

Sonography of the Salivary Glands



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KEYWORDS

- Sonography • Salivary glands • Parotid gland • Submandibular gland • Sublingual gland • Calculi
- Tumor • Inflammation

KEY POINTS

- The salivary glands are superficially located and can be investigated by sonography in detail.
- It is important to scan each gland in a systematic manner.
- The salivary glands can be affected by inflammatory, benign, and malignant pathology that can be detected by sonography.
- The salivary glands can have congenital anatomic abnormalities and can contain calculi that are also detected by sonography.
- The learning objective is to obtain deep knowledge about structure of healthy glands, applicable sonographic technique, pathologic changes, and differential diagnosis of the pathologies.

PHYSICS AND INSTRUMENTATION

Ultrasound is a high-frequency acoustic wave using frequencies outside the normal hearing range (20 Hz–20 kHz). Most equipment for head and neck and maxillofacial use is set at 8 MHz (8 million/cycles per second) or higher. This contrasts with ultrasound equipment used for general surgery or obstetrics, which works at 5 to 6 MHz, allowing a greater depth of tissue penetration but reduced resolution. Probes generating frequencies up to 20 MHz and, in the case of ultrasound biometrics, up to 50 MHz, are now also used for salivary gland imaging. These allow resolution of very small structures. Three large salivary glands (the parotid gland, the submandibular gland, and the sublingual gland) are arranged in pairs and easily accessible to sonographic diagnosis, including high-frequency linear probes (8–18 MHz), because of their superficial location.¹

Nowadays the use of high-end ultrasound devices features a sonographic image like in an anatomy book. Resolution and penetration depth of ultrasound depends on the deployed frequency. The higher the frequency, the better the resolution but the penetration is worsened.² For imaging of the salivary glands linear arrays with 7.5 MHz (5.0–13.5 MHz)^{3,4} are most useful. **Box 1** outlines scanning sequence.

Under normal conditions, the three large salivary glands exhibit similar homogeneous intermediate echogenicity with sharp borders.^{5–7} Small salivary glands become accessible to sonographic diagnosis only when pathologic lesions are present (eg, tumorous or neoplastic gland enlargement). The indications for sonographic examination include swelling or enlargement in the region of the salivary glands, and pain.^{8,9} Examination by ultrasound (**Box 2**) enables the sonographer to verify whether masses are localized in, or merely

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Box 1**Scanning sequence**

- It is important to scan the gland in a systematic manner.
- Initially a wide window is used, particularly to visualize the gland itself.
- Subsequently concentrate at any solid lesions and other pathology.

adjacent to, the inspected salivary gland. This distinction often cannot be made solely based on clinical examination.¹⁰

HOW TO SCAN (PROTOCOLS)***The Parotid Gland***

The parotid gland can be easily assessed with the patient's head turned sideways and hyperextended. A summary of scanning procedures is found in **Box 3**.

First, the transverse section is scanned, proceeding from the angle of the jaw up to a point slightly above the tragus. Next, the longitudinal section is scanned. The ultrasound probe must be adequately adapted to the surface of the skin by applying a sufficient amount of gel, particularly in the region of the angle of the jaw.^{1,7,11}

The Submandibular Gland

If the patient's head is moderately extended, the submandibular gland can be sonographically examined without any problems.^{1,7,11} First, in the midline of the neck, the ultrasound scanner is moved in transverse orientation from the hyoid up to the horizontal ramus of the mandible. Occasionally, both submandibular glands can be imaged simultaneously. Next, by shifting the scanner to one side, parallel to the horizontal ramus of the mandible, a clear image of the respective

Box 2**Components to ultrasound examination**

- Topographic examination, to assess the shape and location of any abnormality
- Quantitative assessment, to assess reflectivity, attenuation, and structure of any abnormality within the salivary gland
- Kinetic evaluation, to assess the mobility of abnormal structures (calculi, foreign bodies) within the salivary gland
- Doppler, elastography

Box 3**Parotid gland scanning procedure**

- The supine position
- Transverse and longitudinal scans over the mandibular angle
- Cover the preauricular, infra-auricular, retroauricular, and cervical regions
- Examine the gland bilaterally because some diseases may occur bilaterally

submandibular gland can be obtained. The gel contact of the scanner to the skin has to be ensured here.

The Sublingual Gland

The examination of the sublingual gland involves no essential differences in procedure compared with the examination of the submandibular gland. The scanner is placed on the skin in a transverse plane in the median line immediately below the mandible, thus allowing visualization of both sublingual glands. It is important to note that all the averaged scans should be within 0.2 mm of each other, and any outliers carefully assessed and discarded and rescanned if necessary.

ANATOMY***Refresh Your Gray's Anatomy***

The parotid glands consist of a prismatic body and two extensions: the anterior portion resting on the deep masseter muscle and the deeper extension, which reaches the lateral wall of the pharynx passing between the prestyloid muscles and the stylo-mandibular ligament.

The submandibular glands are located in the submandibular space beneath the floor of the mouth and they have a mesial extension called the "hook." Wharton excretory duct arises from this extension running at the base of the lingual frenulum to open into the sublingual caruncle.

The sublingual glands are a group of glands situated in the sublingual space, surrounded by the lingual fossa, the floor of the mouth, and the mylohyoid muscle.

Normal Anatomy by Ultrasound***The parotid gland***

The parotid glands, which are the largest of the salivary glands, are enclosed by a separate fascia that penetrates the glands thereby forming changeable lobes. In a transverse section, the parotid gland presents as a sharply bordered,

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