ORIGINAL ARTICLE

Modified Kenneth Jones Criteria for Diagnosing Tuberculous Meningitis in Children

Muhammad Anwar, Ameer Ahmad, Fiaz Ahmad and Attaullah Mazhar

ABSTRACT

Objective: To evaluate accuracy of modified Kenneth Jones scoring criteria (MKJSC) as a screening tool to diagnose tuberculous meningitis in children.

Study Design: Cross-sectional study.

Place and Duration of Study: Paediatric Medicine, Unit-I, Bahawal Victoria Hospital, Bahawalpur, from May 2006 to March 2007.

Methodology: A total of 100 children admitted through emergency in Paediatric Medicine, Unit-I, were included who were having fever and features suggestive of central nervous system (CNS) infection. Lumbar puncture was done in all patients after written consent. Findings of lumbar puncture were taken as gold standard for the diagnosis of TBM. MKJSC was applied on each patient and accuracy determined against the gold standard.

Results: Out of 100 children, 47 were diagnosed as TBM on the basis of CSF results. All children had scored 0-7 or above according to MKJSC. A score 1-2, 3-4, 5-6 and 7 or more was obtained in 23, 25, 30 and 22 children respectively. Children who had scored 5 or more received ATT. Accuracy of MKJSC was calculated to be 91%.

Conclusion: MKJSC is a simple and accurate tool to improve tuberculous meningitis case detection rate in children.

Key words: *Tuberculosis (TB). Tuberculous meningitis (TBM). Modified Kenneth Jones Scoring Criteria (MKJSC). Antituberculous treatment (ATT).*

INTRODUCTION

Tuberculosis (TB) is a leading cause of death throughout the world especially in children.[1-3] There has been a 20% increase in its incidence over the past decade,[4-6] that is why WHO has declared TB a global emergency in 1993.[7]

Presently, it is estimated that one-third of the world's population is infected with tuberculosis and each year about 9 million people develop TB, of whom about 2-3 million die. Of the 9 million annual TB cases, about 1 million (10%) occur in children (under the age of 15 years). Of these childhood cases, 75% occur annually in 22 high burden countries that together account for 80% of the world's estimated incident cases. In countries worldwide, reported percentage of all TB cases occurring in children varies from 3% to more than 25%.[8]

Pakistan is identified as eighth among 22 countries of EMRO region with the highest burden of TB.[9] It contributes about 44% of tuberculosis burden in the Eastern Mediterranean Region. In 2001, the Government of Pakistan declared tuberculosis as a National Emergency. Incidence of central nervous system (CNS) tuberculosis is related to prevalence of TB in community, and it is still the most common type of chronic CNS infection in developing countries.

Despite advancement in medical technologies, diagnosis of tuberculosis in children has remained a challenge. This is particularly true for primary health care providers such as paediatricians and family practitioners who deal with most of childhood illnesses. This is simply because unlike adults there is no "Gold Standard" for diagnosis of tuberculosis in children. Children seldom bring forth sputum and hemoptysis is a rare feature in small children. Sputum induction is technically difficult and hazardous and yield is low. Yield of acid fast tuberculous bacilli is even lower in gastric lavage. Treatment outcome is worse in children with smear negative pulmonary tuberculosis.[10]

A high index of suspicion is required to diagnose TB in children because about in 30% of the cases of TBM, CSF findings are normal.[11] Even in majority of tertiary care hospitals, expensive and sophisticated investigations like PCR and immunodiagnostic facilities are not available and a delay in diagnosis may influence outcome.[12] Different diagnostic approaches have been tried by different workers; none is without its shortcomings. Out of 16 clinical scoring criteria,[13] MKJSC formulated by Kenneth Jones and his colleagues is the one, which is now recommended by Pakistan Paediatric Association for screening purposes to detect TB in children (Table I).[10] The aim of this study was to verify the usefulness of MKJSC in paediatric population.

Department of Paediatrics, Bahawal Victoria Hospital, Bahawalpur.

***Correspondence:** Dr. Ameer Ahmad, 89-C, Medical Colony, Bahawalpur.*
E-mail: hmanwar157@gmail.com

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METHODOLOGY

This cross-sectional study was carried out from May 2006 to March 2007 at Paediatric Medicine, Unit-I, Bahawal Victoria Hospital, Bahawalpur. One hundred children with non-probability purposive sampling were included who were having fever and features suggestive of central nervous system (CNS) infection like altered state of conscious with or without fits or patients with signs of meningial irritation. While the patients in whom clinical findings were not suggestive of CNS infection were excluded from the study.

History, examination and investigations were done according to MKJSC. Lymphocytosis and increased protein with or without decreased sugar in CSF were taken as gold standard for the diagnosis of TBM.

Variables in this study are age, gender, fever, cough, history of contact with tuberculosis patient, history of measles and whooping cough, immunocompromised/ immunosuppressant, family history of acute respiratory infection, socioeconomic status (lower socioeconomic class defined as having income of Rs. 5000 or less/month, middle class as having income in between Rs. 5001-10,000/month and upper class as having income greater than Rs. 10,001/month), PCM-III, BCG scar, radiological findings, BCG response, CSF findings and culture. Data was collected on a specially designed proforma. MKJSC was applied to each patient. Sensitivity, specificity, positive predictive value and negative predictive value were calculated to find out accuracy of MKJSC. Microsoft Excel and SPSS version 10 were used to analyze data.

RESULTS

Mean age was found to be 45.22±37.87 months. Sixty one (61%) children were male while 39 (39%) were female with male to female ratio of 1.5:1.

Forty seven children were diagnosed as TBM on the basis of history, physical examination and investigations. A score 1-2 (tuberculosis unlikely) was obtained in 23 children, 3-4 score (to be kept under observation) was obtained in 25 children, 5-6 score (tuberculosis probable) was obtained in 30 children and score 7 or more (tuberculosis unquestionable) was obtained in 22 children. Children who had score 5 or more according to MKJSC received ATT and showed marked clinical and radiological improvement.

Out of the 47 children diagnosed as TBM on the basis of CSF findings, MKJSC was suggestive in 44 (93%) children and remaining 3 were not supported by this scoring criteria but there were 6 children in this study in which MKJSC favoured TBM while CSF findings were not suggestive in these children (Table I).

Fifty five children in present study had history of contact with tuberculosis sputum positive adults; 45 (81%) were suggested by MKJSC while remainder 10 (19%) were not suggested by this.

Fifty nine children in present study were vaccinated with BCG; out of those 59, MKJSC indicated TBM in 27 (45%) vaccinated children and remaining 32 (55%) vaccinated children did not have TBM by this criteria. Fifteen children had history of contact with patients of measles and whooping cough within previous 3 months prior to the diagnosis of TBM; 10 (67%) children favoured by MKJSC as TBM while remaining 5 (33%) could not be favoured by this scoring criteria.

Forty six children in present study were belonging to the lower socioeconomic class; 25 (54%) were picked-up by MKJSC, 43 were from middle socioeconomic class; 22 (51%) were identified as TBM and only 11 children belonged to the upper socioeconomic class. Twenty four children had PCM-III; 19 (79%) children suffering

Table I: Modified Kenneth Jones scoring criteria/Pakistan Paediatric Association Scoring chart for diagnosis of TB in children.[10]

Features	1	2	3	4	5	Score
			History			
Age	< 2 years	-	-	-	-	
Contact	With sputum -ve TB patient	-	With sputum +ve TB patient	-	-	
BCG scar	Absent	-	-	-		
History of measles and whooping cough	3-6 months	Within 3 months	-	-	-	
Immunocompromised/ Immunosuppressed	Yes	-	-	-	-	
Pcm III	Yes	-	Not improving	-	-	
			Examination and investigation			
Physical examination	-	Suggestive of TB*	-	Strongly suggestive**	-	
Radiological finding	Non specific***	Strongly suggestive of TB****	-	-	-	
Tuberculin tests/BCG	5-10 mm	-	> 10 mm	-	-	
Granuloma	-	-	-	-	Specific TB	
AFB	-	-	-	-	Positive	

0-2 TB unlikely; 3-4 Keep under observation; 5-6 Tuberculosis probable; Investigations may justify therapy; 7 or more TB unquestionable.

**consolidation not responding to antibiotic therapy; **pleural effusion/gibbus etc; ***ill-defined opacity/bronchovascular marking; ****paratracheal /mediastinal adenitis, miliary mottling.*

from PCM-III were suggested by MKJSC and 5 (21%) children suffering from PCM-III were not suggested by this criteria. Radiological investigations were suggested in 63 children; MKJSC picked-up 47 (75%) children as TBM and remaining 16 children (25%) could not be picked-up by this scoring criteria.

Sensitivity of MKJSC was calculated to be 93.6% with specificity of 88.6%. Positive predictive value and negative predictive value of MKJSC were as 88% and 94% respectively while the accuracy was 91% (Table I).

DISCUSSION

Up-till now sixteen scoring systems have been evolved for rapid detection of tuberculosis in children.[13] Comparison of different scoring systems is difficult because characteristic definitions and the ranking of characteristics are not standardized; only few studies have been performed to validate these diagnostic approaches, and gold standard of diagnosis is not practicable in most settings. Any new diagnostic approaches developed should be relevant to developing countries with limited resources. This scoring criteria had eleven parameters, each were given a score (1-5) depending upon weightage given to it. However, major drawback of most of these scoring criteria is the emphasis placed on investigations as scoring criteria precluding their use in a peripheral setup. It is universally accepted that gold standard for diagnosis of tuberculosis is isolation of M. tuberculosis.[14]

Of various parameters in MKJSC history of contact with a sputum positive adult is of particular importance. In this study, history of sputum positive adult was obtained in 55% of children suffering from TBM. Similar observation had been observed in studies conducted in Karachi, Faisalabad and Argentina.[6,16,17]

Protection against tuberculosis provided by BCG vaccination varies in different studies ranging from 0-80%.[18] Fifty nine percent of children in present study were immunized for tuberculosis with BCG as evidenced by presence of BCG scar. Shah in his study showed that 38% and Vishwanath in his study showed that 91% of children had BCG scar.[14,15,18]

Malnutrition is another important risk factor which depresses immunity thereby, making children more prone to infections. In this present study, 79% of children with tuberculous meningitis were malnourished.[21] Similar findings were observed in a study conducted in Karachi where 60% of children with tuberculosis were malnutrition.[6]

One of the important contributory factors to resurgence of TB is socioeconomic status. This study showed that 54% of children with TBM belonged to lower socioeconomic class, 51% of children were from middle socioeconomic class and only 3 children indicated as TBM by MKJSC belonged to upper class. A similar thing had been found to be by Vishwanath.[15]

Physical and radiological examinations are important factor which help in making a diagnosis of TB in children and in this study all patients with TBM had favourable physical and radiological findings, which showed that radiological examination is helpful in suspected children with TBM. Similar findings were obtained in a study conducted in Karachi.[6] The sensitivity and specificity of MKJSC in this present study had been calculated to be 93.6% and 88.6% respectively. Similar sensitivity i.e. 93% of MKJSC was found by Mathur *et al.* in 1974 in India which coincides with the present finding.[20] Positive predictive value and negative predictive value of this MKJSC in this present study were obtained as 88% and 94% respectively. And finally, accuracy of this criterion is calculated to be 91% in the present study, which is similar to sensitivity i.e. 93% that had been found in a study conducted in Jaipur (India).[20]

These results showed that MKJSC has very favourable points for the applicability in resources limited developing countries like ours for early detection TB in children, especially TB of central nervous system so that global resurgence of this disease can be minimized.

CONCLUSION

For rapid and early diagnosis of TB in children, Modified Kenneth Jones Scoring Criteria is a simple and cost effective tool, which can easily be applied to improve case detection rate in children.

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