

## SOME COMMENTS ON THE PRESENT STATUS OF TUBERCULOSIS

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I believe that your Secretary was of the opinion that one's army experience must always give one some new ideas, when he asked me to appear before you with a paper. It certainly is the belief that I have acquired a clearer vision of the tuberculosis situation as a result of my army service, that leads me to comply with his request to read a paper on a subject which has been so much discussed and written about.

The greater part of my army service was spent at the U. S. Army General Hospital No. 8 at Otisville, N. Y., the seaboard hospital where the overseas chest cases were received and treated.

In general, my experience has given me a much more hopeful feeling toward the tuberculosis outlook than I had previous to entering the service.

I think that during the early months of our entrance into the war, the entire medical profession was much misled by the gloomy prophecies of our tuberculosis specialists. These men, basing their estimates on the reports of the Allied Countries, foretold the return of thousands of our American boys, victims of tuberculosis acquired in France. They pictured these victims scattering through our towns and villages, each a menace to his community, a carrier and spreader of the germs of the dreaded white plague.

It later appeared that the only basis for these false prophecies was the reports of the French on the situation in France. Particularly misleading was the report of Professor Landouzy, who first voiced this apprehension with his estimate of 150,000 cases of tuberculosis in the French army. This unfortunate exaggeration was widely quoted and quite generally accepted as representing the danger to French military efficiency from this source, and

by inference therefore, to the arms of the other nations as well.<sup>1</sup>

As a matter of fact, the later, more authentic reports on the French situation developed the fact that the number of soldiers discharged from the French army from August 2, 1914, to October 31, 1917,<sup>2</sup> was 89,430. Of these 70,196 were discharged previous to March 1, 1916, and largely represent pre-existent cases of tuberculosis caught into the army by the urgently rapid mobilization.

These cases constituted about 1.75 per cent. After these early cases were eliminated the percentage fell to .63 per cent, which is about the same as was later found in the Italian army where Sforza in charge of the diagnostic tuberculosis center of Rome, relates that the call to arms poured the entire male tuberculosis morbidity of the country into the army. Thus we were all led to believe that the high tuberculosis incidence among soldiers was due to the war, and that tuberculosis was rapidly increasing.

In the mobilization of the American army<sup>3</sup> the draft boards rejected 69,935 men for tuberculosis. The army surgeons afterward rejected 14,967 men who had been passed by the local draft boards, or a total of 84,903. It therefore appears that as the result of the careful medical examinations of our draft boards and army surgeons<sup>4</sup> tuberculosis was 13 times more prevalent among civilians than among soldiers. Instead of army life increasing the incidence of tuberculosis and returning our boys from France a menace to their communities, the army life really diminished the hazards from tuberculosis<sup>5</sup> so that

<sup>1</sup> Tuberculosis Among European Nations at War, by James Alexander Miller in the American Review of Tuberculosis, August, 1919.

<sup>2</sup> Tuberculosis Among European Nations at War, by James Alexander Miller in the American Review of Tuberculosis, August, 1919.

<sup>3</sup> The Present Status of Soldiers and Draft Rejects with Tuberculosis, by William H. Baldwin in the American Review of Tuberculosis, August, 1919.

<sup>4</sup> Victor C. Vaughn and George T. Palmer in The Journal of Laboratory and Clinical Medicine, July, 1919.

<sup>5</sup> Tuberculosis Among European Nations at War, by James Alexander Miller in the American Review of Tuberculosis, August, 1919.

The Army in Relation to the Tuberculosis Problem, by Col. G. E. Bushnell in J. A. M. A., June 15, 1918.

The Present Status of Soldiers and Draft Rejects with Tuberculosis, by William H. Baldwin, American Review of Tuberculosis, August, 1919.

whereas of the civilians applying for military service, 2.34 per cent were found tuberculous, only .05 per cent of those who came up for demobilization were found to have tuberculosis.

The facts that were to be learned from the examinations and care of some two thousand of these cases are the basis of my optimistic feeling toward the tuberculosis situation. These facts I will now discuss in a somewhat didactic manner.

#### CAUSATIVE ORGANISMS

Although we handled a large amount of tuberculous material in the laboratory and our work naturally led us to constant review and perusal of recent literature on the subject, yet I am unable to note that the war developed any new facts relative to morphology, colony growth, motility, staining reactions or viability in vitro of the causative organism of tuberculosis.

As to the character of the toxin produced by this organism, the work of Vaughn,<sup>6</sup> wherein he identifies the various split products and determines their toxicity, appears to be the last and accepted facts of the situation.

#### LIFE OF THE ORGANISM WITHIN THE HUMAN BODY

In a consideration of the organism and its probable entrance into the body, the burden of argument leads one to think that the tubercle bacillus finds its entrance into the human organism through the oral passage, rather than through the respiratory tract as I had formally believed. It may enter on food or in the food, or on the hands of the baby, soiled from the oral excreta of the adult carrier. Once within the oral passage, it possibly not infrequently finds its first point of localization in the tonsils.<sup>7</sup>

The paths of transmission from tissue to tissue in the body have been for a long time, as regards the tubercle

<sup>6</sup> Protein Split Products in Relation to Immunity and Diseases, Vaughn, 1913. Chap. 8.

<sup>7</sup> Bacillus Tuberculosis in the Tonsils of Children Clinically Non-Tuberculous, R. S. Austin in American Journal of Diseases of Children, July, 1919.

Tuberculosis of the Ear, Throat and Nose, Arthur E. Prince and W. G. Bain, Illinois Medical Journal, September, 1910.

bacillus, a much debated question. A study of the relation of infected lymphatic glands to other localizations of the tubercle bacillus, is strongly convincing that the paths of transmission are by the way of the lymphatics, though, of course, there is the obvious transmission from one portion of an organ to another by contiguity.

#### THE ANATOMICAL POINTS OF LOCALIZATION

Though it formerly had appeared that the tubercle bacillus might develop in any anatomical localization, the lungs being the most frequent location, it would now appear that the glandular tissue is primarily and most frequently involved.<sup>8</sup>

The bones and joints are involved secondarily in children. The apices of the lungs are involved most frequently in adults, our own autopsies showing the upper lobe more than 95 per cent, the middle lobe more than 80 per cent, and the lower left lobe slightly below 80 per cent, and more often involved than the right lower.

The effects of the growth of the tubercle bacillus on the infected tissues is a matter of greatest interest, in view of the fact that it is this particular phase of the situation upon which hinges the hopeful outlook for the future. \* It is the reactions to the primary lesion which must determine prognosis. The pathology, therefore, of the primary lesion, is all important. The following case cited by Dumas and Beclere<sup>9</sup> possibly throws some light on the character of the primary lesion.

“The breast fed infant of 13 month contracted tuberculosis from a nurse and developed spleno-pneumonic bacillaire with signs of tracheobronchial glandular involvement. The child threw it all off finally, and six years later not a trace can be found except one small shadow, evidently a calcified gland. This was probably the initial lesion, and around it was a perituberculous congestion so intense that it simulated pleurisy of the right side.”

<sup>8</sup> Deycke's Epidemiological Observations on the Occurrence of Tuberculosis in Turkey.

<sup>9</sup> Bulletins de la Societe Medical des Hopitaux, Paris.

Such a reaction occurs only in the individual who has no acquired immunity from previous tuberculous infection. These lesions, it appears from numerous authorities, occur in the infant under two years of age, and give rise, according to Hesse and others<sup>10</sup> to more deaths during the first year of life than any other period except between 35 and 40. This primary lesion occurs in one class of adults only, those who have been out of touch, from infancy, with civilization, with these it is particularly severe and often fatal.<sup>11</sup>

Romer, who reports on tuberculosis in Argentina and elsewhere, concludes that, "the less extensive the prevalence of tuberculosis in a population the greater the fatality of tuberculosis, or reversing the process, the more widespread tuberculosis is in a population, the less fatal is the form of the disease." In civilized communities the primary lesion does not occur in adults. The primary lesion is less fatal to infants, and the secondary lesion less fatal to adults.

It is the slowness of development of the secondary lesion and the reaction of the tissues to the toxins of the tubercle bacillus that convince one of the existence of a potential immunity. Statistics generally agree that the tuberculous lesion is found in more than 95 per cent of autopsies from deaths not tuberculous. These lesions show a calcareous center surrounded by a firm fibrous wall of tissue, and a third line of defense consisting of giant cells and endothelial leucocytes. It is this evidence that makes one certain that immunity can be developed.

On the other hand the remnants of defensive structures which are seen in the autopsies of those dead of tuberculosis give us additional evidence of this immunity. Here we find these walls of fibrous tissue, not of microscopic size, but in masses firm and solid, oftentimes thicker than one's hand.<sup>12</sup>

<sup>10</sup> The Significance of Tuberculosis in Infants and Children, Alfred F. Hess, J. A. M. A. January 11, 1919.

<sup>11</sup> Review of Fulminating Tuberculosis of Tracheobronchial Glands, A. Dumas, J. A. M. A., June 7, 1919.

<sup>12</sup> Manifest Pulmonary Tuberculosis, Col. G. E. Bushnell, The Military Surgeon, April, 1918.

It is, in viewing such an autopsy that one feels that had the potential immunity been reinforced by the cooperation of the patient and community, the fight against the tubercle bacillus would have been won instead of lost.

#### THE EFFECT OF THE TOXINS ON THE SYSTEM

Beside the local reactions above described, the toxins of the tubercle bacillus developing in an active lesion, have certain general effects upon the system. The toxins tend to bring about a depression of cell activity. This is manifested by the low white count frequently observed and recorded in our work, also by the general muscular weakness and low blood pressure. There is, too, a distinct singling out of the nervous system by these poisons which manifests itself in the reaction to stimuli of different kinds.<sup>13</sup> Advanced cases of tuberculosis show frequently mental weakness. These patients have erratic appetites. This may be due to the action of the toxin on the central nervous system or of tuberculous inflammation of the abdominal viscera. These tuberculous inflammations were present in a very large percentage of cases either as a tubercular involvement of the peritoneum, small intestines, the appendix, or cecum, or as a toxic cirrhosis of the liver.

#### ATRIA OF EXIT

As to the atria of exit of the tubercle bacillus from tuberculous patients, the bacilli in the case of open lesions are undoubtedly constantly leaving the body in the feces. Occasionally we have found them in the urine. We always found them in the sputum in open lesions of the lungs, and in the discharges from pleural fistulae.

#### MEANS OF DIAGNOSIS

From the standpoint of diagnosis the problem of tuberculosis was approached in at least five different ways. First, the application of the usual staining reactions to the sputum, by which means in open lesions one is usually able to determine the presence of tuberculosis positively.

<sup>13</sup> The Nervous System in the Tuberculous, A. Ferrannini in *Riforma Medica*, Naples.

So far as I could observe in the making of thousands of examinations, the number of tubercle bacilli present bore no relation whatever to the physical condition of the patient. Thus if the tubercle bacilli were present in the sputum, the patient undoubtedly had tuberculosis. If the tubercle bacilli were not present, the burden of proof must then rest on the other means of diagnosis.

The second was the skin test of Von Pirquet, in which test, a small amount of Koch's old tuberculin is applied to a scarification of the skin, or by interdermic injections. This test was not used on tuberculous patients. However, some experimental work was done on healthy soldiers who volunteered, that we might determine the relation of a positive Von Pirquet to the normal individual. In these tests our observations were, that more than 95 per cent of adults give a positive reaction. There was considerable variation in the size and character of the reacting lesion, and the amount of tuberculin in a small percentage of cases had to be increased.

Two conclusions from these experiments could be drawn. First that the Von Pirquet has no diagnostic value in adults and second, the reaction is probably in proportion to the acquired immunity of the individual against the tubercle bacillus.<sup>14</sup> Spolverini applied this test to 900 supposedly non-tuberculous children under one year of age. He obtained a positive reaction in 7 per cent, .8 per cent positive at the age of four months, 2.4 per cent at six months, and the remainder, six to twelve months.

Third, the X-ray as a diagnostic means appeared to have much value, not, however, in determining an unrecognized tuberculosis, but in determining the extent of the lesion, its exact location, and its retraction under treatment when plates made at different periods were compared.

Roubier states in this connection on observation of a thousand cases of tuberculous suspects, that with an act-

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<sup>14</sup> Observations which would have a bearing on the age at which the child began to acquire tuberculosis, by L. M. Spolverini in *Rivista di Clinica Pediatrica*, Florence, 1919.

ual tuberculous lesion at the apex<sup>15</sup> clinical and roentgen findings harmonized in 90 per cent of the cases. The roentgen ray always revealed more extensive lesions than would have been surmised otherwise. 4½ per cent were not diagnosed clinically but *were* diagnosed with the X-ray.

The X-ray does not differentiate an active lesion from an inactive.

Fourth, the use of the complement fixation test for the diagnosis of tuberculosis was tried on a series of cases, with the result that it was only positive in cases of tuberculosis. It was not positive in all cases of active tuberculosis. It was negative in all normal individuals.<sup>16</sup>

Stoll summarized a number of cases in this connection as follows: Forty robust men gave negative fixation tests. Of 161 of all kinds of cases, 45 were positive. In our work we found that a higher percentage of positives was observed when the anti-sheep haemolytic system was used instead of the anti-human.

Fifth, the determination of active tuberculosis appeared to rest finally upon the question of the presence or absence of moisture in the alveoli in the suspected tuberculous area. When at the end of expiration the separating of the moist walls of the tiny alveoli with the resulting rale was heard upon auscultation, the case was assumed to be one of active tuberculosis.<sup>17</sup>

#### EPIDEMIOLOGY

A study of the tubercle bacillus outside of the body has led us to believe that an organism in the bright sunshine retained its ability to multiply for a minimum period of about six minutes. As the sunshine and light are decreased and conditions of moisture are preserved, it is supposed that the organism will live for days, weeks, or possibly months. Thus its presence in old houses, on

<sup>15</sup> A Thousand Cases of Tuberculous Suspects, reviewed by C. Roubier, *Progres Medical*, Paris, June 14, 1919.

<sup>16</sup> The Complement Fixation Test in the Diagnosis of Tuberculosis, Henry F. Stoll, J. A. M. A., April 12, 1919.

<sup>17</sup> Francis Trudeau in A. M. A. September 7, 1918.

Physical Examination in the Diagnosis of Early Pulmonary Tuberculosis, by Louis V. Hamman.

the floor, in cracks, and rising in the dust, makes the organism a possible menace to the creeping infant, long after the carrier who left the organisms has gone from the premises, moved from the community, or died.

The organism on the other hand, may be transmitted to the child by inhaling the spray from the coughing tuberculous person, or by direct contact when the tuberculous fondle the uninfected child. The carrier of tubercle bacilli to the child may be without clinical evidence of tuberculosis. Some such lesion as a cavity communicating with the bronchus, frequently observed, may retain the bacillus for long periods of time. An adult in a high state of immunity to the tubercle bacillus may have a tuberculous tonsil or sinus from which the bacilli are excreted from time to time, and which local lesions are not of serious moment to the patient, but the excretions from which are capable of infecting the non-tuberculous child.

From what has been said it ought to be plain, that only infants from birth to two years are without tuberculous infections, except adults living away from civilized communities. These two classes of people then, are highly susceptible to tuberculous infection, originating outside of their own bodies. The adult in a civilized community acquires an active tuberculosis by a reactivation of an ancient tuberculous focus, which focus has been surrounded by a protective fibrous tissue wall, but which has been unable to prevent further dissemination, when the physical resistance of the individual remained lowered over a great period of time. It, to me, seems doubtful, in view of all of the evidence that has recently been brought to bear, that tuberculosis in the adult is ever acquired from association with the tuberculous.

What now are the lines along which the fight against tuberculosis is being directed? The measures adopted in the Army for the cure of the tuberculous soldier were, first and most important, and without exception, if the patient had an active lesion, to take complete rest in bed, night and day, week after week, until the moisture in the infected area had disappeared. During this period of

rest in bed, patients were given wholesome food and plenty of it. Their minds as far as possible, were put at ease by allowing the patients to do whatever mental work was best suited to their mental capacity. If they were unable to read or write, one of the many faithful and self-sacrificing Red Cross volunteers was sent to their bedside where for hours, day after day, and week after week, if necessary, these women would bring to bear every maternal instinct in order to keep the boys in a contented state of mind. If the patients were able to use their hands and so desired, they were allowed to knit, crochet, do basket work, draw, or work at some similar form of entertaining employment under the direction of one of the corps of Reconstruction Aides.

Once a patient had reached a state of recovery that classed him as a case without moisture or rales, he was allowed to take part in one of the innumerable physical activities arranged for his benefit. These consisted of everything from graduated marches to the regular work in the shop, automobile department, or camp activities. The end and aim of all this treatment was to give the natural forces every chance, and to give every aid to the immune forces of the body to produce the ferments by which growth and extension of the tubercle bacillus could be checked. This alone was the specific treatment for tuberculosis.<sup>18</sup>

Next, such protective measures as will separate the tuberculous with open lesions from contact with the uninfected infant, so that the infant will not at any time acquire a massive infection of tubercle bacilli from the excreta of the adult. For the protection of the adult against tuberculosis, there is primarily the maintaining of physical resistance, which resolves itself into the civic problem of housing, wages and conditions of work, and which makes incumbent upon you as free citizens, as Otto R. Reichel of the New York Board of Health expresses it, the following duties:

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<sup>18</sup> Manifest Pulmonary Tuberculosis, Col. G. E. Bushnell in The Military Surgeon, April, 1918.

1. It is your duty to stop careless spitting. Public sentiment against this dirty habit must become so strong that nowhere will it be tolerated.

2. Do all in your power to keep the place in which you live and work absolutely clean, and especially to prevent dust.

3. Insist upon fresh air and sunlight at all times and in all places; become a fanatic on the subject. Fresh-air fanatics are very badly needed. They are especially needed on railroad trains, in drawing rooms, in many offices, and, alas, not only in many theatres but also in many lodges, clubs and churches.

4. Never occupy a new home until it has been thoroughly cleaned and aired. Prefer places that have exposure to sunlight.

5. It is almost superfluous to add, keep clean in body and mind, be moderate in all things; eat only plain, wholesome food; drink and smoke in moderation or not at all. It is best to abstain entirely.

6. Last of all, everything that you can do to make life healthier and happier helps to avoid tuberculosis—better wages, better working hours, better food at lower prices, playgrounds for children and adults, better factories, schools, homes and work places. We can do no better than try to live healthy, happy and useful lives, and to assume a strict personal responsibility, as is our civic duty in a republic, to see to it that opportunities for these things are available to all the people, but especially to those less fortunate in life than ourselves.