

Salivary Glands: Anatomy & Pathology

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Disclosures

- No financial disclosures

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- Rick Wiggins, MD
- Michael W. Sim, MD
- Ric Harnsberger, MD

Objectives

- Discuss the imaging appearance and anatomic structures of the parotid, submandibular, and sublingual spaces
- Detail common and uncommon pathologies involving the parotid, submandibular, sublingual, and minor salivary glands of the head and neck

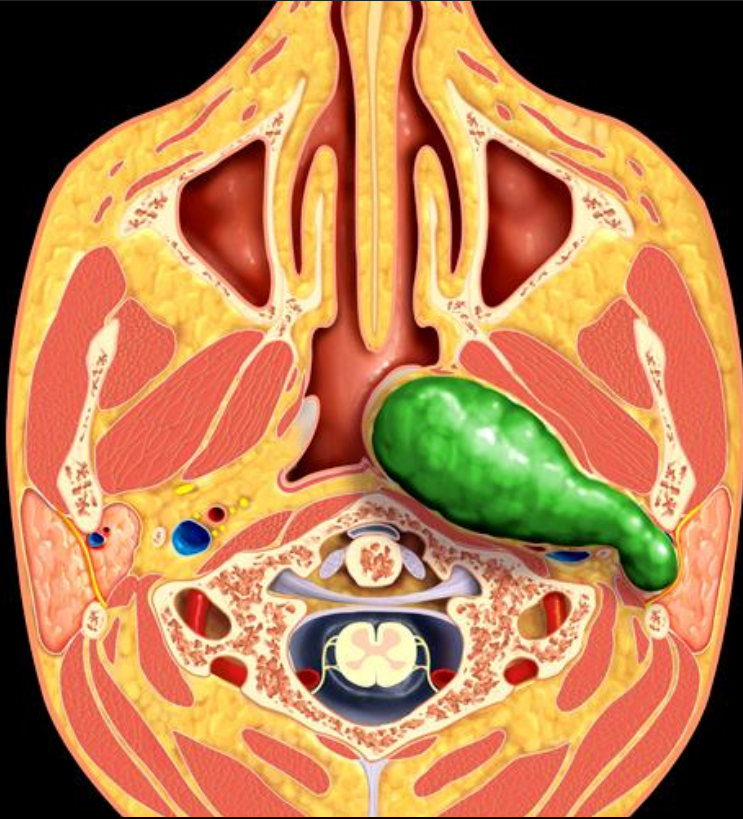
Introduction

- Three major salivary glands found in the head & neck
 - Parotid
 - Submandibular
 - Sublingual
- Numerous (up to 1,000) minor salivary glands (MSG)
- Major salivary glands located in unique spaces
 - Parotid gland → parotid space
 - Submandibular gland → submandibular & sublingual space
 - Sublingual gland → sublingual space

Introduction

- Salivary gland neoplasms are NOT common
 - ~3% of all H&N tumors
- > 80% of salivary gland neoplasms arise in the parotid
- **As gland size ↓, odds of mass = malignant ↑**
 - Parotid gland = 20% malignant
 - Submandibular gland = 50% malignant
 - Sublingual & MSG = 60-80% malignant
- Salivary neoplasm far more common in adults
 - Greater proportion malignant in kids (2-3x)

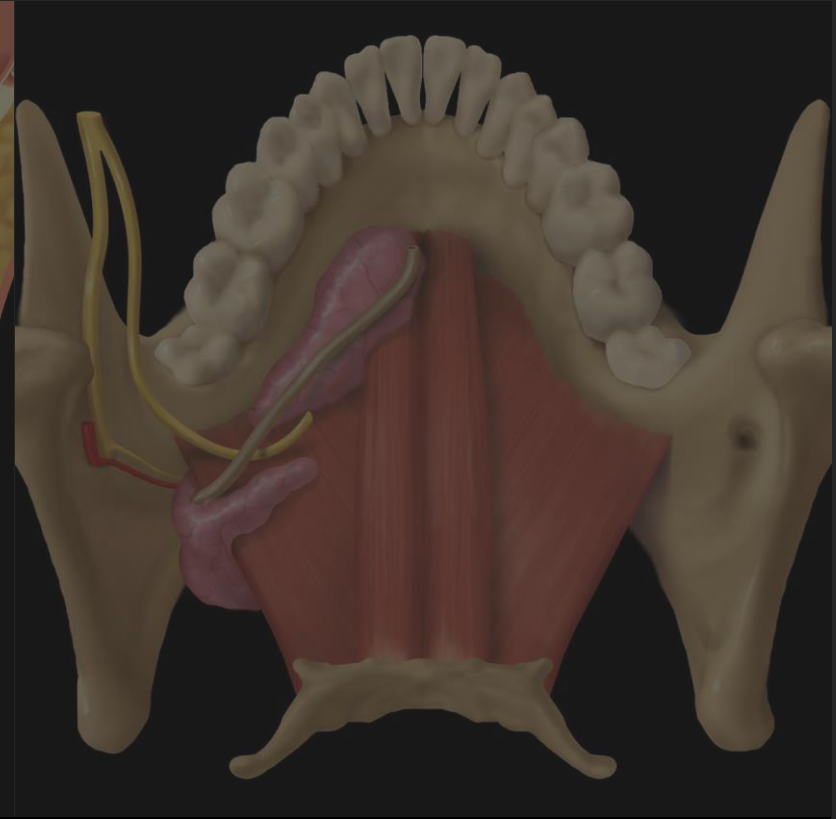
Salivary Glands: Anatomy & Pathology



PAROTID



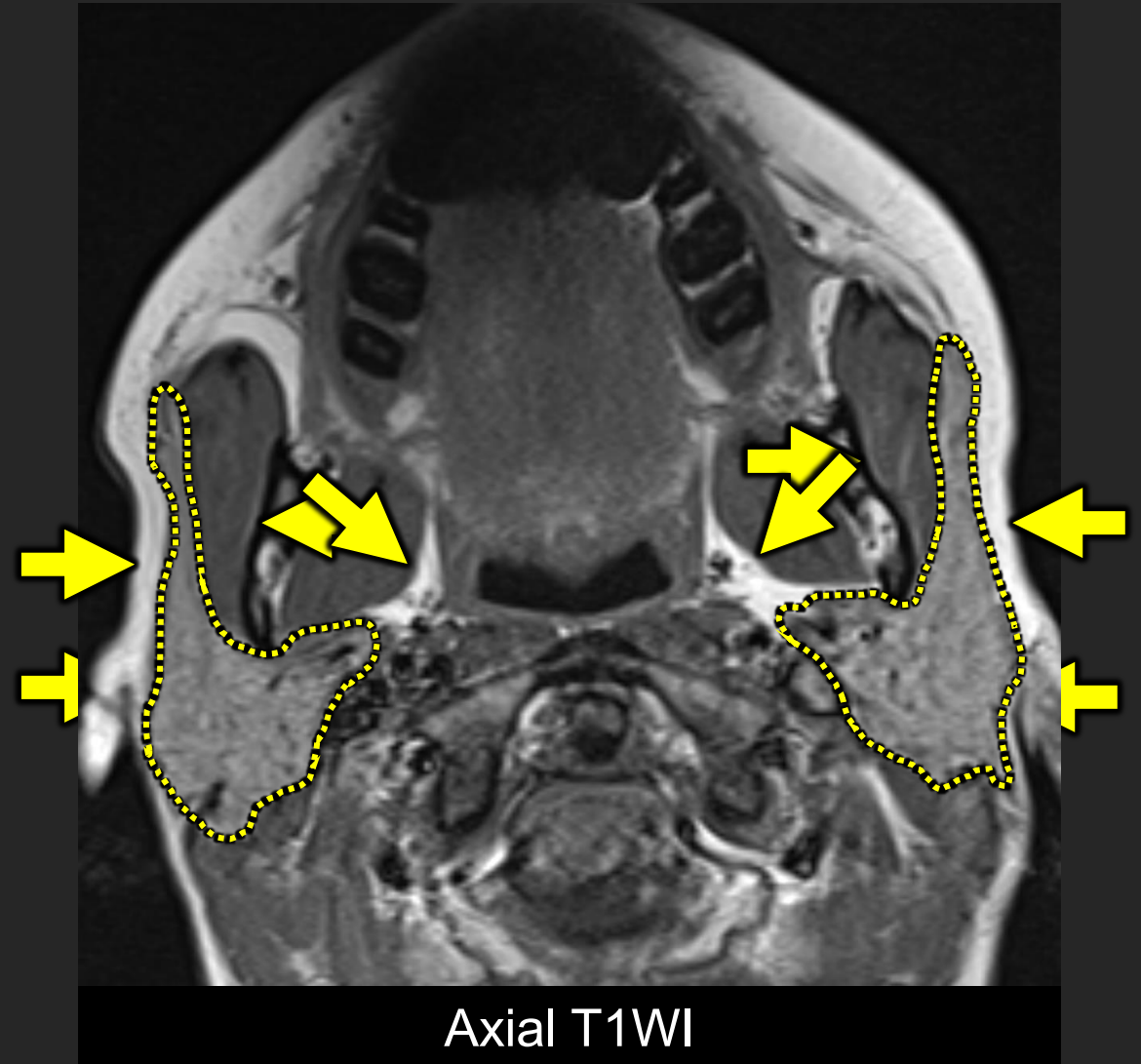
SUBMANDIBULAR



SUBLINGUAL

Parotid Space

- Paired suprahyoid neck
- Extent
 - Superior
 - Skull base, mastoid tip, EAC
 - Inferior
 - Submandibular space, parotid tail
 - Medial
 - Masseter (superficial), parapharyngeal space (deep)
 - Lateral
 - Subcutaneous cheek



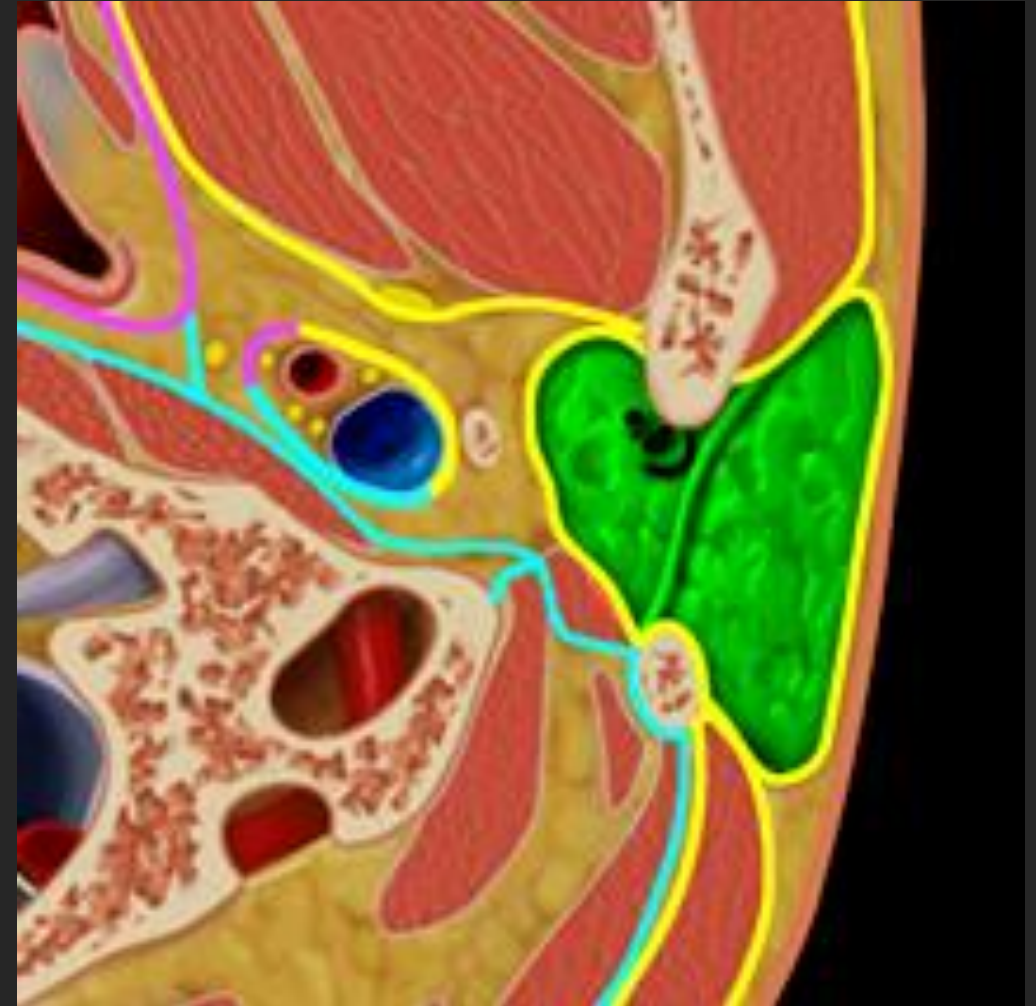
Parapharyngeal Space Relationship

- Deep lobe parotid mass → anteromedial PPS displacement



Deep Cervical Fascia

- **Superficial layer** of deep cervical fascia surrounds parotid space
 - Superficial lamina
 - Adherent to gland
 - Stylomandibular ligament
 - Separates parotid tail from submandibular gland



Parotid Space Contents

- Parotid gland + duct
- Facial nerve (CN7)
- External carotid artery
- Retromandibular vein
- Lymph nodes



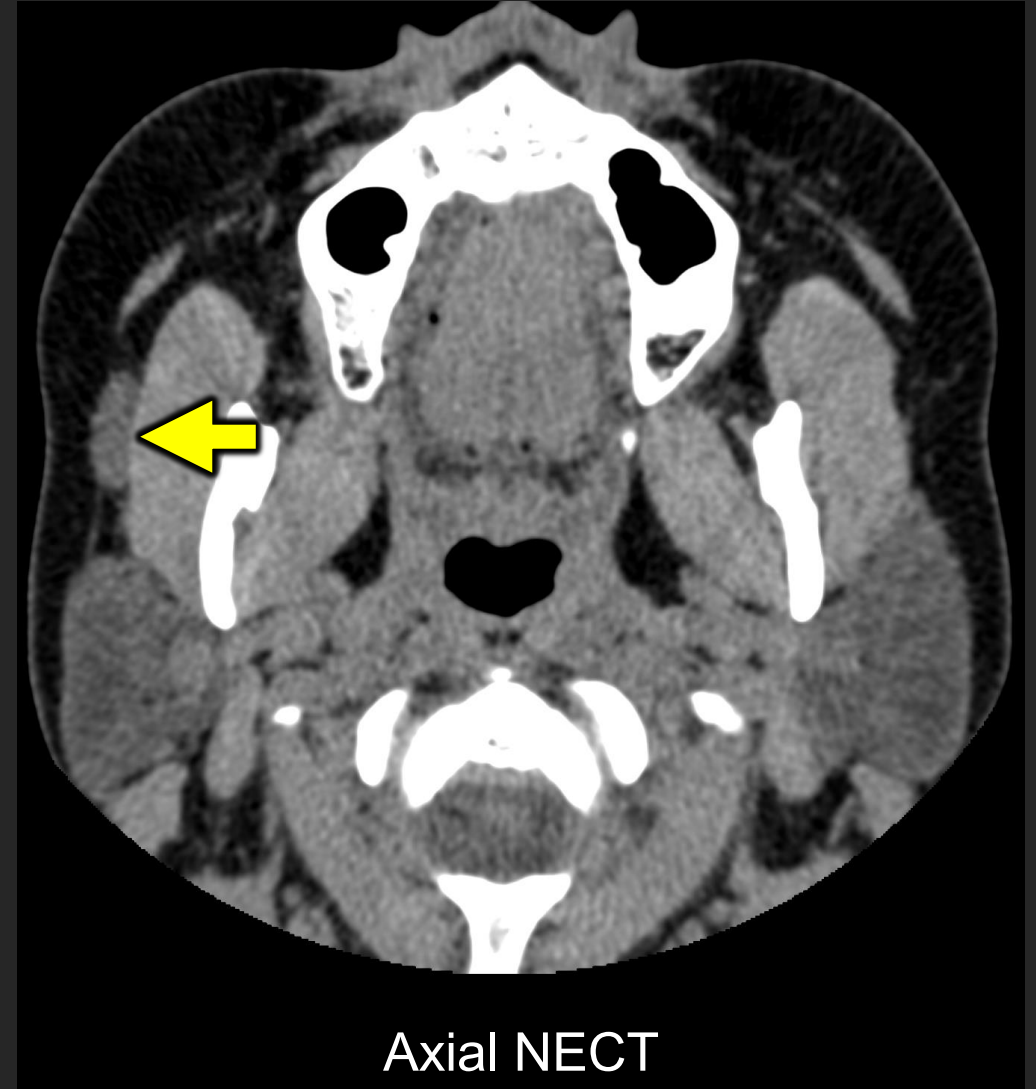
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- Lymph nodes



Parotid Gland

- Parotid = “Beside the Ear”
- Largest salivary gland
- Exocrine gland
 - Serous saliva (~25%)
 - Salivary amylase
- Dense capsule + DCF
 - Risorius muscle (smile!)
- Ductal tree
 - Striated + intercalated
- Accessory parotid (~20%)



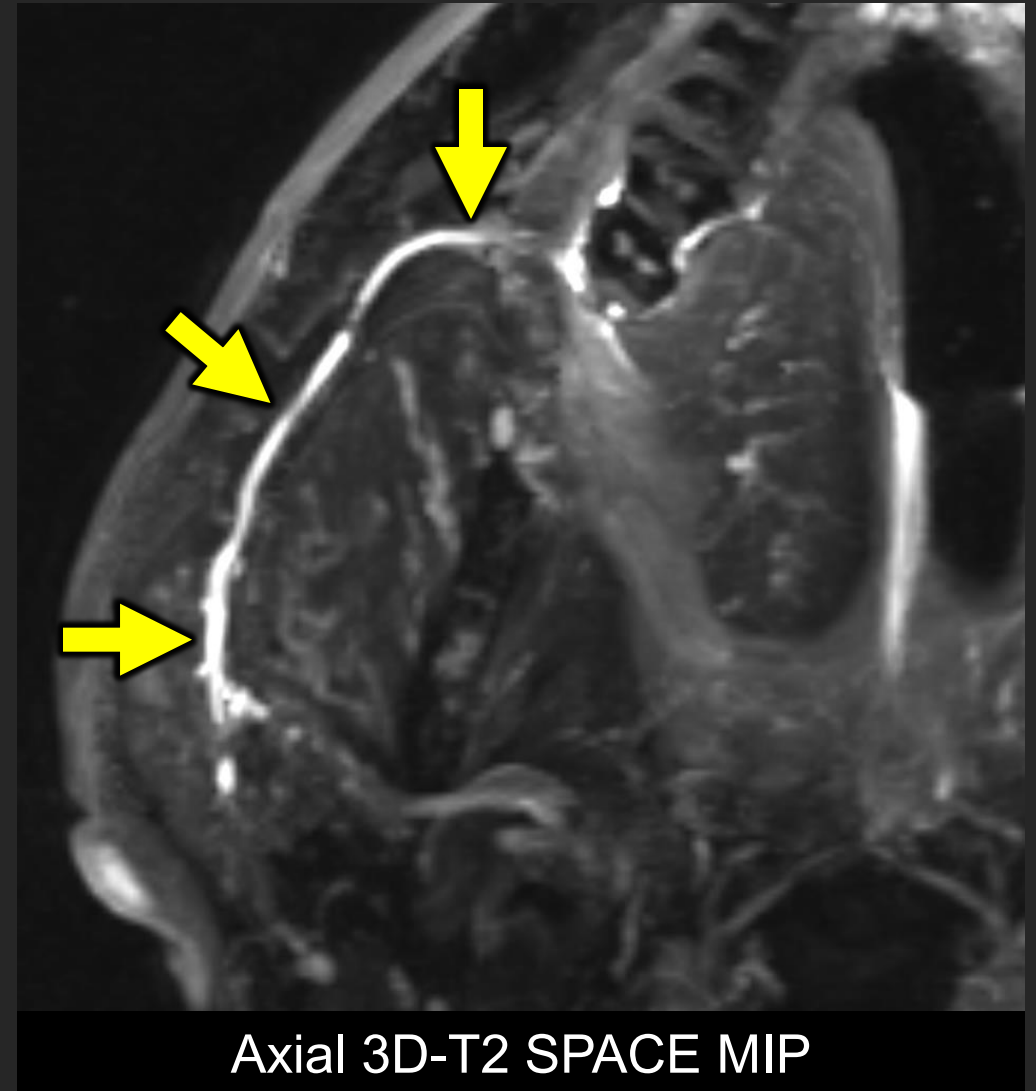
Parotid “Lobes”

- No true anatomic division
 - Partitioned relative to plane of the facial nerve (CN7)
 - Retromandibular vein = CT & MR imaging surrogate
- Superficial lobe (~80%)
 - Superficial to masseter, mandibular ramus & angle
- Deep lobe (~20%)
 - Medial extent of parotid via stylomandibular tunnel



Parotid Duct

- Salivary flow
 - Alveoli → intercalated → striated → excretory → main → parotid orifice
- Parotid duct segments
 - Intraglandular
 - Extraglandular (masseteric)
 - Buccal
- Smooth, arborized appearance on imaging



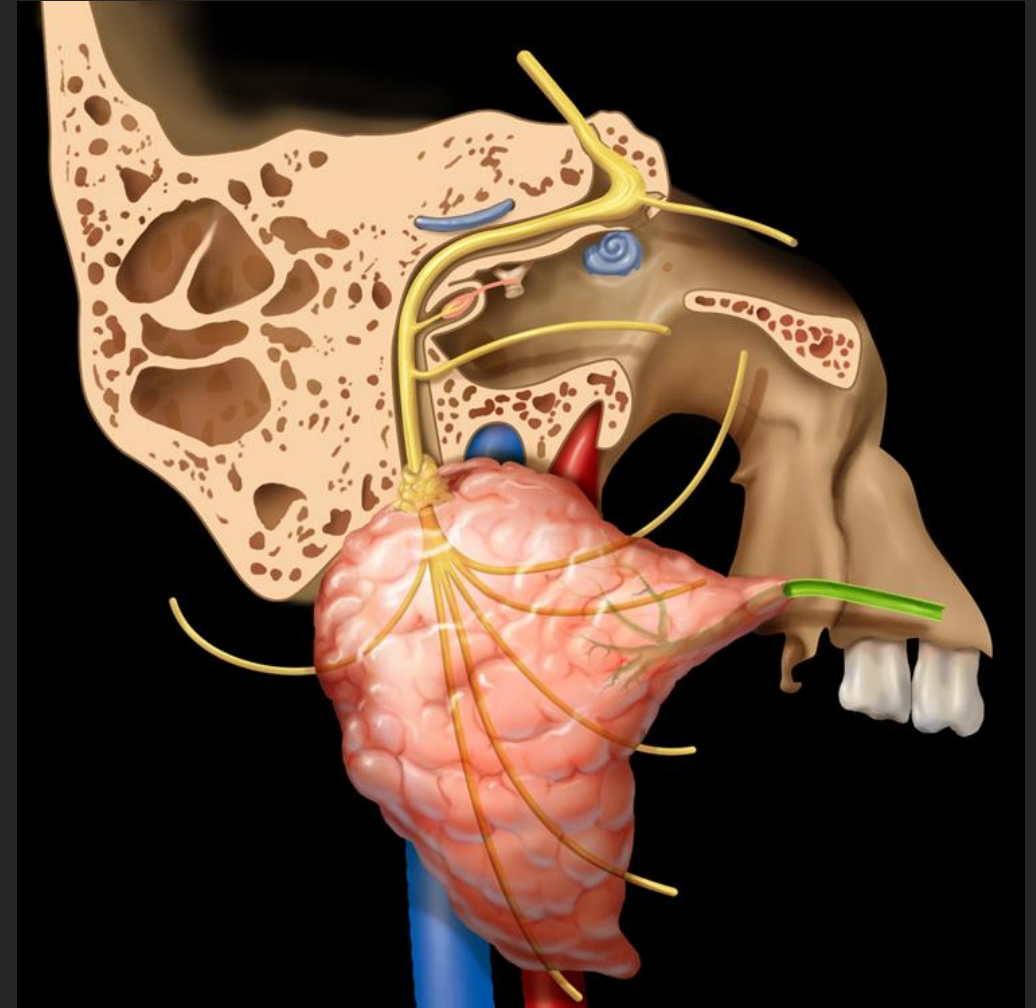
Parotid Space Contents

- Parotid gland + duct
- **Facial nerve (CN7)**
- External carotid artery
- Retromandibular vein
- Lymph nodes



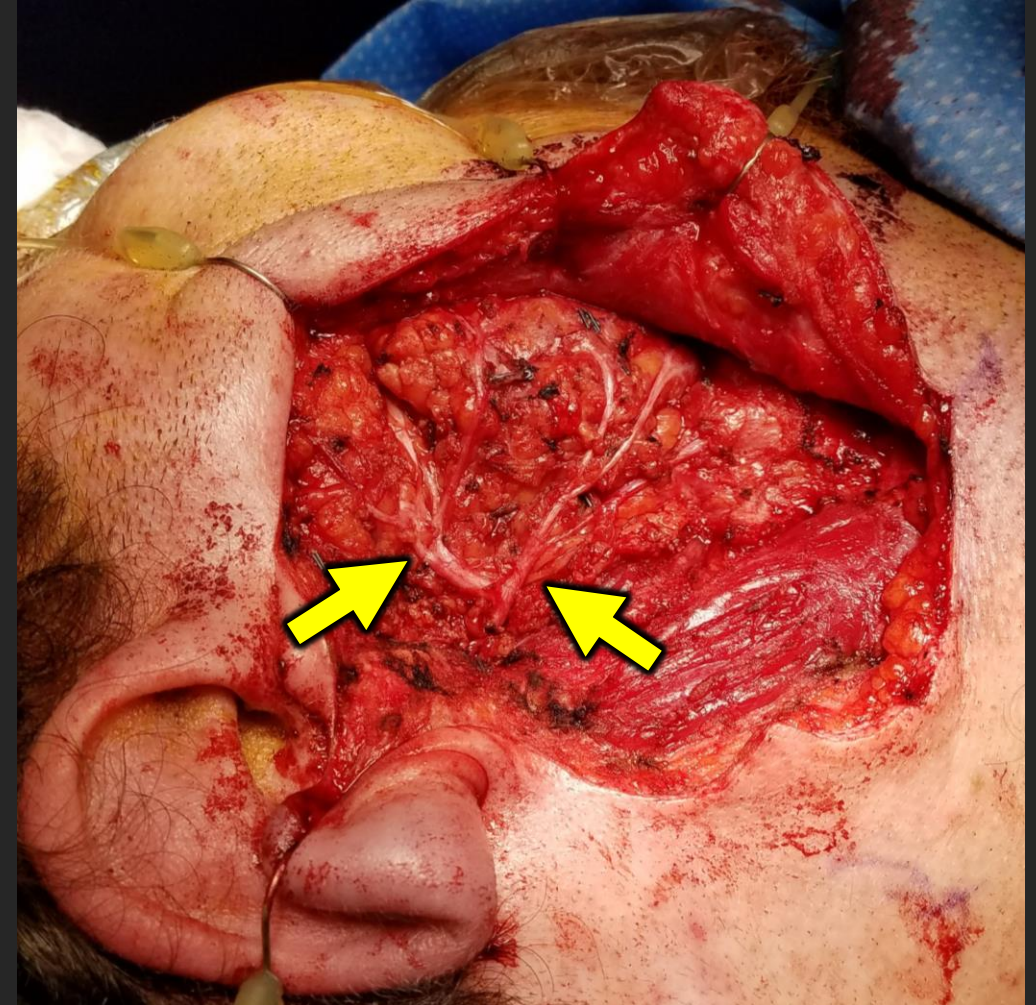
Intraparotid Facial Nerve

- Extracranial course
 - “To Zanzibar by motor car”



Intraparotid Facial Nerve

- Extracranial course
 - “~~To Zanzibar by motor car~~”
 - CN7 exits skull base at stylomastoid foramen
 - Runs lateral to RMV
 - Ramifies in parotid space
 - Temporofacial branch
 - Temporal
 - Zygomatic
 - Cervicofacial branch
 - Buccal
 - Marginal mandibular
 - Cervical



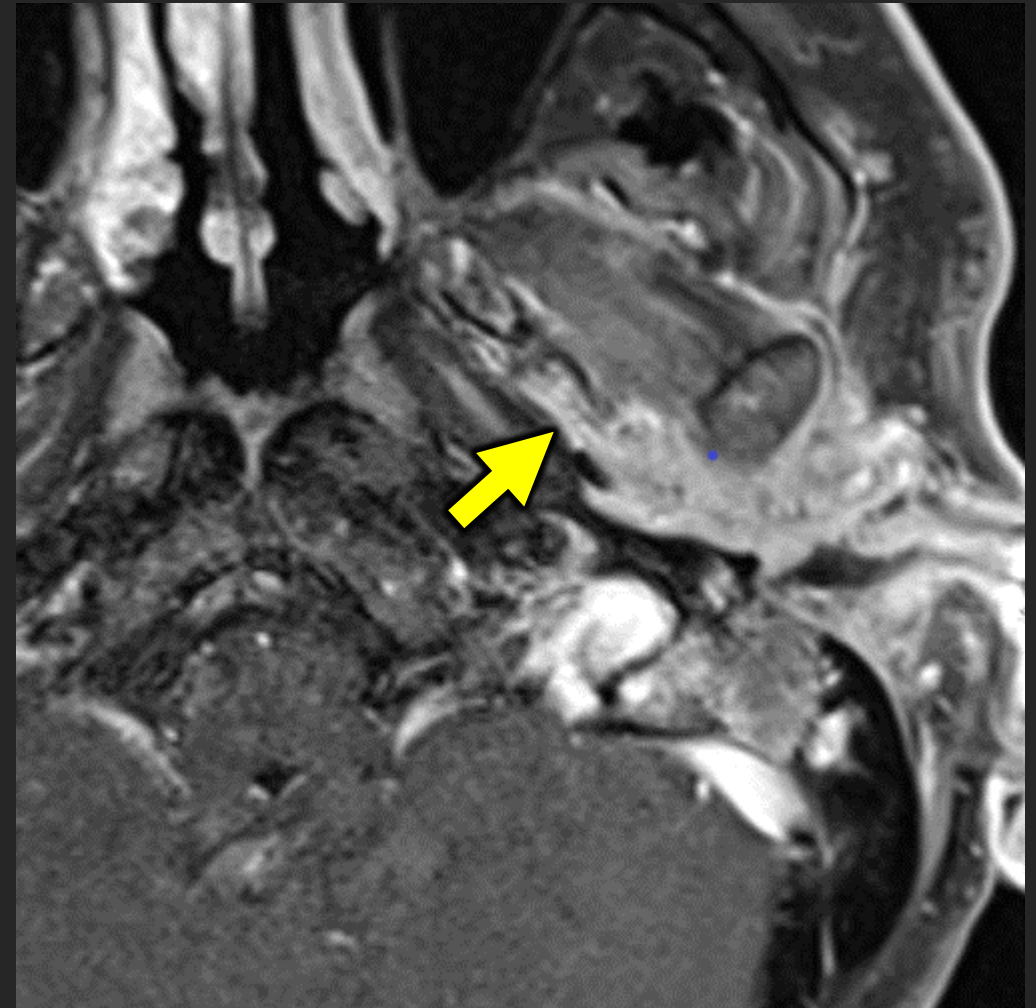
Intraparotid Facial Nerve

- Defines plane of deep and superficial lobes of parotid
- Only proximal intraparotid CN7 visible on MRI
 - Retromandibular vein = surrogate imaging marker



Auriculotemporal Nerve

- CNV3 branch
 - Secretomotor innervation to parotid gland
- Perpendicular to CN7, crossing parotid gland
 - Not seen on imaging
- **Extracranial bridge linking CN7 and CNV3**
 - Perineural tumor spread



Axial T1WI C+ FS

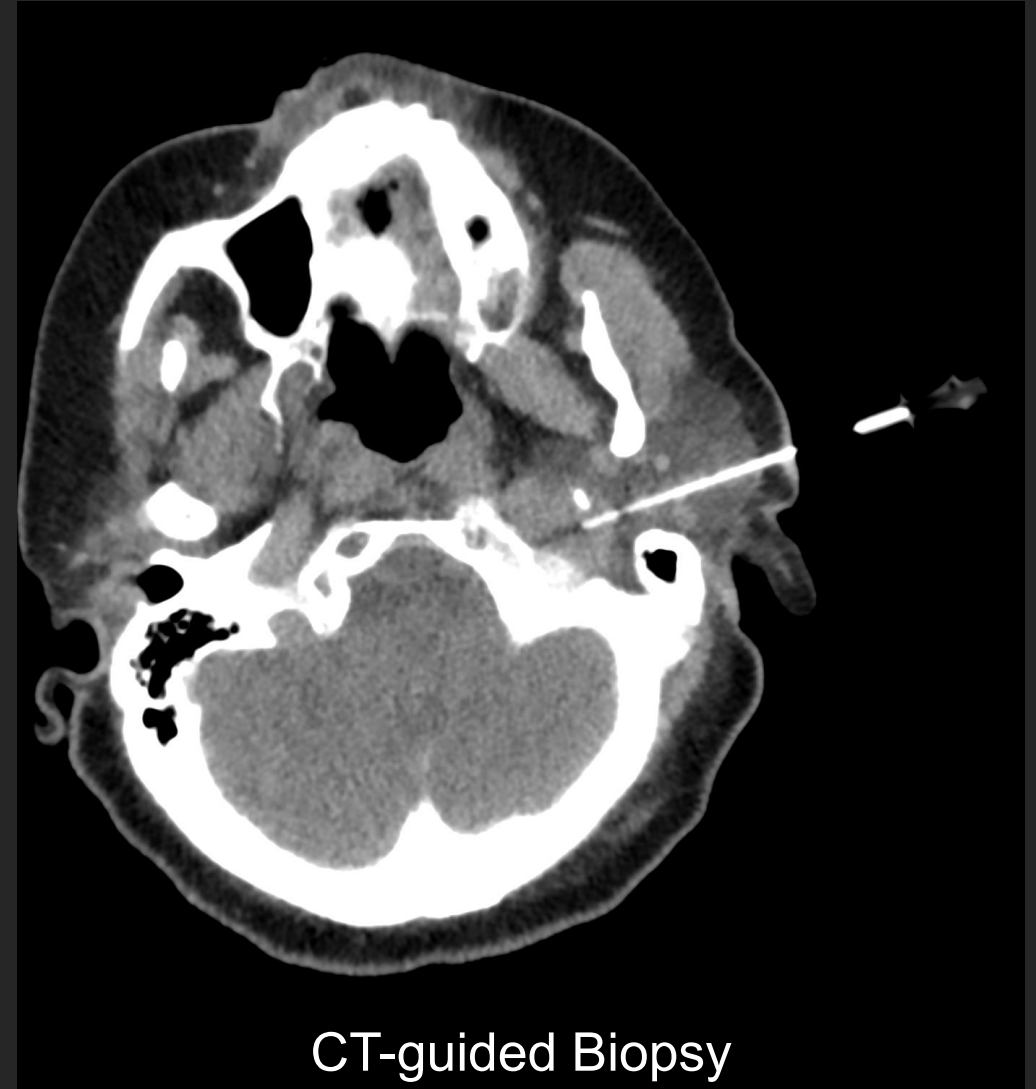
Parotid Space Contents

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- Facial nerve (CN7)
- **External carotid artery**
- Retromandibular vein
- Lymph nodes



External Carotid Artery

- Located posterior to mandibular ramus
- Usually medial to and smaller than retromandibular vein
- Considerations:
 - Tumoral involvement
 - Biopsy planning



CT-guided Biopsy

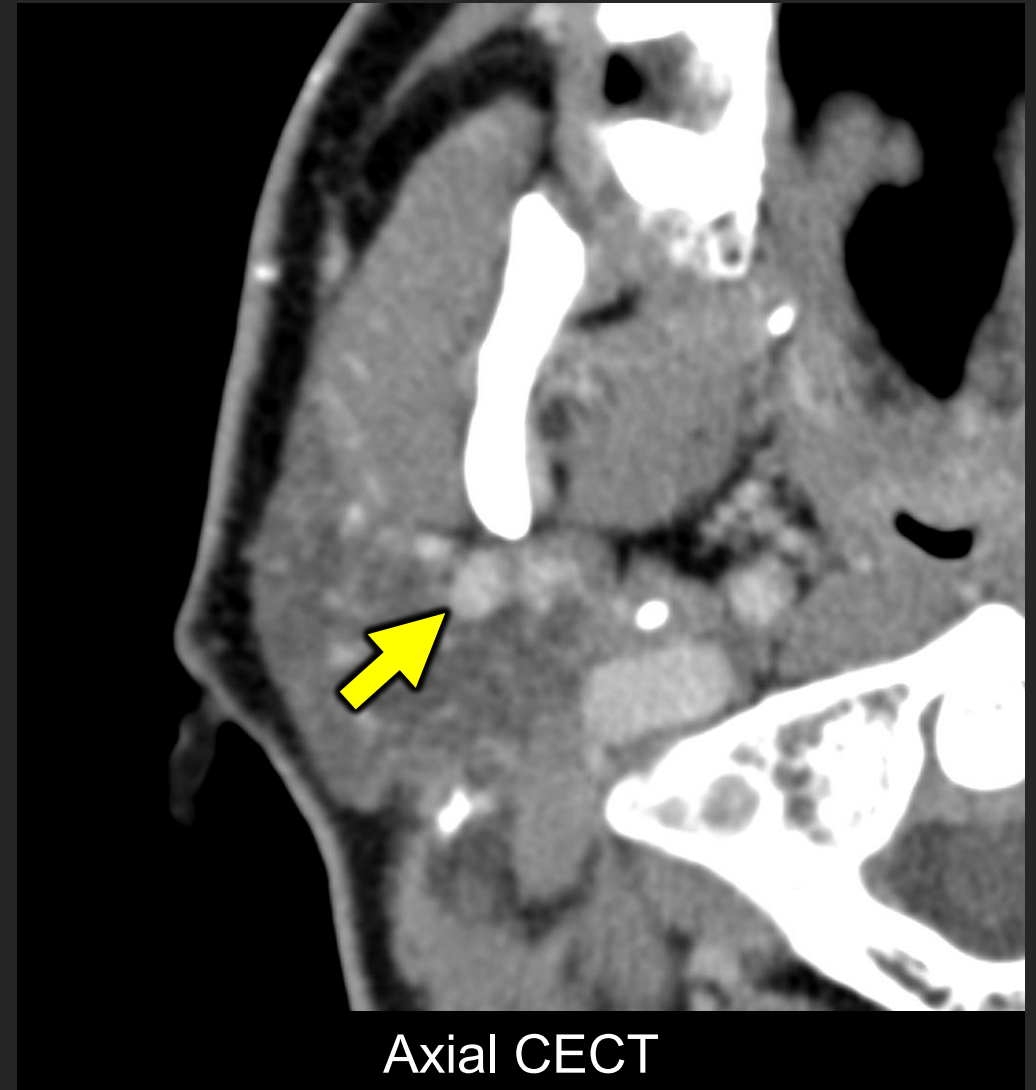
Parotid Space Contents

- Parotid gland + duct
- Facial nerve (CN7)
- External carotid artery
- **Retromandibular vein**
- Lymph nodes



Retromandibular Vein (RMV)

- Located posterior to mandibular ramus
- Usually lateral to and larger than ECA
- Surrogate imaging marker for intraparotid CN7
 - CN7 lives lateral to RMV
 - Plane divides superficial and deep lobes of parotid



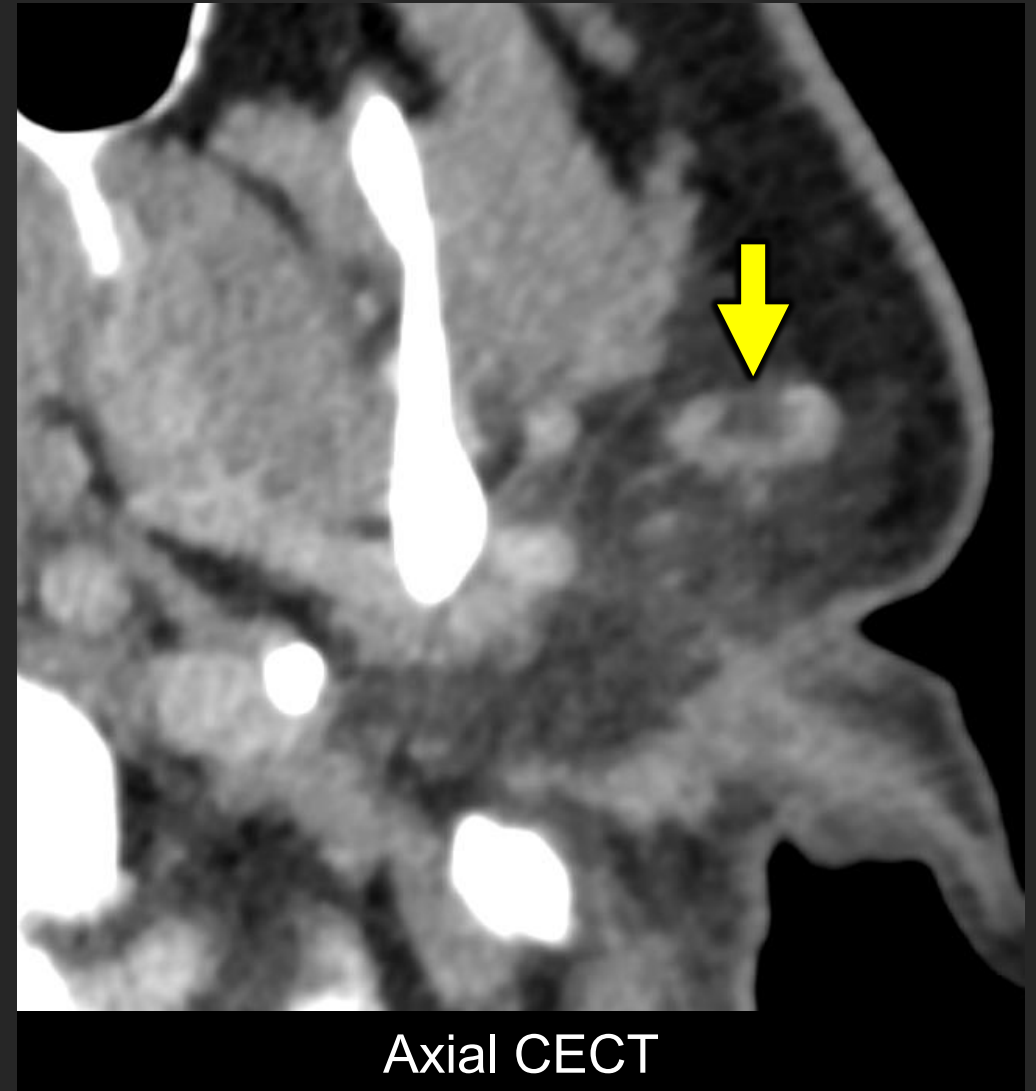
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- Facial nerve (CN7)
- External carotid artery
- Retromandibular vein
- **Lymph nodes**



Intraparotid Lymph Nodes

- Only major salivary gland to contain lymph nodes
 - Late developmental encapsulation
- ~20 lymph nodes
 - Superficial > deep
- 1st order nodal drainage:
 - External auditory canal
 - External ear
 - Scalp
 - Face



Selected Parotid Pathologies

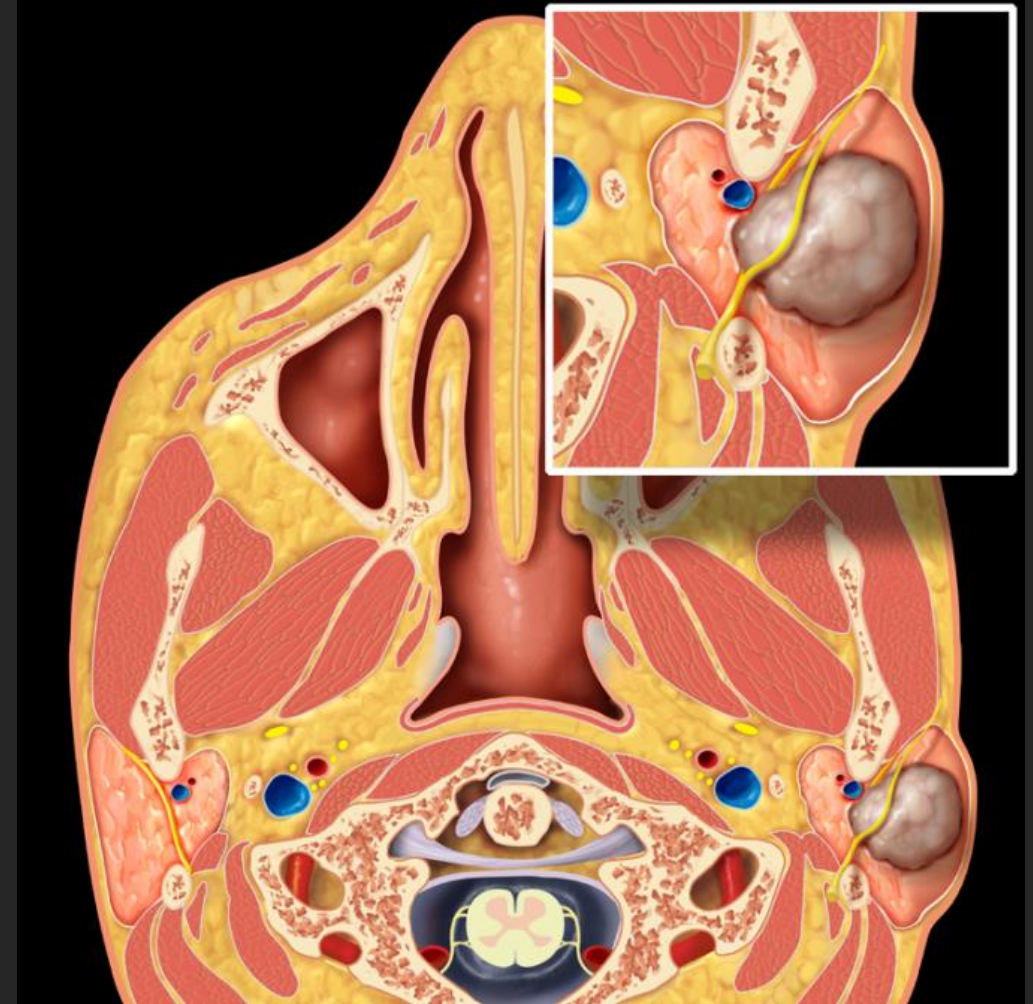
- Parotid gland & duct
 - Neoplasms (benign & malignant)
 - Parotitis (including calculous)
 - Sjögren syndrome
- Facial nerve
 - Schwannoma
 - Perineural tumor spread
- Lymph nodes
 - Metastases
 - Lymphoma

Selected Parotid Pathologies

- Parotid gland & duct
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Pleomorphic Adenoma

- Benign mixed tumor
- Most common parotid space mass (~80%)
- ~85% superficial lobe
- Epithelial, myoepithelial, and stromal components
- Can be bad actors
 - Risk of seeding
 - Carcinoma ex pleomorphic adenoma



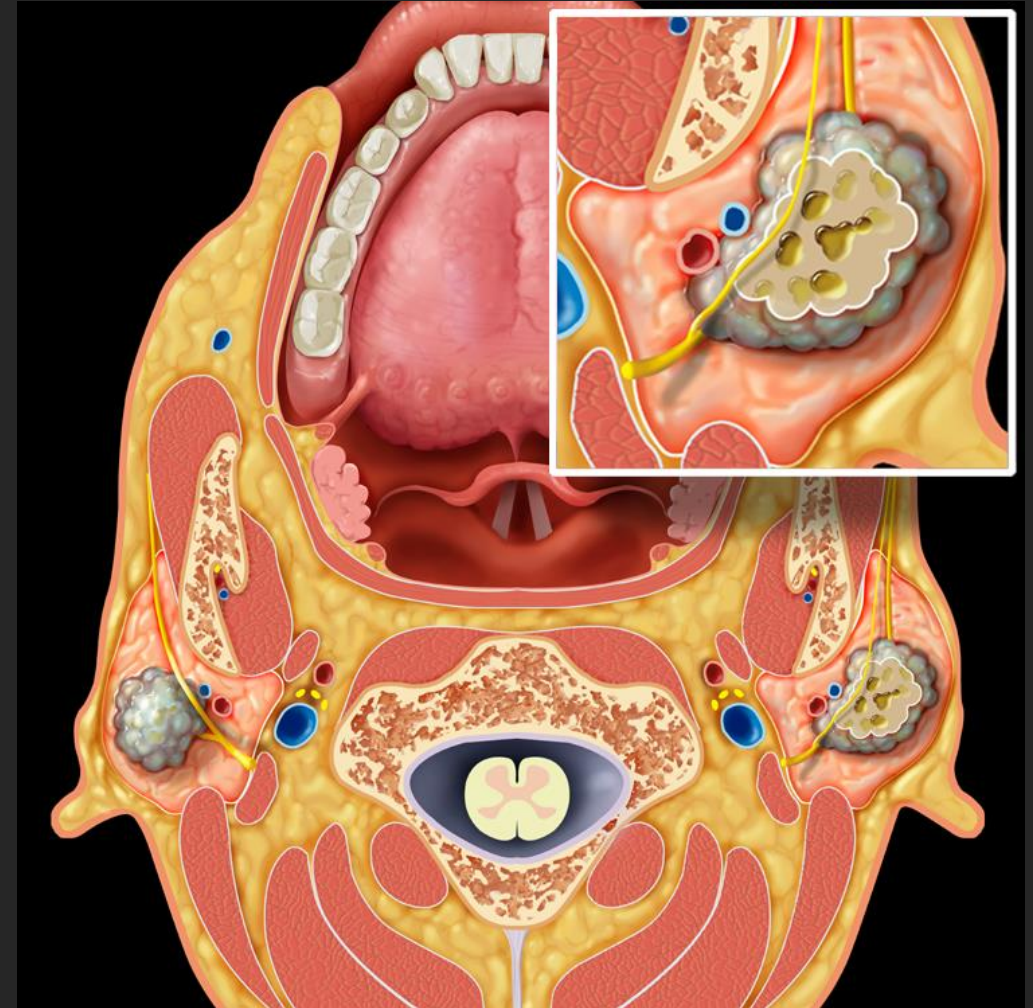
Pleomorphic Adenoma

- When small:
 - T2 bright
 - Circumscribed
 - Bosselated margins
 - Fairly uniform enhancement
- When large:
 - Heterogeneous signal and enhancement
 - Mass effect on tonsil, parapharyngeal space



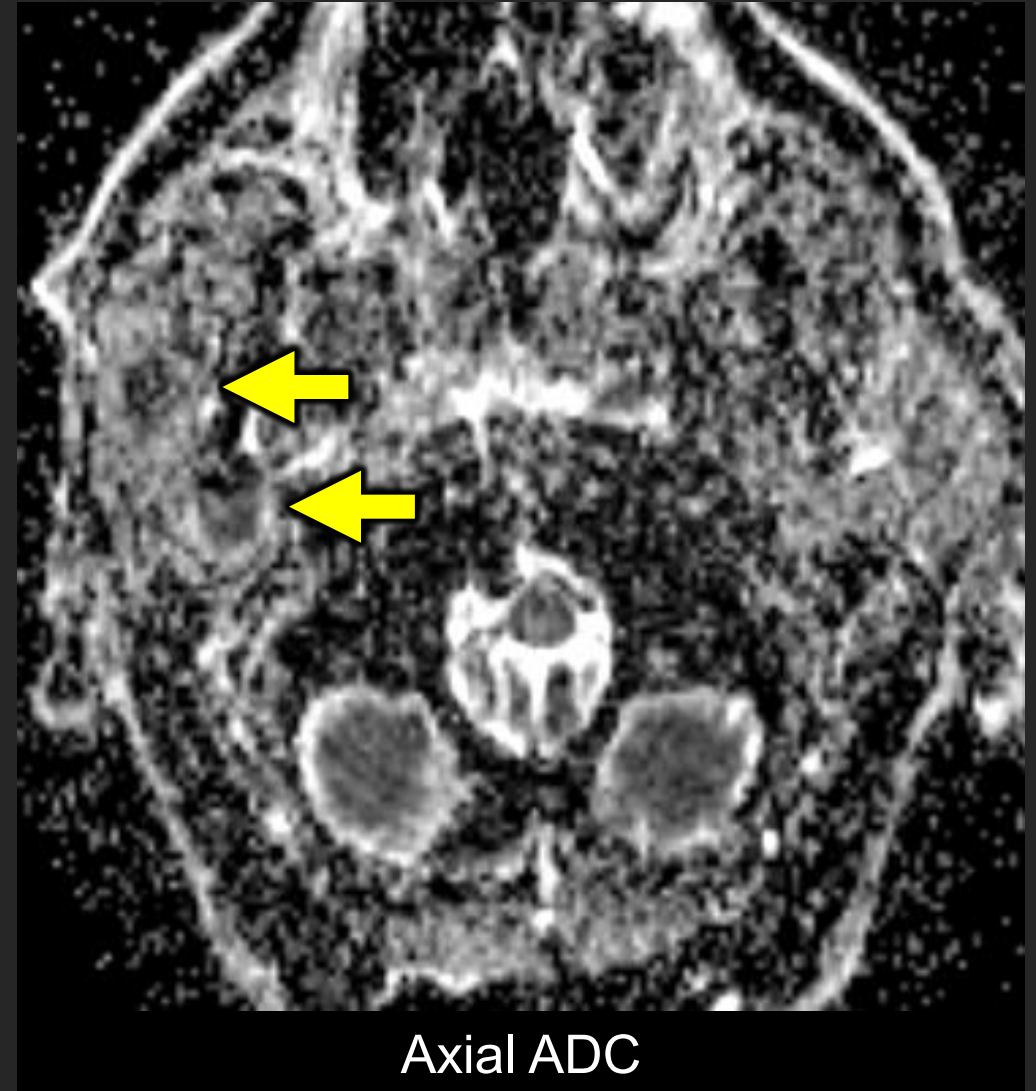
Warthin Tumor

- Papillary cystadenoma lymphomatosum
- Older men, smokers
- Second most common parotid mass
- 20% multifocal
- Unilateral or bilateral
- Commonly parotid tail
- Rarely (< 1%) malignant



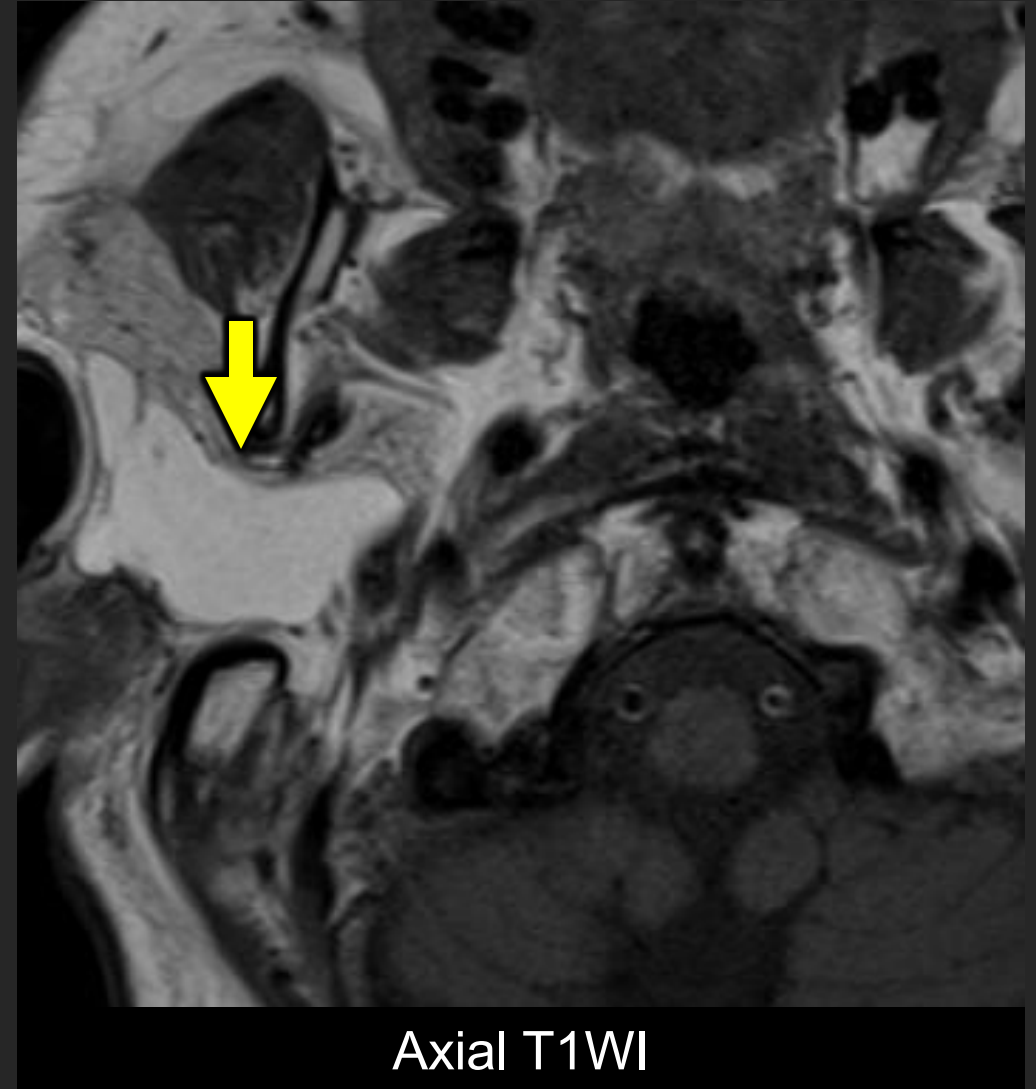
Warthin Tumor

- Solid, circumscribed
 - 30% cystic component
- Heterogeneous, variable enhancement
 - Rapid enhancement and washout on DCE
- FDG uptake
- Relatively low ADC
- Biopsy or excision for definitive diagnosis



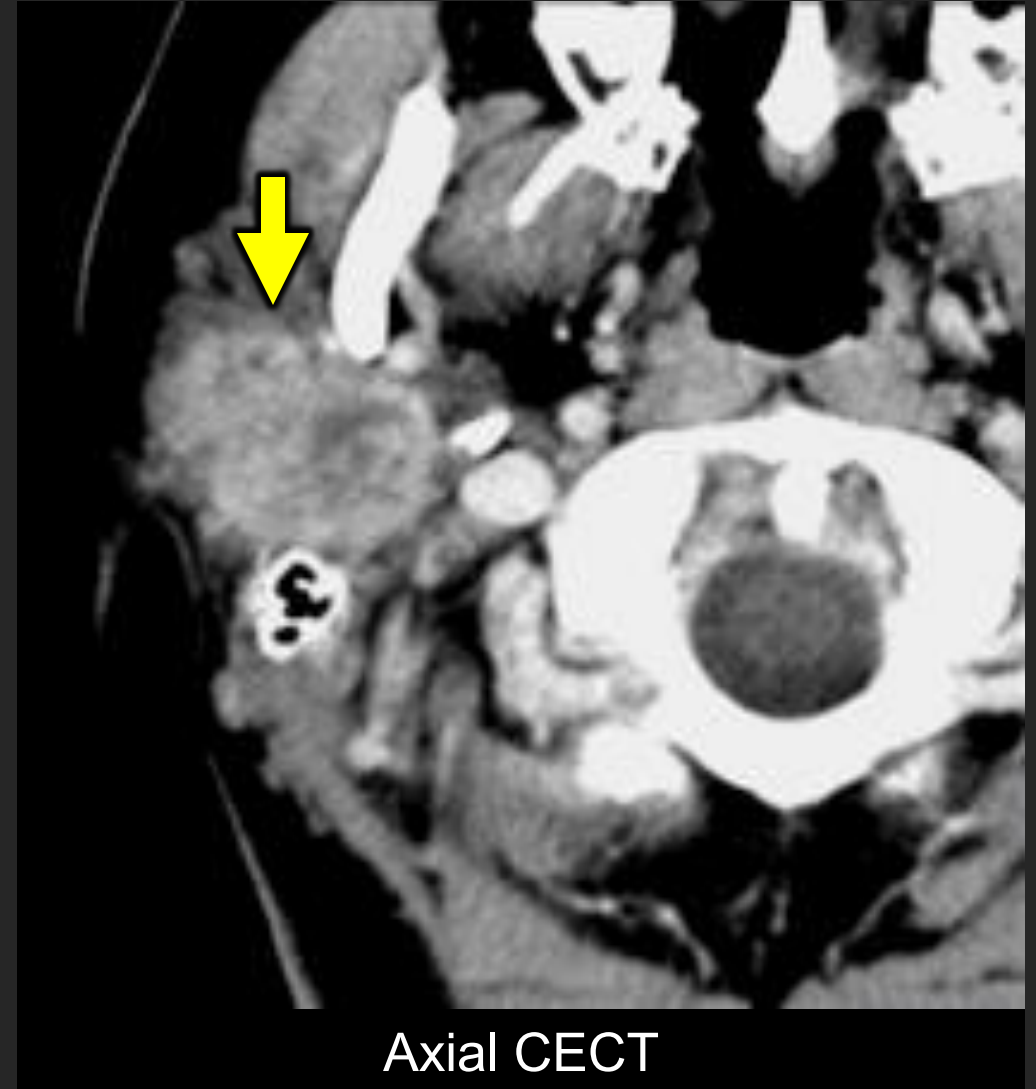
Lipoma

- Uncommon site of a common mass
- Fat attenuation
- Circumscribed, mildly lobulated, T1 bright
- No enhancement
- Can be multiple



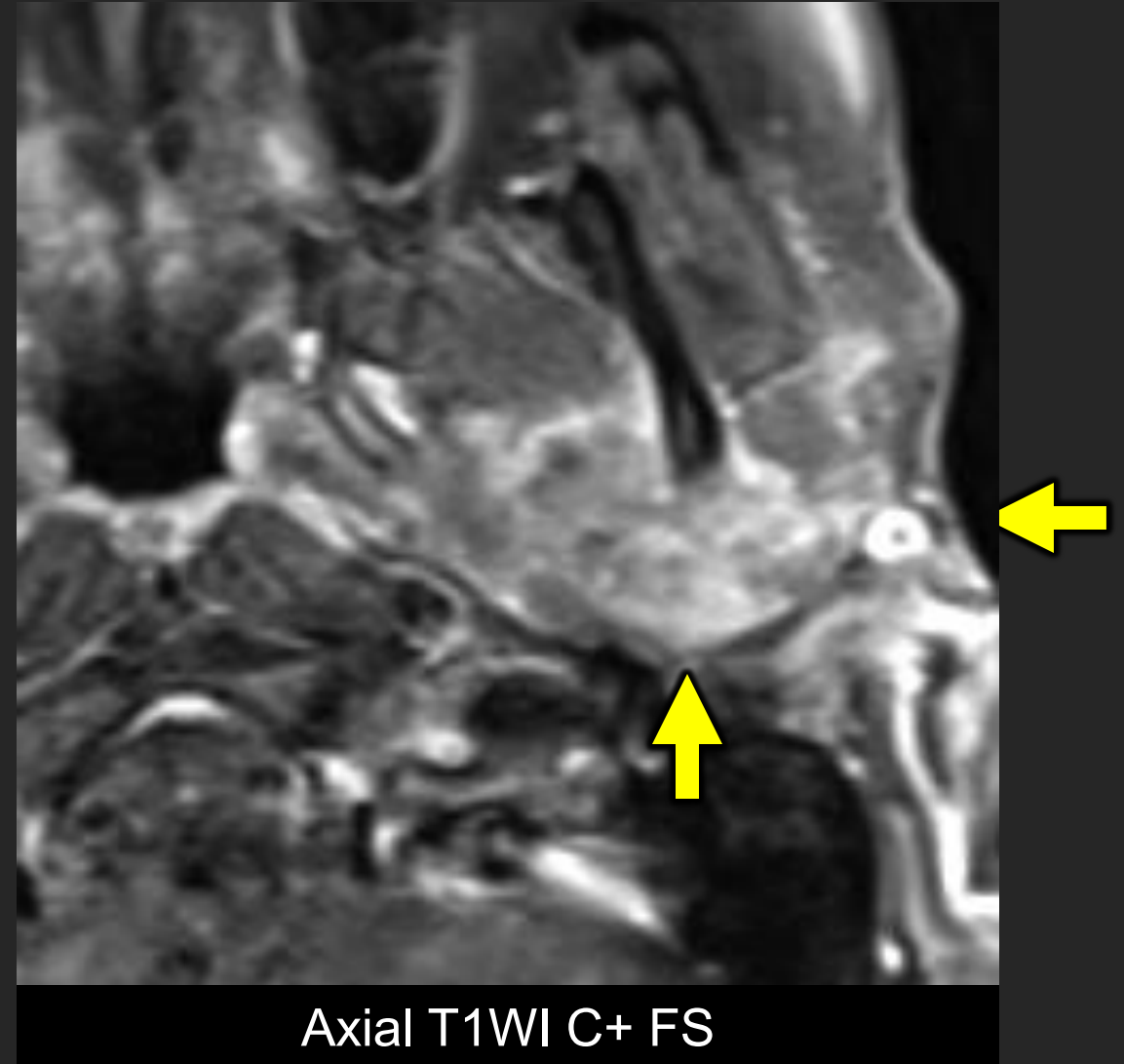
Mucoepidermoid Carcinoma

- Most common malignant parotid tumor
- Epidermoid & mucus-secreting cells arising from ductal epithelium
- Circumscribed → infiltrative
- **Nodal metastases**
 - Less commonly perineural tumor spread
- Late recurrence



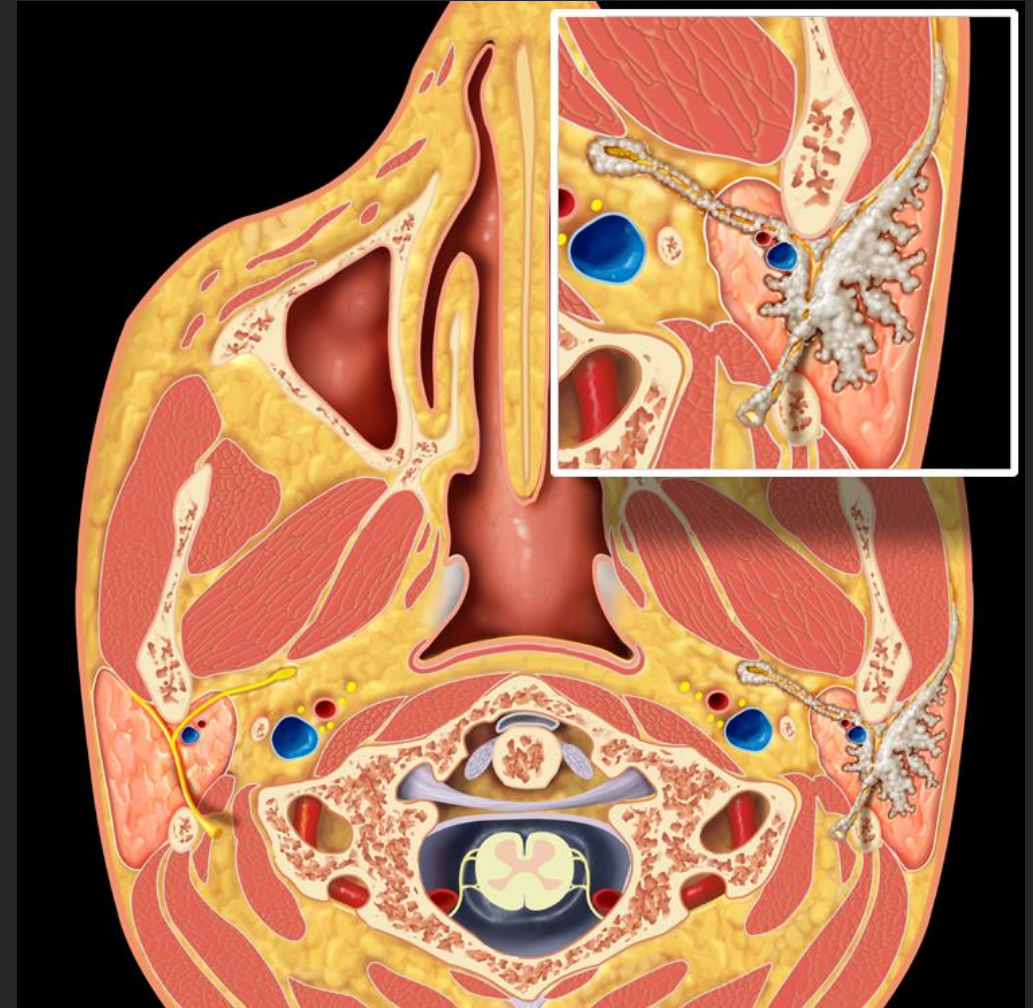
Mucoepidermoid Carcinoma

- Margins can help predict tumor grade
- May have low density mucous cystic areas
- Characteristic, but non-pathognomonic low T2 signal intensity
- Heterogeneous enhancement
- Lower ADC than BMT



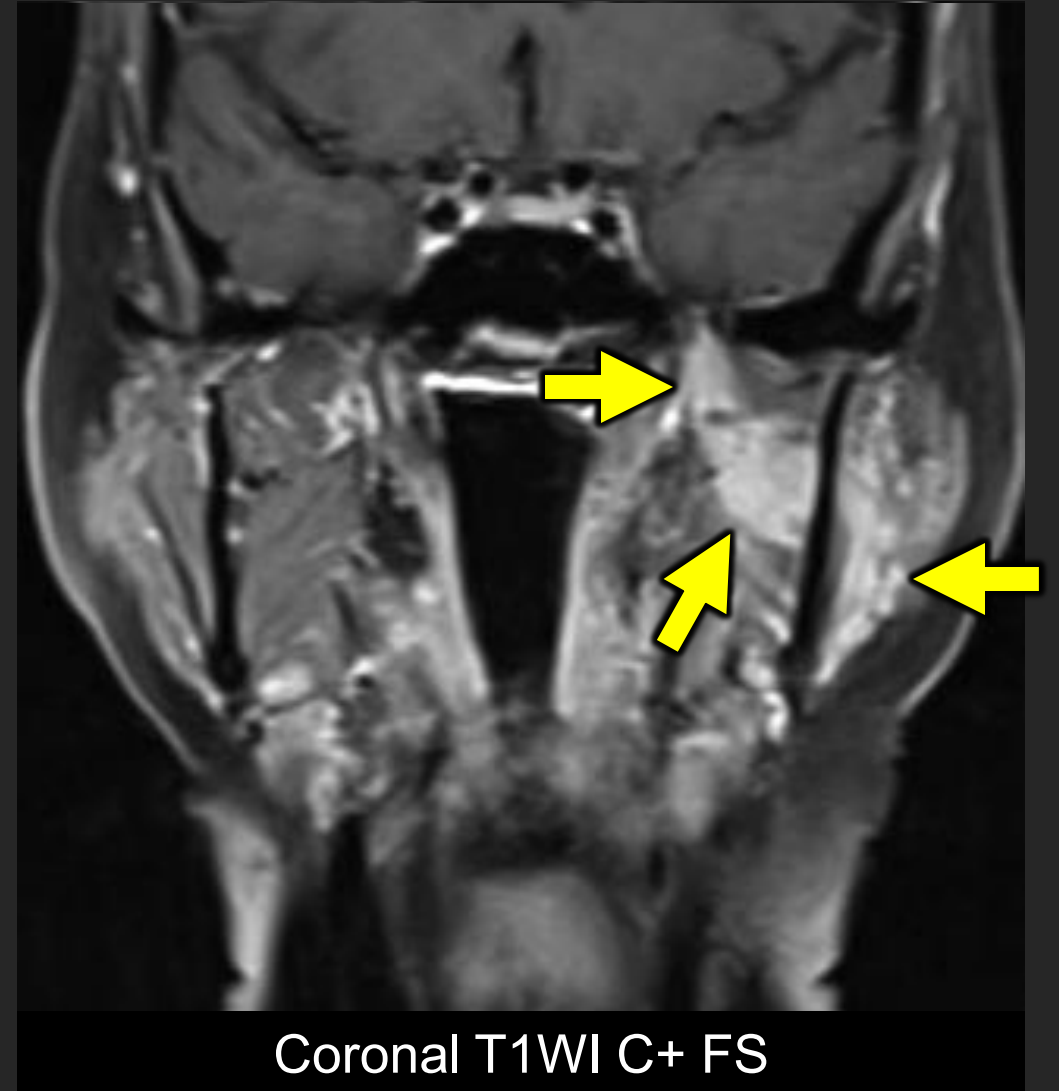
Adenoid Cystic Carcinoma

- #2 parotid malignancy
- Arises from peripheral ductal epithelium
- Circumscribed → infiltrative
- **Perineural tumor spread**
 - CN7
 - Auriculotemporal nerve → CNV3
- **Late recurrence**



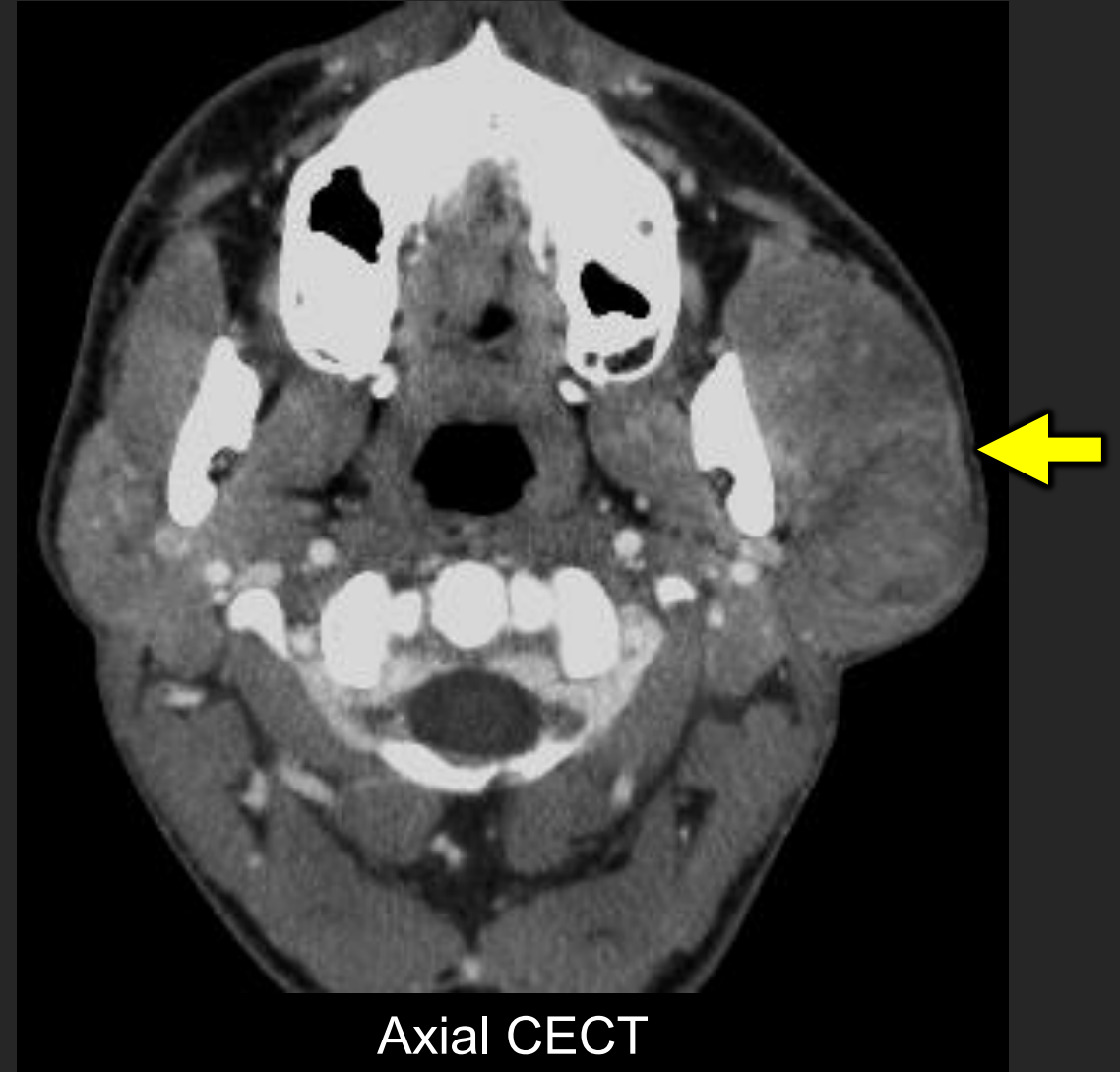
Adenoid Cystic Carcinoma

- Margins can help predict tumor grade
- Low to intermediate T1 signal intensity
- Moderate T2 signal, decreases with grade
- Avid enhancement
 - **Follow the nerves!**
- Low ADC → cellular tumor



Malignant Mixed Tumor

- Two varieties
 - Carcinoma ex pleomorphic adenoma
 - Carcinosarcoma (rare)
- Early = mimics BMT
 - May have areas of lower T2 signal intensity
 - Lower ADC
- Late = aggressive, invasive



Axial CECT

Reporting Parotid Masses

- Imaging has poor specificity for predicting histopathology
- Checklist
 - Location (superficial lobe, deep lobe, proximity to CN7)
 - Size
 - Margins
 - Benign/low-grade vs. high-grade
 - Multiplicity
 - Warthin, metastases, lymphoma, oncocytoma
 - Perineural tumor spread/CN 7 involvement
 - Nodal metastases

Reporting Parotid Masses

“Further imaging will confer no additional specificity to the diagnosis”

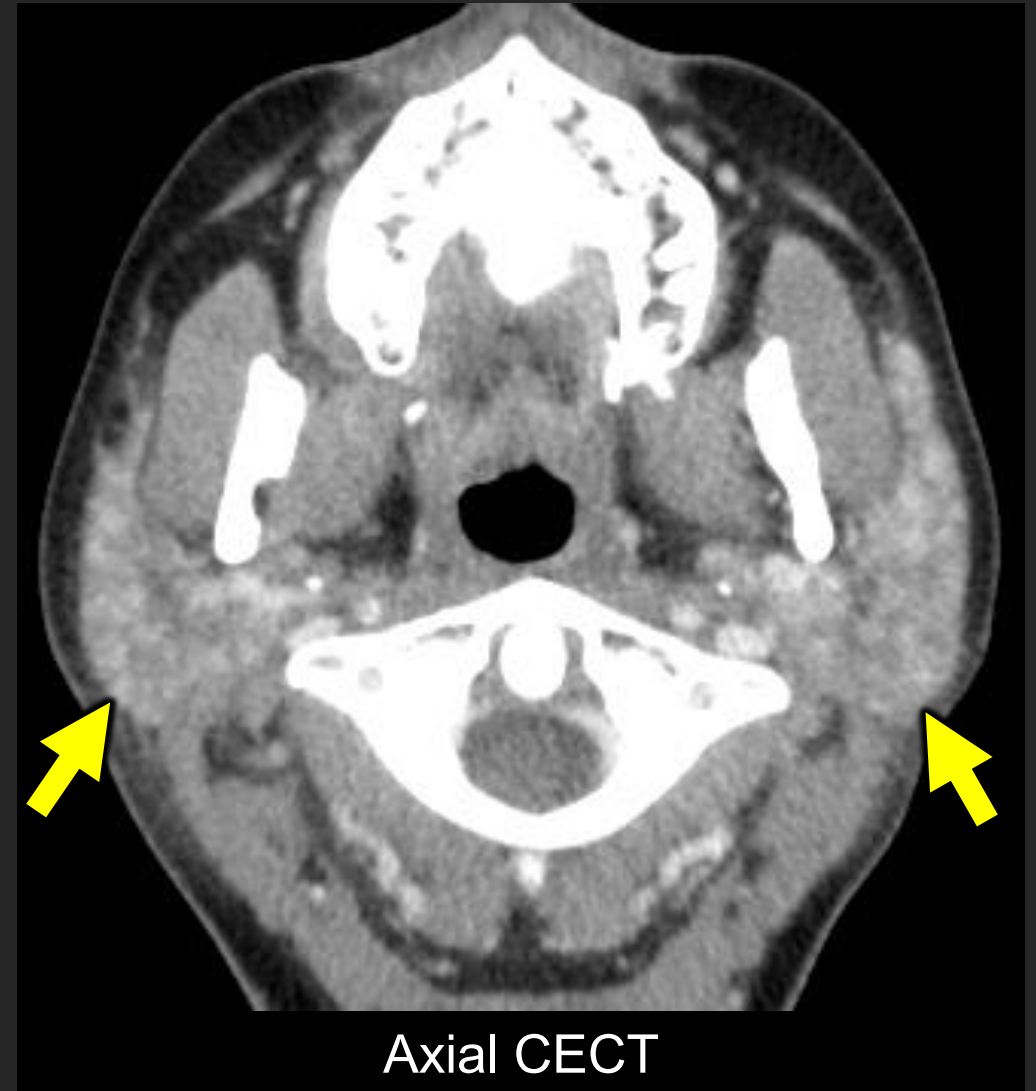
**If you want to know what it is,
stick a needle in it!**

Selected Parotid Pathologies

- **Parotid gland & duct**
 - Neoplasms (benign & malignant)
 - **Parotitis (including calculous)**
 - Sjögren syndrome
- Facial nerve
 - Schwannoma
 - Perineural tumor spread
- Lymph nodes
 - Metastases
 - Lymphoma

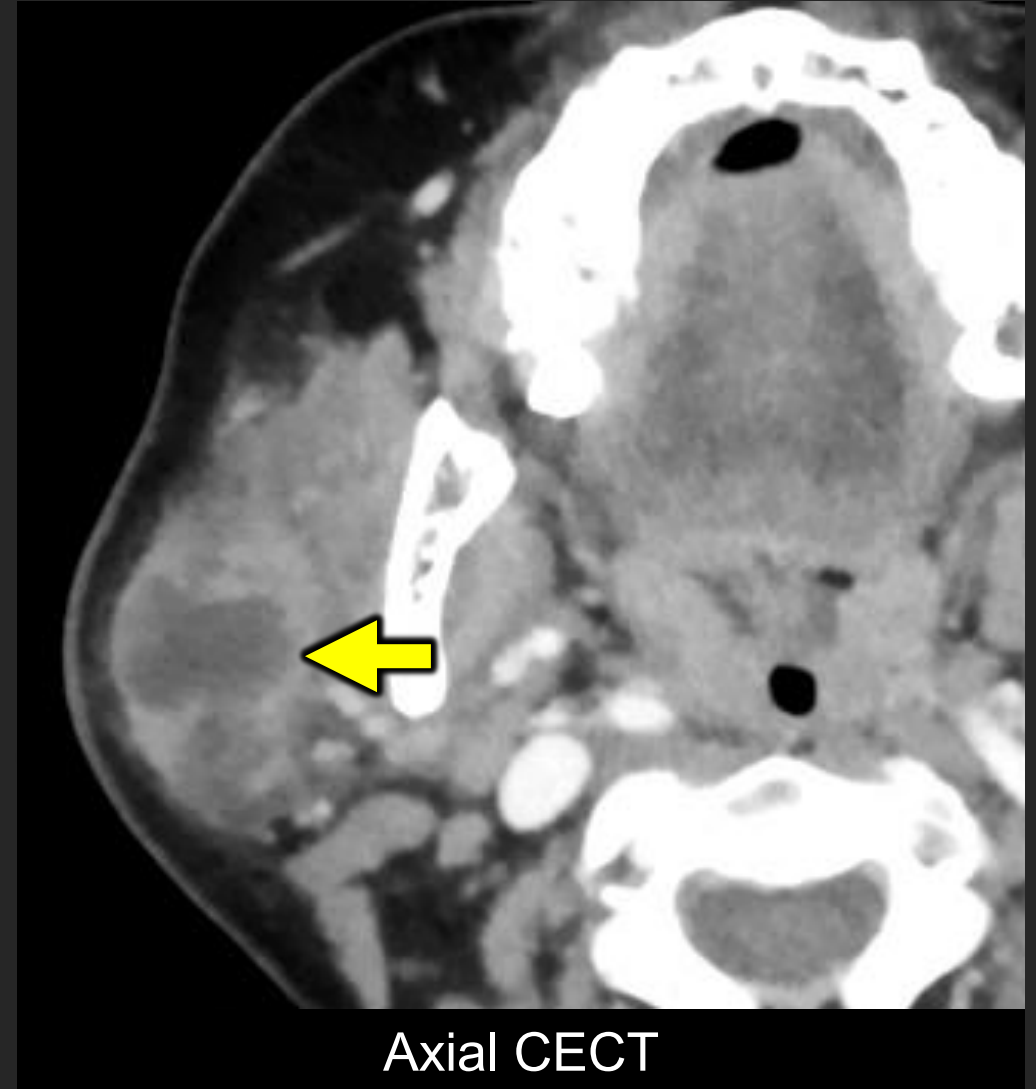
Acute Parotitis

- Acute inflammation of parotid gland
- Etiologies
 - Bacterial
 - Viral
 - Calculous
 - Autoimmune
- Enlarged, hyperemic parotid +/- edema



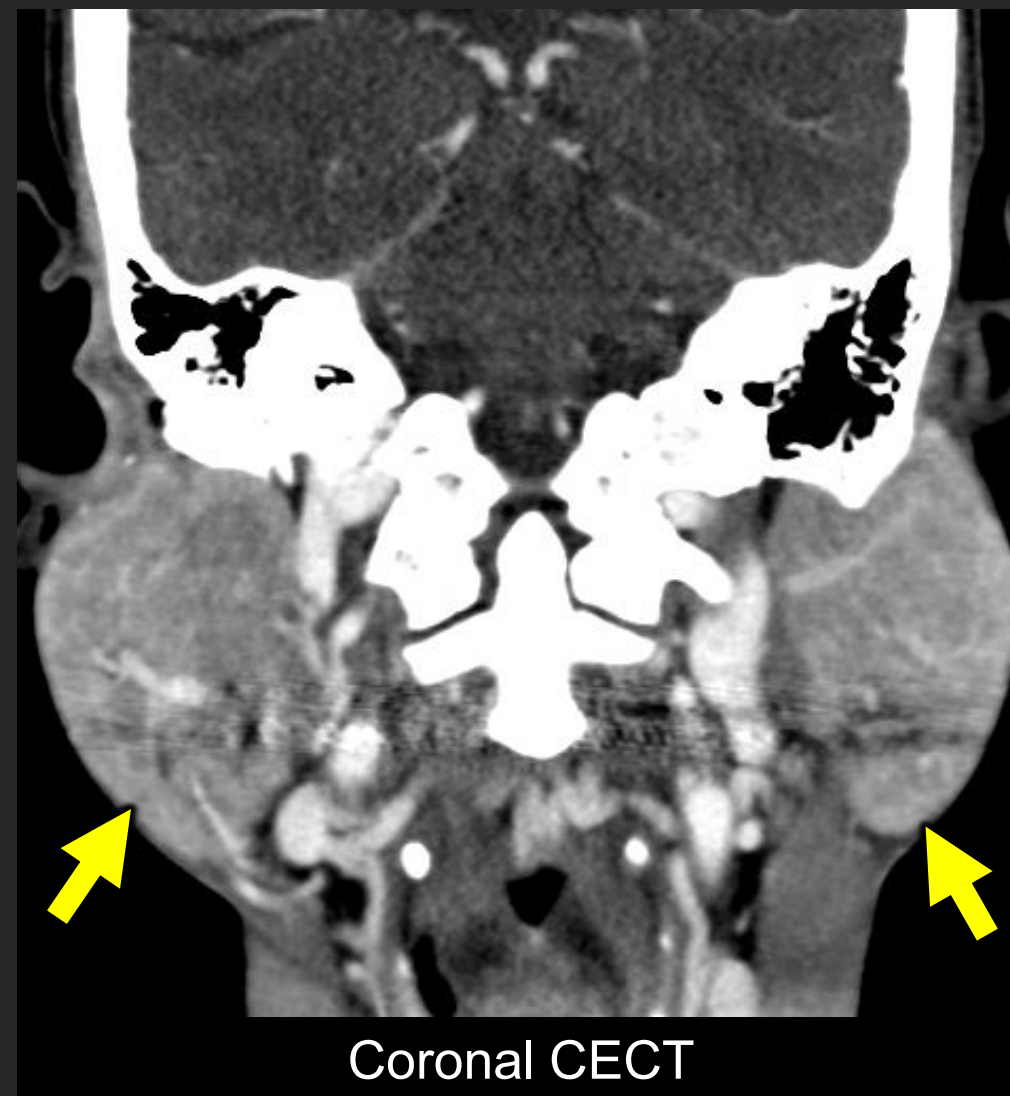
Bacterial Parotitis

- *S. aureus* (50-90%)
- Typically, unilateral
- Enlarged, ill-defined gland
- Diffusely enhancing
- Periparotid edema
- +/- Abscess
- **Conventional sialography contraindicated!**



Viral Parotitis

- Usually, a clinical diagnosis
- Mumps >> influenza, parainfluenza, Coxsackie, COVID
- **75% bilateral**
- +/- Submandibular and sublingual involvement
- Enlarged, hyperenhancing glands



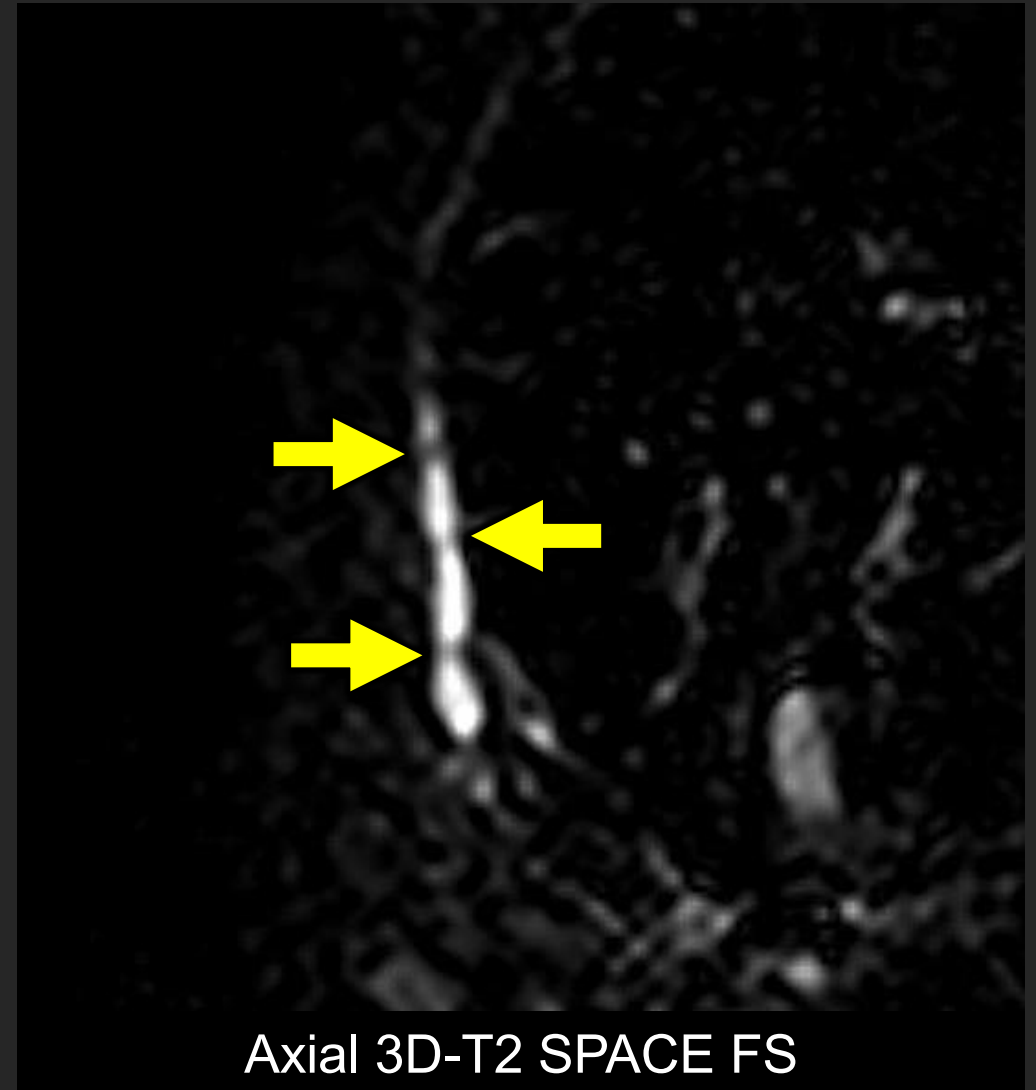
Calculous Parotitis

- Acute or recurrent food-related pain and swelling
- Unilateral
- Dilated duct
 - +/- Enhancing duct wall
- Radiopaque stone
 - Hilum or distal duct
 - Iso- to slightly hyperdense debris within duct



Autoimmune Parotitis

- Acute episodes of chronic pain and swelling
- Serum markers
- Typically, bilateral
- Acute
 - Enlarged, hyperemic
 - Less adjacent edema
- Chronic
 - Duct dilatation, stricture

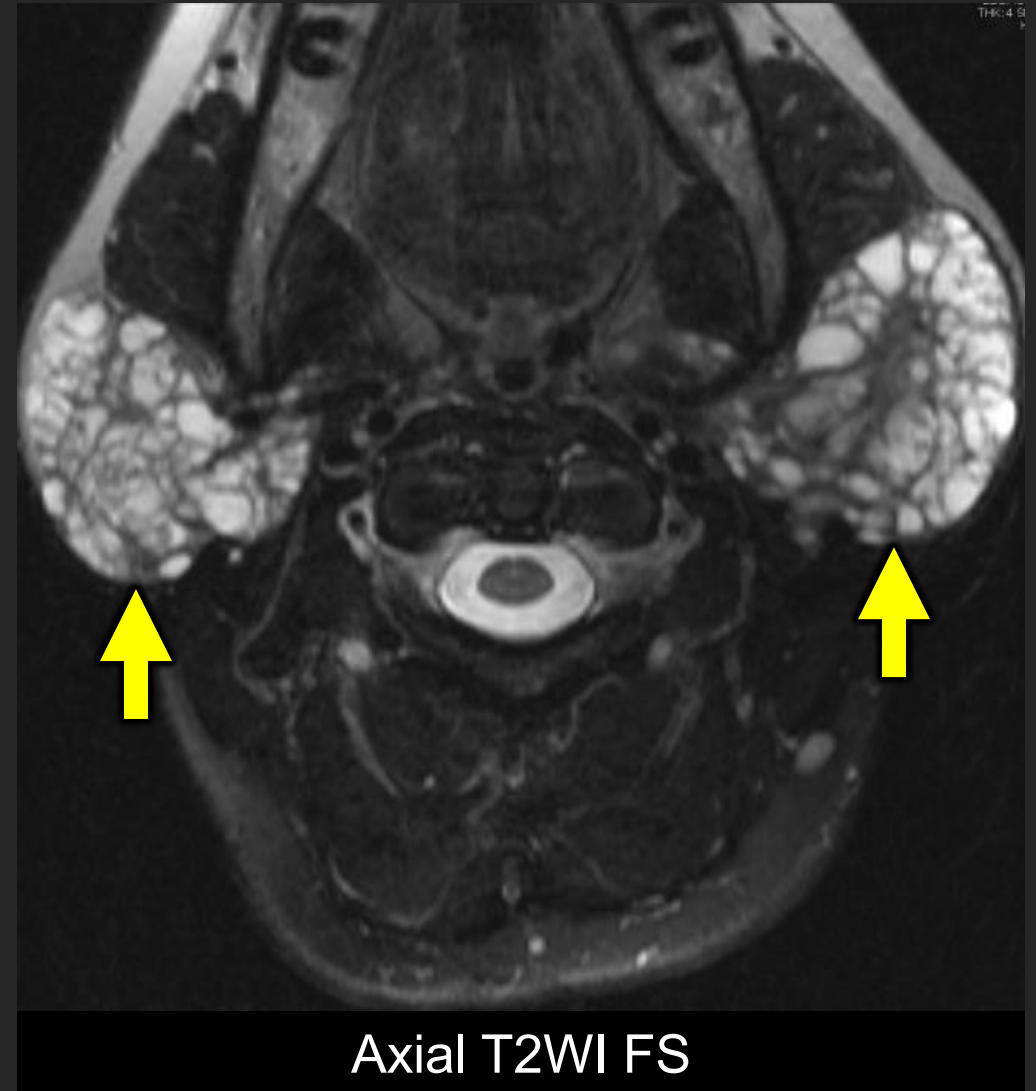


Selected Parotid Pathologies

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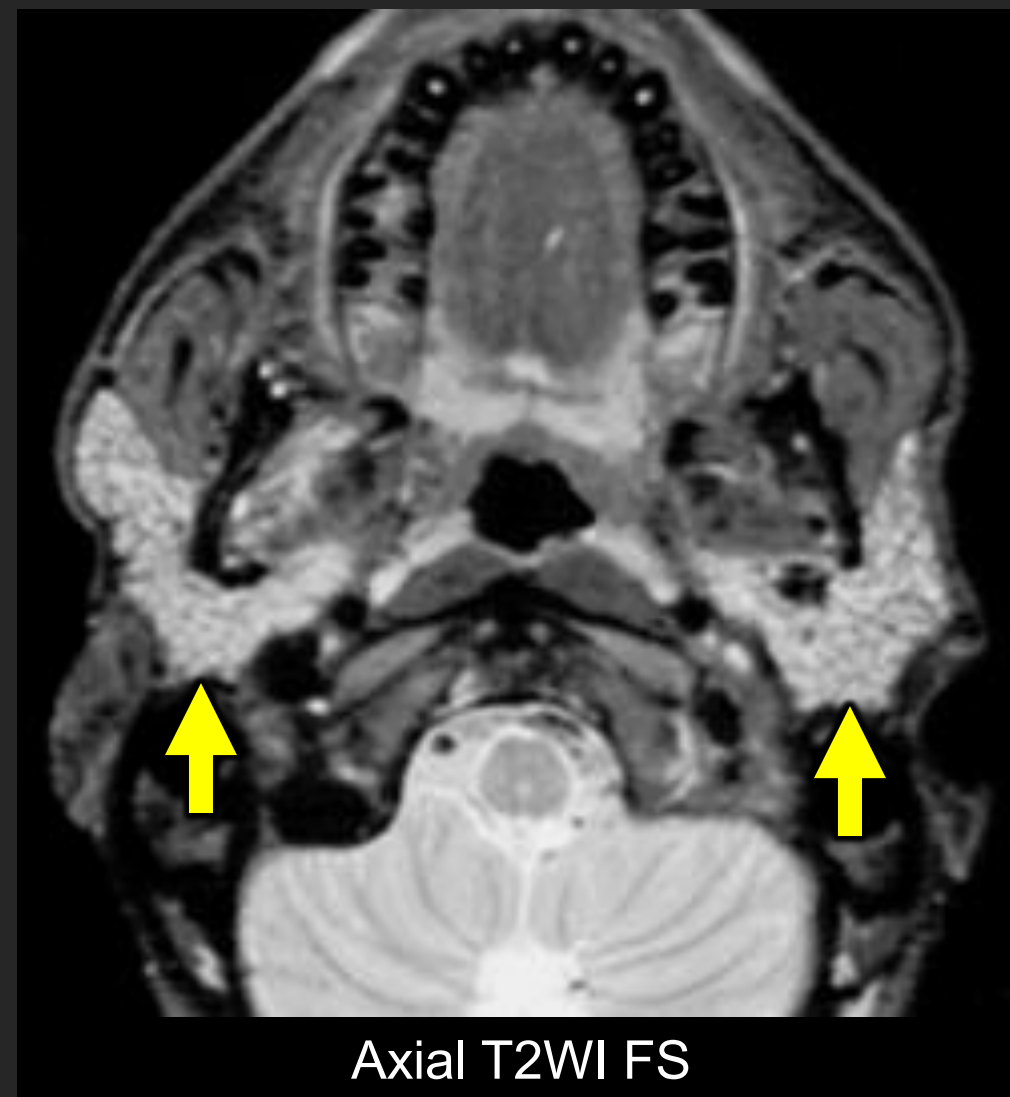
Parotid Sjögren Syndrome

- Chronic systemic autoimmune exocrinopathy
- Salivary and lacrimal gland destruction
- Striking (>90%) female predominance
- Sicca syndrome
- SSA + SSB autoantibodies
- RA >> SLE > PSS



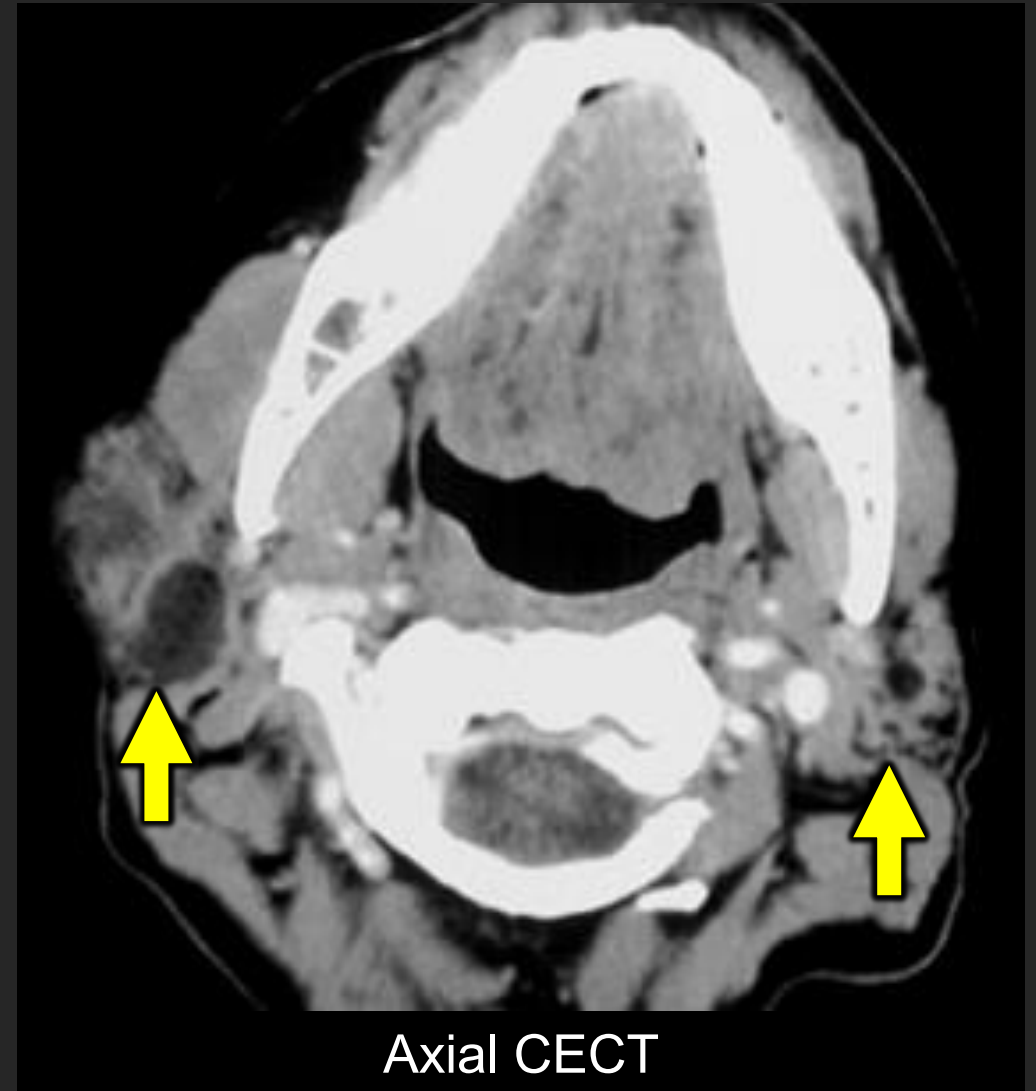
Early Sjögren Syndrome

- CT
 - Symmetric enlargement
 - Punctate calcifications
 - Diffuse sub-2mm cysts
- MRI
 - Diffuse sub-2mm cysts
 - +/- Small lymphoid aggregates (solid nodules)
 - Heterogeneous mild enhancement



Late Sjögren Syndrome

- CT & MRI findings similar
 - Larger, more confluent cysts
 - Increased solid nodules from lymphocytic aggregates
 - Enhancing glandular fibrosis
 - Diffuse atrophy with fatty replacement
- **Consider malignant transformation to NHL**

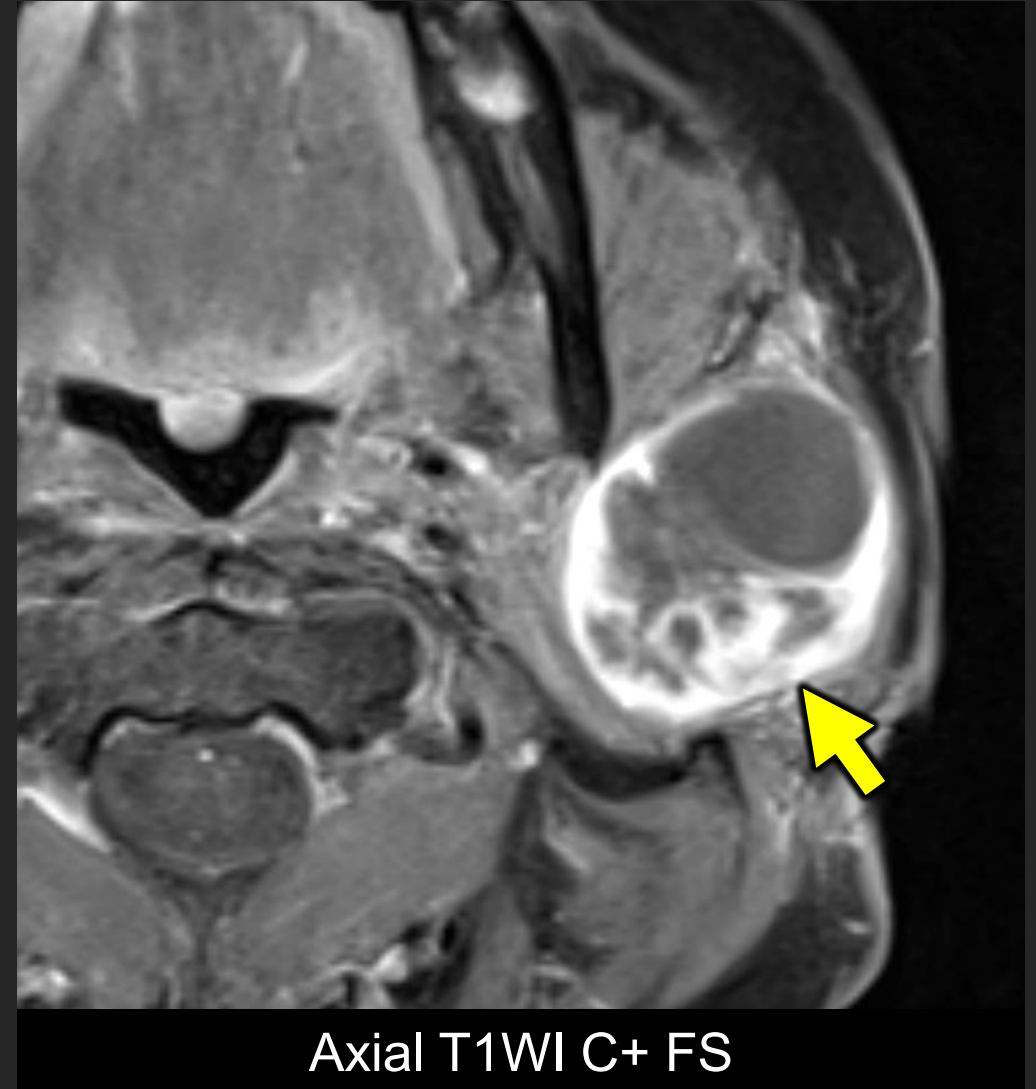


Selected Parotid Pathologies

- Parotid gland & duct
 - Neoplasms (benign & malignant)
 - Parotitis (including calculous)
 - Sjögren syndrome
- **Facial nerve**
 - **Schwannoma**
 - Perineural tumor spread
- Lymph nodes
 - Metastases
 - Lymphoma

Schwannoma

- Uncommon site of a common mass
- Identical appearance of schwannomas in other places
- Extends along CN7 and its branches
- Controversial management due to risk of CN7 injury

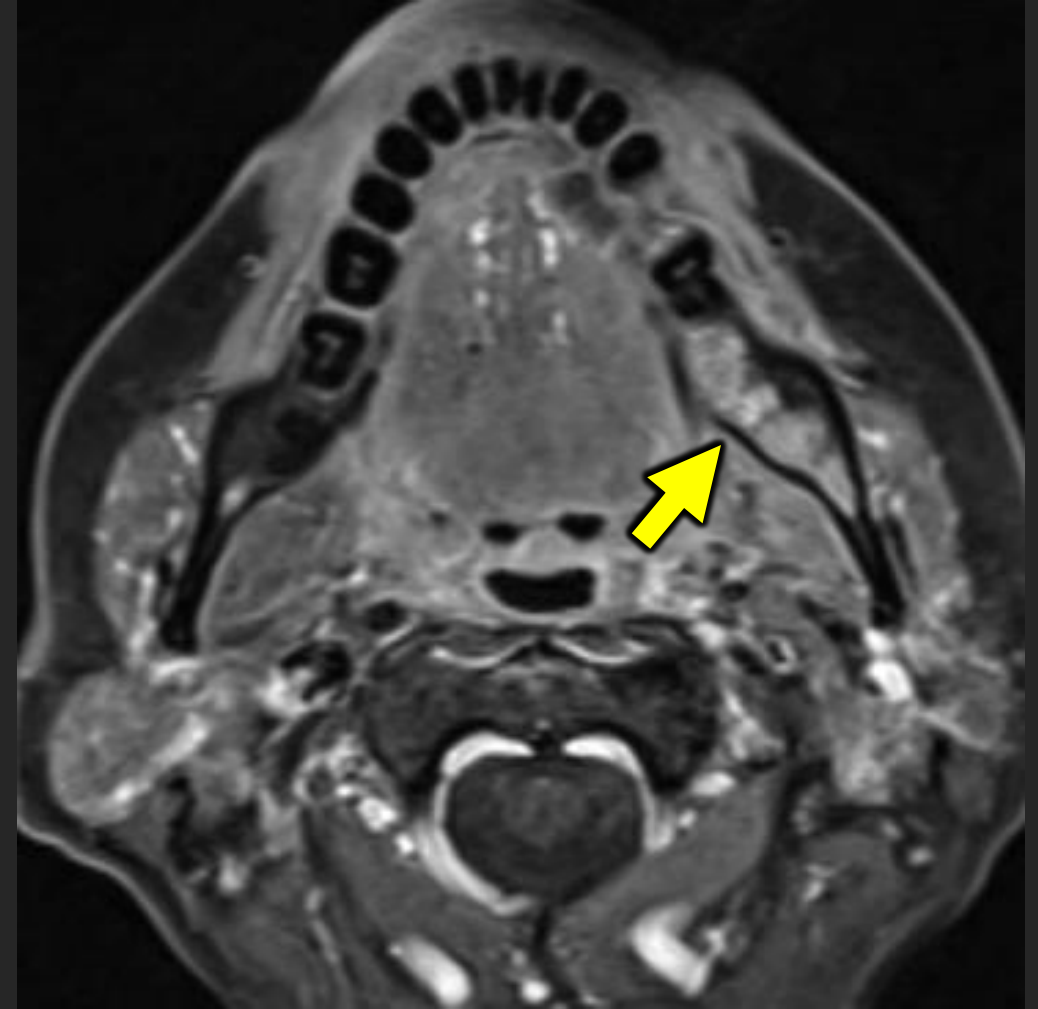


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 - **Perineural tumor spread**
- Lymph nodes
 - Metastases
 - Lymphoma

Perineural Tumor Spread

- Creeping extension of tumor along the intraparotid facial nerve (CN7)
- Any malignant tumor, but adenoid cystic is notorious
- **Don't forget about the auriculotemporal nerve!**
 - Extracranial bridge between CN7 and CN5



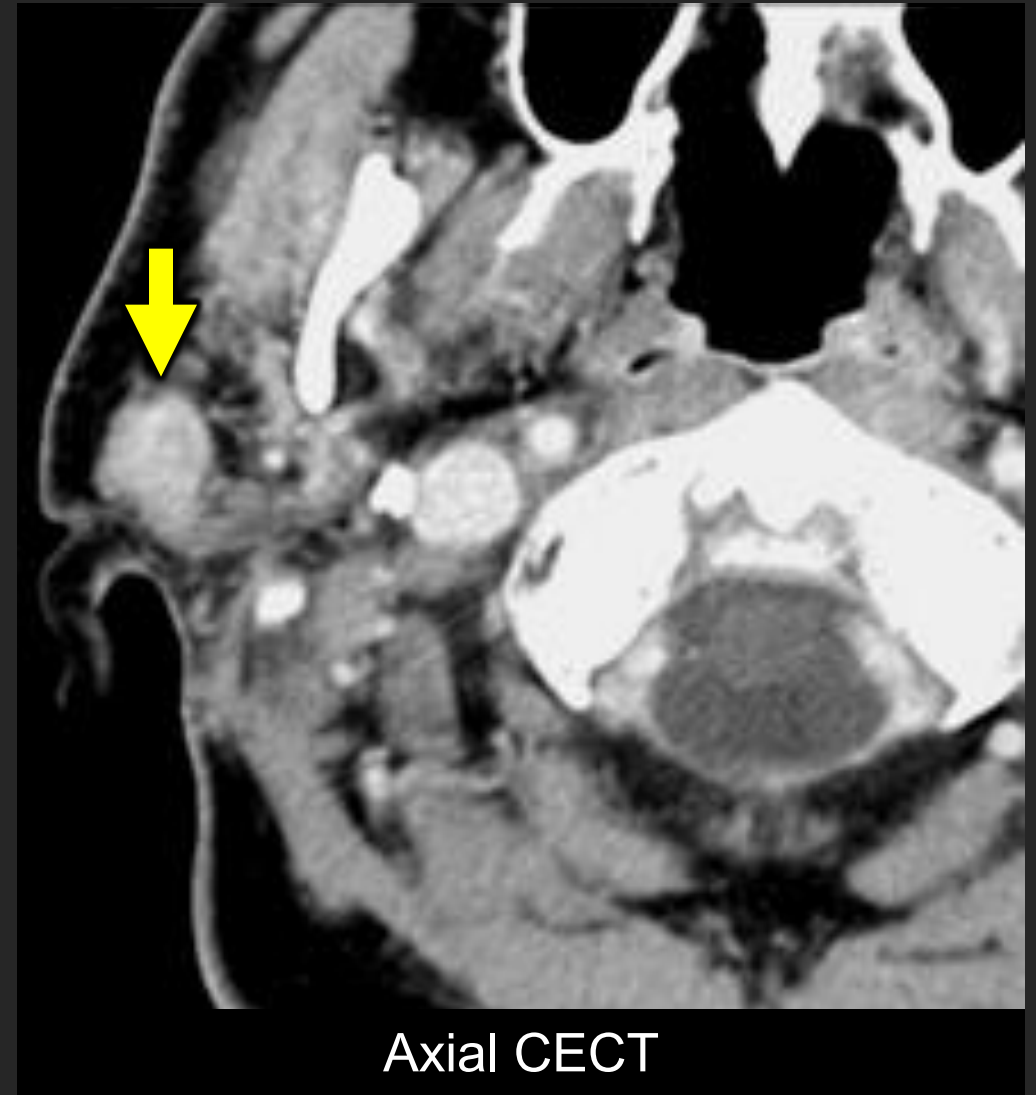
Axial T1WI C+ FS

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- Facial nerve
 - Schwannoma
 - Perineural tumor spread
- **Lymph nodes**
 - **Metastases**
 - Lymphoma

Metastases

- Intraparotid & periparotid nodes = 1st order drainage
 - Auricle & external auditory canal (EAC)
 - Scalp
 - Face
- Think SCCa & melanoma!
 - Systemic mets occur (rare)
- Multiplicity can be helpful

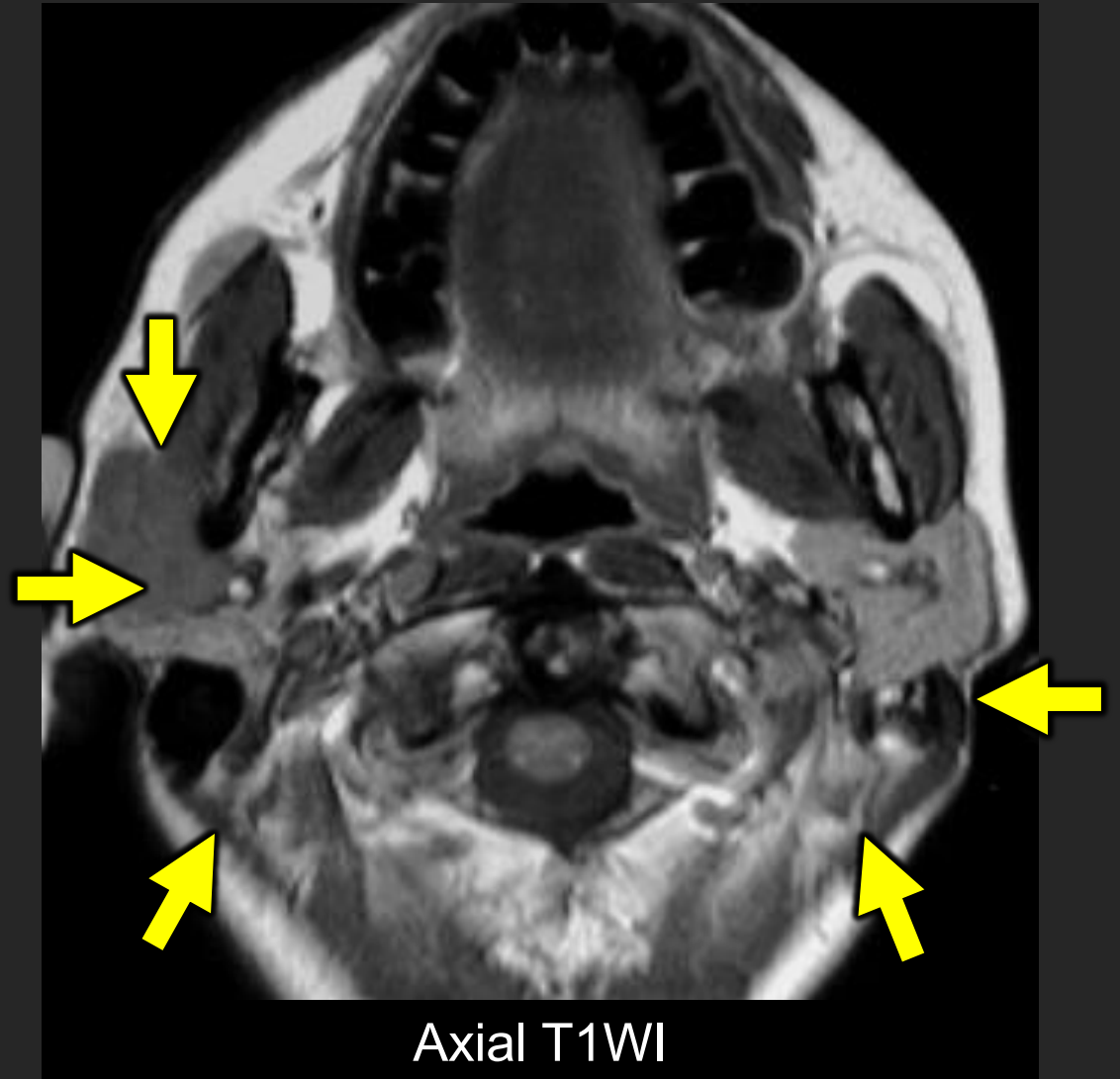


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 - Neoplasms (benign & malignant)
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 - Sjögren syndrome
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- **Lymph nodes**
 - Metastases
 - **Lymphoma**

Non-Hodgkin Lymphoma

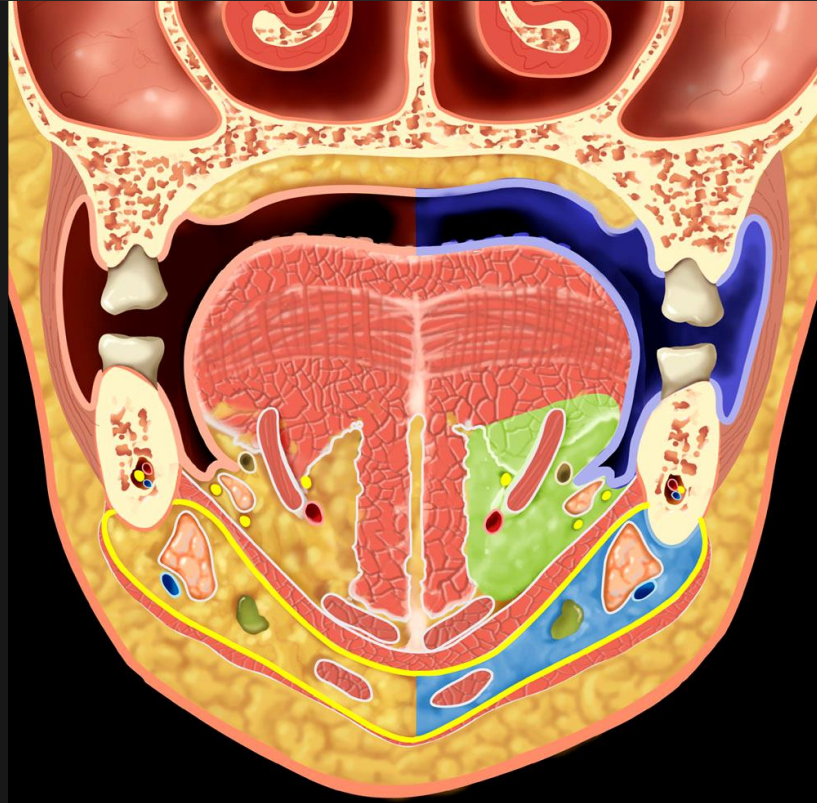
- 3 varieties
 - Primary nodal NHL
 - Systemic NHL
 - Primary parenchymal NHL
- Nodal NHL
 - Multiple defined intraparotid masses +/- bilateral
 - Cervical adenopathy
- Parenchymal
 - Infiltrative mass



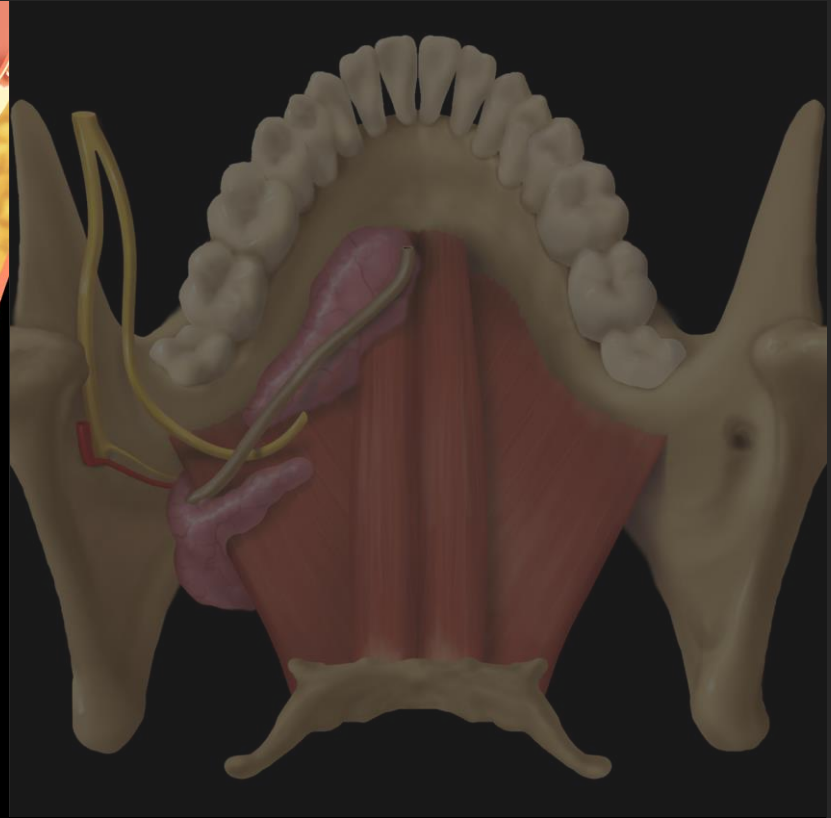
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PAROTID



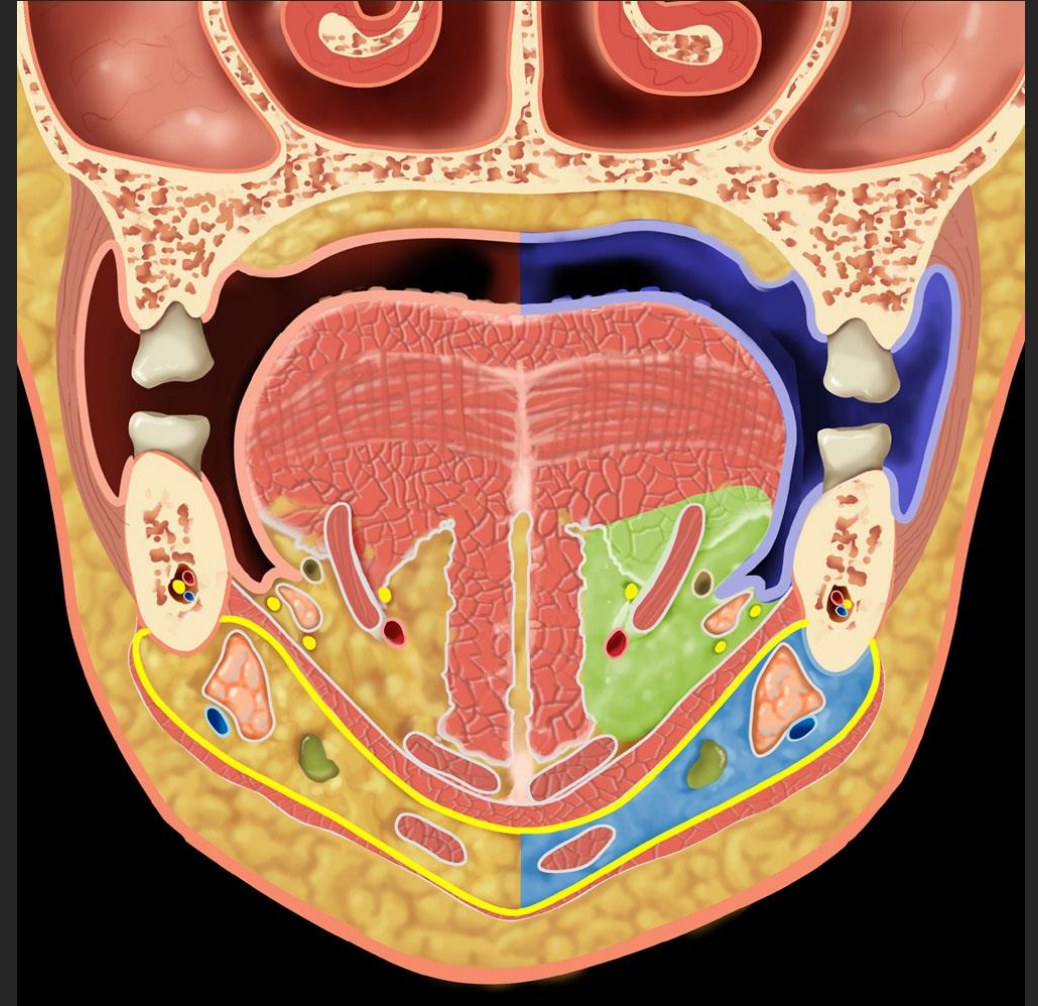
SUBMANDIBULAR



SUBLINGUAL

Submandibular Space

- Considered a component of the oral cavity:
 - Oral mucosal surface
 - Root of tongue
 - **Submandibular space**
 - Sublingual space

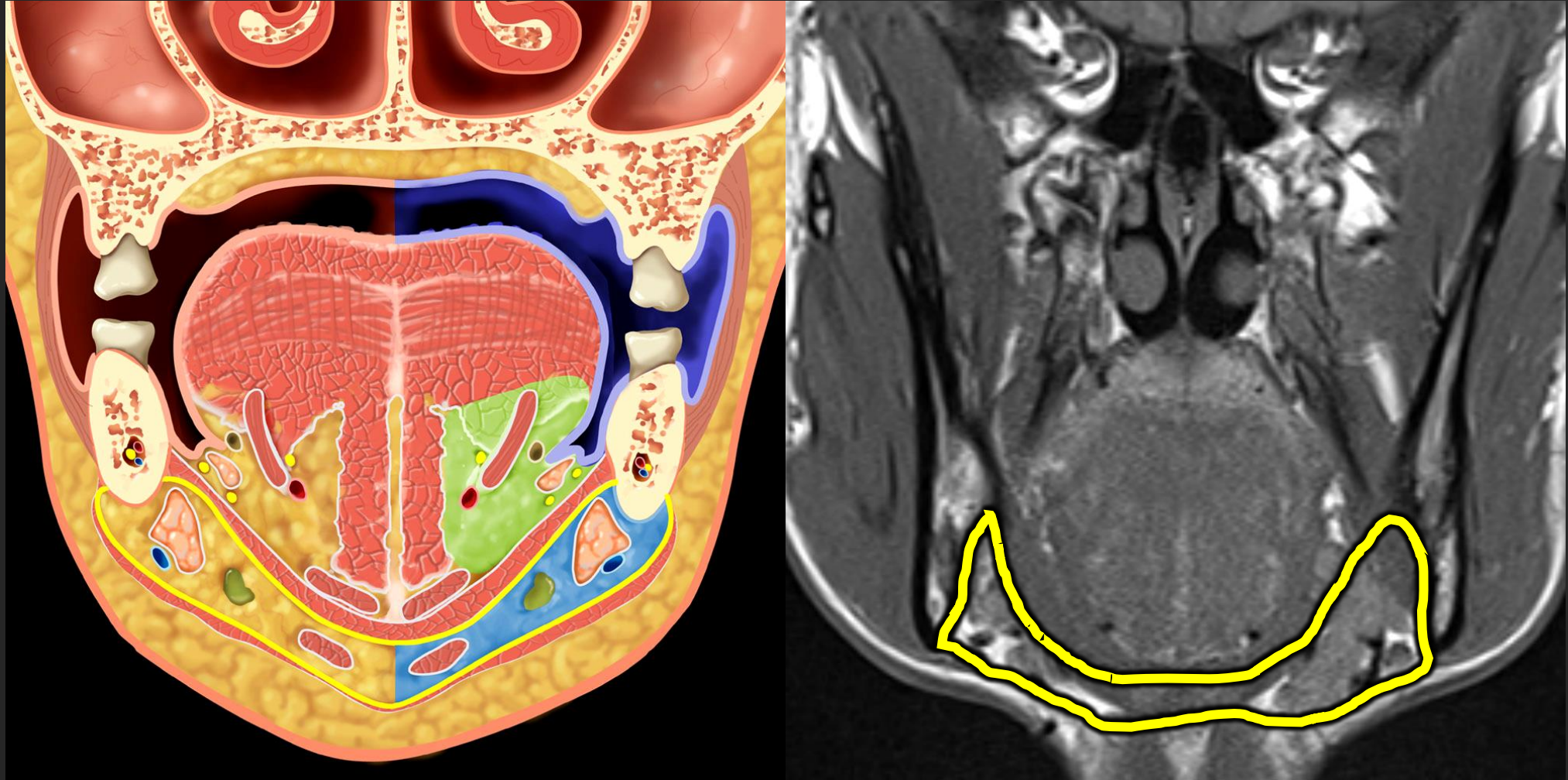


Submandibular Space

- Location
 - Deep to platysma
 - Superficial to mylohyoid
 - Above hyoid bone
- Forms a vertical horseshoe
- Communicates with sublingual and parapharyngeal spaces
- Invested in superficial layer deep cervical fascia

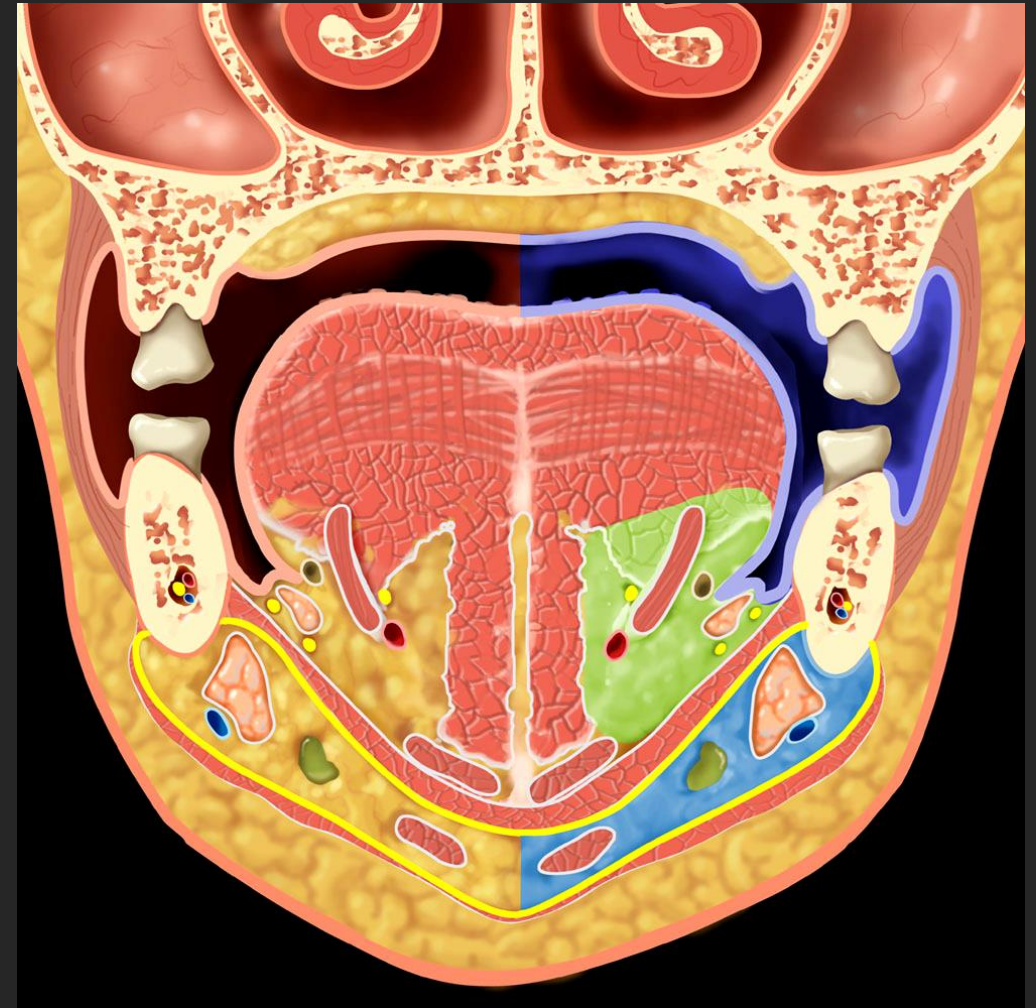


Submandibular Space



Submandibular Space Contents

- Submandibular gland
- Lymph nodes (IA and IB)
- Facial artery & vein
- CN12 (caudal loop)
- Anterior belly of digastric
- +/- Parotid tail



Selected Submandibular Space Pathologies

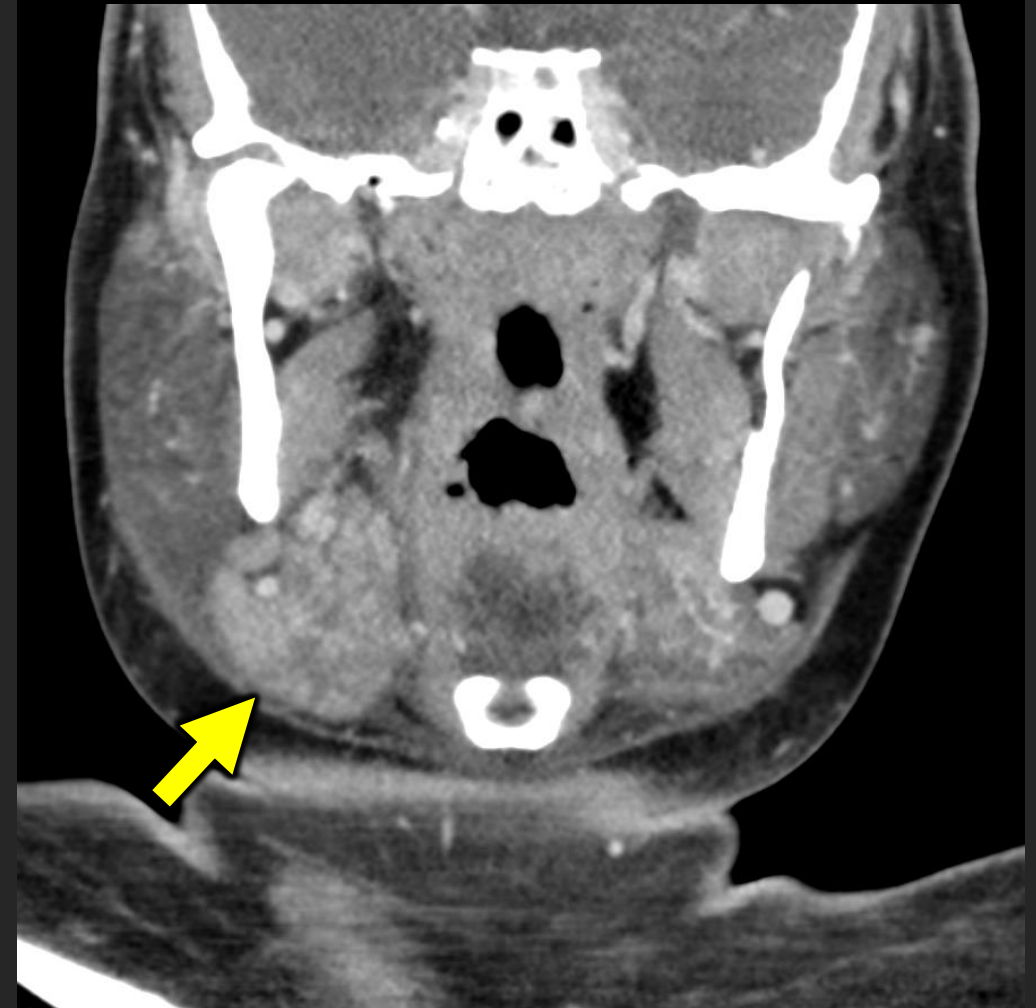
- Submandibular gland
 - Sialadenitis
 - Neoplasms (benign & malignant)
- Lymph nodes
 - Reactive & suppurative adenopathy
 - Metastatic adenopathy
 - Lymphoma
- Other
 - Dental abscess
 - Floor of mouth infection (Ludwig angina)
 - Diving ranula

Selected Submandibular Space Pathologies

- **Submandibular gland**
 - **Sialadenitis**
 - Neoplasms (benign & malignant)
- Lymph nodes
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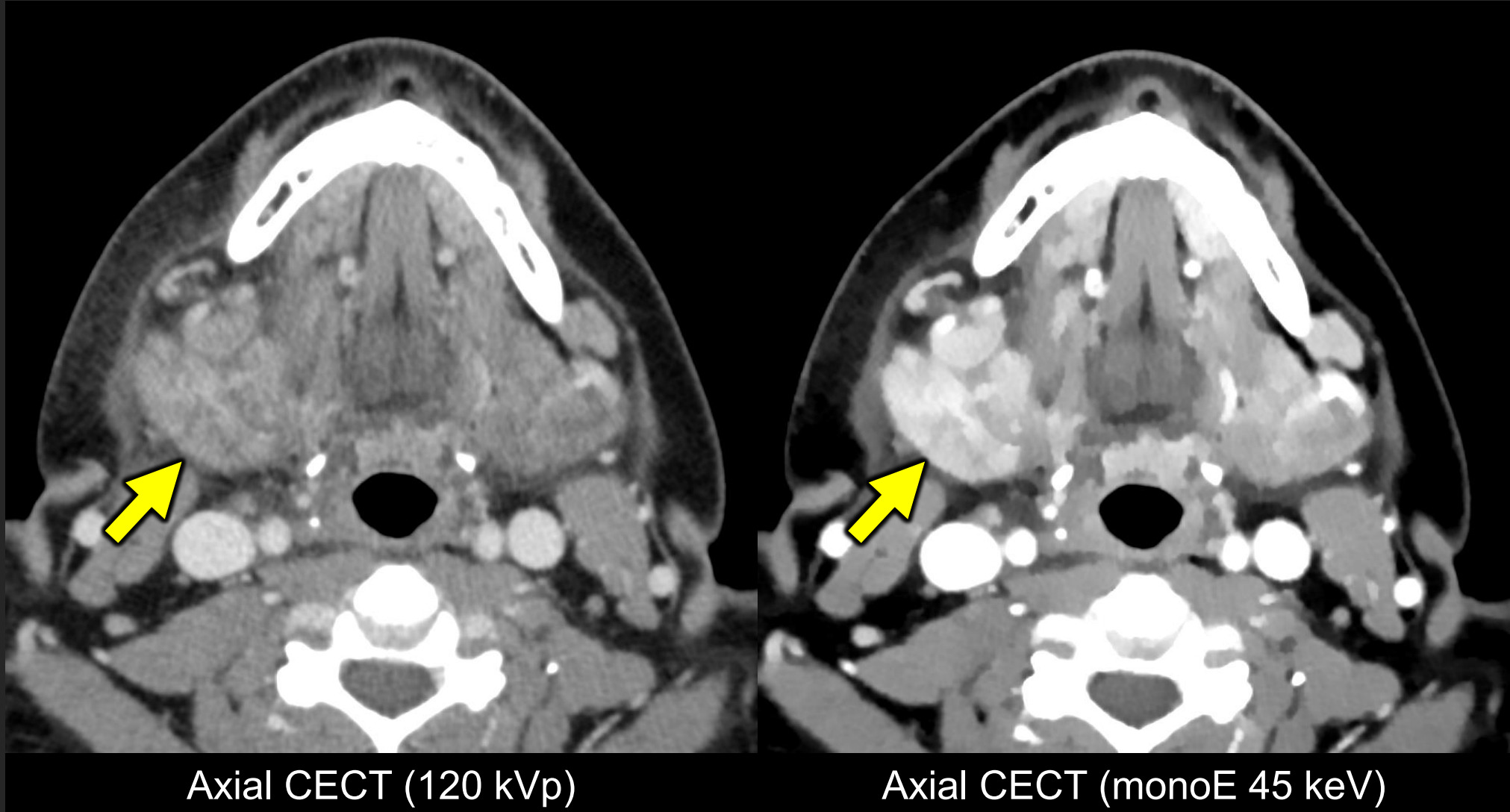
Submandibular Sialadenitis

- Acute inflammation of submandibular gland
- Usually, obstructive:
 - Calculous >> stenosis > floor of mouth tumor
- Bacterial, viral, and autoimmune etiologies
- Edematous, hyperemic gland with surrounding inflammation



Coronal CECT

Acute Submandibular Sialadenitis

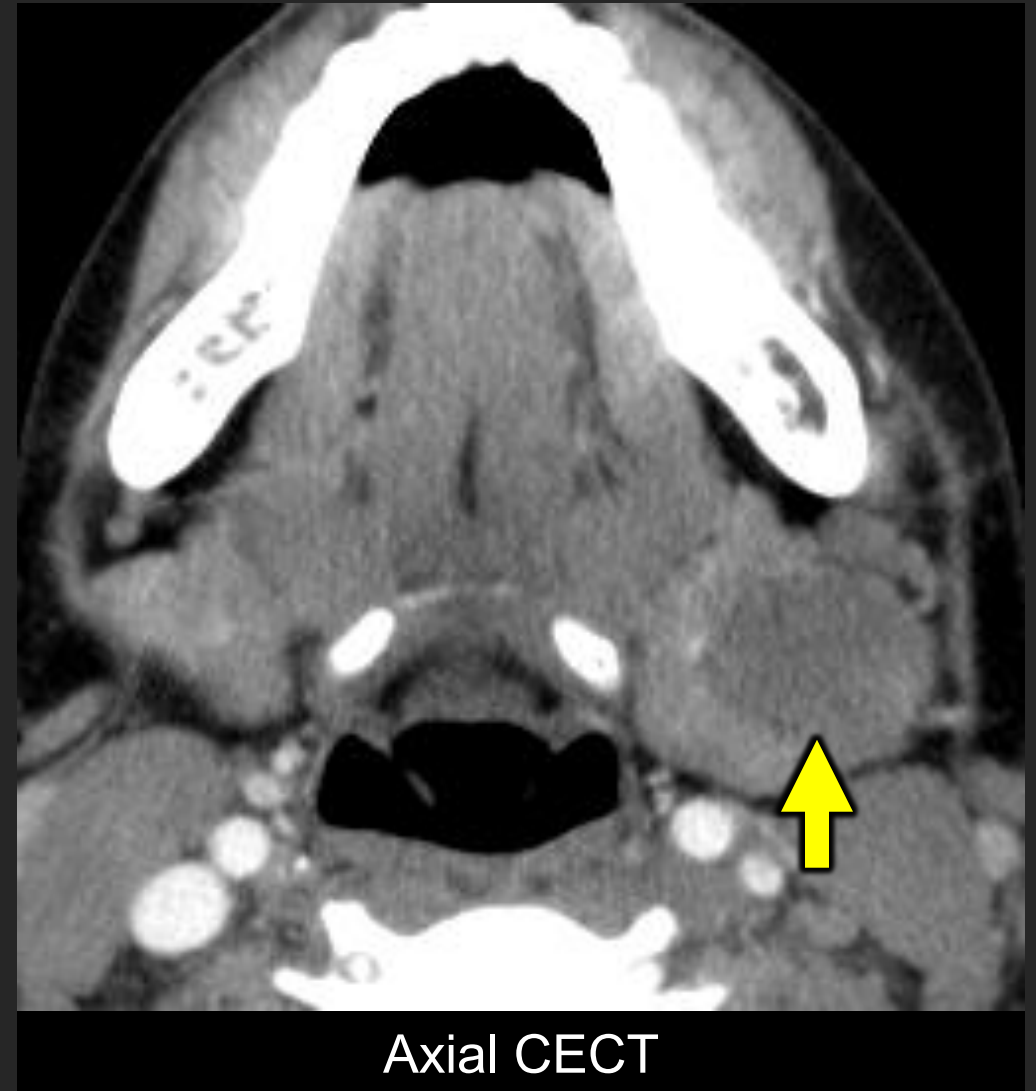


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 - **Neoplasms (benign & malignant)**
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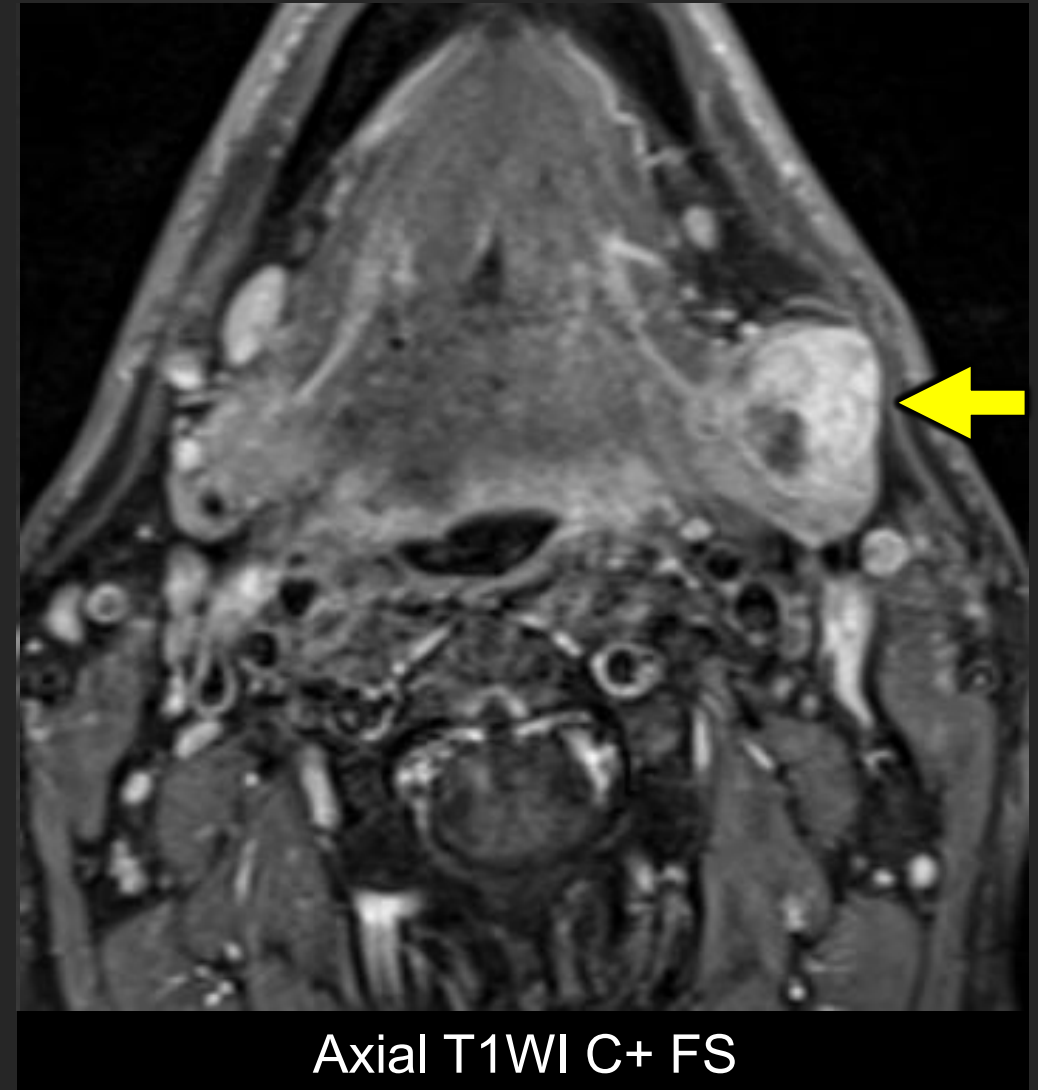
Pleomorphic Adenoma

- Benign mixed tumor
- Most common submandibular gland tumor
- Slow-growing, painless
- Epithelial, myoepithelial, and stromal components
- Can be bad actors
 - Risk of “seeding”
 - Carcinoma ex pleomorphic adenoma



Pleomorphic Adenoma

- CECT
 - Defined margins (at least when small)
 - Heterogeneous attenuation
 - +/- Calcifications
 - Mild-moderate enhancement
- MRI
 - Low T1, high T2 signal
 - Enhancing
 - Heterogeneous when large



Lipoma

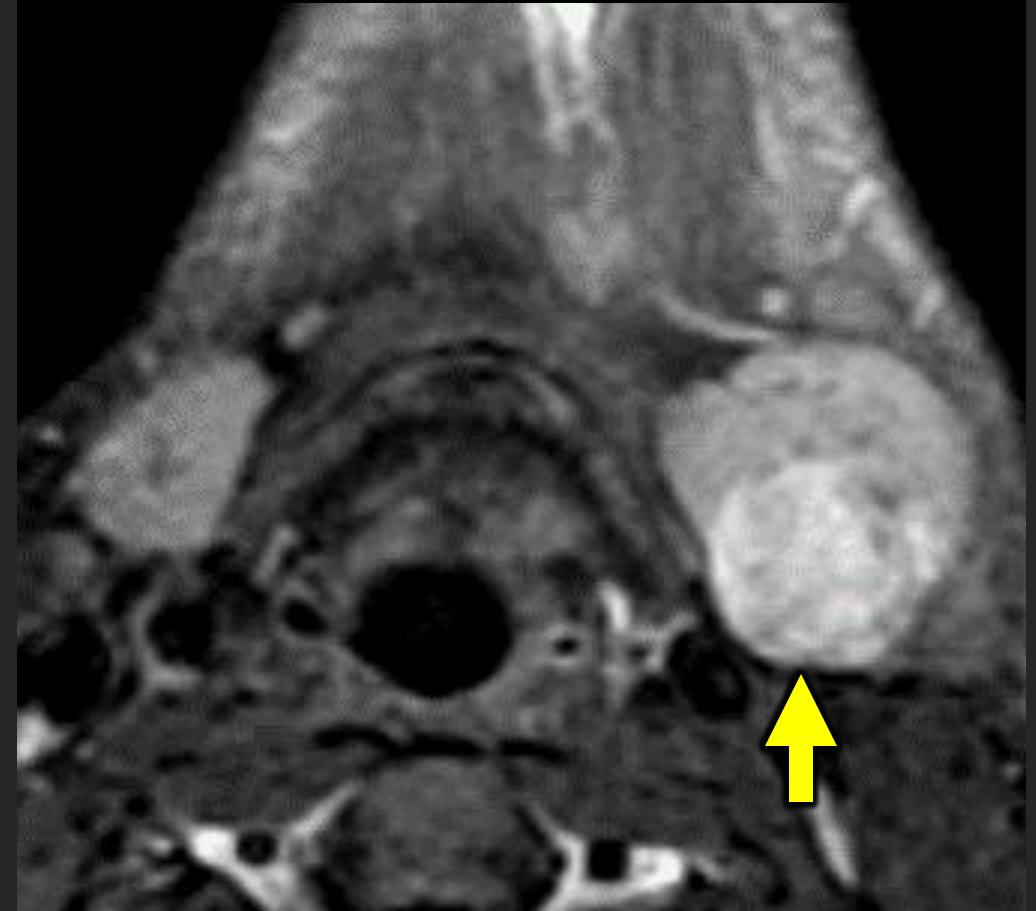
- Uncommon site of a common mass
- Circumscribed, mildly lobulated
- Fat density
- T1/T2 bright; dark with fat saturation
- No enhancement
- Rarely multiple



Submandibular Gland Carcinoma

- **BEWARE: ~50% of submandibular masses are malignant!**
- Most common:
 - Adenoid cystic (~40%)
 - Mucoepidermoid
 - Adenocarcinoma
- Others
 - SCCa, undifferentiated, ex pleomorphic adenoma

Adenoid Cystic Carcinoma

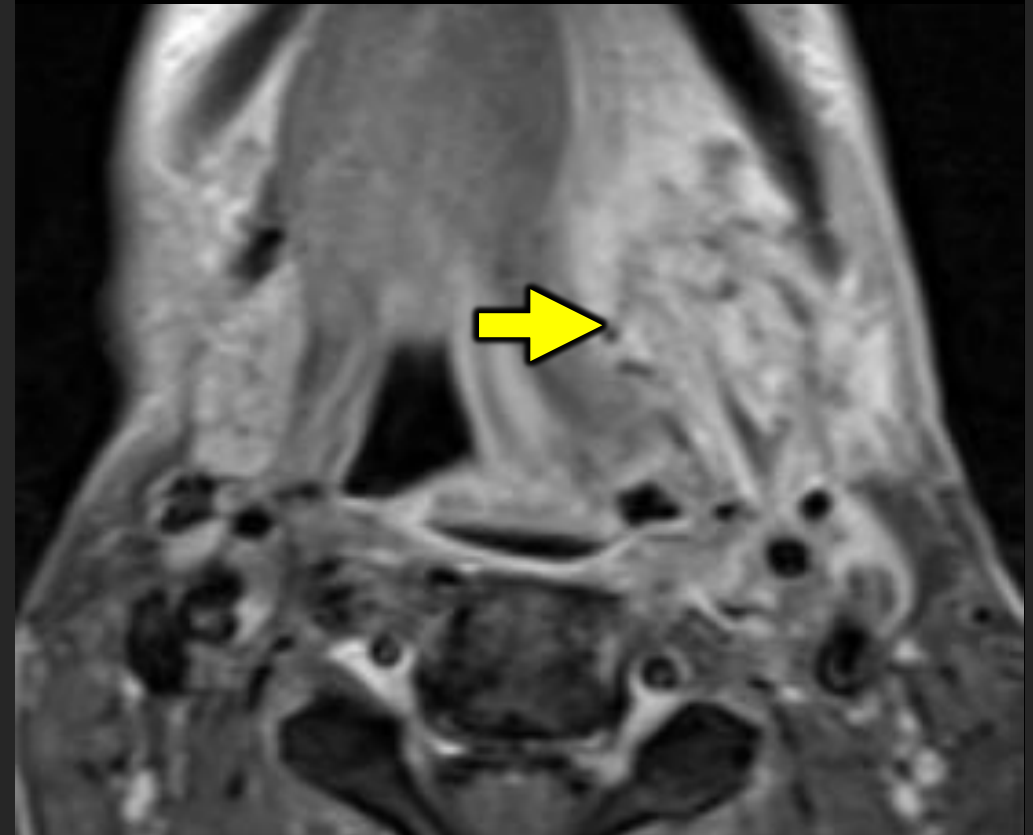


Axial T1WI C+ FS

Submandibular Gland Carcinoma

- Low grade
 - Circumscribed
 - T2 bright; ADC bright
 - Variable enhancement
- High grade
 - Infiltrating margins
 - Lower T2 signal; ADC dark
- Impossible to give specific diagnosis based on imaging appearance!

Sclerosing Epithelial-Myoepithelial Carcinoma



Axial T1WI C+ FS

Submandibular Gland Lymphoma

- Much less common than primary parotid lymphoma
- Localized or diffuse intraglandular mass
- Often lobulated
- +/- Cysts, calcifications
- Look for additional cervical adenopathy



Reporting Submandibular Gland Masses

- Checklist
 - Size
 - Margins
 - Benign/low-grade vs. high-grade
 - Invasion of surrounding structures
 - Mandible, skull base, pterygoid plates, carotid space, skin
 - Perineural tumor spread
 - Adenoid cystic carcinoma
 - Nodal metastases
 - Mucoepidermoid carcinoma

Reporting Submandibular Gland Masses

“Further imaging will confer no additional specificity to the diagnosis”

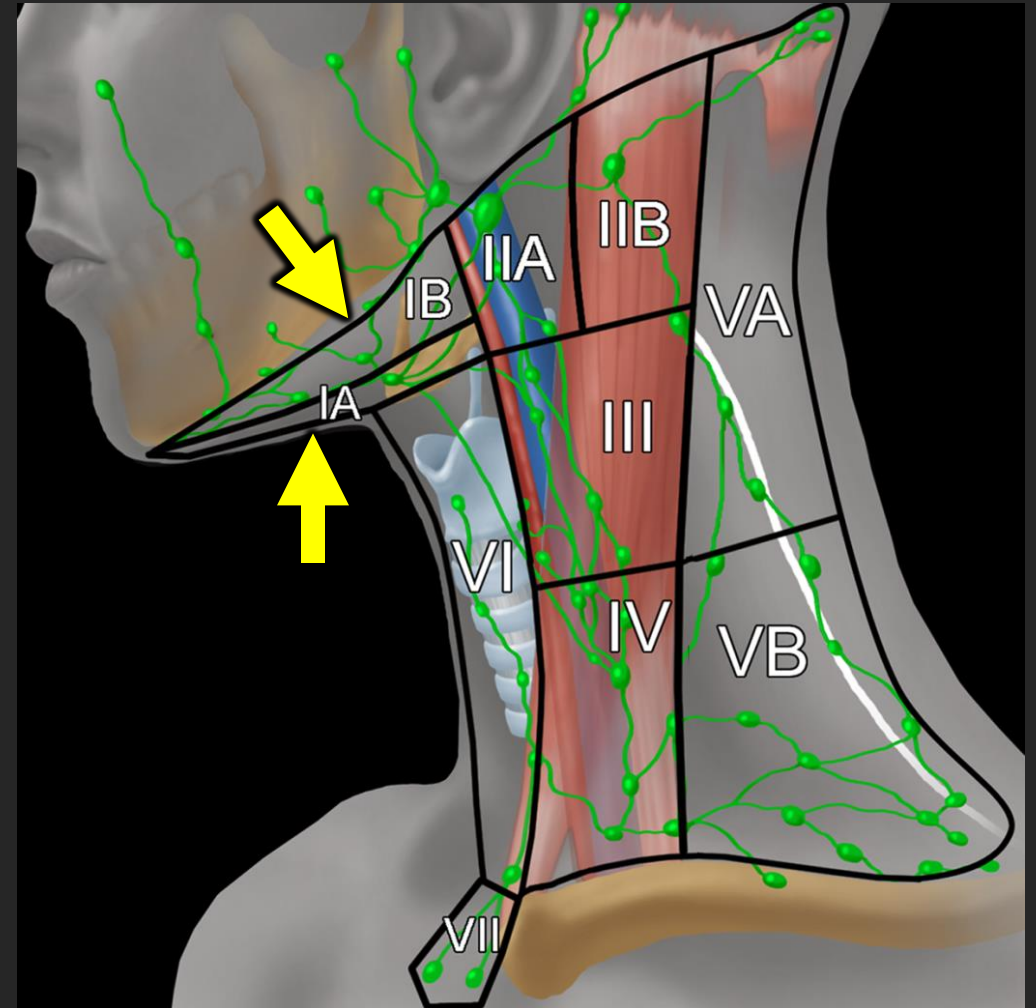
**If you want to know what it is,
stick a needle in it or resect it!**

Selected Submandibular Space Pathologies

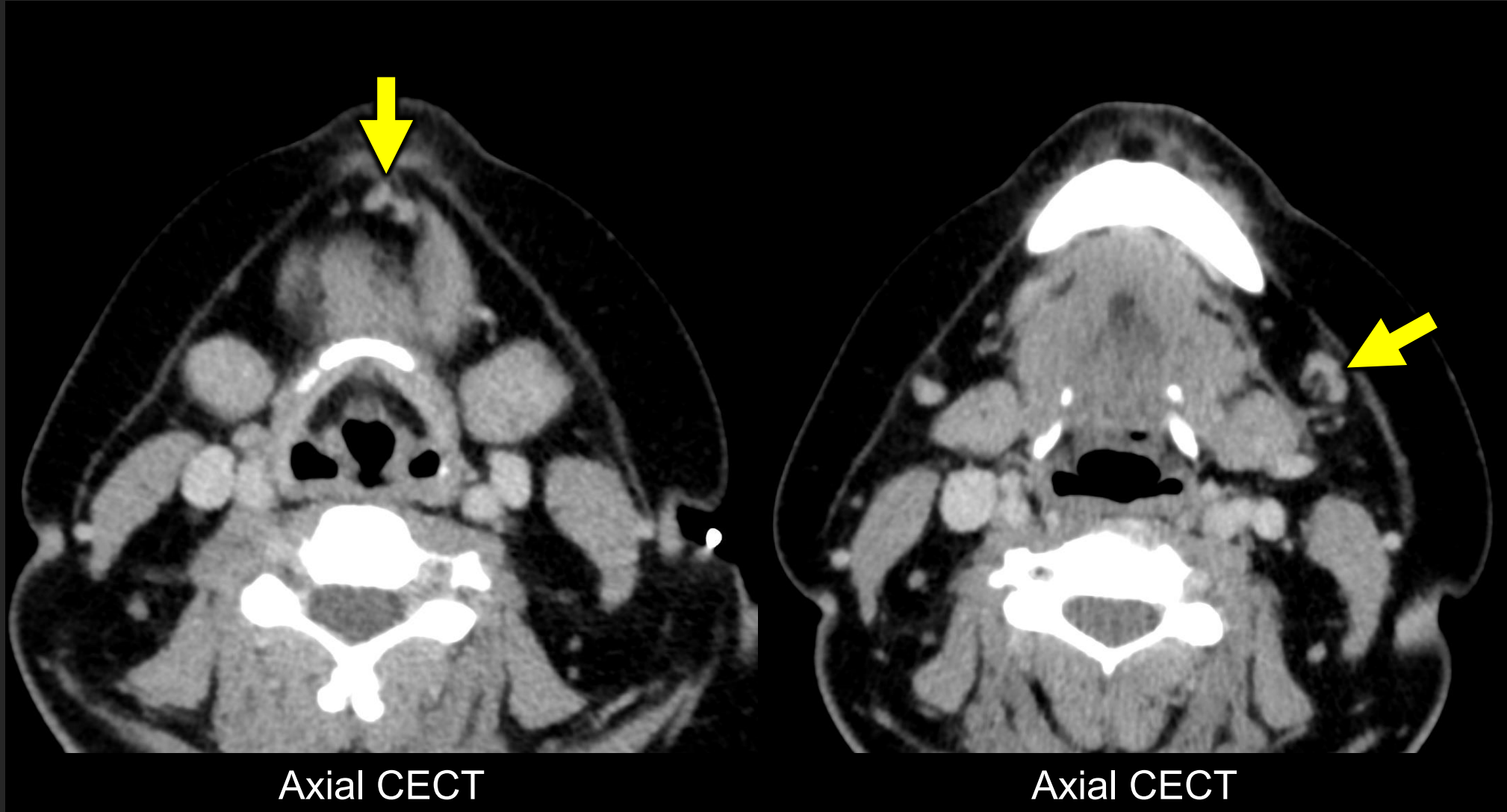
- Submandibular gland
 - Sialadenitis
 - Neoplasms (benign & malignant)
- **Lymph nodes**
 - **Reactive & suppurative adenopathy**
 - Metastatic adenopathy
 - Lymphoma
- Other
 - Dental abscess
 - Floor of mouth infection (Ludwig angina)
 - Diving ranula

Submandibular Space Lymph Nodes

- Submandibular space contains lymph nodes
- IA = submental nodes
 - Between medial margin of anterior bellies of digastrics
- IB = submandibular nodes
 - Posterior & lateral to medial margin of anterior belly of digastric
 - Around & in front of posterior margin submandibular gland



Level IA and IB Lymph Nodes



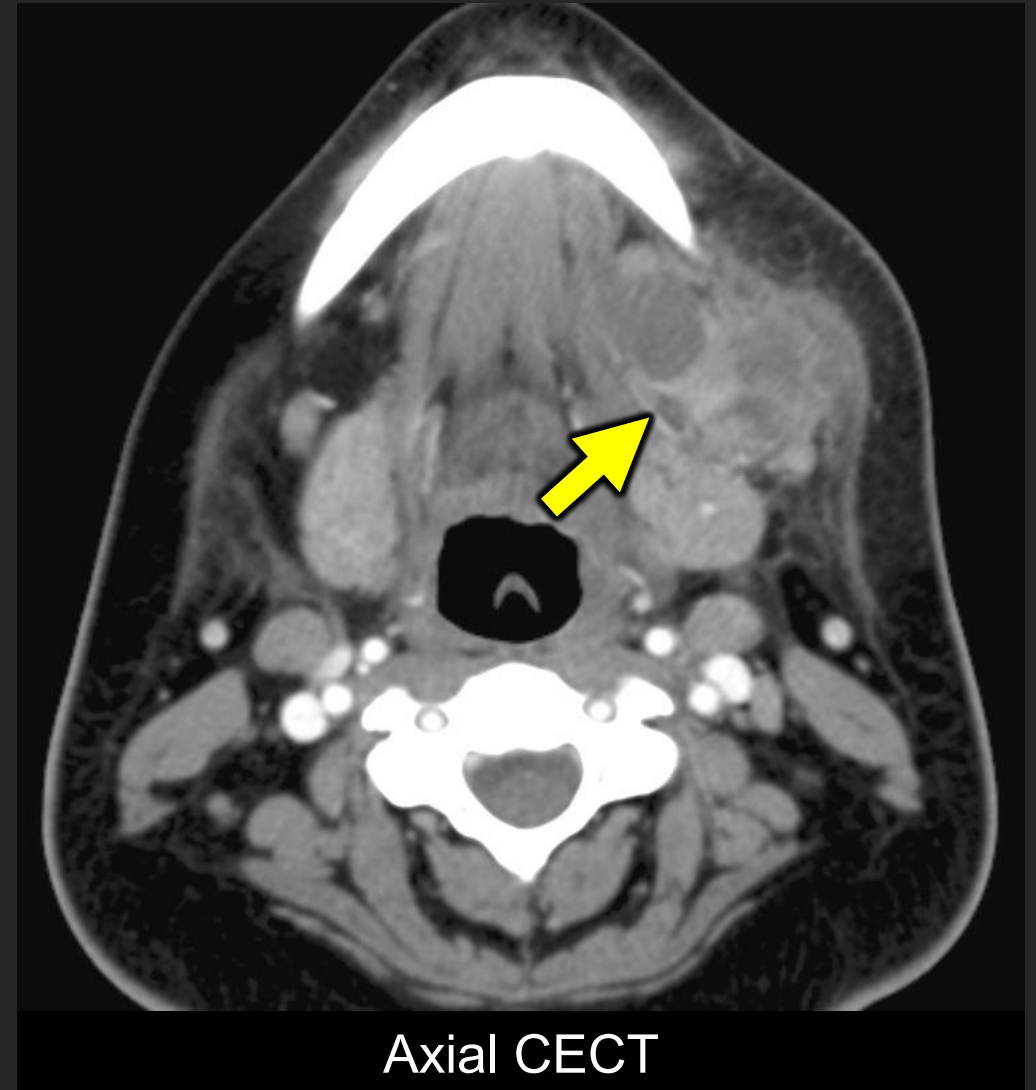
Reactive Adenopathy

- Benign, reversible nodal enlargement in response to antigen stimulus
- Enlarged, but typically reniform morphology
- Mild homogeneous enhancement
 - Often linear hilar hyperenhancement
- No necrosis



Suppurative Adenopathy

- Pus formation in node due to bacterial infection
 - *Staph* & *Strep* most common
- Enlarged node with surrounding inflammation
- Enhancing nodal wall with internal hypoenhancement
- May progress to abscess
- **Look for source:**
 - **Dental, pharyngitis, and sialadenitis**

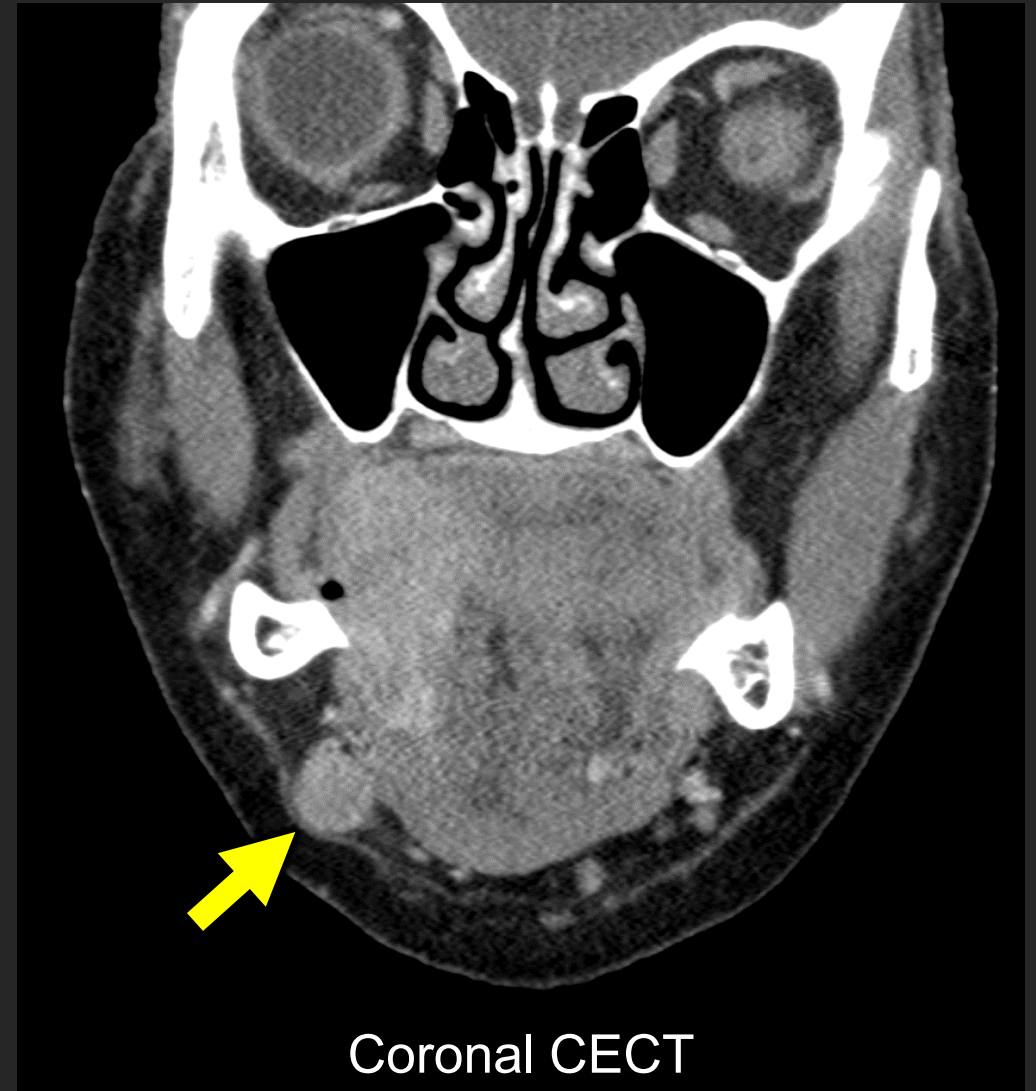


Selected Submandibular Space Pathologies

- Submandibular gland
 - Sialadenitis
 - Neoplasms (benign & malignant)
- **Lymph nodes**
 - Reactive & suppurative adenopathy
 - **Metastatic adenopathy**
 - Lymphoma
- Other
 - Dental abscess
 - Floor of mouth infection (Ludwig angina)
 - Diving ranula

Metastatic Adenopathy

- Submandibular space lymph nodes common site of metastatic SCCa
- Primary site
 - Oral cavity > oropharynx > cutaneous
- **Morphology trumps size**
 - Enlarged
 - Rounded
 - Heterogenous enhancement
 - Cystic/necrotic change

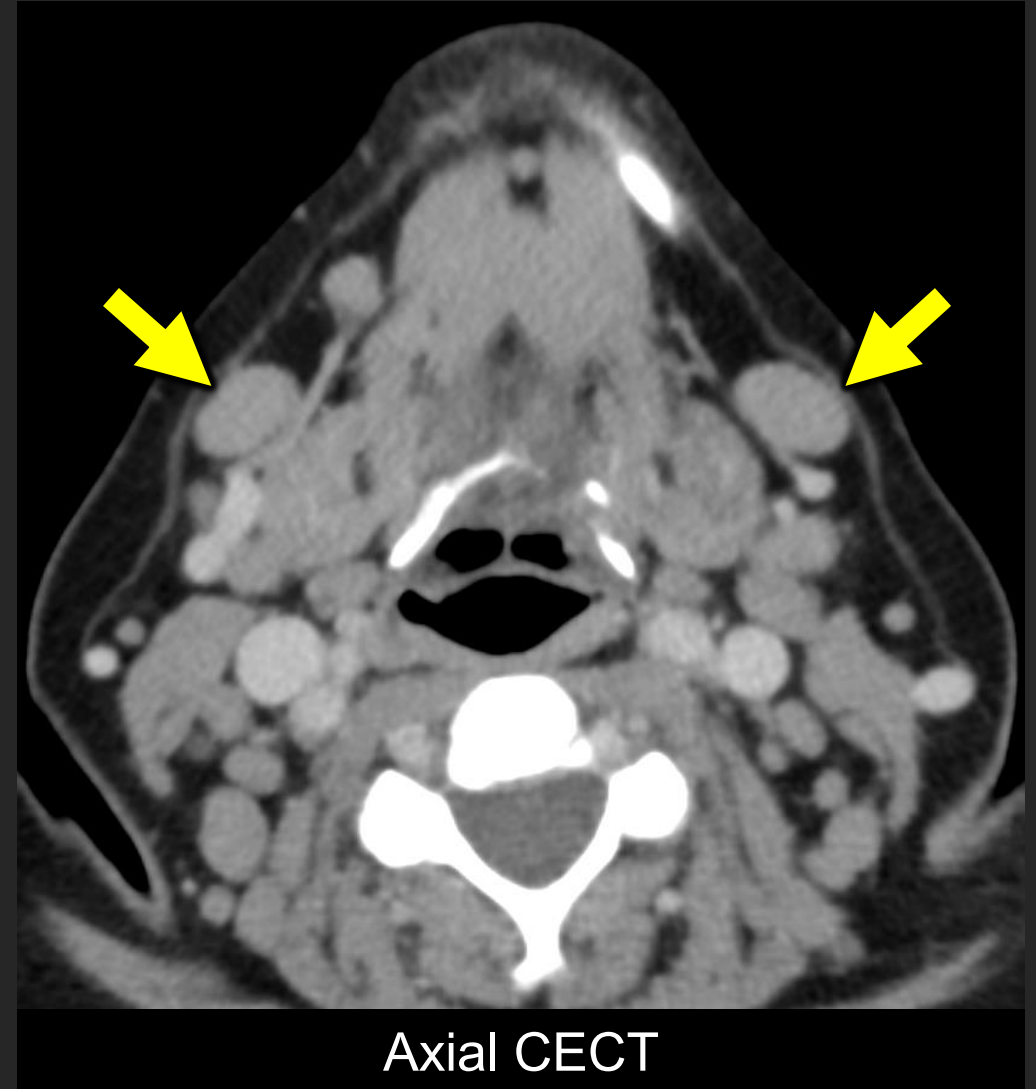


Selected Submandibular Space Pathologies

- Submandibular gland
 - Sialadenitis
 - Neoplasms (benign & malignant)
- **Lymph nodes**
 - Reactive & suppurative adenopathy
 - Metastatic adenopathy
 - **Lymphoma**
- Other
 - Dental abscess
 - Floor of mouth infection (Ludwig angina)
 - Diving ranula

Lymphoma Nodes

- Typically, older adult with painless neck masses
- +/- B symptoms
 - Fever, night sweats, and weight loss
- **Bulky, solid, round, nonnecrotic lymph nodes**
- Look for involvement of other nodal stations
 - Can be necrotic if treated or aggressive disease

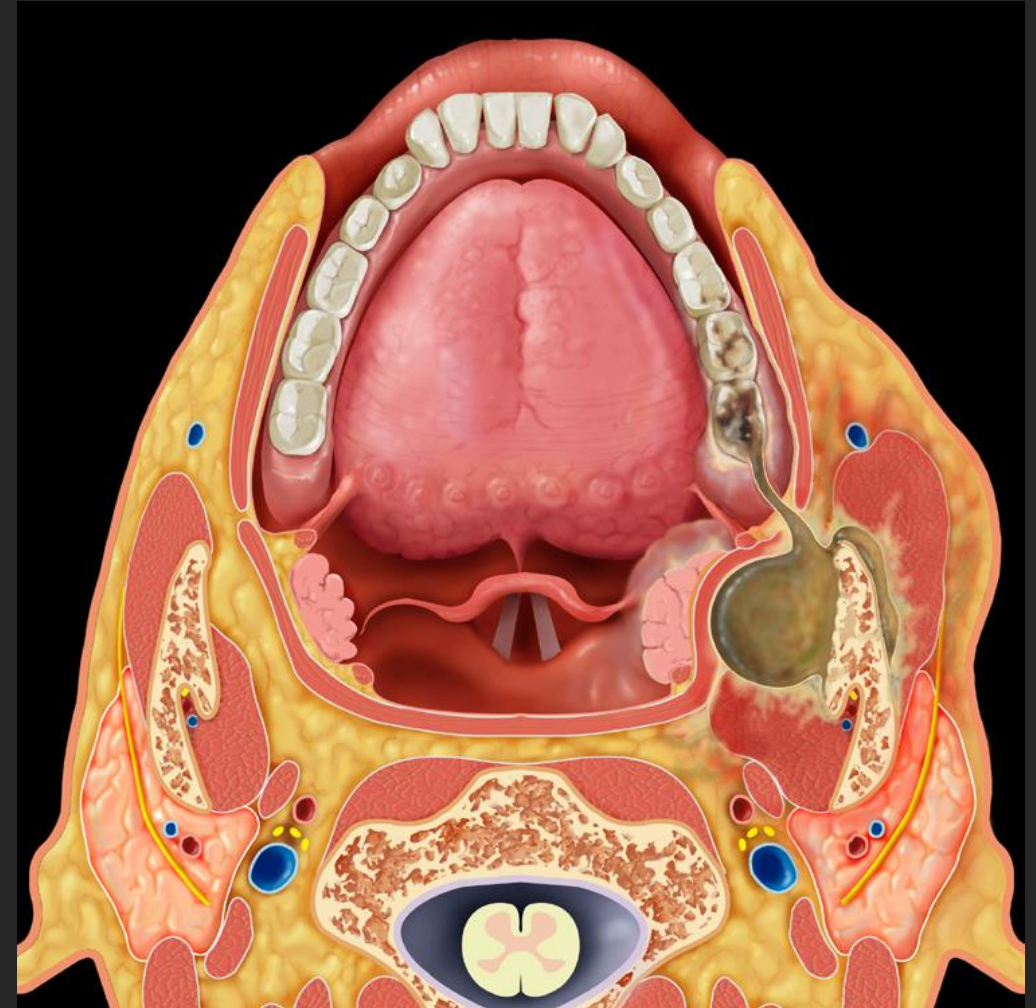


Selected Submandibular Space Pathologies

- Submandibular gland
 - Sialadenitis
 - Neoplasms (benign & malignant)
- Lymph nodes
 - Reactive & suppurative adenopathy
 - Metastatic adenopathy
 - Lymphoma
- **Other**
 - **Dental abscess**
 - Floor of mouth infection (Ludwig angina)
 - Diving ranula

Dental Abscess

- Tooth decay → apical +/- intraalveolar abscess
- “Pus out” into surrounding tissues, forming abscess
 - Mandible above MH line → sublingual space
 - Mandible below MH line → submandibular space
 - Suppurative node → submandibular space
 - Molar → masticator space



Submandibular Space Dental Abscess

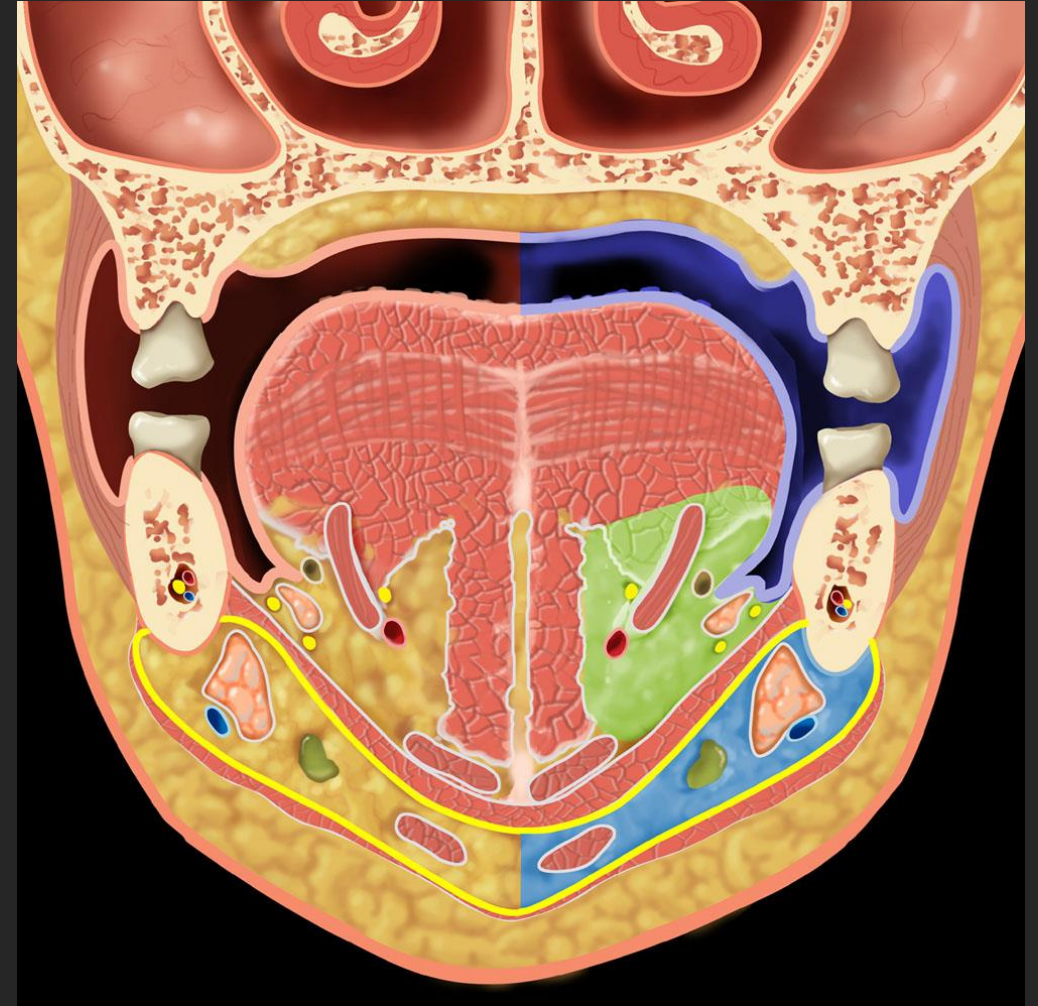


Selected Submandibular Space Pathologies

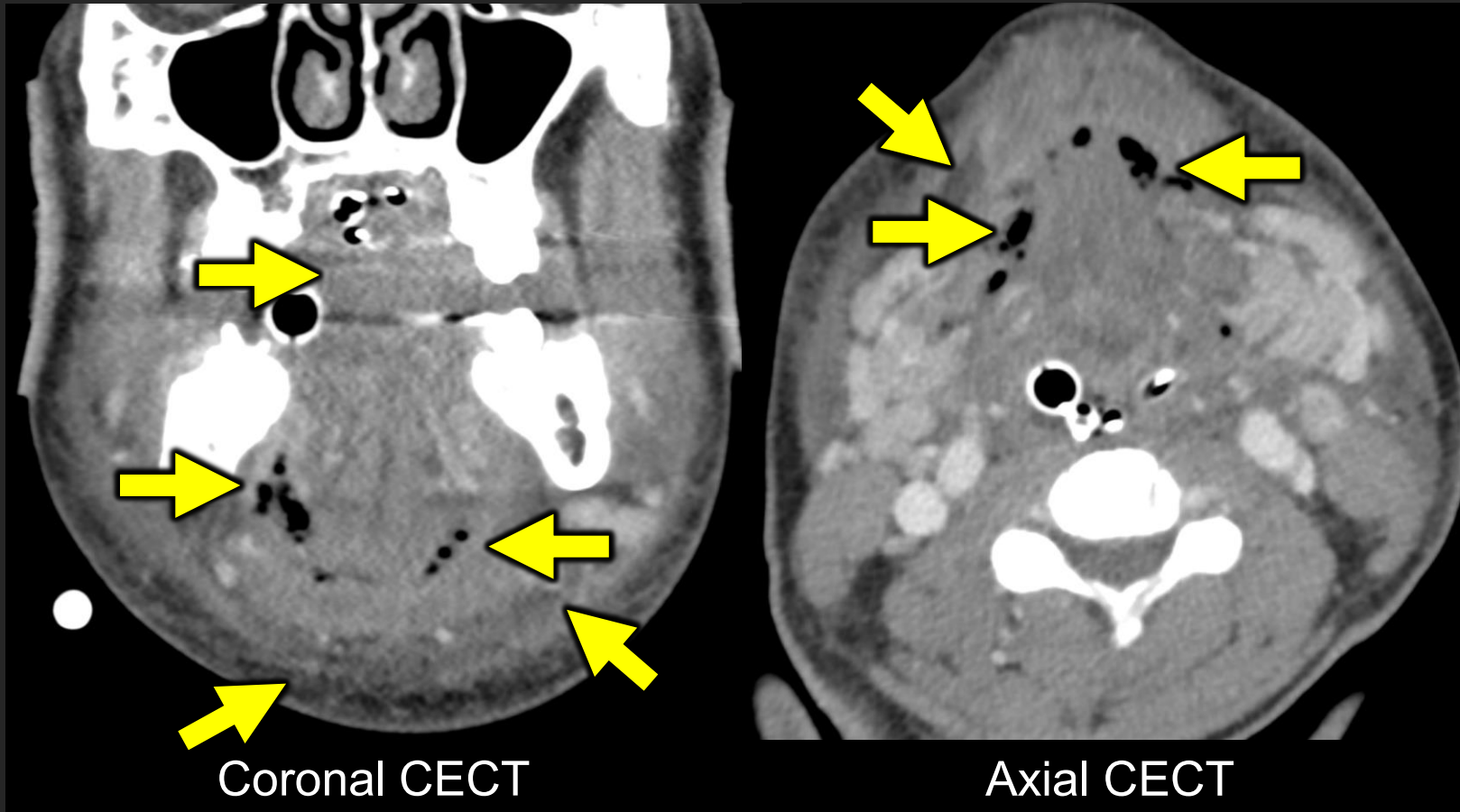
- Submandibular gland
 - Sialadenitis
 - Neoplasms (benign & malignant)
- Lymph nodes
 - Reactive & suppurative adenopathy
 - Metastatic adenopathy
 - Lymphoma
- **Other**
 - Dental abscess
 - **Floor of mouth infection (Ludwig angina)**
 - Diving ranula

Floor of Mouth Infection

- AKA “Ludwig angina”
- **Rapidly progressive with life-threatening airway compromise**
 - 3 S’s = Submandibular, sublingual, and submental
 - Mediastinitis (extreme case)
- Usually, dental origin
 - Sialadenitis, penetrating trauma, epiglottitis, peritonsillar abscess

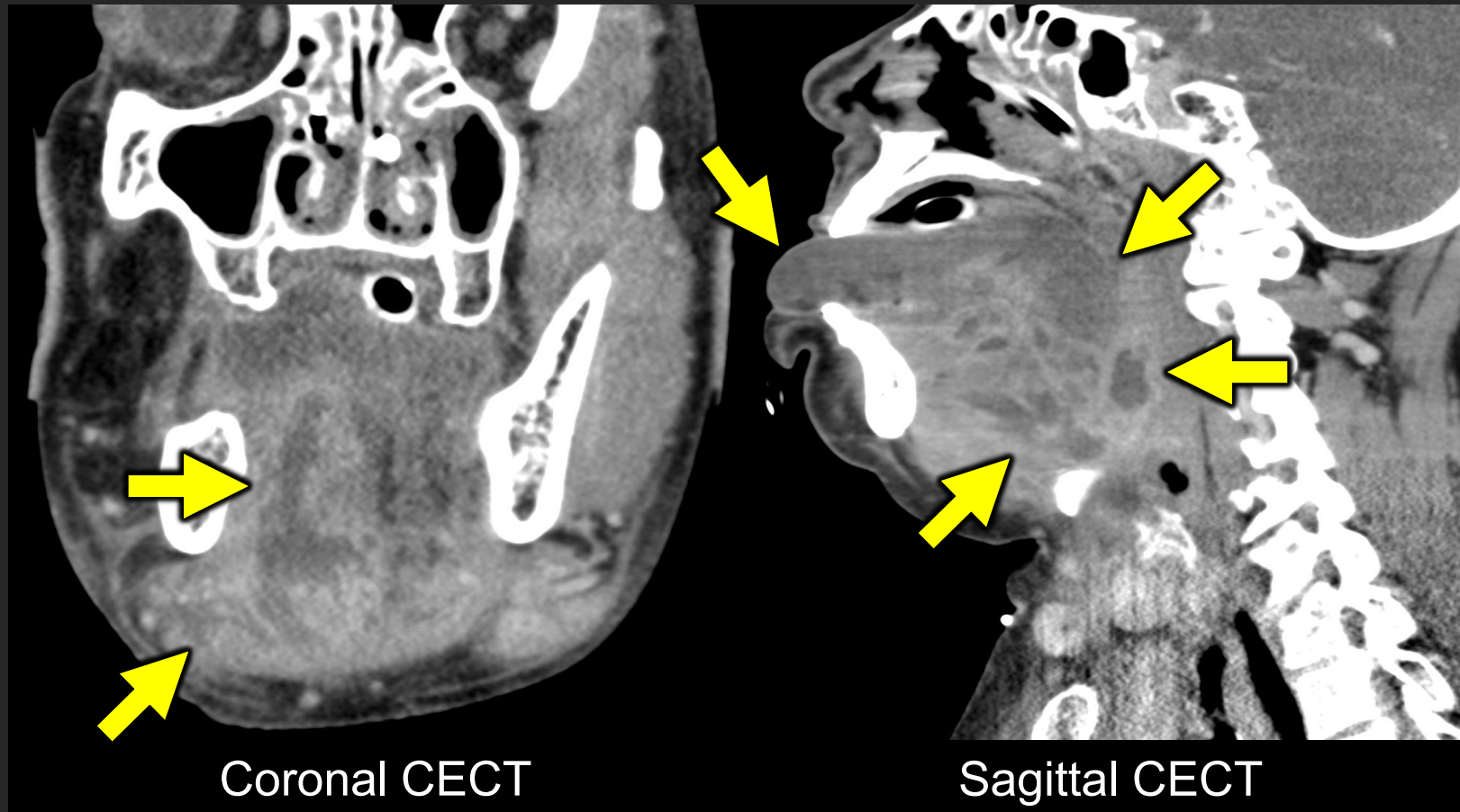


Necrotizing Fasciitis



Multispatial edema and emphysema, massive tongue swelling

Trans-Spatial Floor of Mouth Abscess



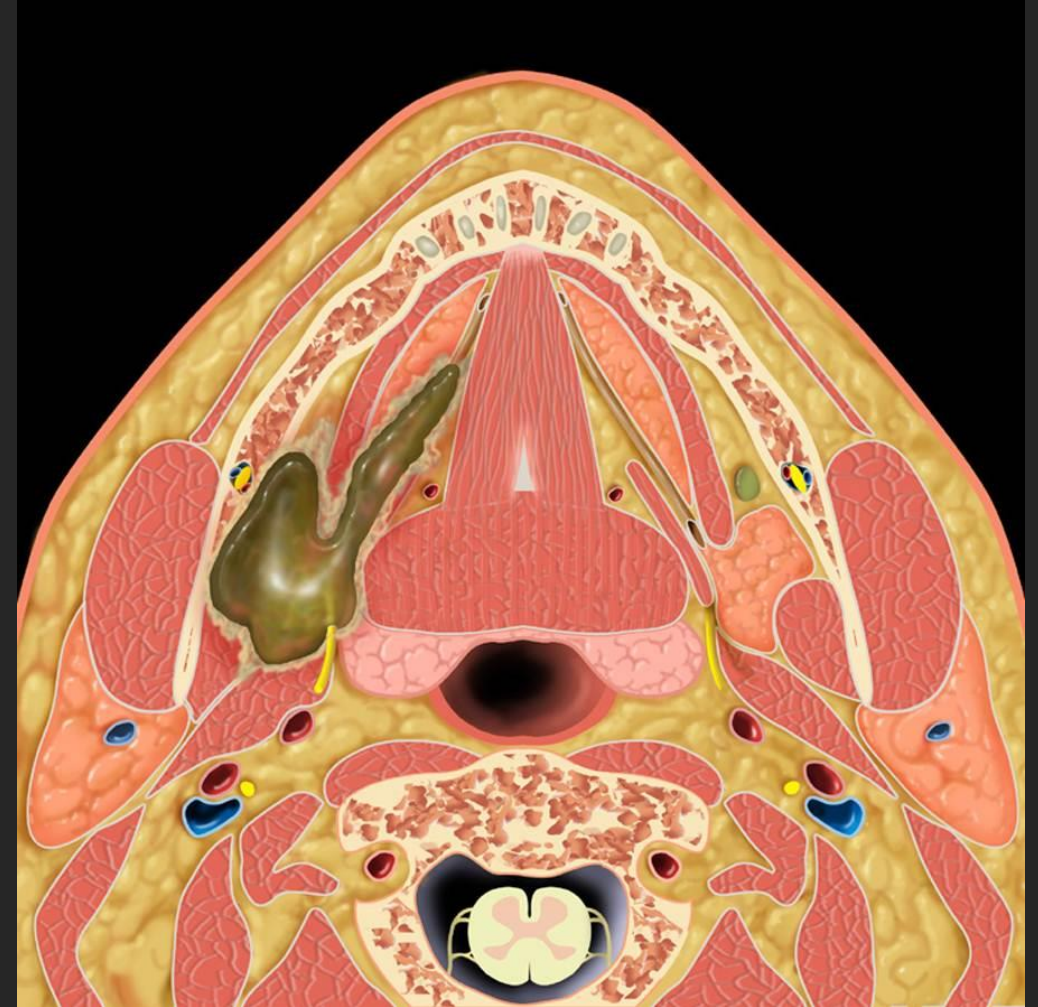
Ludwig abscesses are uncommon – transcervical drainage

Selected Submandibular Space Pathologies

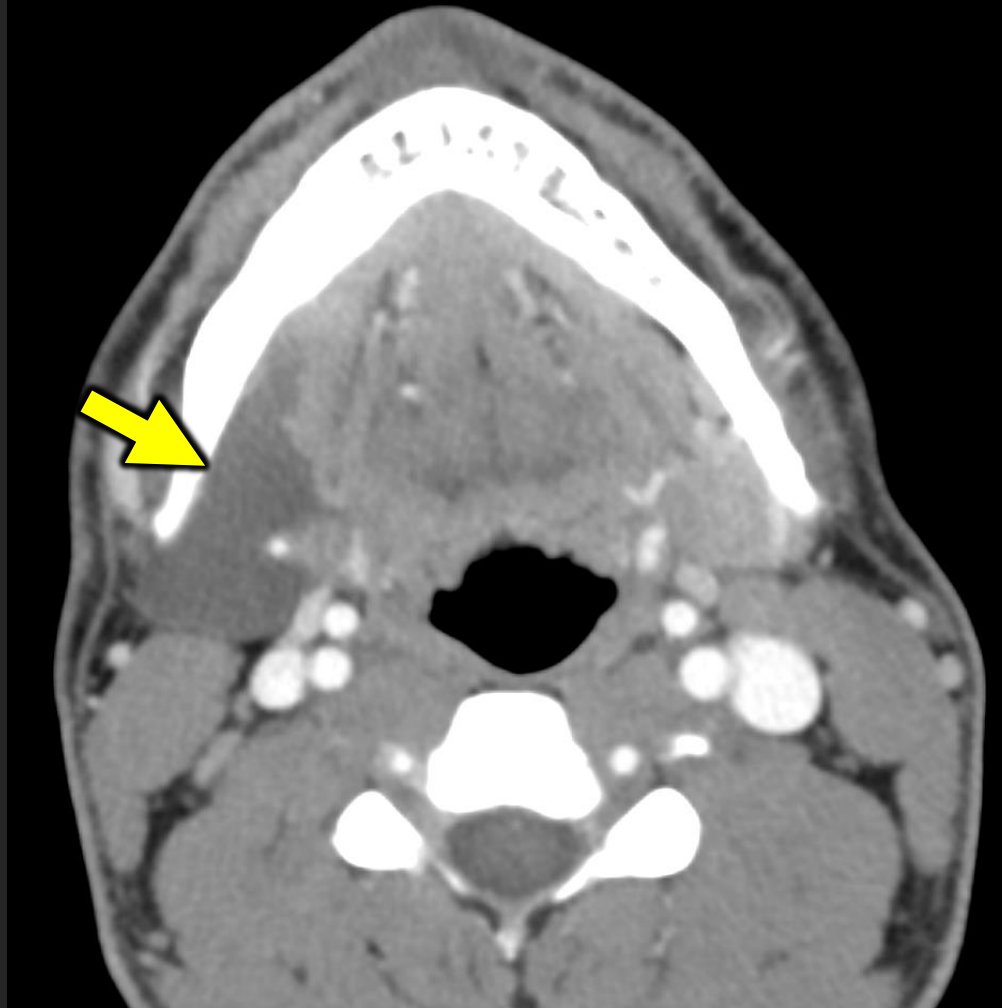
- Submandibular gland
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 - Reactive & suppurative adenopathy
 - Metastatic adenopathy
 - Lymphoma
- Other
 - Dental abscess
 - Floor of mouth infection (Ludwig angina)
 - Diving ranula

Diving Ranula

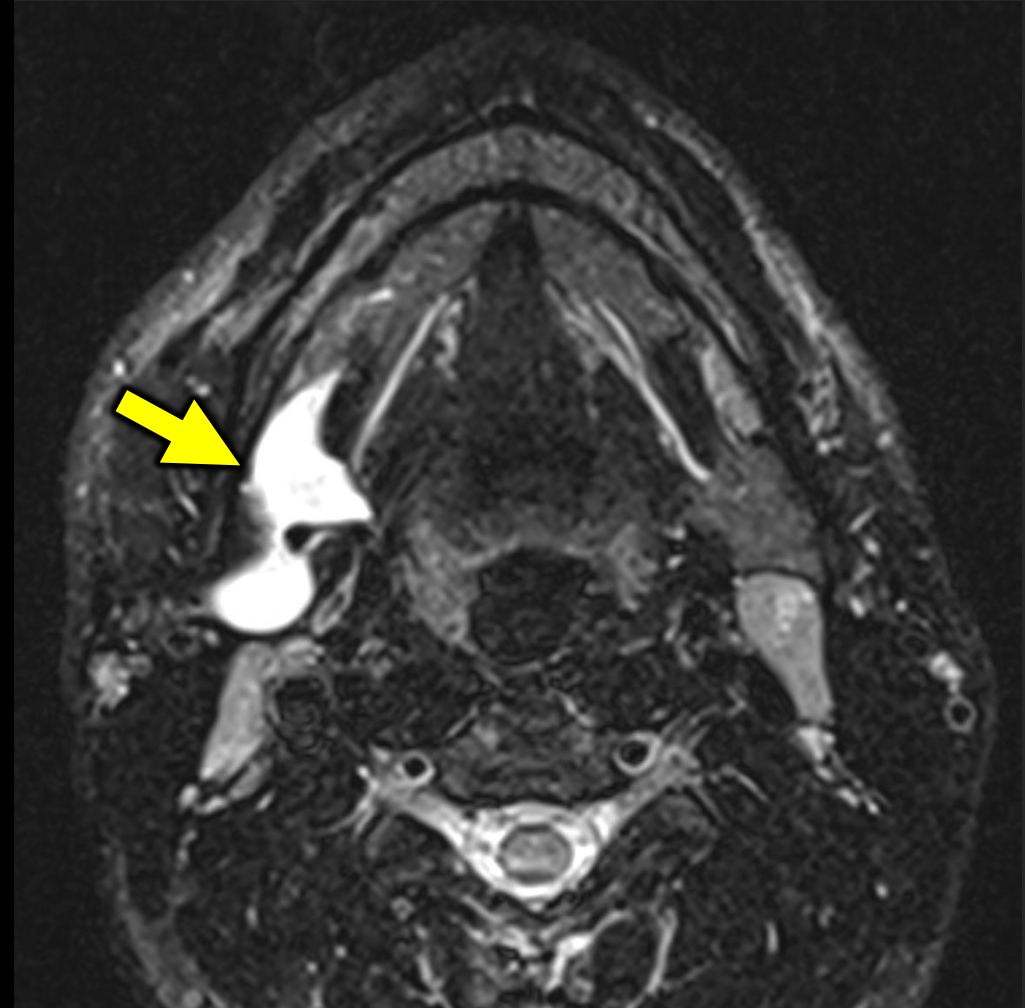
- Ranula = retention cyst of sublingual gland or MSG
 - Simple ranula = confined to sublingual space
 - **Diving ranula = ruptures into submandibular space**
- Comet-shaped morphology
- Circumscribed, T2 bright +/- thin wall enhancement
- Can become infected
 - Thicker rind of enhancement



Diving Ranula

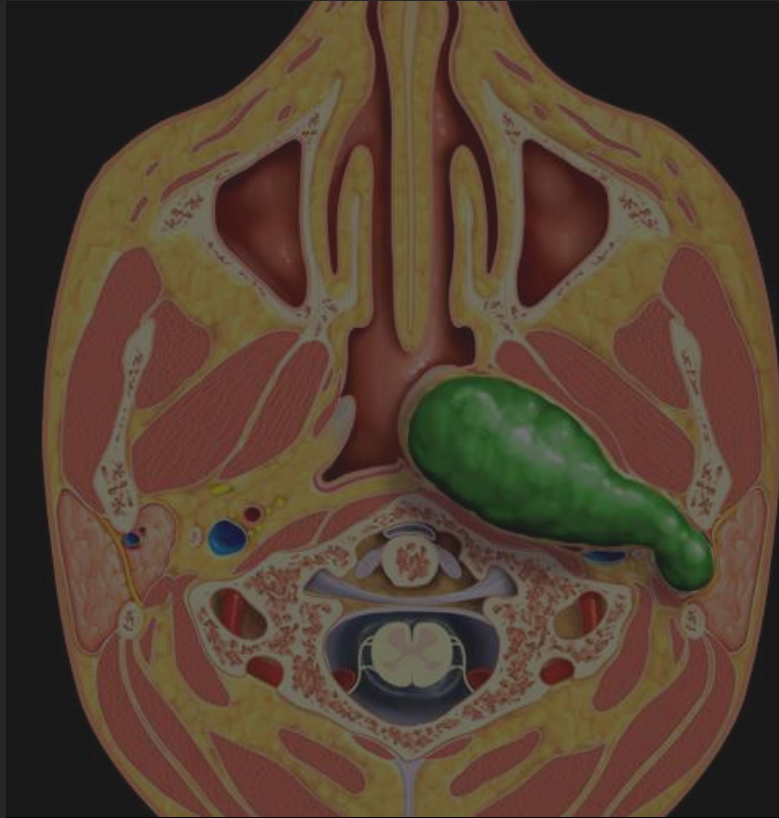


Axial CECT



Axial T2WI FS

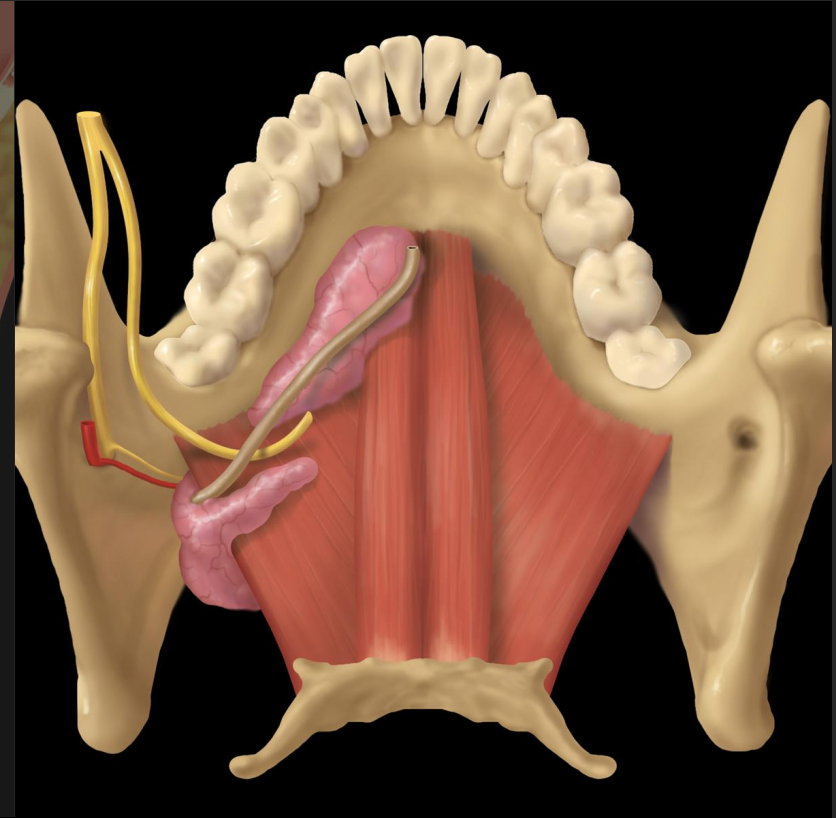
Salivary Glands: Anatomy & Pathology



PAROTID



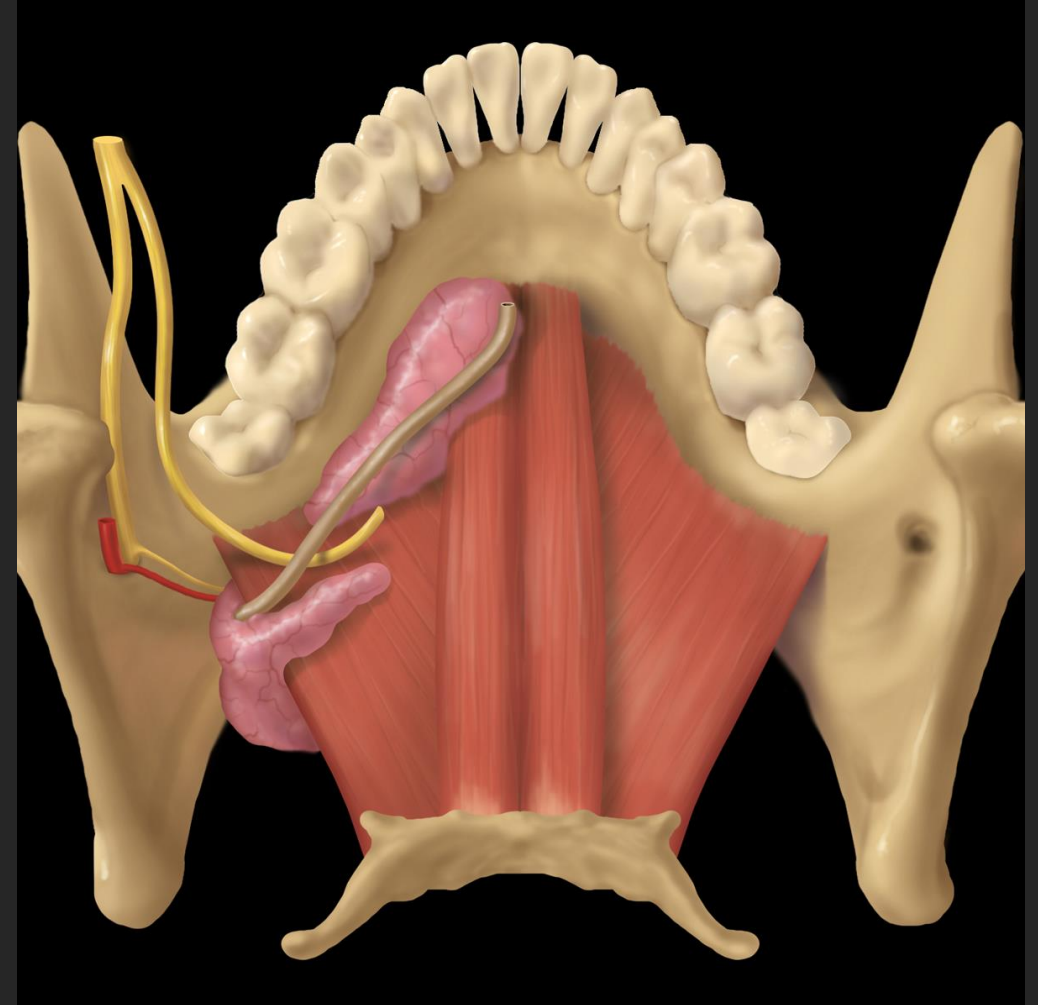
SUBMANDIBULAR



SUBLINGUAL

Sublingual Space

- Considered a component of the oral cavity:
 - Oral mucosal surface
 - Root of tongue
 - Submandibular space
 - **Sublingual space**



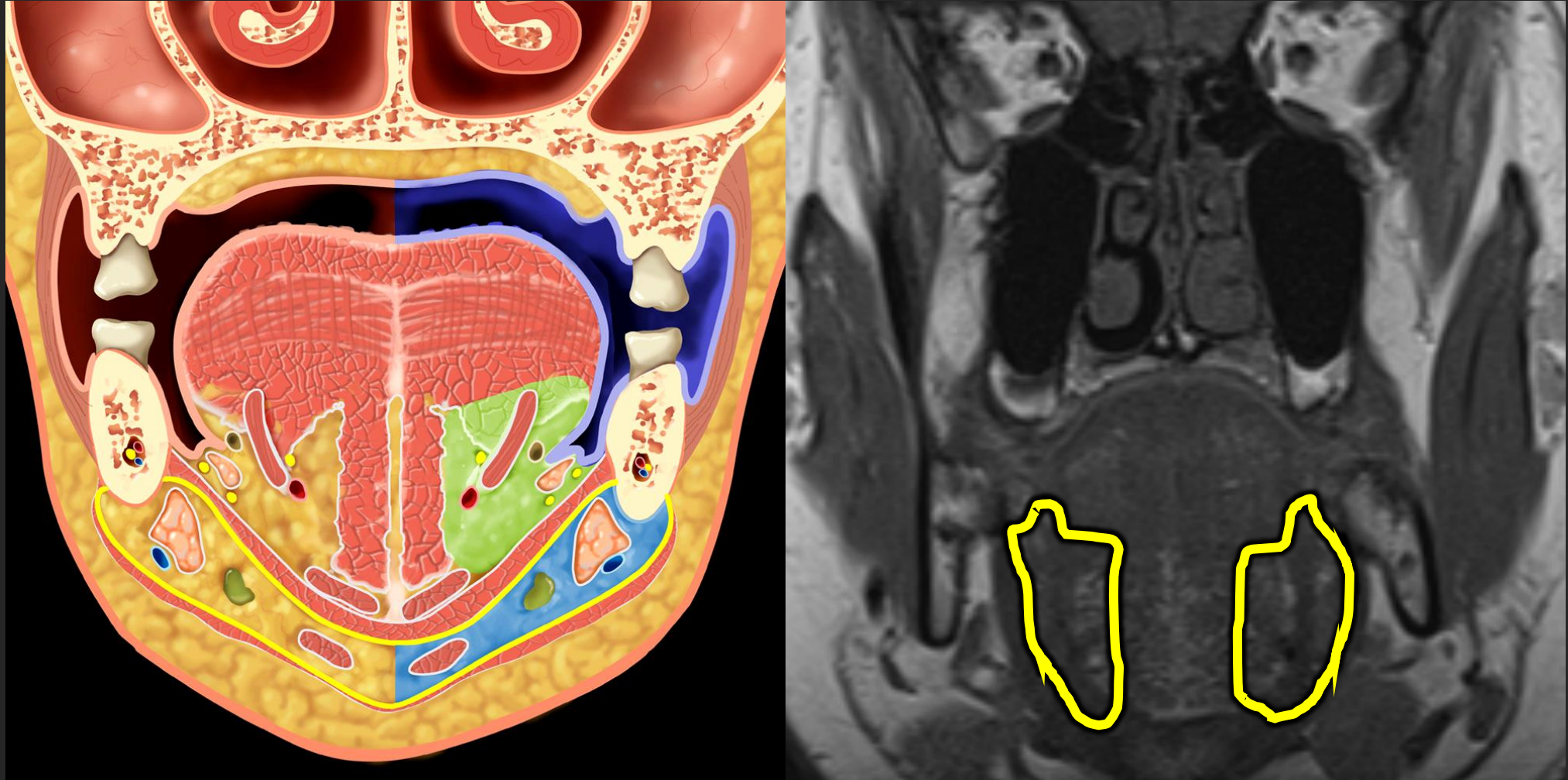
Sublingual Space

- Paired oral cavity spaces
- Location
 - Deep/medial to mylohyoid
 - Below floor FOM mucosa
 - Separated by root of tongue
 - Connected by isthmus
- Horizontal horseshoe
- Connects to submandibular & parapharyngeal spaces
- No fascial investment



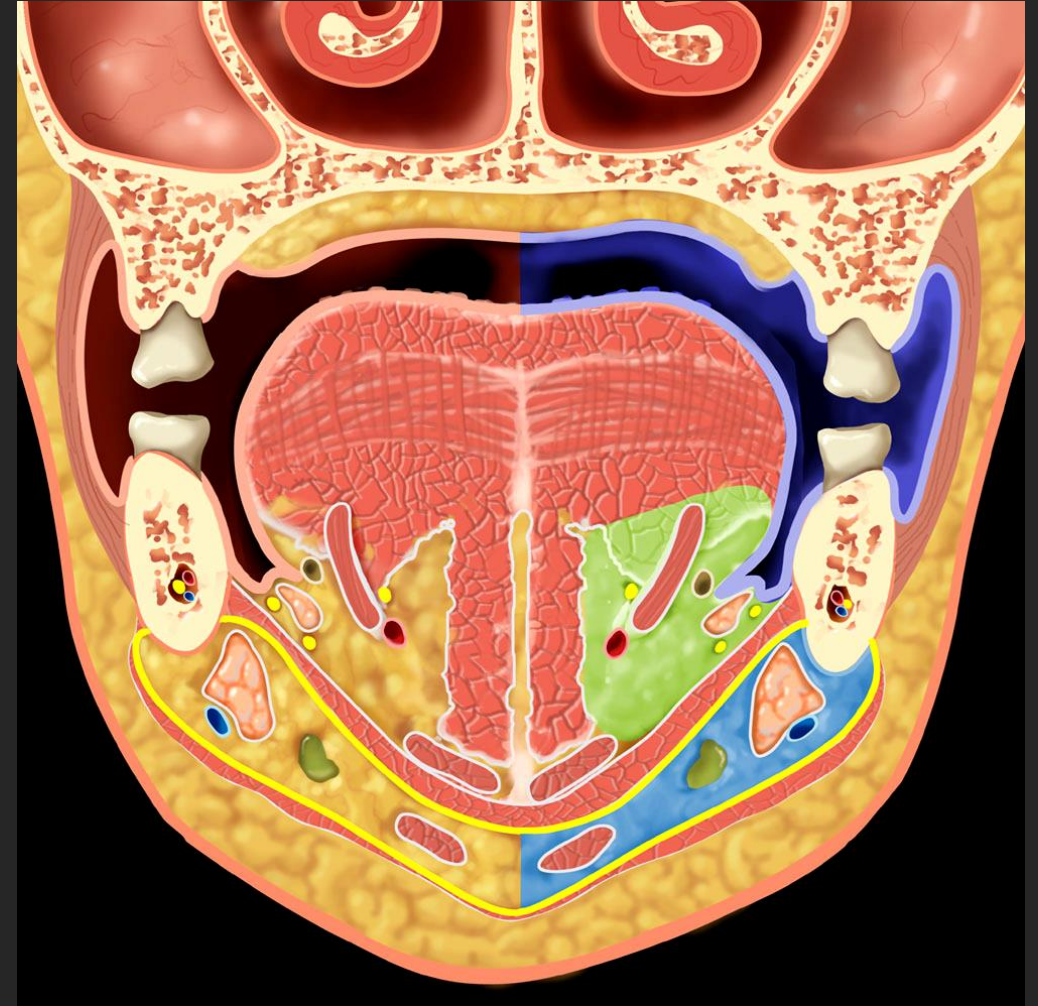
Axial T1WI

Sublingual Space



Sublingual Space Contents

- Sublingual gland & duct
- Submandibular gland (partial) & duct
- CN9
- CN12
- Lingual nerve (CNV3) + chorda tympani (CN7)
- Lingual artery & vein



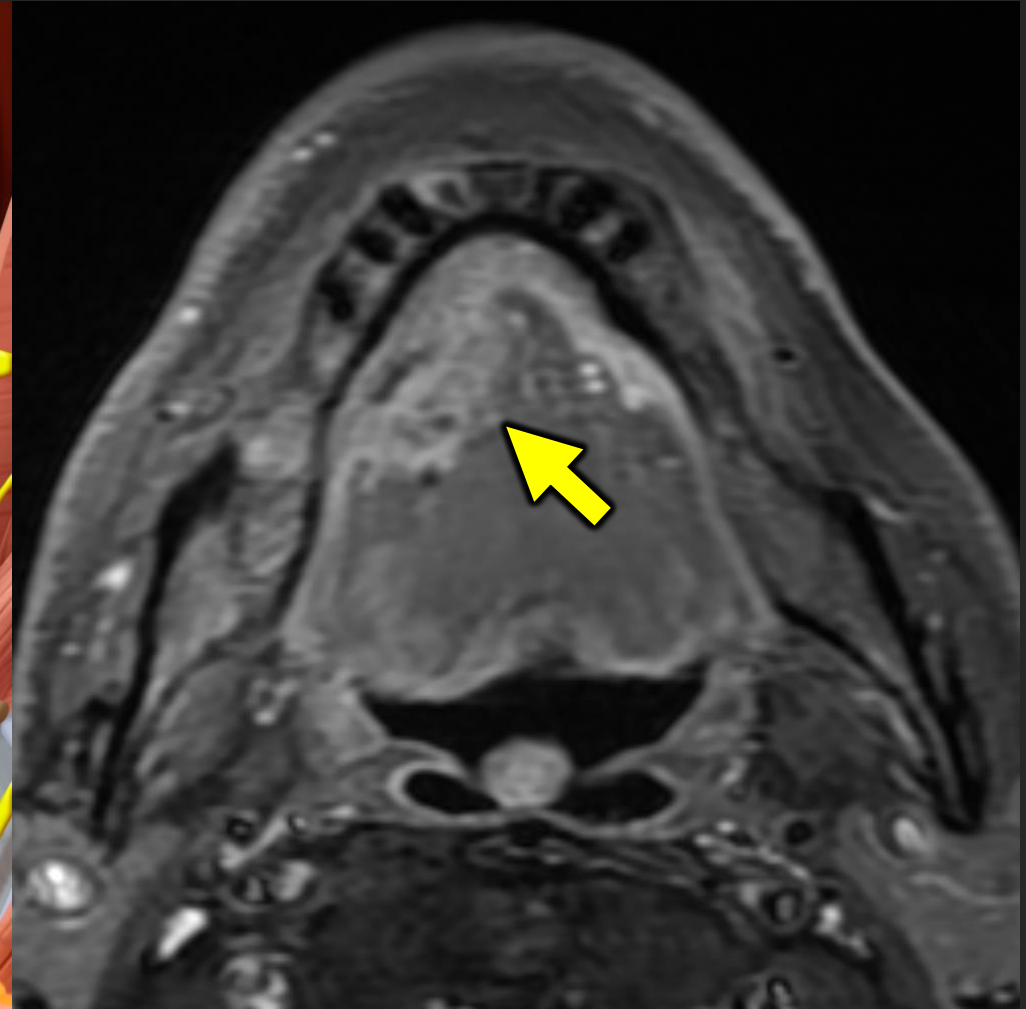
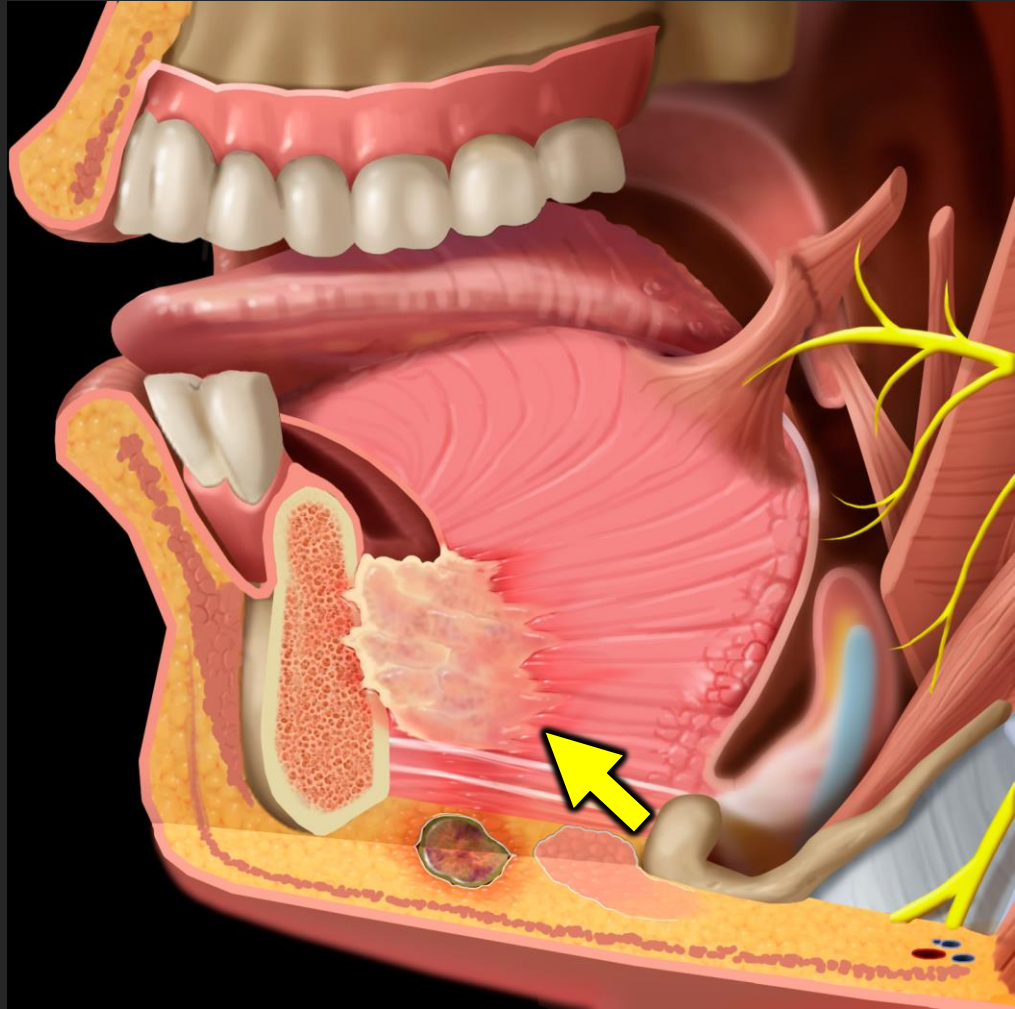
Selected Sublingual Space Pathologies

- Sublingual & submandibular glands, ducts
 - Neoplasms (benign & malignant)
 - Ductal calculus
 - Simple ranula
 - Sialocele
- Lingual artery
 - Aneurysm & pseudoaneurysm
- Other
 - Dermoid & epidermoid
 - Vascular malformation

Selected Sublingual Space Pathologies

- Sublingual & submandibular glands, ducts
 - Neoplasms (benign & malignant)
 - Ductal calculus
 - Simple ranula
 - Sialoceles
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 - Aneurysm & pseudoaneurysm
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 - Dermoid & epidermoid
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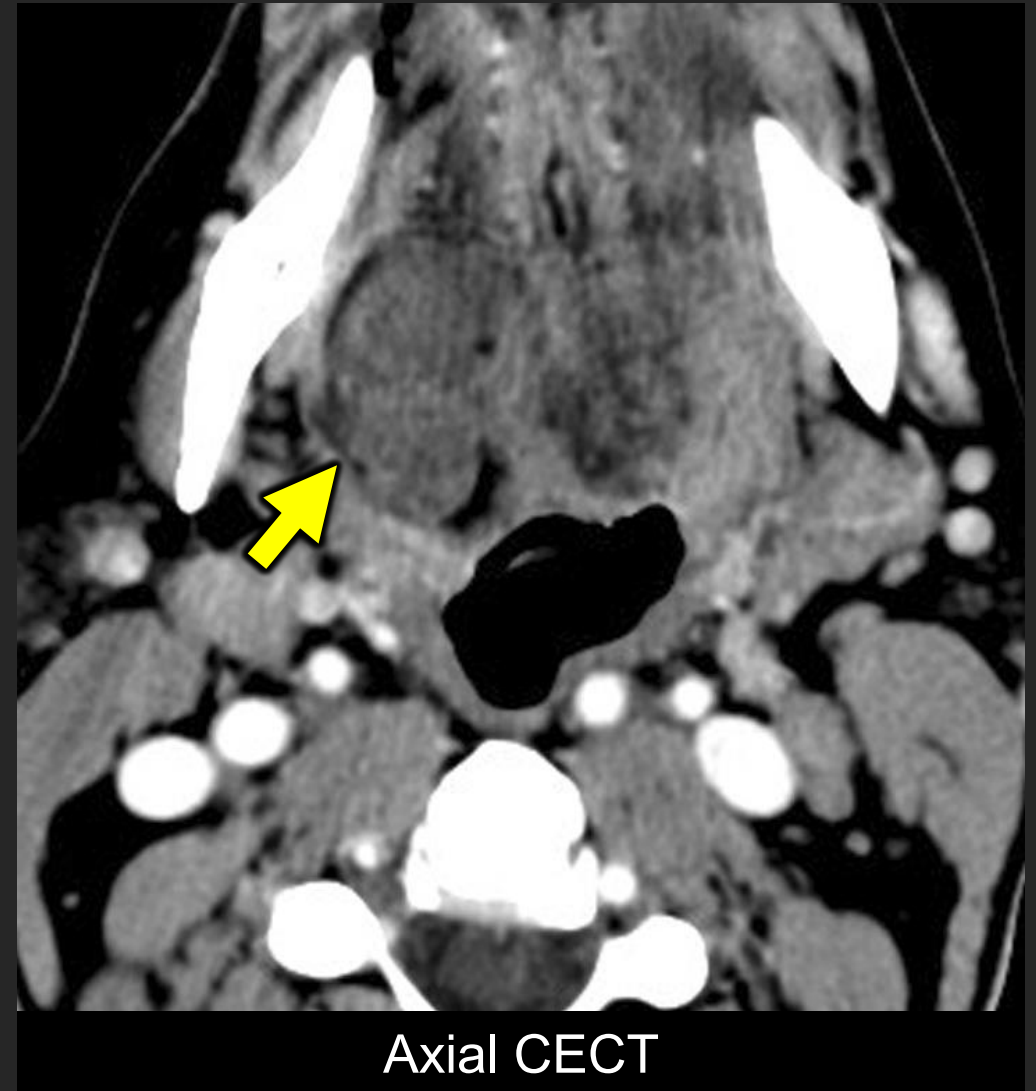
Floor of Mouth SCCa



Axial T1WI C+ FS

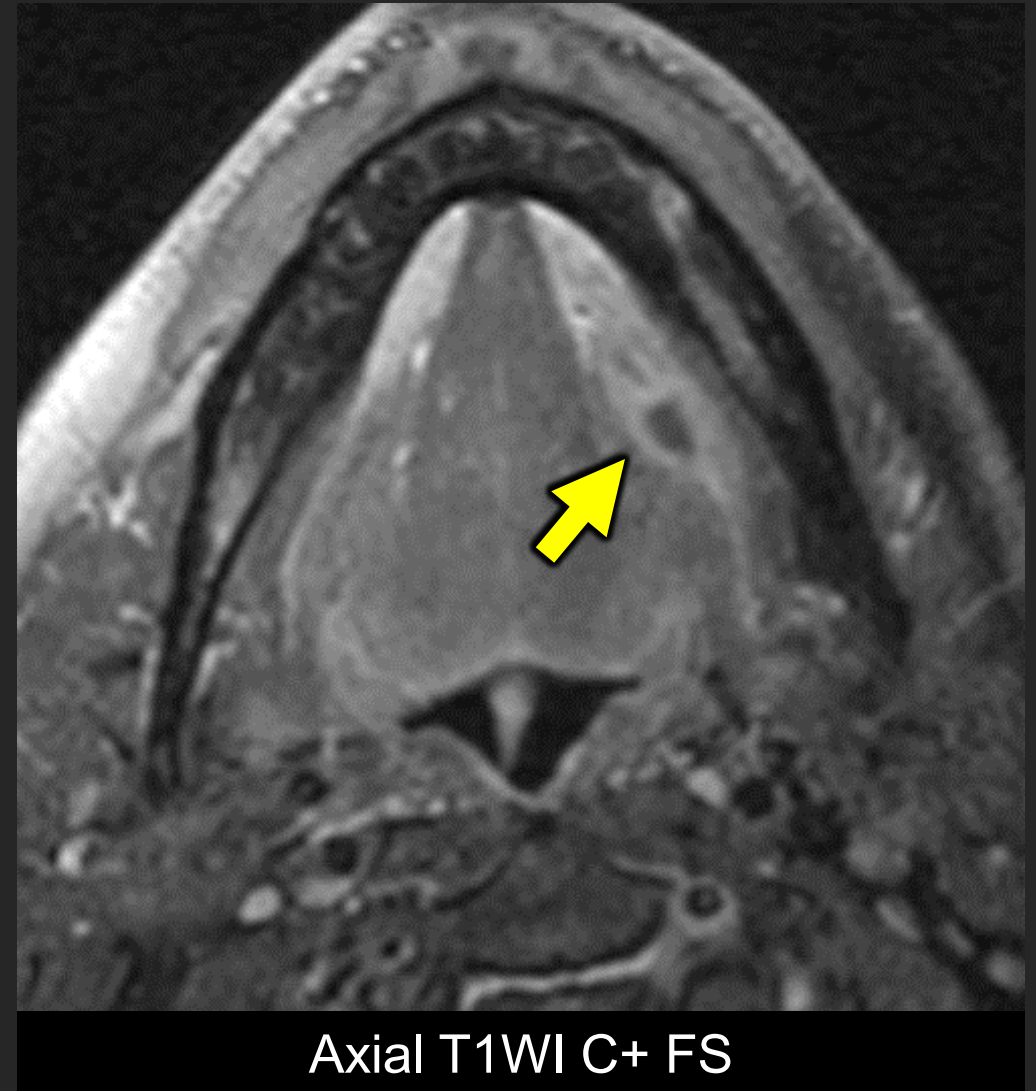
Pleomorphic Adenoma

- Most common tumor of sublingual gland
- Origin
 - Sublingual gland
 - Sublingual space minor salivary gland
- Looks like BMT elsewhere
- Risk of seeding
- Carcinoma ex pleomorphic adenoma



Sublingual Gland Carcinoma

- ~60-80% of sublingual gland masses = malignant!
- Extremely rare
 - Adenoid cystic
 - Mucoepidermoid
 - Carcinoma ex pleomorphic adenoma
- Variable signal and enhancement
 - Dark T2/ADC = BAD



Reporting Sublingual Gland Masses

- Checklist
 - Size
 - Margins
 - Benign/low-grade vs. high-grade
 - Invasion of surrounding structures
 - Mandible, lateral tongue, root of tongue, lingual artery, skin
 - Perineural tumor spread
 - Adenoid cystic carcinoma
 - Nodal metastases
 - Mucoepidermoid carcinoma

Reporting Sublingual Gland Masses

“Further imaging will confer no additional specificity to the diagnosis”

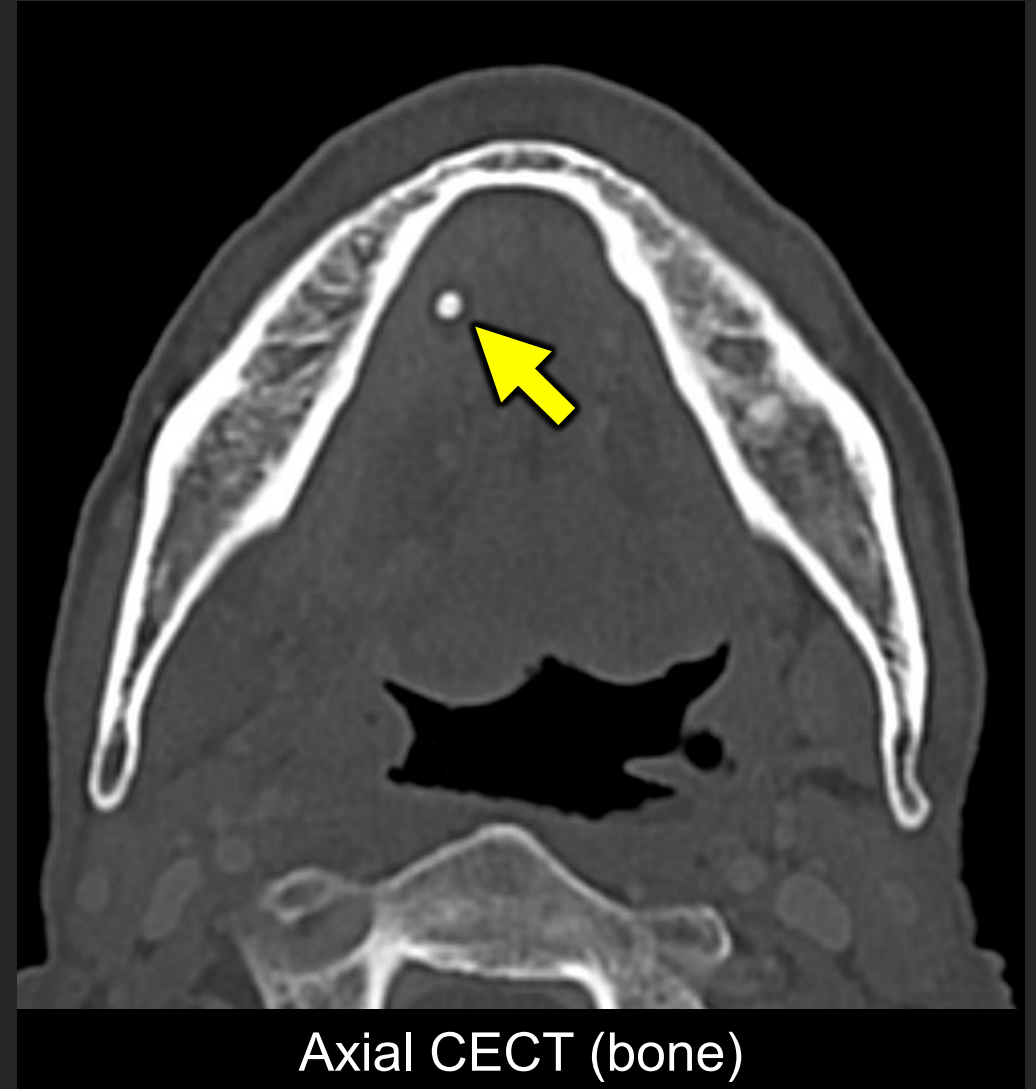
No matter what you think it is it's probably malignant → H&N oncologic surgeon needs to see them soon!

Selected Sublingual Space Pathologies

- **Sublingual & submandibular glands, ducts**
 - Neoplasms (benign & malignant)
 - **Ductal calculus**
 - Simple ranula
 - Sialoceles
- Lingual artery
 - Aneurysm & pseudoaneurysm
- Other
 - Dermoid & epidermoid
 - Vascular malformation

Distal Submandibular Duct Stone

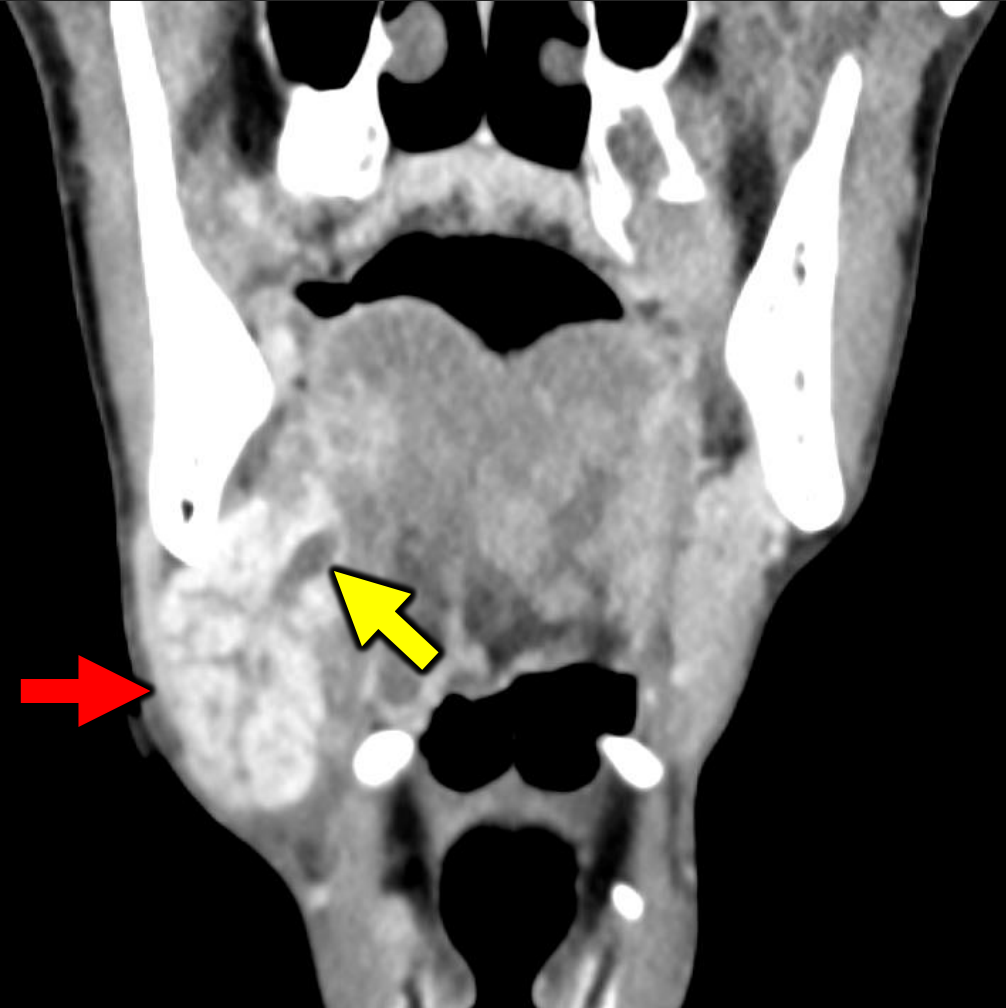
- Submandibular duct (distal to mylohyoid) turn courses through SLS to FOM
- Distal duct common location for calculus
- Look for:
 - Obstruction with dilated upstream duct
 - Acute sialadenitis
- Measure stone on bone windows (blooming)



Obstructing Stone with Acute Sialadenitis



Axial CECT



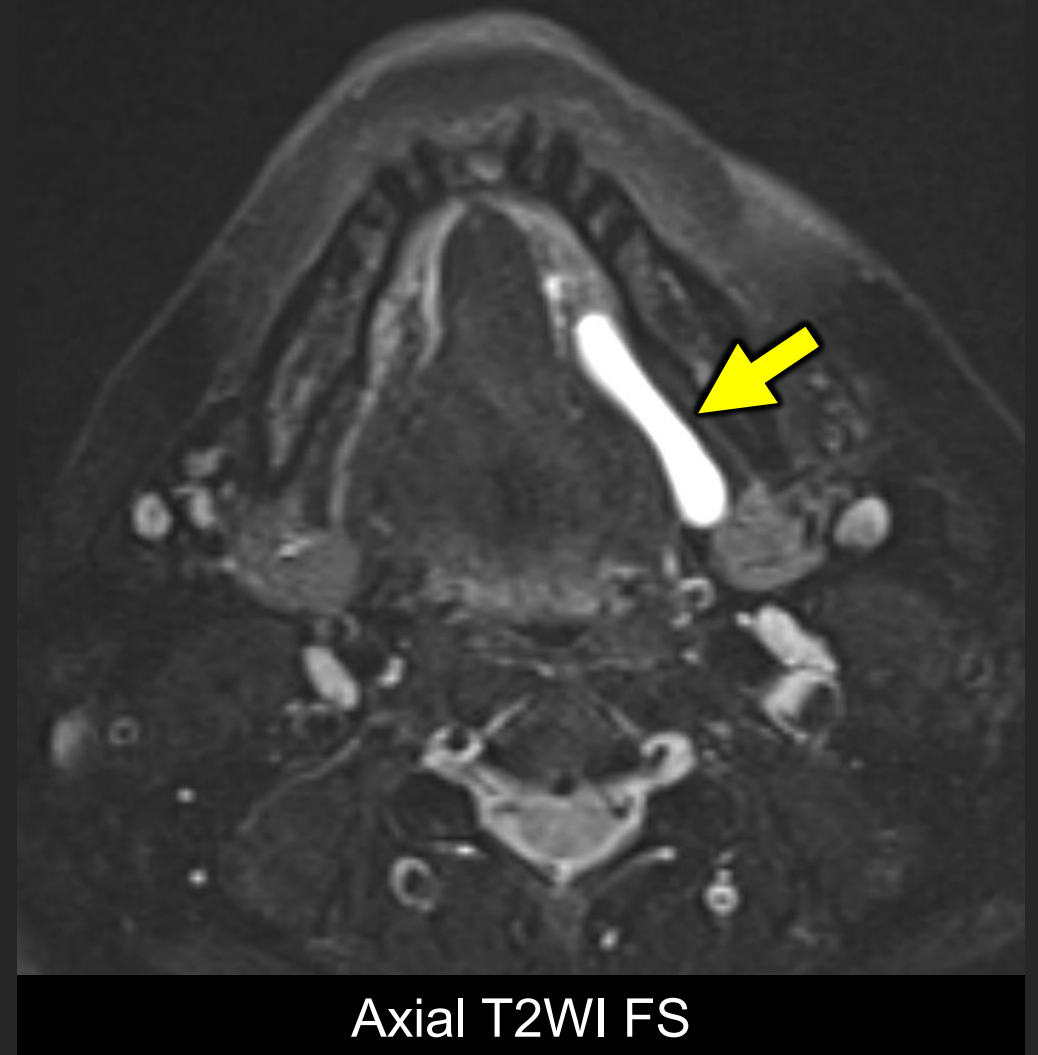
Coronal CECT

Selected Sublingual Space Pathologies

- **Sublingual & submandibular glands, ducts**
 - Neoplasms (benign & malignant)
 - Ductal calculus
 - **Simple ranula**
 - Sialoceles
- Lingual artery
 - Aneurysm & pseudoaneurysm
- Other
 - Dermoid & epidermoid
 - Vascular malformation

Simple Ranula

- Ranula = retention cyst of sublingual gland or MSG
 - Simple ranula = confined to sublingual space
 - Diving ranula = ruptures into submandibular space
- Oval-shaped morphology
- Circumscribed, T2 bright +/- thin wall enhancement
- Can become infected
 - Thicker rind of enhancement

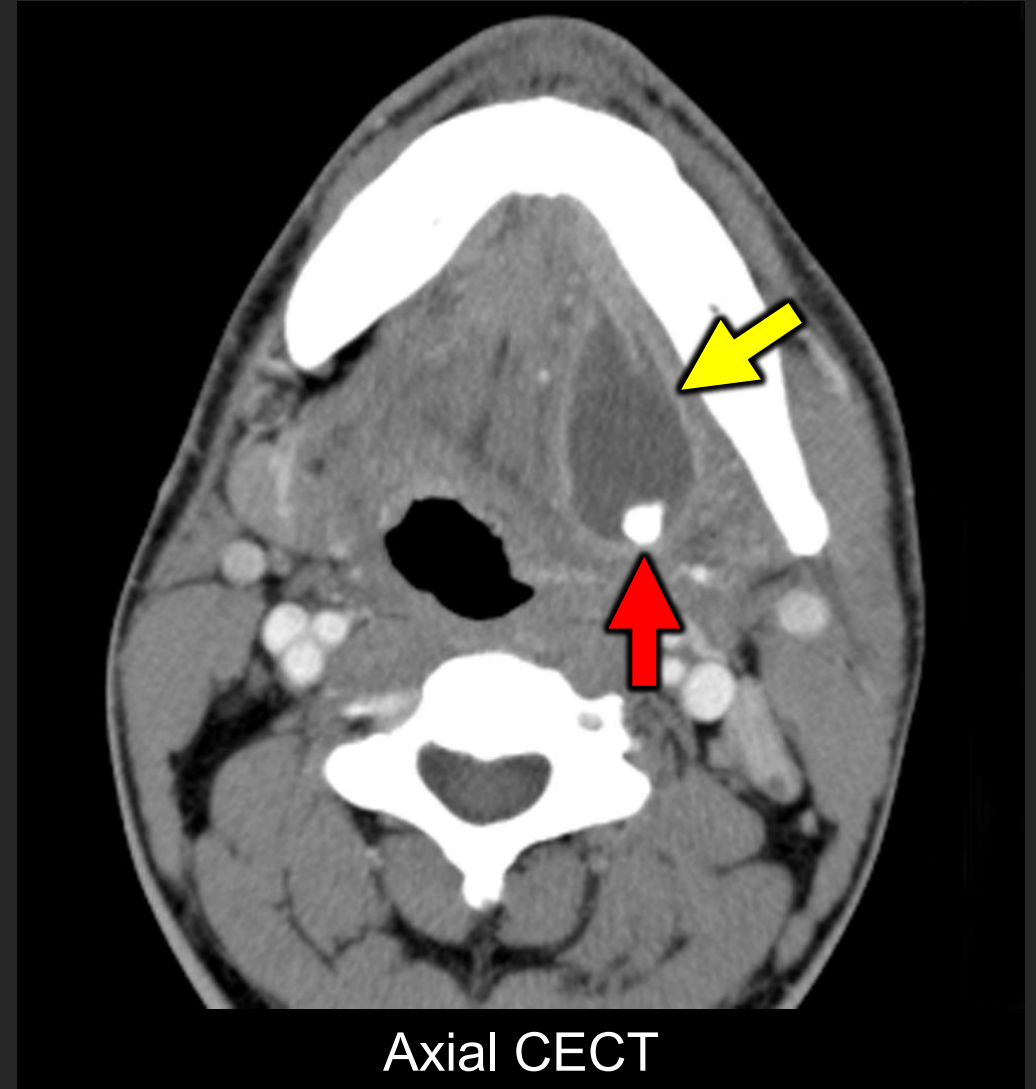


Selected Sublingual Space Pathologies

- **Sublingual & submandibular glands, ducts**
 - Neoplasms (benign & malignant)
 - Ductal calculus
 - Simple ranula
 - **Sialoceles**
- Lingual artery
 - Aneurysm & pseudoaneurysm
- Other
 - Dermoid & epidermoid
 - Vascular malformation

Sialocele

- Ruptured submandibular duct → saliva leaks into sublingual space
- Painless, fluctuant mass
- Etiology
 - Stone >> trauma, surgery
- Imaging appearance:
 - Fluid collection within SLS, separate from duct
 - +/- Rim enhancement
- Clue: look for calculi

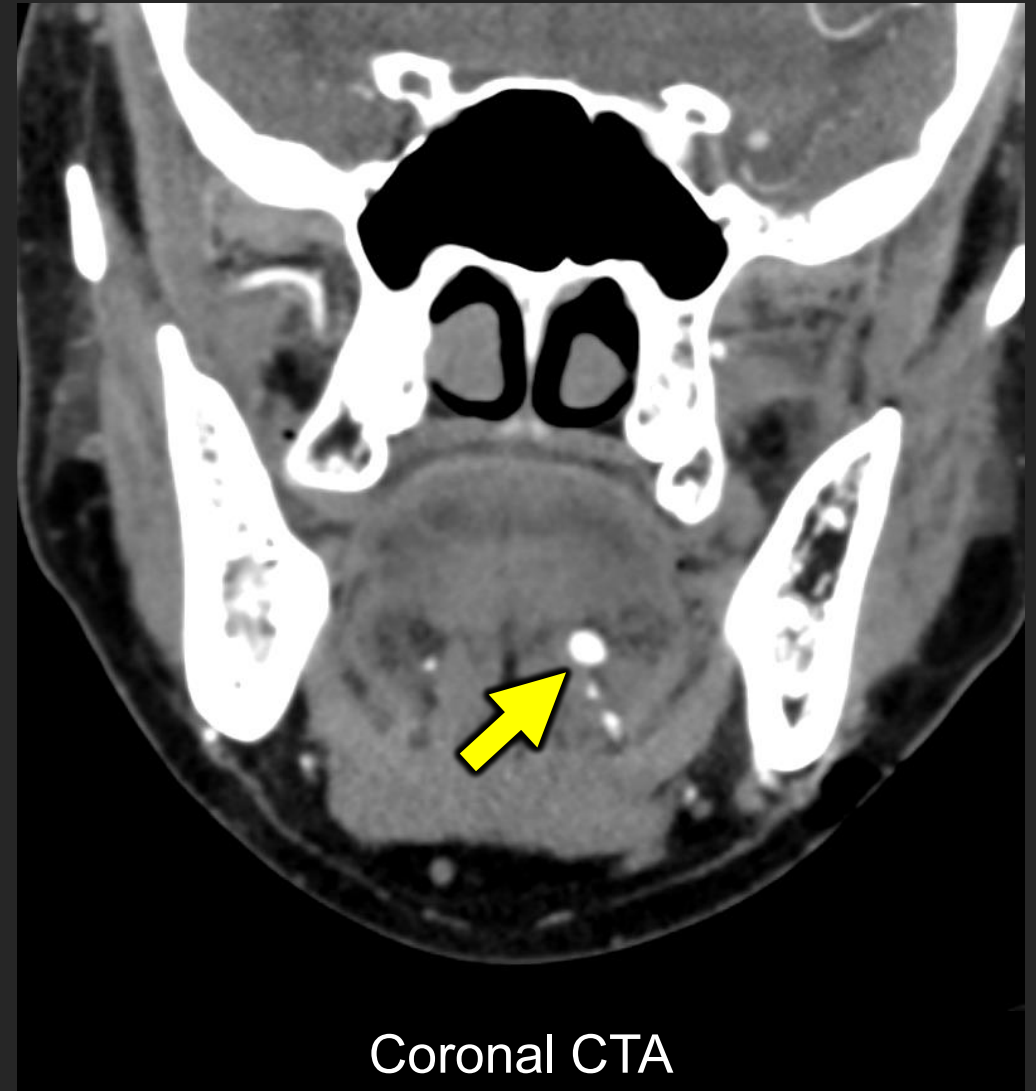


Selected Sublingual Space Pathologies

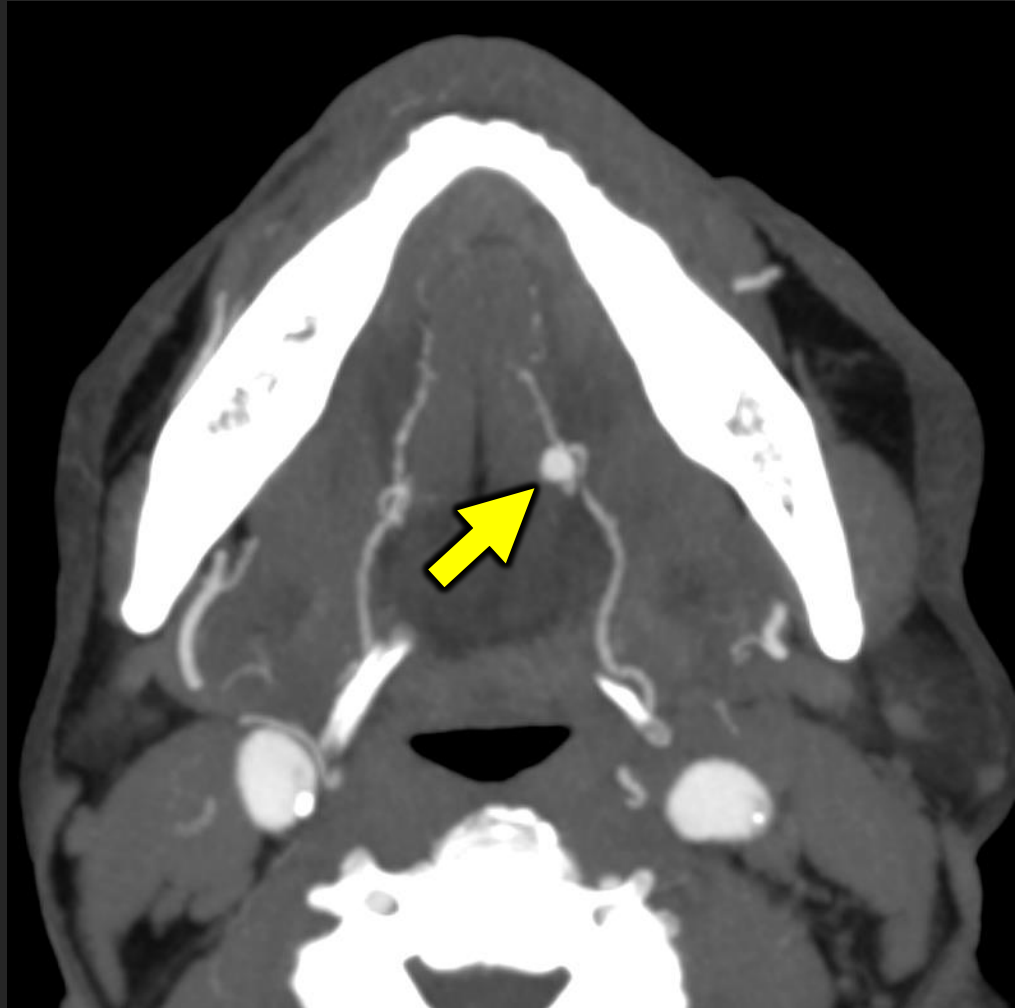
- Sublingual & submandibular glands, ducts
 - Neoplasms (benign & malignant)
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 - Simple ranula
 - Sialoceles
- **Lingual artery**
 - **Aneurysm & pseudoaneurysm**
- Other
 - Dermoid & epidermoid
 - Vascular malformation

Lingual Artery Aneurysm & Pseudoaneurysm

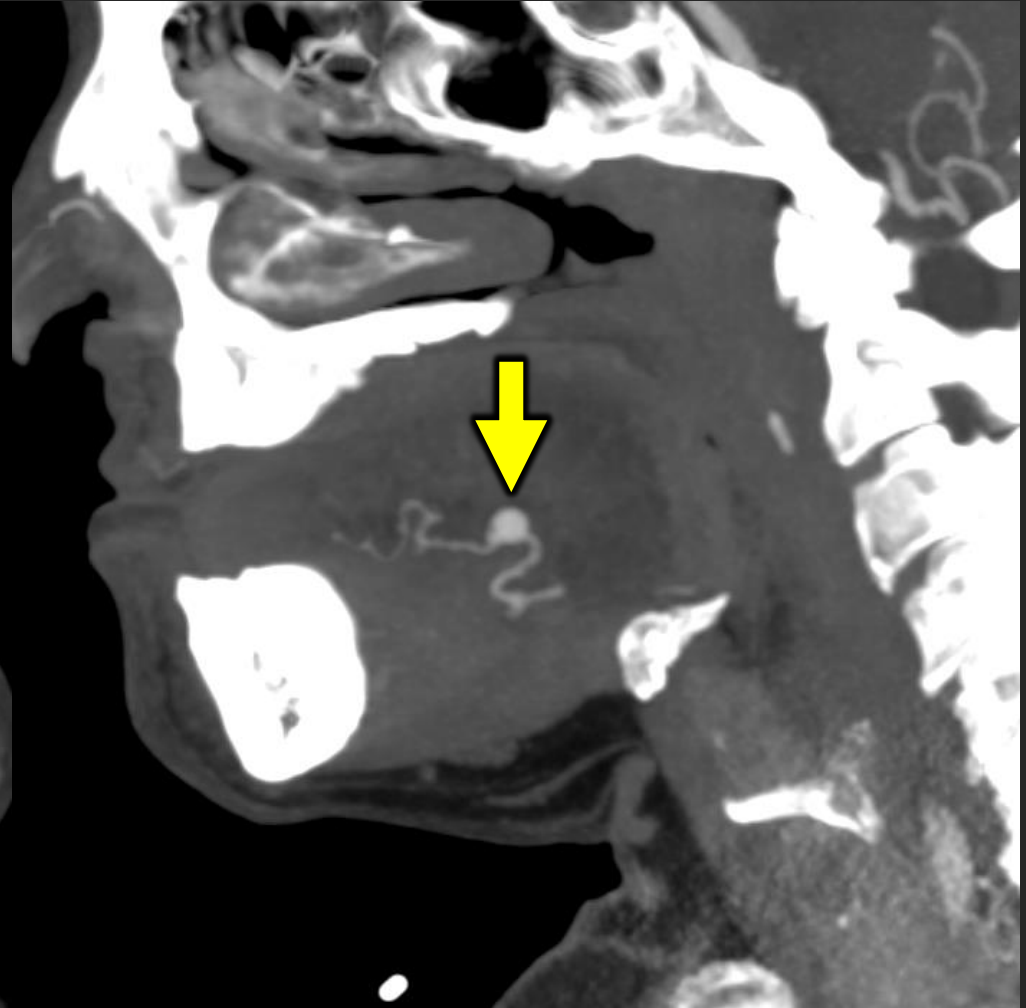
- Rare, but important
- **Massive bleeding → hypovolemic shock, death**
- May be SCCa-related
 - Tumor invasion → pseudoaneurysm
 - Post-surgical or post-XRT
- Other etiologies
 - Trauma, infection, idiopathic
- Opacified outpouching from lingual artery in SLS



Lingual Artery Aneurysm



Axial CTA MIP



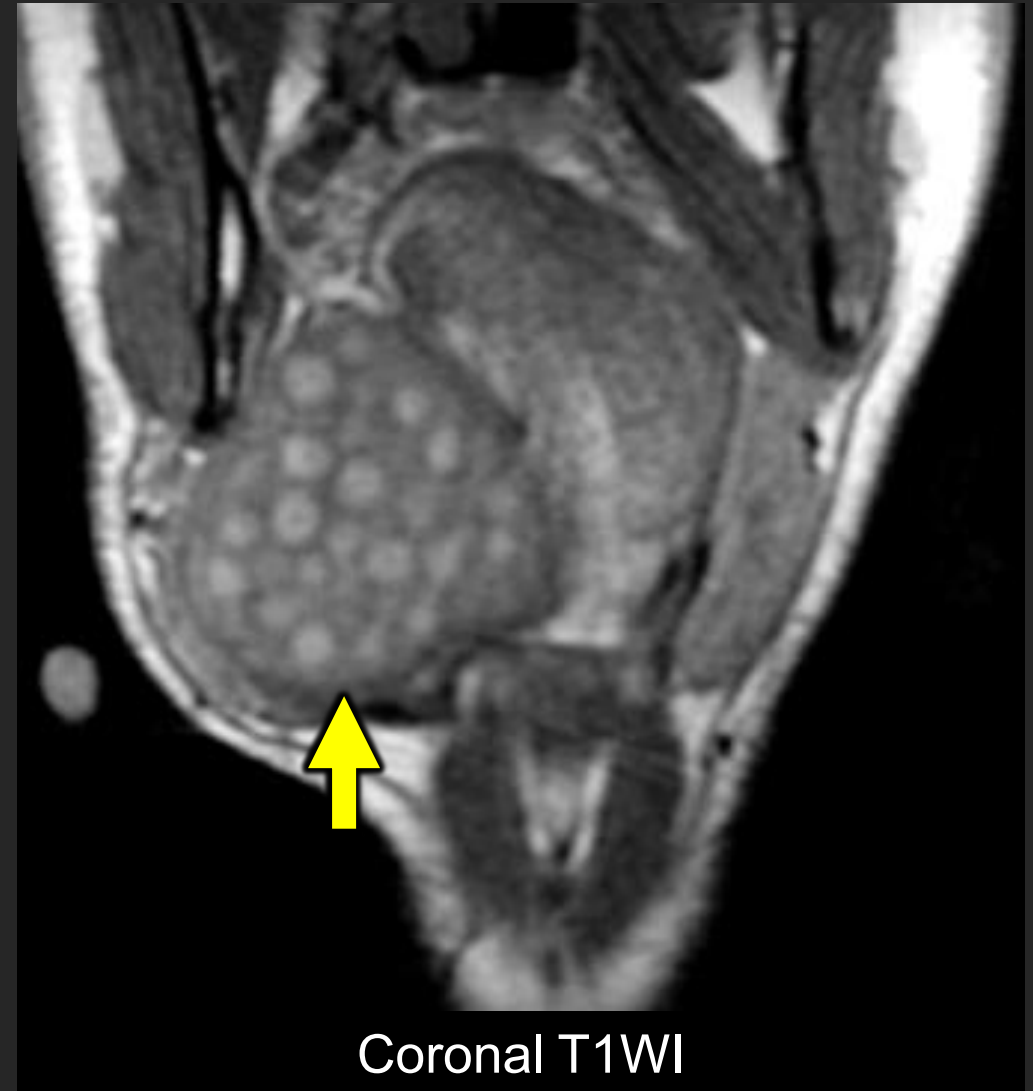
Sagittal CTA MIP

Selected Sublingual Space Pathologies

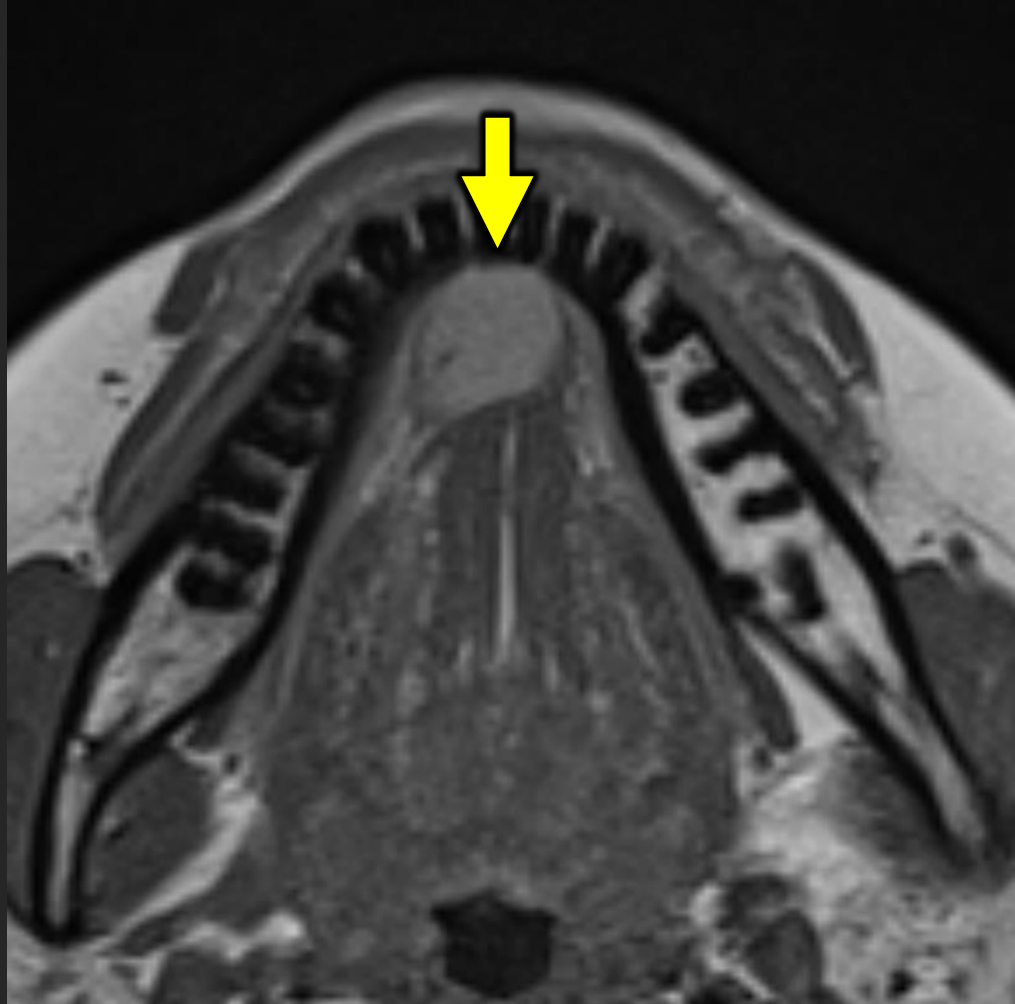
- Sublingual & submandibular glands, ducts
 - Neoplasms (benign & malignant)
 - Ductal calculus
 - Simple ranula
 - Sialoceles
- Lingual artery
 - Aneurysm & pseudoaneurysm
- **Other**
 - **Dermoid & epidermoid**
 - Vascular malformation

Sublingual Space Dermoid & Epidermoid

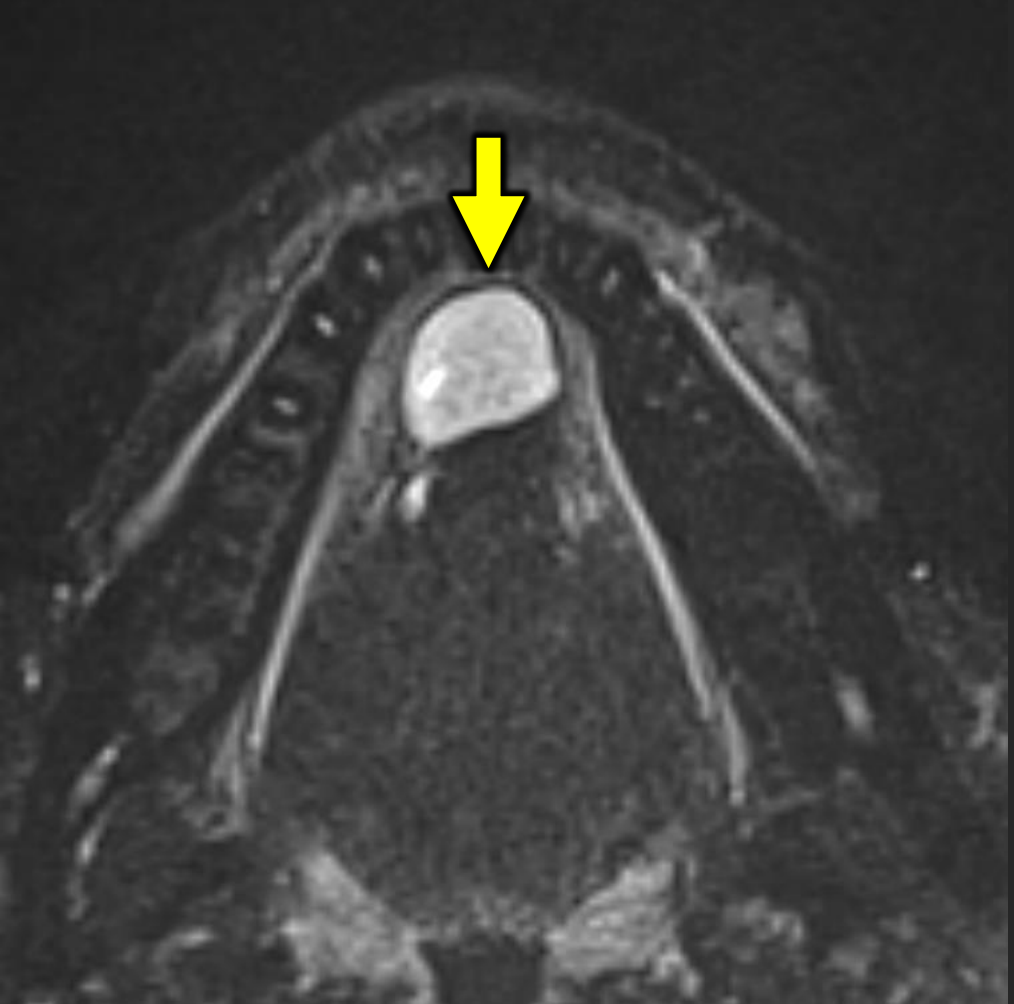
- Congenital epithelial rest or inclusion → cystic mass
 - Dermoid = epithelial elements + dermal adnexa
 - More commonly midline
 - Complex cystic mass +/- fat, calcifications
 - Epidermoid = epithelial elements only
 - Fluid contents only
- **Both may demonstrate reduced diffusivity**



Sublingual Space Dermoid

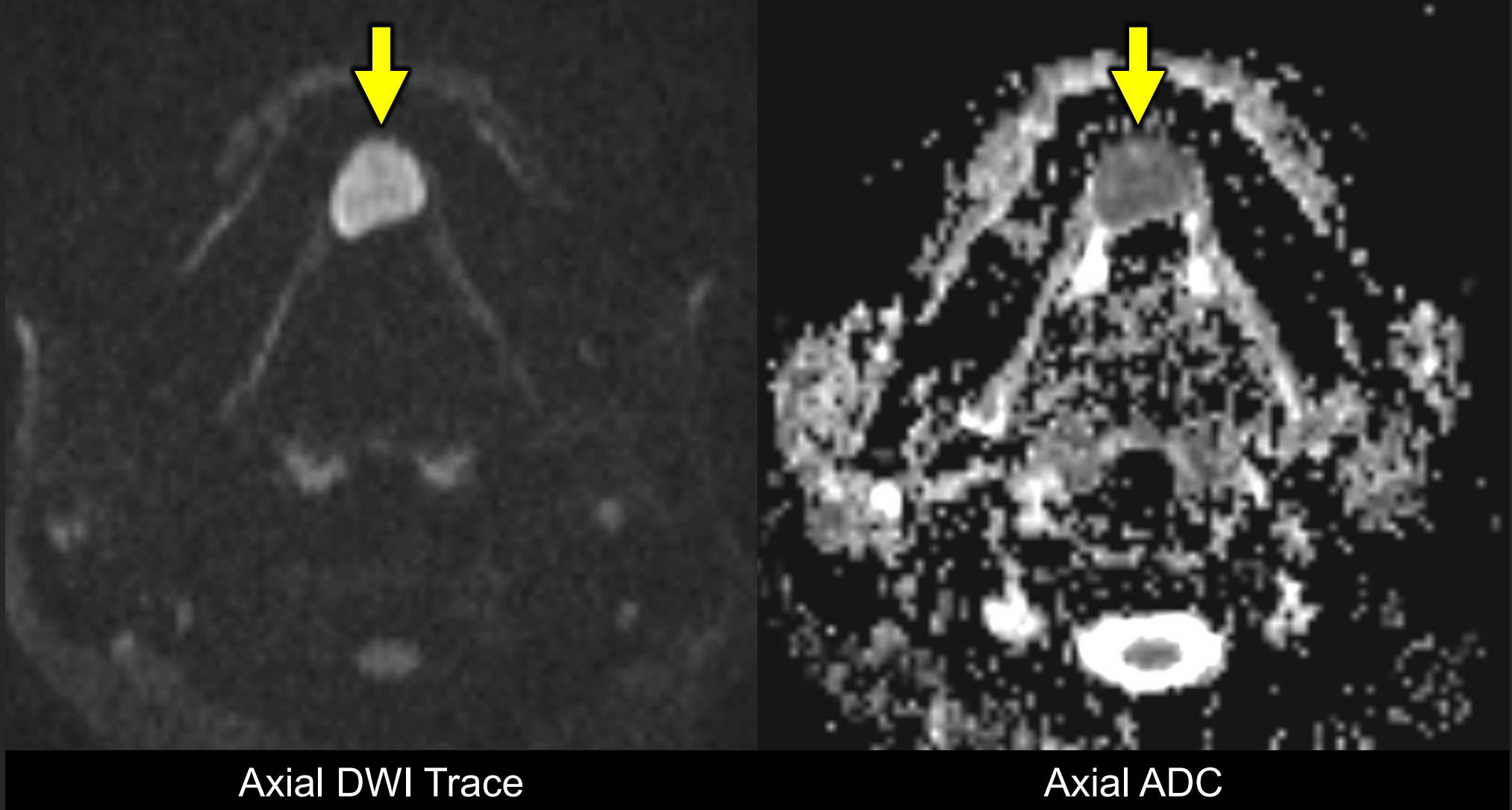


Axial T1WI



Axial T2WI FS

Sublingual Space Dermoid

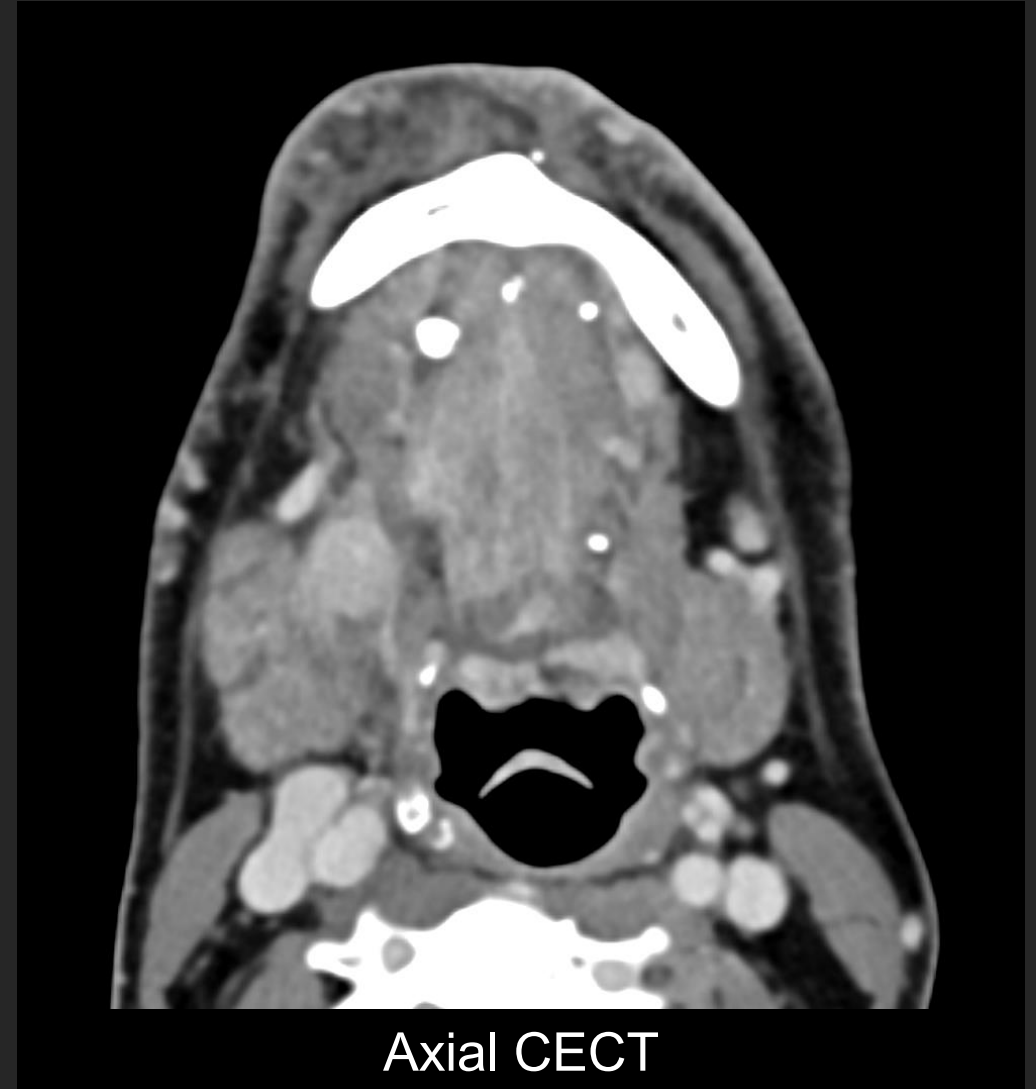


Selected Sublingual Space Pathologies

- Sublingual & submandibular glands, ducts
 - Neoplasms (benign & malignant)
 - Ductal calculus
 - Simple ranula
 - Sialoceles
- Lingual artery
 - Aneurysm & pseudoaneurysm
- **Other**
 - Dermoid & epidermoid
 - **Vascular malformation**

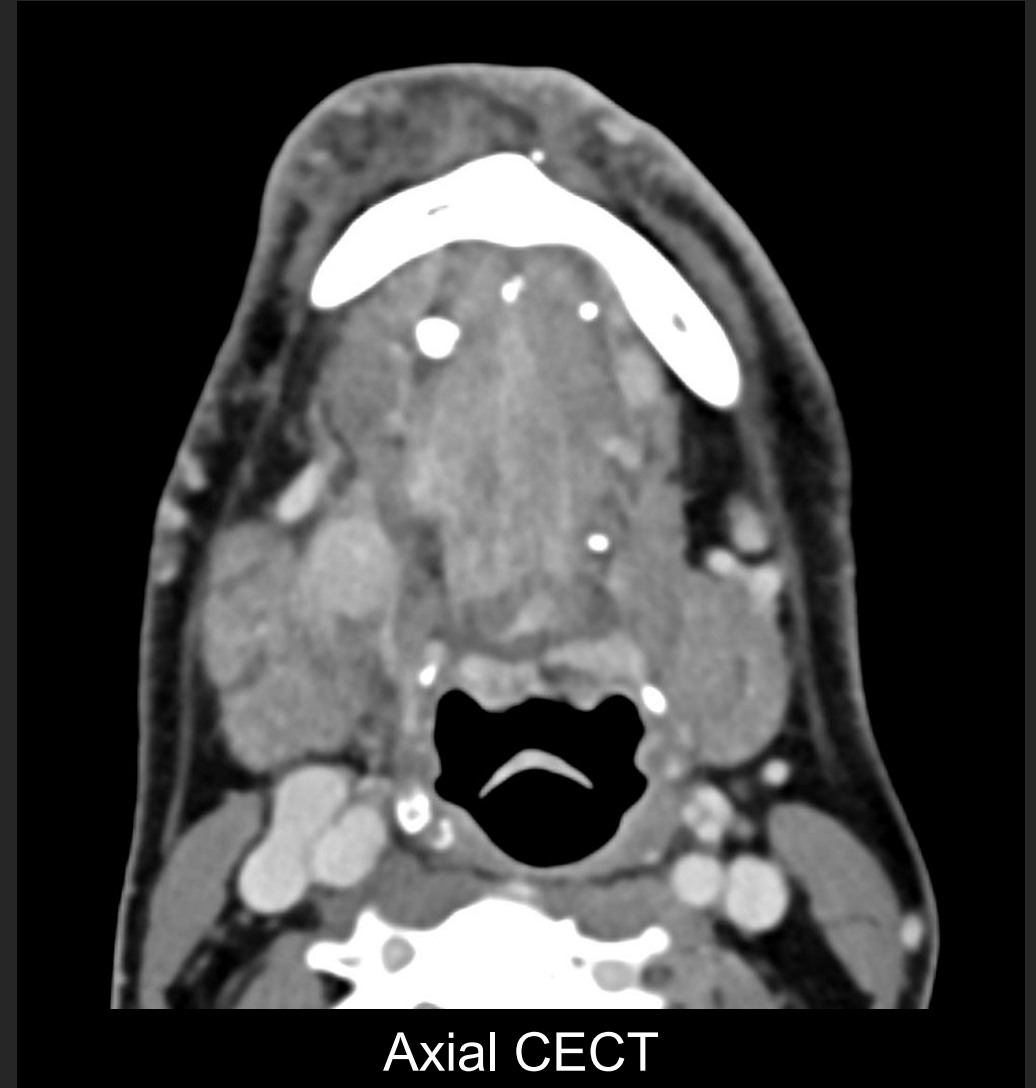
Sublingual Space Vascular Malformation

- Non-neoplastic, malformative lesion of vascular proliferation
- Spectrum of flow
 - AVM (high)
 - Venous malf (low)
 - Lymphatic malf (very low)
- **Commonly, trans-spatial or multi-spatial**
- Use correct ISSVA terminology

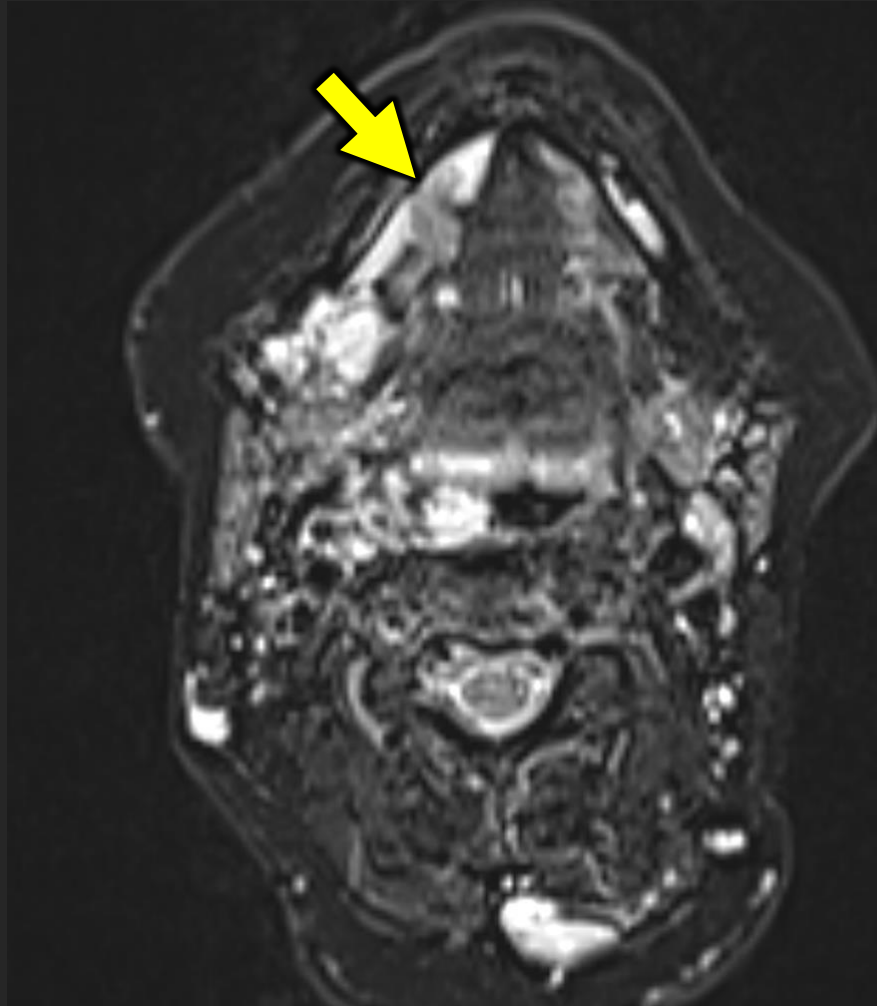


Venous Malformation

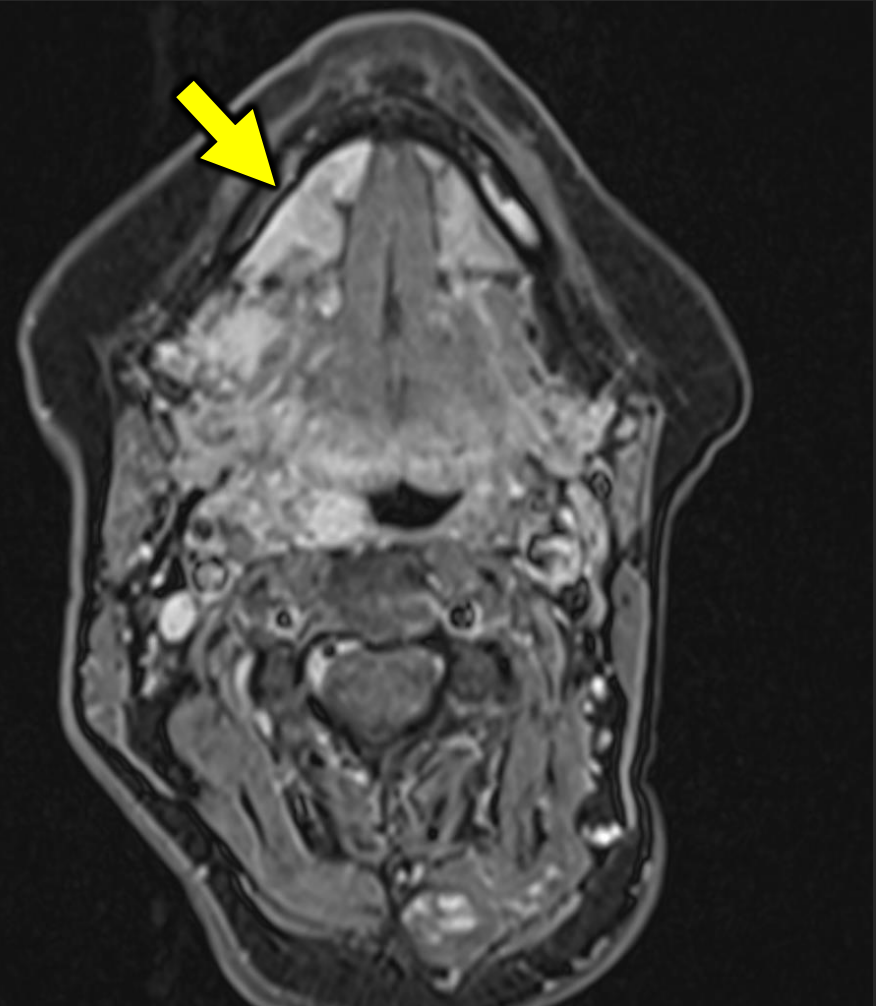
- Lobular soft tissue mass
- T2 bright
- +/- Phleboliths
- +/- Fluid-fluid levels
- Variable enhancement
 - Mild-to-avid
 - May have delayed enhancement with wash-in
- Often trans- or multi-spatial



Sublingual Space Venous Malformation



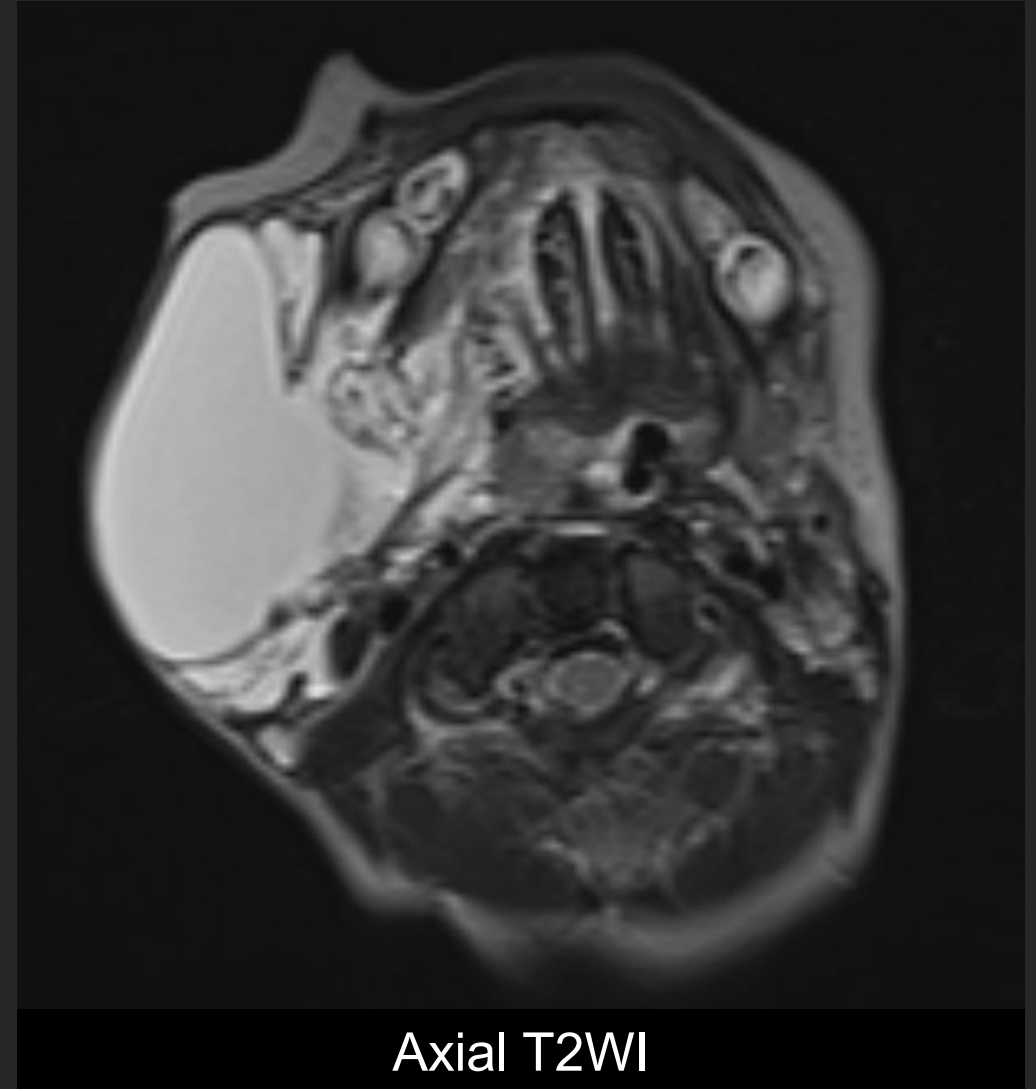
Axial T2WI FS



Axial T1WI C+ FS

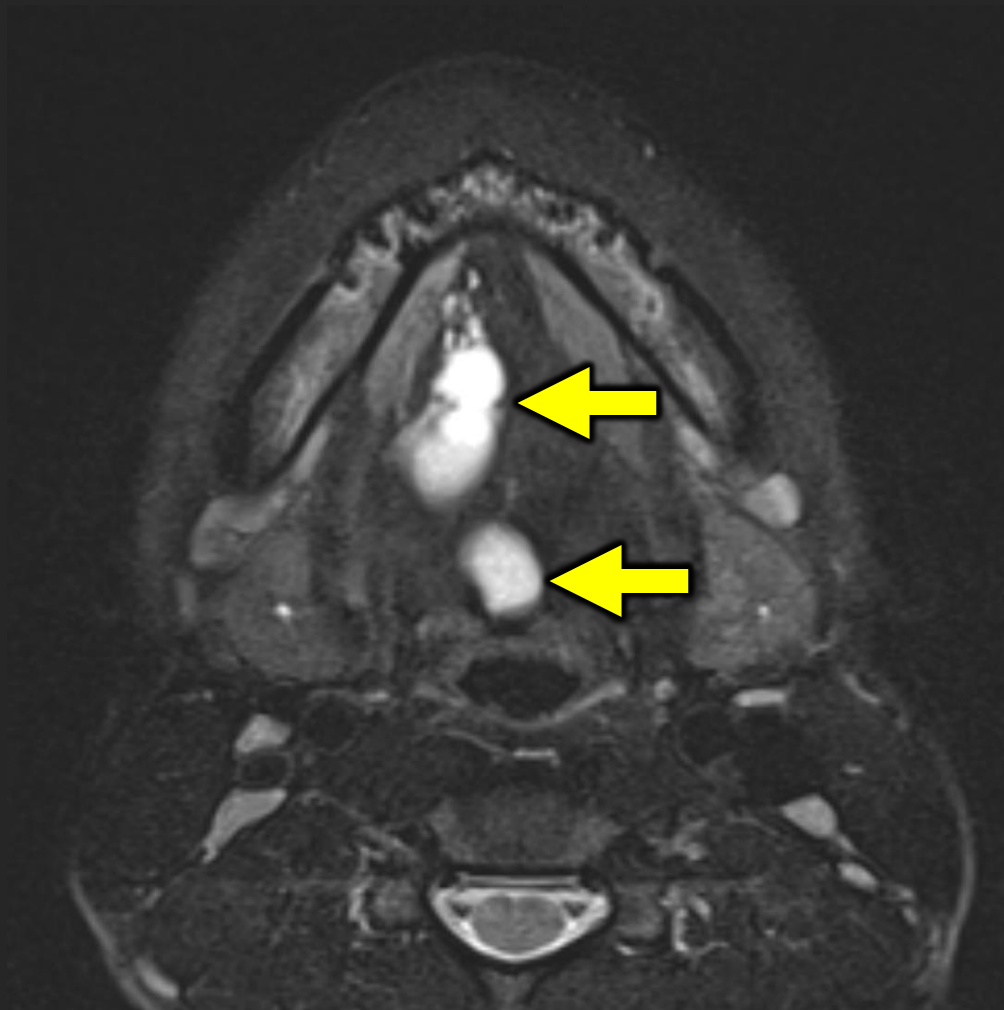
Lymphatic Malformation

- Very low flow malformation
- Macrocystic
 - Multiloculated; cysts > 1 cm
 - Commonly, fluid-fluid levels
 - +/- Thin septal enhancement
- Microcystic
 - Ill-defined and infiltrative; comprised of tiny cysts
 - May appear solid, enhancing
- Often trans- or multi-spatial
- Rarely, lymphatic-venous



Axial T2WI

Macrocystic Lymphatic Malformation

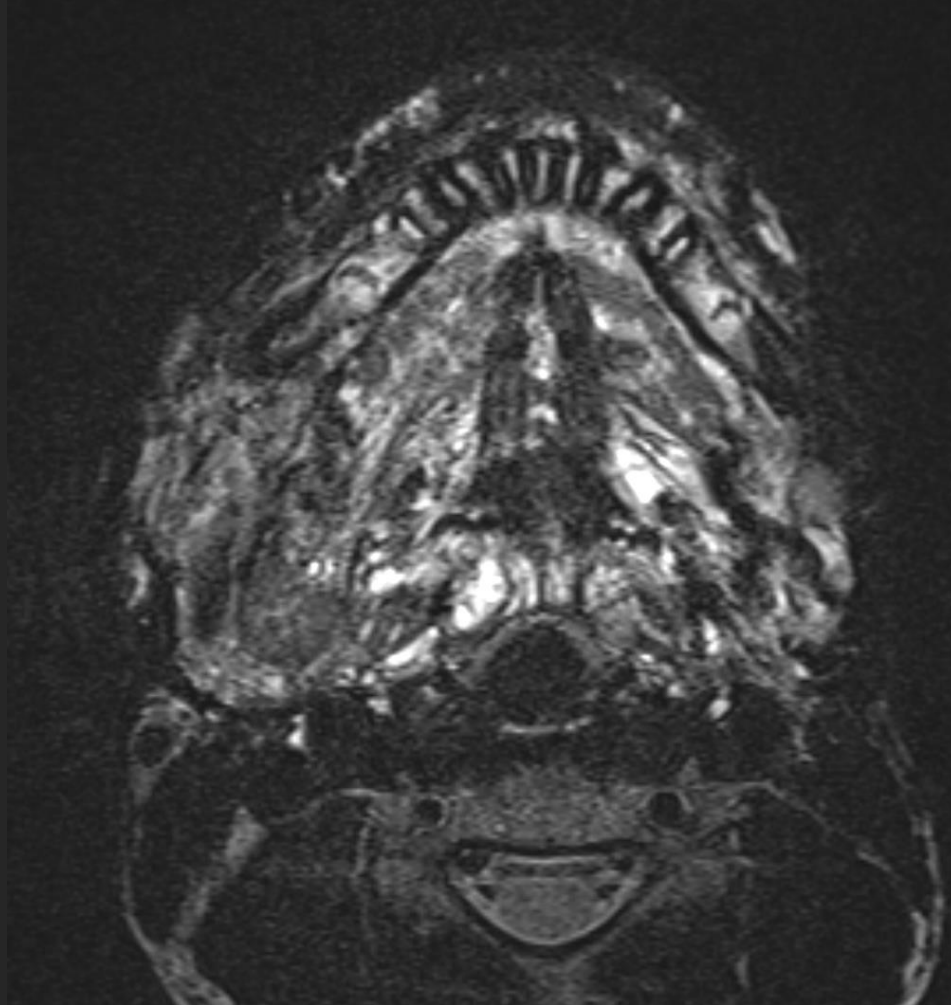


Axial T2WI FS

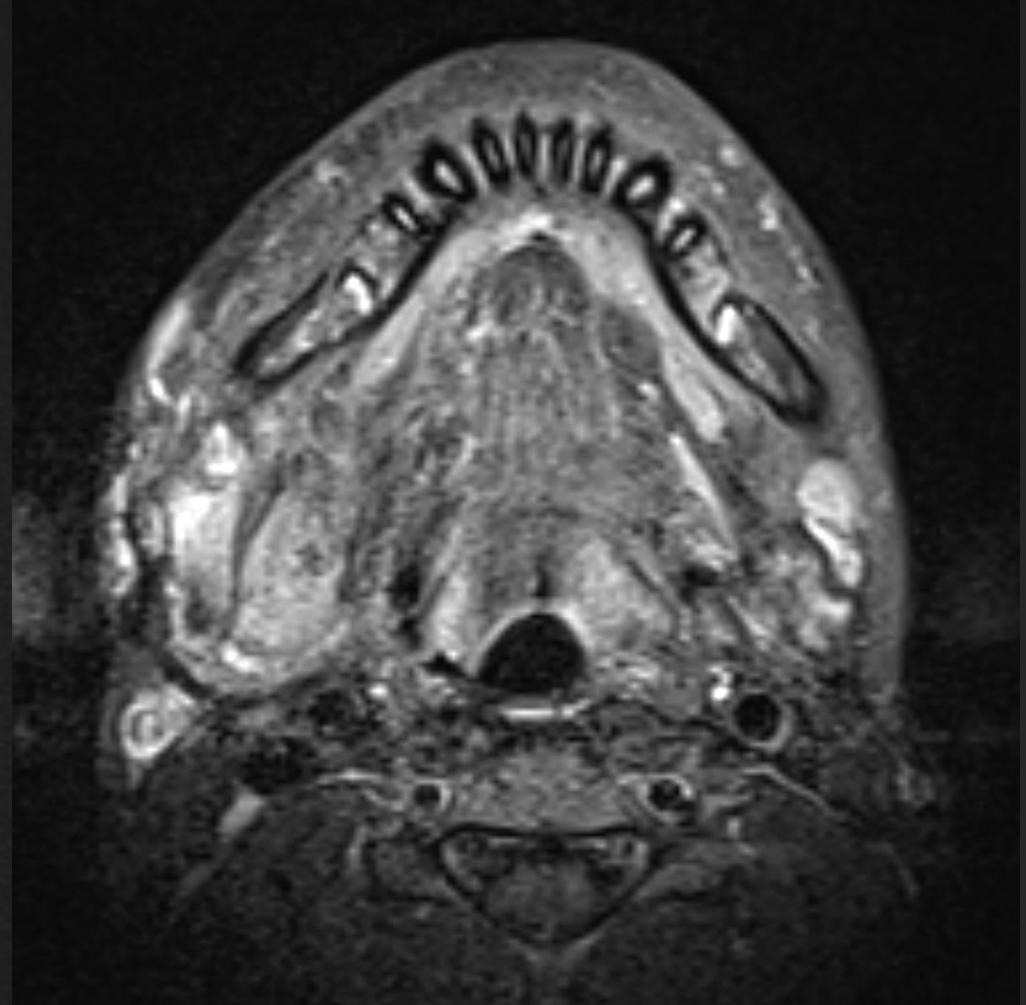


Axial T1WI C+ FS

Microcystic Lymphatic Malformation

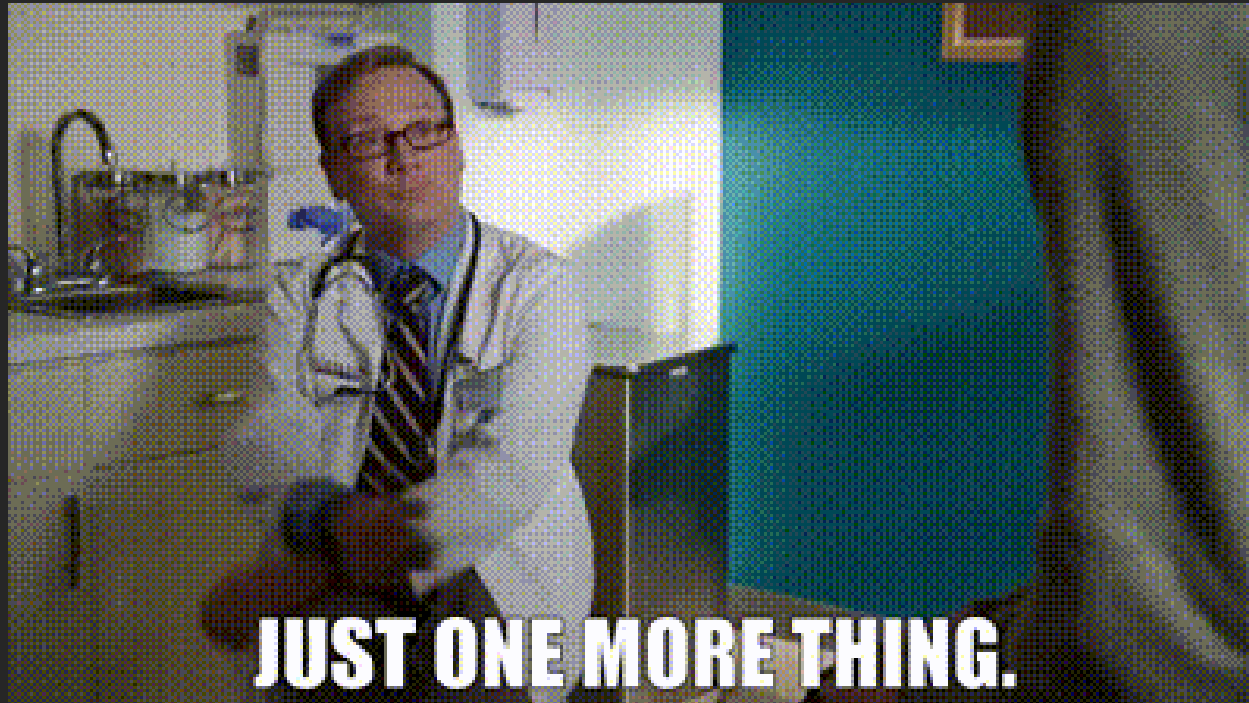


Axial T2WI FS



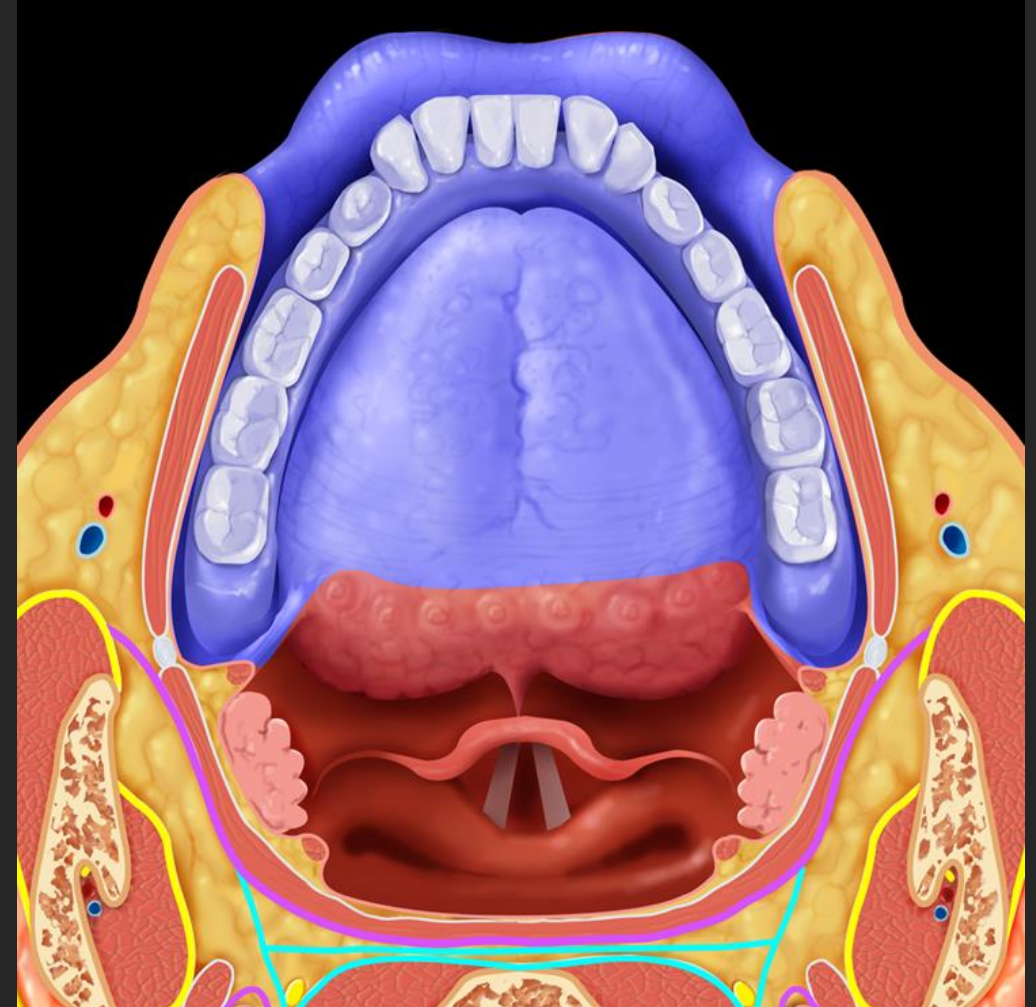
Axial T1WI C+ FS

Final Note



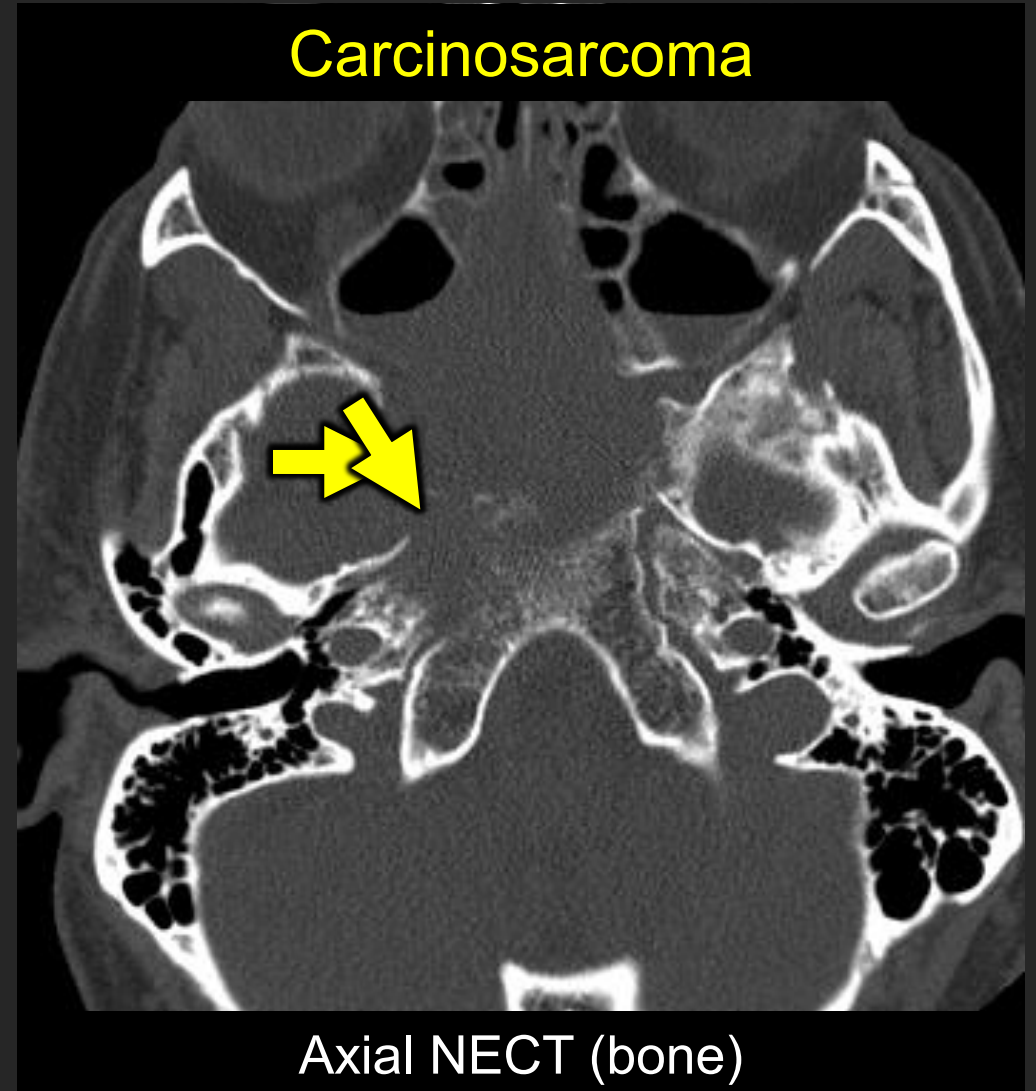
Minor Salivary Glands

- 800-1,000 tiny mucous-seromucous tubuloalveolar glands in submucosal H&N
 - Lips & cheeks
 - Hard & soft palate
 - Base of tongue
 - Retromolar trigone
 - Peritonsillar
 - Sinonasal/nasopharynx
 - Parapharyngeal space



Minor Salivary Gland Malignancy

- Any of the previously described neoplasms
 - Adenoid cystic
 - Adenocarcinoma
 - Mucoepidermoid
- Look for features that upstage disease!
- Look for perineural tumor spread!



Summary

- Know the normal anatomic contents of the parotid, submandibular, and sublingual spaces
- Identifying space of origin of a head & neck lesion immediately narrows the differential diagnosis
- If lesion is trans-spatial or multi-spatial, think about congenital or aggressive lesions
- CT and MRI are often complementary



Humphreys Peak (12,633 ft)
Kachina Peaks Wilderness, Coconino National Forest, AZ
Twitter/X: @nakoontz

Salivary Glands: Anatomy & Pathology

Nicholas A. Koontz, MD

Senior Associate Consultant, Neuroradiology Division

Associate Professor of Radiology, Mayo Clinic College of Medicine

Department of Radiology

Mayo Clinic Arizona

