Neck Lymph Nodes, Cysts, and Salivary Glands

Jason Wagner, MD

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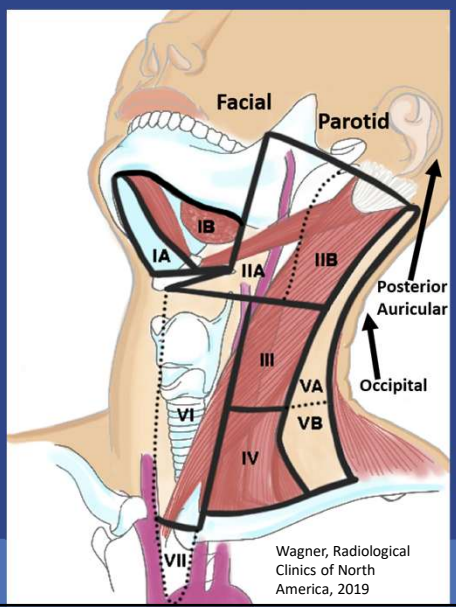
Objectives

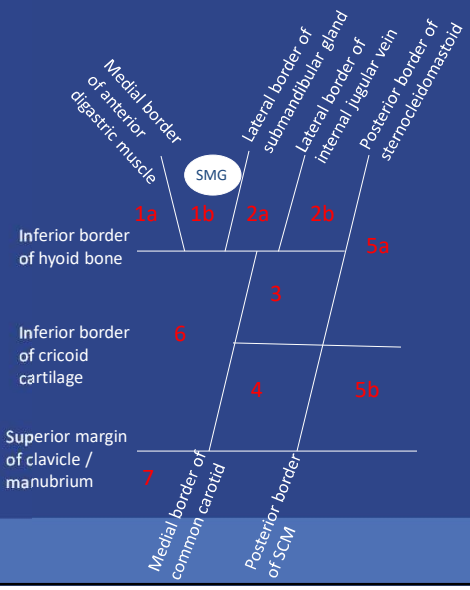
- Identify the cervical lymph node levels based on anatomic landmarks visible with sonography.
- Classify common cervical lymph node pathology based on sonographic findings, location, and patient history.
- Discuss the differential diagnosis of cystic lesions of the neck.
- Recognize the sonographic findings of common salivary gland pathology.

4

Cervical Node Classification

(Som et al, Arch Otolaryngol Head Neck Surg 1999)





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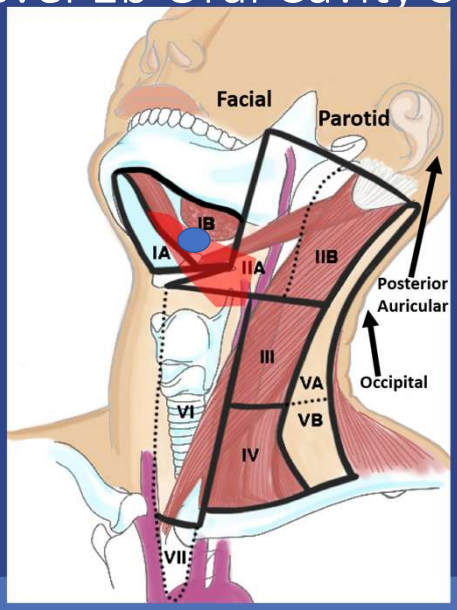
Level 1b Oral Cavity SCC met



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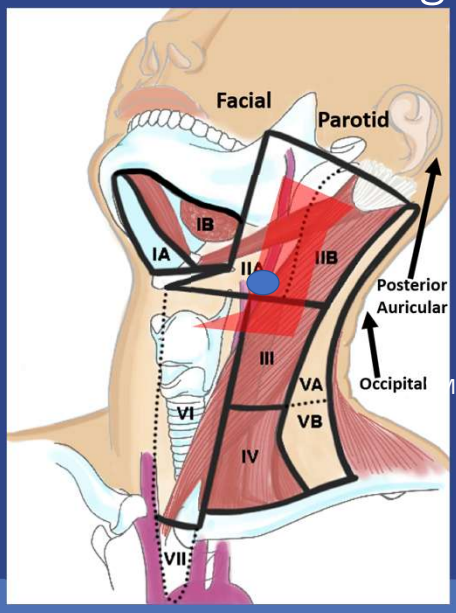
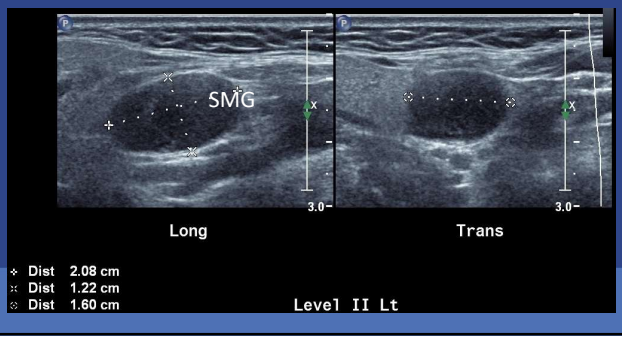
Level 2a Base of Tongue SCC met





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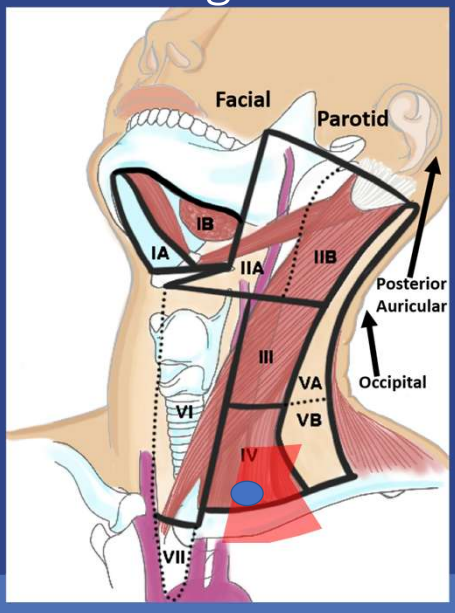
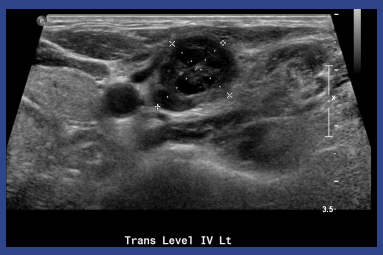
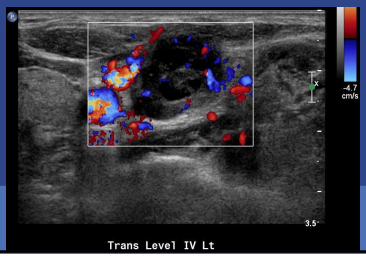
Level 4 Tongue SCC met







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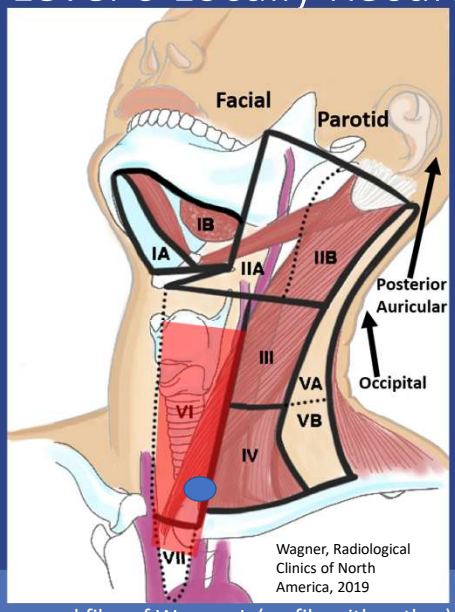
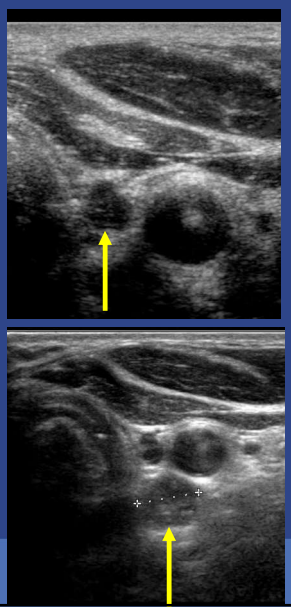
Level 6 Locally Recurrent Thyroid Cancer





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Neck levels – determine with the neck in neutral position

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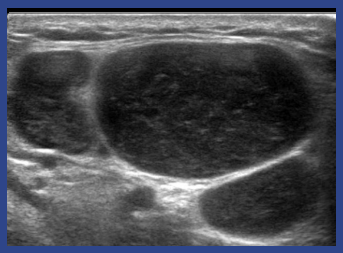
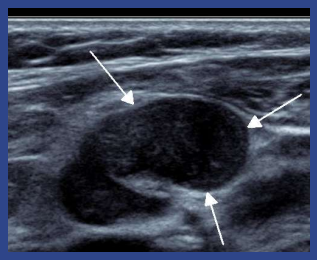
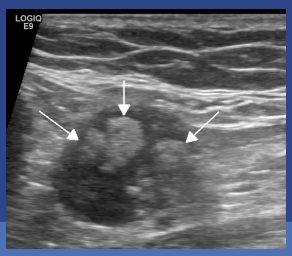
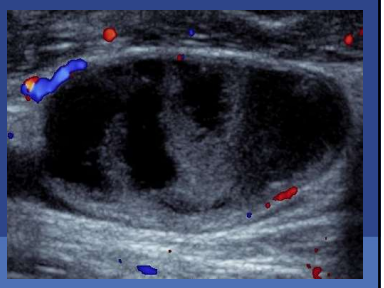
Evaluation of Cervical Lymph Nodes

- Patient history
- Node location
- Node morphology
- Size is the least helpful









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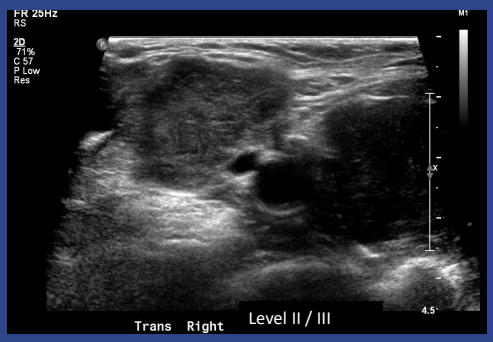
71 y/o female with a history of lung cancer who presented with a right neck mass



Recent chest CT showed stable post XRT changes with no active disease.
No supraclavicular adenopathy by US.
What is the most likely diagnosis?

A. Metastatic lung cancer
B. Head/neck primary cancer
C. Lymphoma
D. Granulomatous infection

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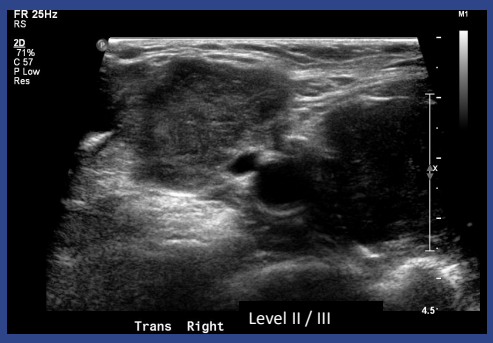

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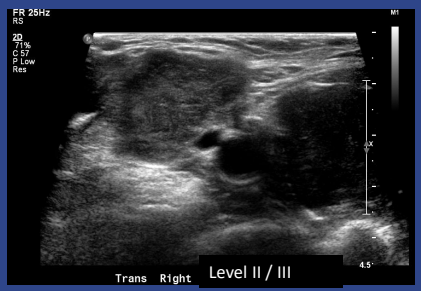

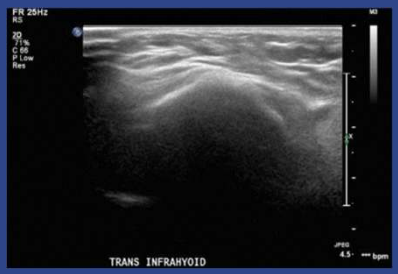

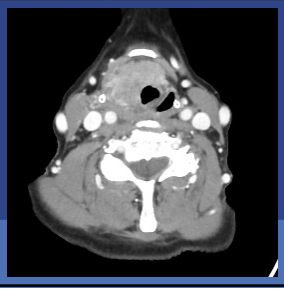

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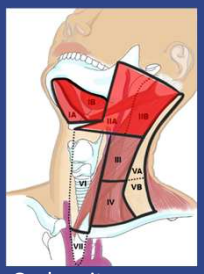
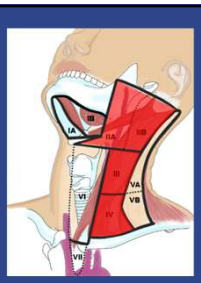
Head & Neck Squamous Cell Carcinoma (SCC)

- 55,000 cases of H&N carcinoma in the U.S. per year with 12,000 deaths
- 3-5% of all cancers in the U.S.
- Males > females 2:1 – 4:1
- Overall 5 year survival 60-65%
- Heterogeneous group of diseases with unique biology and clinical course based on location of the primary tumor

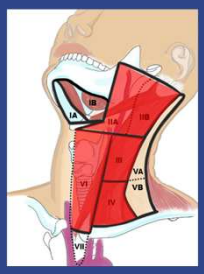
- For comparison – Thyroid cancer
  - 63,000 new cases per year
  - 1800 deaths per year
  - 98% 5 year survival



Oral cavity cancer



Oropharyngeal cancer



Laryngeal cancer

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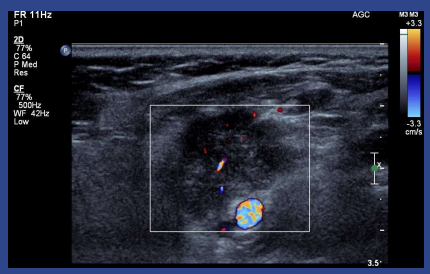
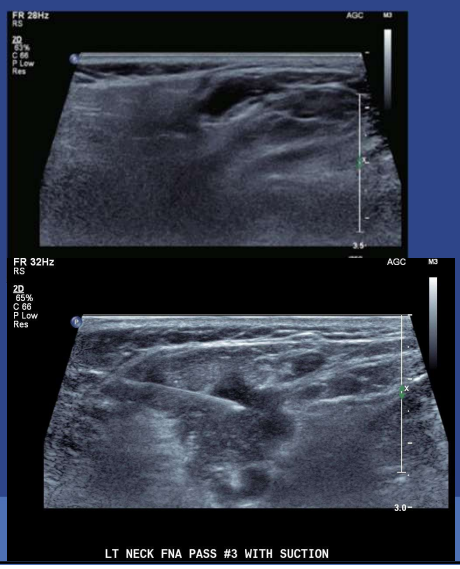
68 y/o female with a lateral neck mass, diagnosed as a probable paraganglioma at another institution and referred for biopsy



Why is this NOT a paraganglioma?

1. Displaces carotid posterior/medial
2. Extranodal spread into SCM
3. Hypovascular (less helpful)



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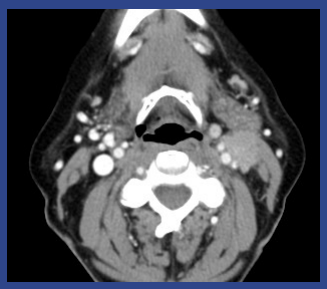

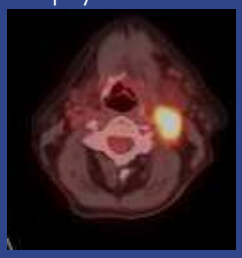

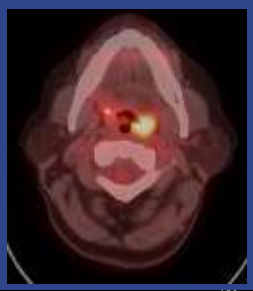

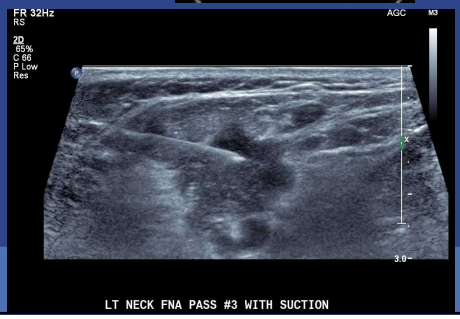

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Metastatic tonsillar SCC

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Extranodal spread

Necrosis but no extranodal spread

Extranodal spread present

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Recognizing carotid displacement

- Level 2/3 nodal metastases (common in SCC) displace the carotid artery posterior/medial
- Carotid body tumors splay the carotid bifurcation
- Vagal paragangliomas displace the carotid anterior/lateral

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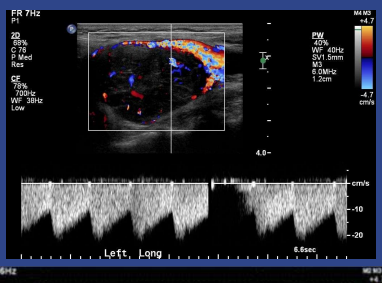
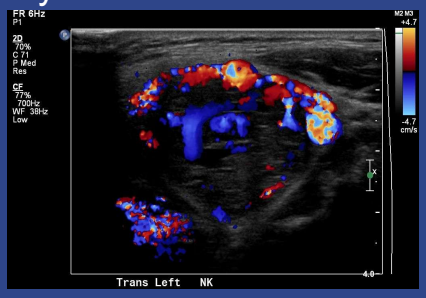
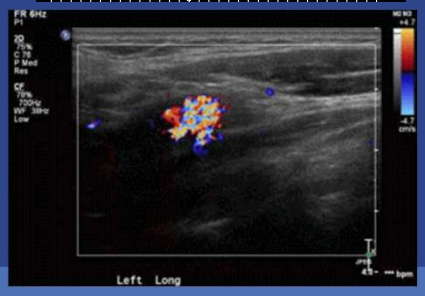
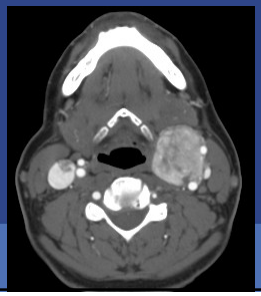
34 y/o female sent for biopsy of a neck mass (didn't happen) - Carotid Body Tumor









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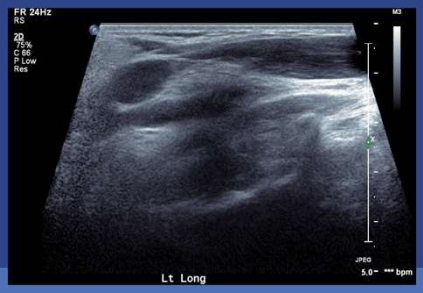
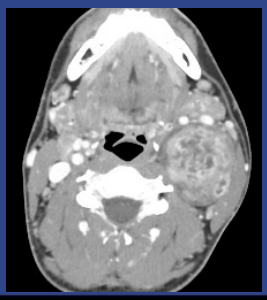
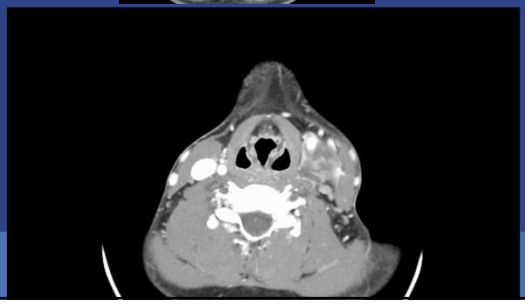
31 y/o male with a vagal paraganglioma







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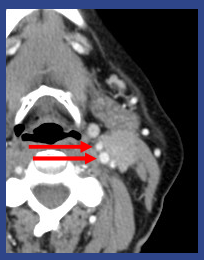
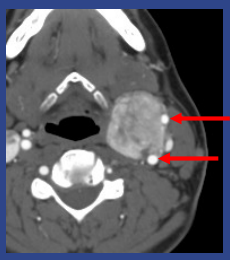
Recognizing carotid displacement

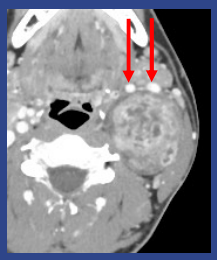
- Level 2/3 nodal metastases (common in SCC) displace the carotid artery posterior/medial
- Carotid body tumors splay the carotid bifurcation
- Vagal paragangliomas displace the carotid anterior/lateral
- PRACTICAL POINT – if a mass displaces the carotid anterior/lateral, it is probably not adenopathy and MR (or CT) should be obtained prior to biopsy



Metastatic adenopathy



Carotid body tumor



Vagal paraganglioma

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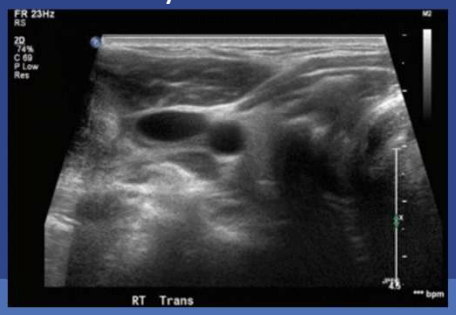
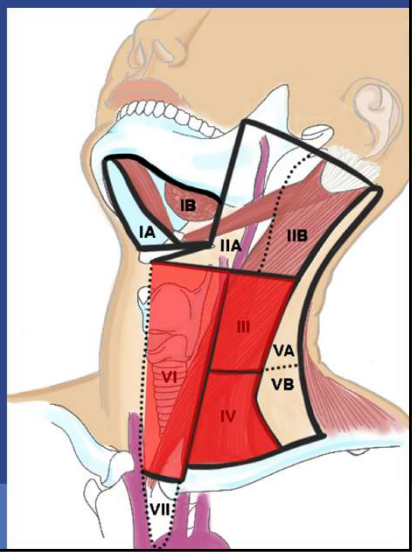
Thyroid Cancer Metastasis

- Levels 3/4 & 6/7
- Isolated 2 & 5 unusual
- 1 very rare
- Cystic changes, microcalcifications, echogenic foci, hypervascularity





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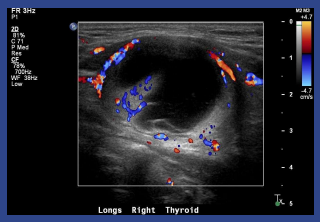
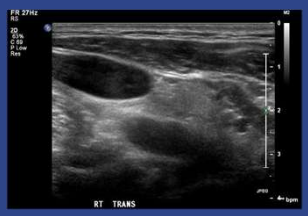
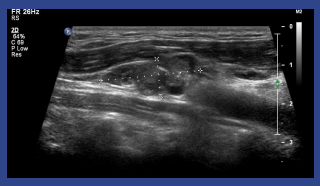
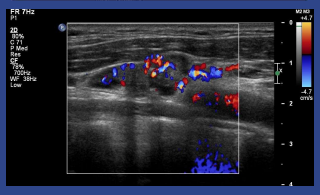
Why I ALWAYS look for nodes before a thyroid biopsy

35 y/o male with 2 prior nondiagnostic thyroid FNAs









Ipsilateral Level 3 nodal metastatic papillary thyroid cancer, 3rd biopsy of thyroid nodule also nondiagnostic

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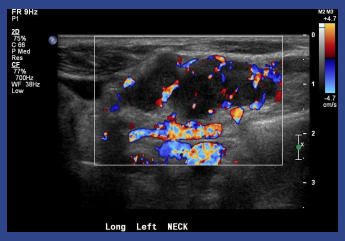
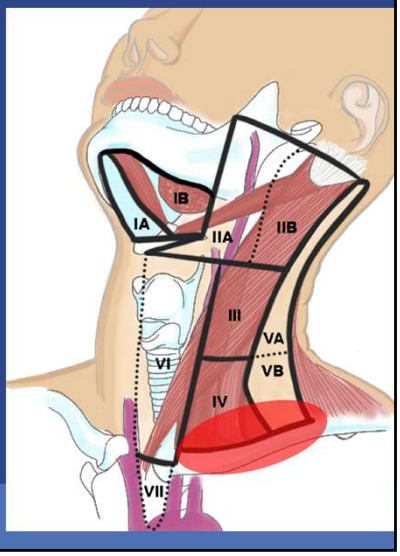
Usual Locations of Metastasis – Distant Primary

Lymphatic spread from a primary cancer in the chest, abdomen or pelvis

- Supraclavicular fossa
- 4 / 5b



72 y/o female with metastatic vulvar SCC



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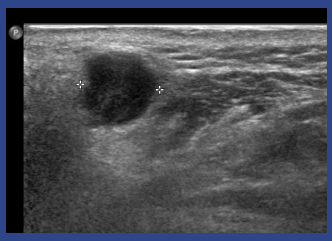
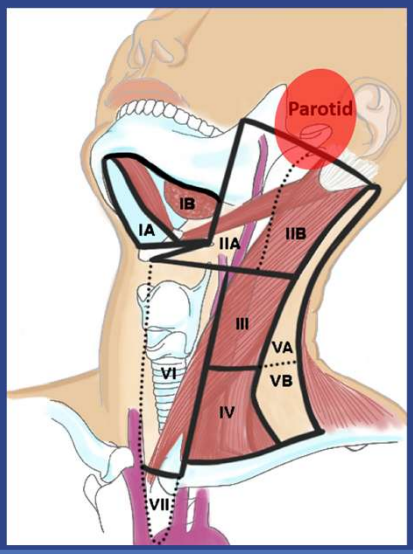
Usual Locations of Metastasis – Skin Cancer

- Intraparotid
- Perineural spread (aggressive SCC)



86 year old male with metastatic Merkel cell carcinoma in the parotid



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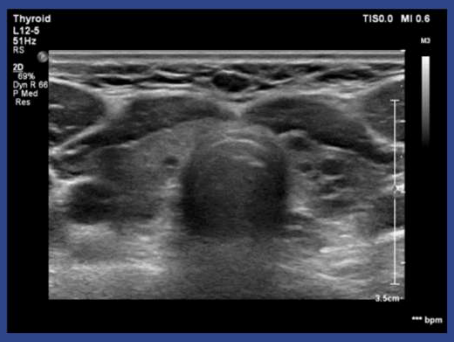
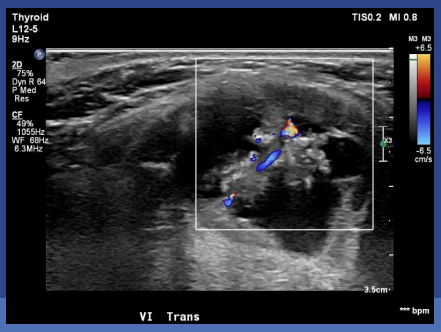
14 year old female with a nontender superior neck mass, enlarging over several months.
What is the most likely diagnosis?
A. Osteosarcoma of the hyoid bone
B. Chondrosarcoma of the larynx
C. Papillary thyroid cancer in a thyroglossal duct cyst
D. Osseous metaplasia in a second branchial cleft cyst





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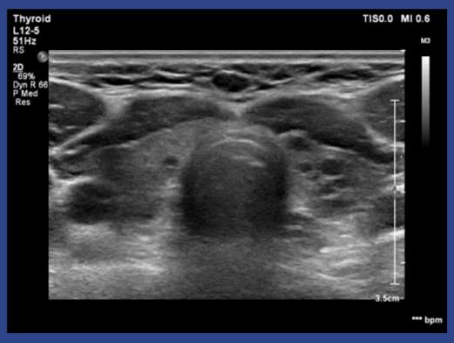
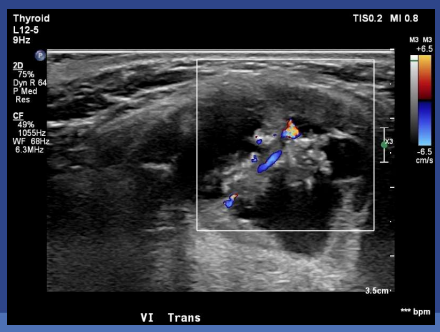
27

14 year old female with a nontender superior neck mass, enlarging over several months.
What is the most likely diagnosis?
A. Osteosarcoma of the hyoid bone
B. Chondrosarcoma of the larynx
C. Papillary thyroid cancer in a thyroglossal duct cyst
D. Osseous metaplasia in a second branchial cleft cyst





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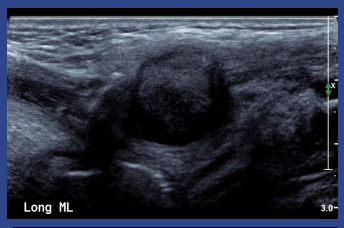
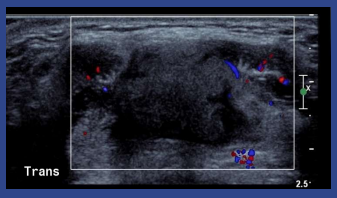
28

Thyroglossal duct cyst

- Located in the midline or just off midline
- Most occur at or below the level of the hyoid bone
- Small risk of developing papillary thyroid cancer





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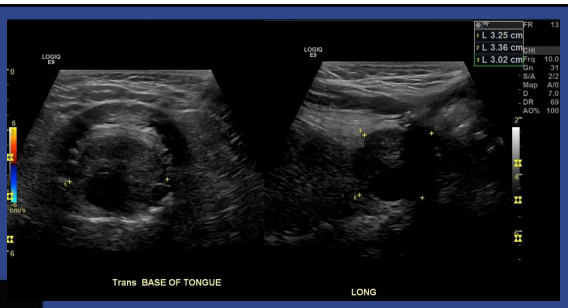
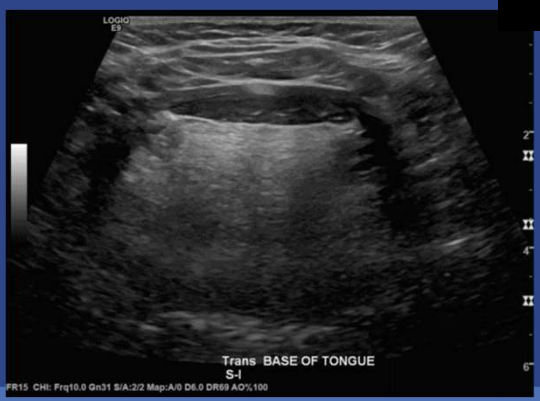
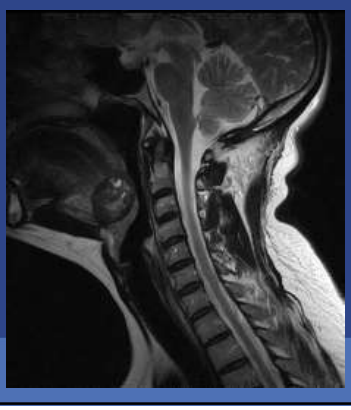
Lingual Thyroid







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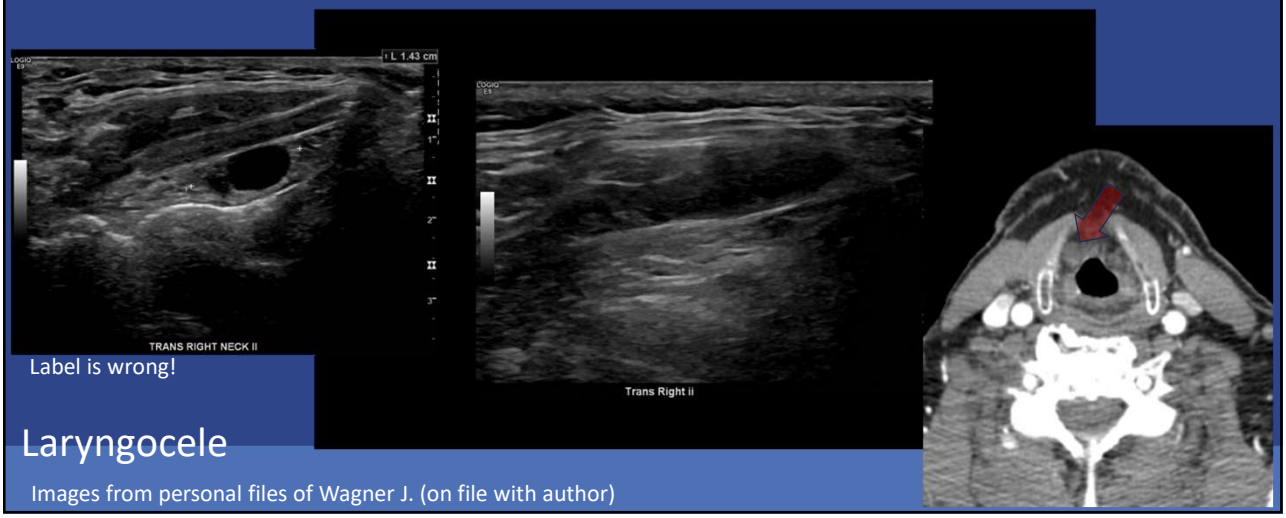
30

75-year-old with thyroid nodules and a new "cystic lesion" found on a follow-up scan



Label is wrong!

Laryngocele

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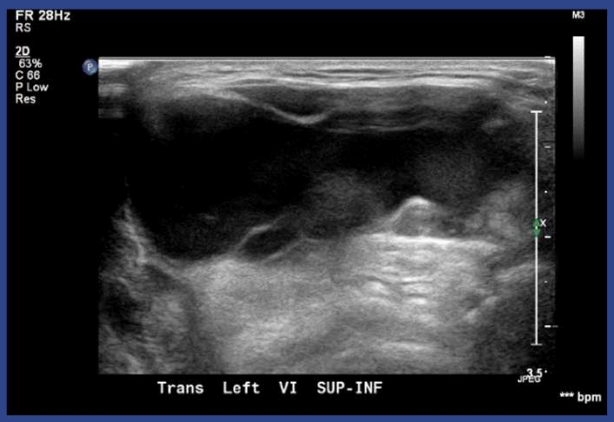
Large Laryngocele in a 67-year-old man



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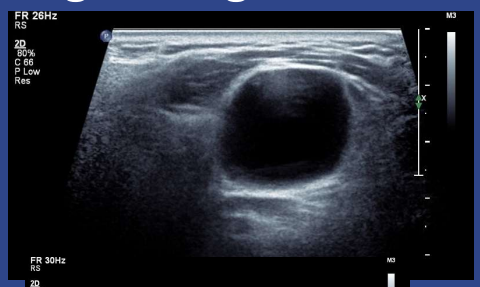
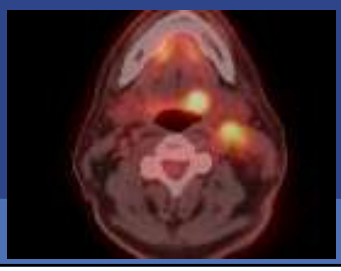
54 y/o male with new painless lateral neck mass growing over 3 months





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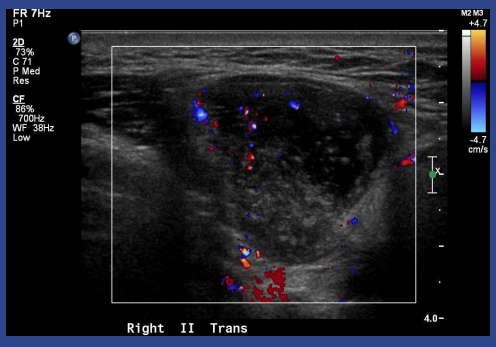
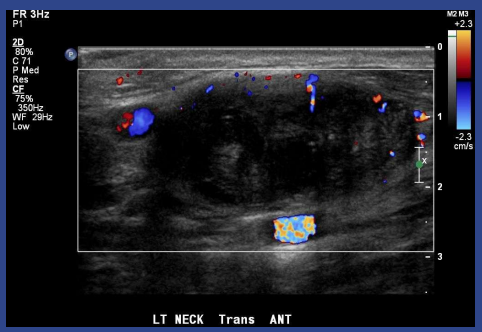
Branchial Cleft Cyst vs Necrotic Tumor



Branchial cleft cyst, 44 y/o male, surgically proven



Metastatic squamous cell cancer, 55 y/o male, biopsy proven

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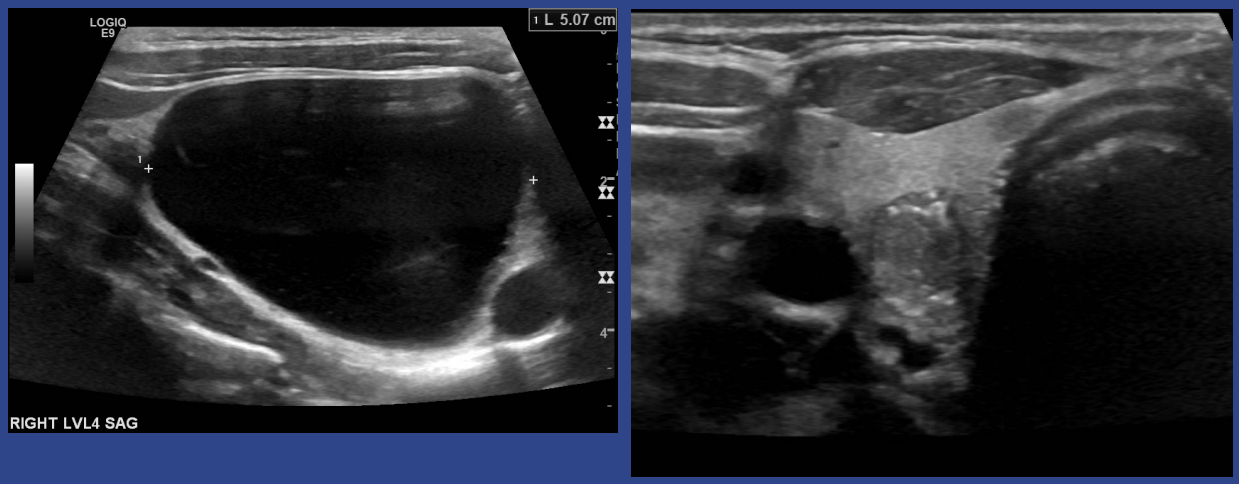
Metastatic Papillary Thyroid Cancer



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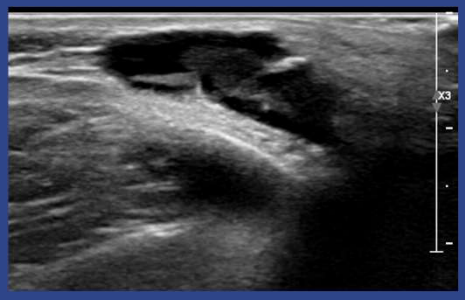
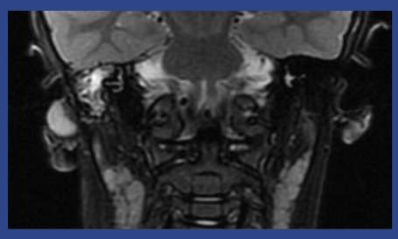
35

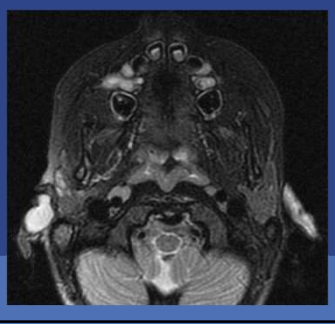
First Branchial Anomaly

- Typically involves the parotid gland and/or external auditory canal
- Cyst, fistula, or both
- May become manifest during URI / otitis media



11-year-old boy





4-year-old boy

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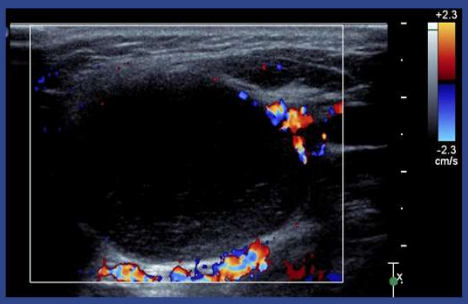
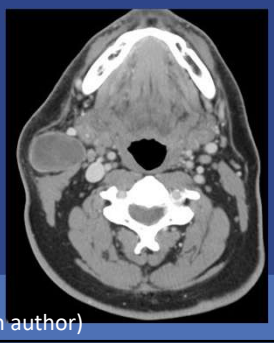
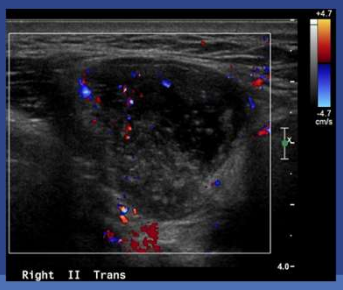
Second Branchial Anomaly

- 92%-99% of all branchial anomalies
- Cyst far more common than fistula/sinus
- Most common position is lateral to the carotid sheath, posterior to the submandibular gland and anterior to the sternocleidomastoid muscle
- May have a thick wall if infected
- Be VERY suspicious of metastatic squamous cell carcinoma in adults



20-year-old woman





44-year-old man

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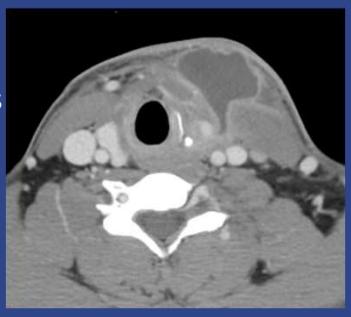
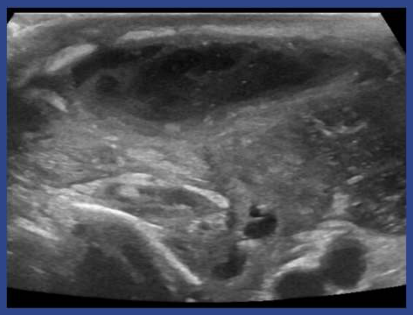
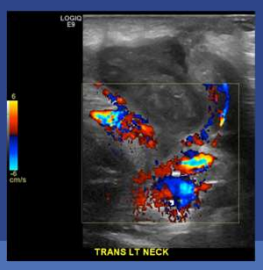
Third / Fourth Branchial Anomaly

- Uncommon
- Fistula / sinus connects to the pyriform sinus
- May present as an abscess anterior to the thyroid or within the thyroid





28-year-old man 3rd branchial cyst



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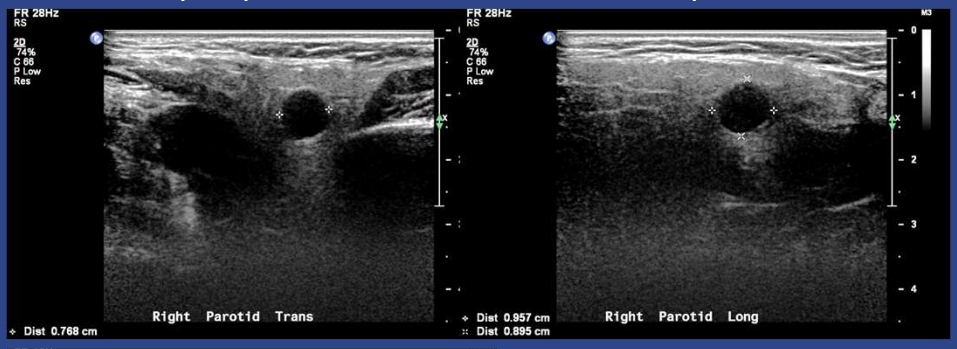
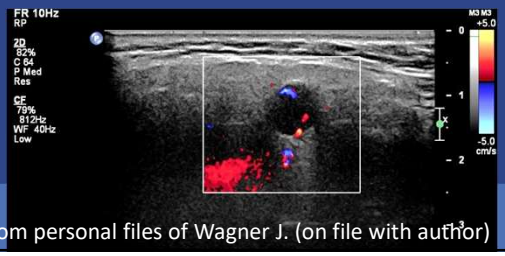
36-year-old woman, 4th branchial cyst

38

48-year-old healthy woman has an ultrasound to evaluate a submental lymph node – incidental parotid finding





What is the appropriate management?

A. No follow-up needed
B. Follow-up US in 6 months
C. US guided biopsy
D. Surgical resection

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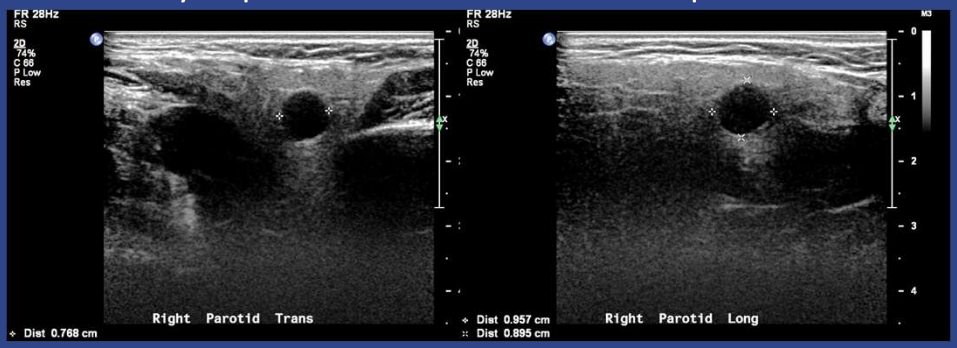
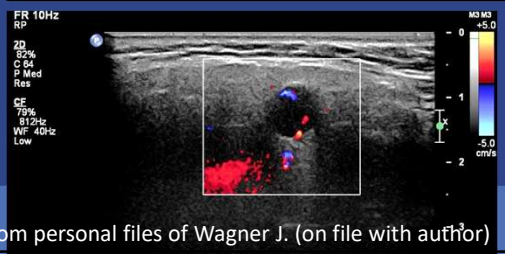
39

48-year-old healthy woman has an ultrasound to evaluate a submental lymph node – incidental parotid finding





What is the appropriate management?

A. No follow-up needed
B. Follow-up US in 6 months
C. US guided biopsy
D. Surgical resection

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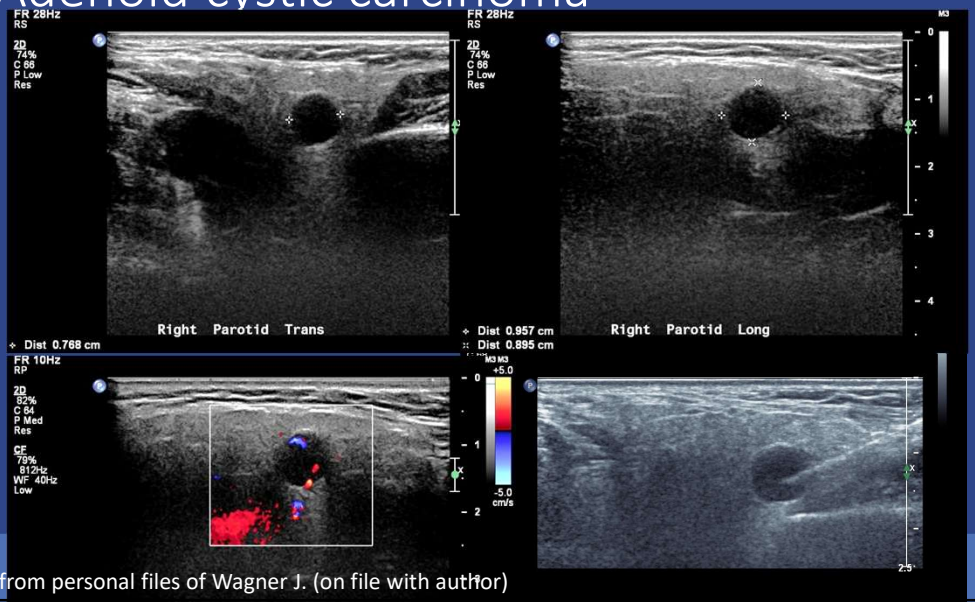
40

Adenoid cystic carcinoma



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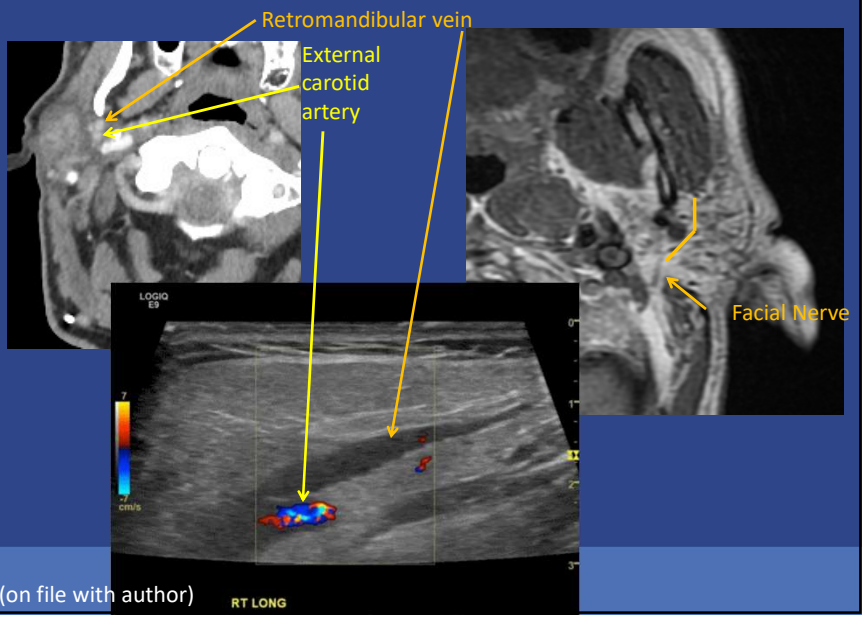
41

Parotid Gland Anatomy

- The facial nerve divides the parotid gland into superficial and deep lobes
- Retromandibular vein is an imaging marker for the facial nerve, with the nerve just lateral to the vein in 65% of cases.
- ECA ends within the parotid
- Drained by Stensen's duct
- Most parotid glands contain lymph nodes, mostly in the superficial gland



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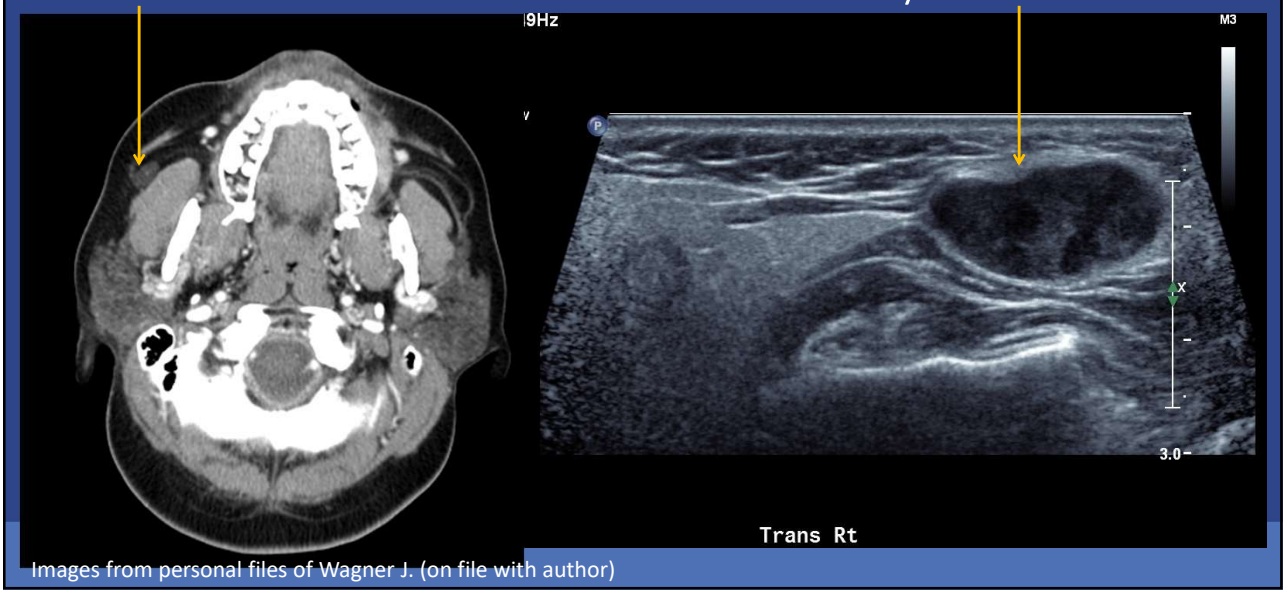
Parotid Accessory Lobe

Pleomorphic adenoma in the accessory lobe



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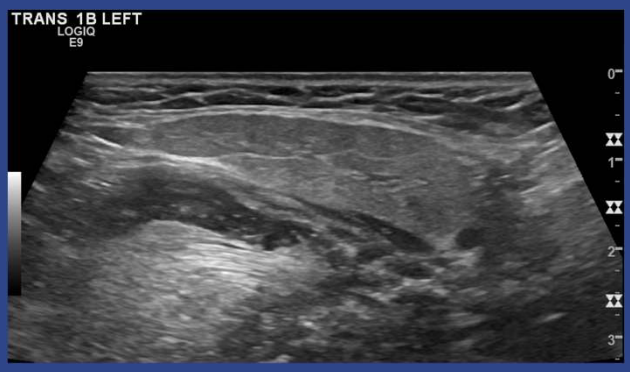
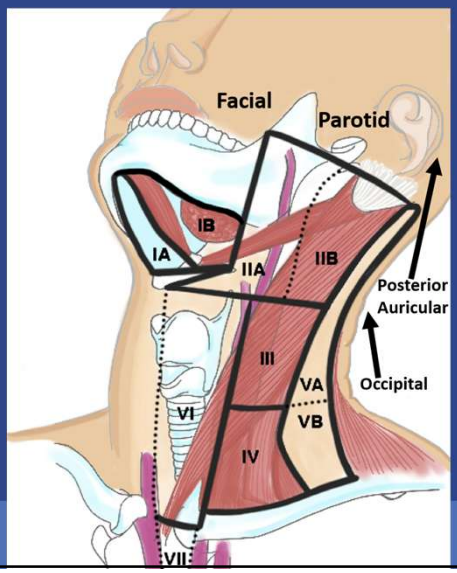


Submandibular Gland Anatomy

- Located between mandible and mylohyoid muscle
- Drained by Wharton's duct (antigravity drainage)
- Many adjacent lymph nodes (level 1b / 2a)
- Lymph nodes within the submandibular gland occur, but are uncommon



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44

Sialolithiasis

- Submandibular gland (Wharton's duct) involved in 60-90% of cases
- Parotid (Stensen's duct) involved in 10-20% of cases
- Only 20% of stones seen on conventional radiographs
- Ultrasound 90% sensitive and 97% specific for the diagnosis of sialolithiasis

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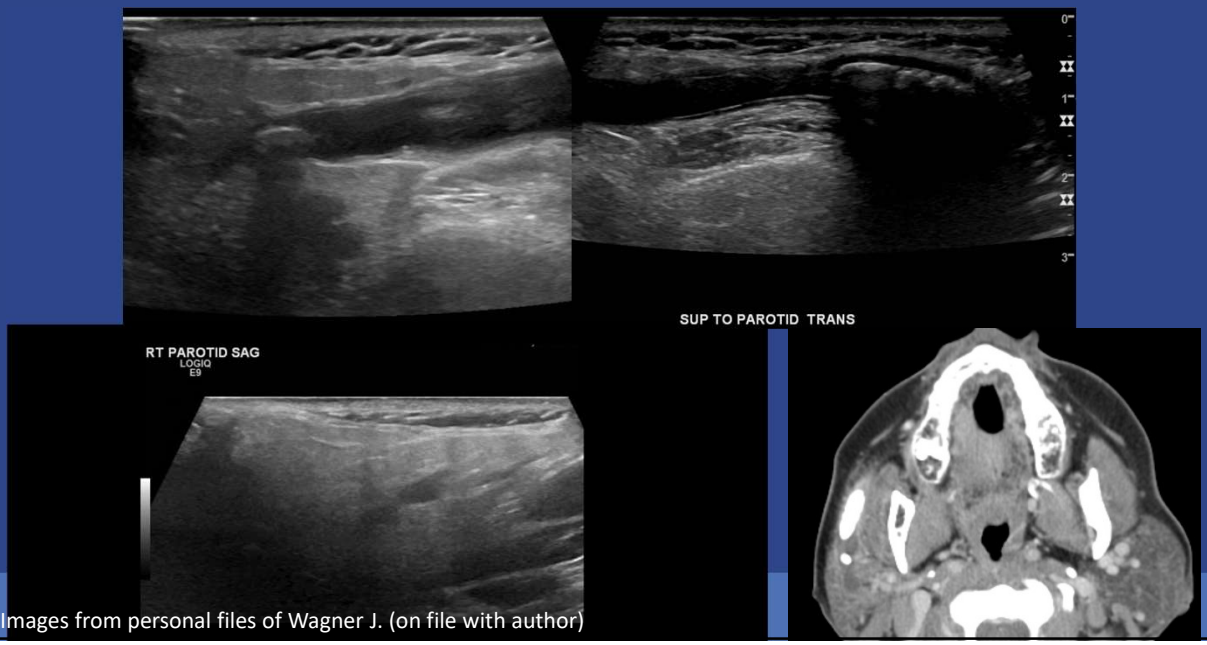
Sialolithiasis - Parotid



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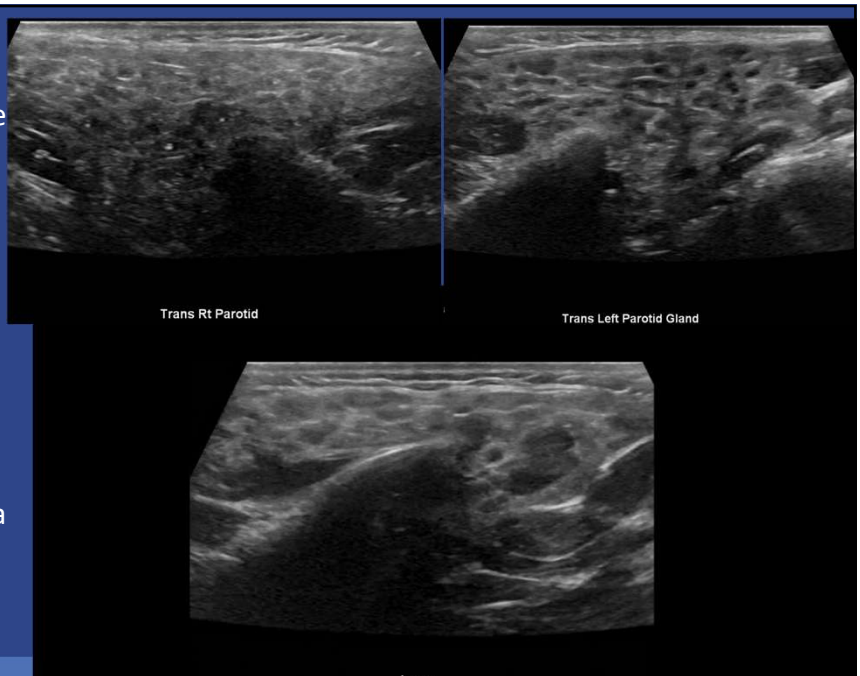
Sjogren syndrome

- Presents with sicca syndrome (dry eyes and mouth)
- Autoantibodies against Ro and La, + rheumatoid factor
- Heterogeneous salivary glands with rounded hypoechoic structures and hyperechoic bands
- Various ultrasound staging systems have been proposed
- Elastography is an active area of research



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Lymphoma complicating Sjogren syndrome

- 5-10% of patients with Sjogren syndrome will develop lymphoma within 10-15 years after diagnosis
- Any confluent mass in the setting of Sjogren syndrome should have a biopsy

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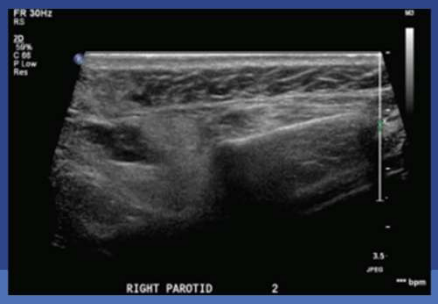
Cystic lesions of the salivary glands

- Simple cysts are uncommon but do occur in the salivary glands
- Simple cysts are often aspirated to confirm benign nature
- Complete aspiration with no suspicious cells on cytology is consistent with a benign lesions even if the cytology is "nondiagnostic"



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Cystic lesions of the salivary glands

- Benign lymphoepithelial lesions may present as multiple cystic lesions in patients with HIV

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Salivary Gland Pathology

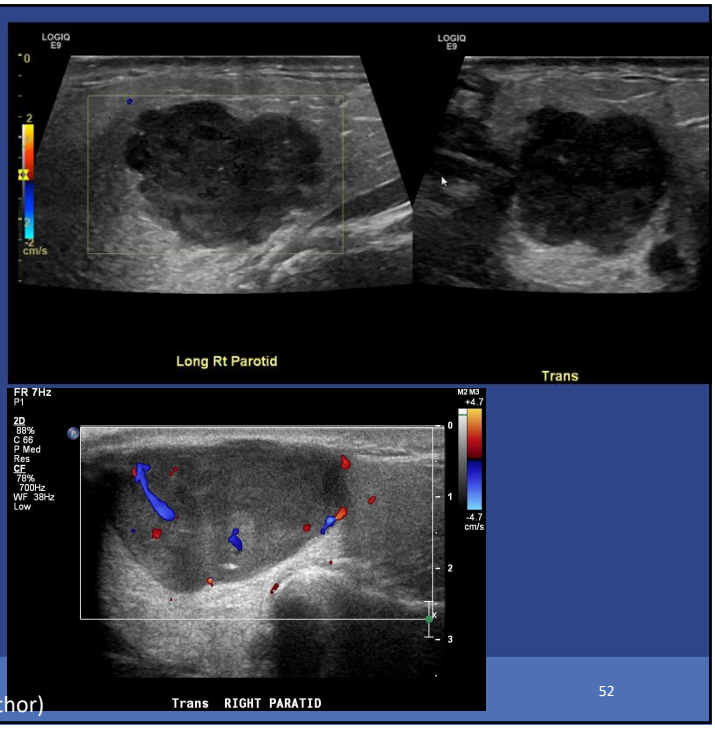
- 70% of parotid “masses” are neoplasms
- Risk of malignancy of a salivary neoplasm is inversely proportional to size of gland…
  - 20-25% of parotid neoplasms are malignant
  - 50% of submandibular gland neoplasms are malignant
  - 75% of sublingual gland neoplasms are malignant
- 70% of salivary malignancies arise in the parotid
- WHO classification includes 28 different histological types of salivary malignancy, many of which have low, intermediate, and high-grade variants
- The “most heterogeneous of any group of cancers”

Haldar (2016) World J of Radiology
Kuan (2016) Otolaryngology Clinics of North America
Lewis (2016) Otolaryngology Clinics of North America
Guzzo (2010) Crit Review in Oncology/Hematology

51

Pleomorphic Adenoma

- Most frequent salivary tumor
- Usually solitary
- 80% occur in the superficial portion of the parotid, 10% in the deep portion
- Composed of epithelial, myoepithelial, and mesenchymal tissue
- Hypoechoic solid mass with lobulated borders and relatively little blood flow
- May contain calcifications
- Malignant transformation in up to 5% (carcinoma ex pleomorphic – 40% 5 year survival)



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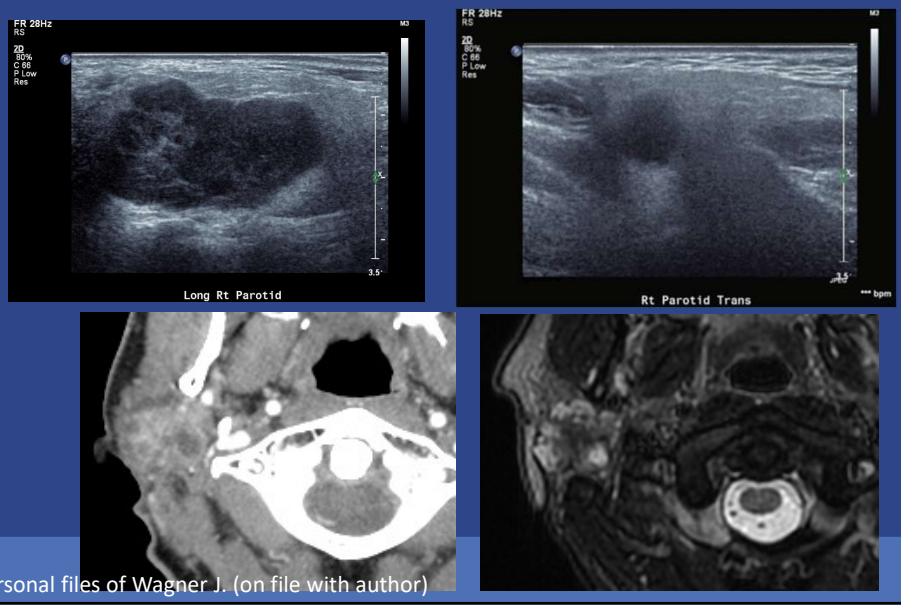
Carcinoma ex pleomorphic (56 y/o male)



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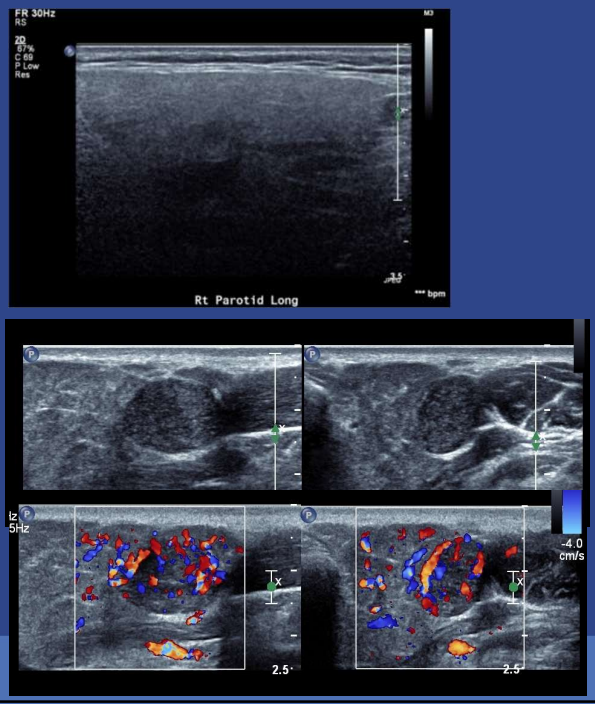
Warthin's Tumor

- "Cystadenolymphoma"
- Contain epithelial and lymphatic tissue
- Almost all occur in the parotid
- Strong association with smoking
- May be multiple/bilateral (30% of cases)
- May have cystic components
- Tend to be more vascular than pleomorphic adenomas
- Malignant transformation is rare (if ever)



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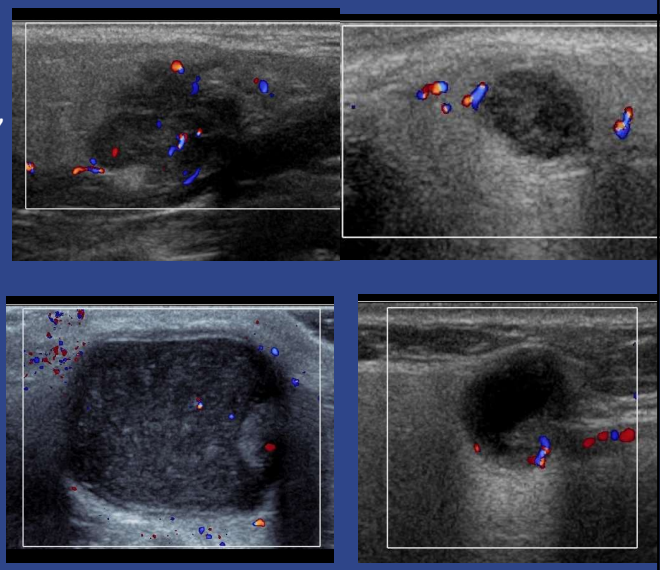
Mucoepidermoid Carcinoma

- Most common primary salivary malignancy in adults
- Composed of mucus-secreting, intermediate, and epidermoid (squamous) cells
- Low grade has a 75%-89% 5 year survival
- High grade has 23%-50% 5 year survival
- May have cystic components
- High grade tumors may have irregular margins
- Small tumors and low grade tumors often mimic benign lesions



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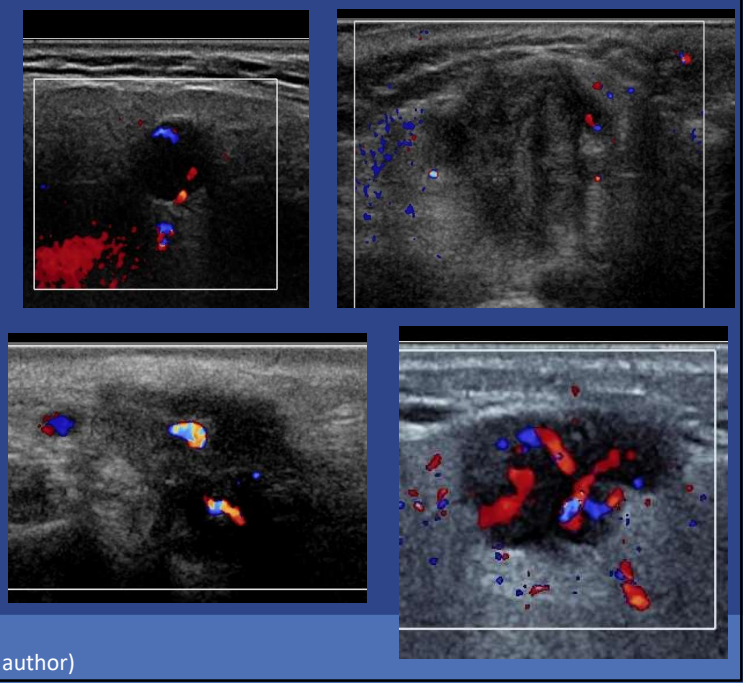
Adenoid Cystic Carcinoma

- 2nd most common primary parotid malignancy
- Intermediate grade tumor
- "Indolent, yet often highly fatal"
- 35%-70% 5 year overall survival, but only 10%-20% 10 year disease free survival
- High frequency of distant metastatic disease (lung and bone)
- High frequency of perineural invasion (30%-62%)
- Variable appearance on imaging



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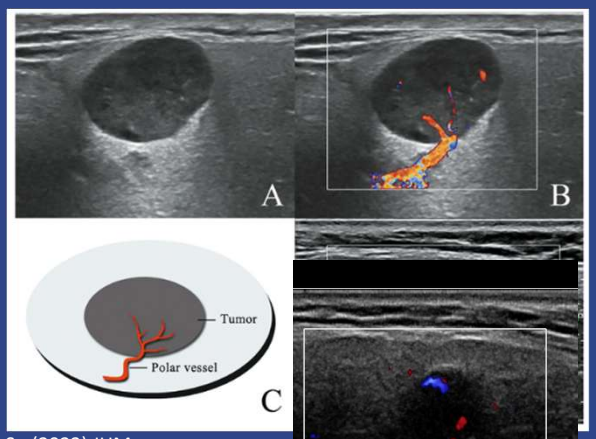
Adenoid Cystic Carcinoma

Polar vessel sign – single prominent feeding vessel is reported as more common in adenoid cystic carcinoma than other salivary tumors



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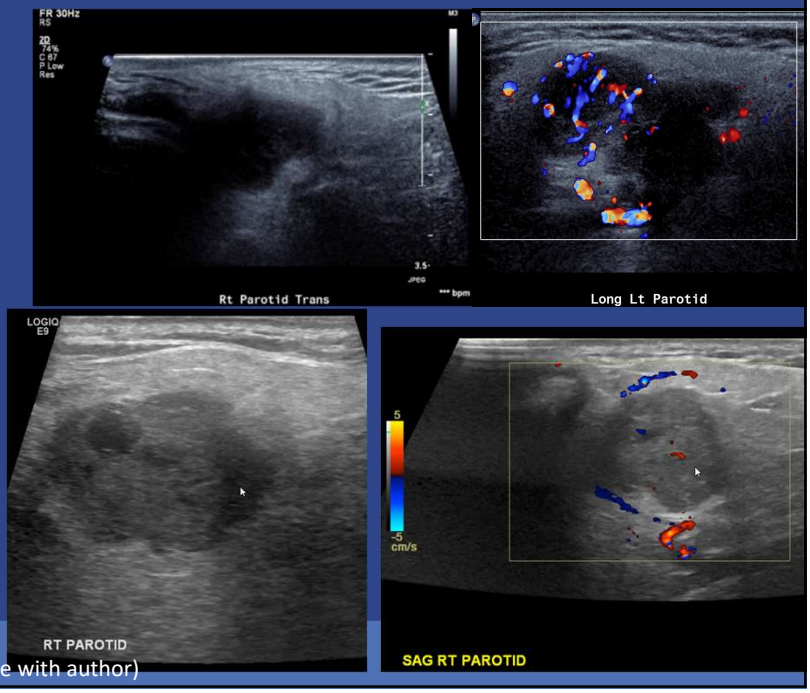
Acinic Cell Carcinoma

- Low-grade malignancy, previously regarded as a benign tumor
- Serous acinar cell differentiation is the hallmark, but multiple variants
- Unpredictable behavior
- 75%-96% 5 year survival



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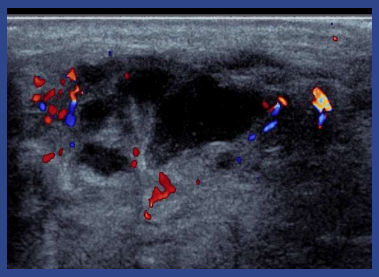
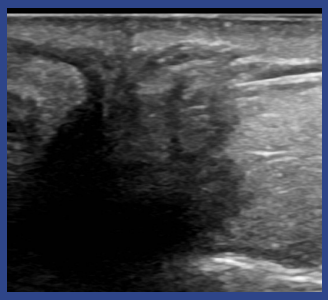
Metastasis to the Parotid

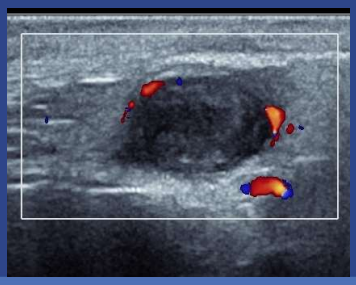
- Common site of metastasis from skin primaries in the midface and scalp
- Reported as multiple, well-defined lesions (melanoma)
- Squamous and basal cell metastasis may present as single large infiltrative masses



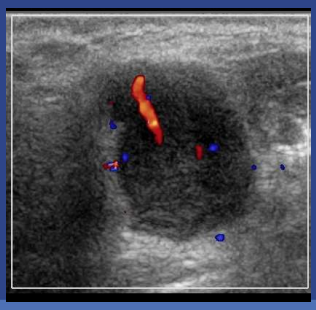
Squamous Cell Carcinoma



Basal Cell Carcinoma



Melanoma



Merkel Cell Carcinoma

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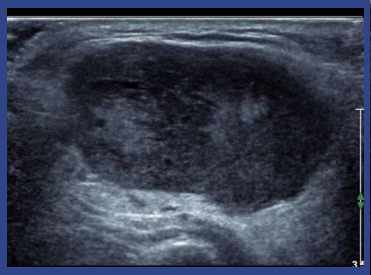
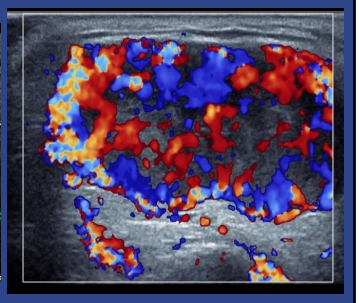
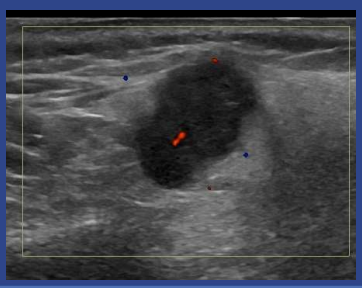
Metastasis to the Parotid

- Common site of metastasis from skin primaries in the midface and scalp
- Reported as multiple, well-defined lesions (melanoma)
- Squamous and basal cell metastasis may present as single large infiltrative masses
- Occasional location of metastasis from sinonasal carcinoma or distant metastasis from infraclavicular primary malignancy





Renal Cell Carcinoma



Lung Cancer – bilateral metastases

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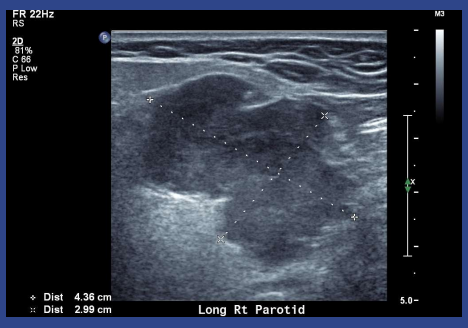
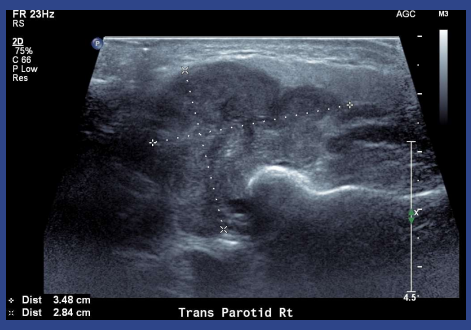
Can ultrasound determine if a parotid mass is benign or malignant?

61

Which lesion is malignant?



Pleomorphic Adenoma



Adenoid Cystic Carcinoma, high grade

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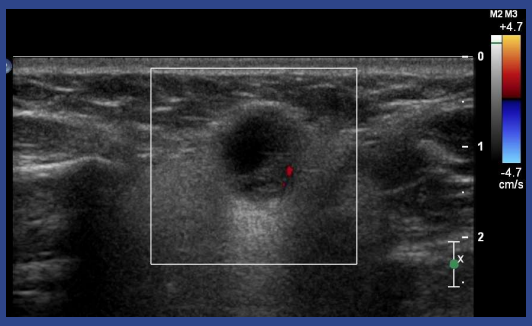
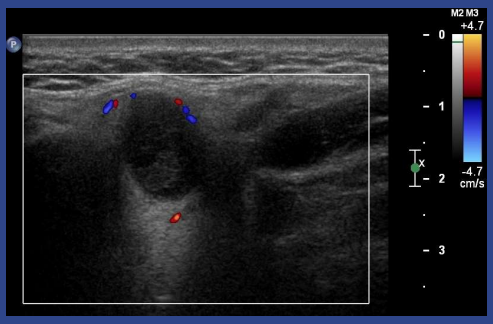
Which lesion is malignant?



Mucoepidermoid Carcinoma



Pleomorphic Adenoma

Images from personal files of Wagner J. (on file with author)

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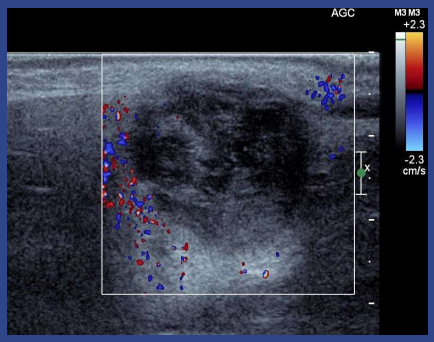
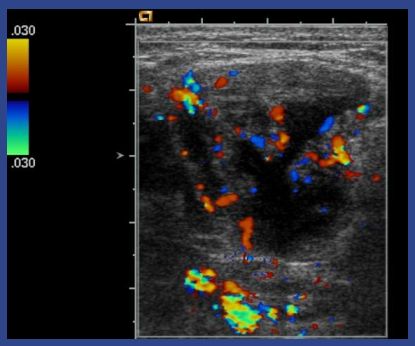
63

Which lesion is malignant?



Mucoepidermoid Carcinoma
high grade



Warthin's Tumor

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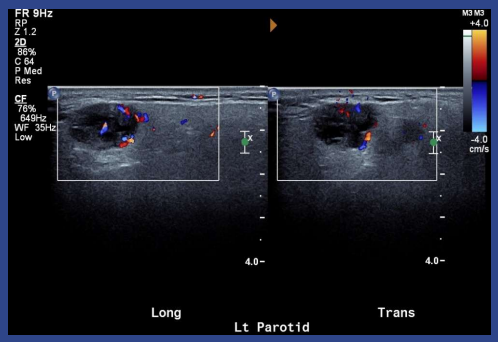
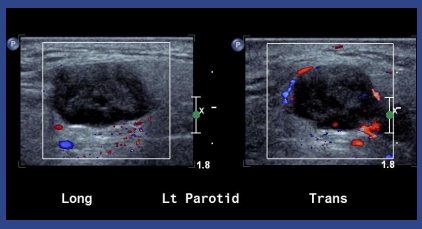
Which lesion is malignant?



Warthin's Tumor



Metastatic Squamous Cell Carcinoma in an intraparotid lymph node

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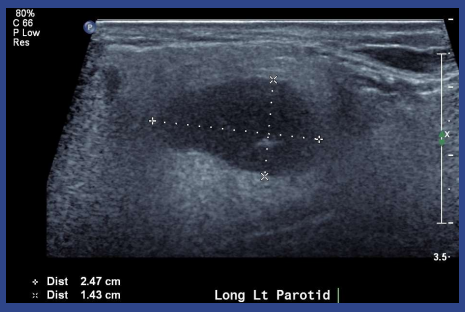
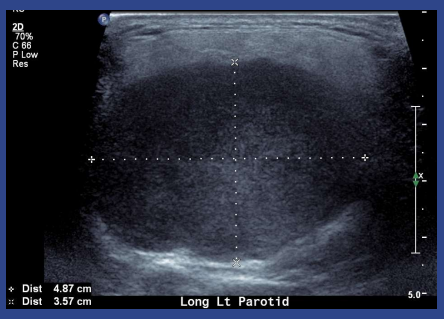
Which lesion is malignant?



High grade salivary ductal carcinoma



Pleomorphic Adenoma

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Can ultrasound determine if a parotid mass is benign or malignant?

- Largest series reported correct classification in 272/302 (90%) of lesions
  - "unsharp border" was the sign of malignancy
  - 16/58 (28%) of malignancies called benign
- More recent articles (including CEUS) have mostly concluded that ultrasound cannot correctly classify lesions, but are limited by small numbers of malignant lesions
- Malignant features
  - Irregular / infiltrative margin
  - Encasement of the retromandibular vein or ECA
  - Local adenopathy
  - Rapid growth
  - Neural symptoms – pain / facial weakness
- Many parotid malignancies have NONE of these features

Gritzman (1989) AJR
Bozzatto (2007) Otolaryngology – Head and Neck Surgery
Wu (2012) Dentomaxillofacial Radiology

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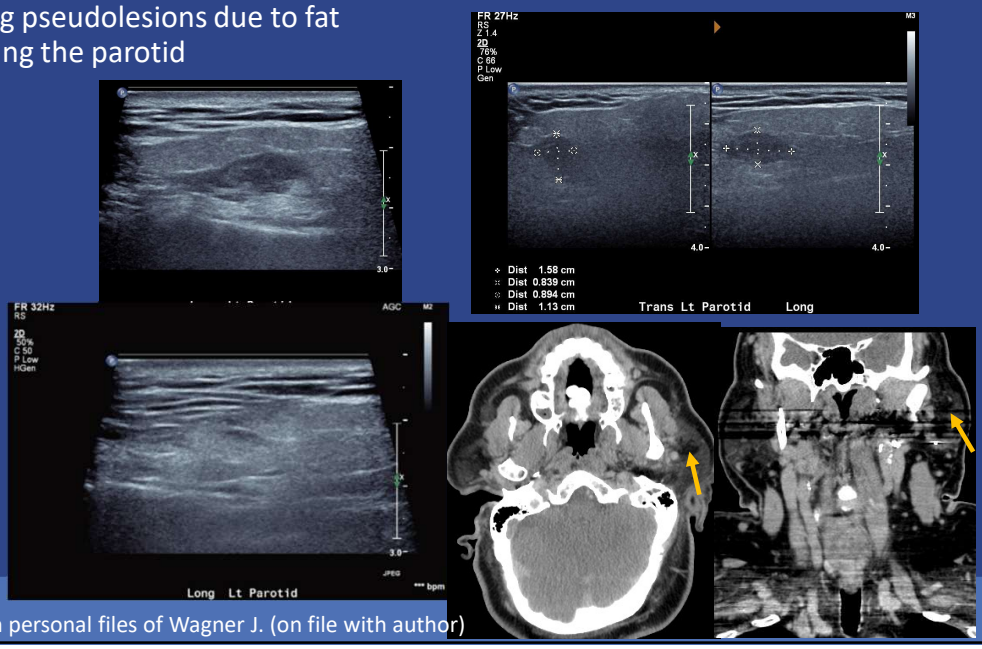
Pitfalls in Parotid Mass Ultrasound

1. Creating pseudolesions due to fat bordering the parotid



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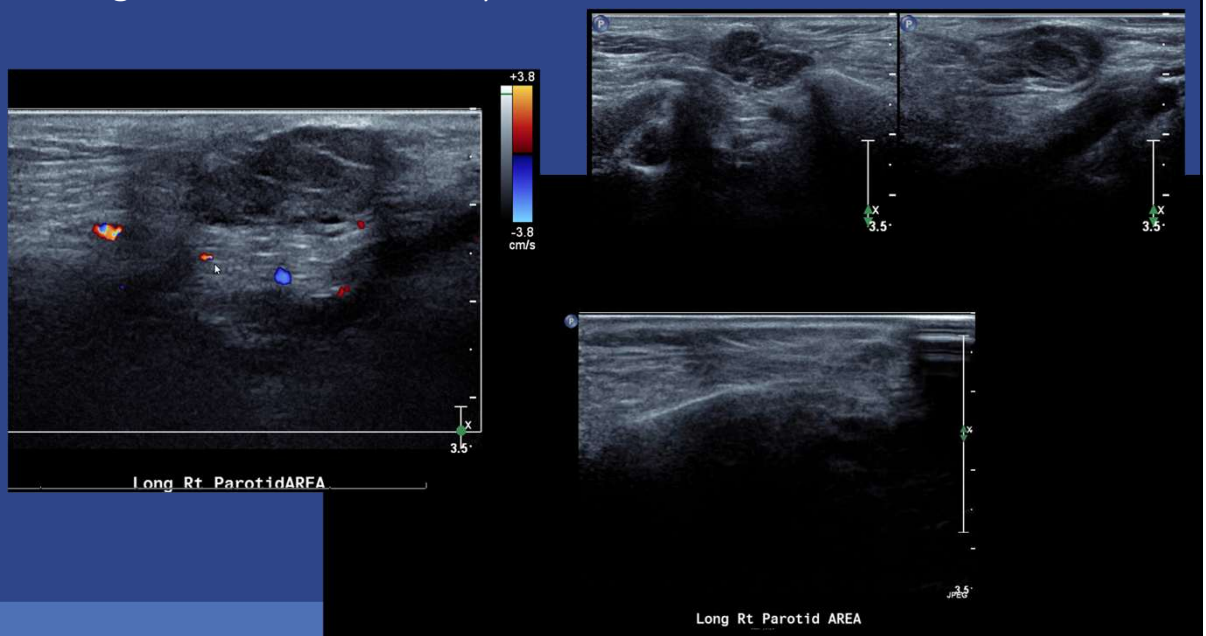
Fat Packing in the Parotidectomy Bed



Images from personal files of Wagner J. (on file with author)

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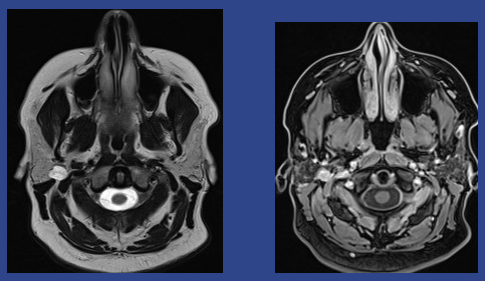
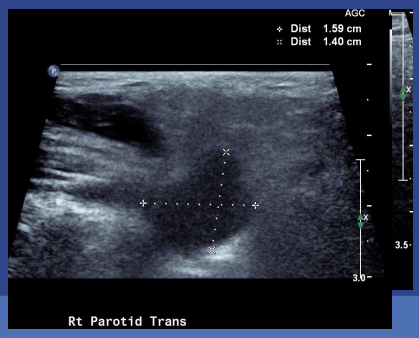
Pitfalls in Parotid Mass Ultrasound

1. Creating pseudolesions due to fat bordering the parotid
2. Not finding deep lobe masses





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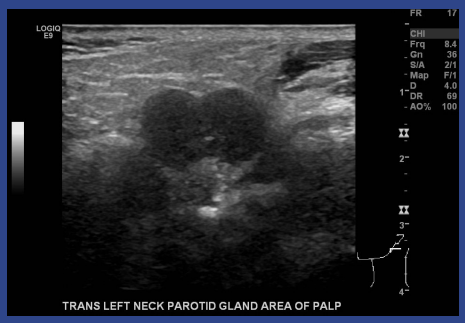
Pitfalls in Parotid Mass Ultrasound

1. Creating pseudolesions due to fat bordering the parotid
2. Not finding deep lobe masses
3. Failure to visualize the deep extent of masses



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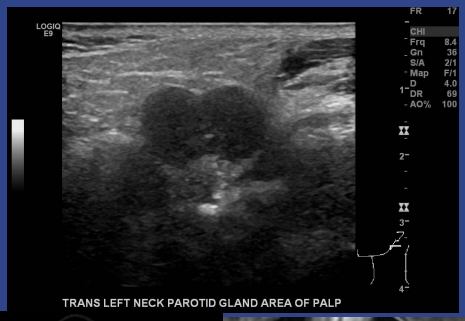
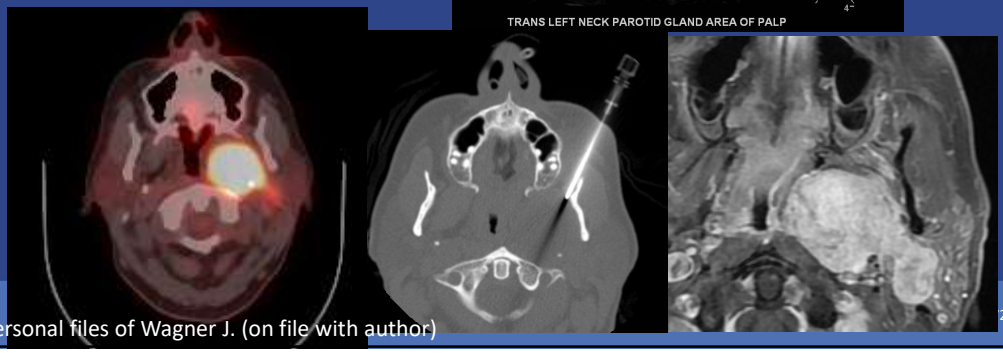
Pitfalls in Parotid Mass Ultrasound

1. Creating pseudolesions due to fat bordering the parotid
2. Not finding deep lobe masses
3. Failure to visualize the deep extent of masses





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Take home points

- Use numerical lymph node stations to describe lymph node position in the neck.
- Evaluate cervical lymph nodes based on patient history, lymph node location, and lymph node morphology.
- Cystic lateral neck lesions may be 2nd branchial cleft cysts in young patients, but metastatic oropharyngeal squamous cell carcinoma and thyroid cancer must be considered
- Sialolithiasis occurs mainly in the submandibular gland
- Lymph nodes are a normal finding in the parotid
- There is substantial overlap in the ultrasound features of benign and malignant salivary masses

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