Tuberculin Reaction Size Measurement by the Pen Method Compared to Traditional Palpation*

Theresa J. Jordan, Ph.D.; Gnana Sunderam, M.D.; Lannie Thomas, R.N.; and Lee B. Reichman, M.D., F.C.C.P.

A prospective, double blind study was conducted to determine the degree of concordance of pen and palpation methods of measuring skin induration to Mantoux tuberculin tests. One hundred thirty-five skin tests were performed in patients with previously bacteriologically proven tuberculous disease. An experienced reader who was only able to see the forearm of the patient measured the

induration by the palpation technique. The measurement was then repeated by the pen method under the same conditions, on the same day. Results of the study indicated that the pen method yielded statistically the same frequency distribution of indurations as the palpation method and the pen method appeared to be more sensitive.

The tuberculin test is indispensable for the identification of tuberculous infection, recent or remote, and may lead to the diagnosis of disease.1,2 There are many reasons for variability in performance and interpretation.3,4 Unfortunately, the utility of this simple and universally available method is substantially affected by the variation in measurements of skin induration by different observers.5,6 It has been shown previously that experienced observers may have considerable difficulty in the measurement of induration by the traditional method of palpation. The so-called pen method has been suggested as a better alternative for determining the induration.6

To our knowledge, the pen method has not been standardized in an acceptable way. Most previous reports on this subject have not been done in an unbiased, double blind fashion. But even without such a controlled comparison, the pen method has achieved widespread use and popularity.

In order to determine if the pen method is an acceptable means of reading skin tests, and if so, to document the degree of concordance with the traditional reading methods, we studied the variability of test results found with the different techniques of measurement in a prospective double-blind fashion.

METHOD

One hundred thirty-five skin tests were performed utilizing the Mantoux technique14 in patients with previously bacteriologically proven tuberculous disease. Eighteen of these patients were found to have no skin reaction. This was explainable on the basis of their clinical picture of concurrent abnormalities of immunologic function.

After informed consent, 5 TU of PPD was administered intradermally on the volar aspect of the forearm, taking necessary precautions to avoid any bias due to the quality, quantity, or method of administration. Skin tests were read after 48 hours by a highly experienced skin test reader from the Tuberculosis Division of the Centers for Disease Control. In each test, the patient was standing behind a screen through which only the forearm was exposed through a hole, so that the reader did not know the identity of the patient. Induration was first measured by the palpation technique in two axes at right angles, and the average for each patient was recorded.

Then at a separate reading on the same day, in a random sequence of patients, the measurement was repeated in the same manner. A line was drawn with a medium ball pen from a point 3 to 4 mm away from the margin of the skin test reaction towards its center. When resistance was felt to further movement, the pen was lifted. The procedure was repeated on the opposite side and similarly in an axis at right angles. Again, only the forearm was seen, and the reader was unaware of the identity of the patient or his previous reading by the palpation method.

RESULTS

The frequency distributions of induration generated by the two methods are shown in the histogram in Figure 1. The induration ranged from 0 to 25 mm by the palpation method and from 0 to 33 mm by the pen method. Of the total 135 skin tests, 116 by palpation and 113 by the pen method were found to have an induration of equal to or greater than 5 mm; 5 to 9 mm induration was present in 13 by the palpation method and six by the pen method; 10 mm or greater induration was found in 103 by palpation method and in 107 by the pen method (Table 1).

A goodness-of-fit test was applied to the data to determine if the two methods yielded significantly different frequency distributions across three categories: <5 mm induration, 5 to 9 mm, and ≥10. The
While the paired Student's t-test indicated a statistically significant difference between the pen and palpation methods, the limits around the observed difference of .88 mm were relatively narrow, suggesting that the differences between methods would not be significant from a clinical standpoint in an individual patient.

Of the 135 tests, 117 were "expected" to have a significant skin reaction by documented previous skin test results and the known immunologic status of the subjects. Both reading methods had more than 96 percent sensitivity in being able to identify induration of 5 mm or more. Using 10 mm as a cut point for significance, the observer was able to identify eight more subjects which would have been classified as having significant reaction by the pen method but not by palpation. However, there were four tests in which the pen method "underestimated" as having a nonsignificant reaction as compared to palpation.

**DISCUSSION**

Even though the technique of diagnosing tuberculous infection by the measurement of tuberculin induration is rather primitive and flawed, it is still a reliable test. Until cheaper techniques with better test characteristics are developed, the tuberculin test will remain valuable.

Joseph Sokal introduced the pen method of measurement of skin induration, which he felt might "overcome errors due to the rather crude method of determining the borders of the indurated area with the finger tips during palpation." Unfortunately, this method had not been standardized in a double-blind fashion.

In our study of 135 tests, intraobserver bias was felt to be eliminated by removing the possibility that the reader might remember the identity of the subject, and thus, recall the subject's previous skin test reading. The study was designed to permit the same reader to determine the induration by both methods, thereby avoiding a potentially confounding source of interobserver variation.

Results of the study indicated that the pen method yields statistically the same frequency distribution of indurations as the palpation method. The pen method also appears to be somewhat more sensitive. The magnitude of difference in actual measurements obtained by the two methods was relatively small, and unlikely to be of clinical importance.

After the study was completed, the experienced tester/observer, who was previously more familiar with the palpation method, volunteered that she felt she was getting a more reliable result and a faster reading by the pen method, whereas she had to make several attempts before being sure of the induration by palpation.

---

**Table 1—Tuberculin Reaction Size Measurement by the Pen Method Compared to Palpation**

<table>
<thead>
<tr>
<th></th>
<th>&lt;5 mm Induration</th>
<th>5-9 mm Induration</th>
<th>≥10 mm Induration</th>
<th>&gt;5 mm Induration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palpation</td>
<td>19</td>
<td>13</td>
<td>103</td>
<td>116</td>
</tr>
<tr>
<td>Pen Method</td>
<td>22</td>
<td>6</td>
<td>107</td>
<td>113</td>
</tr>
</tbody>
</table>

*Total 135 tests.
We conclude that the pen method of measurement of tuberculin skin test induration is at least as good as, if not better than, palpation.

ACKNOWLEDGMENT: We thank Maybelle Schein, R.N., for performing the tuberculin tests, John Beil of the Waymon Lattimore Comprehensive Pulmonary Disease Clinic, Ms. Jean Chou for statistical analysis, and Ms. Jean Norwood for secretarial assistance.

REFERENCES

2 Reichman LB. Tuberculin skin testing: the state of the art. Chest 1979; 76:764-70
7 Erdtmann FJ, Dixon KE, Llewellyn CH. Skin testing for tuberculosis antigen and observer variability. JAMA 1974; 228:479-81

35th Annual James J. Waring Chest Conference

This conference, sponsored by the Colorado Trudeau Society, will be held September 3-5 at Longs Peak Inn, Estes Park, Colorado. For information, contact Ms. Shirley Lindquist, American Lung Association of Colorado, PO Box 921, Loveland 80539 (303:667-5198).

Advances in Pulmonary Rehabilitation and Management of Chronic Respiratory Failure

This international conference, sponsored by the Societas Europea Physiologiae Clinicae Respiratoriae (SFACR) and the Italy Chapter, ACCP, will be held October 15-17 at the Medical Center of Rehabilitation, Veruno, Italy. For information, contact the office of the Medical Director, Pulmonary Division, Gaylord Hospital, PO Box 400, Wallingford, CT 06492 (203:269-3344 (ext 3353).