

ORIGINAL RESEARCH

DIAGNOSTIC ROLE OF ULTRASONOGRAPHY IN TUMORS OF MAJOR SALIVARY GLANDS

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ABSTRACT

Introduction: Major salivary glands pathologies are a significant source of morbidity in general population. The role of ultrasonography in evaluation of salivary glands masses is become increasingly important due to availability of high frequency probe which permit visualization of more subtle anatomical and pathological details.

Objectives: The study was conducted to determine the diagnostic role of real-time ultrasonography & color Doppler in diagnosis of major salivary gland tumors.

Material and methods: This study was conducted in the Radiodiagnosis, Department of Gajra Raja Medical College and Hospitals, Gwalior (M.P.) in USG Machine SSD4000SV (Aloka Trivitron) from August 2011 to September 2012. A total 46 patients was enrolled in study after taking detailed history and relevant clinical examination. Subsequently the patient was subjected to real time ultrasonography followed by histological examination by On-site fine needle aspiration cytology.

Results: According to the study out of 46 major salivary gland tumors, benign tumors 32(69.57%) were more common than malignant 14 (30.43%). The age distribution of the patients with salivary gland neoplasm ranged from 1-80 years and majority of belongs to the 30-70 years age group. Male : Female ratio for malignant tumors is 6:1 and equal in benign tumors.

Parotid gland was the most common site accounting for 91.30% followed by submandibular gland (8.7%) of all salivary gland tumors. On USG examination all tumors were hypoechoic. 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. According to the study the commonest tumors was pleomorphic adenoma which accounted for 60.87% of all cases followed by mucoepidermoid carcinoma(17.4%)of all cases confirmed by histopathological examination.

Conclusion: Ultrasonography is a highly sensitive, specific,easily available and affordable imaging modality to assess salivary gland tumors.however it is more sensitive for detecting benign tumors and more specific for malignant tumors.

Key Words: Ultrasonography, Major Salivary Glands, Tumors, Pleomorphic Adenoma, Warthin tumor, Adenocarcinoma.

INTRODUCTION

Salivary glands pathologies are a significant morbidity in general population. Salivary gland tumors (SGTs) account for about 3% of head and neck tumor¹. Only Clinical examination is not sufficient to identify the nature of lesion. Ultra Sonography is first imaging modality after clinical examination required in most of cases^{2, 3}. Ultrasound is used to identify salivary gland tumors, whether it is intra or extraglandular⁴. Color Doppler may help in differentiation between benign & malignancy when there is disorganized internal color flow. The accuracy can be further enhanced by FNAC under ultrasound guidance⁵. CT and MRI are best diagnostic aid but are highly expensive and not universally available.^{6, 7, 8}. So we can say that High resolution ultrasound has played a key role in assessment of tumors of salivary gland.

MATERIAL AND METHODS

This study was conducted in the Radio-diagnosis Department of Gajra Raja Medical College and Hospitals, Gwalior (M.P.) from August 2011 to September 2012 . A total 46 patients was enrolled in study. patient was subjected to real time ultrasonography followed by histological examination by On-site fine needle aspiration cytology.

INCLUSION CRITERIA

Total 46 patients of all age groups attending the various outdoor and indoor departments of hospital with sign and symptoms related to salivary gland tumors.

EQUIPMENT

All the ultrasound examination was performed with real time sonography equipment SSD4000SV (Aloka Trivitron Pvt. Ltd., Tokyo Japan) by using linear array and 3.5 transducer.

RESULTS

The present study was conducted in the department of radio diagnosis, Gajra Raja medical college and J.A. Group of Hospitals, Gwalior, from August 2011 to Oct.2012 .A total of 46 patients with clinical symptoms pertaining to the salivary gland tumors referred

from E.N.T., Medicine and Surgery Department, were assessed by high resolution ultrasonography.

According to the study Out of 46 major salivary gland tumors benign tumor's 32(69.57%) were more common than malignant 14 (30.43%) (Table-1). The age distribution of the patients with salivary gland neoplasm ranged from 1-80 years and Majority of belongs to the 30-70 years age group. Benign tumors were more common in 30-40 years age group. Malignant tumors were more common after 50 years of age (Table-2)

Male: Female ratio for malignant tumors is 6:1 and equal in benign tumors. (Table-3). On USG examination all tumors were hypoechoic. 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. According to the study the commonest tumors was pleomorphic adenoma which accounted for 60.87% of all cases followed by mucoepidermoid carcinoma (17.4%) of all cases confirmed by histopathological examination.

In the study Parotid gland was the most common site accounting for 42/46 (91.30%) followed by submandibular gland 4/46 (8.7%) of all salivary gland tumors. All of 42 parotid tumor's 30(71.4%) were benign and 12(28.5%) were malignant. where's in submandibular gland 50% were benign and 50% were malignant tumors. All patients presented with swelling. Features of rapid growth, pain, and associated facial paralysis were considered as signs of malignancy. Ten out of 46 patients presented with pain in swelling, all are malignant. Pain occurred in 71.4% of malignant tumors. Two patients with malignant tumor presented with facial nerve palsy accounting for 4.3%. Deep lobe involvement was seen in 2 patients presenting as parapharyngeal masses, in malignant tumor accounting for 4.3% of all tumor's. 4 patient with malignant tumor presented as lymph node swelling in the cervical region 8.7% of all tumors (Table-4)

All tumors were hypo echogenic 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 (Table-5).

In this study all neoplastic ultrasonography diagnosis confirmed by histopathological examination & found that the pleomorphic adenoma (**Figure-1**) was commonest which accounted 60.4% followed by mucoepidermoid carcinoma . 17.4% and accounting for Adenocarcinoma 4.35% (**Figure-2**) of all cases (Table-6,7). Over all In our study, Ultrasonography showed a sensitivity of 100% and specificity of 87.5% for benign tumors and 87.5% sensitivity and 100% specificity malignant tumors after confirmation all sonographic finding of all pathology by histopathology examination.

Table 1: Relative frequency of benign and malignant major salivary gland tumour

S.No.	Type Of Tumor	No. Of Cases	Percentage
1	Benign	32	69.57%
2	Malignant	14	30.43%
3	Total	46	100%

According to the study benign tumor's (69.57%) were more common than malignant tumors (30.43%).

Table 2: Age distribution of patients with salivary gland neoplasm

Age in years	Benign		Malignant		Total	
	NO.	%	NO.	%	NO.	%
0-10	2	4.35%	0	0.00%	2	4.35%
10-20	2	4.35%	0	0.00%	2	4.35%
21-30	2	4.35%	0	0.00%	2	4.35%
31-40	14	30.43%	2	4.35%	16	34.78%
41-50	6	13.04%	2	4.35%	8	17.39%
51-60	4	8.70%	2	4.35%	6	13.04%
61-70	2	4.35%	6	13.04%	8	17.39%
71-80	0	0.00%	2	4.35%	2	4.35%
Total	32	69.57%	14	30.43%	46	100.00%

The age distribution of the patients of patients with salivary gland neoplasm ranged from 1-80 years. Majority of the tumors in this study occurred between the age from 30-70 years (4rd to 6th decade). Benign tumors are more common in 30-40 years. Malignant tumors are more common after 50 years.

Table 3: Sex distribution of patients with salivary gland neoplasm

Sex	Benign		Malignant		Total	
	No.	%	No.	%	No.	%
Male	16	34.78%	12	26.09%	28	60.87%
Female	16	34.78%	2	4.35%	18	39.13%
Total	32	69.57%	14	30.43%	46	100.00%

In this study out of 46 patients with salivary gland neoplasm, (60.87%) patients were males and (39.13%) were females.

M:F ratio is 5:1

M:F ratio for benign tumors is 1:1

M:F ratio for malignant tumors is 6:1

Table 4: Mode of presentation**Symptoms of salivary gland tumors**

Symptoms	No. Of Patients	Percentage
Swelling	46	100%
Pain	10	21.7%
Facial Palsy	2	4.34%
Cervical Node Swelling	4	8.7%
Parapharyngeal Mass	2	4.34%

All patients presented with swelling. Features of rapid growth, pain, and associated facial paralysis were considered as signs of malignancy. Pain occurred in 21.7% of malignant tumors. Two patients with malignant tumor presented with facial nerve palsy accounting for 4.3%. Deep lobe involvement was seen in two patients presenting as parapharyngeal masses, in malignant tumour accounting for 4.3% of all tumors. Four patient with malignant Tumors presented as lymph node swelling in the cervical region 8.7% of all tumors.

Table 5: Ultrasonographic features of benign and malignant Salivary gland tumour histological diagnosis

Parameter		Benign Tumor (n = 32)		Malignant Tumor (n = 14)	
		No.	%	No.	%
Shape	Lobulated	14	43.75%	2	14.29%
	Ovoid	10	31.25%	0	0.00%
	Irregular	8	25.00%	12	100.00%
Margin	Well defined (sharp)	28	87.50%	2	14.29%
	Ill defined	4	12.50%	12	85.71%
Echogenicity	Anechoic	0	0%	0	0.00%
	Hypoechoic	32	100%	14	100.00%
	Isoechoic	0	0%	0	0.00%
	Hyperechoic	0	0%	0	0.00%
Echotexture	Homogeneous	12	37.5%	0	0.00%
	Non homogeneous	20	62.50%	14	100.00%
	Calcifications	10	31.25%	4	28.57%
	Cystic areas	4	12.50%	4	28.57%
Vascularization	Absent	2	6.25%	0	0.00%
	Poorly vascularized	22	68.75%	4	28.57%
	Well vascularized	8	25.00%	10	71.43%

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.

Table 6: Ultrasonographic features of pleomorphic adenoma

Parameter	Pleomorphic adenoma n =28	
	No.	%
Shape		
Lobulated	14	50%
Ovoid	8	25%
Irregular	6	18.7%
Margin		
Well defined	26	92.8%
Ill defined	2	7.1%
Echogenicity		
Anechoic	0	0%
Hypoechoic	28	100%
Isoechoic	0	0%

Hyperechoic	0	0%
Echotexture		
Homogeneous	12	42.9%
Non homogeneous	16	57.1%
-Calcifications	10	21.7%
-Cystic areas	2	7.1%
Posterior acoustic		
Enhancement	28	100%
Unchanged	0	0%
Vascularization		
Absent	2	7.1%
Poorly vascularized	22	78.5%
Well vascularized	4	14.3%

100% of pleomorphic adenoma was hypoechoic. 92.8% pleomorphic adenoma had well defined margin the remaining 7.1% had ill-defined margins. 55% of pleomorphic adenomas had a lobulated shape. 42.9% pleomorphic adenoma had homogenous and 57.1% had non-homogenous 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%

Table 07: The distribution of benign and malignant tumors, according to histological type

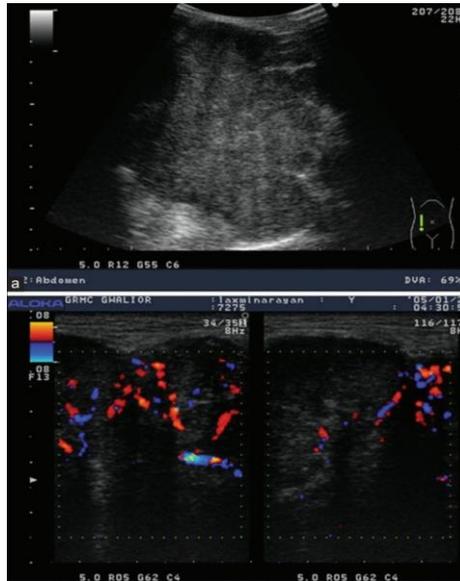
Salivary Gland Tumor		Cases (n=46)	Percentage
Benign	Pleomorphic adenoma	28	60.87%
	Warthin tumor	2	4.35%
	Haemangioma	2	4.35%
Malignant	Mucoepidermoid carcinoma	8	17.39%
	Adenoid cystic carcinoma	2	4.35%
	Adenocarcinoma	2	4.35%
	Pleomorphic ex carcinoma	2	4.35%

According to the study the commonest tumors was pleomorphic adenoma which accounted for 60.4% of all cases followed by mucoepidermoid carcinoma, accounting for 17.4% of all cases.

Figure 1: Color Doppler ultrasonography image of pleomorphic adenoma of Parotid gland



Figure 2: (a and b) Grayscale and Color Dopplerultrasonography image of adenocarcinoma of Parotid gland.



DISCUSSION

The present study was undertaken to evaluate the role of high ultrasonography color Doppler sonography in the evaluation of salivary gland tumor pathology. A total 46 patients included in this study. All cases were properly followed up sonographically /medically /surgically /pathologically wherever indicated to arrive at a final diagnosis.

DISTRIBUTION OF SALIVARY GLAND TUMORS BY AGE AND SEX

Benign salivary gland tumors were observed in 32 (69.5%) patients comprised of 16 (50%) males and 16 (50 %) females.

Pleomorphic adenoma was the most common benign salivary gland tumor that was encountered, affecting 28 (60.87%) patients comprised of 12(42.8%) males and 16(57.1%) females .Females were slightly more affected than males. Majority 14 (50%) of patients with pleomorphic adenoma belonged to the 31-39 years age group followed by 6 (21.4%) patients in 41-50 years age group, 2 (14.3%) patients in 51-60 years age group 1 (7.1%) patients in 01-10 age group and 2 (7.1%) patients in 11-20 age group.

SilversA Ret al, Rene hanAet al, EllisGLet al found that, pleomorphic adenoma occurred in the fourth and fifth decades of life but may arise at any age. **Rene hanAet al** described a slight predominance in women⁹⁻¹¹.

Two patient with Warthin tumor and two patient with haemangioma was seen in the 61-70 and 1-10 years age group respectively ,both were males.**Rene hanAet al, EllisGLet al** reported that Warthin tumor was most common in elderly males in the fifth and sixth decades of life. **Baker SR et al** described that; infantile haemangioma was the most common vascular lesion in infancy and childhood⁹⁻¹².

Malignant salivary gland tumors were observed in 14 (30.5%) patients comprised of 12 (85.7%) males and 2 (14.3%) females. **Musani MA et al** also reported, malignant tumors were more common in males. Majority 8 (57.1%) patients affected by

malignant salivary gland tumors were aged between 51 and 70 years followed by 2 (14.3%) patients in the 31-40 years age group and 2 (14.3%) patients in the 71-80 years age group and 2 (14.3%) patients in 41-50 age group. The age groups 01-10, 11-20, and 21-30 years were free of malignant salivary gland tumors¹³.

The commonest observed malignant salivary gland tumor was mucoepidermoid carcinoma in 8 (6.45%) patients followed by pleomorphic ex carcinoma, adenocarcinoma and adenoid cystic carcinoma 2 (1.6%) patients in each.

DISTRIBUTION OF SALIVARY GLAND TUMORS BY ANATOMICAL SITE

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

Majority 26 (92.8%) of pleomorphic adenoma were commonly detected in the parotid salivary gland followed by 2 (7.1%) in the submandibular salivary gland.

Musani MA et al, N. Gritzmann et al and Dana Dumitriu et al also found the same result¹³⁻¹⁵.

Salivary gland tumors in sublingual gland was not seen in this study

CLINICAL PRESENTATION OF SALIVARY GLAND DISEASES

The most frequently encountered clinical presentation of salivary gland diseases in this study was swelling, seen in all 46 (100%) patients. It was followed by pain in the swelling in 10 (21.7%) patients.

All 14 (100%) patients with malignant salivary gland tumors presented with swelling, while in addition 10 (71.4%) of them presented with pain, 4 (28.5%) patients with cervical nodal mass, and 2 (14.3%) had facial nerve palsy.

Facial nerve palsy was observed in patient with mucoepidermoid carcinoma. All tumors were hypo echogenic compared with the surrounding parenchyma **Gitzmann Net al** also described the similar finding¹⁴.

Dana Dumitriu et al described that, most benign tumors (87.8%) had sharp borders, but 39.9% of malignant tumors also presented sharp borders¹⁵. In our study Most benign tumors (87.5%) had well defined margin, but 12.5% of malignant tumors also presented well defined (sharp) margin.

Margin of tumors, was the most significant criteria for differentiating between benign and malignant tumors. However, if this criterion alone is considered, it becomes obvious that almost 12.5% of malignant tumors would be diagnosed as benign. Out of the 4 benign tumors with ill-defined margin, 2 was hemangiomas. It presented as heterogeneous structure. This aspect is consistent with the commonly accepted pattern for hemangiomas. In our study most (75%) benign tumor's had either lobulated or ovoid shape while 25% benign tumor had irregular shape. Most (85.7%) malignant tumors had irregular shape.

Dana Dumitriu et al, found that 51.50% benign tumors were homogenous 48.5% were nonhomogeneous in echotexture. In case of malignancy 50% were homogenous and 50% were nonhomogeneous¹⁵.

S Wu et al, found 9.6% of benign tumors were homogenous and 91.2% were heterogeneous (nonhomogeneous). Among malignant tumors 16.7% were homogenous and 83.3% were heterogeneous¹⁶.

In our study 37.5% of benign tumors had homogeneous echotexture while 62.5% had nonhomogeneous echotexture. All malignant tumors had nonhomogeneous echotexture.

Calcification was seen in 10 benign and 4 malignant tumors. Cystic areas were seen in equal no. of benign and malignant tumors i.e. 4 cases each.

Above findings suggest that echotexture of the tumor was not a relevant indicator for differentiating between benign and malignant tumors.

Dana Dumitriu et al found that on CDS examination 60.6% of benign and 55.5% of malignant tumors were poorly vascularized; While 30.30% of benign and 38.8% malignant tumors were well vascularized¹⁵.

In our study 68.75% benign tumors were poorly vascularized, 25% were well vascularized and absence of vascularization was seen in 6.25% of patients. Among malignant tumors 10 (71.4%) were well vascularized and 4 (28.53%) were poorly vascularized.

Ultimately, all of these numbers confirm the fact that vessel density, as appreciated by CDS, is a reliable factor in the differential diagnosis between benign and malignant tumors, although the no. of patients in the study was less. This is not consistent with other studies, which state that CDS is not enough, but that the measurement of peak flow velocity and, particularly, that of the resistance index (RI) and pulsatility index (PI) could be more useful

Bradly et al¹⁷.

Ultrasound is also very useful for detecting regional cervical lymphadenopathy associated with salivary gland tumors.

In our study 10 out of 14 i.e. 71% patients with malignant salivary gland neoplasm showed associated cervical lymphadenopathy, cervical lymphadenopathy was not seen in any case with benign salivary gland neoplasm.

All above findings show that Ultrasound is very useful in the description of many features of a salivary gland tumor, such as its exact location, size, shape, borders and structure. CDS can provide accurate information about the density of vessels in the mass.

In our study in the department of radio diagnosis, all cases of malignant tumors were in advanced stage hence it was possible to differentiate between benign and malignant cases by 2D and color Doppler sonography however the accuracy was not 100% as 1 sonographically diagnosed case of benign tumors turned out to be malignant on HPE.

Pleomorphic Adenoma

At final diagnosis 28 cases of pleomorphic adenoma were seen. **Zajkowski P et al** found 100% of the lesions were hypoechoic. 80.6% of all tumors were well-defined. The remaining 19.4% had predominantly well-defined borders. 55% of pleomorphic adenomas had a lobulated shape¹⁸.

Bialek EJ et al demonstrated histopathologic heterogeneity of pleomorphic adenomas 73% and 95% (21/22) had 5 or fewer vessels detectable in the whole lesion¹⁹.

Yuan WH. et al found all lesions were hypoechoic, and only 22.9% had a homogeneous echotexture. Most of the tumors (87.5%) were ≥ 10 mm, and 93.8% were well defined. on CDU, 91.7% had intermediate (+ and ++) grades of vascularity²⁰.

Dana Dumitriu et al 90% of pleomorphic adenoma had sharp border. 65% had homogenous and 35% had nonhomogeneous 80% were poorly vascularized and 15% were well vascularized¹⁵

In our study 100% of pleomorphic adenoma were hypoechoic, 92.8% pleomorphic adenoma had well defined margin, the remaining 7.1% had ill-defined margins. 55% had a lobulated shape. 42.9% pleomorphic adenoma had homogenous and 57.1% had nonhomogeneous echotexture. The CDS examination revealed that 78.5% of Pleomorphic adenoma was poorly vascularized; 14.3% were well-vascularized and absent vascularization was seen in 7.1%. Our findings were consistent with other studies.

Above finding shows on ultrasound pleomorphic adenoma are hypoechoic in echogenicity, most has well defined margin, lobulated shape, and poor vascularity. However echotexture of pleomorphic adenoma is not a relevant indicator, so ultrasonography is a useful method for the evaluation of pleomorphic adenomas

Heamangioma – in our study two cases of Heamangioma in parotid gland were found. Ultrasound showed irregular shape heterogeneous echotexture and very high vascularity. **Som PM et al** also described the similar finding²¹.

CONCLUSION

Ultrasonography is a highly sensitive, specific, easily available and affordable imaging modality to assess salivary gland tumors, however it is more sensitive for detecting benign tumors and more specific for malignant tumors.

SOURCE OF SUPPORT

Nil

CONFLICT OF INTEREST

None

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