

Leprosy and Tuberculosis— A Comparison

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There are so many points in common between these two diseases, and so many points of variance that it may be of profit to compare them in some detail.

The bacilli show a considerable resemblance in their morphology and staining reaction. Stained by Ziehl Neelsen's method *B. leprae* is somewhat less acid-fast than *B. tuberculosis*, and has a greater tendency towards bipolar staining. The former also tends to take up a formation in "globi", i.e. masses of bacilli lying in parallel formation, but rounded into the form of a globular cell. This is probably the result of intracellular multiplication of bacilli. The lepra cell, so typical of the cutaneous form of leprosy, is apparently the result of the low toxicity of *B. leprae* and the slight degree of response which it calls forth from the tissues. Ingested bacilli instead of being phagocytosed are able to multiply in the cytoplasm forming the lepra cell and later the "globus". The greater toxicity of the tubercle bacillus does not seem to encourage intracellular multiplication, and growth is confined to the intercellular spaces.

The histopathological picture in the neural type of leprosy much more closely resembles that of tuberculosis. The so-called "tuberculoid" macule has frequently been mistaken for a leprous lesion by those not closely conversant with the latter disease. In both there are the small cell infiltration, epitheloid cells and multi-nucleated giant cells. In both there is the slowly spreading lesion, active at the margin and self-healing with scar formation at the centre; only that the latter (the forming of scars) is as a rule much less marked in leprosy. The main distinguishing feature, however is the nerve involvement in leprosy. In practically every case in which there would otherwise be doubt in the differential diagnosis, there is marked sensory nerve thickening and/or definite loss of sensation, if the lesion be leprous; whereas in the tubercular lesion sensation is practically unimpaired. Why the infection should spread up the sensory nerve branches in the one disease and not in the other in spite of the similarity of the skin lesions is a problem worthy of study by cytologists.

Both diseases affect the lymph nodes; but the pathological changes caused by leprosy are generally easy to distinguish,

both macro-and micro-scopically, from those of tuberculosis. In leprous patients with high resistance to *B. leprae*, i.e. those of the pure neural type in which typical "tubercloid" macules occur, the lymph nodes are seldom affected to any marked extent, the infection being as it were sealed up within a few sensory or mixed nerves. In the cutaneous and mixed types with comparatively low resistance, the infection filters up from the skin through the lymph channels and lodges in the lymph nodes. There it produces lesions of the cutaneous type, characterised by lepra cells. In such cases mixed leprous and tubercular lesions may occur side by side, the macroscopic appearance of the former showing yellowish streaks and the latter whitish tubercles.

An interesting comparative study of these two diseases is found in the respiratory organs. Whilst the gravest tubercular lesions are those of the lungs, there is grave doubt as to whether these organs are ever seriously affected by leprosy. Both of them affect the larynx, but as has been shown by Lie (1936) the trachea and bronchi may be much more seriously affected by leprosy. The reason for this is probably that tuberculosis of the larynx is generally a secondary infection due to prolonged expectoration of *B. tuberculosis* from the lungs, and occurs in comparatively advanced cases in which there is little time for invasion of the trachea before death takes place. Whereas in leprosy the spread takes place downwards by gradual invasion from the mouth and throat, and there is abundant time for infiltration of the trachea and bronchi as such cases often survive for many years.

The genito-urinary system gives another interesting comparative study. Leprosy affects the male genital organs even more than tuberculosis, probably because a fatal result is not caused in the former and there is time for entire destruction of glandular tissue to take place. In contradistinction to the sister disease, leprosy does not affect the bladder and ureters, and the kidneys are affected more by waxy degeneration following on toxæmia from a mixed infection elsewhere in the body, than by actual invasion with *B. leprae*, the latter being comparatively slight even in severe cases.

While tuberculosis of the suprarenals is a serious and generally fatal condition, leprosy of these organs, though it does occur, does not appear to affect their function to a noticeable extent.

Leprosy of the liver and spleen, though extensive and capable of causing marked enlargement, especially during

lepra reaction, does not, as far as we are aware, interfere with their function.

Likewise, in contrast to the condition in tuberculosis, the gastro-intestinal tract, though involved to a mild extent in severe cases, never shows macroscopic lesions; and the digestive and absorptive complications in leprosy are due to secondary causes.

Allergy. Another marked contrast between tuberculosis and leprosy centres round this subject, still so imperfectly understood. The injection of lepra bacilli into the tissues of those already infected with leprosy does not call forth a reaction at all comparable to Koch's phenomenon. The reaction to such an injection is delayed and is almost entirely local. On the other hand, *lepra reaction* or lepra fever appears to be of allergoid nature, being a general reaction accompanied by wide-spread focal swelling and engorgement. Lepra reaction is seldom caused by injecting lepra bacilli, though in advanced cases in a debilitated condition any slight depressing factor may be sufficient to induce it. In mild cases of leprosy, or in those in thoroughly good general health, it does not occur. Here, however, we have another contrast with tuberculosis: the fact that a leper with moderate or even extensive lesions, may be in excellent general health, whereas the tubercular patient with even a fraction of the same degree of infection or tissue involvement is almost invariably in a precarious state of health.

We may summarise the various factors which appear to underlie the main contrasts between tuberculosis and leprosy:—

The tissues involved;
The degree of virulence;
Allergic reaction and mixed infection.

(1) *The tissues involved.* If the lungs, urinary system, gastro-intestinal tract and supra-renals were affected no more in tuberculosis than they are in leprosy, it is possible that the former would be reduced to the low degree of fatality of the latter, which differs from it in avoiding vital organs, or at least in not directly seriously affecting their function.

Leprosy attacks not the *vital organs* but those which are vital from the social standpoint—the face and the limbs—the organs which express personality. That is why it is more dreaded than tuberculosis.

(2) *The degree of virulence.* It has been proved that various strains of *B. tuberculosis* are more active than others, and the virulence of the disease depends partly on the strain

and partly on tissue resistance. Available evidence tends to show that the virulence of leprosy depends entirely on the latter factor, but direct proof of this must wait till actively growing *in vitro* cultures of *B. leprae* can be obtained.

It is in their least virulent forms, and when a common tissue—the skin—is invaded, that the two diseases can most closely resemble each other, producing respectively lupus and the “tuberculoid” lesion of leprosy. In both of these the tissues succeed, or almost succeed, in holding up the advance of the invading enemy. In the more virulent forms of each disease in which the resistance is less, their respective characteristics diverge more widely.

Immunity. Small infections appear to produce a slight degree of immunity in both diseases, resulting in types with mild and limited lesions—such as surgical tuberculosis, and the neural and especially the tuberculoid form of leprosy. The prognosis is good and they are amenable to treatment.

On the other hand, severe infections tend in both diseases to produce the graver types in which signs of immunity are absent, the prognosis comparatively bad and treatment much more difficult.

In both diseases children are more susceptible than adults. Tuberculosis is fatal in a large proportion of child infections; but in survivors latent infection tends to show itself, as it does in leprosy, at adolescence, due to the increased physical strain at that period of rapid development.

(3) *Allergy and Mixed Infection.* *B. tuberculosis* produces a more virulent disease, though this may be chiefly or entirely due to its attacking more vital organs and the seriousness of allergy and mixed infection in these vital organs. It is on account of this virulence and the consequent fatality that this organism never attains the enormous concentration in the body that *B. leprae* does.

We have referred above to the differences between tuberculosis and leprosy as regards allergy. Mixed septic infection takes many forms in leprosy, but the most common is in perforating ulcers of the feet. Folliculitis and other forms of dermatitis, and septic conditions of the nose, gums, etc., are much more common than is realised. Absorption from septic lesions has a profound effect in leprosy, producing degenerative changes in the internal organs and predisposing to the increase of the leprous infection; but it has not the rapidly fatal effect often seen in pulmonary tuberculosis.

Tuberculosis complicating Leprosy. In some countries this is a not uncommon cause of death in leper institutions. Like so many complicating diseases, tuberculosis often produces an apparent amelioration of leprosy lesions. This is probably due to its debilitating effect on the tissues which diminishes their power of reaction to *B. leprae*; but it is doubtful if the actual leprosy infection becomes less when tuberculosis intervenes.

Treatment. In the therapeutic field leprosy and tuberculosis resemble each other closely. We have referred above to the resistant forms of both diseases, so much more amenable to treatment than the progressive forms with low resistance.

In neither have we the aid of immunity progressing *pari passu* with the severity of infection. In neither have we—nor are we likely to have—a specific remedy.

The main treatment in leprosy, as in tuberculosis, may be summarized as follows: restoration of general health by rest, healthy surroundings, improved nutrition, removal of accompanying and predisposing diseases and other debilitating factors, desensitization, progressive exercise.

The last of these—progressive exercise—can as a rule be brought into force much more rapidly in leprosy than in tuberculosis. Occupational therapy is now recognised as the most important asset in treating the former disease.

Certain of the heavy metals, given in small doses, have long been recognised as valuable in leprosy. Chief among these are arsenic, antimony and gold. The writer, however, considers that their action is more that of a desensitizing agent than of a destroyer of the causal germ. Possibly the action of sanocrysine and other gold preparations in tuberculosis is of the same nature.

In tuberculosis there is no drug which takes the special place of chaulmoogra oil in leprosy, sadly limited though that action may be. Until recent years leprosy was considered an incurable disease. We may now state, however, that, comparing corresponding types, leprosy is at least more amenable to treatment than tuberculosis.

Comparative Epidemiology. Leprosy belongs to a more primitive stage of human development than tuberculosis. In India leprosy is uncommon among aboriginal races, but appears when they leave their mountain and jungle life and mix with more civilised peoples. It is therefore a disease of semi-aboriginals, or of those who are emerging from aboriginal life. It is primarily a disease of villages and only

secondarily of towns. It would tend to die out of towns if the number were not constantly replenished from the villages.

Tuberculosis, on the other hand, is primarily a disease of towns and industrial centres. It tends to spread to the villages from towns.

In England leprosy as an endemic disease vanished centuries before tuberculosis began to become a serious problem.

At the present time in countries like India and Africa, where communications have been opened up rapidly and industrialism and the more superficial attributes of Western civilization have not had time to grow, but have been introduced wholesale, we find tuberculosis racing after and making up on leprosy, so that the two diseases are found side by side.

Control. Tuberculosis is now gradually becoming eliminated from England and other countries where it was once so prevalent. This is the result largely of an educative campaign accompanied by better nutrition, more hygienic methods of living, and wisely planned and gradually applied sanitary regulations. In planning the control of leprosy among backward races we must be guided by similar principles, though the details will necessarily vary according to circumstances. These two sister diseases are among the most dreaded of the evils to which mankind is heir. But dread of them has had a powerful effect in driving humanity towards more healthy and natural living. On this account they may be regarded as not altogether unmixed evils.

Reference: LIE, H. P. *Tracheitis and Bronchitis Leprosa*. Internal. Lep. Jl. Vol. 4, No. 3, July-Sept 1936, pp. 281.