

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ
الْحَمْدُ لِلَّهِ الَّذِي
خَلَقَ السَّمَوَاتِ وَالْأَرْضَ
وَالَّذِي جَعَلَ الْمَوْتَاضِعَ
وَالَّذِي جَعَلَ اللَّيْلَ
لِلنَّجْمِ وَالنَّجْمِ لِلزُّجُرْجُرِ
وَالَّذِي جَعَلَ الْبَحْرَ
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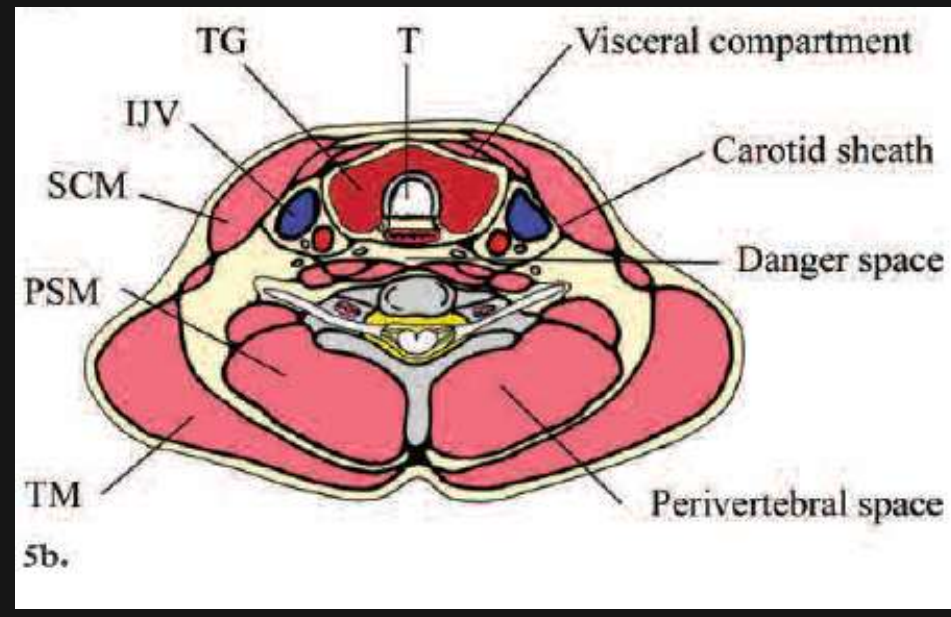
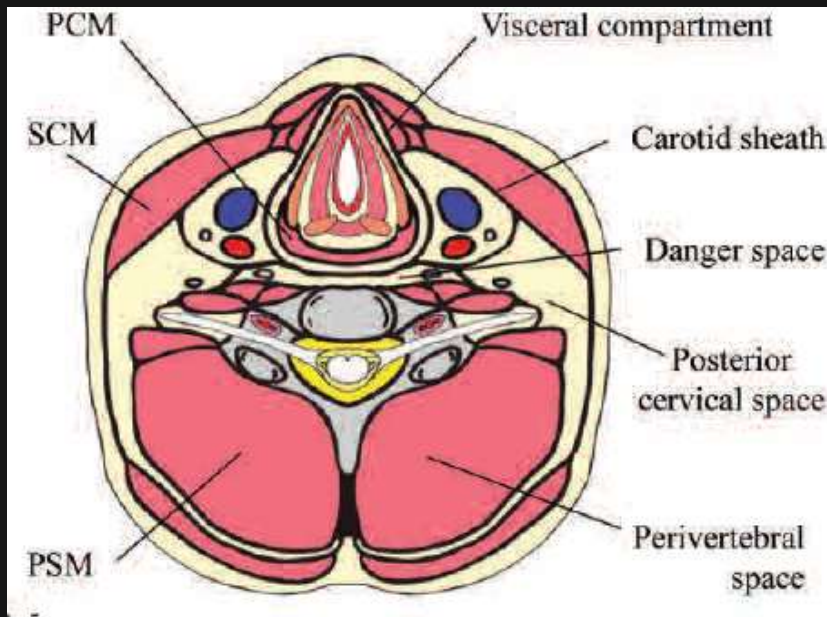
Approach TO Imaging Diagnosis of Neck Masses

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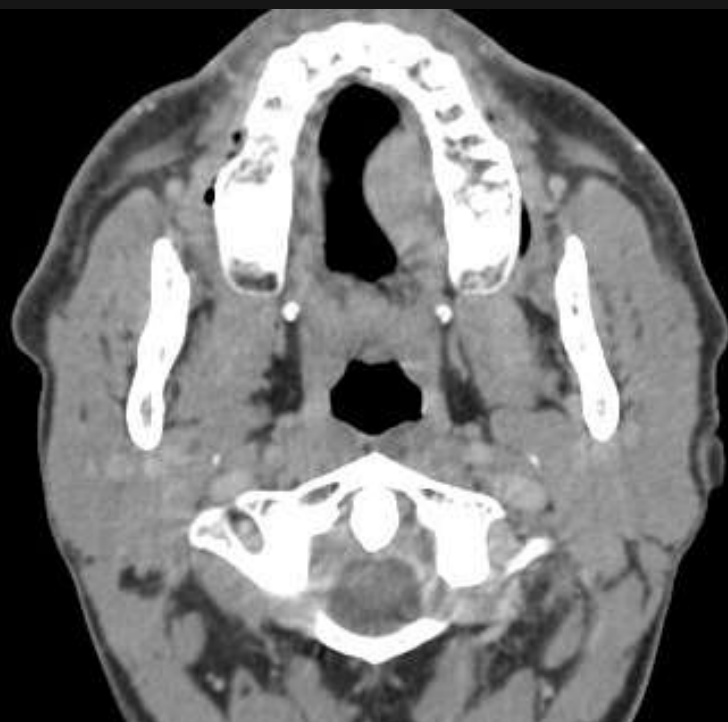
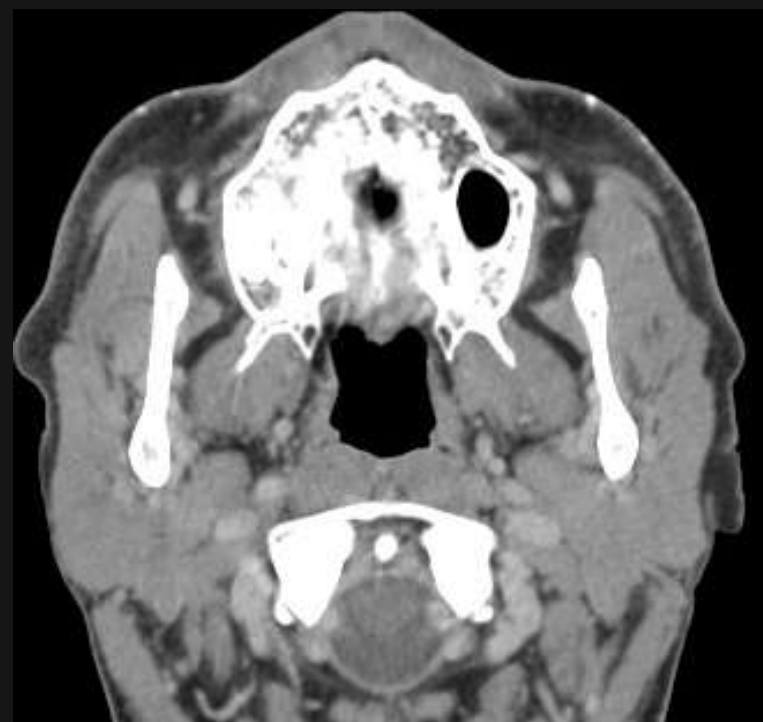
- Neck masses are a common finding in children and can present a difficult diagnostic challenge.
- These masses may represent a variety of conditions having a congenital, acquired inflammatory, neoplastic or vascular origin.
- The fascial spaces and compartments of the neck provide an approach to D.D.
- The fascial spaces or compartments are regions of loose connective tissue that fill the areas between the fascial layers.
- Some of these regions are virtual, whereas others contain major anatomic structures.
- These spaces and their contents provide an approach to D.D.
- Several imaging techniques, including X-ray, gray-scale and Doppler US, CT, MRI & MRA are used to evaluate such lesions.
- Careful attention to clinical history and physical examination is important.

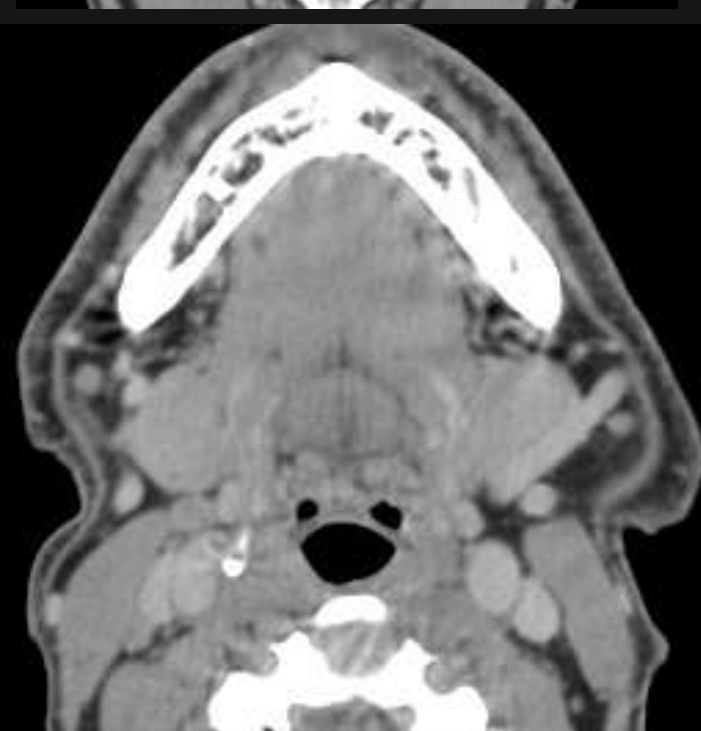
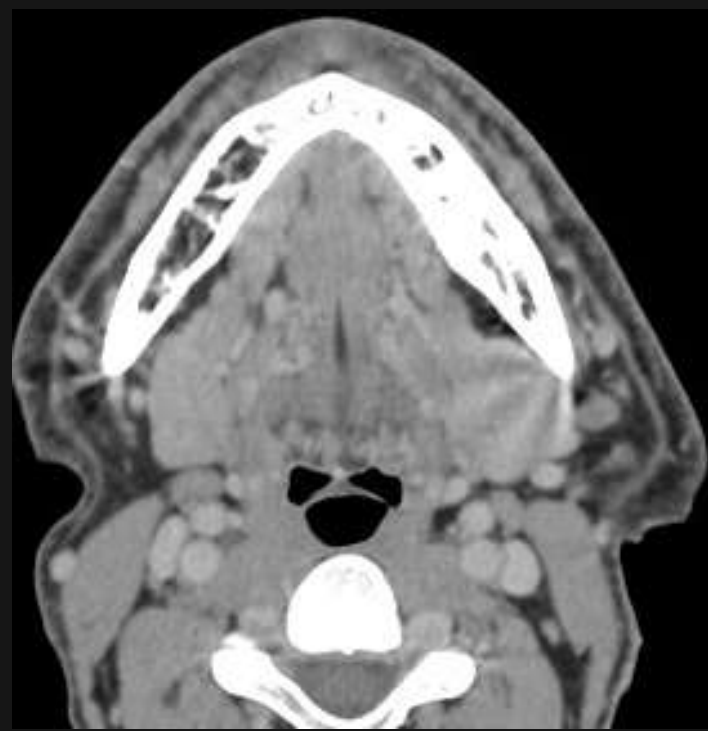
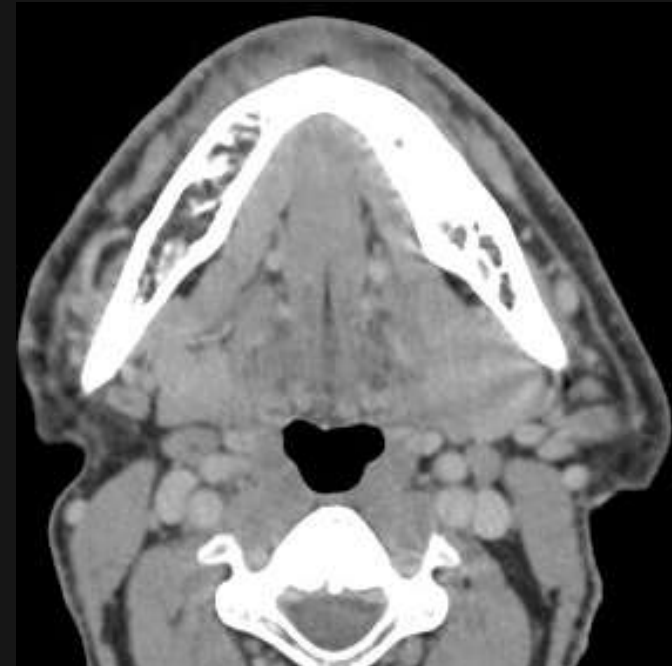
Anatomy

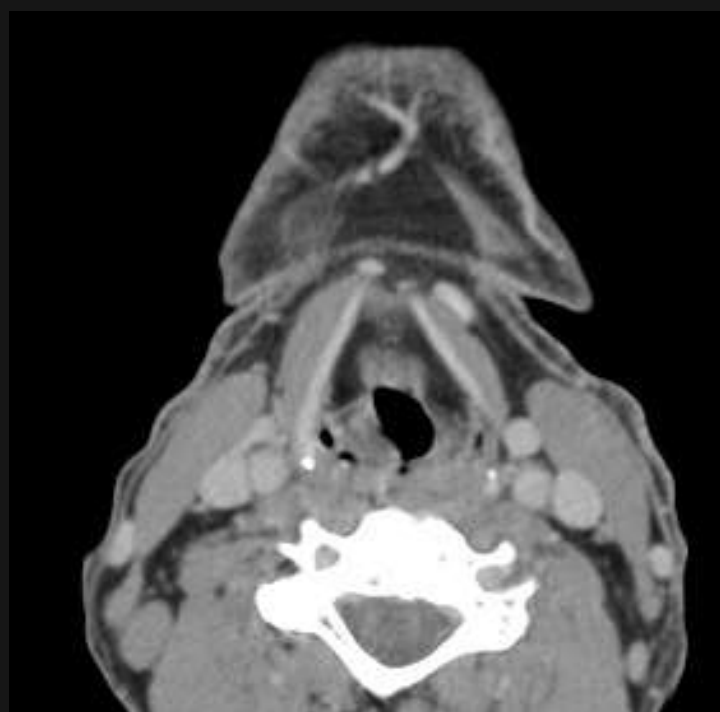
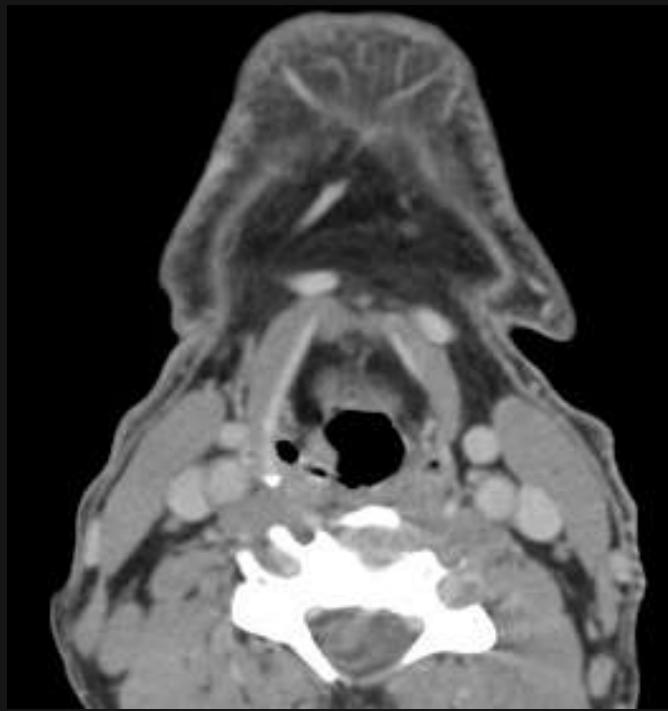
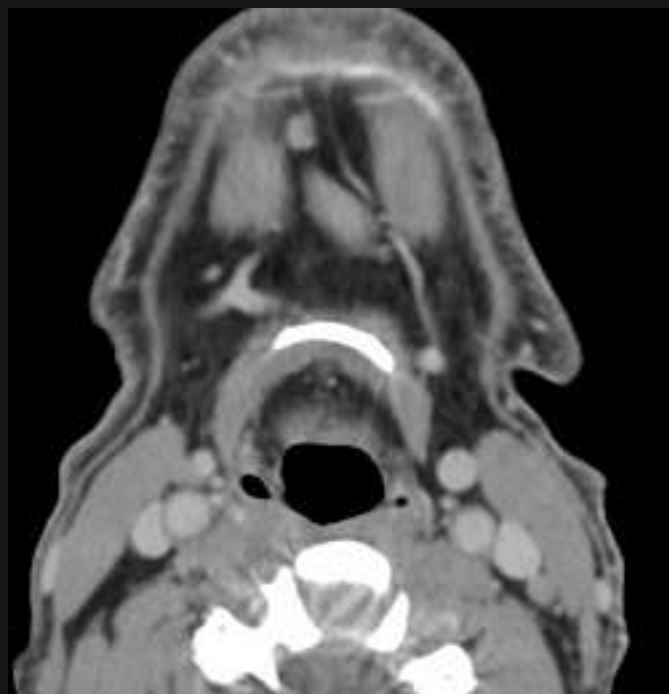
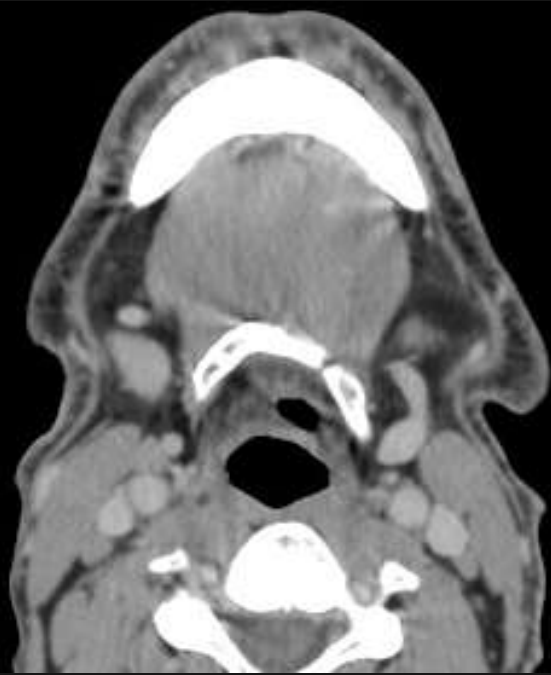
Spaces & Facial Planes

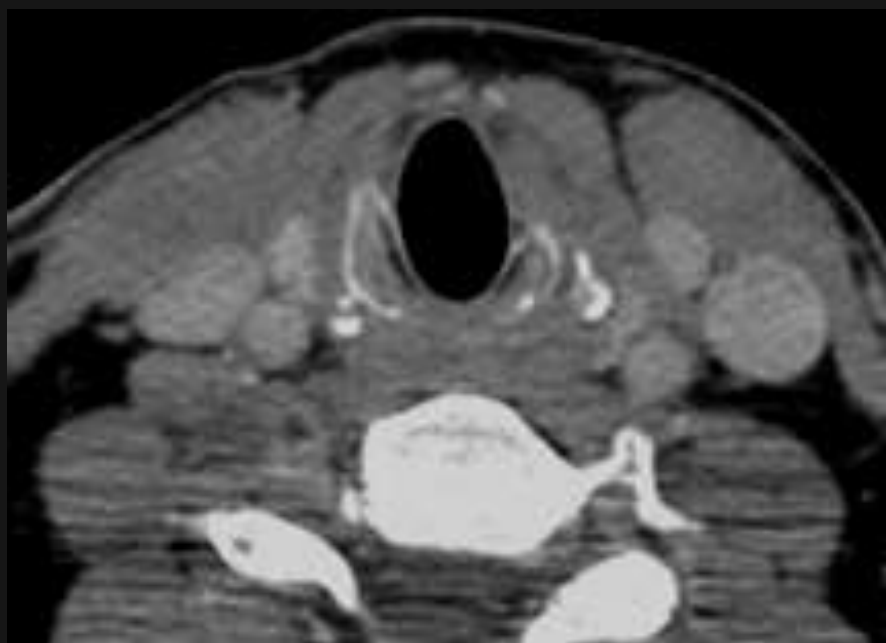
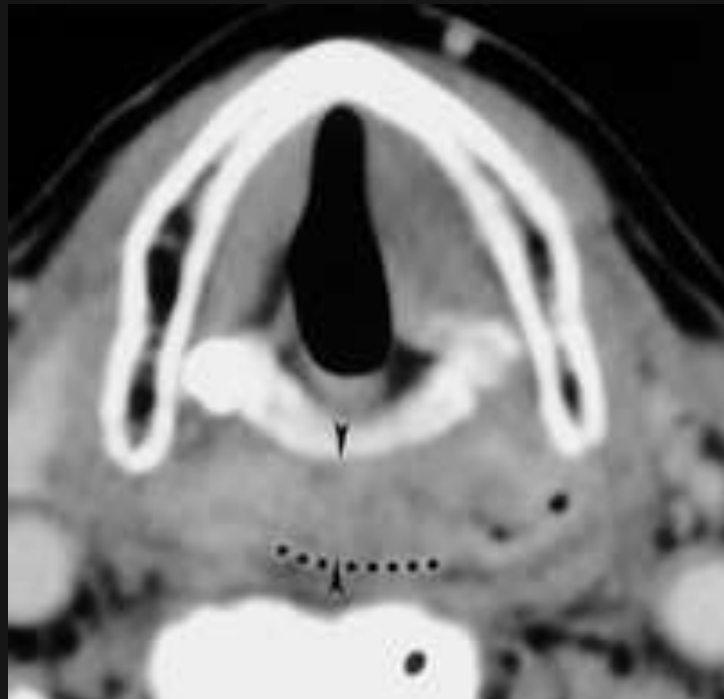
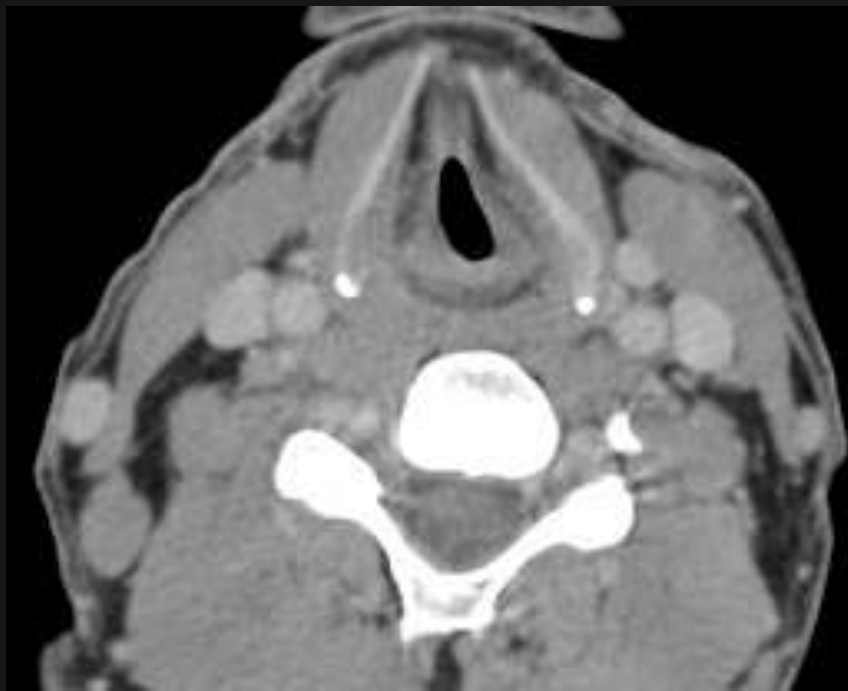


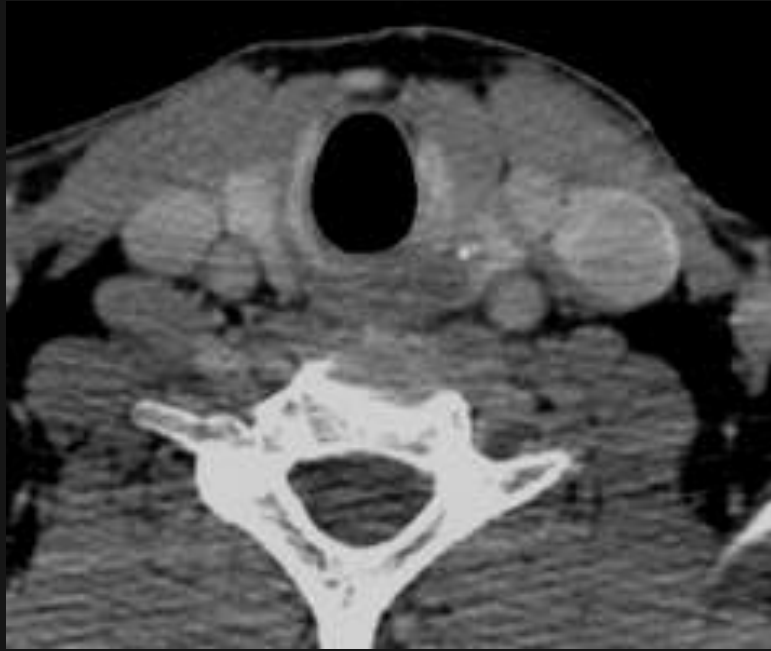
Drawings of axial sections through the level of C4 (a) and C7 (b) shows the spaces in the upper and mid cervical visceral compartment, respectively. *IJV* = internal jugular vein, *PCM* = pharyngeal constrictor muscle, *PSM* = paraspinal muscle, *SCM* = sternocleidomastoid muscle, *T* = trachea, *TG* = thyroid gland, *TM* = trapezius muscle.

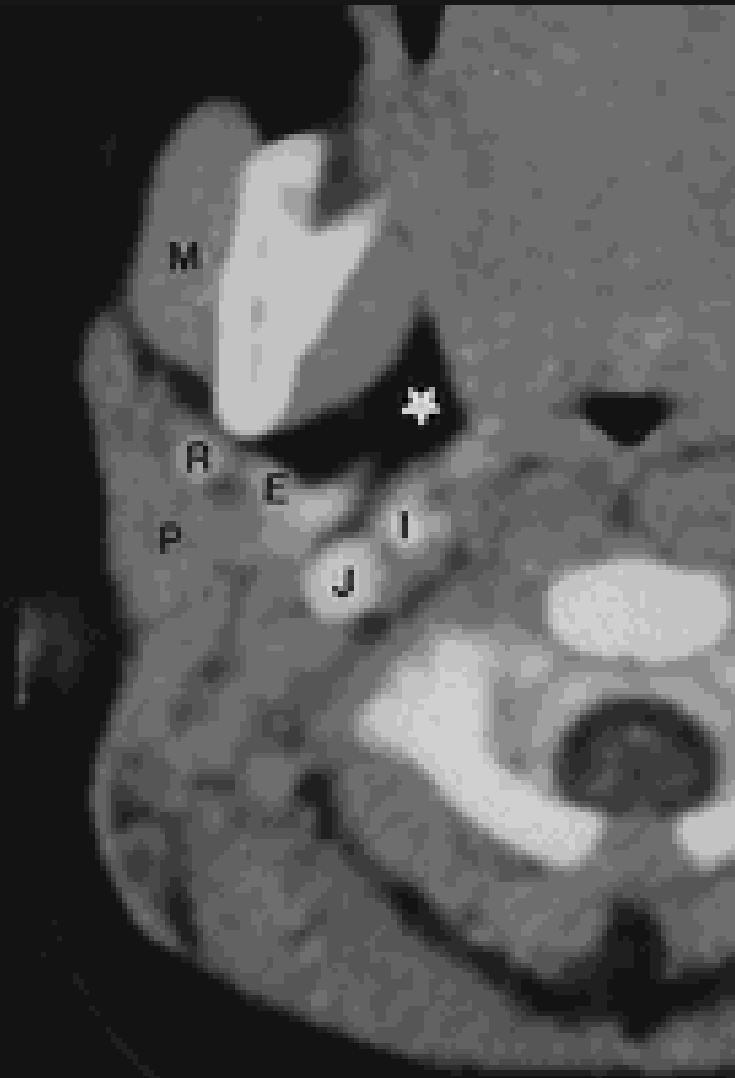












P = parotid gland, E = ECA, I = ICA, J = IJV, M = masseter Ms, R = retromandibular vein).

Naso, oro, para & retropharynx

1- Ph. mucosal space

- Tonsils
- Adenoid
- Minor salivary gland
- Mucosa

2- Retroph. space

- LN
- Fat

3- Paraph. space

- Fat.

- Tonsillitis, Abscess.
- Retroph. abscess.
- Adenoid hypertrophy
- Salivary T. → pleomorphic adenoma
→ carcinoma.
- Nasoph. sq. cell ca.
- LN (Inflamm, 2ry, lymphoma).
- Lipoma, dermoid.
- Nasoph. angiofibroma.
- Plasmacytoma.
- Rhabdomyosarcoma.
- Extension from PNS.
- Antrochoanal polyp.
- Haematoma.
- Hemangioma.
- Cysts → Meningocele.
→ Thornwaldt cyst
→ Mucous retention cyst.
→ Paraph. 2nd branchial cleft cyst.

Masticator space

- Masticatory Muscles (4)
- Their Ns.
- Mandible.
- Accessory parotid gland.
- Masseter hypertrophy.
- Rhabdomyosarcoma.
- Trigeminal schwannoma.
- Odontogenic cellulitis & abscess.
- Osteosarcoma, Ewing sarcoma.
- T.M.J. chondrosarcoma.
- Accessory parotid gland.
- Metastasis.
- Hemangioma.
- Lipoma.

Retropharyngeal space

- Suprahyoid → Fat & LNs.
- Infrahyoid → Fat only.

Carotid space (Upper neck)

- ICA
- IJV
- C.Ns. (9:12)
- Sympathetic plexus.
- LN.
- ICA (Thrombosis/aneurysm/dissection/ectasia)
- IJV (Thrombophlebitis).
- Schwannomas.
- Neurofibromas.
- Meningioma.
- Glomus T.
- LN (2ry / Lymphoma).

Carotid space (Lower neck)

- CCA
- IJV
- Vagus N.
- Sympathetic plexus.
- LN.
- CCA (Thrombosis/aneurysm/dissection/trauma)
- IJV (Thrombophlebitis).
- Carotid body T.
- Schwannoma.
- Neurofibroma.
- LN (inflamm, TB, 2ry, Lymphoma).
- Atypical 2nd branchial cleft cyst.
- Abscess.

Parotid space

- Parotid gland.
 - Intraparotid LNs.
 - Facial N.
 - ECA.
- Parotid lesions
 - Pleomorphic adenoma.
 - Pap. cystadenoma (Warthin`s T.).
 - Carcinoma.
 - 2ry.
 - Lymphoma.
 - Acute suppurative parotitis.
 - Ch. recurrent parotitis.
 - Granulomatous parotitis.
 - Sialadenosis.
 - Sjogren Sy.
 - Lymphoepithelial cyst.
 - Facial N. schwannoma.
 - Cap. hemangioma.
 - Cystic hygroma.
 - 1st branchial cleft cyst.

Prevertebral space

- Brachial plexus (Schwannoma, neurofibroma)
- Spinal & Phrenic Ns.
- Vertebral A. & V.
- C.spine (osteophytes, spondylitis, 2ry, chordoma).

No LNs.

Posterior cervical space

- Spinal accessory N.
- Spinal accessory LN
- Brachial plexus.
- Schwannoma.
- Neurofibroma.
- LN (2ry, Lymphoma).
- Lipoma, liposarcoma.
- Hemangioma (cap / cav).
- Cystic hygroma.
- 3rd branchial cleft cyst.

Oral Cavity, Sublingual, Submandibular spaces

Sublingual space

- Subling. Gland & duct.
- Submand. gland (deep part & duct).

Submandibular space.

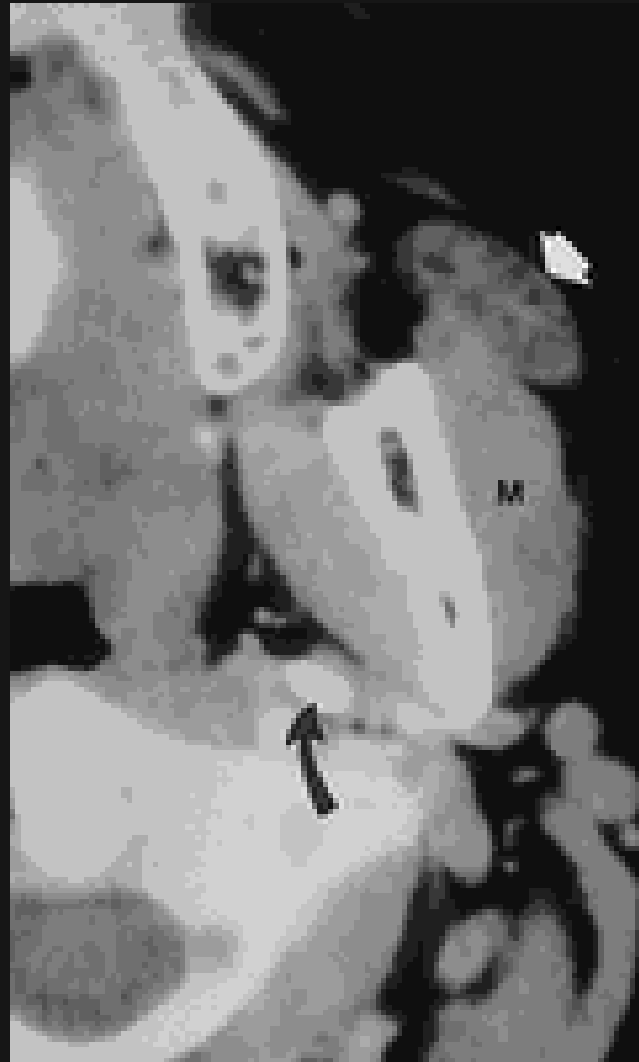
- Submand. gland (sup. part)
- LNs.

- Salivary Gland (sialadenitis, adenoma, ca)
- LN (inflamm, 2ry, Lymphoma)
- Tonsil ca
- Ludwig angina.
- Tongue (sq.c.ca)
- Lipoma.
- Dermoid, epidermoid.
- Ranula (subling retention cyst)
- Cystic hygroma.
- Cap. hemangioma.
- Cav. hemangioma.
- 2nd branchial cleft cyst.
- Thyroglossal duct cyst.
- Lingual thyroid.

Visceral space (Lower neck)

- Larynx.
- Trachea.
- Hypopharynx.
- Oesophagus.
- Thyroid.
- Parathyroid.
- Rec. laryngeal N.
- LNs.
- Hypoph. ca.
- Oesophag. ca.
- Zenker diverticulum.
- Parathyroid (cyst, adenoma).
- LNs.
- Cervical thymic cyst.
- Abscess.
- Larynx
 - Retention cyst.
 - Laryngocele.
 - Chondroma / chondrosarcoma.
 - Schwannoma / neurofibroma.
 - Lipoma, leiomyoma.
 - Sq. c. ca.
 - Lymphoma.
- Thyroid
 - Thyroglossal duct cyst.
 - Multinodular goitre.
 - Adenoma.
 - Carcinoma.
 - Lymphoma.

Accessory parotid gland

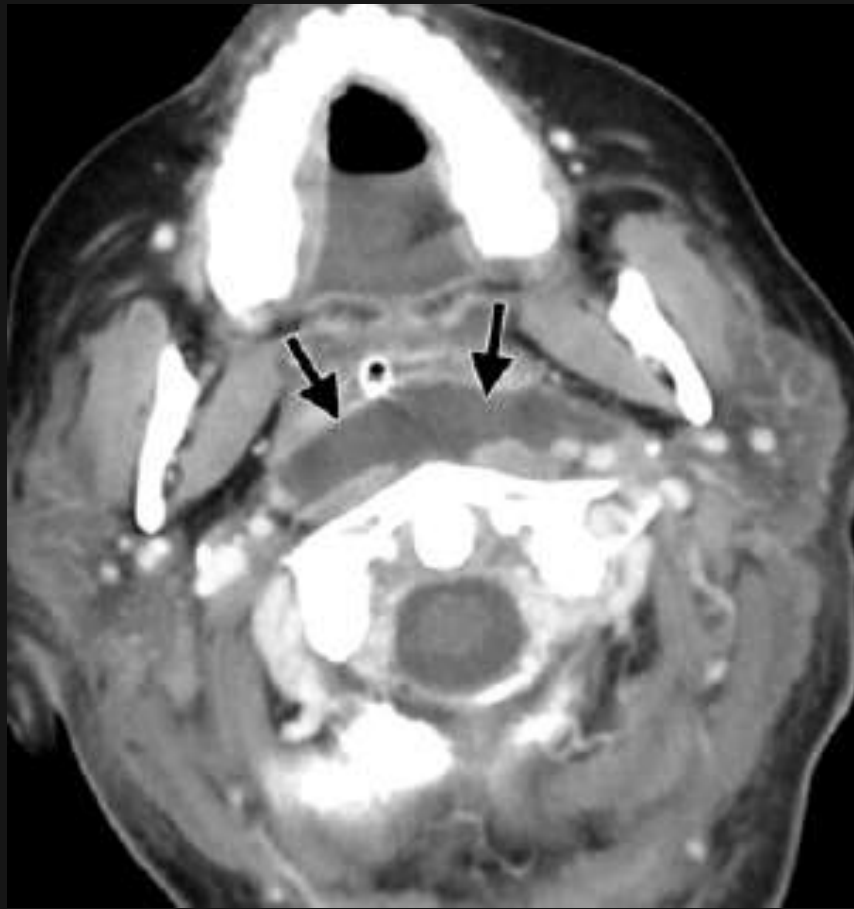


Accessory parotid gland with characteristic architecture and partial fatty replacement. Black arrow indicates the styloid process .M = masseter muscle

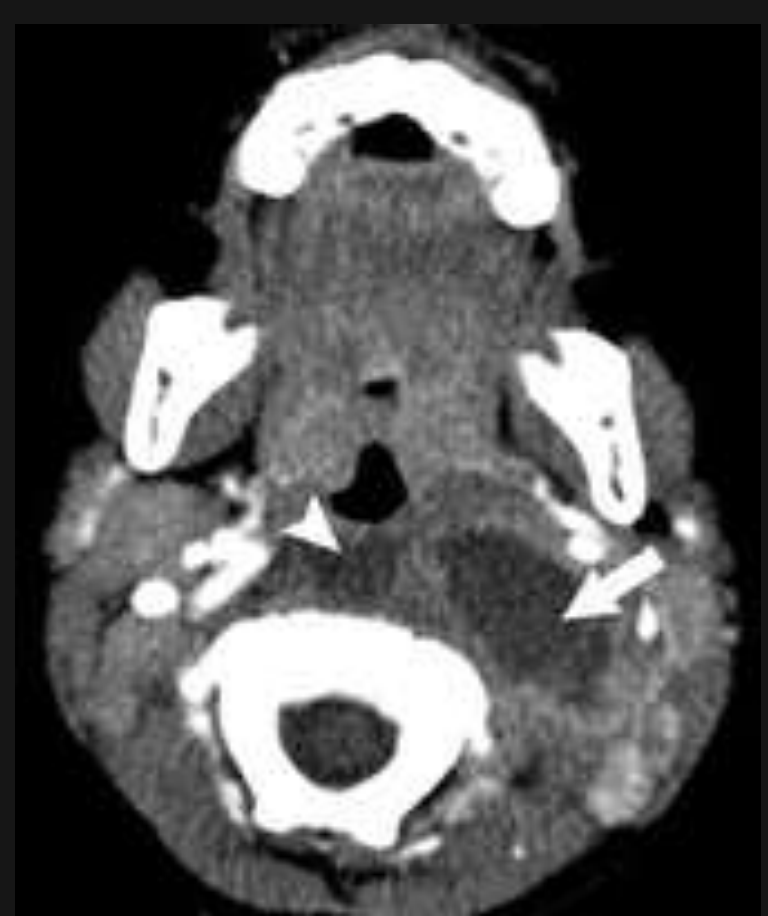
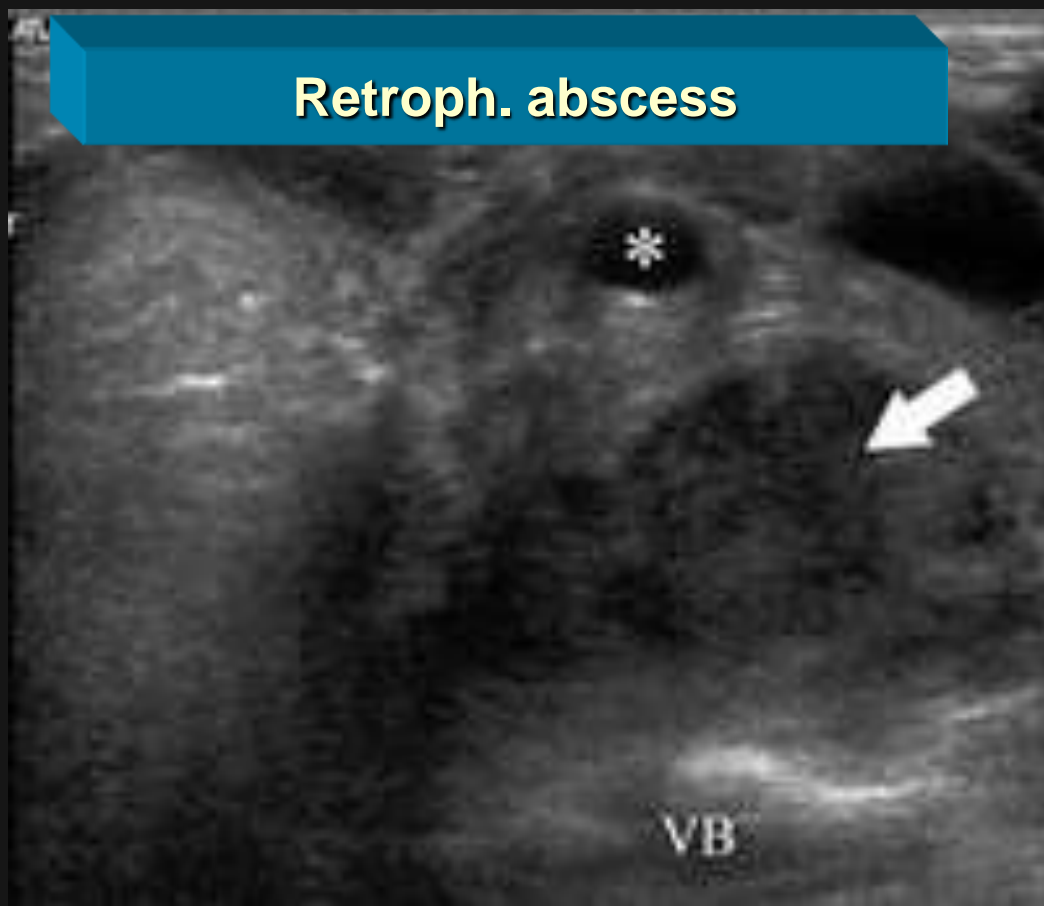
Retroph. abscess



Retroph. abscess



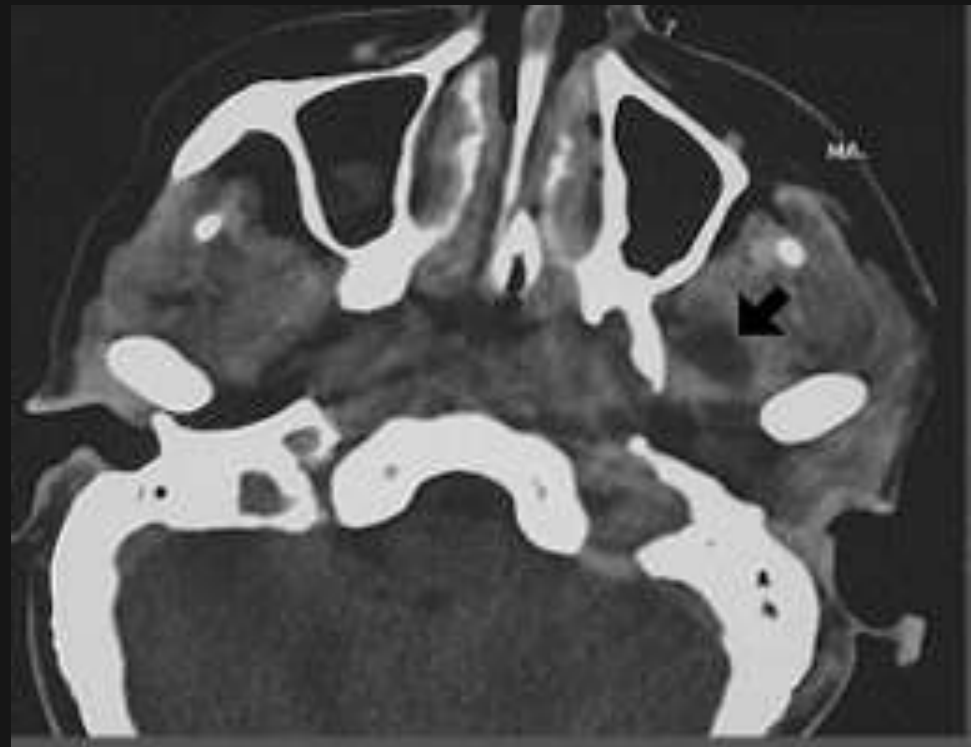
Retroph. abscess



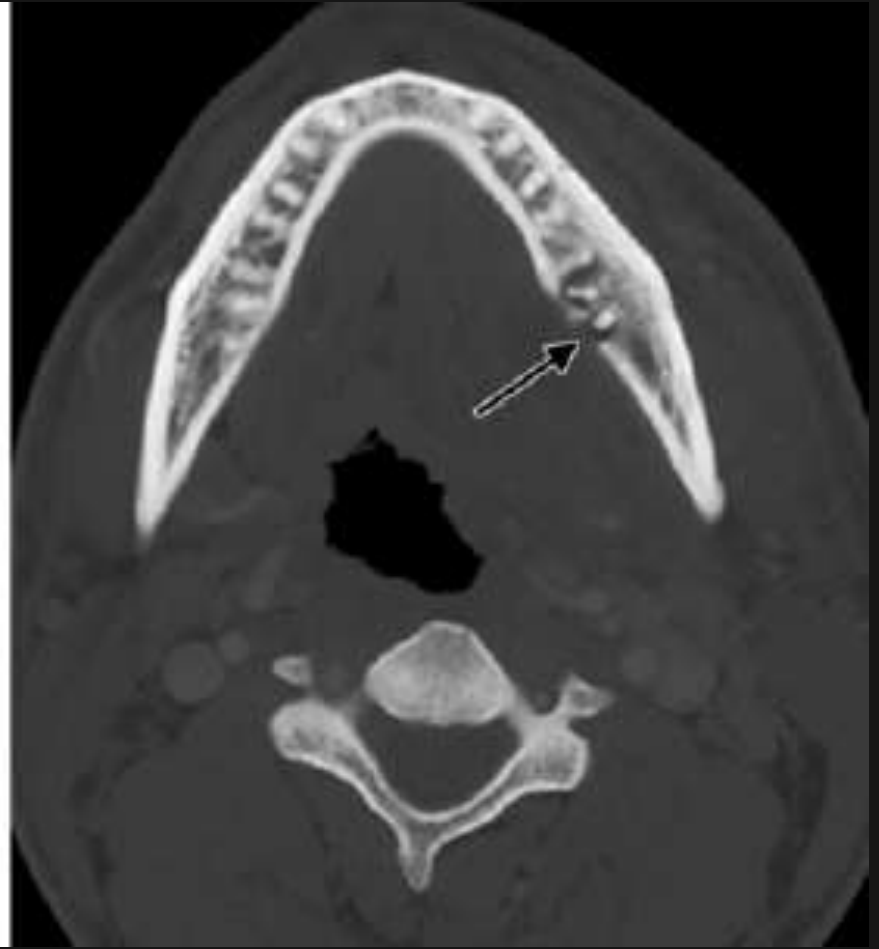
Retropharyngeal abscess in a 1y old girl.

- (a) US shows a hypoechoic mass (arrow) between the carotid sheath (*) and vertebral body (VB).
- (b) Enhanced CT shows two heterogeneous hypodense masses, one in Lt retropharyngeal space with peripheral rim enhancement (arrow), and the other on the midline.

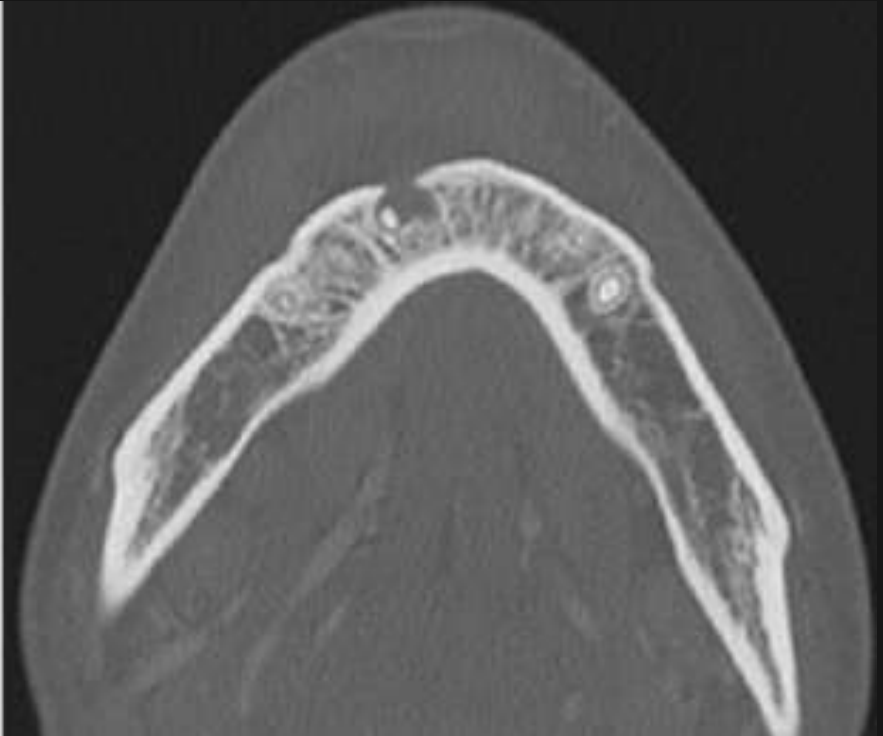
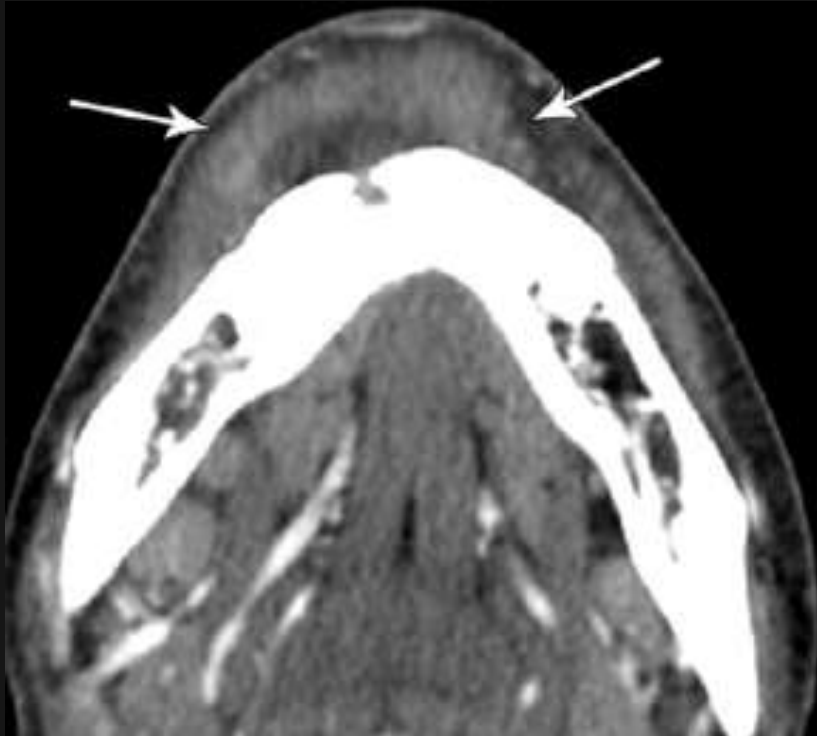
Masticator space abscess



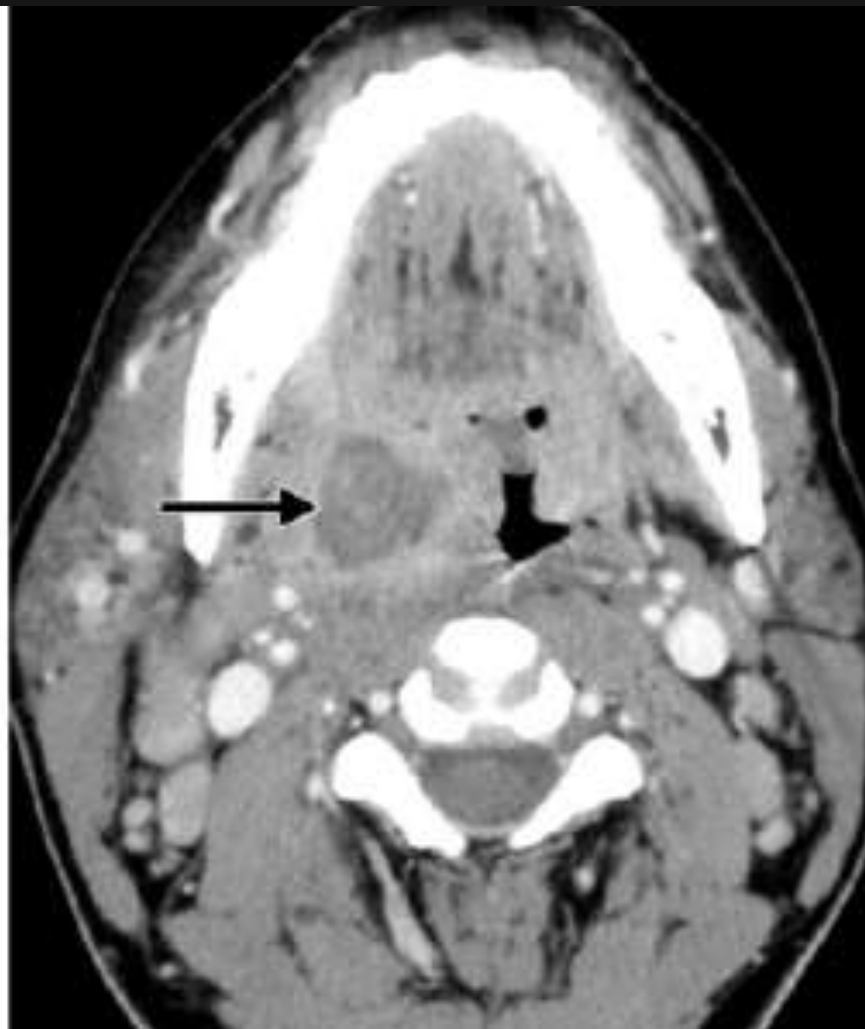
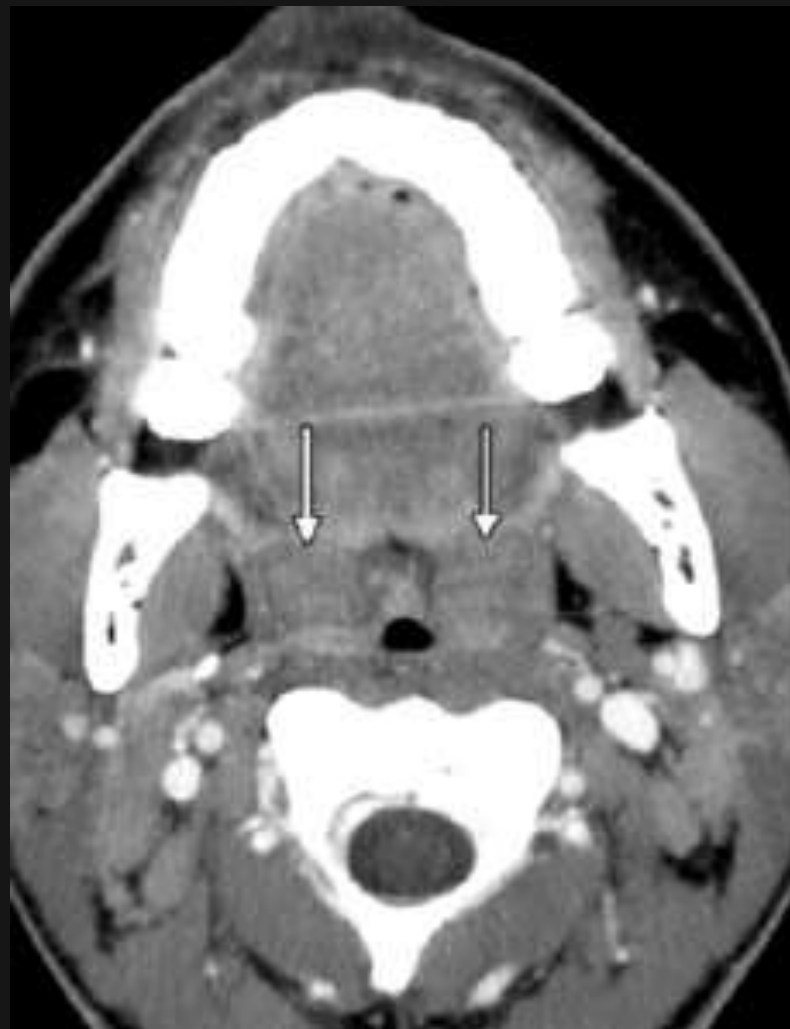
Submandibular abscess



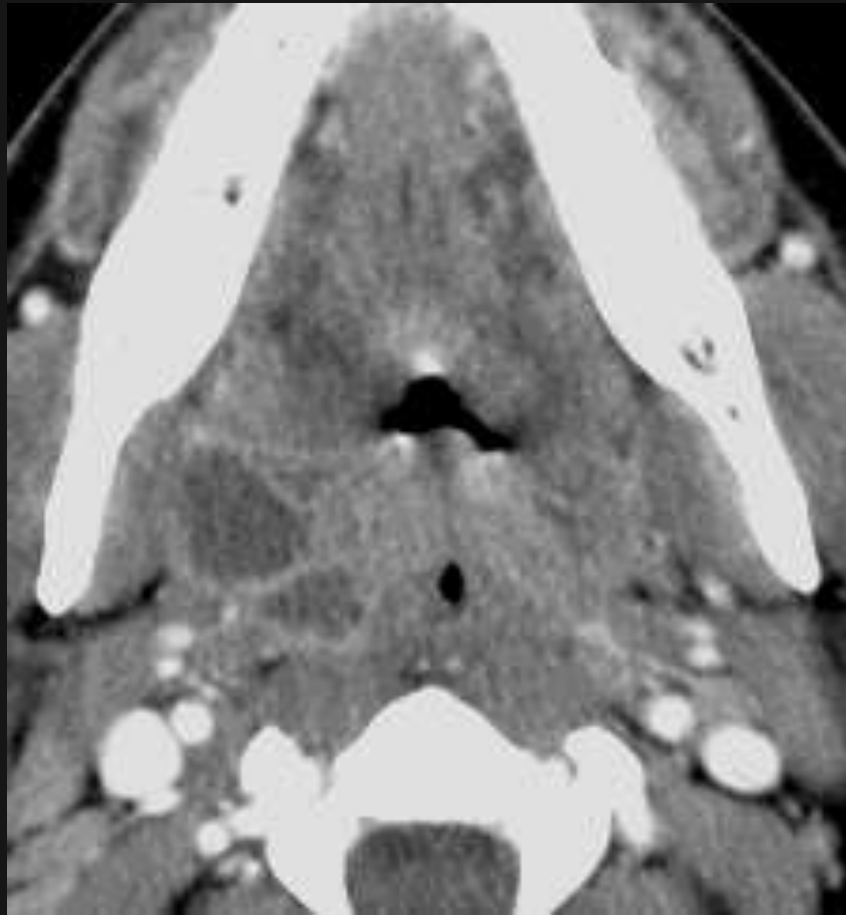
Odontogenic abscess



Paraph. abscess



Paraph. abscess

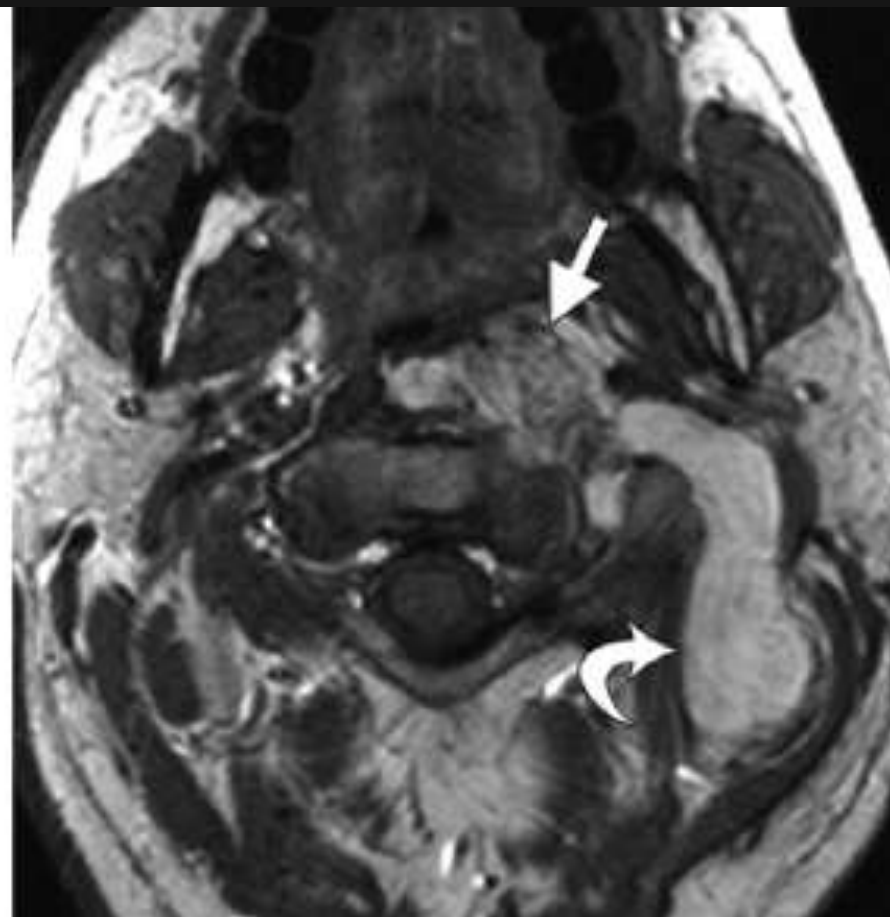


Intramuscular lipoma

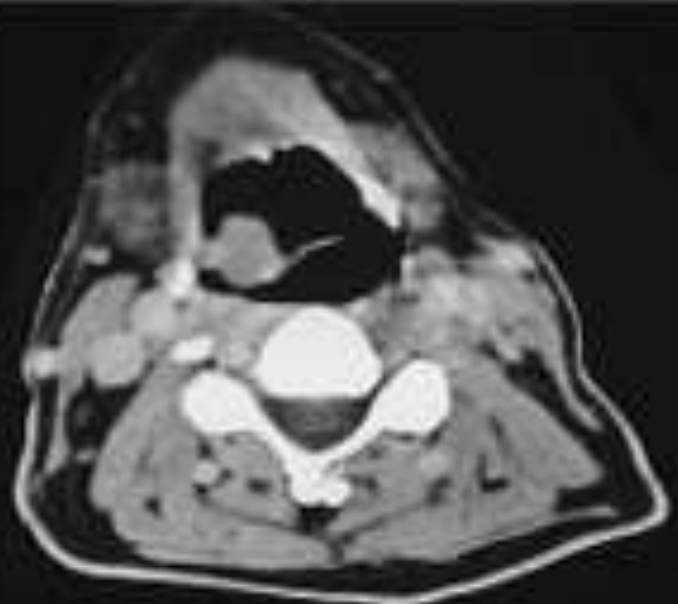
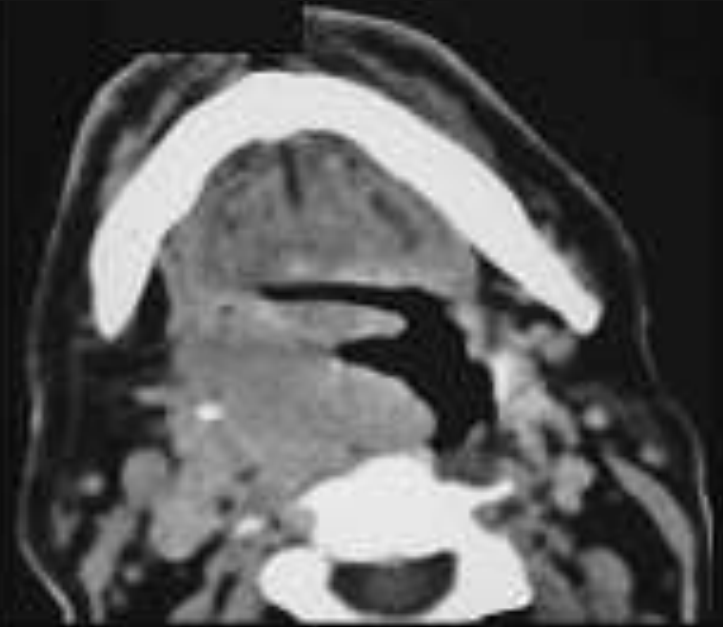
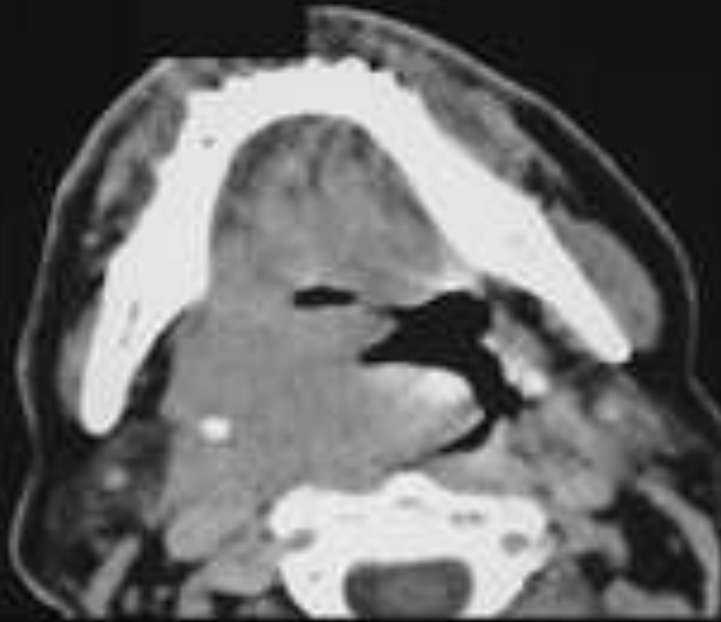


Liposarcoma should be considered due to the presence linear elements in the lipoma.

Paraph. lipoma



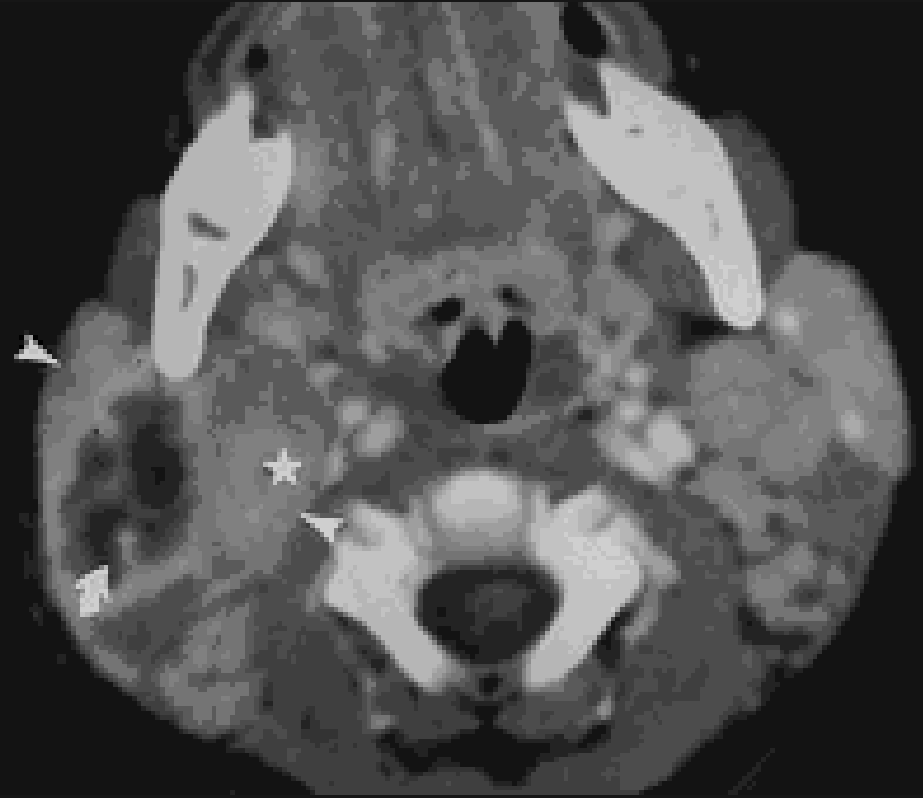
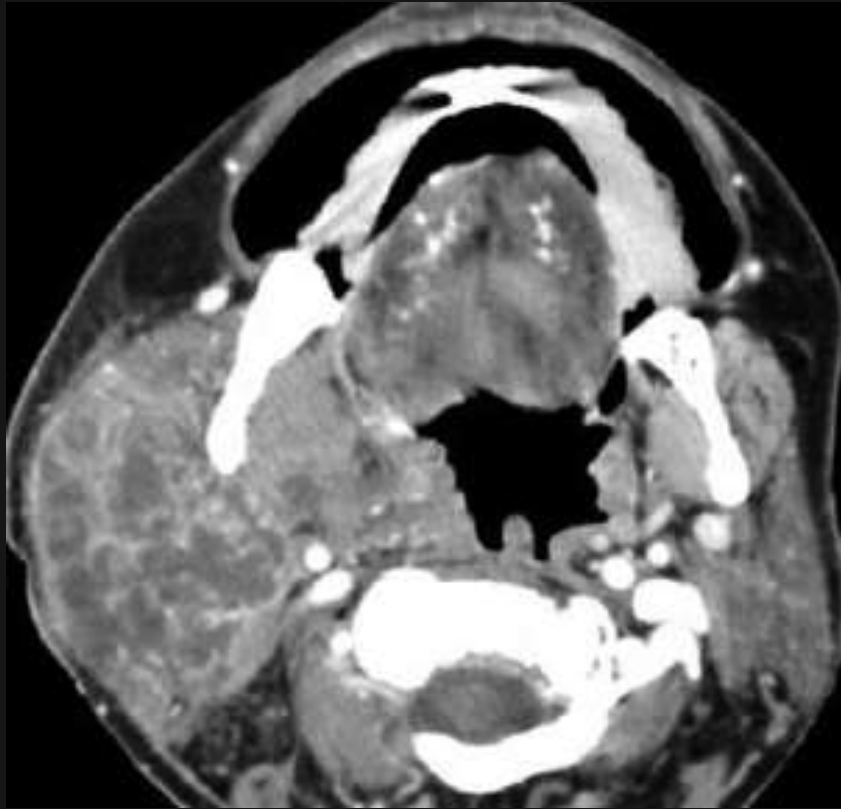
Oropharyngeal lymphoma



Submandibular sialadenitis



Acute suppurative parotitis



Enhanced CT shows an abscess (arrow) in an enlarged enhancing Rt parotid gland (arrowheads). Note the medial shift of the parapharyngeal and carotid spaces due to swelling of the deep lobe of parotid. Multiple small LNs noted on Lt side .

Dermoid Cyst

- Dermoid cyst is a benign cystic teratoma.
- The essential difference between dermoid and epidermoid cyst is the presence of skin appendages (eg, sebaceous glands, hair follicles) in the wall of the dermoid cyst.
- Usually manifest during the 2nd & 3rd decades of life.
- Only 7% of dermoid inclusion cysts occur in the H& N.
- Commonly manifest as a midline suprahyoid neck swelling with slow growth (The most common location is the floor of the mouth).
- It is soft, mobile & unattached to overlying skin.
- No intimate association with the hyoid bone and therefore do not move with tongue protrusion.
- The size ranges from a few mm : 12 cm.

Radiologic Features

-Thin wall unilocular cyst.

CT

-The cavity is homogeneous hypodense (0–18 HU).

-Small coalescent fat nodules within the fluid matrix (sac of marbles).

-/Cyst may be heterogeneous with fat- fluid levels.

-The rim of the cysts often enhance after IV contrast.

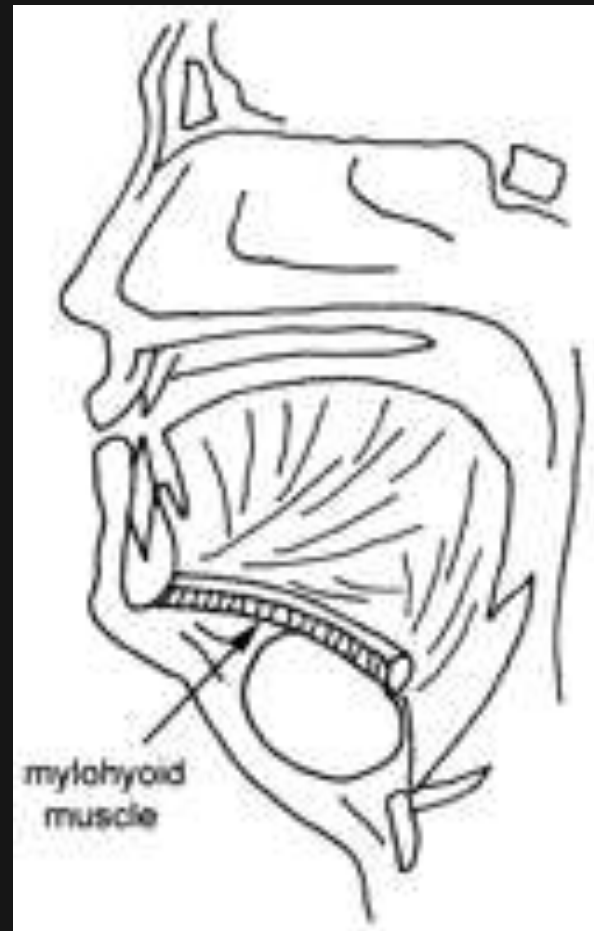
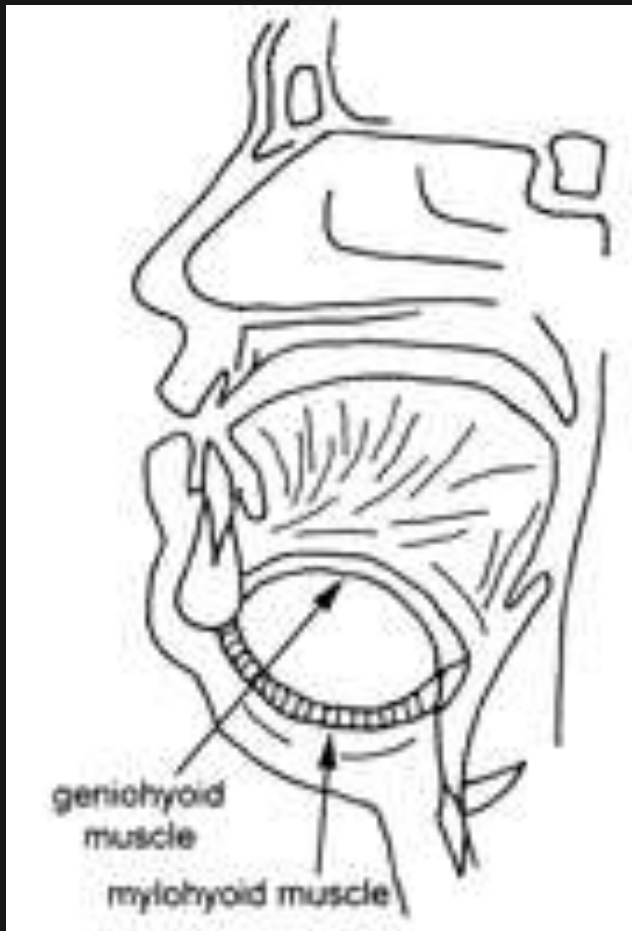
MRI

-Variable signal intensity on T1

May be hyperintense (sebaceous lipid) or isointense relative to muscle.

-Usually are hyperintense on T2.

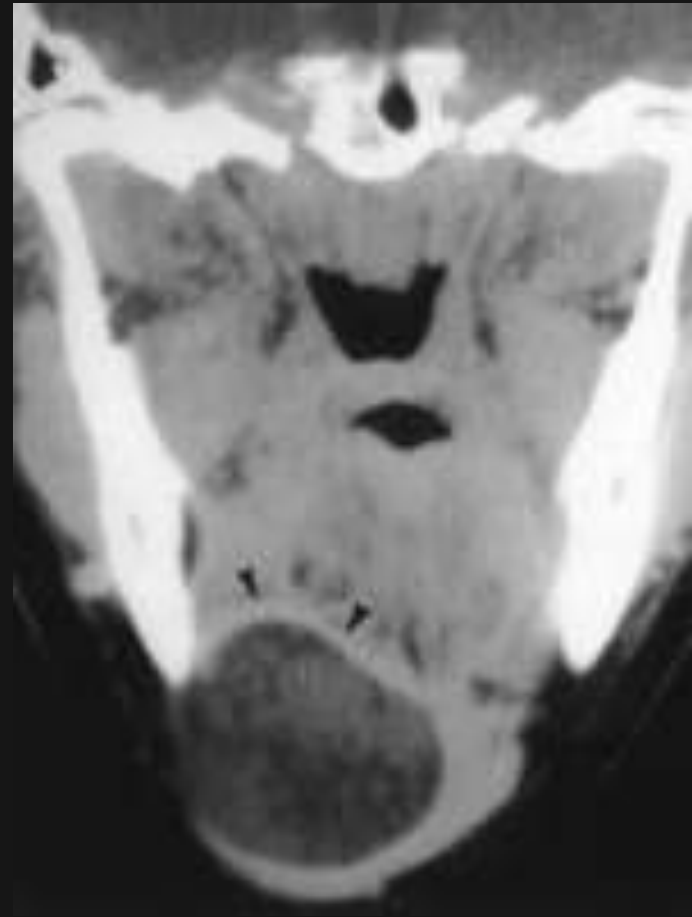
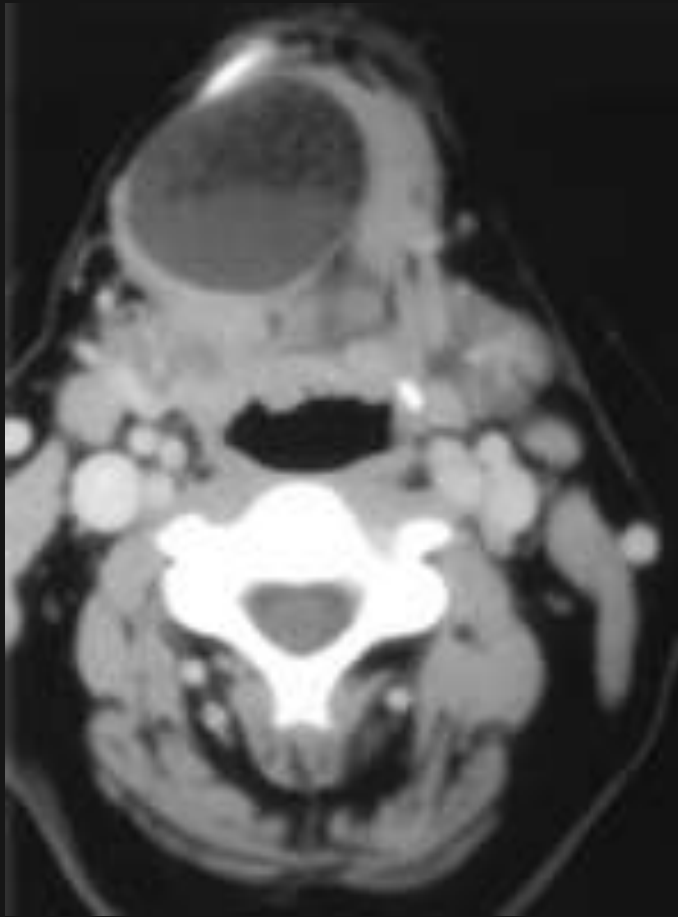
-Clearly demarcated margin but frequently with heterogeneous internal appearance.



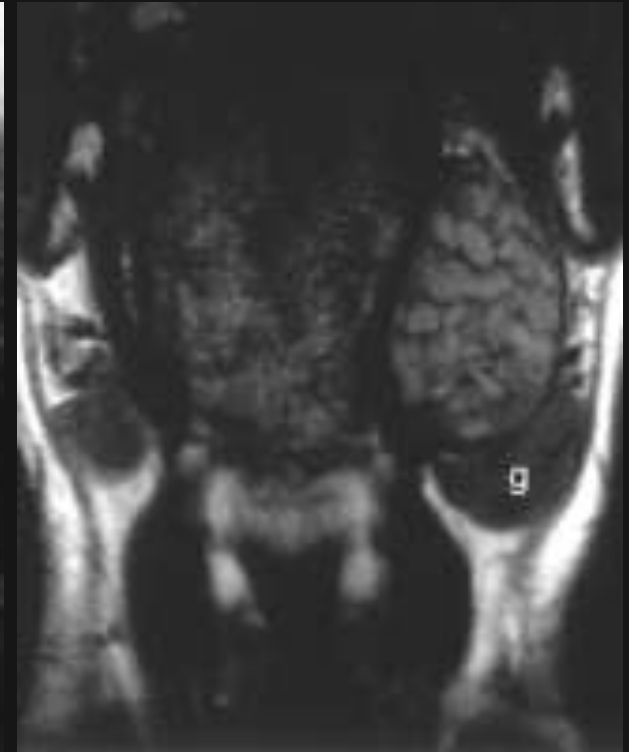
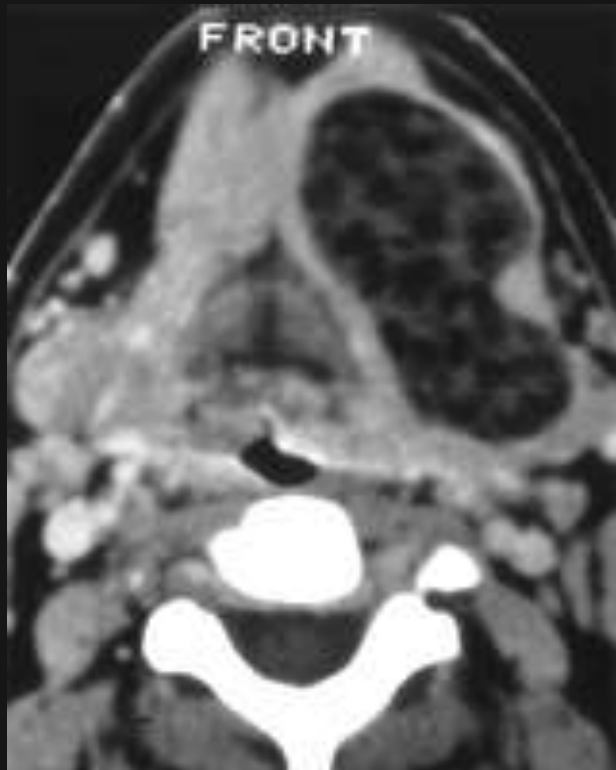
Location of the cyst with respect to the mylohyoid muscle

(a) Diagram shows the cyst above mylohyoid muscle.

(b) The cyst is below mylohyoid muscle.



- (a) Enhanced CT shows a well defined mass in submandibular-submental region with multiple discrete hypodense foci in the nondependent portion of the cyst.
- (b) Coronal CT shows the cyst inferior to mylohyoid muscle (arrowheads).



- (a) Enhanced CT shows a well defined mass in the submandibular space with a sac-of-marbles appearance.
- (b) US shows multiple echogenic foci and shadowing inside.
- (c) Coronal T1 shows discrete hyperintense intracystic foci. It displaces the Lt submandibular gland (*g*) inferiorly.

Epidermoid Cyst

- They are rare congenital lesions and are much less common than dermoid cysts in the H& N.
- They appear earlier than dermoid cysts (most lesions evident during infancy).

Imaging

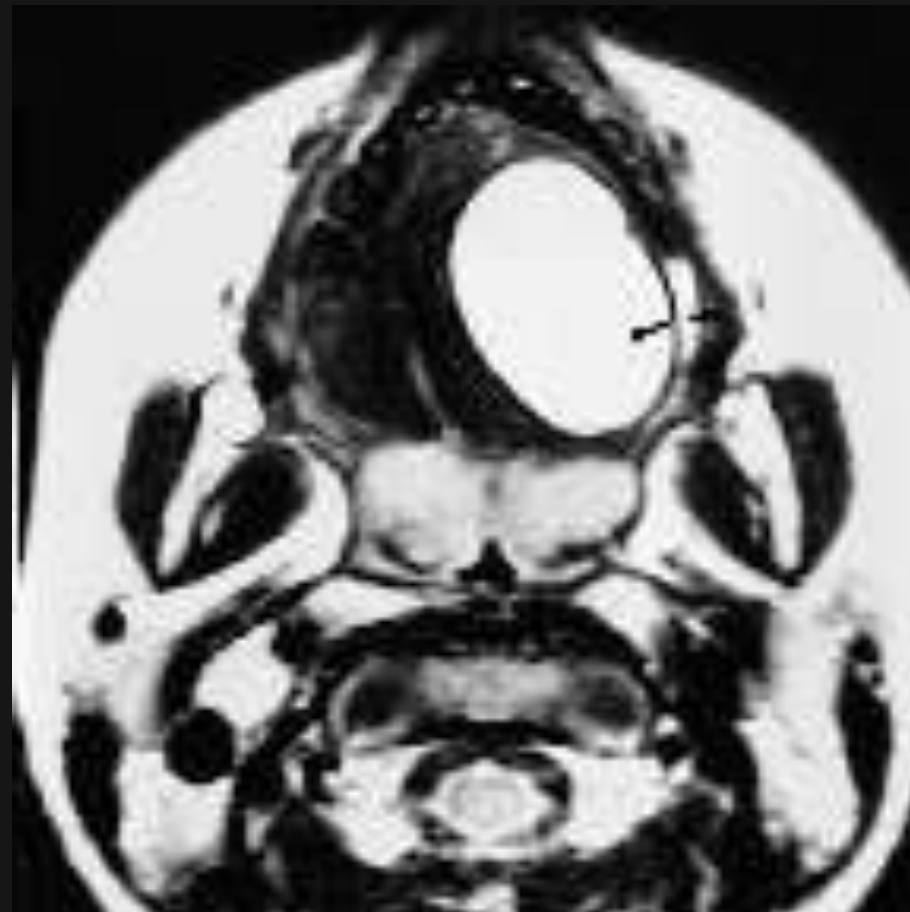
CT

- They are homogenous hypodense.
- Do not enhance.

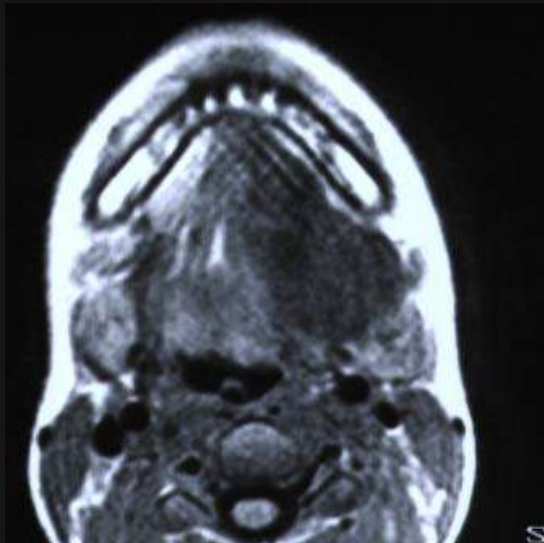
MRI

- Hypo on T1, hyper on T2 (as fluid).

Epidermoid cyst



Ranula



Branchial Cleft Cysts

- The 1st branchial cleft gives rise to eustachian tube, tympanic cavity, mastoid antrum and contributes to the formation of tympanic membrane.
- The 2nd branchial cleft gives rise to palatine tonsil & tonsillar fossa.
- The 3rd branchial cleft forms the inferior parathyroid gland, thymus & pyriform sinus.
- The 4th branchial cleft gives the superior parathyroid gland & apex of the pyriform sinus.

- Branchial cleft anomalies manifest as any combination of sinus, fistula or cyst.
- Sinuses open externally on the side of the neck.
- Fistulas manifest as a patent abnormal canal opening externally on the neck surface and internally in the pharyngeal mucosa.
- Cysts manifest usually in older children or young adults.

1st branchial cleft cyst

- Called parotid lymphoepithelial cyst.
- Most common in middle aged women.
- Usually manifest as recurrent abscesses or sinus tract either around the ear or at the angle of the mandible.
- Patients typically have history of recurrent parotid abscesses.

CT

- Cystic mass within / superficial to / deep to parotid gland.
- Wall thickness and enhancement are variable and increase with recurrent infections.
- It may extend into adjacent fat-containing parapharyngeal space.
- Neither the CT nor MRI appearance is characteristic enough to differentiate it from any other cystic parotid mass.

2nd branchial cleft cyst

- Over 90% of branchial anomalies arise from the 2nd branchial apparatus, with a predominance of cysts.
- Most lie in submandibular space, antero-medial to SCM muscle, lateral to carotid space & posterior to submandibular gland.
- It can occur anywhere along a line from the oropharyngeal tonsillar fossa to the supraclavicular region of the neck
- They are painless fluctuant masses between 10-40 ys of age.
- Fistulas / sinuses are commonly found during the 1st decade of life.

US

Thin wall well margined ovoid anechoic mass +/- fine internal echoes.

CT

Homogenous hypodense mass with thin wall at the classic location.

MRI

-Hypo to iso on T1, hyper on T2, +/-enhancement.

“**Beak sign**” on CT / MRI (curved rim of tissue or "beak" pointing medially between ICA & ECA) and is pathognomonic.

3rd & 4th branchial cleft anomalies

-Extremely rare and occur in children and young adults.

However, 3rd branchial cleft cyst

-Is the 2nd most common congenital lesion of the posterior cervical space after cystic hygroma.

-Lie in posterior cervical space posterior to SCM muscle.

-Must lie posterior to CCA / ICA.

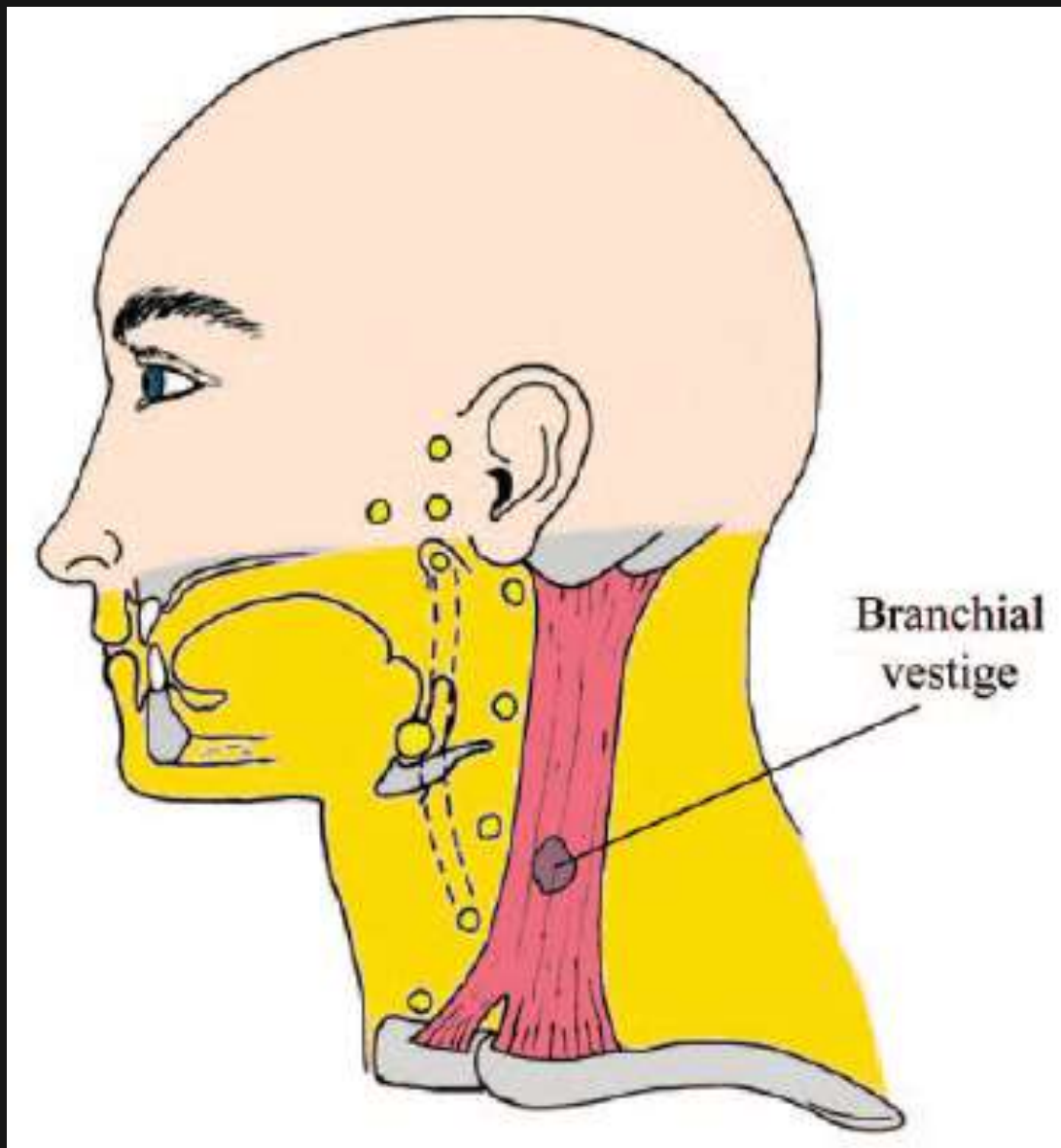
-Seen as unilocular cyst in posterior cervical space on CT & MRI.

-Cyst fluid vary in signal on T1, hyper on T2.

The 4th branchial cleft anomalies

-Usually manifest as a sinus tract rather than a cyst or fistula.

-Mostly occur on Lt side.

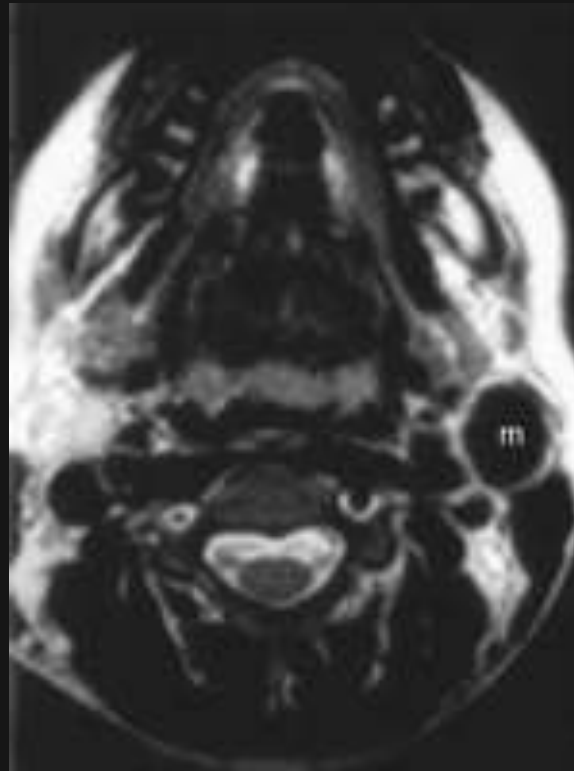


Drawing illustrates possible sites of branchial cysts and of skin openings of branchial sinuses and fistulas.

1st Branchial cleft cyst

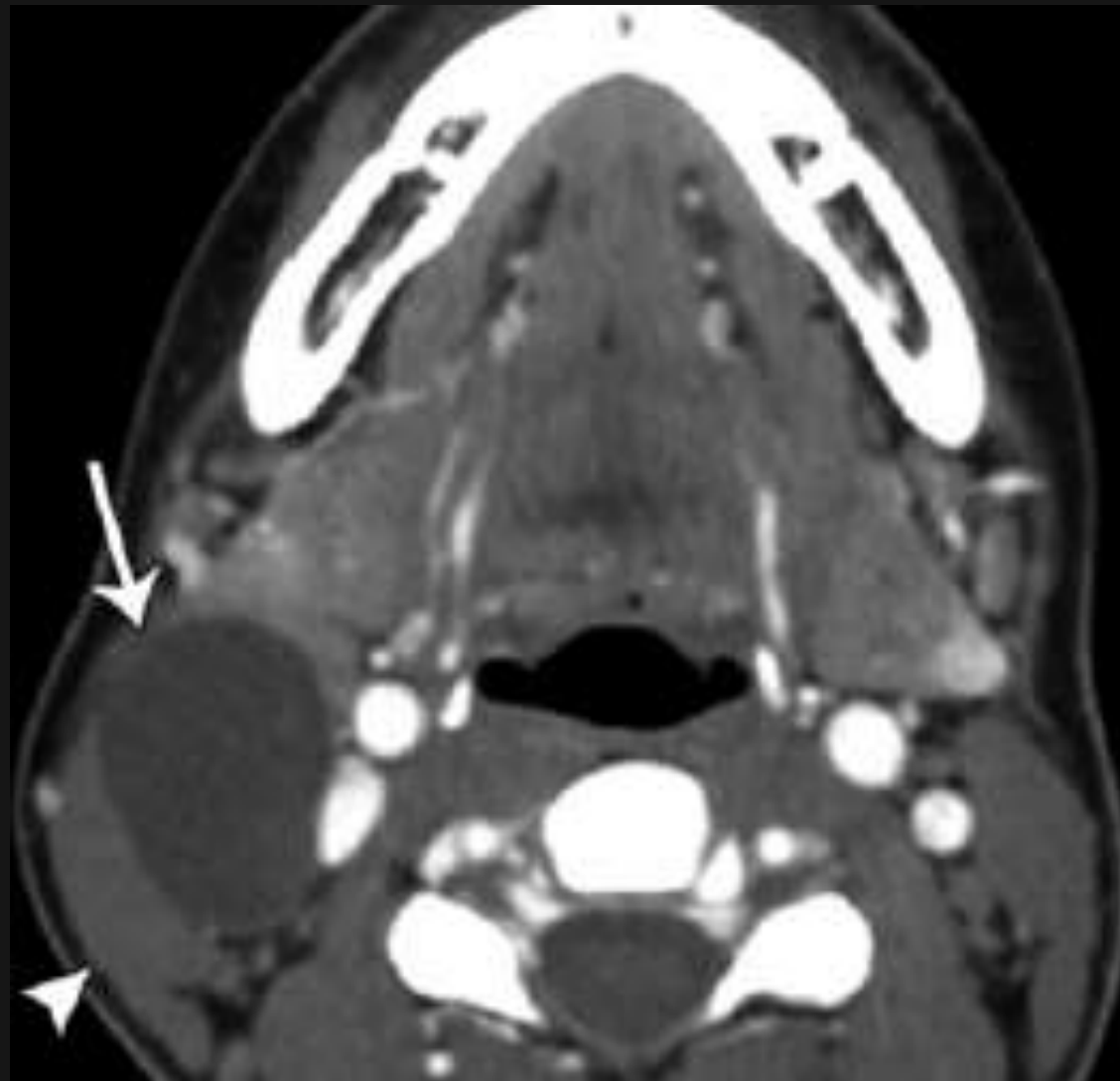


2nd Branchial cleft cyst

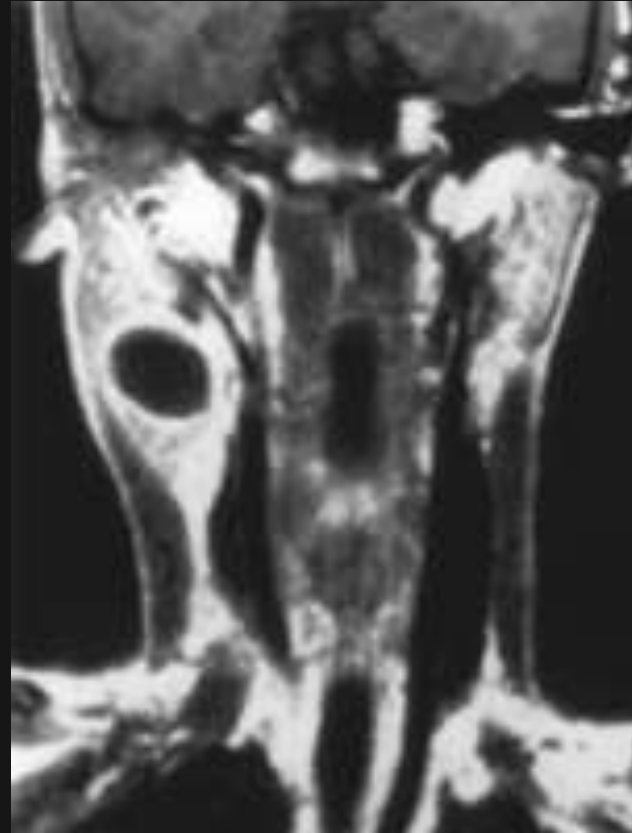
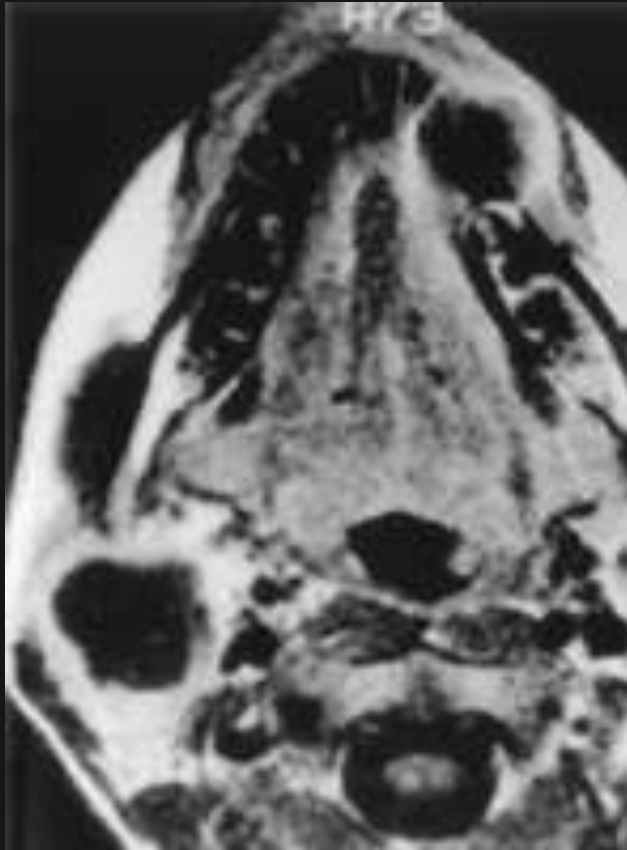


- (a) Axial T1 shows a well defined mass (*m*) along anterior border of Lt SCM (arrowhead), lateral to carotid space (white arrow), and posterior to submandibular gland (black arrow) (**classic location**). Increased intensity is due to proteinaceous debris / hage.
- (b) Axial T2 shows moderate to marked hypointensity (*m*).
- (c) Coronal FS T1-Gad shows mild rim enhancement (*m*).

2nd Branchial cleft cyst



2nd Branchial cleft cyst



- (a) Axial T1-Gad shows a hypointense mass in the Rt side of the neck in the classic location. Irregular inner border suggests an associated inflammation.
- (b) Coronal T1 shows the cyst at the inferior margin of Rt parotid gland and lateral to carotid vessels.

2nd Branchial cleft cyst



Fluid density mass



Fluid density mass with rim enhancement

Teratoma

Teratomas are common congenital neoplasms consisting of tissues of all three germ cell layers.

The spectrum of teratomas includes dermoid cysts, epidermoid cysts & teratoid cysts.

Fetal cervical teratomas are considered benign but malignant transformation may occur.

US

Heterogenous solid & cystic mass.

Calcifications, +/- cartilage and bone formation.

CT

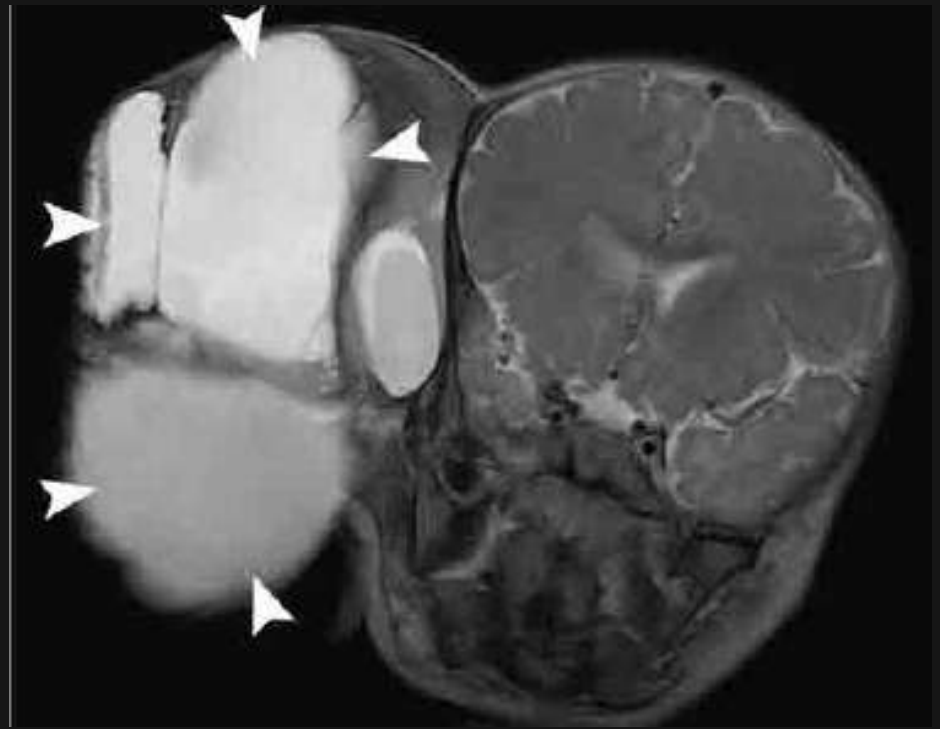
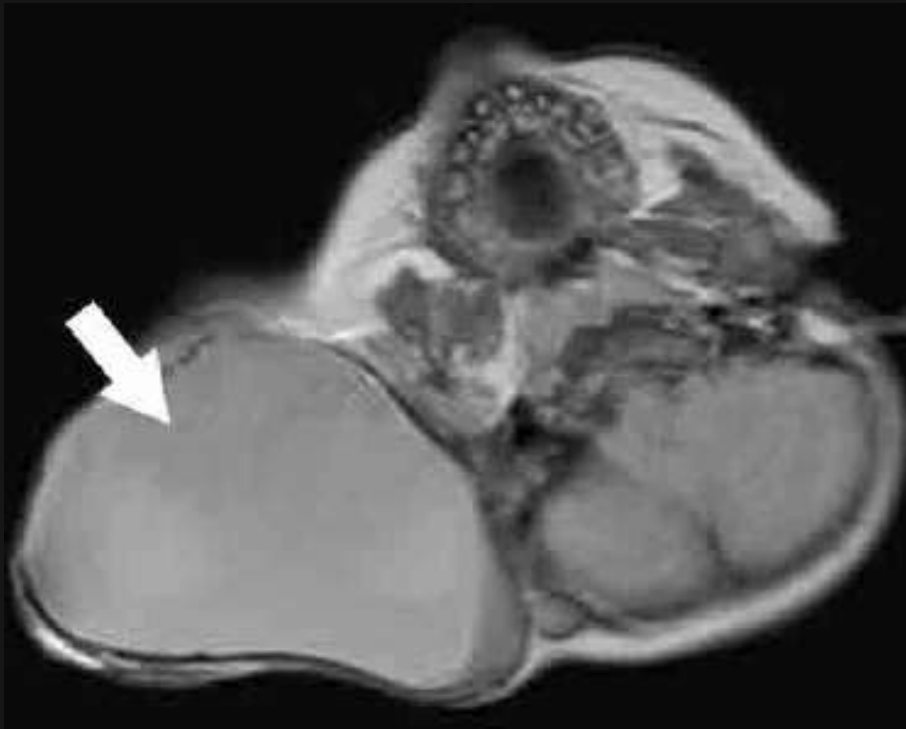
Hypodense thin wall unilocular mass with heterogeneous contents.

MRI

Hypo- isointense on T1.

Hyperintense on T2.

Teratoma



- (a) Axial PD shows a hyperintense subcutaneous mass in Rt side of the neck (arrow).
- (b) Coronal T2 shows multiple cysts with heterogeneous signal intensity (arrowheads).

Venous Malformation

Venous malformations are sometime wrongly classified as cavernous hemangiomas.

Unlike hemangiomas, they do not involute with time & may involve bone.

Venous malformations frequently affect oral cavity, extracranial H&N, may involve skeletal muscle in H&N region (masseter & pterygoid muscles +/- trapezius and SCM muscles).

-They are slow flowing lesions supplied by small arteries.

Color / power Doppler

-May not be able to detect flow in the lesion.

US

-Usually seen as a well marginated, ovoid, hypoechoic mass +/- fine internal echoes.

CT

-Lesions are isodense to muscle on unenhanced scans.

-Have variable patterns of enhancement.

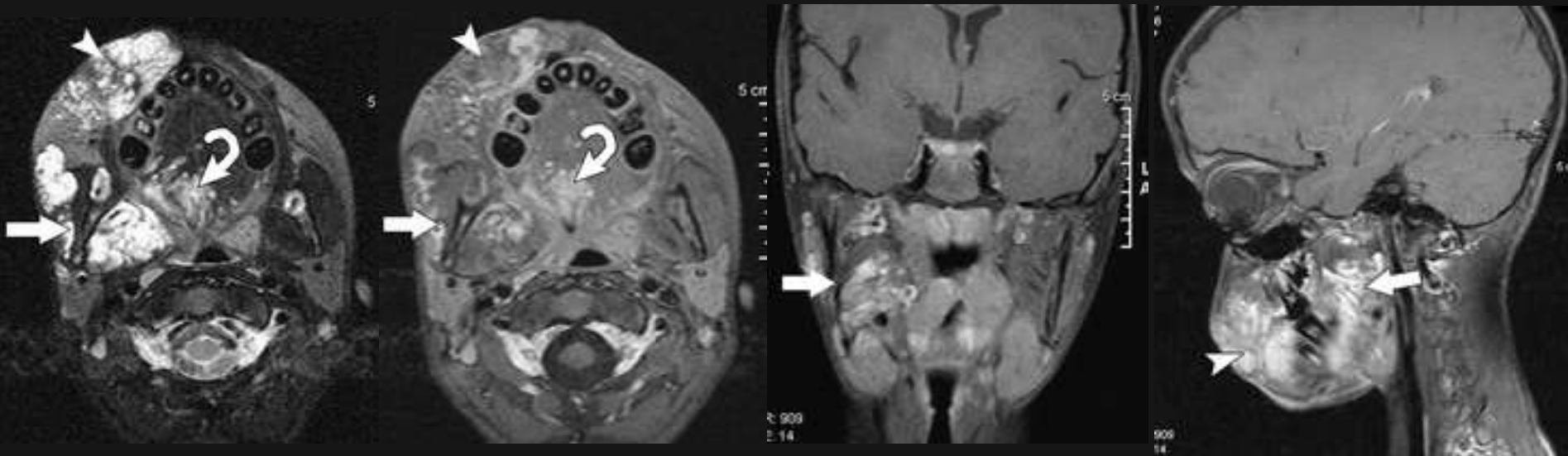
MRI

-They are iso / hyper on T1, hyper on T2.

-Show strong enhancement on T1-Gad.

-The presence of venous lakes / phleboliths as hypointense lesions on both T1 & T2 is more specific.

Venous malformations



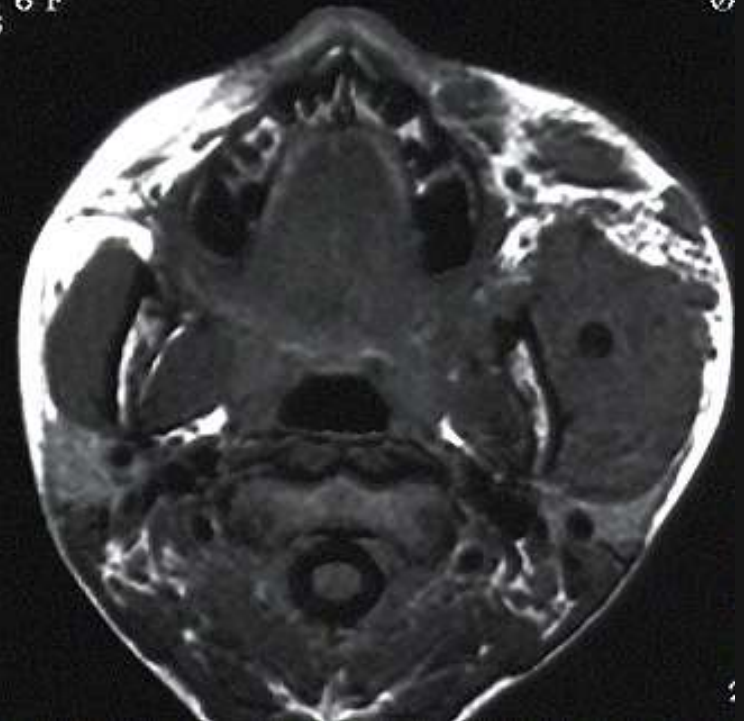
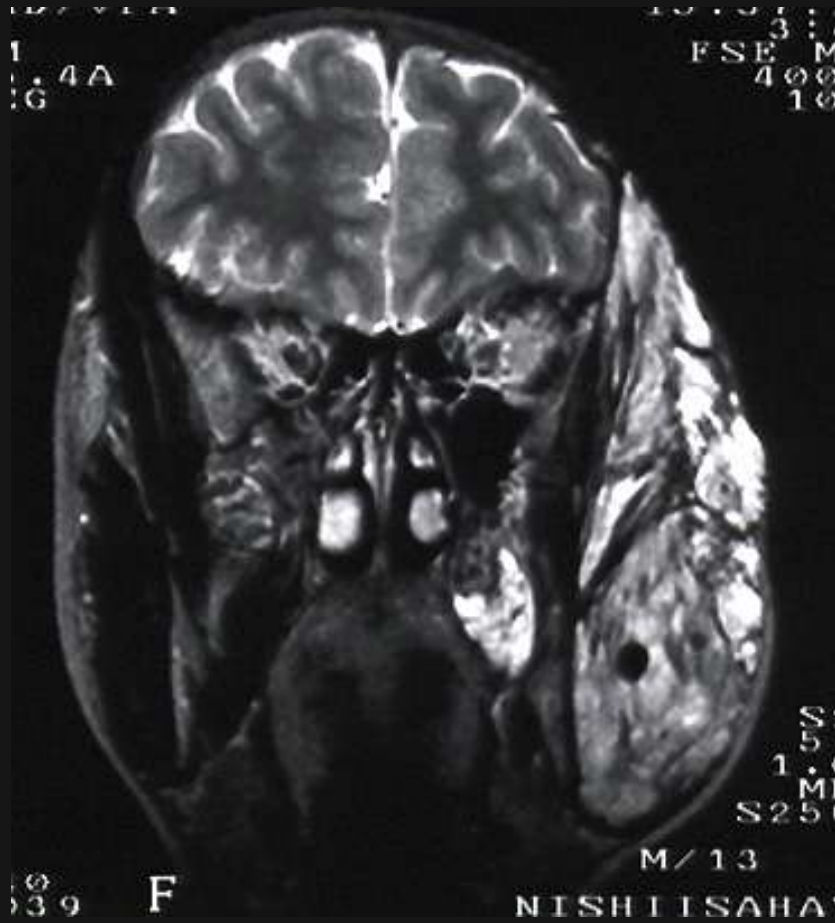
Axial T2 **(a)** and axial **(b)**, coronal **(c)** & sagittal **(d)** FS T1-Gad show a mass in Rt masticator space (straight arrow).

Associated infiltration of the superficial fasciae of lower lip (arrow-head) and deep infiltration of soft palate (curved arrow in **a** and **b**). The mass is hyper on T2 and shows enhancement on T1-Gad.

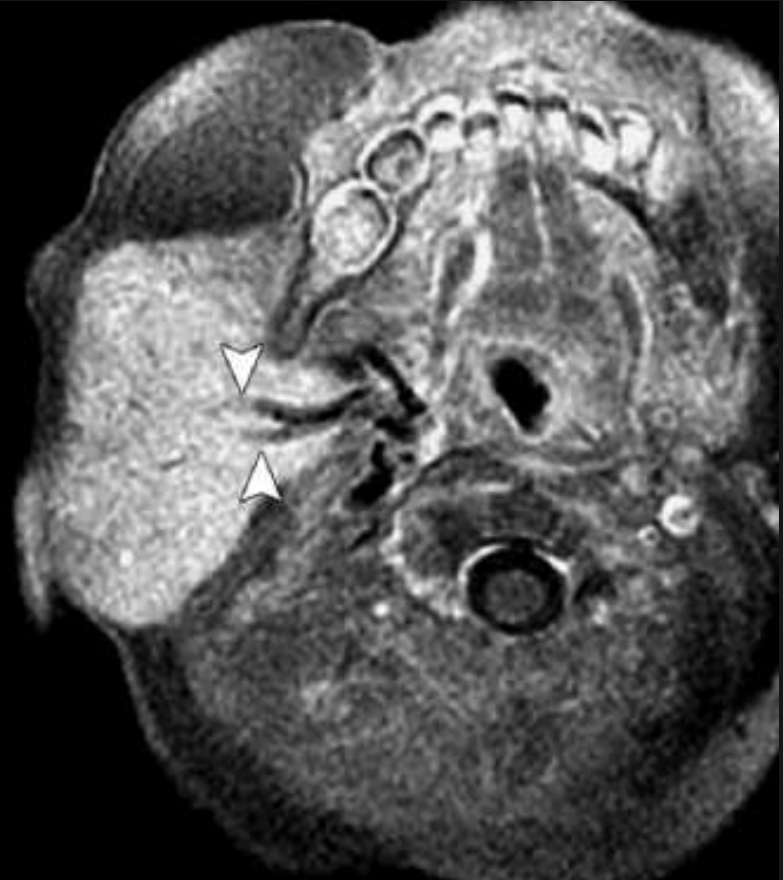
Hemangioma



Hemangioma



Hemangioma



Axial T2 shows a homogenous hyperintense multicompartmental mass (arrows) in Rt parotid, parapharyngeal & buccal spaces with several branching flow voids (arrowheads). The mass is slightly less intense than adjacent fat.

Axial FS enhanced T1 shows intense homogenous enhancement (arrowheads = flow voids).

Cap. hemangioma



Hypervascular mass with intense homogeneous enhancement (solid arrows) replacing the parotid gland. Note the deep lobe involvement with widening of the stylomandibular foramen (bracket) and extension into the parapharyngeal space (open arrow).

Cystic Hygroma

-Cystic hygroma is due to early sequestration of embryonic lymphatic channels.

-Alternatively, it may arise from a failure of the juguloaxillary lymphatic sac to drain into the IJV leading to congenital obstruction of lymphatic drainage.

Sites

-75-80% of cystic hygroma involve the neck and lower portion of the face.

-Posterior cervical space & oral cavity in children.

-Sublingual, submandibular and parotid spaces in adults.

Other locations include axilla, mediastinum, abdominal cavity (colon, spleen and liver), retroperitoneum (kidneys) & scrotum.

-They are infiltrative and do not respect fascial planes.

-Currently, it is believed that cystic hygroma and the other three types of lymphangioma (cavernous, capillary or simple lymphangioma) are manifestations of the same disease process.

US

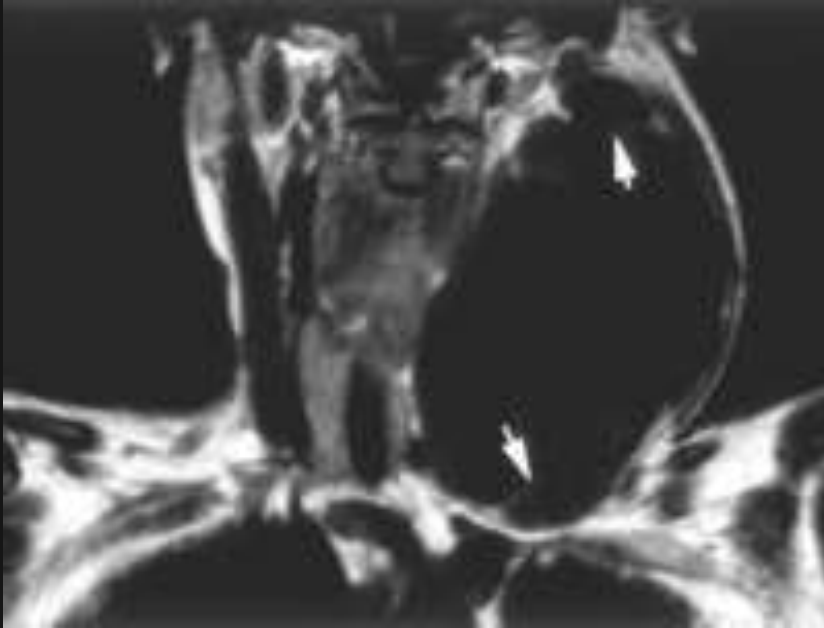
- Multilocular cystic mass with septa of variable thickness.
- Echogenic areas may present (clusters of abnormal lymphatic channels).
- Fluid levels are common.

CT

- Poorly circumscribed multilocular hypodense masses.
- Typically have homogeneous fluid attenuation with fluid levels.

MRI

- Hypo - iso on T1, hyper on T2.
- Fluid-fluid levels.
- The walls of the septa may enhance after contrast.
- Infection / haze can modify the signal intensity (High on T1).

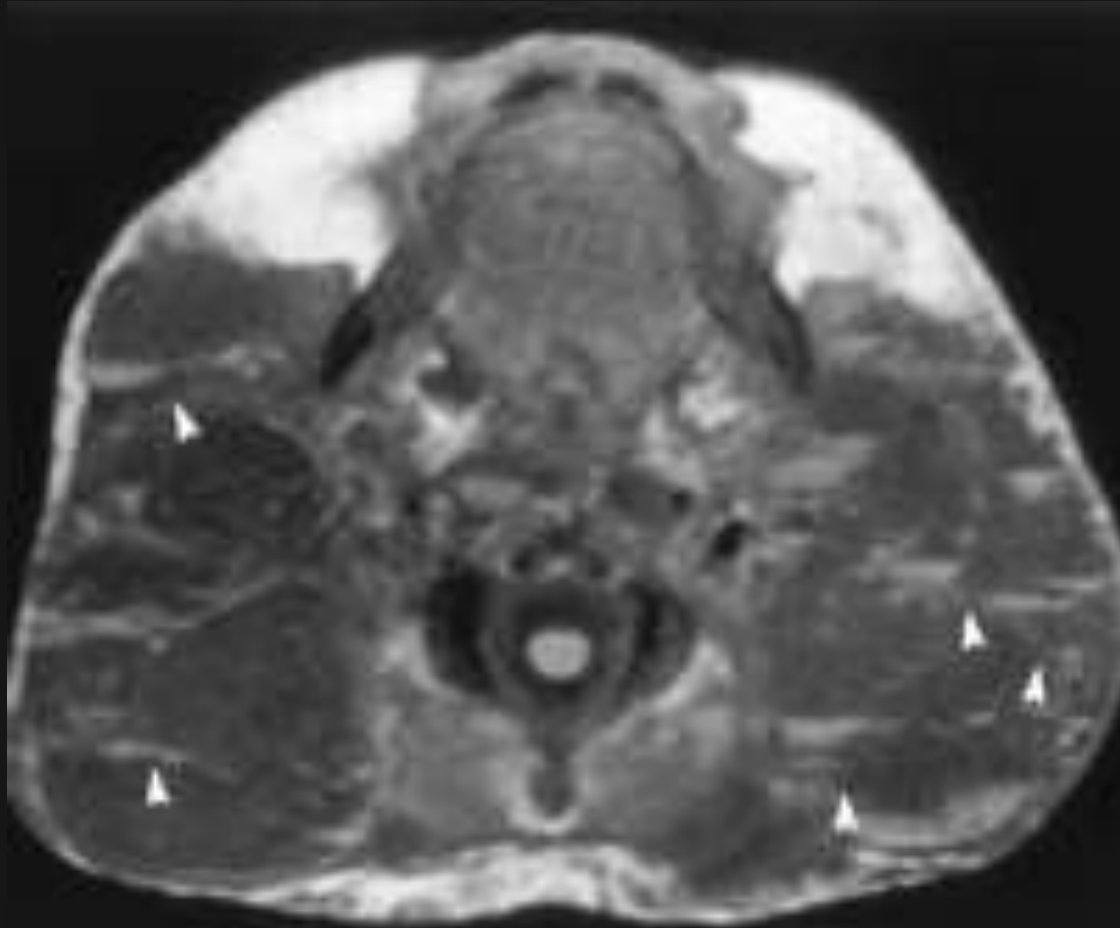


Enhanced CT shows a hypodense mass (*h*) in posterior cervical space deep to SCM muscle.



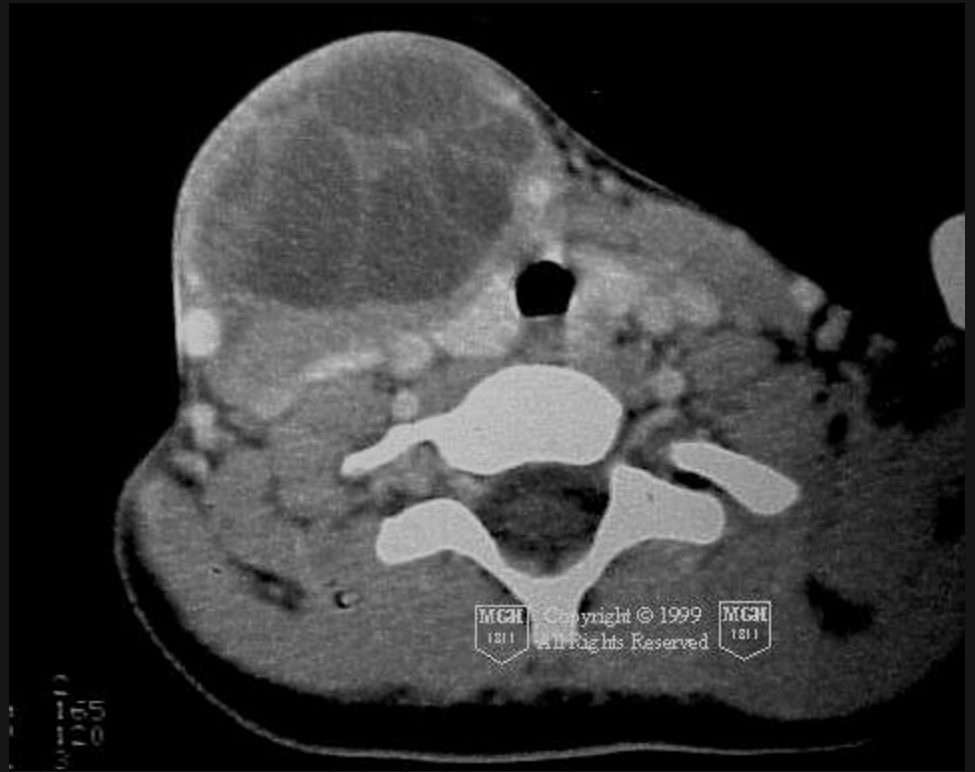
Coronal **(a)** & axial **(b)** T2 and axial FS T1-Gad **(c)** show a multiloculated cystic mass in the Lt posterior triangle of the neck (arrow). Cysts are hyper on T2 and show peripheral enhancement on T1-Gad.

Lymphatic malformations



Huge multi-septated cystic mass with hagic areas & fluid-fluid level.

Lymphangioma

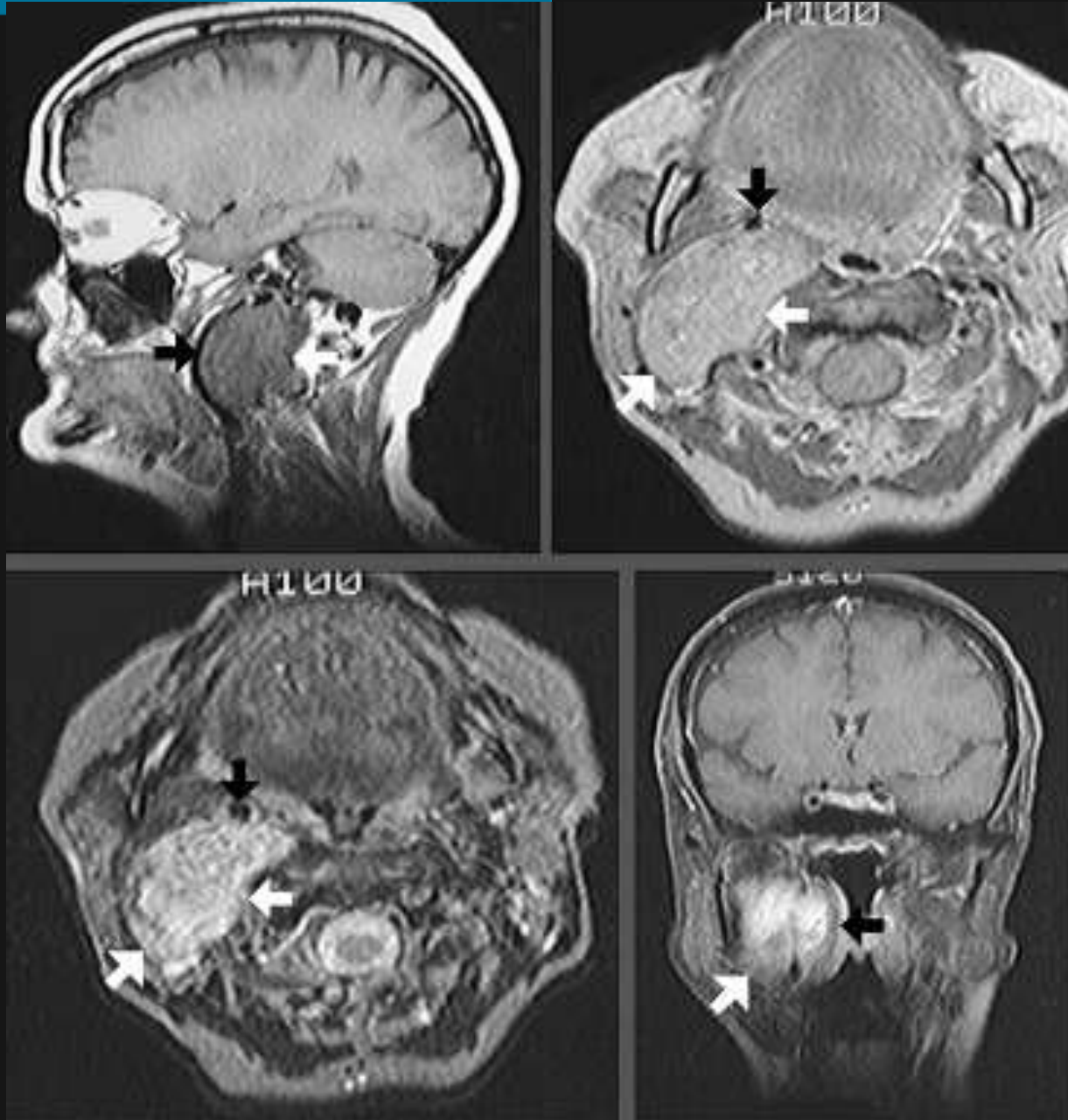


Lymphangioma



T2 FS shows a multiloculated mass with fluid levels and variable signal (arrows). The mass infiltrates the parotid, parapharyngeal & masticator (M) spaces.

Carotid sheath schwannoma



Hemangiopericytoma

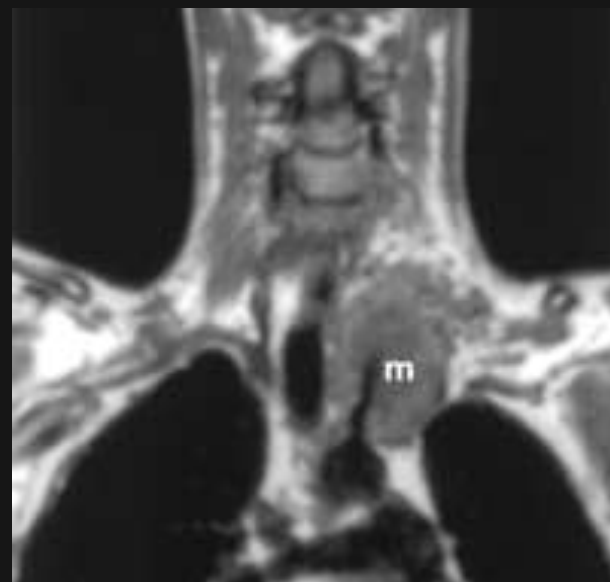
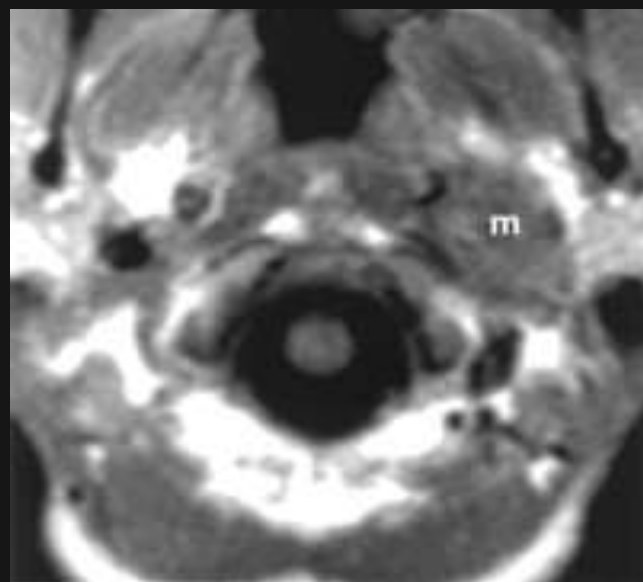
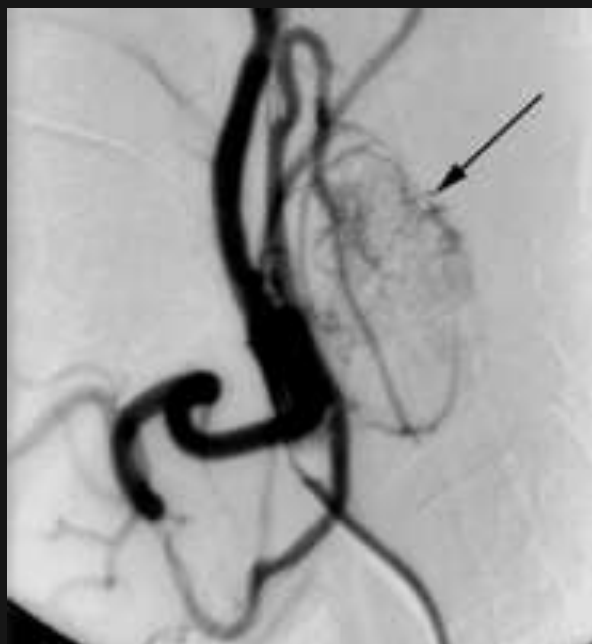


Coronal T1 shows a well defined homogenous Lt paraspinal mass (arrow) slightly hyperintense than muscle (arrowheads = pseudocapsule).

Axial T2 shows heterogenous predominantly hyperintense mass which extends into the transverse foramen (arrow). Peripheral low signal rim (arrowheads) is a pseudocapsule.

Enhanced CT shows avid enhancement.

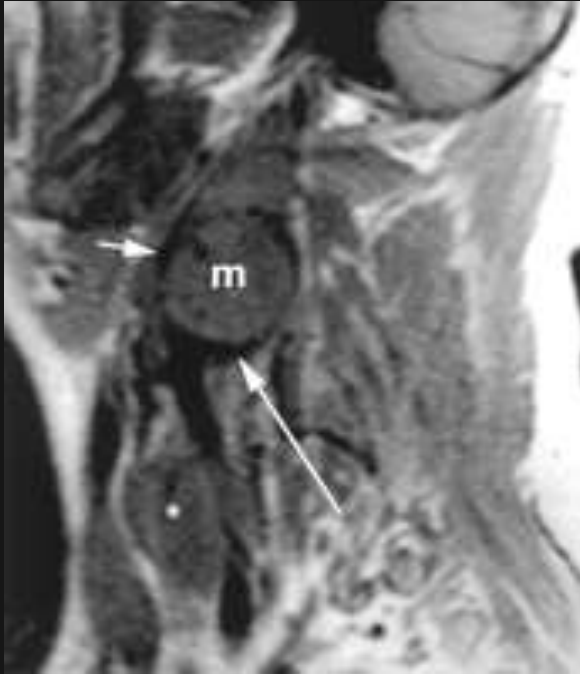
Vagus paraganglioma



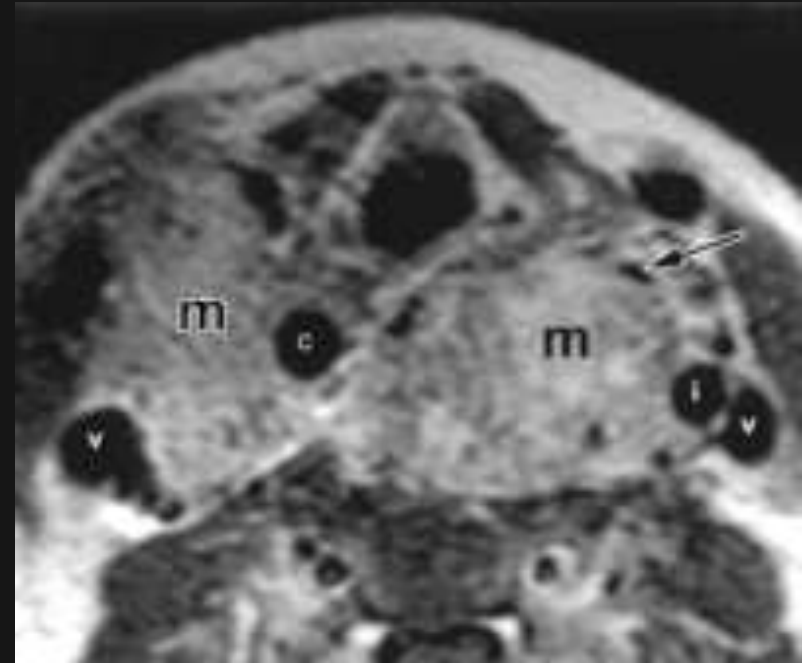
Carotid body T.



Bilat. Carotid body T.



Sagittal T1 shows a Lt sided neck mass that is iso to muscle at the level of the CCA bifurcation. The ECA (short arrow) is splayed from the ICA (long arrow). An additional component of the mass (*) extended inferiorly .



Axial T1 shows bilateral carotid space masses) *m* .(*c* = right CCA ,*i* = left ICA ,
v = IJV, arrow = ECA .

Thyroglossal Duct Cyst

Site suprahyoid location (20%), at level of hyoid bone (15%) and in infrahyoid location (65%).

About 50% present before 20 years of age.

Manifests as an enlarging painless midline mass in a pediatric or young adult patient.

US

-Hypoechoic mass with a thin outer line.

-Lie in midline of the anterior neck close to the hyoid bone or paramedian within the strap muscles.

-Heterogeneity in the cyst is due to the proteinaceous content.

CT

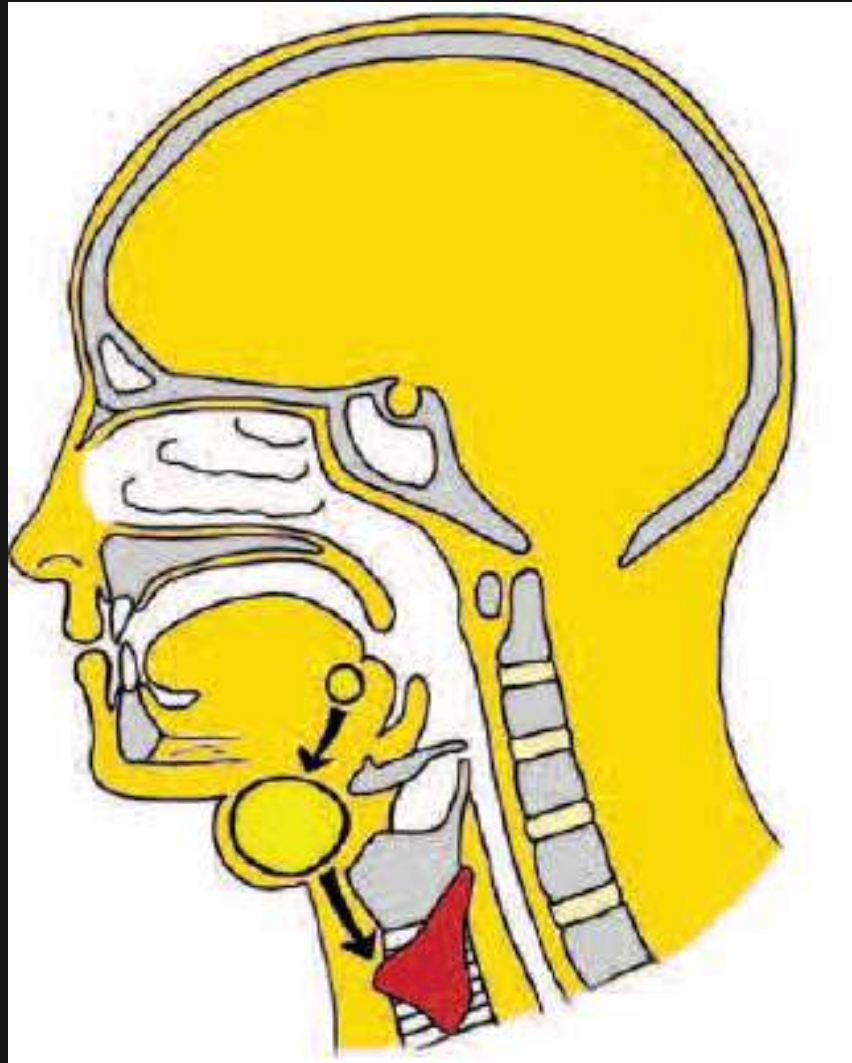
-Well circumscribed masses with thin walls & fluid content (10-18HU).

-Rim enhancement may be observed after contrast.

MRI

-Uncomplicated cyst is low on T1 & high on T2.

Rim enhancement may occur

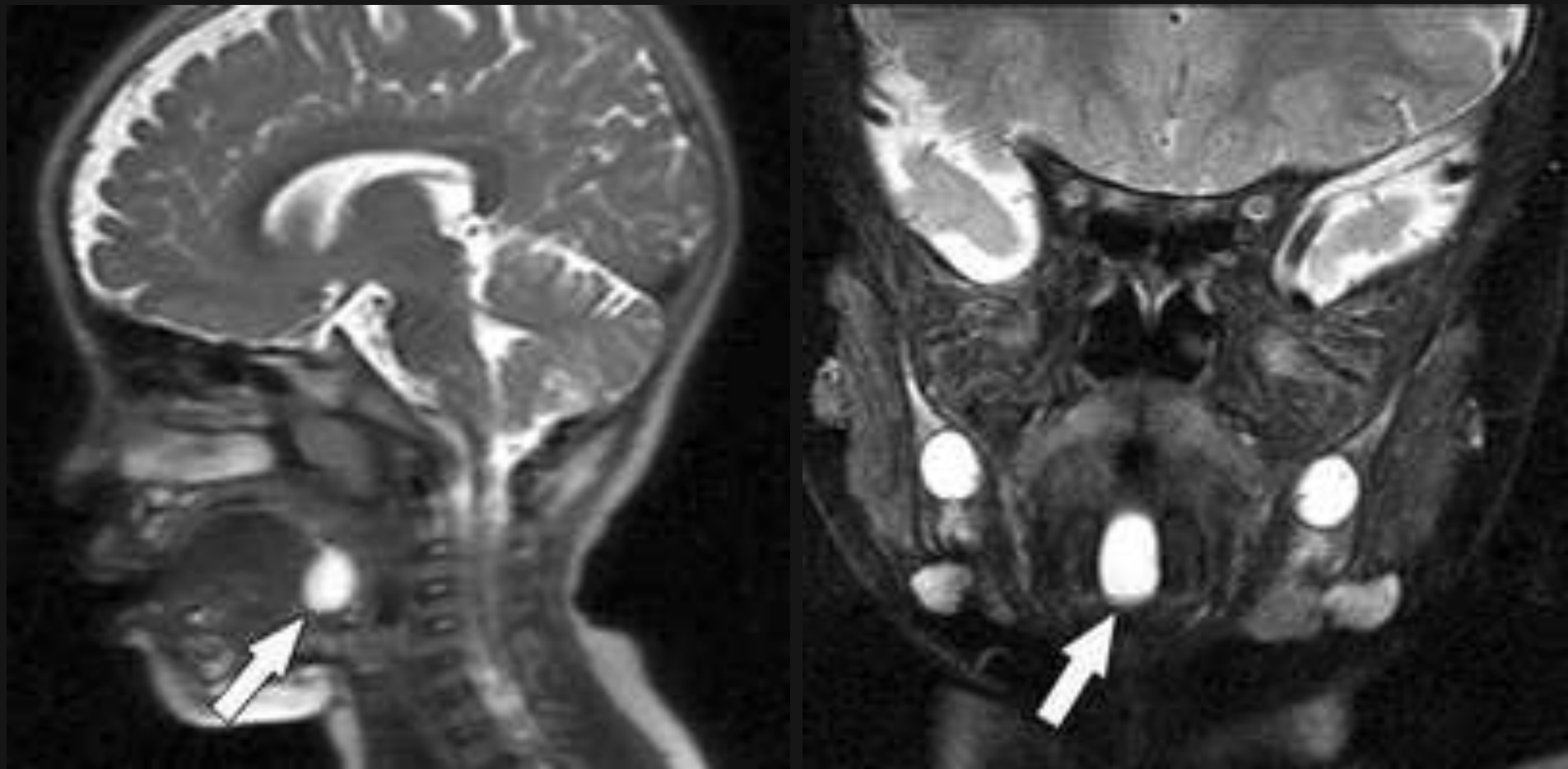


Drawing illustrates possible locations of lingual and cervical thyroglossal duct cysts. Arrows indicate the migration pathway of the thyroid tissue.



Thyroglossal duct cyst in a 41y old man.

Enhanced CT show a cystic mass in the anterior midline of the neck at the level of hyoid bone.



Thyroglossal duct cyst in a 3y-old boy.

Sagittal **(a)** & coronal **(b)** T2 show a hyperintense midline cystic mass of the foramen cecum (arrow).

Laryngocele

- The laryngeal ventricle (of Morgagni) is a slitlike cavity, the orifice of which lies between the false and true vocal cords.
- Laryngeal saccule or appendix arises along the anterior third of the roof of this ventricle arises a small blind pouch.
- The saccule extends superiorly between the false vocal cord and aryepiglottic fold medially and the thyroid cartilage laterally.
- So, a laryngocele is a dilated laryngeal saccule.

Types are internal (40%), external (26%)& mixed (44%).

Internal type is confined to the larynx and do not pierce the thyrohyoid membrane.

External type extend through thyrohyoid membrane.

-Infection of laryngoceles occurs in 8:10% and is called a laryngopyocele

X-Ray

-Sharply defined round or oval radiolucent area in paralaryngeal soft tissues (external / mixed laryngocele).

CT

-Well defined smooth mass in the lateral aspect of superior paralaryngeal space.

-The density vary depending on the amount of secretions, air & soft tissue from an associated laryngeal neoplasm.

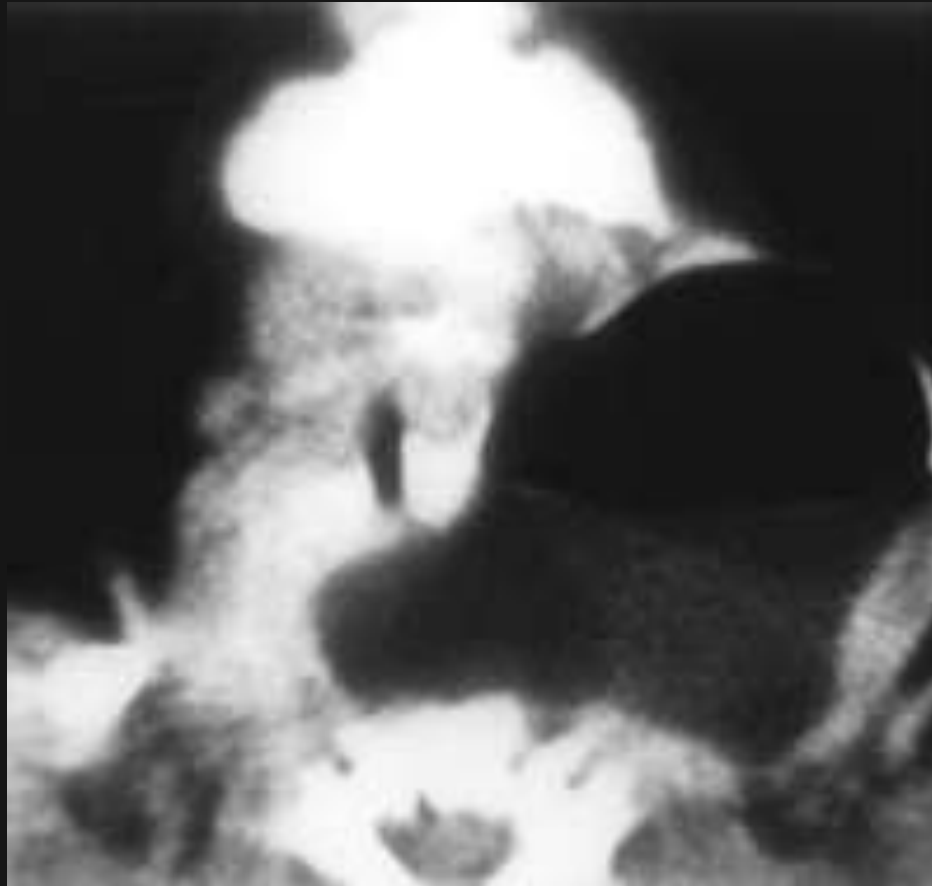
-It may be filled entirely with air or contain air-fluid level.

-If it is obstructed, it may be completely filled with mucoid secretions.

-The presence of soft-tissue density within a laryngocele suggests an underlying laryngeal neoplasm.

MRI

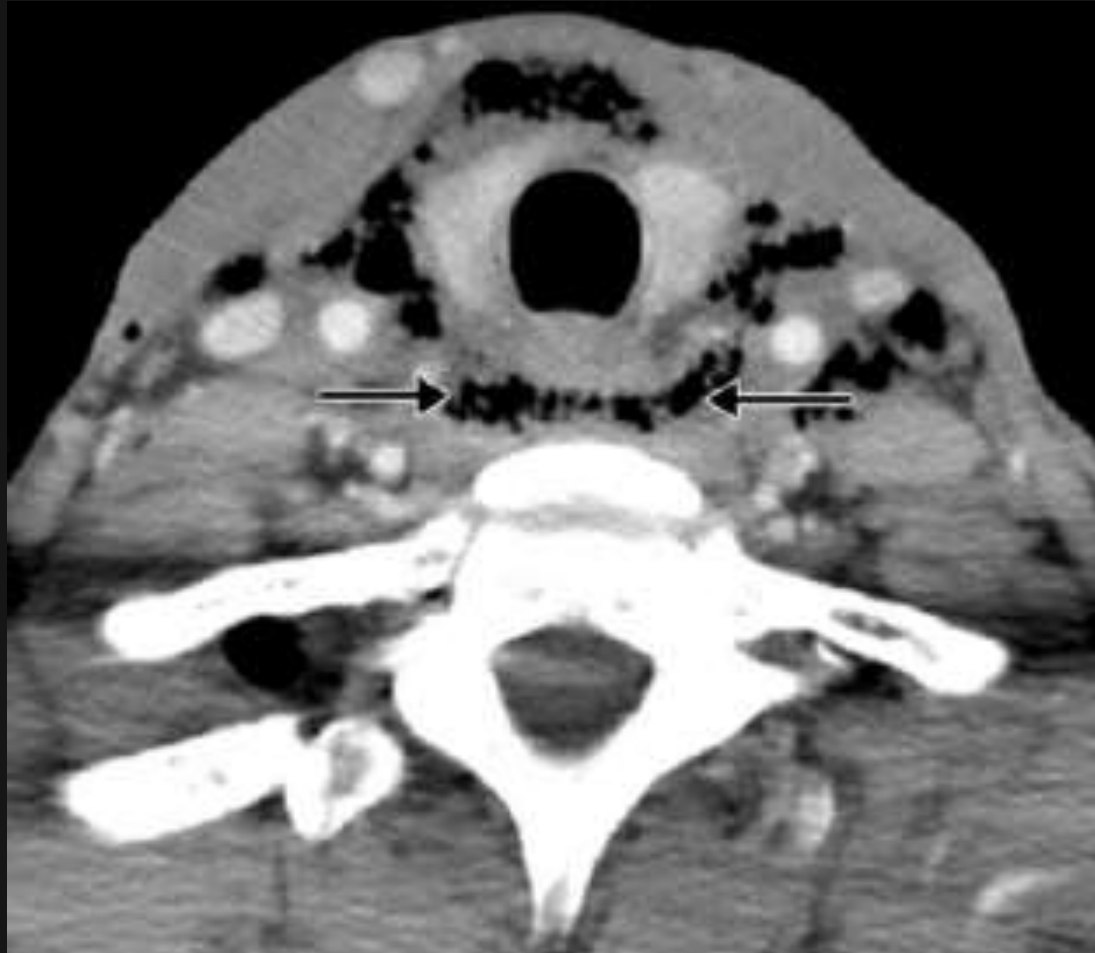
-Superior to CT for distinguishing the laryngocele from an underlying laryngeal neoplasm.



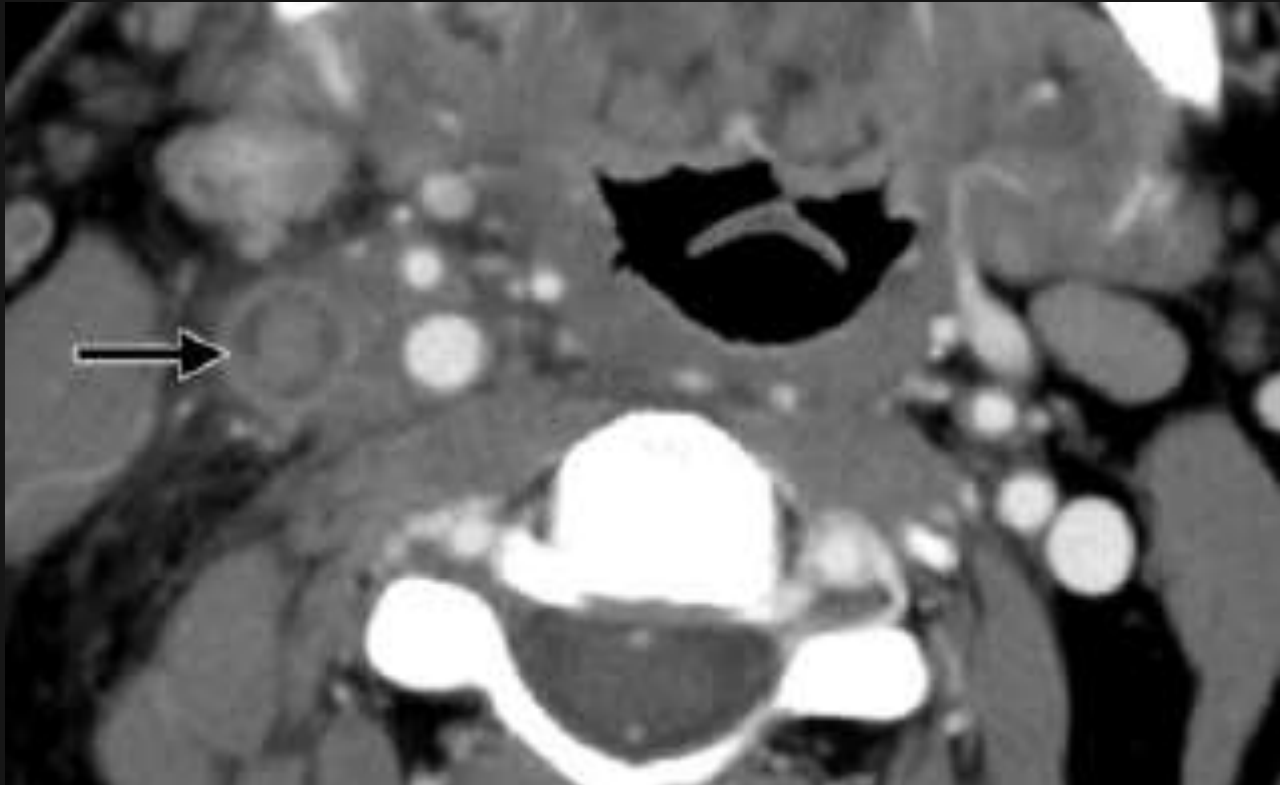
Congenital laryngocele in a 2-day-old infant boy.

CT shows a large retro & paratracheal cystic lesion displacing and narrowing the airway lumen. Air-fluid level within the mass suggests communication with the airway.

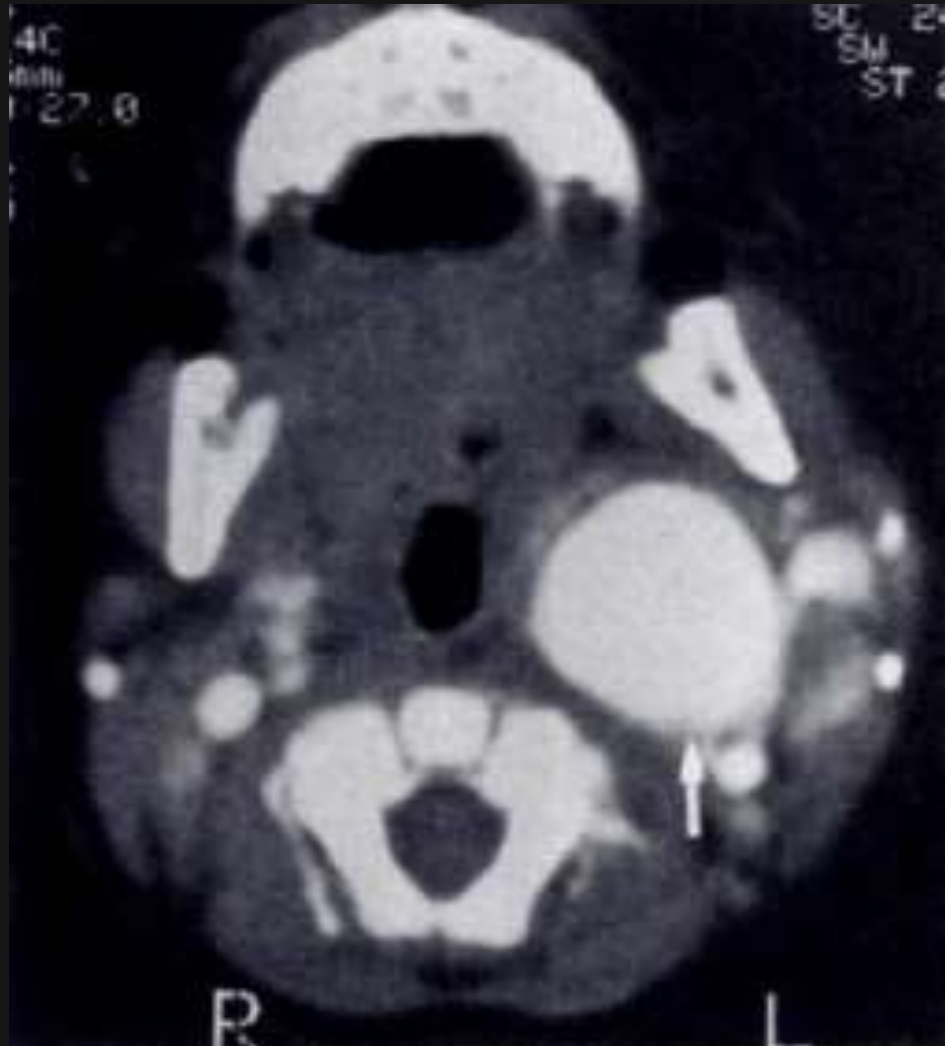
Subcutaneous emphysema



IJV thrombosis

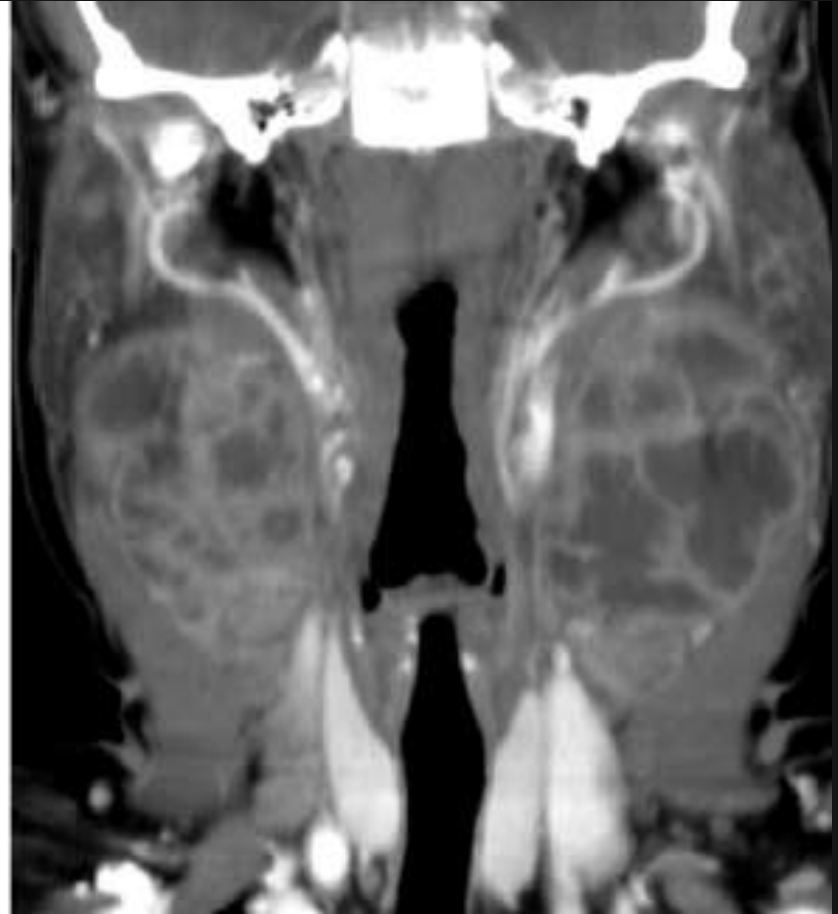


Aneurysm

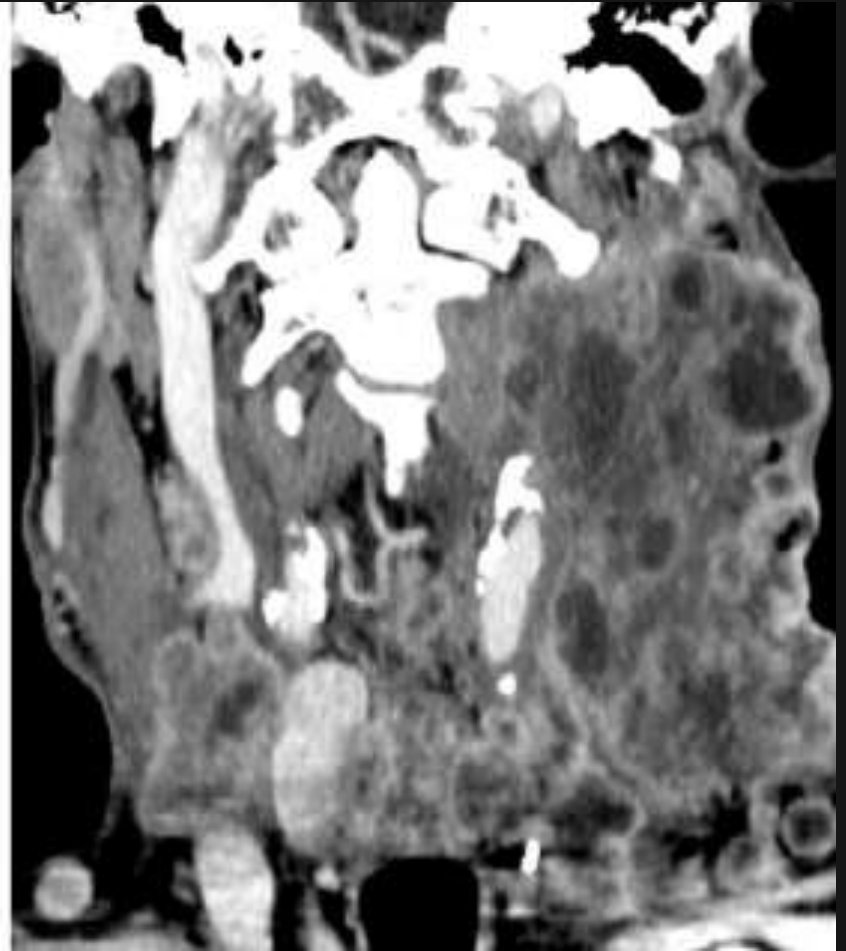
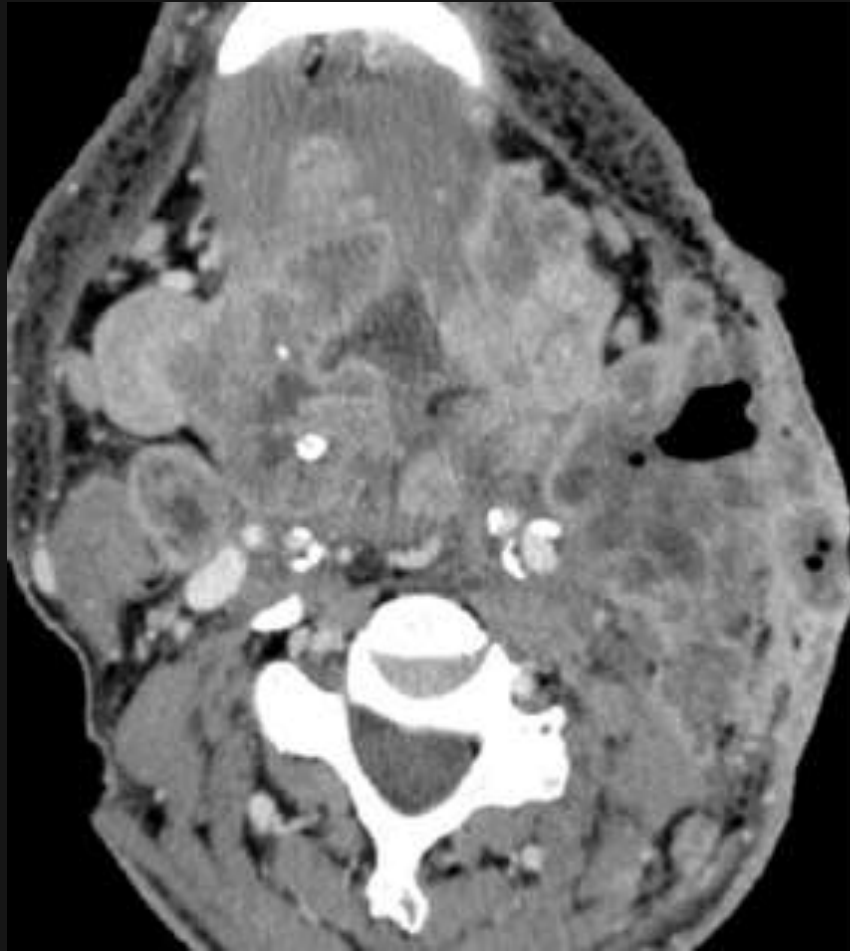


Lymphoma

Suppurative lymphadenitis



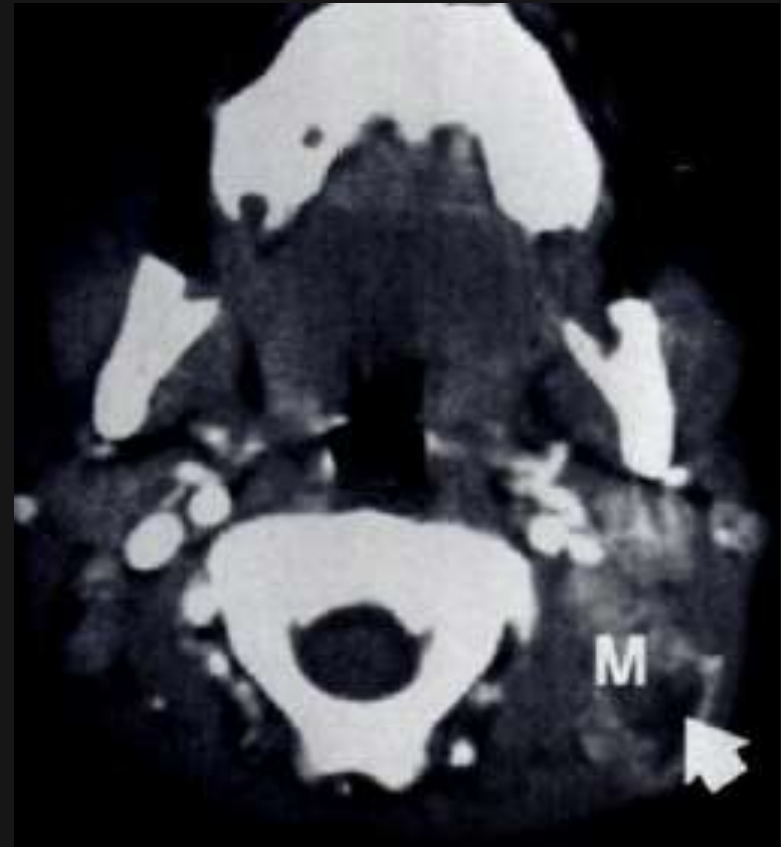
Necrotic lymphadenopathy (Sq.c.c.)



LN metastasis



TB lymphadenitis



NHL





THANK YOU