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To Detect Accuracy of MRI to Differentiate Between Benign and Malignant Lesions in Sellar and Suprasellar Region by Histopathological Correlation

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Abstract
Introduction
The procedure of choice for evaluation of sellar, parasellar and suprasellar pathologies is MRI in this developing phase of the medical world. MRI provides detailed information about the content of sella, parasellar and suprasellar region and their pathologies. It is important to characterize the histological typing of masses. This is of high clinical importance as this determines importance of non-surgical techniques (MRI) versus surgical. We studied the clinical and radiological characteristics of sellar, parasellar and suprasellar masses correlated with histophathological findings.
MATERIALS AND METHODS
The prospective study was conducted in Department of Radiodiagnosis, Mahatma Gandhi Medical College and Hospital, Sitapura, Jaipur for a period extended for eighteen months between August 2019 and October 2022.
DISCUSSION
Most of the patients presented in the third to fourth decade of life. Males (66%) were more commonly affected as compared to females (34%).The most common sellar, parasellar and suprasellar lesion observed was pituitary adenoma. The next most common abnormality detected was craniopharyngiomas. ACTH secreting microadenoma producing Cushing syndrome was observed to be the most common. Meningioma were the third most common pathologies. There were two cases of metastases. Two cases of Rathke cleft cysts were noted. One germ cell tumor was noted.
Conclusion
The MR imaging characteristics of the three most common lesion were sufficiently disctinct to allow them to be differentiated from each other and from most other enities. MRI has very good diagnostic accuracy in the characteriazation of masss with good correlation to histopathology.

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I. Introduction

Anatomically, the pituitary gland is a ‟two-in-one‟‟‟ structure consisting of the anterior pituitary and the posterior pituitary. These parts have different embryonic origins and function very differently. There is anterior lobe (adenohypophysis) derived from an outpouching of the roof of the pharynx, called Rathke's pouch. It is composed of glandular epithelium and secretes a number of hormones.

The posterior lobe (neurohypophysis) consists of nervous tissue.[1] It arises from the embryonic forebrain, and is, in essence, an extension of the hypothalamus. Cavernous sinuses are the most important of all the structures surrounding the sella turcica in parasellar region from the practical and clinical aspects. Wide diversity of pathology includes the tumors, cysts, vascular lesions, inflammation, infection and congenital lesions.[2]

The cavernous sinuses (CSs) are irregularly shaped, trabeculated venous compartments that lie along the sides of the sella turcica. The CSs are contained within a prominent lateral and a thin (often unapparent) medial dural wall. Important CS contents include the cavernous ICA segments and several cranial nerves.[3]

The abducens cranial nerve (CN VI) is the only cranial nerve that actually lies within the CS, inferolateral to the cavernous ICA. Cranial nerves III, IV, V1, and V2 all lie within the lateral dural wall. The oculomotor nerve (CN III) is the most cephalad of the cavernous CNs and is contained within a thin sleeve of CSF-filled arachnoid called the oculomotor cistern. The trochlear nerve (CN IV) lies just below CN III. Two divisions of the trigeminal nerve (CN V), the ophthalmic (V1) and maxillary, (V2) divisions, lie below the trochlear nerve. The mandibular nerve (CN V3) does not enter the CS. The trigeminal ganglion lies within

another arachnoid lined CSF space, Meckel's cave. CN V3 exits inferiorly from the trigeminal (gasserian or semilunar) ganglion and passes through the foramen ovale into the masticator space.

Various clinical features which are associated with sellar, parasellar and suprasellar region includes endocrine dysfunction which are directly under control of pituitary, visual field defects, hydrocephalus, intracranial mass effect etc. depending on effect on sellar and parasellar structures.

The procedure of choice for evaluation of sellar, parasellar and suprasellar pathologies is MRI in this developing phase of the medical world. MRI provides detailed information about the content of sella, parasellar and suprasellar region and their pathologies. Multiplanar reconstruction, better soft tissue contrast, no radiation hazard and no artefacts from bones are the major advantages of this modality. Different MRI sequences help to reach accurate diagnostic dilemma.[4]

Also, involvement of optic chiasma, cavernous sinus, sphenoid sinus, orbit, temporal lobes and carotid arteries can be evaluated more precisely with MRI. Main drawback of MRI is its high cost and need of expertisation for interpretation.

CT is also useful and is preferred for evaluating calcification and delineation of osseous margins of sella and evaluating bone changes related to pathological processes.

Ct remains the useful screening modality and widely accepted.

The pituitary gland does not have a blood-brain barrier, so it enhances rapidly and intensely following contrast administration. Pituitary gland enhancement is slightly less intense than that of venous blood in the adjacent cavernous sinuses. The infundibular stalk and tuber cinereum also lack a blood-brain barrier and enhance on T1 C+. Enhancement of pituitary gland and infundibulum on T1 contrast enhanced image

It is important to characterize the histological typing of masses involving sellar, parasellar and suprasellar region. This is to high clinical importance as this determines importance of non surgical techniques (MRI) versus surgical. We studied the clinical and radiological characteristics of sellar, parasellar and suprasellar masses correlated with histophathological findings.[5]

II. Aims And Objectives

To study the spectrum of imaging features of various sellar, parasellar and suprasellar lesions that helps in the diagnosis of lesion.

To evaluate the diagnostic accuracy of MRI in detection of sellar and parasellar lesions with histophathological correlation as the gold standard.

III. Materials And Methods

The prospective study was conducted in Department Of Radiodiagnosis, Mahatma Gandhi Medical College and Hospital, Sitapura, Jaipur For a period extended for eighteen months between August 2019 and October 2022.

INCLUSION CRIETERIA

All patients referred from department of Neurosurgery, Neurology, Endocrinology M.G.M.C.H willing to go under MRI who have sellar and parasellar lesions.

EXCLUSION CRITERIA:

A subject will be excluded if he has a contraindication to MR scanning. For example, metal clips or wires of the type that can concentrate radiofrequency fields and can cause tissue damage.

MRI SELLA PROTOCOL Pre contrast study First the brain screening sequences were performed with T2W and FLAIR axial sequences. Secondly, high resolution T1SE and T2SE sequences focused on sellar regions were performed in each case. The following parameters were used. Localizer A three plane localizer is taken in beginning to localize and plan those sequences. Localizers are generally less than 25sec and are T1 weighted low resolution scans in property.

Contrast injection Pituitary only Power inject contrast @ 2cc/sec

Inject when the 1st dynamic scan ends and then the 2nd dynamic begins with 20cc saline flush @ 2.0 cc/sec.

You may increase number of slices, but it needs to be ensured that no DYNAMIC scan does NOT EXCEED 20 sec.

Dynamic Post Contrast Study In cases of pituitary microadenoma, the rapid dynamic post contrast images were obtained. Scanning commenced with T1 TSE weighted images obtained in the corona plane using thin three mm sections. The FOV was maintained at 20-25 cm. Twenty four dynamic sequential images in six fixed sections in the coronal plane over a period of 240 seconds were obtained during the intravenous injection of IV Gadolinium DTPA. In all patients, the dose of Gadolinium DTPA (0.1 mmol/kg body weight) was preloaded in 20 ml syringe and was injected intravenously over a period of fifteen seconds with a 21 gauge butterfly needle. Saline flushing with 5 ml was performed before and after injection of intravenous Gadolinium

DTPA. Finally, for objective evaluation, a graph was plotted demonstrating the enhancement pattern of a microadenoma and adjacent normal pituitary gland parenchyma.

IV. Result

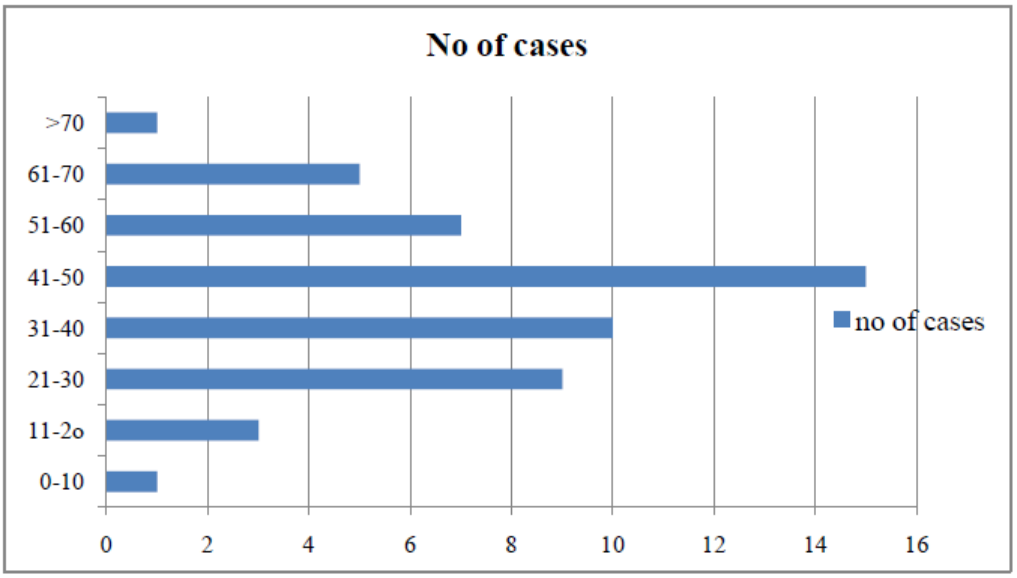


Figure 1: Mean age of study subjects

[Figure 1] shows that incidence of sellar neoplasm versus age irrespective of pathology type. We found that sellar masses are most common in 3rd and 4th decades of life. We encountered the youngest patient of 4 years of age and the oldest patient of 72 years of age.

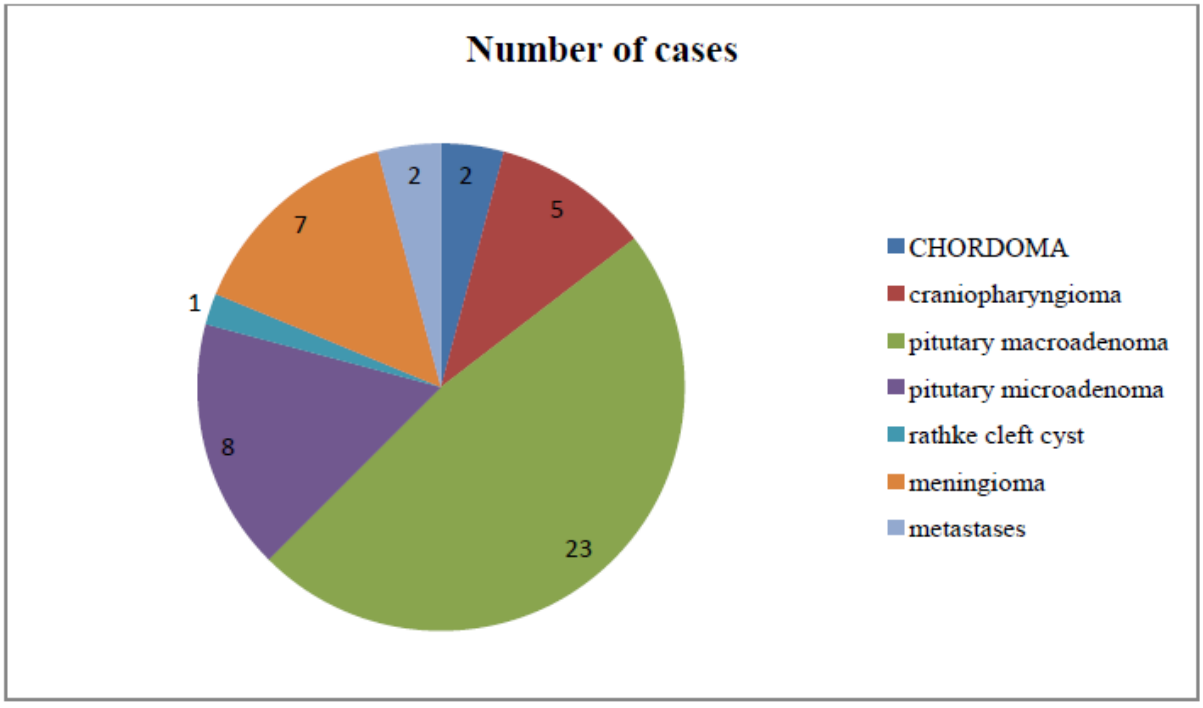


Figure 2: Pathology wise no of cases

[Figure 2] details the number of cases of each respective pathology with Pituitary Macroadenoma being the most common and Rathke‟s Cleft Cyst being the least.

Table 1: The following table is created to show the common symptoms associated with sellar pathologies.

	Blurring	Headache	Vomitting	DIV one eye	DIV both eye (BTH)	Diplopia	Drooping
Macroadenoma	5	13	4	19	6	5	4
Meningioma	2	4	2	5	1	1	1
Craniopharyngioma	2	4	2	2	1	1	1
Microadenoma	1	4	1	0	0	0	0
Metastases	2	2	1	1	0	0	0
Chordoma	1	1	0	1	0	0	0

DIV= Decrease in Vision BTH = Bitemporal Hemianopsia

- Above table shows that the headache is the most common symptomassociated with any sellar lesion followed by decrease in vision in one eye.
- Although optic chiasm is involved in majority of cases of sellar pathologies, still the typical bitemporal hemianopsia is found in total 8 cases.
- Drooping of eyelid resembles involvement of third cranial nerve.

Table 2: Number of patients with Cavernous sinus involvement

Cavernous Sinus Involvement	Number Of Cases
Cavernous Sinus Invasion	8
Cavernous Sinus Abutting	7
Does not Involve Cavernous Sinus	8

[Table 2] shows that Cavernous sinus can be invaded/infiltrated and/or abutted/mildly compressed by Pituitary Macroadenoma more than 50% of the times.

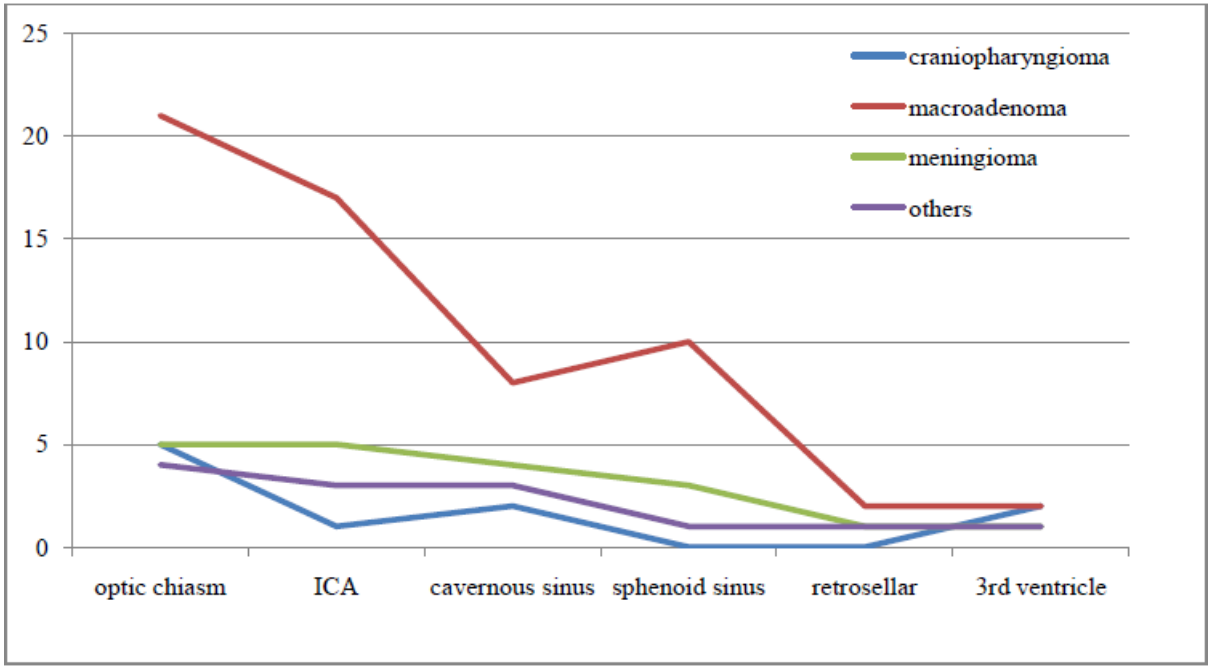


Figure 3: Extension wise distribution of Pathologies

[Figure 3] shows the frequency in which structures are involved by respective sellar pathologies. It shows that optic chiasm is most frequently involved and retrosellar area is involved uncommonly.

Table 3: Concordance rate between MRI diagnosis & HPE diagnosis

	FINAL DIAGNOSIS OF HISTOPATH											
MRI DIAGNOSIS	Meningioma	Macroadenoma	Agg. Adenoma	Microadenoma	Craniopharyngioma	Chordoma	Metastases	Rathke cleft cyst	OTHERS	Total	Concordant rate	Percent
Micradenoma				8						8	8/8	100
Macroadenoma		23								21	21/21	100
Meningioma	7									7	7/7	100
Craniopharyngioma					4					4	4/4	100
Chordoma			1			1				2	1 / 2	50
Metastases							2			2	2/2	100
Rathke cleft cyst					1			1		2	1 / 2	50
Others									2	2	4/4	100
Total	7	23		7	5	1	2	1	5	50	48/50	

[Table 3 and Figure 4] show compares the concordance rate between MRI diagnosis and histophathological diagnosis of sellar and parasellar mass. The concordance rate is highest for Pituitary adenomas and meningiomas.

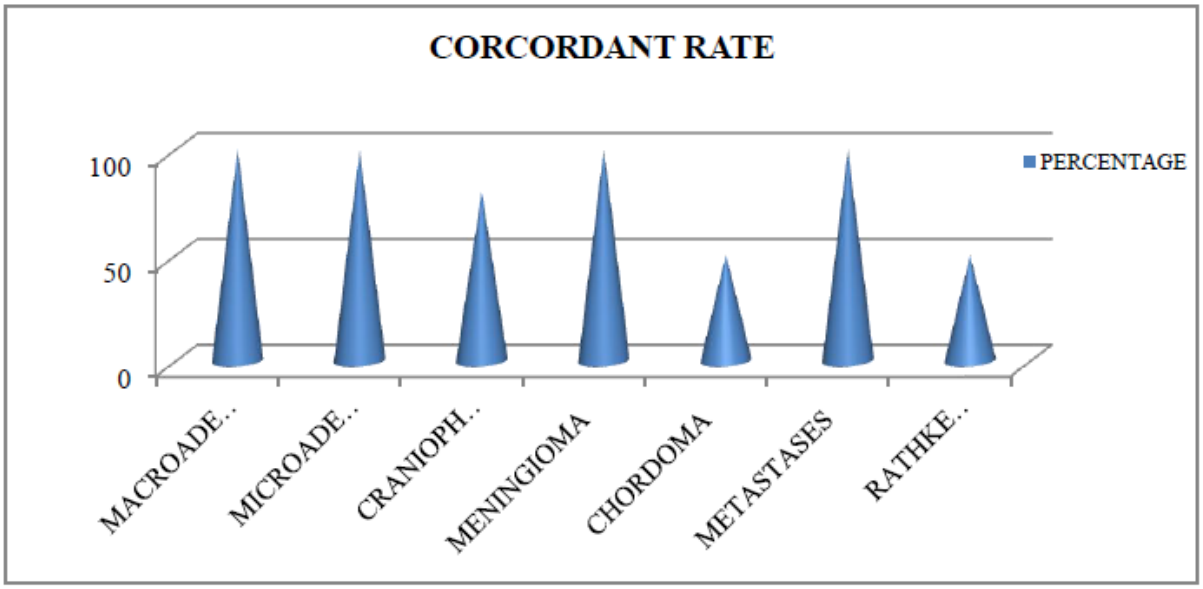


Figure 4: Concordance rate between MRI diagnosis & HPE diagnosis

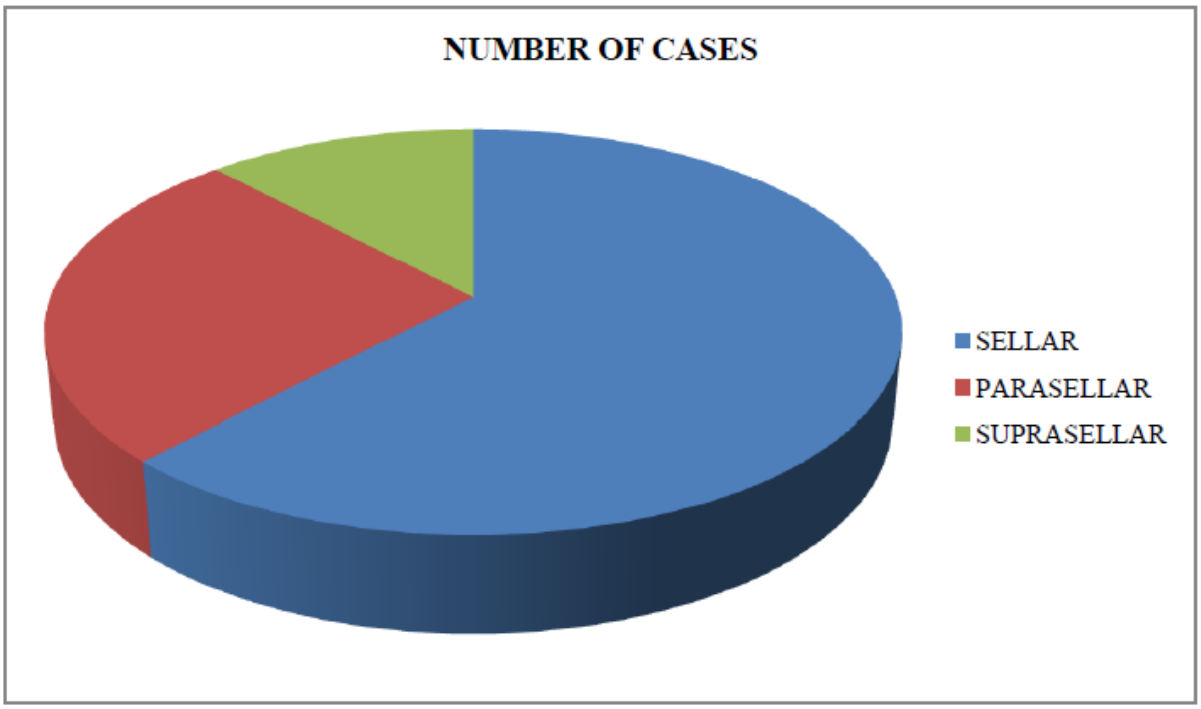


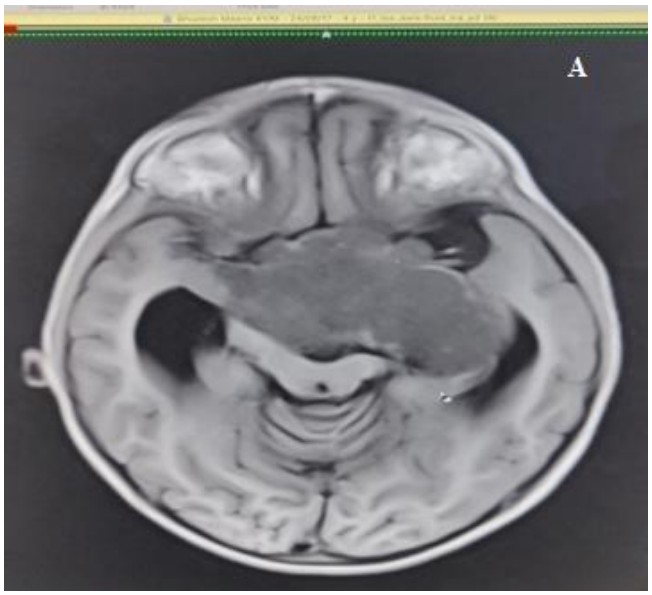
Figure 5: Location wise distribution of Pathologies

[Figure 5] shows the proportion of sellar vs suprasellar vs parasellar masses with sellar masses being in the largest quantity.

Table 4: T2W Characteristics of different pathologies

T2W intensity	Macro adenoma	Micro adenoma	Craniopharyngioma	Meningioma	Metas tases
Isointense	4.7%	0	0	28.5%	0
Hypointense	14.2%	62%	0	0	0
Hyperintense	33.3%	25%	80%	71.5%	0
Heterogenous	47.6%	12.5%	20%	0	100%

[Table 4] shows the T2W image characteristics in various sellar and parasellar lesions. It shows that macroadenoma are mainly heterogenous, microadenomas are hypointense, craniopharyngiomas are hyperintense, meningiomas are hypointense and metastases are heterogenous.



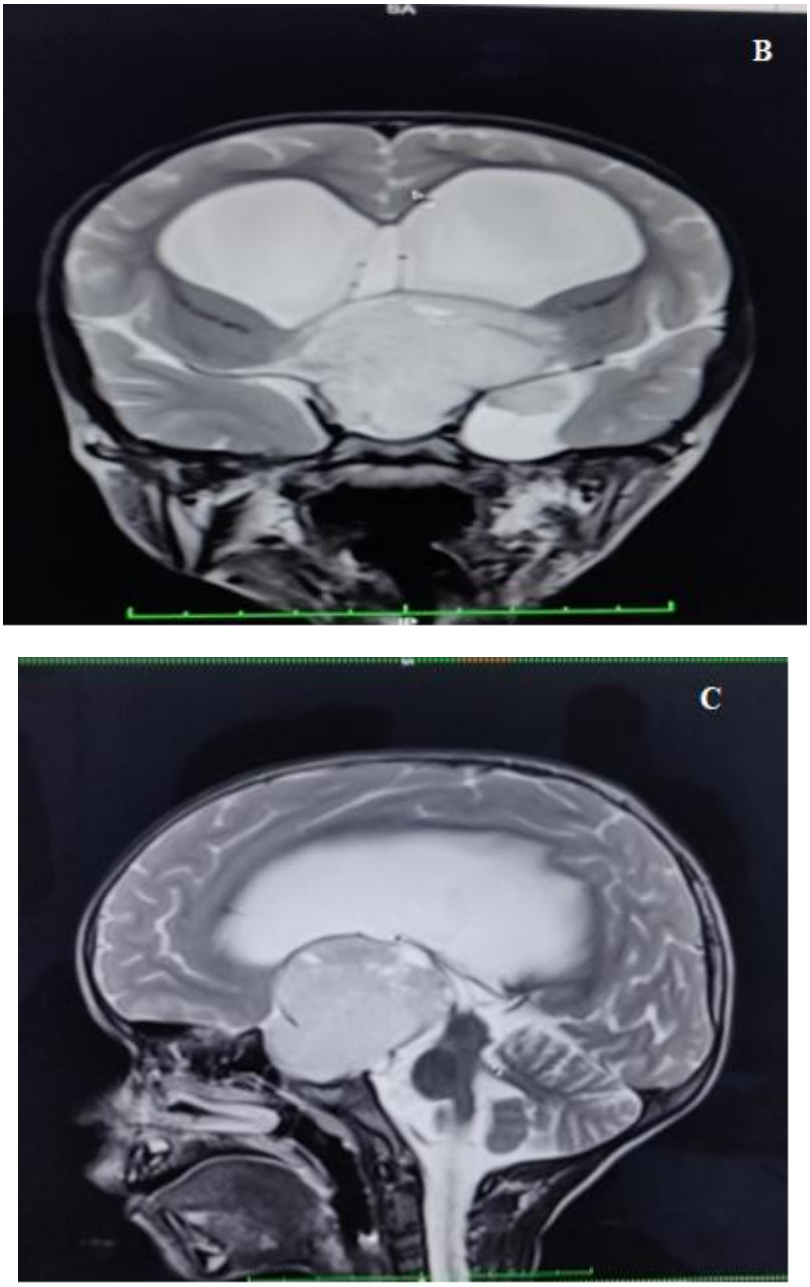
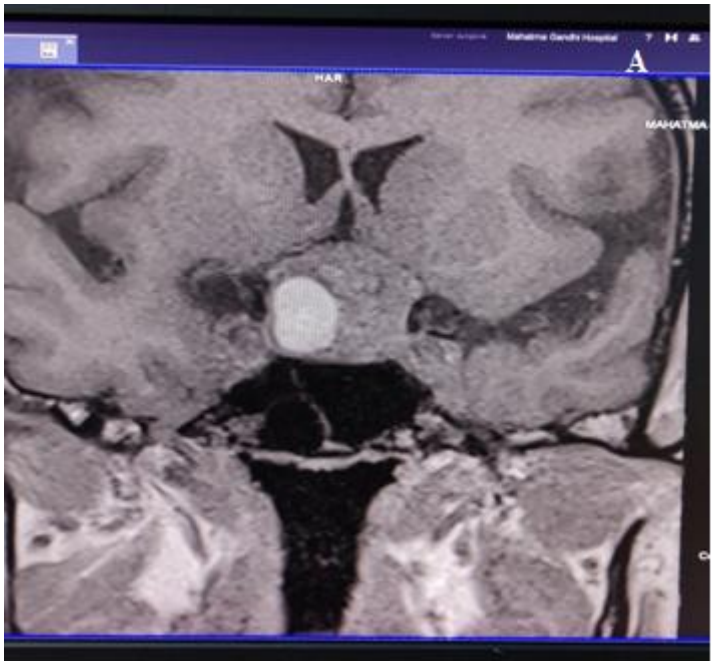


Figure 6: Case of craniopharyngioma, a: Top left image is T1W image, b: Bottom left image is T2W sagittal image showing extension, c: Top right image is T2W coronal image showing extension.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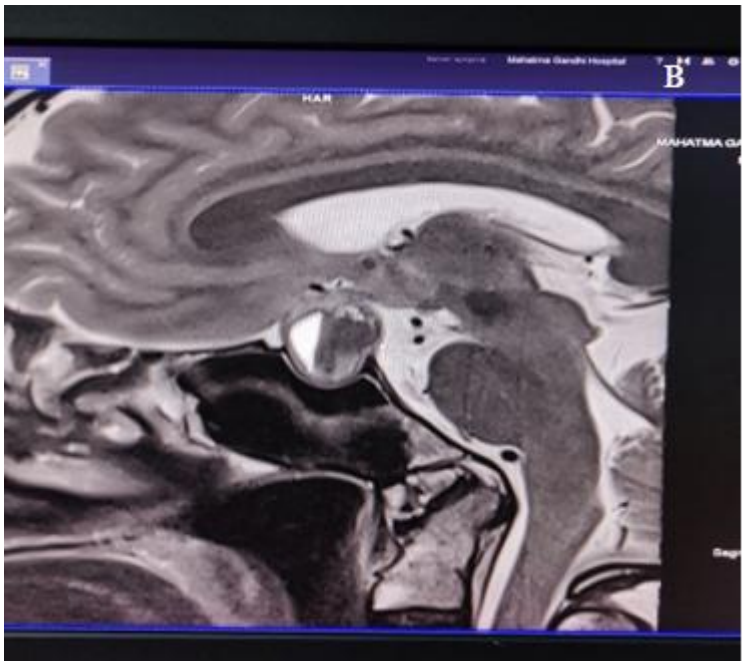
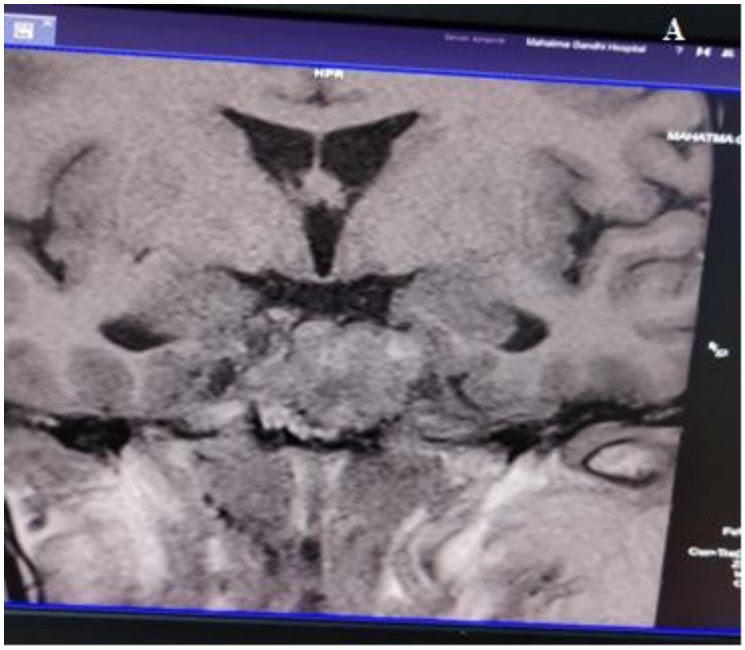

B

Figure 7: Case of pituitary macroadenoma with apoplexy. a:T1W coronal image in top left section, b: Bottom left image showing mildly heterogenous contrast uptake in T1W post contrast image, c: Top right image is T2W sagittal showing fluid-fluid level within it in Top right section.



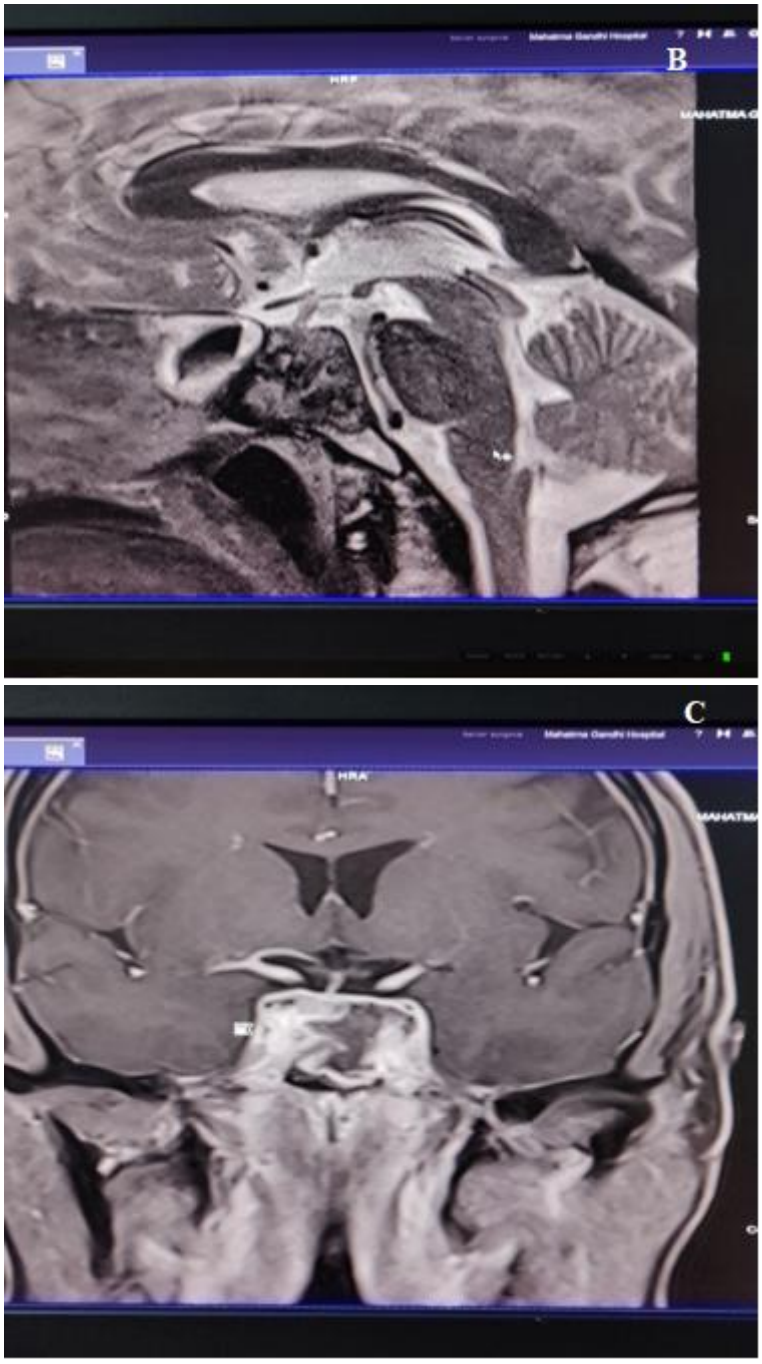


Figure 8: Case of Chordoma. A: Top left image is T1W coronal image. It is showing sphenoid sinus invasion, B: Bottom left image is T1W post contrast image showing heterogenous enhancement, C: Top right image is T2W sagittal image showing infra and suprasellar extension.

V. Discussion

The present study was aimed at diagnosing MRI findings in sellar, parasellar and suprasellar lesions and to evaluate the diagnostic accuracy of MRI in the characterization and histophathological typing of the sellar, parasellar and suprasellar masses. This was done by comparing MRI findings with clinical features and with HPE findings taken as gold standard. Total 50 patients referred to our radiology department were evaluated for the study. The patients were referred with strong clinical suspicion and prior CT scan showing abnormality in sellar, parasellar and suprasellar region.

It is interesting to note that most of the patients presented in the third to fourth decade of life.[6]

Sellar, parasellar and suprasellar lesions were most commonly present in the third and fourth decade. Males (66%) were more commonly affected as compared to females (34%). Visual complaints followed by the

headache were the most common presenting complaints in patients having sellar, parasellar and suprasellar lesions.[7]

Gadolinium enhanced scans helped to detect the extension and patten of enhancement of lesion.

The most common sellar, parasellar and suprasellar lesion observed was pituitary adenoma comprising of 30 out of 50.[5]

Out of 29 adenomas 21 were macroadenomas and 8 were microadenomas based on size criterion. Patients with maroadenomas typically presented with problems due to mass effect over optic chiasm rather than endocrinological disturbances. In contrast, macroadenomas were presented with signs and symptoms of hormonal disturbances. Pituitary apoplexy was found in 5 patients. Macroadenomas were predominantly (60%) isointesne on T1W and hyper on T2W images. Heterogenous and homogenous patterns of contrast enhancement were equally found.

Macroadenomas commonly showed cavernous sinus invasion. The most specific feature to diagnose was total encasement of the internal carotid artery by a tumor.[8] The most sensitive sign to diagnose invasion was found to be asymmetry or lateral bulge of lateral wall of the cavernous sinuses.

ACTH secreting microadenoma producing Cushing syndrome was observed to be the most common. Most of the microadenomas appeared hypointesne on T2 W relative to surrounding pituitary. On post contrast study, anterior and normal pituitary enhances early as compared to lesion and thus become more easily detectable.

Sellar, parasellar and suprasellar meningiomas were the third most common pathologies detected in our study. Most common in the fourth decade with a female preponderance.

The next most common abnormality detected was craniopharyngiomas (5 cases). Most common occurrence was observed in fourth decade of life.[9] This was the most common sellar, parasellar and suprasellar tumor having the calcifications. They are also called as adamantinomatous type since they arise from odontogenic precursors and present with calcifications. Two cases of papillary craniopharyngiomas were found which are generally cystic in nature. They are liable to be confused with Rathke cleft cyst as it is also largely cystic and also find in suprasellar region sometimes.[10,11]

Most of the Craniopharyngiomas were primarily suprasellar with intrasellar extension. Craniopharyngiomas appeared T2W hyperintense. craniopharyngioma, MRI showed diagnostic efficiency of 80%.

There were two cases of metastases out of which one showed heterogenous enhancement and other showed peripheral ring enhancement. There to were cases of carcinoma breast and carcinoma lung repectively. Other tumors in the brain were also noted. There was one case of hematological malignancy which later turned out to be multiplem yeloms. Extensive osteolytic destruction was seen in parasellar and infrasellar region along with advancing age which led to the primary suspicion with no involvement of the pituitary.[12,13]

Two cases of Rathke cleft cysts were noted out of which one was hostologicaly proven. One germ cell tumor was noted.

VI. Conclusion

Hence, finally to conclude, the MR imaging characteristics of the three most common lesion were sufficiently disctinct to allow them to be differentiated from each other and from most other enities. Rest of the pathologies, can be differentiated by spectrum of findings including extrasellar versus intrasellar location, nature of contrast material enhancement, the presence of cystic components and clinincal findings and help in reaching to differential diagnosis. The superior resolution and multiplanar capacity of MR imaging best depicts the extent of sellar and parasellar and suprasellar lesions. Overall, MRI has very good diagnostic accuracy in the characteriazation of masss with good correlation to histopathology.

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