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Study Of Computed Tomography (CT) And Magnetic Resonance Imaging (MRI) Correlation In Brain Tumors In Tertiary Care Hospital.

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ABSTRACT

Our study aimed to compare the diagnostic efficacy of computed tomography (CT) and magnetic resonance imaging (MRI) in detecting neoplastic brain tumors. A hospital-based prospective study was conducted at a tertiary care center between November 2020 and May 2022. A total of 50 cases with clinically suspected brain tumors underwent both CT and MRI scans. Demographic data, symptom duration, and imaging findings were recorded. Sensitivity, specificity, and area under the curve (AUC) were calculated for both imaging modalities. The majority of cases (60%) were in the 5th and 6th decades of life, with an average age of 43.14 years. Most patients (52%) reported symptoms not older than 3 months. MRI demonstrated superior diagnostic accuracy compared to CT, with an AUC of 0.905 (95% CI 0.73 to 1.0) versus 0.833 (95% CI 0.62 to 1.0), respectively. MRI had a sensitivity of 97.7% and specificity of 83%, while CT had a sensitivity of 86.7% and specificity of 80%.MRI outperformed CT in detecting neoplastic brain tumors, exhibiting higher sensitivity and specificity. These findings highlight the importance of MRI as the preferred imaging modality for comprehensive evaluation of suspected cases, although CT remains valuable in certain clinical scenarios.
Keywords: Neoplastic brain tumors, Computed tomography, Magnetic resonance imaging.

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INTRODUCTION

CT and MRI are an important in diagnosing intracranial tumors, offering detailed insights into location, extent, and characteristics [1]. CT, introduced in the mid-70s, revolutionized diagnosis, displaying bone, blood clots, and calcifications in white, while brain tissue appears gray. MRI, available since the mid-80s, provides axial, coronal, and sagittal views, facilitating three-dimensional examination [2]. MR scans, utilizing T1/T2-weighted, FLAIR, postcontrast T1-weighted, DWI, and PWI sequences, offer superior sensitivity compared to CT. DWI delineates cellular structure, while PWI assesses tumor vascularity, aiding treatment prognosis. Despite CT's ability to detect hemorrhage and ventricular enlargement, MRI remains the gold standard due to its superior tissue contrast and multiplanar capabilities [3]. Comparative studies evaluating CT and MRI underscore MRI's superiority in diagnosing brain tumors accurately. Thus, understanding the diagnostic efficacy of both modalities is essential for optimal patient management and treatment planning.

METHODOLOGY

A hospital-based prospective study was conducted at a tertiary care center between November 2020 and May 2022. The study aimed to assess the diagnostic efficacy of CT and MRI in patients clinically suspected of having brain tumors. A total of 50 cases were included in the study, referred to the Department of Radiodiagnosis. Inclusion criteria comprised patients with neurological symptoms suggestive of brain tumors who were willing to participate in the study and undergo both CT and MRI scans. Patients who met the inclusion criteria and provided informed consent underwent imaging investigations.

The study utilized advanced imaging equipment, including a Siemens SOMATOM Definition AS 128-slice CT scanner with CPS software and a 1.5 Tesla GE-Signa MRI machine equipped with standard head coils or head Angio coils. Contrast media, such as gadolinium and iodinated contrast agents, were administered as per standard protocols. Patients with contraindications such as deranged renal function, adverse reactions to contrast agents, pregnancy, or metallic implants were excluded from the study. The study design employed a cross-sectional observational approach to analyze the diagnostic efficacy of CT and MRI in detecting brain tumors.

Upon completion of imaging procedures, characteristic CT and MRI findings were described and correlated with histopathological diagnoses. Detailed clinical histories, including onset, duration, associated diseases, family and personal history, as well as birth and developmental history, were obtained for each patient. The imaging results were then compared with the histopathological findings to evaluate the accuracy and reliability of CT and MRI in diagnosing brain tumors.

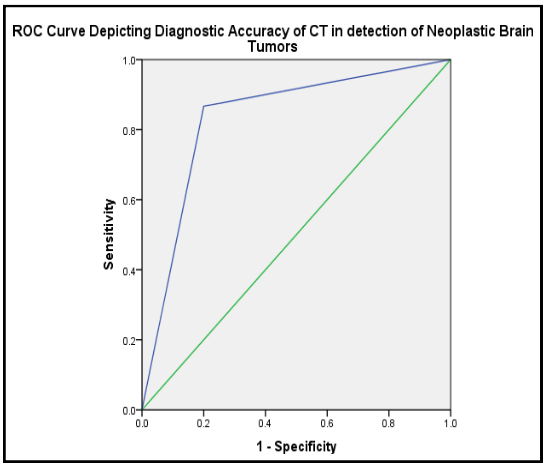
RESULTS

Majority (60%) of the cases in this study were found in the 5th and 6th decade of their life. 30% cases were reported between 3rd and 4th decade of life whereas only 6% were reported below 20 years. Average age of the study participants was calculated to be 43.14±12.4.

Majority (52%) of the patients reported the symptoms not older than 3 months. 40% cases reported complaint duration between 4-6 months whereas only 8% cases had complaints since 7-9 months.

Table 1: ROC curve depicting diagnostic accuracy of CT in detection of neoplastic brain tumour.

Area Under the Curve				
Test Result Variable(s): CT				
Area	Std. Error	Asymptotic Sig.	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
0.833	0.109	0.015	0.620	1.000



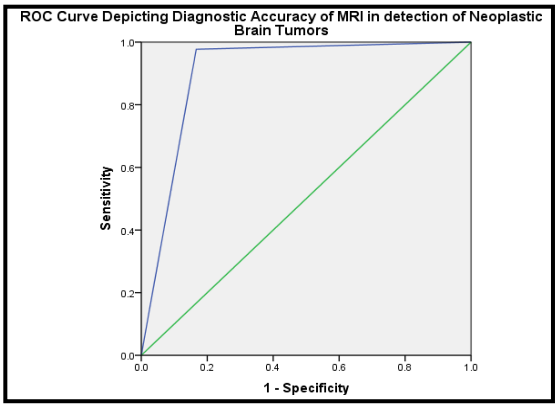
Sensitivity	86.70%
Specificity	80%

ROC curve depicting diagnostic accuracy of CT in detection of neoplastic brain tumour showed area under the curve (AUC) of 0.833 (95% CI 0.62 to 1.0) (p=0.015).

In detection of neoplastic tumors, the sensitivity of CT was 86.7% and specificity was 80%.

Table 2: ROC curve depicting diagnostic accuracy of MRI in detection of neoplastic brain tumour.

Area Under the Curve				
Test Result Variable(s): MRI				
Area	Std. Error	Asymptotic Sig.	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
0.905	0.091	0.001	0.727	1.000



Sensitivity	97.70%
Specificity	83%

ROC curve depicting diagnostic accuracy of MRI in detection of neoplastic brain tumour showed area under the curve (AUC) of 0.905 (95% CI 0.73 to 1.0) (p=0.001).

In detection of neoplastic tumors, the sensitivity of MRI was 97.7% and specificity was 83%.

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DISCUSSION

The study aimed to compare the diagnostic accuracy of CT and MRI in detecting neoplastic brain tumors. The results revealed that both imaging modalities demonstrated high sensitivity and specificity, with MRI showing slightly superior performance compared to CT.

The demographic characteristics of the study participants indicate that the majority of cases were in the 5th and 6th decades of life, consistent with the known prevalence of brain tumors increasing with age. Additionally, the average age of the study population was calculated to be 43.14 years, reflecting the typical age range affected by brain tumors. Furthermore, the distribution of symptom duration suggests that a significant proportion of patients presented relatively early after symptom onset, with the majority reporting symptoms not older than 3 months. This underscores the importance of prompt diagnostic evaluation in patients with suspected brain tumors to facilitate timely intervention and management [4].

The ROC curves depicting the diagnostic accuracy of CT and MRI in detecting neoplastic brain tumors illustrate the superior performance of MRI over CT. The AUC for MRI was 0.905, indicating excellent discriminatory power, while the AUC for CT was slightly lower at 0.833. These findings suggest that MRI is more effective than CT in distinguishing between neoplastic and non-neoplastic intracranial lesions [5, 6].

Furthermore, the sensitivity and specificity analyses corroborate the superiority of MRI in tumor detection. MRI demonstrated a sensitivity of 97.7% and a specificity of 83%, indicating its high accuracy in correctly identifying true positive cases while minimizing false positives. In comparison, CT exhibited slightly lower sensitivity (86.7%) and specificity (80%), although still within acceptable ranges for diagnostic imaging modalities [7].

The superior performance of MRI in detecting neoplastic brain tumors can be attributed to several factors. Firstly, MRI offers superior soft tissue contrast resolution compared to CT, enabling better visualization and characterization of intracranial lesions. Additionally, MRI provides multiplanar imaging capabilities, allowing for detailed evaluation of lesion morphology and spatial relationship with surrounding structures. The use of advanced MRI sequences such as T1-weighted, T2-weighted, FLAIR, DWI, and PWI further enhances the diagnostic utility of MRI by providing complementary information about tissue characteristics and vascularity.

While CT remains valuable in certain clinical scenarios, such as emergent evaluation of acute intracranial hemorrhage or assessment of bony abnormalities, its limitations in soft tissue characterization make it less suitable for primary imaging of suspected brain tumors. In contrast, MRI has become the imaging modality of choice for comprehensive evaluation of intracranial pathology, including neoplastic lesions, due to its superior sensitivity and specificity [8].

The findings of this study have important implications for clinical practice. The high sensitivity and specificity of MRI in detecting neoplastic brain tumors support its role as the preferred imaging modality for initial evaluation and characterization of suspected cases. However, it is important to acknowledge that MRI may not be readily available or feasible in all clinical settings, particularly in resource-limited environments. In such cases, CT may serve as a valuable alternative for initial screening, with MRI reserved for cases where further characterization is warranted or in situations where CT findings are inconclusive.

CONCLUSION

In conclusion, the results of this study highlight the superior diagnostic accuracy of MRI compared to CT in detecting neoplastic brain tumors. MRI offers excellent sensitivity and specificity, making it the imaging modality of choice for comprehensive evaluation of suspected cases. However, the clinical utility of CT should not be overlooked, particularly in settings where MRI may not be readily available. Overall, a multimodal imaging approach tailored to individual patient characteristics and clinical presentation remains essential for accurate diagnosis and optimal management of brain tumors.

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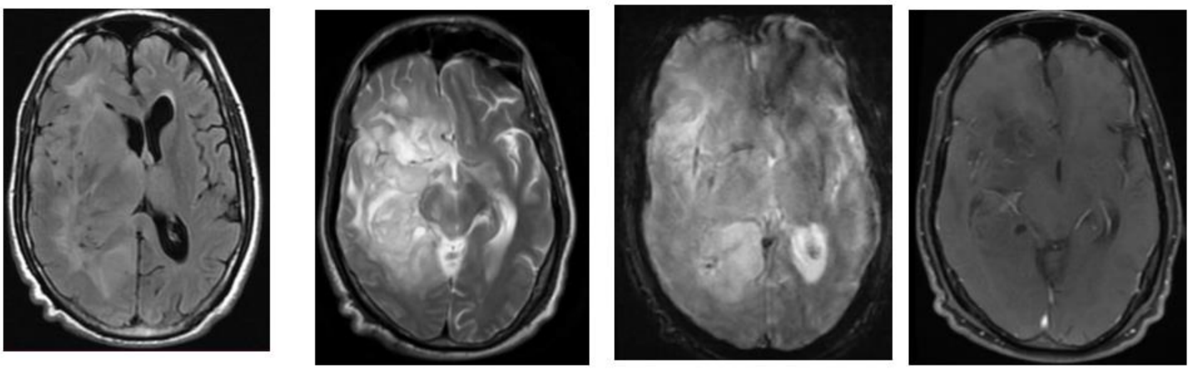

Clinical history

45 year old male presented with h/o headache, vomiting, hemiparesis since last 5 months. Multiple episodes of loss of consciousness since last 3 months. No h/o fever noted.

Imag MRI findings

Large ill-defined heterogenous intra-axial mass lesion is noted involving cortex and subcortical white matter of right fronto-temporo-parietal, right occipital region, right basal ganglia, genu of corpus callosum.

It is causing mass effect in the form of effacement of adjacent sulcal spaces, ipsilateral lateral ventricle and midline shift towards left.

Few areas of blooming are noted on GRE images. Mild surrounding perilesional edema noted.

It shows minimal post-contrast enhancement. No intra-ventricular extension seen.

These features s/o neoplastic etiology likely high grade glioma.

Images: (Top) Axial T2 FLAIR, Axial T2 propeller (Bottom) Axial GRE, Axial T1 post contrast.

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