CHEST DISEASES IN THE ARMY
A SURVEY AT THE CONNAUGHT HOSPITAL IN 1950

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CHAPTER I

INTRODUCTION
This survey is based on a study of 534 consecutive admissions to the Connaught Hospital, Hindhead, Surrey, between December 1949 and January 1951. (This hospital was later renamed the Army Chest Centre, and has closed down as from January 1962.) The patients, whose ranks were staff-sergeant and below, were interviewed personally. Officers, warrant officers class 1 and female patients were few and were excluded from study. Not all serving soldiers who had diseases of the chest were admitted to this hospital; some were dealt with elsewhere, while the clinical condition of some others did not necessitate their transfer. The aims of the survey were (a) to collect information about chest diseases in the Army during this period, because very little had been recorded since the review by Hutchison (1942), and (b) to elucidate further the pathogenesis of tuberculosis. The results are reported in four chapters.

Chapter I describes some of the clinical and contact-history data of the patients in the five main disease groups encountered, and includes for comparison similar data obtained from a group of healthy soldiers from neighbouring companies of troops (see Groups 1-6 below).

In Chapter II, after regrouping the data, comparisons are made by statistical methods between the contact histories of the groups. Before this main part of the work is considered, however, it is shown that the regrouping is not detrimental to further analysis of the results; on the contrary, the value of any conclusions will be enhanced. The results of the statistical calculations are in keeping with much of the previous work on the natural history of tuberculosis, but attention is drawn to the possibility of the results being biased because of significant differences between the mean ages of the groups of patients.

In Chapter III, therefore, efforts are made to compare the contact-history data relating to patients in the age-group 18 to 23 years, thus preventing any bias which age differences may have caused; it is shown that the results remain statistically significant, although the degree of significance is reduced. In the course of studying these results several questions arise, but only one is capable of being tackled as a result of the detailed contact-history records which were compiled for each patient. These records included the number of known tuberculous persons encountered by each subject among his family and relatives, among his Army acquaintances, at his place of civilian employment, among neighbours at home and among people met in a social

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context. In addition, all available information was noted about the time of the first contact, how frequently contact was made, the degree of intimacy of contact, the overall duration of contact, the length of time since contact was last made, and how well each contact had responded to treatment. In this way it was possible to build up a picture of each subject's rate of contact with known tuberculous persons as well as to grade each contact history in a rather arbitrary fashion as being of mild or moderate severity or being very severe. The latter part of Chapter III compares all this information and some hitherto unrecognized results are obtained.

In Chapter IV, which concludes this study, the significance of the results is discussed in relation to possible fallacies in the material itself and in relation to the relevant literature on tuberculosis. An attempt is also made to show how our understanding of the pathogenesis of tuberculosis is altered by the results obtained.

In this introductory chapter, the diagnoses are the final ones which were applicable when the patients appeared before medical boards before being discharged home, transferred to a civilian hospital or returned to their units. The basic data relating to the subjects surveyed is summarized in Table 1.

**Group 1. Primary Pleurisy with Serous Effusion (52 patients).**

Thirty-two patients had right-sided lesions, and in 20 the left was the affected side. No patient had bilateral effusions.

Most of the patients (40 in all) complained of acute pleuritic pain accompanied by breathlessness, dry cough, fever, weakness and loss of appetite. Effusion developed rapidly and diagnostic aspiration showed a clear straw-coloured fluid bearing cells with lymphocytes predominating. The fluid was sterile for pyogenic bacteria and tubercle bacilli were found on culture, or by guinea-pig inoculation, in 23 patients (44 per cent). Eight of the remaining 12 patients had low-grade chest pain for several months without abnormal radiological findings and later developed more acute pain accompanied by pleural effusion. The remaining four patients had no symptoms; in three, effusions were discovered by mass miniature radiography (M.M.R.) shortly after entry to the Army, two of these effusions being active and a third encysted. The fourth patient reported sick, although feeling well, in order to escape fatigue duties. He was referred to a military hospital and X-ray showed a left-sided effusion.

All but two patients were found to be Mantoux positive after the onset of the effusion, but whether or not this illness coincided with Mantoux conversion is unknown in most cases because routine testing on entry to the Army was not performed at this period. Of the two patients negative to 1/100 dilution, one developed a right interlobar effusion within 24 hours of his initial T.A.B. inoculation. The other patient had vague progressive symptoms prior to the effusion. In both patients the effusion had tuberculous characteristics, although tubercle bacilli were not cultured, and both were discharged from the Army. It is not known if Mantoux conversion occurred during convalescence.

Following absorption of the fluid, three patients showed parenchymal lesions. In two the lesion resembled a primary focus and, in the third, there was collapse of the lower lobe.

Sixteen patients (31 per cent) gave a history of contact with a total of 27 tuberculous persons, and four of these patients had contacts from more than one source.
Table 1. Subjects Surveyed—Summary of Basic Data

<table>
<thead>
<tr>
<th>Clinical Condition of Subjects</th>
<th>Age</th>
<th>Service</th>
<th>Regulars</th>
<th>No. with Positive Contact History</th>
<th>No. of Contacts</th>
<th>Family Contacts</th>
<th>Army Contacts</th>
<th>Works Contacts</th>
<th>Neighbour Contacts</th>
<th>Social Contacts</th>
<th>Degree of Contact</th>
<th>Total Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleural Effusion</td>
<td>19</td>
<td>16–32</td>
<td>1</td>
<td>2 days-12 yrs.</td>
<td>11 21 16 27</td>
<td>11 8 4 4 0 0 9 5 3 3</td>
<td>10 5 1 52</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bronchiectasis</td>
<td>19</td>
<td>14–24</td>
<td>1</td>
<td>2 days-7 yrs.</td>
<td>4 19 8 14</td>
<td>9 6 0 0 1 1 1 3 3</td>
<td>1 6 1 21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-tuberculous Conditions</td>
<td>22</td>
<td>18–43</td>
<td>3</td>
<td>1 week-28 yrs.</td>
<td>32 36 35 58</td>
<td>24 17 9 7 2 2 7 5 16 12</td>
<td>19 11 5 87(a)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulmonary Tuberculosis</td>
<td>22</td>
<td>15–54</td>
<td>3</td>
<td>0–22 yrs.</td>
<td>105 30 205 347</td>
<td>179 130 52 46 33 25 23 12 60 43</td>
<td>102 79 24 355</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary Pulmonary Tuberculous Complexes</td>
<td>19</td>
<td>18–29</td>
<td>1</td>
<td>2 mths.-5½ yrs.</td>
<td>3 17 10 15</td>
<td>8 5 3 3 0 0 1 1 3 2</td>
<td>6 2 2 18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healthy Controls</td>
<td>20</td>
<td>18–42</td>
<td>2</td>
<td>6 mths.-22 yrs.</td>
<td>13 9 40 57</td>
<td>19 15 6 6 14 6 9 6 9 8</td>
<td>24 14 2 139</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: (a) Eighty-eight patients in all. No information was taken from the patient who had an osteochondrosarcoma of rib (see text and Table 2).
(b) Figures in bold print refer to number of contacts.
(c) Figures in ordinary print refer to patients.
The rest of the contact-history data is shown in Table 1. The degree of contact was graded as mild (ten cases), moderate (five cases) and severe (one case), according to the criteria detailed earlier. It is appreciated that the definition of these standards is placed on a basis which is not scientifically sound. Other workers (Aspin 1952, Springett and Eley 1956, and Parsons 1960) have made somewhat similar attempts to grade contact histories.

**Group 2. Bronchiectasis (21 patients).**

Fifteen patients showed bilateral disease, four had right-sided disease and two had left-sided disease.

Most patients (15 in all) reported sick to their unit medical officer, and 13 of these had had symptoms for less than one year, consisting of a pyrexial illness with chest pain, dyspnoea, cough, purulent sputum and occasionally hæmoptysis. One regular soldier had had symptoms intermittently for 16 years. Nine of these patients had undergone M.M.R. previously without any abnormality being noted, seven of them within the previous year. Five other patients were diagnosed by M.M.R.; all had bilateral disease and only one was symptom-free.

The remaining patient had cough with excessive sputum for four years, and a pre-operative chest X-ray taken elsewhere prior to repair of a hernia showed an irregular opacity with streaking in the left lower lobe, shown later to be due to bronchiectasis. An M.M.R. film taken two months earlier was reported to be normal.

Nightingale (1952), recording an M.M.R. team's work during one year among soldiers, stated that out of 44,868 people at risk, 28 cases of bronchiectasis were diagnosed (11 proved and 17 unproved). My results show that five patients with bilateral bronchiectasis were discovered by M.M.R., whereas ten patients (six had bilateral disease and four had unilateral disease) were missed by M.M.R. This experience confirms the comparative unreliability of M.M.R. in the diagnosis of early bronchiectasis, which is already well recognized.

Eight (38 per cent) of the patients gave a history of known contact with a total of 14 tuberculous persons, three having contacts from multiple sources. The rest of the contact-history data is shown in Table 1. Contact was assessed as mild in one case, moderate in six cases and severe in one case.

**Group 3. Other Non-tuberculous Chest Conditions (88 patients).**

The final diagnosis was very varied in these patients (Table 2). Twelve patients were discovered by M.M.R. Most patients (74 in all) reported sick, 32 with a history of hæmoptysis; 44 had "normal" M.M.R. films and, of these, 22 were taken less than two years previously. Four other patients had abnormal X-ray films on previous occasions; three had chronic bronchitis and the fourth had a hydatid cyst of his left lung. The remaining two patients were referred because of abnormal full-plate X-ray films; one was thought to have a lung abscess following appendicectomy, but tomography showed the opacity to be due to peaking of the diaphragm; the other had a family history of tuberculosis, but suspicious shadows seen on an X-ray film taken elsewhere were not confirmed at this hospital.

The clinical presentation was typical in most instances and only those groups
where there is some point of clinical interest are discussed. Of the 19 patients finally
diagnosed as N.A.D. (Table 2), 15 had reported sick at their units and the other four
had "abnormal" M.M.R. films, which were unsubstantiated by full-plate examina-
tion. Three cases of spontaneous pneumothorax were left-sided and one was right-
sided, no parenchymal lesion could be demonstrated in any, none caused anxiety
clinically and none was submitted to thoracoscopy. One patient had intermittent
pneumothorax involving both pleural cavities, but up to the time of recording, the
condition had never occurred simultaneously on both sides. All three patients with
acute tonsillitis had typical symptoms, but all three were admitted with hæmoptysis
requiring investigation. Another three patients were admitted because of hæmoptysis;
one had swallowed a tablet in a hurry; the second had lost a tooth four days previously
and X-ray revealed a segmental opacity which cleared rapidly without providing
evidence of any tooth having been aspirated; no cause was found in the third case.
Of the two cases of traumatic hæmorthorax, one was due to an injury at hockey and
the other to a gunshot wound of the chest received in Korea. Decortication was
necessary in this latter case, with a successful functional result. The patient with
bronchial carcinoma was a 20-year-old soldier giving a history and rapid clinical

Table 2. Diagnoses in respect of 88 patients who suffered neither from Tuberculosis nor Bronchiectasis

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.A.D.</td>
<td>19</td>
</tr>
<tr>
<td>Chronic bronchitis</td>
<td>14</td>
</tr>
<tr>
<td>Pneumonitis</td>
<td>7</td>
</tr>
<tr>
<td>Aspiration pneumonia</td>
<td>6</td>
</tr>
<tr>
<td>Spontaneous pneumothorax</td>
<td>4</td>
</tr>
<tr>
<td>Non-tuberculous empyema</td>
<td>4</td>
</tr>
<tr>
<td>Acute bronchitis</td>
<td>4</td>
</tr>
<tr>
<td>Lobar pneumonia</td>
<td>3</td>
</tr>
<tr>
<td>Acute tonsillitis</td>
<td>3</td>
</tr>
<tr>
<td>Hæmoptysis</td>
<td>3</td>
</tr>
<tr>
<td>Abdominal adhesions</td>
<td>3</td>
</tr>
<tr>
<td>Traumatic hæmorthorax</td>
<td>2</td>
</tr>
<tr>
<td>Lung abscess</td>
<td>2</td>
</tr>
<tr>
<td>Collapsed lobe</td>
<td>2</td>
</tr>
<tr>
<td>Cystic lungs</td>
<td>1</td>
</tr>
<tr>
<td>Bronchial carcinoma</td>
<td>1</td>
</tr>
<tr>
<td>Crohn's disease</td>
<td>1</td>
</tr>
<tr>
<td>N.Y.D.</td>
<td>1</td>
</tr>
<tr>
<td>Emphysema</td>
<td>1</td>
</tr>
<tr>
<td>Ganglioneuroma</td>
<td>1</td>
</tr>
<tr>
<td>Intercostal neuritis</td>
<td>1</td>
</tr>
<tr>
<td>Post-sulphonamide anuria</td>
<td>1</td>
</tr>
<tr>
<td>Osteochondrosarcoma of rib</td>
<td>1</td>
</tr>
<tr>
<td>Chronic myeloid leukaemia</td>
<td>1</td>
</tr>
<tr>
<td>Bronchial asthma</td>
<td>1</td>
</tr>
<tr>
<td>Acute appendix with subphrenic abscess</td>
<td>1</td>
</tr>
</tbody>
</table>
progress similar to the five cases reported by Large and Morgan (1958). The patient with thoracic ganglioneuroma was diagnosed by M.M.R., and the patient with chronic myeloid leukaemia presented with cervical lymphadenopathy, and broadening of the mediastinum was revealed by X-ray examination.

Thirty-five (40 per cent) of 87 patients gave a history of contact with a total of 58 tuberculous persons, eight of them having contacts from multiple sources. The rest of the contact-history data is shown in Table 1. No information was taken from the 88th patient, who had an osteochondrosarcoma of rib (see fig. 159, Barrett 1955), because he had a chest-wall abnormality rather than intrathoracic disease.

After full consideration of each history, the degree of contact was assessed as mild in 19 cases, moderate in 11 cases and severe in five cases.

**Group 4. Post-primary Pulmonary Tuberculosis (355 patients).**

Fifty-nine patients (16 per cent) had no symptoms. Two hundred and sixty-six patients (75 per cent) had had symptoms for less than six months before the diagnosis was made; 24 patients (7 per cent) had had symptoms for less than one year, and only six patients (2 per cent) had had symptoms for more than one year. Haemoptysis occurred in one-quarter of cases and was no more frequent a symptom in this series than was anorexia.

One hundred and twenty-five patients (35 per cent) were discovered by M.M.R. The disease was so limited in these that it was possible to foresee its control. Two-thirds of this group had symptoms which had not been severe enough to cause the patients to report sick. Seventeen patients (5 per cent) were diagnosed by routine full-plate chest X-rays taken for various reasons—family history, routine medical examination, routine X-ray of hospital staff, pre-operative X-rays, etc.

The remainder (213 patients, or 60 per cent) reported sick. Nearly half (98, or 46 per cent) had had "normal" M.M.R. films of which 63 were taken within the previous two years. Eleven other patients gave histories of abnormal chest X-ray films. Two of these were in bed at home with active disease awaiting a sanatorium vacancy when their call-up papers arrived, and they dutifully reported to their respective training establishments. Review of the histories of the other nine patients suggests that they probably had active disease at the time of their previous X-ray, the disease being considered quiescent by their medical attendants. None of these patients was absent from his civilian employment for any significant period of time.

On admission, 114 (32 per cent) were sputum positive, and a proportion of the remainder had also given a positive result at other military hospitals before being transferred. Their X-ray films showed unilateral disease in 158 cases and bilateral in 197 cases. Among those with unilateral disease, the right lung was affected more frequently than the left (ratio 5 : 4).

Of 27 patients still in this hospital after three months, whose X-ray film on admission had been classified by me as being inactive/fibrotic, in conjunction with "negative" sputa and normal erythrocyte sedimentation rate, 18 showed radiological improvement. They had been treated by a modified sanatorium régime of bed rest and graduated activity. Would this improvement have shown had they been observed at a civilian chest clinic and allowed to continue with their various occupations? Is it
not possible that in some patients the disease would have appeared static on X-ray examination, although it was in fact active, and would have been interpreted erroneously as being quiescent? The futility of assessing the quiescence or activity of minimal lesions from one X-ray examination is re-emphasized. Since the soldier is paid whether he is engaged actively at his unit or is in hospital, he does not suffer economic hardship, as a civilian would if he contracted the same type of disease and was subjected to the same treatment. It is possible to give the military patient a sanatorium course if there is any doubt about the activity of a lesion; and this doubt there must be when a lesion is first discovered, even although the E.S.R. is normal and the sputum or laryngeal swab is negative for \textit{M. tuberculosis}.

In addition to tuberculosis, two patients had bronchiectasis and one each had diabetes mellitus, myasthenia gravis, simple pneumoconiosis, a chronic gastric ulcer and a prolapsed intervertebral disc.

Two hundred and five patients (58 per cent) gave a contact history with a total of 347 tuberculous persons, and 51 of these patients had contacts from multiple sources. The rest of the contact-history data is shown in Table 1. The degree of overall contact was assessed as mild in 102 cases, moderate in 79 cases and severe in 24 cases.

Williams (1954) states that the pulmonary tuberculosis morbidity rate for males in the Army for 1950 (the year of the present investigation) was 1.21 per 1,000; this figure includes officers and warrant officers class 1, who have been excluded from my series. As the strength of the Army was about 500,000 at that time, 600 cases of pulmonary tuberculosis arose in all ranks in 1950, and 425 of these are included in this survey (i.e. 52 with pleural effusions, 355 with post-primary pulmonary tuberculosis and 18 with primary tuberculosis). For the same year, the Annual Report of the Ministry of Health (1950) states that the incidence and crude death rate for respiratory tuberculosis were 107 and 36.4 respectively per 100,000 general population.

The proportion of patients having previous contact with tuberculosis is high, but the average number of contacts per person is comparable with the figures derived for the previous sections of this article. The family is the most important source of contacts. An extraordinary discovery is that two patients, knowing that they had active tuberculosis, allowed themselves to be called up for military service; it is fortunate that neither patient suffered any serious consequence.

\textbf{Group 5. Primary Pulmonary Tuberculosis (18 patients).}

The diagnosis of primary tuberculosis demands the satisfaction of several criteria: (a) knowledge that the patient has been tuberculin negative, (b) the development of a primary focus with lymphatic spread to the regional lymph nodes and (c) tuberculin conversion. Such criteria are very exacting and only two cases, who were members of the hospital staff, satisfied them completely.

Thirteen primary foci were in the right lung and five were in the left. While none was complicated by pleural effusion, seven patients developed other complications. In two the primary focus cavitated, and a hydro pneumothorax resulted in one of these. Two other patients developed collapsed lobes, the fifth had a dry pleurisy accompanying an active primary focus, another had tuberculous reinfection—there was radiological evidence of a healed previous primary complex—and the seventh patient, whose
primary lesion was healed, had active tuberculosis of the dorso-lumbar vertebrae.

After a period of observation, four patients were considered to have healed foci. These cases are not excluded from further consideration because a group of patients is being gathered who are experiencing or who have recently experienced their primary complex.

Only four patients had no symptoms, and in the case of the others the interval between the onset of symptoms and the establishment of the diagnosis was less than one month in eight cases and less than six months in four cases.

Ten cases were discovered by M.M.R.; six had symptoms and only two had inactive disease. Two patients were discovered by routine X-ray; they were members of the staff of the Connaught Hospital. Six patients reported sick, and three of these had had previous M.M.R. films reported as normal; the interval was one month and two months in two cases, and the third case had symptoms after the M.M.R. examination had been made but before the report was available. The sputum was negative for tubercle bacilli on admission in all these cases.

Ten patients (56 per cent) gave a positive history of previous contact with a total of 15 tuberculous persons. One patient had one family contact and two social contacts. The rest of the contact-history data is shown in Table 1. The total contact history was assessed as being of mild severity in six cases, of moderate severity in two cases and severe in two cases. The proportion of patients in this series who had previous contacts is as high as in the series of patients with post-primary pulmonary tuberculosis, but the average number of contacts per case is lower.

Group 6. Staff Control Group (139 soldiers).

The personnel interviewed were male, with the rank of warrant officer class 2 and below. These soldiers belonged to the Company staff at this hospital and of the Depot and Training Establishment, Queen Alexandra's Royal Army Nursing Corps; their parent corps included the Army Catering Corps, Royal Artillery, Royal Army Dental Corps, Royal Army Medical Corps and Royal Army Service Corps. The group is not representative of the whole army as far as regiments and corps are concerned, but this is a feature which is not considered to have any significant influence on the results.

One soldier had been under treatment seven years previously for tuberculous cervical adenitis. Treatment lasted for one year. He had no recurrence and no other serious illness. Forty soldiers (29 per cent) gave histories of known contact with 57 tuberculous persons, and only one of these had multiple sources of contact, one in his family and four work contacts. The rest of the contact-history data is shown in Table 1. By the same standards as those applied to the other groups, 24 soldiers had a mild contact history, 14 had a moderate contact history and two a severe contact history.

It is unlikely that information concerning contact histories of normal healthy persons has been recorded previously; this is an aspect of tuberculosis which has rarely been considered. The proportion of these soldiers revealing a contact history is slightly lower than in any other group, as is the average number of contacts per soldier.
Chest Diseases in the Army

Discussion

During 23 months at the Connaught Hospital, many interesting clinical conditions were seen, and this synopsis records those encountered during 14 months of this period. This chapter provides the necessary detail for the succeeding chapters, which utilize the data available to the author in a discussion of the natural history of pulmonary tuberculosis.

Summary

A synopsis is given of the chest diseases seen at the Connaught Hospital, Hindhead, Surrey, during a period of 14 months, which includes the whole of 1950.

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I wish to express my indebtedness to the Commandant and to the Adjutant, Depot and T.E., Q.A.R.A.N.C., Hindhead, in 1951, for the enthusiasm shown by them during their assistance with my survey; to them, and to the O.C., Connaught Hospital, Hindhead, for permission to interview the personnel of the two units, and to the N.C.O.s and men who were either patients in the hospital at the time or who were members of these units for entering this survey so willingly and for volunteering so much information.

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(To be continued)
Chest Diseases in the Army: A Survey at the Connaught Hospital in 1950

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