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Agreement between Computed Tomography and Histopathology in the evaluation of different suprasellar masses

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ABSTRACT

Background & objective: The suprasellar region of the brain, which contains critical structures, is susceptible to various pathological processes, leading to significant diagnostic and therapeutic challenges. Accurate evaluation of suprasellar masses is essential for effective patient management. This study aimed to evaluate the consistency and diagnostic accuracy of computed tomography (CT) imaging compared to histopathological findings in patients with suprasellar masses.

Methods: Conducted between July 2004 and June 2005 at Bangabandhu Sheikh Mujib Medical University and Dhaka Medical College Hospital, this study included 60 patients with suprasellar masses who underwent preoperative CT scans with thin slices (1.5–3 mm) followed by histopathological analysis of biopsy materials taken from the resected suprasellar masses. The histological study of the excised suprasellar masses was done to establish a diagnosis, classify its type, and compare the same with its CT diagnosis to decide whether CT scan can fairly diagnose and classify types of suprasellar masses.

Results: The patient population predominantly included young and early middle-aged individuals, with a mean age of 30.2 years (range: 7 – 55 years). Notably, CT scans identified pituitary macroadenomas in 60% of cases, while histopathology confirmed this in 51%. The diagnostic results for craniopharyngiomas were consistent across both modalities. The comparison of diagnoses between CT and histopathology revealed comparable outcomes for various suprasellar masses, with an insignificant Chi-square result ($p = 0.818$), suggesting a consistent diagnostic capacity.

Conclusions: While CT imaging provides valuable initial insights into suprasellar masses, histopathology remains the gold standard for definitive diagnosis. This study highlights the importance of combining both diagnostic modalities to enhance accuracy and improve management strategies for patients with suprasellar masses. Future research should focus on optimizing imaging techniques and exploring additional biomarkers to further refine the diagnostic process.

Keywords: Computed Tomography (CT), histopathology, suprasellar masses, agreement etc.

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INTRODUCTION:

The suprasellar region of the brain is a complex area housing critical structures, making it vulnerable to various pathological processes. Suprasellar masses pose significant diagnostic & therapeutic challenges due to their potential to cause a range of symptoms. The suprasellar region, located above the sella turcica and the pituitary gland, contains vital structures such as the optic chiasma and hypothalamus. Suprasellar masses can lead to diverse symptoms, including visual disturbances, hormonal imbalances, and neurological deficits, creating significant challenges in diagnosis and treatment. Accurate evaluation and characterization of these masses are crucial for effective patient management.

Computed Tomography (CT) is a cornerstone in the diagnostic imaging of brain pathologies. It produces high-resolution, cross-sectional images that allow detailed visualization of internal structures. In assessing suprasellar masses, CT provides invaluable information regarding lesion

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location, size, shape, and density, as well as their effects on adjacent structures. Its non-invasive nature, rapid acquisition times, and widespread availability make CT essential for the initial assessment of patients with suspected suprasellar masses. The spectrum of suprasellar masses is broad, encompassing both benign & malignant neoplasms, cysts, inflammatory processes, & 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 & 10% meningiomas.[1]

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. 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.[2] Moreover, in emergency situations, where rapid assessment is necessary, CT's speed and availability make it the preferred choice.[3]

Despite its various advantages in evaluating suprasellar masses including its superiority in identifying calcifications and evaluating bony structures, the definitive diagnosis of suprasellar masses relies on histopathological findings. Histopathology remains the gold standard for diagnosing and classifying these masses. It is, therefore, imperative to determine the consistency between the two diagnostic modalities (CT and histopathology) in the evaluation of suprasellar masses, which may serve to improve diagnostic accuracy and therapeutic outcomes for patients with suprasellar masses.

METHODS:

This study was conducted in collaboration between the Department of Radiology and Imaging and the Department of Neurosurgery at Bangabandhu Sheikh Mujib Medical University (BSMMU) and Dhaka Medical College Hospital (DMCH) from July 2004 to June 2005. We included a total of 60 patients with suprasellar masses, irrespective of age and sex, who underwent CT examinations before surgery and subsequent histopathological analysis postoperatively.

CT scans were performed with and without contrast, utilizing a 120 kV and 150 mA protocol. Imaging was conducted after a fasting period of 4 to 6 hours, scanning from the caudal to cephalad levels at an angulation of 15 to 20 degrees relative to the canthomeatal line. Thinner slices, ranging from 1.5 mm to 3 mm, were obtained specifically through the sellar region, and expert opinions were sought for each case. Following the CT scans, all patients underwent surgery. Specimens were collected via excisional biopsy, placed in a container with 10% formalin, and sent for histopathological examination. For histopathological analysis, two or three tissue blocks, each 3-5 mm thick, were prepared from the specimens, processed into routine paraffin sections, and stained using the haematoxylin and eosin methods. The histological examination of the excised suprasellar masses was performed to establish a diagnosis, classify the type of mass, and compare the findings with the CT diagnosis. This approach aimed to determine whether CT scans can reliably diagnose and classify different types of suprasellar masses.

Data were processed and analyzed using SPSS

(Statistical Package for Social Sciences) version 23.0. Descriptive statistics-including frequencies with corresponding percentages, mean, median, and standard deviation (SD)-were employed to summarize the data. The comparison between CT diagnoses and histopathological evaluations was performed using Chi-square (χ^2) with the level of significance being set at 5%.

RESULTS:

The patient cohort comprised nearly 50% young and early middle-aged individuals, aged between 21 and 40 years, with a mean age of 30.2 ± 5.3 years (range: 7 – 55 years). Additionally 20% were aged 11–20 years, 16.7% were in the 41–50 year age bracket, 10% were over 50 years, and 6.7% were aged 5–10 years (Table I). The mean ages of patients varied based on diagnosis. Individuals with pituitary adenoma had a mean age of 33.1 years; those with pediatric craniopharyngioma had a mean age of 9 years; adults with craniopharyngioma had a mean age of 50 years. Patients with suprasellar and parasellar meningiomas averaged 35.1 years; hypothalamic glioma patients had a mean age of 10 years; and those with metastatic tumors had a mean age of 50 years (Table II).

Table III summarizes the comparative effectiveness of CT imaging versus histopathological evaluation in diagnosing various conditions. Notably, 60% of patients were identified as having pituitary macroadenomas via CT scan, while histopathology confirmed this diagnosis in 51% of cases. The diagnoses of craniopharyngioma were consistent across both modalities. Furthermore, 13.3% of suprasellar masses were identified as suprasellar or parasellar meningiomas by CT, compared to 16.7% by histopathology. Other suprasellar masses-including hypothalamic glioma, suprasellar arachnoid cysts, suprasellar epidermoid cysts, parasellar schwannomas, metastatic tumors, and ICA aneurysms-exhibited comparability between the two diagnostic methods. Overall, the diagnostic outcomes for the various types of suprasellar masses utilizing CT imaging and histopathology were comparable, as indicated by an insignificant Chi-square (χ^2) result from crosstab analysis (p=0.818).

Table I. Distribution of patients by age (n = 60)

Age (years)	Frequency	Percentage
≤ 10	4	6.7
11 – 20	12	20.0
21 – 30	14	23.3
31 – 40	14	23.3
41 – 50	10	16.7
> 50	6	10.0
Total	**60**	**100**

Mean age = 30.2 ± 5.3 years; **range** = 7-55 years.

Table II. Distribution of patients by tumour-type and mean age at diagnosis

Disease	Mean age at diagnosis (years)
Pituitary adenoma	33.1
Paediatric Craniopharyngioma	9.0
Adult Craniopharyngioma	50.0
Supra and Parasellar meningioma	35.1
Hypothalamic glioma	10.0
Metastatic tumours	50.0

Table III. Comparison between CT and Histopathological findings of suprasellar masses

Type of suprasellar masses	Diagnostic modalities		χ^2 (p-value)*
	CT	Histopathology	
Pituitary Macroadenoma	36(60.0)	31(51.7)	
Craniopharyngioma	10(16.7)	11(18.3)	
Suprasellar or parasellar meningioma	8(13.3)	10(16.7)	
Hypothalamic glioma	2(3.3)	3(5.0)	
Suprasellar arachnoid cyst	1(1.6)	1(1.6)	0.929(0.818)
Suprasellar epidermoid	1(1.6)	1(1.6)	
Parasellar schwannoma	0(0.0)	1(1.6)	
Metastatic tumours	1(1.6)	1(1.6)	
ICA aneurysm	1(1.6)	1(1.6)	

Figures in the parentheses denote corresponding percentages.
*Data were analyzed using **Chi-squared** (χ^2), and a p-value < 0.05 was considered significant.

DISCUSSION:

The suprasellar region of the brain is a critical area containing essential structures, making it susceptible to various pathological conditions. This study aimed to evaluate the diagnostic

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accuracy of CT imaging compared to histopathology in patients with suprasellar masses, highlighting the importance of accurate characterization for effective management.

Our findings indicate that nearly half of the patients with suprasellar masses were young and early middle-aged, with a mean age of 30.2 years. This demographic distribution aligns with existing literature that suggests a higher prevalence of certain types of tumors, such as pituitary adenomas and craniopharyngiomas, in these age groups. The mean ages for specific diagnoses varied significantly, underscoring the diverse nature of suprasellar masses and their clinical implications. For example, pediatric craniopharyngiomas presented a mean age of 9 years, whereas adult cases peaked at 50 years, reflecting the age-specific pathology associated with these tumors.

The comparative analysis of CT &histopathological diagnoses revealed notable insights. While CT scans identified 60% of patients with pituitary macroadenomas, histopathology confirmed this diagnosis in 51% of cases. This discrepancy highlights the limitations of CT in definitively diagnosing certain lesions, despite its strengths in visualizing structural characteristics. The consistency in diagnosing craniopharyngiomas across both modalities suggests that CT can be reliable for certain tumor types, particularly those with distinct imaging features. Moreover, the comparable rates of diagnosis for other suprasellar masses, such as meningiomas and gliomas, indicate that CT can serve as an effective initial diagnostic tool. The insignificant Chi-square result ($p = 0.818$) further supports the notion that CT and histopathological evaluations yield similar diagnostic outcomes for suprasellar masses. However, it is essential to acknowledge that while CT provides valuable information regarding lesion characteristics, histopathology remains the gold standard for definitive diagnosis and classification. Based on the CT results and clinical symptoms, differential diagnosis between the various tumor entities may be feasible in many cases. However, histological confirmation is indispensable in strictly defined cases, such as typical chiasmatic/hypothalamic & optic pathway gliomas or bilocular germ cell tumors.[4]

CT is the preferred method for the initial evaluation of patients with potential suprasellar masses. In our experience, CT has proven to be entirely reliable for detecting or ruling out the presence of a suprasellar mass, assessing the direction and extent of parasellar extension, and identifying any calcified or cystic components of the lesion. When multiple CT scans have yielded negative results, further diagnostic studies have often proven unproductive. Conversely, when CT results are positive, additional studies may be necessary in some cases to rule out aneurysms prior to craniotomy.[5]

The integration of advanced CT techniques, such as multidetector CT (MDCT) and the use of contrast agents, has enhanced the diagnostic capabilities of CT in evaluating suprasellar masses. These advancements allow for improved visualization of small or complex lesions, aiding in surgical planning and risk assessment. Nevertheless, the reliance on histopathological findings for definitive diagnosis underscores the need for a multidisciplinary approach in managing patients with suprasellar masses.[6]

CONCLUSION:

In conclusion, this study emphasizes the importance of accurate evaluation and characterization of suprasellar masses for effective patient management. While CT imaging is an invaluable tool in the initial assessment of these lesions, histopathology remains essential for confirming diagnoses and guiding treatment decisions. The findings advocate for continued collaboration between radiologists and neurosurgeons to optimize diagnostic accuracy and therapeutic outcomes for patients with suprasellar masses. Future research should focus on refining imaging techniques and exploring additional biomarkers that may enhance the diagnostic process & improve patient management strategies.

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