Section: Radiodiagnosis

Original Research Article

# ROLE OF MRI IN RING ENHANCING LESIONS IN BRAIN IN CORRELATION WITH MR SPECTROSCOPY

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## Abstract

**Background:** Magnetic Resonance Imaging (MRI) stands as a cornerstone technology, enabling clinicians to visualize intricate details of brain anatomy and pathology with unprecedented clarity. Ring enhancing lesions in the brain present a particularly challenging diagnostic scenario. Magnetic resonance spectroscopy (MRS) can assist differentiate among tumorous and nontumorous lesions with the aid of using measuring biochemical markers within side the brain. It offers radiologists a device to attain a definitive analysis noninvasively. **Materials and Methods:** This prospective study was conducted at M.G.M. Medical College & L.S.K. Hospital on 50 patients reporting in last one year of time period after written informed consent from patient/ guardian. **Result:** Out of the 50 patient's evaluated 22 cases were tuberculomas, 16 were NCC, 5 abscesses, 5 metastasis, 1 case of pilocytic astrocytoma and 1 case of tumefactive demyelination. Seizures are the commonest presenting complaint seen in 42 cases. **Conclusion:** Intracranial ring enhancing lesions appear similar on conventional MRI. So, with the help of MRS, differential diagnosis of the etiology of lesions is better diagnosed because of its higher specificity (93.3%) and sensitivity (87.5%) and thus acts as diagnostic tool of choice.

## INTRODUCTION

In the realm of neuroimaging, Magnetic Resonance Imaging (MRI) stands as a cornerstone technology, enabling clinicians to visualize intricate details of brain anatomy and pathology with unprecedented clarity. Among the myriad abnormalities encountered, ring enhancing lesions (RELs) in the brain present a particularly challenging diagnostic scenario.[1] To make this distinction, we depended on clinical assessment and an invasive histopathological analysis. Magnetic resonance spectroscopy (MRS) can assist differentiate among tumorous and nontumorous lesions with the aid of using measuring biochemical markers within side the brain.[2,3] It offers radiologists a device to attain a definitive analysis noninvasively.[4]

MRS scan can assist to diagnose extensive type of disease which include tumors, cerebral ischemia, and trauma whilst used as an accessory to the MRI.[5] It measures the resonant frequencies of diverse metabolites within the brain which include choline (Cho), creatinine (Cr), NAA etc and presents these values in form of line graph with amplitudes. These values themselves aren't diagnostic; however, they must be interpreted co parallely with MRI.[6]

MRS can be used for both diagnostic as well as prognostic purposes, especially in paediatric age groups. Thus MRS considered as future of neuroimaging. [7]

This paper aims to explore the pivotal role of MRI in the evaluation of Ring enhancing lesions, emphasizing the complementary utility of MRS in refining diagnostic accuracy and guiding therapeutic decision-making. Through a comprehensive review of current literature and clinical case studies, the integration of these imaging modalities will be elucidated, highlighting their synergistic value in characterizing RELs of diverse origins.[8]

**Aim and Objectives:**

1. To differentiate neoplastic from non-neoplastic brain lesions using conventional and advanced MR imaging techniques
2. To study the characteristic imaging findings of various ring enhancing lesions on MRI
3. To establish differential diagnosis of various ring enhancing lesions on conventional MRI


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4. 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.

## MATERIALS AND METHODS

This prospective study was conducted at M.G.M. Medical College & L.S.K. Hospital on 50 patients reporting in last one year of time period after written informed consent from patient/ guardian.

Out of the 50 patients, 17 pediatric patients in the 0–18 age group and rest are adults, with focal brain lesions on MRI who underwent MRS and clinical diagnosis were included. We excluded all patients who did not have a radiologic diagnosis, a histopathological analysis, or a clinical signs.

**Source of Data:** The main source of data for study was the patients referred to the department of radiodiagnosis of our institute from department of General Medicine and Paediatrics.

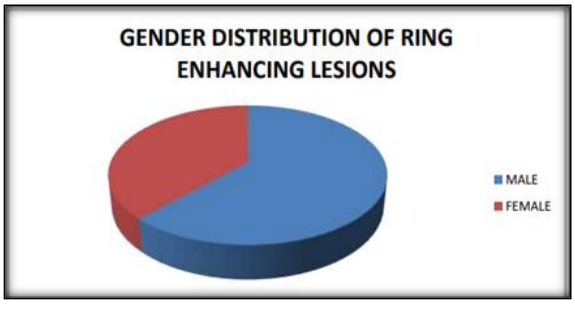
**Sequences:** These patients were subjected to MRI study over 1.5 Tesla GE machine. T1, T2, FLAIR, DWI, ADC & GRE sequences were applied. Post contrast T1 Fat Suppression sequence followed by MRS.We used a single voxel method in our MRS examinations. Initially, we localized the lesion via a contrast MRI scan, and a voxel was subsequently placed at its location.

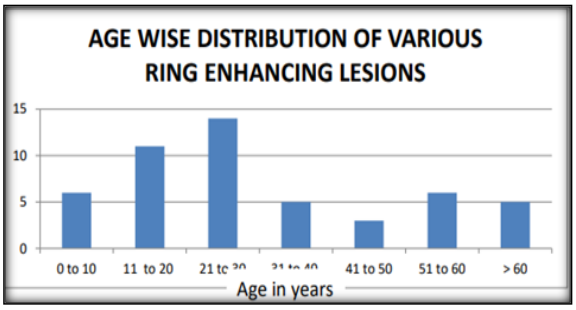
We checked out the spectrum of N-acetyl aspartate (NAA), Cho, and creatinine (Cr). Additionally, we checked for the lipid,lactate and certain amino acids peak on MRS. NAA is the indicator of neuronal integrity with its highest peak at 2.02 ppm, Choline (Cho) indicates cell turnover with its peak at 3.22 ppm and creatinine (Cr) reflects cellular metabolism with its peak at 3 ppm.

## RESULTS

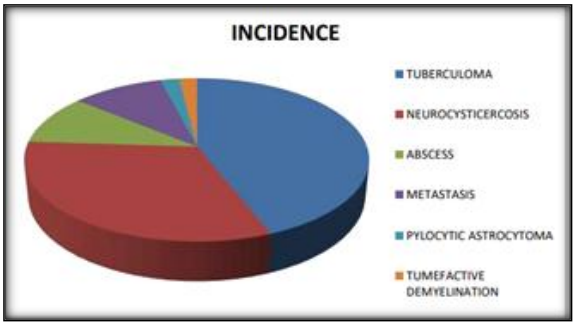
Out of the 50 patient's evaluated 22 cases were tuberculomas, 16 were NCC, 5 abscesses, 5 metastasis, 1 case of pilocytic astrocytoma and 1 case of tumefactive demyelination. Seizures are the commonest presenting complaint seen in 42 cases.

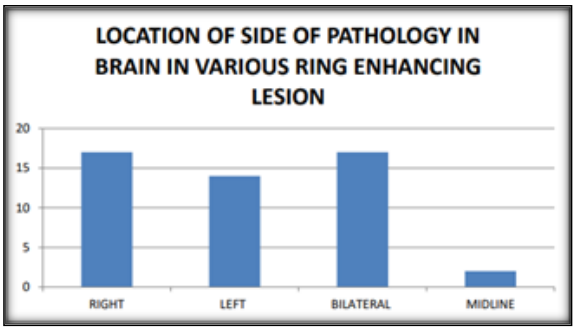
Gender distribution: In the present study majority of patients were malesout of total 50 patients ,31 patients were males and thus contributes ~ 62%. The Male to female ratio was 1.63:1.

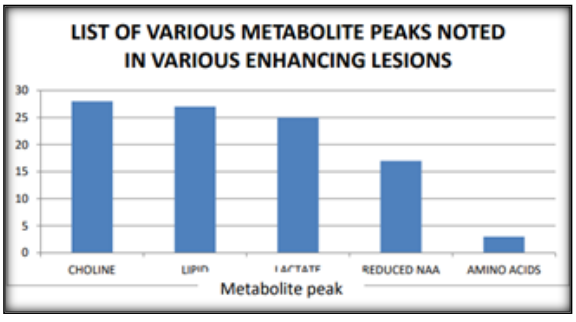


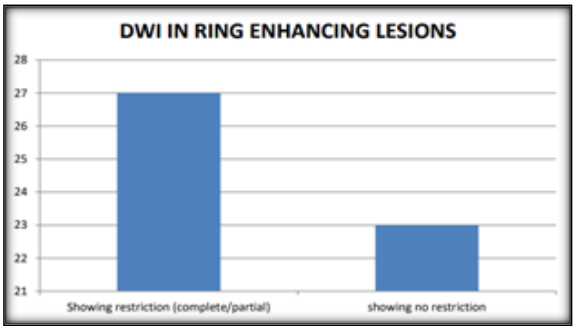




Age wise distribution: Out of 50 patient evaluated in our study, maximum no of patient were in age group of 21- 30 years and 11-20 years, comprising 28% and 22% respectively.





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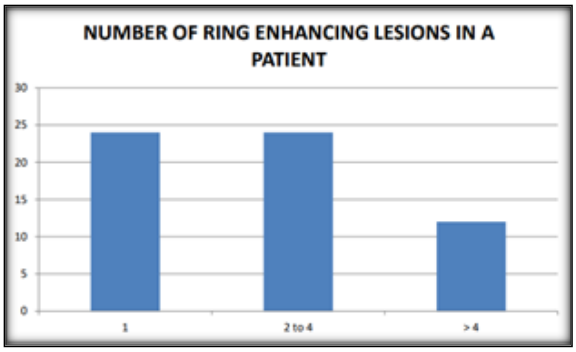


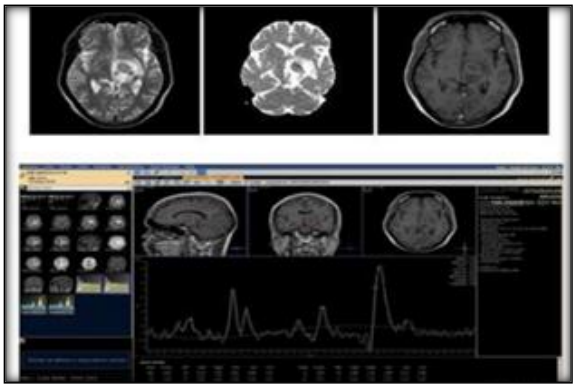

**Images 1: Single T2 hypointense lesion in the left thalamus showing partial diffusion restriction and elevated lipid, lactate and choline levels suggestive of tuberculoma**

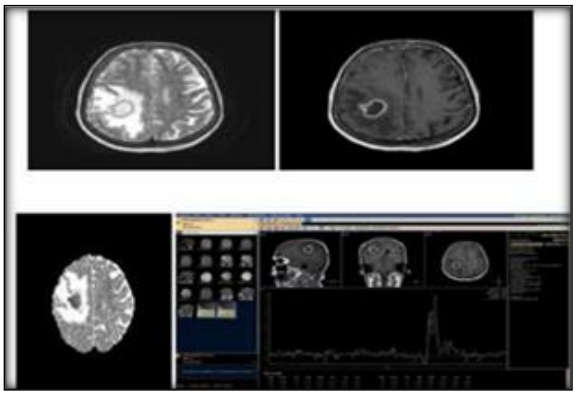

**Image 2: T2 hyperintense lesion with hypointense rim showing complete diffusion restyriction and lactate, amino acids on MRS suggestive of Abscess.**

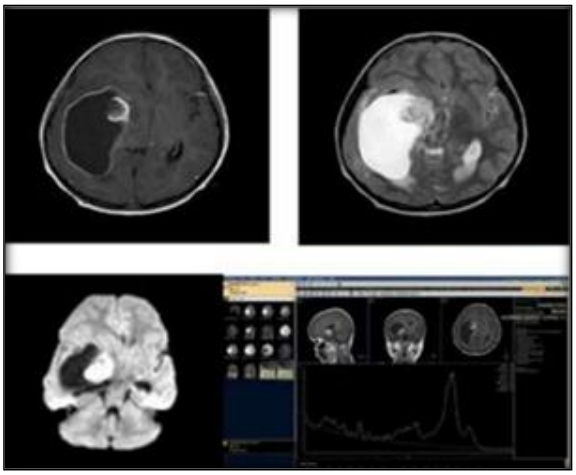

**Image 3: Heterogenous mass (both solid and cystic component) showing ring enhancement and diffusion restriction with high choline,lactate peak within the solid portion. Features suggestive of pilocytic astrocytoma.**

## DISCUSSION

In present study, 50 patients were evaluated by MRS to diagnose ring enhancing lesions of the brain. 28% of the patients belonged to the age group of 21-30 years. The study involved large number of male patients (62%). A significant number of patients in this study experienced seizures (66%) followed by headache (38%) and vomiting (24%). Similar findings were reported by SethS et al., where seizures (80%) were the most common presentation, followed by headache (28%) and vomiting (18%). An study done by Elsadway ME and Ibrahim Ali H stated that majority of the patients experienced headache, among them Tuberculoma (36%) and neurocysticercosis (22%) were the most prevalent lesions in this study.[9]

Among all MRI is the most sensitive modality for characterisation of intra cranial ring enhancing lesions and MRS plays an important role in characterizing various types of rings enhancing lesions.[10]

Pattern of signal intensity on T2 and FLAIR, Diffusion weighted imaging & MR spectroscopy helps us to differentiate benign from malignant lesions. Hypointense on T2WI showing partial or complete restriction on diffusion weighted images & lipid peak on MR spectroscopy favours towards tuberculoma. Hyperintense on T2WI with no evidence of diffusion restriction & presence of scolex on 3D CISS sequence suggests NCC. Abscesses show a hypointense rim on T2 with complete diffusion restriction. Lactate and Amino Acid peak is usually seen on MR spectroscopy. Metastases are well defined hyperintense lesions on T2 which show high choline peak on MRS. Pilocytic astrocytoma presents as heterogeneous mixed solid cystic enhancing lesion having lactate doublet at 1.3ppm with reduced Cr and NAA and elevated Cho peak.[11,12]


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## CONCLUSION

Intracranial ring enhancing lesions appear similar on conventional MRI. So with the help of MRS, differential diagnosis of the etiology of lesions is better diagnosed because of its higher specificity (93.3%) and sensitivity (87.5%) and thus acts as diagnostic tool of choice.

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