

## Role of Magnetic Resonance Imaging in The Evaluation of Ring Enhancing Lesions in Brain in Correlation With Magnetic Resonance Spectroscopy



### Medical Science

**KEYWORDS :** MRI, MRS, Ring Enhancing Lesions, Tuberculoma, NCC, GBM, Abscess, Tumefactive Demyelating Disease, Metabolite peaks

<b>Dr Sangeeta Saxena</b>	Professor & HOD, Department of Radiodiagnosis, Govt. Medical College, Kota, Rajasthan, India
<b>Dr Devendra K Khatana</b>	P.G Resident Doctor Department of Radiodiagnosis, Govt. Medical College, Kota, Rajasthan, India
<b>Dr Harsh Vardhan Khokhar</b>	Assistant Professor Department of Radiodiagnosis, Govt. Medical College, Kota, Rajasthan, India
<b>Dr Dharamraj Meena</b>	Associate Professor Department of Radiodiagnosis, Govt. Medical College, Kota, Rajasthan, India
<b>Dr Akshay Meena</b>	P.G Resident Doctor Department of Radiodiagnosis, Govt. Medical College, Kota, Rajasthan, India
<b>Dr Devendra Verma</b>	P.G Resident Doctor Department of Radiodiagnosis, Govt. Medical College, Kota, Rajasthan, India

### ABSTRACT

*The MRI has created many important advances in the detection and characterization of brain lesions. The detection rate of most types of brain lesions by MRI exceeds 90%, without the invasiveness or risk of iodinated intravenous contrast agents or the inherent problem of the radiation effect of X-rays. Magnetic resonance spectroscopy (MRS) is a potential tool for differential diagnosis between brain abscesses and non-infectious lesions. MRS provides information about the possible extent and nature of changes on a routine MRI scan by analyzing the presence and/or ratio of tissue metabolites such as NAA, creatine, choline, and lactate etc. In our study Fifty patients with Ring Enhancing Lesions on MRI were evaluated conducted over a period of 1 years from Nov 2014 to Nov 2015 of various age groups. Out of 50 cases, 16 are tuberculomas, 14 cases of Primary brain tumours, 9 are NCC, 8 metastasis, 2 are abscess, and 1 tumefactive demyelination.*

### INTRODUCTION

Multiple ring-enhancing lesions are one of the most commonly encountered neuroimaging abnormalities. Widely available imaging techniques, computed tomography and magnetic resonance imaging (MRI) are used to detect these lesions. Typically, the ring-enhancing lesions are located at the junction of the gray and white matter, but they could be located in the sub-cortical area, deep in the brain parenchyma or may even be superficial<sup>1</sup>.

MRI's clinical advantage in early detection of disease is visually demonstrated as unmistakable contrast between gray and white matter and tumour, ischaemia /infarct, edema, MS plaques, infection/abscess and hemorrhage.

A wide range of etiologies may present as cerebral multiple ring-enhancing lesions<sup>1,2</sup>.

1. Primary brain tumor (high grade lesions)
2. Metastasis (especially post chemotherapy)
3. Abscess
4. Multiple sclerosis
5. Resolving hematoma (10-21 days)
6. Tuberculoma
7. Radiation necrosis

Magnetic resonance spectroscopy (MRS) is a potential tool for differential diagnosis between brain abscesses and non-infectious lesions such as primary brain tumor, lymphoma, brain metastasis, and tuberculoma. MRS provides information about the possible extent and nature of changes on a routine MRI scan by analyzing the presence and/or ratio of tissue metabolites such as NAA, creatine, choline, and lactate etc.

Widespread usage of faster MRS applications with higher signal-to-noise ratio (SNR) and spatial resolution, allows us to detect

functional metabolic changes, which provides more data to understand the exact nature of the tumour and the morphological and physiological changes occurring in the surrounding brain parenchyma. Longitudinal studies have demonstrated that HMRS is useful in monitoring disease progression and treatment effects. MR spectroscopy also has a prognostic implication<sup>4</sup>.

### AIMS & OBJECTIVES OF THE STUDY:

- To differentiate neoplastic from non neoplastic brain lesions using conventional and advanced MR imaging techniques.
- To study the characteristic imaging findings of various Ring enhancing lesions on MRI and establish a differential diagnosis b/w them.
- To study the role of MR spectroscopy in the evaluation of various ring enhancing lesions in the brain with a single voxel proton MR spectroscopy with establish the importance of MRS.

### MATERIALS AND METHODS:

This prospective study was carried out at Govt. Medical College and attached group of hospitals, Kota, Rajasthan, India. 50 patients with ring enhancing lesions on MRI (34 cases were referred to MRI after prior CT showed ring enhancing lesions) were evaluated in this study conducted over a period of 1 years from Nov 2014 to Nov 2015. Appropriate approval of the institutional ethical committee was obtained for the study. Informed written consent from each patient was also obtained.

**Inclusion criteria-** All cerebral ring enhancing lesions detected on contrast MR & CT studies are taken up retrospectively.

**Exclusion Criteria-** Patient having history of claustrophobia, metallic implants, cardiac pacemakers and metallic foreign body in situ

**Equipment and technique** - MR PHILIPS ACHIEVA 1.5 T. With

SENSE coils

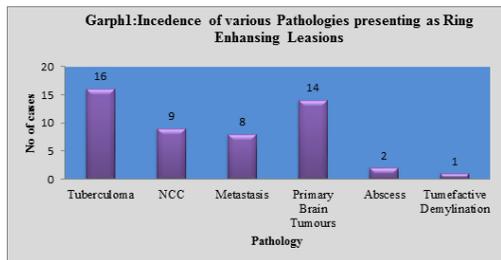
**Sequences:** Axial T1, T2 and FLAIR: Coronal T2; Sagittal T1; Post contrast axial, coronal and sagittal;DWI; T2 GRE,Single voxel spectroscopy

**OBSERVATIONS & RESULTS**

**Total 50 Patients Presenting With Ring Enhancing Lesions**

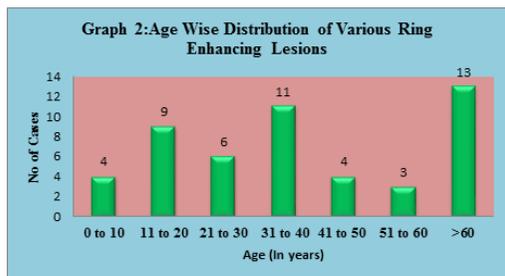
**Table 1: Incidence Of Various Ring Enhancing Lesions.**

Lesions	No of cases
Tuberculoma	16
NCC	9
Metastasis	8
Primary Brain Tumours	14
Abscess	2
Tumefactive Demyelination	1



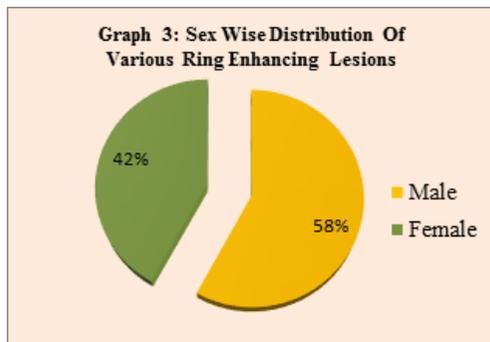
**Table 2: Age Wise Distribution of Various Ring Enhancing Lesions**

Age (In Years)	No of Cases
0 to 10	4
11 to 20	9
21 to 30	6
31 to 40	11
41 to 50	4
51 to 60	3
>60	13



**Table 3: Sex Wise Distribution of Various Ring Enhancing Lesions**

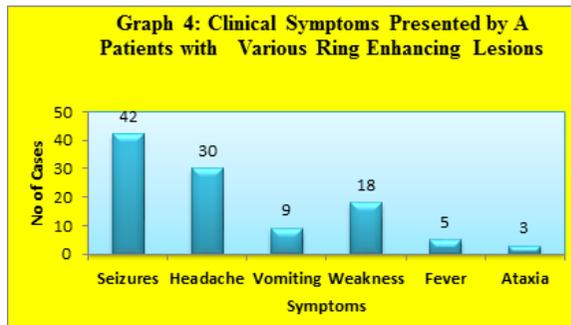
Sex	No. Of Cases
Male	29
Female	21



**Table 4 :-Clinical Symptoms Presented by A Patients with**

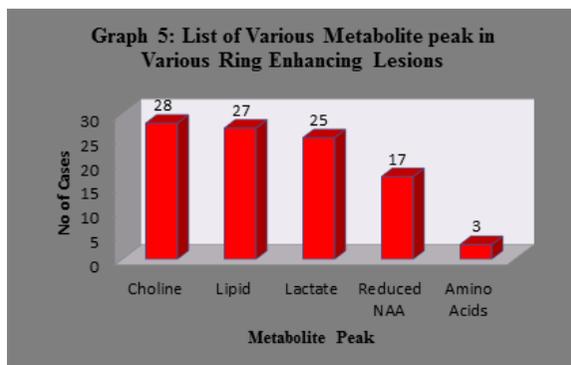
**Various Ring Enhancing Lesions**

Symptoms	No. Of Cases
Seizures	42
Headache	30
Vomiting	9
Weakness	18
Fever	5
Ataxia	3



**Table 5:-List of Various Metabolite peak in Various Ring Enhancing Lesions**

Metabolite Peak	No. of Cases
Choline	28
Lipid	27
Lactate	25
Reduced NAA	17
Amino Acids	3



**DISCUSSION**

Magnetic resonance imaging is a noninvasive, multiplanar and highly accurate method with better inherent contrast that demonstrates the lesion accurately. MRI provides an accurate assessment of the brain changes in various ring enhancing lesions, for accurate diagnosis and introduction of immediate treatment.

This is a prospective study done in the Department of Radiodiagnosis and Imaging, Govt. Medical college, Kota, Rajasthan aimed at studying the MR appearances in various ring enhancing lesions of the brain . In our study of MR imaging of ring enhancing lesions of the brain , we evaluated 50 patients.

**Age Distribution**-50 patients were evaluated, whose age group ranged from 1 to 79 years. The highest incidence of Ring Enhancing Lesions were found in more than 60 years age group accounting for 26 % of cases and least was seen in age group of 51-60 years constituting 6%.

**Sex Distribution**-Fifty patients were evaluated of which 29 (58%) were males and 21 (42%) were females.

**Clinical Features**-Seizures are the most common presenting complaint in 84 % of cases. Headache (60%), fever (10%), vomit-

ing (6%), ataxia (6%) and motor weakness (36%) were the other presenting complaints.

**Pathologies**-Out of the 50 patients who were evaluated, tuberculomas (32%) is the most common pathology followed by primary brain tumour (28%) NCC (18 %), metastasis(16%), Abscesses (4%), and tumefactive demyelination (2%). In a study conducted by Schwartz et al<sup>33</sup> 40% cases were gliomas. The higher incidence of tuberculomas is probably due to the higher prevalence of tuberculosis in India.

**Number of Lesions**-50 patients were evaluated - 17 (34%) of them presented with a single lesion. 2-4 lesions were noted in 21 (42%) of cases and > 4 RELs were seen in 12 (24%) of cases.

**Size of the Lesion**-50 patients were evaluated - majority 34 (64%) of them showed RELs < 2cm, 11 (22%) of them showed lesions of sizes between 2-4 cm and only in 5 (10%) lesions size is greater than 4 cm.

**MR Spectroscopy**-Out of the 50 patients evaluated spectroscopy was in 49 Cases. Choline peak was observed in 28(56%) cases, Lipid in 27 (54%)cases, Lactate in 25(50%) cases, reduced NAA peak in 17(34%) cases and amino acids in 3 (6%)cases.

Jayasundar R, Singh VP, Raghunathan P, Jain K, Banerji AK (1999) .concluded that presence of lipid can be used for differentiating tuberculomas from both non-specific IG and NCC.<sup>5</sup>

We did not find a single case of intraventricular cysticercosis probably because of the small sample of study. Martinez et al reported intraventricular neurocysticercosis in 22 % of cases. <sup>6</sup>

Parenchymal cysticercosis is better identified on MRI than CT in our study as compared to the study done by Suss Ra et al. <sup>7</sup>

Features of parenchymal forms of NCC in our study are similar to the study done by do Amaral LL et al. <sup>8</sup>

Cho / Cr ratio was less than 1.1 in all NCC and more than 1.2 in all tuberculoma which is similar to the study performed by Kumar et al and Jayasunder et al <sup>9,10</sup>

In abscess our findings were similar to the study conducted by Tsui EY et al, Shukla-Dave A et al <sup>11</sup> and Leuthardt EC et al<sup>12</sup>. In metastasis our findings were similar to the study conducted by Vieth RG et al <sup>13</sup>

**CONCLUSION**

MRI is the most sensitive modality in the characterization of intracranial ring enhancing lesions – RELs

Irregular type of ring enhancement is the most common feature noted in most of the lesions .

Most common lesion seen is tuberculomas (32%) pathology followed by primary brain tumour (28%) NCC (18 %), metastasis(16%), Abscesses (4%), and tumefactive demyelination (2%).

>60 years is the most common age group involved ( 28% of cases

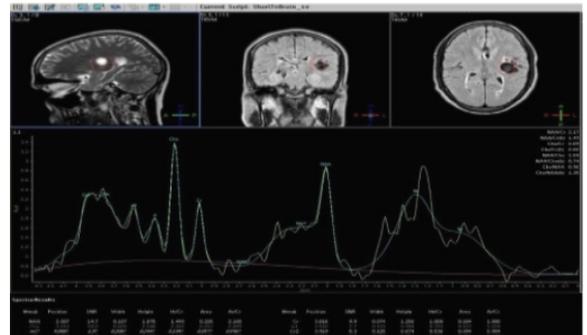
Seizures is the most common presenting complaint (84%).

MRI being non invasive and non- radiating is an ideal imaging modality.

MRS are to be routinely used in evaluation of ring enhancing lesions.

MRI plays a critical role in patient management by suggesting the correct diagnosis based on characteristic imaging findings.

**Fig-1 Tuberculoma**



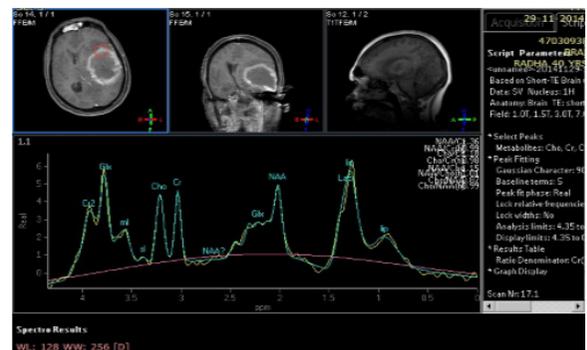
Small, oval, hypointense lesion on T1W & hyperintense on T2W, non enhancing cavitiatory lesion in left temporo-parietal region with adjacent calcification showing elevated lactate, lipid & choline peak s/o Tuberculoma.

**Fig 2 Oligodendroglioma.**



Cortical and subcortical mass lesion in left parietal-temporo-occipital lobe which is isointense on T1W & mild hyperintense on T2W with multiple dense calcifications MRS imaging reveals, marked reduction in NAA, increase choline and marked increase in the Choline: Creatinine (Cho/Cr) ratio s/o Oligodendroglioma.

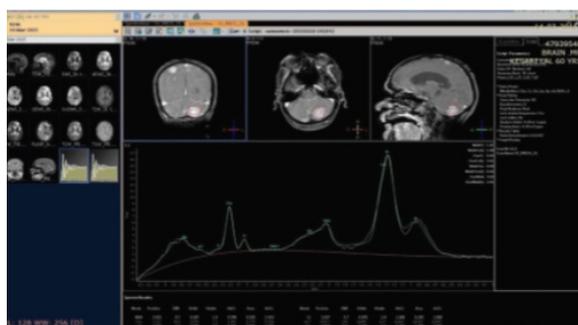
**Fig 3 GBM (high grade glioma)**



Large, well defined rim enhancing cystic lesion in left temporo-parietal lobe, hypointense on T1 hyperintense on T2W & FLAIR images; Multiple foci of blooming on periphery of lesion. these areas showing increase values in diffusion weighted images. On post contrast images, moderate peripheral irregular thick rim en-

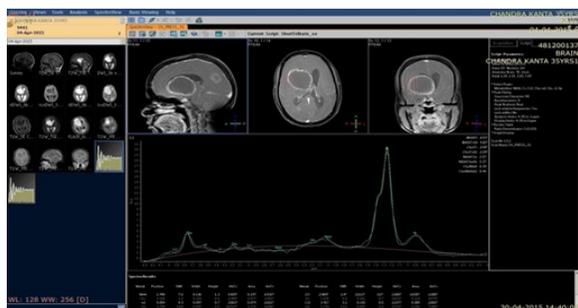
hancement with increased choline & creatinine s/o GBM

**Fig 4 Metastasis**



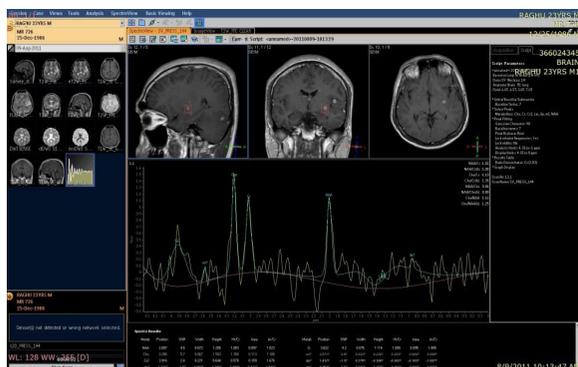
Multiple, varying size mildly enhancing lesions in bilateral cerebellum, right hippocampal region, bilateral periventricular fronto-parietal white matter and left occipital lobe with adjacent edema, decrease in NAA peak & choline (Cho) peak in the solid markedly enhancing peripheral portion of the mass lesion which suggest neuronal loss and. Consequently, there is marked increase in Cho/NAA ratio). Prominent Lipid (Lip) peak & small Lactate (Lac) peak. Prominent Lipid peak suggesting favours necrotic area; while small Lactate peak seen in few areas favouring anaerobic glycolysis s/o Metastasis.

**Fig 4 Abscess**



Irregular, thick walled CSF dense lesion is seen in right frontoparietal lobe region showing lipid lactate peak on MRS s/o brain abscess

**Fig 4 NCC(Neurocysticercosis)**



Multiple ring enhancing lesions in both cerebral hemisphere with NAA & choline peak s/o NCC

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