Paradoxes of Tuberculosis in India

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Tuberculosis is a worldwide disease, communicated from country to country, as well as from person to person. Its complete eradication in any country is jeopardized by its continued prevalence in others with whom contacts occur. Moral and material assistance in the control of tuberculosis in other countries is, accordingly, a matter of enlightened self-interest, as well as a manifestation of social conscience. The acid-fast bacilli which produce the disease in different countries, however, are not all alike, and the methods of detection, diagnosis, treatment and prevention which have proved so effective in Europe and America may not be directly transferrable to other places. The paradoxical conflict between accepted concepts and the actual situation is particularly exemplified in India.

Tuberculosis was described as a common communicable disease in India thousands of years ago,† but writers frequently assume that the country was “virgin soil” for the disease until recent years.‡ According to official estimates, most Indians have been infected by the tubercle bacillus, five million suffer from active tuberculosis, and half a million die of it every year.§ Opinions differ, however, not only on how much tuberculosis there is in India, but even on whether it is increasing or decreasing.¶

One hundred and forty million tuberculin tests have been performed in India during the past dozen years.‖ Nearly 60 per cent of those completed were reported to be positive. Experienced workers, however, believe that a large part of these were not due to infection by the tubercle bacillus.¶¶ Most Indians respond to the injection of tuberculin with areas of induration of relatively small diameter.¶§ Some of these weak reactions are specific, with low sensitivity early in the course of infection or after the tuberculous lesions are healed. Others result from induced or spontaneous desensitization from endocrine, nutritional and other physiologic variations in the host. Some may represent merely technical defects in the performance or interpretation of the tests.

Some specific weak reactions to tuberculin also result from infection or vaccination with BCG or other attenuated or avirulent strains of tubercle bacilli, or from absorption of large amounts of dead tubercle bacilli. Many of the weak reactions, however, are false or nonspecific. False reactions result from various skin irritants, or from minor infections. Nonspecific responses have been attributed to sensitization or infection by heterologous acid-fast bacilli other than tubercle bacilli, such as the photochromogens or the “Battey type” bacilli.¶¶

Some differences in the frequency of positive reports resulted from changes in the potency of the tuberculin, or the dosages used. The recent change from five international units of PPD to one unit of a new more potent preparation with the addition of Tween-80 may have increased its specificity, but decreased its sensitivity.

The minimum diameter of induration reported as positive was changed from 5 to 8 mm. in the middle of the program. This greatly decreased the percentage of positive reactors reported, but not to the same extent in different population groups. In one published series, the change from 5 to 8 mm. would have caused a decrease of about 15 in the percentage reported as positive, but in South India the effect would have been twice as great as in the North. If only reactions over 12 mm. were accepted as indicating tuberculous infection, as has been urged, less than half of the reactions over 5 mm. would have been called positive. Thus, whether the tuberculin tests in the course of the BCG vaccination campaign indicate that nearly two-thirds, or less than one third, of the
population of India had ever been infected by the tubercle bacillus depends on the interpretation of these weak reactions.

Analysis of the available data does not indicate that tuberculous infection is increasing in India. An apparent decrease in the percentage of all tests reported as positive in the last five years as compared with those tested previously, and a slight increase in the last two years may be accounted for by changes in the performance and reading of the tests. The uniform logarithmic manner in which the percentage negative decreased with advancing age also indicates that the attack rates have not changed greatly in recent years. The positive tuberculin reactions were not greatly or consistently lower in the villages than in the towns and cities, despite earlier impressions to the contrary.

A minifilm sample survey of carefully selected representative populations in different parts of India was conducted by the Indian Council of Medical Research during the past few years. More than 10 per cent of the nearly 300,000 films taken were classified as abnormal by one or both of two local readers and nearly 3 per cent were recorded as “active or probably active.” From the findings of central readers who reread about an eighth of all films, and a fifth of those called abnormal by local readers, elaborate correction factors were computed, by which the frequency of “active or probably active” tuberculosis was calculated separately for various segments of the population.

The incidence of such cases varied from 1.35 per cent to 2.44 per cent in various places, averaging 1.8 per cent for the cities, 2.0 per cent for the towns and 1.6 per cent for the villages. On the assumption that the rural rates were significantly lower than those in urban areas, and that the “true” rates in inaccessible villages not included in the survey would be only half of those which were found, it was concluded that “the total number of pulmonary tuberculosis cases in the country is likely to be in the neighborhood of about five million, i.e. 1.3 per cent of the total population.”

A supplemental survey of so-called “inaccessible” villages in India, however, carried out more recently yielded results quite similar to those found in the villages which had previously been reached. Accordingly, it would appear that the survey actually indicated that there are about eight million “active or apparently active” cases of tuberculosis, detectable on x-ray film, or nearly 2 per cent of the population, rather than the lower figures which were published.

Some of the x-ray films may have been overread, and some densities due to pneumoconiosis, animal parasites or other infections may have been erroneously ascribed to tuberculosis. Bronchogenic carcinoma and fungus disease of the lung, however, are rare, and it seems more likely that the true incidence of tuberculosis was greatly understated in this survey. Only half of those reported as active or apparently active tuberculosis by a field reader were so included in the final figures. About three quarters of those that were so accepted were classified as having advanced disease and cavity was recorded in nearly a third of them. Lesser lesions were especially apt to be missed.

Bacteriologic examination of sputum and laryngeal swabs was carried out on about 15,000 persons whose films were called abnormal by a local reader. About 1,000 of these were reported positive for acid-fast bacilli on smear or cultures. It was concluded that from two to eight per thousand, in the entire population of India, or about one and one-half million persons are expectorating tubercle bacilli at any time. According to the survey report, “the ratio of one in ten assumed for asymptomatic cases of tuberculosis established as positive in one bacteriologic examination appeared justified, both in the light of data obtained in the present survey as well as of experience of tuberculosis workers in India.” This ratio of one in ten would imply, however, that there are about 15 million “cases of tuberculosis” in India, rather than five million, as stated.

Animal inoculation has long been established in Europe and America as the most sensitive and most specific test for the presence of tubercle bacilli. This measure would be misleading in India, however, since a majority of the strains of tubercle bacilli
isolated there have low virulence for guinea pigs.\footnote{11} How many of the specimens contained tubercle bacilli which were missed because of inadequate bacteriologic technique,\footnote{12} and how many of those reported as positive actually contained only acid-fast bacilli that were not tubercle bacilli,\footnote{13} accordingly, could not be so determined.

Less than 50,000 deaths from tuberculosis in all India are recorded in official vital statistics, but this is generally believed to be only a small fraction, perhaps less than a tenth of the number which actually occur.\footnote{14} About 10 per cent of all deaths in hospitals and prisons in India were attributed to tuberculosis. A similar proportion of the deaths in policy holders in the Oriental Life Insurance Company, who tended to be of a higher economic status, were recorded on their claims.\footnote{15} More reliable information was sought by an examination of more than 10,000 routine medico-legal, hospital and medical college necropsies in different parts of India. Tuberculosis was recorded as the chief cause of death in about 10 per cent of these protocols. It was less common in the medico-legal necropsies and in the army than in general hospital or medical school necropsies, but was relatively frequent in all.\footnote{16}

Combining the information obtained from mortality statistics, hospital reports, insurance data, prisons, the armed forces, and other sources, and the medico-legal, general hospital, medical college and military necropsies, it appears that tuberculosis probably accounts for about one-tenth of all deaths in India. Accordingly, the death rate is somewhere around 150 per 100,000 population, and the number of deaths from this disease is about half a million annually.

**Conclusions**

The prevalence of tuberculosis infection in India is probably much lower than the percentage of skin tests reported as positive. The attack rate of new infections is relatively similar at different ages and has not changed much in recent years. The prevalence of active disease, as shown by x-ray film surveys and bacteriologic follow-up is probably greater than the five million officially stated. This does not indicate that it has increased recently, but that older estimates were probably too low. The tuberculosis death rate in India is probably around 150 per 100,000 population, or about half a million deaths are due to this cause annually. The tuberculosis death rate has probably decreased in recent years, paralleling the drop in deaths from other causes. Owing to the increased population, however, the total number of deaths annually has not shown a similar decrease.

Many apparent paradoxes in tuberculosis in India arise from attempts to apply the results of Western experience to conditions to which they are not appropriate. The high incidence of weak or nonspecific reactions to tuberculin, the difficulties in sensitization with BCG vaccination, the low guinea pig virulence of human tubercle bacilli, the paucity of morbidity and mortality data seem strange and unexpected. The linguistic, psychologic, social and physical barriers to communication, the climatic, nutritional and economic stresses and the inadequacy of diagnostic and therapeutic facilities make many of the control methods which are so effective elsewhere, simply inapplicable in India. Special studies are needed to recognize these differences and to make the necessary adaptations. Fundamentally, however, tuberculosis in India, like that in the rest of the world, is amenable to intelligent and energetic application of appropriate control measures, and with equal effort to that displayed elsewhere, should respond as well.

**Summary**

The criteria used in the West for estimating the incidence and prevalence of tuberculous infection and disease, and for the determination of the death rate, even for the identification of the tubercle bacillus itself, are not adequate in India. Reactions to the tuberculin test in India are not all due to previous infection by human tubercle bacilli. X-ray readings give rise to wide differences in interpretation. Even the tubercle bacilli which are isolated are different from those reported from other countries. Death
records are misleading and necropsies may be unrepresentative. Recognition of these facts facilitates the evaluation of the available data and the correction of estimates derived from them.

**Resumen**

En la India no son adecuados los criterios que se usan en el Occidente para estimar la incidencia y la prevalencia de la infección tuberculosa, para la determinación de la mortalidad y aún para identificación del bacilo. Las reacciones a la tuberculina en la India no son todas debidas a una infección previa por el bacilo tuberculoso humano. Las lecturas de radiografías produjeron diferentes interpretaciones.

Aún los bacilos que fueron aislados son diferentes de los descritos en otras partes. Los registros de defunciones son engañosos y las necropsias pueden no ser representativas.

El reconocimiento de estos hechos facilita la valoración de los datos obtenibles y la corrección de las estimaciones derivadas de ellos.

**Resumo**

Os critérios que se usam no Oriente para estimar a incidência e a prevalência da infecção tuberculose e do tuberculose-malária, assim como a determinação do porcentagem dos déces e mesmo aqueles que são utilizados para a identificação do bacilo tuberculóce não convinem nulmente aos índes. Les reações aos testes tuberculínicos aos índes não são todas de uma infecção anteríe e por um bacilo tuberculóce humano. A leitura dos radiografias dá lugar a grandes diferenças de interpretação. Même les bacilles tuberculéux qui sont isolés sont différents de ceux décrits ailleurs. Le taux de la mortalité est déroutant et les autopsies ne sont pas représentatives de l'ensemble. Cet recensement de ces faits facilite l’estimation des données que l’on peut obtenir et permet de corriger les conclusions que l’on peut en tirer.

**Zusammenfassung**


**Referências**