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Educational Gap

A variety of lesions, some malignant, can manifest as masses in the neck, presenting real diagnostic challenges. Clinicians must understand the embryologic development of the head and neck and be familiar with the most recent diagnostic techniques.

Objectives

After completing this article, readers should be able to:

1. **Know the differential diagnosis of the pediatric neck mass.**
2. **Understand how to conduct an evaluation of the pediatric neck mass.**

The broad differential diagnosis of pediatric neck masses typically fits into two main categories: congenital and acquired. Appreciation of the head and neck formation can simplify and greatly assist in identification of the underlying condition. We first review the embryonic formation as it relates to head and neck pathology, followed by key points of history and physical examination. The differential diagnostic possibilities are separated into categories of congenital and acquired neck masses. Finally, diagnostic clues and evaluation options are discussed.

Formation of the Head and Neck

The head and neck are derived from the branchial apparatus, an anatomically distinct structure that undergoes a complex formative process involving generation and resorption. Appreciating some aspects of the degeneration process helps explain the relationship between anatomic structures as well as the actual formation process.

By the fourth week of gestation, the individual branchial arches initially become visible. Each arch has its own group of uniquely designated tissue types. For simplification, arch structures will be referred to as a numbered arch without differentiation of clefts, pouches, or other structures.

The six paired branchial arches forming the branchial apparatus have ectodermal, mesodermal, and endodermal components, each with its own unique designations and components as listed in Table 1. Branchial arches are numbered based on their appearance and resulting structure across many species. In humans, the fifth arch regresses rapidly or does not form, and thus generally is omitted from discussion. Each arch has an artery and nerve associated with it. As the arch develops its own characteristic structures, the overall formation of the head is enabled by rapid proliferation of the second arch. This process results in the branchial apparatus folding on itself toward the area of the fifth arch, enclosing the internal aspects in the cervical sinus of His. The structures form and fuse together, resulting in the fetal neck.

The relation of these components and their final resulting structures helps to conceptualize and categorize congenital neck masses and to add understanding of the relation and spread of inflammatory and neoplastic lesions. Figure 1 illustrates prominent anatomic features of the head and neck, as well as final distribution of the branchial arch structures. The development process explains how primary neck masses can

Abbreviations

CRP: C-reactive protein
CT: computed tomography
ESR: erythrocyte sedimentation rate
FNA: fine needle aspiration
MRI: magnetic resonance imaging

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Table 1. **Major Structures of the Branchial Apparatus**

Arch	Nerve	Soft Tissue	Muscular	Skeletal
First (mandibular)	Trigeminal CN V	External ear canal Maxillary artery	Muscles of mastication	Malleus Incus Mandible
Second (hyoid)	Facial CN VII	Palatine tonsils Hyoid artery	Muscles of facial expression	Stapes Styloid process Lesser horn of the hyoid
Third	Glossopharyngeal CN IX	Internal carotid artery	Superior constrictor muscles	Greater horn of the hyoid
Fourth and sixth	Branches of vagus CN X: Superior laryngeal Recurrent laryngeal	Aortic arch Right subclavian artery Aorta Thyroid gland Parathyroid glands	Inferior constrictor muscles Striated muscles of the esophagus	Thyroid cartilage Cricoid cartilage Arytenoid cartilage Corniculate cartilage Cuneiform cartilage

CN=cranial nerve.

have a wide range of atypical presentations, such as otorrhea, and can extend into the mediastinum.

Congenital Neck Masses

Congenital lesions are a common cause of the pediatric neck mass. Appreciating the implications of embryologic origin as related to final anatomic location can assist in devising a diagnostic strategy, decrease complications, and improve outcome. Some lesions discussed within this category may be rare; thus, inclusion of these lesions is indicated because of their unique features and associations.

Many congenital lesions present while acutely infected, and procedural interventions in these acute settings have significant risk if anatomic relationships are not appreciated. This point needs to be considered before any elective procedural intervention, especially in an acute setting or without subspecialist guidance. Congenital abnormalities of the head and neck are closely associated with major nerves and vessels, with some lesions extending into the mediastinum (Fig 2). The ultimate treatment of the majority of congenital neck masses is surgical resection.

Branchial cleft cysts are the most common congenital neck lesions and account for approximately 20% to 30% of all pediatric neck masses. (1) These lesions present commonly in late childhood or early adulthood when the cyst becomes acutely infected. Branchial cleft cysts are subdivided based on embryologic origin as listed in Table 2.

Complications of branchial cleft cysts include recurrent infections as well as fistula formation. In type I branchial cleft cysts, injury to the parotid gland and facial nerve may occur from recurrent infection or acute procedural intervention, such as incision and drainage. Infection of a third or fourth branchial cleft cyst can cause airway edema or difficulty swallowing. Acute treatment generally involves infection control. Once the acute infection has been resolved, the cyst and any associated fistula tracts are surgically removed to prevent recurrence.

Thyroglossal duct cysts are midline lesions found in the anterior neck that present generally with acute infection after an upper respiratory tract infection (Fig 3). Based on their developmental pattern, these cysts will have a tract or fistula passing through the hyoid bone up to the base of the tongue. On physical examination, thyroglossal duct cysts may move with swallowing, and the patient may note that compression of the lesion expels material up through the fistula. Although these lesions usually are diagnosed after acute infection during childhood, up to 40% present after age 20 years. Treatment for thyroglossal duct cysts is always complete excision, including removal of the middle one third of the hyoid bone. Without removal of the hyoid, the thyroglossal duct cyst may recur. Due to the potential for malignant transformation, specimens should be submitted for complete pathologic examination.

Cystic hygromas (lymphangiomas) are spongy, mobile, nontender lesions located in the posterior triangle

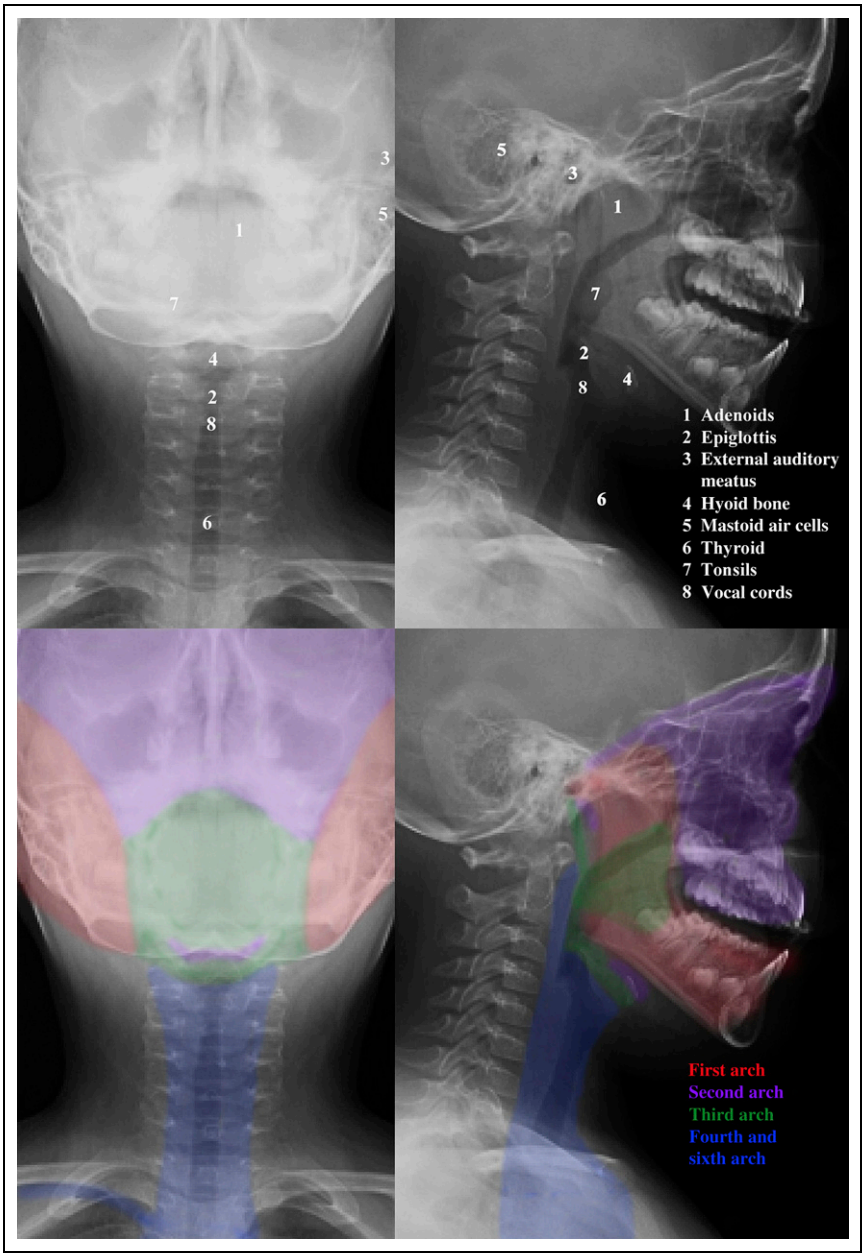

Figure 1. Key anatomic reference points and general areas of structures of the branchial arches demonstrated over radiographic image for anatomic orientation.

of the neck. Cystic hygromas are located more frequently on the left side of the body. Most cystic hygromas are diagnosed in the period immediately after birth, with large lesions being noted on prenatal ultrasonography. Later presentations generally follow a viral infection, which can induce significant expansion of these lesions. Large lesions can result in airway compromise. If a large cystic hygroma is detected prenatally, delivery should be performed at a center capable of managing the lesion immediately after birth. Fine needle aspiration (FNA) should be avoided in diagnosing cystic hygromas unless treating a patient who has airway compromise because FNA can result in hemorrhage into the lesion, causing a rapid expansion.

Laryngoceles result from herniation of the saccule of the larynx. Laryngoceles can be limited anatomically to the laryngeal space or can extend through the thyrohyoid membrane. Laryngoceles may present as an air-filled cyst, but their presentation usually involves cough with the sensation of a foreign body. Treatment of laryngoceles is surgical excision.

Dermoid cysts are formed by entrapment of epithelium in deeper tissue and can be of embryologic or traumatic origin. Congenital dermoid cysts are found more commonly in the midline, and infection of these lesions is rare. Due to their midline position, they may be confused with thyroglossal duct cysts. Dermoid cysts are not associated with the thyroid gland and thus will not move with swallowing on physical examination. Treatment is surgical excision.

Teratoma malformations involve all three germ layers and thus have a wide range of potential presentations throughout the body. Neck teratomas generally are discovered within the first year after birth and can cause significant airway obstruction, as well as feeding dysfunction. Obstructive teratomas can be associated with the prenatal history of polyhydramnios. (1) Treatment is surgical excision.

Thymic cysts can be found anywhere from the angle of the mandible to the midline and arise from implantation of thymic tissue during embryologic descent of the thymus. The treatment of choice is surgical excision.

Hemangiomas are extremely common and typically are characterized by a rapid expansion phase after birth,

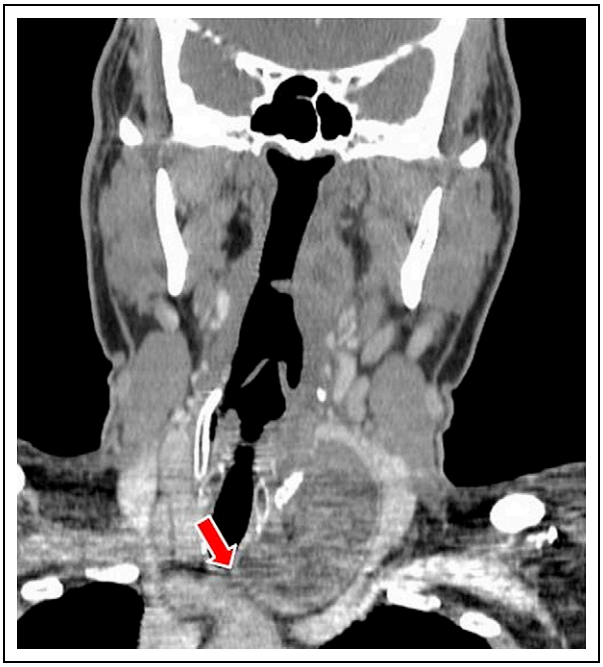

Figure 2. Type 4 branchial cleft cyst demonstrated on computed tomography coronal section. Note the close association of this lesion with the arch of the aorta.

followed by a slow regression. Hemangiomas may not be visible on physical examination for the first few weeks after birth. On physical examination, hemangiomas are characterized as a compressible red-to-blue mass, which may or may not have an audible bruit. Most hemangiomas regress spontaneously and do not require intervention. Half to 60% of lesions resolve by age 5 years; 95% resolve by age 9 years. Any visible hemangioma warrants a full examination to check for further cutaneous lesions, and cutaneous hemangiomas may be a sign of hemangiomas in other organs that are capable of causing complications. Examples include intestinal, spinal, and subglottic hemangiomas. One half of infants who have subglottic hemangiomas have a cutaneous hemangioma on physical examination, occurring primarily in the head and neck regions. "Beard distribution" hemangiomas warrant particular concern, because studies note an association of up to 63% between these lesions and symptomatic airway hemangiomas. (2)

The majority of hemangiomas are managed with time, but when intervention is required, oral or topical propranolol is an evolving treatment of choice. (3) Complications of hemangiomas may be localized, such as ulceration, infection, or bleeding. Scarring or cosmetic deformity due to excess residual skin after resolution of the hemangioma also can be a long-term complication. Kasabach-Merritt syndrome is a severe complication of hemangiomas. This disorder presents at approximately 1 month of age and is characterized by acute enlargement of a kaposiform hemangioendothelioma or tufted angioma with associated consumptive thrombocytopenia. This process can progress into disseminated intravascular coagulopathy and may cause significant morbidity and mortality.

Hemangiomas also may be part of a spectrum of anomalies referred to as the PHACE syndrome, defined by Posterior fossa malformations, Hemangiomas, Arterial lesions, Cardiac defects, and Eye abnormalities. Patients who have PHACE syndrome generally have large (>5 cm) segmental hemangiomas of the head and neck. It is important to identify this condition early because many of these patients have significant aortic arch anomalies and cerebral vascular anomalies, and serious complications may be prevented by early intervention.

Ranulas (mucoceles) are created by obstruction of the sublingual salivary glands. They are generally painless, slowly accumulating masses. A ranula can evolve into a plunging ranula when the salivary duct ruptures and a pseudocyst forms, expanding within the fascial planes of the neck; the lesion can extend through the mylohyoid muscle down into the neck. Treatment is surgical resection, and it is important to note that the hypoglossal nerve and lingual nerve can be closely associated with these lesions.

Acquired Neck Masses

Thyroid Masses

Thyroid masses are relatively uncommon in children. These masses often are better visualized in the lateral position rather than by palpation alone. Despite their low number, pediatric thyroid masses are significantly more likely to have a malignant origin. Estimates for the percentage of pediatric thyroid nodules found to be malignant range between 9% and 50%. (4) Pediatric patients diagnosed with a thyroid malignancy also are more likely to have metastatic disease at time of diagnosis. A complete family history is essential in any patient presenting with a thyroid nodule because many autosomal dominant syndromes exist that carry an increased risk of thyroid malignancy. In addition, clinicians should inquire about a history of irradiation to the head and neck, which has been associated with thyroid carcinoma.

Evaluation involves initially obtaining serum thyroid function testing, including thyrotropin and free thyroxine. A nodule that suppresses thyrotropin is suggestive of a hyperfunctioning nodule, such as multinodular goiter or toxic adenoma; in these cases, an iodine-123

Table 2. **Types of Branchial Cleft Cysts**

Branchial Cleft Cyst Type	Percentage	Location
First	<1%	Type I: Duplication anomaly of external auditory canal; often associated with parotid gland and facial nerve. Type II: Usually below the angle of the mandible. Also commonly associated with parotid gland and facial nerve.
Second	Most common type (>95%) 10% of these cases have bilateral lesions	Usually inferior to angle of the mandible and anterior to sternocleidomastoid. May travel between the branches of the internal and external carotid artery.
Third	Uncommon	Usually deep to the lower third of the sternocleidomastoid. More likely to be lateral to the carotid artery. Can be associated with the thyrohyoid membrane and the hypoglossal nerve.
Fourth	Extremely rare	Usually deep to the internal carotid artery and vary in anatomy based on side of the body. Can extend into the thyroid gland. Left side: Extend into the mediastinum and are associated with the aorta medial to ligamentum arteriosum. Right side: Associated with subclavian artery.

radionucleotide scan is indicated. The vast majority of patients presenting with a thyroid nodule are euthyroid.

Thyroid nodules should be visualized by using ultrasonography to evaluate size, density, nodularity, and involvement of surrounding structures. FNA of the pediatric thyroid nodule can be helpful in confirming diagnosis, especially when cancer cells can be demonstrated.

Pediatric thyroid malignancies are found more often in females, and up to 90% of these patients have metastatic lesions in the cervical lymph nodes at presentation. Although adolescent females have an increased incidence of thyroid carcinoma overall, a thyroid nodule found in a male younger than 15 years of age is significantly more likely to be malignant. (4) Papillary thyroid carcinoma is the most common thyroid malignancy in children, accounting for 80% to 95% of cases. Follicular thyroid carcinomas occur less commonly in pediatrics, making up approximately 5% to 15% of cases. Follicular thyroid carcinomas are more likely to invade vascular tissue and thus result in systemic metastatic lesions.

Medullary thyroid carcinoma is rare, representing only 5% to 10% of pediatric thyroid malignancies. However, medullary thyroid carcinoma is unique due to its association with increased calcitonin levels. Consideration of this condition is particularly important in individuals who have a known family history of type 2 multiple endocrine neoplasia syndromes because calcitonin can be monitored annually, and detection of an elevation in levels may result in early diagnosis and treatment of medullary thyroid carcinoma before significant disease progression. Hyperplastic parafollicular cells have been observed in children as young as 1 year in these syndromes. A diagnosis of medullary thyroid carcinoma should always prompt a genetic evaluation.

The treatment of thyroid carcinomas is primarily surgical, involving total thyroidectomy and lymph node dissection, sometimes followed by radioactive iodine therapy. Hormone supplementation should be kept at the minimal dose that will suppress serum thyrotropin levels due to the risk of osteoporosis from long-term hyperthyroidism.

Enlarged Lymph Nodes

The majority of cases of cervical lymphadenopathy are infectious or reactive in origin; however, malignancy must be considered. In general, a cervical lymph node that is tender on physical examination is a reassuring finding. Cervical lymph nodes with a diameter greater than 2 cm or that are firm and matted should prompt a more expedited evaluation, because these nodes are more

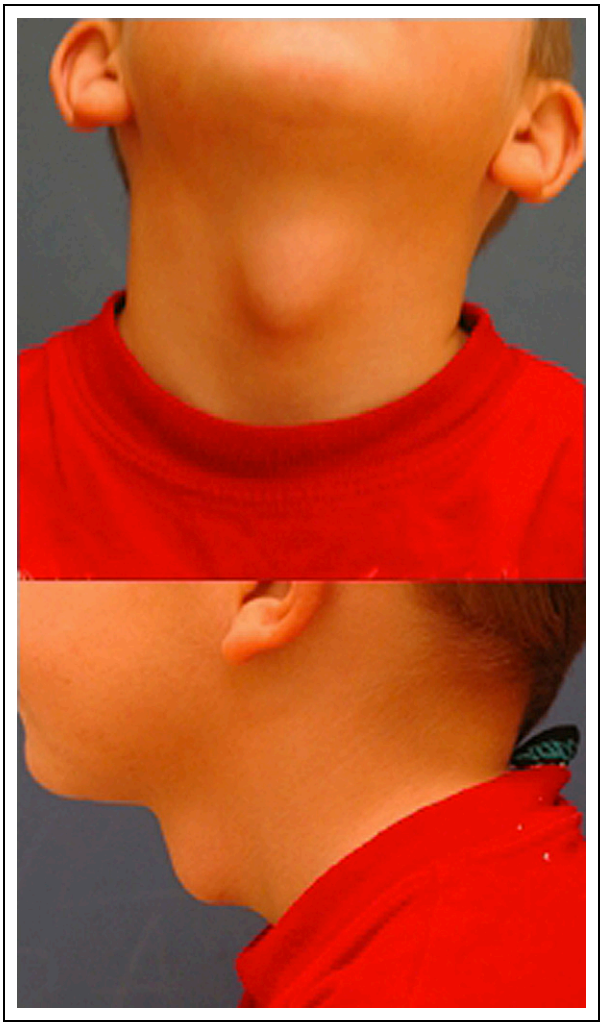

Figure 3. Thyroglossal duct cyst, showing typical midline location. Courtesy of Doernbecher Children's Hospital, Portland, Oregon.

suggestive of a malignancy. Supraclavicular lymph nodes always should be evaluated aggressively. Excluding patients in whom the enlarged nodes are causing cardiopulmonary compromise, no patient who has lymphadenopathy should be placed on corticosteroids without a firm diagnosis. Pretreatment with corticosteroids in a patient who has lymphoma or leukemia automatically increases their risk status and alters the chemotherapy regimen. (5) FNA is not a reliable diagnostic modality for evaluating a suspicious lymph node because of the high false-negative lymphoma diagnosis rate caused by sampling error.

Lymphadenitis is a common cause of cervical lymphadenopathy and is defined as inflamed, enlarged, and tender lymph nodes. Eighty percent of cases of cervical lymphadenitis are due to bacterial infection with *Staphylococcus* or *Streptococcus* species. Emerging as a common cause of cervical adenitis, methicillin-resistant *Staphylococcus aureus* should be considered when choosing antibiotics. Presentation usually is acute in onset, with fever accompanying tender, erythematous lymph nodes that become fluctuant over the course of a few days. Ultrasonography may be helpful for evaluating fluctuant lymph nodes, which may ultimately need incision and drainage in addition to antibiotics.

A brief overview of possible causes of lymphadenitis is listed in Table 3. Because they are common disorders, readers should be familiar with the clinical presentations of Epstein-Barr virus infection, cat-scratch disease, and atypical myobacteria infection. Tuberculosis should be suspected in patients who are at risk for that infection.

Malignant Causes of Acquired Neck Masses

Malignancies of the head and neck account for approximately 12% of pediatric malignancies, but the incidence of pediatric head and neck cancers is increasing. (6) Masses of the head and neck encompass a diverse set of conditions. These cancers occur most commonly in the age range of 15 to 18 years, followed by those under 4 years.

Lymphoma is the number one cause of malignant head and neck masses. Malignant lymphadenopathy typically is painless, firm, fixed, and rapidly expanding. Although non-Hodgkin's lymphoma is more common in pediatrics than Hodgkin's disease, up to 80% of pediatric patients with Hodgkin's disease have cervical lymph node involvement. Given that only approximately 33% of those with non-Hodgkin's disease have cervical lymph node involvement, Hodgkin's disease is a more common cause of a malignant cervical lymph node. Chest radiography is extremely important in the evaluation of a patient suspected of having lymphoma to evaluate for mediastinal involvement or impending respiratory compromise. (5)

Rhabdomyosarcoma is the most common pediatric solid tumor of the head and neck. The head and neck are also the most common sites for this type of tumor, which often causes symptoms through localized structural compression or infiltration. Investigation of the nearby bony structures should be part of the evaluation if rhabdomyosarcoma is suspected. Primary nasopharyngeal tumors can be particularly difficult to diagnose due to local anatomic symptoms such as nasal congestion, mouth breathing, and unilateral serous otitis media, which are common in pediatrics. Persistent unilateral symptoms should prompt consideration of evaluation for anatomic obstruction.

Table 3. Causes of Lymphadenitis (5)

Bacterial	Viral	Fungal
Localized lymphadenitis	Epstein-Barr virus	Coccidiomycosis
Staphylococcus aureus	Cytomegalovirus	Cryptococcosis
Group A *Streptococcus*	Herpes simplex virus	Histoplasmosis
Actinomycosis	Human immunodeficiency virus	Protozoal
Cat-scratch disease	Hepatitis B	Toxoplasmosis
Tularemia	Mumps	Leishmaniasis
Bubonic plague	Measles	Spirochetal
Diphtheria	Rubella	Lyme disease
Chancroid	Dengue fever	Syphilis
Mycobacterial	Other	
Tuberculosis	Kawasaki disease	
Atypical *Mycobacteria*		

Neuroblastoma is the most common malignancy in the first month after birth, and the most common malignancy of the head and neck in children under age 5 years. Neuroblastoma can occur anywhere along the sympathetic chain, including the cervical ganglia (Fig 4). When located in the cervical region, neuroblastoma may be associated with Horner syndrome. Due to secretion of catecholamines by the tumor cells, systemic signs may include diaphoresis and hypertension. Neuroblastoma often will contain calcifications that are evident on imaging studies.

Melanoma has become an increasingly identified cause of malignancy in pediatrics. Pediatric melanomas are more likely to present with a lesion that has atypical features, such as being amelanotic. (7) A 2002 review of the National Cancer Institute's Surveillance Epidemiology and End Results database by Albright et al (6) found more melanomas reported in the pediatric head and neck than neuroblastomas. This data set also reported more melanoma cases than follicular and medullary thyroid carcinomas combined. Pediatric melanomas are still a topic of evolving knowledge but should be included in the differential diagnosis of pediatric head and neck masses. Melanoma should be considered not only as a primary tumor but also as a cause for a malignant lymph node.

Diagnostic Approach

Figure 5 is an algorithm that outlines a logical approach to the evaluation of a neck mass in a pediatric patient.

History and Physical Examination

The majority of neck masses in pediatrics are diagnosed accurately by using patient history and physical examination. Given the broad differential diagnosis, narrowing the potential diagnoses is essential to an efficient, appropriate evaluation.

A child who has a history of a neck mass should have a local as well as systemic review of systems. Recent upper respiratory tract infection can be suggestive of a congenital lesion, and a history of similar swelling in the past after upper respiratory tract infections is highly suggestive. Presence or absence of vocal changes, dysphagia, stridor, or drooling should be noted, because these symptoms can suggest structural compression of the airway. Systemic symptoms such as fevers, night sweats, bleeding, weight loss, bone pain, and limp should be noted because they are common signs of malignancy involving bone marrow dysfunction as well as severe systemic infections.

The history should include atypical exposures and risk factors for infection and malignancy. An evolving area of

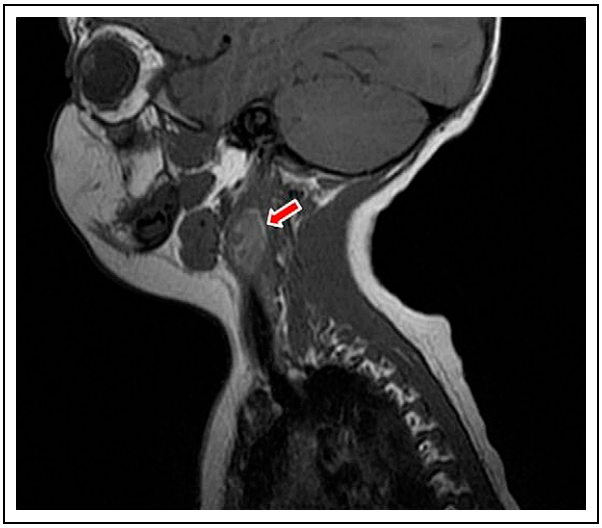

Figure 4. Neuroblastoma demonstrated on magnetic resonance imaging sagittal section.

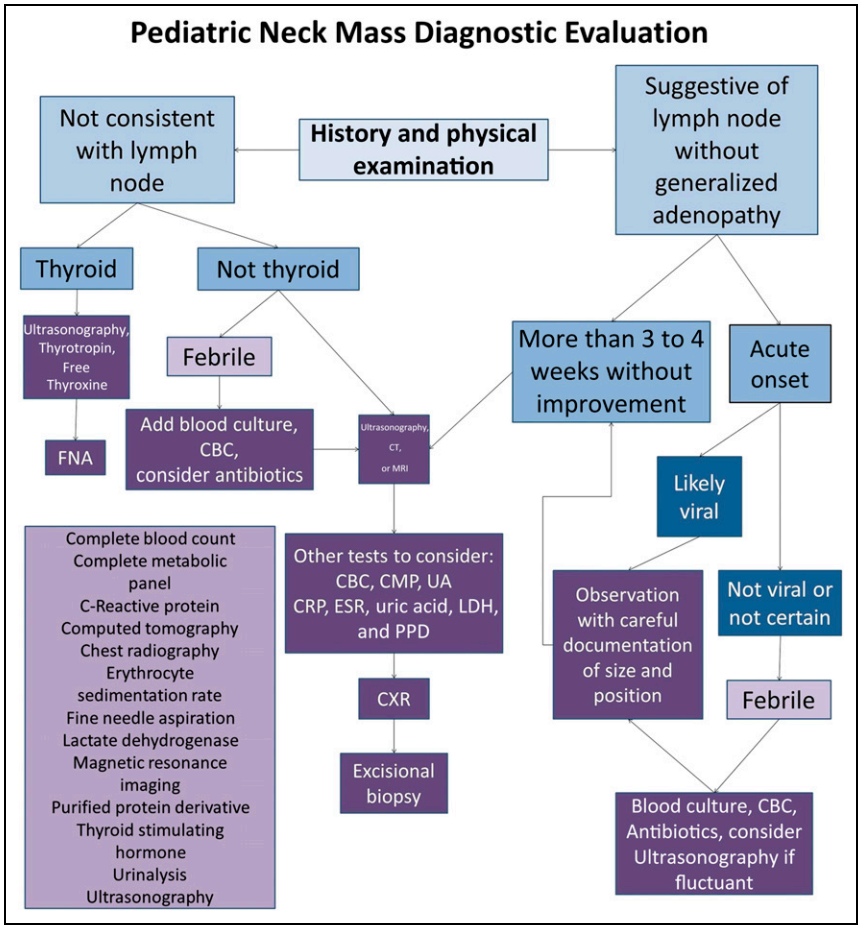

Figure 5. Diagnostic evaluation algorithm for the pediatric neck mass. CBC = complete blood cell count; CMP = complete metabolic panel; CRP = C-reactive protein; CT = computed tomography; CXR = chest radiography; ESR = erythrocyte sedimentation rate; FNA = fine-needle aspiration; LDH = lactate dehydrogenase; MRI = magnetic resonance imaging; PPD = purified protein derivative; UA = urinalysis.

interest is the effect of repeated imaging studies on children. A medical history of significant illness (eg, prematurity with prolonged hospital stay) may be important to note due to the large number of imaging studies frequently performed in these children.

Physical examination and documentation in the pediatric patient presenting with a neck mass should include complete ear, eye, nose, mouth (including dentition), and throat evaluations. The exact anatomic location of the mass within the neck, generally relating the position to structures such as the sternocleidomastoid muscle and cricoid cartilage, is helpful. Important characteristics of the mass are tenderness, fluctuance, and mobility. For midline masses in particular, movement with swallowing implicates thyroid involvement; this association should therefore always be evaluated and noted. However, lack of movement does not exclude thyroid involvement. Presence of a bruit or pulse indicates a vascular lesion or a lesion closely associated with a vascular structure.

Systemic physical examination of a child presenting with a neck mass should include a complete lymph node evaluation, including epitrochlear, popliteal, supraclavicular, axillary, and inguinal nodes. Skin evaluation should include appreciation of petechiae, bruising, birthmarks, and hemangiomas. Petechiae and bruising may be an indication of bone marrow abnormality or severe illness. Atypical birthmarks or lesions on the head and neck associated with an enlarged lymph node should prompt consideration of a skin malignancy. Evaluation of the cranial nerves and pupillary response should be documented. Horner syndrome is highly suggestive of neuroblastoma in the cervical sympathetic chain. Congenital lesions also can be associated closely with cranial nerves and may cause functional compromise.

A careful respiratory examination should always be performed. Asymmetric breath sounds, stridor, and wheezing may indicate thoracic involvement, either by direct extension of a congenital lesion or metastatic spread of a malignant lesion. Mediastinal involvement must be considered if jugular venous distention is observed. Tachycardia and heart murmur may suggest anemia due to a systemic process, infection, or compromised oral intake secondary to a direct mass effect. Abdominal examination should note whether there is palpable hepatosplenomegaly. Common locations for congenital and acquired lesions are illustrated in Fig 6.

Further Diagnostic Evaluation

The evaluation of the pediatric neck mass should be based largely on the history and physical examination. Review of systems or physical examination positive for signs of systemic involvement requires a more extensive evaluation. Lesions suspicious for malignancy will nearly always require surgical biopsy for definitive tissue diagnosis. A

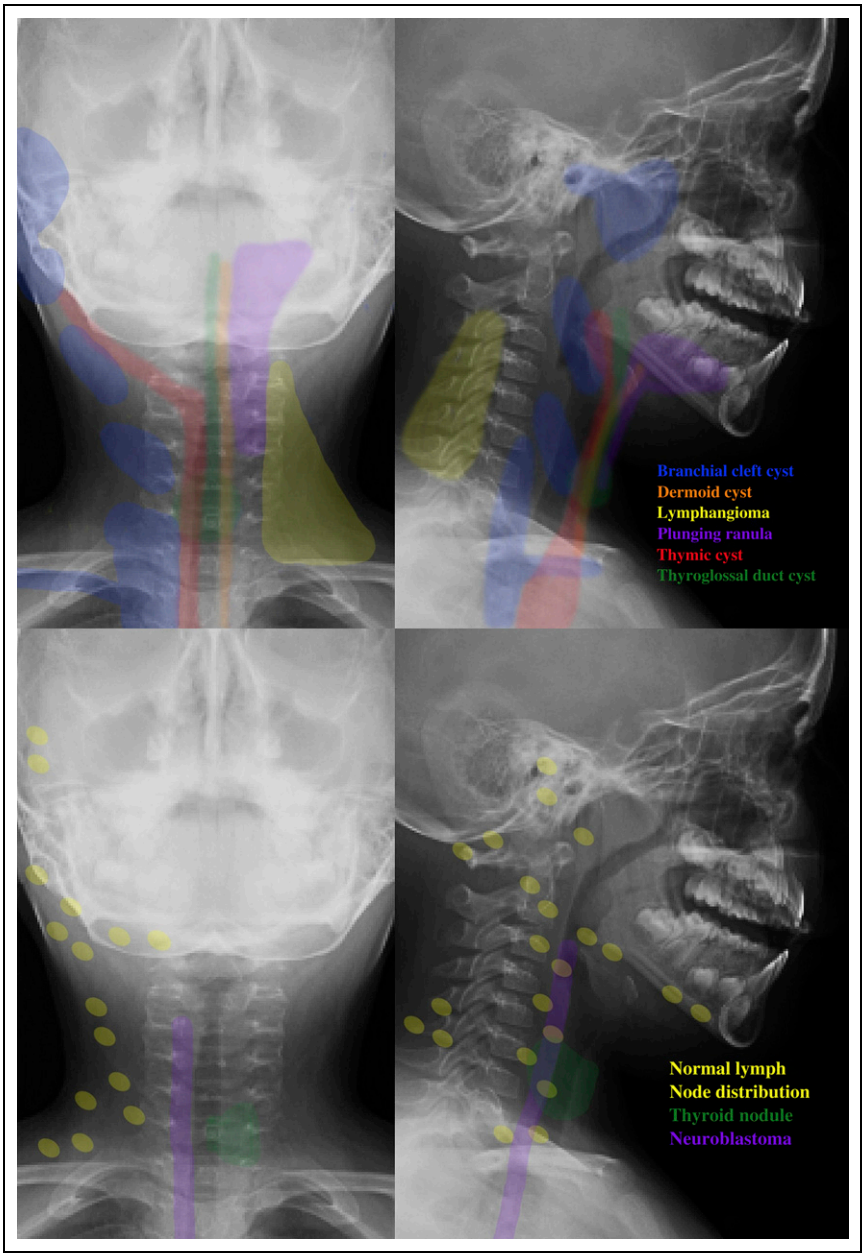

Figure 6. Classic anatomic locations of congenital lesions contrasted with classic anatomic locations of acquired lesions over radiographic image for anatomic orientation.

summary of diagnostic evaluations and their clinical indications is listed in Table 4.

Masses associated with the thyroid should prompt diagnostic imaging with ultrasonography as well as quantification of thyrotropin and free thyroxine levels.

Febrile patients who appear ill should have a blood culture and complete blood count with differential performed. If the mass is draining, a culture and Gram-stain of the drainage also should be sent. C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR) may be helpful in evaluating the extent of systemic reaction. CRP levels increase quickly, over the course of hours, and CRP has a relatively short half-life. CRP can be useful in tracking infections that require long-term treatment. ESR is an indirect assay of elevated serum acute phase reactants, particularly fibrinogen, and takes much more time to decrease. The ESR is influenced by other factors, such as anemia. Pronounced thrombocytosis is strongly suggestive of an infectious or inflammatory process.

In the context of suspicion for malignancy, the diagnostic evaluation is much more extensive. A complete blood cell count with manual differential, complete metabolic profile, including phosphate, uric acid, and lactate dehydrogenase levels, should be part of the initial evaluation. A complete metabolic profile with phosphorus level will show signs of tumor lysis as well as assess overall organ status. Imaging with contrast may require evaluation of current renal function before completion. Lactate dehydrogenase is a nonspecific marker of cellular turnover, and significant elevation raises suspicion of malignancy. There should be a low threshold for chest radiography in a patient suspected of having a malignancy.

Imaging Options

Ultrasonography is the initial imaging evaluation of choice for many pediatric neck masses due to the lack of radiation exposure, characterization of cystic versus solid lesions, ability to show the relation of the mass to nearby structures, and ability to have real-time visualization for FNA or other procedural intervention. Disadvantages of ultrasonography are limited anatomic reference in the images used for surgical intervention, as well as

Table 4. Clinical Indications for Diagnostic Evaluations

Diagnostic Test	Clinical Indication
Blood culture	Any febrile patient with concern for acute infection or malignancy
Chest radiography	Unknown neck masses in a patient undergoing sedation or anesthesia
Complete blood count (with manual cell differentiation)	Persistent neck lesions Lesion suspicious for acute bacterial infection with toxic-appearing patient
Complete metabolic panel	Masses suspicious for malignancy
C-reactive protein	Masses suspicious for inflammation
Erythrocyte sedimentation rate	Masses suspicious for inflammation
Free thyroxine thyrotropin	Masses associated with the thyroid
Lactate dehydrogenase	Masses suspicious for malignancy
Tuberculosis skin test	Persistent neck masses
Uric acid	Masses suspicious for malignancy

a level of dependence on technician experience and technique.

Computed tomography (CT) is the most commonly used method for evaluating neck masses in the United States due to the speed with which it can be obtained and ability to appreciate fully the mass in relation to other critical head and neck structures without dependence on knowledge of probe position. CT should be obtained with intravenous contrast for visualization of surrounding vasculature. Disadvantages of CT are radiation exposure (particularly to the thyroid gland) and risk of contrast reaction.

Magnetic resonance imaging (MRI) with contrast is indicated for a more complete evaluation of soft tissue involvement, particularly with a potentially infiltrative soft tissue mass. Advantages are lack of radiation exposure, lower risk of contrast reaction, and good soft tissue visualization, making MRI a stellar evaluation for pediatric neck masses. Despite these diagnostic advantages, MRI is not used as an initial imaging method regularly due to the significant disadvantage of the length of the study that often requires the patient to be under sedation.

Summary

- Lymphadenitis caused by *Staphylococcus* or *Streptococcus* is the most commonly encountered cause of pediatric neck masses requiring intervention. Coverage for methicillin-resistant *Staphylococcus aureus* must be considered when choosing treatment.
- Many congenital pediatric neck masses present while acutely infected.
- Lymph nodes that are nontender, in the supraclavicular position, firm, matted, or greater than 2 cm in diameter should be assessed more aggressively because these signs are associated more frequently with malignancy. (5)
- Excisional biopsy is helpful in the evaluation of pediatric neck masses not associated with the thyroid. Fine needle aspiration is helpful in the evaluation of thyroid masses. (4)
- Unless airway compromise has created an urgent situation, corticosteroids should not be administered to a pediatric patient with a neck mass until malignancy has been excluded. (5)
- Chest radiograph should be considered on every pediatric patient with a neck mass of uncertain etiology. (5)

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1. An obstetrician informs you that ultrasonography shows a large mass in the left posterior neck of the fetus of a mother whose other children are your patients. The size and location of this mass should prompt you to anticipate and counsel the parents regarding the need for:
   A. Anticipation of a cesarean delivery.
   B. Importance of delivering the infant in a hospital with pediatric subspecialist.
   C. Necessity of a fine-needle biopsy immediately after birth.
   D. Possible necessity of chemotherapy.
   E. Risk of other masses elsewhere in the body.

2. A 4-year-old girl has a tender anterior cervical tender lymph node measuring 1.0 × 1.5 cm. The lymph node is tender and mobile, but there is no fluctuance. Her temperature is 39.5°C. The most appropriate intervention is:
   A. Antibiotic therapy.
   B. Fine-needle aspiration.
   C. Free thyroxine testing.
   D. Prednisone administration.
   E. Ultrasonography.

3. A 1-month-old boy has several bluish-colored masses over his back and neck. The masses increase in size, and the infant is seen in the emergency department. His platelet count is 35,000 per mcL. The combination of the physical findings and laboratory result are strongly suggestive of:
   A. Hodgkin's disease.
   B. Kasabach-Merritt syndrome.
   C. Lymphadenitis.
   D. Neuroblastoma.
   E. Papillary thyroid carcinoma.

4. A 15-year-old boy has a painless, firm, fixed neck mass. He has had increasing cough over the last month. His chest radiograph shows a mediastinal mass. This clinical picture is most consistent with:
   A. Cervical adenitis.
   B. Hodgkin's disease.
   C. Medullary thyroid carcinoma.
   D. Neuroblastoma.
   E. Rhabdomyosarcoma.

5. A 2-month-old girl has a mass in the right anterior cervical area. On examination, she has right ptosis and pupillary miosis. Her blood pressure is 100/75 mm Hg. She has had frequent sweating throughout the day. Another finding likely to be present is:
   A. Bacteremia.
   B. Calcifications on imaging.
   C. Elevated free thyroxine level.
   D. Erosion of bone.
   E. Lesions in the liver.

Pediatric Neck Masses

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