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MRI EVALUATION OF INTRACRANIAL RING ENHANCING LESION WITH MR SPECTROSCOPY

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ABSTRACT

OBJECTIVE: To study the MRI features of various etiologies presenting as ring enhancing lesions in the brain with the help of MR spectroscopy. **METHODOLOGY:** The study was conducted on 45 patients over the period of 2 years, from Aug 2017 to Sep 2019 in the Department Radio-diagnosis of Dr Vasantrao Pawar Medical College, Nasik. **RESULTS:** Of the 45 patients with ring enhancing lesions who were evaluated, tuberculomas (40%) turned out to be the most common pathology causing the ring enhancing lesions followed by NCC (31 %), Abscesses (9%), metastasis (13%), primary brain tumour (2%) and Toxoplasmosis (4%). **CONCLUSION:** MRI is the most sensitive diagnostic tool in the characterization of intracranial ring enhancing lesions. MRI with MR spectroscopy can help in the differentiation on different etiologies presenting as Ring Enhancing leisons.

KEYWORDS

Mrspectroscopy; Neurocysticercosis; tuberculoma; abscess; neoplastic

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INTRODUCTION

Ring enhancing lesions are encountered commonly and their diagnosis is challenging. neuroimaging abnormalities encountered by the radiologists Multiple etiologies may present with either single or multiple cerebral ring-enhancing lesions[1,2].

Diseases causing multiple ring-enhancing lesions of the brain can be infectious, neoplastic, vascular or inflammatory in etiology. Various primary and secondary brain neoplasms, such as low and high-grade gliomas, lymphomas and brain metastases can also present with multiple ring-enhancing lesions. Infective etiologies such as cysticercosis, tuberculosis, pyogenic abscess, toxoplasmosis, demyelinating disorders, fungal infections, neurosyphilis, sarcoidosis, radiation encephalopathy also presents as ring enhancing lesions 3. The differential diagnosis of ring-enhancing lesions depends on the age and the immune status of the patient. In the immunocompetent hosts, malignancies, metastatic and pyogenic abscesses remain the most likely diagnoses in patients with large-sized lesions. Infective pathologies were the most common aetiology for multiple ring-enhancing lesions of the brain in India. Tuberculosis is the commonest infective pathology 4 followed by neurocysticercosis. Thus establishing an accurate diagnosis with the help of advanced MR techniques such as spectroscopy is be beneficial to patients to establish an early and correct diagnosis 5. Magnetic resonance imaging is an excellent method for anatomical and structural diagnosis of the brain, but it does not provide functional or metabolic information. Thus, arising to a specific conclusion about the possible aetiology of the Ring enhancing lesion is a challenging task for radiologists. Magnetic resonance spectroscopy (MRS) allows the non-invasive measurement of absolute and relative levels of various brain tissue metabolites [6]

AIM AND OBJECTIVES

To evaluate various MRI findings in ring enhancing lesions in the brain with MR spectroscopy.

MATERIAL AND METHODS

This study was carried out with due approval from the ethics committee on 45 patients over the period of 2 years, from Aug 2017 to Sep 2019 in the Department Radio-diagnosis of Dr Vasantrao Pawar Medical College, Nasik. The demographic profile and clinical features were obtained after informed written consent to correlate the findings.

All the MRI scans were done on 1.5-T magnet MR system (Siemens Magnetom Essenza). Patients were made to lie supine for the scan and a dedicated head coil was used. The exact MR imaging pulse sequences vary among different institutions. MRI by multiplanar T1- and T2-weighted, FLAIR, diffusion, gradient images, using spin echo sequences, was obtained in all the patients. Proton magnetic resonance spectroscopy on single and multivoxels chemical shift imaging was done. The voxel is placed on the lesion so that it covers the maximum area of the lesion in a single voxel. We use Tl postcontrast sequence as localization sequence with 5 mm thickness.

RESULT

Forty five patients were evaluated, whose age group ranged from 3 to 75 years. The highest incidence of REL's was found in 21-30 years age group accounting for 29% of cases and least was seen in the age group of above 70 years constituting 4%.

Table 1: Age wise distribution of Patients.

Age(InYears)	No. of Cases
0-10	6
11--20	7
21-30	13
31-40	3
41-50	5
51-60	5
61-70	4
>71	2

Forty five patients were evaluated of which 25 (56%) were males and 20 (44%) were females.

Table 2: Sex wise distribution.

Sex	No. of Cases	Percentage
Male	25	56 %
Female	20	20 %

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Out of the 45 patients who were evaluated Tuberculomas (40%) is the most common pathology followed by NCC (31 %), Abscesses (9%), Metastasis (13%), primary brain tumour (2%) and Toxoplasmosis (4%).

Table 3: Incidence of ring enhancing lesions.

Lesions	Total
Neurocysticercosis	14
Tuberculoma	18
Abscess	4
Metastasis	6
Primary Brain Tumour	1
Toxoplasmosis	2

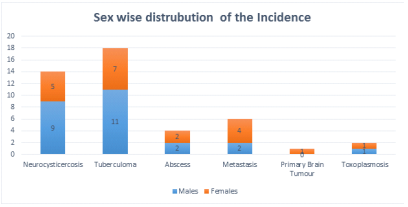


Chart 1 Sex wise distrubution of the Incidence

Spectroscopy was performed in all of the Forty five patients. Choline peak was observed in 28 cases, Lipid in 27 cases, Lactate in 22 cases, reduced NAA peak in 13 cases and amino acids in 1case.

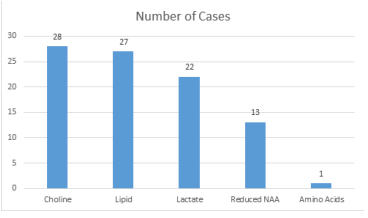


Chart 2 Various Peaks on spectroscopy

Tuberculoma

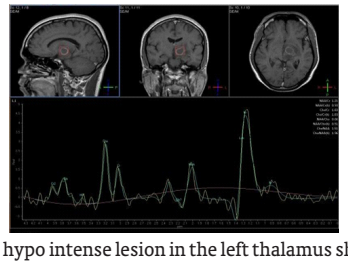


Fig 1 Single T2 hypo intense lesion in the left thalamus showing partial diffusion restriction and elevated lipid, lactate and choline levels suggestive of tuberculoma.

Abscess

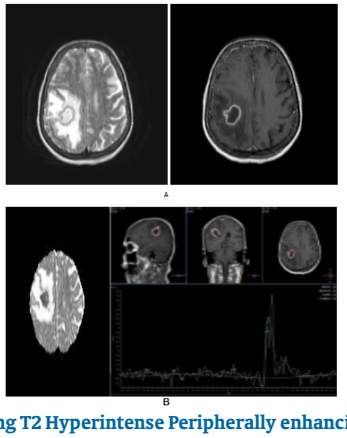


Fig 2 A showing T2 Hyperintense Peripherally enhancing lesion. 2B - MRS showing lactate peak.

Neurocysticercosis

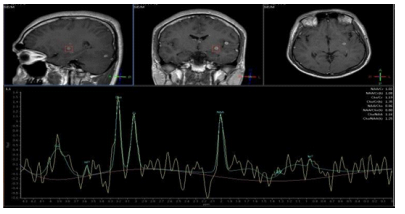
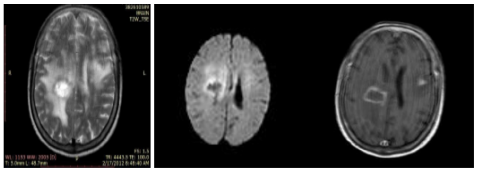


Fig 3 Multiple ring enhancing lesions showing choline peak and scolex on suggestive of NCC granuloma.

Metastasis



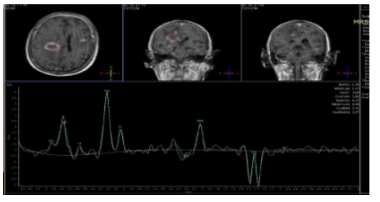
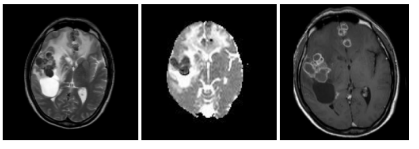


Fig 4 Bilateral T2 Hyperintense lesions showing diffusion restriction and elevated choline levels suggestive of metastasis.

Tuberculoma



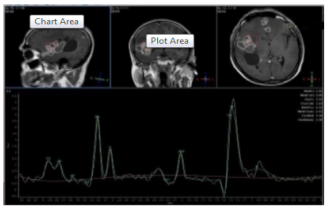


Fig 4 Multiple conglomerate ring enhancing lesions showing elevated lipid lactate peak suggestive of tuberculoma.

DISCUSSION

Spectroscopy was performed in all of the Forty five patients and showed Choline peak was observed in 28 cases, Lipid in 27 cases, Lactate in 22 cases, reduced NAA peak in 13 cases and amino acids in 1 case.

MR SPECTROSCOPY

Spectroscopy was performed in all of the Forty five patients. Choline peak was observed in 28 cases, Lipid in 27 cases, Lactate in 22 cases, reduced NAA peak in 13 cases and amino acids in 1 case.

TUBERCULOMA

Out of forty five patients, Tuberculoma was noted in 18 (40%) cases. Of these 18, 11 (61%) patients presented with seizures thus making it as the most common clinical presentation of Tuberculoma.

Among the 18 cases (males = 11: females = 7). Single lesions were noted in 2 cases (11.1%) and multiple in 16 cases (88.9 %). They were seen as conglomerated lesions which were hypointense on both T1 and T2. On Post contrast imaging they show iso to hyperintense peripheral ring enhancement which was seen in all cases in our study. Partial or complete diffusion restriction was seen in 12 cases – 66.7 %.

The lesions may show a nodular or irregular ring-like enhancement. All our cases presented with presented with ring-like enhancement.

MRS showed a Lipid peak in 17 (94.4%) cases and it plays an important role in the identification of tuberculomas from other infective granulomas. The stage of the tuberculoma whether it is caseous or non-caseous could also be identified on MRI with the help of T2 weighted images. Postcontrast images are very helpful in identifying the size of the tuberculomas due to its excellent spatial resolution and differentiates the granuloma from its surrounding edema.

Garg RK et al also concluded that seizure is the most common clinical presentation of tuberculoma. Similar findings were also noted in our study 7.

A study done by Vasudev M K et al in which thirty-three patients with intracranial tuberculomas (histologically confirmed in 22) were evaluated using proton density/T2- weighted, T1-weighted (with and without MT), and echo-planar diffusion-weighted imaging sequences, T2 relaxation coefficient (ADC) values8. Their study concluded that Intracranial tuberculomas were characterized by decreased MTR, relatively short T2 relaxation times (compared to normal grey matter), and mostly no restriction of diffusion. These quantitative parameters in combination could thus be of help in the noninvasive diagnosis of tuberculomas.

Tae Kyoung Kim , Kee Hyun Chang, Chong Jai Kim, Jin Mo Goo, MyeongCherl Kook, and Moon Hee Han (1995) showed that on T1-weighted images, the granulomas showed a slightly hyperintense rim. A slightly heterogeneous isointensity or hypointensity with small markedly hypointense foci was seen on the entire portion of the granuloma on T2-weighted images. On postcontrast T1-weighted images, there were single or multiple conglomerate ring enhancements within a tuberculoma in all six patients9.

Jayasundar R, Singh VP, Raghunathan P, Jain K, Banerji AK (1999) concluded that the presence of lipid can be used for differentiating tuberculomas from both non-specific IG and NCC10.

NEUROCYSTICERCOSIS

Out of forty five patients evaluated neurocysticercosis was seen in 14 (males=9; females=5) cases. 6 patients presented with single lesions whereas 8 patients presented with multiple lesions. All the cases were showing intraparenchymal forms of NCC with retro-orbital cysticercosis seen in one case. Scolex was identified in 5 cases. using 3D sequence. MRS shows Choline peak and reduced NAA peak. All the lesions were hypo to isointense on T1 weighted images. T2W images showed hyperintense signal in 12 cases and Iso to hyperintense in 2 cases. Intense ring enhancement with surrounding perilesional edema was seen in all cases suggestive of active lesions.

Parenchymal cysticercosis is better identified on MRI than CT in our study as compared to the study done by Suss Ra et al 11.

Features of parenchymal forms of NCC in our study are similar to the study done by do Amaral LL et al. and Gupta RK et al 12, 13.

Cho / Cr ratio was less than 1.1 in all NCC and more than 1.2 in all tuberculoma in our study which is similar to the study performed by Kumar et al and Gupta et al 14,15.

ABSCESS

Out of the 45 patients , abscess were found in 4 cases – 8.9 % (males =2; females =2). The abscess was single in 3 cases (75%) whereas 1 case had multiple abscesses. The size of the lesion caused by abscesses was larger as compared to the other ring enhancing lesions. The largest lesions in all the case were measuring >2 cm in size and two of these cases were >4 cm. All were hypointense on T1 weighted images with a hyperintense rim noted in 3 patients and were hyperintense on T2 weighted images. They showed complete diffusion restriction and MRS showed Lactate peak in all 4 cases suggesting anaerobic glycolysis with amino acids like glutamine seen in 1 case.

Halmes et al described the appearance of abscesses on MR16. We correlated our findings with those described and distinguished peripheral oedema, central necrosis and the characteristic pattern of peripheral enhancement of the abscess capsule.

Our findings were similar to the study conducted by Tsui EY et al, Shukla-Dave A et al and Leuthardt EC et al 17,18.

TOXOPLASMOSIS

Out of the 45 patients, 2 cases were Toxoplasmosis.(males = 2 ; females =4). Multiple lesions were identified in 1 case. Both the cases were iso intense on T1W images and ISO to hyperintense on T2W images. Lactate and lipid peaks are noted in these cases. One of the cases also showed reduced NAA levels.

Our findings were similar to the study conducted by A.Batra et al and Leuthardt EC et al 18,19.

METASTASIS

Out of the 45 patients, 6 cases were of metastasis (males = 2 ; females =4). Multiple lesions were identified in all six cases. All the cases showed high Cho / Cr and Cho / NAA levels . All 6 cases were hyperintense on T2W images. Two patients were known cases of Prostatic cancer and breast cancer respectively. Thick, irregular type of ring enhancement was noted after contrast administration.

Our findings were similar to the study conducted by Sijens PE et al 20.

CONCLUSION

- So we concluded that MR Spectroscopy play a vital role in patient management by aiding in the correct diagnosis based on characteristic findings seen on imaging.
- Pattern of signal intensity on T2, DWI, MRS and FLAIR help differentiate between benign and malignant lesions.
- MRS aids in characterization of various ring enhancing lesions.

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