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Original Research Article

Magnetic resonance imaging features of parotid mucoepidermoid carcinoma: a retrospective analysis

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ABSTRACT

Background: Parotid mucoepidermoid carcinoma (P-MEC) is the most common of malignant salivary gland tumors and its accurate preoperative diagnosis is crucial for better management and prognostication. This becomes even more critical because in most cases P-MEC is difficult to distinguish from other common benign parotid lesions including abscess both clinically and radiologicall, but where management is entirely different. MRI could prove a vital cog in the wheel in this whole endeavor. This study aims to analyse the various MRI features in parotid mucoepidermoid carcinoma and the control group of non-MEC benign parotid masses which will aid in better distinguish between the two entities thereby coming to a confident diagnosis which will aid in management planning and better prognosis.
Methods: This retrospective study was conducted at Sree Uthradom Thirunal Academy of Medical Science (SUTAMS), Thiruvananthapuram, India from July 2021 to July 2022 after obtaining Institutional Ethical committee approval. An informed consent was obtained from all patients before conduct of MRI imaging. The various MRI findings was applied in 60 patients in age bracket of 45-90 yrs with HPE proven parotid gland tumors. The cohort was divided into 2 groups: MEC (n=30) and non–MEC (n=30) as a control group.
Results: Logistic regression analysis identified presence of cystic component ($p<0.001$), T1 hypointense signal ($p<0.001$), T2 hyperintense signal ($p<0.001$), heterogeneous post contrast enhancement ($p<0.001$) and perineural invasion ($p=0.002$) as characteristic MRI features of parotid MEC that aided in its accurate distinction from other non-MEC lesions of parotid.
Conclusions: MRI can be a valuable tool for reliably distinguishing parotid mucoepidermoid from other parotid lesions.

Keywords: Parotid mucoepidermoid carcinoma, Non parotid mucoepidermoid carcinoma lesions, Magnetic resonance imaging

INTRODUCTION

Mucoepidermoid carcinoma (MEC) is the most common malignant salivary gland tumor, with the parotid gland being the most frequently affected site.[1] Accurate preoperative diagnosis is critical for appropriate surgical planning and prognosis. MRI has potential to emerge as a valuable tool in the evaluation of parotid gland tumors due to its excellent soft tissue contrast and multiplanar capabilities.[2-7]

Many a times clinicians face a dilemma in differentiating parotid mucoepidermoid carcinoma from other parotid lesions say for example parotid abscess because many of the clinical findings overlap. The radiologists also face a similar dilemma because both MEC and abscess may essentially present as a complex cystic SOL. It's in this

very scenario and in the absence of authentic literature throwing light on this topic that our retrospective analytical study derives its relevance.

Aims and objectives

This study aims to investigate the Magnetic resonance imaging (MRI) features of mucoepidermoid carcinoma of the parotid gland thereby improving diagnostic accuracy and aiding in the management of this very debilitating malignancy. We retrospectively analysed MRI findings of histopathologically confirmed parotid MEC cases and compared them to benign parotid lesions to identify distinctive imaging characteristics.

METHODS

This retrospective study was conducted at Sree Uthradom Thirunal Academy of Medical Science (SUTAMS), South India from July 2021 to July 2022 after obtaining Institutional Ethical committee approval. An informed consent was obtained from all participants after explaining all study aspects including scope of the study and its objectives along with their permission for any images presented.

Sample size

To allow for 95% confidence and 20% allowable error our retrospective study included 60 patients in total divided to two cohort groups of 30 each consisting of MEC (n=30) and non-MEC (n=30), the latter taken as control group.

Inclusion criteria

Patients with histopathologically confirmed parotid gland lesions patients in age bracket of 45-90 years who underwent preoperative MRI was included in the study till the targeted sample size was reached.

Exclusion criteria

Parotid lesions caused by trauma or known etiologies were excluded to avoid bias.

Contraindications for MRI such as MRI incompatible implants / stents / pacemakers / foreign body and claustrophobic patients were exempted.

Patients with CKD/or with eGFR <35 ml/min/1.73 m^2 were also excluded for fear of Gadolinium induced NSF.

Image acquisition

Images were acquired using Siemens Magnetron Sempra 1.5 T (1.5 Tesla) MRI machine. Small field of view (FOV), thin sections were obtained with the patient lying supine and head positioned in neutral position. Gadoversetamide (Optimark) was used as contrast at a dose of 0.1 mmol/kg. Images acquisition technique are elaborated in Table 1.

Table 1: Sequences used in MRI.

Sequence	TR	TE	FOV	ST
T1 axial	614	12	274	3
T1 sagittal	624	12	200	3
STIR axial	4925	50	274	3
STIR sagittal	3500	22	200	3
STIR coronal	3000	33	160	3
T2 axial	6630	81	200	3
GAD T1+C	687	12	251	3

TR: Repetition time; TE: Time of echo; FOV: Field of view; STIR: Short tau inversion recovery; GAD: Gadolinium; SAG: Sagittal.

Image interpretation

MRI evaluation of all parotid lesions in both groups were done in all relevant parametrics including lesion shape, size, location, margins, T1, T2 signal intensities, post contrast enhancement patterns (Figure 1,2).

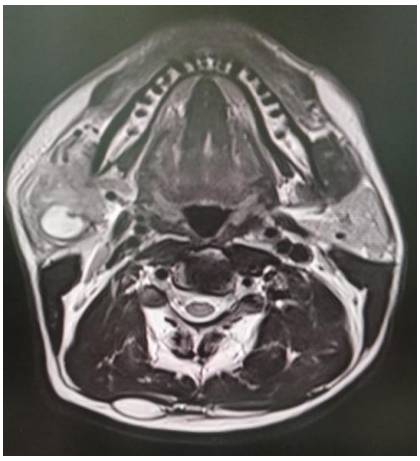

Figure 1: T2-weighted axial image shows hyperintense ill-defined lobular complex cystic mass.

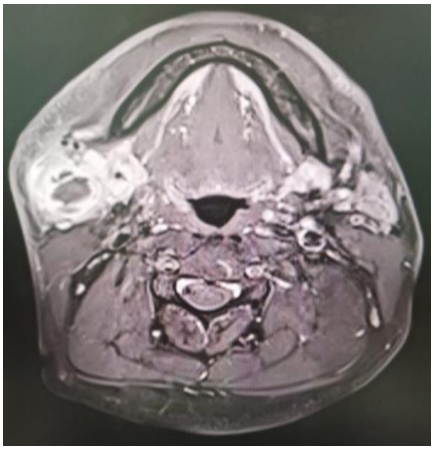

Figure2: Post contrast T1-weighted shows the same mass showing heterogeneous enhancement.

Statistical analysis

The MRI features in MEC group were compared to the control group (non-MEC) using logistic regression analysis and Fishers exact test to identify significant features for differentiating between the two.

MRI findings were later correlated with histopathology / culture reports.

RESULTS

Out of 30 MEC patients, 27 patients (90%, p<0.001) showed ill-defined margins, cystic changes, T1 hypointense and T2 hyperintense signals and heterogeneous post contrast enhancement (compared to only 60% in non-MEC group), 21 of the MEC group showed lobulated shape (70%, p<0.001, versus 16% in non-MEC group) and 12 (40%, p=0.002) showed perineural involvement while none in the non-MEC grouped showed the same.

Analysis of data thus showed that parotid MECs demonstrated a significantly higher frequency of T1 hypointense, T2 hyperintense signals, lobular shape, cystic components, irregular margins and heterogeneous post contrast enhancement compared to non-MEC lesions. A combination of these MRI features thus improves diagnostic accuracy in evaluating Parotid MEC versus non MEC parotid lesions.

The study results are comprehensively captured in easy to comprehend table format below (Table 2 and 3).

Table 2: Demographic data and relevant clinical characteristics of parotid MEC patients with significant parameters of study outcome along with statistical values.

	Clinical characteristics	Male (n and %)	Female(n and %)	Statistical values
Age (in years)	45 yrs-60 yrs	4 (13.3)	1 (3)	p=0.248
	61yrs -75 yrs	10 (33.3)	6 (20)	
	76yrs-90 yrs	6 (20)	3 (10)	
Signs	Pain	11 (55)	4 (40)	p=0.043*
	Swelling	17 (85)	8 (80)	p=0.039*
	Paraesthesia	8 (40)	4 (40)	p=0.037*
MRI findings	Lobulated shape	14 (70)	7 (70)	p<0.001*
	Ill-defined margins with heterogeneous post contrast enhancement	19 (95)	8 (80)	p<0.001*
	Perineural involvement	8 (40)	4 (10)	p=0.002*

*Statistically significant value.

Table 3: Demographic data and relevant clinical characteristics of parotid non-MEC patients (control group) with significant parameters of study outcome along with statistical values.

	Clinical characteristics	Male (n and %)	Female (n and %)	Statistical values
Age (in years)	45 yrs-60 yrs	4 (13.3)	1 (3)	p=0.248
	61yrs -75 yrs	10 (33.3)	6 (20)	
	76yrs-90 yrs	6 (20)	3 (10)	
Signs	Pain	11 (55)	4 (40)	p=0.043*
	Swelling	17 (85)	8 (80)	p=0.039*
	Paraesthesia	8 (40)	4 (40)	p=0.037*
MRI findings	Lobulated shape	3 (15)	2 (20)	p<0.001*
	Ill-defined margins with heterogeneous post contrast enhancement	13 (65)	5 (25)	p<0.001*
	Perineural involvement	Nil	Nil	NA

*Statistically significant value; NA: Not applicable.

DISCUSSION

Findings of our study suggest that MRI can effectively differentiate MEC from benign/non MEC parotid lesions. The presence of lobulated shape, ill-defined margins, hypointense T1 and hyperintense T2 signals, heterogeneous post contrast enhancement, cystic components and perineural invasion (specific to malignant etiology in our study) are indicative of MEC.[2-8] These MRI characteristics can aid in pre-operative diagnosis and management planning.

During our references, we came across a study by PM Som et al which showed poorly defined margins and low T1 and T2 signal intensities in malignant parotid lesions, our study also showed ill-defined margins in malignant lesions but showed T1 low and T2 high signal intensities.[9] Also our study was specific to Mucoepidermoid carcinoma of parotid gland.

Study by Vogl et al comparing MRI features of malignant and benign parotid lesions was more targeted towards to the benefits of administering or not administering of MRI contrast to differentiate between malignant and benign parotid lesions and not specific to mucoepidermoid carcinoma of parotid.[10]

Freling et al study on malignant parotid tumors showed tumor margins or signal intensity were not discriminative factors to correctly predict benign or malignant disease but our study suggested ill-defined tumor margins and T1, T2 signal and post contrast enhancement patterns were accurate parameters to distinguish between malignant (MEC in our study) and other benign parotid lesions.[11]

Yet another of our references was a study by Teresi et al which too was a generalised study which sought to differentiate between benign and malignant lesions of the parotid using MRI whereas our study is focused clearly on providing a comprehensive MRI protocol and diagnostic clues for diagnosing MEC of parotid gland with confidence.[12]

Thus our study has the potential to be a seminal literature in MRI evaluation of mucoepidermoid carcinoma of parotid gland and thereby of distinguishing between malignant and benign lesions of parotid gland.

But our study is not without its limitations-the contraindications of MRI and those diabetics with CKD, low EGFR who could not be taken up for CE-MRI are among them. Also the MRI findings needed HPE for confirmation before management could commence. Last but not the least MRI investigation is still very expensive to afford for a vast majority of the population and MRI scanner availability is scarce.

CONCLUSION

MRI is a reliable tool for the evaluation of mucoepidermoid carcinoma of the parotid gland. Recognising the distinctive MRI features can improve diagnostic accuracy, thereby allowing for better treatment/surgical planning and prognostication.

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