

**Original research article****Etiological profile of single ring enhancing lesion on computer tomography brain****<sup>1</sup>Dr. Nandini Devru, <sup>2</sup>Dr. Krupali, <sup>3</sup>Dr. Manjunath Siddanna Biradar, <sup>4</sup>Dr. Megha B Amarapur**<sup>1</sup>Associate Professor, Department of General Medicine, ESIC Medical College, Kalaburagi, Karnataka, India<sup>2</sup>Assistant Professor, Department of General Medicine, ESIC Medical College, Kalaburagi, Karnataka, India<sup>3</sup>Senior Resident, Department of General Medicine, GIMS, Kalaburagi, Karnataka, India<sup>4</sup>Assistant Professor, Department of General Medicine, GIMS, Kalaburagi, Karnataka, India**Corresponding Author:**

Dr. Megha B Amarapur

**Abstract**

Single ring enhancing computed tomography lesions is commonly seen in clinical practice, since from discovered in the late 1970s due to invention of Computed Tomography (CT) of the brain. The advent of CT was made a great impact on medicine because it creates the detail anatomical image. This gives the precise location of slice, soft tissue, revealing bones, organs, brain and blood vessels. Contrasted image of the CT scan enhance the lesion and enables to evaluate the images better. It also helps in accurately localizing the site of lesion and types of lesion in a cost-effective manner as compared to Magnetic Resonance Imaging (MRI). A Prospective study of 25 patients satisfying the inclusion criteria attending OPD and inpatients of Medicine, Neurology, Neurosurgery departments were included in the study. CT is the most sensitive modality in the characterization of single ring enhancing lesions. In this study, single ring enhancing lesions seen are Neurocysticercosis (28%), Tuberculoma (24%), abscess (20%), followed by Toxoplasmosis (8%), Neurosyphilis (4%), metastasis (4%), malignancy (8%) and CNS lymphoma (4%). Finally, it is concluded that the various clinical aspects in diagnosis of single enhanced ring do not correlate exactly with CT scan findings in all cases. Hence both thorough clinical examination and CT Scan Brain are mandatory.

**Keywords:** CT scan, single ring enhancing lesion, MRI, neurocysticercosis, tuberculoma**Introduction**

Neurocysticercosis (NCC) present as the single ring enhancing lesion in most of the patients. It is a most common parasitic disease which affects the Central Nervous System (CNS) and it is caused by larvae of *Taenia solium*. Cyclicercs enters into the intestine and may develop into adult worm in any organ within a period of three to eight weeks <sup>[1]</sup>.

CNS TB is the severe form of TB which presents itself as cerebritis, spinal tuberculous arachnoiditis, meningitis, and abscess or rarely as tuberculoma. Tuberculoma or Tuberculous granulomas are well defined focal masses that results from mycobacterium tuberculosis infection and is the serious complications of CNS tuberculosis [30]. Most of the time, it is a result of the bacteraemia <sup>[2]</sup>. Brain abscess is a focal collection within the brain parenchyma commonly secondary to complication of a variety of infections, trauma, or surgery. The direct spread of organisms from a contiguous site usually causes a single brain abscess. The location of a brain abscess reflects the site of the primary infection that spreads to the cerebral cortex. The sub-acute and chronic otitis media and mastoiditis -spread to the temporal lobe and cerebellum, frontal and ethmoid sinusitis-spread to the frontal lobe and dental infection usually spread to frontal lobe <sup>[3]</sup>.

Fungal and fungal-like infections of the CNS are uncommon and occur most frequently in immunosuppressed persons living in endemic areas with neutropenia and HIV in particular. Routes of dissemination include direct extension, hematogenous spread and cerebrospinal fluid seeding <sup>[4]</sup>.

Toxoplasmosis is the most common central nervous system infection in patients with the acquired immunodeficiency syndrome (AIDS) who are receiving inappropriate prophylaxis and is caused by the intracellular protozoan parasite, toxoplasmosis gondii. In immunosuppressed patients, especially patients with AIDS usually when the CD4 count falls below 100 cells/micro, the parasite can reactivate and cause disease and the most common site of reactivation is the central nervous system (CNS). CNS toxoplasmosis usually present with headache, confusion, and fever. Focal neurologic deficits or seizures are also common with raised intracranial pressure symptoms. Mental status changes range from dull affect to stupor and coma. Cerebrospinal fluid (CSF) analysis typically reveals a mild mononuclear pleocytosis with an elevated protein levels <sup>[5]</sup>.

Primary Central Nervous System Lymphoma (PCNSL) is an uncommon variant of extranodal Non-Hodgkin Lymphoma (NHL) involving the brain, leptomeninges, eyes, or spinal cord without evidence of

systemic disease. Common age of presentation is between 45 and 65 years with a median age at diagnosis is fifth decade. Rare cases have been described in children with a median age of 14 years. Men and women are equally affected [6].

**Methodology**

A prospective study of patients satisfying the inclusion criteria attending OPD and inpatients of Medicine, Neurology, Neurosurgery departments were included in the study.

**Inclusion Criteria**

- All patients with Contrast Computed Tomography (CT) of brain showing single ring enhancing lesions.
- Cases of age more than or equal to 18 years, irrespective of sex

**Exclusion Criteria**

All patients who is having multiple lesions on the CT brain.  
Patient having history of metallic implants insertion, cardiac pacemakers and metallic foreign body in situ.

**Methodology**

A detailed history, clinical and laboratory data of these patients at admission and then on daily basis will be recorded as per the Proforma. Details of the patient’s history were taken in pretested Proforma at the time of admission and recorded. Various Examination was done like General, Systemic and neurological. At the time of enrollment several tests were undergone by patients such as routine hematological, biochemical, Human Immune Deficiency Virus (HIV), Venereal Disease Research Laboratory (VDRL), X-Ray of Chest, Urea, Blood sugar level, Electrolytes and Liver function tests. After consent by the respective patient CT brain with single enhancing lesion was considered for enrollment in the study.

**Equipment and Technique used**

The CT scan was performed CT Philips multi slice scanner.

**Technique of examination**

The CT examination was carried out by scanning the head in a series of axial slices at 10-12. To the reids base line in all the patients and sections were taken in parallel to the reids base line. During the scanning, 10-12 slices of 10 mm thick were taken and they are sufficient to visualize the intermediate slices. The plain as well as contrast enhanced scans were recorded in all the patients in order to study the CT finding. The study of CT finding includes such as size, number, and wall thickness, location of ring lesions, internal features and surrounding edema.

**Results**

**Table 1:** Incidence of Various Diseases Presenting as Single Enhancing Lesions

Diseases	Male	Female	No. of Cases	Percentage
Neurocysticercosis	7	0	7	28
Tuberculoma	3	3	6	24
Abscess	3	2	5	20
Toxoplasmosis	1	1	2	8
Neurosyphilis	1	0	1	4
Metastases	1	0	1	4
Malignancy	1	1	2	8
CNS Lymphoma	0	1	1	4

In our study, NCC are 7 (28%), tuberculoma 6 (24%), abcess 5 (20%), toxoplasmosis 2 (8%), Neurosyphilis 1 (4%), Metastasis 1 (4%), malignancy 2 (8%) and CNS lymphoma 1 (4%).

**Table 2:** Correlation between infectious and non-infectious Diseases in terms of Clinical Symptoms

Diseases	Seizures	Headache	Vomiting	Weakness	Fever	others	Mean	SD
Infectious	18	13	5	6	5	14	8.6	5.56
Non-Infectious	3	3	1	2	0	4	2.17	1.47
P<0.005 Hence it is correlated								

There is statistically significant correlation (P = < 0.05) in clinical symptoms between infectious and non-infectious diseases in this study.

**Table 3:** Correlation between infectious and non-infectious Diseases in terms of Neurological Features

Diseases	Pure Motor	Motor Hemideficit with cortical deficits	Cranial nerve	Pure sensory	Higher cerebral Dysfunction	Mean	Standard Deviation
Infectious	3	4	1	0	3	2.2	1.64
Non-Infectious	0	3	0	0	0	0.6	1.34
P>0.005, Hence, it is not correlated							

Above table showing that there is no statistically significant correlation ( $P = > 0.05$ ) between infectious and non-infectious Diseases in terms of Neurological Features.

**Table 4:** Correlation between infectious and non-infectious Diseases in terms of Site Selection

Diseases	Brain parenchyma	Subcortical region	Gray white matter junction	Periventricular region	Meninges	Mean	Standard Deviation
Infectious	11	5	3	2	0	4.2	4.21
Non-Infectious	2	0	0	1	1	0.8	0.84
p>0.005, Hence it is not correlated							

Above table and bar diaram showing that there is no statistically significant correlation ( $P = > 0.05$ ) between infectious and non-infectious Diseases in terms of Site Selection.

**Table 5:** Correlation between infectious and non-infectious Diseases in terms of Risk Factors

Diseases	Habits	Diet	Primary Malignancy	Known/Active TB	Trauma/Surgery	Seizure Disorder	RVD	Others	Mean	Standard Deviation
Infectious	4	4	0	4	1	1	2	3	2.375	1.49
Non-Infectious	1	1	1	0	0	0	0	0	0.375	0.521
P<0.005, Hence it is correlated										

Above table showing that there is statistically significant correlation ( $P = < 0.05$ ) between infectious and non-infectious Diseases in terms of Risk Factors.

**Discussion**

In the present study, 25 cases had single ring enhancing lesion in CT brain. Out of these, 7(28%) patients were neurocysticercosis and most common pathology followed by tuberculoma 6(24%). 5(20%) were abscess, 2(8%) were toxoplasmosis, 1(4%) were metastasis, 1(4%) were neurosyphilis, 2(8%) was Malignancy and 1(4%) was CNS Lymphoma. Comparable incidence was found in Chandy MJ *et al.* [7] study of small ring enhancing lesion diagnosis was done by biopsy showed 28% were neurocysticercosis. Ravindra KR Garg *et al.* [8] have made studies on 101 patients having single CT lesions at least six months before the enrolment. The most of the patient’s age was considered less than 10 years. Out of 101 patients non contrast CT scan of 49 patients revealed cerebral oedema, 17 patients with complete cysticercal larvae and rest of them were normal. After contrast administration, most of them revealed ring or disc enhancing lesions and 50% of them scottex. Around 47% patients were treated with anti-tubercluosis or albendazole with anti-epileptic drugs and remaining patients with anti-epileptic monotherapy. From these treatments most of the patients’ lesion was disappeared. Authors concluded that CT lesion, benign tend to disappear or regress spontaneously. The seizure associated also disorder in case of benign and controlled. The anti-elliptic theory is sufficient for shorter duration. Eric T. Kimura-Hayama *et al.* [9] have discussed radiological and pathological correlation of NCC. It is a parasitic disease of the CNS caused by Taenia Solium Tapeworm. Traditionally, it is classified into two forms such as active and non-active forms based on location of disease. The imaging appearance is variable which differential diagnosis is. The several factors like location, number of parasites, associated complications, inflammatory response and degree of abstraction based on imaging findings. Authors concluded that prognosis, management and diagnostic approach for NCC differs depending on the infraction time.

Ravidra Kumar Garg have reviewed that the single enhancement CT lesions with seizures in few patients. The lesions may be Tuberculoma. From the histo-pathological study showed that NCC is the common cause for lesions. The acute disorders are due to acute inflammation in and around the cerebral lesions of cysticecosis. Most of these lesions were disappear after 8-12 weeks and few of them may calcify. These patients with anti-elliptic drugs may be discontinued. CT shows the resolution of lesion. After Seizure recurrence the anti-elliptic therapy may be continued for 2 to 3 years [8].

Phaneendra Kolla has presented a study of ring enhancing lesions using computed tomography images, where he compared pathological diagnosis with CT morphology. For the study, he considered 100 patients of age group in between 21 to 50 at SIMSR Centre Hyderabad. The patients were under gone CT examination and CSF analysis. From the analysis, he found that the neurocysticercosis, tuberculoma, metastasis, brain abscess and GBM were 45%, 22%, 12%, 11% and 10% respectively. At last he

concluded that, CT is preferred image modality because of lower cost, less time consumption and wide availability. S Ray *et al.* have distinguished between non-neoplastic and neoplastic lesions showing ring lesion or ring enhancement in CT or MRI findings of the brain with the help of nuclear imaging correlation. 75 patients were considered for the correlation with different types of ring enhancing lesions detected in CT/MRI brain/CT with MRI. The correlation was carried out with the study of cerebral pass-1, SPECT and planar imaging with different radiotracer such as 99m, Tc-HMPAO. Tetrofosmin or 99mTc-MIBI, 99mTc-DTPA/GHA and TI-201. From the result it is shown that the 42% of the cases are doubtful in distinguishing between non-neoplastic and neoplastic conditions with the help of nuclear scanning.<sup>10</sup>

## Conclusion

In this study, single ring enhancing lesions seen are Neurocysticercosis (28%), Tuberculoma (24%), abscess (20%), followed by Toxoplasmosis (8%), Neurosyphilis (4%), metastasis (4%), malignancy (8%) and CNS lymphoma (4%).

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