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CT SCAN;
THE DIAGNOSTIC VALUE OF THE BASAL ENHANCEMENT IN TUBERCULOUS MENINGITIS

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ABSTRACT...Objective: To study the diagnostic value of basal enhancement on computed tomography (CT scan) in differentiating tuberculous (TBM) from pyogenic (PM) meningitis**. Design:** Retrospective case control study. **Setting:** The Pediatric department in collaboration with the department of Radiology and Diagnostic imaging of Bahawal Victoria hospital, Bahawalpur. **Methods:** The reports of CT scan (contrast) done within 5 days of admission of children 4 month to14 years of age with a diagnosis of either TBM (case group) or PM (control group) were analyzed for the basal enhancement. **Results:** The sensitivity, specificity, PPV and NPV of basal enhancement in the diagnosis of TBM was 0.97,1,1 and 0.95 respectively. **Conclusions:** The presence of the basal enhancement on CT scan can effectively distinguish TBM from PM.

KEY WORDS Tuberculous meningitis, childhood tuberculosis, pyogenic meningitis, CT scan, basal enhancement.

ABBREVIATIONS

Tuberculous meningitis	TBM	Acid-fast bacilli	AFB	Cerebrospinal fluid	CSF
Pyogenic meningitis	PM	Positive predictive value	PPV	Negative predictive value	NPV

INTRODUCTION

Tuberculous meningitis (TBM) is the most dreaded form of tuberculosis especially in children but its diagnosis is problematic despite the invention of many new, advanced diagnostic methods[1,2].The laboratory confirmation is based on the detection of acid-fast bacilli (AFB) in the cerebrospinal fluid (CSF) and its culturing for Mycobacterium tuberculosis bacilli[3]. However, the sensitivity of direct AFB smears from CSF ranges from 5–10% and culturing techniques take 4–6 weeks. Clinical as well as CSF features are helpful for diagnosing TBM, but these cannot be used to differentiate TBM from other infectious and non-infectious disorders[4, 5]. The pyogenic meningitis (PM) is the most important differential diagnosis[6].

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The most of the newer tests for tuberculosis are unlikely to be available where they are needed for at least the next decade or two. Further, the accuracy of these newer tests is also still under study. Computerized tomography (CT) is now a widely available investigation with a low marginal cost in public sector hospitals. The common findings of TBM on CT include basal enhancement (on contrast CT), hydrocephalus, tuberculomas and brain infarctions. The basal enhancement is the most common finding[7]. The purpose of this study is to compare the diagnostic yield of basal enhancement on contrast CT in TBM as compared to PM.

SUBJECTS AND METHODS

It is a retrospective case control study conducted in the Pediatric Department with the collaboration of Department of Radiology and diagnostic imaging of Bahawal Victoria hospital, Bahawalpur. The record of children between 4 month to 14 years of age admitted in the Pediatric units during the period of May 2007 to September 2008 with a diagnosis of either TBM (diagnosed on the basis of negative CSF Gram stain or culture negative for pyogenic organisms; with no clinical and CSF response to exclusive antibiotic therapy but clinical response to antituberculous treatment, with or without other antibiotics) or PM (diagnosed on the basis of positive CSF Gram stain or culture positive for pyogenic organisms with clinical and CSF response to exclusive antibiotic therapy) was analyzed. The children with a diagnosis of TBM (case group) or with a diagnosis of PM (control group), whose CT scan (contrast) was arranged within 5 days of admission to the hospital, were included for the study. The conray 420 was used as a contrast medium in a dose of 1 ml/kg intravenously. The scan was obtained with a Toshiba Xpress machine. Slice direction was parallel to the orbito-meatal plane and the slice thickness varied between 5 and 8 mm was used. The CT scan reports of both the groups were analyzed for the presence of basal enhancement. The basal enhancement was defined as presence of more than one criteria[8] which were (1-Contrast filling the cisterns, 2-Double and triple lines, 3-Linear enhancement, 4-Y-sign, 5-Infundibular recess of the third ventricle, 6-Ill-defined edge, 7-Join the dots, 8-Nodular enhancement, 9-Asymmetry)

The radiologist was unaware of the diagnosis when he reported on CT scan.

The children were excluded in case of absent clinical notes or incomplete clinical data; incomplete CSF data; incomplete, inadequate or missing CT scans reports and HIV positive children. No consent or approval from ethical committee of the hospital was necessary as it was retrospective study.

STATISTICAL ANALYSIS

The sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) for basal enhancement was calculated.

RESULTS

176 children were included for the study, 99 children with TBM (cases) while 57 children with PM (control group). There were 96 children with TBM who showed basal enhancement while none from the control group showed basal enhancement on contrast CT. According to the grading of TBM by the British Medical Research Council[10] there were 10 cases from grade I, 45 cases from grade II and 44 cases from grade III. All cases except 3 cases from grade I did not show basal enhancement. The sensitivity, specificity, PPV and NPV of basal enhancement in the diagnosis of TBM was 0.97,1,1 and 0.95 respectively. There was no involvement of convexity in any case.

Table-I. Comparison

Study	Our study	Przybojewski S et al (8)
Cases	99	34
Control	57	31
Sensitivity	0.97	0.91
Specificity	1	0.97
Positive Predictive Value	1	0.97
Negative Predictive Value	0.95	0.91

DISCUSSION

The 'gold standard' for the diagnosis of TBM and PM in this study was the clinical course in the hospital and response to exclusive antitubercular or antibiotic treatment. Bacteriological proof of TBM is not available in this area and even if it would have been available it would have positive in a minority of patients and, thus, these would then not be representative of the entire spectrum of the illness. In our set up bacterial culture of CSF is seldom positive (possibly because of prior antibiotic intake, among other things). So, response to therapy and follow up often has to substitute for investigations as a 'gold standard' and this is universally accepted as a valuable tool for retrospective diagnosis.

Basal enhancement was not reported in PM in earlier studies[8, 11, 12, 13, 14, 15, 16, 17, 18] and was not seen in any of our PM cases. The studies[16,18,19,20,21,22] showed basal enhancement in 17-100%cases of TBM.

Basal enhancement is not entirely specific for TBM, being seen also in torulosis, neurosarcoidosis, neurosyphilis and coccidiodal meningitis[16]. But these conditions are rare and were excluded by clinical response to the anti-tuberculous drugs. So, basal enhancement thus may be specific for TBM in this situation.

The only other study comparing the sensitivity, specificity, PPV and NPV is that of Przybojewski S et al [8] as shown in table-I. The results are similar to those of ours.

CONCLUSION

The presence of the basal enhancement on CT scan can effectively distinguish TBM from PM.

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REFERENCES

1. Leonard JM, Des Prez RM. **Tuberculous meningitis.** Infect Dis Clin North Am 1990; 4:769-787.
2. Thwaties GE, Chau TT, Mai NT: **Tuberculous meningitis.** J Neuro Neurosurg Psychiatry 2000; 68:289-99.
3. Katti MK: **Immunodiagnosis of tuberculous meningitis: rapid detection of Mycobacterial antigens on cerebrospinal fluid by reverses passive hemagglutination assay and their characterization by Western blotting.** FEMS Immunol Med Microbial 2001; 31:59-64.
4. Newton RW. **Tuberculous meningitis:** Arch Dis Child 1994; 70:364-366.
5. Ahuja G, Mohan K, Prasad K, Behari M: **Diagnostic criteria for tuberculous meningitis and their validation.** Tubercle Lung Dis 1994; 75:149-15.
6. Kumar R, Singh SN, Kohli N. **A diagnostic rule for tuberculous meningitis.** Arch Dis Child. 1999; 81: 221-224.
7. Andronikou S, Smith B, Hatherhill M, Douis H, Wilmshurst J. **Definitive neuroradiological diagnostic features of tuberculous meningitis in children.** Pediatr Radiol 2004; 34:876–885.
8. Przybojewski S, Andronikou S, Wilmshurst J. **Objective CT criteria to determine the presence of abnormal basal enhancement in children with suspected tuberculous meningitis.** Pediatr Radiol. 2006; 36: 687-96.
9. Hulley SB, Cummings SR. **Designing Clinical Research: An epidemiologic Approach.** Baltimore: William & Wilkins, 1985: 216.
10. **The streptomycin treatment of tuberculous meningitis trials committee.** The Medical Research Council. Streptomycin treatment of tuberculous meningitis. Lancet 1948; i: 548–96.
11. Chaveria LE, du Boulay GH, Moseley IF. **Intracranial infections: investigation by computerised axial tomography.** Neuroradiology 1976; 12: 59–71.
12. Danziger A, Price H, Schechter M. **An analysis of 113 intracranial infections.** Neuroradiology 1980; 19: 31–42.
13. Bodino J, Pedro L, Del Valle M, et al. **Computed tomography in purulent meningitis.** Am J Dis Child 1982; 136:495– 501.
14. Cockrill HH, Dreisbach J, Lowe B, Yamauchi T. **Computed tomography in leptomeningeal infections.**

Am J Roentgenol 1978, 130: 511-515.

15. Price HI, Danziger A. **Computed tomography in cranial tuberculosis.** Am Roentgenol 1978; 130: 769-771.

16. Bilanuik LT, Zimmerman A, Brown L, Yoo HJ, Goldberg HI. **Computed tomography in meningitis.** Neuroradiol 1978; 16: 13-14.

17. Bullock MRR, Welchman JM. **Diagnostic and prognostic features of tuberculous meningitis on CT scanning.** J Neurol Neurosurg Psychiatr 1982; 45: 1098-1101.

18. Nai-Shin Chu. Tuberculous meningitis: **Computerised tomographic manifestations.** Arch Neurol 1980; 37: 458-460.

19. Kumar R, Kohli N, Thavnani H, Kumar A, Sharma B. **Value of CT scan in the diagnosis of meningitis.** Indian Pediatr 1996; 33: 465-468.

20. Ozateş M, Kemaloglu S, Gürkan F, Ozkan U, Hosoglu S, Simsek MM. **CT of the brain in tuberculous meningitis. A review of 289 patients.** Acta Radiol 2000; 41:13-7.

21 Van der Weert EM, Hartgers NM, Schaaf HS, Eley BS Pitcher RD, Wieselthaler NA, et al. **Comparison of diagnostic criteria of tuberculous meningitis in human immunodeficiency virus-infected and uninfected children.** Pediatr Infect Dis J 2006; 25:65-9.

22 Theron S, Andronikou S, Grobbelaar M, Steyn F, Mapukata A, du Plessis J. **Localized basal meningeal enhancement in tuberculous meningitis.** Pediatr Radiol. 2006; 36:1182-5.

23 Seth R, Sharma U. **Diagnostic Criteria for Tuberculous Meningitis.** Ind J Pediatr 2002; 69: 299-303.