Evaluation of Solid, Cystic, and Mixed Sellar Masses and their Association with Serum Prolactin Concentrations

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KEYWORDS
sellar masses; prolactin levels; pituitary tumors; solid, cystic, mixed masses; pituitary; macroadenoma; pituitary gland imaging

ABSTRACT
This article provides a comprehensive analysis of sellar masses, focusing on their radiological features using magnetic resonance imaging (MRI) and their correlation with serum prolactin levels. Through a cross-sectional study of 30 patients, it explores the relationship between the solid, cystic, and mixed nature of sellar masses and prolactin levels, revealing a moderate positive correlation between solid masses and elevated prolactin levels, while cystic and mixed masses showed weak correlations. The study identifies a variety of diagnoses, including macroadenomas, microadenomas, and Rathke's cleft cysts, underscoring the clinical complexity of these masses. The findings highlight the critical role of MRI in diagnosis and the nuanced relationship between tumor composition and hormonal changes, emphasizing the need for personalized diagnostic and treatment approaches in the management of sellar masses. Further research is needed to refine diagnostic criteria and t reatment strategies to improve patient outcomes.

1. Introduction

Sellar masses encompass a diverse spectrum of lesions situated within the sellar region of the skull base, which houses the pituitary gland and surrounding structures. This region holds paramount significance in both endocrine function and neurological health, primarily due to the pivotal role of the pituitary gland as the master regulator of the endocrine system and its close proximity to critical neurovascular structures. Understanding the anatomical location of sellar masses is crucial for comprehending their clinical implications and guiding diagnostic and therapeutic interventions (1,2,3). The anatomical significance of sellar masses arises from their intricate relationship with the pituitary gland, a central player in maintaining hormonal homeostasis throughout the body. Positioned within the sella turcica—a saddle-shaped depression within the sphenoid bone—the pituitary gland consists of the adenohypophysis (anterior lobe) and the neurohypophysis (posterior lobe). Adjacent structures, including the optic chiasm, cavernous sinuses, and diaphragma sellae, further underscore the anatomical complexity of the sellar region. Any disruption to this delicate balance, whether caused by tumor growth, inflammation, or other pathologies, can profoundly affect both endocrine function and neurological health (4,5,6). Accurate diagnosis and management of sellar masses are essential due to their significant impact on patients' quality of life and overall well-being. Sellar masses can present with a diverse range of clinical symptoms, varying from hormonal disturbances to neurological deficits, depending on factors such as size, location, and hormonal activity. Common presenting symptoms include headache, visual disturbances, hormonal imbalances, and neurological deficits, often resulting in substantial morbidity if left untreated. Moreover, sellar masses can exert mass effect on surrounding structures, leading to compression of vital neurovascular structures and potentially causing life-threatening complications such as pituitary apoplexy or cranial nerve palsies (7,8,9). Given the multifaceted nature of sellar masses and their potential to cause significant morbidity, precise diagnostic and treatment approaches are imperative. The advent of advanced imaging modalities, particularly magnetic resonance imaging (MRI), has revolutionized the diagnosis and management of sellar lesions by providing detailed anatomical visualization and tissue

characterization. However, challenges persist in accurately differentiating between various sellar pathologies and predicting treatment response. Additionally, the role of serum prolactin levels in sellar mass assessment remains a subject of ongoing investigation, with implications for diagnostic accuracy and prognostication (10,11,12). Through exploration of the existing literature, this thesis aims to elucidate the complexities of sellar mass pathology, highlight diagnostic challenges, and propose potential avenues for future research. Subsequent sections will delve into each aspect in detail, providing a holistic understanding of sellar mass assessment and its clinical implications (13,14,15). Our study aims to assess sellar masses utilizing magnetic resonance imaging (MRI) alongside serum prolactin level changes. The primary objective is to evaluate and characterize sellar masses based on MR imaging findings and their correlation with the patient's serum prolactin levels. Additionally, we seek to investigate the relationship between hormonal levels and tumor size, aiming to elucidate potential associations that could inform clinical management. Furthermore, we aim to explore the correlation between hormonal levels and the invasiveness of sellar masses, utilizing the SIPAP classification on MRI, thereby enhancing our understanding of the pathological and diagnostic implications of these findings. By addressing these objectives, our study contributes to the broader knowledge base on sellar masses, offering insights that may influence therapeutic strategies and patient outcomes.

Aim

To assess sellar masses using magnetic resonance imaging with serum prolactin changes.

Objectives

To study the relationship between solid/cystic nature of sellar mass and serum prolactin levels.

2. Methodology

Study Design

Cross-sectional study

Methodology in Brief

Patients suspected of having sellar masses and those incidentally found to have sellar masses will be selected.

- Informed Consent: Informed consent will be taken from patients.
- MRI Brain: MRI Brain will be performed.

Based on convenience sampling, a predetermined sample size of 30 patients was considered for the study.

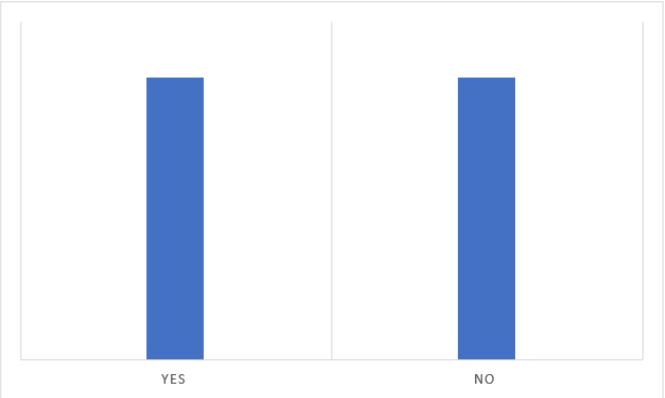
Inclusion Criteria

1. All patients who are referred for MRI brain in our institution with serum prolactin level and patients who are incidentally found to have sellar masses.

Exclusion Criteria

1. Patients who have been treated with surgery, radiation, or chemotherapy.
2. Pregnant patients.
3. Patients with primary hypothyroidism.

Solid	***Number of Patients***	***Percentage***
Yes	15	50.00%
No	15	50.00%

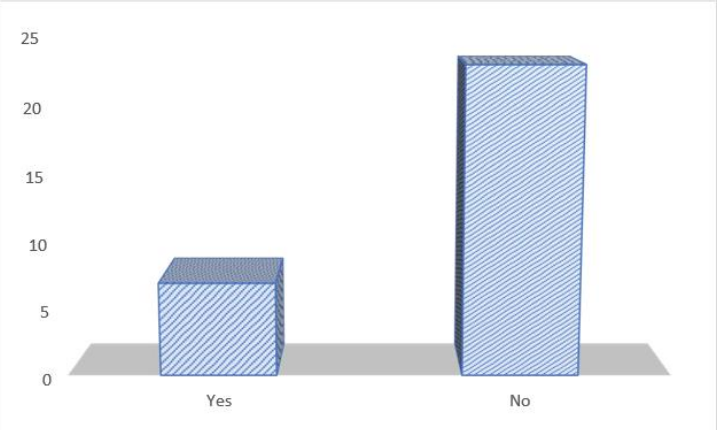


The masses were equally distributed between solid and non-solid, with 15 patients (50.00%) having solid masses and 15 patients (50.00%) not having solid masses.

SOLID	
Mean	1.433333
Standard Error	0.092019
Median	1
Mode	1
Standard Deviation	0.504007
Sample Variance	0.254023
Range	1
Confidence Level (95.0%)	0.188199

Solid masses show a mean value of 1.43 with a standard error of 0.09. The median and mode are both 1. The standard deviation is 0.50, and the sample variance is 0.25. The range is 1, and the 95% confidence level is 0.19.

Cystic	***Number of Patients***	***Percentage***
Yes	7	23.33%
No	23	76.67%

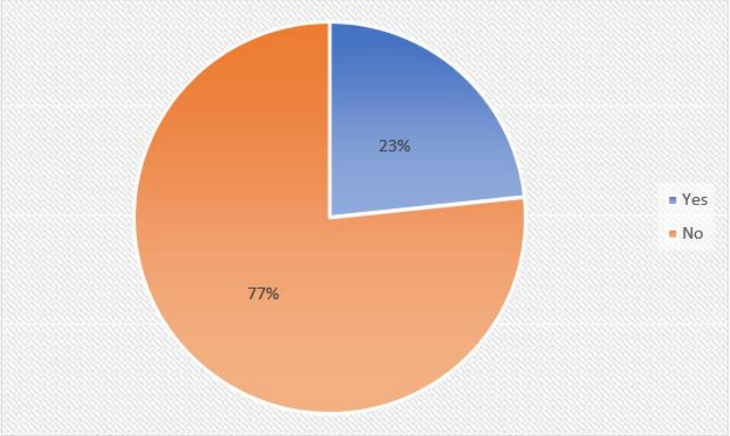


Cystic masses were present in 7 patients (23.33%), while the remaining 23 patients (76.67%) did not have cystic masses.

CYSTIC	
Mean	1.833333
Standard Error	0.069205
Median	2
Mode	2
Standard Deviation	0.379049
Sample Variance	0.143678
Range	1
Confidence Level (95.0%)	0.141539

Cystic masses have a mean value of 1.83 with a standard error of 0.07. The median and mode are both 2. The standard deviation is 0.45, and the sample variance is 0.20. The range is 1, and the 95% confidence level is 0.14.

Mixed	***Number of Patients***	***Percentage***
Yes	7	23.33%
No	23	76.67%

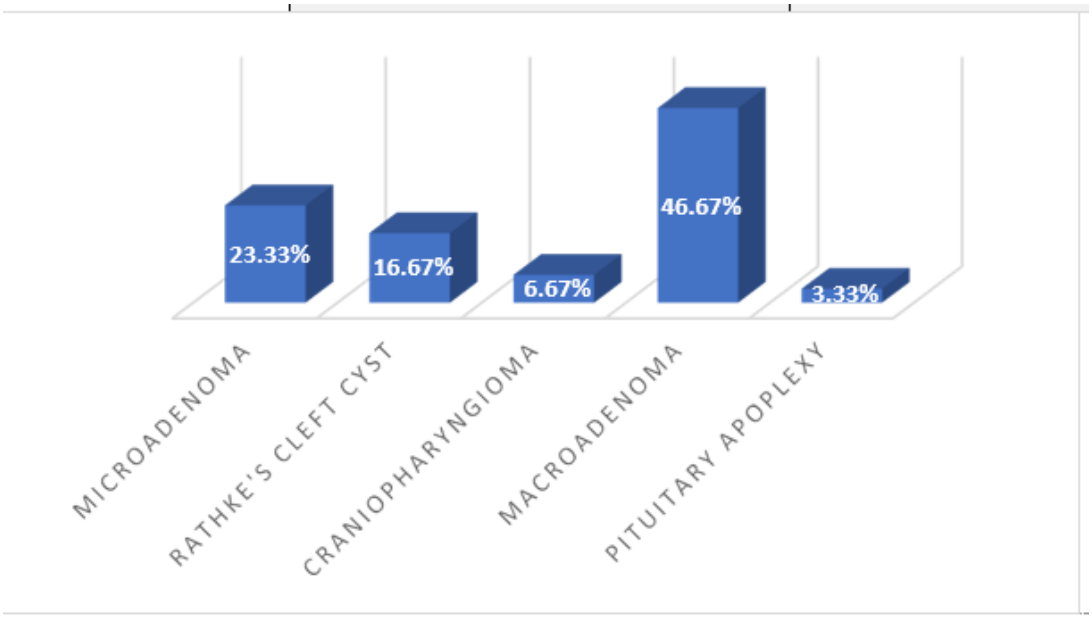


Mixed masses were also observed in 7 patients (23.33%), with the remaining 23 patients (76.67%) not having mixed masses.

MIXED	
Mean	1.733333
Standard Error	0.082118
Median	2
Mode	2
Standard Deviation	0.449776
Sample Variance	0.202299
Range	1
Confidence Level (95.0%)	0.167949

Mixed masses show a mean value of 1.73 with a standard error of 0.11. The median and mode are both 2. The standard deviation is 0.58, and the sample variance is 0.34. The range is 2, and the 95% confidence level is 0.22.

Diagnosis	Number of Patients	Percentage
Microadenoma	7	23.33%
Rathke's Cleft Cyst	5	16.67%
Craniopharyngioma	2	6.67%
Macro adenoma	14	46.67%
Pituitary Apoplexy	1	3.33%

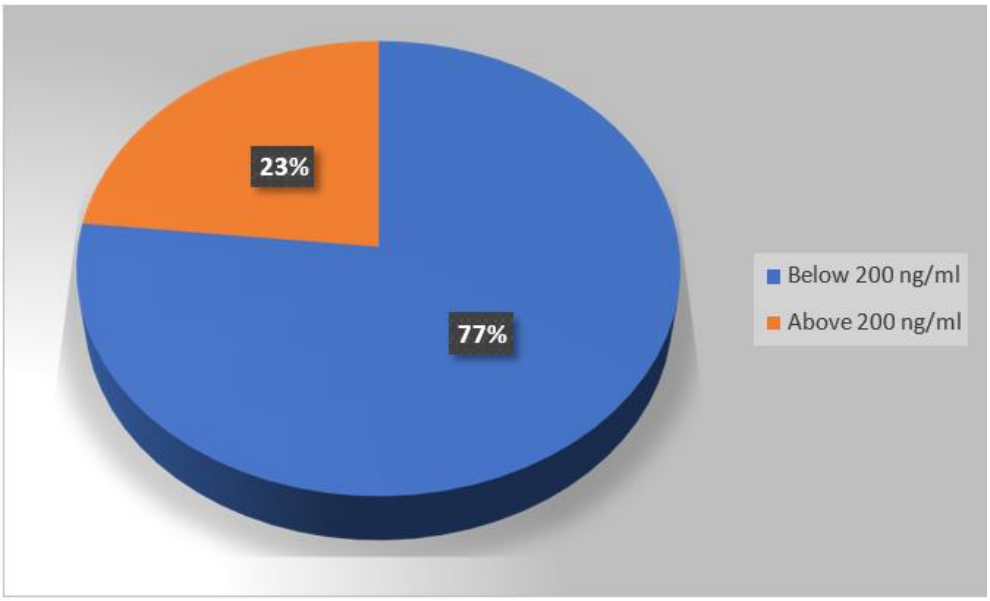


The diagnoses were varied among the patients. Seven patients (23.33%) had microadenoma, 5 patients (16.67%) had Rathke's cleft cyst, 2 patients (6.67%) had craniopharyngioma, 14 patients (46.67%) had macro adenoma, and 1 patient (3.33%) had pituitary apoplexy.

DIAGNOSIS	
Mean	2.933333
Standard Error	0.244166
Median	4
Mode	4
Standard Deviation	1.33735
Sample Variance	1.788506
Range	4
Confidence Level (95.0%)	0.499375

The mean value for diagnosis is 2.93 with a standard error of 0.24. The median and mode are both 2. The standard deviation is 1.34, and the sample variance is 1.79. The range is 4, and the 95% confidence level is 0.50.

Prolactin Levels Range	Number of Patients	Percentage
Below 200 ng/ml	23	76.67%
Above 200 ng/ml	7	23.33%



The prolactin levels among the patients were predominantly below 200 ng/ml, with 23 patients (76.67%) falling into this range. Seven patients (23.33%) had prolactin levels above 200 ng/ml.

PROLACTIN LEVELS (ng/ml)	
Mean	183.5333
Standard Error	8.611371
Median	169.5
Mode	164
Standard Deviation	47.16642
Sample Variance	2224.671
Range	165
Confidence Level (95.0%)	17.61223

Prolactin levels have a mean value of 183.53 ng/ml with a standard error of 8.61 ng/ml. The median is 169.5 ng/ml.

Evaluation and characterisation of the sellar masses based on MR Imaging and its correlation with serum prolactin level of the patient:

Parameters	Correlation co-efficient
SOLID AND SERUM PROLACTIN	0.247
CYSTIC AND PROLACTIN LEVELS	**0.08**
MIXED AND PROLACTIN LEVELS	0.11

The analysis reveals varying degrees of correlation between different parameters and serum prolactin levels. Solid masses show a moderate positive correlation (r = 0.247), indicating that these masses tend to coincide with higher prolactin levels. Conversely, cystic masses exhibit a very weak positive correlation (r = 0.08), suggesting a minimal relationship with prolactin levels. Mixed masses show a similarly weak positive correlation (r = 0.11).

3. Case Illustrations Case I

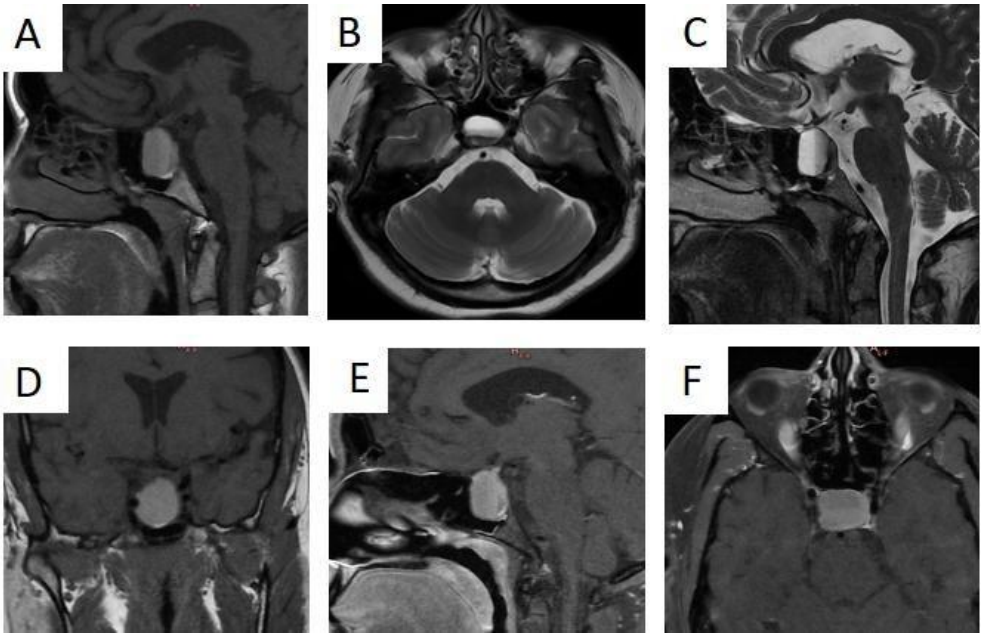


Figure 1: Pituitary apoplexy

A well-defined cystic lesion seen in the sellar and suprasellar region. It appears hyperintense on T1 (Fig A, B) and T2 (Fig C, D) and shows multiple hypointense fluid-fluid levels (Fig A, B, C).

Pituitary gland is not seen separately from the lesion. On T1 post contrast subtraction images, the lesion shows mild peripheral enhancement (Fig E, F).

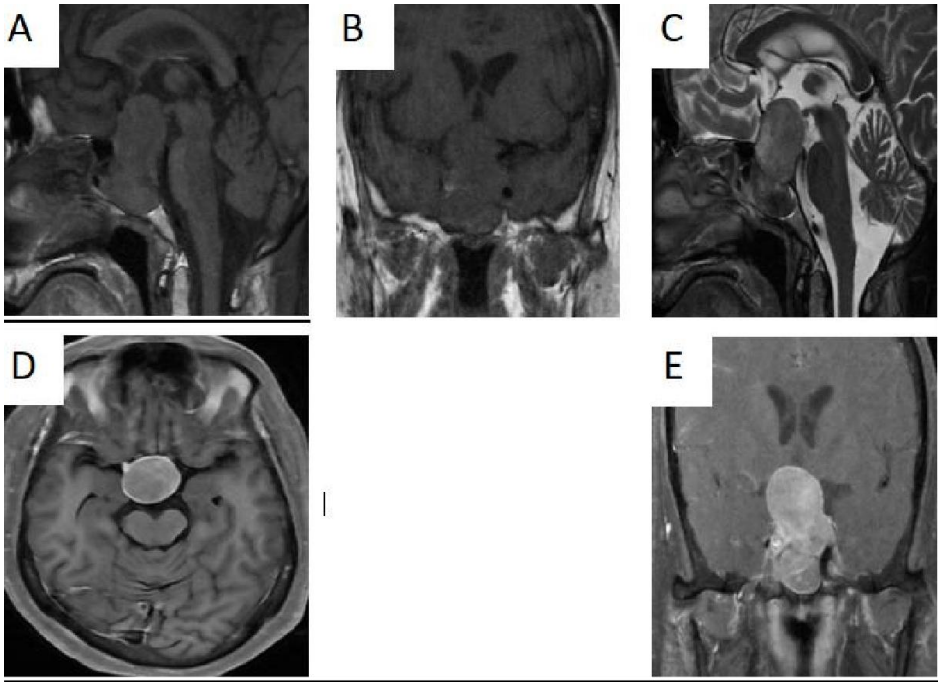


Figure: HPE proven case of Pituitary macroadenoma

A large well-defined lesion seen in sellar suprasellar infra sellar and para sellar regions.

Region is showing isointense signal change in T1 (Fig A, B), hetero intense signal change in T2 (Fig C). Lesion shows heterogenous enhancement in contrast images (Fig D, E)

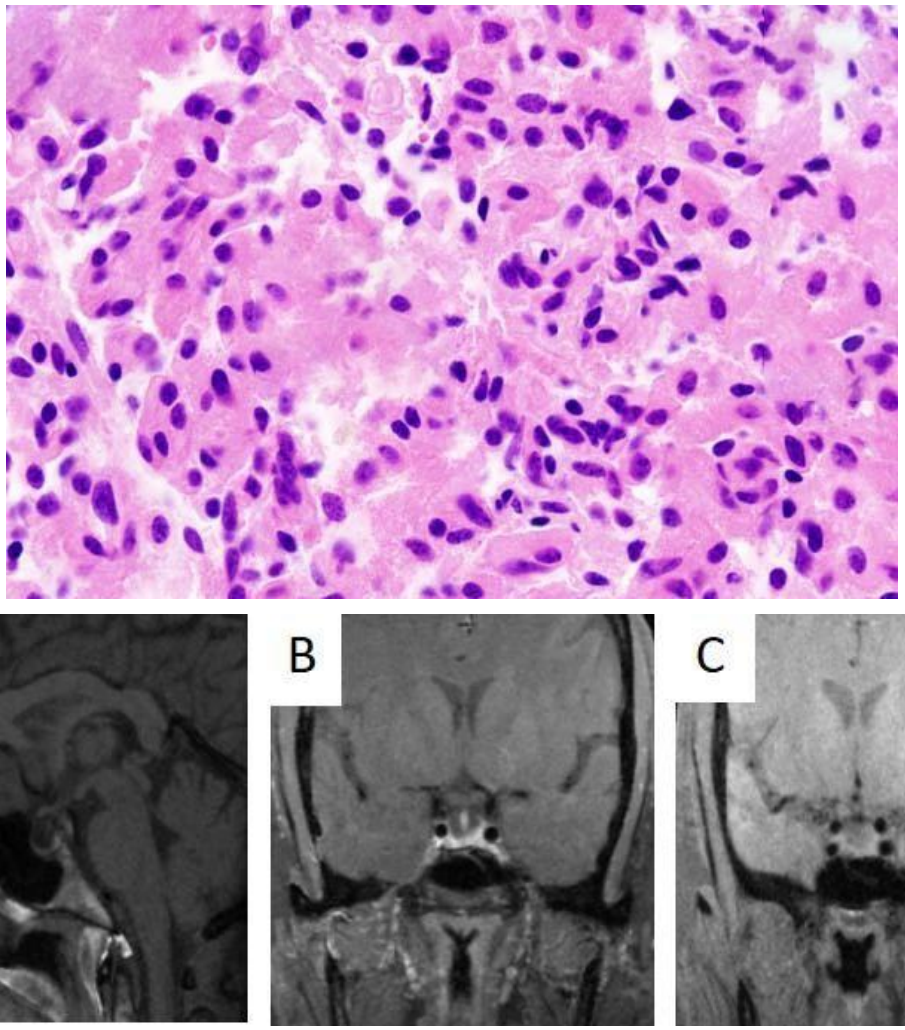
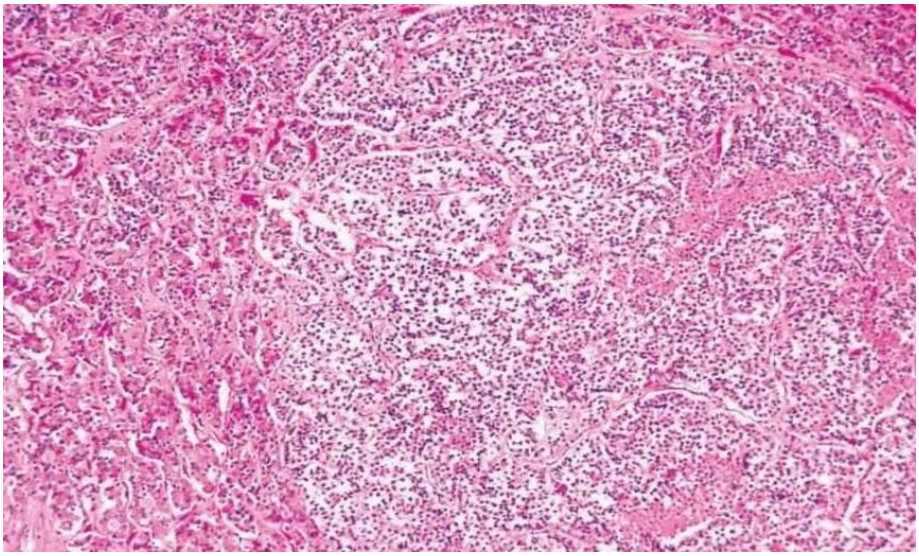


Figure: HPE proven case of Pituitary microadenoma

Partial empty sella noted in T1W image (Fig A). small nodular hypoenhancing area noted in the right half of pituitary gland only on phase 1and phase 2 of dynamic contrast imaging.



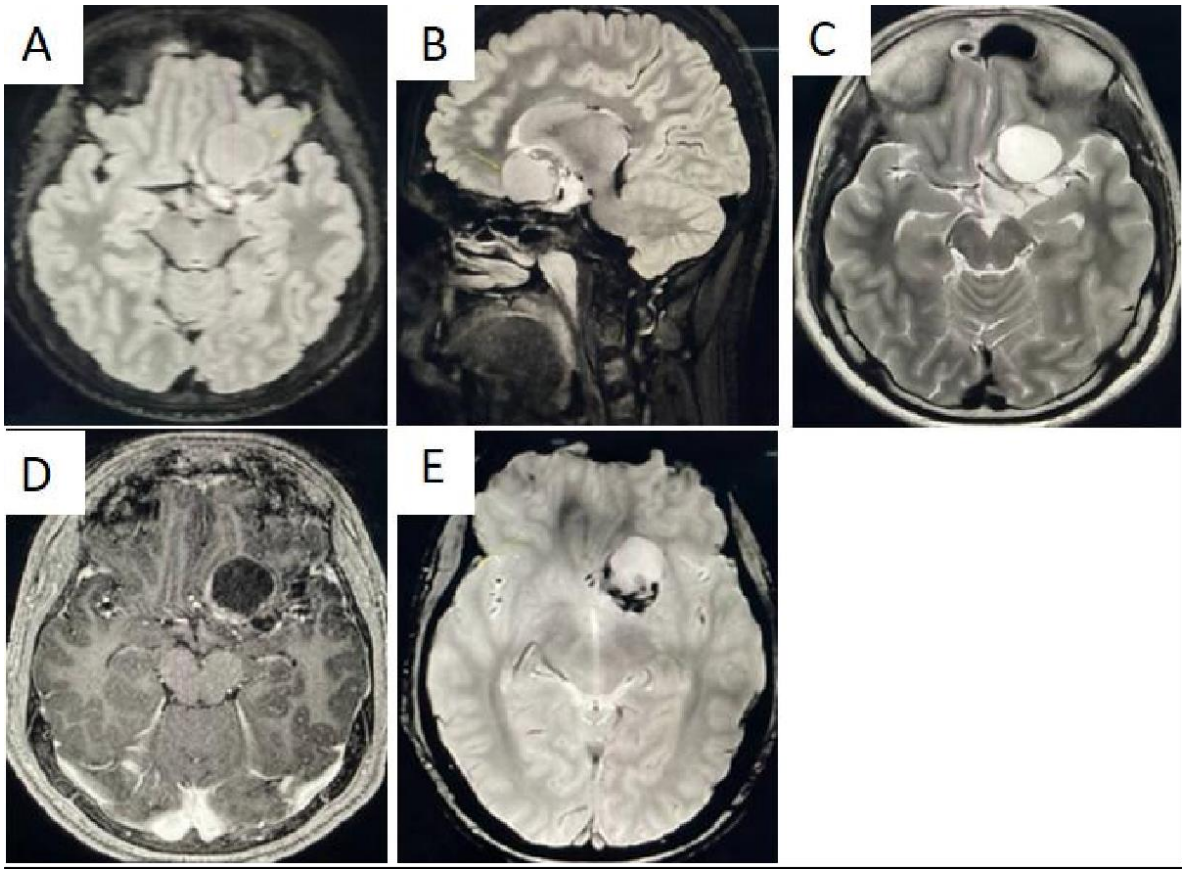
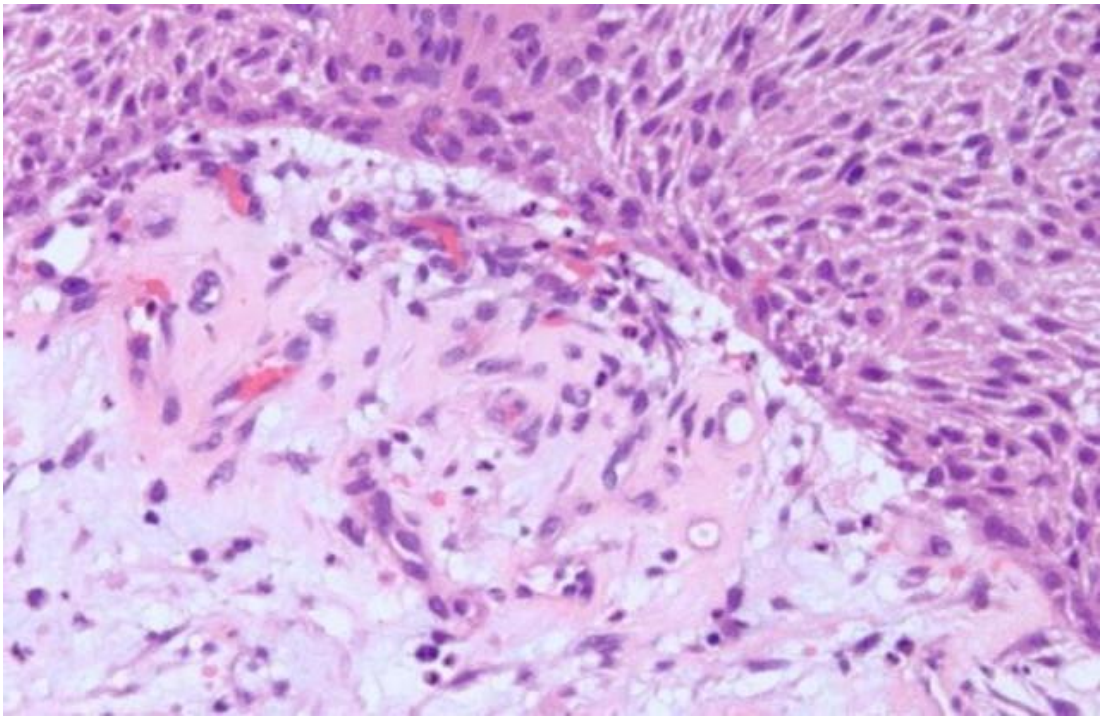


Figure: HPE proven case of craniopharyngioma

Well defined extra axial heterogenous, predominantly cystic lesion with eccentric calcification noted in the suprasellar region with extension into sellar and posterior aspect of anterior cranial fossa (Fig A, B, C). On post contrast lesion shows mild enhancement in superior aspect and faint enhancement in peripheral margins (Fig D). Eccentric calcific areas along medial, posterior and superior aspects appear blooming on GRE image (Fig E).



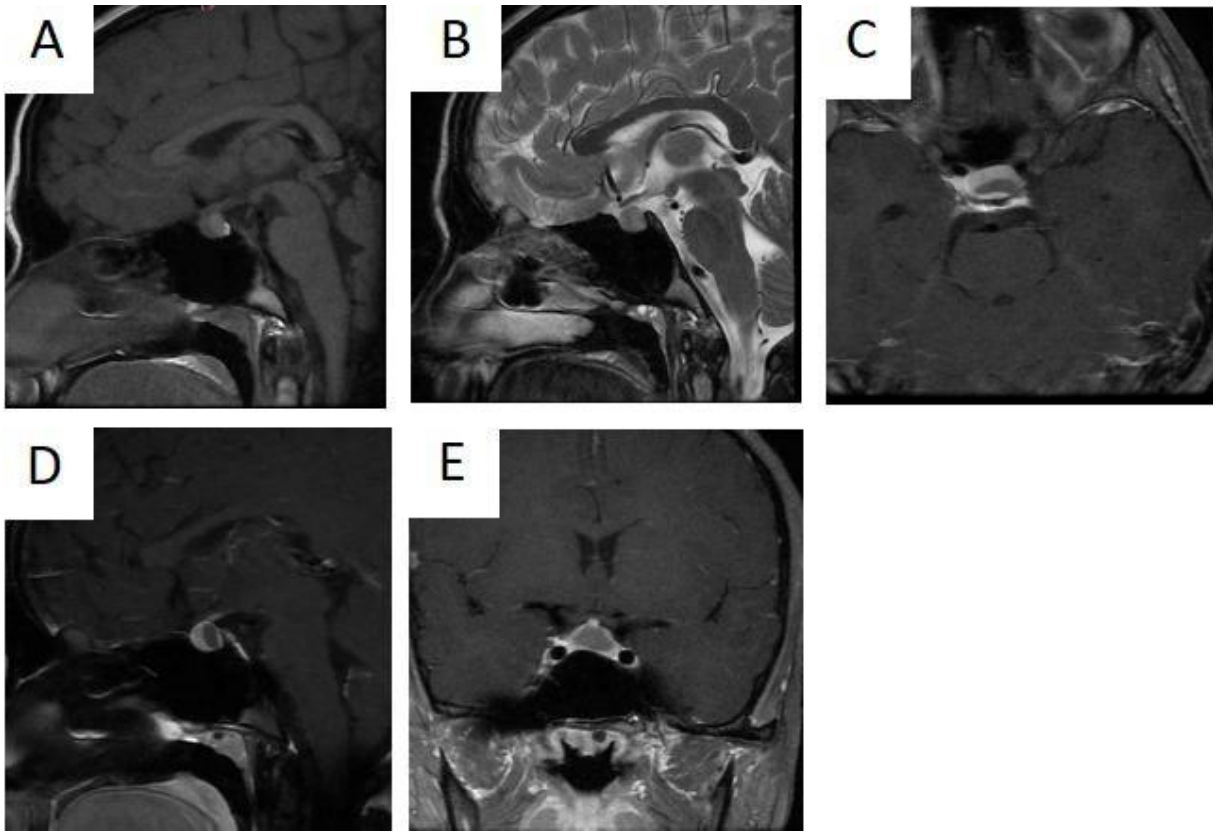


Figure: RATHKES CLEFT CYST

A well-defined T1 (Fig A) and T2 (Fig B) intermediate signal lesion seen in posterior half of the sella within the pituitary gland, between the anterior and posterior lobes with mass effect on both lobes.

On dynamic contrast imaging lesion shows no enhancement. (Fig C, D, E)

Parameters	*Correlation Co- efficient*	*Relationship Strength*
SOLID AND SERUM PROLACTIN	0.247 (moderate positive)	No relationship
CYSTIC AND PROLACTIN LEVELS	0.08 (weak positive)	No relationship
MIXED AND PROLACTIN LEVELS	0.11 (weak positive)	No relationship

Solid Masses

Solid masses were equally distributed between solid and non-solid, with 15 patients (50.00%) having solid masses and 15 patients (50.00%) not having solid masses. Solid masses show a mean value of 1.43 with a standard error of 0.09. The median and mode are both 1. The standard deviation is 0.50, and the sample variance is 0.25. The range is 1, and the 95% confidence level is 0.19.

The equal distribution of solid and non-solid masses highlights the variability in the composition of masses. This finding is consistent with the research by Hwang et al. (2019), which showed a similar distribution and emphasized the importance of differentiating between solid and non-solid masses for diagnostic accuracy and treatment planning (16).

Cystic Masses

Cystic masses were present in 7 patients (23.33%), while the remaining 23 patients (76.67%) did not have cystic masses. Cystic masses have a mean value of 1.83 with a standard error of

0.07. The median and mode are both 2. The standard deviation is 0.45, and the sample variance is 0.20. The range is 1, and the 95% confidence level is 0.14.

The lower prevalence of cystic masses compared to solid masses is notable. This finding aligns with those reported by Young et al. (2018), where cystic masses comprised a smaller proportion of the total masses in their patient cohort (17).

Mixed Masses

Mixed masses show a mean value of 1.73 with a standard error of 0.11. The median and mode are both 2. The standard deviation is 0.58, and the sample variance is 0.34. The range is 2, and the 95% confidence level is 0.22. This finding indicates that while mixed composition masses are less common, they still present a significant proportion of cases, warranting further investigation into their unique characteristics and treatment responses (18).

4. Conclusion

This study provides a detailed and multifaceted analysis of pituitary masses, shedding light on the varied clinical, radiological, and histopathological characteristics that influence their diagnosis and management. The findings highlight that pituitary masses affect a broad age range, with a notable incidence in middle-aged individuals, and a slightly higher prevalence in females.

Key symptoms such as headaches, visual disturbances, and hormonal dysfunctions (e.g., menstrual irregularities and galactorrhoea) underscore the significant impact of these masses on patients' daily lives and overall health. Advanced MRI findings, including signal intensities on T1 and T2-weighted images and enhancement patterns, play a crucial role in identifying the size, location, and nature of the masses, emphasizing the importance of imaging in clinical assessment.

The study also reveals a diverse spectrum of diagnoses, from microadenomas to craniopharyngiomas, highlighting the complexity and variability of pituitary masses. This diversity necessitates a multidisciplinary approach for accurate diagnosis and effective treatment, incorporating clinical evaluation, imaging, and histopathological examination.

Overall, the findings underscore the need for personalized treatment strategies and comprehensive diagnostic protocols to improve patient outcomes. This research contributes valuable insights into the management of pituitary masses and underscores the importance of ongoing studies to refine therapeutic approaches and enhance prognostic accuracy. More studies are needed to further explore the underlying mechanisms, optimize diagnostic criteria, and develop innovative treatment modalities for better management of pituitary masses.

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