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Radiodiagnosis

ROLE OF MRI IN SELLAR AND JUXTASELLAR LESIONS WITH CLINICAL AND HISTOPATHOLOGICAL CORRELATION : A PROSPECTIVE STUDY IN A TERTIARY CARE CENTRE.

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ABSTRACT **Background:** Sellar and juxtasellar regions are anatomically complex areas of the brain, hold delicate neurovascular structures. The diseases that affect the pituitary-hypothalamic axis can have profound clinical endocrinological as well as neurological consequences. Preoperative non-invasive diagnosis with MRI is essential for treatment planning.

Aim Of The Study: To highlight the role of MRI in characterizing sellar and juxta sellar lesions and to correlate with histopathology findings.

Materials And Methods: This prospective observational study was conducted in the Department of Radiology, Andhra Medical College, King George Hospital, Visakhapatnam, India from January 2020 to March 2021 for 1 year. Reviewed 76 patients of 0- 80 years age group with strong clinical complaints suggestive of sellar and juxtasellar lesions and previous CT showing abnormality were also evaluated. Radiological appearances were correlated with intra-operative findings and post-op histopathology.

Results: A total of 76 patients were enrolled in the study. The majority of patients presented to the Department of radio-diagnosis belonged to the age group 10-19, (1st decade). MRI based radiological diagnosis showed 33 normal cases, 9 cases of pituitary Macroadenoma, 5 cases of Microadenoma, 5 cases of Craniopharyngioma, 4 cases of Meningioma, , 3 cases of aneurysm, 2 cases of Clival chordoma, 1 case of Metastasis with primary renal cell carcinoma (RCC) ,1case of Glioma ,3 cases of Empty sella syndrome, 1 case of Lymphocytic neurohypophysitis, 1 case of Rathke's cleft cyst, 8cases of pituitary hypoplasia. In the present study, most common pathological mass lesions were encountered in the 3rd decade and of equal distribution in both males and females. The diagnostic accuracy for non-neoplastic and neoplastic pathologies were 100% and 76.4 % respectively.

Conclusion: MRI is the investigation of choice for characterizing sellar and juxtasellar lesions, their morphology, enhancement pattern, extent and mass effect on adjacent structures. The present study revealed a strong correlation with histopathological diagnosis.

KEYWORDS : Magnetic Resonance Imaging, Sellar and Juxtasellar lesions, Neoplastic and Non-neoplastic pathologies

INTRODUCTION:

The sellar and juxtasellar regions are anatomically complex areas in the skull base and cover a wide pathology spectrum with a variety of neoplastic and non-neoplastic conditions occurring in this confined space [1,2]. The sellar region, although small, encompasses a number of important structures, including the bone component of the sella turcica, as well as the pituitary gland, cavernous sinus, and suprasellar cistern. Abnormalities in this region can be attributed to the underproduction or overproduction of hormones or to the neurological signs and symptoms resulting from the compression of adjacent structures [3,4]. Various neoplastic conditions include pituitary adenoma/apoplexy, hypothalamic glioma, craniopharyngioma, meningioma, Rathke cleft cyst, germinoma, teratoma, metastasis, leukemic infiltration, lymphoma and Langerhans cell histiocytosis. Non-neoplastic conditions nclude infectious, inflammatory, posttraumatic, congenital/developmental, vascular diseases and physiological. Infectious and inflammatory causes include tubercular/lymphocytic hypophysitis, sarcoidosis, and Wegener's granulomatosis [5]. For accurate diagnosis require a combination of endocrinologic, ophthalmologic and neurologic examination along with advanced neuroimaging modalities.

Manifestations due to endocrine dysfunction or mass effect with compressive symptoms such as headache or visual symptoms are the different types of clinical presentation. Extensive knowledge on sellar and jaxtasellar anatomies along with the use and interpretation of various imaging modalities are necessary to reach correct diagnosis of sellar and juxtasellar lesions and to offer the appropriate therapeutic approach including surgery, radiotherapy and primary or adjuvant medical treatment including replacement of endocrine deficits.[6]

MRI is the gold standard non-invasive imaging modality of choice to characterize such lesions due to superior soft tissue contrast differentiation, availability of advanced sequences offering high spatial resolution, multiplanar capability, allowing accurate visualisation of mass effects on neighbouring soft-tissues and lack of ionizing radiation[7,8]. With this above background, the present study was conducted to evaluate the MRI imaging findings in sellar and juxtasellar pathologies and correlated with histopathology to find out the diagnostic accuracy of MRI.

MATERIALS AND METHODS

A hospital-based prospective observational study was conducted throughout 1 year from January 2020 to March 2021 in the Dept of Radiodiagnosis, King George Hospital, Visakhapatnam AP a tertiary care institute in INDIA. A convenient sampling of 76 clinically suspected patients of sellar and juxtasellar masses referred to the Radiology department was taken. After thorough clinical history and physical examination, and with the information provided by blood investigations.All patients with suspected sellar juxtasellar masses with symptoms were subjected to MRI.

MRI imaging aims to obtain a high-spatial-resolution image with a reasonable signal to noise ratio. It is important to identify the gland separately from the lesion if possible. Initially, pre-contrast T1- and T2-weighted spin-echo coronal and sagittal sections are acquired using a small FOV (20×25 cm), thin slices (3 mm), and a high-resolution matrix (256×512). Both the dynamic and routine postcontrast images and delayed scanning after 30-60 minutes may be combined in one study for optimum imaging. In our department, MRI was performed in GE 1.5 tesla scanner with standard MRI protocol. Detailed scrutiny of images was done and tabulated. The radiological features that are taken into consideration are margins, signal intensity pattern, contents, mass effect, bony changes, hydrocephalus, calcification, abnormal vasculature, the pattern of enhancement and extension into adjacent structures.

The consistency of different lesions was categorized into solid, cystic and mixed. The patients are followed up, correlated with Histopathological findings, and sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of MRI were calculated.

Inclusion Criteria

1. Suspected pituitary mass lesion.
2. Patients of both male and female sex.
3. The age group of 0 to 80 years

Exclusion Criteria

1. Post-traumatic / post-chemotherapy / post-radiotherapy patients 2.
2. Patients having a recurrence.

RESULTS:

The findings of 76 patients were compiled and analysed. The majority of patients belonged to the age group of 10-19 yrs. There was female predominance with male to female ratio of 36:39

Table.1 Distribution Of Patients In Relation To Age

Age	No.of Persons (n=76)	%
0-9	9	11.84
10-19	22	28.94
20-29	17	22.36
30-39	12	15.78
40-49	6	7.89
50-59	5	6.57
>60	5	6.57

Table2. Distribution Of Symptoms

Symptoms	No of Cases (n=76)	%
Headache, Vomiting &giddiness, Visual symptoms, Behavioural changes	16	21.05
Short stature	7	9.21
Hypothyroidism	5	6.57
Precocious puberty	4	5.26
Hyperprolactinemia	3	3.94
Acromegaly	3	3.94
Irregular periods/Oligomenorrhoea	5	6.57
Hypogonadism	2	2.63
Slurring of speech/deviation of angle of mouth	1	1.31
Incidental /asymptomatic	30	39.47

In this study Headache, giddiness and visual symptoms were the common presentations followed by other complaints due to hormonal imbalance leading to short stature, hypothyroidism, irregular periods, hyperprolactinemia, secondary amenorrhoea, galactorrhoea and acromegaly.

In this study out of 76 cases sent for MRI, 33 cases were normal. Among the rest of the 43 cases, the neoplastic pathologies were 27 and the non-neoplastic pathologies were 16. More common pathological lesions in our study were pituitary adenomas followed by craniopharyngeomas, microadenomas and meningiomas. Less common pathological conditions are clival chordoma, hypothalamo optochiasmatic glioma. We also diagnosed congenital lesions like pituitary hypoplasia (pituitary anomalies) and normal imaging variants like partial empty sella. In most of the cases imaging findings were very typical but in few cases where the findings were equivocal differential diagnosis was offered. CT was done in few cases to confirm the presence of calcifications and bony erosion. The study was very useful to the neurosurgeon for managing the cases and for further follow up.

Table.3 Distribution Of MRI Diagnosis

Diagnosis	No of Cases (76)	%	Mean Age	Male: Female Ratio	Pediatric Age <12
1.Normal	33	43.42	21.8	15:18	7
2.Neoplastic (27)					
Microadenomas	5	6.57	25.4	1:4	0
Macroadenomas	9	11.84	40.3	4:5	0
Craniopharyngiomas	5	6.57	19.8	3:2	2
Parasellar meningioma	4	5.26	37.25	0:4	0
Clival chordoma	2	2.63	53.5	1:2	0
Metastasis	1	1.31	73	0:1	0
Otic chiasma glioma	1	1.31	25	1:0	0
3.Non Neoplastic (16)					
Aneurysm	3	3.9	61.6	1:2	0
Rathkes cleft cyst	1	1.31	17	1:0	0
Pituitary hypoplasia	8	10.52	12.87	6:2	3
Empty sella syndrome	3	3.9	21.6	3:0	1
Lymphocytic neurohypophysitis	1	1.31	37	0:1	0

Table 4.MRI Features In Various Neoplastic Lesions

MRI detected lesions	Micro adenoma	Macro adenoma	Cranio pharyngioma	Meningioma	Glioma	Metastasia	Chordoma
Sellar	5	1	0	0	0	0	0
Juxtasellar	0	0	1	2	1	1	0
both	0	8	4	2	0	0	2
Consistency	4	8	1	4	1	1	2
Solid	0	0	0	0	0	0	0
Cystic	1	1	4	0	0	0	0
Mixed							
T1WI	3	4	1	4	1	1	1
Isointense	2	0	2	0	0	0	1
Hypo	0	2	0	0	0	0	0
Hyper	0	3	2	0	0	0	0
mixed							
T2WI	0	4	2	2	1	1	0
Isointense	2	0	0	0	0	0	0
Hypo	3	1	0	2	0	0	2
Hyper		4	3	0	0	0	0
mixed							
No enhancement	5	0	0	0	0	0	0
Homogenous	0	5	0	4	1	1	0
heterogenous	0	4	4	0	0	0	2
Adjacent structures Involvement/ Mass effect over (Optic chiasm/ Stalk/ 3rd ventricle	Nil	3	3	1	1	1	2
Hydrocaphalus	nil	1	2	1	1	0	1
Sella widening	nil	8	3	1	0	0	2
Erosion		3	0	1			
Cavernous sinus invasion / ICA encasement	1	3	2	2	0	0	2
<90		1	1	2			
(knosp)							
>90							
Calcifications	0	0	3	0	0	0	0
Haemorrhage	0	2	0	0	0	0	2

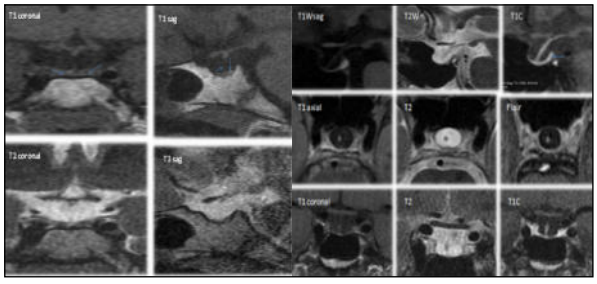
Table 5.MRI Diagnosis Of Non Neoplastic Pathologies Vs Final Diagnosis

Type of lesion	MRI diagnosis	Final diagnosis/ clinical correlation	Accuracy
Pituitary hypoplasia	5	5	100%
Empty sella	3	3	100%
Rathkes cleft cyst	1	1	100%
Lymphocytic neurohypophysitis	1	1	100%
aneurysm	3	3	100%

Table 6. MRI Diagnosis Of Neoplastic Lesions Vs Histopathological Diagnosis

Type of lesions	MRI diagnosis	Histopathology correlation	Sensitivity	Specificity	PPV	NPV	Diagnostic accuracy
Microadenoma	5	5	100%	100%	100 %	100%	100%
Macroadenoma	9	7	77.7%	94.11 %	77.7 %	94.11 %	90.69%
Craniopharyngioma	5	4	80%	97.3 %	80%	97.3 %	95.34%
Meningioma	4	3	75%	97.43 %	75%	97.43 %	95.34%
Metastasis	1	1	100%	100%	100 %	100%	100%
Glioma	1	1	100%	100%	100 %	100%	100%
Clivalchordoma	2	1	66.6%	97.5 %	66.6 %	97.5 %	95.34%
Total	27	22	81.48 %	68.7 %	81.4 %	68.7 %	76.74%

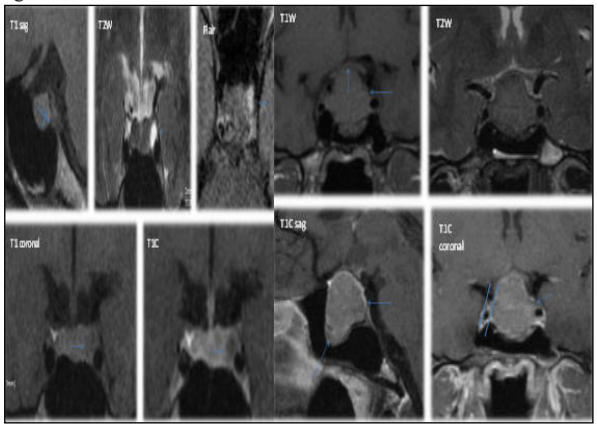
Case Studies:



Case 1. pituitary hypoplasia (fig1) 14-year-old male patient came with short stature.

Case2. Secondary emptysella syndrome 45year old female came with h/o Snake bite & hypothyroid (fig2)

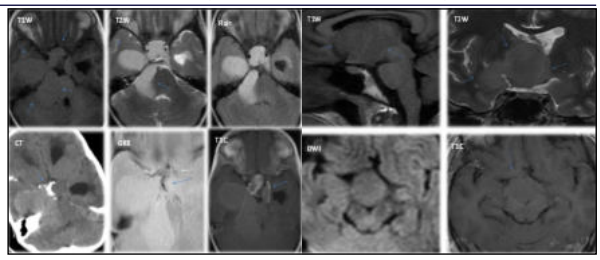
Fig.1MRI showing pituitary hypoplasia(both anterior and posterior) measuring 2.7 x 5.8 x 8.2mm (Height x AP x TR). with interrupted/thin stalk Fig 2. MRI shows CSF filled sella and pituitary gland flattened against the sellar floor.



Case3. Pituitary microadenoma (Fig.3) 29^{yr} old female with h/o cushings disease

Case4. Pituitary macroadenoma (Fig. 4) 30/F with h/o acromegaly &2 amenorrhoea

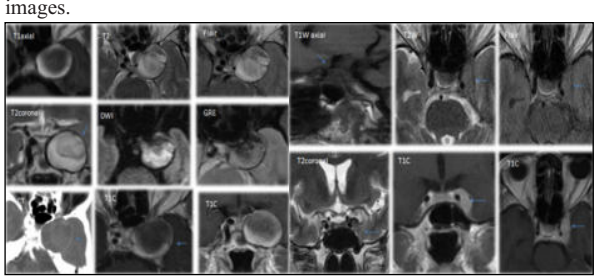
Fig3. A fairly well defined T2 Hyperintenseand T1 isointense lesion of size 3x2.5mm involving left lateral aspect of pituitary gland with slight mass effect over left cavernous sinus which is non enhancing on early contrast. Fig4. Well defined T1&T2 Isointense lesion of size 2.5 x 1.7 x 2.4cms (CC x AP x TR) in sellar region extending into supra sellar cistern showing homogenous post contrast enhancement. Expansion of sella, erosion of floor and extension of lesion into sphenoid sinus present. The lesion is displacing optic chiasma superiorly and laterally encasing internal carotid artery. Pituitary stalk is displaced posteriorly. A1 segment of right anterior cerebral artery is hypoplastic.



Case5. Craniopharyngioma 5-year-old female child came with h/o vomitings (Fig5)

Case6. Hypothalamooptochiasmatic Glioma 25-yr old male patient came with visual symptoms (Fig6)

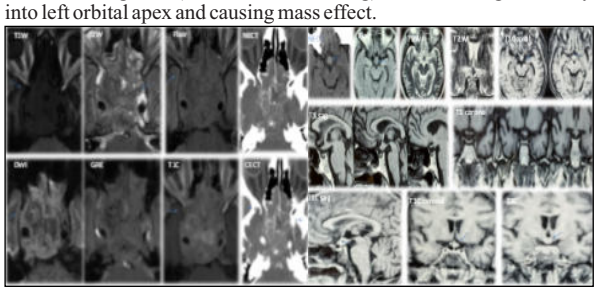
Fig5. Large lobulated T1 hypo and T2/flair hyper intense signal lesion noted predominantly involving sellar and juxtasellar region extending & involving Rt middle cranial fossa, basal cisters,posterior cranial fossa causing mass effect on midbrain & 4th ventricle with upstream ventricular dilatation and showing solid and ring like enhancement on contrast. Calcifications are well demonstrated on CT. Fig6 Ill-defined altered signal intensity lesion noted predominantly in suprasellar region with Rt parasellar extension measuring 3.5 x 3.7 x 4.2cms which is showing minimal homogenous enhancement on post contrast images.



Case 7 left parasellaraneurysm (Fig.7) Came with headache &fronto orbital pain

Case 8 left parasellar Meningioma(Fig.8) came with headache, loss of vision. k/c/oHTN

Fig.7.Round mass with heterogenous lamellated internal signal in T1WI and T2WI consitent with thrombosed aneurysm. Anterosuperiorly flow void noted consistent with patent lumen probably arising from left ICA pressing on adjacent optic nerve and cavernous sinu. Fig 8 A fairly well defined homogenousy enhancing T1 & T2 isointense lesion is noted along lateral wall of left cavernous sinus encasing ICA (with subtle narrowing) and extending anteriorly into left orbital apex and causing mass effect.



Case 9. plasmacytomaCase (Fig9) Unable to stand & slurring of speech

Case 10. Lymphocytic neurohypopohysitis(Fig10) 35yr female came with panhypopituitarisn&DI

Fig 9.large predominantly T1 hypo and T2 hyperintense mass lesion noted involving base of skull with underlying bone destruction and adjacent soft tissue extension into sella & juxtasellar structures invading bilateral cavernous sinuses causing ICA encasement. There is moderate enhancement noted on post contrast images. An expansile osteolytic lesion without a scleroticrim & slightly hyperdense on NECT.Fig10.CT shows dense thickened symmetric enlargement in stalk region and extending superiorly into optic chiasm and hypothalamus in suprasellar cistern. MRI showing T1,T2 isointense signal with homogenous intense enhancement on contrast.

DISCUSSION

The purpose of doing this prospective study is to describe MRI

imaging features of the sellar and juxtasellar region and to correlate with histopathological findings and also to assess the diagnostic accuracy of MRI in the differentiation of various lesions. 76 patients having strong clinical suspicion based on the symptomatology of sellar&juxtasellar lesions or previous ct showing abnormality were evaluated. In the present study, the majority of pathological lesions were seen in 3rd decade and of equal distribution in both males and females. The most common lesion reported in our study was pituitary adenoma, which was similar to studies of Benjamin et al and johnsen et al. [9,10].

Sellar and juxtasellar are basically divided into pituitary lesions and non pituitary /nonadenomatous lesions [11]. Pituitary adenomas are the third most common intracranial brain tumours. Functional adenomas, comprising roughly 70% of Pituitary adenomas(PAs), produce excess hormone secretion that can lead to a variety of clinical symptoms and associated syndromes. The most common functional PAs, in descending order, are prolactin-secreting (prolactinomas), growth hormone (GH)-secreting, corticotropin (ACTH)-secreting, gonadotropin (LH or FSH)-secreting, and thyrotropin (TSH)-secreting adenomas. The remaining 30% of PAs are classified as nonfunctional, which mainly produce symptoms due to their mass effect. PAs are further subdivided based upon their size macroadenomas (>10mm) and microadenomas (<10mm). Both the size and functional status can influence the diagnostic workup, treatment plan, and prognosis for these tumors. Lesions confined to the pituitary gland particularly small size may be asymptomatic.[12]

In our study, there are 9 cases of Macroadenoma. Almost all cases presented with visual disturbances (homonymous hemianopsia) due to mass effect on optic chiasm. T1 and T2 hypointense and larger lesions are heterogeneous due to cystic, necrotic and hemorrhagic areas. Majority showing homogenous enhancement and mass effect on optic chiasm (Fig4).DWI and ADC may be more useful than conventional MRI features for predicting tumour respectability. In our study 2 macro adenomas showing subtle diffusion restriction and low ADC value representing soft to intermediate consistency. All patients underwent transsphenoidal hypophysectomy and correlated with histopathology. Only 7 cases turned out to be the same and 2 cases were misdiagnosed. Histopathology revealed one meningioma and one craniopharyngioma. 2 cases were diagnosed as pituitary apoplexy and prompt neurosurgical intervention was done. No syndromic associations are found in our study.

In our study, there are 5 cases of microadenomas. Though minorities can pose imaging and management challenges . Difficult to identify in anything other than dedicated pituitary imaging. As they are confined to the Sella, there are no symptoms of mass effect. T1 hypo and T2 hyperintense/variable signal intensity and non enhancing on early contrast and delayed washout (retained contrast) on dynamic contrast-enhanced imaging (Fig3). After clinical correlation, 3cases were given medical management for hormonal imbalance (especially for hyperprolactinemia and hypothyroidism).2 cases diagnosed as Cushing's disease, surgically managed by trans-sphenoidal endoscopic removal.

there are 5 cases of craniopharyngiomas in our study solid cystic lesions. Predominantly suprasellar in-location with sellar and parasellar extension is seen. calcifications seen in 2 cases. Nodular and ring enhancement are seen in 3 (Fig 5). 3 cases are Adamantinomatous type and 2 cases are solid papillary type. Our findings were similar to Johnson et al. Because of the overlapping morphological characteristics on MRI. One case was misdiagnosed. Histopathology revealed macroadenoma. There are 3 cases of meningiomas. Isointense on T1 and T2W images showing homogenous intense enhancement on contrast (Fig 8). Dural tail sign & narrowing of ICA seen in 1 case. One case was wrongly diagnosed. histopathology revealed macro adenoma. In our study, 2cases were diagnosed as clival chordoma involving skull base causing clival destruction.1 case was misdiagnosed and later found out to be plasmacytoma(Fig 9). one k/c/o RCC with skull base lesion correctly diagnosed as clival metastasis..1 case of hypothalamo optiochiasmatic glioma predominantly in the suprasellar region correctly diagnosed by conventional MRI. (Fig 6) and well correlated with postoperative histopathology findings.

In our study we correctly diagnosed 3 cases of aneurysm. one of those was a giant aneurysm. One middle aged female patient came with panhypopituitarism, Diabetes insipidus (DI). CT showing dense thickened symmetric enlargement in the stalk region and extending superiorly into optic chiasm and hypothalamus in the suprasellar cistern. MRI showing an isointense signal on T1 and T2WI with homogenous intense enhancement on contrast. Posterior pituitary and the stalk not separately visualized. We rightly diagnosed it as lymphocytic neurohypophysitis/acute pituitary inflammation and the patient responded well with steroids and hormone replacement therapy(Fig10). We saw 7 cases of congenital pituitary hypoplasias. one of those is with interrupted/ thin stalk (Fig1) and advised medical management with hormone replacement. We saw 3 cases of normal variants like partial empty sella syndrome. Among those one is diagnosed as secondary empty sella syndrome with h/o snake bite and hypothyroidism.(Fig2)

All the above neoplastic and non-neoplastc pathologies are correlated both clinically and postoperatively by histopathology and conclusions were drawn. Diagnostic accuracy for non neoplastic pathologies was 100% whereas for neoplastic pathologies it was 76.74% (microadenomas 100% ,macroadenomas 90.69%, craniopharyngioma 95.34%,meningiomas 95.34, metastasis100%, glioma 100%, clival chordoma 95.34%) and thus partially correlating with previous studies by Johnson et al.

CONCLUSION:

Thus, we conclude that MRI is the investigation of choice for evaluating hypothalamic-pituitary-relatedsellar and juxtasellar region endocrine diseases. MRI not only helps in the diagnostic differentiation of these lesions but also provides useful information about the relationship of the gland with adjacent anatomical structures and helps to plan medical or surgical strategies. The introduction of dynamic contrast-enhanced MRI has further refined this technique.DWI should become a part of the routine assessment of macroadenomas for planning the surgical approach. Proton MR spectroscopy can be helpful in differentiating various types of lesions involving the pituitary-hypothalamic axis.

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