



ROLE OF MRI AND MR SPECTROSCOPY IN THE EVALUATION OF RING ENHANCING LESIONS IN BRAIN

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ABSTRACT

INTRODUCTION : Radiological modalities to identify and diagnose the ring enhancing lesions include various modalities like CT , MRI , FDG – PET etc, the most commonly used diagnostic tool being MRI. This study assesses the role of MRI and MR-Spectroscopy (MRS) in the evaluation of ring enhancing lesions in brain.

AIM : To evaluate the imaging findings of various ring enhancing lesions on MRI and MR- Spectroscopy.

METHODOLOGY: 50 patients aged between 5 to 70 years , referred to the department of Radiodiagnosis (GMC, Haldwani) were included in this study from January 2016 to January 2017 . MRI along with MRS was performed using SEIMENS Somatom 1.5T .

RESULTS : In our study, males constituted majority of the cases (70%). The most common pathology was found to be tuberculoma (40%), followed by neurocysticercosis, abscess, metastasis and primary brain tumor. MR spectroscopy showed choline peak in 29 cases, lipid peak in 26 cases and increased lactate in 24 cases.

CONCLUSION : MRI along with MRS is the most sensitive modality in the characterization of intracranial ring enhancing lesions and their differential diagnosis.

KEYWORDS : . Ring enhancing lesions, Diffusion weighted imaging (DWI), MR Spectroscopy (MRS).

INTRODUCTION:

Ring enhancing lesions are one of the most common neuro-imaging abnormalities encountered by the radiologists. A wide range of etiologies may present as cerebral multiple ring-enhancing lesion [1]. Clinically, they present as visual impairment, focal neurological deficit, recurrent seizures, and raised intracranial pressure (severe headache, vomiting and papilledema). If vasogenic edema is severe, patients may develop altered sensorium and posturing of limbs because of transtentorial brain herniation . Intractable headache , focal neurological deficits and vision loss are the long-term sequelae [2]. These lesions may present as solitary or multiple on routine brain MRI , and are characterized by a contrast enhancing halo and a non enhancing center . The central part may present with low signal intensity on T1 and high signal intensity on T2 weighted images. 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. [3] Routine brain MR imaging is very sensitive in the identification of ring enhancing lesions but it cannot distinguish between neoplastic and non-neoplastic lesions, in a large percentage of these cases. Frequently, the differentiation of a tumor from an infection is quite difficult, based solely on conventional MRI. Therefore, advanced MR imaging techniques such as Diffusion Weighted Imaging (DWI), Perfusion and proton Magnetic Resonance Spectroscopy (1HMRS) have been employed in the differential diagnosis of these lesions, with variable success rates. These studies are employed in combination with conventional MRI as complimentary imaging tests and may significantly increase its specificity.

AIMS & OBJECTIVES

- To evaluate imaging findings of various ring enhancing lesions on MRI.
- To establish a differential diagnosis of the various ring enhancing lesions on conventional MRI .
- 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.

METHODOLOGY

- 50 patients referred to the department of Radiodiagnosis from

various departments with clinical symptoms of seizures , headache , vertigo , ataxia , fever were included in this study for a period of one year from January 2016 to January 2017.

- MRI along with MRS was performed using SEIMENS Somatom 1.5T in selected patients.

MRI PROTOCOL

- MRI protocol at 1.5T includes the conventional spin echo sequences, axial T1, T2 and FLAIR; Coronal T2; Sagittal T1; post contrast axial; coronal and Sagittal; DWI; T2 GRE single voxel spectroscopy was performed at TE of 144.
- The Voxel was placed on the lesion so that it covers the maximum area of the lesion in a single voxel.
- PRESS and T1 post contrast sequence as localization sequence with 5mm thickness.

OBSERVATION AND RESULTS

In our study, ring enhancing lesions were seen predominantly in males, comprising 35 cases (70%), while only 15 cases (30%) were females.

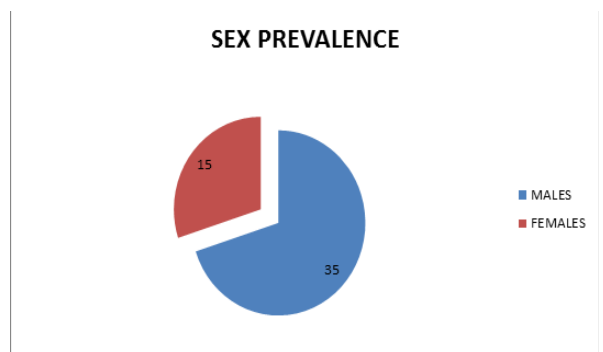


Fig a: Pie chart showing sex prevalence.

Seizures were the most common presenting complaint in 40 cases (80 % of cases). Headache was seen in 14 cases (28%), fever in 10 cases (18%), vomiting in 9 cases (18%), ataxia in 5 cases (10%) and motor weakness in 3 cases (6%).

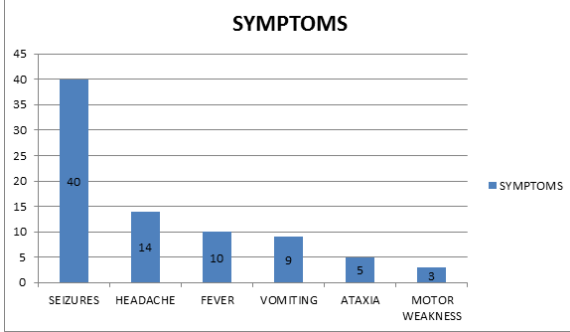


Fig b: Bar Graph depicting the symptoms.

Out of the 50 patients who were evaluated, tuberculomas were the most common pathology, seen in 20 (40%) cases, followed by neurocysticercosis (30 %), abscesses (18%), metastasis (8%) and primary brain tumour (4%).

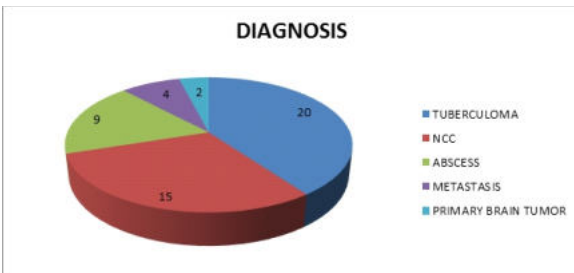


Fig c: Pie chart depicting the diagnosis.

Out of the 50 patients evaluated – 35 (70%) patients show diffusion restricting lesions (partial / complete) and 15 (30%) of cases shows no diffusion restriction.

Out of the 50 patients evaluated, choline peak was observed in 29 cases, Lipid in 26 cases, Lactate in 24 cases, reduced NAA peak in 18 cases and amino acids in 4 cases

1) TUBERCULOMA

- Most of the lesions appears isointense on T1 weighted image, hypointense on T2 weighted image, showing ring enhancement on post contrast image. Diffusion weighted imaging (DWI) shows restriction in tuberculomas with liquid necrosis, whereas there is no such restriction of diffusion in lesions with solid caseation. On MR spectroscopy it shows lipid and lactate peak. Choline to creatine ratio is greater than 1.

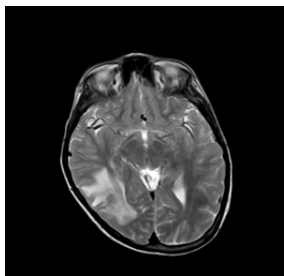


Fig 1) - T2 weighted axial image showing hypointense lesion with moderate perifocal edema.



Fig 2) - MRS showing high lipid and lactate within the lesion. There is mild choline rise and mild NAA reduction.

2) NEUROCYSTICERCOSIS

- Most of these show multiple well circumscribed ring enhancing lesion with central dot sign and shows hyperintense foci within on T1 weighted image representing scolex. Choline and lactate peaks were noted. However, there is no lipid peak.

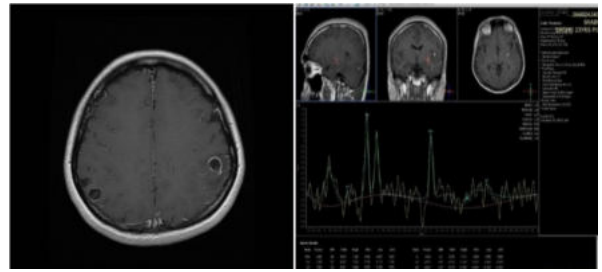


Fig 3)- T1 axial post contrast image showing few ring enhancing lesion with central dot sign.

Fig 4)- MRS showing choline peak and lactate peak.

3) BRAIN ABSCESS

- Most of these lesions show hypointense lesion with hyperintense rim on T1WI, hyperintense lesion with hypointense rim on T2WI. It shows marked diffusion restriction on DWI. MRS shows elevated amino acid and lipid lactate peak with reduced NAA peak.

4) BRAIN METASTASIS

- Most of these lesions appears hypointense on T1WI, hyperintense on T2WI and FLAIR with ring enhancement on contrast. Disproportionate perilesional edema is seen. MRS shows intratumoral choline peak with no choline elevation in the peritumoral edema.

DISCUSSION

This was a prospective study done in the Department of Radiodiagnosis, Government Medical College, Haldwani aimed at studying the MR appearances in various ring enhancing lesions of the brain. 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. In a study by Pretell *et al.*^[7], MR Spectroscopy was used to differentiate single enhancing brain lesions as due to tuberculomas or neurocysticercosis. Tuberculomas (n=4) had a high peak of lipids, more choline and less N acetylaspartate and creatine. The choline/ creatine ratio was greater than 1 in all tuberculomas but in none of the cysticerci (n=6)(2). Similar findings in tuberculomas have been reported by Kumar, *et al.* and Jaysunder, *et al.*^[6-7]. MRS findings of cysticercosis include a combination of elevated levels of lactate, alanine, succinate and choline and reduced levels of NAA and creatine^[7]. Similar finding are reported in our study.

CONCLUSION:

MRI is the most sensitive modality in the characterization of intracranial ring enhancing lesions (RELs). It shows characteristic imaging findings which helps in differentiating the various RELs. MRI plays a critical role in patient management by suggesting the correct diagnosis based on characteristic imaging findings. Proton MRS may contribute in their differential diagnosis and may enhance, alone or in combination with other advanced MR Imaging modalities, the specificity and the diagnostic accuracy of conventional MRI. N-acetyl-aspartate, Cho, Cr, Lac, Lipids, MI, cytosolic aminoacids, and metabolic ratios of NAA/Cho, NAA/Cr, and Cho/Cr are the most commonly calculated metabolites.

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