

A study of diagnostic accuracy of multimodal magnetic resonance imaging in brain tumors

Anil Baliram Bonde^{1*}, Kiran Choldas Patil²

¹Associate Professor, ²Professor, Department of Radiology, Dr Ulhas Patil Medical College, Jalgaon, Maharashtra, INDIA.

Email: pramod.bhirud@yahoo.com

Abstract

Introduction: The MRI techniques are constantly improving. Hence, the human body analysis reproduced in the anatomophysiological and functional study techniques contributed to the advancement of care of brain tumors. **Methodology:** This was a cross-sectional study carried out at the Radiology department of Tertiary health care center. All the Patients with the Space occupying lesions were referred to Radiology department was included into the study during the one year period from March 2015 to March 2016. All the patients which were include were examined with conventional MR sequences, DWI, and with PWI and/or MRS. The concordance between the diagnoses obtained with multimodal MRI and with the conventional MR sequences, and the final diagnosis obtained by biopsy after the Surgical removal of the Mass. The Diagnostic accuracy was estimated with the help of Sensitivity and Specificity and Positive predictive Value and Negative Predictive Value. **Result:** The majority of the patients were from the age group of >60 i.e. 28.88% followed by 50-60-24.44%; 40-50-20.00%; 30-40-15.55%; 20-30-6.66%; 10-20-4.44%. The majority of the Patients were Male i.e. 64.44% as compared to Females 35.55%. The Sensitivity of MMRI was 92.68% and Specificity was 75%, Positive predictive value is 97.43% and Negative Predictive Value is 50%. **Conclusion:** The Diagnostic Accuracy of the MMRI is very high as the Sensitivity was 92.68% and Specificity was 75%, Positive predictive value is 97.43% and Negative Predictive Value is 50%. So the MMRI should be used to Detect the Space occupying lesions for differentiation of Neoplastic or no non neoplastic lesion of brain.


Key Words: Multimodal Magnetic Resonance Imaging (MMRI), Brain Tumors.

*Address for Correspondence:

Dr. Anil Baliram Bonde, Associate Professor, Department of Radiology, Dr Ulhas Patil Medical College, Jalgaon, Maharashtra, INDIA.

Email: pramod.bhirud@yahoo.com

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INTRODUCTION

The MRI techniques are constantly improving.⁷ Hence, the human body analysis reproduced in the anatomophysiological and functional study techniques contributed to the advancement of care of brain tumors. This allowed the joint supply of anatomophysiological (anatomical MRI), functional (diffusion, perfusion, bolus contrast, “BOLD”, and so forth) and metabolic information provided by magnetic resonance

spectroscopy (MRS).^{1,2,7,14} The major advantage of this imaging approach is that it is completely non-invasive.^{3,6,12,13} The combination and confrontation of the various MRI modalities’ data supply clinicians with valuable information allowing improvement in the diagnostic approach that is decisive in many pathological situations. Magnetic resonance imaging is a medical imaging technique used to visualize internal structures of the human body in detail. The MRI makes use of the properties of nuclear magnetic resonance (NMR) to image nuclei of atoms inside the body.^{1-5,15} An MRI scanner is equipped with a strong magnet where the magnetic field is used to align the magnetization of water hydrogen nuclei in the body, and radio frequency fields to systematically alter the alignment of this magnetization.^{1-5,9}

METHODOLOGY

This was a cross-sectional study carried out at the Radiology department of Tertiary health care center. All the Patients with the Space occupying lesions were referred

to Radiology department was included into the study during the one year period from March 2015 to March 2016. All the patients which were include were examined with conventional MR sequences, DWI, and with PWI and/or MRS. The concordance between the diagnoses obtained with multimodal MRI and with the conventional MR sequences, and the final diagnosis obtained by biopsy after the Surgical removal of the Mass . The Diagnostic accuracy was estimated with the help of Sensitivity and Specificity and Positive predictive Value and Negative Predictive Value .

RESULT

Table 1: Age wise distribution of the Patients

Age	No.	Percentage (%)
10-20	2	4.44%
20-30	3	6.66%
30-40	7	15.55%
40-50	9	20.00%
50-60	11	24.44%
>60	13	28.88%
Total	45	100.00%

The majority of the patients were from the age group of >60 i.e. 28.88% followed by 50-60-24.44%;40-50-20.00%; 30-40-15.55%; 20-30-6.66%;10-20-4.44%.

Table 2: Gender wise distribution of the Patients

Sex	No.	Percentage (%)
Male	29	64.44%
Female	16	35.55%
Total	45	100.00%

The majority of the Patients were Male i.e. 64.44%as compared to Females 35.55%.

Table 3: Distribution of the Patients As per Diagnostic accuracy of MMRI

MMRI	Biopsy		Total
	Brain Tumors	Other lesion	
Brain Tumors	38	1	39
Other lesion	3	3	6
Total	41	4	45

From above table the Sensitivity of MMRI was 92.68% and Specificity was 75% , Positive predictive value is 97.43% and Negative Predictive Value is 50%.

DISCUSSION

In patients with brain lesions, an accurate diagnosis is fundamental for an accurate therapy choice, to avoid unnecessary brain surgery, and to prevent delay in initiating treatment. Studies on diagnostic accuracy have shown that MRI is superior to contrastenhanced CT in the diagnosis of brain metastases. Combining MRI and MRS has been shown to provide better diagnostic value than MRS alone, especially in contrast-enhancing

tumours.¹⁷ Another study on the diagnostic accuracy, sensitivity and specificity of diagnostic imaging strategies to differentiate various intra-axial brain masses also showed a high accuracy for multimodal imaging. In contrast to our study, the histological findings, laboratory findings or clinical diagnosis were the reference standard in the aforementioned retrospective study, the field strength for MRI was 1.5 Tesla, and the MRS was performed using single voxel technique. To our knowledge, there are limited data for diagnostic accuracy and the added utility using a multimodal MRI performed on 3 Tesla MR field strength and using MRS with CSI technique in the differentiation of different types of brain tumour. In our study we found The majority of the patients were from the age group of >60 i.e. 28.88% followed by 50-60-24.44%;40-50-20.00%; 30-40-15.55%; 20-30-6.66%;10-20-4.44%.The majority of the Patients were Male i.e. 64.44% as compared to Females 35.55%. The Sensitivity of MMRI was 92.68% and Specificity was 75%, Positive predictive value is 97.43% and Negative Predictive Value is 50%. Law *et al.*¹⁸ showed that a combination of the estimation of rCBV, Cho/Cr and Cho/NAA in 160 gliomas resulted in a sensitivity, specificity, PPV and NPV of 93.3%, 60.0%, 87.5% and 75.0% respectively, in grading these tumours, compared with a sensitivity, specificity, PPV and NPV of 72.5%, 65.0%, 86.1% and 44.1% respectively, in grading when only conventional MRI images were evaluated. Our study showed that the diagnostic accuracy of MRI increases when a multimodal MRI approach is used in the work-up of brain tumours. In some tumours, e.g. lymphomas and some types of metastases, this finding might help in planning tumour therapy, without the need for biopsy. Solid tumours, such as lymphomas with high cellularity as the predominant feature, usually exhibit low rCBV, and PWI can help to differentiate these tumours from solid malignant tumours, such as glioma and metastases.¹⁶

CONCLUSION

The Diagnostic Accuracy of the MMRI is very high as the Sensitivity was 92.68% and Specificity was 75% , Positive predictive value is 97.43% and Negative Predictive Value is 50%. So the MMRI should be used to Detect the Space occupying lesions for differentiation of Neoplastic or no non neoplastic lesion of brain.

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