Head and Neck Ultrasound Workshop , Marriot Hotel, Swansea
6-7th May 2014

Ultrasound of the Salivary Glands

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Salivary Calculi

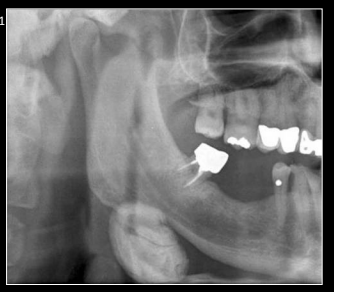
- Males > females
- Peak incidence between 30-60 years of age
- Multiple calculi in 25% of cases
- Bilateral calculi in approximately 2% of cases

Bryan R, Miller R, Ferreyro R, Sessions R (1982) Computed tomography of the major salivary glands. AJR 139:547–554

Som PM, Brandwein MS (2003) Salivary glands: anatomy and pathology. In: Som PM, Curtin HD (eds) Head and neck imaging, 4th edn. Mosby, St. Louis, Missouri, pp 2005–2133

Distribution of Salivary Calculi

- Submandibular gland 80-90% [1]
- Parotid gland 5-20% [1]
- Sublingual gland rarely



1. Lustmann T et al. *Int J Oro-Max-Fac Surg* 1990; 19:135-138

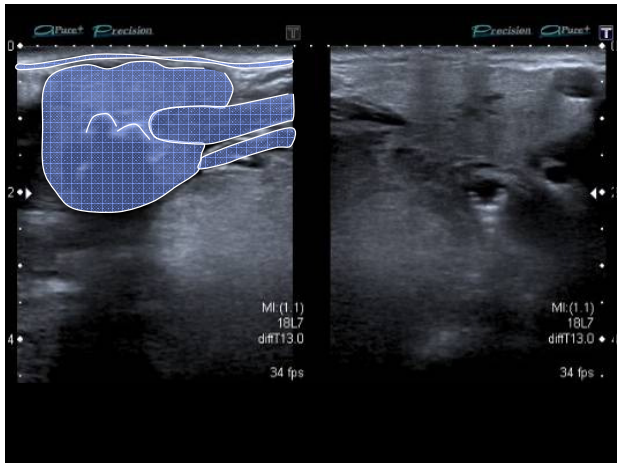
Location of calculi

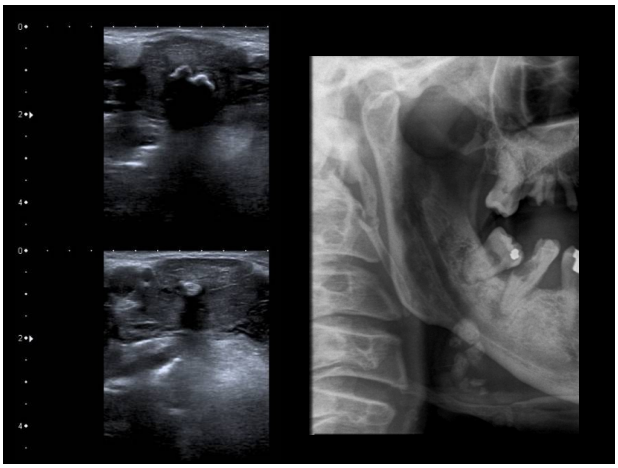
Submandibular Gland	
Distal half of main duct	50.3%
Proximal half of main duct	18.7%
Hilus and intraglandular	31.0%

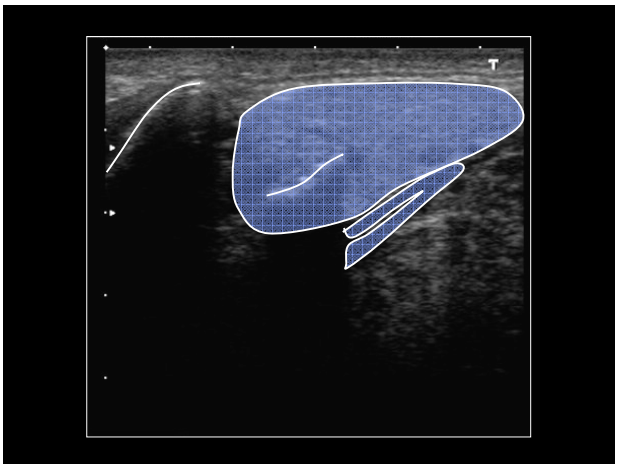
Lustmann J, Regev E, Melamed Y. Sialolithiasis. A survey on 245 patients and a review of the literature. Int J Oral Maxillofac Surg. 1990;19:135-8.

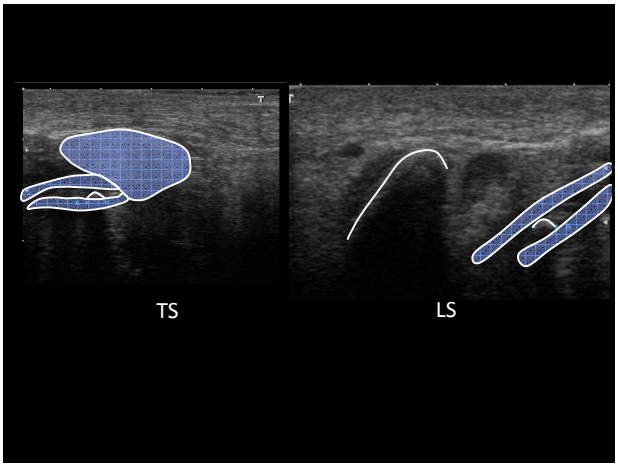
Salivary Calculi

- Bright (hyperechoic) curvilinear focus with posterior shadowing
- If calculus <2mm in diameter, acoustic shadow may be missing
- Salivary stimulation may make small calculi easier to identify
- Duct dilation
- Gland hypoechoic
- Hypervascular





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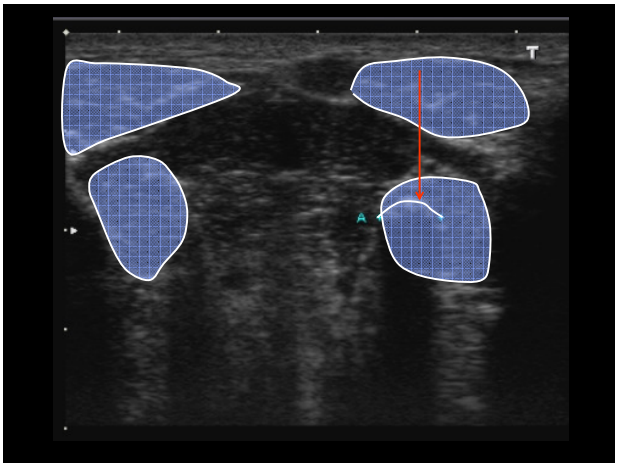
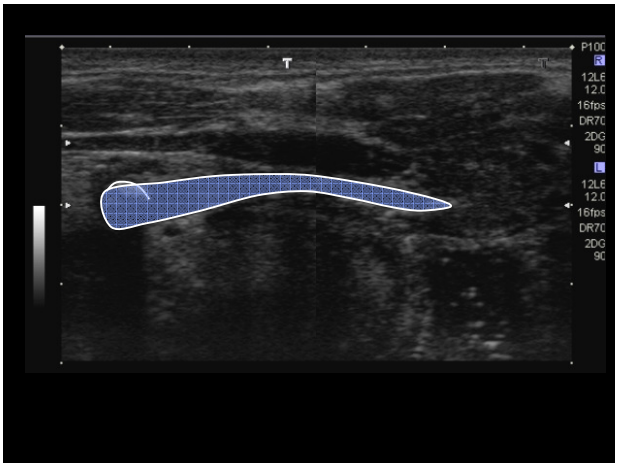
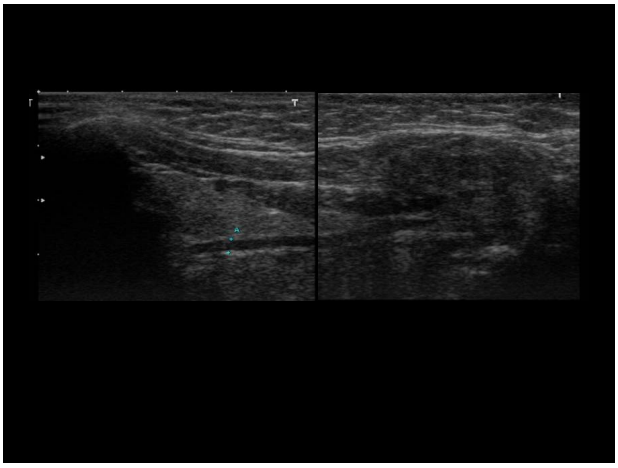
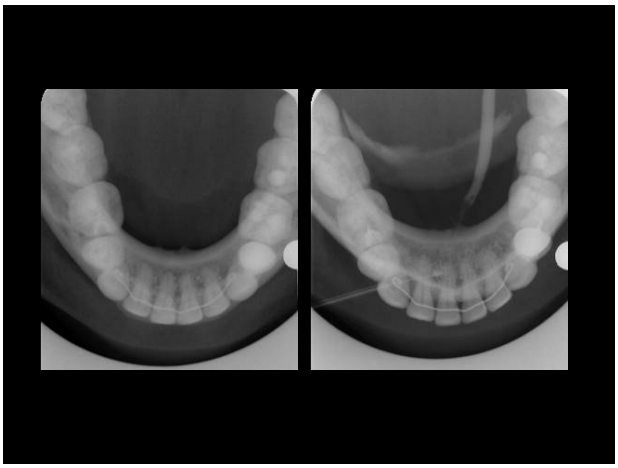
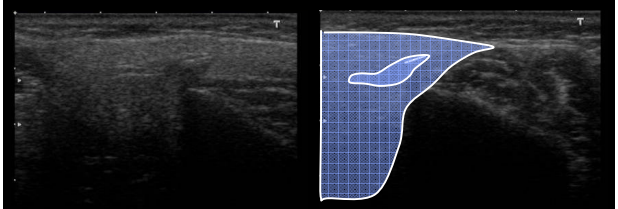


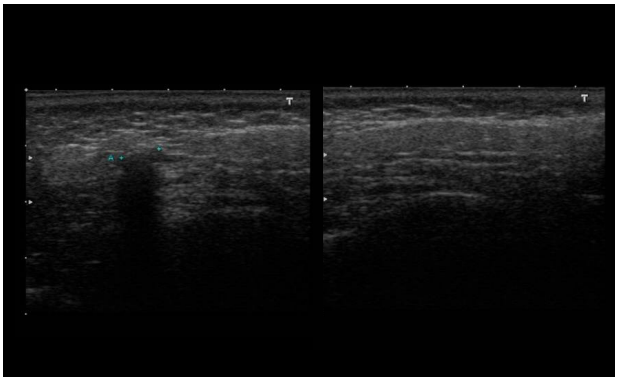




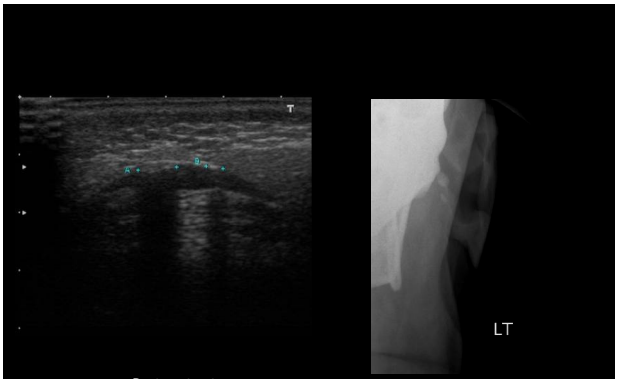


Parotid calculi





Pre contrast



Post contrast

Salivary Strictures

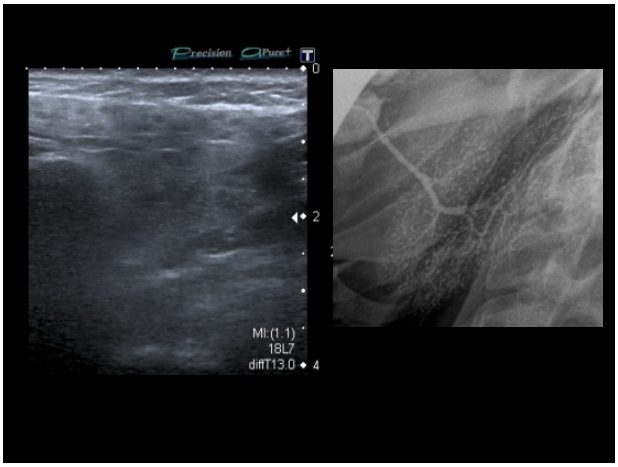
Incidence at sialography

- Salivary strictures account for 22% of cases of salivary obstruction
- 75% arising in the parotid gland
- 7% of patients presented with bilateral stenoses
- 72% of stenoses in females

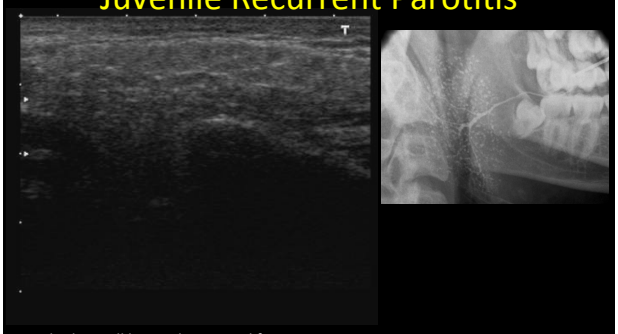
Ngu RK, et al. Salivary duct strictures –nature and incidence in benign salivary obstruction. *DentoMaxFac Radiol*. 2007;36:63-7

Bacterial Sialadenitis

- Hypoechoic / heterogeneous gland parenchyma
- Enlarged intraglandular nodes (parotid)
- Hypervascularisation
- May be abscess
- May be calculus (50% of adult cases)
- Salivary duct dilation



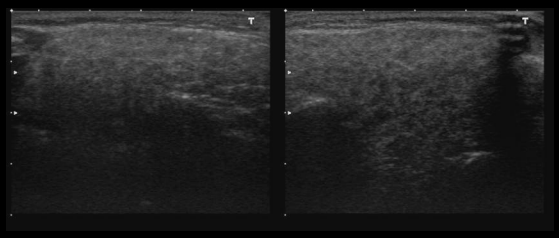
Juvenile Recurrent Parotitis



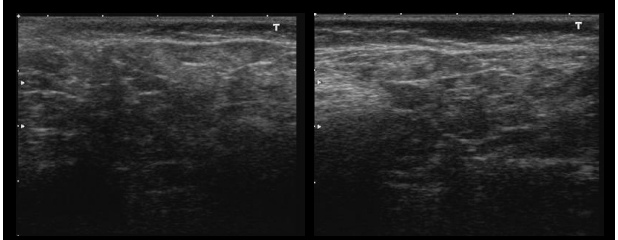
Multiple small hypoechoic round foci
Gland hypervascular

Sjögren's syndrome

- Parenchyma heterogeneous with multiple scattered small hypoechoic or anechoic areas
- May be multiple small cysts
- Hypervascular in the acute phase
- In later stages glands become small
- For hypoechoic lesions larger than 2cm and for rapidly growing lesions consider MALT lymphoma and carry out biopsy



Right Parotid TS Left Parotid TS



Right Parotid TS Left Parotid TS

Sjögren's syndrome

- Objective salivary gland involvement:
  - Focal lymphocytic sialadenitis in minor salivary glands (by biopsy)
  - Plus one positive finding from one of the following
    - Unstimulated whole salivary flow (≤1.5ml/15min)
    - Parotid sialography
    - Sialoscintigraphy

Milic V et al. Ultrasonography of major salivary glands could be an alternative tool to sialoscintigraphy in the American-European classification criteria for primary Sjogren's syndrome. Rheumatology (Oxford). 2012;51:1081-5.

Sjögren's syndrome

- US is more sensitive than sialography as a diagnostic test in patients with suspected SS.

Poul JH, Brown JE, Davies J. Retrospective study of the effectiveness of high-resolution ultrasound compared with sialography in the diagnosis of Sjogren's syndrome. Dentomaxillofac Radiol. 2008 ;37:392-7.

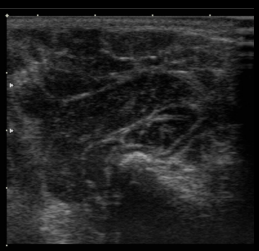
Sjögren's syndrome

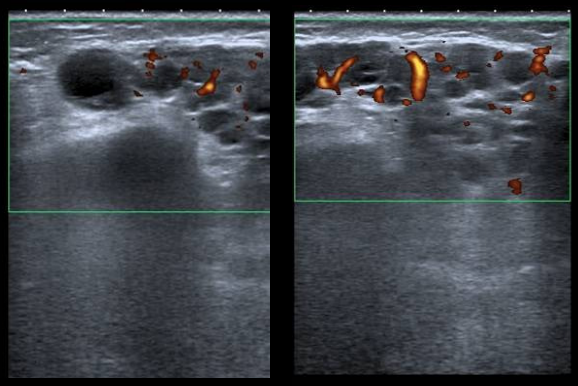
'We agree the scientific evidence supports the substitution of SGUS in the AEC criteria for both sialography and salivary scintigraphy.'

Vitali C, Carotti M, Salaffi F. Is it the time to adopt salivary gland ultrasonography as an alternative diagnostic tool for the classification of patients with Sjögren's syndrome? Comment on the article by Cornec et al. Arthritis Rheum. 2013 ;65:1950.

MALT lymphoma

- Subset of B-cell non Hodgkin's lymphoma
- Enlarged glands
- Multiple hypoechoic foci with increased vascularity



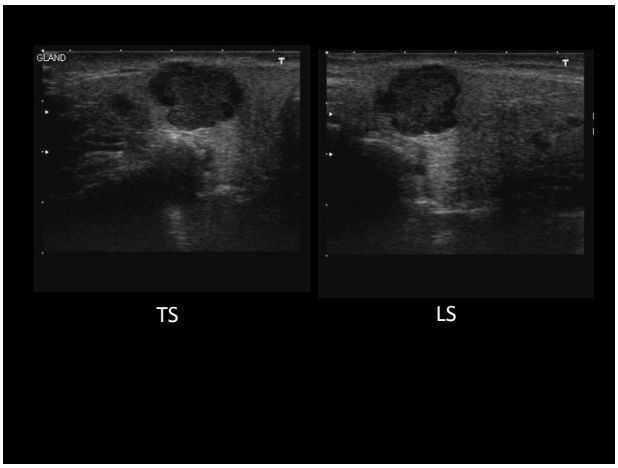


Salivary tumours

- Uncommon: 2-10% of head and neck neoplasms
- 70% in the parotid gland, 8% in the submandibular gland
- 70-80% of tumours are benign
- 75-90% are either pleomorphic adenoma or Warthin's tumour (adenolymphoma)

Pleomorphic Adenoma

- Hypoechoic
- Often lobulated
- Well defined margins
- Acoustic enhancement common
- Moderate vascularisation
- Peripheral flow pattern has been described
- May contain calcifications
- Rapid growth of formerly stable mass is suspicious for Carcinoma ex pleomorphic adenoma (5% of cases)



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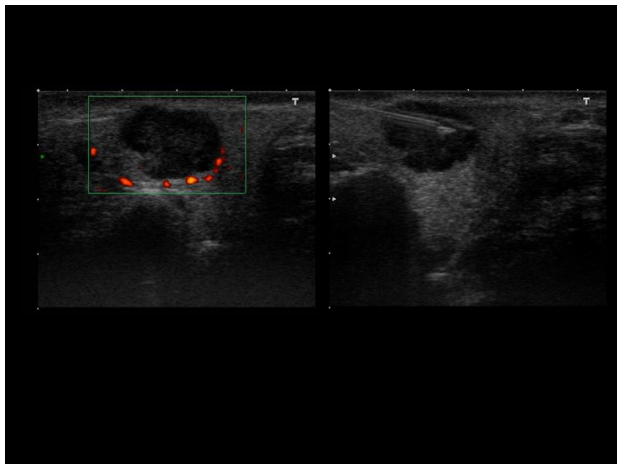


Accessory Parotid Gland

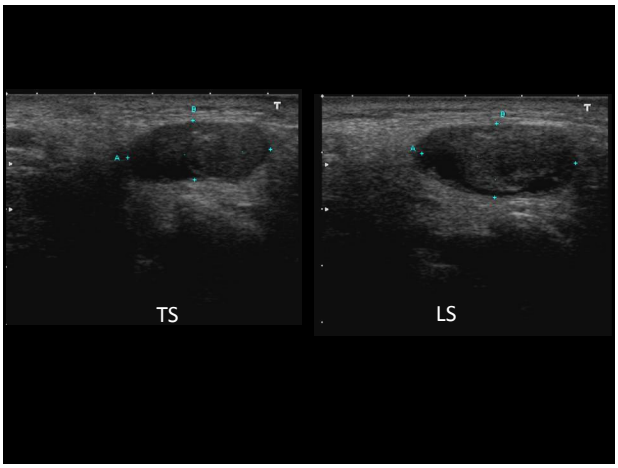
- 21%-56% have an accessory parotid gland

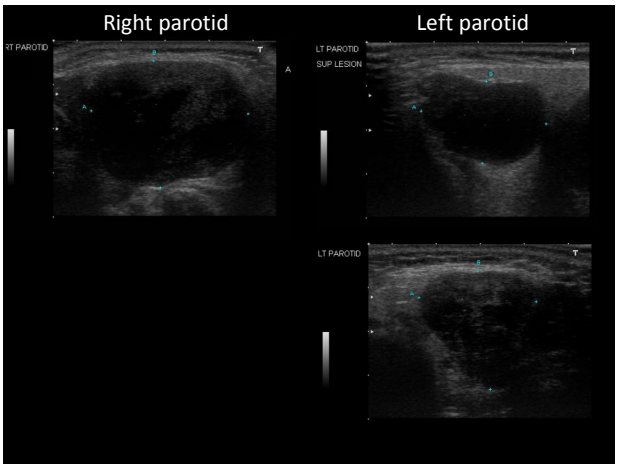
Frommer J. The human accessory parotid gland: its incidence, nature, and significance. Oral Surg Oral Med Oral Pathol. 1977;43:671-6.

Toh H, Kodama J, Fukuda J, Rittman B, Mackenzie I. Incidence and histology of human accessory parotid glands. Anat Rec. 1993;236:586-90.

Warthin's tumour

- Hypoechoic
- Well defined margins
- May be lobulated, oval or irregular in shape
- Cystic components present
- More common in the tail of the parotid
- Multiple in up to 30% of cases
- Acoustic enhancement less common





Malignancy

Gland	% of malignant tumours
Parotid	20-30%
Submandibular	45-60%
Sublingual	70-85%
Minor salivary glands	49-80%

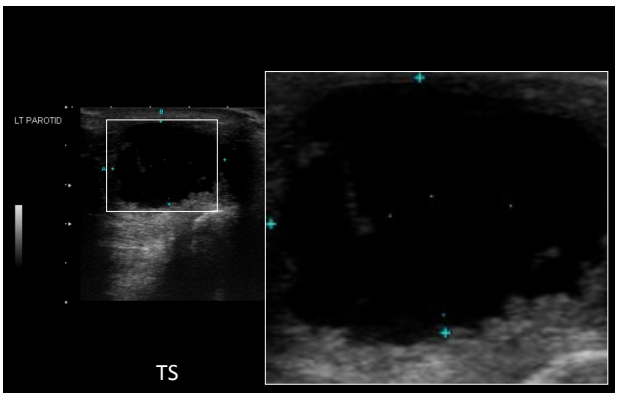
Malignant tumours

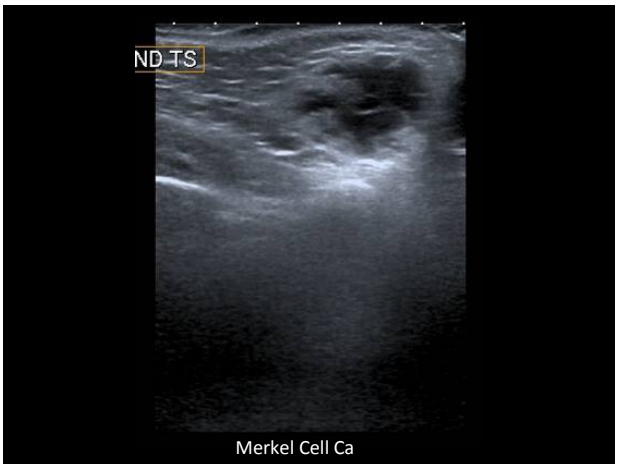
- Mucoepidermoid Ca
  - Most common malignancy of the salivary glands
  - Most common malignancy in the parotid gland
  - Second most common malignancy in the submandibular gland
- Adenoid cystic Ca
  - Second most common salivary malignancy
  - Most common malignancy in submandibular gland and sublingual gland
- Acinic cell Ca
  - Second most common parotid malignancy

Malignant tumours

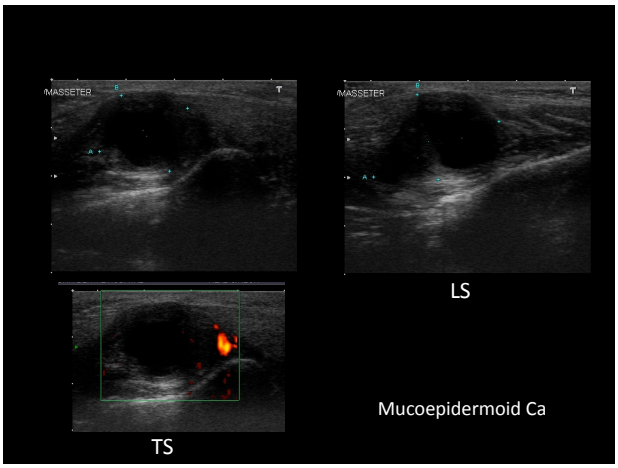
(Mucoepidermoid Ca, Adenoid cystic Ca, Acinic cell Ca)

- Irregular shape
- Ill-defined and irregular margins
- Heterogeneous
- Hypervascular and chaotic pattern of flow
- May be acoustic shadowing
- Abnormal lymph nodes
- However small lesions and low grade tumours such as mucoepidermoid Ca often appear 'benign' on US





Merkel Cell Ca



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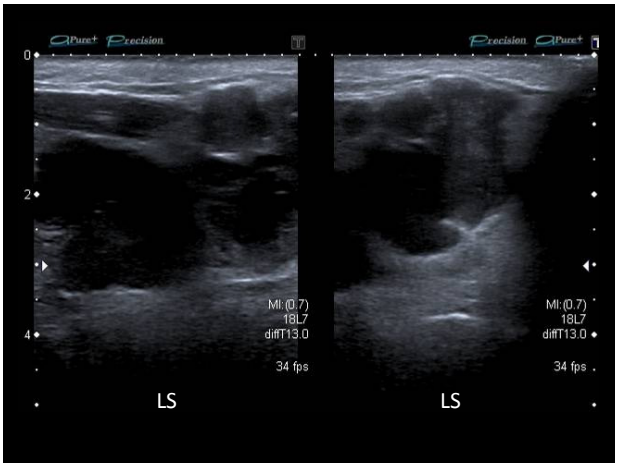
Mucoepidermoid Ca



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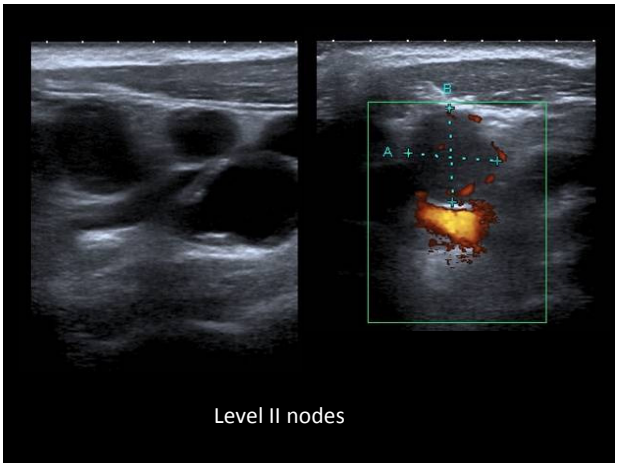
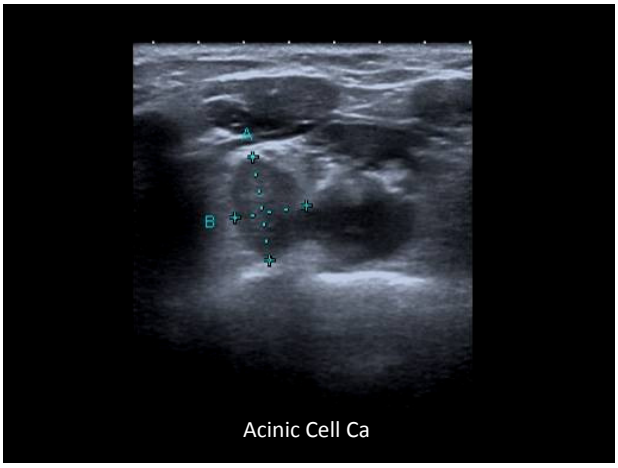
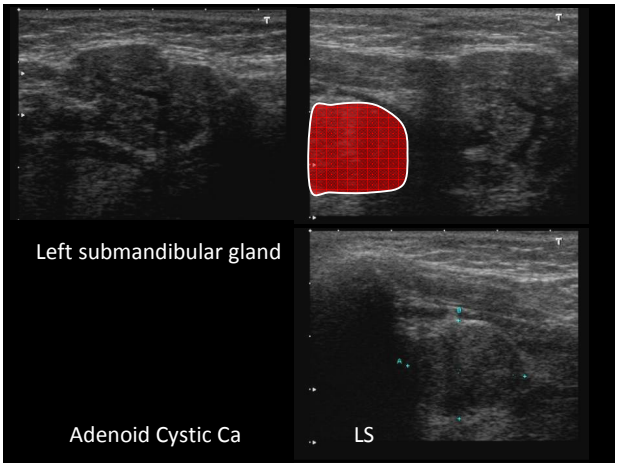


Level II nodes



Acinic Cell Ca



Left submandibular gland

Adenoid Cystic Ca

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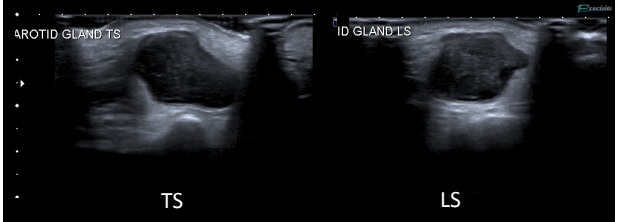
Lymph node metastasis to the parotid

- Malignant melanoma
- Sq Cell Carcinoma

} Nodes drain anterior face, lateral scalp and EAM

- Breast
- Lung



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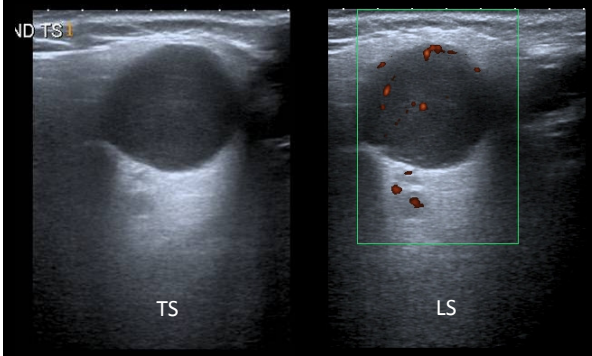
Metastasis from malignant melanoma



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Acinic Cell Ca

Can US confidently distinguish benign and malignant lesions?

'The sonographic characteristics of parotid masses between benign and malignant lesions had no significant differences.'

Wu S, Liu G, Chen R, Guan Y. Role of ultrasound in the assessment of benignity and malignancy of parotid masses. Dentomaxillofac Radiol. 2012;41:131-5.

Can US confidently distinguish benign and malignant lesions?

- *High vascularisation and high systolic peak flow should raise the possibility of malignancy.*
- *Evaluation of tumour vascularisation using colour Doppler sonography and pulsed Doppler sonography cannot differentiate benign and malignant tumours with certainty.'*

Schick S, Steiner E, Gahleitner A, Böhm P, Helbich T, Ba-Ssalamah A, Mostbeck G. Differentiation of benign and malignant tumors of the parotid gland: value of pulsed Doppler and color Doppler sonography. Eur Radiol. 1998;8:1462-7.

Can US confidently distinguish benign and malignant lesions?

'US can accurately differentiate benign from malignant lesions. There is an overlap in features of pleomorphic adenoma and Warthin's tumours and some benign and malignant conditions.'

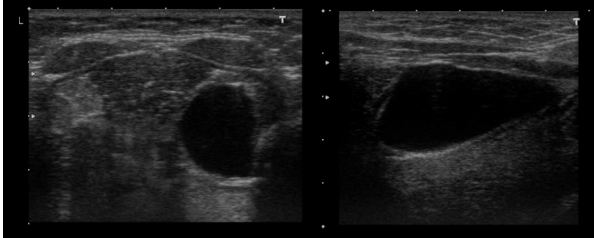
Sriskandan N, Hannah A, Howlett DC. A study to evaluate the accuracy of ultrasound in the diagnosis of parotid lumps and to review the sonographic features of parotid lesions - results in 220 patients. Clin Radiol. 2010;65:366-72.

There is overlap in the US appearance of salivary masses, therefore biopsy is required

Others:

Mucous retention Cyst

- Arise from the sublingual gland
- Well defined hypoechoic mass
- Acoustic enhancement present
- Important to describe the relationship to the mylohyoid muscle



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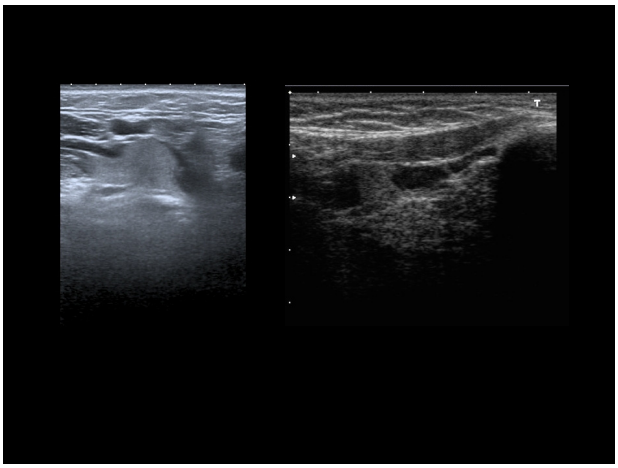
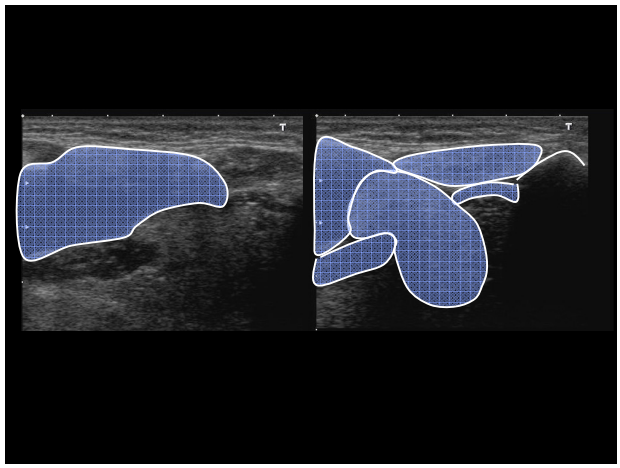
Herniation of the mylohyoid muscle

Grade	Degree of sublingual gland penetration	Percentage
Grade 0	Normal	
Grade 1	Thinning of mylohyoid muscle, vertical reduction in muscle thickness during swallowing, no signs of glandular penetration	40%
Grade 2	Herniation of gland during swallowing, normal anatomical features at rest	17%
Grade 3	Constant hiatus in the mylohyoid muscle with permanent herniation of the sublingual gland	2%

Kiesler K, Gugatschka M, Friedrich G. Incidence and clinical relevance of herniation of the mylohyoid muscle with penetration of the sublingual gland. Eur Arch Otorhinolaryngol. 2007 ;264:1071-4.





Thank you for listening