ORIGINAL RESEARCH PAPER
Volume - 13 | Issue - 11 | November - 2024 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

A PROSPECTIVE STUDY OF DIAGNOSTIC ACCURACY OF MRI IN DIAGNOSING BRAIN TUMOURS FROM MADHYA PRADESH

Radiology

Dr Manish Bhagat Professor & Hod, Department Of Radiology, Saims & Pg Institute, Indore.

Dr Prakhar Jain* Junior Resident, Department Of Radiology, Saims & Pg Institute, Indore. *Corresponding Author

Dr Yogesh Choudhary Junior Resident, Department Of Radiodiagnosis, Sri Aurobindo Institute Of Medical Sciences, Indore.

ABSTRACT

Background: MRI remains essential in diagnosing and monitoring brain tumors, but ongoing research into advanced MRI techniques and their applications continues to expand our understanding of tumor biology and improve patient care. The aim of this study was to assess diagnostic accuracy of MRI in diagnosing brain tumours. **Material And Methods:** A prospective study was conducted among 50 cases for 18 months in the department of Radiodiagnosis at Sri Aurobindo Medical College and Post Graduate Institute, Indore (Madhya Pradesh). Patients diagnosed with primary brain tumor referred to study site qualifying the inclusion and exclusion criteria formed the sampling frame. **Results:** The mean age of the study subjects was 40.18 ± 14.280 years. The majority of the subjects had lesions in the parietal lobe (26.0%). Sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of MRI in the diagnosis of low-grade (among brain tumors) were found to be 84.62%, 100.0%, 100.0%, 94.87%, and 96.0% respectively. For diagnosing moderate -grade tumors, MRI showed moderate sensitivity (75.0%) and specificity (83.33%). MRI showed high sensitivity (82.76%) and specificity (90.48%) for diagnosing high-grade tumors. **Conclusion:** The results indicate that while MRI is a robust tool for diagnosing brain tumors, especially for low-grade and high-grade types, there is room for improvement in the accuracy of moderate- grade tumor diagnosis.

KEYWORDS

brain tumors, imaging modality, histopathological findings, specificity

INTRODUCTION

Brain tumors represent a significant challenge for public health due to the poor prognosis associated with malignant forms, with an average five-year survival rate of just 35%. MRI has become a cornerstone in this diagnostic and therapeutic process due to its ability to provide detailed images of brain structures, which are vital for treatment planning and assessing treatment efficacy. Despite its strengths, MRI has limitations such as the potential for false positives and negatives and issues with artifacts like motion or chemical shift distortions [1]. Moreover, although MRI can suggest possible diagnoses, definitive diagnosis often requires histopathology and molecular analyses.

The 2021 WHO Classification has emphasized integrating histologic features with genetic information for more precise tumor characterization [2-3]. MRI remains essential in diagnosing and monitoring brain tumors, but ongoing research into advanced MRI techniques and their applications continues to expand our understanding of tumor biology and improve patient care [4,5].

MRI stands as the primary imaging modality for brain tumors due to its high-resolution imaging capabilities, diverse sequences, and ability to provide detailed anatomical, functional, and metabolic information [6]. In India, there is a need for further studies to explore MRI's utility in primary brain tumors, including examining the imaging spectrum of brain tumors, grading them using diffusion-weighted imaging, and correlating MRI findings with histopathological outcomes. The present study aims to assess diagnostic accuracy of MRI in diagnosing brain tumours.

MATERIALS AND METHODS

This cross-sectional study was conducted among fifty (n=50) patients at Department of Radiodiagnosis of Sri Aurobindo Medical College and Post Graduate Institute, Indore (Madhya Pradesh). Study was undertaken for a period of 18 months after the approval from the ethical committee. Patients diagnosed with primary brain tumor referred to Department of Radiodiagnosis from Department of Medicine, Surgery, Obstetrics & Gynaecology of SAIMS & PG Institute, Indore qualifying the inclusion and exclusion criteria formed the sampling frame.

Patients of all age group irrespective of sex with clinical suspicion of brain tumour, undergoing MRI, during study duration formed the inclusion criteria. Patients who are not willing to give consent and patients in whom MRI is contraindicated, were excluded from this study.

Patients with clinical presentation of referred from various department of our institute were subjected to MRI after taking written informed consent.

The study was done on a Siemens 1.5 T MAGNETOM® Symphony® with Tim technology MR Machine. Contrast-enhanced T1-weighted spin echo images were obtained after i.v administration of gadolinium at dose of 0.1 mmol/ kg. The Images were analyzed by experienced radiologist and relevant data was noted in a Proforma

The findings were recorded on prestructured proforma for the study and descriptive statistics was carried out to identify characteristics of the collected data.

The data was coded and entered into Microsoft excel 2010 (Microsoft corp.), analyzed using excel 2010 and SPSS 22.0 for Windows (SPSS inc). The results of the study were tabulated and statistically analyzed. Descriptive statistics was carried out to identify the characteristics and features of collected data. Mean and Percentage was used to represent the data. Chi square test was applied to identify the association between variable, P value < 0.05 will be considered statically significant. Sensitivity, Specificity, Positive predictive value, Negative predictive value was calculated.

RESULTS

The mean age of the study subjects was 40.18 ± 14.280 years (range- 8 to 65 years). The majority of the subjects belonged to the age groups of 41-50 years (30.0%). The majority of the subjects had lesions in the parietal lobe (26.0%), followed by temporal lobe (16.0%), and frontal lobe (16.0%). (Figure 1)

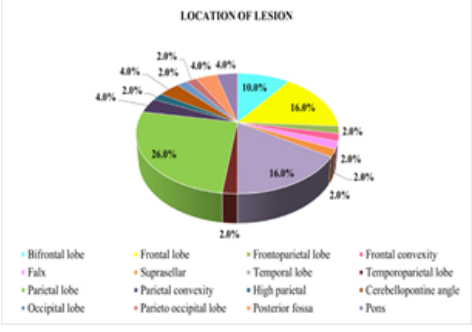

Figure 1. Distribution of study subjects based on location of lesion

Diagnostic Accuracy Of Mri In Diagnosing Brain Tumours

There was a statistically significant correlation between MRI and histopathological findings (p-value <.05). Sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of MRI in the diagnosis of low-grade (among brain tumors) were found to be 84.62%, 100.0%, 100.0%, 94.87%, and 96.0% respectively. (Table 1)

Table 1. Correlation between MRI and histopathological findings.

MRI finding		Histopathological finding			Total
		Low grade	Moderate grade	High grade	
Low grade	No.	11	0	0	11
	%	84.6%	0%	0%	22%
Moderate grade	No.	2	6	5	13
	%	15.4%	75%	17.2%	26%
High grade	No.	0	2	24	26
	%	0.0%	25.0%	82.8%	52%
Total	No.	13	8	29	50
	%	100%	100%	100%	100%

Chi-square- 53.272, df-4, p-value <.001

Sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of MRI in the diagnosis of moderate-grade (among brain tumors) were found to be 75.0%, 83.33%, 46.15%, 94.59%, and 82.00% respectively.

Sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of MRI in the diagnosis of high-grade (among brain tumors) were found to be 82.76%, 90.48%, 92.31%, 79.17%, and 86.00% respectively. (Table 2)

Table 2. Sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy of MRI.

Statistic	Diagnosis of low-grade	Diagnosis of moderate-grade	Diagnosis of high-grade
	Value (95% CI)	Value (95% CI)	Value (95% CI)
Sensitivity	84.62% (54.55% to 98.08%	75.0% (34.91% to 96.81%)	82.76% (64.23% to 94.15%)
Specificity	100.0% (90.51% to 100.0%	83.33% (68.64% to 93.03%)	90.48% (69.62% to 98.83%)
Positive Predictive Value (PPV)	100.0% (71.51% to 100.0%	46.15% (28.09% to 65.29%)	92.31% (76.06% to 97.84%)
Negative Predictive Value (NPV)	94.87% (83.79% to 98.51%	94.59% (83.95% to 98.32%)	79.17% (62.85% to 89.51%)
Accuracy	96.0% (86.29% to 99.51%	82.0% (68.56% to 91.42%)	86.0% (73.26% to 94.18%)

CI- Confidence interval

DISCUSSION

Magnetic Resonance Imaging (MRI) is a cornerstone in the diagnostic evaluation of brain tumors, offering detailed insights into the tumor's location, type, and grade. Our study assessed MRI's performance in diagnosing brain tumors across various grades. The following metrics were evaluated: sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy.

In this study, MRI showed high sensitivity (84.62%) and specificity (100%) for diagnosing low-grade tumors. Another study found that MRI is highly effective for identifying low-grade gliomas, with sensitivity ranging from 80% to 90% and specificity approaching 100% [7]. Our results are consistent with these findings, indicating that MRI is very reliable for diagnosing low-grade brain tumors. Other study reported slightly lower sensitivity (82.0%) but higher specificity (97.0%) for low-grade tumors [8]. The high accuracy in both studies underscores MRI's effectiveness in diagnosing low-grade tumors.

For diagnosing moderate -grade tumors, in this study, MRI showed moderate sensitivity (75.0%) and specificity (83.33%). Another study reported that the diagnostic accuracy of MRI for moderate-grade tumors like anaplastic astrocytomas can vary, with sensitivity and specificity around 70-80% [9]. Our study's values fall within this range, reflecting MRI's role in diagnosing moderate-grade tumors but also indicating limitations in distinguishing these tumors from other conditions. Other study found comparable sensitivity (70.0%) and slightly higher specificity (85.0%) for moderate-grade tumors [10]. Our study's findings are consistent with existing literature, reflecting moderate diagnostic performance for this grade.

In this study, MRI showed high sensitivity (82.76%) and specificity (90.48%) for diagnosing high-grade tumors. Wen, P. Y., et al. (2010) demonstrated that MRI is highly effective for high- grade gliomas, with sensitivity of around 80% and specificity of 90% [11]. Our findings align with these results, showing MRI's strong performance in identifying high-grade tumors. Brown et al. reported similar sensitivity (80.0%) and slightly lower specificity (88.0%) [12]. Our study confirms that MRI is highly effective in identifying high-grade tumors.

Our study confirms that MRI is highly effective for diagnosing low-grade and high-grade brain tumors. The high specificity for low-grade tumors (100%) suggests MRI's effectiveness in confirming the presence of low-grade tumors when histopathology is positive. Similarly, the high sensitivity and specificity for high-grade tumors (82.76% and 90.48%, respectively) underscore MRI's role in detecting aggressive tumor types.

The high sensitivity and specificity of MRI for low-grade and high-grade tumors make it a valuable tool for brain tumor diagnosis. However, the moderate accuracy for moderate-grade tumors suggests that MRI should be used in conjunction with other diagnostic modalities, such as advanced imaging techniques or biopsy, for a more comprehensive assessment.

CONCLUSION

The results indicate that while MRI is a robust tool for diagnosing brain tumors, especially for low-grade and high-grade types, there is room for improvement in the accuracy of moderate- grade tumor diagnosis. Combining MRI with other diagnostic techniques, such as PET scans or biopsy, could enhance diagnostic precision.

REFERENCES

1. Weber MA, Zoubaa S, Schlieter M, Juttler E, Huttner HB, Geletneky K, Ittrich C, Lichy MP, Kroll A, Debus J, Giesel FL. Diagnostic performance of spectroscopic and perfusion MRI for distinction of brain tumors. Neurology. 2006 Jun 27;66(12):1899-906.
2. Danieli L, Riccitelli GC, Distefano D, Prodi E, Ventura E, Cianfoni A, Kaelin-Lang A, Reinert M, Pravatà E. Brain tumor-enhancement visualization and morphometric assessment: a comparison of MPRAGE, SPACE, and VIBE MRI techniques. American Journal of Neuroradiology. 2019 Jul 1;40(7):1140-8.
3. Zhou Q, Xue C, Ke X, Zhou J. Treatment response and prognosis evaluation in high grade glioma: an imaging review based on MRI. Journal of Magnetic Resonance Imaging. 2022 Aug;56(2):325-40.
4. Shaffer A, Kwok SS, Naik A, Anderson AT, Lam F, Wszalek T, Arnold PM, Hassaneen W. Ultra-high-field MRI in the diagnosis and management of gliomas: a systematic review. Frontiers in Neurology. 2022 Apr 5;13:857825.
5. Di Carlo DT, Cagnazzo F, Benedetto N, Morganti R, Perrini P. Multiple high-grade gliomas: epidemiology, management, and outcome. A systematic review and meta-analysis. Neurosurgical review. 2019 Jun 1;42:263-75.
6. Abbasi AW, Westerlaan HE, Holtman GA, Aden KM, van Laar PJ, van der Hoorn A. Incidence of tumour progression and pseudoprogression in high-grade gliomas: a systematic review and meta-analysis. Clinical Neuroradiology. 2018 Sep;28:401-11.
7. Cuccarini V, Erbetta A, Farinotti M, Cuppini L, Ghielmetti F, Pollo B, Di Meco F, Grisoli M, Filippini G, Finocchiaro G, Bruzzone MG. Advanced MRI may complement histological diagnosis of lower grade gliomas and help in predicting survival. Journal of neuro-oncology. 2016 Jan;126:279-88.
8. Resende LL, Alves CA. Imaging of brain tumors in children: the basics—a narrative review. Translational Pediatrics. 2021 Apr;10(4):1138.
9. Romanowski CA, Hoggard N, Jellinek DA, Levy D, Wharton SB, Kotsarini C, Batty R, Wilkinson ID. Low Grade Gliomas. Can We Predict Tumour Behaviour from Imaging Features?. The Neuroradiology Journal. 2008 Sep;21(1_suppl):47-66.
10. Chishty IA, Rafique MZ, Hussain M, Akhtar W, Ahmed MN, Sajjad Z, Ali SZ. MRI characterization and histopathological correlation of primary intra-axial brain glioma. J Liaquat Univ Med Heal Sci. 2010 May;9(2):64-9.
11. Wen PY, Macdonald DR, Reardon DA, Cloughesy TF, Sorensen AG, Galanis E, DeGroot J, Wick W, Gilbert MR, Lassman AB, Tsien C. Updated response assessment criteria for high-grade gliomas: response assessment in neuro-oncology working group. Journal of clinical oncology. 2010 Apr 10;28(11):1963-72.
12. Brown PD, Jensen AW, Felten SJ, Ballman KV, Schaefer PL, Jaeckle KA, Cerhan JH, Buckner JC. Detrimental effects of tumor progression on cognitive function of patients with high-grade glioma. Journal of clinical oncology. 2006 Dec 1;24(34):5427-33.