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Original Articles.

THE EXAMINATION OF SOLDIERS FOR TUBERCULOSIS IN THE U. S. ARMY.

BY EDWARD O. OTIS, M.D., BOSTON,

Late Contract Surgeon for the Examination of the National Guard of New England.

NEVER before in any war or in any army have such comprehensive methods for detecting and eliminating tuberculosis from the fighting force been inaugurated and pursued as are now in operation in the U. S. Army. The Surgeon-General with his profound knowledge of and experience in preventive medicine determined, early in the mobilization of the great army, that, so far as humanly possible, tuberculosis should not be a leading factor in incapacitating men, already trained and on the fighting line in Europe, from further service. The deplorable losses in the French army from this disease have been shown by Biggs¹ after his return from investigating the subject in France. "By the end of December, 1915," he says, "86,000 soldiers had been returned to their homes with active tuberculous disease." And "In February of this year it was estimated that about 150,000 had thus been returned, and more are constantly being discharged for this cause." In the armies of other warring countries the history of France has been repeated to a greater or less extent, he says, the least so in England and in the Canadian Expeditionary Force. Even with all imaginable precautionary measures our army is sure to have many losses from tuberculosis, owing to the static conditions in

trench life, with all the accompanying hardships under which the warfare on the Western front is conducted, so different from the fighting in the "open" of other wars, when life led in the open air, to a certain extent, may be supposed to have counterbalanced other unusual hardships and in which even active tuberculous soldiers have maintained their strength and fighting ability and even improved.

In order to accomplish his object, the Surgeon-General ordered that all the troops in the then existing armies should receive a special examination for tuberculosis, and the management of this truly colossal task was put into the hands of Col. G. E. Bushnell of the United States Army, who had for many years been at the head of the United States Army Sanatorium at Fort Bayard, New Mexico. No more experienced or efficient man could have been selected.

The problem with the New England National Guard was to examine every single man, officers as well as soldiers, about 30,000 in all, and to complete this examination within about two months before the force sailed for Europe. It was done in rather less time. For the purpose of this examination an officer of the Reserve Corps, experienced in tuberculosis work, was detailed to take charge of the work and under him was a number of contract surgeons, some giving their whole time and some half time, all of whom had been selected for their fitness for the work on account of special experience in tuberculosis—in hospital, sanatorium or dispensary. What was required in the examinations can perhaps be best shown by quoting the instructions given to each examiner:

"INSTRUCTIONS FOR SUGGESTIVE PHYSICAL EXAMINATION OF THE CHEST."²

"The subject should be stripped to the waist and scrutinized for various developmental defects of the thorax and if found associated with an apparent delicate constitution may constitute a cause for rejection or discharge even if no definite disease is discovered. All that is absolutely necessary is to determine the presence of a tuberculous lesion of sufficient activity to constitute a cause for rejection or discharge. This can be done in well marked cases of active tuberculosis in a few moments. To demonstrate the absence of disease in suspicious cases naturally requires a longer time.

"*Auscultation.*—The subject is instructed to breathe more rapidly and deeply than normally, yet avoiding noisy respiration and relaxation of the shoulder muscles as much as possible. The examiner standing in front of the subject applies the stethoscope to the lower axillary region going upward anteriorly comparing points on both sides; note carefully any change in breathing sounds from the level of the third rib upward.

"*Examination of Back.*—Secure the breath sounds right base, proceeding upward, comparing symmetrical points on either side.

"*Physical Signs.*—Look especially for (1) Harshness and jerky inspiration. (2) Prolonged expiration. (3) Fine crackling râles. (4) Feeble breath sounds. (5) The presence of any type of râle is cause for a deferred examination. (6) Search for enlarged lymphatic glands.

"(a) The question of activity is determined by the presence of typical râles; if disseminated râles are present the examiner needs to go no further to recommend rejection, discharge or deferred examination.

"(b) Deep expiration and cough will be necessary to elicit the indeterminate râles.

"(c) Indeterminate râles in abundance are easily heard and are usually cause for rejection, discharge or deferred examination.

"(d) Severe pleural adhesions which bind the lung tissue firmly to the thoracic wall is cause for rejection or discharge.

"(e) It is left entirely to the individual examiner to determine whether a deferred examination is advisable. A recommendation for discharge should not be made until after a careful deferred examination.

"(f) Examiners are detailed for the special work of detecting tuberculosis. They will, of course, take the same action if they encounter conditions in the thorax due to other causes which demand discharge, special treatment or a deferred examination, but these cases should be reported to the camp surgeon with recommendations."

Although it is stated in these instructions, "that all that is absolutely necessary is to determine the presence of a tuberculous lesion of

sufficient activity to constitute a cause of rejection or discharge," it was also determined that every case which exhibited undoubted evidence, from the physical examination, of non-active, latent or arrested disease should either be recommended for discharge, or for further careful investigation by other members of the examining board. The reason for rejecting non-active cases is thus stated by Biggs³: "Any man," he says, "with even a very limited amount of pulmonary tuberculosis that is latent or arrested, is almost certain to break down under the physical strain of military training and army life, and a focus of disease previously latent or arrested will almost certainly become active." This statement seems to the writer to be rather extreme; in the first place a "very limited amount of pulmonary tuberculosis" is not always easy of detection; and, secondly, it has been found by many observers that arrested cases may bear the strain of military life perfectly well. "Clinically cured tuberculosis subjects," says Roepke, quoted by Fishberg⁴, "who stand the training well may be sent to the front." Fishberg, after citing various European authorities with regard to the effect of military service upon non-active tuberculosis, concludes that the facts which he has just cited would seem to indicate that military service in the field is no more likely to reactivate dormant or quiescent tuberculosis lesions "than any other civil occupation requiring muscular exertion, walking, exposure to the vicissitudes of the weather, etc." Life on the firing line, however, under trench conditions, makes far greater demands upon one's vitality than "muscular exertion, walking and exposure to the vicissitudes of the weather, etc."

The medical superintendent of the Manitoba Sanatorium, Canada, Dr. Stewart⁵, who has had experience in the care of tuberculous soldiers, says, on the other hand, that the war has not increased the number of tuberculous men so much as it has stirred *latent* disease into activity. "War, therefore," he continues, "and the training for war, creates the very conditions which lead to tuberculosis breakdown. That *latent* disease subjected to such conditions should in hundreds and thousands of cases flare up into *activity* is only to be expected."

The experience in the British Army is of a similar nature. "A twofold influence is exercised by military service on pulmonary tuberculosis," says Dr. H. Hyslop Thompson,⁶ "while the conditions inseparable from active service *abroad* tend to reactivate the disease in soldiers with latent tuberculous foci or to induce an entirely fresh infection, the open-air life, physical exercise and ordered routine of military training in *this country* undoubtedly exercise a beneficial effect on the health of soldiers who have latent pulmonary tuberculosis, or who, from inheritance or other causes, are predisposed to the disease."

It is also to be remembered that these men

of the National Guard were soon to go to the front and there was no time to keep them under observation for any extended period. It may be mentioned here that all the men had received at least two previous examinations, one when they first enlisted, and the other when they were taken over by the national government into the federal service. Some, for one reason or another, had received several additional examinations. I recall the case of one soldier who said he had been examined six times previously. It was obviously impossible to obtain any previous history from the rapidity with which the examinations had to be made and consequently one had to depend chiefly or wholly upon inspection and the physical signs. Moreover, one had to work with great celerity in order to accomplish such a stupendous task as the examination of nearly 30,000 men—the exact number being 29,950—in the short space available. After a certain amount of training, however, in this rapid method of action, the “flying squadron of heart and lungs,” as we were facetiously called, was enabled to examine 100 men or more per examiner a day, and with a fair degree of accuracy, I believe. Col. Bushnell⁷ states that in an experimental examination of 25 men at Fort Bayard Sanatorium the time occupied was 58 minutes, the time for each patient varying from one and one-half to two and one-half minutes. “Of course,” says Col. Bushnell, “a diagnosis made with such speed is more or less of a ‘snap’ diagnosis, and the method is not recommended for universal adoption except as a preliminary examination to select cases that may appear doubtful for later and more thorough study. Still the results were more accurate than had been expected, and show, it is thought, unmistakably, that a sufficiently correct diagnosis to exclude cases of manifest and active tuberculosis from the army could be made very quickly.” Of course there was a certain number of border-line cases or suspects upon whom, both in justice to the examiner, the service, and the man himself, a definite diagnosis could only be made, if made at all, by a second or repeated examinations at intervals after observation. The limited time, however, did not permit of an observation period, and the only thing to be done under the circumstances was a consultation over the case by several members of the examining board; and if three of the number agreed upon a verdict, the man was passed or rejected, according to the decision. If no three men could agree, the man was passed. The active cases as evidenced by persistent râles and generally defective development, with other corroborative evidence, were easy of detection and there was no doubt as to their rejection except in certain cases of acute infection, such as influenza or bronchitis. There were, however, surprisingly few of patently open active cases. The diagnosis of the non-active, latent or arrested cases,

the “old tops,” as some one called them, was not always so easy; here, the diagnosis had to be made mainly from inspection, the quality of the resonance and respiration, and the voice sounds, with what little history one could obtain in the limited time.

Undoubtedly mistakes were made with these cases and some were rejected who, upon re-examination at intervals, would not have given sufficient evidence of any tuberculous infiltration or old fibroid condition. I believe, however, that such mistakes were few, and all such cases had the advantage of an examination by several experts, at least three of whom had to agree before the final judgment for rejection was pronounced. It seemed regrettable to reject a man who had already been partially trained and who was doing his duty without apparent discomfort, who appeared to be well and robust and who had no symptoms, but the assumption was, as has been said above, that under the strenuous life and exposure of trench work he would break down and the latent or arrested disease become active. Of course there was the chance that he would go through all right, but it was considered that the chance was largely the other way. It would seem sensible that some service should be arranged for such cases whereby they could be retained in the army and the training they had already received be utilized. Klebs⁸ suggests the creation of a service for tuberculous subjects otherwise fulfilling certain minimal standards, in which they could be under observation and yet be trained for some of the many occupations in the rear of an army which “modern military practice tends more and more to assign to especially organized and trained bodies of unarmed men.” Elliott⁹ also is of the opinion that “men who do not come up to the standard required for service in a combatant unit (and among such we may include our tuberculous subjects and arrested or latent cases) may yet be fit for one of the non-combatant services—or may be attached to the home service in clerical or other light duties and relieve a man physically fit for overseas.”

In addition to the rapidity with which the examination had to be made there were other inconveniences under which the work had to be done which added to its arduousness. In the first place, all sorts of places had to be utilized in which to conduct the examinations—outdoors under the trees or in a field or any open space, in noisy mess halls, in crowded tents, rarely in any place where it was quiet, so that one had to become oblivious to extraneous noises and hear only the sounds elicited by percussion or heard on auscultation—not always an easy thing to do. Again, after continuous and rapid work for a time, one’s ears became so sensitive that it was actually painful to apply the stethoscope to them and one’s head became so weary that finally the examination became a sort of automatic procedure instead of an intelligent

mental process. Experience and training, however, largely obviated this difficulty.

Further, one had to watch out for deception. The man under examination might be trying to get out of or remain in the army, and in consequence would give false symptoms or misleading answers or would wilfully breathe in such a way as to make it difficult to interpret the respiratory sound. Such cases, however, were comparatively rare.

As was stated above, most of the men had received a general physical examination at least twice before; one upon their original entrance into the National Guard, and again when they entered the federal service, and the thoroughness of these examinations, so far as the lungs were concerned, appeared to vary considerably, for quite a number of obviously active cases, beyond the incipient stage, had somehow slipped through. Probably the eagerness to fill up the ranks to the maximum strength had much to do with this.

The effect of the previous occupation was strikingly noticeable in many cases; in general, the men who had led outdoor lives, like the lumbermen of northern Maine, or the farmers of Vermont, were a far more rugged set, and were almost entirely free from tuberculosis, while those who had been operatives in mills and factories and had led an indoor life were far inferior in physical development and afforded many more cases of tuberculosis. Those who had used alcohol more or less constantly also gave many cases of tuberculosis. The many cases of slight acute bronchitis, amounting to almost an epidemic in some camps, made the interpretation of localized râles without other evidence difficult if not impossible. Such cases, of course, needed interval observations in order to arrive at a definite diagnosis, but as this was not usually possible under the circumstances the cases had to be decided upon the present condition with such additional evidence and previous history as could be obtained in the limited time.

As the greater part of the examinations had to be done in camps the employment of the x-ray in suspects and doubtful cases was not available, nor was the use of tuberculin feasible. As regards x-ray examination as the sole criterion in determining the existence of tuberculosis—as I understand was done with one of the New York regiments—I believe that more errors in judgment will be made as to rejection or retention of the subject than when the decision is based upon a careful physical examination by an experienced expert. As an aid or a decisive factor in doubtful cases it is of undoubted value.

As to the results, out of 29,950 men examined 680 were found to be tuberculous and were recommended for discharge, a little over two per cent. It is to be remembered, however, that the greater number of these were of the non-

active or latent type. As will be observed, the conditions under which this large body of men were examined were far from ideal, both on account of the limited time at our disposal and the often unfavorable circumstances under which the work was done. Still I believe that the results were substantially correct and that few men were discharged or retained who ought not to have been. With one or two exceptions we received most courteous treatment and cordial co-operation from the commanding staff and the regimental surgeons, which rendered our duties very much easier. Coincident with our appearance or just preceding us in some of the camps was the psychiatric squadron, so that it would not have been strange if the officers had been somewhat impatient at this succession of examinations and asked "what next?"

The following is a general suggestive scheme for tuberculosis examinations when they can be made under more favorable auspices in a permanent camp and with sufficient time for more leisurely work and for observation:

I. So far as possible only experienced experts should be employed; the technic of percussion and auscultation may be learned in an intensive course of instruction and more or less skill acquired, but judgment in making a correct interpretation of signs and symptoms comes only from long experience.

II. Only a certain number of examinations should be made by the examiner in a day. After a period of time—differing with different examiners—spent continuously in percussion and auscultation one becomes mentally weary and his ears "dull of hearing" and his judgment uncertain.

III. The place of examination should be such that comparative quiet can be maintained; one can make an examination under noisy conditions, but it is far more exhausting to the examiner and a certain amount of accuracy is likely to be sacrificed.

IV. A short history should be taken of each soldier, which can be done by an intelligent and honest, non-commissioned officer according to a prepared schedule of which the following questionnaire is an illustration:

- (a) Have you ever had pleurisy, pneumonia, typhoid fever, influenza or any severe illness?
- (b) Did you ever spit up blood?
- (c) Have you been losing weight or strength recently?
- (d) Are you short of breath on exertion?
- (e) Have you a cough, and, if so, how long has it lasted?
- (f) Are you subject to colds?
- (g) How is your appetite and digestion?
- (h) Do you use alcohol?

V. All suspicious cases should be deferred for a second examination and consultation, and if then the doubt still exists the subject should be kept under observation for a period of time, or, if an x-ray outfit is at hand and a competent technician in charge, an x-ray negative

can be taken. It is a common experience that suspicious physical signs upon the first examination may at a subsequent examination at an interval of a few days be found to have entirely disappeared.

VI. When sputum is obtainable in a suspected case it should, of course, be examined, and for this purpose a clinical laboratory should be at hand as well as for other bacteriological examinations.

VII. All cases with any developmental defects of the chest, such as rachitis, or with defective musculature, should receive especial attention in the examination.

VIII. In suspicious cases, particularly with a pulse above the normal, the temperature should be taken at stated periods for several days.

IX. All acute respiratory infections, such as bronchitis, influenza, laryngitis, etc., should be kept under observation in the hospital.

Elliott¹⁰ advises that each man should be re-examined once in three months as a routine measure. And "a most thorough medical examination is essential," he says, "when he is warned for departure overseas." While this may not be necessary or possible with a large army, and when departures are uncertain and often unexpected, at least all cases which for any reason aroused suspicion in the former examination should be re-examined, at intervals, as well as those suffering from any "bronchial trouble." If "eternal vigilance is the price of liberty," it is equally the price of keeping tuberculosis out of the army.

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- ⁸ Tuberculosis and Military Organization, by Arnold C. Klebs. Reprint from the U. S. Naval Bulletin, Vol. ii, No. 4.
- ⁹ Lessons from Canada's War Experiences with Tuberculosis. Reprint from the American Review of Tuberculosis, Vol. i, No. 5, June, 1917.
- ¹⁰ Same as above.

THE AFTER-CARE OF THE WAR CRIPPLE.*

By F. A. MCCARTHY, M.D., FALL RIVER, MASS.

THE privilege of addressing you I consider not only an honor but a patriotic duty to discuss with you such an important and timely subject as "The After-Care of the War Cripple." The preceding speaker has told you what is to be done with the soldier maimed and scarred, from an industrial standpoint. Allow me, if you will, to tell you a few things about

the status and purpose of the orthopedic surgeon in this conflict.

In order that there should not be any misunderstanding, it perhaps would be the proper thing to define the word, "Orthopedic," for we have been called, by the laity, many beautiful and sacred names. We have been called the bone doctor, the foot doctor, the toe doctor; and one woman, who called at my office, eagerly inquired if I was the toe-nail doctor. According to Col. Sir Robert Jones, who, in the opinion of orthopedic surgeons, is probably one of the greatest in the world, the misspelling of the word, "Orthopedic" is probably responsible for the wrong understanding of its service. The fact that in America the word is spelled o-r-t-h-o-p-e-d-i-c leads many to believe that the p-e-d is derived from the Latin word, *pes*, meaning foot, and therefore it is a common error that this specialty deals with disorders of the feet. The word "Orthopedic," properly spelled, is as follows: o-r-t-h-o-p-a-e-d-i-c, and it is derived from the two Greek words, *ὀρθός* meaning "straight," and *παῖδρον*, meaning "a little child." It was originally intended to indicate that orthopedic surgery has to deal with the straightening of deformed children.

In the last three years' war, the experience of our Allies has shown that we must consider the soldier, wounded in battle, from a different aspect than ever before. In past wars, it was the practice, if a man was totally or partially unfit for further service to his country, to give him a pension and allow him to shift for himself, the nation believing it had done its part when this questionable form of charity had been provided. The enormity and extent of the present conflict has shown that such an attitude by any nation toward the disabled soldier would lead to an economic catastrophe and almost to the destruction of the nation.

Just think for a moment what the condition of Great Britain, with 600,000 crippled soldiers for whom no special preparation had been made at the beginning of the war, would be to-day, and in the days to come, if she had not inaugurated those marvelous curative workshops for the rehabilitation of her disabled soldiers by the aid of orthopedic surgery.

Probably the greatest leader of this particular phase of the war has been Col. Sir Robert Jones of Liverpool, and through him has grown up the system in vogue in the British empire by which cripples are taught, as soon as possible, some form of training whereby they may earn either more than they earned before the war or very nearly as much. Of course, this depends upon the amount and character of the disability with which the soldier is afflicted. In his very interesting book, under the very modest title of "Notes on Military Orthopedics," Col. Sir Robert Jones tells how, when preliminary stages of operative and surgical treatment are over, the orthopedic hospital affords a steady gradation through massage, exercise, and stim-

* Read at the Rhode Island State Conference of Charities and Correction, on Oct. 24, 1917.