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Role of MRI in Evaluation of Parapharyngeal Masses: Correlation with Histopathological Findings

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Abstract
Introduction: *Parapharyngeal space is one of potential fascial planes of head and neck, that may become involved by various pathological processes. The aim of study was to establish diagnostic value of MRI for detection, characterization and localization of parapharyngeal masses and correlating these with histopathological findings which will be of great help for surgeon to adopt right choice of surgical approach and non operative management by superior diagnostic value of MRI and minimize surgical morbidity, as well as risk of surgical recurrence.*
Materials and Methods: *The study was conducted for this purpose in 30 patients from all age groups, of either sex, having parapharyngeal masses suspected clinically or ultrasonographically.*
Results: *The MRI findings positively correlated with histopathology and has superior diagnostic value for detection, characterization and localization of parapharyngeal masses. Out of total 30 patients, 16.67% had origin primarily from paraphayngeal space and 50% had secondary extension to parapharyngeal space. Rest 33.34% had no extension to parapharngeal space. Male have more incidence as 20 male and 10 female. Male have maximum incidence in 5th decade of life while female have almost equal incidence in 3rd, 4th and 5th decade. Most common presenting complain was neck swelling and parotid gland (70%) was most common involved.*
Conclusions: *MRI almost correctly differentiated all benign and malignant lesions and almost correctly characterized all lesions and excellent regarding tissue content and was in agreement with the histopathological diagnosis.*
Keywords: *Parapharyngeal space, Masses, Magnetic resonance imaging, Histopathological, Correlation.*

Introduction

Parapharyngeal space is one of potential fascial planes of head and neck, that may become involved by various pathological processes like infections, inflammatory and neoplastic process. These represent less than 1% of all head and neck tumors.[3] The parapharyngeal space is an anatomic recess which is deep seated facial space divided by the fascia of tensor veli palatini into two prestyloid and retrostyloid spaces:

Parapharyngeal space masses produce relatively few symptoms which may explain why such lesions often grow to 4 to 6 cm before diagnosis. Patients may have specific complaints such as sore throat, change in voice quality, dysphagia, trismus, nasal obstruction or a sensation of aural fullness and deficits of any or all of the last four cranial nerves may occur.

The advent of MR imaging provided an even more reliable distinction between intra parotid and extra parotid lesions and allowed differentiation of most schwanomas from extra parotid salivary gland tumors, differentiate between the tumor and muscle, and it has greater resolution in defining the great vessels and their relationship to the tumor, intracranial extension, better visualization of fat for differentiating parotid from extra parotid lesions.

The diagnosis can often be made on the basis of characteristic MRI findings. MRI scanning is hence, probably the diagnostic procedure of choice to evaluate a parapharyngeal mass lesion.[3,6]

In terms of imaging, the most important landmarks to note, when evaluating a parapharyngeal space mass are (1) the deep portion of parotid gland and the stylomandibular tunnel region (2) the ICA, its size, shape, and direction of any displacement (3) the direction of any displacement of the fat of prestyloid compartment, and (4) the effect of a mass on the surrounding structures, including the pharynx, masticator space, mandible and skull base.

Aims and Objectives

To assess diagnostic value of MRI for detection, characterization and localization of parapharyngeal masses and correlate MRI findings with histopathological findings.

Material and Methods

A minimum of thirty patients from all age groups, of either sex, having parapharyngeal masses suspected clinically or ultrasonographically were included in the study.

Patients presenting with complaints related to parapharyngeal region mass which are unexplained otherwise, for example change in voice quality, trismus, nasal obstruction, sensation of aural fullness, sore throat or chronic headache as well as due to deficit of last four cranial nerves were included.

All those cases which had implanted medical devices containing ferro-magnetic objects like cardiac pacemakers, internal defibrillator devices, orthopedic implants, intracranial aneurysm clips, ocular implants, ocular magnetic foreign bodies, magnetic dental implants, magnetic sphincters, ferromagnetic IVC fitters, coils and stents were excluded.

MRI was done in all the patients after written informed cosent. Philips Achieva 1.5 Tesla MRI was used for this purpose. Patient was examined in supine position with head and neck coil. The patient was positioned with his head as far into the coil as the patient's shoulders permitted. The examinations were carried out with plain T1W, T2W and STIR sequences were done in axial and coronal plane. For post contrast sequences gadodiamide was administered and images were taken in axial, coronal and sagittal planes.

The magnetic resonance imaging features of the parapharyngeal mass were correlated with later histopathological findings to assess the role of MRI in parapharyngeal masses.

Results

Thirty patients of clinically or ultrasonographically suspected parapharyngeal masses underwent MRI after clinical examination.

The median age of our patients was 41.6 years with males largely outnumbering the females, 20 as compared to 10.

Neck swelling was most common symptom which was present in all the patients. Ten patients presented with pain in the swelling. Five presented with decreased hearing due to involvement or compression of acoustic nerve. Hoarseness and dysphagia was present in four each and headache was complaint of three patients.

Analysis of various features of parapharyngeal lesions on MRI

Analysis of 30 patients revealed that the masses originating primarily from parapharyngeal space is 5/30 = 16.7%. 15 /30 cases (50%) involved the space secondarily and 10/30 cases (33.3%) did not involve parapharyngeal space. Hence 20/30 cases were true parapharyngeal masses (Table 1). In our study MRI was able to characterize the solid and cystic components of all the lesions correctly. Out of total 30 cases 26 (86.67%) were predominantly solid and 4 (13.34%) were predominantly cystic (Table 2).

There were 5 cases with masses origin in parapharngeal space. Out of total 5 cases 2 (40%) were of squamous cell carcinoma, 1 patient (20%) of pleomorphic adenoma from extra parotid salivary rests and 2 patients (40%) of Neurofibroma with characteristic imaging findings on T1W, T2W and post contrast images (Table 3). Neurofibroma also showed the bowing of ICA posterolaterally and lateral displacement of the internal jugular vein.

There were 15 cases with masses secondarily extending to parapharyngeal space. There were 6 patients (40%) of pleomorphic adenoma which extended from deep part of parotid gland to prestyloid parapharyngeal space. One patient (6.67%) suffering from mucoepidermoid carcinoma of parotid gland which extended to prestyloid compartment of parapharyngeal space, 2 cases (13.33%) of non hodgkin lymphoma extending from nasopharynx to parapharyngeal space, 2 cases of parotid inflammation extending to prestyloid space, 2 cases (13.33%) suffered from squamous cell carcinoma and the lesion extended to post styloid parapharyngeal space and 2 patients (13.33%) were suffering from muco epidermoid carcinoma of both superficial and deep lobe of parotid with extension into retro styloid parapharyngeal space. Theses masses showed characteristic imaging findings on T1W, T2W and post contrast images (Table 4).

There were 10 cases with masses which did not originate or extend parapharyngeal space. Four patients (40%) ailing from pleomorphic adenoma of both superficial and deep lobe of parotid but the lesions did not extend to parapharyngeal space, two patients (20%) who had inflammatory lesion in parotid but the lesions did not extend to parapharyngeal space, two patients (20%) suffered from Warthin's tumor of parotid gland and these lesions did not extend to parapharyngeal space, one patient who suffered from mucoepidermoid carcinoma of superficial lobe of parotid and one patient was suffering from sialoblastoma of superficial lobe of parotid. Theses masses showed characteristic imaging findings on T1W, T2W and post contrast images (Table 5).

Out of total 30 cases, 21 (70%) were related to parotid gland.11 out of 21 cases (52.39%) were extending into parapharyngeal space and rest 10 (47.62%) of parotid masses did not extend to parapharyngeal space (Table 6).

Total 9 out of 30 cases (30%) were not of parotid origin however they are extended to parapharyngeal space which showed 100% extension (Table 7).

Total 20 out of 30 cases (66.67%) were benign and 10 (33.33%) were malignant.

Table 1 Location of mass on MRI (n=30)

Location	No. of patients	Percentage
Origin of mass from parapharyngeal space	5	16.7%
Extension of mass to parapharyngeal space	15	50%
No involvement of parapharyngeal space	10	33.3%

Table 2 Tissue content of the masses on MRI and comparison with histopathological diagnosis (n=30)

	Frequency on MRI	Histopathological diagnosis	Percentage
Predominantly solid	26	26	100%
Predominantly cystic	4	4	100%

Table 3 MR characteristics of masses originating in parapharyngeal space (n=5)

S No.	T1W	T2W	Enhancement	MRI Diagnosis
1	Isointense	Heterogenously hyperintense with few bright signals	Heterogenous	Pleomorphic adenoma from extraparotid salivary rests
2	Isointense with hypointense area	Hyperintense with bright signal foci	Moderate	Parapharyngeal mass
3	Isointense	Moderately hyperintense	Heterogenous	Parapharyngeal mass
4	Isointense	Hyperintense	Heterogenous avid enhancement	Neurogenic tumor
5	Isointense with hypointense foci	Hyperintense with bright foci suggestive of necrosis	Heterogenous	Neurogenic tumor

Table 4 MRI features of masses extending to the parapharyngeal space (n=15)

S No.	T1W	T2W	Enhancement	MRI Diagnosis
1	Isointense	Iso to hyperintense	Heterogenous	Pleomorphic adenoma of parotid
2	Isointense	Hyperintense	Moderate	Pleomorphic adenoma of parotid
3	Hypointense	Heterogenously hyperintense with few bright signals	Heterogenous	Mucoepidermoid carcinoma of parotid
4	Iso to hyperintense	Hyperintense	Heterogenous	NHL of parapharyngeal space and nasopharynx
5	Hypo to isointense	Iso to hyperintense	Heterogenous	Pleomorphic adenoma of parotid
6	Isotense	Hyperintense with bright signals	Moderate	Parotid abscess
7	Isotense	Moderately hyperintense	Heterogenous	Nasopharyngeal carcinoma
8	Isotense	Heterogenously hyperintense	Heterogenous	Nasopharyngeal carcinoma
9	Hypointense	Isointense	Moderate	Mucoepidermoid carcinoma of parotid
10	Hypo to isointense	Heterogenously hyperintense	Heterogenous	Mucoepidermoid carcinoma of parotid
11	Hypo to isointense	Hyperintense	Heterogenous	Pleomorphic adenoma of parotid
12	Isotense	Hyperintense	Mild enhancement	Parotid inflammation
13	Iso to hyperintense	Heterogenously hyperintense with few bright signals	Heterogenous	NHL of nasopharynx & parapharyngeal space
14	Isointense	Hyperintense	Heterogenous	Pleomorphic adenoma of parotid
15	Hypo to isointense	Hyperintense with bright signals	Moderate	Pleomorphic adenoma of parotid

Table 5 MRI features of masses which did not originate or extend to parapharyngeal space (n=10)

S No.	T1W	T2W	Enhancement	MRI Diagnosis
1	Isointense	Hyperintense	Heterogenous	Pleomorphic adenoma of parotid
2	Hypointense	Hyperintense	Minimally enhancing	Inflammatory cyst in right parotid
3	Hypointense	Hyperintense with debris fluid level	Heterogenous mild enhancement	Inflammatory lesion
4	Hypointense	Hyperintense	Heterogenous with few bright foci	Warthin's tumor
5	Isointense	Moderate hyperintense with few isointense foci	Heterogenous	Warthin's tumor
6	Hypointense	Mixed signal intensity	Peripheral modular enhancement with less central enhancement	Mucoepidermoid carcinoma
7	Isointense	Low to intermediate intensity	Heterogenous	Sialoblastoma
8	Isointense	Hyperintense	Heterogenous	Pleomorphic adenoma of parotid
9	Hypo to isointense	Iso to hyperintense	Heterogenous	Pleomorphic adenoma of parotid
10	Isointense	Hyperintense	Moderate	Pleomorphic adenoma of parotid

Table 6 Various parotid lesions = 21/30

Lesions	Total No. of Cases	Extension to parapharyngeal space
Pleomorphic adenoma	10	6
Mucoepidermoid carcinoma	4	3
Warthin's tumor	2	0
Inflammatory lesions	4	2
Sialoblastoma	1	0
Total	21	11

Table 7 Various non parotid lesions = 9/30

Lesions	Cases	Extension to parapharyngeal space
Squamous cell carcinoma	4	4
Non Hodgkin lymphoma	2	2
Neurofibroma	2	2
Pleomorphic adenoma from salivary rests	1	1
Total	9	9

Figure 1 Neurofibroma : Mass in right parapharyngeal space appears isointense on T1W coronal (a, black open arrow),and hyperintense with bright foci on T2W saggital (b, black straight arrow),and shows heterogenous avid enhancement on post contrast study (c and d, black star).

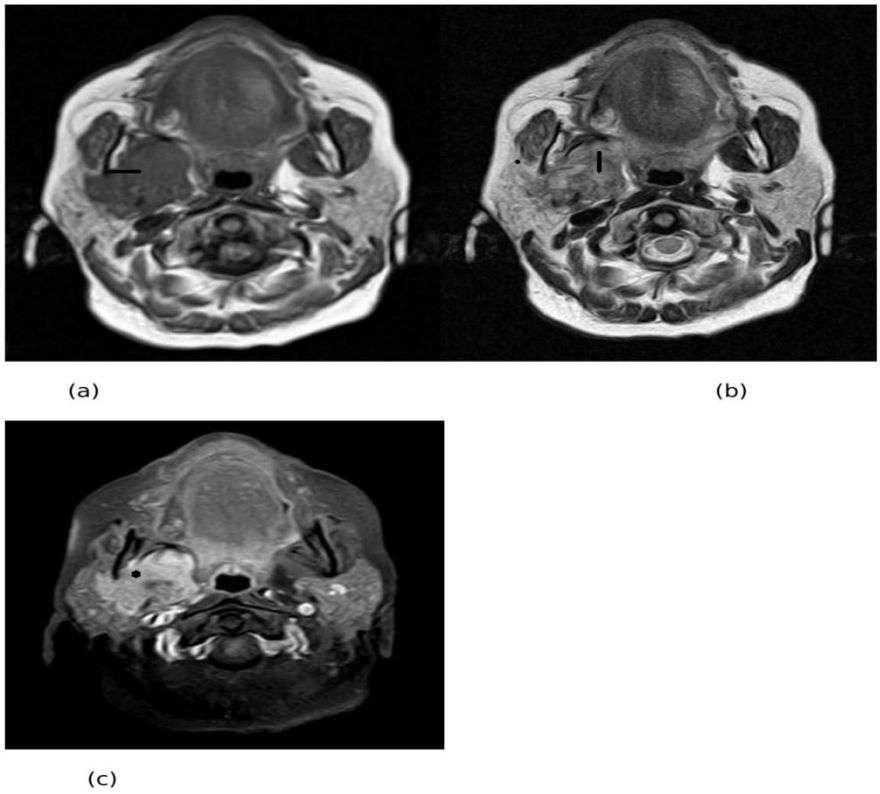

Figure 2 Mucoepidermoid Carcinoma of Parotid Gland : Mass in right parotid appears hypo to isointense on T1W axial (a, black horizontal arrow), and hyperintense on T2W axial (b, black vertical arrow), and shows heterogenous enhancement on post contrast study (c, black star).

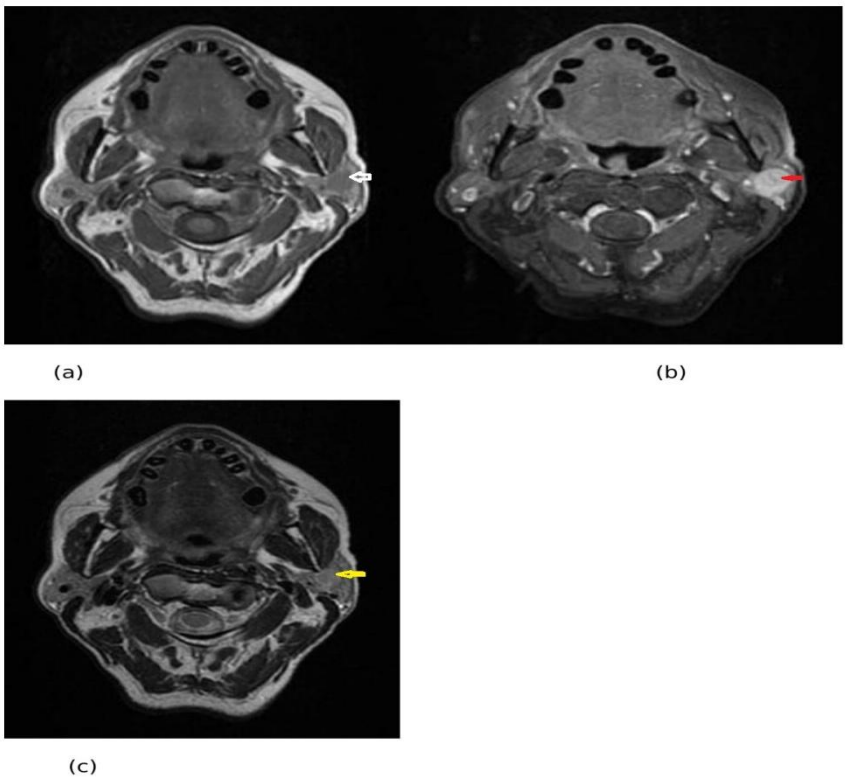

Figure 3 Pleomorphic Adenoma of Parotid Gland : Lesion in left parotid appear isointense on T1W axial (a,white arrow), and hyperintense on T2W axial (c, yellow arrow), and shows moderate to avid enhancement (b, red arrow).

Discussion

Masses involving the PPS infrequently originate from within the PPS proper. When discussing PPS masses, we are referring not only to those that arise directly from within the PPS, but also to those that originate in adjacent structures and displace or invade the PPS.

Tissue content and characterisation of masses

Pleomorphic adenoma

On MRI these cases were hypo to isointense on T1W, Iso to hyperintense on T2W and showed moderate to heterogenous enhancement on contrast enhanced MRI.

Warthin tumor

Lesions were of smooth margin, hypointense on T1W1 and hyperintense on T2W1 with mild heterogenous contrast enhancement.

Mucoepidermoid carcinoma

Two of four cases had irregular margins while 2/4 had smooth margins. Masses were iso to hypointense on T1W and iso to hyperintense on T2W and was moderately enhancing on CEMR.

Sialoblastoma

The margins of the lesion was smooth and lesion had isointense signal intensity on T1W and hypo to intermediate signal intensity on T2W and heterogenously enhancing on CEMR.

Inflammatory lesion

These cases were smooth in margins with cystic density, showing hypointense signals on T1W and hyperintense signals on T2W with mild to moderate enhancement on CEMR.

Squamous cell carcinoma

Two cases showed smooth margins and other two showed irregular margins. These cases were isointense on T1 and moderately hyperintense on T2W with heterogenous enhancement on contrast imaging.

Neurogenic tumors

On MRI the lesions were ovoid with smooth margin. The density of lesions was a soft tissue one. On T1W the lesions were isointense with hypointense foci. The lesions were hyperintense with areas of bright signal in it on T2W (papper salt appearance in paraganglionoma) and heterogenously enhancing after contrast administration. The lesions were pushing the ICA posterolaterally.

Non- Hodgkin's lymphoma

On MRI the lesions were ovoid with ill defined margins. Lesions were iso to hyperintense on T1W and hyperintense on T2W and heterogenous enhancement.

In our study 20 of total 30 cases were benign and 10 were malignant. We were able to define the origin and extent of the lesions fully when we compared our findings to histopathological findings while we were wrong footed at two places while labeling the final diagnosis of tumor. In one case our radiological diagnosis was warthin's tumor while the histological diagnosis came out to be mucoepidermoid carcinoma. In another one case we gave our diagnosis as mucoepidermoid carcinoma while histological diagnosis was warthin's tumor. In rest 28 cases, our findings correlated well with histological findings. We were able to differentiate the malignant from benign lesion.

In our study, we were able to locate and characterize most of the cases and could draw inference that MRI is superior to other radiological techniques in evaluating the parapharyngeal masses.

Conclusions

MRI almost correctly differentiated all benign and malignant lesions and almost correctly characterized all lesions and excellent regarding tissue content and was in agreement with the histopathological diagnosis.

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