CHAPTER 21

TUBERCULOSIS

PULMONARY tuberculosis was of course the only form of tuberculous infection of importance in the Services. That it was not of even greater importance and magnitude as a problem of health was chiefly due to the early use of miniature X-ray examination of recruits for the armed forces. The story of the introduction of this method is told in the section on radiology and may briefly be retold here. The question of making a radiographic check of the lungs of all recruits had been for some time before the war under consideration by Major-General Downes, Director-General of Medical Services. The drawbacks of using large films for mass surveys were realised, though early in 1939 Dr H. W. Wunderly, of Adelaide, under a grant from the National Health and Medical Research Council, had conducted a survey of 3,500 young women between the ages of 15 and 30 years. Those who reacted to the Mantoux test were examined by radiography on 17″ x 14″ films. On learning of the successful use of 35 mm. film for photographing the image on a fluorescent screen in a large scale survey in Germany, Dr Wunderly tried this method, and brought it to the notice of Colonel S. R. Burston, D.D.M.S. of the South Australian Military District, and Dr J. H. L. Cumpston, Director-General of Health. The 35 mm. fluorograph was then attracting notice in England, and on receiving Dr Wunderly's letter Dr Cumpston asked Dr C. E. Eddy of the Commonwealth X-ray and Radium Laboratory to report on the technical problems involved. As told elsewhere, the value of the method was soon established, and the personal efforts of Dr Eddy, Dr J. O'Sullivan and Major E. L. Cooper soon placed it on a practical basis. So it came about that a locally made apparatus for miniature fluorography was recommended in October 1939 for examining recruits for the volunteer force for service overseas, and before the end of December 1939 the first miniature set for the use of the Australian Army was ready.

In spite of the loss of the first set by accident, the members of the 16th Brigade of the 6th Division, A.I.F., were all radiographically examined before embarkation early in January 1940. Most of the administrative problems concerned with miniature fluorography in the services are matters for the operational part of this history, but some of them involved also the clinical aspects of tuberculosis. One of these problems was related to the differences in the constitution of the two distinct forces in the Australian Army, the volunteer A.I.F. prepared to serve anywhere, and the militia called up for periods of training and for home defence in a limited area. Though X-ray examination of the chest was at once employed for the whole A.I.F., and rapidly extended to the navy, the air force and women's services, opposition was raised to its use for the militia, in spite of strong advocacy by the army medical service. Only in South Australia were members of the militia radiographically examined from the begin-

ning, and then chiefly through local initiative. General application of radiographic tests to the militia forces was not made till 1942.

The result of this short sighted policy was that numbers of men were brought into the militia ranks suffering from pulmonary tuberculosis. Unfortunately, existing repatriation legislation did not provide for their acceptance for benefits. They were, therefore, not eligible for pension rights or treatment under the Repatriation Commission. They could not be easily discharged from the army as the facilities for handling them in civil institutions were meagre in most centres, and thus they were held in army hospitals for considerable periods. This may have done good in the end in two ways. It emphasised that Australia, though a country favoured with a low tuberculosis rate, was laggard in providing and coordinating the weapons for controlling the disease. It also showed that, as neither civil nor repatriation hospitals would be able to cope with the number of servicemen and women with tuberculosis for some time, their care would be an army responsibility. As will be shortly told, a special organisation was built up for this purpose, and maintained by the army after the end of the war until such time as the Repatriation Commission was able to take over the base hospitals.

Had the micro-film test not been applied to militia troops in 1942, the position would have been still more difficult. A War Cabinet Agendum pointed out that as 250,000 trainees were about to be called up, some 2,500 might have shown radiographic lesions and perhaps one-half (more probably one-third) of these might have been found to be active.

Though tuberculosis continued to appear, as it will among young adults, there is no question that much invalidity was saved by radiography. The early discovery of pulmonary infection was of importance; not only did it give rejected recruits an opportunity to recover, but it limited contagion among non-immunes. The financial argument of outlay saved to the community was used to offset cavils at the cost of taking X-ray pictures and in support it was pointed out that 2,400 soldiers of the 1914-1918 war were pensioners of the Repatriation Department for tuberculosis. A much sounder argument is, of course, based not on questions of the cost of repatriation benefits, but on the health of the community. The cost of the micro-film method was in any case small. Careful records were kept in all commands, and the average cost per recruit was found to be 5d to 6d, including all costs of staff and material, and allowing for the larger films wherever there was a doubt. Even charges for maintenance and depreciation brought the cost to only 10d a recruit.

Naturally the accuracy of the miniature method was a matter of great interest and importance. Though assailed at first by some radiologists, it soon proved itself. Great care was taken in the interpretation of the micro-films. Teams including two radiologists and a physician viewed enlarged images of the films, and either accepted or rejected each; where a film was technically unsatisfactory or revealed shadows suggesting a lesion tuberculosis or otherwise, a 17″ x 14″ film was taken. No recruit was rejected on the evidence of a small film alone. Care was taken, too, to

avoid fatigue of the examining teams by unduly long sessions. During 1940 alone over 100,000 X-ray examinations were made. The results were surveyed by Major J. D. Galbraith. Radiological evidence of active or latent tuberculosis was found in 1.04 per cent of those examined, and a little over half of the foci were thought to be active. Some of the early opposition and prejudice which were encountered, as all innovations must, arose because of a claim that pulmonary lesions are sometimes missed by the miniature method. Experience has shown that this source of error is small. Each recruit's micro-film was kept, and as time went on comparison with films taken at later dates gave opportunity for critical survey. In one series of 14 men with proven tuberculosis it was shown by reference to the original micro-film that some evidence of infection was present on enlistment. This is not a fault of the technical method, but of interpretation. It is of course admitted that occasionally tubercle bacilli can be demonstrated in the sputum of persons whose chest radiographs, even on 17″ x 14″ films, show no apparent lesion. Radiologists have also questioned their ability to decide on the question of activity of a lesion of the lungs on the evidence of a miniature film alone. With this all would agree. Indeed, activity can often only be surmised from X-ray films of the chest, and an opinion is sometimes a dangerous guess. In any case, infectivity of a lesion is not the same as clinical activity, and bacteriological methods alone can tell that.

The criticism was also made that recruits were sometimes rejected for non-tuberculous lesions. This happened occasionally, of course, but the military question at issue was the acceptance or rejection of each individual. Examiners were instructed not to use the diagnosis of pulmonary tuberculosis, but to preface it with "suspected" or "query". All rejects were informed as to any doubts of their physical condition and referred to civil clinics for further investigation. In this connection the difficulty of delay in recruiting depots may be mentioned. Though of administrative rather than clinical interest, this was an important matter. It was obviously important not to absorb a number of recruits and allow them to begin training in propinquity with others before their eligibility was established. Care was taken in various ways in different commands to avoid undue delays. As a rule finality could be given in three days, and the delay seldom exceeded a week, even when repeat X-ray examination was necessary.

A most important check on the accuracy of radiological diagnosis in this military survey was begun by Major R. Webster in 1940, and the results were published in 1941 and 1943. With full military cooperation and all the advantages of discipline it was possible to investigate recruits whose chest films showed evidence of tuberculous infection. In the laboratory these men were paraded fasting, and the contents of the stomach were aspirated unless a satisfactory specimen of sputum could be produced on the spot. Direct smears were made from sputum and acid-fast bacilli so found were accepted as tubercle bacilli. Cultures were also made, and organisms with characteristics of tubercle bacilli grown from these

were accepted as such if they were obtained from sputum of a man diagnosed as having "active tuberculosis". Cultures from gastric contents or from the sputum of men whose X-ray report indicated an inactive or healed lesion were accepted as tubercle bacilli only if guinea pig inoculation into guinea pigs caused progressive tuberculous lesions. This work among army recruits in 1940 proved of such value that it was extended to the navy, air force and women's services in 1941 and 1942. The validity of Webster's cultural criteria were confirmed by Phyllis Anderson working for the National Health and Medical Research Council. Acid-fast saprophytes were not found to be a serious source of error. Further, there was no doubt that in the vast majority of instances tubercle bacilli demonstrated in the gastric mucus were derived from a lesion of the lung.

In all 1,630 individuals were examined, 1,548 being recruits suspected of pulmonary tuberculosis. In 364 tubercle bacilli were demonstrated, 25 per cent by smears, 75 per cent by cultures. The results can thus be summarised:

Number of recruits	X-ray diagnosis	tubercle bacilli cultured
505	active lesion	272 (53.8%)
237	doubtfully active	37 (14.3%)
374	quiescent or healed	21 (5.6%)
224	aberrant shadows of doubtful nature	21 (9.3%)

In four other men examined for various reasons, tubercle bacilli were found in the absence of radiological lesions. This research showed the high value of confirmatory bacteriological investigation in radiographic surveys, and also confirmed the dependability of the micro-film method. Later an instruction was issued that bacteriological examinations would cease as a routine measure in recruits who showed any radiological abnormality in the lungs. This was in no way critical of the value of the work: it was due to the growing demands of war. Naturally a certain delay was unavoidable with cultural investigations. Webster found that a positive report could not be returned in less than three weeks, and a period of six weeks was needed to give a final reply in every instance. D. B. Rosenthal found the average time for 130 tests was 24 days, and that about 10 per cent required six weeks.

There was, of course, no reason why this precision method should not be used where decisions were important and dependent on exact diagnosis. It is important to state that no recruit was discharged from the Services solely on the grounds of an X-ray report. It must also be pointed out that these military experiences have emphasised that in civilian surveys for tuberculosis X-ray examination is only the beginning. The problem for the future is the disposal of those suspected or proved to have active pulmonary tuberculosis. The outlook of public health authorities must be changed by the introduction of mass radiological surveys. Hitherto calculations of the hospital and clinic accommodation needed for those infected with tuberculosis had been based to some extent on mortality or

at least gross morbidity figures. Now rates of incidence as revealed by comprehensive surveys are of dominant importance.

There is little of significance to report on tuberculosis from the various action fronts. In Palestine, through an unfortunate error in administration, a number of men suspected of tuberculosis on radiological grounds were sent to Palestine with the first convoy from Australia, despite the efforts of the medical services to have them sent back. No harm was done, save to the spirits of the men, but most of them had to be held in hospital for months till the first hospital ship arrived.

Arrangements were made for the segregation of men with tuberculosis in service medical units and special accommodation was provided in hutted hospitals. When in 1941 the 2/6th Australian General Hospital took over the 62nd British General Hospital in Palestine, this duty involved the care of a special tuberculosis ward to which all tuberculous British soldiers in the Middle East were sent.

Difficulties were found at times in the disposal of soldiers with tuberculosis. Once the disease is recognised as of infective origin it is perhaps inevitable that it is regarded as highly contagious, even on casual contact. Thus in the more distant Pacific areas patients could not be easily moved; neither aircraft nor transport vessels would take them and only hospital ships would carry them. Occasionally there, as elsewhere, rapidly cavitating lesions were discovered in men who had apparently been well a short time before. Efforts were always made to prevent dispersal of tuberculous patients, but these were not always simply translated into action. Contact was prevented as far as possible between susceptible native races and soldiers with infective states like tuberculosis. The Angau organisation in New Guinea recognised this, and in Northern Territory of Australia the Deputy Director of Medical Services had pointed out in 1942 that the local aborigines were subject to rapidly progressive and fatal forms of the disease. In the latter area suspects among soldiers were received in a special centre in the 121st Australian General Hospital at Katherine, and here men were held who were not taken by the Repatriation Department or were unsuitable for sending south. There were also occasional difficulties in the disposal of female members of the services with tuberculosis, as appropriate facilities in some centres were not always available.

Prisoners of war with tuberculosis were severely handicapped. Those in the European zone suffered from varying degrees of impaired nutrition, but the prisoners of the Japanese were subjected to much greater hardships in every way. It is not surprising that a higher proportion of men with pulmonary tuberculosis have been found in those returned from Japanese prison camps than among others. However, the medical officers of the hospitals in Singapore, Burma and Thailand have noted the comparative rarity of the disease in Australian soldiers, and remarked that considering the poor state of nutrition of these men the small numbers was a tribute to the selective examination of the force. In Changi, it was twelve months before the first case of tuberculosis was demonstrated among the A.I.F., whereas 30 had been recognised among British troops in the first six

months. In this area an excellent clinic was run jointly by British and Australian medical officers where methods such as artificial pneumothorax and phrenic evulsion were practised with good results. Major Fisher in 1945 in Nakom Paton had only 5 Australians among 56 patients with tuberculosis; the remainder were chiefly Dutch and British, in that order. In August 1945 there were 64 patients with pulmonary tuberculosis collected in Changi, but few of these appeared to be recently infected. Cotter Harvey at Kranji found only two fresh infections in two years. When the men in Singapore were liberated, of 1,266 radiologically examined (apart from patients already under treatment) only 28 suspicious films were seen, about 2.2 per cent. Not much could be done for these men during imprisonment, but as liberal a diet as possible was given, and in a few favourable cases artificial pneumothorax was carried out. A group of A.I.F. officers and men in Rabaul were exposed to an atmosphere heavily impregnated with silicate dust after the volcanic eruption just before the Japanese landings were made on New Britain. The possible danger of this dust was not fully realised at the time, but it seems significant that out of 66 men 5 developed pulmonary tuberculosis while imprisoned in Japan.

Mention has been made of the difficulties with regard to the official acceptance of a diagnosis of active tuberculosis. On occasion a diagnosis made by a final army medical board was not accepted by the Repatriation Commission. Convincing clinical standards cannot be laid down for the diagnosis of active tuberculosis, but finally a service instruction was issued embodying principles acceptable to all parties. This technical instruction to medical officers laid down that this diagnosis was not to be made unless:

(a) the tubercle bacillus was found on at least two occasions in sputum expectorated in the presence of a medical officer or member of the nursing services, or in the gastric contents, or in pleural fluid, or
(b) the diagnosis was agreed upon by a medical representative of the Repatriation Commission, who should be afforded the opportunity of seeing the patient attending the medical board, or examining the clinical notes and evidence before the board met.

In the later years of the war the number of servicemen needing treatment for tuberculosis increased by accumulation. Although the incidence rate per 1,000 per year for the years 1942 to 1945 was only 1.14, the total number over this period was 1,334 in Australia, 74 in the South-West Pacific Area and 92 in the Middle East. Of these totals there were still considerable numbers requiring active treatment, therefore it was decided in 1944 to concentrate all men and women from the army at one hospital, the 106th Australian General Hospital at Bonegilla near Albury. Arrangements were made to take members of the R.A.N. and R.A.A.F. also, and when a large British fleet arrived in the Pacific area 110 beds were promised for the use of the Royal Navy. Treatment was coordinated at this hospital under Lieut-Colonel H. Wunderly. There were many administrative problems to overcome. For example, discipline was

not simply applied to a mixed population of patients belonging to different services or under the care of repatriation. Frequent changes of nursing staff were another real problem, and delays were considerable before satisfactory arrangements could be made for necessary surgical treatment of special kinds.

In order to maintain continuity of treatment a General Routine Order (71/45) was promulgated enabling patients with tuberculosis to be kept twelve months in service hospitals before they were brought before a final medical board. An interim board examined them after six months and determined if their condition was sufficiently stabilised to warrant their discharge, when they were placed under the Repatriation Department. Members of the R.A.N. and R.A.A.F. were sometimes boarded at once or transferred to repatriation sanatoria if suitable, but by the end of the war the three Services standardised their methods of dealing with these patients. As a result, more of the members of these Services were retained in service hospitals for treatment.

The need outran the accommodation at Bonegilla and though high priority was given to building originally, to save time waiting for more permanent structures in capital cities, belated approval was not given for the erection of more suitable wards till some months after the Pacific war had ended. Some months later the Royal Navy removed their own patients to England, but beds thus freed had to be kept for prisoners of war then arriving.

It was not possible to concentrate all patients at Bonegilla, and gradually as facilities were available in the base hospitals, patients were moved to hospitals in their own home States. In order to cope with this extension of the army organisation for tuberculosis, a survey of the base hospitals was carried out, for it was evident that responsibility for the care of men and women with tuberculosis would remain with the army well beyond the war period. Therefore a chest wing was opened in the base hospitals of all the State capital cities before the Repatriation Commission began to take over these hospitals. It is interesting to note that the accommodation then available in base hospitals for tuberculosis depended a good deal on the power of paludrine to control relapses of benign tertian malaria.

At Bonegilla a high standard of treatment was maintained. Due care was taken that nurses and other attendants were not exposed to risk of infection. They were subjected to skin tests with the purified protein derivative of tuberculin, and reactors to this test were allowed to work in the wards only if X-ray examination of the chest showed no lesion. Non-reactors were re-examined at intervals. On one occasion a non-reactor showed a reaction within a few weeks. Efforts were made to minimise the risk of infection from sputum by the use of masks and waxed inserts for sputum mugs; and by control of dust by oiling. The Australian Red Cross Society was helpful in these matters.

Little can be said about the results of treatment, as patients were not under unified control for a long enough period for figures to be of value. The full resources of modern treatment were available. Artificial pneumo-

thorax was employed whenever indicated. Over 100 patients were having this form of treatment at Bonegilla at June 1945. In some both lungs were involved. Pneumolysis was carried out where adhesions prevented satisfactory collapse of the lung. Phrenic crush was found a useful adjuvant with suitable indications. More extensive procedures were approached with care and undertaken only after full consideration and consultation. Streptomycin was obtained in limited quantities after the end of 1945. Promin jelly gave promising results in the treatment of fistulae.

The need for the general adoption of standard methods was felt at Bonegilla. Patients were not infrequently admitted with extensive lesions, a difficult type to handle. Others arrived with minimal lesions, but treated in varying fashions. Pleural effusions were treated differently in different places, some with air replacement, others without. Though there was no desire to cramp the independence of medical officers, those responsible for handling a large number of patients could not but feel the need for some coordination.

Problems of importance arose in connection with surgical forms of treatment. Numbers of patients required division of adhesions as an adjunct to artificial pneumothorax, and other surgical measures. At first a "shuttle service" was run between Bonegilla and Heidelberg Military Hospital in Melbourne. There all necessary thoracic surgery could be undertaken, including thoracoplasty and lobectomy, but it was found wise to move only well stabilised patients who needed and were ready for major procedures. Moving of patients with artificial pneumothorax for pneumolysis was also inadvisable. By carrying out this procedure at Bonegilla the incidence of effusions and spontaneous pneumothorax was reduced.

Therefore a thoracic surgeon, Major J. Hayward, visited Bonegilla at regular intervals. In the same way it was found that patients whose artificial pneumothorax was begun at Concord (Sydney) or Heidelberg (Melbourne) were better kept there till stabilised, any further necessary surgical procedures being carried out on the spot. This experience is in keeping with that of physicians and surgeons specialising in chest work, but it was of value in underlining the need for complete facilities, including thoracic units, for all forms of appropriate treatment in all institutions caring for patients with pulmonary tuberculosis.

An unusual surgical event relating to tuberculosis may be mentioned here. Howard reported the case of a soldier with a "sucking" wound of the chest who had a pyopneumothorax. This man had a high febrile reaction and clubbing of the fingers, and tubercle bacilli were found both in the sputum and pus from the empyema. Two years before, X-ray examination on enlistment had not shown any pulmonary lesion.

The story of pulmonary tuberculosis in the forces has twofold interest: it tells of a step along the road of prevention, and a further step towards control. The elimination of 1 per cent of recruits who had suspected pulmonary disease was an important contribution to the war effort; so,

too, was the coordination of treatment for a time under one authority. It is hoped that a greater plan will rise out of this example.

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