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ROLE OF IMAGING IN EVALUATION OF SALIVARY GLAND TUMORS

Radio-Diagnosis

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ABSTRACT

Salivary gland tumours are a common clinical dilemma and imaging plays a useful role in establishing diagnosis, differentiating benign from malignant tumors, evaluating extent of local and distant involvement and thus providing a firm aid to the clinician for the management of these tumors. Ultrasonography is the first line imaging modality for localization and characterization of lesions in the major salivary glands. CT /MRI help to identify spread of tumor in inaccessible areas like para-pharyngeal spaces , define the tumor's size and extent better and give more detailed information about the involvement of surrounding structures.

KEYWORDS

Imaging, Salivary glands, tumors

INTRODUCTION

Tumors of salivary glands are uncommon, accounting for 2–10% of head and neck neoplasms. The vast majority of salivary gland tumors originate in the major salivary glands [i.e., parotid gland (70%) and submandibular gland (8%)], less than 0.5% arise in the sublingual gland.]

Most of them are benign and parotid gland is the commonest site. As a general rule, the smaller the involved salivary gland, the higher is the possibility of the tumour being malignant.

Pleomorphic adenoma and Warthin's tumor the two most common benign salivary gland tumors, comprising 75–90% of all salivary gland neoplasms. The most common malignant neoplasms are mucoepidermoid carcinoma and adenoid cystic carcinoma.

The role of imaging in assessment of salivary gland tumors is to define intra-glandular vs. extra-glandular location, detect malignant features, assess local extension and invasion, detect nodal metastases and systemic involvement.

AIMS AND OBJECTIVES

- To differentiate malignant neoplasms from benign lesions.
- To characterize and differentiate the different salivary gland tumors according to their pathological classification.
- To localize the exact site, size, extension and multiplicity of the lesion.

METHODS & MATERIALS:

Retrospective observational study

DURATION OF STUDY: From March 2021- March 2022.

STUDY SITE:

Department of Radio-Diagnosis;
SVPIMSR
Smt. NHL MMC; Ahmedabad.

SAMPLE SIZE: 30 cases

SELECTION OF PATIENTS:

Inclusion Criteria:

- Only those patients willing to participate in the study were included.
- Clinically suspected patients with complaints suggestive of salivary gland tumors referred to the radiology department and found to have positive findings.
- Already diagnosed cases of salivary gland tumors who needed follow up radiological investigations and were referred to radiology department for the same.
- Patients coming for investigations for other diseases and accidentally found to have salivary gland tumors.
- No age and gender bias followed.

Exclusion Criteria:

- All patients unwilling were excluded from this study.
- All patients suffering from salivary gland tumors but already diagnosed, treated and not needing follow up were excluded from this study.

RESULTS

- Most common age group in this study was 41-60 years (56%), followed by 61-80 years and 21-40 years having an incidence rate of 20% and 16% respectively.
- In this study, salivary gland tumors were found to be more common in males (66.6%) than in females (33.3%) which is a ratio of 2:1.
- In this study, the most common site of salivary gland tumors was parotid gland (80%) followed by submandibular gland (16.6%) and lastly minor salivary glands (3%) with no case affecting the sublingual gland.
- **COMPARISON OF BENIGN VS MALIGNANT SALIVARY GLAND TUMORS:** 80% of all tumors affecting the salivary glands were benign and only 20% of the tumors were malignant.

COMPARISON OF DIAGNOSIS:

1) Pleomorphic adenoma was the most common tumor affecting the salivary glands in this study, with an overall incidence rate of over 60%.
2) Among the benign tumors, the most common was Pleomorphic adenoma with an incidence rate of 78%. The second most common benign tumor was Warthin tumor with an incidence rate of 9%.
3) The most common malignant tumor was Mucoepidermoid carcinoma with an incidence rate of over 60%.

Table 1: Imaging Features Of Benign And Malignant Salivary Gland Neoplasms On CT SCANS (n=30)

Features	Variables	Benign (n=24)	Malignant (n=6)
Contour	Smooth	17	2
	Lobulated	6	1
	Irregular	1	3
Margin	Clear	20	3
	Poor	4	3
Tissue plane obliteration	Present	2	4
	Absent	22	2
Enhancement pattern	Rim	5	1
	Solid	19	5
Cystic change	Present	6	2
	Absent	18	4
Necrosis or hemorrhage	Present	8	3
	Absent	16	3

Calcification	Present	2	1
	Absent	22	5

Table 2: Imaging Features Of Benign And Malignant Salivary Gland Neoplasms On MRI (n=30)

Features	Variables	Benign (n=24)	Malignant (n=6)
Contour	Smooth	16	3
	Lobulated	8	1
	Irregular	0	2
Cystic change	Present	4	1
	Absent	20	5
Necrosis	Present	9	1
	Absent	15	5
Tissue plane obliteration	Present	4	3
	Absent	20	3
Signal void	Present	0	1
	Absent	24	5
Margin clearance	T1<T2	8	2
	T1=T2	4	1
	T1>T2	12	3
Enhancement pattern	Rim	1	0
	Solid	23	6
T1-weighted image	High	7	1
	Intermediate	17	5
T2-weighted	High	21	3
	Intermediate	0	1
	High/Low	0	1
	Low	3	1

For CT scan, among the features evaluated, the contour of tumor, the margin and tissue plane obliteration were found to be indicators of malignant neoplasm. Other findings, such as the pattern of contrast enhancement, cystic degeneration, calcification and necrosis/hemorrhage did not show any significance in differentiating 'benign' from 'malignant' lesions. On reviewing MRI, the irregular contour of the lesion significantly favoured malignancy and intermediate to low signal intensity on T2-weighted images seemed to be indicative of malignancy.

Table 3: Usg Features Of Pleomorphic Adenomas And Warthin's Tumors Of The Parotid Gland

USG features		Pleomorphic adenomas (n=18) (n (%))	Warthin's tumors (n=2) (n (%))
Shape	Oval	6 (33.3)	2 (100)
	Lobulated	11 (61.2)	0 (0)
	Irregular	1 (5.5)	0 (0)
Border	Well-defined	11 (61.1)	1 (50)
	Predominantly well-defined	5 (27.8)	1 (50)
	Ill-defined	2 (11.1)	0 (0)
Echogenicity	Hypoechoic	18 (100)	2 (100)
	Isoechoic	0 (0)	0 (0)
	Hyperechoic	0 (0)	0 (0)
Homogeneity	Homogeneous	8 (44.4)	1 (50)
	Heterogeneous	10 (55.6)	1 (50)
Presence of cystic areas	Yes	3 (16.7)	2 (100)
	No	15 (83.3)	0 (0)
Presence of calcifications	Yes	1 (5.5)	0 (0)
	No	17 (94.5)	2 (100)
Distal acoustic enhancement	Yes	17 (94.5)	2 (100)
	No	1 (5.5)	0 (0)
Tumor vascularization	Grade 0	5 (27.8)	0 (0)
	Grade 1	10 (55.6)	0 (0)
	Grade 2	2 (11.1)	1 (50)
	Grade 3	1 (5.5)	1 (50)
Distribution of vessels	Peripheral	11 (61.1)	0 (0)
	Central	5 (27.8)	1 (50)
	Mixed	2 (11.1)	1 (50)

The lobulated shape was more frequent in pleomorphic adenomas whereas presence of cystic areas was more frequent in Warthin's tumor. The differences in the grading and distribution of tumor vascularisation between pleomorphic adenomas and Warthin's tumors was significant.

The other sonographic features of boundaries, echo pattern, homogeneity, calcification, and distal acoustic enhancement exhibited no significant differences between pleomorphic adenomas and Warthin's tumors.

DISCUSSION:

The role of imaging in assessment of salivary gland tumours is to define intra-glandular vs. extra-glandular location, detect malignant features, assess local extension and invasion and detect nodal metastases and systemic involvement.

Ultrasound is a quick and relatively inexpensive modality which can differentiate intraglandular from extraglandular lesions, classify salivary gland lesions as focal or diffuse, also help guide the site of biopsy/aspiration and differentiate benign from malignant disease by means of assessing the architecture of the tumor, its vascularity and associated lymphadenopathy.

In evaluating salivary gland tumour, both MRI and CT assess similar features such as internal homogenicity/heterogenicity, ill-defined edge, extra glandular extension, enhancement pattern, tumour extent and regional lymphadenopathy. MRI is superior in its soft tissue differentiation. It is particularly helpful in detecting deep tissue extension, marrow infiltration/edema and perineural spread. It also detects signal change and extra-capsular spread in regional lymph nodes.

The disadvantage of MRI is the relative high cost, susceptibility to motion artifacts and poorer cortical bone delineation and detection of calcification as compared to CT. When bony erosion is a concern, such as in palatal minor salivary gland malignancy, CT may be required.

Imaging can help to differentiate benign from malignant salivary gland tumors. According to the results of this study, it was found that radiologic features indicating malignancy were similar in both of CT scan and MRI, i.e., a lobular or irregular contour of the mass, a poor tumor margin or obliteration of the adjacent tissue plane, as observed in earlier reports [2]. An additional feature from MRI that can be used for differential diagnosis is signal intensity on T2-weighted images. Joe and Westesson indicated that carcinomas showed intermediate to low signal intensity, whereas pleomorphic adenomas had high signal intensity [3]. Som et al. [4] also pointed out that the characteristic findings of high-grade malignancy of the parotid were poorly defined margins and low signal intensities on T1- and T2-weighted images. This study also revealed similar results.

Specific signs predictive of malignancy were the following: T2 hypointensity, ill-defined margins, diffuse growth infiltration of subcutaneous tissue, perineural spread and lymphadenopathy.

Cystic/necrotic areas were not useful for the diagnosis of malignant tumors because there was a high prevalence of cystic/necrotic regions in benign tumors like Warthin tumor or pleomorphic adenoma.

For determination of benign disease, a strong SI on T2-weighted images, well-defined borders, and a location in the superficial lobe were significant imaging findings. The degree of tumor enhancement after contrast administration did not help to distinguish benign from malignant tumors, though there was a tendency towards strong enhancement of benign tumors.

Features of US imaging, such as multiple occurrences, shape, intrinsic cystic changes, and the grade and distribution of tumor vessels, can be used to differentiate pleomorphic adenomas from Warthin's tumors.

Zajkowski et al. [1] and Shimizu et al. [6] reported that the majority of pleomorphic adenomas had lobulated shapes. This study concluded similar results.

Warthin's tumors presented with multifocal or bilateral lesions. Cystic areas were more frequently present in Warthin's tumors than in pleomorphic adenomas, this result is in agreement with most reports in the literature.

In the current study, we found a significant difference in vascularization between pleomorphic adenomas and Warthin's tumors.

The grade of vascularity in Warthin's tumors was higher than that in pleomorphic adenomas. Central and mixed perfusion occurred more often in Warthin's tumors than in pleomorphic adenomas These findings are in agreement with the results of Bozzato et al [7].

The other sonographic features of boundaries, echo pattern, homogeneity, calcification, and distal acoustic enhancement exhibited no significant differences between pleomorphic adenomas and Warthin's tumors.

CONCLUSION:

Salivary gland tumours are a common clinical dilemma and imaging plays a useful role in establishing the diagnosis, evaluating extent of local and distant involvement and thus providing a firm aid to the clinician for the management of these tumors.

USG should always be considered as the initial imaging modality in salivary gland tumors, as it is easily accessible, has no risk of any radiation exposure and particularly because it can be readily combined with FNAC.

CT /MRI help to identify spread of tumor in inaccessible areas like para-pharyngeal spaces , define the tumor's size and extent better and give more detailed information about the involvement of surrounding structures.

Thus, CT/MRI are more specific than Ultrasound in diagnosing salivary gland tumors.

For lesions in the superficial parotid and submandibular gland, ultrasound is an ideal tool for initial assessment.

If deep tissue extension is suspected or malignancy confirmed on cytology, an MRI or CT is mandatory to evaluate tumour extent, local invasion and perineural spread.

For all tumours in the sublingual gland, MRI should be performed as the risk of malignancy is high.

For lesions of the deep lobe of parotid gland and the minor salivary glands, MRI and CT are the modalities of choice.

Imaging can help to differentiate benign from malignant salivary gland tumors and can also be used to differentiate the two most commonly encountered benign tumors: Pleomorphic adenomas from Warthin's tumors.

PLEOMORPHIC ADENOMA

Fig 1: Ultrasound image shows a well-defined, hypoechoic solid mass lesion the right parotid gland.The lesion shows areas of internal calcification and posterior acoustic enhancement.

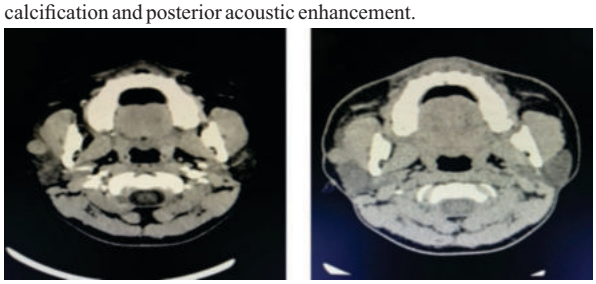

Fig 2: Axial NCCT(Right) and CECT (Left) images show a well-defined homogenously enhancing isodense lesion in the superficial lobe of right parotid gland.

WARTHIN TUMOR

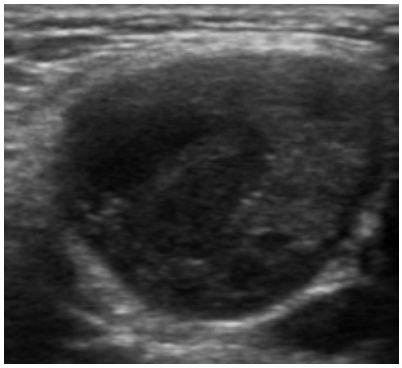

Fig 3: Ultrasound image shows a well-defined, mixed density, predominantly hypoechoic mass lesion involving the left parotid gland with internal cystic areas. No evidence of any calcification noted.

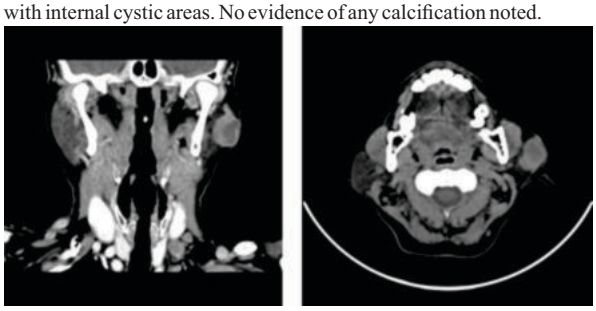

Fig 4: CT images show irregular soft tissue mass in left parotid gland with solid and cystic component.

On Post contrast study, there is homogenous enhancement of solid component and rim enhancement of the cystic component.

MUCOEPIDERMOID CARCINOMA

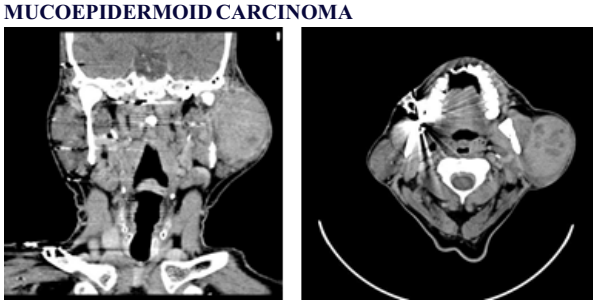

Fig 5: CT contrast coronal and axial images show well-defined heterogeneously enhancing soft tissue mass lesion involving superficial lobe of left parotid gland and extending up to the deep lobe with internal areas of necrosis, with abutment over masseter muscle anteriorly.

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