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Ultrasound and fnac correlation in parotid lesions

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Abstract

The distinction between benign versus malignant nature of parotid gland tumor is important in determining surgical recommendation and in patient management. With introduction of ultra sound elastography and contrast ultrasound, lesions are more efficiently characterized. The present study was thus conducted to establish a correlation between the various findings reported by sonography and cytology and to evaluate and compare the results of USG, fine-needle aspiration cytology (FNAC). This study was conducted as a facility based prospective observational study on all patients with Parotid swelling referred for imaging in the department of Radiodiagnosis, N.S.C.B.

Medical College and Hospitals, Jabalpur, Madhya Pradesh and sent for FNAC examination during the study period of 01 March 2019 to 31 August 2020. USG and FNAC examination was done for all the lesions. Diagnostic accuracy of USG diagnosis was calculated against FNAC diagnosis and expressed as percentage. The study was conducted on a total of 40 cases with mean age of 44.57 years (Range- 15-61 years). Out of 40 cases, 32 (80%) of the lesions were benign whereas 8 (20%) were malignant based upon FNAC findings. Majority of cases i.e., 27 (67.5%) were benign and 13 (32.5%) were malignant according to USG diagnosis. The sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of ultrasound in differentiation of malignant parotid gland lesion from benign lesion were 75.0%, 78.12%, 46.15%, 92.59%, 77.50% respectively.

This study highlights the usefulness of ultrasonography in the evaluation of parotid gland swelling as an adjunct to clinical examination. Ultrasound has added advantage of being safe, noninvasive, rapid, reliable, acceptable, economical and probable imaging modality without hazard of radiation. It can also guide interventional procedures like cysts & abscess aspiration and fine needle biopsy. It has also capability to detect small non palpable parotid masses. Tissue characterization is not

always possible by the ultrasound, it can help to differentiate a Malignant lesion from benign masses, with some limitation. Sonographic features of benign and malignant parotid lesion overlapped but some feature are suggestive of malignancy like heterogeneous echotexture, indistinct margin, increased vascularity, and absence of distal acoustic enhancement. So, it can be used as a valuable adjunct to clinical examination and should be offered to all patient presenting with parotid swelling.

Keywords: USG, parotid lesions, malignant, diagnostic accuracy, FNAC

Introduction

Parotid gland is readily accessible, superficial major salivary gland. Preoperative assessment of parotid swelling by sonography and cytology is especially important in our country because tuberculosis and metastatic squamous cell carcinoma often invade peri salivary lymph nodes which mimic as a parotid swelling.[1] Parotid gland pathologies mainly include Benign tumours, Malignant tumours and Chronic inflammatory lesions /disease.[2,3] The distinction between benign versus malignant nature of parotid gland tumor is important in determining surgical recommendation and in patient management. Clinical presentation of parotid tumors, especially the malignant depends on its involvement with facial nerve, staging it according to House Brackman scale, and involvement of other cranial nerve, as well as involvement of other 3 structure outside the parotid such as Masseter and Sternocleidomastoid muscle, mastoid, skin, ear canal, mandible, skull base.[4]

Different MR pulse sequences as diffusion-weighted MR imaging, dynamic contrast MR imaging, dynamic susceptibility contrast perfusion weighted MR imaging and MR spectroscopy were used for differentiating malignant from benign parotid lesions. However, their results are overlapping and MR imaging is expensive and time consuming. [5,6] Delayed contrast CT and perfusion CT of the parotid gland are of limited value and associated with radiation exposure and hazards of intravenous contrast reaction. [7,8] In modern clinical practice, high resolution ultrasound examination is commonly used for assessment of major salivary gland pathologies. Sonological evaluation is readily available, cost effective and avoid radiation exposure.[3] Ultrasound with Color Doppler study allows the identification of even small pathologies within parotid gland tissue with assessment of vascular perfusion pattern as well.[3] Some studies [9,10] found that ultrasound was able to differentiate between benign and malignant parotid masses with high accuracy.[4]

With introduction of ultrasound elastography and contrast ultrasound, lesions are more efficiently characterized. However, there are few limitations of this technology like the deep lobe of parotid gland cannot be thoroughly examined and resolution of tissue is poorer than in CT and MRI. Accurate subtyping and grading of salivary neoplasm are only possible with combined efforts of Radiologist and a Pathologist.[1] At the same time, fine-needle aspiration cytology (FNAC) is also gaining ground as a diagnostic modality and because of high rate of tumor seeding in open biopsy, FNAC has become an established technique for diagnosis4 but histology remains the final tool for diagnosis. Till date, ultrasonography (USG) is acting as a bridge between surgery and pathology. However, with increasing use, it is evident that USG is becoming more reliable as a predictor of the exact nature of parotid lesions.[1] The present study was thus conducted to establish a correlation between the various findings reported by

sonography and cytology and to evaluate and compare the results of USG, fine-needle aspiration cytology (FNAC).

Methodology

This study was conducted as a facility based prospective observational study on all patients with Parotid swelling referred for imaging in the department of Radiodiagnosis, N.S.C.B. Medical College and Hospitals, Jabalpur, Madhya Pradesh and sent for FNAC examination during the study period of 01 March 2019 to 31 August 2020. All the patient presenting with swelling in the parotid region (both symptomatic and asymptomatic) were included in our study whereas already Diagnosed cases of parotid lesion, patients with non-conclusive FNAC report, and patients not willing to participate were excluded from the study.

Figure 1: ultrasound and colour doppler machine.

Technical consideration

1. Color Doppler ultrasound unit- MINDRAY DC 30 ultrasound and color doppler System.
2. High frequency linear array ultrasound transducer with a range 5-11 MHz Linear array transducer was preferred to sector traducers because of wider near field of view and capability to combine high frequency gray scale and Color Doppler images. Examination was carried out with the highest frequency transducer i.e., with a median frequency above 10Mhz was useful in evaluation of internal structure of salivary gland. Doppler frequency was kept 8mhz 40–45-degree insonation angle, wall filter at lowest level, 2-5 mm sample volume, color and Doppler gain set at 30- 50 percent and asynchronous data collection. Doppler setting were standardised to compare the vascularity of parotid pathologies among different patient and to ensure intra individual consistency. Observation were recorded in the proforma and hard copy of imaging mode.

Technique of scanning

Patients were scanned in supine position. Basic examination was performed in gray scale at first with all variables (gain, focus, and depth) set to obtain an optimal image quality. Subsequently all lesion were assessed in color and /or power Doppler mode. Low flow mode and appropriate gain setting (slightly above the level of artifact) were used to detect as many vessels as possible. In doubtful cases tissue harmonic imaging mode was also applied. The lesions were examined in at least 2 perpendicular planes together with their surroundings. Neck was also scanned in all patient to asses lymph nodes.

Location, size and shape of the lesion was recorded along with tumor characteristics, its margin, texture, echogenicity, homogenecity), any regional lymph node, distal acoustic enhancement, and vascularity of lesion. Vascularization was assessed in four grades

- Grade 1 indicates no vessels visible in the mass in colour Doppler flow imaging (CDFI) low-flow mode;

- Grade 2 indicates a few vessel segments of no more than three blood vessels visible in the whole mass;
- Grade 3 indicates up to five vessels visible in the mass; and
- Grade 4 indicates more than five vessels visible in the mass.

In unilateral multifocal or bilateral lesion, the largest diameter of largest lesion that appeared as discrete mass was recorded.

Statistical analysis

Data was compiled using Ms Excel and analysed using IBM SPSS software 20 (Illinois, Chicago). Categorical data was expressed as proportions whereas continuous data was expressed as mean. Diagnostic accuracy of USG diagnosis was calculated against FNAC diagnosis and expressed as percentage.

Results

The study was conducted on a total of 40 cases with mean age of 44.57 years (Range- 15-61 years). Out of 40 cases, 32 (80%) of the lesions were benign whereas 8 (20%) were malignant based upon cytological diagnosis.

Table 1: Distribution according to sociodemographic variables

Sociodemographic variables		Benign (n=32)	Malignant (n=8)	Total (n=40)
Age	Mean (years)	44.53	44.75	44.57
Sex	Male	14 (43.75)	4 (50)	18 (45)
	Female	18 (56.25)	4 (50)	22 (55)

Mean age of patients with benign lesions was 44.53 years whereas mean age of patients with malignant lesions was 44.75 years. Out of total 40 cases 22(55%) were females out of which 18 cases had benign lesions and 4 cases were malignant. On the other hand, of the 18 male patients, 14 cases were benign and 4 were malignant. (Table 1)

Table 2: Distribution according to USG findings.

USG findings		Total (n=40)	Benign	Malignant
Number of lesions	Solitary	30 (81.25)	7(18.75)	37 (92.5)
	Multifocal	2 (66.6)	1 (33.3)	3 (7.5)
Size of lesion	Mean	24.1×14.3 mm	20.06×17.1 mm	-
Echogenicity	Hypoechoic	27(77.10)	8(22.8)	35 (87.5)
	Isoechoic	2(100)	0(0)	2 (5)
	Anechoic	3(100)	0(0)	3 (7.5)
Homogenicity	Homogenous	17(94.4)	1(5.6)	18 (45)
	Heterogenous	15(68.1)	7(31.9)	22 (55)
Shape	Oval	16(88.8)	2(11.1)	18 (45)
	Irregular	6(60)	4(40)	10 (25)
	Lobulated	5(83.33)	1(16.6)	6 (15)
	Rounded	5(83.3)	1(16.6)	6 (15)
Margins	Spiculated	2(50)	2(50)	4 (10)
	Irregular	6(66.6)	3(33.3)	9 (22.5)
	Circumscribed	24(88.8)	3(11.11)	27 (67.5)
Regional lymphnodes	Present	8(61.5)	5(38.5)	13 (32.5)
	Absent	24(88.8)	3(11.2)	27 (67.5)

Calcification	Present	4(80)	1(20)	5 (12.5)
	Absent	28(80)	7(20)	35 (87.5)
Intraparotid lymphnodes	Present	13(81)	3(18)	16 (40)
	Absent	19(79.16)	5(20.8)	24 (60)
Vascularity	High vascularity grade 4	2(40)	3(60)	5 (12.5)
	Moderate vascularity grade 3	7(70)	3(30)	10 (25)
	Poor vascularity grade 2	14(93.3)	1(6.6)	15 (37.5)
	no vascularity grade 1	9(90)	1(10)	10 (25)
Posterior acoustic enhancement	Present	18(94.7)	1(5.3)	19 (47.5)
	Absent	14(66.6)	7(33.3)	21 (52.5)

In our study, majority of lesions were solitary (92.5%), and majority of solitary lesions were benign. The average size of benign tumor was 24.1×14.3mm; of malignant tumor was 20.06×17.1mm and of non- neoplastic lesion was 18.7×17.9mm. About 35(87.5%) lesions were hypoechoic; of which 27(77.10%) were reported as benign and 8(22.8%) were malignant in pathological study. About 8 lesions (45%) were homogenous in echo pattern, out of which 17(94.4%) were benign and 1 (5.6%) were malignant. In our study, 10 cases (25%) were irregular comprising of 6(60%) benign and 4 (40%) malignant.

Our study reported well-defined circumscribed margin in 27 cases (67.5%) consisting of 24(88.8%) benign and 3(11.11%) malignant. About 9 lesions (22.5%) had irregular margin, and of them, 3 (33.31%) lesions were malignant. About 13 cases (32.5%) with regional lymph node enlargement on USG, were documented comprising of 8(61.5%) benign, and 5 (38.5%) malignant lesions. Grade 4 vascularity was noted in 5(12.5%) lesions, consisting of 2 benign and 3 malignant. Posterior Acoustic Enhancement presented in 19(47.5%) lesions including 18(94.7%) benign and 1 (5.3%) malignant. (Table 2)

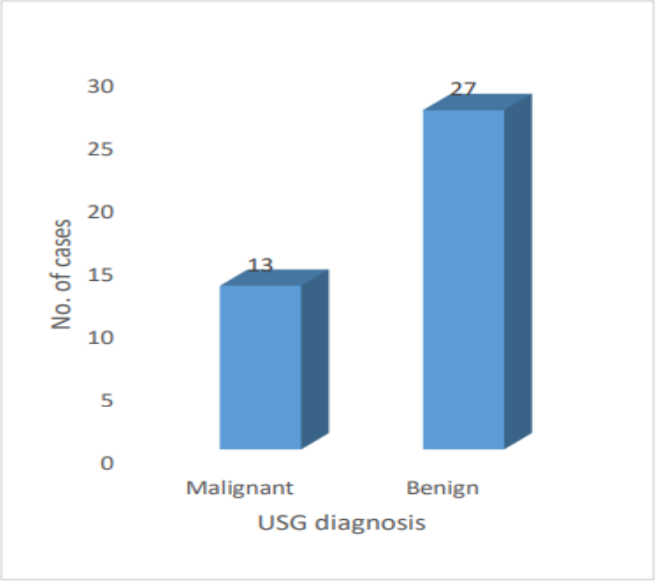

Figure 2: Distribution according USG findings.

Majority of cases i.e. 27 (67.5%) were benign and 13 (32.5%) were malignant according to USG diagnosis.

Table 3: Diagnostic accuracy of USG for parotid lesions.

Sonography	Cytological		
	Benign	Malignant	Total
Benign	25	2	27
Malignant	7	6	13
Total	32	8	40

The sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of ultrasound in differentiation of malignant parotid gland lesion from benign lesion were 75.0%, 78.12%, 46.15%, 92.59%, 77.50% respectively. (Table 3)

Discussions

Clinical, imaging, cytological and histological assessment must be closely coordinated in patient with parotid swelling for confirmation of diagnosis. Present study included 40 patients presented with parotid swelling referred from various departments for ultrasonographic evaluation. In our study the average size of benign tumor, malignant tumor and non- neoplastic condition respectively was 24.1×14.3mm, 20.06×17.1mm and 18.7×17.9 mm. Most of the patients had solitary lesions, and no bilateral lesion was found. We observed that size and singularity/multiplicity of lesions are not very helpful to differentiate between benign and malignant lesion. Wu et al reported maximum dimension of benign and malignant masses were 26.4 mm (±7.4 mm) and 27.1 mm (±6.5 mm), respectively.[2] Kovacevic et al reported their experiences with 80 parotid lesions (18 malignant, 62 benign). Of the 18 malignant tumors, 9 (50%) were solitary, 2 (11%) were unilateral multifocal, and 7 (39%) were bilateral. Of the 30 benign tumors, 24 (80%) were solitary, 4 (13%) were unilateral multifocal, and 2 (7%) were bilateral. Of the 32 nonneoplastic lesions, 21 (66%) were solitary, 6 (19%) were unilateral multifocal, and 5 (15%) were bilateral ($p > 0.05$).[11]

Echogenicity and homogenecity of the parotid lesions could be elicited on USG to determine the character of lesion. We observed that majority of lesions were hypoechoic (87.5%) and of them majority of lesions were benign. About 5.6% and 31.9% of the homogenous and heterogenous parotid lesions were malignant respectively. Rezopwaska et al reported in their study benign tumor mostly pleomorphic adenoma typically (85%) slightly hypoechoic as opposed to monomorhic adenoma and malignancies that were highly hypoechoic in more than 50 % cases.[3] Islam et al reported their experience with 39 patients shows 29 hypoechoic lesions (23 benign, 6 malignant lesion).[12] Mansour et al studied 33 parotid gland lesions in which 26 are benign tumor ,4 were malignant tumor, and 3 are duct dilatation. Out of 26 benign and 4 malignant, 7 and 2 lesions were heterogeneous respectively.[13]

We found that majority of malignant lesion appear irregular in shape on USG while majority of benign lesion appear with definitive shape like oval, rounded, lobulated. Shimizu et AL reported that out of 72 benign lesion 32 have oval shape ,36 have lobular shape (in which 20 are pleomorphic adenoma out of 22 pa),2 are polygonal shape and 1 lesion was unclassified. Out of 14 malignant lesion 2 oval,7 lobular,4 polygonal,1 unclassified.[14] Bialek et al reported their experience with 22 cases with pleomorphic adenoma reported 6 cases have oval shape 16 have polycyclic shape.[15]

We found most of benign parotid lesion have circumscribed margin, and malignant lesion have spiculated or irregular margin. Similarly, Shimizu et al reported their experience with patients of parotid gland lesion that, out of 72 benign lesion 40 show very clear margin,31 relatively clear margin ,1 have partially unclear margins, and out of 14 malignant lesion 2 have very clear margins, 5 have relatively clear ,7 have partially unclear margin.[14]

In present study, out of all the malignant lesions, 62.5% showed regional lymphadenopathy and the rest did not, in contrast 75% of all benign lesions did not have any regional lymphadenopathy, while 25% has enlarged nodes of most of are inflammatory lesion. Kovacević et al reported their experience with 48 parotid lesions in which they found regional lymph node enlargement in 10 cases, and all were malignant lesions. And out of 32 non-

neoplastic cases 12 show reactive enlargement of regional lymph node.[11]

In our study we found 10 cases with grade 1 vascularity (9 benign, 1 malignant); 15 had grade 2(14 benign,1 malignant); 10 had grade 3(7 benign, 3 malignant), while 5 had grade 4 vascularity (2 benign ,3 malignant). Majority of malignant lesion show moderate or high vascularity on USG and most of benign lesion show poor or no vascularity. Wu et al reported that 67 out of 189 cases to have grade 1 vascularity (62 benign ,5 malignant), whereas grade 2 vascularity was noted in 82 cases (75 benign,7 malignant),23 had grade 3 (20 benign,3 malignant),17 had grade 4(14 benign,3 malignant) vascularity. In present study we also concluded that majority of benign lesions have lower grade vascularity i.e. grade 1 and grade 2, while malignant lesions have higher grade vascularity i.e. grade 3 and grade 4. PAE suggested a benign tumor with sensitivity of 56.25% and a specificity of 87.5%. Kovacević et al reported PAE in 18 out of 48 lesions, in which 16 lesions were benign and 2 lesions were malignant. So, PAE suggested a benign tumor with sensitivity of 53% and a specificity of 89%.[11] LA mount et al reported that all solid lesion are hypoechoic and show posterior acoustic enhancement and majority of solid lesion are benign.[16]

The sensitivity, specificity, positive predictive value, negative predictive value, accuracy of ultrasound in differentiation of malignant parotid gland lesion from benign lesion were 75.0%, 78.12%, 46.15%, 92.59%, 77.50% respectively. Rzepakowska et al reported the sensitivity, specificity, and accuracy of US in differentiation of malignant from benign lesions in the parotid gland were 60, 95.2, and 90.3%, respectively. The predictive values were: PPV 66.8% and NPV 93.6%.[3]

Conclusion

This study highlights the usefulness of ultrasonography in the evaluation of parotid gland swelling as an adjunct to clinical examination. Ultrasound has added advantage of being safe, noninvasive, rapid, reliable, acceptable, economical and probable imaging modality without hazard of radiation. It can also guide interventional procedures like cysts & abscess aspiration and fine needle biopsy. It has also capability to detect small non palpable parotid masses. Tissue characterization is not always possible by the ultrasound, it can help to differentiate a Malignant lesion from benign masses, with some limitation. Sonographic features of benign and malignant parotid lesion overlapped but some feature are suggestive of malignancy like heterogeneous echotexture, indistinct margin, increased vascularity, and absence of distal acoustic enhancement. So, it can be used as a valuable adjunct to clinical examination and should be offered to all patient presenting with parotid swelling.

Ultrasound acts as an aid in distinguishing between benign and malignant lesions of parotid gland; however, its features overlap between the two entities, therefore ultrasound is not confirmatory for the same. To make a definite diagnosis FNAC or biopsy is advocated.

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