ORIGINAL ARTICLE

MRI in the evaluation of the ring enhancing lesions of brain – A cross-sectional study

Sagar Dubey, Bhoop Chand, Deeksha Singh, Trapti Shukla, Iman Ikram, Mohmmad Talha, Lalit Kumar

Department of Radiodiagnosis, Rohilkhand Medical College, Bareilly, Uttar Pradesh, India

Corresponding Author:
Dr. Lalit Kumar,
Department of Radiodiagnosis,
Rohilkhand Medical College,
Bareilly, Uttar Pradesh, India.
E-mail: drlalit169@gmail.com

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Background: The Most commonly found neuroimaging abnormalities are ring-enhancing lesions. Widely available two imaging methods on which these lesions found are computed tomography and magnetic resonance imaging (MRI) This study is intended to characterize and narrow down the differential as much as possible. **Objective:** To determine and characterize ring enhancing lesions of the brain. **Methodology:** The present cross-sectional study was carried out at the Radiology Department of Rohilkhand Medical College and Hospital in Bareilly, Uttar Pradesh. **Results:** In our study out of 50 cases, siezure was most common complaint when presenting in 82.0% of cases followed by fever in 15% and headach in 15% of cases. Out of 50 cases in our study maximum 38 % was NCC cases, 36% have tuberculoma cases, 10% cases have metastasis, 10% abscess, 4% primary brain tumour and 2% was demyelination. Gender distribution was of 30:20 in age distribution range of 1 year to 70 year. **Conclusion:** Men (31-62% of cases) were affected more frequently than women (20-38%). • T2 signal intensity, DWI, and MRS play a very important role in characterizing ring-enhancing lesions. Seizures are the most common clinical manifestation, reported in 82% of cases MRI plays an important role in patient management by suggesting the correct diagnosis based on characteristic imaging findings. MRS is useful for characterizing various ring-enhancing lesions. However, MRS findings alone are not diagnostic of lesions.

KEY WORDS: MRI, Ring enhancing lesions, Neurocysticercosis, Metastasis, MRS.

INTRODUCTION

One of the most typical neuroimaging abnormalities is several ring-enhancing lesions. Widely available two imaging methods on which these lesions found are computed tomography and magnetic resonance imaging (MRI). Multiple ring-enhancing lesions in the brain can have a variety of etiologies.[1,2] These lesions show up on neuroimaging studies as isodense or hypodense mass lesions on plain computed tomography. The area of hypodensity shows disc or ring like enhancement on injection of contrast.

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Edema of vasogenic origin is seen around these lesions. Near the intersection of the grey and white matter, ring enhancing lesion is very common and also in the sub-cortical region, deep inside the brain parenchyma, or even superficially.[2]

The Visible Advantage of MRI in the Early Diagnosis of the Disease are in Following Cases

- Distinct contrast between grey and white matter
- Tumor ischemia/infarct
- Edema
- MS plaques
- Infection/abscess and bleeding.

The capacity and sensitivity of MRI to detect directly in any location without reformatting and to remain unhindered by bony structures all contribute to the precise imaging and early diagnosis.[3]

Primary brain tumors such as lymphomas, brain metastases, and tuberculomas have been differentiated with non-neoplastic lesion through magnetic resonance spectroscopy (MRS). MRS metabolites and their ratio might provide information regarding the potential scope and character of changes on a standard MRI scan[4] with widespread use of faster MRS features like increase intensity of signal-to intensity of noise ratio and detailed visibility, detection of functional metabolites becomes easy. With this plethora of knowledge to comprehend and brings about precise description of the tumor, the variation of external and functional manifestation seen in the brain parenchyma becomes convenient.[5] Parallel investigations have proved the convenience of HMRS in tracking the disease management and its development. In addition, the prognostic implication also noted with MRS.[4]

Study Place

This study will be conducted in the Department of Radiodiagnosis, Rohilkhand Medical College and Hospital Bareilly, Uttar Pradesh.

Study Design

This was a cross sectional study of diagnostic efficacy.

Study Period

The duration of the study was 1-year cross-sectional study from November 1st, 2020 to October 31st, 2021.

Source of Data

All patients with documented ring enhancing lesions in brain whose MRI will be performed in Department of Radiodiagnosis, Rohilkhand Medical College and Hospital Bareilly, Uttar Pradesh, will be included in this study.

Sample Size

Sample size was calculated using power analysis and sample size software.

A pilot study was done in the radiology department of Rohilkhand Medical College and Hospital, Bareilly, by taking in account the departmental records from March 2019 to march 2020. The prevalence of ring enhancing lesions as per the pilot study came out to be 6%. The power of the study was set as 80% and alpha error was taken as 5%.

Considering the above parameters, the minimum sample size calculated for the study and it comes around to be 46. Hence, I will be including a minimum of 50 patients.[19]

Selection Criteria

Inclusion criteria

- All the patients having ring enhancing lesions on MRI were included in the study.

Exclusion criteria

The following criteria were excluded from the study:

- Previous history of allergic reactions to MRI contrast agents. Patient with known contraindication to MRI.
- Pregnant patients.

Equipment Used

- MR machine of 1.5 Tesla Magnetom Sempra-Siemens machine will be used.
- The MRI protocol for the assessment of patients with ring enhancing lesion of brain will include the following sequences
- Axial T1-weighted spinecho
- Axial T2-weighted fast spinecho
- Axial 2D T2 FLAIR
- T2*GRE
- Susceptibility-weighted imaging
- Sagittal T2 fast spin echo and
- FLAIR coronal
- Axial DWI
- MRS.[5]

Statistical Analysis

All the qualitative data will be reported in terms of frequency and percentage. Relationship of qualitative variables will be determined by Chi-square test.

Quantitative data will be represented using mean ± standard deviation and median inter quartile range. Results will be graphically represented wherever deemed necessary.

Appropriate statistical software, including MS Excel, Statistical Package for the Social Sciences Version 23 will be used for statistical analysis.[6]

RESULTS

With better intrinsic contrast and non-invasive versatility, MRI can effectively define lesions. A precise diagnosis and quick treatment initiation are made possible by MRI's excellent assessment of brain alterations in diverse ring-enhancing lesions. The objective of this cross-sectional investigation, which was carried out at the Rohilkhand College of Medicine and Hospital Radiological and Imaging Department, was to examine how MR developed in various ring-enhancing lesions of the brain. We looked at 50 patients in his MR imaging investigation of ring-enhancing brain lesions.

NEUROCYSTICERCOSIS (NCC)

Of the 50 individuals that were examined, NCC was found in 19 cases (ten cases in men and nine in women) of those patients. A single lesion was present in eight cases. Multiple lesions were present in eleven subjects. In all three cases, the NCC was intraparenchymal, and spinal cysticercosis and subarachnoid

cysticercosis were both found in one case and two cases, respectively. In eight cases, Scolex used the CISS 3D sequence to identify him. A peak for choline and a declining peak for her NAA is visible on the MRS. Gradient echo imaging was crucial in locating the calcified lesions that were seen in six cases (or 37.5%) of the cases. On T1-weighted images, all lesions were hypointense to isointense, and 12 were hyperintense on T2. Nine of these 12 lesions displayed FLAIR reversal, indicating a resemblance to CSF content. In every instance, an active lesion was seen as a significant annular enhancement with surrounding perilesional edema. The lack of intraventricular cysticercosis instances was likely caused by the study's small sample size. Martinez and co. In 22% of cases, intraventricular NCC was noted.[7]

ABSCESS

Of 50 patients, 5–10% (five males and no women) had abscesses. In two of his cases (40%), there was only one abscess discovered; in the other three cases, there were several abscesses. patients with tetralogy of Fallot who have a history of congenital cardiac disease. Each case measured more than 2 cm, and one case measured more than 4 cm. T1-weighted scans of all were hypointense, while T2-weighted images of three patients were hyperintense with surrounding hypointense boundaries (five cases). They displayed total diffusion limitation, all five MRS analyses revealed lactate peaks, and three cases involved anaerobic glycolysis involving amino acids such glutamine. Harms and others, I talked about how MR developed abscesses. Our results were compared to those previously reported, and we were able to identify the distinctive patterns of peripheral edema, core necrosis, and peripheral enlargement of the abscess bursa.[8]

METASTASIS

Five of the 50 patients (three men and two women) had metastatic disease. All five cases involved multiple lesions. High levels of Cho/Cr and Cho/NAA were present in all instances. All five had T2 hyperintensities, and two had FLAIR reversals, which are indicative of cystic metastases. Three instances, mostly in the breast, lung, and prostate, were found. Following the application of contrast, a thick, erratic, and ring-shaped enhancement was observed.[9]

TUBERCULOMA

Eighteen individuals (35%) of the 50 patients examined had tuberculosis among 18 cases (nine males and nine females). Of his patients, 11 (72%) had numerous lesions, compared to 7 (27.2%) with a single lesion. Conglomerate lesions are what they are referred to as.

The iso to hyperintense rings seen in the 12 instances in our investigation are visible on weighted images. In 17 cases (77.2%), partial or complete limitation can be seen. Nodular or atypical annular enhancement may be present in lesions. All of the shown cases show enhancement like rings. In two cases, nodule enhancement was also observed in addition to ring-enhancing lesions. In 15 instances (68.1%), MRS demonstrated a lipid peak, which was crucial in separating tuberculosis from other infected granulomas.[10] Using MRI and T2-weighted imaging, the stage of tuberculosis, whether psoriatic or not, can also be identified. Due to their great spatial resolution, post-contrast pictures are very helpful in identifying the extent of tuberculosis and differentiating granulomas from surrounding edema.[11]

AGE DISTRIBUTION

Fifty patients, ranging in age from 1 month to 70, were assessed. The age groups of 31–40 had the highest incidence of ring-enhancing lesions –30% of cases-and 41–50 had the lowest incidence –6% of cases.

GENDER DISTRIBUTION

Fifty individuals were examined, with 30 (60%) men and 20 (40%) women.

CLINICAL TRAITS

In 82% of patients, seizures are the most frequent complaint. Other concerns were fever (15%) and headache (15%).

PATHOLOGY

NCC (38%) was the most prevalent condition among the 50 patients evaluated, followed by tuberculosis (36%), metastasis (10%), abscess (10%), primary brain tumor (4%), and demyelination (2%). In a research by Schwartz *et al*., gliomas affected 40% of the participants. The increasing frequency of tuberculomas is probably due to India's higher tuberculosis prevalence.

SIDES OF THE LESIONS

Of the fifty patients, 17 (34%) had RELs on the right side, 20 (40%) on the left, 12 (24%) had them bilaterally, and 1 (2%) in midline.

NUMBER OF LESIONS

Fifty people were examined and 17 (or 34% of them) only had one lesion. Twelve patients (24%) had more than five RELs, while 21 patients (42%) had 2–5 lesions.

DIMENSIONS OF THE LESION

When 50 individuals were assessed, only 13 (25%) had lesions smaller than 1 cm, while the majority (26/50%), who had RELs 1–3 cm, had lesions greater than 3 cm. When there were many lesions, the most lesions that fit within one group were considered.

RESTRICTION ON DIFFUSION

Fifty people were examined; of these, 30 (60%) had partial or complete lesions that hindered diffusion, while 20 (40%) had none at all.

SUMMARY AND CONCLUSION

The study was conducted over his 1-year period from November 1, 2020, to October 31, 2021, and included 50 of patients with ring-enhancing lesions on MRI (34 were his previous CT had a ring contrast lesion) referred to MRI. A wide age ranges from 1 month old to 70 years old. Various parameters of ring-enhancing lesions were evaluated range of MRI findings.

- Of the 50 cases, 19 were NCC, 18 tuberculoma, five abscesses, five metastases, two brain tumors, and one neoplastic demyelination.
- Men (31–62% of cases) were affected more frequently than women (20–38%). T2 signal intensity, DWI, and MRS play a very important role in characterizing ring-enhancing lesions. Seizures are the most common clinical manifestation, reported in 82% of cases. Follow-up CT/MRI of 28 patients showed lesion resolution and associated perilesional edema.
- MRI plays an important role in patient management by suggesting the correct diagnosis based on characteristic imaging findings. MRS is useful for characterizing various ring-enhancing lesions. However, MRS findings alone are not diagnostic of lesions.

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