

# To Test the Applicability of Modified Ahuja Criteria in Early Diagnosis of Tuberculous Meningitis in Children

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## ABSTRACT

**Objective:** To test the applicability of modified Ahuja criteria in early diagnosis of tuberculous meningitis in children.

**Patients and methods:** This was a cross section study conducted in the Pediatrics Medicine Department, Bolan Medical Complex Hospital Quetta from November 2011 to November 2012. One hundred patients suspected of tuberculous meningitis were selected, between the ages of 6 months to 16 years. Those included had history of contact of tuberculosis in the family, headache and fever for >2 weeks, fits/SOMI for >4 weeks, cerebrospinal fluid suggestive of tuberculous meningitis and were subjected to Mantoux test regardless of Bacille Calmette–Guérin (BCG) scar. The validity of criteria was tested against polymerase chain reaction (PCR) and response to treatment. The sensitivity and specificity of the criteria was calculated.

**Results:** One hundred patients were included in the study and were subjected to Ahuja criteria. PCR performed in all patients and was positive in 61% of patients. Response to antituberculous drugs for one year was 82%. The sensitivity of modified Ahuja criteria was 87%, specificity 77%, positive predictive value 90% and negative predictive value was 75%.

**Conclusion:** Modified Ahuja criteria is a good screening test in the diagnosis of tuberculous meningitis.

**Keywords:** Tuberculosis, Ahuja Criteria, Meningitis, Sensitivity, Specificity

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## INTRODUCTION

Tuberculous meningitis (TBM) is a challenge for clinicians because of the difficulty in making an early diagnosis and the severe consequences of delaying treatment.<sup>1</sup> Thus, while early diagnosis is crucial for effective treatment in children, it is also imperative for the control of tuberculosis at the public health level since it allows rapid identification of contagious adult cases<sup>2</sup>. The diagnostic workup involves detection of acid-fast bacilli (AFB) in the cerebrospinal fluid (CSF) by microscopy or culture, however, the difficulty in detecting the organism poses a challenge to diagnosis<sup>3</sup>. Bacteriological diagnosis of tuberculosis in childhood is often unsuccessful owing to the difficulty in obtaining suitable specimens<sup>4</sup>. Many criteria have been described to assist in the diagnosis of Tuberculous meningitis<sup>5,6</sup> and especially when CSF culture is negative.<sup>7,8</sup> One of the criteria used has been described in detail by Ahuja et al<sup>9</sup> (Table 1). Initially the criteria were applied in diagnosing TBM in adults and showed increase sensitivity and specificity but when applied to children had increase false negative result. Later with addition of two more variable i.e. Mantoux test and history of contact, made it more applicable with increasing accuracy<sup>10</sup>.

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## METHODOLOGY

This was a cross section study conducted in the Pediatrics Medicine Department, Bolan Medical Complex Hospital Quetta from November 2011 to November 2012. By non-probability convenience sampling 100 patients suspected of TBM were selected. The included patients were between the ages of 6 months to 16 years and had the following features: fever >2 weeks, headache >2 weeks, fits/signs of meningeal irritation. The following patients were excluded: those who had previously been treated for tuberculosis, those whose meningitis had responded to antibiotic therapy for <4 weeks. Those who were selected, went through detail history with emphasis on contact of tuberculosis in the family, headache and fever for >2 weeks, fits, vaccination history especially measles and BCG vaccination. Complete physical examination was done especially detail neurological assessment. They had complete blood count with erythrocyte sedimentation rate. Radiological investigations included chest X ray, computed tomography (CT) scan brain. Mantoux test was done in all patients regardless of presence of BCG scar with 0.1 ml (1 TU) intradermal on ventral surface of forearm, and was read after 48 hours late looking for induration. Test was considered positive when induration was >10 mm. After fundoscopy all had lumbar puncture and CSF was subjected to biochemistry and cytological analysis. Treatment was started with four

antituberculous drugs consisting of isoniazid (10 mg/kg/day), rifampicin (15 mg/kg/day), Pyrazinamide (25 mg/kg/day), Streptomycin (30 mg/kg/day) along with dexamethasone in a dose of (0.6 mg/kg/day). Initially 4 drugs were given for 2 months along with steroid followed by isoniazid and rifampicin for remaining 10 months. They were discharged and put on specific therapy once diagnosis was confirmed and then followed monthly for year at OPD of Bolan Medical Complex Hospital. Validity of criteria was checked against PCR examination and response of treatment. The sensitivity, specificity, positive predictive value, negative predictive values of criteria was calculated using SPSS 10. Continuous variables were analyzed using the Student's t-test and proportions were analyzed by the Chi-square test.

Table 1: Modified Ahuja criteria for tuberculous meningitis

<b>Mandatory</b>
Fever for two weeks. Abnormal CSF finding (Pleocytosis with more than 20 cells, predominantly lymphocytes (greater than 60%), protein greater than 100mg%, sugars less than 60% of the corresponding blood sugars.)
<b>Plus any Two of the Following</b>
Evidence of extra neural tuberculosis. Positive (family) history of exposure to a case of TB. Positive Mantoux reaction (1TU) (>10 mm induration) Abnormal CT scan findings (as in original criteria)
<b>CT studies of head showing 2 or more of the following:</b>
Exudates in the basal cisterns or in the Sylvain fissures Hydrocephalus Infarcts Gyral enhancement

## RESULTS

One patients were enrolled in the study and were subjected to modified Ahuja criteria. The age was from 6 months to 16 years with mean age of 60 months. Male to female ratio was 1:1.4. History of fever >2 weeks was present in 100%, history of fits and altered sensorium in 75% and contact was positive in 60%. Previous history of measles was present in 30%. BCG scar was present in only 15%. Cerebrospinal fluid finding suggestive of tuberculous meningitis was seen in 65%. Chest X ray suggestive of tuberculosis was seen in 50%. CT Scan showed hydrocephalous in 85%, basal enhancement in 90%, infraction in 35%, and calcification in 15%. Mantoux test was positive in 50%. The presence extra neural tuberculosis was seen in 80%. PCR performed in all patients and was positive in 61% of patients. Response to antituberculous drugs for one year was

82%. The sensitivity of modified Ahuja criteria was 87%, specificity 77%, positive predictive value 90% and negative predictive value was 75%.

## DISCUSSION

In this study fever was present in 100% of children and this is consistent with other regional studies<sup>11</sup> while western workers have found fever to be present in 55% of patients<sup>12</sup>. Fits and altered consciousness were found to be present in 75% of the patients, this is also collaborated by international studies<sup>11</sup>. Our study showed contact to be positive in 60% while Kondo et al<sup>13</sup> found it to be 36% and Farinha et al<sup>12</sup> found contact to be present in 47%. BCG is known to protect from tuberculous meningitis<sup>14</sup> but BCG scar was found in a fraction of patients in our study, showing lack of immunization in this part of the world. Cerebrospinal fluid chemical and cytoanalysis is used as gold standard in many studies<sup>5</sup> but it has been shown to be confounding in some studies<sup>15,16</sup>. Our study showed that positive CSF finding to be present in 65% of cases, which is in contrast to other studies<sup>11,17,18</sup>. This could be due to laboratory error or may be a representative picture of tuberculous meningitis in this region. Our chest X-ray positivity was almost equal to those shown in other studies.<sup>12</sup> Computed tomography (CT) scan abnormalities were found in the majority of patients and this is consistent with international data<sup>11-13,19-22</sup>. Mantoux test was positive in half of the patients, which is also shown by other workers<sup>23</sup>. It could be due to malnutrition or specific to tuberculous meningitis<sup>24</sup>. PCR has recently been found to be an effective test in the diagnosis of tuberculous meningitis.<sup>25,26</sup> It was one of the gold standards used in this study. PCR was positive in 61% of the patients while it was positive in 70% in a study conducted by Rafi et al<sup>27</sup>. The other gold standard was response to therapy which has been used by other studies as well<sup>28</sup>.

Over the years many criteria have been used in the diagnosis of tuberculous meningitis<sup>5,7,10</sup>. The results of these studies have been variable. The original Ahuja study showed the sensitivity of 65% and 63% false positive rate, while Seth and Sharma<sup>10</sup> showed the modified Ahuja criteria to have a sensitivity of 83% , specificity of 63% and a false positive rate of 38%. Our study showed sensitivity of modified Ahuja criteria 87%, specificity 77%, positive predictive value 90% and negative predictive value was 75%. Thus we found that modified Ahuja criteria to be a good screening test for the diagnosis of tuberculous meningitis.

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