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MODERN VIEWS IN THE PREVENTION OF TUBERCULOSIS*

BY

D. M. DUNLOP, M.D., F.R.C.P.Ed.

Physician, Royal Infirmary, Edinburgh

It is a commonplace that in the majority of Western European countries and in North America the mortality from tuberculosis has been declining for many years. Stated concisely, the death rate from tuberculosis in England and Scotland has fallen in the last fifty years by about 75 per cent. Moderately reliable tuberculosis mortality statistics began for the first time to be available coincidentally with Koch's discovery of the tubercle bacillus, which discovery set on foot the campaign against the disease. The decline in tuberculosis mortality thus became apparent at much the same time as the antituberculosis measures were initiated, and since then the fall in the one has run parallel with the development of the other. It was natural enough, therefore, for many to believe, and to continue to believe, that this gratifying decline in tuberculosis has been almost entirely due to the noble campaign which has been waged against the disease, largely inspired in this country by Sir Robert Philip fifty years ago. There is much evidence to suggest, however, that the tuberculosis mortality had been declining for many years prior to the special measures taken to combat the disease. Indeed, it is probable that the death rate from tuberculosis had been decreasing in this country since the early part of the nineteenth century. It is, however, apparent that as we go backwards in time an increasing death rate from tuberculosis cannot have continued indefinitely; otherwise everyone would have died of tuberculosis a few hundred years ago, which we know not to have been the case. It has thus been suggested, with considerable evidence for the assumption, that we are at present at the end of a protracted epidemic of tuberculosis, and that the disease is subject to the same epidemic waves as measles, scarlet fever, and diphtheria, with this difference, that whereas the epidemic waves of these latter are relatively short, that of tuberculosis may last a hundred years or more, which is only fitting in a disease which may continue for the lifetime of an individual, in contrast to those which only affect him for a few days or weeks. Further, it is probable that during the course of such an epidemic those nations which have been particularly exposed to the infection have acquired a strong resistance to it, and that those individuals who are peculiarly susceptible to the tubercle bacillus have died at an early age, leaving relatively few descendants who may have

inherited their particular susceptibility. Lastly, the number of young people alive to-day in proportion to the number of people over 40 is relatively less than was the case in the Victorian age, and it is well known that tuberculous disease, particularly where females are concerned, reaches its most lethal peak between the ages of 25 and 35. Thus the decline in tuberculosis mortality may to a large extent be due to circumstances over which we have no control—to the fact that, being on the down grade of an epidemic curve, the seed of tuberculosis is less common than formerly, and that this seed has a proportionately smaller number of susceptible persons on which to produce its effects.

Whether or not we believe that these are potent facts in producing the fall in tuberculosis mortality, it should not lead to a fatalistic attitude in regard to the preventive aspects of the disease. There is no reason to believe that an epidemiological curve cannot be modified beneficially by human efforts. No one, for example, would suggest that the worst effects of epidemics of acute infectious diseases cannot be ameliorated by popular education, by social and public health measures, and by the private efforts of medical practitioners. The same can be said of tuberculosis. The recognition of the fact that we may not be able complacently to congratulate ourselves that the whole fall in tuberculosis mortality has been due to antituberculosis measures does not justify the opposite extreme, now adopted by some—to sneer at the great efforts which have been made to combat the disease, or to deny that these have been a potent contributory factor in lowering tuberculosis mortality. We have only to look, for example, to the increase of tuberculosis in Germany during the war, to its great incidence in certain trades, to its wide occurrence in districts smitten by poverty and unemployment, and to the virtual absence of glandular and bone and joint tuberculosis in countries with a clean milk supply, to be certain that epidemiology, immunity, and natural selection are not the only factors in this great problem.

Factors Leading to Tuberculosis

The factors contributing to the spread and morbidity of tuberculosis are many, but the essential cause is, of course, contact with the infecting agent from either the human or the animal source. It therefore becomes of interest to inquire to what extent such infection can or

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should be avoided, and whether attempts to prevent infection should occupy an important place in antituberculosis measures. The answer to this question depends to some extent on whether adult exogenous infection occurs with significant frequency in civilized communities. I would suggest that adult tuberculosis usually occurs as a late visceral manifestation of an earlier disease, just as general paralysis is a late visceral manifestation of syphilis, and that it is exceptional for an adult to develop tuberculous disease as the result of an outside superinfection, protected as he is by tubercle bacilli acquired in childhood. As one German writer had it, adult tuberculosis is the last verse of the song, the first verse of which was sung to the infant in its cradle. Occasionally a rather high rate of tuberculous morbidity has been shown to occur among medical students and nurses as the result of professional contact with cases of open tuberculosis. Heimbeck has pointed out, however, that this excessive morbidity is found only among those probationers and students who give a negative tuberculin test on starting training, and who are thus to some extent comparable as regards susceptibility to tuberculosis to the Red Indian when first brought in contact with white men. No doubt this immunity in tuberculized adults to exogenous tuberculous reinfection may occasionally disappear, just as it occasionally disappears in the case of the common exanthemata. No doubt also it may be temporarily in abeyance as the result of one of the acute infectious fevers like measles, or during the puerperium. At such times a massive exogenous infection may cause tuberculous disease; but such accidents are exceptional, and in the great majority of cases it is as hard to reinfect a previously tuberculized adult as Koch found it to reinfect a tuberculous guinea-pig. How else can one explain the fact that cases of tuberculous adenitis in sanatoria are not superinfected by cases of open tuberculosis in the same ward; that those most cautious corporations—the insurance companies—do not see fit to load the premiums of tuberculosis officers; and, above all, that there is no statistical evidence to suggest that the tuberculous husband infects his healthy consort with any frequency, or vice versa?

Primary Infection in the Child

If it be true—and there will be many to deny it—that a tuberculized adult is not usually susceptible to a secondary exogenous infection, the attempt to prevent infection in adults is not a matter of primary importance. Our efforts should rather be directed to the prevention of massive primary infection in the young child, who, like the savage, forms virgin soil for the tubercle bacillus. It is probable that some 40 per cent. of children who show a positive tuberculin reaction before the age of 2 die from acute tuberculosis before reaching the age of 5. It is highly desirable, therefore, that infection with tuberculosis should be delayed as long as possible, since it would seem that the younger the child when infection occurs the more likely it is to develop lethal disease, the result of the infection. It would seem, from the results of tuberculin tests, that in this country the tuberculinization of the community is on the average occurring at a later age than heretofore, and this is all to the good.

In the absence of sufficient proof as to the efficacy or harmlessness of the B.C.G. vaccine—and its possibilities might be explored more fully in this country than they have been—efforts to prevent massive infection in young children must continue to be directed along two main channels: their segregation from close contact with cases of open tuberculosis, and the provision of a clean milk

supply. These two measures, if effectively carried out, would go far in themselves to diminish child mortality and morbidity from tuberculosis. They would in my opinion go further: they would tend very considerably to reduce the pulmonary tuberculosis and other late visceral manifestations of the disease in adult life, since experience shows that such manifestations occur very frequently in adults who were subjected to repeated massive infections in childhood.

The segregation of young children from close and continuous contact with open cases of tuberculosis in their family is a matter of great difficulty. The chief ways in which the risk of infection from the human type of the bacillus in a child's home life can be prevented, or reduced to a minimum, are by the removal to a residential tuberculosis institution of an open case of tuberculosis among the parents or those living in the house, or by the removal of the child from the tuberculous home. The second method, or Grancher system, is practised to a considerable extent in France. It aims at bringing up the child in an institution where it will lead a healthy life, no longer exposed to the risk of massive infection. The objection to it is that it interferes with the continuity of the child's home life, and though it is practised to a limited extent in this country, it seems an impossible ideal, and one that it is perhaps undesirable to adopt universally. It is much more satisfactory to remove and treat the adult patient who is the potential source of the infection. With the limited number of beds at our disposal in tuberculosis institutions even this is at present a counsel of perfection. In many districts more beds for tuberculous patients are urgently needed, and in a few cases medical officers of health and tuberculosis officers are too ready to comply with the natural desire of the local authorities to reduce the rates at the expense of adequate accommodation. It is doubtful if any physician in the public health service does his duty adequately unless he is being a continual nuisance to his committee in this respect. No doubt, also, many beds are occupied by patients who might well be nursed at home without detriment to themselves or any risk of infecting young children. Lastly, patients are often inadequately informed of the risk of infecting their children. When this is carefully and considerably explained, it is very rare for them to refuse segregation, however painful such segregation may be.

Infection from Milk

If the segregation of the young child from massive human infection is a matter of extreme difficulty, its segregation from massive infection through milk is eminently practicable. As the result of researches by Griffith, Munro, and others, there is no doubt that bovine type tuberculosis is responsible for a considerable percentage of tuberculous morbidity among children, particularly in Scotland; and though the bovine type of disease is mostly to be found in glandular, lupoid, abdominal, bone and joint, and meningeal lesions, yet it may on occasion cause any type of tuberculosis—not even excluding the pulmonary variety. Having regard to the great prevalence of tuberculosis among the dairy herds of this country, and the absence of a national plan for dealing with it, it is clear that, if conditions are allowed to remain as they are, large numbers of children are doomed to die of bovine tuberculosis or to become crippled by it. In several countries of the world, notably America and New Zealand, bovine tuberculosis has been largely eradicated, owing to the measures adopted to ensure a clean milk supply; but large quantities of tuber-

culous milk are still consumed in this country. As Griffith says, "It is hardly too much to say that if bovine tuberculosis in the human was as distinct clinically from tuberculosis caused by human bacilli as, say, diphtheria is from tonsillitis, public opinion would long ago have insisted on the eradication of tuberculosis in the bovine animal—a perfectly feasible proposition given the necessary dictatorial powers." It is common to hear the remark that a child is all the better for being immunized by a small dose of bovine bacilli. Unfortunately one cannot regulate the dose, and no one would be so bold as to suggest that it is good for a child to drink a teaspoonful of tuberculous pus in its milk.

The provision of a clean milk supply would involve extensive legislative measures and considerable expense. The effort and expense involved, however, would be a fraction of that being at present very necessarily undertaken in rearmament, and would be a productive rather than an unproductive expenditure. It is perhaps not too much to hope that when men have learnt to beat their swords into ploughshares this problem will be seriously tackled.

To those obsessed by the difficulties of the problem of providing a clean milk supply the following postulates, which are accurate enough for all practical purposes, may be put forward for their consideration: any cow giving tuberculous milk to-day will be dead within a year; any cow affected with tuberculosis to-day will be dead in five years; almost every cow which will be giving milk in 1944 is either yet unborn or will be still free from tuberculosis.

Until the ideal of a national clean milk supply is achieved it seems only common sense that all milk given to young children should be pasteurized. It is true that this method is not 100 per cent. efficient in preventing the occasional occurrence of tubercle bacilli in milk, and that in the process certain insignificant losses occur in the milk in respect of its vitamin and mineral content. No one, however, with any knowledge of the subject can believe that these drawbacks do not pale into utter insignificance in comparison with the great risks which are run by children in consuming unpasteurized milk from herds that have not been tuberculin-tested.

Having, by segregation and by the provision of a safe milk supply, taken measures against the massive contamination of virgin soil, the factors that conduce to tuberculous disease must be looked for, not so much among the seed as in the soil in which the seed is sown. That is, infection is almost certain to take place—ideally in small and infrequent doses—and thereafter all our efforts should be directed not so much to the prevention of infection as to raising the resistance of the infected individual, particularly the young adult, against the infection becoming a disease.

Raising the Resistance

Apart from the question of race and breeding, over which we have no control, the resistance of an individual to his tuberculous infection will depend very largely on certain environmental conditions: housing, nutrition, habits, and intercurrent infections.

One has only to glance at the innumerable statistics produced from all over the world to see that tuberculosis and overcrowding go hand in hand—the death rate in many cases running almost exactly parallel to the extent of the overcrowding. The aetiological relation of overcrowding to tuberculosis has, however, been somewhat difficult to resolve into its component parts. On the one

hand, tuberculosis may have a profoundly deleterious effect on the earning capacity of an individual household, causing an excess of tuberculous families to live in poverty-stricken circumstances; on the other, overcrowding itself, with its concomitant inferior nutrition, may act by favouring contact infection and by reducing the resistance of the individual to the disease. As the result, however, of the Tyneside inquiry, recently undertaken by Bradbury at the instigation of the National Association for the Prevention of Tuberculosis, it would seem quite definite that overcrowding *per se* is an extremely important causal factor in tuberculosis, though its relative importance will depend to some extent on the nature of the other adverse conditions present. Overcrowding is a factor which is capable of elimination in the course of time, and the problem is being steadily tackled in this country. There is every reason to believe that the better housing of the future will cause a marked diminution in the incidence of the disease.

Undernourishment as a Factor

If, on the other hand, good environmental conditions as regards housing are only obtained at the expense of increased rents, and therefore cause reduction of the family's food-purchasing power, the advantages which accrue from good housing may be considerably outweighed by nutritional depreciation. This was shown quite clearly in some well-controlled observations by McGonigle in Stockton-on-Tees, where the death rate from tuberculosis actually rose in a new housing area. The increased rate could be definitely correlated with a diminished expenditure on food as the result of increased rents. Again, from Bradbury's Tyneside inquiry, and from numerous other well-controlled observations, a definite statistical association can be traced between tuberculosis and undernourishment. It appears that tuberculous families, while eating more bread, consume less meat, less butter, and particularly less milk than non-tuberculous families. Up till now the principles of good nutrition and the subject of dietetics have been largely neglected in the medical curriculum, and while every doctor can prescribe bottles of medicine comparatively few can prescribe detailed diet sheets. It is not surprising, if ignorance, or lack of enthusiasm, on the subject of nutrition is common in the medical profession, that it should be even more common in the general population; and it is almost certain that a great educational campaign on the subject of nutrition, particularly among girls and young women, would be far more conducive to national physical fitness than the less prosaic campaign now being waged on the subject of playing-fields. At the same time there is nothing more annoying than to hear well-fed people arguing that the deficient diets of the poor are entirely due to their ignorance of what are the best foods to buy. As Sir John Orr has shown, it would tax the skill of the most competent dietitian to provide entirely adequate diets in respect of first-class protein, vitamins, and minerals on the income of many of our working-class families. Still, progress is being made in this field also, and the population as a whole has probably never been so well fed as it is to-day. This progress is likely to be expedited when money becomes available for the saving of life rather than for its destruction. One of the most important pieces of public health legislation of recent years took place when milk was made more generally available for school children. The Minister responsible for that measure was then only the Minister for Agriculture; now that he has become Minister of Health even greater things may be expected.

Training in Tuberculosis

It is apparent that preventive measures taken against tuberculosis can never hope to be entirely successful without the active and intelligent co-operation of all those engaged in the practice of medicine. It may be questioned whether in many medical schools the doctors of the future are being adequately trained in the broader aspects of tuberculosis and in its clinical manifestations. Now that tuberculous cases have been almost entirely removed from the general teaching hospitals and relegated to special institutions, the training of the average medical undergraduate in tuberculosis is too often limited to an occasional visit to a chest clinic or a chest hospital. Here he is given the opportunity of examining a few patients suffering from advanced fibroid disease who are usually called "good teaching cases," and of listening to the sighing of amphoric breath sounds to the accompaniment of consonating crepitations and crack-pot notes—archaic physical signs of little vital clinical importance. It would be just as sensible to teach syphilis only by the demonstration of cases whose knee-jerks were absent and whose pupils had long since failed to react to light. Over-emphasis is laid on physical signs in the chest, which are often difficult or impossible to elicit in early pulmonary tuberculosis, whereas too little instruction is given on the general signs of tuberculous intoxication, common to all forms of the disease, which are often apparent to the patient's relatives and friends but overlooked by the doctor obsessed by his hunt for crepitations in the lungs. Again, the significance of history-taking in the diagnosis of tuberculosis is often insufficiently stressed; and yet the vast majority of patients repeat with variations the same history with the regularity of a theme in a symphony. In many medical schools, in short, the student is not educated in the natural history of tuberculosis, and he graduates with the idea that a slight knowledge of percussion and auscultation is sufficient equipment to enable him to grapple with the disease.

It is not surprising under these conditions that most cases are far advanced before they are diagnosed, and that meanwhile the patients may have grossly infected the youthful members of their family; that patients in need of complete rest, and perhaps collapse therapy, are simply advised to take a holiday in the country, or to change their occupation—from a sedentary one like that of a clerk to a strenuous one like that of a chicken farmer; and that the segregation of young children from open cases of tuberculosis is too often neglected even in circumstances where it is perfectly practicable.

I am only too conscious that there is nothing new in the foregoing remarks. Their object has been to focus discussion on some of the more important questions confronting those working for the prevention of tuberculosis. Owing to lack of time, certain subjects have not even been touched upon. It is generally recognized, for instance, that the open-air school is invaluable in raising the resistance of the delicate child to the disease, and it might be questioned why his more healthy brother should not share in its advantages. Again, the prevention of certain diseases which strongly predispose towards tuberculosis, such as silicosis, might be discussed. Lastly, the thorny problem of contact examination will doubtless find strong protagonists on either side. On the one hand its difficulties and impracticability may be stressed; on the other it may be claimed that contact examination, in its widest sense, is among the most important functions of the dispensary in the prevention of tuberculosis. With the latter view I cannot too strongly agree.

FOUR CASES OF WEIL'S DISEASE INFECTED FROM THE SAME STREAM

BY

KENNETH M. ROBERTSON, M.D., M.R.C.P.

*Honorary Physician, Royal Hampshire County Hospital,
Winchester*

Weil's disease is still rare enough in this country to make its diagnosis difficult unless the clinical manifestations are familiar and its possibility is borne in mind. It is a disease that is admittedly serious, and must threaten life whenever it appears. Different writers have recorded a mortality varying from 10 to 50 per cent. of all cases.

Specific treatment in the form of antiserum is available, and may be of great value, especially if administered in large doses and early in the disease. Davidson and Campbell (1934), in reporting a series of cases from Aberdeen, came to this conclusion: "Hence it appears to us that the clinical diagnosis in the early stage, before jaundice occurs, presents almost insuperable difficulties. Accordingly, the full benefit of serum treatment is unlikely to be realized."

During the past two years it has been my good fortune to have seen and treated four cases of leptospirosis. In addition to these I have had under my care, and have investigated, three other possible but unproved cases. The experience gained by the study of each individual case, as it has appeared, has made possible the early diagnosis and treatment of the later cases, with, I maintain, the most satisfactory results.

The diagnosis should escape no one when jaundice, associated with nephritis and nitrogen retention, has followed upon an acute febrile illness in which headache, severe muscular pain, and scattered haemorrhages have been well marked. But all writers are agreed that at least 50 per cent. of these cases never do become jaundiced, while to wait for a laboratory diagnosis before starting serum treatment is to endanger the patient's life.

I feel, however, that in the very earliest stages the clinical picture is suggestive enough to make justifiable the use of serum before the diagnosis can be proved. Sudden onset of a severe illness, with headache, and quite frequently meningeal signs, high fever, severe pain, and great tenderness in the limb muscles; haemorrhages from the nose and the gastro-intestinal and urinary tracts; and a most characteristic watery suffusion of the conjunctivae such as I personally have never seen in any other condition—these well-marked and very characteristic features should make it possible for the condition to be suspected. If in the presence of these symptoms and signs there is the history of a possible source of infection to which the patient has recently been subjected, as indeed there was in each of the proved cases here described, serum treatment should be instituted at once, without waiting for the laboratory to confirm the diagnosis. The very fact that all these cases—so far as I can discover the only cases of this particular infection that have been reported from South Hampshire—should have come under the eye of one practitioner would suggest that cases are occurring and are not being recognized, and that a fuller and wider knowledge of the infection and of its manifestations would bring to light other cases with, one would hope, a shortening of illness and even a saving of life. It is with this end in view that these cases are here reported in full.