



Study of CNS Tuberculosis in Children with Special Reference to Cranial MRI Findings

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Abstract

Background: Early diagnosis of CNS TB is necessary for appropriate treatment to reduce morbidity and mortality. Noninvasive imaging modalities such as CT scan and MRI Scan are routinely used in the diagnosis of neurotuberculosis, with MRI offering greater inherent sensitivity and specificity than CT scan.

Aim: To study the symptomology of CNS tuberculosis in children and to study various finding of MRI in proved case of CNS tuberculosis.

Materials and Methods: In this prospective study, 65 clinically diagnosed cases of CNS tuberculosis were enrolled and subjected to MRI BRAIN. Cases were divided according to spectrum of lesions in CNS Tuberculosis as per MRI findings.

Results: In this study we found Cranial MRI findings as follows: Out of 65 Cases, 38.46% cases were having multiple small infarction, 33.84% having basal exudates, 15.38% having hydrocephalus and 6.15% having CNS tuberculoma and tuberculous cerebritis.

Conclusion: No finding of MRI SCAN is diagnostic or pathognomonic of Central Nervous System Tuberculosis, but these abnormalities raise high degree of suspicion. Thus, MRI scan findings supported by CSF examination play a significant role in diagnosis of Central Nervous System Tuberculosis.

Introduction

Tuberculosis (TB) in any form is a devastating disease, which in its most severe form involves the central nervous system (CNS), with a high mortality and morbidity. Noninvasive imaging modalities such as computed tomography (CT) scan and magnetic resonance imaging (MRI) are routinely used in the diagnosis of neuro-tuberculosis, with MRI offering greater inherent sensitivity and specificity than CT scan. Therefore this study is on role of MRI in various form of CNS tuberculosis in children in Ajmer region. India continues to have the highest number of tuberculosis (TB)

cases in the world according to the Global TB Report 2017⁽¹⁾ released by World Health Organization (WHO). According to the report, in India, an estimated 27.9 lakh patients were suffering from TB in 2016 and up to 4.23 lakh patients were estimated to have died during the year.

Material and Methods

The proposed study is a prospective hospital based study conducted from July 2018 to June 2019 in Department of Paediatrics, JLN Medical College and associated group of Hospitals, Ajmer.

Inclusion Criteria

- Patient clinically presented with vague ill health lasting 2-8 weeks prior to the development of meningeal irritation. These non-specific symptoms include malaise, anorexia, fatigue, fever, myalgia and headache.
- Child presented with stiffness of neck along with focal neurological deficits, behavioural changes and alteration in consciousness.
- Fever with weight loss or no weight gain
- History of contact in last two years
- Tuberculin skin test positivity
- CSF findings consistent with tubercular meningitis
- Cranial MRI suggestive of CNS Tuberculosis
- Child on Antiretroviral Treatment.

Exclusion Criteria

- Cases of pyomeningitis, viral meningitis and other central nervous diseases.
- All the selected patients were subjected to the following: Detailed history, General physical examination, Systemic examination, Routine investigations, Haematological investigations (Level of haemoglobin, TLC, DLC & ESR), Mantoux test, X-ray chest, CSF EXAMINATION, CT SCAN and MRI.

- MRI performed for suspected intracranial tuberculosis should include axial pre -contrast T1W, T2W, diffusion weighted and post-contrast T1W scans in all three planes. MRI was performed on MAGNETOM Avanto 18 Channel 1.5 Tesla TM MR machine by Siemens India Ltd. Protocol consisted of localizers in coronal, axial, and sagittal plane after proper positioning of the patient. The positive findings were recorded. MRI differentials were correlated with clinical differentials based on CSF/biochemical analysis.

Observation and Results

Age wise distribution of cases

Maximum number (56.90%) of patients belonged to 0-5 years age group followed by 10-12 years (23.10%) and 5-10 years (20.00%) age group.

Distribution of cases according to Gender

55.4% of cases were male while 44.6% of cases were females.

Distribution of cases according to Socio-economic status

Majority of cases belonged to lower middle (38.5%) and upper lower (33.8%) followed by upper middle (16.9%), lower (7.7%) and upper (3.1%) class.

Distribution of Cases according to Presenting Complaints

92% of cases presented with complaint of fever >2 weeks, 76.9% with altered sensorium, 70.6% with meningeal irritation, 69.2% cases with seizure and 44.6% with headache.

History of Contact

History of contact was present in 60% cases while absent in 40% cases.

CT scan Findings And Association With Different Type of CNS Tuberculosis

In CT scan 30.68% cases were having infarction, edema, 15.38% having periventricular oozes and 23.07% having basal exudates, 10.76% having cerebral hydrocephalus and 4.61% having tuberculoma.

Table 1: Cranial MRI Findings Association with Spectrum of CNS Tuberculosis

S.N.	Type of CNS TB	MRI Findings	No of Cases	% of Cases
1	Tubercular Meningitis with Basal exudates	Axial T1W post-contrast image shows meningeal enhancement in and around the basal cisterns and subarachnoid spaces.	22	33.84 %
2	Tubercular Meningitis with Hydrocephalus	Ventriculomegaly, Periventricular, hyper-intensity signal on T2W FLAIR Evan's ratio >30 %	10	15.38 %
3	Infarction	In a patient with TB meningitis, axial T2W FLAIR image shows diffuse hyper-intensity in the right parasagittal region with restriction on DWI.	25	38.46 %
4	CNS Tuberculoma	Axial T2W and post-contrast T1W shows round hypointense lesion (tuberculous granuloma with caseation), lobulated ring like enhancement surrounded by edema	4	6.15 %
5	Tuberculous cerebritis:	Axial T2W FLAIR shows well- defined round hypointense tuberculous nodule with caseation and post-contrast T1W shows patchy enhancement.	4	6.15 %

Table 2: Distribution of Cranial MRI findings and age

			Age(Years)			Total
			0-5	5-10	10-12	
MRI findings	Normal	N	3	0	0	3
		%	8.1%	0%	0%	4.61%
	Abnormal	N	34	13	15	62
		%	91.89%	100%	100%	95.38%
Total	N	37	13	15	65	
	%	56.9%	20.0%	23.1%	100.0%	

Table no. 2 shows that 34 out of 37 cases in 0-5 years age group , 13 out of 13 cases in 5-10 years, 15 out of 15 cases in 10-12 years age group detected cranial MRI findings.

Table 3: Distribution of Cranial MRI findings and gender

			Gender		Total
			F	M	
Cranial MRI findings	Normal	N	1	2	3
		%	3.44%	5.55%	4.61%
	Abnormal	N	28	34	62
		%	96.55%	94.44%	95.38%
Total		N	29	36	65
		%	44.6%	55.4%	100.0%

Table no 3 shows Cranial MRI findings detected in 28 females and 34 males with p-value 0.42 which shows no significant statistical difference.

Table 4: Distribution of Cranial MRI findings And Socioeconomic Status

			Socioeconomic Status					Total
			Class I	Class II	Class III	Class IV	Class V	
Cranial MRI finding	Normal	N	2	1	0	0	0	3
		%	40%	12.5%	0%	0%	0%	4.61%
	Abnormal	N	3	7	22	22	8	62
		%	60%	87.5%	100%	100%	100%	95.38%
Total		N	5	8	22	22	8	65
		%	7.69%	12.3%	33.8%	33.8%	12.3%	100.0%

Table no 4 Abnormal cranial MRI findings was found 100% in 3rd, 4th and 5th class, 87.5% in class 2nd, 60% in class 1st socioeconomic status.

Table 5: Distribution of Cranial MRI findings and History of contact

			History of Contact		Total
			No	Yes	
Cranial MRI findings	Normal	N	1	2	3
		%	33.33%	32.25%	4.61%
	Abnormal	N	2	60	62
		%	66.66%	96.77%	95.38%
Total	TOTAL		3	62	65
			%	46.15%	95.38%

Table no 5 Cranial MRI findings found abnormal in 96.77% of contact positive cases and 66.66% of contact negative cases.

Table no. 6: Comparison of CT scan and MRI findings of CNS tuberculosis

S.N.	CNS Findings	No. of cases in CT Scan	No. of cases in MRI
1	Hydrocephalus	10	10
2	Basal exudates	15	22
3	Infarction	20	25
4	Periventricular oozes	10	4
5	Cerebral edema	7	4
6	Tuberculoma	3	4

Discussion

Out of 65 cases, 37 were in the age group 0-5 years, 13 in the age group 5-10 years and 15 in the age group 10-12 years. Similar results were found by Sheena Gupta et.al 2016⁽²⁾, in their study observed that high risk group of pediatric CNS tuberculosis in infancy and early childhood.

In our study out of 65 patients, 55.4% were males and 44.6% were females. Similarly, Sheena Gupta et.al 2016⁽²⁾, observed that CNS Tuberculosis was more in male as compared to female. Contrast to our study, R.S.

Solomons et al, 2015⁽³⁾, showed CNS Tuberculosis in 47% male & 53% female.

Tuberculosis is high in children of low socio-economic groups. This is because of high prevalence of chronic pulmonary tuberculosis in adults, overcrowding, close contact with sputum positive cases, poverty, poor ventilation and unhygienic living conditions.

According to Kuppaswamy Scale which assess socioeconomic status, 38.5% belonged to grade III, 33.8% belonged to grade IV, 16.9% belonged to II, 7.7% belonged to grade V and 3.1% belonged to grade

I. Similarly, Sanjay K Jain et al. 2013⁽⁴⁾ in their study showed CNS tuberculosis in 57% belonged to grade III. Among the symptoms the patients presented with, majority 78.5% cases were having altered sensorium, 70.8% having meningeal irritation. Likewise, seizure, nausea & vomiting was present in 69.2%, fever > 2 weeks in 60%, weight loss / no weight gain in 49.2%, decreased appetite in 47.7% and headache in 44.6%. Goyal G et al 2017⁽⁵⁾ in their study observed that fever was present in 100% of patients followed by altered sensorium (54.5%), Vomiting (50%), headache (45.4%) and seizures in 40.9% patients.

Definite history of contact was observed in 95.38% cases in our study.

Lesser incidence of positive history of contact was observed by Joshi et al⁽⁶⁾ (1977) – 36% Benakappa and Chandrashekhar et al⁽⁷⁾ (1983) – 20.8% Singh.

In our study in cranial MRI findings of CNS tuberculosis Leptomeningeal enhancement seen in most cases (33.64%) followed by hydrocephalus in 15.38%, Infarction in 38.46%, TB vasculitis in 6.15% cases, CNS Tuberculoma in 6.15% cases. Garvit Devmohan Khatri, Venkatram Krishnan, and Gaurav Saigal et al⁽⁸⁾ 2018 in their study showed Leptomeningeal tuberculosis in 41%, tubercular brain abscess in 10% cases, CNS tuberculoma in 12%, tubercular encephalopathy in 5% and TB vasculitis in 32% cases. Likewise, Vandana V Ahluwalia, G Dayananda Sagar, TP Singh, Nitish Arora, Shamrendra Narayan, MM Singh et al⁽⁹⁾ 2013 showed Leptomeningeal tuberculosis in 42%, tubercular brain abscess in 12% cases, CNS tuberculoma in 15%, tubercular encephalopathy in 18% and TB vasculitis in 10% cases. Richa Trivedi, Sona Saksena, Rakesh K Gupta et al⁽¹⁰⁾ 2009 showed that Tuberculous meningitis (TBM) is the most common (49%), tubercular brain abscess in 4%,

tuberculoma in 25% cases, TB encephalopathy in 9%, TB vasculitis in 10% and spinal TB in 3% cases. As compared to other study, TB vasculitis incidence were more in our study due to secondary complication of TB meningitis which was the result of late presentation of cases to our hospital.

Summary and Conclusions

Early diagnosis and timely intervention of cranial TB cases can be life-saving and prevents severe physical and mental sequelae. This can be diagnosed very early, easily and quickly by MRI SCAN. No finding of MRI SCAN is diagnostic or pathognomonic of Central Nervous System Tuberculosis, but these abnormalities raise high degree of suspicion. Thus, MRI findings supported by CSF examination plays a significant role in diagnosis of Central Nervous System Tuberculosis.

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