MEDICAL PRACTICE

*Clinical Topics***Assessment of tine tuberculin test**

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British Medical Journal, 1979, 1, 1325-1326**Summary and conclusions**

Mantoux (10 tuberculin units) and tine tuberculin tests were performed in 190 subjects and the results recorded at 48, 72, and 96 hours. Altogether 1010 readings were recorded. Of these, 555 (55%) were Mantoux-test positive and 525 (52%) tine-test positive.

While the tine test is marginally less sensitive, its advantages are simplicity and ease and speed of application. It thus provides a useful screening test for eliciting tuberculin sensitivity.

Introduction

Since the tine test has not yet been examined in a large co-ordinated trial similar to that for the Heaf test,¹ it must be viewed critically. Lunn and Johnson² reported on the poor specificity of the tine disc tuberculin test when compared with the Mantoux test, but this is contrary to our own clinical experience. We report the results of a further study comparing tuberculin sensitivity using the tine disc and Mantoux tests.

Patients and methods

Altogether 190 subjects were selected for study. They comprised 58 student nurses; 74 young men who were contacts of a patient with

pulmonary tuberculosis; and 58 hospital inpatients, including 13 receiving treatment for tuberculosis.

The Mantoux test was applied to the volar aspect of one arm; 0.1 ml of a solution containing 10 tuberculin units (TU) of purified protein derivative was injected intradermally. The tine test was applied to the other arm according to the manufacturer's instructions but firm skin application was ensured for at least two seconds. Six different batches of tine discs were used to exclude any batch variability. The tests were applied by three members of the medical staff, all experienced in the use of these techniques. The Mantoux test result was read by two independent observers at 48 or 72 hours after application. In subjects whose Mantoux test result was read at 48 hours the result of the tine test was also read independently by two observers at 48 hours and again by two observers independently at 96 hours after application. In subjects whose Mantoux test result was read at 72 hours the result of the tine test was similarly read by two observers at that time only. Each reader recorded the result of the tine test before that of the Mantoux test. This order was maintained throughout to avoid bias.

For the Mantoux test the transverse and longitudinal diameters of the area of palpable induration were recorded in millimetres; for the tine test the diameter of the largest indurated papule was recorded in millimetres, or, where the papules were fused, the transverse diameter of palpable induration was measured in millimetres. At the same time the tine test was graded from 0 to 4 (0, no reaction; 1, one or more papules with definite induration; 2, coalescence of papules to form a ring; 3, filling in of papules to form a weal 5-10 mm in diameter; and 4, a weal of greater than 10 mm diameter or vesiculation). This additional assessment was made because it followed the original method of recording results of Heaf tuberculin skin tests.³

Readings of the Mantoux test were classified as negative (0-4 mm) and positive (≥ 5 mm); those of the tine test were classified as negative (0-1 mm), positive (2-4 mm), and strongly positive (≥ 5 mm).

Results

All subjects except one had duplicate readings by two independent observers of both the Mantoux and tine test results at either 48 or 72 hours. Most of those who had readings taken at 48 hours had repeat readings at 96 hours. For the 190 subjects studied we had 379 readings of the Mantoux test and 631 readings of the tine test—that is, a total of 1010 readings.

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Of the total readings, 555 (55% $\pm$ SE 3%) were Mantoux-test positive (≥ 5 mm), while 242 (24% $\pm$ SE 3%) of the tine-test readings were strongly positive (≥ 5 mm) (table I). When the positive category of the tine test was included with the strongly positive readings, however, this increased to 525 (52% $\pm$ SE 3%). Of the 555 Mantoux-test-positive readings, 73 (13.2% $\pm$ SE 3%) were associated with negative tine-test readings, but when these negative tine-test readings were compared with the 454 strongly positive Mantoux-test readings (≥ 10 mm) this was reduced to 27 (5.9%). Out of a total of 455 Mantoux-test-negative readings, 43 were associated with positive tine-test readings (9.5%), but only two were strongly positive (table I).

In table II tine grades are compared with Mantoux readings. To calculate agreement grade 2 was included with grades 3 and 4. While there was a good measure of agreement (70%), we were concerned at the considerable proportion of negative Mantoux-test readings associated with doubtful-positive (grade 1) tine-test readings (112/451; 25%). On the other hand, 142 out of 440 strongly positive Mantoux-test readings (32%) were associated with doubtful-positive tine-test readings. In all, 341 (34%) tine-test readings were doubtful-positive. The difficulty in assessing grade 1 tine-test readings makes such a comparison of limited value.

We examined inter-reader agreement for Mantoux and tine-test measurements and found close agreement (93% and 84% respectively). Because reactions to multipuncture tuberculin skin tests are known to persist longer we compared readings at 48 and 96 hours in 128 subjects (table III). The number of positive (2-4 mm) readings increased slightly at 96 hours, but overall no significant difference between readings and no advantage for the late readings emerged. Six different batches of tine discs were used in this study. We compared the results obtained with each of these batches and found no significant differences.

TABLE I—Combined readings of Mantoux and tine tests at 48, 72, and 96 hours. Percentages given in parentheses

Mantoux-test reading	Tine-test reading			Total
	Negative (0-1 mm)	Positive (2-4 mm)	Strongly positive (≥ 5 mm)	
Negative (0-4 mm)	412 (40.8)	41 (4.1)	2 (0.2)	455 (45.1)
Positive (5-9 mm)	46 (4.5)	47 (4.6)	8 (0.8)	101 (10)
Strongly positive (≥ 10 mm)	27 (2.7)	195 (19.3)	232 (23)	454 (45)
Total	485 (48)	283 (28)	242 (24)	1010 (100)

TABLE II—Combined readings of Mantoux tests and tine grades at 48, 72, and 96 hours. Percentages given in parentheses

Mantoux-test reading	Tine grade*				Total
	0	1	2	3 and 4	
Negative (0-4 mm)	337 (33.4)	112 (11.1)	2 (0.2)	0	451 (44.7)
Positive (5-9 mm)	16 (1.6)	87 (8.6)	12 (1.2)	4 (0.4)	119 (11.8)
Strongly positive (≥ 10 mm)	14 (1.4)	142 (14.1)	136 (13.4)	148 (14.6)	440 (43.5)
Total	367 (36.4)	341 (33.8)	150 (14.8)	152 (15.0)	1010 (100)

*Tine grades: 0, no reaction; 1, one or more papules with definite induration; 2, coalescence of papules to form a ring; 3, filling in of papules to form 5-10 mm diameter weal; 4, weal of ≥ 10 mm or vesiculation. Agreement: 337 + 87 + 284 = 708 (70%).

TABLE III—Comparison of tine-test readings at 48 and 96 hours. Figures in parentheses are proportions of total number of readings in 128 subjects (n = 512)

At 96 hours	At 48 hours		
	0-1 mm	2-4 mm	≥ 5 mm
0-1 mm	220 (43)	16 (3.1)	0
2-4 mm	46 (9)	82 (16)	24 (4.7)
≥ 5 mm	0	14 (2.7)	110 (21.5)

Discussion

Our findings show close agreement between the positive results of both tine and Mantoux tests (87%), and thus support our clinical experience. Nevertheless, they are at variance with those recently reported by Lunn and Johnson,² who found only 31.9% agreement between positive tine and Mantoux test results. Three large series,¹⁻³ in which over 3000 subjects were studied, have been reported and are summarised in table IV.

TABLE IV—Comparison of agreement between positive results of tine and Mantoux tests in previous studies

Series	Number of subjects	Strength of Mantoux test (TU)	% agreement between positive results
Rosenthal ¹	710	10	88
Capobres <i>et al</i> ²	1322	5	97
Badger <i>et al</i> ³	976	5	95

TU = Tuberculin units.

These all emphasise an excellent degree of agreement between positive results of both tests.

We chose to adhere to the conventional strength (10 TU) for our Mantoux tests. Since the size of the Mantoux reaction is related to the log of the dose, the differences in Mantoux readings between 5 TU and 10 TU are negligible. We do not agree with the recommendation that 2-4 mm of induration in the tine test is a "doubtful reaction" and that only 5 mm or more of induration is a positive reaction. If these recommendations were accepted then 195 readings (43% of those with strongly positive Mantoux test results) would be disregarded. This is clearly not acceptable. We consider that the 2-4 mm category of induration is important and must be considered as positive. This agrees with the study of Badger *et al*,⁶ in which they drew attention to the good correlation between Mantoux-test readings of 6 mm or more and tine-test readings of 2 mm, while negative Mantoux readings correlated well with tine-test readings of less than 2 mm.

The use of clinical grades of the tine test has no advantage and measuring the size of the papules gives better results. Delaying readings to 96 hours has no appreciable advantage. Badger *et al*⁶ examined the results of readings at 2-7 days and found those at 72 hours to be optimal. The manufacturer of the tine test recommends that the disc should be applied to the forearm for one second. We ensured firm application for at least two seconds, and think that attention to the technique of application is an important factor in obtaining consistent and reliable results.

In summary, we believe that the tine tuberculin test is a useful screening procedure and is valuable, firstly, when time is limited and many patients have to be examined and, secondly, for the occasional screening test, especially in primary care practice. We agree that the Mantoux test remains the most suitable for use in hospital practice.

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