ORIGINAL ARTICLE

COMPUTERIZED TOMOGRAPHY (CT) BRAIN FINDINGS IN CHILDREN WITH TUBERCULOUS MENINGITIS

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ABSTRACT

Objective: To study the frequency of Computerized Tomography (CT) brain findings in children with tuberculous meningitis.

Material and Methods: This descriptive study was carried in Khyber Teaching Hospital, Peshawar from June 2014 to May 2016. Forty-four children with tuberculous meningitis admitted in children A unit had their CT scan done and the findings were compared.

Results: Forty-four children were included in this study. Meningeal enhancement was found in 35(81.4%) of CT scans. Ventricular dilatation in 32 (74.4%) cases and frank hydrocephalus in (27.9%) cases. Infarcts were found in 10(23.3%) cases. Tuberculoma in 4(9.3%) cases.

Conclusion: Meningeal enhancement followed by ventricular dilatation and hydrocephalus were the common findings which can be used for diagnosis of tuberculous meningitis (TBM).

Key Words: CT scan, Tuberculous meningitis, children.

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INTRODUCTION

Tuberculous meningitis is a devastating disease of the brain and meninges especially in children. It is caused by mycobacterium tuberculosis. Globally it is a health issue and more so in developing countries like Pakistan. The clinical diagnosis is difficult and is made on clinical suspicion and on an array of investigations. Neuro imaging plays a major role in diagnosis as well as planning surgical intervention.

There are 11 million prevalent cases of TB worldwide. Estimated 9.6 million people developed TB in 2014; 58% were in south East Asian and pacific region[1]. Out of these 9.6 million cases 1million are children. There was an estimated 1.5 million tuberculosis deaths in 2014[1] out of which 140,000 were children. TBM is an extra pulmonary TB with higher morbidity and mortality. 15% of the pediatric TB patients have TBM. Fifty percent of patients with TBM either die or become disabled[2]. In Pakistan out of 308417 cases of TB 27245(9%) are under 15 years of age[1]. Extra pulmonary TB accounts for 57463 cases which includes TBM[1].

Mycobacterium tuberculosis spreads hematogenously to meningies and brain parenchyma. Forming multiple granulomas which ruptures in CSF leading to inflammation of meninges, formation of thick gelatinous exudates, and occlusion of cerebral arteries, infarcts, hydrocephalus and sometimes tuberculoma.[3,4,5] If not treated, TBM is universally fatal and even when treated is associated with high morbidity and mortality. In case of delay in initiation of treatment because of difficulty in diagnosis. Diagnosing TBM in its early stage is really difficult and depends on clinical history, examination, laboratory investigation and radiological studies including chest X-ray and neuroimaging.[6]

Both CT scan and MRI are valuable for the assessment of patients with TBM; MRI is considered better. In early stages CT findings may not reveal any abnormality[7]. The neuroimaging findings characteristic of TBM are leptomeningial and basal cisternal enhancement, periventricular infarcts, hydrocephalus and the pres-

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ence of tuberculoma.[6] CT scan can be used in follow up of patients when indicated and helps in decision about surgical intervention.

MATERIAL AND METHODS

This descriptive study was conducted in pediatric A Unit of Department of Child Health, Khyber Teaching Hospital, Peshawar from June 2014 to May 2016. All patients admitted to the unit with suspicion of TBM were included in the study. The sample included 44 patients both males and females under 15 years of age. A thorough history was taken and clinical examination done. Base line investigations along with chest X-Ray, CSF examination and CT scan performed. All the findings recorded on a specified performa. The inclusion criteria was children both male and female, age under 15 years, with prolong history, contact with TB patient, unvaccinated, malnourished, with signs of meningeal involvement and CSF findings suggestive of TBM. The exclusion criteria was age more than 15 years, short history, no contact with TB patient, vaccinated and CSF findings suggestive of septic meningitis. All the data was recorded on a Performa and analyzed on spss 23.

RESULTS

This study included 44 patients with tuberculous meningitis. All of them had a CT scan head done as per protocol of the ward and was being reported by Radiology Department of Khyber Teaching Hospital, Peshawar, Pakistan. Three patients were advised MRI by the radiologist. The gender distribution is depicted in Table 1. The age groups are shown in Table 2. The CT scan findings are shown in table 3. All tables showed the actual numbers and their percentages.

Table 1: gender distribution in children with TBM

	Frequency & percentage
Male	25 (56.8%)
Female	19 (43.2%)
Total	44 (100.0%)

Table 2: age groups of children with TBM

Age group	Frequency & percentage
Under 2 years	14 (31.8%)
2 to 5 years	10 (22.7%)
5 to 8 years	9 (20.5%)
8 to 11 years	6 (13.6%)
11 to 14 years	5 (11.4%)
Total	44 (100.0%)

Table 3: CT scan findings in TBM Frequencies CT scan findings

	Responses Percent of cases (N)
CT findings in TBM	
Meningeal enhancement	35 (81.4%)
Ventricular dilatation	32 (74.4%)
Infarct	10 (23.3%)
Tuberculoma	4(9.3%)
Frank hydro cephalus	12 (27.9%)

DISCUSSION

Tuberculous meningitis is known for being lethal and has highly variable presentation[8] so it is very difficult to diagnose it clinically. Despite anti tuberculous treatment majority of survivors may have severe disability[9]. There is no single diagnostic test which can be considered as the gold standard for its diagnosis. An array of biochemical and radiological investigations are employed for this reason. Delay in diagnosis results in delay in treatment and increase in morbidity and mortality. There is a growing need for early detection.

This study included 44 patients with tuberculous meningitis diagnosed using history findings, examination findings, biochemical investigations especially CSF examination and radiological findings including chest X-ray. CT scan brain of all these patients was done and MRI brain of only 3 patients was advised by radiologists.

Tuberculous meningitis most commonly affects the extreme of ages that is the old and very young. In this study 17 (38.6%) children were under 2 years of age 10 children were in 2-5 years age group. In a local study the same age was found to be more commonly affected[10]. In other local and international studies children under 5 years were found to be the most commonly affected.[11-14]

Most of the studies nationally and internationally had male predominance. The same gender difference is found in this study as well. 24(54.5%) males as compared to 20(45.5%) females presented with TBM.[10-14] Clinical diagnosis of TBM can be difficult; therefore, neuroimaging has an important role in establishing the diagnosis. CT is widely used for making diagnosis and detecting complication of tuberculous meningitis in children.

Contrast enhanced CT of the brain in patients with TBM shows meningeal enhancement and basal cistern enhancement[15]. Ventricular dilatation (eg, dilatation of the third and fourth ventricles) due to hydrocephalus is seen which may progress to frank hydrocephalus is usually seen.[15,16]Infarcts; seen as hypodense areas on CT result from associated vasculitis.[17] Tuberculoma demonstrates various pattern; noncaseating, ring enhanced; with or without calcification and may have a milliary pattern.[18-20]

Meningeal enhancement is more common in this study. Basal enhancement (89%) on contrast enhanced CT was reported as most sensitive feature of TBM in a study and the same study reported hyperdensity (100%) of non contrast CT being most specific.[20] Another study reviewed CT scans at 1 week and 1 month of initial CT in children with proven and probable TBM. On initial CT, meningeal enhancement was more common in 44 out of 50 cases. 8 developed hydrocephalus and 24 developed infarcts on follow up CT scan.[21] Hydrocephalus was found to be more common in a few local[21,22] and international studies[23-26]. This study has 12 patients with frank hydrocephalus. There is ventricular dilatation in 32 cases. Ventricular dilatation is an early presentation of hydrocephalus and is the two extremes of the same presentation. If both are taken together hydrocephalus would be more common in this study as well, as compared to local and international studies.

Infarct was found in 10(23.3%) of cases in this study. Infarcts were found in 15% and 18% in local studies.[22,23] In international studies it was found in 15% of cases.[27] It is less common than hydrocephalus and meningeal enhancement.[28] It may not be seen initially but may develop later and seen on follow up CT scan.[21] Tuberculoma was found in 4(9.3%) of cases. It is also a less common finding in other studies.[29] It was 6.6% in one latest study.[25] Hosoglu et al found that tuberculoma are present in 8% of CT brain performed on patients with TBM.[26]

The preferred method of initial investigation is MRI[28,29]. It detects the extent of leptomeningeal involvement and parenchymmal disease such as tuberculoma and abscess. Conventional MRI misses early infarcts.[7,28,29] MRI was done in 3 cases on suggestion of radiologist. MRI is considered to be more specific for diagnosis of TBM even in early stages but in our set up due to economic constraints it is departmental policy to do CT. MRI is done only in selected cases. MRI was done only in three patients who showed tuberculomas in two cases and one of the cases had hydrocephalus along with tuberculoma.

CONCLUSION

Meningeal enhancement, hydrocephalus and infarct can be used for diagnosis of TBM as suggested by many studies depending on the stage of presentation.

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AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

Amir S: Data collection and manuscript writing.

Rahim F: Designing a Performa and compilation of the results.

Afridi JM: Case collection.

Munir A: Case Collection.

Khawar N: Data supervision.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.