Role of Computed Tomography in the Evaluation of Different Suprasellar Masses with Histo-Pathological Correlation

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Abstract:

Introduction: Computed tomography (CT) plays a pivotal role in assessing suprasellar masses due to its ability to provide detailed anatomical information. This imaging modality aids in delineating the extent, composition, and surrounding structures, crucial for guiding further management and correlating findings with histopathological diagnosis. Objective of this study is to evaluate the effectiveness of computed tomography (CT) in identifying and characterizing various suprasellar masses and to correlate these imaging findings with histopathological results.

***Methods**: This study was carried out in Department of Radiology and Imaging with collaboration of Department of Neurosurgery, BSMMU and DMCH for a period of 1 year.*

Patients with suprasellar masses who have undergone CT scan before surgery and histopathological study was carried out post operatively were included in this study irrespective of age and sex. Total 60 patients age ranging between 7 and 55 years (with a mean age of 30.18 years) were included in the study.

***Results:** The mean age of the patients were 30.18 years of whom 56.7 % patients were male and 43.3% were female. Commonest 3 suprasellar masses diagnosed radiologically include pituitary macroadenoma (60%), craniopharyngioma (16.67%) suprasellar and parasellar meniogioma(13.34%).After histopathology 51% pituitary macroadenoma,18% cranio-pharyngioma and 16% suprasellar parasellar meningioma were confirmed.*

***Conclusion:** It was concluded that CT scan can be accepted as a primary imaging modality in the diagnosis of different suprasellar masses.This study was limited to the patients who underwent CT with subsequent histopathological examination.MRI can be added as an additional imaging modality in solvent patients and its diagnostic accuracy can be compared to CT.*

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Introduction:

The suprasellar region of the brain, located just above the sella turcica and the pituitary gland, is an anatomically and functionally complex area. This region is home to various critical structures, including the optic chiasm, hypothalamus, and major blood vessels, which makes it particularly susceptible to the impact of pathological processes. Suprasellar masses, therefore, represent a significant diagnostic and therapeutic challenge due to their potential to cause a wide array of symptoms ranging from visual disturbances to hormonal imbalances and neurological deficits. Accurate evaluation and characterization of these masses are crucial for effective patient management, and this is where imaging modalities like Computed Tomography (CT) play a pivotal role. Computed Tomography has long been a cornerstone in the diagnostic imaging of brain pathologies. Its ability to produce high-resolution, cross-sectional images of the body allows for detailed visualization of the internal structures. In the context of suprasellar masses, CT provides invaluable information regarding the location, size, shape, and density of lesions, as well as their effects on adjacent structures. The non-invasive nature of CT, combined with its rapid acquisition times and widespread availability, makes it an essential tool in the initial assessment of patients with suspected suprasellar masses. The spectrum of suprasellar masses is broad, encompassing both benign and malignant

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neoplasms, cysts, inflammatory processes, and congenital anomalies. Common entities in this region include pituitary macroadenomas, craniopharyngiomas, meningiomas, gliomas, and Rathke's cleft cysts. Each type of lesion presents distinct imaging characteristics and clinical implications. For instance, pituitary macroadenomas are often identified by their sellar origin and potential suprasellar extension, whereas craniopharyngiomas are typically characterized by their mixed solid and cystic components and frequent calcifications, which are well visualized on CT.Sellar and suprasellar tumours constitute about 25% of total intracranial mass lesions.50% of them are pituitary adenomas,25% are craniopharyngiomas and 10% meningiomas .[1]

CT imaging excels in identifying calcifications, a feature commonly associated with craniopharyngiomas and certain meningiomas. The presence of calcification within a suprasellar mass can significantly narrow the differential diagnosis and guide further management. Additionally, CT is highly effective in evaluating the bony structures of the skull base, detecting bone erosion or hyperostosis, which can provide important clues about the nature and behavior of the lesion. In emergency settings, CT is invaluable for the rapid assessment of acute presentations such as hemorrhage within a tumor, which may necessitate urgent intervention.

While CT provides critical anatomical details, it is the correlation with histopathological findings that ultimately confirms the diagnosis and guides treatment. Histopathology, the microscopic examination of tissue samples obtained through biopsy or surgical resection, remains the gold standard for diagnosing and classifying suprasellar masses. It provides detailed information on the cellular and molecular characteristics of the lesion, distinguishing between different tumor types and subtypes, and determining the grade and potential aggressiveness of the neoplasm. This histopathological correlation is essential for developing an accurate and comprehensive diagnostic picture.

The integration of advanced CT technologies, such as multidetector CT (MDCT) and high-resolution imaging, has significantly enhanced the diagnostic capabilities of CT in evaluating suprasellar masses. MDCT allows for the acquisition of thin-slice images, providing superior spatial resolution and enabling the detailed assessment of small or complex lesions. Furthermore, advanced post-processing techniques, including multiplanar reconstruction and 3D rendering, offer additional perspectives on the lesion's anatomy and its relationship with surrounding structures. The use of contrast agents in CT scan and CT angiography further augments the diagnostic utility by highlighting the enhancement pattern, exact size estimation as well as vascular supply of the masses, which is crucial for surgical planning and risk assessment. Despite its numerous advantages, CT is not without limitations. One of the primary concerns is radiation exposure, particularly in younger patients and those requiring multiple follow-up scans. Additionally, CT has lower soft tissue contrast compared to Magnetic Resonance Imaging (MRI), which can limit its ability to differentiate between various soft tissue components. Consequently, CT is often used in conjunction with MRI, which provides superior soft tissue contrast and is particularly effective in delineating the extent of tumor invasion into surrounding brain parenchyma, as well as in identifying cystic or necrotic areas within the mass. Subdividing sellar/juxtasellar lesions into intra,supra and juxtasellar masses facilitates diagnosis although some disease processes involve more than one area.[2]

In clinical practice, the choice between CT and MRI, or the combination of both, depends on various factors, including the specific clinical scenario, patient characteristics, and the nature of the suspected lesion. For instance, in cases where MRI is contraindicated due to patient factors such as the presence of metallic implants or severe claustrophobia, CT becomes the primary imaging modality. Moreover, in emergency situations where rapid assessment is necessary, CT's speed and availability make it the preferred choice. Though the superiority of MRI over CT is well known,MRI is expensive and limited availability, Hence CT remains the most widely used form of neuroimaging for diagnosis of brain tumours. [3]

The collaboration between radiologists, pathologists, and clinicians is essential for the

effective management of patients with suprasellar masses. Radiologists play a critical role in the initial identification and characterization of the lesion through imaging, while pathologists provide definitive diagnosis through histopathological analysis. Clinicians integrate these findings to develop a comprehensive treatment plan tailored to the patient's specific condition. Advances in imaging and histopathological techniques continue to enhance the diagnostic accuracy and therapeutic outcomes for patients with suprasellar masses.

Method:

Study area and population

This prospective study was carried out in the Department of Radiology and Imaging with collaboration of the Department of Neurosurgery, BSMMU and DMCH for a period of 1 year.Total 60 patients were included, age ranged between 7 and 55 years (with mean age of 30.18 years).Data was processed and analyzed using SPSS version 23.0.

Inclusion criteria:

i) Patients with suprasellar masses who have undergone CT examination before surgery and histopathological study post operatively.

ii) Patients were selected irrespective of age and sex.

Exclusion criteria:

i) Patients who have not undergone operative treatment.

ii) Those cases where histopathological reports were not available.

iii) Drop out cases

The patients were evaluated by CT scan with contrast and expert opinion taken in every cases.Patient was followed upto completion of surgery.Specimen was sent for histo-pathological examination.

CT examination technique: After 4-6 hours of fasting CT scan brain was performed with and without contrast from caudal to cephalad levels with 15 to 20 degree angulation to the canthomeatal line. Thinner slices of 1.5 mm to 3 mm were taken through the sellar region.CT scan brain was performed at 120 KV and 150 mA.

Histopathological examination: Biopsy specimens were collection by excisional biopsy.The biopsy specimen was collected in a container containing 10% formalin and sent for histopathology.Gross examination of the excised brain mass was done with particular emphasis to size,consistency and cut surface appearance.They were subjected to two or three tissue blocks of 3-5 mm thickness from the specimen and processed for routine paraffin sections and stained according to haematoxilin and eosin staining method

Results:

Age distribution of patients:

Among the patients the mean age was 30.18 years (range from 7-55 years).The patient age distribution shows a peak incidence between 21-41 years for all sellar/suprasellar tumours.

Table I

Distribution of patients by age, N=60

Age Group	Frequency	Percent
5-10yrs	4	6.7%
11-20 yrs	12	20%
21-30Yrs	14	23.3%
31-40 yr	14	23.3%
41-50 yrs	10	16.7 %
>501yrs	6	10%
Total	60	100%

Distribution of mean age:

For pituitary adenoma, mean age was 33.1 years.For paediatric Craniopharymgioma 9 years and for suprasellar meningioma 35.1 years.

Table II

Distribution by mean age according to disease profile

Disease	Years
Pituitary adenoma	33.1 years
Paediatric Craniopharyngioma	9 years
Adult Craniopharyngioma	50 years
Supra and Parasellar meningioma	5.1 years
Hypothalamic glioma	10 years
Metastasis	0 years

Table III

Comparison between CT and Histopathological findings of Suprasellar Masses

No		Frequency (Radiological diagnosis)	Frequency (Histopathological diagnosis)
1.	Pituitary Macroadenoma	36 (60%)	31 (51%)
2.	Craniopharyngioma	10 (16,67%)	11(18%)
3.	Suprasellar/parasellar meningioma	8 (13.34%)	10(16%)
4.	Hypothalamic glioma	2(3.3%)	3(5%)
5.	Suprasellar arachnoid cyst	1(1.67%)	1(1.6%)
6.	Suprasellar epidermoid	1(1.67%)	1(1.6%)
7.	Parasellar schwannoma	0(0%)	1(1.6%)
8.	Metastasis	1(1.67%)	1(1.6%)
9.	ICA aneurysm	1(1.67%)	1(1.6%)

Discussion:

This study was performed to determine the diagnostic accuracy of CT in the evaluation of suprasellar masses.This prospective study was carried out in the Department of Radiology and Imaging with the co-operation of Department of Neurosurgery ,BSMMU and Dhaka Medical College Hospital during a period of 1 year.

In our study we have seen that peak age of sellar,suprasellar tumour was in between 21 and 40 yrs (48.3%),followed by 20% in 11-20 years of age.16.7% cases occurred in 41-50 years age group.(Table I)

For Pituitary macroadenoma peak age was 33.1 year,paediatric craniopharyngioma 9 years ,adult Craniopharyngioma 50 yrs and suprasellar/ parasellar meningioma was 35.1 yr.(Table II).

These findings were correlated with textbook findings which shows that mean age for pituitary adenoma is 20-50 yrs,for craniopharyngioma peak age is 0-20 yrs and second peak at 50 yrs and meningioma 40-60 yrs.

Among 60 patients radiologically diagnosed sellar/ suprasellar masses comprises of pituitary macroadenoma 36 (60%), craniopharyngioma 10 (16.67%) suprasellar and parasellar meniogioma 8 (13.34%), hypothalamic glioma 2(3.3%). Suprasellar arachnoid cyst,epidermoid, metastasis, ICA aneurysm was diagnosed in 1(1.67%) case only.(Table III)

Histological study of these 60 cases showed 31(51%) cases of pituitary adenoma,11 (18%) cases of craniopharyngioma,10(16%) meningioma,3(5%) hypothalamic glioma,1 (1.6%) each of arachnoid cyst,epidermoid,metastasis,ICA aneurysm and parasellar schwannoma.(Table III)

In contrary to the adult age the most common suprasellar tumors in children are with decreasing frequency craniopharyngiomas, chiasmatic/ hypothalamic low-grade gliomas, germinomas and lesions attributable to a Langerhans cell histiocytosis. For differential diagnostic purposes also the rare hypothalamic hamartoma and meningeal metastases in the infundibular recess of the third ventricle are included. The typical aspects of the various tumors on computed tomography (CT) and magnetic resonance imaging (MRI) together with important clinical differences are illustrated. On the basis of imaging results and clinical symptoms differential diagnosis between the various tumor entities should be feasible in many cases. Of course, only in strictly defined cases like typical chiasmatic/hypothalamic and optic pathway gliomas or bilocular germ cell tumors a histological confirmation is dispensable [4]

Computed tomography is the method of choice for initial evaluation of patients with potential suprasellar masses. In our experience, CT has proved completely reliable for detecting or ruling out the presence of a suprasellar mass, the direction and degree of parasellar extension, and the presence of any calcific or cystic component of the lesion. When multiple cut CT has been negative, further diagnostic studies have proved unrewarding. When CT has been positive,

additional studies have been required in some cases to rule out aneurysm prior to craniotomy.[5]

Rapid advances in imaging technology are a challenge for health care professionals, who must determine how best to use these technologies to optimize patient care and outcomes. Hybrid imaging instrumentation, combining 2 or more new or existing technologies, each with its own separate history of clinical evolution, such as PET and CT, may be especially challenging. CT and PET provide complementary anatomic information and molecular information, respectively, with PET giving specificity to anatomic findings and CT offering precise localization of metabolic activity. Historically, the acquisition and interpretation of the 2 image sets have been performed separately and very often at different times and locales. Recently, integrated PET/CT systems have become available; these systems provide PET and CT images that are acquired nearly simultaneously and are capable of producing superimposed, co-registered images, greatly facilitating interpretation .[6]

Before 2004, the limitations of using computed tomography (CT) in evaluating suprasellar masses included lower resolution and image quality compared to modern standards, limited ability to differentiate soft tissue contrast relative to MRI, and higher radiation exposure, particularly concerning for repeated use in patients. Additionally, CT imaging was less effective in identifying small or subtle lesions and distinguishing between different tissue types within complex masses. Technological advancements in CT and MRI post-2005 have significantly improved diagnostic accuracy, resolution, and safety, addressing many of these earlier limitations.

Conclusion

Computed tomography (CT) plays a critical role in the evaluation of suprasellar masses, providing detailed anatomical information that aids in the initial diagnosis and characterization of these complex lesions. By correlating CT findings with histopathological results, this study demonstrates that CT is effective in identifying key features such as calcifications, bone involvement, and lesion density, which are crucial for differentiating between various types of suprasellar masses. This correlation enhances the accuracy of non-invasive diagnostic methods, ultimately leading to more precise and timely diagnoses. Given the effectiveness of CT in evaluating suprasellar masses, it is recommended that CT be utilized as a primary imaging modality in the initial assessment of patients with suspected suprasellar lesions.

Future research should focus on advancing CT technology and exploring its combined use with other imaging modalities like MRI to further improve diagnostic accuracy and patient management. Enhanced imaging protocols and techniques can lead to better detection, characterization, and monitoring of suprasellar masses, ultimately optimizing patient care.

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