Original Research Article

A study on validity of reading Mantoux test at 24 hours

Soundaiyan Balasankar, Jeyaraman Balasubramanian*

Department of Pediatrics, Institute of Child Health and Research Centre, Government Rajaji Hospital, Madurai Medical College, Madurai, Tamil Nadu, India

Received: 08 May 2017

Accepted: 29 May 2017

*Correspondence:

Dr. Jeyaraman Balasubramanian,
E-mail: drbaladch@yahoo.co.in

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Tuberculosis (TB) is a chronic infectious disease caused by mycobacterium tuberculosis and one of the major disease affecting children throughout the world. Prevalence of active disease in adults in India is 18 per 1000 population. The aim of the current study was to see whether reading Mantoux test at 24 hours can predict Mantoux positivity at 48 hours.

Methods: A Prospective observational study was conducted in Tertiary care hospital which caters for people in and around Madurai, Tamil Nadu, India. Total 6560 children in the age group of 6 months to 12 years with suspicion of Tuberculosis. (Positive contact history or Low weight for age or persistent fever for more than 2 weeks or cough for more than two weeks or significant lymphadenopathy) were given Mantoux test. Of these 5904 (90%) children turned up for 24 hours and 48 hours reading. Transverse diameter of the induration was measured. More than 10mm was considered as Mantoux positivity. The size of induration at 24 hours and 48 hours were compared.

Results: Out of 5904 children, 206 (3.48%) children had Mantoux positivity at 48 hours. Of these 206 children, 131 (63.6%) children had more than 10 mm at 24 hours. Remaining 75 (36.4) showed less than 10 mm at 24 hours, but become more than >10 mm at 48 hours. Overall tuberculin positivity is 3.5%.

Conclusions: Positivity of tuberculin test must be confirmed at 48 hours only. There is no standard reading at 24 hours which can be presumed to become positive at 48 hours.

Keywords: Childhood tuberculosis, Mantoux test, Purified protein derivative

INTRODUCTION

Tuberculosis (TB) is a chronic infectious disease caused by mycobacterium tuberculosis and one of the major disease affecting children throughout the world. Prevalence of active disease in adults in India is 18 per 1000 population.¹ In children, the clinical features are vague and non-specific. Symptoms include low grade fever for >2 weeks, loss of appetite, poor weight gain, recent weight loss, night sweats, dry cough of >2 weeks, significant lymphadenopathy. About 25-35% have an extra pulmonary presentation. Ratio of pulmonary to extra pulmonary TB is 3:1.²

Diagnosis of TB is still a tough task in children. Tuberculin skin test (Mantoux test) using Tuberculin-PPD RT23 still plays a major role especially in children.

Conventionally Mantoux reading is done at 48-72 hours only. Some patients may find it difficult to come back after 2 days and may be willing to come back the next day. A few patients may not turn up to the physician once the symptoms for which they seek medical advice resolves.

Thus a few Mantoux tests go unread. Reading Mantoux at 24 hours itself can bring down this dropout rate. With

these aspects in mind, this study was done with an aim to find out whether reading Mantoux at 24 hours can predict positivity at 48 hours.

METHODS

This prospective observational study was conducted in the Institute of Child Health and Research Centre, Government Rajaji Hospital, Madurai, Tamil Nadu, India after obtaining informed consent from the care givers. The study enrolled 6560 children between 6 months to 12 years age group with any of the following features.

- Positive contact history
- Low weight for age (<80% of expected/recent weight loss of 10%)
- Persistent fever for >2 weeks
- Persistent cough for >2 weeks
- Significant lymphadenopathy

Children with recent vaccination, recent viral illness, prior Mantoux positivity were excluded.

SPAN's tuberculin PPD (Code NO: 18411) was used in current study. It is a diluted and ready to use solution for performing Mantoux test. Source material is calibrated against batch RT23 manufactured by Statens Serum Institute, Denmark. It is diluted with a buffer containing Tween-80 as a stabilizer.

All children were given 0.1 ml of 1TU PPD intradermally over the mid-volar aspect of left forearm using tuberculin syringe after cleansing the area with spirit. Plastic disposable Tuberculin syringe with 27-gauge needle was used.³ The skin of the arm is lightly stretched lengthwise and the pointer of the needle is inserted lengthwise, with bevel upward, intradermally. After injection, appearance of a pale wheal of 6-10 mm was taken as correct intradermal administration. Care givers and children were educated not to wipe/scrub/massage/apply cream over the test site. They were specially advised about the importance of reporting at 24 hours and 48 hours for reading the test. 24 hours and at 48 hours readings were taken in all cases that turned-up for reading. Transverse diameter of the induration was palpated and marked by Ball point pen technique (sokal method) and measured with a transparent ruler in mm by the same observer in all cases.⁴

Data was collected on pretested proforma with clinical details.

RESULTS

Baseline data

6560 children with clinical suspicion of tuberculosis were given Mantoux test. Among them, 5904 cases (90%) turned up for reading at 24 hours and 48 hours. In 206

cases (3.48%) reading was more than 10 mm at 48 hours and were considered Mantoux positive.

Table 1: Age distribution of 206 positive cases.

Age group	Cases	
	No.	%
<1 year	9	4.4
1-5 years	90	43.7
5-10 years	82	39.8
>10 years	25	12.1
Total	206	100
Range	11 months – 12 years	
Mean	6.1 years	
S.D.	3.2 years	

Table 2: Induration values at various time intervals for 206 positive cases.

Induration (mm)	Time interval (hours)			
	24		48	
	No.	%	No.	%
0	5	2.4	-	-
1-4	6	2.9	-	-
5-9	64	31.1	-	-
10 and above	131	63.6	206	100
Total	206	100	206	100
Range	0-30		0-40	
Mean	11.53		16.61	
SD	5.11		3.85	
p	0.0001 (significant)			

This Table shows age wise distribution of patients. Among the 206 positive cases, 131 cases (63.6%) had induration >10 mm at 24 hours, 64 cases (31.1%) were between 5-9 mm at 24 hours, 6 cases (2.9%) were between 1-4 mm and only 5 cases (2.4%) had no induration at 24 hours.

Table 3: Comparison of results at 24 hours with results at 48 hours for all cases.

48 hours induration	24 hours induration	
	≥10 mm	<10 mm
≥10 mm	131	75
<10 mm	0	5698
True positive	131	
False positive	Nil	
True negative	5698	
False negative	75	
Sensitivity	63.5%	
Specificity	100%	
Positive predictive value	100%	
Negative predictive value	98.7 %	

On comparing 24 hours reading to 48 hours reading, it was observed that sensitivity was 63.5%, specificity and PPV was 100% and NPV was 98.7%.

Among the 5904 cases, 131 cases had >10 mm at 24 hours compared to 206 cases at 48 hours 634 cases were

Table 4: Induration values for all cases at various time intervals.

Induration (mm)	Time interval (hours)			
	24		48	
	No.	%	No.	%
0-4	5139	87.0	5203	88.1
5-9	765	10.8	701	8.4
10 and above	131	2.2	206	3.5
Total	5904	100	5904	100
Range	0-30		0-40	
Mean	2.37		2.39	
SD	2.89		3.39	
p	0.0014 (significant)			

between 5-9 mm at 24 hours compared to 495 cases at 48 hours. 5139 cases were between 0-4 mm at 24 hours compared to 5203 cases at 48 hours. So, if Mantoux is positive by >10 mm at 24 hours, it remains as positive (>10mm) at 48 hours also. But, Mantoux readings between 5-9 mm at 24 hours, does not show any relation to Mantoux positivity at 48 hours. It shows if the induration is <5 mm at 24 hours, it is less likely to become positive (>10 mm) after 48 hours.

DISCUSSION

The tuberculin skin test has been the traditional method of diagnosing infection with mycobacterium tuberculosis. The decision to select one test over the other depends upon the population to be tested, purpose of testing and resource availability. The skin test only measures the degree of hypersensitivity and not immunity to tuberculosis. The larger the reaction, greater is the probability that the responsible organism is *M. tuberculosis*. Tuberculin skin test is useful in the evaluation of children suspected of having tuberculosis that a significant reaction supports the diagnosis.

The health-care provider should inform the patient of the need to return for the reading of the test. Self-reading of the test has been shown to be unreliable as said by APIC guidelines committee about the responsibility for reading the tuberculin skin test.⁵ In our study, among the 6560 cases, 5904 cases (90%) only turned for reading at both 24 hours and 48 hours and are only analysed further.

In a review by Udani et al tuberculin testing using 1TU RT23 was positive in 52.3% (range 19.3-73.3%) of children with tuberculosis.⁶ In present study, the positivity of the tuberculin skin test is 3.48% among

children with symptoms suggestive of tuberculosis infection.

In a study at Pondicherry among healthy school children, 18.4% were found to be tuberculin positive.⁷ In India, the overall prevalence of tuberculin reactivity in adults is about 30%; males 35% and females 25% as shown in the survey conducted by the National Tuberculosis Institute, Bangalore.⁸ In our study among the 206 positive cases, 105 cases (51%) are male and 101 (49%) are female. There is no significant difference in Mantoux positivity based on sex of the children.

In a study by Oztwik to evaluate the predictive value of a 24 hours induration, the mean (SD) size of the induration at 24 hours was less than that of the induration present at 48 and 72 hours.⁹ Differences were statistically significant ($p < 0.001$). There was no difference between 48 and 72 hours reading ($p > 0.5$).

In present study, the mean size of induration at 24 hours (11.53) was less than that of induration present at 48 hours (16.61) with a significant p value ($P = 0.0001$). The difference was significant especially when the induration at 24 hours was between 0-9 mm and there is little difference when the induration was more than 10 mm at 24 hours. In a study at Pondicherry among healthy school children, the positive and negative predictive value for induration >10 mm at 24 hours was estimated at 96.7 and 99.5% respectively.⁷ Even in children who had a reaction of 0-9 mm at 24 hours, the tendency to remain negative was very high as indicated by the positive and negative predictive values of 98.5% and 96.7% respectively.

In a study by Oztwik to evaluate the predictive value of a 24 hour induration, any induration 24 hours after placement of the tuberculin test had a sensitivity of 94% and a specificity of 75%.⁹ At 24 hours, induration of any size had a relatively low positive predictive value (63%), although induration >5 mm had a higher (86%) positive predictive value and also demonstrated that it will not always be possible to tell whether any induration (>5 mm) will develop into a positive test but if there is no induration especially in children, it is highly possible (98%) that the tuberculin test will be negative.

In present study, it is found that on comparing 24 hours reading to 48 hours Mantoux reading it was observed that sensitivity was 63.5, specificity and PPV was 100 and NPV was 98.7%. There is no. of false positivity and the percentage of false negative is 75. If the induration is <5 mm at 24 hours, it is unlikely to become positive (>10 mm) at 48 hours.

CONCLUSION

Tuberculin positivity is 3.5% in this study among children with symptoms suggestive of tuberculosis. 63.6% of Mantoux positive cases at 48 hours had >10 mm induration at 24 hours itself. Only 2.4% of cases had

no induration at 24 hours. Validity of reading Mantoux at 24 hours instead of 48 hours have high specificity and PPV but low in sensitivity. Induration of >10 mm at 24 hours will remain positive at 48 hours but <10 mm at 24 hours has to be verified at 48 hours. There is no cut off value at 24 hours, that will suggest positivity (>10 mm) at 48 hours.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee of Government Rajaji Hospital, Madurai, Tamil Nadu, India

REFERENCES

1. Udani PM, Parthasarathy A. Tuberculosis in children. In: Parthasarathy A, Nair MKC, Menon PSN, eds. IAP Textbook of paediatrics. 3rd ed. New delhi:Jaypee publishers;2006:206-20.
2. Chauhan LS, Arora VK. Management of pediatric Tuberculosis under the revised National Tuberculosis Control Programme. Indian J Pediatr. 2004;71:341-3.
3. World Health Organisation: The WHO standard tuberculin test, WHO/TB/Tech. Guide/3; 1963.
4. Pouchot J, Grasland A, Collet C, Coste J, Esdaile JM, Vinceneux P. Reliability of tuberculin skin test measurement. Ann Intern Med. 1997;126:210-21.
5. APIC Guidelines Committee. APIC position paper: responsibility for interpretation of the PPD tuberculin skin test. Am J Infect Control. 1999;27:56-8.
6. Udani PM. Evaluation of tuberculin test in pediatric practice. Indian Pediatr. 1982;19:469-86.
7. Serane VT, Nalini P, Mahadevan S. Predictive value of tuberculin induration at 24 h in healthy schoolchildren. J tropical pediatrics. 2002;48(1):29-32.
8. National Tuberculosis Institute, Bangalore. Bull WHO. 1974;51:473-487.
9. Oztwik P, Eskiocak M, Bay A, Sancak R, Dabak S, Gnrses N. Predictive value of a 24-hour tuberculin skin test evaluation. Arch Dfs Child. 1997;76:452-3.

Cite this article as: Balasankar S, Balasubramanian J. A study on validity of reading Mantoux test at 24 hours. Int J Contemp Pediatr 2017;4:1236-9.