

The Evolution of Tuberculosis in Southern Rhodesia

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PART II

PATHOGENESIS: THE RELATION OF INFECTION TO DISEASE

The presence of a positive tuberculin test indicates all those who have at any time been infected with tuberculosis. Most of these are not diseased, but have overcome the infection in the earliest stages.

The infection rate in a particular area depends on the number of infectious cases and on the number of effective contacts made by them. In practice, this latter is mainly a matter of living habits and hygiene, though the density of the population may also play a part.

The infection rate does not depend directly on the resistance of the population. Resistance, however, is very important in determining the disease rate. In electricity,

$$\text{Current} = \frac{\text{Voltage}}{\text{Resistance}}$$

and in hydrodynamics the same rule is expressed as

$$\text{Flow} = \frac{\text{Pressure}}{\text{Resistance}}$$

Exactly the same applies here. The infection rate is the potential that threatens tuberculosis, and the magnitude of the community's resistance determines the current of disease that will be allowed to run through it. Thus:

$$\text{Disease} = \frac{\text{Infection}}{\text{Resistance}}$$

The factors which govern resistance are therefore very important and deserve study. They are considered in some detail below.

It has been mentioned that the resistance of the group does not directly influence the infection rate. However, it does have an indirect effect in so far as a low resistance will lead to a larger number of infectious cases.

The above description applies to an area where "tuberculisation" is complete, but in a comparatively remote group, which is being newly exposed to the disease, the amount of infection will depend on how much intercourse there has been with industrial centres and will be no guide to the disease rate.

RESISTANCE

Under African conditions resistance is lowered in special ways, and these have been studied fairly thoroughly.

Natural Selection.—European nations have been exposed to tuberculosis for centuries, with the result that the most susceptible strains have been eliminated by it. The view is held widely, and with reason, that the acute form of disease and high fatality rate found in the African are due to the lack of this selection in the past.

A number of authors, such as Professor Lyle Cummins in his review of the paper by Dormer, Friedlander and Wiles in the *Bulletin of Hygiene* (1944), maintain that there is a fundamental difference of reaction between Africans and Europeans regardless of environmental conditions. If this is true, natural selection is the obvious explanation.

Mining and Industrial Employment.—Other workers lay more stress on environmental conditions as the cause of the African's special susceptibility.

From the public health reports of Southern Rhodesia it is clear that tuberculosis was first noticed in the mines, then in the towns, and finally in cases from rural areas. In 1953 the notification rate for the Midlands province (excluding Gwelo town), which includes the main mining area of Southern Rhodesia, was 141/100,000 as against 61/100,000 for the whole Colony. (Allowance must be made for more complete diagnosis on the mines.) In Kenya, Clark (1951) notes that the constant migration to and from Nairobi of young workers appears to be important in the dissemination of tuberculosis in the reserves.

The Tuberculosis Research Committee in South Africa (1932) attributes the special susceptibility of industrial workers to the sudden commencement of strenuous work, the unaccustomed food and housing, the absence of assistance of their womenfolk and the psychological trauma of being away from home.

It is of interest that the Bills of Mortality, a primitive form of death notification used in England during the eighteenth century, showed that in London there was an increase in mortality from pulmonary tuberculosis between 1700 (12 per cent. of all deaths) and 1800 (26 per cent.). Though diagnosis was not exact, it has been estimated that the Bills gave at least a fairly accurate idea of the proportion

of deaths due to tuberculosis. After 1800 a drop began, pulmonary tuberculosis representing 12 per cent. of deaths in 1850 and 9 per cent. in 1910 (Kayne, 1937). This epidemic wave coincided with the industrial revolution, when the village life of the people was largely exchanged for a factory existence. These changes are in many ways analogous to those occurring to the African who enters industry. It may be that the factors of overcrowding, hard work and a radical change of environment play a large part in the increase in tuberculosis amongst Bantu who have entered industry, and that we should guard against attributing all or most of it to lack of racial immunity and natural selection, or to immunity due to previous infection.

The importance of adequate feeding and housing is indicated by the findings of Dormer and Wiles (1946). Although urban mortality figures (Cape Town, Durban, Port Elizabeth and Johannesburg) were high, those for Johannesburg were low in comparison with the others. Making a calculation to allow for the fact that mine Natives are sent home as soon as the diagnosis is made if they are fit to travel, they estimated that the death rate for 1942 would still be less than half that for the other municipalities. Part of the reason for this, in their view, is that mining Natives have proper diet scales laid down and are much better fed than the average industrial labourer. Mines also provide accommodation of a fairly high standard. Haynes (1951) considers that the deficiency of first-class protein in the African diet may have an important bearing on the tuberculosis problem in Kenya.

Other less tangible considerations than those of material welfare are also involved. These are unnatural and unfamiliar surroundings and separation from other people of their own family, tribe and language. In the Southern Rhodesia public health reports for the three years 1927-29 the deaths from various diseases among mine workers from different countries were recorded. Table II gives these data for tuberculosis. These figures are consistent, and suggest strongly that those who leave their own country to work in Southern Rhodesia are much more likely to die from tuberculosis than are Natives of Southern Rhodesia. A similar trend is shown by the mortality from *all* diseases and accidents among mine workers from these different countries. De Brie (1945), in an article on the policy of social stabilisation by the Katanga Mining Union, gives a striking example of how the settlement of wives and

families can bring down the death rate. The position was that a shortage of labour was developing, as there were not enough workers to man the mines as well as keep up the agriculture of the country; and secondly, miners went home often after only a few months of employment, and it was uneconomical to be constantly transporting them to the mines. To remedy this, wives and families were encouraged to settle at the mines and facilities were provided for them. The author states that this has (at that time) been the only effort in Africa to make a permanent society in labour. It has borne fruit, as shown by a great decrease in the death rate (51/100,000 in 1926, down to 4/100,000 in 1939) and an increase in the birth rate.

Effect of Urban Industry on Rural Areas.—Dormer, Friedlander and Wiles (1943) noted that in certain Native areas, even with a large amount of infection, there was very little disease. They postulated that the disease was aided in the case of the town Native by malnutrition and physical effort, and suggested that Europeans under the same conditions would react the same way.

Since the spread of tuberculosis depends so much on the general state of resistance of the populace, and since it has always thrived in times of upheaval, it is worth considering the study made by Dr. Margaret Read (1942) on the effect of the excessive migration of young men that takes place from Nyasaland to the Union of South Africa, the Rhodesias, the Belgian Congo and Tanganyika. She states in her conclusions that "in the last 50 years the labour demands of an alien economic enterprise have completely undermined the old economic life of the country and are going to undermine its social life as well." She found village life becoming strained and tense, especially between in-laws, as a result of the absence of the men. Many men did not return and came to be called "the lost ones." She emphasises that "in all East and South Africa . . . the economic future of the Africans in their villages depends upon the policy followed for meeting the European demand for labour." Wilcocks (1953) laments the disequilibrium caused in South, Central and East Africa by the migration of young men to and from the industrial centres. He quotes sources from the Transkei, Nyasaland, Kenya and the Belgian Congo, all expressing deep apprehension about the effects of industrial attraction of men away from their homes.

The Tuberculosis Research Committee, 1932, reporting on tuberculosis in previously uninhabited communities, gave their opinion that "the return of individual cases infected elsewhere to such communities does not invariably or even usually light up epidemic tuberculosis. Provided that the community still retains its isolated character and continues to follow its primitive mode of life, the spread of the disease when thus introduced may, it seems, be arrested or only proceed very slowly." If more cases are introduced from time to time, they say, a type of benign endemic tuberculosis may be established in the community. The committee conclude that isolated communities exhibit a marked susceptibility to tuberculosis when brought into contact with infection. This susceptibility is very dangerous when there is at the same time a sudden change in occupation, food, housing and mode of life; but under natural conditions the disease may be fairly well tolerated. MacVicar (1907) observed in the Transkei Native territory that "in spite of conditions which seem so favourable to its spread, the tubercular infection, when introduced into a family, does not as a rule spread rapidly from person to person. In some families, while some members suffer, others escape, regardless it would seem of age, and in those who are attacked the period of incubation is long—two years and even longer." Allan (1932) also noticed that many of the cases in the Transkei had a long course. Here there is a community living in its natural surroundings, but subject to overcrowding and malnutrition. Even though the resistance of the population was low, leading to a high endemicity and high prevalence, the form of disease occurring was the chronic European type, because there was no disturbance of natural living conditions.

In view of this, the warnings of Read and Wilcocks sound a note of alarm for the future of tuberculosis in country areas. If loss of men-folk to town results in economic loss at home, with poverty and malnutrition, and in social disruption and tensions in village life, conditions are no longer natural, and in fact in many ways they resemble those in the industrial centres. The Southern Rhodesian legislation now being implemented to stabilise urban and rural communities is therefore likely to be a great boon to those concerned with the control of tuberculosis.

The Possession of Tuberculo-Allergy.—The follow-up done by the Tuberculosis Research Committee after tuberculin tests of Rand mine

recruits showed that Africans yielding a positive reaction to this test were more likely to develop a recognisable tuberculosis than were those reacting negatively. In those with a positive reaction, 855 per 100,000 developed the disease, whereas in the negative reactors the rate was 105 per 100,000. Thus in these subjects the presence of tuberculo-allergy was associated with a lowered resistance against infection.

Specific Immunity.—There is evidence that specific immunity against tuberculosis exists along with the susceptibility that clearly results in many individuals from a previous infection. Allan (1932) found that there were more cases of tuberculosis on the mines recruited from the high Native areas, which had low reactor rates, than from the low-lying areas, where the rates were high. It was also found by the Tuberculosis Research Committee (1932) that in mine workers who had been tested on employment the septicaemic type of tuberculosis arose more frequently in the negative reactors. Haynes (1951) found in rural Kenya that in similar types of country a low disease incidence was associated with a high reactor rate, and *vice versa*.

Parasitic Infestation.—In tuberculosis, lack of personal resistance is so important in determining the initiation and progress of the disease that the co-existence of other pathology must affect it considerably. In the tropics of Africa parasitic diseases are the rule rather than the exception. It is a maxim of African practice that if malaria parasites are found in the blood of a febrile patient, one then proceeds to look for the other infection that allowed them to proliferate. Hookworm disease, which is very common, causes an anaemia which will be a serious setback to any tuberculosis patient. The effect of other helminths such as roundworms, tapeworms, threadworms, whipworms and bilharzia are harder to measure, but they may be expected to have an adverse effect.

Fatalism.—Once a case has occurred, resistance is greatly lowered by the natural fatalism of the African. A sick person seldom shows an interest in the outcome of his disease; if he is to die, he will die. There is no concept "prognosis" in Shona thinking. This fact robs the tuberculosis sufferer of a powerful weapon: the determination to get better. The attitude results from the religious beliefs of the MaShona, who attribute all disease to supernatural agents. Bullock (1950) gives an outline of the main

tenets of Shona religion. Their most important deity is the familial ancestral spirit or mudzimu, which takes a personal and benevolent interest in the family, but if offended punishes the miscreants with sickness and death. The debasing spirits also play their part; Ngozi, for one, is the spirit of a wronged person such as a murdered man, which kills another in vengeance. Again, there are the witches amongst the people, who have the power to cause misfortune, including illness, in any person who is unlucky enough to cross them. If it were possible to eradicate this way of thinking one could expect a great decrease in the death rate from, for instance, pneumonia. Tuberculosis, above all diseases, requires a high morale and the desire to get better.

(To be continued)
