Ultrasonographic Evaluation of Salivary Gland Enlargements: A Pilot Study

T Sridhar¹,*, N. Gnanasundaram²

¹Department of Oral medicine and Radiology, Priyadarshini Dental College, Thiruvallur, India
²Department of Oral Medicine and Radiology, Saveetha Dental College and Hospital, Chennai

*Corresponding author: Sridhar_tha@yahoo.com

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Abstract

Purpose: Radiography, Sailography, Scintigraphy, Computerized Tomography, MRI and Ultrasonography are the available diagnostic aids to diagnose salivary gland lesions. All the diagnostic aids have their own limitations in the diagnosis of salivary gland diseases. The advantage of ultrasonography in the diagnosis of salivary gland enlargements is its ease to use, less expensive, less time consuming, non ionizing and suitable for peripheral location of the salivary gland enlargement. In the current study, the efficacy of ultrasound sonography to differentiate a wide variety of salivary gland enlargements is evaluated. Materials and methods: A total number of 20 patients with different salivary gland enlargements were taken for the study. Ultrasonography was carried out using Philips ATL: HDI 3000. Transducer (linear): 5 to 12 mHZ for all the patients. Results: Ultrasonography findings which includes echogenisity, internal echoes, acoustic enhancement, shape, borders, calcifications vascularity and ductal findings of all the subjects were recorded and tabulated. Conclusion: Ultrasonography is very useful in diagnosing lymph node and salivary gland enlargement in submandibular region. Further, ultrasonography helps in identifying the salivary calculi and accessory salivary gland tissue.

Keywords: salivary glands, salivary gland diseases, sialadenosis, ultrasonography

1. Introduction

Salivary gland diseases are diverse ranging from the minor inflammatory conditions to a diverse group of benign and malignant neoplasms. Many of these salivary gland diseases are rare and the investigative methods available are also minimal and less productive. Although diverse, most of the salivary gland disorders manifest themselves as the enlargement of the gland [1].

Inflammatory salivary gland lesions are usually of bacterial or viral in origin. In addition inflammation of salivary glands can also be seen in sialolithiasis, sialadenosis and autoimmune salivary gland disorders like sjogrens syndrome [1].

Salivary gland neoplasms are relatively uncommon, comprising only about 2% of all head and neck neoplasms. Histopathology of these tumors is said to be the most complex and diverse of any organ in the body [2].

Radiography, Sailography, Scintigraphy, Computerized Tomography, MRI and Ultrasonography are the available diagnostic aids to diagnose the salivary gland lesions. Radiography has its own limitations producing a two dimensional shadowgraph. In sailography needle injury, cathedral injury, spread of contrast media to other structures and hypersensitive reactions are usually encountered [3,4]. Since salivary gland lesions are purely soft tissue lesions, Computed Tomography have limited implications. MRI is expensive and cannot be easily used for many patients [3,4,5].

Since the salivary glands are enveloped by capsule surgical biopsy of the enlarged salivary gland may cause damage to the gland and may lead to further spread of the lesion. It is also important to note that salivary gland lesions arise not only from the major salivary glands but also from any of the numerous intra oral minor salivary glands.

Under these circumstances ultrasonography can be an appropriate imaging technique for diagnosing salivary gland lesions. Pathological changes in salivary glands can be studied with ultrasonography. It is easy to use, less expensive, less time consuming, non ionizing and suitable for peripheral location of the salivary gland enlargement [6].

In ultrasonography the electrical impulses are converted into high frequency sonic waves by transducer. Transducer is a device in the ultrasound scanner which can convert electrical energy into sonic energy. These waves are transmitted into the tissues which are absorbed, reflected, refracted or diffused. As the sonic waves pass through the pathological tissue they produce different types of echoes. These echoes vary in different diseases and the echogenesity is recorded for variations. The echoes are broadly described as hypoechoic, isoechoic and hyper echoic. The results of these echo-changes are recorded and studied [7].
The sonographic features also help to identify the borders, shape, distribution of internal echoes, acoustic enhancements, presence of calcification and vascularity of the salivary glands [8,9]. The present study was designed to investigate the salivary gland enlargements by using the sonographic methods and to record the characteristics of each lesion with reference to border, shape, distribution of internal echoes, acoustic enhancement. The presence of vascularity and the presence of calcifications are also identified.

2. Materials and Methods

2.1. Subjects

A total number of 20 patients with different salivary gland enlargements were taken for the study and clinical evaluations for salivary gland enlargements were carried out. Since 5 patients were not willing for diagnosis and treatment of salivary gland disease only 15 patients were taken for ultrasonographic study. In the total 20 patients 8 were male patients and 12 were female patients. The male patients were in age group of 12 to 60 and female patients were in the age group of 19 to 62. All the patients were free from any known systemic diseases after medical examination with physician.

2.2. Ultrasonography

Ultrasonography was carried out using Philips ATL: HDI 3000. Transducer (linear): 5 to 12 mHZ. Ultrasonography was done for the salivary glands by the following procedure.

2.2.1. Parotid Gland

All the patients were subjected to ultrasonography. Parotid glands were scanned making the patients head turned sideways and extended. A transverse section was scanned starting from the angle of the jaw up to tragus. Next a longitudinal section was scanned. The ultrasound probe was adequately adapted to the surface of the skin by applying a sufficient amount of gel particularly in the region of the angle of the mandible. After the enlargement is identified the echogenesity, internal echoes, acoustic enhancement, shape, borders, calcifications and ductal pattern were assessed. The vascularity of the lesion was assessed by color and pulsed Doppler sonography.

2.2.2. Submandibular Gland

The submandibular gland was scanned making the patient’s head moderately extended. The transducer is moved transversely from the hyoid up to the horizontal ramus of the mandible in the midline of the neck. By shifting the scanner to one side, parallel to the horizontal ramus of the mandible, a clear image of the respective gland was obtained. After the lesion is located the echogenesity of the lesion, internal echoes, acoustic enhancement, shape, borders and the presence of calcifications and ducts were assessed. The vascularity of the lesion was obtained by color and pulsed Doppler method.

2.2.3. Sublingual Gland

The sublingual salivary glands were scanned by making the patients head moderately extended. The scanner was placed on the skin with sufficient amount of gel in the midline immediately below the mandible, allowing the visualization of both the salivary glands. Same as the other glands, after the lesion is located the echogenesity of the lesion, internal echoes, acoustic enhancement, shape, borders and the presence of calcifications were assessed. The vascularity of the lesion was obtained by color and pulsed Doppler method. The intra-oral salivary gland lesions were scanned by placing the probe horizontally below the zygomatic arch making the patients mouth open widely.

2.2.4. Lymph Nodes

Submandibular lymph nodes, submental lymph nodes and cervical lymph nodes were scanned for all the patients. Echogenesity of the lesion, internal echoes, acoustic enhancement, shape, borders and the presence of calcifications were assessed. The vascularity of the lesion was obtained by color and pulsed Doppler method.

After recording these sonographic findings the salivary gland enlargement were subjected to biopsy and fine needle aspiration biopsy to study the histopathological changes. The observations of sonographic findings and histopathological findings were then compared. It is aimed to describe the definite criteria and characteristic features of ultrasonography in salivary gland pathology. Thus an effort is made to get simple process to diagnose pathologic enlargement of salivary gland through ultrasonography.

3. Results

The present study comprised of 20 individuals with 12 females and 8 males. The age range of these individuals ranged from 14 to 72 years.

Individuals were also categorized based on the etiology of the enlargement.

The ultrasonography findings which include echogenesity, internal echoes, acoustic enhancement, shape, borders, calcifications vascularity and ductal findings of all the individuals are recorded.

4. Discussion

The clinical appearance of most of the salivary gland diseases appear in the form of swelling or enlargement. Hence, salivary gland diseases cannot be diagnosed based on the features of enlargement alone as the features of glandular enlargement overlap in most of the conditions. Current methods used for the diagnosis of salivary enlargements include sialography, CT and MRI scan and biopsy [3]. Sialography is helpful to diagnose the enlargements of inflammatory origin and it may not be helpful to identify the enlargements of neoplastic origin. Moreover the technique of sialography needs expertise and time consuming [8]. Since the other modalities of diagnostic methods are not satisfactory it is rightful thought to select ultrasonography and study its use for diagnosis of salivary gland enlargements. In the present study though the sample is small it covers inflammatory, non-inflammatory, benign and malignant enlargements of the salivary glands [9].
Ultrasonographic imaging of normal parotid gland results in a homogenous pattern of multiple median level echoes reflected from the multiple acoustic interferences of glandular parenchyma and stroma. The echoing of salivary gland is greater than the surrounding muscles and fat.

**Figure 1.** Ultrasonographic evaluation of sailadenosis

**Figure 2.** Ultrasonographic evaluation of sailadenosis

**Figure 3.** Ultrasonographic evaluation of sailadenosis
4.1. Sialadenosis

Sialadenosis is a non-inflammatory bilateral enlargement of salivary gland sometimes confused with Sjogren’s syndrome. In our observation the ultrasonographic observations are isoechoic with homogenous internal echoes and there was no variation in size. Thus sialadenosis can be differentiated from Sjogren’s syndrome with ultrasonography.

However in our observation in sialadenosis the ultrasonographic observations were isoechoic with homogenous internal echoes. Shape was roughly oval with diffuse borders. Calcifications, vascularity and dilated ducts were not present. Thus the shape and borders help to differentiate it from normal salivary gland (Figure 1, Figure 2, and Figure 3).

All the three cases of sialadenosis in our observation showed similar features in ultrasonography irrespective of the size of the gland. Since no other peculiar changes were seen like calcifications, vascularity and dilated ducts, sialadenosis on ultrasonography appeared as a mere enlargement of the gland. From this observation we can conclude that ultrasonography is a useful aid in the diagnosis of sialadenosis.

4.2. Chronic Inflammatory Disease

Ultrasonographic observations of chronic inflammatory disease in the parotid gland were observed as hypoechoic masses with non-homogenous internal echoes. Borders were regular with specks of calcification. Vascularity and dilated ducts were not observed (Figure 4). Identification of calcifications in the gland suggests that calcifications are common in long standing chronic inflammatory diseases [10]. The difference in echo nature is because of the inflammatory changes in the parotid gland. This finding is compatible with that of Mayumi Shimizu [11].

4.3. Developmental Swelling

Ultrasonography of bilateral developmental swelling (was diagnosed as accessory salivary gland on biopsy after ultrasonography) in the floor of the oral cavity was also recorded. On ultrasonography the image showed isoechoic gland with homogenous internal echoes. Borders were irregular in shape and diffuse. Image also showed adequate vascularity without calcifications and dilated ducts (Figure 5). This observation helped to suggest that it
is a normal salivary gland either a submandibular salivary gland or sublingual salivary glands extending as hyperplasia. But on surgical intervention it was found to be an accessory salivary gland, which has no connection with either submandibular or sublingual salivary glands. Biopsy also revealed that it is a normal gland with both serous and mucous acini.

Thus ultrasonography is helpful in the diagnosis of accessory salivary gland because the echo system of the normal gland and this accessory gland was same.

4.4. Sialolith

Ultrasonographic observations of sialolith in the present study showed isoechoic gland, homogenous internal echoes, posterior shadowing, irregular stone and intraductal calcification with dilated ducts (Figure 6). Sialoliths can be identified on intraoral oral radiographs when they are fully calcified. However, they cannot be interpreted when the salivary stone is in the process of calcification. The other modality to diagnose salivary stone is sialography. Sialography has its own limitations where it cannot be used in all glands. In such cases ultrasonography is very much beneficial as calcifications can be detected in the enlarged duct as a hyperechoic mass [8].

4.5. Benign Neoplasms

Three benign neoplasms were subjected to ultrasonography in the present study. Two were pleomorphic adenomas of the parotid gland and one was myoepithelioma of the minor salivary gland. On ultrasonography both the cases of pleomorphic adenoma showed hypoechoic mass, non-homogenous internal echoes, lobulated, spherical shape with vascularity and dilated ducts without calcifications. Borders were regular in one patient and irregular in other case [7,8,9]. The difference in border in each case might be attributed to their extensions to the periphery (Figure 7, Figure 8).
In myoepithelioma the ultrasonographic findings are hypoechoic with non-homogenous internal echoes. Outline of gland was oval in shape with irregular borders. Ultrasonography also showed adequate vascularity without calcifications. Clinically this lesion presented as a large swelling with smooth surface and regular borders. However, ultrasonographic findings peculiarly showed vascularity with non-lobulated appearance (Figure 9).

To conclude, though benign tumors have got the same echogenisity, myoepithelioma differs from pleomorphic adenoma with reference to the borders and lobulation.

4.6. Malignant Neoplasms

The present study we have evaluated ultrasonographic findings for two malignant tumors in which one is malignant pleomorphic adenoma of the parotid gland and the other being adenocarcinoma of the palate. In pleomorphic adenoma the ultrasound observations are hypoechoic mass with non-homogenous internal echoes [7,8,9]. The gland appeared oval in shape with irregular borders and multiple calcifications (Figure 10). In adenocarcinoma of the minor salivary gland of the palate the ultrasonographic observations are hypoechoic mass with non-homogenous internal echoes. Enlargement appeared oval in shape with regular borders. Ultrasonography also showed adequate vascularity without calcifications (Figure 11).

The present study revealed that there is no much difference in the ultrasonographic observations between benign and malignant tumors. But, the malignant tumors had non-homogenous internal echoes and non-lobulation appears to be the characteristic feature of malignant tumors.
Figure 10. Ultrasonographic evaluation of malignant pleomorphic adenoma

Figure 11. Ultrasonographic evaluation of adenocarcinoma

Figure 12. Ultrasonographic evaluation of lymph nodes
4.7. Lymphadenitis

It is difficult to diagnose lymph node enlargement and salivary gland enlargement in the submandibular area in the early stages. Usually the benign neoplasm of submandibular salivary gland will simulate lymph node as the neoplasm being small and slow growing. The enlargement of submandibular lymph nodes may occur in different conditions with different symptoms [12]. Wrong conclusion can be made when there is an enlargement in the submandibular region. But the present study gives characteristic ultrasonographic finding for the tumors of submandibular gland and lymph node enlargement in the submandibular region. Both tumors and lymph nodes are hypoechoic, non-calcified with vascularity. Salivary gland tumors showed irregular borders with non-homogenous internal echoes differing from lymph node enlargements showing regular borders with anechoic or homogenous internal echoes (Figure 12). These differences can help to diagnose whether the enlargement in the submandibular region is a lymph node or a salivary gland tumor.

5. Conclusion

From the present study we observed that ultrasonographic findings are very useful to diagnose sialadenosis, sialolith, accessory salivary gland, inflammatory condition and differentiation of salivary gland enlargement and lymph node enlargement in submandibular region.

Though slight variation was found in the present study with reference to ultrasonographic observation of benign neoplasm and malignant neoplasms, it gives good results to confirm malignancy because of the fact of unclear borders. Though ultrasonography suggests whether the enlargement is neoplastic, it could not replace the histopathological examination for final diagnosis. However, ultrasonography helps to find out calcifications in the tumor mass.

Our study gives a clear observation that ultrasonography is very useful in diagnosing lymph node enlargement and salivary gland enlargement in submandibular region. Further ultrasonography helps to establish correctly the accessory salivary gland tissue.

References