



Role of MR Spectroscopy in Evaluation of Various Ring Enhancing Lesions in Brain

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ABSTRACT:

Background-A wide range of etiologies may present as multiple ring-enhancing lesions in brain, including infectious, neoplastic, vascular or inflammatory etiology.

Methods-This study was a prospective observational study. The study included 120 patients referred to the department of Radiodiagnosis in SMS medical college, Jaipur with clinically suspected ring enhancing lesions or those detected on contrast enhanced CT scan in the period of 1yrs.

Results- Out of the 120 patients that were evaluated spectroscopy was done in all the cases. The spectroscopy finding revealed - Lipid peak was observed in 62 cases, Choline in 44 cases, Lactate in 32 cases, reduced NAA peak was noted in 21 cases

Conclusion- MRI along with MRS has emerged as the most sensitive modality in the characterization of intracranial ring enhancing lesions. MRS helps in differentiation and characterization of various ring enhancing lesions based on various metabolites leading to accurate diagnosis.

Keywords- MRI, Ring Enhancing Lesions, Tuberculoma.

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. A wide range of etiologies may ^{1,2} present as cerebral multiple ring-enhancing lesions. MRI's clinical advantage in early detection of disease is visually demonstrated as unmistakable contrast between gray and white matter and tumor, ischaemia/infarct, edema, infection/abscess and hemorrhage. Contributing to this is MRI's inherent sensitivity as well as its capability to directly image in any plane without reformatting, and to be unimpeded or undistorted by bony structures. MR spectroscopy is a potential tool for differential diagnosis between brain abscesses and non-infectious lesions such as

primary brain tumor, lymphoma, brain metastasis; and tuberculoma. Magnetic resonance spectroscopy (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.

Diseases causing multiple ring-enhancing lesions of the brain can be infectious, neoplastic, vascular or inflammatory in etiology. Many types of primary and secondary brain neoplasms, such as low-grade and high grade gliomas, lymphomas and brain metastases can also present as multiple ring-enhancing lesions. Many non-neoplastic neurological disorders can mimic brain neoplasms on neuroimaging. These diseases include cysticercosis, tuberculosis, pyogenic abscess, toxoplasmosis, demyelinating disorders, fungal infections, neurosyphilis, sarcoidosis, radiation

encephalopathy, Behcet disease, cerebral venous thrombosis as well as several other vasculitic disorders. The differential diagnosis of multiple ring-enhancing lesions depends on the age and the immune status of the patient. In the immunocompetent host, malignancies (both primary and metastatic) and pyogenic abscesses remain the most likely diagnoses in patients with large-sized lesions. Abscesses caused by atypical microorganisms and demyelinating disease should also be considered in the differential diagnosis of multiple enhancing lesions of the brain. In tropical countries, cysticercus granuloma frequently needs to be differentiated from intracranial tuberculoma. Magnetic resonance spectroscopy (MRS) is a non invasive physiological imaging that measures absolute and relative levels of various brain tissue metabolites³⁻⁴.

MATERIAL AND METHODS

This study was a prospective observational study. The study included 120 patients referred to the department of Radiodiagnosis in SMS medical

college, Jaipur with clinically suspected ring enhancing lesions or those detected on contrast enhanced CT scan in the period of 1yrs. MRI was done on Philips achievea series 3T machine using phase array brain coil. Contrast study was done (by intravenously injecting gadolinium based contrast agent) according to body weight (0.1mmol / kg). Routine sequences like T1, T2, FLAIR, DWI were taken along with 2D PRESS with TE of 35 and 144. Various ring enhancing lesions were classified according their etiology, metabolites like lipid, lactate, choline, amino acids, alanine, acetate, myo-inositol and reduced NAA.

RESULTS

120 patients were evaluated, whose age group ranged from 2 to 70 years. 76 cases were male and 46 cases were female. Out of the 120 patients that we evaluated, tuberculomas (42.5%) was the most common pathology followed by NCC (33.33 %), Abscesses (10%), metastasis (10.8%), and toxoplasma infection (1.67%).

Table1: Presenting Features in Patients

Presenting features	No. of patients	Percentage
Headache	58	48.33
Seizure	67	55.83
Vomiting	24	20.0
Hemi paresis	36	30.
Visual problems	21	17.5

Most common (55.83%) presenting feature was seizure.

Table 2: Various Metabolite Peaks Noted in Various Ring Enhancing Lesions

Metabolic peak	No. of patients	Percentage
Lipid	62	51.67
Lactate	32	26.67
Choline	44	36.67
Amino acids	5	4.17
Alanine	8	6.67
Reduced NAA	21	17.5

Out of the 120 patients that were evaluated spectroscopy was done in all the cases. The spectroscopy finding revealed - Lipid peak was observed in 62 cases, Choline in 44 cases, Lactate in 32 cases, reduced NAA peak was noted in 21 cases.

Discussion

Magnetic resonance imaging is a highly accurate, noninvasive, multiplanar method with better inherent contrast for demonstrating any abnormal lesion accurately. 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. Animesh, Saha, Sajal Kumar Ghosh et al. conducted a study on 72 patients, of which headache was the most common symptom that was documented in patients with ring enhancing lesions (66.7 %) followed by vomiting (54.1 %).⁵

Seizure was the most common presenting symptom which was seen in all the cases of Neurocysticercosis (NCC). Scolex was identified in 4 cases which appeared as a hypointense focus on T2WI. Moderate to intense and regular ring enhancement with surrounding perilesional edema was seen in most of the cases. Alanine peak was noted in 8 cases, amino acid peak was seen in 5 cases. MRS findings of cysticercosis include a combination of elevated levels of lactate, alanine, succinate and choline and reduced levels of NAA and creatine.⁶

Abscesses appeared hypointense on T1 weighted images with a hyperintense rim in 10 patients, whereas all of them appeared hyperintense on T2WI showing complete or partial diffusion restriction and MRS showed Lactate peak in all 10 cases suggesting anaerobic glycolysis with 5 of the cases showing lipid peak. MR spectroscopy may shed light on 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.^{7,8}

CONCLUSION

MRI along with MRS has emerged as the most sensitive modality in the characterization of intracranial ring enhancing lesions. MRS helps in differentiation and characterization of various

ring enhancing lesions based on various metabolites leading to accurate diagnosis.

REFERENCES

1. Rajshekhar V, Chandy MJ. Tuberculomas presenting as isolated intrinsic brain stem masses. *Br J Neurosurg* 1997;11(2):127-33.
2. Enberg GM, Quezada B Mde L, de Toro VC, Fuenzalida LL. Tuberculous meningitis in adults: review of 53 cases. *Rev Chilena Infectol* 2006;23(2):134-6.
3. Cagatay AA, Ozsut H, Gulec L, Kucukoglu S, Berk H, Ince N, et al. Tuberculous meningitis in adults - experience from Turkey. *Int J Clin Pract* 2004;58(5):469-73.
4. Fan HW, Wang HY, Wang HL, Ma XJ, Liu ZY, Sheng RY. Tuberculous meningitis in Chinese adults: a report of 100 cases. *Zhonghua Nei Ke Za Zhi* 2007;46(1):48-51
5. Saha A, Ghosh SK, Roy C, Choudhury KB, Chakrabarty B, Sarkar R. Demographic and clinical profile of patient with brain metastases: a retrospective study. *Asian journal of neurosurgery*. 2013; 8(3):157.
6. Pandit S, Lin A, Gahbauer H, Libertin CR, Erdogan B. MR spectroscopy in neurocysticercosis. *Journal of computer assisted tomography*. 2001; 25(6):950-2.
7. Garg M, Gupta RK, Husain M, Chawla S, Chawla J, Kumar R, et al. Brain Abscesses: Etiologic Categorization with in Vivo Proton MR Spectroscopy 1. *Radiology*. 2004; 230(2):519-27.
8. Lai PH, Li KT, Hsu SS, Hsiao CC, Yip CW, Ding S, et al. Pyogenic brain abscess: findings from in vivo 1.5-T and 11.7-T in vitro proton MR spectroscopy. *American journal of neuroradiology*. 2005; 26(2):279-88.
9. Metwally LI, El-din SE, Abdelaziz O, Hamdy IM, Elsamman AK, Abdelalim AM. Predicting grade of cerebral gliomas using Myo-inositol/Creatine ratio. *The Egyptian Journal of Radiology and Nuclear Medicine*. 2014; 45(1):211-7.