Role of MRI in Evaluation of Sellar and Parasellar Masses

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Abstract:

Background: Sellar and parasellar masses comprise a diverse group of lesions affecting the central skull base, often leading to significant endocrine and neurological dysfunction. Accurate differentiation of these masses is crucial for clinical management. Magnetic Resonance Imaging (MRI) is the preferred imaging modality due to its superior soft tissue resolution, multiplanar capabilities, and contrast differentiation.

Objectives: To evaluate and differentiate various sellar and parasellar masses using MRI, based on their imaging characteristics, clinical presentation, and anatomical features.

Methods: This retrospective study included 45 patients who underwent MRI brain scans with pituitary protocol at Dr. BVP Rural Medical College, Loni. Imaging was performed using a Philips Ingenia Elition 3 Tesla MRI machine, including T1-weighted, T2-weighted, and post-contrast T1-weighted images in multiple planes. Lesions were analyzed based on size, enhancement pattern, cystic components, and anatomical involvement.

Results: Out of 45 cases, the most common diagnoses were microadenomas (18), macroadenomas (11), pituitary apoplexy (4), craniopharyngiomas (2), Rathke's cleft cysts (2), skull base meningiomas (2), pituitary hyperplasia (5), and optic chiasmatic glioma (1). MRI effectively differentiated these lesions based on characteristic imaging findings.

Conclusion: MRI is an essential tool in evaluating sellar and parasellar masses, offering precise differentiation for optimal patient management.

Keywords: MRI, Sellar Masses, Pituitary Lesions.

Introduction

The sellar and parasellar regions form a crucial part of the central skull base, housing the pituitary gland, which plays a pivotal role in regulating various endocrine functions. Due to its central location within the sphenoid bone, even minor pathological changes in the sellar and parasellar regions can result in significant physiological and neurological disturbances. Lesions in these regions vary widely in etiology, ranging from benign adenomas to malignant neoplasms and vascular abnormalities. Accurate diagnosis and differentiation of these lesions are critical for appropriate management and treatment planning. (1,2)

Magnetic Resonance Imaging (MRI) has emerged as the gold standard for evaluating sellar and parasellar masses due to its superior soft tissue contrast, absence of ionizing radiation, and multiplanar imaging capabilities.(3) MRI provides detailed anatomical visualization, allowing differentiation based on lesion size, shape, composition, and contrast enhancement patterns. Common sellar and parasellar pathologies include microadenomas, macroadenomas, Rathke's cleft cysts, craniopharyngiomas, pituitary apoplexy, skull base meningiomas, and optic chiasmatic gliomas.(4,5) This study aims to analyze the role of MRI in evaluating these lesions, focusing on their imaging characteristics, clinical presentation, and differential diagnosis to enhance diagnostic accuracy and guide clinical decision-making.

Study Methodology

This study was a retrospective observational study conducted at the Department of Radiodiagnosis, Dr. BVP Rural Medical College, Loni, aimed at evaluating and differentiating various sellar and parasellar masses using MRI imaging. A total of 45 patients who had undergone MRI brain scans with a pituitary protocol were included. The study population comprised patients who presented with symptoms suggestive of sellar and parasellar lesions and had consented to MRI evaluation. Patients with cardiac pacemakers, metallic implants, or those who did not consent to MRI were excluded from the study.

MRI scans were performed using the Philips Ingenia Elition 3 Tesla MRI machine. The imaging protocol included T1-weighted images in coronal and sagittal planes, T2-weighted images in the coronal plane, and post-contrast T1-weighted images in all three planes for detailed lesion characterization. This protocol ensured optimal visualization of lesion morphology, enhancement characteristics, and anatomical extent. The multiplanar capabilities and high-resolution imaging provided by the 3T MRI system enhanced the differentiation between various sellar and parasellar pathologies.

Data analysis was carried out by assessing the lesions based on their size, shape, location (intrasellar vs. extrasellar), presence of cystic components, contrast enhancement patterns, and extent of spread. The lesions were categorized into microadenomas, macroadenomas, Rathke's cleft cysts, craniopharyngiomas, pituitary apoplexy, meningiomas, and optic chiasmatic gliomas based on characteristic MRI features. These findings allowed for a comprehensive evaluation, aiding in accurate diagnosis and treatment planning for patients with sellar and parasellar masses.

Results

Table 1: Distribution of Diagnosed Sellar and Parasellar Masses

Diagnosis	Number of Cases
Microadenoma	18
Macroadenoma	11
Pituitary Apoplexy	4
Rathke's Cleft Cyst	2
Craniopharyngiomas	2
Skull Base Meningioma	2
Pituitary Hyperplasia	5
Optic Chiasmatic Glioma	1

Table 2: MRI Findings Based on Lesion Characteristics

Lesion Type	Size	Enhancement Pattern
Microadenoma	<10 mm	Delayed enhancement
Macroadenoma	Large with suprasellar extension	Intense contrast enhancement
Rathke's Cleft Cyst	Variable	Non-enhancing, T2 hyperintense
Pituitary Apoplexy	Variable	No enhancement, T1 hyperintense fluid-fluid levels
Craniopharyngiomas	Solid-cystic	Heterogeneous with calcifications
Meningiomas	Broad-based	Dural tail sign

Table 3: Clinical Presentation of Patients with Sellar and Parasellar Masses

Case No.	Age & Gender	Clinical Presentation	MRI Diagnosis
1	10F	Hypothyroidism, visual disturbances	Macroadenoma
2	40M	Headache, blurring of vision	Meningioma
3	25F	Headache post-LSCS	Pituitary Apoplexy
4	69F	Gradual vision loss, headache	Optic Chiasmatic Glioma
5	39M	Bitemporal hemianopia, headache	Craniopharyngioma

Discussion

Sellar and parasellar masses are a diverse group of lesions that vary in etiology, clinical presentation, and imaging characteristics. Accurate diagnosis of these masses is crucial for effective treatment planning, and MRI has proven to be the imaging modality of choice due to its superior soft tissue resolution, multiplanar capabilities, and contrast differentiation. This study evaluated 45 patients with suspected sellar and parasellar masses and identified distinct patterns that facilitated diagnosis. (6,7)

Among the lesions identified, microadenomas (18 cases) and macroadenomas (11 cases) were the most common, collectively accounting for nearly two-thirds of the cases. Pituitary adenomas, particularly microadenomas, are often associated with hormonal imbalances and may remain asymptomatic until incidental detection on imaging. Macroadenomas, on the other hand, frequently exhibit suprasellar extension, leading to symptoms such as visual disturbances and headaches due to compression of the optic chiasm. On MRI, microadenomas appeared as small lesions (<10 mm) with delayed enhancement relative to the pituitary gland, while macroadenomas were larger, causing sella widening and showing intense post-contrast enhancement. (8)

Pituitary apoplexy, observed in four cases, is a critical emergency resulting from hemorrhage or infarction of a pituitary tumor. It typically presents with sudden-onset headache, visual disturbances, and hypopituitarism. MRI findings in these cases showed T1 hyperintense fluid-fluid levels within the pituitary gland, indicative of hemorrhage. The absence of post-contrast enhancement helped differentiate apoplexy from other cystic lesions. (9)

Two cases of Rathke's cleft cysts were identified, which are benign, non-neoplastic cysts arising from remnants of Rathke's pouch. These lesions were T2 hyperintense and non-enhancing on MRI, which helped differentiate them from cystic adenomas and craniopharyngiomas. Similarly, two cases of craniopharyngiomas were observed, which are solid-cystic tumors with suprasellar extension and often contain calcifications. Their heterogeneous enhancement and frequent cystic nature make MRI a valuable tool in distinguishing them from other pituitary and suprasellar tumors.

A notable case of optic chiasmatic glioma was seen in a 69-year-old female presenting with gradual loss of vision and headache. These tumors typically arise from the optic nerve or chiasm and are characterized by heterogeneous post-contrast enhancement on MRI. Early diagnosis is essential as these tumors can lead to significant visual impairment.

Two cases of skull base meningiomas were identified, showing typical broad-based dural attachment and a dural tail sign on MRI. Meningiomas are slow-growing tumors, and their differentiation from pituitary adenomas is essential as surgical approaches differ significantly. The superior spatial resolution of MRI allows for clear visualization of dural attachment, aiding in accurate diagnosis. (10)

Lastly, five cases of pituitary hyperplasia were identified, often presenting with mild-to-moderate gland enlargement without a discrete mass. These findings highlight the importance of MRI in distinguishing true neoplastic growth from physiological changes.

Conclusion:

MRI plays a pivotal role in diagnosing and differentiating sellar and parasellar masses based on lesion size, enhancement pattern, cystic components, and anatomical extension. The ability to non-invasively characterize these lesions significantly aids clinical management, ensuring timely intervention and appropriate treatment selection. Future research can further refine imaging protocols and explore advanced techniques such as diffusion-weighted imaging and spectroscopy to enhance diagnostic accuracy.

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