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ORIGINAL ARTICLE

A PROSPECTIVE STUDY TO ASSESS THE RELIABILITY OF ULTRASONOGRAPHY AS A DIAGNOSTIC AID IN VARIOUS SALIVARY GLAND PATHOLOGIES

Akshara Gupta[1], Achal Gupta[2], Kuber Sharma[3]

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ABSTRACT: AIMS AND OBJECTIVE: To assess the reliability of ultrasonography as a diagnostic aid in various salivary gland pathologies. **MATERIAL AND METHODS**: The present study was conducted in the department of radiodiagnosis, GR Medical College & JA group of hospitals, Gwalior during period of one year from August 2012 to October 2013. 62 patients with suspected inflammation or tumors of the major salivary glands were examined by high resolution real-time sonography. Sonographic characteristic of these lesions, including shape, margin, echogenicity, echotexture and vascularization, were studied. Presumed sonographic diagnosis was compared with the histopathology. Patients with periglandular pathology not involving salivary gland were excluded from study. **RESULT**: Out of 62 patients, 23(37.09%) had salivary gland tumors (16 benign, 7 malignant), 22(35.4%) had acute sialadenitis, 8(12.9%) chronic sialadenitis, 1(1.6%) lymphadenitis, 8(12.9%) patients had sialolithiasis, 3(4.8%) patients had abscess, 3(4.8%) fatty infiltration. Few patients had more than one pathologies. **CONCLUSION**: Inflammation is the most common pathology affecting salivary gland (48.3%). In acute inflammation, sonography helps to confirm or rule out abscesses or sialectasia. Salivary calculi can be diagnosed in most cases by sonography and sonography is a valuable primary evaluation for the visualization of salivary gland tumors. Ultrasound is able to distinguish benign from malignant tumors in 87% of cases. Tumor cannot be delineated completely by means of sonography, for which a CT or MRI should be performed.
KEYWORDS: Salivary gland, ultrasonography.

INTRODUCTION: Major salivary glands pathologies are a significant source of morbidity in pediatric as well as in adult population. Clinical examination is alone often insufficient to identify the origin and nature of lesion. Imaging is required in vast majority of cases. Sonography is usually first imaging modality after clinical examination. Being paired superficial structure, parotid and submandibular glands are suitable for high resolution ultrasound examination and its role is well established.[1,2] Sonography, being a real-time, non-invasive, painless, relatively inexpensive and radiation free method, is a valuable addition to salivary gland imaging modalities. The present study was done to assess its role in various salivary gland pathologies and its correlation with histopathology.

MATERIAL AND METHODS: The study was conducted in the Department of Radiodiagnosis, G R Medical College and J A Group of Hospitals, Gwalior (M.P.) from August 2011 to October 2012. The group under study was comprised of 62 patients of all age groups attending the various outdoor and indoor departments of hospital with sign and symptoms related to salivary gland diseases.

All the ultrasound examinations were performed with real time sonography equipment SSD4000SV (Aloka Trivitron Pvt. Ltd., Tokyo, Japan) using high resolution linear array transducer of frequency 7-12 MHz. As and when required, 3.5 MHz transducer was also used for adequate

penetration, particularly in cases of large salivary gland swelling. Acoustic coupling was achieved using standard sonographic gel. Refinement of images was achieved with the use of preprocessing and post processing. The selected images in different planes were stored on hard disc of machine.

Scanning techniques used for Evaluation: Transverse and longitudinal scans were obtained with the patient supine and the head turned away from the side being examined. Transverse scans were performed with the transducer perpendicular and inferior to the ear lobe. When performing longitudinal scans, particular attention was paid to the tail of the parotid gland which may be obscured by the ramus of mandible.

The submandibular gland was evaluated in transverse plane using a submandibular view which provided most of the information. Oblique and coronal adjustments were helpful to localize lesions and to trace vessels.

Colour-flow imaging was a useful adjunctive tool and performed whenever inflammation or a mass in seen on gray scale ultrasound.

Bilateral scanning was done for symmetry and for exclusion of clinically non-palpable lesions, as there was a chance of bilateral disease (e.g. Warthin's tumour). Regional nodal territories in the neck were included as part of ultrasound examination of the salivary glands.

The following sonographic parameters were studied in each Case:

1. Size of salivary gland.
2. Echogenecity of salivary gland.
3. Echotexture of salivary gland.
4. Vascularity of salivary gland.
5. Ductal system of salivary gland.
6. Presence of mass lesion.
7. Bilateral cervical region for evidence of cervical lymphadenopathy.

All the patients with suspected tumors underwent FNAC examination except those presented with acute inflammation of gland. Later those who were operated, their histopathology reports were also collected.

Data Analysis: Comparing the presumed sonographic diagnosis of salivary gland masses with the pathological results, the sensitivity, specificity, positive predictive value, negative predictive value and accuracy were determined. Chi-square test was used for the analysis of ultrasound characteristics of benign and malignant masses and $p<0.05$ was considered statistically significant.

RESULTS: The salivary gland diseases were seen in all age groups. Males (n=35) (56.45%) were more commonly affected than females (n=27) (43.55%). Non-neoplastic salivary gland pathologies (62.9%) were more common than neoplastic salivary gland pathologies (37.1%).

Inflammatory Diseases of Salivary Gland: Acute sialadenitis (66.7% patients) was the most common inflammatory pathology, followed by chronic sialadenitis, abscess and lymphadenitis in 22.4%, 9% and 3% patients respectively. Majority (n=24) (72.7%) of patients with inflammatory diseases of salivary gland belonged to < 30 years of age.

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Among inflammatory diseases, parotid gland was involved in 43.63% of patients, submandibular gland in 33.33% of patients and both parotid and submandibular glands were involved in 26.67% of patients. Sonography showed enlarged and hypoechoic salivary gland in 20(91%) out of 22 cases of acute sialadenitis. Heterogeneous echotexture of gland was noted in 10(45%) cases. Increased blood flow of the affected salivary glands was seen in all 22(100%) cases. Multiple salivary glands involvement was seen in 54.54% patients and associated cervical lymphadenopathy was seen in 18(81.82%) of cases. Most of the cases of chronic sialadenitis showed normal size and normal vascularity (75% cases) of affected salivary gland. Heterogeneous echotexture and hypoechoic echogenicity was seen in 7(87.5%) out of 8 patients. Adjacent lymph node enlargement was seen in 4 out of 8 i.e. 50% of patients.

Sialolithiasis: Submandibular gland was the most common site accounting for 85.7% of all cases, followed by parotid gland accounting for 14.3% of all cases of sialolithiasis. In 6(87.5%) out of 7 cases of sialolithiasis, calculi were extraglandular and showed ductal dilatation. 1(14.3%) case was intraglandular. Associated inflammation of salivary gland was seen in 87.5% of cases.

Tumors of Major Salivary Glands: In this study, benign tumors (69.57%) were more common than malignant tumors (30.43%). The age distribution of the patient with salivary gland neoplasm ranged from 1-80 years. Majority of the tumors in this study occurred between the age from 30-70 years (4th to 6th decade). Benign tumors were more common in 30-40 years. Malignant tumors were more common after 50 years. In this study out of 23 patients with salivary gland neoplasm, 14 (60.87%) patients were males and 9 (39.13%) were females. M: F ratio was 5:1. M:F ratio for benign tumors was 1:1 and M:F ratio for malignant tumors was 6:1.

Parotid gland was the most common site accounting for 91.30% of all cases followed by submandibular gland accounting for 8.7% of all salivary gland tumors. Among parotid tumors, 71.4 % were benign and 28.5% were malignant. Among submandibular gland tumors, 50% were benign and 50% were malignant.

All tumors were hypoechoic compared with the surrounding parenchyma. Most benign tumors (87.5%) had well defined borders, but 12.5% of malignant tumors also had well defined (sharp) borders. The internal structure of tumor was not a relevant indicator of malignancy. The CDS examination revealed that 68.7% of benign and 28.7% of malignant tumors were poorly vascularized, while 25% benign and 71.4% malignant tumors were well vascularized.

100% of pleomorphic adenoma were hypoechoic. 92.8% pleomorphic adenoma had well defined margin, while the remaining 7.1% had ill-defined margins. 55% of pleomorphic adenomas had a lobulated shape. 42.9% pleomorphic adenoma had homogeneous and 57.1% had inhomogeneous echotexture. The CDS examination revealed that 78.5% of pleomorphic adenoma were poorly vascularized, 14.3% were well-vascularized and absent vascularization was seen in 7.1% cases.

On pathologic diagnosis, the commonest tumor was pleomorphic adenoma which accounted for 60.4% of all cases followed by mucoepidermoid carcinoma, accounting for 17.4% of all cases.

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DISCUSSION: Sonography visualizes the sublingual, the submandibular, and the greater part of the parotid gland. Normally, the echostructure of the salivary gland is homogeneous. The echogenicity is higher than the surrounding muscles or fatty tissues.[3]

In cases of acute inflammation, the salivary glands are usually enlarged. The size should be compared with the healthy, contralateral side. In acute inflammation, the echogenicity of the gland decreases and the echo structure becomes more nonhomogeneous.[4] When abscesses are present, the echostructure is usually cystic or hypoechic lesion with reactive vascularity of surrounding parenchyma.[5,6]

The aim of the sonographic investigation in acute inflammation is to rule out sialectasia, which is due to sialolithiasis. In cases of chronic inflammation, sonographic changes are usually more moderate[7]. The structure of the gland becomes inhomogeneous and sometimes a few hypoechogenic lesions up to 1 cm in diameter can be visualized. These lesions usually have an eccentric, echogenic hilum and are assumed to be reactive lymph nodes. However, in chronic inflammation, a normal sonogram does not rule out subtle pathologic changes.[6,8,9]

Sialolithiasis was most frequently observed in the submandibular gland. Escudier MP et al,[10] Lustmann J et al,[11] Marchal F et al,[12] Zenk J et al[13] also described the same findings. Our results indicate that sonography is superior to plain film in the detection of salivary gland calculi because of its ability to detect nonopaque stones. The exact localization of a calculus (Intraductal vs intraglandular) is important for optimal therapy. In small calculus, this shadow is absent or visualized poorly. The sonographic assessment of these calculi is difficult.

Sonographically, all salivary gland tumors were hypoechogenic compared with normal parotid parenchyma.[3] Sonography is more sensitive than palpation in detecting salivary gland tumors. However, not all space-occupying lesions in the salivary glands are due to tumors; these may be caused by inflamed lymph nodes, tuberculosis, abscesses or sarcoidosis. Differentiation of intraglandular and extraglandular lesions was possible in majority of the cases.[14] Because most salivary tumors are located in the superficial part of the parotid gland, sonography successfully delineated 95% of the lesions. Only 5% of the tumors could not be delineated from the parapharyngeal space or from the base of the skull.

In these cases, CT or MR imaging is needed to show the full extent of the lesion. In smaller lesions, the border of the tumor was not sufficient to distinguish benign from malignant lesions, while in larger tumors, because of the good resolution of high-frequency transducers, sonography is better than CT or MRI in the detection of irregularly sharp margins of a mass. However, few of the malignant tumors had sharp borders.[15] Most of these were lymphomas or metastases in which the clinical diagnosis was often clear. The detection of enlarged ipsilateral cervical lymph nodes suggests a malignant lesion. Cervical lymph node staging can be performed sonographically with high accuracy.

CONCLUSION: The present study concluded that high resolution sonography, along with color Doppler sonography should be used as first line imaging modality in evaluation of salivary gland diseases. In acute inflammation, sonography helps to confirm or rule out abscesses or sialolithiasis. Salivary calculi can be diagnosed in most cases by sonography. Sonography is also a valuable primary evaluation for the visualization of salivary gland tumors. The ultrasound distinction of benign and malignant lesions in not precise but certain features should always raise the suspicion of malignancy. Ultrasound is able to diagnose malignant lesion in over 87% of cases.

Color Doppler may help in diagnosing malignancy when there is disorganized internal color flow. The accuracy can be further enhanced by FNAC under ultrasound guidance. When a tumor cannot be delineated completely by means of sonography, CT or MRI should be performed.

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Fig. 1: Sonographic image of pleomorphic adenoma of parotid gland showing a well-defined, ovoid, homogeneous and hypoechoic mass lesion with posterior acoustic enhancement.

Fig. 1

Fig. 2: Sonographic image of acute parotid inflammation showing enlarged and hypoechoic parotid gland with increased vascularity and enlarged intraparotid and cervical lymph nodes.

Fig. 2

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Fig. 3: Sonographic image of enlarged, hypoechoic submandibular gland with dilated submandibular duct secondary to obstructing calculus.

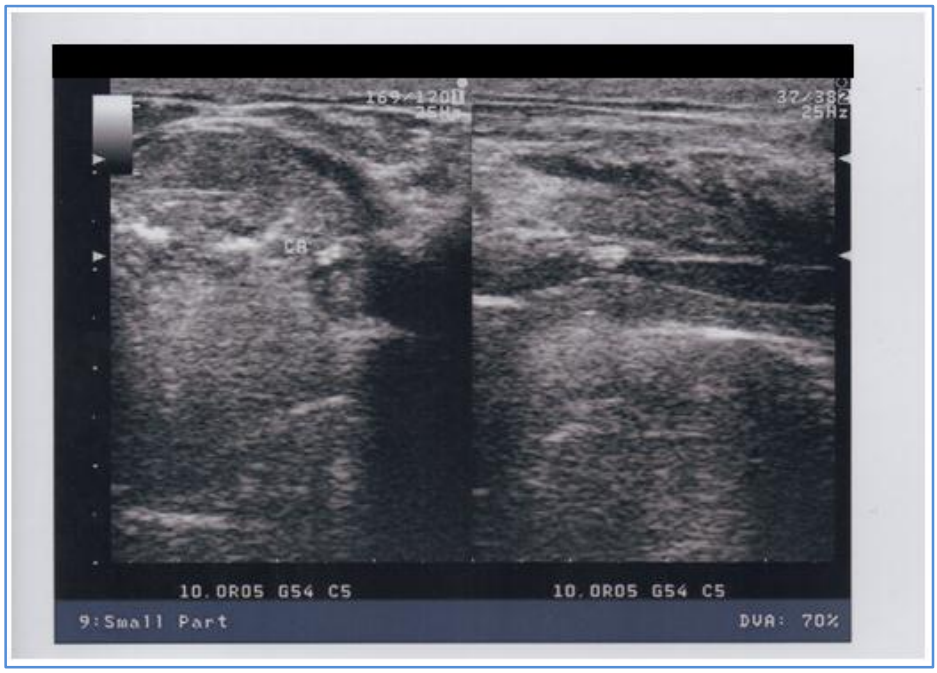

Fig. 3

Fig. 4: Accuracy of sonography in diagnosis of salivary gland tumor.

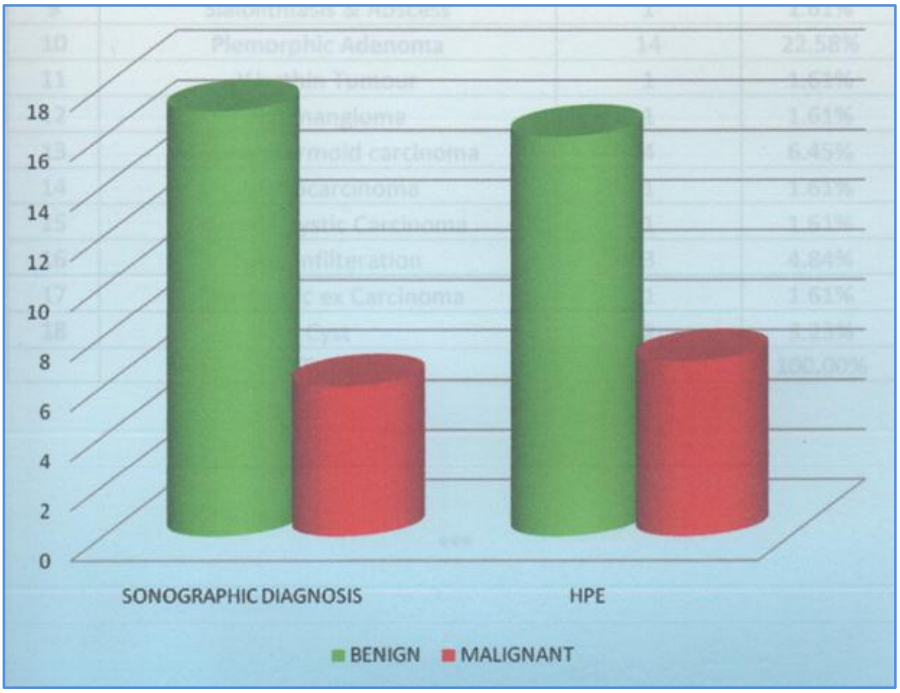

Fig. 4

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Fig. 5: Sonographic features of benign and malignant salivary gland tumors.

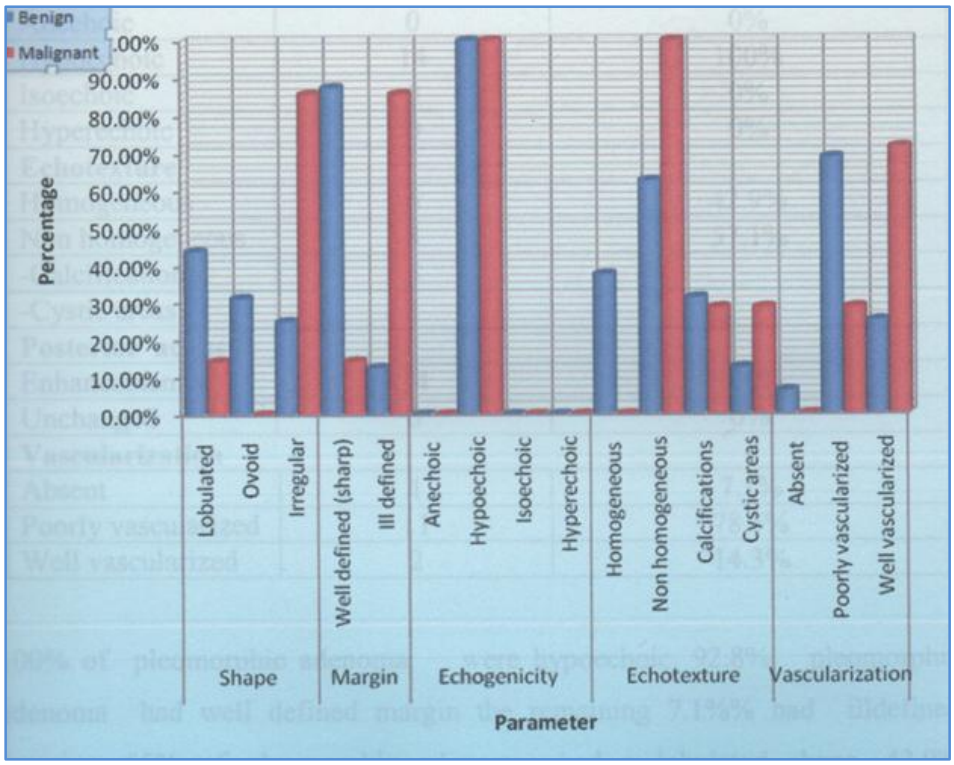

Fig. 5

AUTHORS:

1. Akshara Gupta
2. Achal Gupta
3. Kuber Sharma

PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of Radiodiagnosis, GR Medical College, Gwalior, M. P.
2. Professor, Department of Surgery, GR Medical College, Gwalior, M. P.
3. Post Graduate, Department of Surgery, GR Medical College, Gwalior, M. P.

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NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Akshara Gupta,
Sharad Kunj, Opposite Madhav Dispensary,
Hospital Road, Lashkar, Gwalior-474009.
E-mail: aksharagupta007@gmail.com

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