Original Article

Diagnostic accuracy of Modified Kenneth Jones Scoring Criteria (MKJSC) in confirmed cases of Tuberculosis in children

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Abstract

Background: Tuberculosis (TB) is a granulomatous disease caused by Mycobacterium tuberculosis. The gold standard for the diagnosis of tuberculosis is detection of Mycobacterium tubercle bacilli. However, clinical scoring systems are most widely used for the diagnosis of TB in children.

Objective: To determine the diagnostic accuracy of modified Kenneth Jones scoring criteria (MKJSC) in conformed cases of tuberculosis.

Methodology: This cross-sectional comparative study was conducted in the department of Paediatrics, King Edward Medical University / Mayo Hospital, Lahore from January to June 2007. One hundred children below 15 years of age were enrolled. They were diagnosed as suspected cases of TB on the basis of fever and cough for more than 15 days. MKJSC was applied and each child was subjected to confirmatory test for TB.

Results: There was an overall male preponderance of 54%. The mean age of study population was 1.8 ± 0.7 years. Out of 100 children, 66% were diagnosed as TB cases (23 with confirmatory tests and 43 with MKJSC of 5 or more). Sensitivity, specificity, positive and negative predictive value of MKJSC was 73.91%, 44.16%, 28.33%, and 85% respectively. Diagnostic accuracy of MKJSC was 51%.

Conclusion: Present study does not support the hypothesis that MKJSC is a good alternative to confirmatory tests to diagnose tuberculosis in children. However, MKJSC is a simple tool, which can be applied to improve the case detection rate in the absence of sophisticated tests.

Key words: BCG vaccination, Children, Diagnosis, Modified Kenneth Jones scoring criteria, MKJSC, Tuberculosis.

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Introduction

Tuberculosis (TB) is a granulomatous disease caused by Mycobacterium tuberculosis. TB occurs in every part of the world. In 2011, the largest number of new TB cases occurred in Asia, accounting for 60% of new cases globally. Unfortunately, Pakistan is among those 22 countries where the incidence of tuberculosis is high.[1]

Diagnosis of tuberculosis among children poses technical and operational challenges. Usually a constellation of clinical features is used to arrive at a diagnosis.[2] The gold standard for tuberculosis is Mycobacterium tubercle bacilli detection in the sputum or other body secretions. In children, there is paucity of organism and they cannot bring up sputum. Clinical scoring systems are at present the most widely used method for arriving at a diagnosis.[3] A number of scoring charts produced by world health organization (WHO) and others are being used in different countries to improve the case detection rate.[4] One such criterion was formulated by Kenneth Jones and his colleagues. It has shown promising results. The original Kenneth Jones scoring chart is further modified based on socio-demographic characteristics of our population.[3] The objective of this study was to determine the diagnostic accuracy of MKJSC in conformed cases of tuberculosis.

Patients and Methods

This cross sectional study was conducted in the department of Paediatrics, King Edward Medical University/ Mayo Hospital, Lahore from January to June 2007. Sample was collected by non probability purposive sampling. After informed consent, total 100 children less than 15 years of age were enrolled for the study. They were diagnosed as the suspected cases of TB based on fever and cough for more than 15 days. Children already on anti-tuberculous treatment were excluded from the study. Detailed history of the children fulfilling inclusion criteria was taken regarding duration of fever and cough, history of measles and whooping cough, history of contact with TB, immunocompromised or immunosuppressants, and vaccination history. Their weight, occiptofrontal circumference, length / height were measured. BCG scar was noticed.

Table 1: Modified Kenneth Jones scoring criteria.

Features	1	2	3	4	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 months	Within 3 months	–	–	
Immunocompromised or Immunosuppressants	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	–	

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

Complete general physical and systemic examination was done.

MKJSC that was further modified (Granuloma and AFB smear excluded as they were taken as confirmatory tests for comparison) was applied on all the children) (Table 1). Hence, by excluding granuloma and AFB, a child having score 5 or more by MKJSC was taken as positive case for tuberculosis. Confirmatory tests like AFB staining, culture, biopsy for granuloma and radiological test (computerized tomography of brain) to see tuberculoma, whichever was relevant in study case were also applied on all children. All the information as required on the scoring proforma was recorded. The data was collected on a specially designed proforma. The basic confirmed data and scoring data was independently entered into SPSS version 11 and analyzed. The outcome of the scoring data was then compared with confirmed cases to calculate sensitivity, specificity, and predictive values.

Results

Total study population was 100 children of suspected TB. There was male preponderance (54%). Mean age was 1.8 ± 0.7years (Table 2). Confirmatory tests (AFB staining, culture, tuberculoma, and granuloma) were positive in 23 (34.8%) cases out of 66 TB cases and none in non-TB cases. MKJSC of all the cases is shown in Table 3. Sensitivity, specificity, positive and negative predictive value of MKJSC was 73.91%, 44.16%, 28.33%, and 85% respectively. Diagnostic accuracy of MKJSC was 51% (Table 4).

Table 2: Age and Gender Distribution (n = 100).

Variable	Group A n (%)
Age (in Years)	
< 1 – 5	36 (36)
5 – < 10	48 (48)
10 – 15	16 (16)
Sex	
Male	54 (54)
Female	46 (46)

Table 3: Modified Kenneth Jones Score of Cases (n = 100).

KJ Score	0 – 2	3 – 4	5 – 6	> 7	Total
Confirmed TB cases	0	6	5	12	23
Non-confirmed TB cases	0	0	8	35	43
Non-TB cases	16	18	0	0	34
Total	16	24	13	47	100

Table 4: Diagnostic Accuracy of Modified Kenneth Jones Scoring Criteria (n = 100).

	Confirmatory Tests Positive	Confirmatory Tests Negative	Total
KJ Criteria Positive*	17	43	60
KJ Criteria Negative	6	34	40
Total	23	77	100

(*By excluding granuloma and AFB, a child having score 5 or more by MKJSC was taken as positive case for tuberculosis)

Sensitivity = 73.91%
Specificity = 44.16%
Positive predictive value = 28.33%
Negative predictive value = 85%
Diagnostic accuracy = 51%

Discussion

Tuberculosis is a curable disease. Clinical scoring systems are at present the most widely used method for arriving at a diagnosis in children.[3] MKJSC is one of them which are now recommended by Pakistan Pediatric Association in Pakistan for screening purpose to detect tuberculosis in children.[5]

The present study had overall male preponderance (54%) which was in accordance with the study by Syed et al,[6] Anwar et al,[7] and Borgdorff et al.[8] In the

present study population, 34% children were from 1 – < 5 years and 48% were from 5 – < 10 years which was in accordance with the study by Bai et al.[9] This was in accordance with epidemiological data available.

Examination and radiological findings suggestive of TB were found in 34.8% and 53% TB children respectively. This was in accordance with study by Anwar et al[7] and Marais et al[10] which showed that in endemic areas, the diagnosis of childhood tuberculosis rested predominantly on the subjective interpretation of the X-rays. High index of suspicion was essential and combination of physical findings supported by laboratory and radiological investigations were more useful than using as isolated parameter for diagnosing tuberculosis in children. Confirmatory tests were positive in 23 (34.8%) cases out of 66 TB cases and none in non-TB cases. Study by Marais et al[10] also showed that bacteriologic yield was low.

In present study, sensitivity, specificity, positive and negative predictive value of MKJSC was 73.91%, 44.16%, 28.33%, and 85% respectively. Diagnostic accuracy of MKJSC was 51%. Sensitivity of MKJ was 93% found by Mathur et al[11] in India. Study by Sant' Anna et al[12] mentioned that the diagnostic scoring systems for TB in childhood showed great diversity of sensitivity and specificity. This may be due to the variety of presentations of TB, depending on its prevalence in the different regions of the world. Similarly, Syed et al[6] and Anwar et al[7] found MKJSC as simple and effective tool to diagnose TB in children.

This study had certain limitations. This study was based on clinical – radiological and epidemiological data to diagnose TB in childhood. The scoring criterion needs to be tested on a wider scale to assess its usefulness.

Conclusion

Present study does not support the hypothesis that MKJSC is a good alternative to confirmatory tests to diagnose tuberculosis in children. However, it concludes that it is a simple tool, which can be applied to improve the case detection rate in the absence of sophisticated tests.

References

1. World Health Organization. Tuberculosis 2013. Available from: http://www.who.int/mediacentre/factsheets/fs104/en/index.html.
2. Fasih Z, Hussain E, Ali Z, Hussain S. Predictive features of pulmonary tuberculosis in children and use of polymerase chain reaction for improved early diagnosis of pulmonary tuberculosis in children. Pak Paed J 2004; 28: 7-14.
3. Mehnaz A, Arif F. Applicability of scoring chart in the early detection of tuberculosis in children. J Coll Physicians Surg Pak 2005; 15: 543-7.
4. Mehnaz A. Tuberculosis in Children. Journal of Pakistan Medical Association 2006; 56: 390-91.
5. National guidelines for diagnosis and management in Children, National TB control Programme, Ministry of health, and Government of Pakistan in collaboration with Pakistan Paediatric Association. 1st ed. Feb. 2006.
6. Syed SSM, Basit AK, Mohammad S, Ghumman MZI, Sattar A, Islam A, et al. Screening of childhood tuberculosis with Pakistan pediatric association scoring chart system. Pak Ped J 2012; 36: 220-4.
7. Anwar M, Ahmed A, Ahmad F, Mazhar A. Modified Kenneth Jones criteria for diagnosing tuberculous meningitis in children. J Coll Physicians Surg Pak 2010; 20: 258-61.
8. Borgdorff MW, Nagelkerke NJD, Dye C, Nunn P. Gender and tuberculosis: a comparison of prevalence surveys with notification data to explore sex differences in case detection. 2000; 4: 123-32.
9. Bai SS, Devi RL. Clinical spectrum of TB in BCG vaccinated children. Indian Pediatrics 2002; 39: 458-62.
42. Marais BJ, Gie RP, Anneke C, Hesseling AC, Schaaf HS, Lombard C, et al. A refined symptom based approach to diagnose pulmonary tuberculosis in children. Pediatrics 2006; 118: 1350-59.
11. Mathur HC, Saxena S, Bhardwaj RM. Evaluation of Kenneth Jones criteria for diagnosis of childhood tuberculosis. Indian Journal of Pediatrics 1974; 41: 349-355.
12. Sant'Anna CC, Santos IA, Franco S. Diagnosis of pulmonary tuberculosis by score system in children and adolescents: A trial in a reference center in Bahia, Brazil. Braz J Infect Dis 2004; 8: 305-10.