

MR Spectroscopic Evaluation of Intra-Cranial Ring Enhancing Lesions

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A B S T R A C T

Introduction: MR Spectroscopy is an excellent modality in evaluating intra-cranial ring enhancing lesions, with a high diagnostic yield and detecting the specific cause. Determination of cause of these lesions will help clinicians in planning appropriate further management of the disease. Study aimed to evaluate MR Spectroscopic features in various intra-cranial ring enhancing lesions and differentiate the various causes. Study settings and Design: It is a prospective study conducted in our institute from July 2017 to December 2018 with a sample size of 50.

Material and Methods: 50 patients were evaluated in this study conducted at Dept of Radio-diagnosis, Bangalore medical college and research institute. Contrast enhanced MRI along with MRS was performed using Siemens Magnetom Avanto model B5 1.5 Tesla MRI machine.

Results: Out of the 50 patients that we evaluated, tuberculomas (36%) was the most common pathology followed by NCC (24%), Abscesses (10%), metastasis (20%) and primary brain tumour (10%). Headache was the most common presenting complaint seen (78%).

Conclusions: MRI is an important line of investigation in evaluation of intracranial ring enhancing lesions. MR spectroscopy depicts characteristic imaging findings which helps in differentiating the various causes of ring enhancing lesions. MR spectroscopy by suggesting the accurate diagnosis plays an important role in patient management.

Keywords: MRI; MR Spectroscopy; Ring Enhancing Lesions.

INTRODUCTION

Intra-cranial ring enhancing lesions being one of the commonest neuroimaging abnormality, can be a challenging task to arrive for an accurate diagnosis. Cross-sectional imaging modalities, like computed tomography (CT) and magnetic resonance imaging (MRI) are used to detect these lesions.¹

Ring enhancing lesions are caused by a wide range of conditions such as infections, parasites, primary brain neoplasms, metastases, vascular or inflammatory etc. The patients usually present with as seizures, visual impairment, focal neurological deficits, altered sensorium and features of raised intracranial pressure (headache, vomiting and papilledema).²

Distinguishing non-neoplastic causes from neoplastic lesions is extremely important because a misdiagnosis can lead to unwarranted neurosurgery, exposure to toxic chemotherapy or potentially harmful brain irradiation etc. Magnetic resonance spectroscopy (MRS) is a non invasive physiological imaging modality that measures absolute and relative levels of various brain tissue metabolites. It is an excellent imaging

modality in evaluating intra-cranial ring enhancing lesions, with a high diagnostic yield and detecting the specific cause. Determination of cause of these lesions will help clinicians in planning appropriate further management of the disease.

MATERIAL AND METHODS

Current cross-sectional study was done on 50 patients referred to department of Radiodiagnosis, Bangalore medical college and research institute, Bangalore with intracranial ring enhancing lesions, who were referred for clinically suspected intra-cranial space occupying lesion. It was done in from July 2017 to December 2018

Inclusion Criteria

- All patients with intracranial ring enhancing lesions detected on contrast MR studies.
- All patients with incidentally diagnosed ring enhancing lesion by CT.
- Cases of all age groups irrespective of sex

Exclusion Criteria

- Patient having history of claustrophobia.

- Patient having history of metallic implants insertion, cardiac pacemakers and metallic foreign body in situ.

Equipment and Technique Used

The MRI scan was performed on Siemens Magnetom Avanto model B5 1.5 Tesla MRI machine. It possesses a Ultra-compact, Superconducting, Active shielded superconducting magnet with a magnetic field strength of 1.5 Tesla.

Sequences

Conventional spin echo sequences, axial T1, T2 and FLAIR: Coronal FLAIR; Sagittal T1; Post contrast axial, coronal and sagittal, DWI; T2 GRE. Special sequences such as CISS 3D were used as and when required. Single voxel H1 proton MR spectroscopy was performed at short TE of 35 & long TE of 144. The voxel is placed on the lesion so that it covers the enhancing wall and soft tissue component of the lesion. We used PRESS and T1 post contrast sequence as localization sequence with 5 mm thickness. Spectroscopy was avoided in small lesions close to the bone & CHES sequence was used for water suppression. Various ring enhancing lesions were differentiated according to their metabolites markers on MR spectroscopy like lipid, lactate, choline, amino acids, myo-inositol and NAA. Statistical analysis was performed using percentages and proportions.

RESULTS

Fifty patients were evaluated, whose age group ranged from 2 to 75 years. Fifty patients were evaluated of which 26 (52%) were males and 24 (46%) were females. Headache was the most common presenting complaint seen(78%). The highest incidence of these ring enhancing lesions were found in 21 – 30 years age group accounting for 22% of cases and least was seen in age group of > 61 years constituting 6%. Out of the 50 patients that we evaluated, tuberculomas (36%) was the most common pathology followed by NCC (24%), Abscesses (10%), metastasis (20%) and primary brain tumour (10%) (table-1). Out of the fifty patients that were evaluated spectroscopy

Lesions	No. of Cases	Percentage (%)
Tuberculoma	18	36%
Neurocysticercosis	12	24%
Abscess	5	10%
Metastasis	10	20%
Primary CNS neoplasms	5	10%

Table-1: Incidence of Various Ring Enhancing Lesions

Metabolite	No. of cases	Percentage
Lipid	23	46%
Lactate	18	36%
Choline	15	30%
Amino acids	9	18%
Alanine	5	10%
Acetate	1	2%
Myo-inositol	1	2%
Reduced NAA	21	42%

Table-2: Various MRS metabolite peaks in lesions

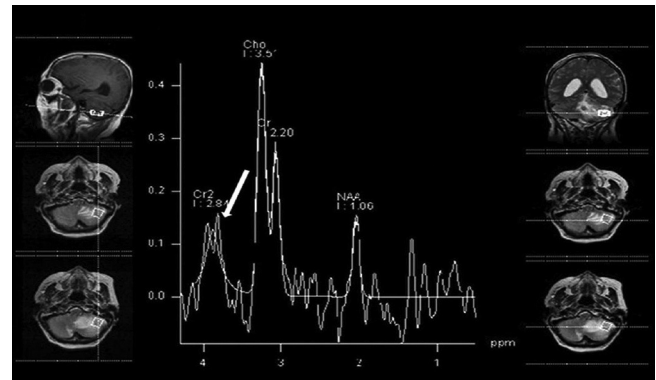


Figure-1: Case of tuberculoma with increased Lipid/lactate and decreased NAA(arrow).

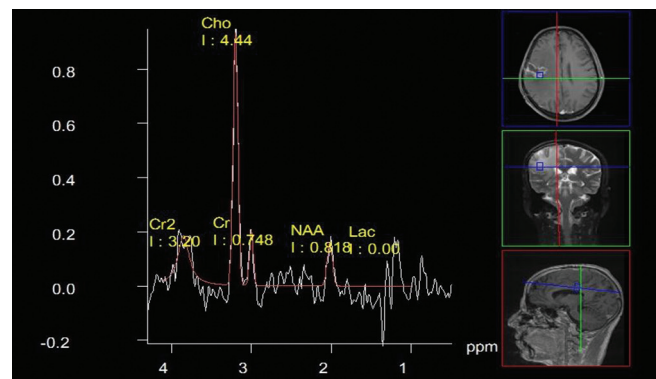


Figure-2: Case of GBM with decreased NAA and increased choline level.

was done in all the cases. The spectroscopy finding revealed - Lipid peak was noted in 23cases, Lactate in 18 cases, Choline in 15 cases, amino acids peak in 9 cases, alanine peak in 5 cases, acetate peak in 1 case, myo-inositol peak in 1 case. and reduced NAA peak was noted in 21 cases (table-2).

DISCUSSION

Magnetic resonance imaging which is a noninvasive, multiplanar and highly accurate technique with better inherent contrast. MRI along with MRS provides an accurate and early assessment of brain changes in various ring enhancing lesions, thus leading to accurate diagnosis and introduction of early treatment.

In our study 18(36%) cases were tuberculomas (Fig 1). Among the 18 cases males were 11 & females were 7. Single lesion was observed in 4 cases (22.2%) and multiple lesions were seen in 14 cases (77.8%). Gupta et al. described the presence of lipids on MRS as markers for tuberculomas.^{3,4} Lipid peaks were seen in all 18 tuberculoma cases.

Among 12 cases of neurocysticercosis males were 8 & females were 4. The diagnosis of neurocysticercosis was based on presence of scolex in a cyst in 3D-CISS sequence in MR images. Pandit S. et al. in their study observed that on MR spectroscopy combination of elevated levels of lactate, alanine, succinate and choline and reduced levels of NAA and creatine was observed.⁵ Alanine peak was noted in 6 cases, amino acid peak was seen in 5 cases, reduced levels of NAA and creatine were seen in all cases and whereas one case showed an acetate peak.

Among 5 cases of brain abscesses 3 were males & 2 were females. Abscesses appeared hypointense on T1 weighted images with a hyperintense rim and hyperintense on T2WI showing patchy or complete diffusion restriction and MRS showed lactate peak in all 5 cases suggesting anaerobic glycolysis. MR spectroscopy provides clue about which organism is responsible for the abscess, because the presence of anaerobic bacteria tends to cause elevated acetate and succinate peaks, whereas absence of acetate and succinate signals are more likely with obligate aerobes or facultative anaerobes.^{6,7}

Among 10 cases of metastatic lesions males were 6 & females were 4. Among 6 males 3 patients had primary lung carcinoma, 2 cases of carcinoma colon and 1 case of prostatic cancer. 3 out of 4 females had primary breast carcinoma and 1 case of carcinoma cervix. All 10 cases with metastatic lesions depicted elevated choline, elevated lipid, reduced creatine and reduced NAA peaks. Delattre JY et al. showed that about 60% of patients of brain metastasis are aged between 50 and 70 years. The majority of patients who develop brain metastases have a known primary cancer (metachronous presentation). Most brain metastases originate from lung (40-50%), breast (15-25%), melanoma (5-20%) and kidney (5-10%).⁸

5 primary brain tumours (Fig 2) were found of which 4 cases were glioblastoma multiforme (GBM) and one case of low grade glioma. Low grade glioma showed a myo-inositol peak in addition to reduced NAA and raised Cho peak. These findings were similar to a study conducted by Metwally LIA et al., who concluded that Mi/Cr ratio and myo-inositol is an important predictor for grading of gliomas, wherein the low grade glioma have a high myo-inositol peak as compared to anaplastic glioma and GBM.⁹

CONCLUSION

Magnetic resonance spectroscopy of brain is a new and smart technique that measures the concentration of several biochemical compounds in the brain in health and various disease states. In contrast to conventional MRI showing images, MRS demonstrates spectra of resonances. Magnetic resonance spectroscopy very critical role in differentiating various of intra-cranial ring-enhancing lesions on conventional neuroimaging and thereby helping clinician in appropriate further management.

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