by fevers and

generalized malaise. Usually self-limiting and requires only supportive treatment.

5. *Actinomycosis* commonly presents in the submandibular region and can be associated with dental procedures. Often the mass is painless and fluctuant. Confirmation of the diagnosis requires biopsy, which demonstrates granulomas with sulfur granules. Penicillin is the first line treatment.
6. *Mycobacterial* infections present in a variety of forms. Tuberculosis is caused by Mycobacterium tuberculosis. The lymphadenopathy is classically diffuse and commonly is bilateral.
7. *Atypical mycobacteria* is more common among the pediatric population and usually presents as a unilateral mass in the parotid or anterior neck. The overlying skin commonly becomes brawny and can appear as a hue of purple, which is almost pathognomonic. Skin testing is usually only weakly positive, so often core needle or excision is needed to obtain tissue for culture in order to confirm the diagnosis. If a focal node is the limit of the disease, surgical excision can be considered as definitive treatment. More extensive disease may be better treated with incision and curettage and antibiotics. (
8. *HIV* associated lymphadenopathy is very common, present in up to 45 percent of patients with HIV infection [9].

Noninfectious inflammatory disorders
Sarcoidosis, Castleman disease, Rosai-Dorfman disease, and Kawasaki disease

Causes of peripheral lymphadenopathy

Cause	Examples
Infections	
Bacterial	
Localized	Streptococcal pharyngitis; skin infections; tularemia; plague; cat scratch disease; diphtheria; chancroid; rat bite fever
Generalized	Brucellosis; leptospirosis; lymphogranuloma venereum; typhoid fever
Viral	Human immunodeficiency virus; Epstein-Barr virus; herpes simplex virus; cytomegalovirus; mumps; measles; rubella; hepatitis B; dengue fever
Mycobacterial	Mycobacterium tuberculosis; atypical mycobacteria
Fungal	Histoplasmosis; coccidioidomycosis; cryptococcosis
Protozoal	Toxoplasmosis; Leishmaniasis
Spirochetal	Secondary syphilis; Lyme disease
Cancer	Squamous cell cancer head and neck; metastatic; lymphoma; leukemia
Lymphoproliferative	Angioimmunoblastic lymphadenopathy with dysproteinemia
	Autoimmune lymphoproliferative disease
	Rosai-Dorfman's disease
	Hemophagocytic lymphohistiocytosis
Immunologic	Serum sickness; drug reactions (phenytoin)
Endocrine	Hypothyroidism; Addison's disease
Miscellaneous	Sarcoidosis; lipid storage diseases; amyloidosis; histiocytosis; chronic granulomatous diseases; Castleman's disease; Kikuchi's disease; Kawasaki disease; inflammatory pseudotumor; systemic lupus erythematosus; rheumatoid arthritis; Still's disease; dermatomyositis; Churg-Strauss syndrome

Infectious causes of cervical lymphadenitis

Presentation	Common	Uncommon	Rare
Acute bilateral	Rhinovirus Epstein-Barr virus*• Cytomegalovirus*• Herpes Simplex Virus Adenovirus Enterovirus Mycoplasma pneumoniae Group A streptococcus Influenza	Roseola• Parvovirus B19•	Corynebacterium diphtheriae Rubella• Measles Mumps•
Acute unilateral	Staphylococcus aureus Group A streptococcus Anaerobic bacteria	Group B streptococcus Tularemia* Alpha streptococcus Pasturella multocida Yersinia pestis• Gram-negative bacilli	Yersinia enterocolitia* Anthrax
Chronic unilateral	Nontuberculous Mycobacterium Cat-scratch disease	Toxoplasmosis• Tuberculosis• Actinomycosis	Nocardia brasiliensis Aspergillosis Sportotrichosis
Chronic bilateral	Epstein-Barr virus Cytomegalovirus•	HIV• Toxoplasmosis• Tuberculosis• Syphilis•	Brucellosis• Histoplasmosis•

Noninfectious causes of cervical lymphadenitis

Malignancy	Miscellaneous
Lymphomas	Kawasaki disease
Leukemia	PFAPA*
Neuroblastoma	Kikuchi-Fujimoto disease
Rhabdomyosarcoma	Histiocystosis
Thyroid cancer	Castleman disease
Collagen vascular disease	Kimura disease
Juvenile rheumatoid arthritis	Postvaccination
Systemic lupus erythematosus	Sarcoidosis
Drugs	
Phenytoin	
Carbamazepine	

* PFAPA: Periodic fever, aphthous stomatitis, pharyngitis, and cervical adenitits.

Physical examination — A complete physical examination should be performed to look for signs of systemic disease. Associated splenomegaly suggests lymphoma, chronic lymphocytic leukemia, acute leukemia, or infectious mononucleosis. All lymph node groups should be examined with the following characteristics in mind:

Location
Localized lymphadenopathy suggests local causes and should prompt a search for pathology in the area of node drainage, although some systemic diseases such as plague, tularemia, and aggressive lymphomas can present with local adenopathy. Generalized adenopathy is usually a manifestation of systemic disease.

Size
Abnormal nodes are generally greater than 1 cm in diameter. In one series, no patient with a lymph node smaller than 1 cm2 had cancer, compared with 8 and 38 percent of those with nodes 1 to 2.25 and greater than 2.25 cm2, respectively [41].

Consistency
Hard nodes are found in cancers that induce fibrosis (scirrhous changes) and when previous inflammation has left fibrosis. Firm, rubbery nodes are found in lymphomas and chronic leukemia; nodes in acute leukemia tend to be softer.

Fixation
Normal lymph nodes are freely movable in the subcutaneous space. Abnormal nodes can become fixed to adjacent tissues (eg, deep fascia) by invading cancers or inflammation in tissue surrounding the nodes. They can also become fixed to each other ("matted") by the same processes.

Tenderness
Tenderness suggests recent, rapid enlargement that has put pain receptors in the capsule under tension. This typically occurs with inflammatory processes, but can also result from hemorrhage into a node, immunologic stimulation, and malignancy.

NEOPLASTIC DISORDERS

Both benign and malignant neoplasm can present in the neck, as noted above. The adult patient should be approached with a presumption of malignancy until proven otherwise..

Metastatic head and neck carcinoma
Predominantly related to metastatic squamous cell carcinoma arising from the aerodigestive tract.

Metastatic nodes in the posterior triangle are often related to nasopharyngeal carcinoma, whereas nodes along the upper jugular chain drain from the oral cavity, oropharynx, and larynx. Isolated supraclavicular nodes should raise concern or a tracheobronchial, distal esophageal or stomach carcinoma.

Thyroid mass
A primary thyroid tumor will usually present as a mass in the anterior neck. While the majority

of these masses represent benign thyroid nodules and cysts, malignancy must be considered.

A thorough work up of these lesions including ultrasound and fine needle biopsy will dictate the course of treatment based on the risk or presence of malignancy. Symptoms of hoarseness or a history of radiation exposure in the setting of a new thyroid mass should increase the suspicion for malignancy.

Salivary gland neoplasm
Approximately 80 percent of salivary neoplasms arise in the parotid gland. Eighty percent of parotid tumors are benign, most commonly pleomorphic adenoma [13]. The incidence of malignancy in tumors of the submandibular gland is much higher, approaching 50 percent.

There are several subtypes of benign salivary neoplasm, including pleomorphic adenoma, Wharthin's tumor, lymphoepithelioma, oncocytoma, and monomorphic adenoma. Pleomorphic adenomas comprise approximately 80 to 85 percent of these benign tumors.

Benign tumors classically present as asymptomatic enlarging masses. Signs or symptoms such as pain, cranial nerve deficits, or overlying skin changes usually herald the presence of malignancy. CT, MRI, and fine needle biopsy all have roles in the diagnosis and evaluation of these tumors.

Paraganglioma
Carotid body and glomus tumors are the two common paragangliomas which can present as a neck mass. They are often pulsatile and a bruit can be heard on auscultation. Classically they are described as being mobile in a side to side direction but not in a vertical direction.

Diagnosis is usually made based on characteristic features demonstrated on MRI/MRA imaging. Treatment is typically surgical excision. Radiation may limit or prevent tumor growth for those tumors which may cause significant morbidity such as skull base paragangiomas involving multiple cranial nerves.

Schwannoma
Schwannomas result from neoplastic proliferation of Schwann cells and generally occur as growths that are closely associated with, but relatively circumscribed from, peripheral nerves. Schwannomas can arise from any peripheral nerve; in the neck, they most often arise from the vagus nerve or superior cervical sympathetic chain.

Schwannoma can have an insidious onset as a slow growing mass, but may also present with neurologic deficits. Vagal schwannomas may cause hoarseness or aspiration when they occur below the skull base. Sympathetic chain tumors often present with a Horner's syndrome.

The diagnosis of a Schwannoma is made with imaging. MRI/MRA or angiography is commonly indicated to establish the diagnosis.

Expectant surgical excision for schwannomas is often the best strategy, in the absence of neural deficit. When vagal injury or Horner's syndrome is already present, surgical therapy is indicated to prevent further growth and injury.

Lymphoma
Lymphoma can present in the head and neck. Neck involvement is very common in children

with Hodgkin disease (HD), found in up to 80 percent of patients. HD should be suspected, especially in young patients, with a history of fever, night sweats, chills, and diffuse lymphadenopathy.

Fine needle aspiration can help establish the diagnosis, however more tissue is typically required to perform adequate histologic classification to optimize the treatment regimen [15].

Lipoma and benign skin cysts
Lipomas are benign neoplasms comprised of fat, and are typically asymptomatic. They present as soft and ill-defined slowly enlarging masses, and can occur in any location on the neck.

Surgical excision is recommended if the mass causes functional or cosmetic problems. Pain, rapid growth, or radiographic abnormality may suggest the presence of liposarcoma and should prompt excision to rule out this aggressive lesion.

Benign skin cysts such as epidermoid inclusion cysts, dermoids, or pylomatrixoma can also present as neck masses. They are traditionally treated with wide local excision to prevent infections and drainage in the neck.

- **Functional disturbance from diseased process**
- **Systemic manifestations resulting from neck conditions (see above conditions for systemic involvment)**
- **Systemic diseases presenting with neck lesions (as for above)**

Investigations:

Age — The age of the patient is a critical factor in the indicated diagnostic workup. The majority of pediatric neck masses are either of inflammatory or congenital origin. These etiologies also account for the majority of neck masses in the age group from 16 to 40, although the frequency of malignant causes starts to increase.

A neck mass in an adult over the age of 40 should be considered neoplastic, and potentially malignant, until proven otherwise. The probability of a malignant neck mass is further increased in the setting of tobacco or alcohol use.

Mass growth pattern — Characteristics of the mass, such as its *duration*, *growth pattern*, and absence or presence of *pain*, are critical in making the diagnosis.

* Masses present for months to years with little change are likely benign neoplasms (eg, benign salivary gland tumors, peripheral nerve sheath tumors or paragangliomas).

* Rapidly expanding masses raise concern for infectious processes or rapidly growing lymphomas.

* Masses which fluctuate over time, and increase with viral illnesses or upper respiratory tract infections, are often congenital cysts.

Symptoms — Pain is often related to rate of growth and expansion, but can be related to direct neural invasion in the setting of certain malignancies. As an example, a 2 cm fixed parotid mass which presents with pain is highly likely to be malignant.

Symptoms of voice change, hoarseness, dysphagia, and otalgia may indicate cervical lymph node metastasis from an underlying upper aerodigestive tract malignancy.

Other history — A review of systems should include the presence of fever, night sweats, or weight loss. This constellation of symptoms is suspicious for lymphoma, whereas high spiking fever suggests acute infection.

Important aspects of the social history include *tobacco use* (frequency, total amount, method of use), *alcohol use, illicit drug* use (specifically intravenous drug use), and HIV status. An occupational history, occupational exposures, animal exposures, and recent travel history should also be included.

PHYSICAL EXAMINATION — The physical examination should include a careful evaluation of all anatomical areas that may be relevant to the neck mass. Although the focus will initially be on the head and neck, a complete examination can indicate signs of systemic illness, including infections, inflammatory conditions, and malignancy.

Anatomy of the neck — The location of the mass can focus the differential. Familiarity with neck anatomy is critical for diagnosis and management of disease processes affecting this region.
The neck is traditionally divided into the central and the lateral necks.

Additionally, the localization of lymph nodes in the neck is shown in a figure (show figure 2), and patterns of lymphatic drainage are shown in a table (show table 1).

* The central neck includes midline structures such as the hyoid bone, thyroid and cricoid cartilages, the thyroid isthmus and the trachea.

* The lateral neck is divided by the sternocleidomastoid muscle (SCM) into an anterior triangle which has its base at the undersurface of the mandible and its peak at the junction of the SCM and sternoclavicular joint. The remaining sides of the anterior triangle are the SCM and the medial abutment to the central neck structures. The anterior triangle can be further subdivided by the digastric muscle into the submental and submandibular triangles.

* The posterior triangle has its base at the clavicle and its peak at the mastoid tip. The anterior border of the posterior triangle is the SCM and the posterior border is the trapezius muscle. The posterior belly of the omohyoid further subdivides the posterior triangle into the subclavian triangle located below this muscle.

Mass localization — Localization of the mass can suggest specific etiologies, as follows:

* **Preauricular and angle of the jaw**: Likely represents either salivary or lymphoid tissue in the parotid system. Therefore, it is essential to consider facial nerve function in evaluation and tissue sampling.

* **Central neck**: Most commonly represents tissue that is thyroid or malignant in origin; could represent a dermoid cyst.

* **Anterior aspect of the SCM, usually the high jugulo-digastric region**: In adults,

enlarged lymph nodes often occur in this location, and suggest potential malignant involvement. Congenital masses, such as the second branchial cleft cyst, are common in the pediatric population, and are occasionally present in adults.

* **Posterior triangle**: Masses in this location should elicit a high index of suspicion for malignancy. In one series of 4768 patients with nasopharyngeal carcinoma, an asymptomatic posterior triangle neck mass was the most common presenting symptom, occurring in 76 percent of patients.

* **Supraclavicular masses, especially on the left side**: Suggest malignancy metastasizing from below the clavicle, such as lung, gynecological, or gastrointestinal sources.

Characteristics of the mass — Palpation of the neck mass is critical, with attention to its location, size, shape, consistency, tenderness, mobility, and color.

* Neck masses due to "reactive" lymph nodes are usually discrete, mobile, firm or rubbery but not rock hard, and are slightly tender.

* Rock-hard, fixed masses raise concern for malignancy. Lymph nodes representing metastatic disease may be matted to the underlying structures and are usually nontender.

* Infected lymph nodes are usually isolated, asymmetric, tender, warm, and erythematous; they may be fluctuant.

* Soft, ballotable, mobile masses are often cystic congenital masses.

* A rapidly expanding mass (over days to weeks) raises concern for infection or a rapidly growing lymphoma.

* A firm, lateral neck mass which moves from side-to-side but not up and down indicates involvement with the carotid sheath, such as a carotid body tumor or vagal schwannoma [14].

* A pulsatile quality or bruit suggests a vascular lesion.

* An immobile midline neck mass which elevates with swallowing indicates a thyroid source, such as a thyroglossal duct cyst or thyroid tumor.

Components of the general examination

The oral cavity and oropharynx should be examined with thorough inspection of visible mucosa and bimanual palpation of the floor of the mouth and palpable portions of the tongue and neck. Examination of the ears may indicate a unilateral serous effusion related to nasopharyngeal carcinoma. A nasopharyngeal examination should be performed if there is no obvious etiology on oral and oropharyngeal examination; this usually requires a mirror examination and/or use of a flexible fiberoptic endoscope.

A thorough examination of the skin of the head and neck can indicate a potential primary skin malignancy such as squamous cell carcinoma or melanoma.

Assessment of cranial nerve function can suggest a neural tumor or ominous neural

involvement by adjacent lymph nodes.

A generalized skin rash may suggest a viral illness, whereas a localized skin lesion may indicate a more specific etiology (eg, cat scratch disease or tularemia).

The thyroid gland should be carefully palpated, and movement of the neck mass with swallowing noted. The position of the trachea should be evaluated for any deviation from midline.

The abdominal examination should pay particular attention to possible enlargement of spleen or liver, and presence of any masses.

LABORATORY STUDIES — Laboratory evaluation should be initiated when the patient history or physical examination does not suggest transient reactive lymphadenopathy as the cause of a neck mass. Persistence of a newly discovered neck mass beyond three weeks should instigate a further evaluation. If the mass is felt to be reactive, secondary to a known viral or bacterial source, a further trial of observation or antibiotic treatment can be undertaken, but follow-up is essential to assure resolution; a directed work-up should be initiated if no improvement is noted.

The extent of the laboratory evaluation will be determined by the potential differential diagnosis.

* Most patients should have:

- Complete blood count (**CBC**) with differential

* The following may be indicated for some patients:

- Erythrocyte sedimentation rate (**ESR**) and/or C-reactive protein (**CRP**) to evaluate for systemic inflammation or infection
- **Liver profile**
- **Blood culture (for febrile patients)**
- **EBV or CMV serology (when adenopathy is diffuse)**
- **HIV serology**

* Specific serologic tests can be ordered when there is an increased index of suspicion for disease based on exposure, history, and examination:

- Serology for **T gondii, brucellosis, bartonella (cat scratch fever), tularemia**
- **Tuberculin skin test**
- Antibodies to the **Ro/SSA and La/SSB antigens, if Sjogren's** disease is suspected as a cause of periparotid or submandibular masses.

Abnormal test results may prompt additional evaluation, such as bone marrow biopsy if the CBC indicates possible hematologic malignancy.

IMAGING STUDIES — Imaging studies offer specific details of anatomic position, mass consistency, adjoining involvement, vascularity and potential primary source of malignancy in the region.

The least invasive of these techniques is ultrasound. **Ultrasound** evaluation of a neck lesion is more commonly used in Europe than in the United States. Advantages of ultrasound include its non-invasive nature, real-time assessment of the mass and its relation to adjoining structures and the ability to easily guide fine needle aspirations. Disadvantages include dependence on operator expertise, and limited permanent images for use in consultant evaluation or the operative setting.

A greater experience has developed in the United States for axial imaging by computed tomography (**CT**) and magnetic resonance imaging (**MRI**) scanning. These studies allow for the characterization of the mass and its relation to normal anatomic structures of the head and neck, and may also help in identifying a primary source when metastatic disease is present. Angiographic imaging variants can be obtained with both study techniques and may be helpful in evaluating masses of possible vascular origin.

Contrast computed tomography is recommended as the initial evaluative study [18-20]. CT is well tolerated by patients, and reformatting algorithms allow evaluations in all relevant planes.

MRI is indicated for masses that require further definition of soft tissue (eg, infiltrative soft tissue masses, suspicion of malignant perineural spread, or potential CNS origin). Advantages of MRI include outstanding soft tissue differentiation, lack of ionizing radiation and infrequent contrast allergy. Disadvantages include the cost of the study and the need for patient compliance during the exam in a closed space.

More recently, positron emission tomography (**PET**)/CT fusion scans have been found useful in the setting of malignancy, aiding in the identification of primary disease or detection of distant metastatic disease. Although helpful in the later evaluation of malignancies, PET/CT **plays little role in the initial evaluation of the neck mass**.

FINE NEEDLE ASPIRATION — Fine needle biopsy (FNA) **is the initial diagnostic step for most neck masses** [23]. The procedure entails the use of a 23- or 25-gauge needle to obtain aspirations of the neck mass for pathologic diagnosis. If the mass is not easily palpable or a specific portion of the mass requires sampling, CT or ultrasound guided needle biopsies can assure accurate sampling. The number of nondiagnostic biopsies can be further reduced by the availability of a cytologist to immediately examine the material obtained for sample adequacy, allowing further needle passes if needed.

The nature of the aspirate may suggest particular etiologies:

* Bloody (vascular lesion)
* Serous dark brown fluid (papillary thyroid cancer)
* Thick viscous yellow fluid (mucocele)
* Turbid yellow fluid (branchial cleft cyst)

Proper collection of material and preparation of slides for analysis is essential. In order for an FNA to be successful, the correct area must be chosen to maximize the diagnostic yield. The higher accuracy rates obtained within specialty clinics, compared to specimens obtained in the outside office setting, might be attributable to better fixation techniques in the specialty centers [24]. The sensitivity for malignancy was 95 percent and the negative predictive value 96 percent in one series of 225 neck masses evaluated with FNA [25].

In addition to cytologic diagnosis of FNA samples, advances in molecular biology now allow polymerase chain reaction (PCR) testing on FNA samples. As an example, PCR may identify the presence of Epstein-Barr virus (EBV), which can suggest the diagnosis of a nasopharyngeal carcinoma.

A major problem with FNA is that it provides only a liquid sample for cytologic analysis, and no material for assessment of tissue architecture; in addition, there is often too little material for immunohistochemical analysis. As a result, FNA should be considered the initial means of tissue sampling for diagnosis, but may not establish the definitive diagnosis.

Open biopsies are generally discouraged since they can adversely affect the success of subsequent surgical resection by field contamination. If the information gained by the FNA does not establish the final diagnosis, **core needle biopsy is usually the next step**. In addition, if the FNA suggests the diagnosis of lymphoma, more tissue is usually required for specific tissue typing.

SUMMARY

* Evaluation of a neck mass must be approached in a thorough and disciplined manner, as it may be the only manifestation of a serious and potentially malignant pathology, especially in the adult population. An outline for this evaluation is shown in an algorithm (show algorithm 1). (See "Introduction" above).

* The evaluation of a new neck mass begins with a thorough history and physical examination. Key components of the history include age, rate of change of the mass, symptoms of pain, symptoms of systemic illness, and use of tobacco, alcohol, or illicit drugs. (See "Patient history" above).

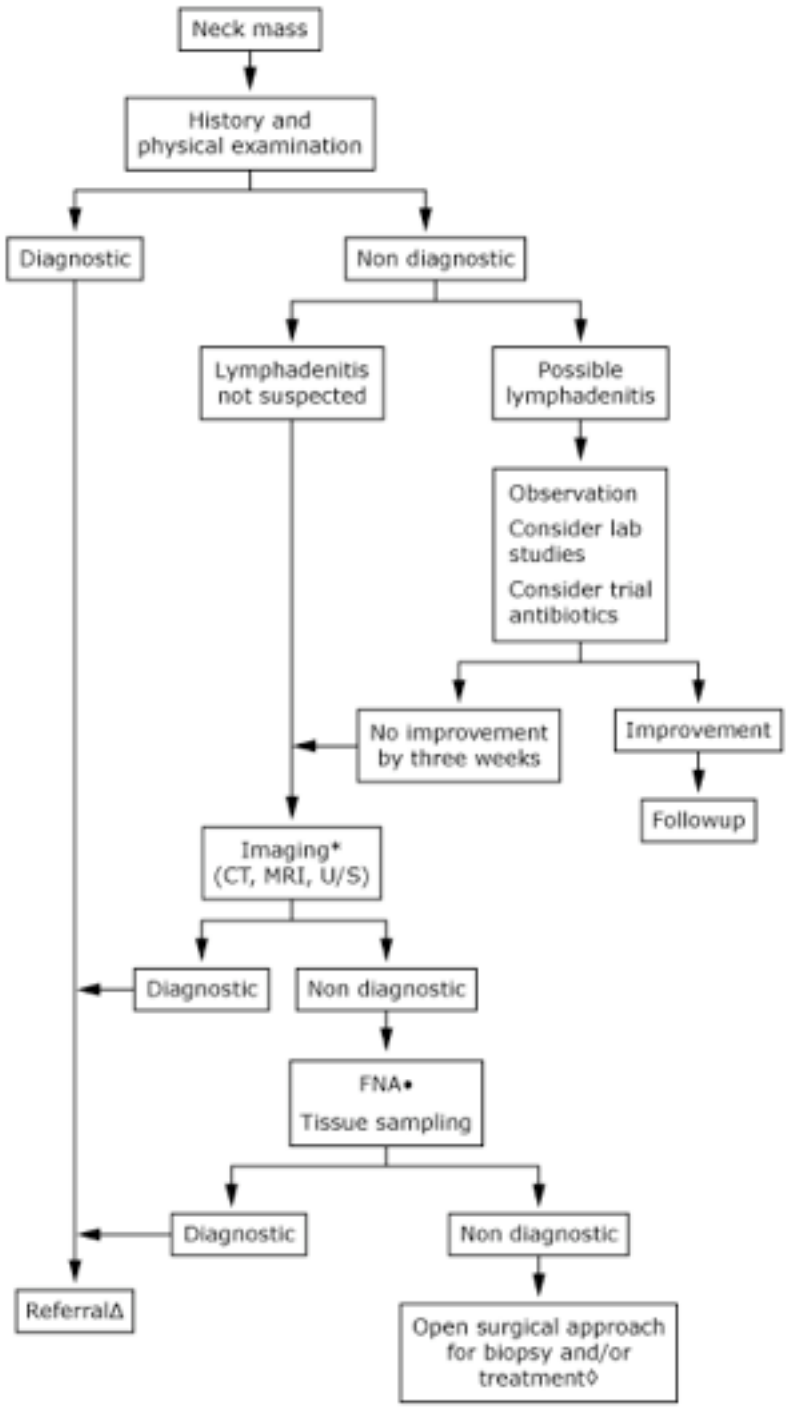
* The physical examination should identify the localization of the mass, its texture and mobility, and include careful evaluation of the oral cavity, cranial nerves, thyroid gland, and a comprehensive general exam.

* Laboratory studies should be ordered based on findings from the history and physical examination. Imaging studies usually start with a contrast CT scan of the neck, though an ultrasound evaluation is also acceptable if there is technical expertise; MRI or PET/CT scanning may be indicated in follow-up. Fine needle aspiration can provide initial tissue sampling, but is not always definitive.

Diagnostic pathology:

- Indicators of systemic infection or inflammation, eg. WCC, ESR, CRP
- Fine needle aspiration (FNA)
- Cytology , microscopic exams , flow cytomtry
- Microbiological examinations,cultures, sensitivities
- Special studies: stains, cultures, immunohistochemical
- Core biopsies
- Excisional biopsies
- Bone marrow studies

This algorithm presents an overall approach to the neck mass



Imaging:

- Plain x-rays
- Barium swallow and meals
- Ultrasound
- CT scans
- MRI
- Angio MRA and MRV
- Bone scans
- Nuclear medicine: radioiodine scans, Sestamibi, Technetium

- Cine-radiography

Diagnosis:

Patient's perspective:

- Cosmetic and functional deficits from ablative surgery and subsequent other adjuvant treatment
- Deformities and their psychological sequelae

Management:

- Conservative monitoring
- Antibiotics and other medications
- Surgery: conservation resection , radical resection with free pedicled grafts
- Radiotherapy
- Chemotherapy
- Hormonal treatment
- Hyperbaric therapy
- Physiotherapy, speech therapy, appliances

Community/Primary Care Issues:

Research needs/Issues to debate: see above some are outlined

- Lump
- Site
- Size
- Tender
- Shape
- Characteristics: consistency, transillumination
- Numbers
- Effects on local and distant structures
- Unilateral vs bilateral
- Functional deficits
- Use of cost effective imaging for diagnosis of neck lumps, ultrasound vs CT scans
- Genetic studies of familial conditions, eg. thyroid cancers with MEN syndromes, glomus tumours
- Accuracy and sensitivities of FNA for diagnosis of neck lumps

CLINICAL SCIENCES

PAL

- Consent and informed consent of patient prior to treatment
- Disclosure of nature of treatment, reasonably likely risks, risks of particular concern, benefits, alternatives
- Disclosure of institutional or professional conflicts of interests (process patents or shares in company manufacturing treatment products)

Consent

1. Competency
2. Explain the diagnosis
3. Options
    a. Nothing
    b. Something
4. Common risks and benefits of procedures
    a. Anaesthetic-death, allergy, lung collapse
    b. General-infection, extended procedure, pain
    c. Particular to the surgery

Recurrent laryngeal nerve:

i. sits posterior to the inferior thyroid artery
ii. *innervates all the intrinsic muscles of the larynx*
iii. Damage unilaterally → hoarse voice
iv. Damage bilaterally → breathing difficulties and aphonia (inability to speak)

External branch of the superior laryngeal nerve:

i. loops around the superior thyroid artery.
ii. *Innervates the cricothyroid muscle*
iii. damage can cause changes in voice quality because cricothyroid muscle tenses/elongates the vocal cords by pulling the thyroid and cricoid cartilages closer together anteriorly
iv. damage causes inability to create a high-pitched sound

Hypoparathyroidism

i. *Parathyroid glands receive blood supply from the inferior thyroid arteries*
ii. When serum calcium is low, PTH increase bone resorption, kidney Ca2+ absorption
iii. Damage, removal or devascularisation to the PT glands causes hypocalcemia
iv. Symptoms: paraesthesia, mentals status changes, prolonged QT interval, muscle cramping/spasm

Thyroxine deficiency

5. Risks of particular concerns
6. Financial consent

POPULATION HEALTH

- Prevalence of neck lumps
- Infective conditions related to density of populations and geographical areas
- Age, sex and socio-economic distribution

INDIGENOUS HEALTH

SOCIAL FOUNDATION OF MEDICINE

RURAL ISSUES

RESOURCES

Suggested reading for interest

1. Surgical anatomy of the Head and Neck. Susan D.John and Michael D. Maves in Head & Neck Surgery—Otolaryngology,3rd Edition by Byron Bailey et al
2. Differential diagnosis of Neck Masses ,W.F. McGuirt Sr ,page l686 in Otolarngology Head and Neck Surgery ,Ed by C. W. Cummings, 3rd Ed.

Articles of interest

1. SistrunkWE Technique of removal of cysts and sinuses of the thyroglossal duct Sur.Gynecol.Obstet 46:109 1928
2. Woods JE, Chong GC, Beahrs OH. Experience with 1,360 primary parotid tumors. Am J Surg. 1975 Oct;130(4):460-2.
3. Chong GC, Beahrs OH, Sizemore GW, Woolner LH. Medullary carcinoma of the thyroid gland. Cancer. 1975 Mar;35(3):695-704.
4. SpiroRH et al : Cervical node metastasis of occult origin Am.J.Surgery l983 146:44l

Theme percentages:

Medical Sci: % PPD: % Population Health: % Clinical skills: %

Frameworks involved: SFM

Keywords: