



RING ENHANCING LESIONS IN CECT BRAIN IN CHILDREN: A COMPARATIVE STUDY OF NCC AND TUBERCULOMA

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ABSTRACT

Background: One of the common indications for CT cranium is seizures, especially first episode seizures in children. There are varying reports of prevalence and incidence of various lesions in CT brain. A single ring enhancing lesion is a common finding in patients with seizures¹. This article provides a systematic evaluation of the current state of knowledge in this area.

Aim: To study the incidence of ring enhancing lesions in Contrast Enhanced Computerized Tomography (CECT) and compare the incidence and clinical manifestations of Neurocysticercosis (NCC) and Tuberculoma, presenting a ring enhancing lesions in CECT brain scan.

Materials and Methods: 170 children with seizures and other non seizure CNS manifestations between 2-12 yr of age were included in study. This study was conducted in Department of Pediatrics in a Teaching Hospital in Telangana state, India during July 2017 to September 2019. According to history, clinical examination and investigations patients were divided into 3 groups. They were cases with NCC, Tuberculoma and Undetermined group. Statistical analysis was done once diagnoses were made.

Results: 90 cases have been shown ring enhancing lesions out of 170 i.e. incidence is 52.94%. Out of 90 cases, 53 patients (58.9%) were diagnosed as NCC and 13 patients (14.4%) were diagnosed as Tuberculoma. 24 patients (26.7%) were kept in undetermined group. Patients with NCC were presented usually with seizures alone and patients with Tuberculoma were presented with raised ICT and/or focal deficit.

Conclusion: Single ring enhancing lesions are the commonest radiological abnormality in children with seizures. The two most common etiologies are neurocysticercosis (NCC) and tuberculoma. The differentiation between these two assumes greater importance because solitary cysticercosis a benign disorder that resolves spontaneously, a tuberculoma requires prolonged therapy with potentially toxic drugs^{2,3}. Our study shows NCC is more common than tuberculoma.

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INTRODUCTION

The introduction of Computerized Tomography (CT) in India in early 1980s demonstrated that several patients presenting with seizures had single ring enhancing lesion⁴. The two most common etiologies for these lesions are neurocysticercosis and tuberculoma, though various presumptive diagnoses such as transient viral encephalitis, micro abscess, postictal enhancement and vascular lesions have also been considered⁵⁻⁷. Neurocysticercosis is the commonest parasitic infection of central nervous system caused by *Taenia solium* or *Taenia saginata* and it is the most frequent cause of seizures in regions where the disease is endemic which includes developing nations of Latin America, Asia and Africa⁸. Generally, patients with neurocysticercosis have partial onset seizures with or without secondary generalization⁹. It may also present with focal deficit, hydrocephalus, features of meningeal irritation, retinal detachment, and iridocyclitis etc.¹⁰⁻¹³.

Overall, tuberculosis of the central nervous system (CNS) accounts for approximately 1% of all of the diseases caused by *Mycobacterium tuberculosis*, but it comprises 10-15% of extra pulmonary tuberculosis. Tuberculoma is the second commonest manifestation of CNS tuberculosis and constitutes a sizable proportion of intracranial space occupying lesions (SOL) in the developing countries where tuberculosis is still quite prevalent. Intra cranial tuberculoma presents a subtle clinical picture. Seizures are frequent and very often the heralding feature and frequently there is evidence of focus of tuberculosis elsewhere in the body¹⁴. Depending up on the location of tuberculoma there may be cranial nerve palsies, paresis or in coordination. Headache, Hydrocephalus, features of meningeal irritation may be there.

In our study we could find ring enhancing lesions presenting with seizures, comparing neurocysticercosis and tuberculoma as an entity in relation to their radiological and clinical presentation.

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REVIEW OF LITERATURE

There are so many studies regarding seizures and ring enhancing lesion in CT brain since last three decades all over the world including India.

1. Bhatia. S *et al.* in 1983 in India studied about solitary microlesions in CT. They noticed in their study that there are so many differential diagnoses for small ring enhancing lesions. They are Cysticercus granuloma, tuberculoma, micro abscess, cavernous hemangioma, sarcoidosis, larva migrans, astrocytoma, resolving hematoma, enhancing infarct, and toxoplasma¹⁵.
2. Del Brutto OH *et al.* in 1992 selected a rural area in Peru. They analyzed 203 patients with epilepsy due to neurocysticercosis. New onset seizures are commonly associated with active cysts rather than calcified granulomas¹⁶.
3. Rajasekhar. V *et al.* 1993 in India. Cysticercus granuloma and tuberculoma are two most commonly considered diagnoses for ring enhancing lesions in CT in patients from endemic areas. These two can be differentiated by clinical features and CT features¹⁷.
4. Schwartz KM, Erikson BJ, Lucchinetti C. Department of Radiology, Mayo Clinic, Rochester, MN 55905, USA in 2006¹⁸. Reviewed 221 ring enhancing lesions seen on MR images and reported that 40% were gliomas; 30% metastases; 8% abscesses; and 6% demyelinating disease. Pattern of T2 hypo intensity associated with ring enhancing brain lesion can help to differentiate pathology.
5. P.N. Jayakumar *et al.* in 2007 in India noticed T2 Relaxometry of ring lesions of the brain. The two most common etiologies for these lesions are neurocysticercosis and tuberculoma⁵. The differentiation between cerebral tuberculomata and cysticercosis granuloma assumes greater importance because of the fact that both disease process usually prevalent in same population.
6. Veena Karla *et al.* in 2009 in India. IJP. The brain parenchyma is the most commonly affected site in NCC, the cortico medullary junction is the primary location¹⁹. 0.3% present as intraventricular cysticercosis. 0-2.3% may develop cysticercal meningitis. 10% have isolated subarachnoid disease²⁰.

Since almost all cases are reported from India, an inflammatory etiology is considered. Of all the etiologies reported for these lesions most common pathology based on biopsy evidence is cysticercosis. Studies were heterogeneous with regard to populations, outcomes, and methodological quality. Further studies are required.

MATERIALS AND METHODS

This study is an observational study conducted in Department of Pediatrics in a Teaching Hospital in Telangana state, India during July 2017 to September 2019. The age group included in study was 2-12 year with history of seizures or focal neurological deficit. Children with neural tube defects or pre existing neurological disorders (cerebral palsy, hydrocephalus, post traumatic) were excluded from study. Total 170 children were included in the study.

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Study Procedure: Proper history was taken and detailed clinical examination was done in selected cases. Afterwards all these cases were subjected to the following investigations.

- Complete Blood picture (CBP)
- Erythrocyte Sedimentation Rate (ESR)
- Mantoux (Mx) test
- Chest X Ray (CXR)
- Cerebro Spinal Fluid (CSF) analysis for NCC antibodies, Adenosine Deaminase (ADA)
- Contrast Enhanced Computer Tomography (CECT)

For the diagnosis of Neurocysticercosis we followed "Diagnostic Criteria and Degree of Diagnostic Certainty for Human Neurocysticercosis" by Del Brutto OH *et al.*²¹. Those patients who met the criteria of definitive diagnosis were diagnosed as Neurocysticercosis. Diagnosis of Tuberculoma was based upon clinical findings and investigations. Those patients who were satisfying the criteria of possible or probable diagnosis were considered as undetermined group. These patients did not meet the criteria of definitive of NCC or Tuberculoma.

Those cases which show ring enhancing lesions in the CECT brain were evaluated with special reference to NCC and Tuberculoma. Comparative evaluation was done to various neurological clinical features. Data was subjected to statistical analysis.

RESULTS

170 children with seizures and other neurological manifestations were included in the study (n=170). Among them 90 children (52.94%) showed ring enhancing lesion in CECT. Out of 90 cases, 53 patients were diagnosed as NCC and 13 patients were diagnosed as Tuberculoma. 24 patients were kept in undetermined group. (Table.1)

Etiology of Ring Enhancing Lesions (n=90) **Table 1**

Lesion	No. of cases	Percentage
Neurocysticercosis (NCC)	53	58.9%
Tuberculoma	13	14.4%
Undetermined	24	26.7%
Total	90	100%

This analysis shows that NCC was commonest cause of ring enhancing lesion in brain. (Fig.1)

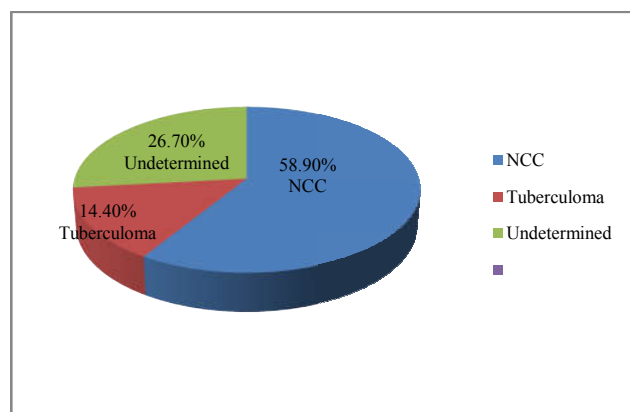


Fig 1

Clinical presentations of ring enhancing lesions were seizures or non seizure manifestations or combination of seizures and non seizure manifestations. (Table.2)

Clinical Presentations of Ring Enhancing Lesions (n=90)

Table 2

S.No.	Clinical Presentations	No. of Cases	Percentage
1	Seizures alone	71	78.9%
2	Seizures with raised ICT	4	4.2%
3	Seizures with focal deficit	2	2.1%
4	Seizures, raised ICT and focal deficit	4	4.2%
5	Seizures with Psychiatric manifestations	1	1.1%
6	Episodic headache	2	2.1%
7	Focal deficit	5	5.5%
8	Increased ICT	1	1.1%
	Total	90	100%

This analysis shows that a seizure alone was the major clinical manifestation of the ring enhancing lesions constituting 2/3rd of the total cases. Focal deficit was the next major clinical manifestation. (Fig.2)

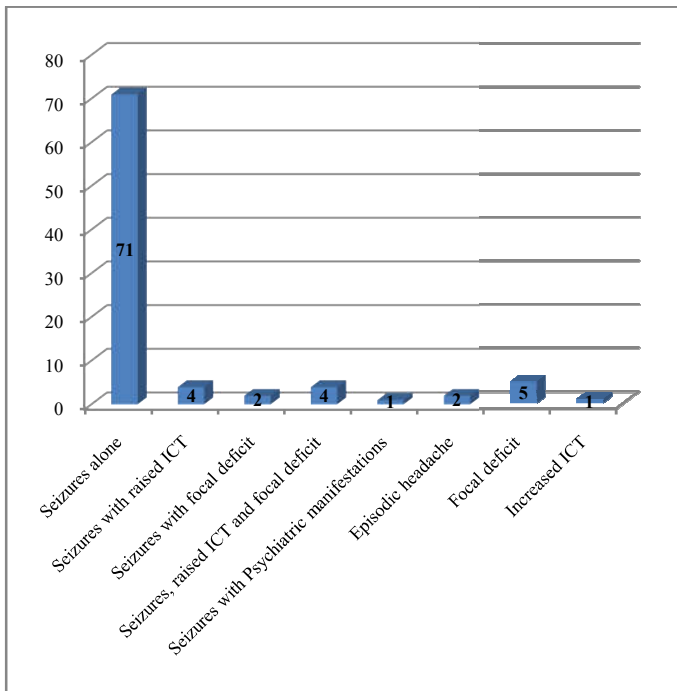


Fig 2

Out of 90 patients 53 had NCC, of which 46(86.7%) presented with seizures and rest with other neurological manifestations. Out of 13 Tuberculoma cases 5(38.4%) presented as seizures. (Table.3)

Comparison of NCC and Tuberculoma In Relation To Clinical Presentation Table 3

S.No.	Clinical Presentations	NCC	Tuberculoma	Undetermined
1	Seizures alone	46	5	22
2	Seizures with raised ICT	-	2	2
3	Seizures with focal deficit	2	-	-
4	Seizures, raised ICT and focal deficit	1	3	-
5	Seizures with Psychiatric manifestations	1	-	-
6	Episodic headache	2	-	-
7	Focal deficit	1	2	2
8	Increased ICT	-	1	-
	Total (n=90)	53	13	24

Patients with NCC were presented usually with seizures alone and patients with Tuberculoma were presented with raised ICT and/or focal deficit. (Fig.3, 4)

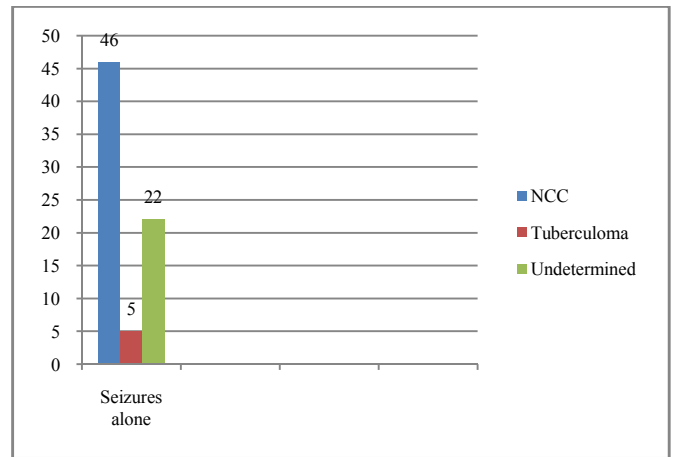


Fig 3

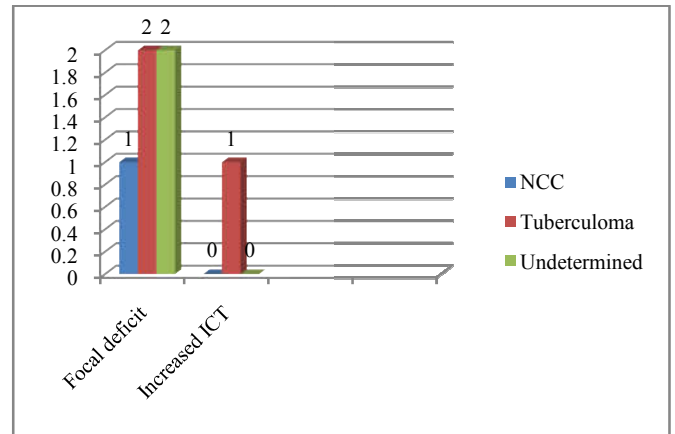


Fig 4

The statistical analysis showed that there was no significant difference in the disappearance of ring enhancing lesion after treatment in NCC and undetermined group. This indicates that patients who were kept in undetermined group probably NCC with negative immunological test for cysticercosis.

DISCUSSION

170 children with seizures and other non seizure CNS manifestations between 2-12 yr of age were included in study. 90 cases showed ring enhancing lesions amounting to 52.94%. Among these, diagnosis of NCC was made in 53 (58.9%) cases, Tuberculoma was confirmed in 13 (14.4%) cases and 24 (26.7%) cases did not meet the criteria for diagnosis of either NCC or Tuberculoma, hence included in the Undetermined group.

Comparable incidence was found in Rajashekar. V *et al.*¹⁷ Study of single ring enhancing lesion. They reported the incidence of NCC was 49%, Tuberculoma was 11.8% and Undetermined was 23.5%. George R.K.²² reported that incidence of NCC was 80% among those presented with seizures with single enhancing lesions. This shows that the common cause of ring enhancing lesion is NCC.

In our study total 9 patients presented with raised ICT. 1 case was NCC and 6 were Tuberculomas. 2 cases were Undetermined. The incidence of Tuberculoma was 14.4%. Most common manifestation of tuberculoma was seizures with raised ICT (46.15%).

Our study is comparable with Mukti Sharma, Arvind Gupta, and Amarjit Singh study²³ “Early Diagnosis of Intracerebral Tuberculoma in Children“ at Command Hospital (WC)

Chandimandir in 2017. They noticed Tuberculomas were presenting as intracranial space occupying lesion with features of raised intracranial tension, seizures and localizing neurological signs. Thacker A. K. *et al.*²⁴ in 1993. A single ring enhancing lesion with features of raised ICT is very unlikely to be a NCC unless the lesion is in periventricular region obstructing the CSF flow.

Merits and Demerits: This study was done in a Teaching Hospital and we have good number of cases. Team approach was there even enquiry was done regarding family atmosphere, school environment and if necessary visiting of these areas was also taken place. The diagnosis of NCC was done according to “*Diagnostic Criteria and Degree of Diagnostic Certainty for Human Neurocysticercosis*” by Del Brutto OH *et al.*²¹. Before confirming diagnosis child was examined carefully and necessary investigations were done. All the investigations are available in our institution only and reliability is good. Statistical analysis was done by Faculty of Pediatrics, Radiology and Preventive and Social Medicine.

However, this study was conducted in children, who were attending to our hospital. Thus our findings may not represent the exact picture in the population. Patients who were kept in undetermined group were probably NCC. So incidence of NCC which has been shown in our study may not be the exact incidence.

Recommendations

Children with seizures excluding typical febrile seizures or focal deficit should be undergone CT scan brain to find any CNS lesion along with other basic investigations. If ring enhancing lesion is found think of NCC and try to do histological demonstration of parasite. Direct visualization of parasite by fundoscopic examination may be helpful some times. Evidence of cystic lesions showing the scolex on CT or MRI also confirms the diagnosis.

If lesion size is more than 20mm with irregular borders go for CSF analysis especially for ADA levels, CXR, ESR, and Mantoux test, to find Tuberculoma. Fundus examination is done whether choroid tubercles are there or not. Clinical correlation is also needed.

When the diagnosis is undetermined take detailed history whether the patient is from endemic area of NCC or history of travel to that area. Evidence of a household contact history has to be taken. Presence of clinical manifestations of NCC and disappearance of intra cranial lesions after a trial with antcysticercal drugs also suggest diagnosis of NCC. Repeat CT scan is advised after 12 -20 weeks of initial scan.

CONCLUSION

The exact pathological nature of ring enhancing lesions has not been verified as biopsy of such lesions only has been carried out in isolated cases. Various presumptive diagnoses such as cysticercosis, tuberculoma, transient viral encephalitis, micro abscess, post ictal enhancement and vascular lesions have been considered⁴. 90 cases showed ring enhancing lesions amounting to 52.94% of total (n=170) cases in our study. Incidence of NCC is 58.9% and tuberculoma is 14.4% among ring enhancing lesions of CT brain. Majority of ring enhancing lesions presented with seizures are NCC. Raised ICT with single enhancing lesion favours the diagnosis of tuberculoma. The etiology in undetermined group might be NCC with negative serology.

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