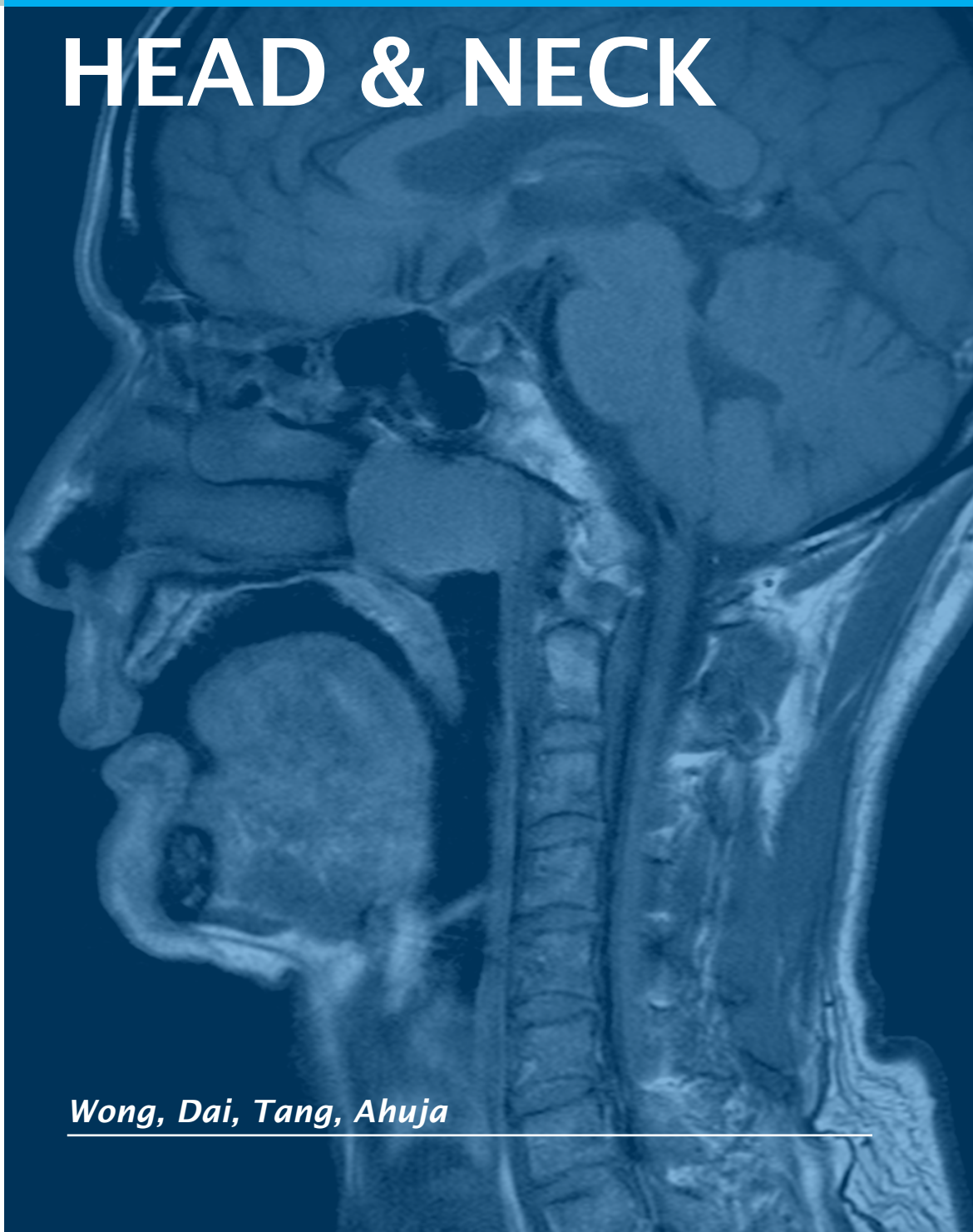
Section 1

HEAD & NECK



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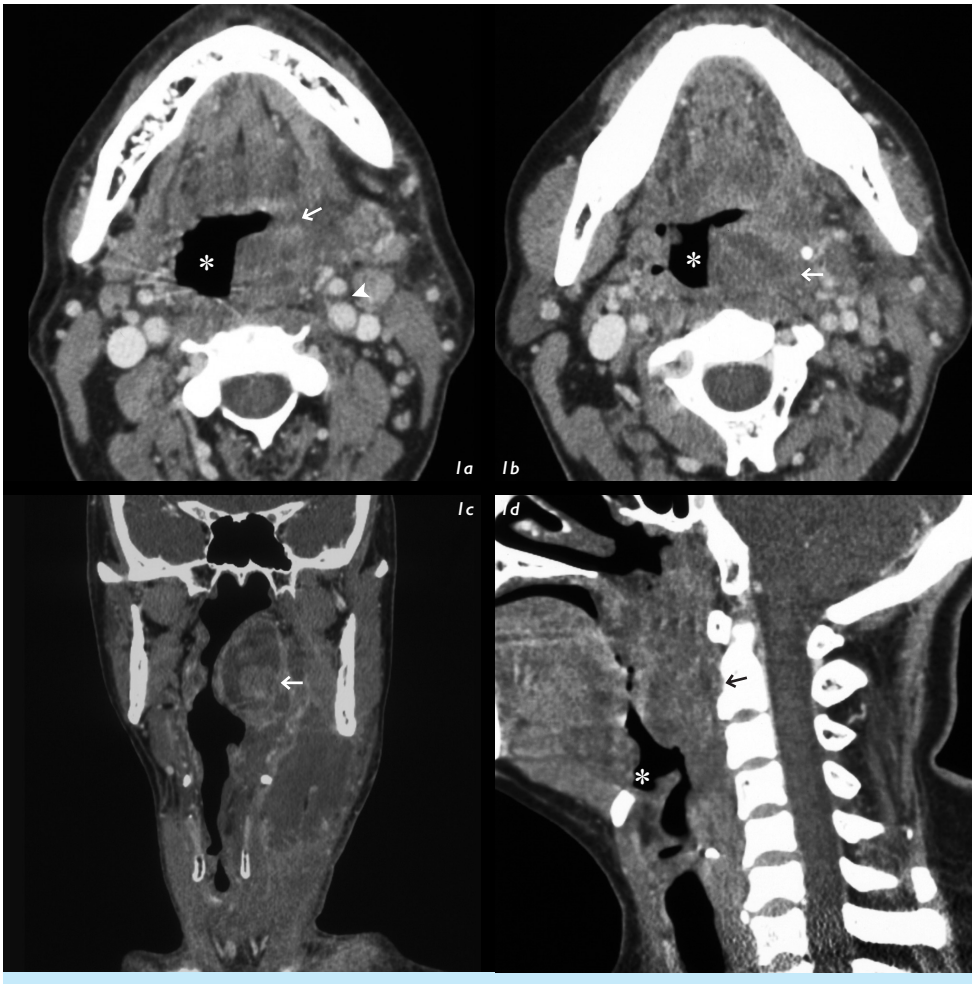
Section 1

Head & Neck

Chapter 1

A 30-year-old gentleman presented to the emergency department with 3 days history of fever and sore throat. Physical examination showed enlarged left tonsil with exudate. An urgent CECT of the neck was performed to rule out peritonsillar abscess (Figs 1a-d)

What are the imaging findings and diagnosis?



Findings:

- Axial (Figs 1a, b), coronal (c) & sagittal (d) CECT show enlarged left tonsil (→) with multiple small round hypodense areas with rim enhancement. The oropharyngeal airway (*) is mildly narrowed. Note the relationship of the abscess to the carotid sheath (▲).

Diagnosis: Acute tonsillitis with peritonsillar abscess

1 Neck Abscess

Introduction

- Neck abscess is an acute condition and can be classified according to etiology and location.
- Common etiologies include foreign body ingestion / impaction, acute tonsillitis, dental caries and iatrogenic (eg. postoperative).
- Common locations include tonsil (Figs 1a-e), submandibular and masticator spaces. There may be extension down the oro- / hypopharynx and mediastinum (Figs 1f ,g).

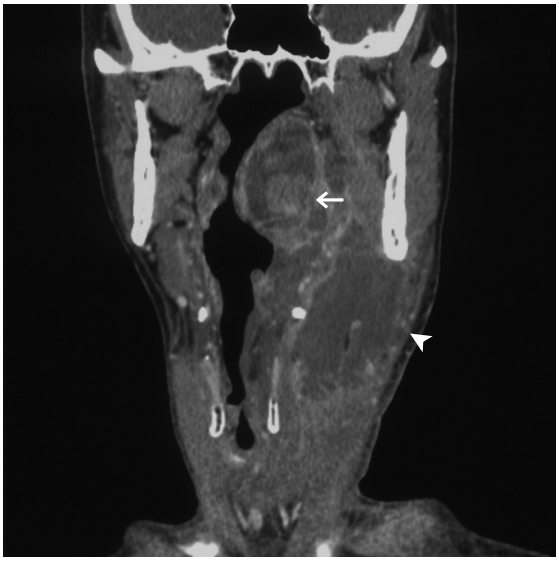


Fig 1e Coronal CECT neck in a drug abuser shows enlarged left tonsil (→) and large neck abscess (▲), seen as multiple hypodense rim enhancing areas extending inferiorly to the left submandibular space and lower neck.

Fig 1f Axial CECT thorax (same patient as above) shows a small hypodense abscess collection in the superior mediastinum (→).

Tonsillar Abscess *Submandibular Abscess* *Oro-/ hypopharyngeal Abscess*

Neck Abscess 1

Fig I g Axial CECT shows large rim enhancing abscess (→) at the left oropharynx, causing significant narrowing of the airway (*).

- Symptoms depend on location of the abscess and can include sore throat, dysphagia, trismus. Systemic symptoms such as fever and chills are usually present.
- CECT is the preferred Imaging modality, particularly in evaluating the deep extent and any inferior extension into the mediastinum. Typical features include a hypodense lesion with rim enhancement. Extension to the retropharyngeal space or mediastinum should also be looked for.
- Although MRI is an alternative imaging modality, its limited availability and longer duration of scan makes it less applicable in acute clinical abnormalities in the neck.

Sterno-cleidomastoid Muscle Abscess

Masticator Space Abscess

1 Neck Abscess

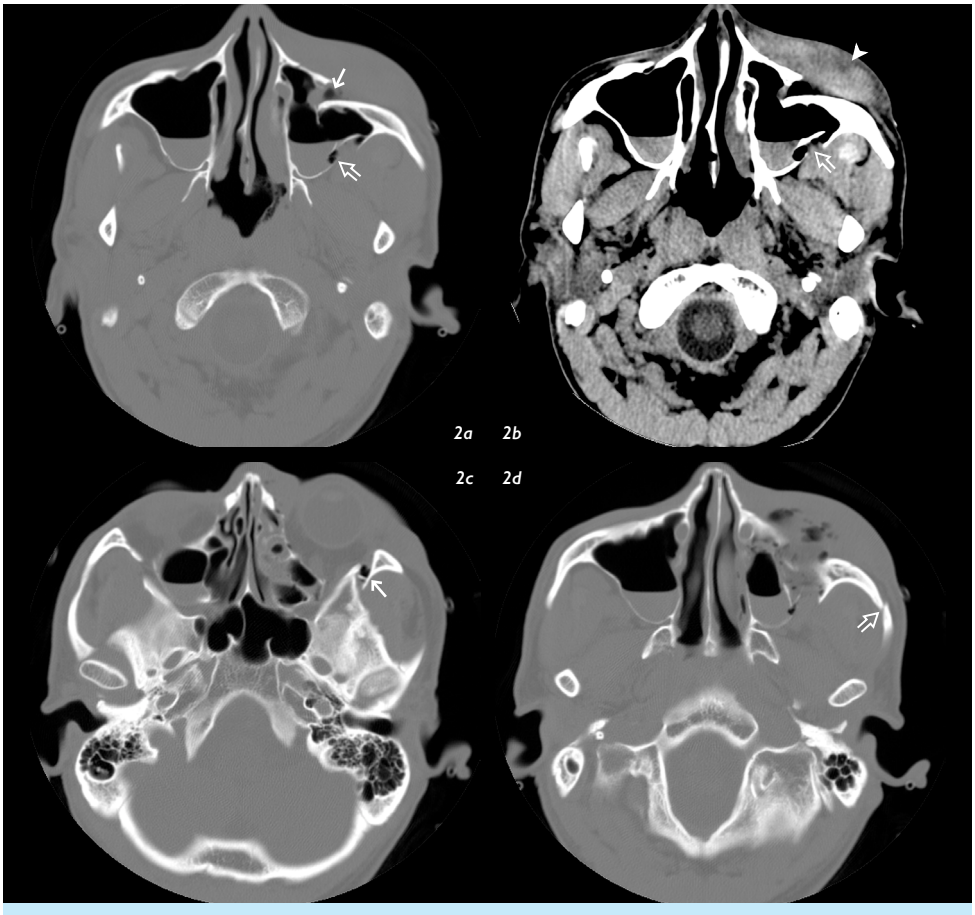
PEARLS:

- Common locations of neck abscess include tonsil, submandibular and masticator spaces. There may be extension to the mediastinum, parapharyngeal and retropharyngeal spaces.
- CECT is the imaging modality of choice. It is readily available, fast and provides excellent anatomical details of local and regional extent.

Chapter 2

A 30-year-old lady was involved in a road traffic accident. She was a pedestrian and was hit by a car at a speed of 40km/hr. She suffered craniofacial injury. She was conscious on arrival to the accident and emergency department and physical examination revealed left facial and periorbital bruises. An urgent CT scan was performed to evaluate craniofacial trauma. (Figs 2a-d)

What are the imaging findings and diagnosis?



Findings:

- Axial CT bone window (Fig 2a) and soft tissue window (Fig 2b) shows moderately displaced fracture of the left maxillary sinus (→). The presence of fluid in the maxillary sinus suggests a hemosinus (⇨). Note the left facial soft tissue swelling (⮝).
- Axial CT bone window (Figs 2c and d) shows fracture of the left lateral orbital wall (→) and fracture of the left zygomatic arch (⇨).

Diagnosis: Left tripod and orbital fractures

2 Facial and Orbital Fractures

Introduction

- Facial and orbital fractures are commonly found in patients sustaining cranial or facial injury.
- Clinical presentations:
  - History of head or facial Injury
- Facial or periorbital swelling and bruising
- Orbital involvement: proptosis, diplopia
- Skull base involvement: CSF rhinorrhoea / otorrhoea
- Associated head / neck injury: neurological symptoms
- Common fracture patterns:
  1. Tripod fracture (Figs 2a-d)
     - zygomatic arch, zygomaticofrontal suture, orbital floor
     - due to direct blow to the lateral aspect of the face
     - associated with effusion / blood in the maxillary sinus
     - may extend to the frontal sinus (Fig 2e)
  2. Blowout fracture (Figs 2e-i)
     - orbital floor
     - due to direct blow to the globe, which transmits the energy to the orbital floor. The orbital floor and lamina papyracea are the weakest walls of the orbit

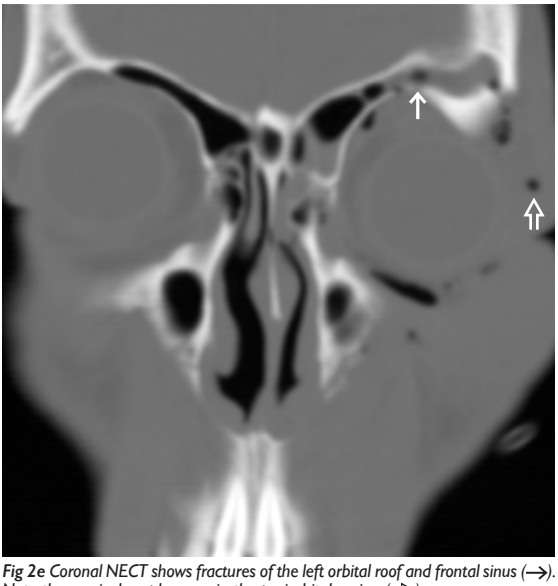


Fig 2e Coronal NECT shows fractures of the left orbital roof and frontal sinus (→). Note the surgical emphysema in the periorbital region (⇨).

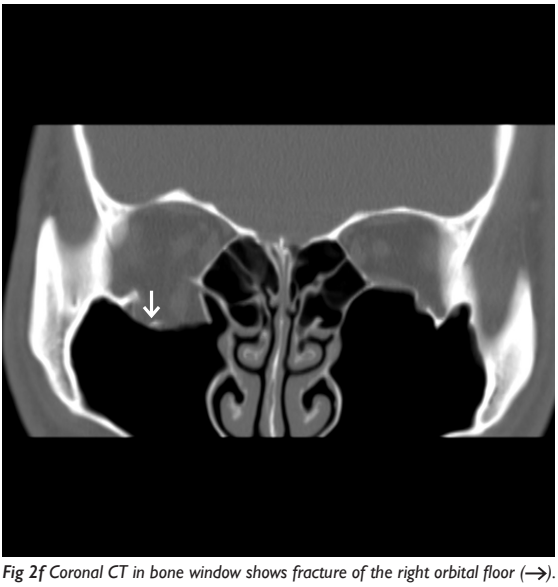


Fig 2f Coronal CT in bone window shows fracture of the right orbital floor (→).

Tripod Fracture *Blowout Fracture*

Fig 2g Coronal CT in soft tissue window shows herniation of right orbital fat into the right maxillary sinus (→), following a fracture of the orbital floor.

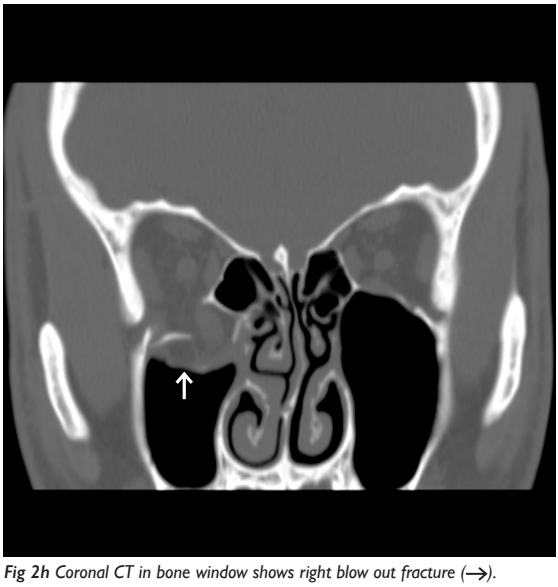


Fig 2h Coronal CT in bone window shows right blow out fracture (→).

3. Le Fort fracture
   - Fracture involving the mid face, leading to separation of the maxilla from the skull base
   - Pterygoid plates are always involved
   - Type 1: alveolar process of maxilla, inferior wall of maxillary sinus
   - Type 2: lateral wall of maxillary sinus, inferior orbital rim, nasal bone
   - Type 3: nasofrontal suture, maxillofrontal suture, zygomatic arch, leading to craniofacial dysjunction

Complications

1. Entrapment of extraocular muscles (EOM): EOM may herniate into the maxillary sinus in a blowout fracture.
   The fracture fragment may spring back and entrap the EOM (Figs 2h, i)
2. Cranial nerve palsy: extension of fracture to the skull base foraminae, eg. optic canal, superior and inferior orbital fissures

EOM Entrapment

2 Facial and Orbital Fractures

Imaging Modalities

- CT is the preferred modality due to its speed of acquisition and excellent bony details in characterizing fracture pattern

PEARLS:

- Tripod and blowout fractures are common patterns of facial fractures
- Potential complications include entrapment of extraocular muscles and cranial nerves

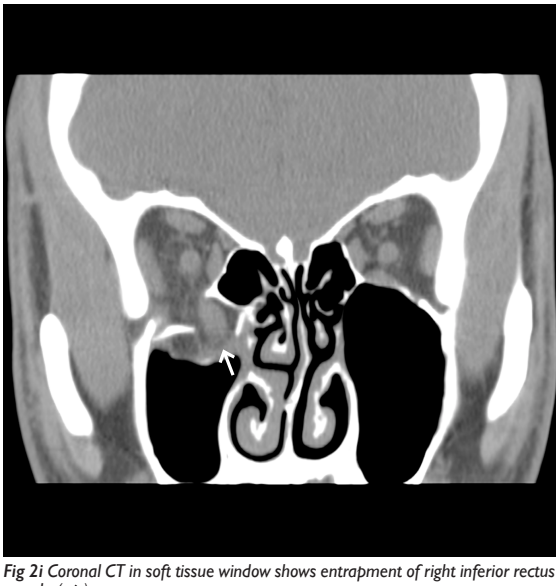
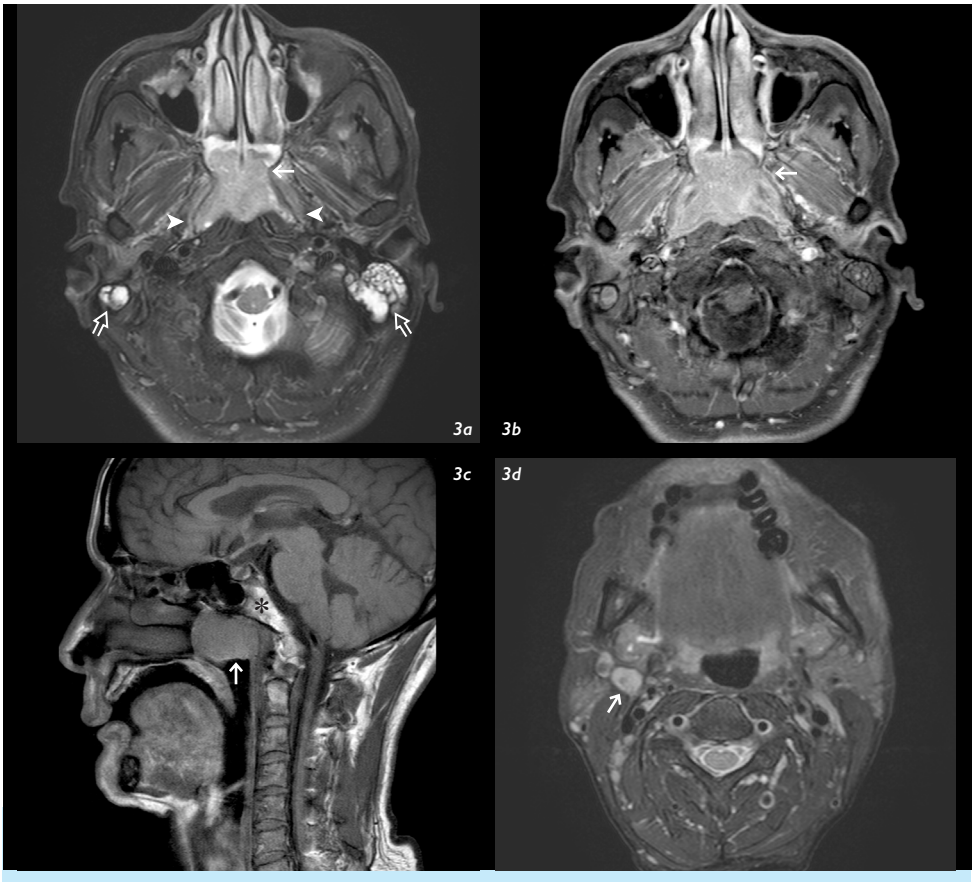


Fig 2i Coronal CT in soft tissue window shows entrapment of right inferior rectus muscle (→).

Chapter 3

A 50-year-old gentleman presented with 2 month history of bilateral hearing loss and epistaxis. Physical examination revealed bilateral middle ear effusion. Nasoendoscopy revealed a large mass at the nasopharynx (NP). MRI scan was performed for further evaluation of the NP mass (Figs3a-d)

What are the imaging findings and diagnosis?



Findings:

- Axial T2W (Fig 3a) and post-Gd T1WFS (Fig 3b) images show a large soft tissue mass epicentered at the nasopharynx (→) with bilateral involvement of fossa of Rosenmuller (▲). Note bilateral ostomastoid effusion (⇨).
- Sagittal T1W image (Fig 3c) shows the relationship between the tumour (→) and the skull base. No definite extension to the clivus (*) is noted.
- Axial T2W (Fig 3d) shows an abnormal right jugulodigastric node, indicating nodal metastasis (→).

Diagnosis: Nasopharyngeal carcinoma with cervical nodal metastasis

3 Nasopharyngeal Carcinoma

Introduction

- Nasopharyngeal carcinoma (NPC) is a common seen head and neck cancers, particularly in southeast Asia.
- Clinical presentations include:
  - Nasal symptoms: nasal obstruction, epistaxis
  - Hearing: hearing loss, otitis media
  - Neck swelling due to cervical nodal metastasis
  - Late: visual impairment, cranial nerve palsy (due to intracranial or orbital extension)

Imaging Features

- MRI
  - Soft tissue mass centered at the nasopharynx
  - Superior extension: skull base (Fig 3e) and intracranial (Fig 3f)
  - Anterior extension: nasal cavity (Fig 3g), Eustachian's tube (otomastoid effusion)
  - Lateral extension: parapharyngeal space (Fig 3h), carotid sheath,
  - Posterior extension: prevertebral muscle (Fig 3g)
  - Inferior extension: oropharynx (Fig 3h)
  - Cervical nodal metastases: retropharyngeal, jugular chain, posterior triangle (Fig 3i)

Fig 3e Sagittal T1W MRI shows large nasopharyngeal carcinoma (*) invading the sphenoid sinus (→).

Fig 3f Post-Gd Coronal T1WFS MRI shows large nasopharyngeal carcinoma (*). Note the small intracranial component the left cavernous sinus (→).

Otomastoid Effusion

Intracranial Extension

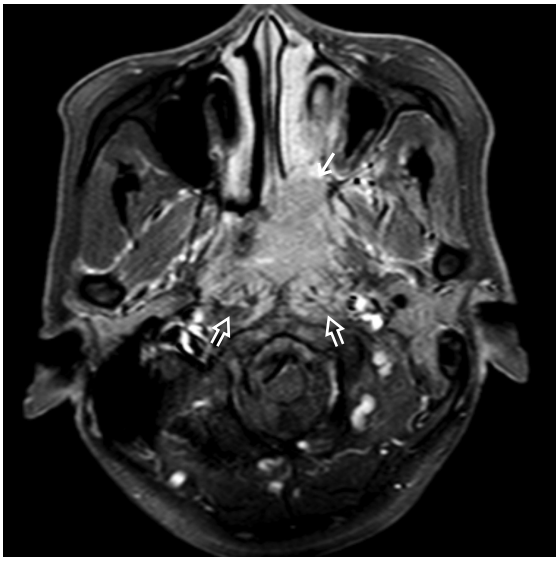


Fig 3g Axial Post-GdT1WFS MRI shows large nasopharyngeal carcinoma extending anteriorly to the left posterior nasal cavity (→) and posteriorly to invade bilateral prevertebral muscles (⇨).

Imaging Modalities

- MRI, because of its excellent soft tissue detail, is the imaging modality of choice for local and nodal staging
- US is useful to evaluate equivocal nodes detected on MRI. It can also guide fine needle aspiration cytology (FNAC) to obtain cytological diagnosis.

Complications

- Otitis media: due to blockage of Eustachian's tube
- Cranial nerve palsy: CN II, III, IV, V2, V3, VI commonly involved
- Carotid blowout: erosion into internal carotid artery, leading to pseudoaneurysm formation and massive epistaxis (Fig 3j). Catheter angiogram is useful for confirming diagnosis and therapeutic intervention.

Fig 3h Coronal Post-Gd T1W MRI shows a large nasopharyngeal carcinoma extending laterally to the right parapharyngeal fat space (→). Note the contralateral normal parapharyngeal fat space on the left side (⮝). There is inferior extension to the right side of oropharynx (△) .

ICA pseudo-aneurysm

3 Nasopharyngeal Carcinoma

PEARLS:

- Evaluate local extent of NPC: nasal cavity, parapharyngeal space, orbit, skull base foraminae, pterygopalatine fossae / fissures, intracranial, prevertebral muscle and oropharynx
- Regional nodal metastases common
- MRI is the primary modality for local and nodal staging
- US is helpful to evaluate equivocal node and guide FNAC

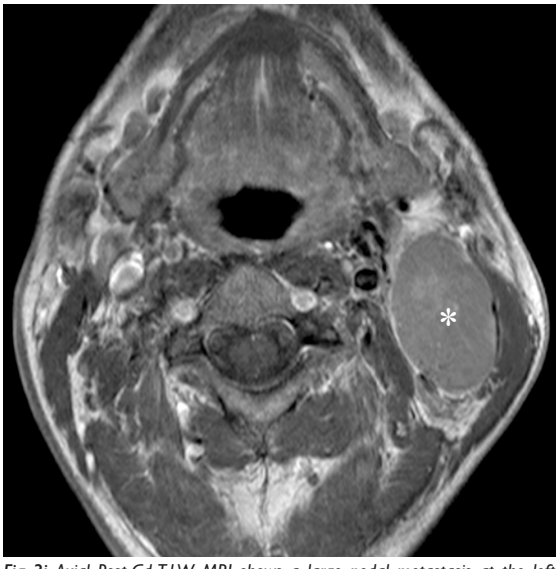


Fig 3i *Axial Post-Gd T1W MRI shows a large nodal metastasis at the left jugulodigastric region (*).*

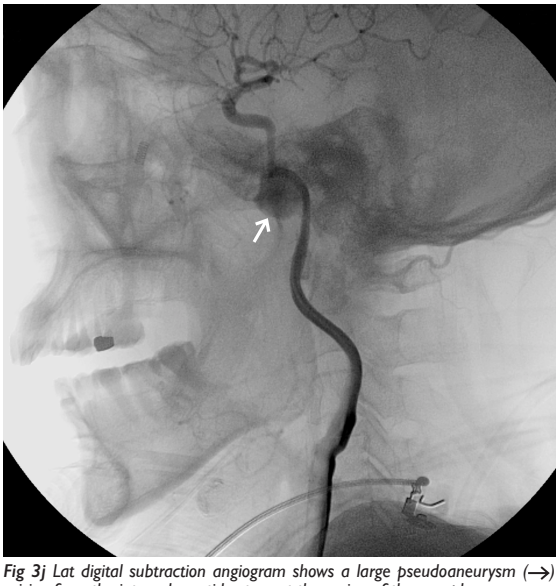
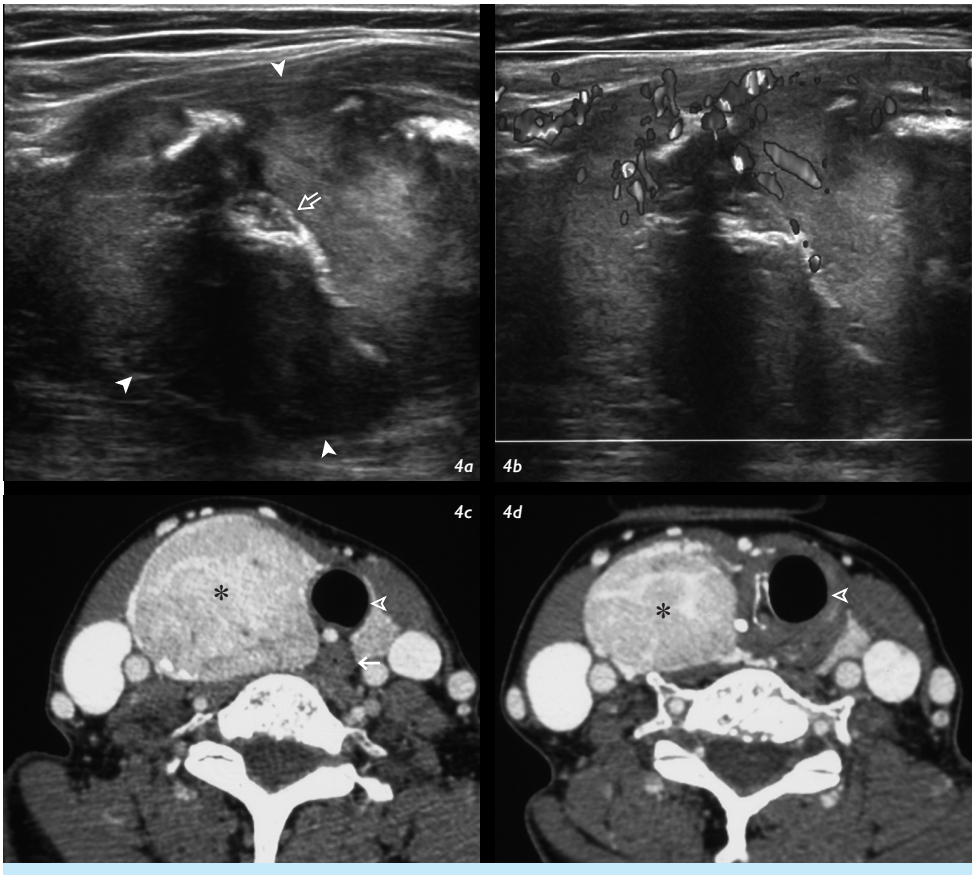


Fig 3j *Lat digital subtraction angiogram shows a large pseudoaneurysm (→) arising from the internal carotid artery, at the region of the nasopharynx.*

Chapter 4

A 50-years-old lady presented with 3 month history of non-painful neck swelling, hoarseness of voice and dysphagia. Physical examination revealed a 6cm hard right thyroid nodule. US and CT neck were performed to evaluate the thyroid mass (Figs 4a-d).

What are the imaging findings and diagnosis?



Findings:

- US neck (Fig 4a) shows a heterogenous mass (⮝) with calcification (⇨) in right lobe of thyroid. Color Doppler (Fig 4b) shows prominent intranodular vascularity.
- CECT neck (Fig 4c and d) shows a large hypoenhancing mass in the right lobe of thyroid (*) displacing the trachea (⮜) and esophagus (→) to the left.

Diagnosis: Follicular neoplasm of the thyroid, at histology it was confirmed to be a follicular carcinoma

4 Focal Thyroid Lesions

Introduction

- Focal thyroid nodule is a common clinical and imaging finding. Patients may be asymptomatic or present with a neck swelling. Pressure symptoms such as dysphagia, dyspnea and hoarseness of voice may be present in large thyroid mass.
- Focal thyroid lesion can be benign or malignant.
- Common benign nodules include colloid nodule, hyperplastic / adenomatous nodule, follicular adenoma
- Common malignant lesions include papillary carcinoma and follicular carcinoma. Anaplastic carcinoma, medullary carcinoma and metastases are less commonly encountered malignant thyroid lesions.

Malignant thyroid lesions

1. Follicular carcinoma (Figs 4a-d)
   Ill defined borders; hypoechoic mass or focal hypoechoic areas in an otherwise iso- / hyperechoic nodule,
2. Papillary carcinoma (Figs 4e, f)
   Ill defined, hypoechoic nodule with internal punctate microcalcifications (representing psammoma bodies). Chaotic internal vascularity may also be noted. Advanced tumour may show extrathyroidal extension and metastatic cervical nodes.

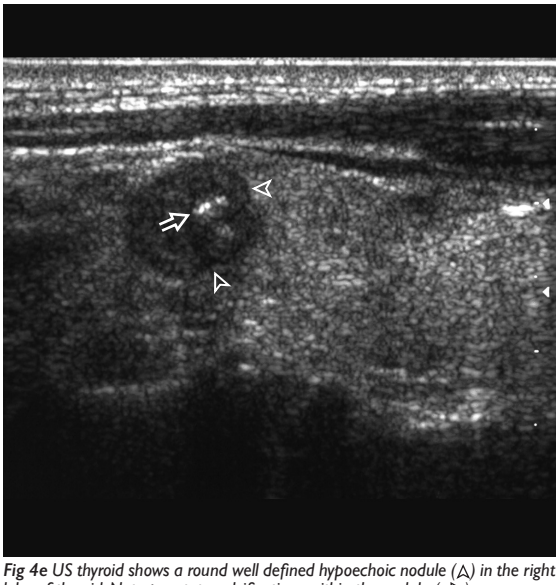


Fig 4e US thyroid shows a round well defined hypoechoic nodule (△) in the right lobe of thyroid. Note punctate calcifications within the nodule (⇨).

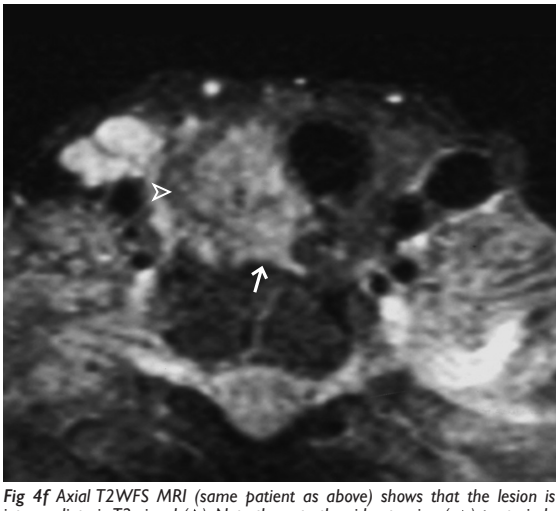


Fig 4f Axial T2WFS MRI (same patient as above) shows that the lesion is intermediate in T2 signal (△). Note the extrathyroid extension (→) posteriorly. Excision confirmed papillary carcinoma.

Papillary Carcinoma *Anaplastic Carcinoma* *Thyroid Metastases*

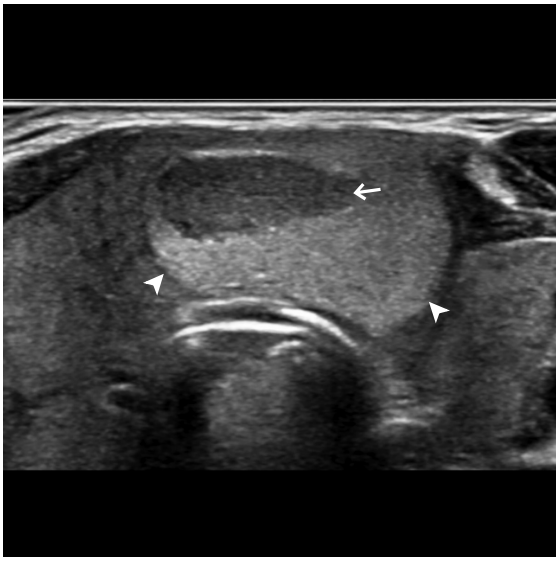


Fig 4g Longitudinal greyscale US shows a well-defined hyperechoic mass (▲) in the right lobe of thyroid. A focal hypoechoic area (→) is noted within it.

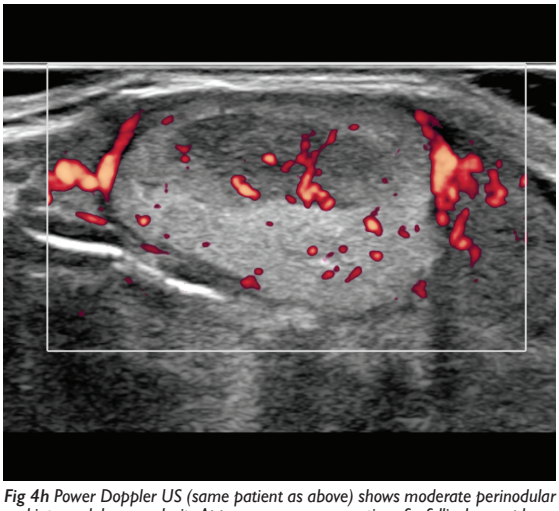


Fig 4h Power Doppler US (same patient as above) shows moderate perinodular and intranodular vascularity. Appearances are suggestive of a follicular neoplasm. Imaging and cytology cannot reliably differentiate follicular adenoma from carcinoma. Therefore final diagnosis relies on histology of resected specimen.

Benign thyroid lesions

1. Follicular adenoma (Figs 4g, h)
   - indistinguishable from follicular carcinoma based on imaging, cytology and frozen section. They are therefore collectively referred to as follicular neoplasm on imaging and cytology. Differentiation is based on histology following surgery. Presence of capsular / vascular invasion confirms malignant nature.
   - US features favour adenoma: well defined oval solid iso- / hyperechoic. Perinodular (rather than intranodular) vascularity.

Follicular Carcinoma

Follicular Adenoma

4 Focal Thyroid Lesions

2. Hyperplastic nodule (Fig 4i-l)
   - results from focal hyperplasia of thyroid tissue
   - usually multiple against a background of multinodular goitre (MNG)
   - haloed nodule with oval heterogenous echopattern
   - fine linear septation
   - small cystic changes (spongiform appearance) common due to variable response of thyroid tissue to hormonal stimulation
   - predominant perinodular halo / vascularity
   - dense, dysmorphic shadowing calcifications
   - large lesions may have retrosternal and mediastinal extension, causing pressure symptoms (Figs 4k, l)
3. Colloid cyst / nodule (Fig 4m)
   - well defined, round or oval cystic nodule
   - +/- echogenic septae
   - comet tail artefact from colloid due to reverberation artefacts from strong acoustic interface produced by colloid
   - non-shadowing (in contrast to shadowing from punctate microcalcifications of papillary carcinoma)

Fig 4i Transverse US thyroid shows multiple areas of dense shadowing calcifications (→) in MNG.

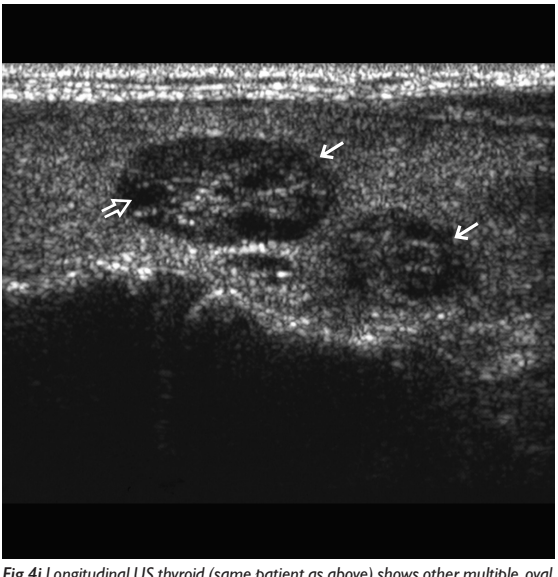


Fig 4j Longitudinal US thyroid (same patient as above) shows other multiple, oval, heterogenous nodules (→) with cystic change and septation (⇨), spongiform appearance. Overall features are in keeping with hyperplastic nodule in background of multinodular goitre (MNG).

Multinodular Goitre CT *Multinodular Goitre MRI* *Hemorrhagic Cyst*

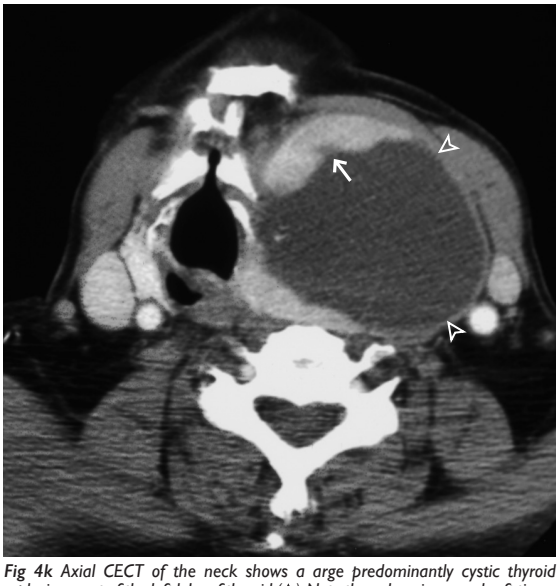


Fig 4k Axial CECT of the neck shows a arge predominantly cystic thyroid replacing most of the left lobe of thyroid (△). Note the enhancing mural soft tissue component (→).

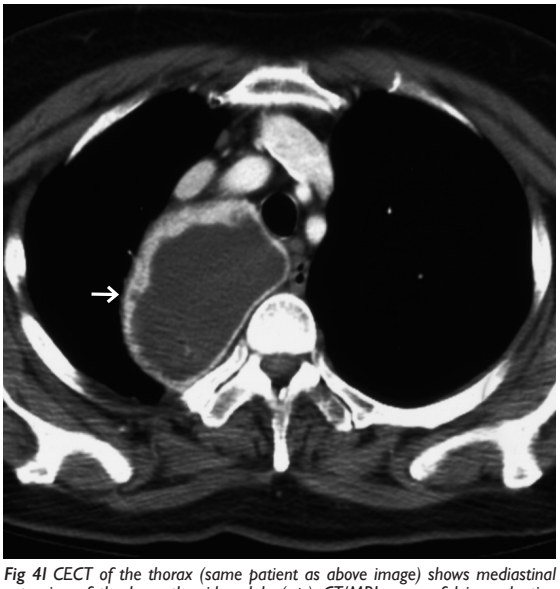


Fig 4l CECT of the thorax (same patient as above image) shows mediastinal extension of the large thyroid nodule (→). CT/MRI are useful in evaluating retrosternal, mediastinal extension of thyroid lesions.

4. Thyroid abscess (Fig 4n)
   - uncommon due to intrinsic resistance of thyroid to infection (thick capsule, high vascularity and iodine content)
   - may be associated with underlying 3rd / 4th branchial anomaly
   - irregular hypoechoic / hypoenhancing mass
   - clinical features usually suggestive, including acute onset of symptoms, fever, neck pain and swelling

Imaging modalities

1. US
   - primary modality to characterize focal thyroid lesions
   - useful in guiding FNAC for tissue diagnosis
   - useful to assess cervical lymph node
2. CT / MRI
   - reserved for evaluating extrathyroidal extent of large thyroid lesions

Thyroid Cyst

4 Focal Thyroid Lesions

PEARLS:

- Benign focal thyroid lesions more common than malignant
- Role of imaging: differentiate benign from malignant, guide FNAC to obtain tissue diagnosis, and to evaluate extrathyroidal extent of large thyroid lesions

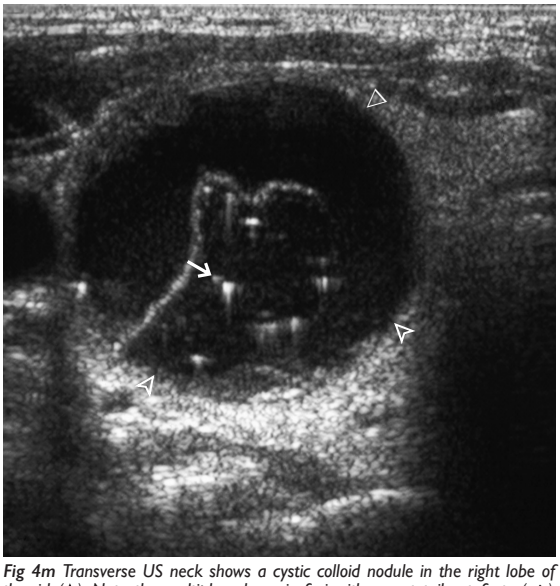


Fig 4m *Transverse US neck shows a cystic colloid nodule in the right lobe of thyroid (△). Note the multiple echogenic foci with comet tail artefacts (→), representing colloid content.*

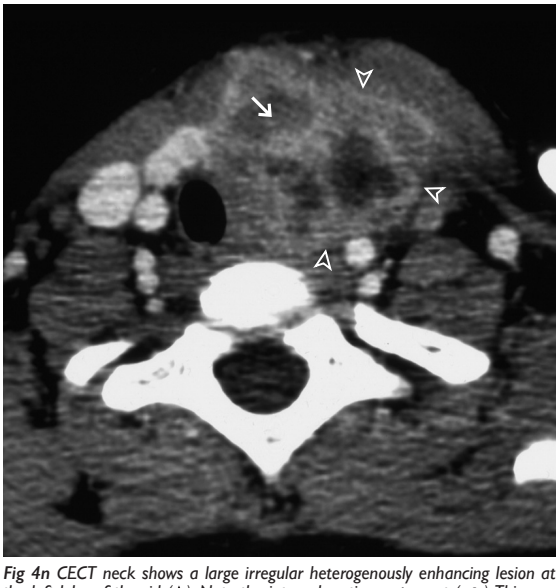
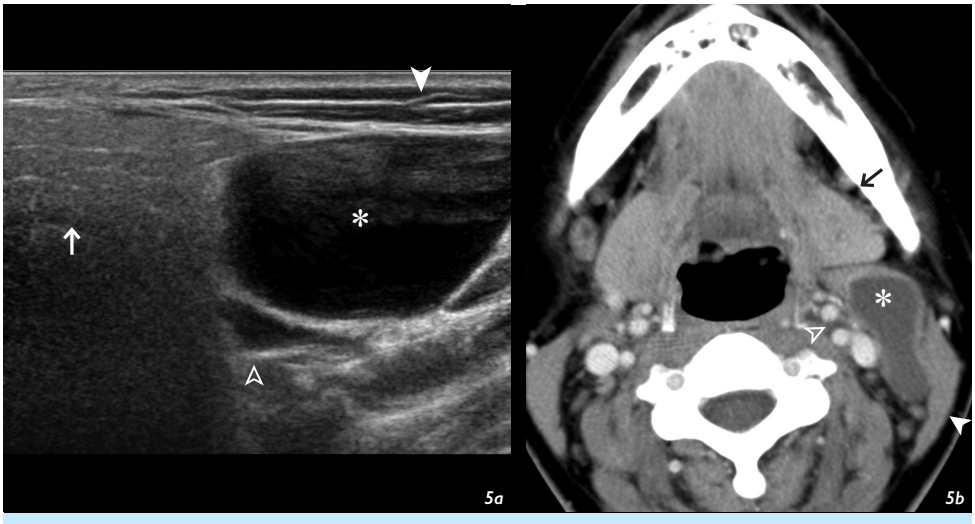


Fig 4n *CECT neck shows a large irregular heterogenously enhancing lesion at the left lobe of thyroid (△). Note the internal cystic component (→). This was proven to be a thyroid abscess.*

Chapter 5

A 30-year-old gentleman presented with 1 year history of left upper neck swelling. Physical examination showed a 3cm non-tender smooth mass at the left submandibular region. The patient was afebrile and blood test showed no evidence of raised white cell count. US (Fig 5a) and CECT (Fig 5b) of the neck were performed.

What are the imaging findings and diagnosis?



Findings:
- Axial US and axial CECT neck shows an oval well defined cystic mass with thin enhancing wall (*).
- Posterolateral to left submandibular gland (→).
- Anteromedial to sternocleidomastoid muscle (▲).
- Anterolateral to carotid sheath (△).

Diagnosis: Second branchial cleft cyst (type II)

5 Branchial Cleft Cyst

Introduction

Branchial apparatus anomalies comprise a group of congenital lesions resulting from incomplete obliteration of the developmental branchial apparati. These can be in the form of fistula, sinus or cyst. Among various types of branchial apparatus anomalies, the first and 2nd branchial cleft cysts are the commonest.

1. Second branchial cleft cyst (2nd BCC)
   - typical location: posterolateral to the submandibular gland, anteromedial to the sternocleidomastoid muscle, anterolateral to the carotid sheath
   - extension through the carotid bifurcation pathognomonic (notch sign)
   - clinical features: neck swelling; pain and fever if infected
   - uncomplicated type (Figs 5a, b)
     - unilocular cystic lesion, no solid component or vascularity, thin wall and rim enhancement
   - hemorrhagic / infected type (Fig 5c)
     - heterogenous content
     - fluid-fluid level with blood product and debris
     - thick enhancing wall
     - internal vascularity
     - adjacent soft tissue inflammatory change
     - can mimic necrotic nodal metastasis (Figs 5d, e). May need FNAC to differentiate

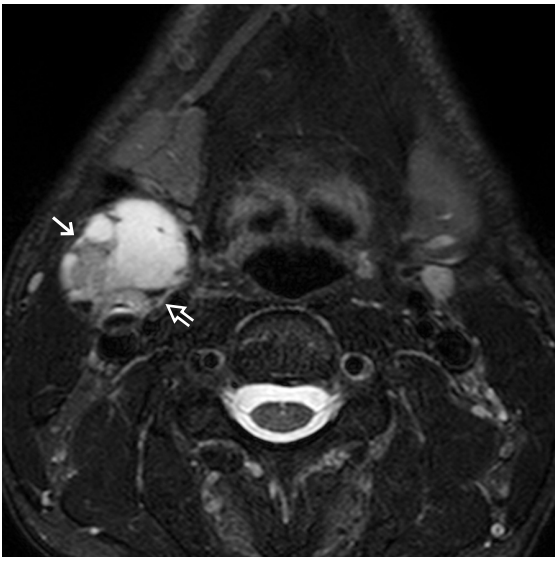


Fig 5c Axial T2WFS MRI shows a right 2nd BCC (→) with fluid-fluid level (⇨) due to previous hemorrhage following an aspiration.

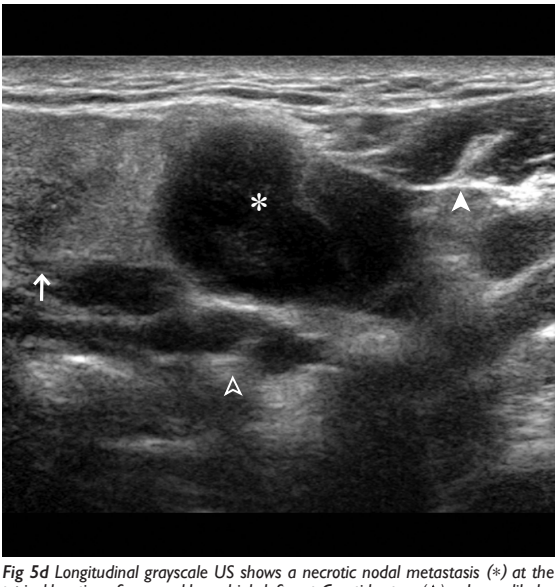


Fig 5d Longitudinal grayscale US shows a necrotic nodal metastasis (*) at the typical location of a second branchial cleft cyst. Carotid artery (△), submandibular gland (→), sternocleidomastoid muscle (▲).

2nd BCC CT | 2nd BCC MRI | Hemorrhagic 2nd BCC

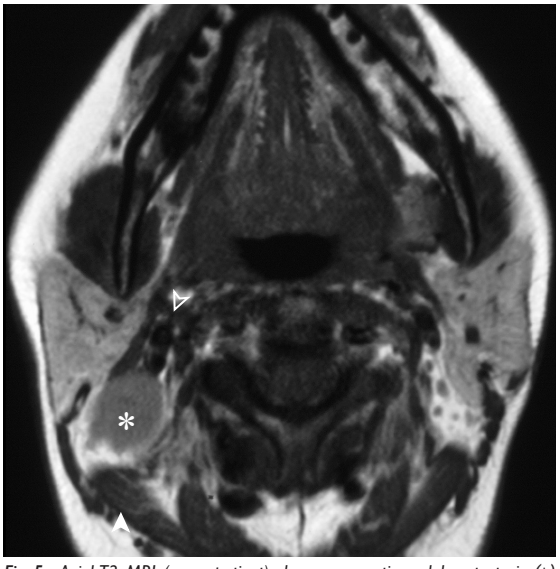


Fig 5e Axial T2 MRI (same patient) shows a necrotic nodal metastasis (*), sandwiched between the carotid bifurcation (△), and sternocleidomastoid muscle (▲). FNAC may be needed to differentiate it from an infected / hemorrhagic 2nd BCC.

Fig 5f Axial T2WFS neck shows a bilobed cystic lesion at left partoid space (*) extending to the left parapharyngeal space (▲).

2. First branchial cleft cyst (1st BCC)
   - typical location: between bony and cartilaginous part of external auditory canal (EAC)
   - Work type I: Periauricular
   - Work type II: Periparotid
   - clinical features: unexplained otorrhoea, recurrent parotid abscess
   - uncomplicated type (Figs 5f-h)
     - unilocular cystic lesion with no solid component or vascularity, thin wall
   - hemorrhagic / infected type
     - heterogenous content with thickened enhancing wall and debris

Imaging modalities

1. US
   - initial imaging modality for assessment of neck mass
   - guide FNAC to differentiate infected / hemorrhagic BCC from cervical nodal metastases
2. CT
   - useful to evaluate deep extent, in particular for infected cyst
3. MRI
   - alternative to CT, but less available due to cost and speed
   - may detect high fluid T2 signal of fistula tract

Infected left 2nd BCC *Infected Right 2nd BCC* *1st BCC*

5 Branchial Cleft Cyst

PEARLS:

- 2nd and 1st BCC constitute majority of branchial apparatus anomalies
- Typical location differentiates BCC from other neck masses
- Infected / hemorrhagic BCC may mimic other neck pathologies such as cervical nodal metastases from head and neck squamous cell carcinoma or thyroid papillary carcinoma. FNAC useful to obtain tissue diagnosis
- Unexplained otorrhoea / recurrent parotid abscess: consider 1st BCC

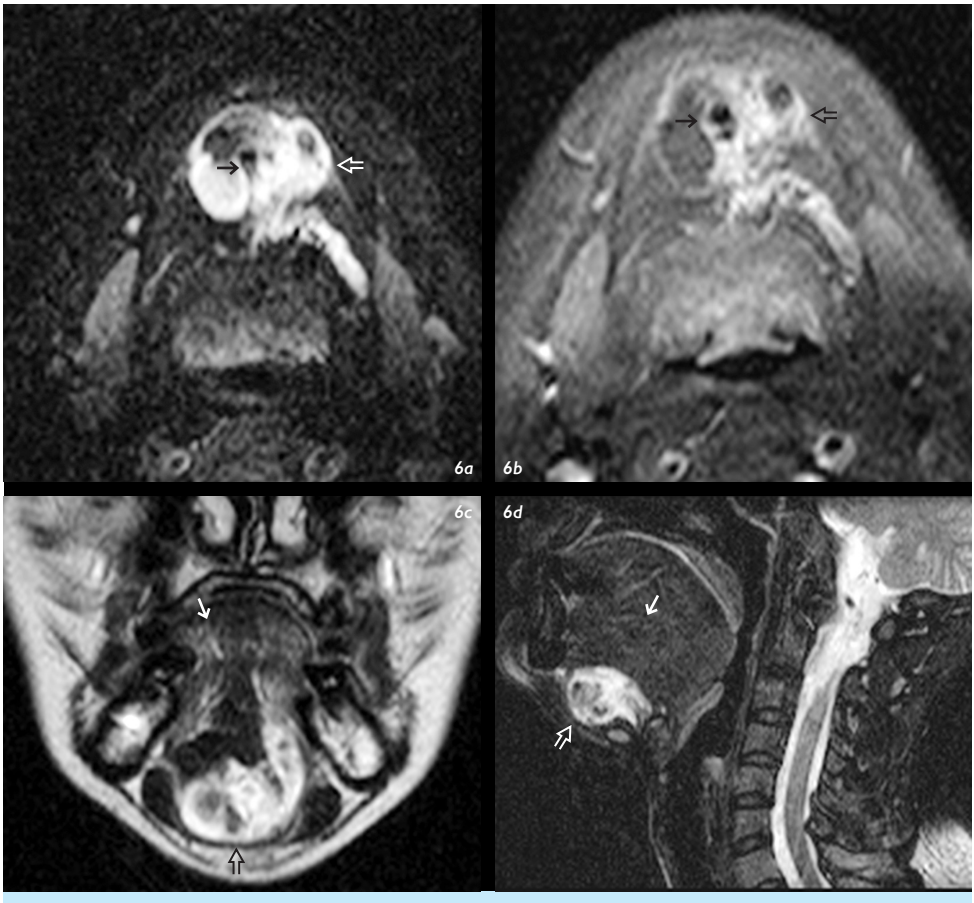
Fig 5g Coronal T2W MRI (same patient as Fig 5e) shows the close relationship of the cystic lesion (*) with the left external auditory canal (#). Overall features are compatible with a first BCC.

Fig 5h Clinical photo of a child showing a right peri-auricular swelling, representing a first branchial cleft cyst.

Chapter 6

A 20-years-old lady presented with 6 month history of swelling of the floor of mouth. Physical examination showed a bluish compressible mass at the floor of mouth. The patient was otherwise well. MRI (Figs 6a-d) was performed.

What are the imaging findings and diagnosis?



Findings:

- Axial T2WFS (Fig 6a) and post-Gd T1WFS (Fig 6b) MRI shows a lobulated heterogenously T2 hyperintense mass which is enhancing following gadolinium injection, at the floor of mouth (⇨) Note the round hypointense foci arrow added in (Fig 6b), representing phleboliths.
- Coronal T2W (Fig 6c) and sag T2WFS (Fig 6d) MRI shows the close relationship of the mass (⇨) to the extrinsic tongue muscles (→).

Diagnosis: Venous malformation of the floor of mouth

6 Vascular Malformation

Introduction

Vascular malformation refers to a group of anomalies composed of abnormal vascular channels. Absence of proliferative or neoplastic component differentiates this identity from vascular tumour.

Vascular malformation is further subdivided into slow or high flow:

- slow flow: capillary, venous or lymphatic channels. Common examples include venous malformation (VM) and lymphatic malformation (LM).
- high flow: arterialised component is present. Common examples include arteriovenous malformation (AVM) and arteriovenous fistula.

Vascular lesions should be included in the differential diagnosis of patients presenting with head and neck masses. Such awareness is important as biopsy of a vascular lesion may lead to significant uncontrolled bleeding.

1. Venous malformation (VM)
   - Slow flow vascular malformation
   - Comprising of abnormal venous channels
   - Presence of phlebolith is characteristic (US: hyperechoic foci with shadowing; CT: calcific density; MR: hypointense focus)
   - Degree of enhancement depends on the proportion of vascular channels and solid component
   - Clinical features:

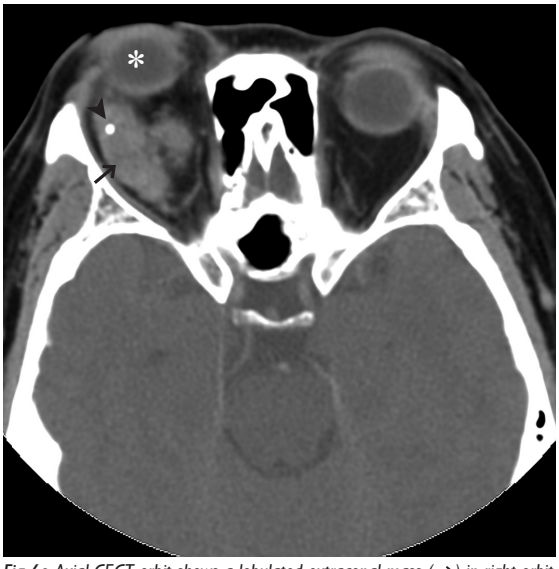


Fig 6e Axial CECT orbit shows a lobulated extraconal mass (→) in right orbit, displacing the right globe (*) anteriorly. Note the hyperdense phlebolith (▲) within. Features are compatible with an orbital venous malformation.

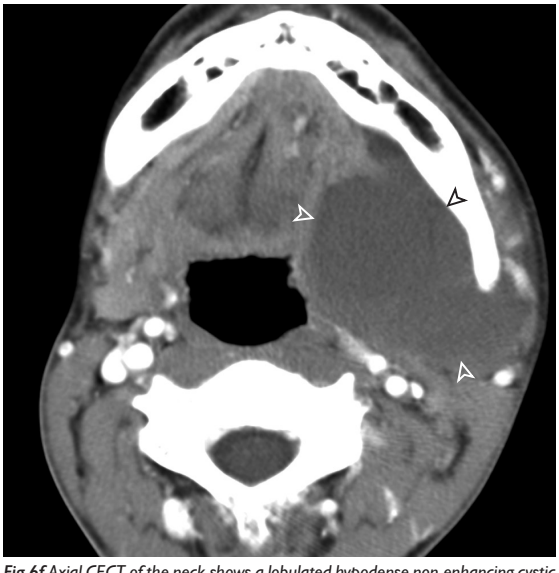


Fig 6f Axial CECT of the neck shows a lobulated hypodense non-enhancing cystic mass with thin imperceptable walls (△) in left submandibular region.

FOM VM

Orbital VM

Fig 6g Axial NECT (same patient as Fig 6f) shows internal hyperdense component (→), suggestive of previous hemorrhage. Overall features indicate a lymphatic malformation with recent hemorrahge.

Fig 6h Axial Post-GdT1W MRI shows an uncomplicated lymphatic malformation in the right submandibular region (△). Note the thin enhancing septa (→).

- Common in young adults
- Common locations: oral cavity and tongue (Figs 6a-d), orbit (Fig 6e), face, intramuscular (masseter, digastric, sternocleidomastoid)
- Treatment: percutaneous sclerotherapy, surgery

2. Lymphatic malformation (LM) (Figs 6f-i)
   - Slow flow vascular malformation
   - Comprising of lymphatic channels
   - Transpatial / multispatial characteristic
   - Unilocular / multilocular cystic lesion insinuating between adjacent structures
   - Uncomplicated LM: thin non-enhancing wall and septations, no vascularity
   - Hemorrhagic LM: fluid-fluid level, hyperdense component on CT
   - Infected LM: thick enhancing wall and septation with mass effect
   - Common locations: submandibular (Figs 6f-h) and posterior triangle, axilla
   - Treatment: percutaneous sclerotherapy, surgery
3. Arteriovenous malformation (AVM) (Fig 6j)
   - High flow vascular malformation
   - Comprises of feeding arteries, nidus and draining veins
   - US/CT: mass lesion with serpinginous vessels. Arterialised flow void can be seen on spectral Doppler ultrasound. Phleboliths / cystic space unusual.

Hemorrhagic LM *Uncomplicated LM* *Occipital LM*

6 Vascular Malformation

- Clinical features:
- Soft tissue mass, compressible, may be pulsatile with thrills/bruits
- Treatment: endovascular embolization, surgery

Complications of vascular malformation

1. Bleeding
2. Mass effect: may compromise airway / esophagus
3. Cosmetic

Imaging modalities

- US: usually the first line of imaging investigation, useful in children, can guide percutaneous injection of sclerosant
- CT / MRI: excellent anatomical details to evaluate complete extent of lesion and response to treatment

PEARLS:

- VM: usually in adult, enhancement variable depending on composition of vascular channels and solid component
- Transpatial multicystic mass with fluid-fluid level in a young patient Is characteristic of LM
- High vascular flow is a hallmark of AVM
- Biopsy of an unsuspected vascular lesion can lead to significant uncontrolled bleeding

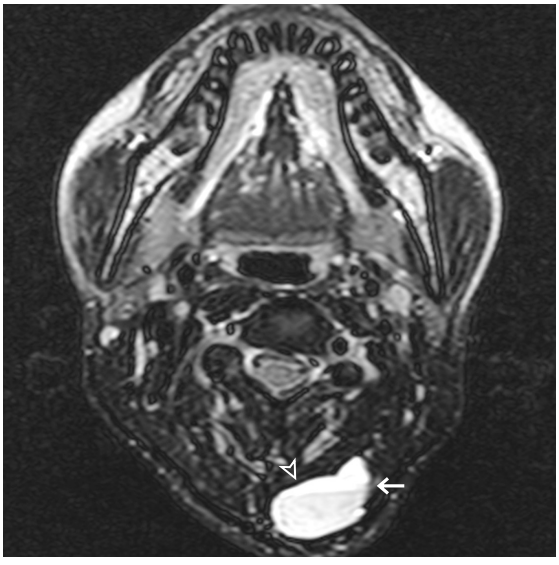


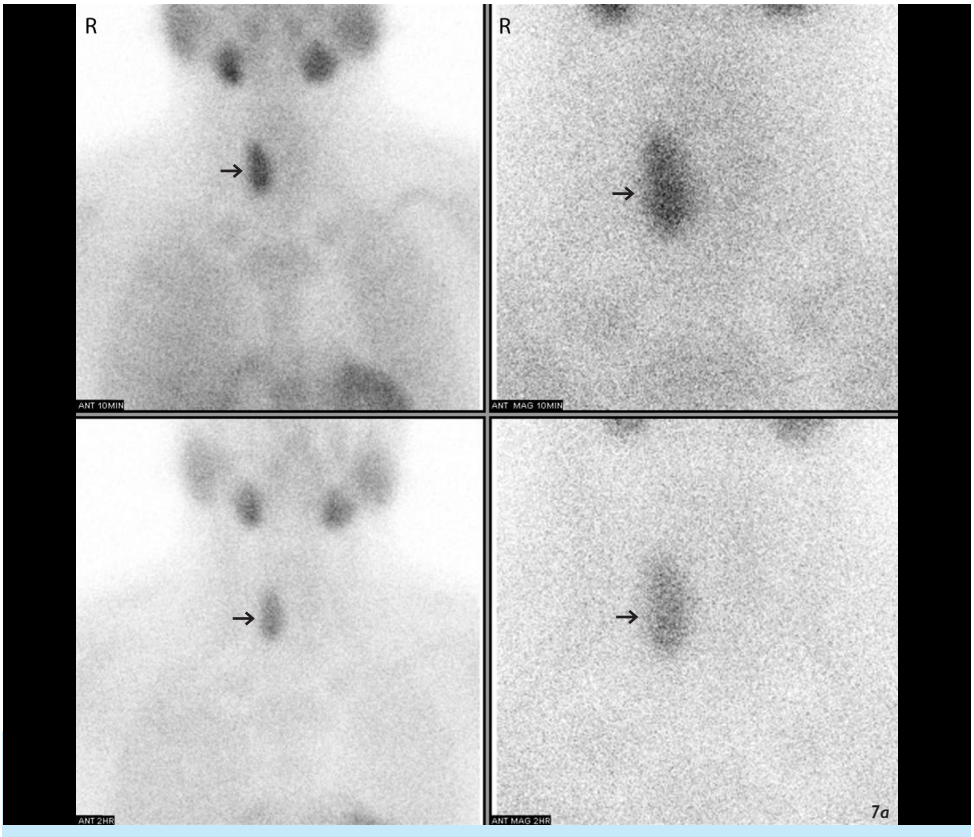
Fig 6i Axial T2WFS neck shows an oval unilocular cystic lobulated mass (△) with fluid-fluid level (→) in the left occipital subcutaneous region. Features are in keeping with a LM with recent hemorrhage.

Fig 6j Coronal T2WFS MRI shows an oval T2 hyperintense mass in the right masseteric region (△). Note the multiple T2 hypointense flow void (→) within it. Features indicate a high flow vascular lesion such as an arteriovenous malformation. High flow was documented within the mass on spectral Doppler (not shown).

Chapter 7

A 40-year-old lady was noted to have hypercalcemia on routine body check-up. Apart from on and off abdominal pain and constipation in the past 1 month, she was otherwise asymptomatic. Physical examination was unremarkable. Further blood test showed elevated parathyroid hormone. Technitium-99m sestamibi scan was performed to detect a parathyroid adenoma (Fig 7a).

What are the imaging findings and diagnosis?



Findings:

- 10min planar images (top row, left: large field of view, right: magnified view) show increase uptake in the right thyroid region (→).
- 2 hour planar images (bottom row, left: large field of view, right: magnified view) show persistent uptake without washout (→).
- No ectopic uptake in the mediastinum is seen

Diagnosis: Hyperfunctioning right parathyroid adenoma

7 Parathyroid Adenoma

Fig 7b Longitudinal grayscale US shows a well defined oval hypoechoic nodule (▲) inferior to the thyroid (⇨), representing a parathyroid adenoma.

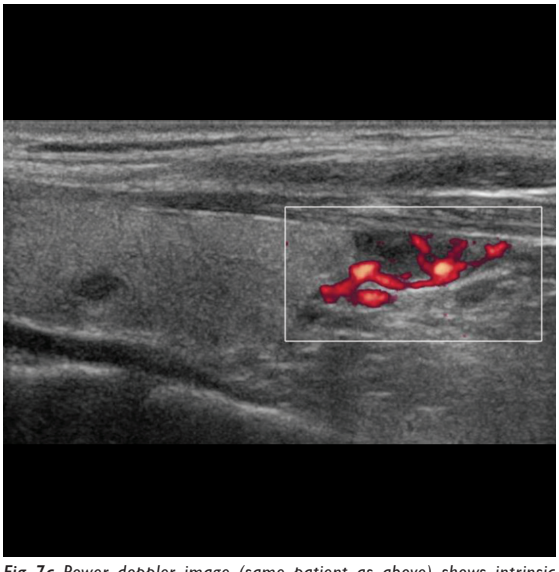


Fig 7c Power doppler image (same patient as above) shows intrinsic hypervascularity within the adenoma.

Small PA MRI

Large PA US

PA Cystic Change

Fig 7d Axial T2WFS MRI (same patient) shows a round well defined homogenous T2 hyerintense mass in the right lower neck (→). Overall imaging features are consistent with a parathyroid adenoma.

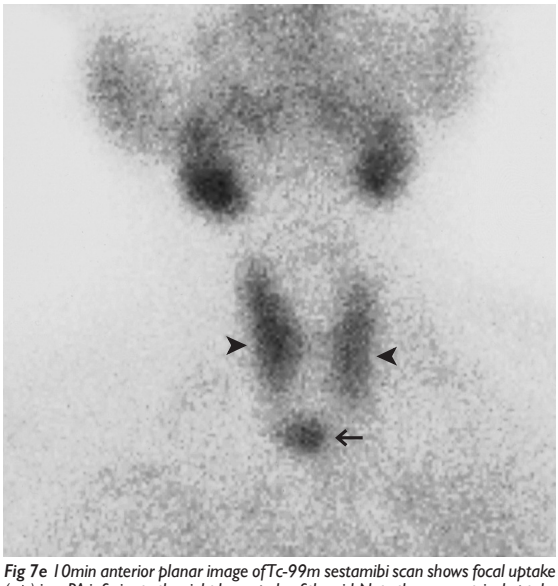


Fig 7e 10min anterior planar image of Tc-99m sestamibi scan shows focal uptake (→) in a PA inferior to the right lower pole of thyroid. Note the symmetrical uptake of both lobes of thyroid (▲).

Imaging Modalities

- Technitium-99 metastable (Tc-99m) sestamibi scan: first line investigation. 10min and 2 hour planar image covering the entire neck and upper mediastinum
- US: useful in evaluating perithyroidal PA, limited use in ectopic PA
- CT / MRI: useful in evaluating ectopic / mediastinal PA
- 3D/4D CT is now becoming a routine preferred initial imaging modality

Imaging Features

- Tc-99m sestamibi (Figs 7a, e)
  - 10min: uptake in both thyroid and parathyroid lesions
  - 2 hour: washout of thyroid lesion, persistent uptake in parathyroid lesion
  - SPECT / CT: better anatomical localisation
- US (Figs 7b, c)
  - Oval, well defined, hypoechoic nodule
  - Usually hypervascular on Doppler, with a single polar vessel within
  - Cystic change/hemorrhage may occur
  - perithyroidal in location
- CT (Figs 7f, g)
  - Well defined avidly enhancing nodule
- May mimic lymph node
- MRI (Fig 7d)
  - T1W: hypointense
  - T2W: hyperintense
  - Post-Gd T1W: avid enhancement

Intrathyroidal PA US

Intrathyroidal PA MRI

7 Parathyroid Adenoma

Complication

- Hyperparathyroidism and Hypercalcemia
  - renal stone
  - pancreatitis
  - peptic ulcer
  - osteopenia
  - arrthymia

Treatment

- Surgical excision

PEARLS:

- Parathyroid adenoma is the commonest cause of primary hyperparathyroidism
- Tc-99m sestamibi scan is usually the first line of imaging
- US, CT, MRI useful in correlation with scintigraphic finding
- Beware of ectopic parathyroid adenoma (search in mediastinum)

Fig 7f Coronal CECT (same patient as Fig 7e) shows an oval well defined homogenously enhancing nodule (→) in the right lower neck, inferior to the right lower pole of thyroid (*).

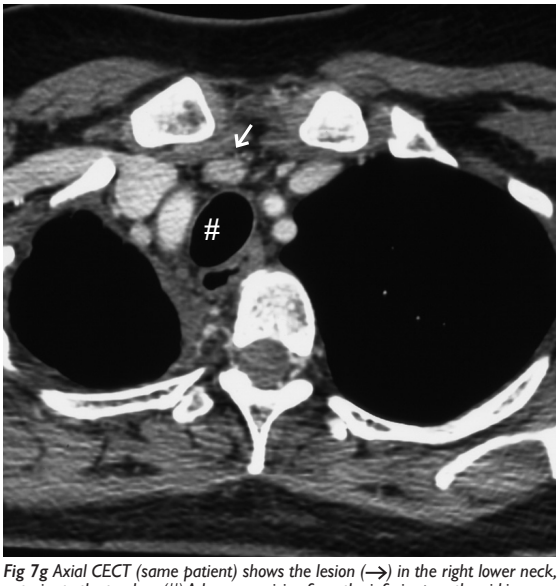
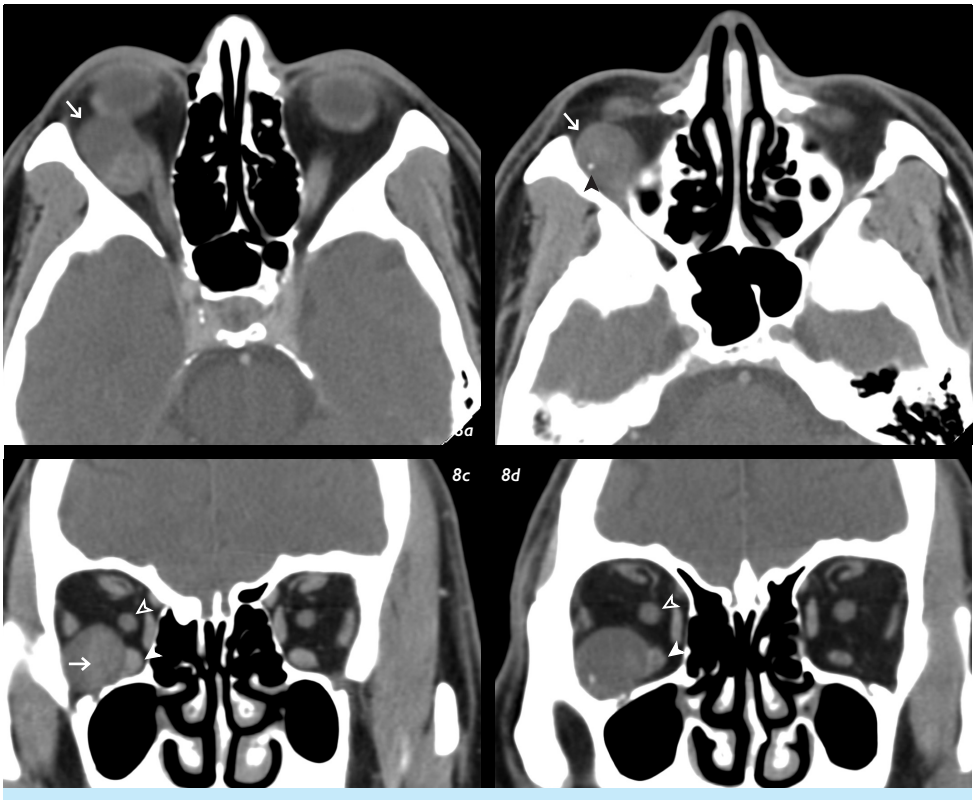


Fig 7g Axial CECT (same patient) shows the lesion (→) in the right lower neck, anterior to the trachea (#) Adenoma arising from the inferior parathyroid is more variable in location.

Chapter 8

A 40-year-old gentleman presented with 3 month history of right eye swelling. Physical examination confirmed mild right proptosis. There were no signs of inflammation or thyroid eye disease and the patient was otherwise well. A CECT of the orbitwas performed (Figs 8a-d).

What are the imaging findings and diagnosis?



Findings:

- Axial CECT of the orbit (Figs 8a and b) shows a well defined, oval mass (→) at the right orbit
- A tiny focus of calcification is noted within the mass (⮝), suggestive of a phlebolith.
- Coronal CECT (Figs 8c and d) shows the mass is partially intraconal and partially extraconal. Note the enhancing component (→), and the relationship of the mass with the optic nerve (⩓) and inferior rectus muscle (⮝).

Diagnosis: Orbital cavernous hemangioma

8 Orbital Masses

Introduction

Location, age and clinical course are important in considering the differential diagnoses of orbital masses.

1. Location:
   - The extraocular muscles form a conical shaped cavity within the orbit. The base of this cavity opens anteriorly while the apex points posteriorly towards the optic canal and superior / inferior orbital fissures.
   - Intraconal space: contains globe, optic nerve
   - Conal: extraocular muscles
   - Extraconal space: lacrimal gland, fat
2. Age
   - Infant / children: congenital lesions such as dermoid, vascular malformation / neoplasm, optic nerve glioma
   - Adult: thyroid eye disease, inflammatory pseudotumor, optic nerve sheath meningioma
   - Elderly: metastasis, lymphoma
3. Clinical course
   - Stable clinical course suggests benign conditions
   - Progressive course suggests aggressive lesions such as metastasis, lymphoma
   - Response to steroid: inflammatory pseudotumor, lymphoma, thyroid eye disease

Imaging Modalities

- US: no ionizing radiation, portable. Useful especially in detection of intraocular llesion and for image guided biopsy. However, complete evaluation

Fig 8e Axial CECT of a child shows a large intraocular mass within the right globe (▲). Note the internal calcification (→). Features are consistent with a retinoblastoma. Note normal left globe.

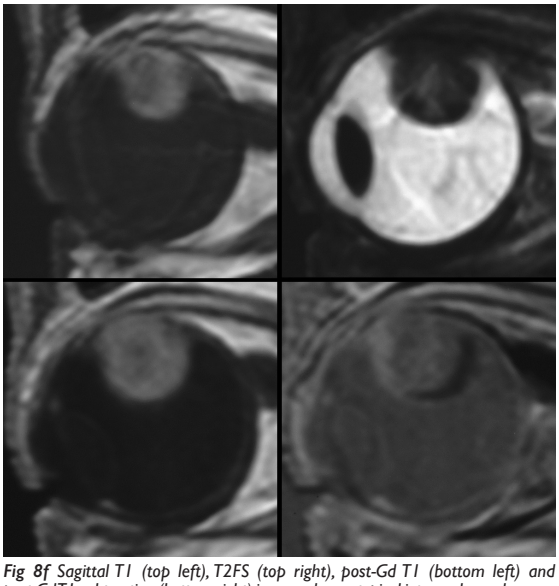


Fig 8f Sagittal T1 (top left), T2FS (top right), post-Gd T1 (bottom left) and post-GdT1 subtraction (bottom right) images show a typical intraocular melanoma. Due to paramagnetic effect of melanin, it appears T1 hyperintense and T2 hypointense, in contrary to most neoplasms. The mild enhancement is best depicted on subtraction image, when the T1 hyperintense signal is subtracted.

Retinoblastoma

Ocular Melanoma

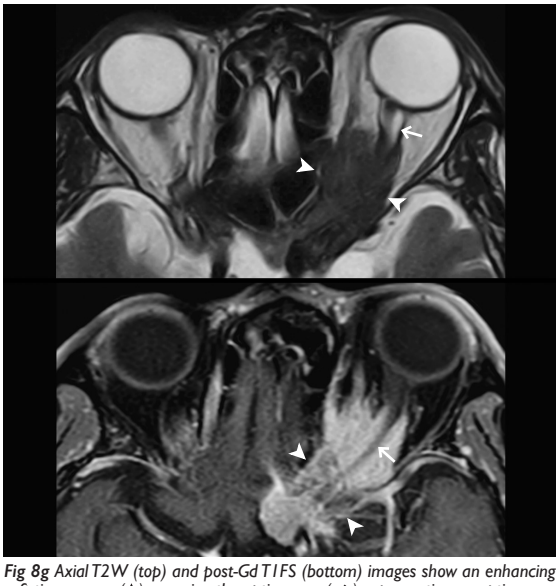


Fig 8g Axial T2W (top) and post-Gd T1FS (bottom) images show an enhancing soft tissue mass (▲), encasing the optic nerve (→), representing an optic nerve sheath meningioma.

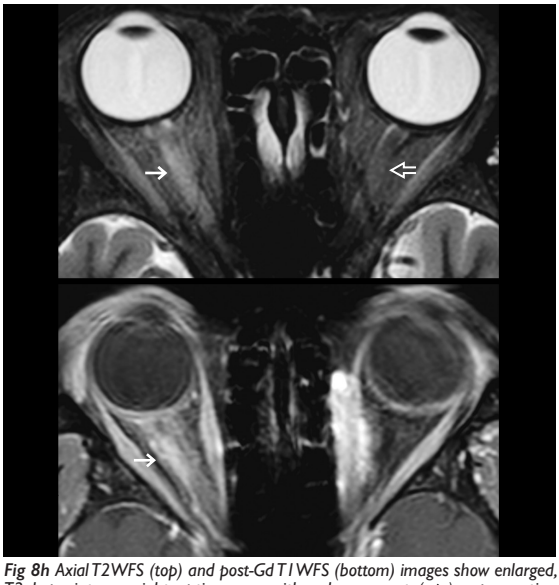


Fig 8h Axial T2WFS (top) and post-Gd T1WFS (bottom) images show enlarged, T2 hyperintense right optic nerve with enhancement (→), representing optic neuritis. Compared this with the normal left optic nerve (⇨).

of the orbit is limited by small acoustic window
- CT: Especially useful to detect calcifications. Radiation to the lens is a concern.
- MRI: ideal modality in evaluation of orbital mass. However, use may be limited by cost, prolonged scanning time and availability.

Imaging Features

Intraocular

1. Retinoblastoma (Fig 8e)
   - Childhood
   - Present with leukocoria
   - CT: Calcified intraocular mass is the hallmark
   - MRI: T2 hypointense with enhancement
   - Look for bilateral disease; also check pineal and suprasellar region for tumour (trilateral / quadrilateral retinoblastoma)
2. Intraocular melanoma (Fig 8f)
   - Adult
   - Present with visual impairment
   - CT: Enhancing soft tissue mass
   - MRI: Melanin shows characteristic hyperintense T1 and hypointense T2 signal, with enhancement after gadolinium
   - May lead to retinal detachment

Optic nerve Meningioma

Optic Neuritis

8 Orbital Masses

Intraconal

1. Optic nerve sheath meningioma (Fig 8g)
   - Adult
   - Painless progressive visual impairment
   - May be associated with neurofibromatosis type 2
   - Arise from arachnoid of the optic nerve sheath
   - CT: Calcifications common, along the optic nerve
   - MRI: Enhancing mass around the optic nerve
2. Optic neuritis (Fig 8h)
   - Young female
   - Acute painful visual impairment
   - CT: Mild diffuse enlargement of optic nerve
   - MRI: Diffuse enlargement with T2 hyperintense signal and enhancement
3. Cavernous hemangioma (Figs 8a-d)
   - Most common orbital mass in adult
   - More common in female
   - Slowly progressive painless proptosis
   - Comprises of dilated vascular channels. No cellular proliferation. More appropriately classified as 'vascular malformation'. 'Hemangioma' is a misnomer as this is not a vascular neoplasm.
   - Location: Intraconal, usually lateral aspect
   - CT: Homogenous well defined iso- / hyperdense mass, avid enhancement, +/- calcification

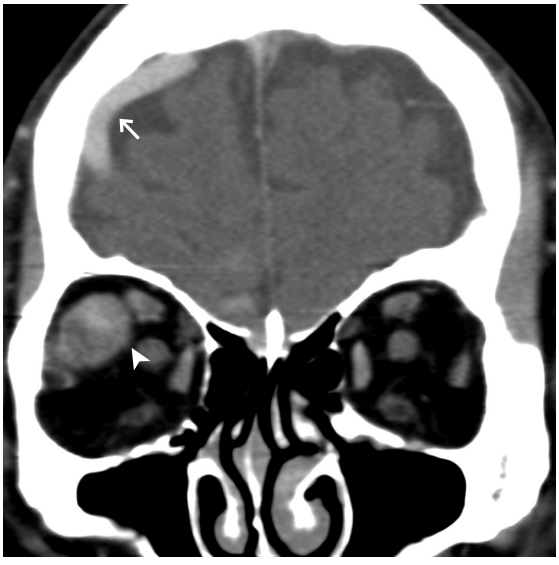


Fig 8i Coronal CECT orbit shows an intensely enhancing intraconal mass (▲) in the right orbit, representing an orbital varix. Note the dilated cortical vein at the right frontal region (→).

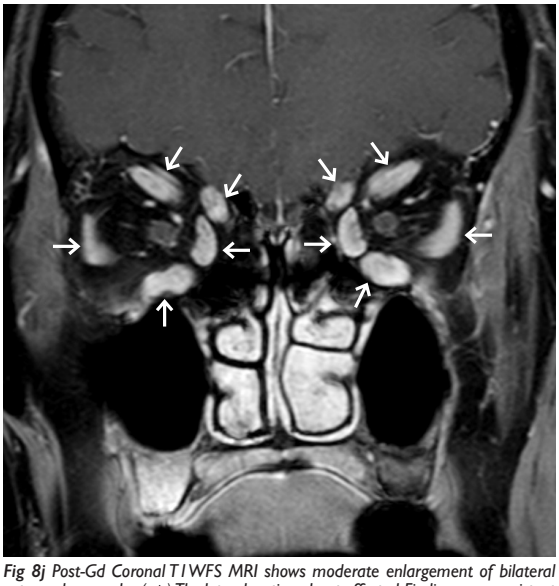


Fig 8j Post-Gd Coronal T1WFS MRI shows moderate enlargement of bilateral extraocular muscles (→). The lateral recti are least affected. Findings are consistent with thyroid eye disease

Orbital Varix *Thyroid Eye Disease* *Orbital Lymphoma*

Fig 8k Axial CECT orbit shows ill defined extraconal soft tissue mass (▲) in the left orbit. Similar mass was also noted at the right orbit as well (not shown). Biospy confirmed lymphoma.

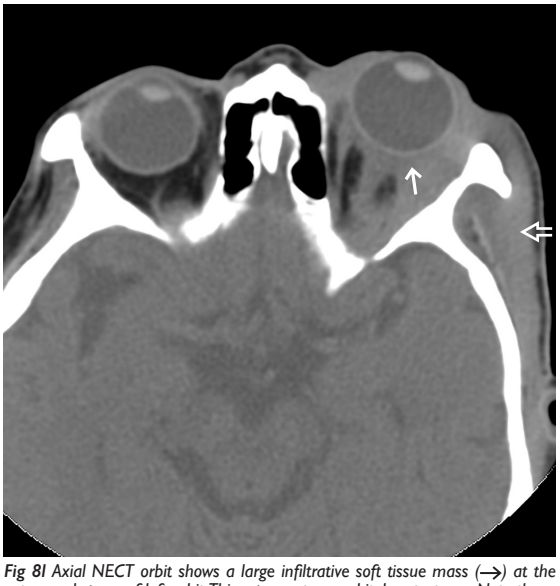


Fig 8l Axial NECT orbit shows a large infiltrative soft tissue mass (→) at the extraconal space of left orbit. This represents an orbital metastases. Note the extraorbital soft tissue involvement (⇨).

- MRI: T2 hyperintense, patchy early enhancement with gradual filling in from the periphery

Conal

1. Thyroid eye disease (Fig 8j)
   - Middle age female
   - Usually seen in Grave's disease
   - Proptosis, lid retraction, chemosis
   - CT / MRI: Swelling of extraocular muslces, sparing the musculotendinous junction (vs IgG4 disease where the musculotendinous junction is involved.
   - Sites of involvement: Inferior rectus > Medial rectus > Superior rectus > Lateral rectus > Oblique

Extraconal

1. Orbital varix (Fig 8i)
   - Comprised of dilated vascular channels with systemic venous connection
   - Dynamic increase in size upon increase venous pressure (eg. Valsalva maneuver)
   - Usually extraconal and retrobulbar
   - CT: Well defined tortuous / tubular mass with intense enhancement. Enlarges or only visible with Valsalva maneuver
   - MRI: Useful if thrombosis / hemorrhage suspected, which shows blood product signal and fluid-fluid level
2. Metastases (Fig 8l)
   - Elderly
   - Primary: CA lung, breast
   - CT/MRI: Infiltrative soft tissue mass with enhancement, +/- bone erosion

Orbital Metastasis

Diffuse Pseudotumor

Myositic Pseudotumor

8 Orbital Masses

Multiple Compartments

1. Lymphoma (Fig 8k)
   - Progressive proptosis
   - Location: typical extraconal, lacrimal
   - Can be bilateral
   - CT: iso- to hyperdense soft tissue mass, homogenous enhancement
   - MRI: Only mildly T2 hyperintense (due to high cellularity)
   - Diagnosis usually made following biopsy
2. Inflammatory pseudotumor (Figs 8m and n)
   - Idiopathic inflammatory infiltration of the orbital structures
   - Myositic > Lacrimal > anterior > diffuse > apical pattern
   - CT: ill defined enhancing mass lesion
   - MRI: Only mildly T2 hyperintense (due to cellularity and fibrosis)

PEARLS:

- Location, age and clinical course narrow down the differential lists of orbital masses
- Calcified intraocular lesion in a child is retinoblastoma until proven otherwise
- Characteristics: melanin (High T1 and low T2 signal), enlarge with Valsalva (varix)
- Always consider lymphoma, metastases and inflammatory pseudotumor
- EOM enlargement: musculotendinous junction spared in Grave's disease but involved in IgG4 disease

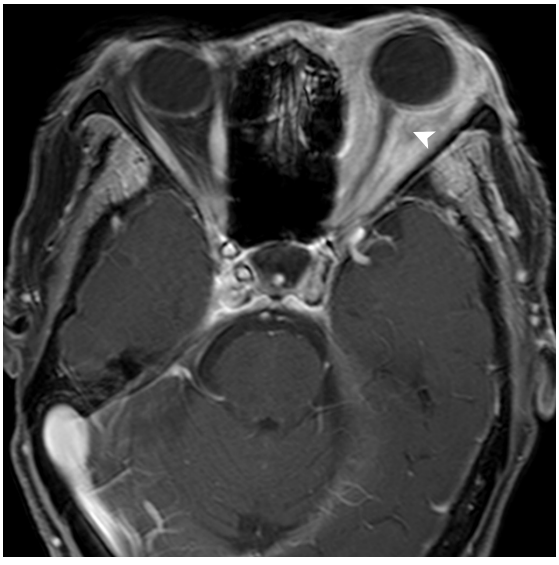


Fig 8m Axial Post-GdT1WFS MRI shows infiltrative enhancing mass (▲) occupying the entire left orbit, representing diffuse form of inflammatory pseudotumour.

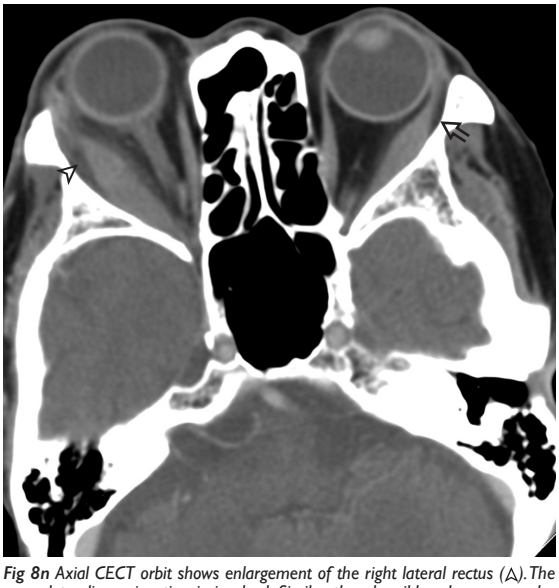
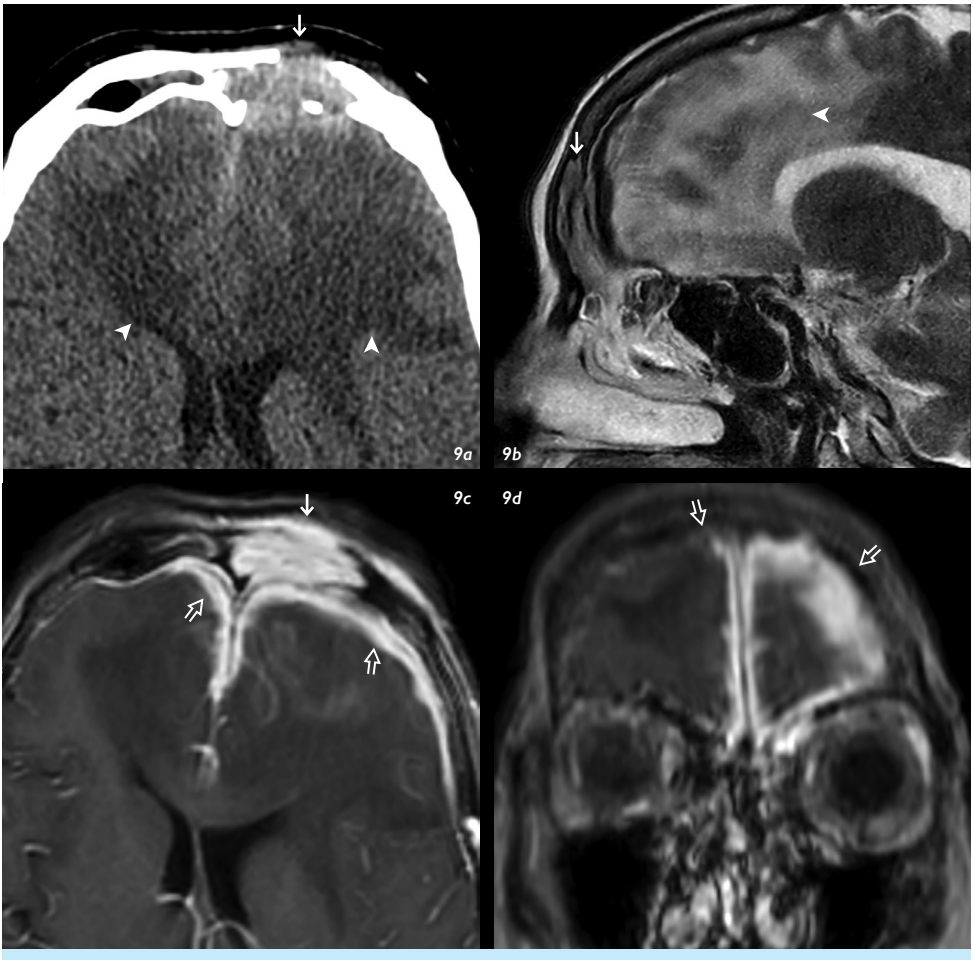


Fig 8n Axial CECT orbit shows enlargement of the right lateral rectus (△). The musculotendinous junction is involved. Similar though milder change are also observed at the left lateral rectus (⇨). The early involvement of lateral recti and musculotendinous junction are suggestive of myositic form of inflammatory pseudotumor / IgG4 disease.

Chapter 9

A 60-year-old lady presented with 1 week history of nasal discharge, frontal headache and fever. She was known to have frontal sinusitis not responding to medical treatment. Physical examination showed swelling, tenderness and erythema over the left frontal region. Contrast CT and MRI were performed to rule out any complication of sinusitis. (Fig 9a-d).

What are the imaging findings and diagnosis?



Findings:

- Axial CECT (Fig 9a), Sag T2W, Ax and Cor CE-MRI (Figs 9b-d) show enhancing soft tissue filling the left frontal sinus (→). Moderate vasogenic edema is noted in bilateral frontal lobes (▲). Extensive leptomeningeal enhancement is noted at both frontal regions (⇨)

Diagnosis: Left frontal sinusitis complicated with meningitis and cerebral edema.

9 Sinusitis

Introduction

Sinusitis refers to inflammation (usually infective) of the paranasal sinuses.

Pathophysiology

- Obstruction of normal mucociliary drainage pathway of the paranasal sinuses, leading to retention of secretion and subsequent infection
- Organisms:
  - Viral (commonest): rhinovirus, influenza virus
  - Bacterial: Streptococcus pneumoniae, Hemophilus influenzae, etc. Usually after viral upper respiratory infection
  - Fungal: Aspergillus

Clinical Presentation

- Symptoms and signs: nasal discharge / obstruction, headache, fever
- May follow an upper respiratory tract infection

Imaging Modality

1. Plain radiograph
   - Usually the first imaging performed
   - May show opacification of the frontal / maxillary sinuses, +/- fluid level
   - Limited value due to overlapping of bony structures and poor detail
2. CT
   - Imaging modality of choice
   - Excellent bony detail
   - Maps the extent of involvement
   - Intravenous contrast is usually unnecessary
   - Pre-operative imaging before FESS

Fig 9e Axial NECT (bone window) shows opacification of the right maxillary sinus (→), with a fluid level (▲) consistent with acute sinusitis.

Fig 9f Axial NECT (soft tissue window) shows mucosal thickening of the right maxillary sinus (▲), consistent with acute sinusitis. Hyperdense component is noted (→), suggestive of recent haemorrhage.

Acute Sinusitis

OMU Pattern

Hemorrhagic Sinusitis

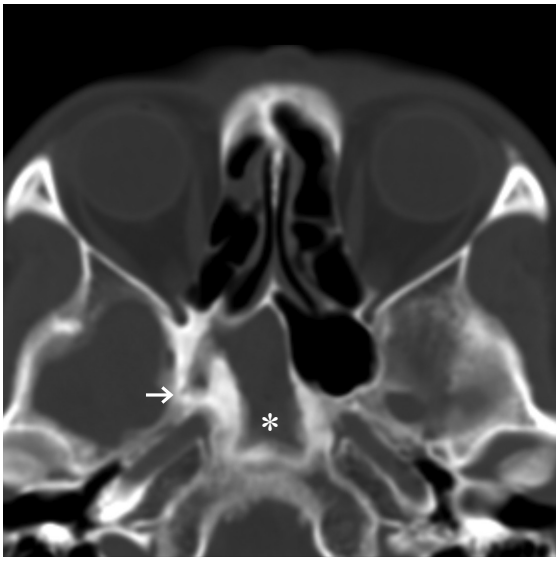


Fig 9g Axial NECT (bone window) shows opacification of the right sphenoid sinus (*).There is bony sclerosis of the sinus wall (→), suggesting of chronicity. Features are consistent with chronic sinusitis.

Fig 9h Axial NECT (bone window) shows bilateral maxillary sinusitis (▲). Thin layer of calcifications are noted along the wall of sinuses (→). Features are consistent with fungal colonisation.

3. MRI
   - Less available due to prolonged scan time and cost
   - Excellent soft tissue details
   - Assesses extension to orbit / brain
   - Limited value in bone assessment

Imaging Features

1. Acute sinusitis (Fig 9e)
   - Mucosal thickening / enhancement of the wall of the paranasal sinuses
   - Fluid opacification of the sinuses, fluid level
2. Chronic sinusitis (Fig 9g)
   - Additional finding of bony sclerosis
   - Content may be hyperdense due to insipitated secretion
3. Fungal sinusitis (Fig 9h)
   - Mycetoma: colonisation of fungus in immunocompetent host. Calcifications / hyperdensities within the sinus. Usually chronic
   - Invasive fungal sinusitis: immunocompromised host. Aggressive soft tissue mass with bony destruction and extension to adjacent structures

Complications

1. Hemorrhage
   - Bleeding into the sinus
   - Hyperdense acute blood within the sinus (Fig 9f)
2. Mucocele (Fig 9i)
   - Persistent obstruction of sinus drainage leading to gradual bony expansion of the sinus
   - Bony dehiscence common
   - Mass effect on adjacent structures (e.g. orbit)

Ethmoid and Sphenoid Mucocele | *Subperiosteal Abscess* | *Complication: Meningitis*

9 Sinusitis

3. Subperiosteal abscess (Fig 9j)
   - Infection spread through bony sinus wall to the subperiosteal areas
   - Fluid / soft tissue / rim enhancing collection adjacent to the sinus wall
   - High risk of extension to adjacent structures, leading to orbital / intracranial abscess
4. CNS infection
   - Spread of infection intracranially
   - Meningitis (Figs 9a-d), cerebritis, brain abscess, subdural empyema, venous sinus thrombosis

Treatment

- Medical: for mild symptoms
- Surgical: functional endoscopic s inus surgery (FESS) to relieve obstruction
- Complications such as orbital / intracranial abscess often require surgical drainage

PEARLS:

- Mild sinusitis usually managed conservatively without imaging
- Imaging indicated in patients with recurrent persistent sinusitis not responding to treatment and if a surgically correctable obstructive element is suspected
- CT is the imaging of choice due to its excellent bony detail. IV contrast is usually unnecessary
- Complications such as orbital / intracranial abscess often require prompt surgical intervention

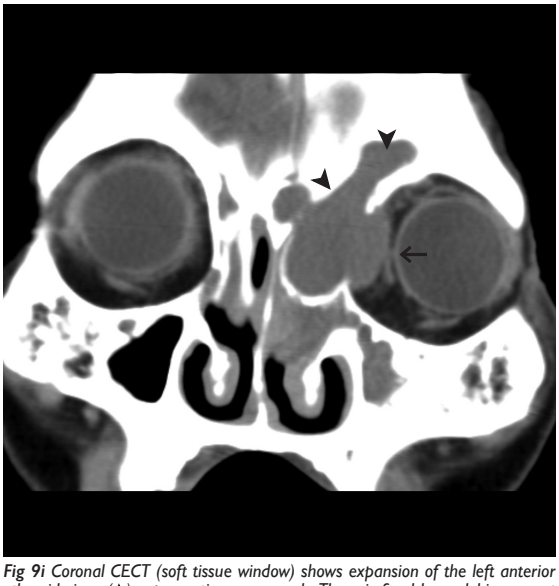


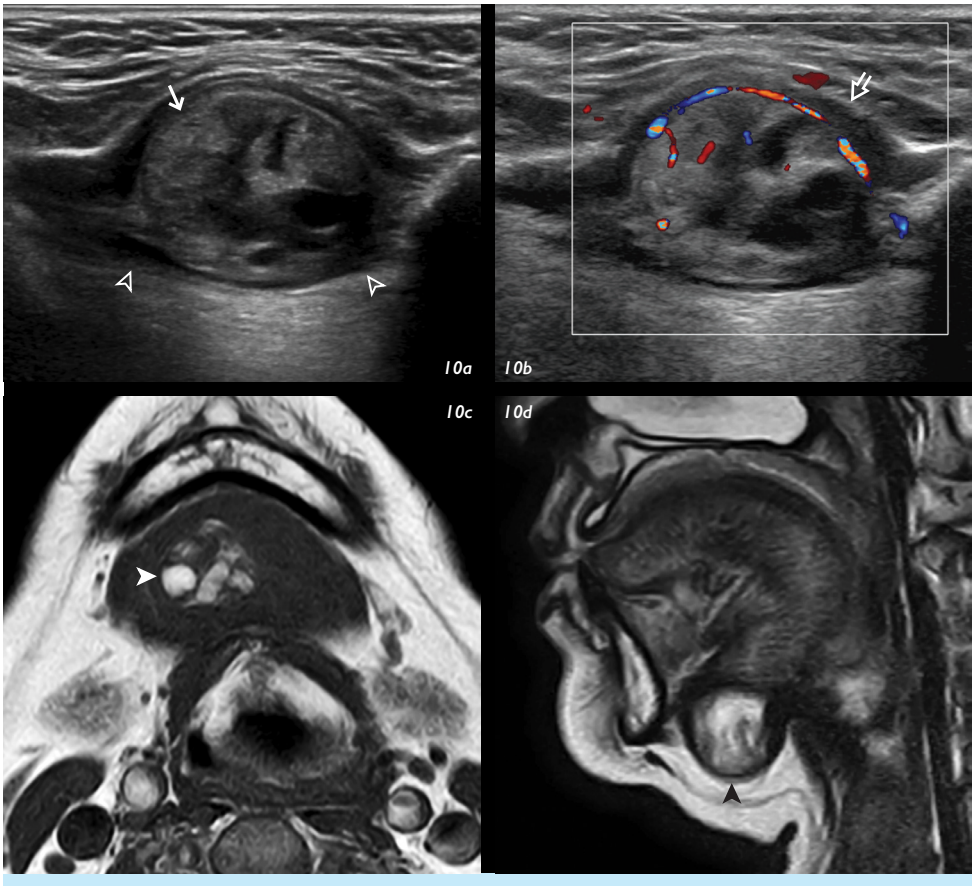
Fig 9i Coronal CECT (soft tissue window) shows expansion of the left anterior ethmoid sinus (▲), representing a mucocele. There is focal bony dehiscence at its lateral aspect with protrusion into the left orbit (→).

Fig 9j Coronal CECT (soft tissue window) shows opacification of the left frontal sinus (▲). Inferiorly there is soft tissue at the extra-conal space of the left orbital roof (→). Features are consistent with acute sinusitis complicated by subperiosteal abscess formation.

Chapter 10

A 60-years-old lady presented with 3 month history of gradually enlarging anterior neck mass. Physical examination showed a midline non-tender neck mass at the floor of mouth. An ultrasound and MRI neck were performed for further evaluation (Fig 10a-d).

What are the imaging findings and diagnosis?



Findings:

- Transverse US of the floor of mouth (Fig 10a) shows an oval well defined mass (A) with heterogenous echotexture. Hyperechoic component (→) is noted. Power Doppler (Fig 10b) shows mild intrinsic vascularity (⇨).
- Ax T1W (Fig 10c) and sag T2W (Fig 10d) MRI show that the lesion (▲) appears predominantly T1 hyperintense, suggestive of hemorrhagic or fat component

Diagnosis: Thyroglossal duct cyst with hemorrhage (thyroid tissue on FNAC)

10 Midline Neck Mass

Introduction

Anterior midline neck mass is a common surgical presentation. Differential diagnoses are in general limited to thyroglossal duct cyst (TDC), ranula and dermoid.

Thyroglossal Duct Cyst

Small remnant of thyroid tissue may be present along the thyroglossal duct, from the foramen cecum to the thyroid bed.

Clinical Presentation

- Midline neck swelling which moves with swallowing
  - usually long duration of history
  - may progressively enlarge if complicated by infection / hemorrhage

Imaging Features

- Uncomplicated (Figs 10e, f)
  - US: well defined anechoic cystic lesion; no mural soft tissue; no vascularity
  - CT: well defined, hypodense, thin enhancing wall
  - MRI: T2 hyperintense, T1 hypointense, may have thin wall enhancement
- Infected / hemorrhagic (Fig 10a-d)
  - US: usually well defined, heterogeneous echopattern, may have vascularity
  - CT: may contain hyperdense heterogenous content, fluid-fluid level

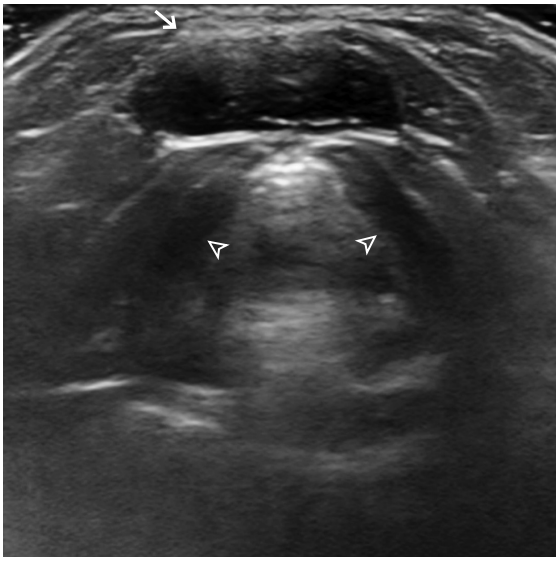


Fig 10e Transverse US of the neck shows a well-defined anechoic cystic lesion (→) at the anterior neck, superficial to the thyroid laminae (△). Features are consistent with a thyroglossal duct cyst.

Fig 10f Axial CECT of the neck (soft tissue window) shows a lobulated thin walled cystic lesion (→) at the infrahyoid neck, abutting the thyroid laminae (△). This represents another case of thyroglossal duct cyst.

Uncomplicated TDC *Hemorrhagic TDC* *Diving Ranula*

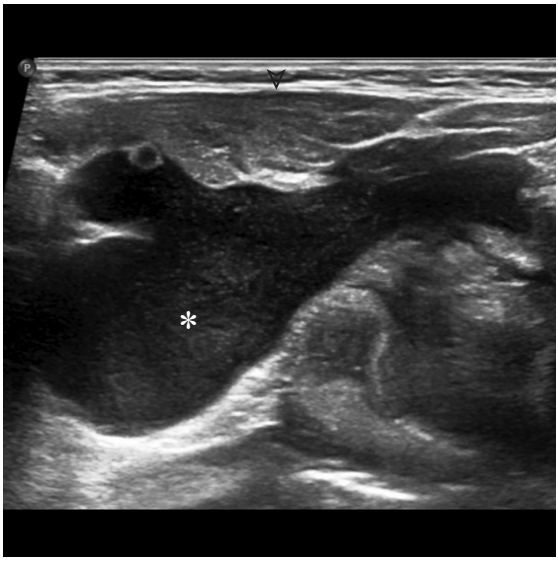


Fig 10g Longitudinal US of the neck shows a large purely cystic mass at the right submandibular region (*), representing a diving ranula. Note its relationship with the submandibular gland (△).

Fig 10h Axial T2WFS MRI (same patient as above) shows the T2 hyperintense lesion (*) insinuating into the right sublingual space (→). It is in close relationship with the sublignual (▲) and submandibular (△) glands.

- MRI: mixed signal, T1 hyperintense blood product, may have enhancement
- Treatment: surgical (Sistrunk procedure)

Ranula

Simple ranula is post-inflammatory mucus retention cyst of the sublingual gland. If rupture to the submandibular space, it becomes a diving ranula (Figs 10g, h).

Clinical Presentation

- Young patient with progressive enlarging mass in the floor of mouth +/- submandibular region; usually painless

Imaging Features

- US: lobulated anechoic cystic lesion in the submental +/- submandibular region; posterior enhancement
- Diving ranula: extend from the sublingual space along the free edge of mylohyoid muscle to the submandibular space
- MRI: T2 hyperintense, thin septation, thin wall enhancement

Dermoid

10 Midline Neck Mass

Dermoid Cyst

Congenital cystic lesion containing fat, fluid and calcification. Commonly at the floor of mouth and lateral orbital region

Clinical Presentation

- Usually in childhood
- Long history before presentation, slow growth

Imaging Features

- US: well defined round / oval lesion with fine internal echo, due to fat content (Fig 10i); dense echogenicity due to calcifications
  - posterior enhancement clue to cystic nature
  - no vascularity
- MRI: mixed signal
  - fat: T1 and T2 hyperintense, signal suppressed on fat suppressed sequence (Fig 10j)
  - calcification: T1 and T2 hypointense
  - fluid: T2 hyperintense, T1 hypointense
  - usually no enhancement

PEARLS:

- Limited differentials for midline neck mass: TDC, ranula, dermoid
- Location along thyroid descend clue to diagnosis of TDC
- Off midline component: consider ranula
- Infected TDC / ranula may mimic abscess / necrotic lymph node

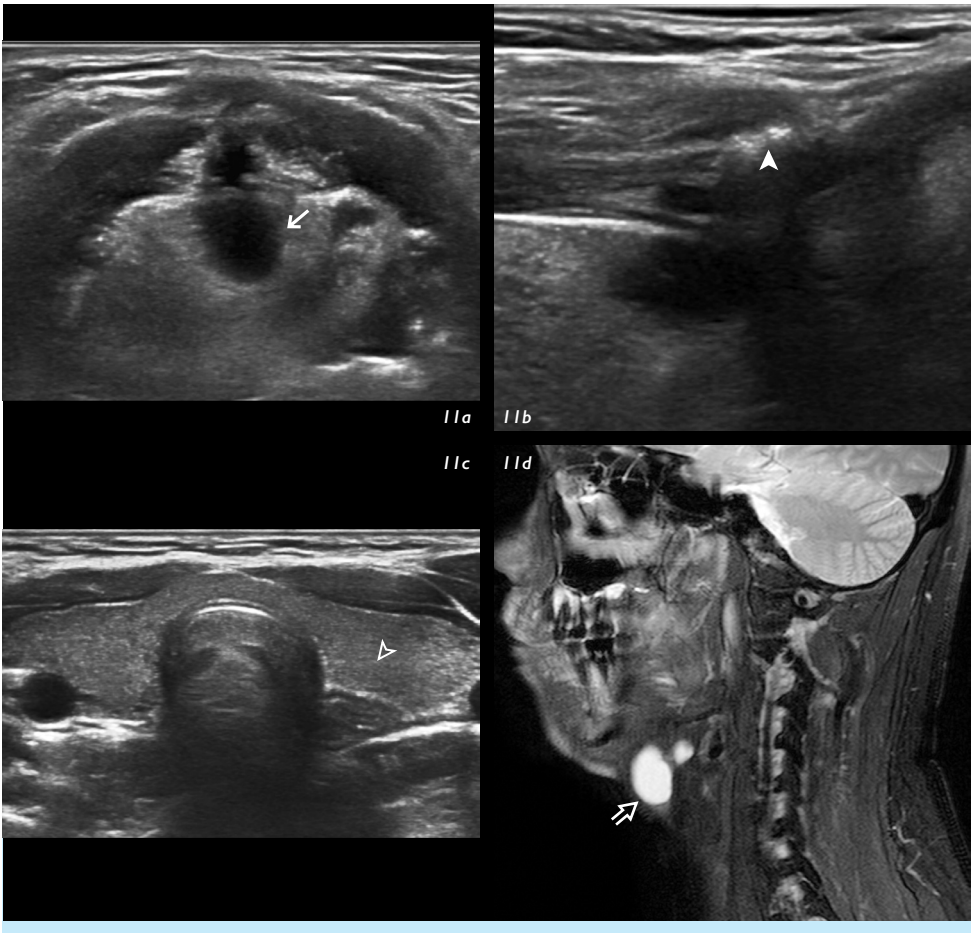
Fig 10i Longitudinal US neck of a child shows an oval well-defined homogenous superficial lesion (△) at the infrahyoid neck. Note the fine intenral echogeniciteis due to fat component (→). This represents a dermoid cyst.

Fig 10j Sagittal T1W MRI shows a lobulated hyperintense midline dermoid (→) at the floor of mouth. The homogenously hyperintense T1 signal represents fat content, characteristic of a dermoid cyst.

Chapter 11

A 12 year old girl presented to the ENT surgeons with an anterior neck mass. Physical examination showed a soft midline neck mass which moved cranially with tongue protrusion. Ultrasound and MRI of neck showed a cystic midline neck mass (Figs 11a-d).

What are the imaging findings and diagnosis?



Findings:

- Transverse (Fig 11a) and longitudinal (Fig 11b) images of the neck at the level of the floor of mouth show a well-circumscribed lobulated cystic lesion (→) at the midline neck, above the level of the hyoid bone (▲). Transverse (Fig 11c) image of the lower neck shows normal thyroid tissue in the thyroid bed (A). Sagittal T2W MRI image (Fig 11d) of neck shows a well circumscribed cystic lesion at the midline region of anterior neck (⇨), above the level of the hyoid bone.

Diagnosis: Thyroglossal duct cyst (suprahyoid)

11 Common Pediatric Cystic Head and Neck Abnormalities

Introduction

Pediatric head and neck conditions are often uncommonly encountered in clinical practice. Most of these lesions are usually benign congenital lesions. The more common pediatric head and neck abnormalities, particularly cystic lesions in the head and neck, will be discussed.

Classification

1. Thyroglossal duct cyst (Figs 11a-d): most common congenital neck cyst. Typically midline in location, but may be paramedian in location. It results from failure of obliteration of the normal thyroglossal duct during development, hence can occur anywhere along the course of the duct. Most commonly infrahyoid in location, occasionally suprahyoid or at level of hyoid bone.
   Complications include infection and rarely malignancy (usually papillary thyroid carcinoma).
2. Branchial cleft anomalies: result from abnormal persistence of branchial cleft / pouch during embryonic development. Most common anomalies are 2nd, followed by 1st branchial apparatus anomalies:

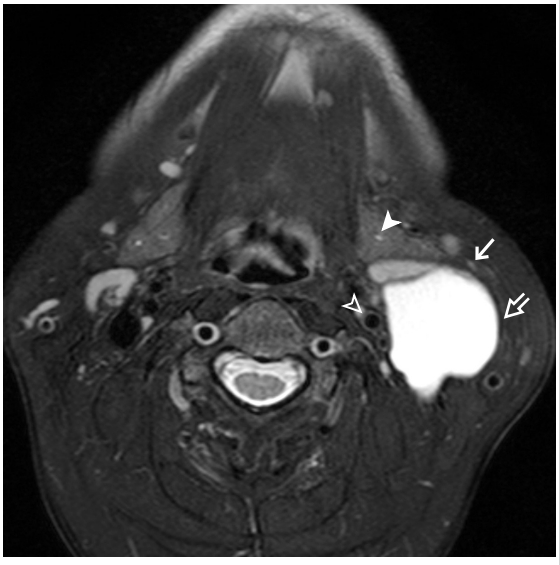


Fig 11e Axial T2W MRI of neck shows a well circumscribed lobulated cystic lesion (→) at the left upper neck, located posterior to the submandibular gland (▲), lateral to the carotid vessel (△) and along the anterior border of sternocleidomastoid muscle (⇨).The location and cystic nature are characteristic for a 2nd branchial cleft cyst.

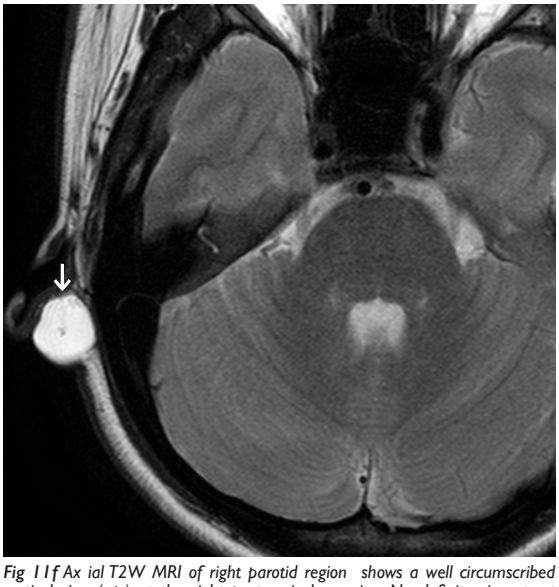


Fig 11f Axial T2W MRI of right parotid region shows a well circumscribed cystic lesion (→) at the right post-auricular region. No definite sinus tract communicating with the skin or external auditory canal was demonstrated. The location is classical for a 1st branchial cleft cyst.

Thyroglossal Duct Cyst 1-2

2nd Branchial Cleft Cyst

1st Branchial Cleft Cyst

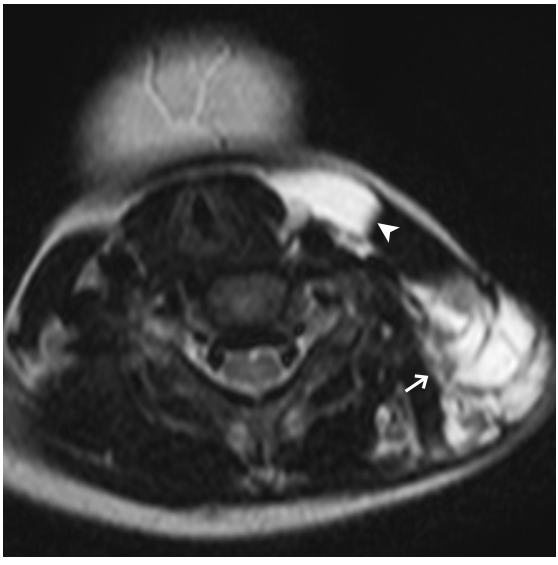


Fig 11g Axial T2W MRI of neck shows an infiltrative multiloculated transpatial cystic lesion (→) centered in the left posterior triangle with extension to the left submandibular region (▲). The lesion also extends inferiorly into the anterior mediastinum (not shown). In a child, the appearances are classical for a lymphatic malformation (also known as cystic hygroma).

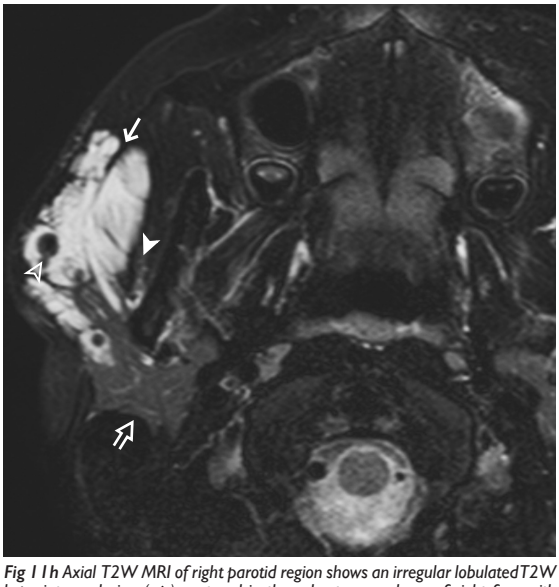


Fig 11h Axial T2W MRI of right parotid region shows an irregular lobulated T2W hyperintense lesion (→) centered in the subcutaneous layer of right face with involvement of right masseter muscle (▲) and superficial lobe of right parotid gland (⇨). A rounded T2W hypointense focus (△) within the lesion is consistent with a phlebolith. Features are consistent with venous vascular malformation.

- 2nd branchial cleft anomaly (Fig 11e): classically located at angle of jaw, posterior to submandibular gland, lateral to carotid vessels and along anterior margin of sternocleidomastoid muscle.
- 1st branchial cleft anomaly (Fig 11f): classically occurs within or close to parotid gland or external auditory canal

3. Vascular malformation: divided into different subtypes depending on slow flow vs. high flow. Most common vascular malformations in children are:
   - Lymphatic malformation (Fig 11g): also known as cystic hygroma. Usually multiloculated, transpatial, septated cystic lesion. Most commonly at posterior triangle, supraclavicular fossa and submandibular space. Can extend into mediastinum.
   - Venous malformation (Fig 11h): lobulated lesion with presence of phleboliths. May show slow flow on greyscale USG and usually hyperintense on T2W MRI. They may be multiple and intramuscular in location (commonest in masseter muscle).

Lymphatic Malformation *Venous Malformation* *Orbital Dermoid Cyst*

11 Common Pediatric Cystic Head and Neck Abnormalities

4. Dermoid cyst (Fig 11i):congenital lesion lined by ectodermal epithelium in the orbit, usually extraconal in location. Can be cystic / solid but usually non-enhancing. Other common locations include midline neck, sublingual space and sternal notch.
5. Ectopic thyroid tissue (Fig 11j): can occur anywhere along the path of embryological descent path of thyroid gland. Most commonly occurs at foramen caecum (lingual thyroid). Usually associated with absence of thyroid tissue in normal location.

Imaging Modalities

- Ultrasound is the first line investigation of choice for investigation of pediatric neck masses due to its easy availability and lack of ionizing radiation.
- MRI may be helpful in selected cases to better demonstrate the full extent of lesion or for further characterisation and multiplicity.
- Nuclear medicine scan e.g. thyroid scan is helpful to localize ectopic thyroid tissue.

PEARLS:

- Cystic head and neck lesions are common in children and ultrasound is a useful first line investigation.
- Congential pediatric cystic conditions have characteristic locations, hence knowledge of the common locations is essential in arriving at a correct pre-operative diagnosis.

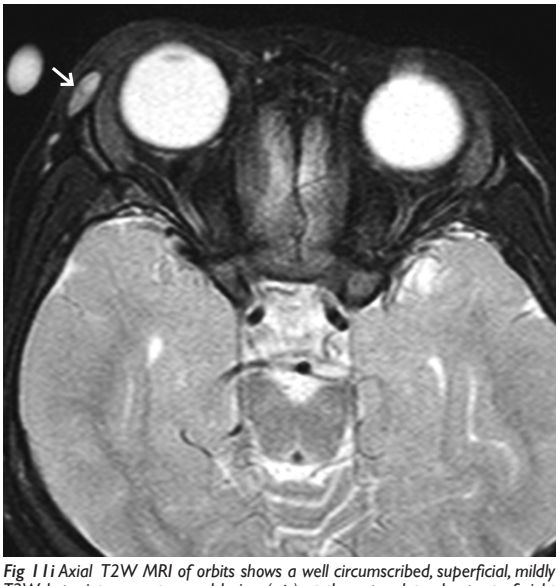


Fig 11i Axial T2W MRI of orbits shows a well circumscribed, superficial, mildly T2W hyperintense extraconal lesion (→) at the superolateral aspect of right orbit adjacent to the orbital rim (beneath the skin marker). No contrast enhancement was depicted (not shown). Features are compatible with an orbital dermoid cyst.

Fig 11j Midline Sag ittal T2W MRI of neck shows mildly T2W hyperintense soft tissue at the tongue base (→) and upper neck just inferior to the hyoid bone (▲). Note the absence of normal thyroid tissue at the expected location of thyroid bed (△). Features are compatible with ectopic thyroid tissue at lingual and infrahyoid locations.