DIAGNOSTIC ACCURACY OF COLOR ANDPULSED DOPPLER IN THE EVALUATION OF PAROTID GLAND TUMORS.

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ABSTRACT

Background: Among all the salivary glands of human body, Parotid glands are the largest one and are exposed to various primary and systemic diseases. The most common benign parotid gland tumor is pleomorphic adenoma. Malignant tumors include 20% of parotid tumors most common of which are mucoepidermoid carcinoma and adenoid cystic carcinoma.

Objectives: To evaluate the diagnostic accuracy of color and pulsed Doppler in the evaluation of parotid gland tumor.

Methods: It was a cross sectional study by design carried out in Department of Radiology and Department of Maxillofacial Surgery, Mayo Hospital Lahore in a duration of two year. All the patients were examined with mind-ray 7.5 MHz linear transducer. There are three methods used collectively; Grey Scale, color Doppler and Pulsed Doppler in sonographic examination. Color Doppler and pulsed Doppler demonstrated number of blood vessels within the tumor, their peak systolic velocity and resistive index respectively. Histopathological results were correlated post operatively with the data obtained from Doppler ultrasound. Data was analyzed using SPSS 23.0.

Results: In this study, 192 patients were included. The mean age was 39.42+11.93 years. 58.85 % (112) were male patients and 41.15% (80) patients were females. The solid masses with regular and irregular margins were evaluated and the diagnostic accuracy of pulsed Doppler was found to be 87.5% taking histopathology as gold standard.

Conclusion: This study shows pulsed Doppler to be more accurate tool for diagnosis of parotid gland tumor as compared to color Doppler taking histopathology as gold standard.

Key Words: Parotid tumour, Doppler, Histopathology.

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INTRODUCTION

Salivary gland tumors include 80% of parotid gland tumors[5].Mucoepidermoid carcinoma is commonest malignancy of salivary glands.2.8%-15.5% of the salivary gland tumors are mucoepidermoid carcinoma[4]. Adenoid cystic carcinoma includes 2%-6% of parotid gland tumor. Nature of tumor can be determined by its location, cystic or solid or mixed components, with well-defined or uneven borders, associated regional lymphadenopathy and if it is a localized lesion or deeply invading the adjacent structures. (AI Khateeb et el, 2007). For the detection of new vessels, color Doppler sonography is used in and around tumors. Vessel distribution is classified as peripheral, scattered or peri-lesional and tumor grading of vascularization as grade (01) and grade (2-3)[2] Spectral Doppler is a kind of ultrasound which demonstrates spectral flow in the form

of resistive index and pulsatility index[2]. 100%, 65% and 81% are the sensitivity, specificity and diagnostic accuracy respectively of pulsed color Doppler according to previous studies[2,5].

Advantages of this study are availability, cost effectiveness and to prove the best results of pulsed color Doppler and easy approach to decide the surgical method of treatment. But the decision will be based on the diagnostic accuracy of the modality as compared to the gold standard like histopathology.

METHODS

Study was ethically approved from research ethics committee. Informed consent was taken from all patients. Ultrasound and color Doppler Ultrasound were used to examine patients with palpable mass at the angle of mandible, histology of which was unknown. Patients were examined with Mindray with 7.5 MHz transducer and the techniques included were grey scale, color and pulsed Doppler sonographic examination. Patients were examined by lying down the patient in the lateral position with tumor facing the machine. Total 192 cases were examined. This sample size was estimated using 95% confidence level, 10% desired precision and by taking expected sensitivity and specificity of pulsed color Doppler as 77%and 88% respectively. (2,5) And by using prevalence of malignant parotid tumors as 36%.

Exclusion criteria included painful, red, tender and recurrent masses. The tumor size was measured in two dimensions, its shape was determined whether rounded or oval and borders were seen whether regular or irregular. The tumor echogenicity was established whether hypoechoic, isoechoic or hyperechoic and its homogeneity was recorded whether homogeneous, slightly heterogeneous or highly heterogeneous. Any lymphadenopathy was seen. Its size, vascularity was noted and contralateral parotid gland was also examined. On color Doppler imaging its vascularity was determined whether having no vessel, few vessels or richly supplied by vessels. Vascular distribution was seen whether it was peripheral or central. On power Doppler its PSV, PI and RI were taken.

Ultrasound examination was considered to label the tumor whether it was benign or malignant on the basis of its shape, borders, homogeneity, lymph node enlargement, vascularity, PSV, RI and PI. The histopathology results were compared with ultrasound results. After that sensitivity, specificity, positive predictive value, and negative predictive value were calculated. Frequency distribution of all the parameters were calculated. Data was analyzed using SPSS 23in. Results were presented in mean, standard deviation and percentages. Diagnostic accuracy was calculated by using 2x2 contingency table.

RESULTS

The mean age of the patients (192) was 39+11.93 years with minimum and maximum ages of 20 & 60 years respectively.58.85% (112) patients were male and 41.15% (80) patients were females. 1.4:1 was the male to female ratio of the patients. It was observed that 154(80.3%) patients were with benign tumors and 38(19.7%) patients were with malignant tumors.

The study results showed that 154(80%) patients were diagnosed having benign tumor by color and pulsed Doppler and 38(20%) patients were diagnosed having malignant tumor by color and pulsed Doppler. (Table 1)

Table 1: Color Doppler Frequency

		Frequency	Percent
Color Doppler	Malignant	38	20
	Benign	154	80
	Total	192	100

P-value for vascularity degree was 0.025 and is significant. The study results showed 86.8% of positive predictive value and 82.4% of negative predictive value. In this study 133(68.9%) patients showed peripheral vessel and 59(31.1%) patients did not show any peripheral vessel. (Table 2)

Table 2: Peripheral vessels frequency

		Frequency	Percent
Peripheral vessels	Yes	133	68.9
	No	59	31.1
	Total	192	100

P-value for peripheral distribution was 0.005 and it is significant. Sensitivity, specificity and diagnostic accuracy were 100%, 68% and 80% respectively.

DISCUSSION

The mean age in the study population was similar as evaluated by Vankatesh et al[6] showed that 46.43 years was mean age for benign tumors and 56.15 years was average age for malignant tumors. Hence although the mean peak occurrence is around 45 years of age for the benign tumors and approximately 55 years for the malignant tumors[7].In this study 58.85%(112) patients were males and 41.15% (80%) patients were females. The male to female ratio of the patients was 1.4:1. Which is consistent with Araya J et al[14] which showed that male to female ratio was 1.4:1 for benign tumors and 1.22:1 in malignant ones. This study included

benign and malignant tumors of parotid gland. About 154 (80%) of tumors were benign and 38 (20%) tumors were malignant which is in concordance with the study conducted by Maahs LGP et al in which 159 cases were selected and 124(77%) had benign neoplasms, 35 (23%) were malignant neoplasms. In present study, pleomorphic adenoma was the most common benign parotid tumor about 77(50%) cases out of 154 benign cases and mucoepidermoid carcinoma was most common malignant tumor 17 cases (43.8%) out of 38 malignant cases (Table no.2B). Adenoid cystic carcinoma was 14(37.5%) cases. The frequency for benign tumor is high and for malignant tumors it is low which is consistent with the study conducted by Lawal O A et al[9] in which percentage of pleomorphic adenoma was 40.9% and for adenoid cystic carcinoma it was 22.5%. Using B-mode Grey Scale Sonography, all the parotid gland tumors whether benign or malignant appeared as hypoechoic masses. Rzepakowska et al[10] reported that 80% of benign tumors presented as slightly heterogenous and 60% of malignant neoplasms were highly heterogenous. Regarding the homogeneity of parotid gland masses, 38(20%) of patients showed heterogeneous consistency and 154(80%) of patients showed homogeneous consistency with insignificant p-value. Dumitriu et al[1] and shick et al[11] reported that echogenicity is not very reliable criterion for diagnosis of parotid tumors. Sensitivity, specificity and diagnostic accuracy of current study were 86%, 82% and 84% respectively which is completely in concordance with study done by El-Khateeb et al which showed that 14(87.5%) cases out of 18 malignant cases had irregular borders and 23(82.1%) cases out of 28 benign cases showed regular border with 87.5%,82.1% and 84% were the sensitivity, specificity and diagnostic accuracy respectively. To sum up our Grey Scale Sonography findings, benign and malignant parotid gland tumors showed a significant difference related to the borders, hypoechogenicity and enlargement of intra-parotid lymph nodes. Bradely et al[12] found that not a single Grey Scale Sonography criterion was statistically significant to rule out benign and malignant lesion. On the basis of histopathological results, Grey Scale Sonography is not a very reliable modality to differentiate benign from malignant parotid gland lesion. Venkatesh et al[6] reported that malignant tumors showed moderate to high vascularity in 52% and 50% respectively and 81% of benign tumors did not show any vascularity. Using Color Doppler Sonography, in our study benign tumors showed peripheral vascularity and malignant tumors showed scattered (hilar) type of vascularity. In our study sensitivity and specificity for peripheral vessel were 100% and 68% .59 (100%) cases out of 59 malignant cases did not show peripheral vascularity whereas 91(68%) cases out of 133 benign cases showed peripheral vascularity. El-Khateeb et al[2] also mentioned that no malignant cases showed peripheral vascularization and 17 cases out of 28 benign cases showed peripheral vascularization. Twenty-two (11.1%) patients showed central vessel whereas 170 (88.9%) patients did not show central vessel. Shick et al (51) reported that 8 (72%) cases out of 11 malignant cases showed peak systolic velocity of greater than 45cm/s and 32 (88%) cases out of 36 benign cases showed peak systolic velocity of less than 45 cm/s and the sensitivity of PSV was 72% and specificity was 88% in the diagnosis of malignant parotid tumors. Mazaher et al[5] stated that PSV has sensitivity of 100% in diagnosis of malignant parotid gland masses. 18 (100%) out of 18 malignant cases showed peak systolic velocity of greater than 45 cm/s supporting the findings of current study. Bradely et al (12) reported that peak systolic velocity had wide range of measurements and benign and malignant tumors did not show any significant difference in PSV.

Strymple et al[15] reported that PSV value was 4 to 90 cm/s (mean 25.15 cm/s) in benign tumors and it was 4 to 68cm/s (mean 32.74cm/s) for malignant tumors.

In the present study the RI is greater than 0.7 in 132 cases (69%) and it is less than 0.7 in 60 (31%) of cases. In our study 0.7 was best cut off value for RI having 100% sensitivity so that all the malignant masses can be diagnosed. All of the 60 (100%) cases out of 60 malignant cases showed a resistive index of less than 0.7 and 113 (85.7%) cases out of 132 benign patients showed RI of greater than 0.7. 100%, 85% and 91% are the sensitivity, specificity and diagnostic accuracy of RI respectively. Khateeb et al[2] also reported that 18 (100%) cases out 18 malignant cases showed RI of less than 0.7 and 24 (85.7%) out of 28 benign cases showed RI of greater than 0.7 and showed sensitivity, specificity and diagnostic accuracy of 100%,85.7% and 90%. Davachi et al[14] reported that mean RI values were 0.77+0.1887 in malignant tumors and 0.78+0.1167 in benign tumors. In our study 75% (144) of the patients were diagnosed benign on histopathology and 25% (48) patients were diagnosed malignant on histopathology.

Parotid gland tumors are very common and may be reported in 5-10% of cases (12) but if to be diagnosed preoperatively by simple diagnostic method, it can be helpful in patient welfare and aid clinical management.

CONCLUSION

According to our study results the pulsed Doppler is more sensitive and specific tool for diagnosis of parotid gland tumor with higher diagnostic accuracy as

compared to color Doppler tool taking histopathology as gold standard.

ETHICAL APPROVAL

The study was approved by the Institutional Review Board of King Edward Medical University, Lahore via reference No. 157/RC/KEMU 20 Dated: October 13, 2014.

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AUTHOR'S CONTRIBUTIONS

ZZ: Manuscript writing, Data collection
NR: Data collection, Manuscript writing (Discussion)
IHD: Data Analysis, Editing, Proof reading
FN, MI: Literature Review, Data collection
SS: Literature Review, Discussion