The Tuberculin Test

THE TUBERCULIN test is a simple and effective method by which a person infected with tubercle bacilli can be distinguished from a person who has not been so infected. The present day emphasis on early diagnosis makes this test extremely valuable since it detects the presence of tuberculosis long before other means of examination have any value. "The time has arrived," says Myers, "when tuberculin testing should be as much a part of every medical examination, regardless of the age of the patient, as the Wassermann or urinalysis tests are."

In essence, the tuberculin test is a practical application of the complex tissue phenomenon known as allergy. Although the exact nature of allergy is still unknown, many of its actions are easily recognized. For example, it has been found that living tissue becomes sensitized or hypersensitive to foreign proteins, proteins differing from those of its own composition, causing a marked reaction to occur whenever the same protein is introduced a second time. Thus the tissues of a person infected with tubercle bacilli will show a definite and specific reaction when injected with the products of tubercle bacilli. Contrary-wise, a person who has never been infected with tubercle bacilli will show no reaction when injected with the same material.

The tuberculin test is simply a visible application of the above mentioned tissue reaction. When tuberculin, a substance composed of the products of tubercle bacilli, is injected into the skin of a tuberculous person the area of injection becomes red, swollen, and slightly brownish by the end of forty-eight hours. A non-tuberculous person, on the other hand, will show no reaction when injected with tuberculin. The tuberculin reaction is, therefore, definite, specific, and accurate. Definite because an area of redness with swelling and a brownish discoloration is easily differentiated from the normal contour and color of the skin. Specific because without a preceding infection with tubercle bacilli no reaction will occur. Accurate because no other known combination of factors will give the same result. That is, a person cannot become sensitive to tuberculin by any means except a previous infection with tubercle bacilli.

Since 1890 when Robert Koch first discovered tuberculin and noted its action, many methods of performing the tuberculin test have been tried. The most accurate, and therefore the most preferable, is the intracutaneous test proposed by Mantoux in 1907. By this method a small measured amount of tuberculin of known concentration is injected into the skin of the forearm producing a small weal at the point of injection. The test is most frequently performed by injecting 0.1 cc of a solution consisting of one part Old Tuberculin in 999 parts of normal salt solution. This dose contains 0.1 milligram of tuberculin and is a satisfactory amount for general purposes in the testing of children. Adults, on the other hand, usually react to a much smaller amount of tuberculin and should always be tested with a dose of 0.01 mg. to avoid excessive and unpleasant reactions. In order to obtain accurate information, all negative reactors must be retested with larger amounts of tuberculin. For children, the dosage is increased from 0.1 mg. to 1 mg., while with adults it is increased from 0.01 mg. to 0.1 mg. and then to 1 mg. When time is not an important factor it is usually advisable to make the first test with 0.01 mg. of tuberculin, even in the testing of children. In 1934 Long, Seibert, and Dorset perfected the material known as Purified Protein Derivative. This substance will, no doubt, soon displace Old Tuberculin as the standard material for making tuberculin tests. On the basis of three thousand

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tests comparing the Purified Protein Derivative with Old Tuberculin, Long, Aronson, and Seibert concluded that PPD is superior in potency, uniformity, and general reliability.

Interpretation of the tuberculin test should normally be made at the end of 48 hours, at which time the reaction usually reaches its maximum. At this time a positive reaction produces a definite area of oedema surrounded by an area of hyperemia. A negative reaction shows nothing at all, or at most, a small area of redness without oedema. According to the National Tuberculosis Association classification, a positive reaction has been arbitrarily designated as one, two, three or four plus, depending upon the extent of oedema present. A reaction with definite oedema from five to ten millimeters in diameter, is recorded as a one plus reaction; with an area of oedema measuring ten to fifteen millimeters, it is called two plus; while one exceeding twenty millimeters is known as a three plus reaction. A four plus reaction consists of even more redness and oedema than the three plus, together with an area of necrosis. When the area of oedema measures less than five millimeters the reaction is called doubtful. Investigations so far have failed to show much significance as far as the extent of the reaction is concerned; consequently, many workers now record the test as simply positive or negative. The discoverers of PPD believe that with their standardized product the degree of reaction may assume significance.

A negative tuberculin test indicates that (1) the person tested has never been infected with tubercle bacilli or that, (2) a previous tuberculous lesion has completely healed and so has become obsolete. In the words of Eugene L. Opie, "A negative tuberculin reaction is evidence that there is no existing tuberculous infection." There are, of course, a few easily recognized exceptions to this rule. It is well known, for example, that the sensitivity to tuberculin may be decreased or even disappear during the course of exanthematous diseases or during the course of other diseases associated with high temperature. Likewise, the tuberculin test is negative immediately following infection with tubercle bacilli (during the pre-allergic stage) because it requires a period of from two to three weeks for the tissues to become sensitized.

A positive reaction has great significance both for the person tested and for the community at large. To the person reacting, it means that he has at some previous time been in contact with someone having active tuberculosis and that he now has at least one focus of living tubercle bacilli in his body. This, of course, indicates that a positive reactor has acquired the primary or first infection type of tuberculosis, and may signify that he has the secondary or reinfection type of disease. Unfortunately, however, the tuberculin reaction does not give information regarding the age, size or type of the tuberculous lesion. An arrested primary lesion too small to be demonstrated even by x-ray; a moderate sized well encapsulated lesion; or a large progressing lesion may produce the same degree of reaction. In short, the tuberculin test does not differentiate between active and latent tuberculosis. All positive reactors should, therefore, be examined thoroughly to determine the kind of lesion present.

Although most positive reactors will be found to have an inactive or arrested primary lesion, Myers maintains that they have a definite health liability. This liability results from two factors. First, there is the ever present danger of reactivation of the primary lesion from overwork, worry, or general unhealthful living. Such a reactivation will, of course, result in active tuberculosis of the secondary type, the kind of tuberculosis which causes disability and death. Second, the tissues of a positive reactor are allergic to tuberculin thus making the comparatively harmless products of tubercle bacilli virulent poisons. At the same time any exogenous infection with tubercle bacilli will of necessity result in a secon-
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dary, and therefore, dangerous type of tuberculosis. From extensive studies at the Lymanhurst School, Myers found that a child with a positive tuberculin reaction was five times as likely to develop active tuberculosis as was a child with a negative reaction. These findings have revolutionized child health procedures since they have clearly demonstrated the necessity of watching all positive reactors very carefully for any symptoms of active disease. This line of action is exactly opposite to the one formerly employed when positive reactors were assumed to have acquired a more than normal resistance to tuberculosis.

The community benefit to be derived from use of the tuberculin test increases with the number of tests performed. When all individuals of a community are tested it is easy to spot sources of infection since the number of positive reactors will increase markedly around each source. Widespread tests also definitely localize the areas in which tuberculosis control should be most stressed. Such a series of tests reveals frequently the presence of unsuspected spreaders of tubercle bacilli and thus allow the community to take precautions against further contamination. Formerly the source of infection was frequently traced to a dairy, but present day checking of dairy cattle by means of the tuberculin test has practically eliminated this source.

World wide use of the tuberculin test has greatly increased present knowledge concerning the prevalence of tuberculous infection. Formerly, it was believed that all adults and 95 per cent of the children of teen age were infected with tuberculosis. Now it is known that these figures were much too high, the correct figures, in the United States at least, are around 50 per cent for adults and 10 per cent for children of teen age. The decrease in the number of positive reactors is taking place quite rapidly in many parts of the United States as shown by tests made upon various classes of the population. For example, at the Lymanhurst school, where repeated tests have been made, there has been a drop of 43 per cent during the last fifteen years. Studies made upon university students have shown that the amount of infection varies markedly in different parts of the country. The highest incidence of positive reactors occurred at Yale University which showed 62 per cent, while the lowest was at Lewis- ton State Normal College, Idaho where only 15 per cent were positive.

Summary.

1. The tuberculin test is a simple and accurate method of determining the incidence of tuberculous infection.

2. The Mantoux or intracutaneous method is the preferable way of performing this test.

3. Interpretation of the reaction should take place 48 hours after the test is performed.

4. The degree of reaction has little significance; therefore, the result should usually be designated as simply positive or negative.

5. A negative test is one which produces no reaction, or at most merely a small area or redness without oedema.

6. A positive test is one which produces a definite reaction with hyperemia surrounding an area of oedema at least 5 mm. in diameter.

7. Aside from a few easily recognized exceptions, a negative tuberculin test is evidence that there is no existing tuberculous infection.

8. A positive tuberculin test is evidence that at least the first infection type of tuberculosis is present.

9. A positive tuberculin reaction denotes a distinct health liability because of danger from:
   (a) Reactivation of the present lesion.
   (b) Active tuberculosis from subsequent exogenous infection.
   (c) Harmful allergic reactions from any tuberculo-protein.

10. Large scale tuberculin tests frequently disclose unsuspected sources of infection.

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Taking to chicken farming.

Probably the best thing for a tuberculous writer or artist is that he should be a ‘leaker’—one in whom small quantities of toxin are liberated from time to time, but never in sufficient amounts to do great harm.

There seems to me to be one characteristic of the tuberculous at all times, even in their good phases: their normal attributes, especially perhaps their expansive ones, are accentuated; the adventurous become more adventurous, the cheery more cheery, the generous more generous. Just as in G.P.I. the megalomaniacs are those patients who were always that way inclined in their normal days, the melancholics are those who were always of rather a depressed nature, while the ordinary natures in whom the cosmic rhythm brought grave and gay phases are alternately megalomaniacs and melancholics, so in tubercle the natural characteristics are enhanced.

There is one very marked type of tuberculous mentality which is not nearly so common in these days of controlled temperature as it used to be: the fervid, fiery, febrile type, the extrovert with a mission and the tuberculous toxin as a compelling force within him. Many cases be culled from history, the records of social reform, and criminology. Probably the two last-mentioned characteristics are due to the same cause, the lowering or poisoning of the more recently acquired inhibitory mechanism or restraint. Another vasodilator poison, alcohol, does the same; and it has this too in common with the tubercular toxin: it renders its victim contentment.

Much has been written about the increased sexuality of the tuberculous, the old puritanical school who thought that tuberculosis was the Nemesis of sexual excess being superseded by the kindlier French school who recognised that the excess was the result of the unnatural stimulus of the toxin. This too seems to be much rarer nowadays—or at any rate it does not obtrude itself—but when it does occur it seems to have one characteristic, which is just what one would expect from a poisonous stimulus: satisfaction is never reached and desire doth outrun performance. The three cases who have been brought to my notice were all ambulant, febrile, and did not know they had the disease.

There are some who regard a certain cantankerousness, a desire to hurt, a waspishness, as part of the abnormal state of the tuberculous. But surely that is acquired through a normal psychological process. A young man with his career shattered, the brand of Naaman imagined, cabined and confined, or a married man, the clouds of financial chaos approaching him, is merely reacting normally to hard circumstances. Prisoners of war apparently did the same, the crews of ships on long voyages certainly do—and without the same excuse.

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11. World wide use of the tuberculin test has shown the incidence of tuberculous infection to be much less than was formerly believed.

REFERENCES


