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Reliability and Comparison of Tuberculin Skin Test

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ABSTRACT

***Background**: To search the reliability of palpation technique in measuring tuberculin skin test and to compare the palpation technique with the ballpoint-pen technique.*

***Materials and Methods**:*

Setting: A dormitory for high school students.

Participants: A total of 230 students were analyzed in this study; all of them were male and their ages ranged between 16 to 18 years.

Measurements: All students were tested using 0.1 ml of purified protein derivative (PPD) containing 5TU (tuberculin unit) via the Mantoux method. Readings of tuberculin skin tests were done 72 hours later. Three readers measured the tuberculin skin test by palpation technique and another read it by ballpoint-pen technique, for each student.

***Results:** With the palpation technique, Confidence Interval (CI) was 95% (0.56-0.76), and kappa coefficient was 0.62. According to these results, there was good reliability between the three observers who made the measurements by palpation technique. Between the measurements that were made by palpation and ballpoint-pen technique, interclass correlation coefficients were found 0.94, and there was good correlation between the two techniques.*

Conclusion**: We conclude that when the two methods were performed by experienced observers, the reliability of results were similar. **(Tanaffos 2003; 2(8): 49-53)

***Key words**: Tuberculin Skin Test (TST), Purified protein derivative (PPD), Ballpoint- pen technique, Palpation technique*

INTRODUCTION

The usual method of tuberculin reaction size measurement is palpation. Unfortunately, even skilled examiners may have considerable difficulty in identifying or measuring induration by this method. It was noted that measurement results of skin tests by ballpoint-pen technique is more reliable than other techniques (1).

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In our study we searched the reliability of palpation technique in measuring tuberculin skin test (TST) and compared the palpation technique with the ballpoint-pen technique.

MATHERIALS AND METHODS

In our study 230 TST were performed in a student group, using 0.1 ml of purified protein derivative (PPD) containing 5TU (tuberculin unit) via the Mantoux method. The mean age of the students was

16.73±1.12 (16-18), and all of them were male. Readings of TSTs were done by the palpation and the ballpoint-pen technique 72 hours later. In the ballpoint-pen technique, a ballpoint-pen is used to draw a line starting 1 to 2cm away from the skin reaction and moving toward its center. When the pen reaches the margin of the induration, an increased resistance to further movement, is felt and the pen is lifted. The procedure is repeated on the opposite side of the skin reaction. The distance between the ends of the opposing lines at the margins of the induration is measured. In the palpation technique, the induration is palpated and the margins are marked with a pen. In both of the techniques, the diameter of induration was measured transversely to the long axis of the forearm with a ruler and recorded in millimeters (2). Three readers measured the TST by palpation technique (Observer 1-2-3), and another read it by ballpoint-pen technique (Observer 4) for each student. Pen marks of the reader were erased with alcohol, and then the next measurement process was repeated. The observers had no information about the previous measurements. The experienced observers of our study were physicians trained in chest diseases for at least two years. They performed and read at least 400 TSTs during this period.

The results of the readers who used palpation method were compared with each other. Furthermore we compared the ball-point method with the palpation method. One reader (Observer 1) was selected from the three observers that had used the palpation method.

The observer who was selected from the observers that used the palpation method was preferred because she had equal experience with the observer who used the ball-point method. Both were researchers in our training and research hospital for four years.

For statistical analysis; programs of SPSS for Windows 10.05 and Unistat 5.0 were utilized. Kappa test (inter-category variation) was used to evaluate the results of the readers who had used the palpation method. ICC (Interclass Correlation Coefficient) was used to compare the results of the ballpoint method and palpation method.

RESULTS

A total of 230 TST measurements were enrolled in the study. The mean value of the measurements was 7.03±7.22 mm, and the measurements ranged between 0-23 mm. The results of the three observers, who had made measurements by palpation technique, were evaluated below statistically: in the range of 0-9 mm, kappa coefficient was 0.71; in the range of 9-14 mm, kappa coefficient was 0.51; and for the readings of 15 mm and over, kappa coefficient was 0.63. The measurements of the three readers were reliable with each other (kappa coefficient 'total' was 0.62, CI 95%, 0.56-0.75). Plot of measurements of induration of tuberculin reactors by the palpation method among three observers are shown in Figure 1.

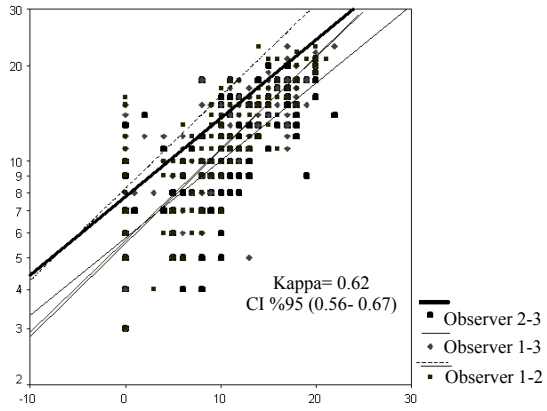

Figure 1. Plot of mesurements of induration of tuberculin reactors by the palpation method between three observers

To compare the ballpoint method with the palpation method, one reader was selected from the three observers who used the palpation method. With the palpation method, measurements for 68 of the 230 (29%) students were reported as zero, 11 of them (0.4%) were between 1 and 4 mm, 33 (14%) of them were between 5 and 9 mm, 68 (29%) of them between 10 and 14 mm, and 50 (21%) of them were reported as over 15 mm. Similarly with the ballpoint-

pen technique, measurements for 61 of the 230 (26%) students were reported as zero, 31 of them (13%) were between 1 and 4 mm, 46 (20%) of them were between 5 and 9 mm, 44 (19%) of them were between 10 and 14 mm, and 48 (20%) of them were reported as over 15 mm (figure 2). Between the measurements that were made by palpation and ballpoint technique, interclass correlation coefficients were found 0.94, and there was good correlation between the two techniques (figure 3). In the ranges of 1-4 mm and 10-14 mm, the results of the two methods were slightly different but not statistically significant.

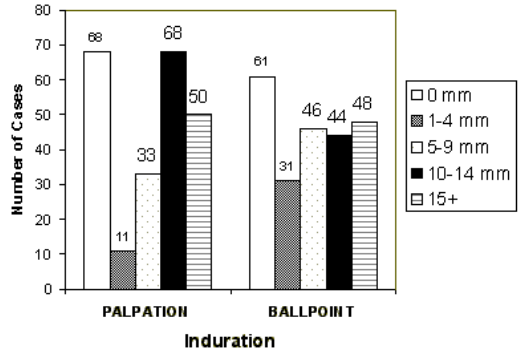

Figure 2. Observer1 - palpation (mm) , Observer 4 - ballpoint (mm). Plot of measurements of induration of tuberculin reactors by the ballpoint-pen vs palpation method

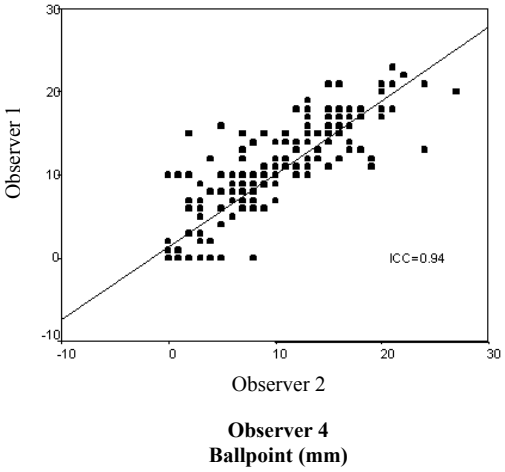

Figure 3. Correlation between the two techniques.

DISCUSSION

TST is a method, used for identifying *Mycobacterium Tuberculosis* infection, although it has many potential sources of error and variability (3). One of the most important of them is measurement of induration. The ballpoint-pen and the palpation technique are two methods of induration measurement. The traditional method of measurement is the palpation method. In this method, identifying the margins of the indurated area is difficult, and it requires experience.

By using the ballpoint-pen method of Sokal, it is noted that interobserver variability may be decreased (1). In our study, 230 TSTs were measured by three readers via the palpation method. The results of the three readers were reliable (according to Kappa test "intercategory variation") (figure 1). It showed that the palpation method was a reliable method.

Although Sokal did not compare the ballpoint-pen technique with the palpation technique, recent studies are performed in this way. In a cross-sectional study of 96 persons, Pouchot et al. investigated the reliability of TST measurements. The ballpoint-pen and the palpation technique were compared, and reliability coefficients were found slightly higher for ballpoint-pen technique than for the palpation technique (4).

In a prospective study of 806 healthy volunteers, Howard et al. noted that there were significant differences between the pen and palpation methods (5). In another prospective study of 1340 healthy subjects, Bouros et al. indicated that the sensitivity and the specifity of the two methods were comparable, and the pen method was found to be as reliable as the traditional palpation method (6). The study of Jordan et al. suggested that there was no significant difference between the two measurement methods (7). Results of our study are in agreement with those of Bouros et al. (6) and Jordan et al. (7). In the study of Ekinci et al., the pencil and the classic

palpation method were compared. As a results of the study, they found that although PPD induration diameter was larger with the pencil method, especially in field studies, pencil method can be used as an easier and quicker method (8).

Between the measurements that were made by palpation and ballpoint technique, interclass correlation coefficients were found 0.94, and there was good correlation between the two techniques (figure 3).

The frequency distributions of indurations measured by the two methods were comparable. The exception was in the ranges of 1-4 mm and 10-14 mm. Results should be interpreted with caution in 1-4 mm and 10-14 mm ranges. There may be slight differences according to the reader. Results of our study indicated that the palpation method was reliable, and when the two methods were performed by experienced observers, the reliability of the results were similar.

ABBREVIATONS

Purified protein derivative (PPD)
Tuberculin skin test (TST)
Tuberculin unit (TU)
Confidence interval (CI)
Interclass correlation coefficient (ICC)

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