Validity of Modified Kenneth-Jones’ criteria in diagnosing tuberculosis in severely malnourished children presenting with pneumonia

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Background

Tuberculosis is common in children with severe acute malnutrition (SAM) presenting with pneumonia; however, it’s diagnosis is very difficult due to subtle clinical signs of TB in such population. Scoring system such as modified Kenneth Jones criteria (MKJC) that uses both clinical and simple laboratory data to assess the likelihood of tuberculosis in children might have greater value, especially in resource poor settings. However, there is limited information on the usefulness of MKJC scoring in the diagnosis of TB in severely malnourished children.

Objective

To validate MKJC score compared to culture and Xpert MTB/RIF in the diagnosis of TB in severely malnourished pneumonic children.

Methodology

In this prospective study, we enrolled under-five SAM children with radiological pneumonia after obtaining signed informed consent from respective care givers. We collected sputum (induced sputum and gastric lavage fluid) for microscopy (AFB), mycobacterial culture, and real-time PCR by Xpert MTB/RIF. Using culture and Xpert MTB/RIF as the reference, we compared the sensitivity and specificity, positive and negative predictive values, and the accuracy of MKJC score in diagnosing TB in this population. MKJC score is shown in first Table .

Approval: Approved by the Institutional Review Board of icddr,b.

Statistical Methods

Pre-tested CRFs were used for data recording. CRFs were manually verified for completeness and errors, edited where necessary, and then data entered onto a personal computer. Data were analyzed using SPSS for Windows version 20.0 and Epi software version 7.0..

All data were entered onto a personal computer (PC) using SPSS for Windows (version 17.0; SPSS Inc, Chicago) and Epi-Info (version 6.0, USD, Stone Mountain, GA). We calculated the sensitivity and specificity, positive and negative predictive values, and accuracy of MKJC score comparing mycobacterial culture, and/or Xpert MTB/RIF.

Enrolled children in the study

We performed MKJC scoring for 388 children, and all of them had microscopy for AFB and mycobacterial culture on induced sputum and gastric lavage fluid but real-time PCR by Xpert MTB/RIF for the last 214 children. The median (inter quartile) age of the study children was 10 (5, 16) months.

Twenty-seven (6.8%) children had microbiologically confirmed TB: by culture in 10, by X-pert MTB/RIF in 21 and by both in 4, thus by culture and/or by X-pert MTB/RIF in 27 cases.

Using the MKJC score TB was diagnosed in 68/388 (18%) children . Only in 8 children TB was diagnosed by both the MKJC scores and the reference methods.

The sensitivity, specificity, PPV, NPV and diagnostic accuracy of MKJC score in comparison with the culture and Xpert MTB/RIF confirmed TB are shown in last Table of summary results.

Modified Kenneth-Jones' criteria score for the diagnosis of childhood tuberculosis

Score +3	Score +2	Score +1	Score -1
AFB from sputum, gastric aspirate, laryngeal swab	X-ray chest suggestive of para-hilar lymphadenopathy	Nonspecific chest X-ray changes	BCG vaccination in the last 2 years
Tuberculous granuloma, Granulomatous lesions in lymph node biopsy or choroid tubercles on fundoscopy	Suggestive physical findings: pleurisy, osteomyelitis, Pott's spine	Compatible physical findings: Erythema nodosum, meningitis, cervical lymphadenitis, arthritis, hemoptysis, etc.	
Positive tuberculin skin test induration >10 mm (≥ 5 mm for SAM)	Doubtful TST (5-9 mm)	History of contact with a patient suffering from TB	
	Recent TST conversion from negative to positive	Nonspecific granuloma	
	Contact with sputum smear-positive patient	Age below 2 years	
		Non-response to therapy	
		Severe malnutrition	

According to this scoring system, 7 or more points indicate unquestionable TB; 5-6 points indicate probable TB, therapy may be justified; 3-4 points indicate that further investigations are needed; For our study we treated all the children whose score ≥5

Validity of MKJC score for the diagnosis of TB in severely malnourished children also having pneumonia

Parameter	Compared to culture positive MTB					Compared to culture and/or Gene X-pert positive TB				
	Sensitivity (95% CI) (%)	Specificity (95% CI) (%)	PPV (95% CI) (%)	NPV (95% CI) (%)	Accuracy	Sensitivity (95% CI) (%)	Specificity (95% CI) (%)	PPV (95% CI) (%)	NPV (95% CI) (%)	Accuracy
MKJC positive	60 (27-86)	84 (79-87)	9 (4-19)	99 (97-100)	83%	37 (20-58)	84 (79-87)	15 (8-26)	95 (91-97)	79%

Conclusions

Our data suggest that diagnosis of TB in SAM children with radiologic pneumonia using MKJC scoring is less sensitive but may minimize the chance of over treatment with anti-TB therapy especially in resource limited settings. However, whenever possible diagnosis of childhood TB should be confirmed by X-pert MTB/RIF or culture in further minimizing the 16% chance of over treatment of TB by using the MKJC score in such population.