How to Cite:
Patel, K., Reddy, D. R. M., Rathore, R., Barai, D., & Chapala, S. (2022). Differentiating between various pathologies showing ring enhancement on MRI. *International Journal of Health Sciences*, *6*(S2), 5466–5475. https://doi.org/10.53730/ijhs.v6nS2.6383

Differentiating between various pathologies showing ring enhancement on MRI

Kalpeshkumar Patel
Professor, Department Of Radiodiagnosis, S.B.K.S Medical Institute & Research Centre, Sumandeep Vidyapeeth,Piparia, Waghodia, Vadodara, Gujarat, India

D Reddi Mithun Reddy
Resident, Department Of Radiodiagnosis, S.B.K.S Medical Institute & Research Centre, Sumandeep Vidyapeeth,Piparia, Waghodia, Vadodara, Gujarat, India

Rajeshkumar Rathore
Professor, Department Of Radiodiagnosis, S.B.K.S Medical Institute & Research Centre, Sumandeep Vidyapeeth,Piparia, Waghodia, Vadodara, Gujarat, India

Durgaprasad Barai
Resident, Department Of Radiodiagnosis, S.B.K.S Medical Institute & Research Centre, Sumandeep Vidyapeeth, Piparia, Waghodia, Vadodara, Gujarat, India

Shashank Chapala
Resident, Department Of Radiodiagnosis, S.B.K.S Medical Institute & Research Centre, Sumandeep Vidyapeeth,Piparia, Waghodia, Vadodara, Gujarat, India

***Abstract*---**Introduction: Ring-enhancing lesions are one of the most commonly encountered neuroimaging abnormalities visualized on MRI. The most common etiologies causing ring enhancing lesion include tuberculomas, neurocysticercosis, abscess, infarct and demyelination disorders. Mostly the ring-enhancing lesions are located at junction of the grey and white matter but in few cases they are seen in the sub-cortical area & deep brain parenchyma. Few specific features of ring enhancing lesions seen in sequences of MRI brain coupled with clinical history helps in narrowing down our diagnosis. Material and methods: 55 patients with ring enhancing lesions on MR imaging in Dhiraj hospital were considered in our study. A detailed clinical history along with general and systemic examination, especially evaluation of neurological status was done in all the patients. Results: 55 indoor patients admitted to medical ward in Dhiraj hospital of age group 16 to 70 years were selected for the study. Majority were in the age group of thirty to forty five years.

International Journal of Health Sciences ISSN 2550-6978E-ISSN 2550-696X© 2022.
Corresponding Author - D Reddi Mithun Reddy
Manuscript submitted: 27 Feb 2022, Manuscript revised: 18 March 2022, Accepted for publication: 09 April 2022

Headache emerged as the most common complaint that the patients presented with. Out of a total of 55, 49 patients complained of headache. Vomiting was seen in 39, Seizures was seen in 21 and episodes of loss of consciousness in 11 patients. Conclusion: Variety of infectious and noninfectious diseases cause multiple ring-enhancing lesions of the brain and is often challenging. The most common etiologies were that of TB, neurocysticercosis and cerebral abscess. Our study concludes that TB is the leading cause of ring-enhancing lesions in the Indian population compared to tumors in the Western world. Hence on the basis of our expertise we are suggesting that in patients who present with multiple ring-enhancing lesions of the brain on MRI examination of cerebrospinal fluid and chest imaging should also be performed.

***Keywords*---**Tuberculoma, Abscess neurocysticercosis, Infarct, MRI, MR spectroscopy.

Introduction

- Multiple ring-enhancing lesions is one of thecommonly observed pathology seen in MRI
- The common etiologies in clinical practice causing ring enhancing lesions are tuberculomas, , neurocysticercosis (NCC), abscess, metastasis, infarct & demyelination disorders.
- Mostly the ring-enhancing lesions are visualized at the junction of grey-white matter, but in few cases seen in the sub-cortical area & deep layers of brain parenchyma.
- To distinguish various pathologies on MRI brain, clinical history and age of the patient along with size, shape, wall thickness of ring-enhancing lesions and the extent of surrounding edema along with Diffusion restriction should be considered.

Aims and Objectives

- To establish the role of Magnetic Resonance Imaging in diagnosing the ring enhancing lesions of the brain.
- To differentiate between neoplastic & non-neoplastic brain lesions presenting with ring enhancement on MRI.
- To study the characteristic imaging findings seen in various ring enhancing lesions on MRI.

Materials and Methods

- An observational study among 55 patients with ring enhancing lesions on MR imaging in Dhiraj hospital were included in the study.
- Detailed clinical history along with neurological status along with few investigations was taken in all the patients.

Results

55 indoor patients admitted to medical ward satisfying the inclusion criteria were selected for the study. The age of patients ranged from twenty to seventy years. Majority were in the age group of thirty to forty five years.

Out of 55 patients symptoms seen were:

Symptoms	Number	Percentage
Headache	49	90%
Vomiting	38	70%
Seizures	21	39%
Loss of consciousness	11	20%
Paralysis	1	0.02%

Pathologies	Number	Percentage
Tuberculoma	29	52%
Neurocysticercosis	13	23%
Cerebral abscess	7	12%
Infarct & Hematoma	2	0.04%
Glioblastomamultiforme	2	0.04%
PRES	2	0.04%

Individual Pathologies

Tuberculoma

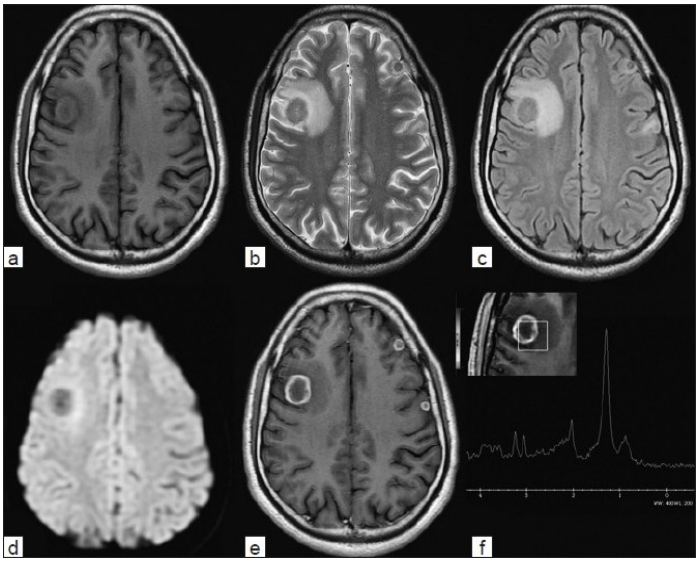
- Tuberculoma was found in 29 out of 55 patients who had presented with ring enhancing lesions on MRI.
- The mean age of patients was 36years with 74% of patients between 21-40 years of age.

Males predominated in all age groups.

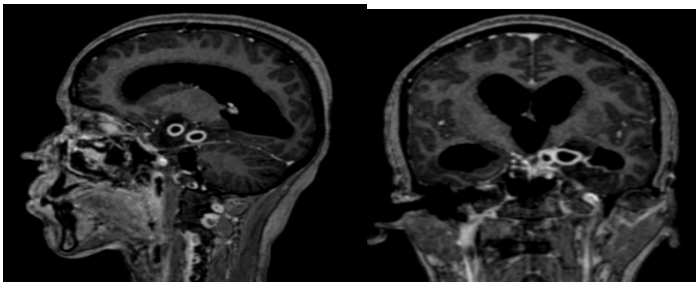
- Pathological site of Tuberculoma in brain is most common parieto-frontal lobe followed by temporo-occipital lobes and least is in central grey matter [1].
- In our study symptoms of tuberculoma include low-grade fever (54%), headache (69%), vomiting (46%), visual complaints (36%), convulsions (41%), constitutional symptoms (53%) and altered consciousness (39%) [2].

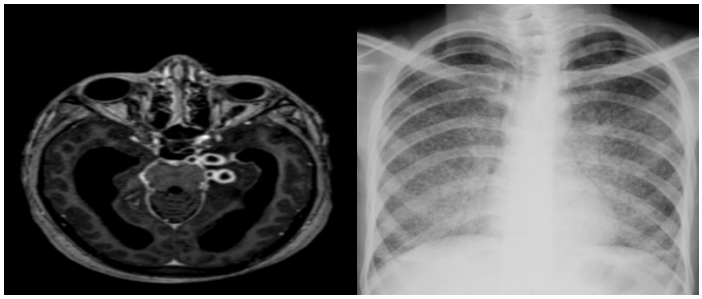
23% patients had evidence of old or active pulmonary TB on chest X-ray. We observed frequent association of multiple ring-enhancing lesions of the brain with miliary TB. In 9 patients (almost 50%) with multiple ring-enhancing lesions of the brain, we observed CSF abnormalities consistent with tuberculous meningitis. On neuroimaging, almost 60% patients had multiplering enhancing lesions.

Patient with Tuberculoma



The lesion appears hypointense on T1 and T2 & shows no restricted diffusion with characteristic ring enhancement seen on T1+C and on MR spectroscopy shows lipid lactate peak.



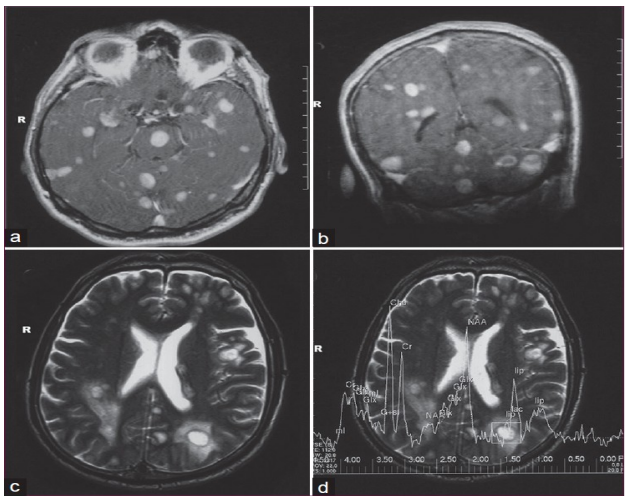


Multiple ring enhancing lesions seen in on contrast imaging and shows no diffusion restriction and later on chest x-ray was found to be military tuberculosis.

Neurocysticercosis

Caused by pork tapeworm Taenia solium. 13 patients out of total 55 patients in my study of ring enhancing lesion had infection of neurocysticercosis. Most patients had history of focal seizures. Signs of raised intracranial tension like headache, vomiting and loss of consciousness were seen in 31% of patients. Patients with NCC responded well to treatment with albendazole and corticosteroids.

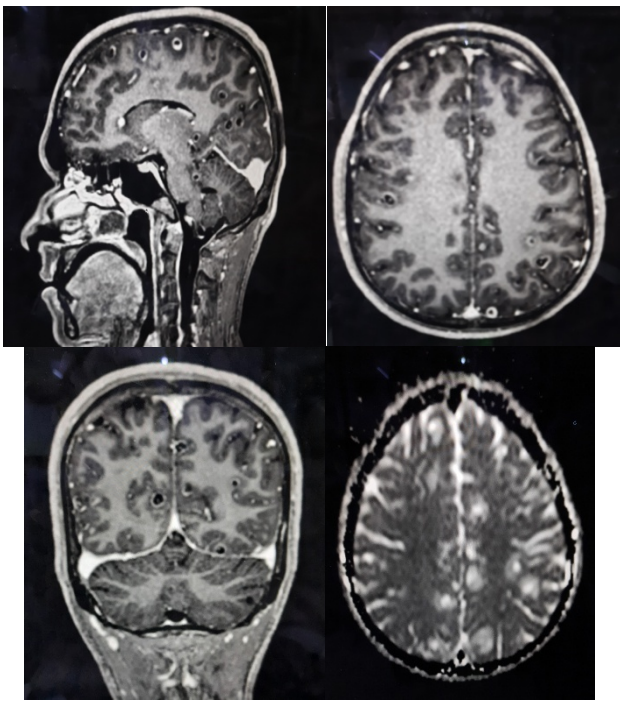
NCC image in a patient showing multiple cystic lesion



T1WI shows hyperintensescolex

Typical ring enhancing lesions are seen on T1+C [3].

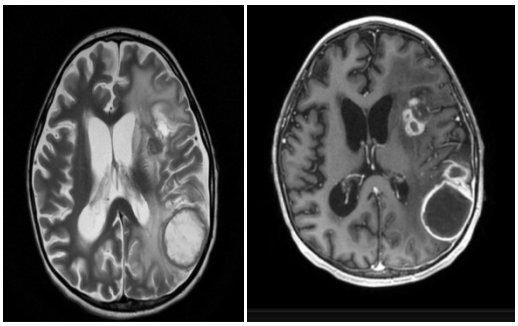
Multiple cystic lesion are seen on MRI and these lesion appears of different stages.

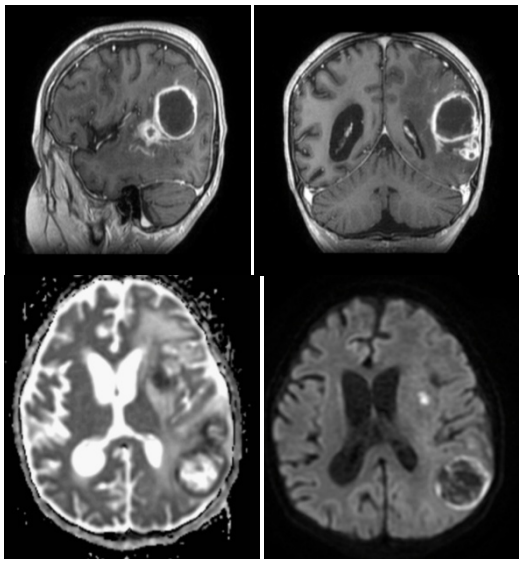


Multiple cysts are seen with dot sign suggestive of viable parasite.
No surrounding edema is seen.
No restriction seen on diffusion weighted images [4].
CEREBRAL ABSCESS:-

7 patients out of total 55 patients in my study had cerebral abscess. Average age in my study was 48 years. Fever and headache occurred in almost all patients. One patient presented with ophthalmological visual complaints followed by neurological loss of consciousness. Frontal and parietal cortices were involved in all cases while 33% cases involved the cerebellum.On post culture study 5 were found to be pyogenic abscess while 2 were found to be fungal abscess caused by aspergillus fumigatus with showed irregular appearance lesion.Points favouring cerebral abscess include lesion at gray white junction and showing diffusion restriction [5].

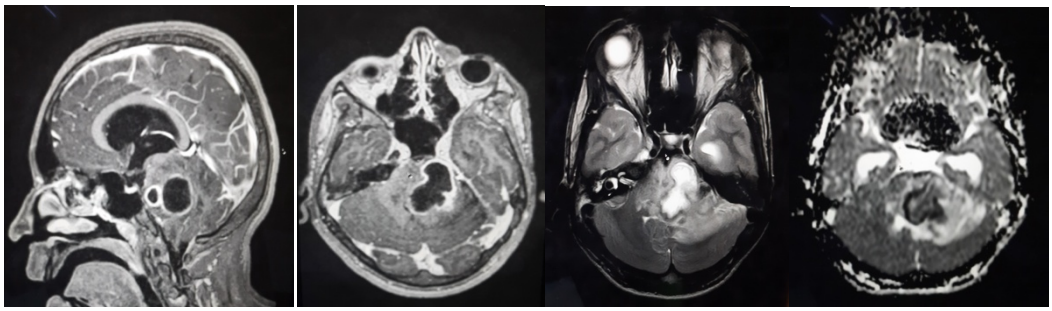
Case of Pyogenic Abscess- Round regular walls





- T2WI shows hyperintense lesion with a capsule seen as low signal thin rim.
- On T1WI with contrast the lesion appears hypointense with ring enhancement & Restricted diffusion is seen on DWI

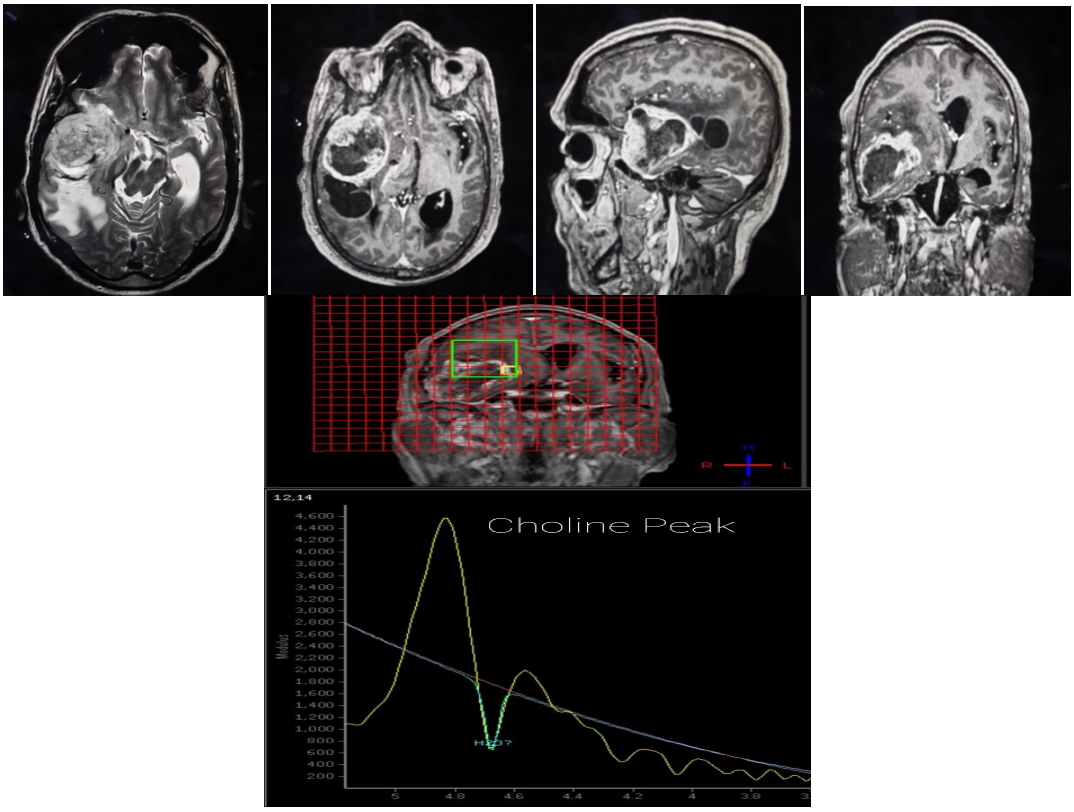
Case of Fungal Abscess- The abscess is seen with Irregular walls



- T2WI shows irregular hyperintense lesion with peripheral vasogenic edema.
- On T1WI with contrast the lesion appears hypointense with ring enhancement & surrounding edema. Restricted diffusion is seen on DWI [6].

Glioblastoma

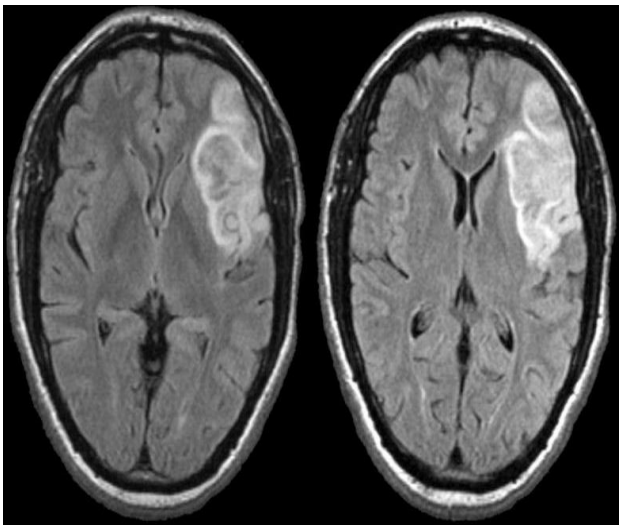
Two patients in the study presented with ring enhancing lesions were diagnosed as Glioblastoma based on MR spectroscopy.



Iso to hyperintense signal seen on T2WI and Post contrast ring enhancement seen on T1 + contrast images [7].MR spectroscopy shows choline peak suggestive of GLIOBLASTOMA.

Infarct and Hematoma

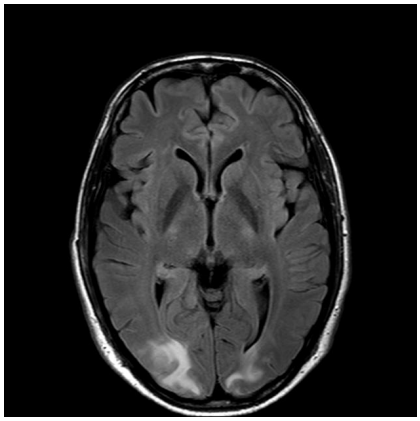
2 patients in the study had suffered from an ischemic cerebrovascular stroke with hemorrhagic transformation in the right temporoparietal and occipital regions, and a hemorrhagic stroke with formation of a right frontoparietal hematoma, respectively that showed peripheral ring enhancement on neuroimaging.



Peripheral ring enhancement around the infarct.

Posterior Reversible Encephalopathy Syndrome (PRES)

Incomplete ring enhancement seen.



Discussion

MRI finding of ring enhancing lesion helps us in diagnosing wide variety of infectious and noninfectious diseases [8]. Although a single feature is not pathognomic a cystic lesion which shows diffusion restriction on DWI should be considered as abscess unless proved otherwise [9].Other important signs helpful in diagnosis [10].

Enhancing wall characteristics

Thick and nodular favours diagnosis of neoplasm.Thin and regular favours diagnosis of abscess.Incomplete ring open towards cortex favours diagnosis of demyelination. Restriction diffusion of enhancing wall favours diagnosis of GBM or demyelination.

Surrounding edema

Extensive edema favours diagnosis of abscess.Increased perfusion favours diagnosis of neoplasm.

Number of lesions

Small lesions with thin walled suggest neurocysticercosis. Similar sized rounded lesions at grey white matter junction favours diagnosis of metastasis or abscess.

Central fluid content

Restriction diffusion favours diagnosis of Abscess. Absence of diffusion restriction favours diagnosis of metastasis likely.

Conclusion

A large number of infectious and noninfectious diseases cause multiple ring-enhancing lesions of the brain. We reviewed the most common diseases that came to our hospital in 55 patients. The most common etiologies were that of TB, parasitic (especially neurocysticercosis) and cerebral abscess. Other rare causes include primary brain tumors (Glioblastoma) and cerebrovascular stroke. Our study establishes the role of TB as the leading cause of ring-enhancing lesions in the Indian conditions when compared to tumors in the Western population. On the basis of our expertise we are suggesting that in patients who present with multiple ring-enhancing lesions of the brain on MRI examination of cerebrospinal fluid and chest imaging should also be performed. The work-up of these patients should include clinical evaluation, imaging and laboratory tests. The specific diagnosis though may always remain a challenge in many cases.

References

1. V Rajsekhar, Chandy M. Tuberculomas presenting as intrinsic brain stem masses. B J Neurosurg 199 -11(2):-127-33.
2. Cagaty A, Ozsut H, Gulc L, Kuckoglu S, Berk H, Inc N & et al. Tuberculous meningitis study in adults - Turkey. Intern J Pract 2004-58(5):- 469-73.
3. MR imaging in neurocysticercosis in a study of 56 cases H R Martinez , R Rangel-Guerra, G Elizondo, J Gonzalez, L E Todd, J Ancer, S SPrakash-AJR Neuroradiology Sep-Oct 1989;10(5):1011-9.

4. Imaging spectrum of neurocysticercosis, Jing Long Zhao, AlexanderLernerZengShu,Xing-JunGao, Chi-ShingRadiology of Infectious Diseases, ELSEVIERVolume 1, Issue 2, March 2015, Pages 94-102
5. Diagnosis of Meningitis Caused by Pathogenic Microorganisms Using Magnetic Resonance Imaging: Systematic Review Alia Saberi, Syed-Ali Roudbary, AmirezaGhayeghran, SamanehKazemi, and MozafarHosseininezha dences 2018 Mar-Apr; 9(2): 73–86.
6. Fungal Infections of the Central Nervous System Pictorial Review by Jose Gavito-Higuera, Carola Birgit Mullins, Luis Ramos-Duran, Cristina IvetteOlivas Chacon, Nawar Hakim and Enrique Palacios- J Clin Imaging Sci. 2016; 6: 24
7. Glioblastomamultiforme presenting with an open ring pattern of enhancement on MR imaging Merit D. Kinon, AlekaSco, Joaquim M. Farinhas, Andrew Kobts, Karen M. Weidenheim, Reza Yassari, Patrick A. Lasala, and Jerome Graber PUBMED neurology international 2017; 8: 106.
8. Ring Enhancing Lesions in the Brain: A Diagnostic Dilemma Guruprasad SHETTY, KadkeShreedaraand BoodyarSanjeev RAIIran J Child Neurol. 2014 Summer; 8(3): 61–64.
9. Patterns of Contrast Enhancement in the Brain and Meninges by James Smirniotopolos, France M. Murphy, Elizabeth J. Rushing, John H. Rees, Jason W. Schroeder Mar 1 2007RadioGraphicsVol. 27, No. 2
10. Characteristics of Ring enhancing lesions in brain in correlation with MRI and MR spectroscopy by Yashraj P Patil ,Chirag Patel ,Rajesh International Journal of Health and Clinical Research, 2021;4(1):120-127.