EFSUMB Course Book, 2nd Edition

Editor: Christoph F. Dietrich

Ultrasound of the salivary glands and soft tissue lesions of the neck

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Topography and sonographic anatomy of the salivary glands

The three pairs of salivary glands can be easily identified within the neck using ultrasound. The parotid gland is located in the retromandibular fossa as a triangular, echogenic structure. The submandibular gland is situated under the body of the mandible, abutting the posterior free edge of the mylohyoid muscle. The sublingual glands lie deep to the mylohyoid muscle, they are identified in the sublingual space lying lateral to the genioglossus muscle.

Sonographic anatomy

Parotid gland

Sonographically, the parotid gland is a triangular, uniformly hyperechoic structure in the retromandibular fossa [Figure 1].

Figure 1 Transverse section of the normal left parotid gland.

The majority of the parotid gland can be easily assessed by ultrasound; however, the deep portion of the gland may be difficult to visualise and the portion of the parotid gland which lies medial to the mandible cannot be identified consistently. The masseter muscle is located deep to the anterior part of the superficial parotid, lateral to the ramus of the mandible. The inferior portion of the parotid gland may be referred to as the cervical lobe. Within the

parenchyma, the retromandibular vein is often identified lying lateral to the external carotid artery. The plane of the retromandibular vein through the parotid can be used to differentiate between the superficial and deep part of the parotid gland [(1)]. Small, bean-shaped or oval, hypoechoic structures within the gland are commonly identified, they represent reactive, hyperplastic lymph nodes.

Normal minor, peripheral, nondilated intraglandular ducts are not visualised by ultrasound. The main duct (Stensen's duct) is sonographically identifiable as either a tubular structure using high resolution transducers (>10 MHz) or is identified as a single echogenic line. The facial nerve is not visualised sonographically [(2)].

Submandibular gland

The submandibular gland is triangular shaped with a homogeneous echogenic structure, identified at the posterior border of the mylohyoid muscle. The facial artery and vein are located posterior to or within the gland, the facial artery passing superiorly behind the submandibular gland, over the inferior body of the mandible. Nondilated intraglandular ducts are usually not identified, but may be seen as faintly visible narrow, confluent tubules. Wharton's duct (main duct) is identified between the mylohyoid and hyoglossus muscles, colour flow imaging may help in differentiating it from the adjacent lingual vessels.

Sublingual gland

Sonographically the sublingual gland is distinguished from the genioglossus muscles as an echogenic mass lying lateral to the genioglossus, deep to the mylohyoid. There may be a direct communication with the submandibular gland situated dorsally. The ducts lead to the sublingual caruncle in the anterior part of the floor of the mouth which cannot be identified with ultrasound.

Colour Duplex Doppler

Salivary glands are well perfused. Their arterial supply and associated veins can be displayed by colour Doppler sonography. The retromandibular vein can be used to differentiate superficial and deep lesions of the parotid gland (venous plane). Colour Doppler sonography is used to assess the vascularisation of salivary gland diseases [(3)]. It is not possible to use

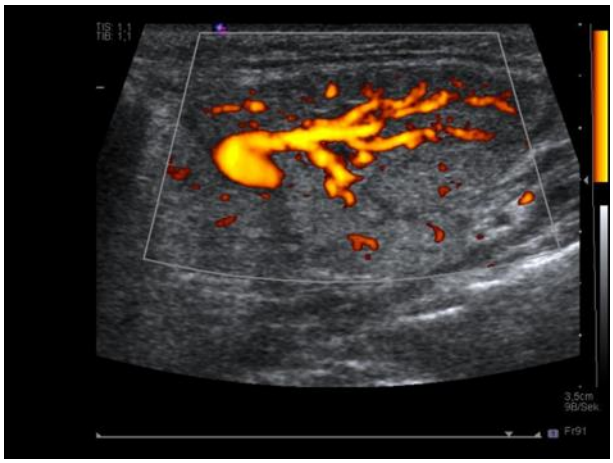
colour flow patterns or specific Doppler characteristics to diagnose specific pathological entities within the salivary glands. However, the peak systolic velocity of the intraparenchymal arteries increases after stimulation (vitamin C or lemon stick). The lack of a detectable increase in peak systolic velocity after stimulation can be used in the assessment of Sjögren's syndrome.

Pathological changes in the salivary glands

Acute inflammation of the salivary glands

Acute bacterial sialadenitis usually arises as a consequence of a bacterial, ductogenic, ascending infection and often affects older patients [Figure 2].

Figure 2 Enlarged submandibular gland. Hypervascularisation is visualised on power Doppler. Typical inflammation of the submandibular gland is visualised.



The main indication for ultrasound is to assess whether an obstructive sialadenitis with ductal dilatation is present or whether there is a cystic mass, i.e. abscess formation. Enlarged, intraglandular, hypoechoic lymph nodes should not be confused with small abscesses. The oval shape of the lymph nodes and their eccentric echogenic hilum with its associated hilar blood flow pattern helps with identification. Purulent abscess formation can

present as a heterogeneous mass or is sometimes identified as a frankly cystic collection. Pus within an abscess can be relatively echogenic.

Colour Doppler sonography demonstrates a reactive hypervascularity in the surrounding parenchyma. Using palpation under sonographic control (sonopalpation), motion of the pus/debris within the abscess can occasionally be visualised. Ultrasound contrast media can be used to delineate the liquefaction of an abscess. Ultrasound guided aspiration can prove or exclude the diagnosis of an abscess. The ability to obtain accurate microbiology can aid management. Viral infections, such as mumps, usually show bilateral hypoechoic enlargement of the parotid glands. Typically hypervascularity is found on colour Doppler sonography. CEUS can help in the early diagnosis of non-vascularised abscesses.

Chronic inflammation of the salivary glands

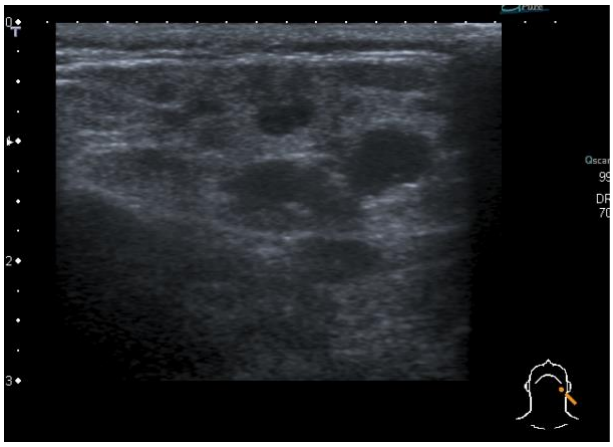
Chronic (recurrent) sialadenitis

Chronic sialadenitis typically presents unilaterally, underlying causes include recurrent bacterial infection. Strictures or stenoses of the ducts may be precipitating factors. The gland is less swollen than in acute sialadenitis and is heterogeneous in appearance. Duct dilatation may be detected. Salivary duct strictures are more accurately visualised by sialography than by ultrasound. Ultrasound is used primarily to exclude a causal sialolithiasis [Figure 3].

Intra- or periglandular, moderately enlarged lymph nodes with hyperechoic hila can be detected in chronic sialadenitis. In children, chronic cystic parotitis can be diagnosed sonographically with small hypoechoic lesions visualised within the echogenic parenchyma. Usually this condition is self-limiting.

Küttner’s tumour is a chronic sclerosing sialadenitis of the submandibular gland. Typical appearances are those of an ill-defined, heterogeneous submandibular gland. Special care should be taken to recognise the intraglandular ducts and vessels in order not to confuse the abnormal submandibular gland with a tumour. Sclerosing sialadenitis may affect the submandibular gland partially. Hypoechogenic areas are visualised within the submandibular gland.

Figure 3 Left parotid gland in a child. Multiple cystic lesions are detected in a gland with a background of normal echogenic parenchyma. Chronic cystic parotitis was diagnosed.



Sjögren's syndrome

Sjögren's syndrome is an autoimmune disease. The clinically significant xerostomia is caused by a myoepithelial sialadenitis with fibrosis. The changes are seen in the parotid and submandibular glands. Chronic sialadenitis and Sjögren's syndrome demonstrate a similar appearance sonographically, however chronic sialadenitis is usually unilateral whereas Sjögren's affects the salivary glands symmetrically. The glands are enlarged, heterogeneous in echotexture, with multiple small hypoechoic areas within. The appearances are sometimes likened to a ‘currant cake’ or ‘leopard skin’ appearance [Figure 4] [(4)].

Enlarged intra- or extraglandular lymph nodes are a frequent finding in Sjögren's syndrome. If an enlarged lymph node mass is identified then biopsy should be considered because there is an increased risk of non-Hodgkin lymphoma in Sjögren's syndrome. It is recommended that when a hypoechogenic mass of more than 1 cm is identified within a salivary gland that displays signs of Sjögren's syndrome, a histological evaluation should be performed.