EVALUATION OF PAROTID GLAND PATHOLOGY BY ULTRASONOGRAPHY AND COMPUTED TOMOGRAPHY IMAGING

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ABSTRACT

BACKGROUND

Ultrasonography (USG) is the first diagnostic procedure to evaluate suspected parotid lesions. USG is capable of differentiating benign and malignant parotid masses. Computed Tomography (CT) is essential for confirmation of diagnosis and preoperative workup in staging of malignancy.

Aims and Objectives:
1. To evaluate role of ultrasound and computed tomography in imaging of different parotid gland pathology.
2. To know role of ultrasound and computed tomography imaging in the identification of different parotid gland tumours.

MATERIALS AND METHODS

A retrospective descriptive study of 80 patients was done. Study group consists of patients with parotid gland enlargement, who underwent ultrasonography with or without CT scan. Patients with normal parotid gland on USG are not included in our study. Out of 80 patients of ultrasonography having parotid gland enlargement, 36 patients underwent CT scan.

RESULTS

Out of 80 patients, most common pathology was infective or inflammatory origin and 98% sensitivity and specificity was seen. Second most common pathology was benign neoplasm where sensitivity was 88%, while specificity was 84%. 43 patients were found to have infective or inflammatory aetiology. 31 patients had neoplasm, among them, 22 patients had benign masses and 8 patients had primary malignant masses and 1 patient had intraparotid metastatic lymph node. Only 1 patient had congenital vascular pathology. In malignant masses, sensitivity and specificity were 80%.

CONCLUSION

Ultrasonography is the basic modality for parotid gland pathology and CT scan is the investigation of choice for parotid masses to confirm benign nature by the pattern of vascular enhancement and staging of malignancies of parotid gland.

KEY WORDS

Parotid Gland, Ultrasonography, Parotid Masses, Computed Tomography

BACKGROUND

Parotid gland is the largest salivary gland. It is located in the retromandibular fossa. Parotid gland pathology is divided into congenital, inflammatory, infective, benign and malignant neoplastic masses.

Sonography is the first imaging modality for evaluating parotid gland due to portability, easy to use, non-ionising, repeatability, real time dynamic study and less expensive as well as for follow-up comparison over and above role in Fine Needle Aspiration Cytology (FNAC).

Ultrasonography with the help of high-frequency linear transducer, colour Doppler and pulse wave Doppler mode is excellent for evaluating parotid pathology. However, deep lobe of parotid gland is sometimes difficult to evaluate on sonography, more in obese patients and having malignant mass in relation to deep lobe.

CT and Magnetic Resonance Imaging (MRI) are useful for detailed evaluation and deeper extension of the masses as well as staging of malignant tumour. The high sensitivity of CT/ MRI, which approaches 100% for detecting parotid neoplasms.[1] CT scan is excellent to detect bony invasion and calcification. However, on CT, low-grade mucoepidermoid carcinoma is difficult to differentiate from pleomorphic adenoma.

Aims and Objectives
1. To evaluate role of ultrasound and computed tomography in imaging of different parotid gland pathology for early diagnosis and for line of management.
2. To know sensitivity and specificity of ultrasound and computed tomography imaging in the identification of different parotid gland tumours.

J. Evolution Med. Dent. Sci./eISSN- 2278-4802, pISSN- 2278-4748/ Vol. 8/ Issue 10/ Mar. 11, 2019

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MATERIALS AND METHODS

Study Design
Retrospective descriptive study.

During the period from April 2016 to October 2017, a retrospective study of 80 patients was carried out. The study group consisted of patients from GMERS Sola Hospital with positive sonographic findings for parotid pathology. All the radiologists of Radiology Department have made substantial contributions by team work for this study. Sonography was done with high resolution linear transducer on Philips Affiniti 80 and Mindray DC-N3. Detailed history and presenting symptoms was evaluated. Ultrasound was performed on the patient in the supine position. A direct contact scanning technique with the use of the acoustic coupling gel was used and scanning was done in the sagittal, transverse, coronal and oblique sections. Diagnosis was confirmed by clinical correlation and by follow-up sonography. Histopathological diagnosis was done selectively in operated cases. All patients did not undergo other radiological and/ or required pathological investigations like FNAC and/ or biopsy. Patients with clinically suspected parotid pathology that turned out normal parotid on sonography and having extra parotid lesions and those patients who could not be followed up till the final diagnosis were not included in our study. Data analysis was done with the help of Microsoft Excel.

RESULTS
In the present study, out of 80 patients 45 were males and 35 were females.

Out of 80 patients, most common pathology was infective or inflammatory origin and 98% sensitivity and specificity was seen. Second most common pathology was benign neoplasm, where sensitivity was 88% while specificity was 84%. 43 patients were found to have infective or inflammatory aetiology. 31 patients had neoplasm, among them 22 patients had benign masses and 8 patients had primary malignant masses and 1 patient had intraparotid metastatic lymph node. Only 1 patient had congenital vascular pathology. In malignant mass, sensitivity and specificity were 80%.

Age Group	No. of Male Patients	No. of Female Patients	Total No. of Patients
Infants to 10 Yrs.	2	1	3
11 to 20 Yrs.	5	3	8
21 to 30 Yrs.	9	8	17
31 to 40 Yrs.	9	11	20
41 to 50 Yrs.	10	7	17
51 to 60 Yrs.	5	3	8
61 to 70 Yrs.	4	2	6
71 to 80 Yrs.	1	0	1
Total	**45 (56.2%)**	**35 (43.7%)**	**80**
Table 1. Age and Sex Distribution of Patients with Parotid Lesions			

	Diagnosis		No. of Cases	Total	%
1	Congenital	Haemangioma	1	1	1.25
		Lymphangioma	-		
2	Infection and Inflammation	Parotitis	31	43	53.7
		Parotitis with Abscess	10		
		Chronic Parotitis	2		
3	Neoplasm (31 patients - 38.7%)	Benign — Pleomorphic Adenoma	18	22	27.5
		Benign — Warthin's Tumour	4		
		Benign — Lipoma	-		
		Benign — Schwannoma	-		
		Malignant — Primary Malignant Mass	8	9	11.2
		Malignant — Secondary Intraparotid Metastatic Lymph Node	1		
4	Miscellaneous	Lymphoepithelial Lesions Associated Immuno-Compromised Patient	1	5	6.25
		Intraparotid Sinus Tract	1		
		Intraductal Obstructing Calculus	3		
	Total Number of Patients			**80**	
Table 2. Types and Distribution of Parotid Lesions					

	Congenital	Infective/ Inflammatory	Benign Lesion	Malignant
Gland Enlargement with Generalised Increase in Vascularity of Gland	-	41	-	-
Dilated Ducts	-	3	-	-
Abscess Formation in Gland	-	10	-	-
Cystic Masses	-	1	1	2
Solid Mass Lesion with Well-Defined Smooth Margin	-	-	22	2
Solid Mass Lesion with Ill-Defined Irregular Margin	1	-	-	6
Calcifications or Phlebolith	1	-	2	3
Calculus	3	-	-	-
Focal Increase Vascularity in Solid Mass	1	-	22	8
Lymph Nodes	-	31	6	5
Table 3. Ultrasound Findings of Parotid Pathology and Associated Findings				

	Benign	Malignant
Hypodense Mass	22	6
Hyperdense Mass	-	2
Well-Defined Margin	21	3
Ill-Defined Margin	1	5
Homogeneous Enhancement	16	3
Heterogeneous Enhancement	6	5
Low Enhancement	5	2
Intense Enhancement	17	6
Necrosis	3	5
Cystic Component	3	3
Fat Density	-	-
Calcification	4	3
Lymph Nodes	15	7

Table 4. CT Criteria of Benign and Malignant Parotid Tumour
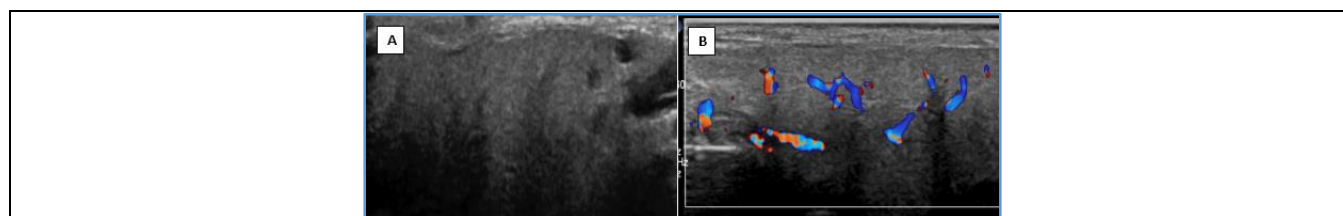
Figure 1. Acute Parotitis: Ultrasonography of Right Parotid Gland (a) B-Mode Shows Generalised Enlargement of Gland with Altered Echo Texture. (b) On Colour Doppler Mode Shows Prominent Vascularity
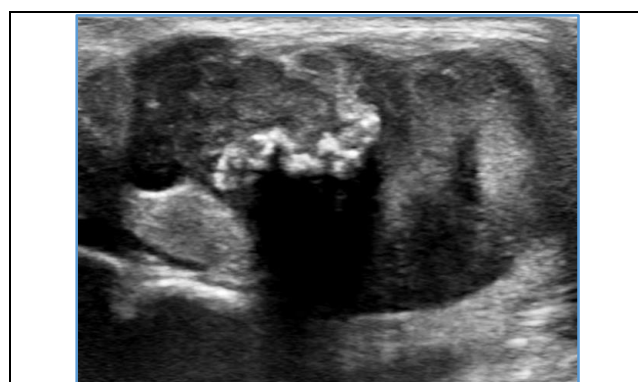

Figure 2. Pleomorphic Adenoma: Ultrasonography of Right Parotid Gland Shows Well-Defined, Lobulated, Hypoechoic Lesion with Coarse Calcification Within It
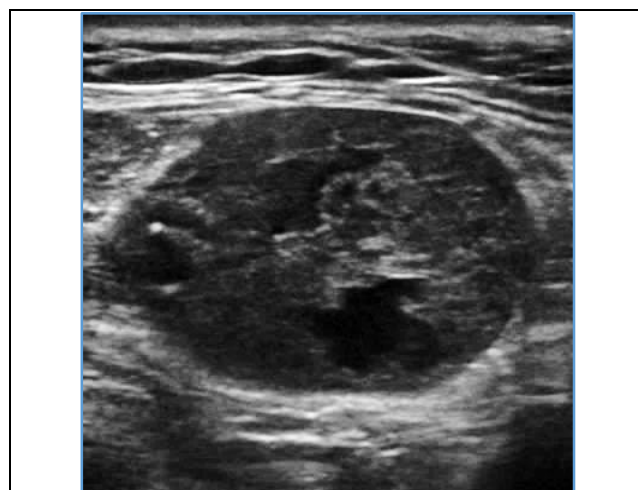

Figure 3. Warthin's Tumour: Ultrasonography of Left Parotid Gland Shows Well-Defined, Oval Shape, Hypoechoic Lesion with Irregular Cystic Areas Within It
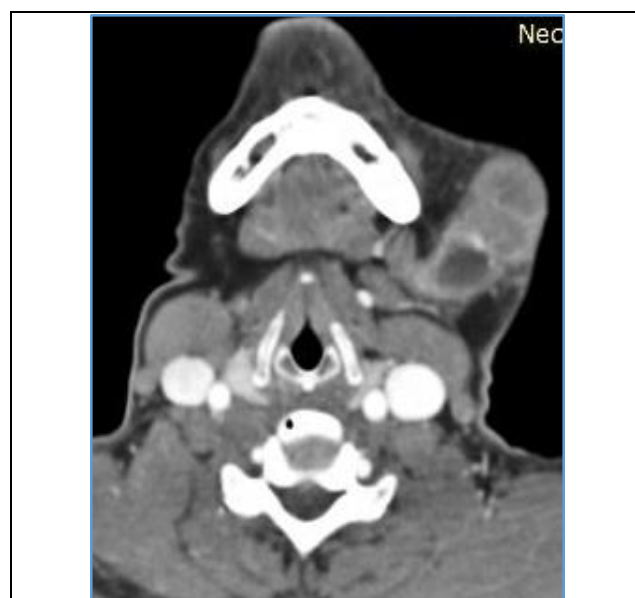

Figure 4. Adenocystic Carcinoma: CECT Scan Shows Heterogeneous Enhancing Irregular Mass Lesion with Non-Enhancing Necrotic/Cystic Areas Within Mass in Left Parotid Gland. Few Enlarged Lymph Nodes Noted in Left Submandibular Region

Figure 5. Mucoepidermoid Carcinoma: CECT Axial Scan Shows Large Heterogeneous Enhancing Solid Lobulated Irregular Mass Lesion with Non-Enhancing Necrotic Areas Within Mass in Left Parotid Gland. Lesion Shows Extension Up To Skin In Left Cheek Region
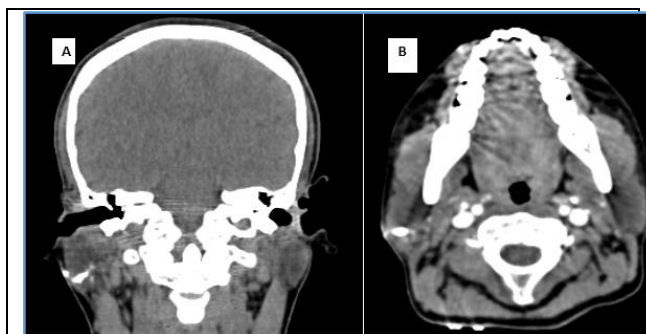

Figure 6. Post-Operative Patient with Intraparotid Sinus Tract: CT Sinogram (A) Coronal and (B) Axial Plane Show Intraparotid Sinus Tract in Right Parotid Gland in Coronal and Axial Images

DISCUSSION

Acute parotitis is the most common lesion of parotid gland.[2,3] In sonography, findings are diffuse enlarged hypoechoic gland with prominent internal vascularity. Inflammatory lymphadenopathy may be seen in neck.

Abscess formation may be seen in patient with acute parotitis. Abscess appears hypoechoic or anechoic lesion with irregular shape and posterior acoustic enhancement noted in sonography.

Sialolithiasis of parotid gland noted in about 10% - 20% of cases.[4] On sonography, calculus was seen as hyperechoic focus with distal acoustic shadowing. Associated findings are dilated intraparotid and excretory ducts. CT allows visualisation of large stones, but without their precise localisation and without the possibility of assessment of the ducts.

Benign tumours are more common than malignant tumour in parotid gland.

Pleomorphic adenoma is the most common benign tumour of parotid gland (80%).[5,6] It is more commonly seen in females of middle age group. Warthin's tumour is the second most common parotid tumour, predominantly seen in male patient in 6th decade.[7,8] Sonographic findings are oval heterogeneous hypoechoic mass, cystic component may be seen. Usually 1 – 4 cm in size and predominantly seen in parotid tail region. Moderate enhancement was noted on CT study.

Malignant parotid lesions are much less common than benign lesions.[9] Mucoepidermoid carcinoma is the most common parotid gland malignancy. This typically large tumour tends to have lobulated borders and moderate hyperdensity. Adenocystic carcinoma is the second most common malignancy of the parotid gland.[9] The sonographic criteria for malignant parotid mass are heterogeneous echo texture with cystic component, non-compressibility, ill-defined or speculated margin, punctate calcification and prominent vascularity and in advanced cases extension to skin and surrounding soft tissue is also seen. In metastatic lymphadenopathy lymph nodes show loss of central hilum with altered echo pattern, irregular margin and necrosis.

Haemangiomas are most common tumours in infants. On imaging, it appears as heterogeneous lesions with sinusoidal spaces and phleboliths as tiny calcifications.[10]

Other lesions of parotid glands are tuberculosis, lipomas, first branchial cleft cysts, schwannomas, collagen vascular disease such as Sjogren's syndrome, sarcoidosis like granulomatous disease and lymphoepithelial lesions associated with immune compromised status.

In present study, parotid gland pathology is classified into congenital, infective/ inflammatory, benign tumours, malignant tumours and miscellaneous conditions.

In present study, males are more affected than females. Middle age group are more commonly affected.

The most common parotid pathology is parotitis. Out of 80 patients, 43 (53.7%) patients had parotitis. Among them 32 patients had acute parotitis and 10 patients had parotitis with abscess formation. Parotitis is common in all age groups without any sex predilection.

In this study, second most common pathology is benign mass. Out of 80 patients, 22 (27.5%) patients had benign mass. Pleomorphic adenoma is the most common tumour in neoplastic lesions. Out of 22 patients of benign neoplasm of parotid gland, 18 patients (81.8%) had pleomorphic adenoma. While Warthin's tumour is the second most common tumour among benign tumours, which is similar to Renehan et al study.

In our study, pleomorphic adenoma is commonly seen in females and especially in middle age group. Characteristic sonographic findings of pleomorphic adenomas are homogeneous hypoechoic, well-defined margin, lobulated shape, low vascularity and posterior acoustic enhancement[11,12] which are similar with our sonographic findings.

Malignant parotid tumours are less common and only 11.2% are seen in our study, which correlate with Lin et al study.[13] Out of 31 patients of neoplastic lesion, only 8 patients (25%) had primary malignant tumour.

We have 8 patients of primary malignant tumour, out of them 5 patients (62.5%) had mucoepidermoid carcinoma and 3 (37.5%) patients had adenocystic carcinoma on histology report. The most common type of malignant tumour was mucoepidermoid carcinoma, which is similar with some other studies.[13,14]

On the basis of ultrasound, it is difficult to differentiate between benign and low-grade malignant parotid masses. FNAC or core biopsy is the confirmative for diagnosis.

In the present study only one patient was misdiagnosed as pleomorphic adenoma, because of small size (2 - 3 cm), well-defined hypoechoic border with low vascularity, but it turned out to be mucoepidermoid carcinoma on histopathological examination.

The sonographic characteristics of parotid masses including shape, margin, echogenicity, echo texture and vascularisation between benign and malignant lesions had no significant difference, which indicated that it is hard to distinguish malignant parotid masses from benign masses using sonography and that this method is unable to distinguish between different benign or malignant lesions, because some tumours and lesions have similar characteristics.[15-17]

Colour Doppler flow imaging may find parotid masses blood supply information, but the distribution in benign and malignant lesions had no significant difference and its value was limited which was consistent with Bradley et al[18] and Schick et al.[19]

In Mohammed et al[20] study, out of 242 patients 183 (75.6%) had benign neoplasms, 51 (21.1%) had malignant neoplasms and 8 (3.3%) had inflammatory or lymphatic lesions. While in our study, inflammatory conditions are the most common (53.7%) conditions followed by benign neoplasm (27.5%) and then malignant neoplasm (11.2%).

In our study, benign and inflammatory lesion sensitivity was more than 99%.

While parotid mass lesion sensitivity was also more than 99%, but specificity was 90% due to one female suspected as benign mass on CT scan was turned out to be malignant on FNAC.

CONCLUSION

On comparing the sonographic diagnosis of parotid gland masses with the pathological results, it was found that the sensitivity, specificity, positive predictive value, negative predictive value and accuracy with USG in differentiating inflammatory/ infective pathology and from neoplastic mass including lipoma, haemangioma is very high.

But it is challenging to diagnose or differentiate between benign and malignant parotid gland masses with USG and CT scan or both, where FNAC gives the final answer.

In staging of advanced malignant parotid mass, CT scan has got definite role.

To make a definite diagnosis in benign tumour from early, small or low-grade malignancy, ultrasound-guided FNAC is suggested for confirmation.

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