Original Article

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A Study of Clinical Presentation and Etiology of Ring Enhancing Lesions in CT Scan Brain in Children

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Abstract

Background: The ring enhancing lesion identification and characterization was entirely in the post CT era. The ring enhancing lesion could not be seen on angiograms, pneumo encephalograms (or) ventriculograms. The introduction of computerized tomography in India in early 1980's demonstrated that several patients presenting with seizures had ring enhancing lesions in brain. The aetiological diagnosis of ring enhancing lesions lies in the pathological examination of excised lesions. However it is not easy to accomplish for several valid reasons. In the post CT era various presumptive diagnoses such as tuberculoma, cysticercosis, transient viral encephalitis, microabscesses, postictal enhancement and vascular lesions were considered. **Subjects and Methods:** This study was conducted in Department of Pediatrics, Narayana Medical College. This study was done over a period of 1 year. A total of fifty cases were taken up for this study. For the diagnosis of NCC "Diagnostic criteria and degrees of diagnostic certainty for human cysticercosis" proposed by Del Brutto et al was followed. Those patients who met the criteria of "Definitive diagnosis" were diagnosed as NCC. Those patients who were satisfying the criteria of "possible or probable diagnosis" and in the absence of criteria for the diagnosis of Tuberculoma were considered as undetermined group, because diagnosis was not confirmative in these groups of patients. **Results:** Of 50 cases studied 32 cases were definitive NCC and 13 cases met the criteria of probable NCC, so kept in undetermined group. Of the 32 children with NCC 94% patients presented with seizures with or without associated features. About 6% patients presented without seizures. Among non-seizure manifestations focal and raised ICT were equal. Of the 5 cases of Tuberculoma 3(60%) presented with seizures alone. 20% cases presented with seizures with raised ICT and 20% presented with seizures with raised ICT and focal deficit. Commonest clinical presentation of Tuberculoma was seizures with or without associated features. **Conclusion:** The most common presentation of children with ring enhancing lesion in CT scan brain are seizures (76%). Seizures with focal deficit and features of raised ICT constitutes (18%), only raised ICT and focal deficit (6%). So, ring enhancing lesion should be considered in those who presented with these symptoms in endemic areas like India. Among the seizures 70.21% are partial seizures, 8.51% are secondary GTCS, 21.28% are primary GTCS.

Keywords: Neonatal Icter, Serum bilirubin, Transcutaneous bilirubin.

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Introduction

The ring enhancing lesion identification and characterization was entirely in the post CT era. The ring enhancing lesion could not be seen on angiograms, pneumo encephalograms (or) ventriculograms.[1]

The introduction of computerized tomography in India in early 1980's demonstrated that several patients presenting with seizures had ring enhancing lesions in brain.[2] The aetiological diagnosis of ring enhancing lesions lies in the pathological examination of excised lesions. However it is not easy to accomplish for several valid reasons.[3]

In the post CT era various presumptive diagnoses such as tuberculoma, cysticercosis, transient viral encephalitis, microabscesses, postictal enhancement and vascular lesions were considered. Bhargava and Tandon et al considered ring enhancing lesions as tuberculomas.[4] However there were fallacies in the recognizing and being the presumptive diagnosis of ring enhancing lesions as tuberculoms.[5]

The lesions disappeared after treatment with anti tuberculous drugs. Some of the patients developed toxicity to antituberculous drugs and these drugs were withdrawn and it was noted that even without antituberculous drugs some of these lesions resolved spontaneously.[6] Gulati et al presented evidence that most of these lesions disappeared when treated with anticounvulsant drugs alone.[7]

Sethi et al reported these lesions showed a spontaneous resolution and they were popularly termed as disappearing lesions. This led to further confusion and controversy on the aetiology of these lesions.[8] Although single ring enhancing are the commonest radiological abnormality in patients with seizures. Several non epileptic manifestations were described in literature with these lesions.[9]

Symptoms include episodic headache, hemiparesis,

monoparesis, hemichorea, ataxia, aphasia, cranial nerve palsies and raised ICT. Like epileptic disorder these also have benign course. The two most commonly considered diagnosis for these lesions are neurocysticercosis and tuberculoma.[10] The differentiation between cerebral tuberculoma and neuro cysticercosis lesions assumes greater importance because of the fact that both diseases processes are prevalent in same population. As both lesions can be managed conservatively it would be ideal if an etiological diagnosis is made without biopsy.[11]

The importance of differentiating these two etiologies cannot be adequately emphasized, Solitary cysticercal granuloma is a benign disorder that resolves sponataneously, where as tuberculoma requires prolonged therapy with potentially toxic drugs.[12]

Aims and Objectives

- To study the clinical presentation of children with ring enhancing lesions in CT scan of brain.
- To find out the etiology of ring enhancing lesions in CT scan brain with special reference to Neurocysticercosis and Tuberculoma.
- To find out the incidence of Neurocysticercosis and Tuberculoma and other ring enhancing lesions.

Subjects and Methods

This study was conducted in Department of Paediatrics, Narayana Medical college. This study was done over a period of 1 year.

A total of fifty cases were taken up for this study.

Inclusion Criteria for the Study

- Patient admitted in the hospital with seizures
- Neurological manifestations (raised ICT and focal deficit)
- CT scan of brain showing ring enhancing lesion/lesions.
- Age of the children between 2 to 12 years.

Exclusion Criteria

- Children with obvious cause for seizures
- Other neurological manifestations like head injuries.
- Family history of epilepsy and other long term neurological illness.

Diagnostic Criteria

Neurocysticercosis:

For the diagnosis of NCC " Diagnostic criteria and degrees of diagnostic certainty for human cysticercosis " proposed by Del Brutto et al 44, was followed.

Those patients who met the criteria of "Definitive diagnosis" were diagnosed as NCC. Those patients who were satisfying the criteria of "possible or probable diagnosis" and in the absence of criteria for the diagnosis of Tuberculoma were considered as undetermined group, because diagnosis was not confirmative in these groups of patients.

Criteria used for the diagnosis of tuberculoma:

CT Scan strongly suggestive of Tuberculoma

- Negative ELISA for CSF anticysticercal antibody
- With (or) without ADA positivie (or) CSF changes.
- With (or) without other supportive evidence

OR

CT scan suggestive of Tuberculoma or NCC

- Negative ELISA for anticysticercal antibody
- With CSF ADA levels >7 or classical CSF picture of TBM.
- If no CSF changes, presence of 2 (or) more peripheral signs suggestive of tuberculosis.

These criteria were followed for all the patients to avoid false positive diagnosis for tuberculoma, because only way of definitive diagnosis for tuberculoma is biopsy for histological examination which is more invasive and risky procedure.

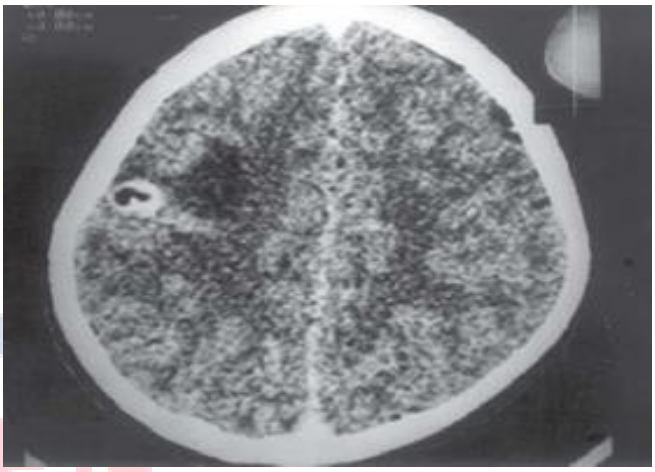

Figure 1: Contrast-enhanced cranial CT scan showing a single enhancing lesion.

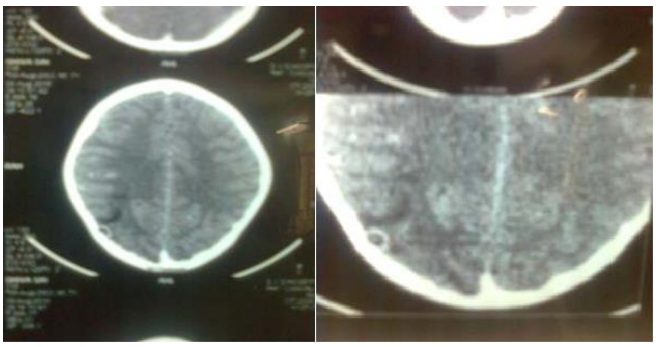

Figure 2: a. CT Scan showing single lesion NCC. b. Enlarged view

Tuberculin test: Positive tuberculin test indicates tuberculosis infection in the child but a negative reading does not exclude it. In stage-I, Tuberculin test is positive in 49.5% of cases while in stage 2 and 3 it is positive in only 25%. Tuberculin test negativity is highest when the child has associated military tuberculosis with meningitis.

CSF examination: Characteristic CSF findings in

Tuberculoma associated with meinigitis are increased CSF pressure, presence of cobweb, increased protein (from 50-200mg/dl), reduced sugar (average 30mg/dl), and CSF ADA levels more than 7. Tuberculoma without meningitis CSF is under increased pressure, may contain cells and increased protein. CSF sugar content usually normal.

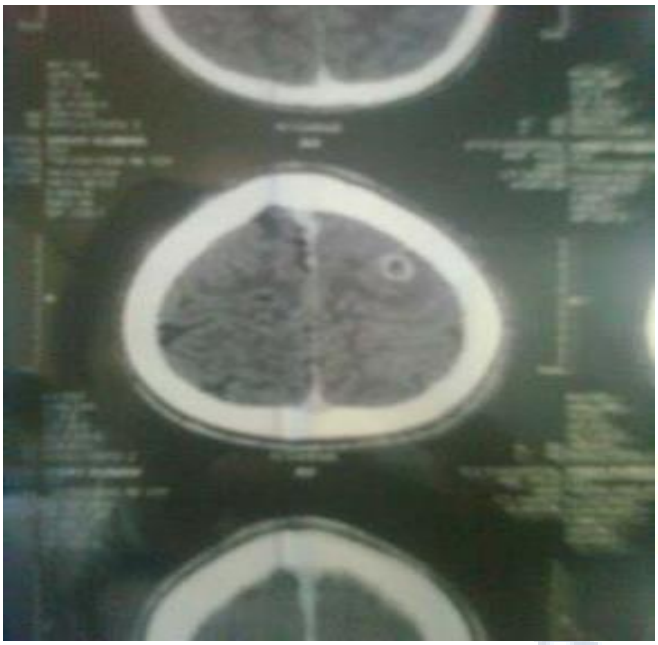

Figure 3: CT brain showing ring enhancing lesion with protoscolex.

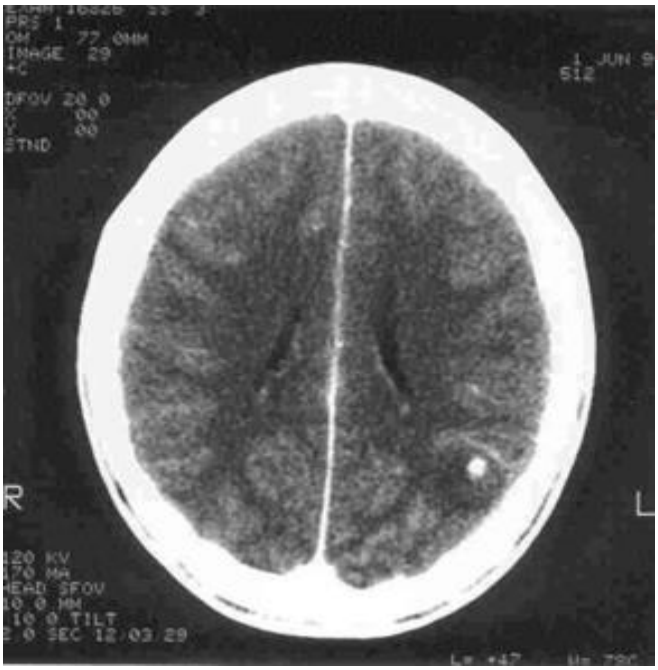

Figure 4: Calcified lesion in the left parieto-occipital region

Treatment: The patients having neurocysticercosis with single lesion < 1cm and patients of undetermined group with seizures were started on antiepileptic drugs only. Whereas patients having tuberculoma were put on ATT with steroids. All the patients were treated symptomatically. Patients with multiple lesions with neurocysticercosis were treated with Albendazole. Prednisolone was given 3days before starting of Albendazole and continued for next 3 days.

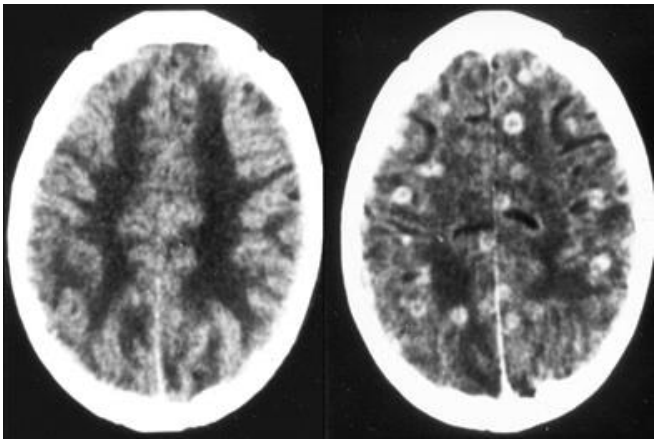

Figure 5: CT scan showing multiple lesion neurocysticercosis

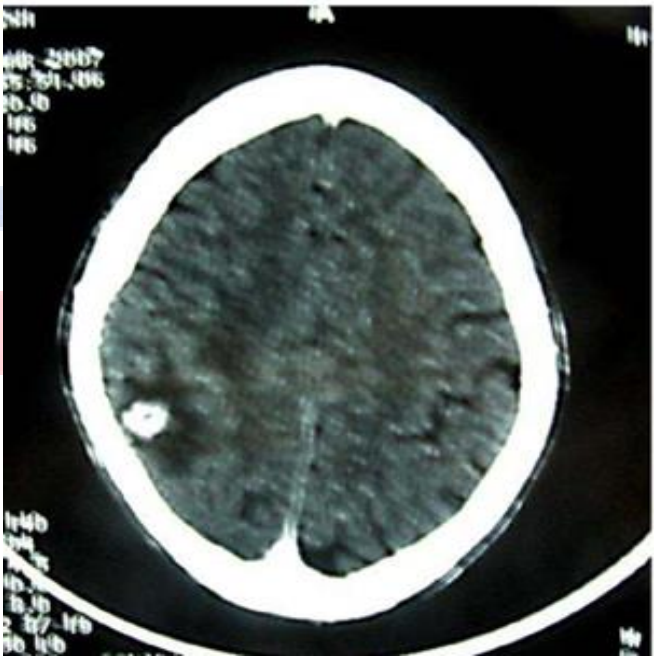

Figure 6: CT scan suggestive of tuberculoma

Results

A total of 50 children with ring enhancing lesion or lesions were studied. Of these 32(64%) were males and 18(36%) were females.

Table 1: distribution of patients according to sex.

Sex	No. of cases	%
Males	42	84
Females	08	16
Total	50	100

Table 2: Age Distribution

AGE(YEARS)	No. OF CASES	%
2 – 5	08	16
6 - 10	32	64
>10	10	20
Total	50	100

The above table showed that 8 cases were recorded between 2 to 5yrs of age comprising 16%, 32 cases recorded between 6 to 10yrs comprising 64% and 10 cases were reported above 10 yrs of age, comprising 20%. From the above analysis it is infered that incidence of ring enhancing lesions was high in children between 6 to 10yrs age.

Table 3: type of focal deficit

Type of focal deficit	No. of cases	%
Monoparesis	03	37.5
Hemiparesis	04	50
VII Nerve palsy	01	12.5
Total	08	100

08 children presented with focal deficits, of these 4 children had seizures with focal deficits, 2 children had associated feature of raised ICT along with focal deficits and 2 children presented with focal deficits alone. Of the deficits hemiparesis was more common (50%).

Table 4: etiology of ring enhancing lesion

Etiology	No. of cases	%
Neurocysticercosis (NCC)	32	64
Tuberculoma	05	10
Undetermined (Probable NCC)	13	26
Total	50	100

Out of 50 cases 32 children were diagnosed as Neurocysticercosis and 05 children were diagnosed as Tuberculoma. 13 patients were kept in undetermined group, as these children did not meet the criteria definitive of NCC or Tuberculoma. This analysis showed that NCC was the commonest cause of ring enhancing lesion in brain.

Table 5: etiology in relation to clinical presentation(seizures)

Clinical Presentation	No. of cases	NCC	Tuberculoma	Undetermined
Seizures alone	38	27	03	08
Seizures with raised ICT	03	02	01	-
Seizures with focal deficits	04	01	-	03
Seizures with focal deficits and raised ICT	02	-	01	01
Raised ICT or Focal deficits	03	02	-	01
Total	50	32	05	13

Of the 38 children who presented with seizures alone, 27 were NCC(71 %), 3 were Tuberculoma(7.8%) and 8 were undetermined etiology(20.2%). In cases of seizures with raised ICT, 2 were NCC (66.67%) and 1 was Tuberculoma (33.33%). Of the 4 cases which presented as seizures with focal deficits 1 was NCC (25%) and 3 were undetermined group(75%). 2 cases of seizures with focal deficits and raised ICT, 1 was Tuberculoma (50%) and 1 was undetermined etiology (50%). Of the 3 children who presented with only focal deficits or raised ICT 2 cases were NCC (66.67%) and 1 undetermined (33.33%).

Table 6: type of seizure & etiology

Type of seizure	No. of cases	NCC	Tuberculoma	Undetermined
Partial	33	23	03	07
Secondary GCTS	04	01	02	01
GCTS	10	06	-	04
Total	47	30	05	12

Out of 47 cases who presented with seizure with or without associated features, 30 were NCC (63.83%), 05 were tuberculoma(10.64%), and 12 were undetermined etiology(25.53%). In all the lesions partial seizures was common.

Table 7: number of lesions & etiology

No. of lesions	No. of cases	NCC	Tuberculoma	Undetermined
Single	41	26	04	11
2 lesions	05	03	-	02
More than 2	04	03	01	-
Total	50	32	05	13

Of the 41 children with single lesion, 26 were NCC(63.41%), 4 were Tuberculomas(9.75%) and 11 were undetermined group(26.84%). Among 5 children with 2 lesion 3 were NCC(60%) and 2 were undetermined group(40%). Out of 4 cases with multiple lesions, 3 were NCC(75%) and 1 was Tuberculoma(25%). This shows that most cases of NCC, Tuberculoma and undetermined etiology presented with single lesion.

Table 8: Age Distribution and Etiology

Age(yrs)	No. of cases	NCC	Tuberculoma	Undetermined
2 – 5	08	04	01	03
6 – 10	32	23	02	07
>10	10	05	02	03
Total	50	32	05	13

Below the age of 5yrs the major cause of ring enhancing lesion was either NCC or undetermined etiology. NCC was more common in children between 6 – 10 yrs.

Neurocysticercosis: Of 50 cases studied 32 cases were definitive NCC and 13 cases met the criteria of probable NCC, so kept in undetermined group.

Table 9: clinical manifestations of NCC

Clinical presentation	No. of cases	%
Seizures alone	27	84.36
Seizures + raised ICT	02	06.25
Seizures + focal deficits	01	03.13
Focal deficit alone	01	03.13
Raised ICT alone	01	03.13
Total	32	100

Of the 32 children with NCC 94% patients presented with seizures with or without associated features. About 6%

patients presented with out seizures. Among non seizure manifestations focal and raised ICT were equal.

Tuberculoma: Of the total 50 cases studied 5 cases were Tuberculomas.

Table 10: clinical presntation of tuberculoma

Clinical presentation	No. of cases	%
Seizures alone	03	60
Seizures + raised ICT	01	20
Seizures + raised ICT+ focal deficits	01	20
Total	05	100

Of the 5 cases of Tuberculoma 3(60%) presented with seizures alone. 20% cases presented with seizures with raised ICT and 20% presented with seizures with raised ICT and focal deficit. Commonest clinical presentation of Tuberculoma was seizures with or without associated features. The incidence of focal deficit in Tuberculoma patient was less compared to seizures and raised ICT.

Discussion

We have studied 50 cases of ring enhancing lesions on CT brain, out of which boys were 42 (84%) and girls were 8 (16%), revealing that boys are more affected than girls which correlates with the study of Chaoshuang L et al,[13] (78.8%) stating that males are more affected than women.

In our study most number of children were encountered in the age group of 6 to 10 yrs i.e 64%. Studies by Bhatia and Tandon (1988), Kumar et al(1990), Sach dev et al reported NCC were common <20yrs of age. The youngest child presented with seizures was a 2 yrs old female child.[14-16]

In our study 82% children had single ring enhancing lesion on the CT scan brain of these 26 are NCC(63.41%),4 were Tuberculoma(9.75%) and 11 were undetermined group(26.84%). Similar to our study Rajashekar et al,[17] reported their incidence of NCC was 49%, Tuberculoma 11.5%, undetermined parasitic granuloma was 23.5%.

R.K Garg,[18] reported that incidence of NCC was 80% among those who presented with seizures and single ring enhancing lesion. Whereas in Mathew J. Chandy,[19] study of small single enhancing lesions the diagnosis was done by biopsy showed 25% were NCC, 20% non-specific parasitic granuloma and 52% were non-specific inflammatory changes.

So we conclude that the common cause of ring enhancing lesion in our population is neurocycsticercosis, even though the Tuberculomas constitute less proportion of single ring enhancing lesions, they have to be differentiated from NCC as they require anti tuberculous therapy.

Amongst those who presented with 2 lesions 60% were NCC and 40% undetermined group. 10% presented with multiple lesions among these 75% were NCC and 25% were Tuberculomas.

In our study among the patients with NCC, 81.25% presented with single lesion on CT scan brain, 9.38% presented with 2 lesions and 9.37% had multiple lesions. In Wendy G. Mitchell58 study, NCC were solitary in 39 patients and multiple in 13 patients. The commission on Tropical Disease of the International League against Epilepsy (1994) had reported that more than 50% patients with NCC had solitary lesion.

In our study the incidence of Tuberculoma was 10%. Tuberculomas were equally distributed in all age groups. Most common manifestation of Tuberculoma in our study was seizures alone(60%), and seizures with raised ICT(40%). Although raised ICT was associated mostly with Tuberculoma. CSF ADA was positive in all Tuberculomas.

Sometimes during therapy Tuberculoma may paradoxically increase in size and tuberculomas usually resolve over period of 9 months.[20] In NCC group children with single lesion > 1 cm and with multiple lesions received specific anti neurocysticercal and anti epileptic therapy and remaining patients received only symptomatic and anti epileptic therapy.

In V. Karla,[21] study of children with NCC reported none of their patients showed calcification on follow up. In contrast to these findings Percy et al found that above 80% of childhood NCC were calcified. There is much controversy about the etiology of disappearing single ring enhancing lesions without any specific management. In majority of previous studies where the diagnosis of lesions was done biopsy,[22,23] showed these were non tuberculous parasitic lesions. In our study, in 10 children lesions disappeared and in 4 cases calcified lesions noticed in follow up scans.

Conclusion

The most common presentation of children with ring enhancing lesion in CT scan brain are seizures (76%). Seizures with focal deficit and features of raised ICT constitutes (18%), only raised ICT and focal deficit (6%). So, ring enhancing lesion should be considered in those who presented with these symptoms in endemic areas like India. Among the seizures 70.21% are partial seizures, 8.51% are secondary GTCS, 21.28% are primary GTCS. So , in patients with GTCS also, the possibility of ring enhancing lesion should be considered. Neurocysticercosis constitutes 64% of ring enhancing lesion. Tuberculoma 10% and undetermined causes 26%. Majority of children presented with single ring enhancing lesion. Among them 63.41% turned out to be NCC,9.75% Tuberculoma, and 26.84% undetermined causes. Among the children diagnosed as Tuberculomas the ring enhancing lesions are mostly single.

References

1. Ahuja G K et al – Lateonset epilepsy a prospective study Actaneurol scand 1982, 66:216-226.
2. Anne & Assbom, Infections of the brain and its linings, Diagnostic neuroradiology, 1st edition, 688-691
3. Arsenci, Cysticercosis of brain, BMJ, 1957 ii 494-97

4. Arseni C Crislesene & epilepsy due to cerebral cysticercosis epilepsia 1972,13:253-258.
5. Basuri L et al, Microabscess and presumptive inflammatory nodules of brain Acta. Neuro. 68 27-32 1983.
6. Batia S et al, Solitary microlesion in CT. Neurol. India 36 139-150, 1988
7. Bhargava , S Tandon , intra cranial Tuberculomas CT study British Journal of radiology 1980, 53; 935-943.
8. Carona J et al anti cysticercus anti bodies in serum and CSF in patients with cerebral cysticercosis J Neurol. Neurosurg. Psychiatry, 1986; 49 ; 1044-49
9. Chao shuang L et al, TROP DOCT July 2008;38(3);192-4.
10. Consensus statement of Indian Academy of Paediatrics 2000.
11. Cook G C tropical medicine post grad. Med. J 1991, 67: 798-822.
12. Cysticercosis, Modern day plague, W John Brown MD, PCNA- vol. 3; No.4 Aug.1985, P.953.
13. Cysticercosis, Nelson Text book of Paediatric 18th edition page 1514-1516.
14. Delbrutto Oh epilepsy due to neurocysticercosis analysis of 203 patients neurology 1992,42; 389-392.
15. Del Brutto OH et al proposal of diagnostic criteria for human cysticercosis and neurocysticercosis J of nurol. Science 1996, 142- 1-6.
16. Dhamija R M et al CT spectrum of neurocysticercosis JAPI 1990; 38. 566-568.
17. Dumas M et al cysticercosis Bull SC path 1990, 830263-274.
18. Dinerker J, Cysticercosis of brain, Neyrology India, 1970: 18, 165-170.
19. Escobar A the pathology of neurocysticercosis cysticercosis of the central nervous system spring field, Illinois 1983, 27-54.
20. Flisser A et al new approaches in the diagnosis of T. solium cysticercosis & taeniasis Ann. Parasito 1` Hum comp 1990, 65, 95- 98.
21. Garg R K et al CT spectrum of neurocysticercosis JAPI, 1991:39,3255328
22. Goni P. B, cysticercosis of nervous system,III. Clinical findings and treatment.J neurosurg 1962;19:641.
23. Goulatia RK, Bhargava et al, CT analysis of first 525 patients, Neurol India, 1980, 1786-94.

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