THE ASSOCIATION OF SURGICAL TUBERCULOSIS WITH PHTHISIS.

by

J. WATSON, M.B., Ch.B.

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ProQuest LLC.
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106 – 1346

INTRODUCTION.

Much has been written about tuberculosis. The medical libraries and journals are full of literature on the subject, thus reflecting its importance as a disease in the medical and lay mind. And rightly so, for the affliction has ever had a heavy toll on mankind. Commencing probably in China it has spread throughout the world like a mighty invading army, till now its latest front of attack has reached the native races of Africa, India, and Australasia. Tuberculosis is known to have existed thousands of years before Christ. Indeed it can be traced in writings for more than 2,500 years previous to his birth. Evidence of actual surgical lesions has been found in Egyptian and other ancient skeletons. Hippocrates (460-377 B.C.) and Celsus (c.30 B.C. -50 A.D.) knew phthisis, as did Plato (430-347 B.C.). Somewhat later in history tuberculosis is mentioned in the writings of Paracelsus (1493-1541). An Italian, Girolano Fracastoro (1483-1553) was the first to recognise its infectivity. This infectivity Pierre Dessault (1675-1740) attributed to the sputum. Pregnancy was denounced as accelerating the disease as far back as 1777 (Cullen). The treatment of tuberculosis throughout the ages has

progressed somewhat slowly. Two main stages may be defined. In the first the principle of treatment was to get rid of any source of ventilation or fresh air. The second and opposite commenced with George Bodington in 1840. It embodied the principle of fresh air. Unfortunately his work was not greatly appreciated at the time of its publication. Actual medication was confined in early times to inhalations. And this line of treatment has been followed even into the present time by such authorities as Wilson Fox and David Lees, etc.

In 1882 was announced the discovery of the tubercle bacillus by Koch. This discovery has done more to regularize the treatment and principles of tuberculosis than any other. Its importance cannot be over-estimated. To Koch the tuberculous owe a deep debt of gratitude. The more indeed as he proceeded to try to find a cure for the disease by the production of tuberculin.

Surgical Tuberculosis, probably because of its lesser activity, as a rule, does not appear to occupy such an important place as pulmonary tuberculosis in historical research. But it was early recognised that heliotherapy was of value in affections of the bones and joints. This, combined with immobilisation, is still the main theme of treatment.

It was not until Laennec (1850), the discoverer of the stethoscope, expounded his theories and findings that the common relationship between pulmonary and non-pulmonary tuberculosis began to dawn upon the medical world. At that time the science of histology was in its infancy - in fact had just been born - and it was due to Laennec's interest and study of this subject that he was enabled to determine the common origin of these afflictions. Virchow (B.1821), as well as Laennec, seems to have recognised the similarity between surgical and phthisical lesions. Possibly Morton (1690) was the first to suspect some relationship for he noted that ulcers of the viscera and membranous parts often ended in consumption of the lungs. Exactly a century later Kortum (1789) noticed a similar relation between 'scrofula' and phthisis. Unfortunately the physicians of this period were inclined to assign the name 'tubercle' to almost any kind of tumour in a viscus, e.g. cirrhosis of the liver or carcinoma. The writings of Matthew Baillie (1787) show much evidence of this as he described cirrhosis of the liver as 'common tubercle' of the liver. Gaspard Laurent Boyle (d.1816) wrote that there were few consumptives in whom the lungs alone were affected. Laennec infected himself on the hand at an autopsy by innoculation. Later he developed

phthisis and thought of the connection between the two events. Indeed he stated that possibly not a single organ was exempt from infection by tuberculosis in consumption. Sometimes he believed the disease commenced in other organs and the phthisis was a secondary eruption. In the latter part of the nineteenth century a physician, Villemin, lived, who was probably the first clearly to understand the relationship between tubercles in the various parts of the body. Since then our knowledge has advanced somewhat more rapidly. (1) (2) (3).

To illustrate the importance of tuberculosis to the community it may be of value to enumerate some of the statistics with regard to the City of Glasgow - a city of 1,119,863 inhabitants in 1937.

In 1937 the notifications of tuberculosis were:-

Pulmonary	under 5	5 & under 10	10 & under 15	15 & under 25	25 & under 35	35 & under 45	45 & under 65	65 & upwards	Total
Males,	27	25	37	239	168	141	225	16	878
Females,	26	28	48	370	156	73	64	11	776
Non-Pulmonary.									
Males,	91	53	51	77	28	15	12	4	331
Females,	72	42	54	84	25	13	17	4	311

The number of cases receiving sanatorium treatment was:-

		In institutions in Jany.1st.	Admitted during the year.	Dismissed during the year.
Pulmonary:	Adults.			
Males,		452	1140	841
Females		309	876	660
	Children.			
Males,		96	102	87
Females,		89	96	77
Non-Pulmonary:	Adults.			
Males,		114	123	100
Females,		100	95	94
	Children.			
Males,		193	151	134
Females,		158	149	153
Total,		1511	2732	2146

The number of persons resident in the area who were known to be suffering from tuberculosis was:-

	under 5	5 & under 10	10 & under 15	15 & under 25	25 & under 35	35 & under 45	45 & under 65	65 & upwards	Total
A.PULMONARY.									
Males,	19	76	108	678	744	590	753	78	3046
Females,	14	52	119	869	733	344	246	36	2413
Total,	33	128	227	1547	1477	934	999	114	5459
B.NON-PULMONARY.									
Abdominal.									
Males,	18	40	94	73	10	8	-	-	243
Females,	7	26	54	85	20	4	3	1	200
Spine.									
Males,	10	26	51	62	38	11	10	1	209
Females,	3	25	34	49	26	13	11	1	162
Bones & Joints.*									
Males,	25	80	87	131	50	24	20	6	423
Females,	29	59	79	107	41	18	10	4	347
Superficial Glands.									
Males,	38	86	64	81	43	21	13	2	348
Females,	21	55	88	111	68	30	23	5	401
Lupus.									
Males,	3	1	6	30	22	13	8	1	84
Females,	2	5	8	14	15	15	15	5	79
Other Parts or Organs.									
Males,	5	8	11	20	33	26	20	1	124
Females,	4	4	5	12	14	14	6	1	60
Total,	165	415	581	775	380	197	139	28	2680
TOTAL A&B	198	543	808	2322	1857	1131	1138	142	8139

* Exclusive of Spine.

The death rate of tuberculosis per thousand persons living was 0.85 for pulmonary disease and 0.21 for non-pulmonary. The mortality rate per thousand suffering from

tuberculosis was 190 for pulmonary and 97.4 for non-pulmonary giving a total of 156 per thousand for all cases.

In addition, 1,704 hospital beds are kept permanently occupied by these patients at a total cost of over £200,000 pounds in the year. The total cost of the schemes for prevention and treatment of tuberculosis in the city amounted to £258,681 in 1937.

The above figures serve to show the enormous importance of the subject not only to medical men and the sufferers themselves, but to local administrators. That more than £250,000 has to be spent in one year in one city alone on tuberculosis services is an outstanding fact, as is the fact that there are 8,139 sufferers (known) from the disease in that city of 1,119,863 inhabitants. Apart from the above huge sum of money there remains to be considered the money lost in wages by tuberculosis patients and the money they cost the insurance societies (the average residence in hospital alone of each phthisical patient is 155 days and of each patient suffering from non-pulmonary tuberculosis, 340 days). From the figures in Table 3 it is seen that the disease mainly affects its sufferers at the age in which, if healthy, they are probably the most important members of the community. They

are at their best working years. For many of them money has been spent on education and fitting them out for their place in the world. But the scourge of tuberculosis lays hold of them just as they are about to make use of this training and become self-supporting. No other infectious disease is so costly in its treatment. The average cost per patient dismissed of pulmonary tuberculosis during 1937 was £62.13.10 and of non-pulmonary, £137.5.4.. The nearest approach to this is £30.10.3 by cases of encephalitis lethargica - and of these there are few. The importance of tuberculosis need not be further stressed.

It would appear therefore to be a most suitable subject for further investigation in the hope that some at least of this huge expenditure may be saved (4).

During 1936 and 1937 the writer was a resident medical officer in a sanatorium for adults (over 15 years of age) under the Public Health Department of the Corporation of Glasgow. Throughout that period the opportunity for an extensive study of tuberculosis in all its aspects, both pulmonary and non-pulmonary, arose. There were never less than 70-80 beds and often as many as 120 beds under personal care, apart from the availability of an approximate total of 482 patients all suffering from tuberculosis in

some form or other. In the sanatorium each patient underwent a complete clinical overhaul every 4-6 weeks, whether there was any apparent conditional change or not. While doing the routine examinations the writer was struck by the fact that often subsequent radiological examinations of chests showed a picture which was different from the clinical findings. This agrees with the findings of Freund (5). Especially was this so in patients who were admitted as non-pulmonary cases. On admission non-pulmonary cases did not have the chest radiologically examined unless the clinical findings were such as to suggest chest involvement. The worker then set out first to examine and review clinically all the available cases during the period January till August, 1937, with non-pulmonary lesions, and then submit these to radiological examination if this had not been done previously. Thereby it was hoped to show (1) in what way the findings by these two methods differed, (2) to promote a study of the relationship between pulmonary and non-pulmonary disease, and (3) finally to decide if there are any means whereby the diagnosis of phthisis can be made more definite and at an earlier stage. This early diagnosis Wingfield and Macpherson (6) state is agreed to be of great importance by all authorities. Other workers

have gone on similar lines but taking series of supposedly normal cases and determining the percentage of phthisical infiltration shown radiologically, e.g. Misgeld (7) took a series of 868 cases and found 20 people, although repeatedly examined clinically, suffering from active disease and half of these with positive sputum. 20,000 Vienna tramway employees were examined by Freund (5) and he found that, radiologically, tuberculous lesions were often discovered - and quite frequently advanced - in clinically free persons.

The writer's cases were divided into two main groups:

(1) Section A - Cases of non-pulmonary tuberculosis with no evidence of chest involvement clinically or physically.

(2) Section B - Cases with symptomatic or clinical evidence of chest involvement.

Some few patients were rejected owing to inaccuracy of details. Apart from this there was no selection.

Number of cases in Section A,	104
Number of cases in Section B,	152
Total number of cases,	256

With regard to the cases in A it may be stated here that the prolongation of expiration or harshness of the

respiratory murmur at the right apex was taken as being normal. At times we still find that chest disease is suspected because of prolongation or harshness of the respiratory murmur etc., at the right apex - Norris Landis (8).

In order to give some idea of the comparison of the cases in Section A with the normal populace, the chests of 50 'normals' were X-rayed. These people were admitted to the hospital for some non-tubercular complaint, e.g. puerperal sepsis, abortion, etc.. This group shall be called Section C.

The type of people in all three classes was essentially the same, being mainly composed of people from the working classes.

ETIOLOGY AND PATHOLOGY.

There are several types of tubercle bacilli recognised. These are human, bovine, reptilian and piscine (9) (10). But of these human and bovine are of most interest, in that they alone are pathogenic to man. The bacillus is normally acid fast, but Pagel (11) has demonstrated, by staining with Giemsa's method, that this is not always so. These he believes are on the one hand young, and on the other degenerate bacilli. They are found mainly in calcified or caseous foci. According to the site of affection and the age of the individual affected, the frequency of bovine or human tubercle varies. In disease of cervical and axillary glands in children under ten it is noted as high as 73% and drops to 30% in those over ten (9). Fraser found 61.2% bovine affection in surgical tuberculosis in Edinburgh, (106).

The reception of the organism into the body may be by one of three methods, inhalation, ingestion, or innoculation. Of the three methods inhalation and ingestion are of the most importance. Innoculation need only be remembered by its historic connection with Laennec. Ingestion is the more common method of entrance of the bovine bacillus, and inhalation that of the human origin.

It has been shown that only 2.3% of phthisis cases are of bovine origin (10), though one worker has made it as high as 20% (12). In this connection it is useful to quote Griffith who found in a series of 66 cases where infection was supposedly by inhalation, only one of the bovine type. In a series of 33 cases where alimentary infection was suspected there were only five of human type (13).

The evolution of the affection by the organism has lately been accepted by authorities to be in three stages (10) (14) (15) (16). Thereby they become to an extent disciples of Ranke (17). First comes the stage of the primary complex. It is the initial infection of the individual which usually, though not inevitably, takes place in the lung, and most often before the age of 21. But sometimes it is later and more often than many people suppose (18). Ghon's focus is the term applied to the primary site of infection in the lung in 'tuberculosis of childhood' (96). Characteristic of the primary infection is the fact that the associated lymph glands are involved. 80% of the primary foci are said to be in the lungs (16). The next most common site is in the abdomen, estimated by Blacklock (19) as high as 32.7% and by Puhl (20) at only 1.8%. Other sites described are in the skin, tonsil and

middle ear (21). Usually there is only one focus but it may be multiple. The primary focus as a rule heals and calcifies, as do the associated glands, but it may progress by enlargement, liquefaction and a final bronchogenic spread. In some cases the lymph barrier does not prove sufficient to block the organisms which spread to the apices of the lungs, kidney, spleen and bone etc. (22)(23). After the organisms have been in the body for one or two weeks a state of allergy or hypersensitivity is set up. This is the second stage or tuberculosis in an over-sensitized body (16). The third stage is that of the isolated organ disease (tuberculosis in a relatively immune body). Most believe this stage is due to a re-infection either exogenous or endogenous (10). In this case the individual has received a second severe dose of the infecting organisms and usually shows the disease as phthisis. He may have had several smaller doses of bacilli between the primary infection and this second severe dose, but owing to the state of immunity produced by the first infection, these smaller doses have not been sufficient to cause an active re-infection.

There are many factors which govern the <u>susceptibility of the host</u> to the invading organism. They are (a) the type of person affected, (b) the condition of

the person affected, (c) the method of reception of the organism, and (d) the virulence of the organism.

With regard to the first condition - the type of person affected - it is known that people with a family history of the disease are more liable to infection and respond more slowly to treatment; although this is denied by Gloyne (24). People with an alar type of chest show a tendency to the disease. The clear-skinned, long eye-lashed, probably freckled, and blue-eyed type has been noted as having a pre-disposition to infection. Some aver this is due to a greater permeability of the skin (25). Race (26) and age enter as factors. Davidson (10) writes that race has no bearing, activity in primitive races being due to no immunity being produced from a lack of early infection. Occupation is of some importance. Sedentary and office workers, i.e. those in confined spaces, are more liable than open-air workers. Miners and quarry-men have a high death rate from tuberculosis at the later age periods (27). But peculiarly enough, in Cardiff, seamen have been shown to have a higher incidence than any other occupation (28).

The condition of the recipient plays quite a part in the subsequent development of events. Under-nourishment, diabetes, insanity and other lung diseases, e.g. silicosis

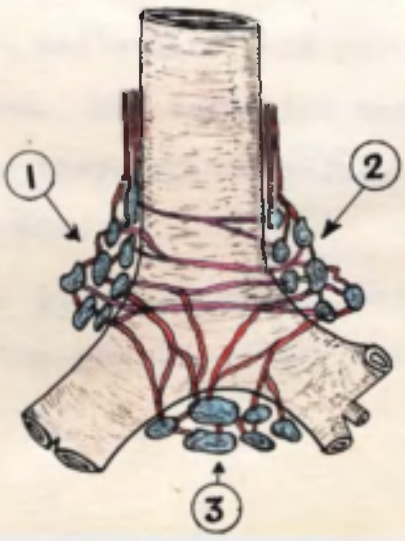
- make the ground more fertile. Gloyne (24) attributes the increase in liability to infection in insanity to unclean habits. Here it must be mentioned that mitral stenosis and Grave's disease appear to confer an immunity (10). Pregnancy is remarkable for the lack of development or of advance in already established disease. But this temporary immunity is more than overshadowed by the rapid acceleration of the disease after parturition. Here again is to be registered the denial of Ornstein and Kovnat (29) (30). (In a series of 85 cases of pregnant women the figures of the ultimate prognosis were the same as for a group of similar non-pregnant females. They concluded that the result depended more on the type of the pulmonary lesion.) People who are under a severe mental strain have a tendency to develop the disease. Finally, bad social conditions affecting the populace influence the spread of the disease - one of the main factors in the spread of the affliction being contact. In a series of 1,000 cases Lloyd and Macpherson (26) proved 42% had a history of contact and in four out of five cases the disease occurred within five years of the contagion.

The influence of the <u>mode of reception</u> depends mainly on factors already mentioned, e.g. type of organism;

mode of entrance, by inhalation or ingestion, etc.. The organism is noted to vary in virulence, exactly why is not known (9).

Once the organism has gained entrance to the body it has four modes by which it may progress, (1) lymphatic, (2) haematogenous, (3) bronchogenic and (4) enterogenous (23).

In considering the lymphatic spread, especially in the chest, it is important to understand the lymph drainage of the lung. There are two main plexi of lymph vessels. The superficial lies beneath the pulmonary pleura and runs round the edges and fissures of the lung to the glands at the hilum. The deep plexus accompanies the pulmonary vessels and bronchi to the tracheo-bronchial glands (31). Lymphatic vessels connect the lymph glands of both hila (16). The tracheo-bronchial glands are divided into four groups:



(1) Right pre-tracheo-bronchial group.
(2) Left pre-tracheo-bronchial group.
(3) Inter-tracheo-bronchial group.
(4) Inter-bronchial (in close relation with the pulmonary vessels and in the lung parenchyma) (10).

These latter may be further divided into broncho-pulmonary, lying between the branch of the bronchial tree, and the pulmonary glands in the lung substance (104). These lymph nodes are in turn connected with the mediastinal and peri-pancreatic glands (16). Sauerbruch and O'Shaugnessy state that the lymphatics on the left side mostly terminate in the thoracic duct and on the right side there is separate drainage by broncho-mediastinal trunk to form, with the subclavian and jugular trunks, the right thoracic duct (32). No better example of lymphatic spread can be given than that of the primary complex. If the infection is a severe one or the host's resistance low, it may involve not only the immediately associated lymph nodes but spread to the other glands round about - mediastinal and peripancreatic - and to the opposite hilum. The infection may spread to the thoracic duct and from there to the veins, whence further spread is haematogenous.

Probably haematogenous spread is of the greatest importance in the consideration of the relationship between

surgical tuberculosis and phthisis. This process of dissemination is best portrayed in acute miliary tuberculosis. A tuberculous process may be in the wall of a blood vessel, which ulcerates and discharges many bacilli into the blood stream (33). Benda has described a method of haematogenous spread by the rupturing of a lymph node into a vein (34). But Auerbach thinks this is rare (16). Once the bacilli have reached the blood stream, it carries them to the various sites giving rise to acute disease. The above shows the maximal type of blood infection. But the number of bacilli exuded into the blood may not be so numerous and may vary from mild, abortive forms to severe and fatal generalizations (35).

Bronchogenic spread is of course limited to the lungs. It is best illustrated in an advancing primary lesion or an 'early' generalization (16). Here a focus liquifies and the resultant material spreads along the bronchi, taking the infection with it.

Enterogenous transmission often takes place in the terminal stages of pulmonary tuberculosis (36). It is caused by the swallowing of bacilli in the sputum which settle in some part of the intestine, most often at some point near the ileo-caecal junction and this gives rise to tubercular processes.

In the present work surgical tuberculosis is taken to include diseases of the bones and joints, abdominal and glandular tuberculosis and tubercular affection of the genito-urinary system as well as lupus. Thus it will be well in the consideration of the pathological association of surgical tuberculosis with phthisis to treat each section separately.

Tuberculosis of Bones and Joints. First comes the most important numerically, disease of the bones and joints. From the foregoing general pathological considerations it can be gathered that the great majority of bone and joint lesions must arise by haematogenous spread from some focus elsewhere in the body. Therefore this type of surgical affection cannot be of itself the primary focus. This primary focus is to be looked for in the lung (or the abdomen) mainly. Therefore it is probable that in quite a number of these cases there will be at least some sign of hilar affection. There are several ways in which the infection may reach its surgical site. It may be a part of the primary infection in those cases where haematogenous infection occurs before the individual's resistance is able to overcome it. If a site of re-infection arises it is evident also that there is always the liability of spread of infection by one of the methods enumer-

ated above. If a few bacilli are spread in this way they will tend to settle in some part of the body made more suitable for them by a state of local lowered resistance - by injury, etc.. There the lesion caused (1) may heal, (2) may progress, or (3) may be dormant, after primary healing, till a further state of general or local lowered resistance allows it to progress.

Abdominal Tuberculosis. It may be primary, especially in children. In adults it tends to be pulmonary in origin, i.e. an enterogenous spread (37). It is conceivable that at times it may have a haematogenous spread from some other focus. Smith and Ames' findings indicated that associated lesions (i.e. other surgical lesions) usually arise from the same source as that responsible for mesenteric infection and not secondary dissemination from glands (38).

Genito-urinary Tuberculosis. The kidney is first invaded in tuberculosis of the urinary tract and this infection arises by haematogenous spread (39). Primary genital tuberculosis in the male is rare. Pottinger believes it possible though not often so (40). Three cases have been reported (41). In the female more cases are reported (42) (43). The infection may reach the genital tract by the lymphatics, by the blood stream, or

direct spread (39). But according to Bucher and Fetter (44), the blood stream is the only route deserving serious consideration.

The lymphatic glands draining the primary site are early infected. In cervical adenitis there is a possibility of the tonsil being the site of the primary infection. Gould says the explanation of the disease is lowered resistance in the glands, e.g. as a result of septic tonsils (45). The spread is progressive and direct from one gland to the other.

Lupus is invariably associated with tubercular adenitis. The mode of infection may be (1) direct, (2) by extension from deep foci, e.g. glands, (3) through the blood stream. Bernier stated that phthisical persons do not develop lupus, whereas patients with lupus frequently become phthisical (9). This would tend to show the probable primary or direct infection which takes place.

To summarise, in all cases where blood stream spread is admitted as a factor the possibility of the focus being in the lung is quite considerable. It may be the primary focus or a focus of re-infection. Once a surgical lesion has been established it is again liable to give rise to further haematogenous spread. This may then cause an

endogenous re-infection of the lung. An illustration of this type of spread is shown in those cases where miliary disease arises after manipulation of an unsuspected tubercular joint or after epidydimectomy. Here also the number of bacilli may not be so great as to cause a generalised miliary disease. If a surgical lesion disseminates bacilli into a vein they will be carried in the first instance to the heart by the returning systemic circulation and then to the lung by the pulmonic circulation. Thus the lung practically acts as a filter, it would appear to the writer, before the bacilli are returned to the systemic circulation. It would seem therefore that infection of the lung from a surgical site is very often possible. The lung too would appear to be the site most susceptible to the invasion of the Koch's bacillus (4). Can this be entirely due to its liability to exogenous infection? The writer does not think so, and believes that its structure is peculiarly adaptable to the growth of the tubercular disease. A factor which may emphasise this point has been noted by the writer. If a patient with phthisis develops a surgical lesion usually there is little change in the general outlook of the case. But if an active pulmonary lesion develops in a person already afflicted by a surgical lesion the out-

look is grave. Does this indicate that a greater degree of immunity is necessary to overcome a lesion in the lung than one in a surgical site? If this is so, it is reasonable to expect that bacilli carried by the blood stream from a surgical lesion are more likely to give rise to active disease in the lung than elsewhere.

Reisner followed 91 of his 240 cases of surgical tuberculosis to death (46). Of these, 14 only presented the character of isolated extra-pulmonary lesions. Fifteen cases had widespread systemic manifestations, while 62 combinations of involvement of two or more anatomical systems, either with or without pulmonary changes, were found. Therefore he concludes that surgical tuberculosis is usually a manifestation of a chronic generalized infection. This is again in favour of the haematogenous method of spread.

CLINICAL FINDINGS.

SIGNS and SYMPTOMS of PHTHISIS.

The symptoms of affection of the lungs by the tubercle bacillus are very varied. Very few of the signs are peculiar to this or any one lung disease but many are common to most (47). In the early stages, especially, there may be only one symptom, and in each case it may be a different one, which is the first manifestation of lung tuberculosis. Chapman (48) in the United States reviewed with very great care 200 cases of phthisis and found that the first symptom noticed in each case was as follows:-

Cough,	46	
General malaise, fatigue,&c,	46	(78% complained of this as a symptom though not the primary one.)
Chills, fever, influenza,	25	
Pain in the chest,	21	
Haemoptysis,	17	
Colds,	17	
Hoarseness,	4	
Indigestion,	3	
Loss of weight,	3	

Cough is noted to share equal place with fatigue, etc. in being the most common preliminary symptom. It is often morning in type especially in the early stages (47). Occasionally it is most marked on going to bed

(8). In advanced disease this symptom, of course, is much more prominent and with it, its concomitant symptom, expectoration. The amount of sputum appears to bear no relation to the severity of the cough. The writer had a patient whose cough was so persistent that it required constant use of sedative medicine. Yet the sputum was negligible in amount. Whereas in the same ward were other patients with little cough but up to five ounces of sputum per diem. "Nummular" sputum is the term used to describe a type commonly found in phthisis where excavation is taking place. It forms flat masses in water resembling the shape of pieces of money (49). This type of sputum is also found in bronchiectasis. There is no other type of sputum specific to tuberculosis.

In Chapman's series fatigue and general malaise rank equal with cough in incidence as a preliminary symptom. These are very insidious symptoms and as Norris Landis (8) says it has led many people to their graves, because its importance is not at first realised. In insidiousness they vie with these cases whose first symptoms may have been a chill or "influenza". Koester of Germany (50) lays particular stress on the significance of an attack of "influenza" or "influenza-like" illnesses, e.g. bronchitis, pneumonia, catarrh, etc., as being the probable beginning

of tuberculosis. Just recently in general practice the writer came in contact with a patient with advanced phthisis which all commenced from a 'neglected cold'. It is affirmed by Koester that 'every prolonged attack of influenza, which does not fall within an epidemic period and with which remains a subfebrile temperature and from which the patient does not reduperate satisfactorily, deserves the most exacting examination, especially radiologically'. With this many workers now agree, although it would not appear to be recognised as often as it should be.

Temperature in tuberculosis affords an interesting study. In phthisis it gives a guide not only to the actual presence of the disease but also helps one to judge the activity of the lesion from time to time.

Chart No. 1 shows the chart of a patient C.B. with massive tuberculosis of the left lung and active spreading disease on the right side. It shows one of the common though not essential characteristics - the evening rise.

Charts Nos. 2 and 3 are shown to illustrate the settling of a temperature with rest in a chronic bilateral case. On the other hand if the disease still progresses, elevation of temperature remains quite evident. It may be remittent, intermittent or continuous in type

(47), going on to hectic in the terminal stages. If early tuberculosis is suspected a careful record of a patient's temperature taken at 8 a.m. and 4 p.m. may help to clinch the diagnosis, especially if the evening rise is found. Occasionally this process is reversed and a morning rise is got as in Chart 4 from case C.I.. But this type is not common.

In patients affected by phthisis slight alteration in the wellbeing of these people is apt to give rise to demonstrable rises in their temperature, especially when the disease is not quite quiescent. Such rises occur in conditions including colds and menstruation, etc.. Chart No.5 from case C.McK. who developed a mild catarrhal cold, demonstrates such a rise as does Chart No.6 from M.D. at her menstrual period. Both of these patients had a chest lesion which was still active to a mild degree.

CHART No. 1.

Name C.B.

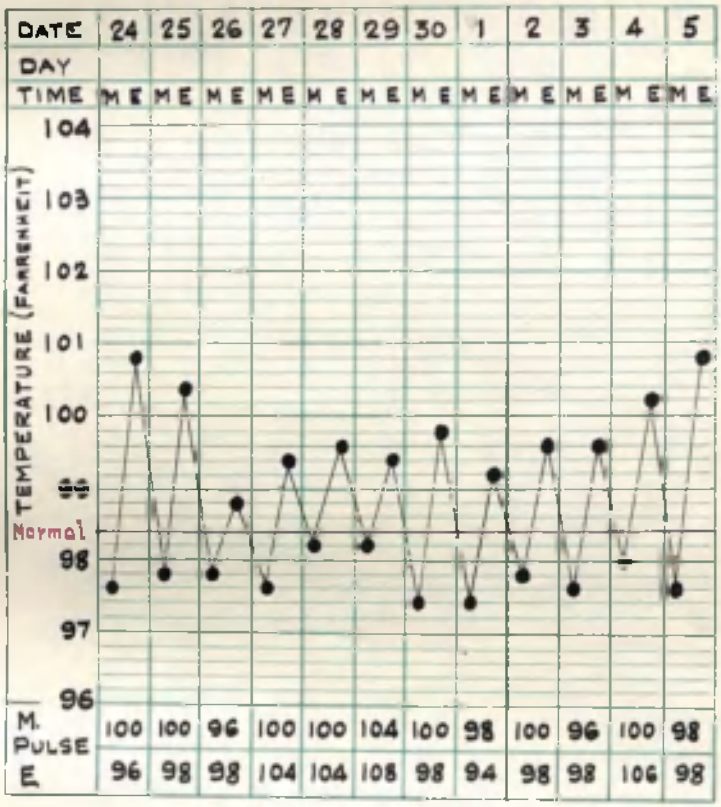
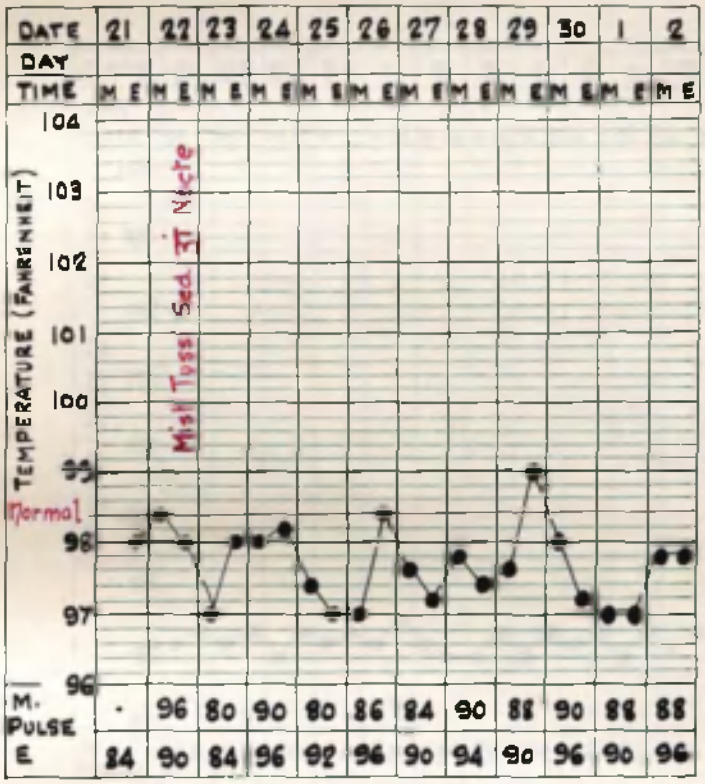


Chart from patient with massive disease of the left lung and active spreading disease from the right foot - note typical evening rise.

CHART No. 2.

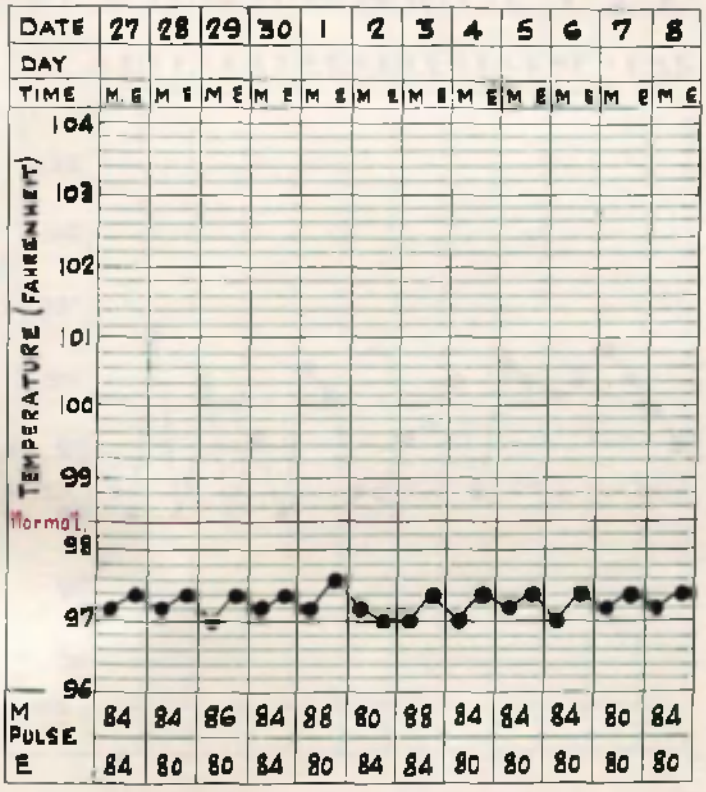
Name J. M^cC.



Compare with Chart No. 3.

CHART No. 3.

Name J.M°C.



Charts Nos. 2 and 3 from patient with active bilateral disease showing settling of temperature after two months in bed.

CHART No. 4.

Name C.T.

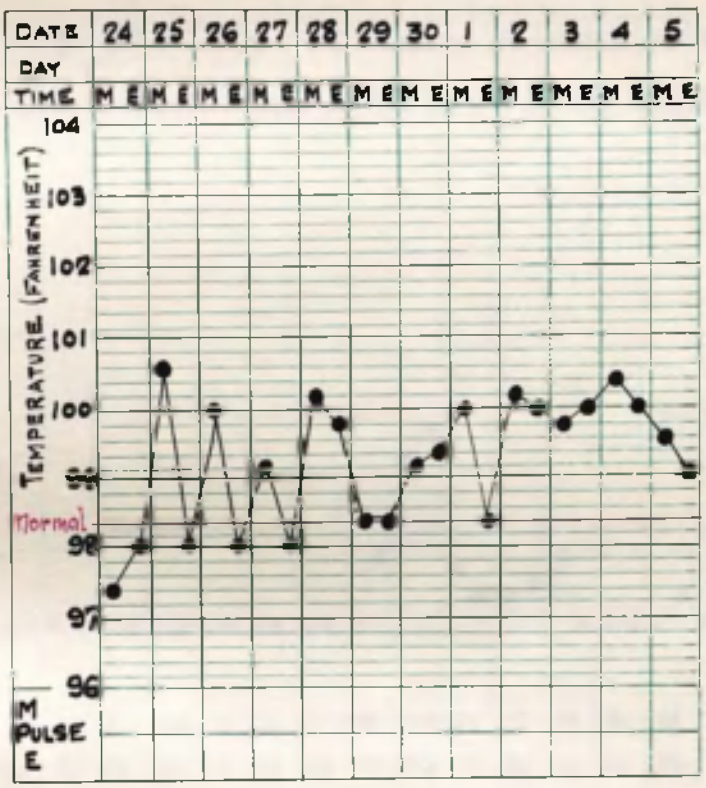


Chart from patient with active phthisis and abdominal disease showing the 'morning rise' type of temperature.

CHART No. 5.

Name C.McK.

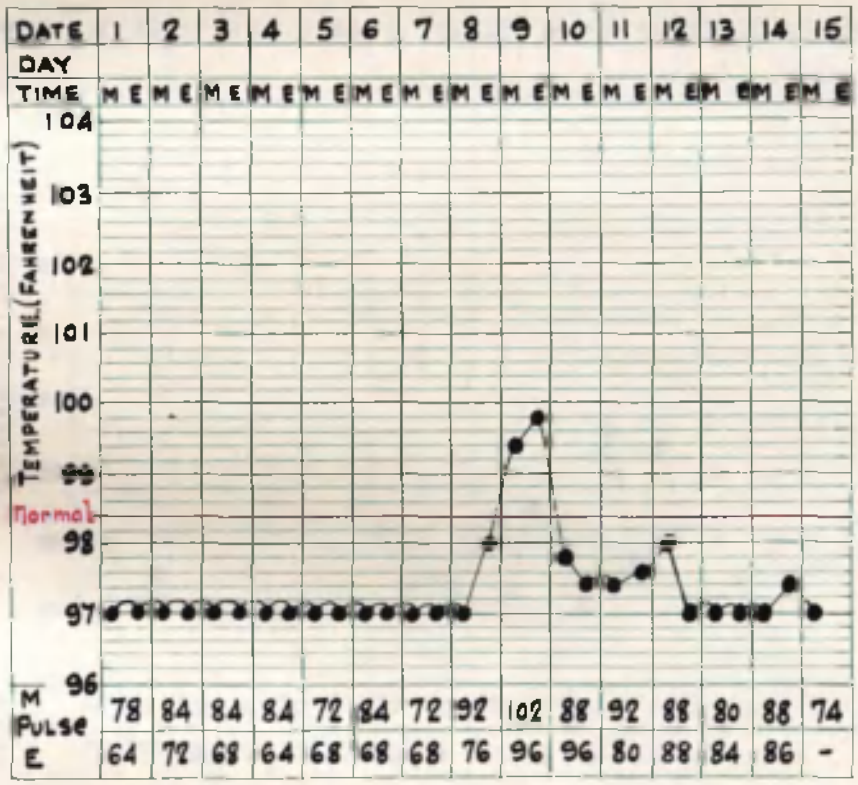


Chart from case of phthisis which was not quite quiescent. It shows the disturbance caused by a catarrhal cold.

CHART No. 6.

Name M.D.

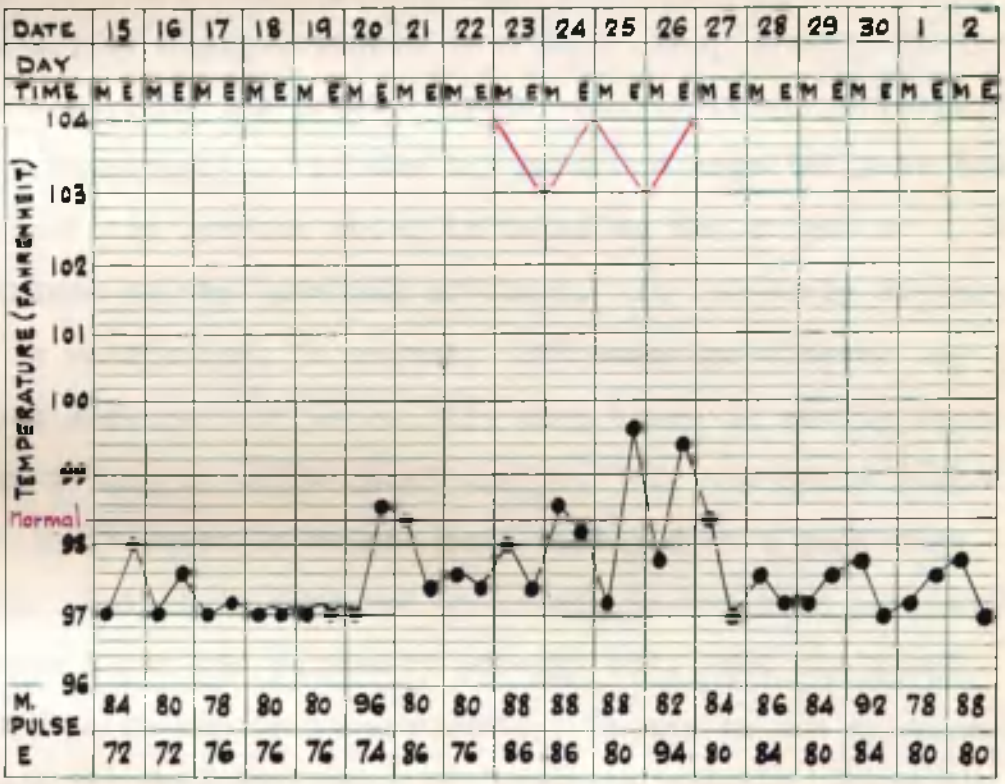


Chart from case of phthisis which was not quite quiescent. It shows the rise in temperature occasioned by a menstrual period.

Returning to Chapman's list the next most important preliminary symptom is pain in the chest. Often this is caused by a degree of pleurisy. It is then felt at the usual sites of pleuritic pain, namely over the site of the irritation, in the shoulder, or in the appendicaecal region. A second type of pain which has been noted by the writer among patients is a dull ache, often felt in the centre of the chest, either anteriorly or posteriorly.

Haemoptysis. To the lay mind and especially to the patient the symptom which is taken as the stigma of phthisis is the spitting of blood. In the early stages it is seldom much in amount. But when the disease becomes advanced and especially when there is cavity formation it may be quite considerable. In the early stages too it is commonly bright red, coming from a pulmonary vein. But it is dark red in colour in the more advanced stages (from the pulmonary artery) (8). Not all blood spitting is due to tuberculosis. It may be due to bronchiectasis, neoplasm, mycotic infection, trauma, pneumonia, heart disease, influenza, abscess of the lung, aneurysm, syphilis or vicarious menstruation (47). Some of these may be eliminated with greater ease than others. But to none of them should be assigned the cause of haemoptysis unless phthisis has been very carefully excluded (8).

Colds accounted for seventeen preliminary symptoms in the 200 cases. It might have been proper to include these under the "chill and influenza" grouping and similar remarks are suited to both groups. Hoarseness is to be looked on as a manifestation of advanced disease in most cases.

Gastro-intestinal disturbances. The importance of these symptoms in tuberculosis has been stressed by Grey and Greenfield (51). They found that 33% of their cases complained of loss of appetite; 25% had nausea with loss of appetite and vomiting and 23% vomiting with or without nausea. Pain and abdominal discomfort was also complained of by some.

Loss of weight although common in association with other symptoms does not rank high as a single initial symptom, but its importance cannot be overlooked.

Shortness of breath on exertion may be a symptom. It is most frequently noticed in the advanced fibrotic type of disease. But it may be found in cases where there is no extensive pulmonary damage, especially if the patient is of a nervous disposition (8).

Miscellaneous symptoms. Other symptoms which should not be overlooked because of their close association with tuberculosis are stressed by Koester (50) - pleurisy,

erythema nodosum, phlectenular conjunctivitis especially in children, chronic otitis media; ischio-rectal abscess with fistula-in-ano.

Exudative pleurisy is now admitted to be generally of a tubercular nature. Koester says 95%, other sources 50% (9) and 40% (52) - 10-20% of which are followed by progressive lung tuberculosis within the next 5 years. Norris Landis (8) indeed says 80% subsequently develop phthisis. Thus at least it may be said that quite a large number of cases of exudative pleurisy at some time thereafter develop active phthisis. At this point it may be noted that in the writer's series were found three cases who had a history of an exudative pleurisy. But this resolved completely and no further chest symptoms arose although surgical tuberculosis subsequently developed. In one case (No.21) it evolved in the ankle and another developed multiple disease one year later (No. 202). The third (No.166) was affected by sacro-iliac disease 3½ years later.

It would appear that erythema nodosum is practically established as a pre-tubercular condition. Often it is found to be the forerunner of the primary complex (Koester). Similarly phlectenular conjunctivitis in a child is often a sign of allergy against the tubercle bacillus.

Thompson (53) reports six cases of erythema nodosum associated with acute tuberculous cervical lymphadenitis. Two of these cases also exhibited phlectenular conjunctivitis. He is inclined to attribute both phenomena to embolic haematogenous tuberculous foci.

Chronic otitis media may be of tuberculous origin. The tuberculous nature of ischio-rectal abscess or fistula is well recognised. Sweating may be a complaint. It is a toxic symptom (47). General inspection of a patient may reveal clubbing of the fingers, a blue discoloration of the nails (in the early stages this is not due to anoxaemia but toxaemia and is a grave sign (8)), the skin harsh and dry, hair thin and brittle, chest veins prominent, poor nutrition, pallor, hectic flush. Poor nutrition is usually an accompanying symptom of tuberculosis but on occasion a case is found, especially in the more chronic type of disease, where even obesity is present. Snell reports the case of a patient who doubled her weight to 13 st. 8 lbs. in seven months with rest (54).

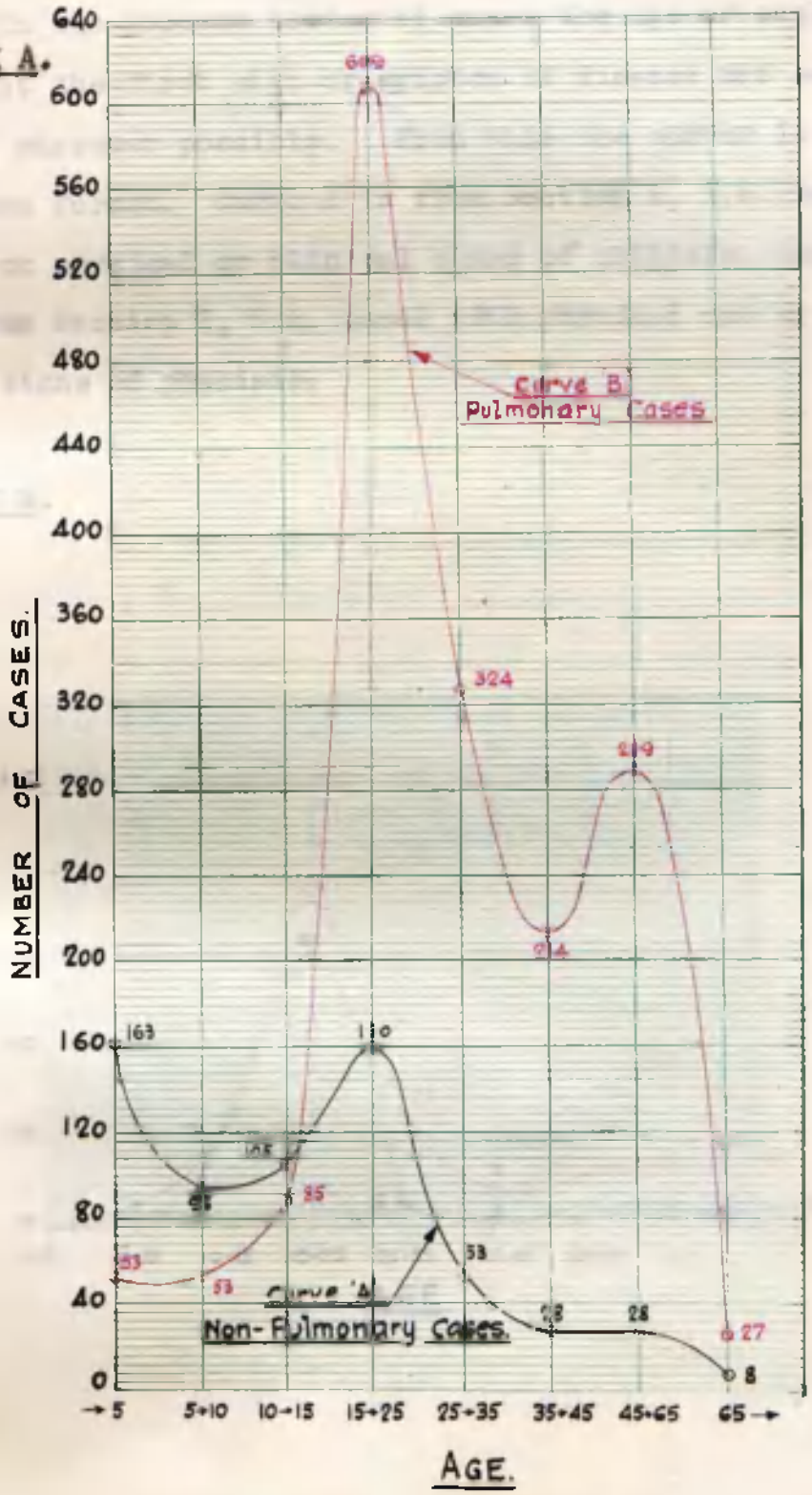
SIGNS and SYMPTOMS of SURGICAL TUBERCULOSIS.

The type of patient usually attacked by surgical tuberculosis varies but little from the type commonly subject to a phthisical lesion. But after a patient has

developed tuberculosis it matters greatly to the general wellbeing of that patient whether the site of attack is a surgical one or in the lungs or both together. In bone and joint tuberculosis the symptoms tend to be local rather than general whereas to a lesser extent the opposite is the case of the pulmonary lesion.

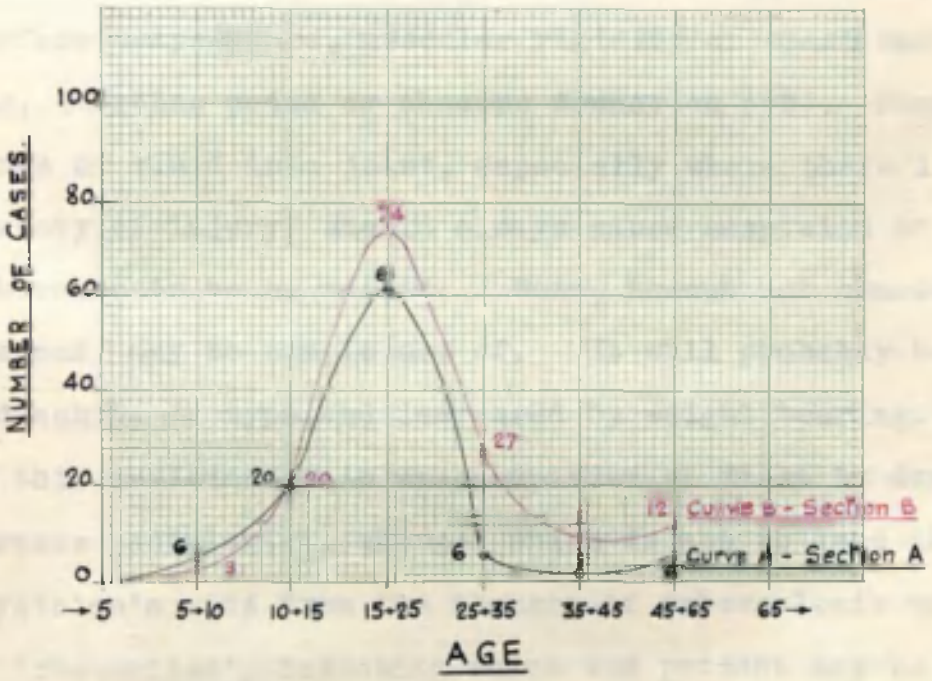
Taking first the clinical findings in surgical tuberculosis it will be seen from the graph reproduced below that there are two maximum peaks in the number of notifications of non-pulmonary disease. This figure is a graphical representation of Table 1 in the introduction. The first peak is in the youngest age period and the second corresponds to the age group of the maximum incidence of pulmonary disease.

GRAPH A.


640
600
560
520
480
440
400
360
320
280
240
200
160
120
80
40
0
NUMBER OF CASES.
Curve B
Pulmonary Cases
324
214
163
110
85
53
Curve A
Non-Pulmonary Cases.
28
27
8
→5
5-10
10-15
15-25
25-35
35-45
45-65
65→
AGE.

In the present series of cases the age of each patient at the first sign or symptom of disease was calculated wherever possible. From this the curves in Graph B. were formed. Curve A is from Section A, i.e. patients with no physical or clinical signs of phthisis, and Curve B. from Section B, i.e. cases with physical and/or clinical signs of phthisis.

GRAPH B.



It will be seen that by far the greatest number of cases come from patients developing the disease at the second peak. That is to say, the 'adult' peak. Thus it would seem that surgical tuberculosis in the adult was seldom a remnant of a childhood affliction; from which it may be deduced that few of these cases would be found to have a bovine infection. This finding agrees with Griffith (13).

Symptoms of joint disease. These tend to be local rather than general, as before noted. They are evidence of fluid in a joint, swelling, periarticular oedema, limitation of movement, flexion of a limb, increase of surface temperature, muscular rigidity or spasm and wasting, starting pains or abscess formation (55). Persistance of fluid in a joint, especially where there is no history of injury, should always cause suspicion of tuberculosis to be raised. Pain, though not constantly present, may be complained of. It will probably be dull and aching in type and increased by weight bearing. It is this insidious pain unaccompanied at first by demonstrable radiological changes which is apt to lead the physician's mind from the thought of tuberculosis to one of 'rheumatism', following which the patient may be sent to a clinic for massage and movement - the most injurious

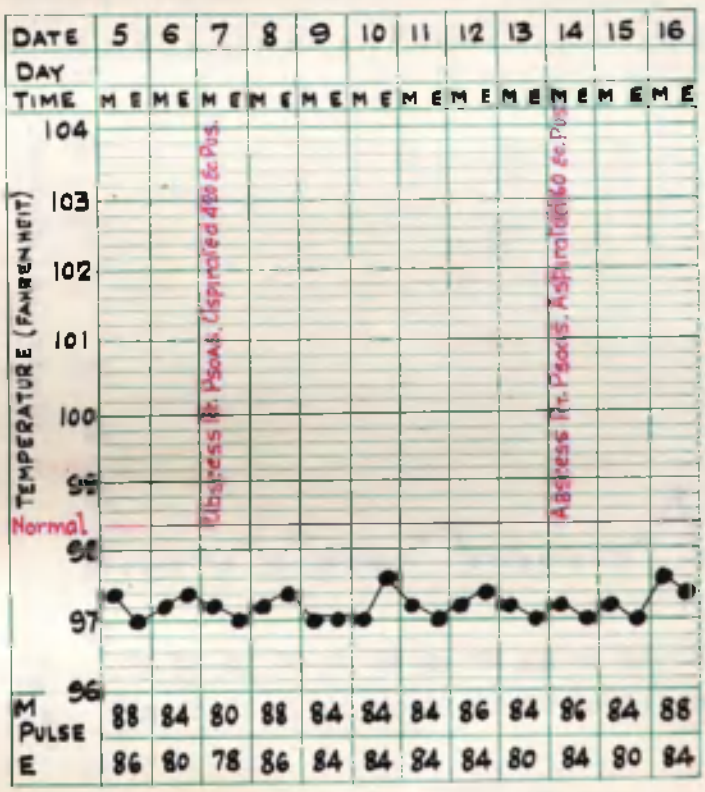
treatment for a tuberculous joint. All premonitory symptoms may be absent, however, until the appearance of abscess or deformity. This is especially so in disease of the spine.

The osseous type of tuberculosis is characterised by its insidious and slow progress and by the frequency with which it is associated with disease of the adjacent joint (56). Painless white swelling is a typical symptom, from which ultimately arises a cold abscess. Other symptoms are pain and muscular wasting (55).

Temperature. Seldom does a surgical lesion give rise to signs of temperature upset unless it has broken down and secondary infection has taken place. See Charts 7 and 8 from cases of spinal disease in the hospital, and Chart No. 9 from a case of similar disease where secondary infection has intervened. The loss of weight, although it may be present, is not on the whole so prominent a feature as in phthisis. Some cases of multiple tuberculosis show more definite loss of weight. Pallor or a waxy type of skin is sometimes noticeable in these cases. This is especially so if the case is developing or has developed amyloid disease, which is found in some long-standing cases of multiple tuberculosis.

CHART No. 7.

Name S.M.



Compare with Chart No. 8.

CHART No. 8.

Name A.McA.

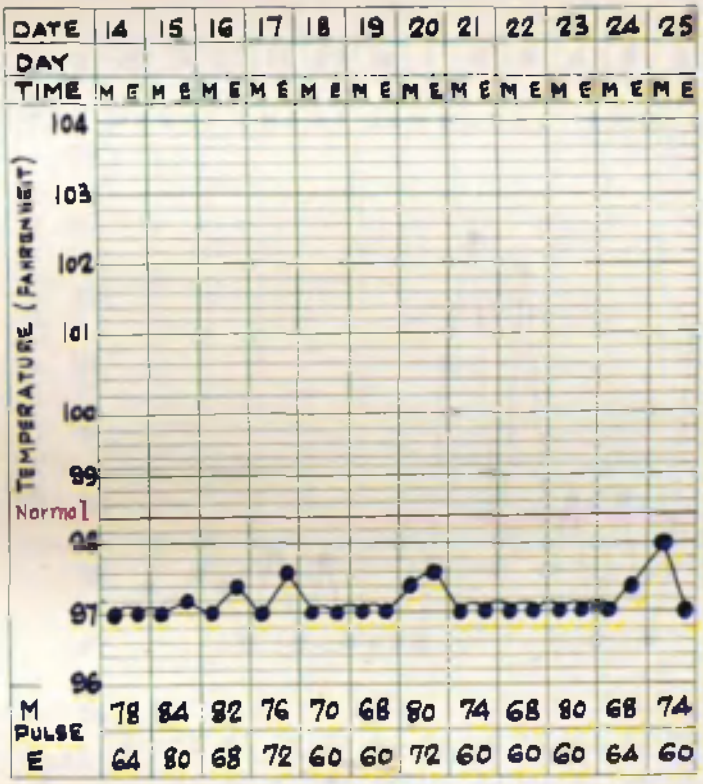


Chart No. 7 and Chart No.8 are from two different cases of spinal disease. Both show the lack of temperature disturbance as compared with that in phthisis.

CHART No. 9.

Name R.McN.

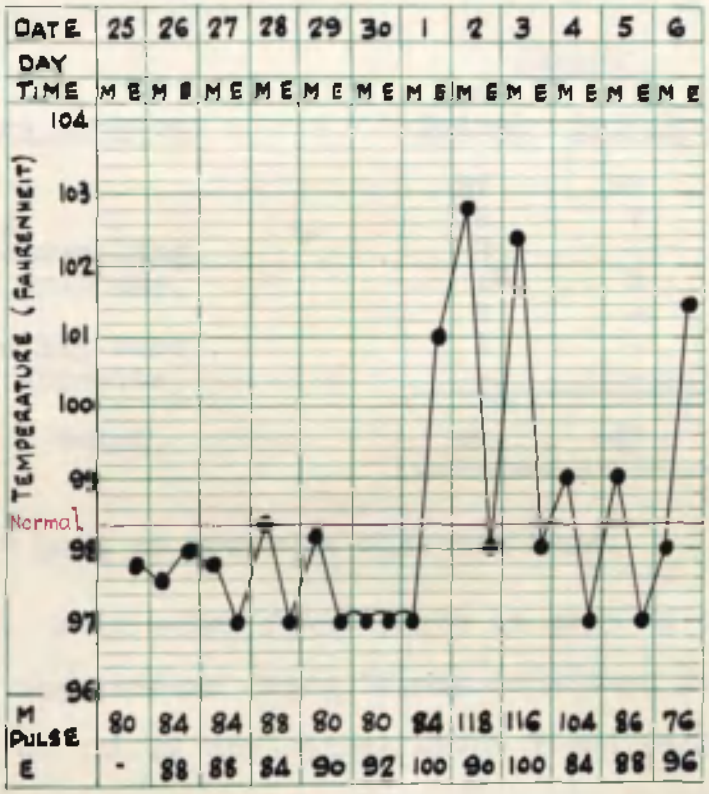


Chart from case of spinal disease where secondary infection has taken place.

Initial Symptoms. 98 cases comprising 87 of osseous disease and 11 abdominal cases were reviewed with regard to the first symptom complained of by the patient. The osseous cases were further subdivided into spinal and non-spinal cases, as the findings seemed to warrant this. The results are tabulated below.

Preliminary Symptom.	OSSEOUS. Non-Spinal	Spinal	Abdominal.
Pain,	27	28	8
Swelling,	13	7	2
Pain and Swelling,	3	-	-
Nervous Symptoms,	1*	5	-
Injury,	2	-	-
Limp (in Hip case),	1	-	-
Lack of Appetite,	-	-	1
Total,	47	40	11

* Loss of power in diseased hand.

Pain. Pain takes first place in each of these groupings. In the osseous cases it may be either local or referred. Of the 27 non-spinal cases 7 had pain of the referred type. Sacro-iliac disease tends to be referred to the hip, and hip disease to the knee. One spinal case (dorso-lumbar) had pain referred to the hip and another (lumbar) to the knee. The pain is usually dull and aching in type. Of the abdominal cases two had pain in the

right iliac fossa. In the abdomen the pain is more often of a griping type.

Swelling. With regard to swelling in the majority of spinal cases this was due to abscess formation. 'White-swelling' is the term applied to the enlargement which takes place in bone and joint tuberculosis.

Nervous Symptoms. Except for one case of disease in the hand, nervous signs are seen to be entirely confined to the spinal cases. These symptoms are due to compression of the spinal cord and evidence themselves as, loss of power in the legs, pain, and girdle sensations.

It is to be noted from the table that only one case showed what may be termed a 'general' symptom: this was loss of appetite in an abdominal case. Injury ranks as the preliminary cause in two cases, both of hip disease.

SIGNS and SYMPTOMS of SURGICAL TUBERCULOSIS with CONCOMITANT PHTHISIS.

Fishberg (57) affirms that the vast majority of persons who present stigmata of glandular, osseous, and articular tuberculosis during childhood do not develop pulmonary tuberculosis. It is found in sanatoria which have children as patients that this statement is true. In

adults this does not hold. A patient with phthisis may subsequently develop a surgical lesion, which event Jacquemin (57) believes to be of good prognostic significance. Similarly a patient with a surgical lesion sometimes develops lung disease. Of the 256 cases, in 49 of bone and joint disease it was possible to assess fairly accurately the time of commencement of the surgical lesion, and also the time of commencement of the concomitant phthisical lesion. In 27 cases the phthisis was the first to proclaim itself and in 22 cases it was subsequent in development to the surgical lesion. The period between the two incidents varied in both instances from a few months to more than 20 years. This is shown in the following table:-

	Years								
Period between Lesions	1	1-2	2-3	3-4	4-5	5-10	10 up	X	Total
Surgical before phthisical,	15	-	-	2	-	2	2	1	22
Phthisical before surgical,	7	3	2	3	5	3	2	2	27

X - indefinite period.

This table is interesting in the fact that it shows 15 out of the 22, or 67%, 'post-surgical' lung affections to develop within one year thereafter.

Incidence of Phthisis in various types of Surgical Disease.

Assuming a chest to be free from tuberculous infection only if there are no detectable physical or clinical signs, and no radiological evidence of lung affection either parenchymal, interstitial or glandular, the following table was constructed showing the incidence of pulmonary affection in each type of surgical case encountered.

Surgical lesion.	Bone or Joint	Multiple.	Abdominal.	Genito-Urinary.	Glandular.	Abscess	Lupus	Total.
With Pulmonary involvement,	135	25	22	17	9	2	2	212
No Pulmonary involvement,	34	5	4	-	1	-	-	44

This table shows two interesting facts. That approximately three quarters of the osseous cases have some sign of intra-thoracic affection. That none of the genito-urinary cases are entirely free. This latter fact will be discussed later.

The clinical findings in a case combining osseous and lung disease depend mainly on the type of phthisis the patient is suffering from. If the patient suffers from an acute active phthisis the general symptoms tend to assume its characteristics, e.g. temperature (see Charts. Nos.

CHART No. 10.

Name W. B.

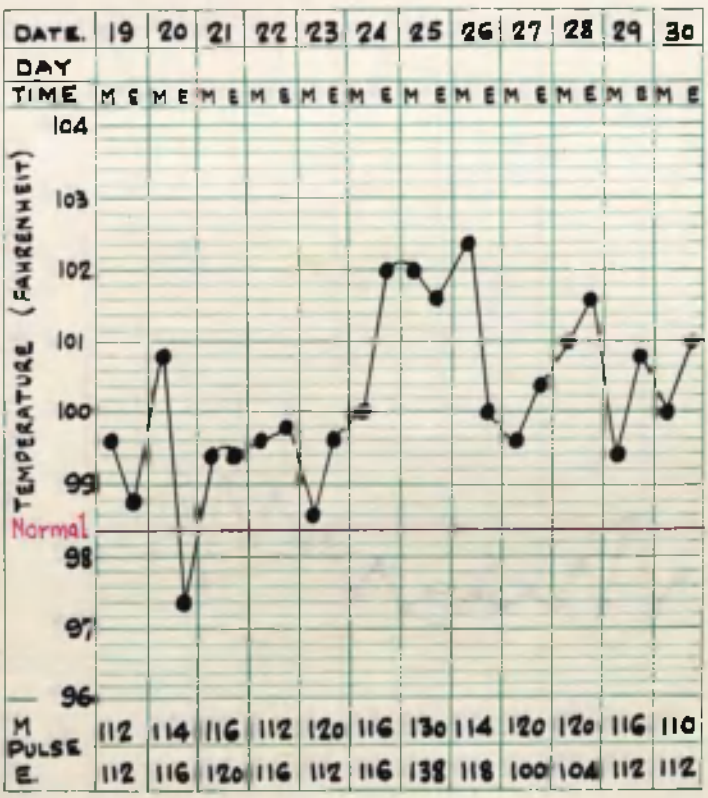


Chart from patient with disease of the right knee-joint and active phthisis on admission.

CHART No. 11.

Name W.B.

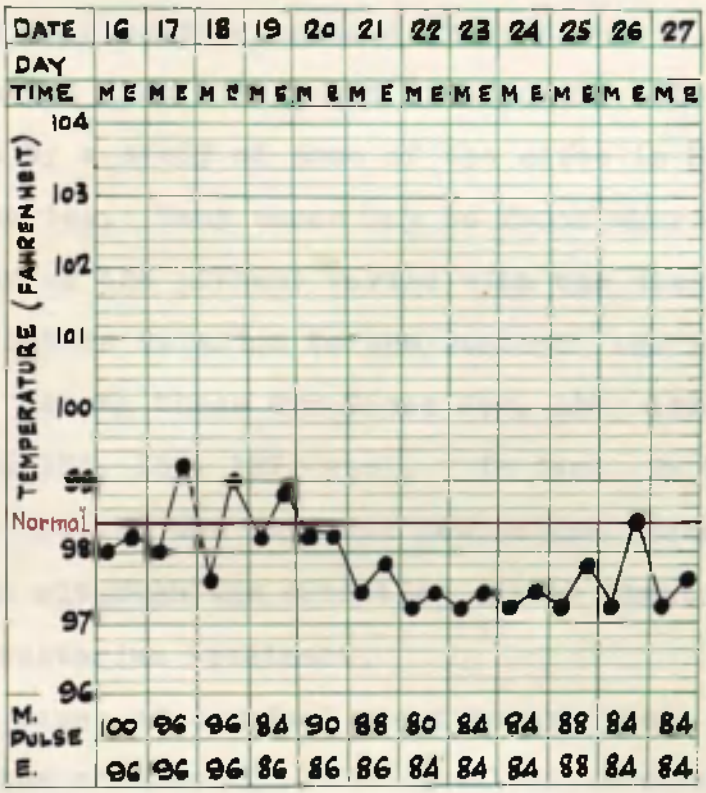


Chart from same patient as above 5 months later, showing settling in temperature due to quietening down of phthisical lesion.

10 and 11). Similarly if the lung disease is of a chronic type the symptoms will be those of a chronic phthisis. The surgical lesion has much less bearing on the general symptoms, unless it has a coincident secondary infection. But where there is no such secondary infection the case tends to exhibit the signs and symptoms as already discussed under phthisis. The surgical lesion then takes over a secondary role. This may be shown by a study of some of the cases in Section B of the series. Many cases may be found where the general condition of the patient varied with the chest condition and had little relation to the state of the surgical lesion. Among these are Cases Nos. 135, 149, 150, 147, 154, 156, 158, 159, 127, etc.. In fact, in Cases Nos. 147, 154 and 158 the surgical lesion had become absolutely quiescent although the condition of the chest still warranted sanatorium treatment.

The cases of cervical gland tuberculosis all showed some degree of intra-thoracic involvement except one. Of the remaining nine cases, only one showed extensive disease. This was case No. 106. It was that of a boy 18 years of age who had active disease of the cervical glands and also very active disease of the whole left lung and the upper third of the right lung. Here again the case

tended to assume the characteristics of the lung affection, the glandular disease undertaking only a secondary position. The rest of the cases had either very minor degrees of involvement or a very chronic slowly progressing type of disease. Two had root glandular enlargement and two had no radiological evidence of abnormality, but had minor physical signs.

In the abdominal cases, 26 in number, the most notable finding was pleural effusion in 5 or almost 25%. Five cases showed fairly extensive and active pulmonary disease. Eleven of the cases had no sign or only minimal sign of chest affection, and other five had a very chronic type of disease. One case showed completely healed foci above both clavicles.

An interesting point which may be mentioned at this juncture was in connection with three cases of rib disease encountered while at work in the hospital. In each of these cases pneumothorax had been induced on the side affected; so that it would seem that this lesion may arise as a result of injury to the rib by a pneumothorax needle. Chaklins (58) of the U.S.S.R. believes that injury does often count in the causation of tuberculous disease of a rib.

DIAGNOSIS.

Diagnosis of phthisis is sometimes difficult. Especially is it so in the early stages of the disease. First, because no physical signs may be detected, even in somewhat advanced disease. Secondly, if present, it may be difficult to determine their exact significance (59). To diagnose phthisis, Pottenger (60) believes symptoms should be considered under three headings:-

(1) Symptoms due to toxaemia, e.g. malaise, fever, etc.

(2) Symptoms due to reflex causes, e.g. cough, chest pains, diminished motion of affected side.

(3) Symptoms due to the tuberculous process itself - haemoptysis, pleurisy.

Many American authors aver that the disease should be diagnosed under three fundamental and correlated investigations:-

(1) Physical examination of the chest.
(2) Examination of the sputum.
(3) Radiological examination. (61).

To this list Snider (62) adds that of history. The physical signs may be discussed first, under the usual headings of inspection, palpation, percussion, and auscultation.

Examination of the chest might be summed up in one word, 'comparison'. Comparison of one side with its counterpart: comparison of different breath sounds, normal and abnormal, and of different percussion notes.

Inspection of the patient should be carried out in a good light with the illumination falling equally on the body surface. The patient may sit in a chair facing the examiner and be asked to breathe deeply. The examination may be divided into general and local inspection. In the general inspection such things as have been discussed in the previous section may be noted, e.g. general nutrition, clubbing of the fingers or curving of the nails, nutrition of the skin and hair, axillary sweating, etc.. The local inspection will be confined to the chest and its immediate surroundings. The type of chest will be noted and also the rate and type of breathing. Then any difference in expansion on the two sides would be looked for. Lag is a sign found on the diseased side. Compare opposing supra- and infra-clavicular fossae for signs of wasting and the opposing angles of the neck and shoulder. A difference in these angles is suspicious. The observance of muscular wasting is important, this usually taking place over the site of

pulmonary lesions (49). Drooping of a shoulder may be noticed on the affected side (8) (25).

Palpation is the next procedure. By it suspected deficiencies in expansion, as noted on inspection, may be confirmed, the width of the intercostal spaces judged and compared, narrowing on one side, giving rise to suspicion of underlying mischief. Myoidema - a twitching of the muscle when struck by the finger causing a nodular swelling to arise which slowly disappears - is sometimes elicited in phthisis over the affected lung (49).

Percussion is an important part of the examination. Here the method of comparison finds full scope. Percussion should be methodical. After tracing out the heart dullness and upper limit of the liver, the two sides should be compared by this method of examination. The position of the heart itself is important, for fibrotic lung disease can cause displacement of the heart. As noted previously, the right apex tends normally to be more dull than the left. After noting any impaired areas of dullness, the percussion should be further carried to detect certain special signs. Kroenig 's isthmus on both sides needs to be defined and the two

compared. Narrowing of one side will suggest unilateral disease, narrowing of both sides, bilateral disease; although, according to Packard, too much stress should not be laid on this examination alone (63). Then the tidal expansion at both bases should be determined (64). Occasionally interscapular dullness is obtained, suggesting disease of root glands (65). This may be combined with slight impairment of percussion note over the upper mediastinum (64). However, several writers say that D'Espines' sign is of no value (8) (65). The above are merely adjuncts to the main theme, which theme is the percussing of opposing and corresponding sections of both lungs for the comparison of the notes obtained on each side. Thereby an attempt is made to arrive at conclusions as to the possibility of structural alterations to the lung tissue beneath or its coverings above.

Auscultation is now performed. All the findings by this method are again those of comparison of the two sides. Having determined these findings, they should then be correlated with the findings obtained by the previous methods of examination, before any conclusion by auscultation alone be drawn. Types of breathing peculiar to tuberculosis may be discussed. The most

common alteration of definite significance found is that of prolonged expiration. It is recognised by the majority of workers that prolongation of expiration at the right apex is not of such significance as previously supposed (8). But evidence of prolonged or harsh expiration elsewhere is of definite significance. Cogwheel breathing at one time was thought to be of importance, but is now considered of little value (10) (66). Diminution of the respiratory murmur is another sign for early diagnosis, especially if found at the apex (10). Râles should be noted, especially on inspiration and in the upper part of the chest (62). These râles may be more clearly elicited by getting the patient to cough and then inspire (67). But it has been shown, and the writer is inclined to agree, that if a person has phthisis, that an increase in râles may take place as disease improves and even may persist after the disease is healed (68). Heise (69) states that râles are to be detected in early cases in 50% of cases, in moderate ones in 75%, and in the advanced in 89%. Prolonged expiration and râles are the clinical phenomena which are looked for in a suspected or early case. In more advanced cases all the above signs become more de-

fined and other more definite findings supervene, such as the signs of massive consolidation and cavity formation.

Radiology. The methods of examination and diagnosis from a radiological plate of the chest now fall to be examined - to decide what we expect to find, both physiological and pathological, on a film. There is the method of reading the plate. It is best to have a definite routine of examination (70). Let the starting point of the examination be taken as the costo-diaphragmatic angle. From here the observer moves on the left side along the chest wall to the apex. From the apex the route lies down along the trachea and the oesophagus to the arch of the aorta, to the pulmonary artery and the right auricle to the left ventricle, where the pleuro-pericardial angle is reached. The last part of this survey is from this angle along the dome of the diaphragm to the starting point. Similarly, on the right side one commences at the right costo-diaphragmatic angle and goes along the chest wall to the apex and from there down along the trachea and oesophagus to the arch of the superior vena cava, the right auricle and right ventricle to the pleuro-pericardial angle on this side.

Finally, one goes along the dome of the diaphragm to the first point on the right side.

Travelling along the above route, what may be found? First comes the costo-diaphragmatic angle. This angle is usually quite sharply defined, though sometimes double and may be somewhat blurred - this is not necessarily evidence of abnormality (71). But a certain amount of opacity in the lung field in this area often indicates a thickening of the pleura, which may be the only remaining sign of a tuberculous activity (25). Sometimes the pleura may be detected as a thin line running parallel to the chest wall. This is normal, but if the line is thickened, it indicates pleurisy (105). At the apex a calcified cervical gland may give an image superimposed on the lung field which may lead to confusion. Similarly, in the appropriate situation, one has to be wary of a calcified axillary gland (See Plates Nos. I and II). The pulling of the mediastinum to one side or the other is the most frequent abnormality found in the next part of the examination (104). Then lower down may be noted some changes which, although of more significance to the cardiologist, may have a definite bearing on the ultimate reading of the lung fields in the

PLATE No.I.

Plate showing massive calcification of lymphatic glands. A button is also to be seen in the field.

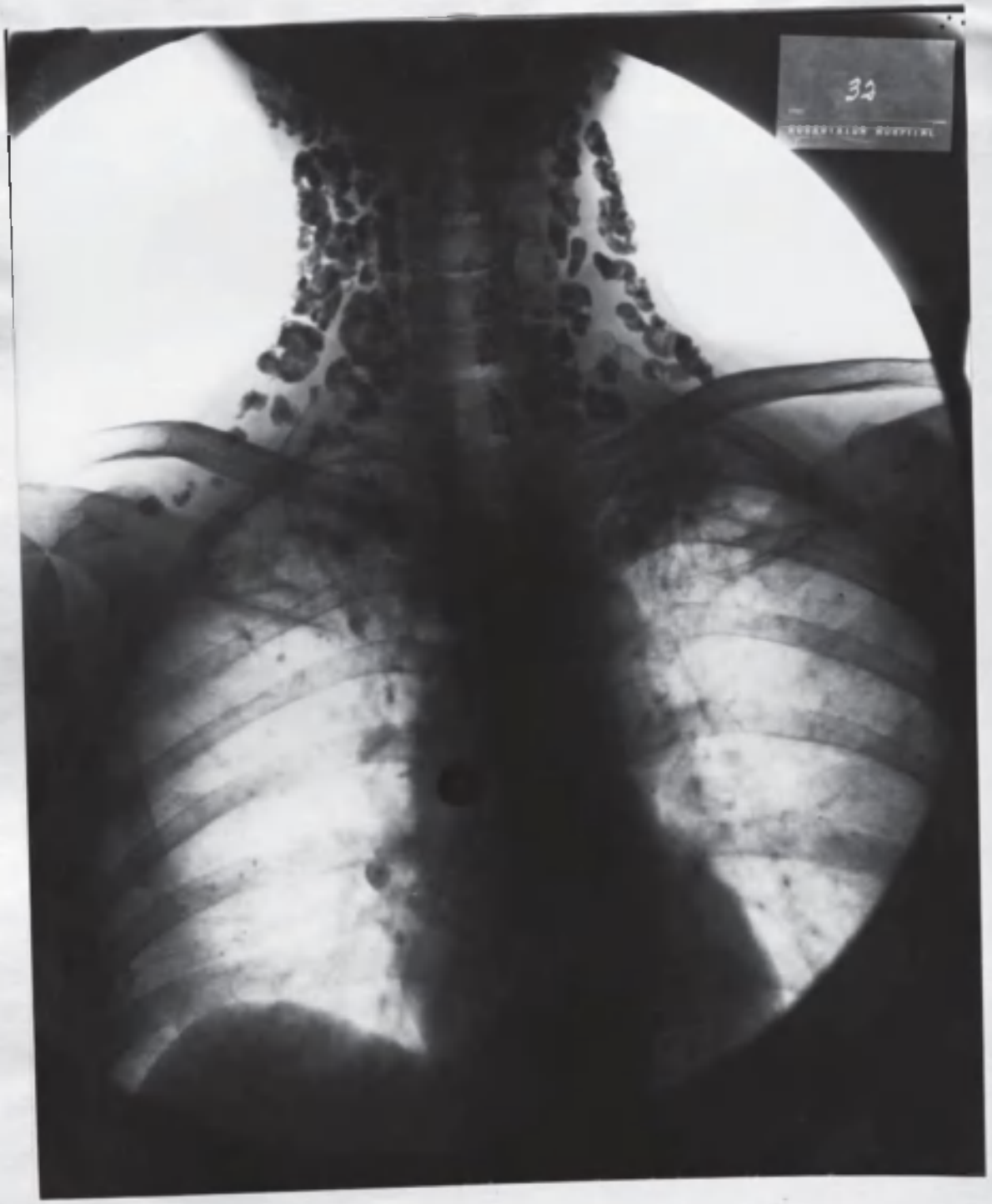

32

PLATE No. II.

Section of Plate showing calcified lymphatic glands superimposed on lung field.

plate. Beneath the heart borders the pleuro-pericardial angle is found. Evidence of adhesions is often found here (Plate No.III). In a normal plate this angle is usually quite defined and distinct, although not necessarily so. The right angle is frequently 'blunted) by the inferior vena cava (10). Generally the diaphragm shows itself as a clear, unbroken dome; the sight side being slightly higher than the left. It is concave upwards and may undulate towards its outer extremity. Diaphragmatic adhesions show themselves as serrations or piques of the dome and at times, a line may be seen 'tacked' on to the serration or pique as though holding it up (See Plate No.IV) (25).

The examination of the lung field itself now falls to be considered. Two methods by which the lung field can be divided into suitable areas may be described. One method is to divide the field into three separate areas as in Fig.1.

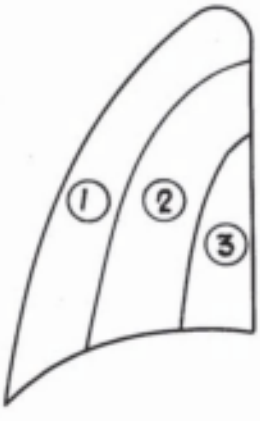


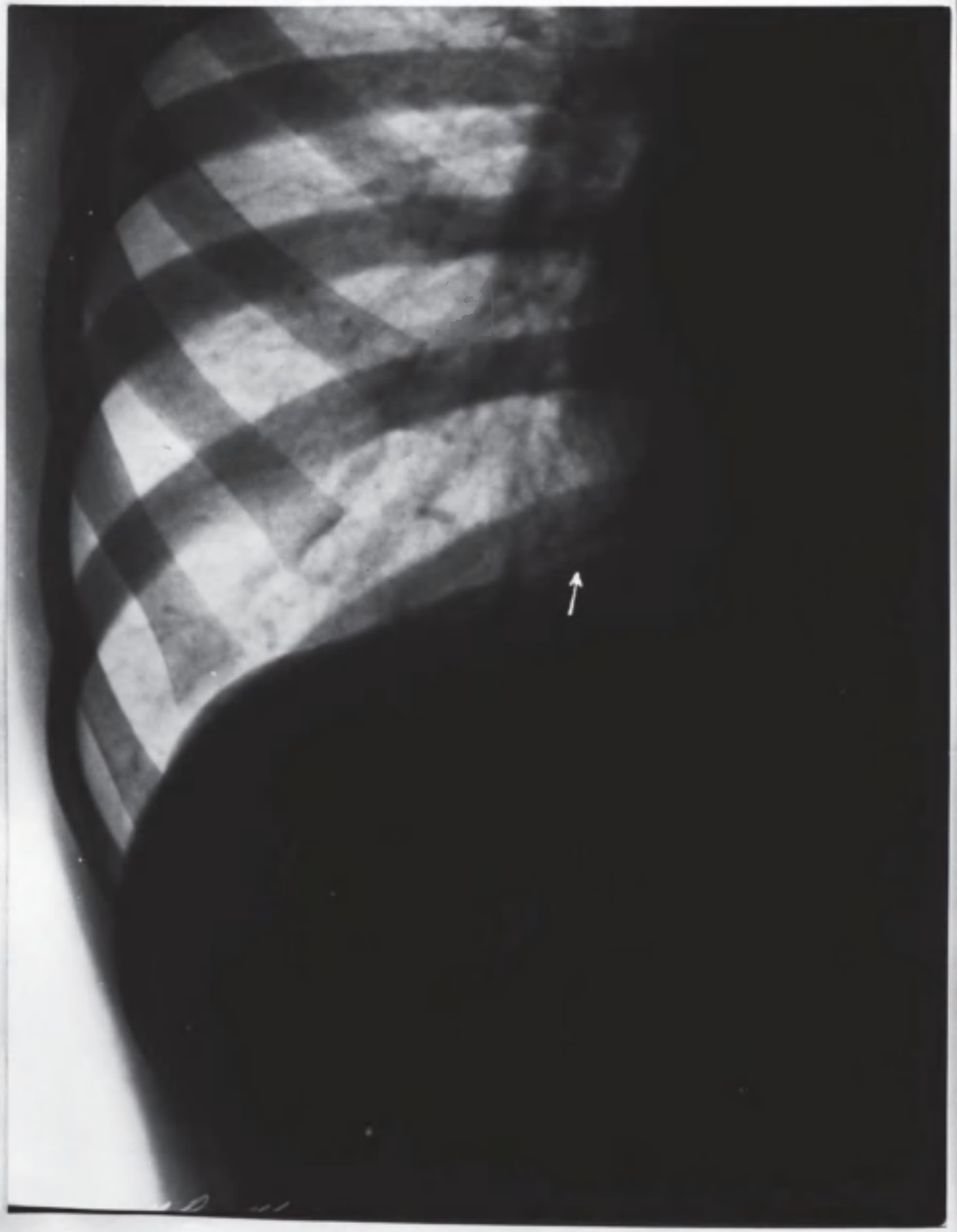
FIG. I

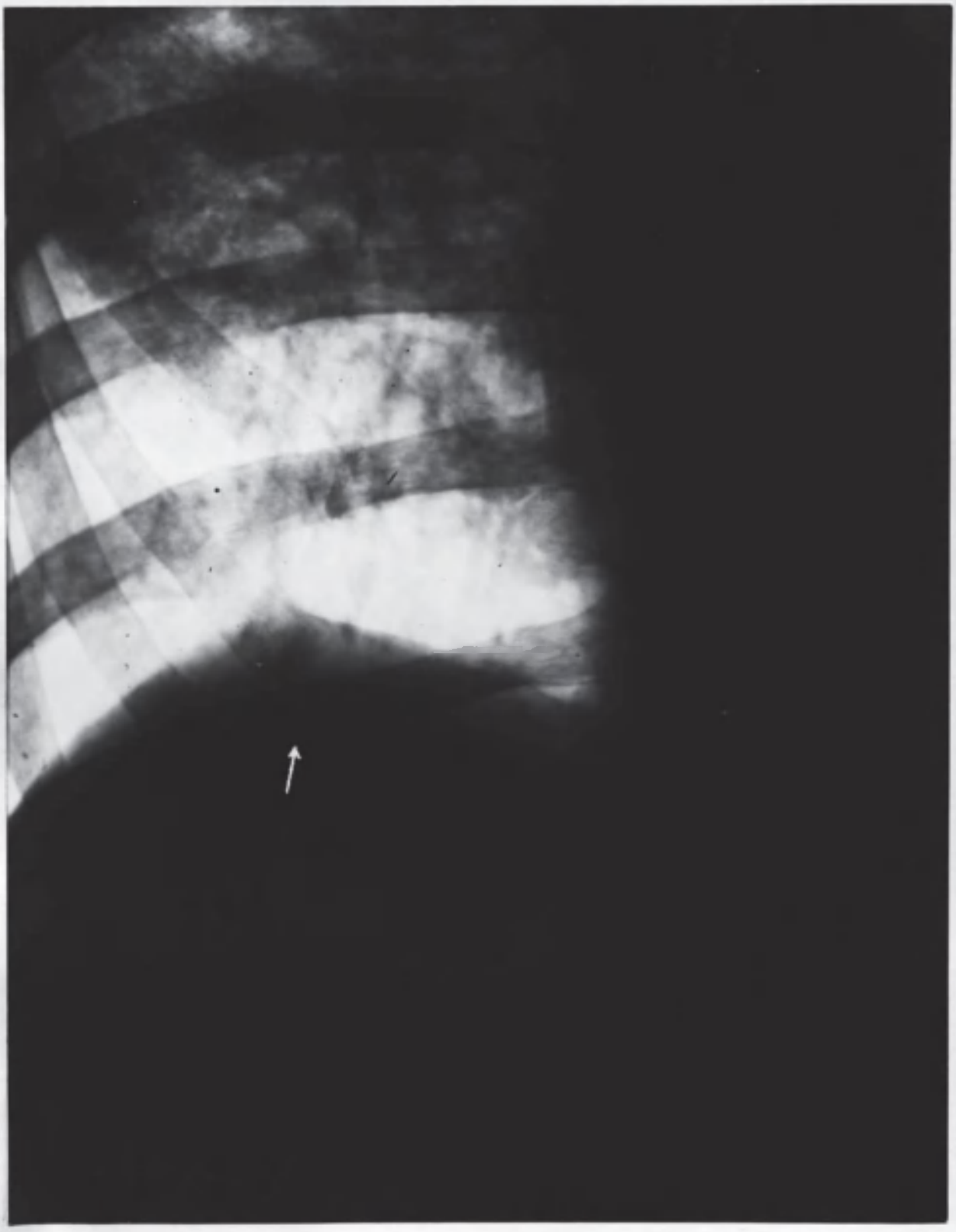
PLATE No. III.

Section of Plate showing evidence of adhesion in pleuro-pericardial angle.

PLATE No. IV.

Section of Plate showing diaphragmatic adhesion.





Area (1) Peripheral.
(2) Intermediate.
(3) Central (Hilum and Root).

This method was described by Meyer of America (70), but is also used in this country (25). In area (1) the lung field should be almost entirely clear and free of arborising bronchi. The evidence of arborising bronchi does not constitute an abnormality in area (2). The hilum and root of the lung are contained in area (3), according to this classification. The other method of division is of French origin and is found in figure II. In comparison with the previously selected divisional partition, it will be seen that areas I, outer parts of II and IV in fig. II correspond roughly to area (1) in figure I. In figure II in area I, according to Stephani and Marechal (71), only very fine and long threads of bronchi should be noticed at the most. Area II should show réseau secondaire - some bronchial markings to the inner part of the area which disappear towards the periphery. Area III is that of the long vessels and at times these may be seen cut in cross section - 'lozenge-shaped'. No. IV, which is called the external basal area, corresponds very closely to the apex in findings. Finally, the fifth area shows the bronchi and vessels curling round and backwards to

supply the base of the lung. These markings in area III are called 'le gros réseau'. It may be noted here that Twining affirms that the markings in the lung field are entirely due to the blood vessels (104); others that they are formed by vessels, lymphatics and connective tissue (25) (105).

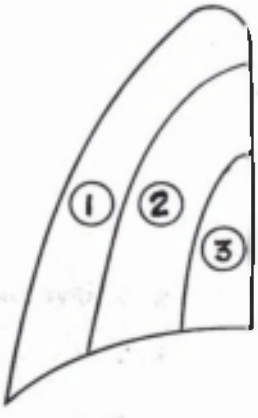


FIG. I

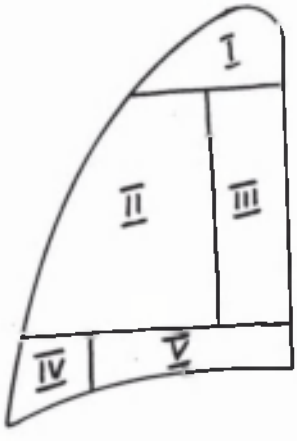


FIG. II

In examining the lung fields generally, evidence of an interlobar pleurisy may be detected (25). Rarely evidence of an azygos lobe may be discovered (71) (72) (104) (105). It is an anatomical abnormality and is found in the right subclavicular area. Even more rarely still may be found evidence of the lobe of Wrisberg - the apex

of the lung appears as though divided into an external and an internal area.

Considering figure I and taking area (3) first, probably the most common abnormality detected here is enlarged or calcified glands. At times it is difficult to distinguish between hilar calcifications and vessels (71).

Area (1) should be entirely free of shadow, excepting an occasional finely threaded bronchial filament. Here one has to be careful not to diagnose a calcified focus in the lung area. This focus really arising from a calcified gland (cervical or otherwise - see Plates I and II). In the upper part of this area, and at the lower border of the second rib, occasionally there is found an 'ombre sattelite' in the form of a thick line (71). In the apices most often one finds small foci of disease, many of them inactive, but at times active. The differentiation is radiologically at times difficult. In fact, foci here are usually less active than elsewhere (71). In one or two of the cases in this series Asmann's foci were evident in this area. In estimating the extent of foci, especially if fresh and acute, it is difficult to assess their true size. This is due to the surrounding congestion or

peripheral reaction which often arises (104). Redecker (71) says he has seen several small fresh nodules arising around an old healed focus. Lowered resistance has allowed a previously controlled infection to spread. In this connection it may be noted that it has been shown that injection of formic acid or dead tubercle bacilli may reproduce a reaction similar to the epituberculous reaction (71) (104). In area (1) calcified remains of congenital abnormalities are occasionally found. This was probably the origin of the abnormality in Case No.79; but here, as is more common, the abnormality was found towards the base (Plate V).

Area (2) still remains to be discussed. The remarks made concerning foci under area (3) also apply to this section. It is here that the thickening of bronchi is most easily detected and noticeable. It is the recognition of the difference between normal and abnormal in the portrayal of the bronchi on the film that is of most importance to the examiner.

Calcification of the costal cartilages can give rise to false images in the lung field (Plate No.VI). An encysted pneumothorax may simulate a cavity (Plate No.VII). Other items which may need to be taken into consideration

PLATE No. V.

Section of Radiograph of chest of Case No. 79, showing abnormality at base. (Wassermann Reaction was negative).

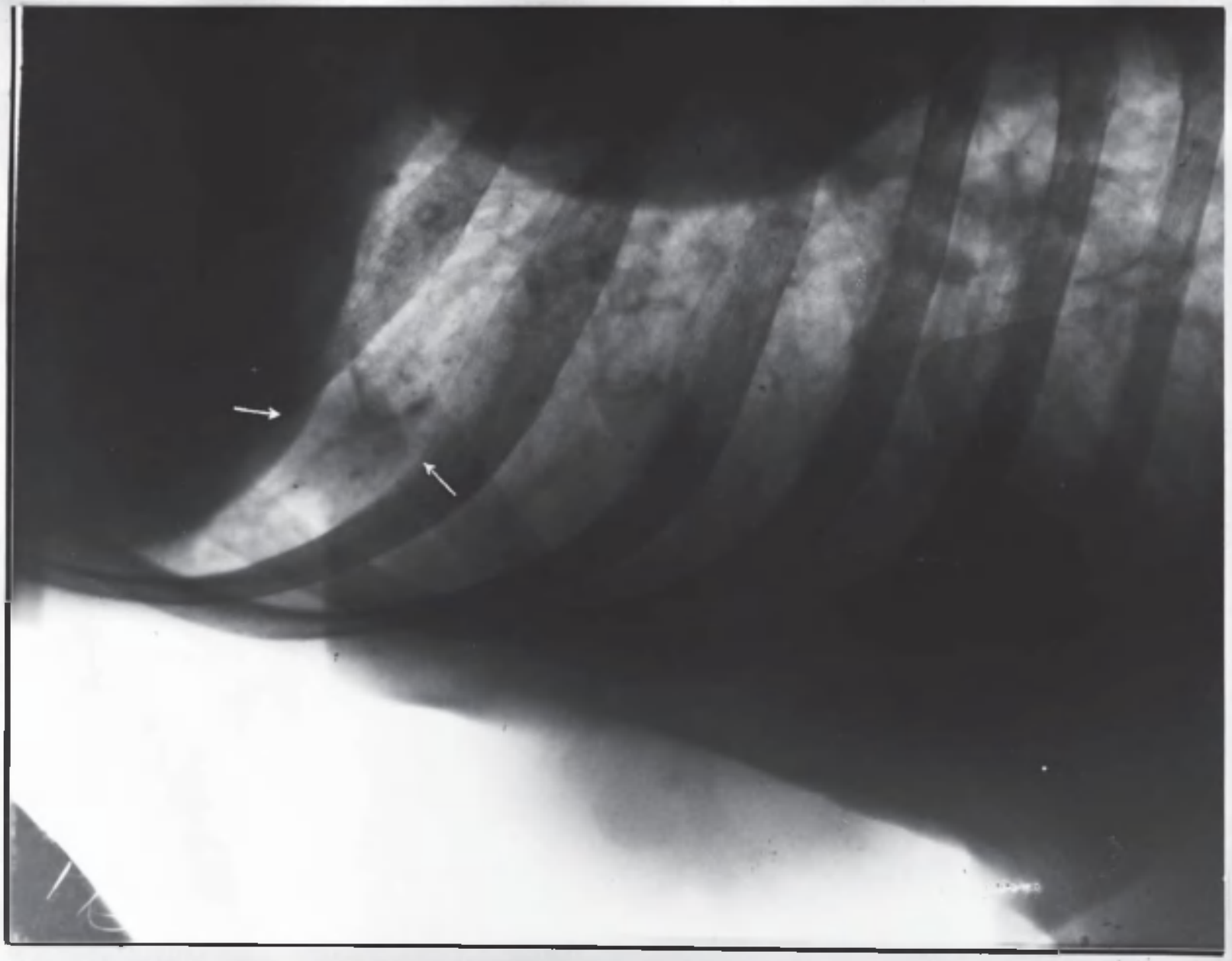


PLATE No. VI.

Radiograph of chest, showing calcification of costal cartilages. Pneumothorax on right side.

PLATE No. VII.

Plate showing encysted pneumothorax simulating a cavity.

in the reading of the plates are:-

(1) The Breasts - especially in women - they may give rise to falsified ideas of thickened pleura.

(2) Muscular Shadows - here again thickened pleura may be simulated, but more often in men than women.

(3) Articles of apparel left in situ - e.g. a button (104).

Being careful to avoid the pitfalls in interpretation of radiological plates, what findings would lead one to suspect the presence of disease in the lung fields? These findings will of course vary with the form the affection is taking. The aim of the plates is to show if the areas pictured are healthy. Any departure from the normal findings as described should give rise to suspicion, e.g. grey spots in the apices or the extension of the bronchial network beyond the limits already described. If abnormal markings are found, the next point to decide is whether these markings are due to active or inactive disease. Minor degrees of activity are difficult to assess. These are best determined by taking a series of plates at short intervals (73). Active lesions tend to have an irregular or 'fuzzy' outline, whereas inactive lesions have definitely demarcated limitations (71) (70).

It is conceivable that the very earliest beginning of a lesion will not be demonstrable on radiological examination, but may give rise to clinical symptoms.

As previously noted, the cases were divided into three sections, A, B, and C. Section B was that in which physical signs or history were such as to suggest the presence of pulmonary disease. In this section, to illustrate the difficulties of diagnosis from history and physical signs alone, it was found that 22 cases showed no radiological evidence of pulmonary involvement. This forms 14.5% of the total 152 cases comprising the section. These cases and the reasons for assigning them to Section B are given below.

	No.Cases.
Rales and/or rhonchi (probably bronchitic in origin)	5
Respiratory murmur, harsh or bronchial, at both apices	4
Respiratory murmur, harsh or bronchial, at right apex	1
Respiratory murmur, harsh or bronchial, at left apex (excessively so)	1
Respiratory murmur, harsh or bronchial, at both apices, with respiratory murmur diminished at right side.....	1
Respiratory murmur diminished at right side	1
Respiratory murmur diminished all over	2
Rales and rhonchi with dullness at left apex	1
Dullness on left side	1

	No.Cases.
Dullness at left apex	1
Dullness at both apices	1
Flattening at both apices	1
History of old pleurisy	1
History of dullness both apices and bases ..	1
Total,	22

The above also serves to affirm the value of radiology in the diagnosis of phthisis, and also how physical signs and radiological findings should always be correlated.

To summarise physical signs used with full knowledge of their weaknesses are of value in the diagnosis of phthisis (59). But the diagnosis should not rest on these alone. Radiology also plays a most important part; for often, as will be seen from the results obtained, these two methods of examination will seem to vary in their assessment of the amount of disease present (46). Rales and rhonchi with crepitations can be obtained in a simple bronchitis. It is only by combination of all the methods available, physical examination, roentgenography, and sputum test, etc., that the diagnosis may be established definitely.

Tomography. Of recent date a new addition has been made to the radiological department, which is helping considerably to discover lesions which before escaped notice. This is the tomograph. In the forefront of

this work from its inception is McDougall (74) (75). He, and other more recent workers, have found it to show up cavities and lesions which were imperceptible before. Its value is that it takes sectional plates of the chest at different levels.

The interpretation of hilar shadows and pulmonary markings has given rise to much controversy. Chadwick (65) says that he does not consider prominent pulmonary markings pathological when not associated with dense lymph node masses, and also that slight changes in the area or of the density of shadow are of no significance. Ordinarily the hilum shadow on the left is less prominent than that on the right (10). The shadows too differ in age, with old bronchial disease, emphysema and cardiac lesions (76). But in many plates the increase in the hilar shadows is so marked that it must be noted and when this occurs in a case of surgical tuberculosis, the most probable pathological condition, if nothing else is obvious, is infection by the tubercle bacillus. This hilar tuberculosis has in general the shape of the vessels or bronchi. Sometimes it is generalised throughout the two lungs; sometimes it is localised to one lung or to one of its segments. The infection seems to spread in

the substance of the lung by means of the connective tissue and lymphatics around the bronchi. This fibrous type of disease is most difficult to diagnose by physical signs and indeed often only becomes evident on X-ray examination. But this type of disease is none the less serious, for from it one may develop all kinds of lung involvement (71) (47). Many plates show evidence of enlarged root glands. This shows that the disease is probably present in these situations, though it may be dormant. It also shows another possibility. At some time there may have been one or more foci of infection in the lung itself, primary or otherwise. It is interesting to note the large number of cases so affected. The point then at issue is whether this dormant infection may again awake at a period of general lowered resistance. If disease can spread by the connective tissue and lymphatics from the outside to the hilum, may it not also spread in the reverse manner? Certainly, being against the lymph flow, it may not be so easy; but if it can, this means that the presence of infected hilar glands is an ever present danger to the health of the lung parenchyma (47).

Laboratory examinations in their aid to diagnosis remain to be discussed. There is examination and staining

of the sputum. It is agreed that the dismissal of the diagnosis of phthisis should not rest on one negative result from sputum test. It is said that it should be done at least ten times before accepting a negative result (Kaufmann) (77); and even then, it has been known to be wrong. Wood has suggested a more accurate method of examining for the tubercle bacillus (78) (79). A laryngeal mirror is placed in the nasopharynx when the patient coughs. This is said to give a 13% increase in accuracy. If a patient has a positive sputum, the course of the disease may be partly judged by the estimation of the number of bacilli in the spit. Lessening in quantity of the bacilli usually means a betterment in the phthisical condition. Care should be taken in the collection of the sputum. This is especially so in new cases where a sample of secretion from the naso-pharynx may be supplied instead of 'true' sputum.

It is difficult to describe a typical tuberculous sputum. Frequently a type with green blobs in a more fluid medium is found. As noted before, the amount of sputum depends but little on the amount of cough. The number of bacilli in sputum is at times few; so methods of concentration of the bacilli have been evolved. The

most common of these is the antiformin method. It was first used by Uhlenhull and Xylender in 1908 (80). The antiformin is prepared by mixing equal parts of 15% solution of sodium hydroxide and liquor sodae chlorinatae (B.P.). The strength, diluted with sputum recommended by Willis (80) is 20-25%. The mixture is well inter-mixed and allowed to stand for 12-24 hours. After the antiformin has disintegrated the sputum the whole is centrifuged. The sediment, which will then contain the bacilli from the whole of the sputum, is spread on slides for staining and examination (81).

The examination of gastric contents for the tubercle bacillus, especially in early cases, is advocated by Stiehm. These contents are examined by direct smear, culture and guineapig innoculations (82). The examination of the faeces is also recommended (81).

The culture of the tubercle bacillus is somewhat more difficult than cultivation of the other infective organisms. Herrold's medium was used by the author. This is composed as follows:-

Agar,	20 grms.
Lemco Beef Extract,	3 "
Peptone,	10 "
Sodium Chloride,	5 "
Dextrose,	0.33 "
Distilled Water,	1000 c.c.

The mixture is adjusted to 7.5 p.h..

The yolk of the egg is added to 150 c.c. of melted agar at a temperature of 60 degrees Centigrade. This is approximately 15% egg yolk. The agar is allowed to cool to about 40 degrees Centigrade.

Alfred Guemen (83) recommends the following as being a medium particularly suited to quickness of culture.

Agar,	0.86%
Peptone,	0.86%
Potato Meal,	1.73%
Glycerine,	3.48%
Egg,	26.09%
Gentian Violet,	1 in 30,000

Other recommended media are Lowenstein's, Petroff's, Dorset's egg, etc., etc.. Sweeny and Evanoff (84) agree that no one medium is sufcessful in all strains of bacilli and often subculture to a different type of medium will enhance the growth. To obtain the best results the material should be innoculated serially on three different media.

Sputum for innoculation requires special preparation. Treat it with 20% citric acid. Leave at room temperature for one hour; then centrifuge and pour off the supernatant fluid. Add a little saline and again leave for one hour. Centrifuge again when the medium may be innoculated. On

culture, the bovine and human types of bacilli do show some difference. The human type usually grows more abundantly and may be found in heaped-up colonies in comparison to the smoother growth of the bovine.

Animals play their part in the diagnosis of tuberculosis. For diagnosis of bovine or human tuberculosis the guineapig is used and to differentiate between the two, the rabbit. There are three routes for innoculation of animals - subcutaneous, intraperitoneal, and intravenous. The writer innoculated material from a few of the cases into rabbits to determine whether the human or bovine strain was the infecting organism. For this the intravenous route was chosen. Material was obtained from abscesses which were being aspirated - thus 'sterile' pus. This was cultured and a suspension made therefrom which was injected into the rabbit. As a dose of 0.01 mgm of bovine tubercle bacilli suspension is fatal to a rabbit and 0.01 mgm. of human suspension does not kill, this amount was used for injection. The results of this investigation will be found in the next section.

SURGICAL TUBERCULOSIS.

"Whenever he sees a persistent area of chronic in-

flammation in any structure of the body the surgeon must think of the possibility of its being 'tuberculous'." (85). Thus writes Da Costa of the diagnosis of surgical tuberculosis. For the diagnosis of surgical tuberculosis the investigation must be local and general, just as in chest disease. Radiology in bone and joint disease, however, plays the most important part; though it is possible to have active disease in a joint or bone with a completely normal picture (86). Locally, the presence of an indolent swelling or a long-standing dull aching pain in bone or joint should give rise to suspicion. The first sign of osteomyelitis, however, might be the evidence of a cold abscess. In certain sites, too, e.g. the spine or hip, deformity may be the first sign. Wasting of muscles around an involved joint may be prominent. Radiographic appearances in bone disease depend on whether the affection is of the periosteal or osteomyelitic type (56). In the periosteal type the surface of the bone is roughened and erroded with sometimes the formation of new bone, or sequestra. A rarifying osteitis is the picture obtained in the second type. In joint disease foci of disease may be detected in adjacent bone - clear areas with ill-defined margins (56). The

synovial membrane may appear as an opacity. Fluid in the joint will cause increase in the space between the ends of the bones forming the joint. Irregular joint surfaces seen on X-rays will denote destruction of the joint surfaces. In practically all cases, the diagnosis can be ascertained by the use of the X-rays, though some American authors (87) believe that a case should never be labelled 'surgical tuberculosis' unless a positive culture or animal innoculation has been obtained.

ABDOMINAL TUBERCULOSIS.

Abdominal Tuberculosis is of three types - enteritis, adenitis and peritonitis (88). Each has peculiarities of its own in diagnosis, but they tend to overlap. The first type is due to ulceration of the bowel wall; hence diarrhoea is one of the main symptoms. Examination for the tubercle bacillus in the stool should be carried out. With reference to this type, Moore in 1248 cases found only five in which it was the sole organ tuberculosis or independent manifestation of the same (89). In the glandular type abdominal pain is more prominent and slight fever with the presence of palpable glands in

the abdomen may be noticeable. Finally comes the peritoneal type. It may be further sub-divided into ascitic and plastic. The ascitic is characterised by the presence of fluid. It is usually due to rapid dissemination from a gland (90). In the plastic there is distension of the abdomen with 'doughy' feeling and masses may be felt in places. In children, for the diagnosis of abdominal tuberculosis, Brown (37) suggests a very careful history-taking - especially with regard to the feeding from birth - double tuberculin tests and four-hourly rectal temperatures at rest.

GENITO-URINARY TUBERCULOSIS.

Genito-urinary Tuberculosis is diagnosed mainly by laboratory means. 'As a preliminary for the determination of the presence of the tubercle bacillus in the urinary tract, a twenty-four-hour specimen of urine should be collected. The sediment from this is centrifuged and examined for the presence of the bacillus. A guineapig is also injected with the material. Catheterisation of both ureters and collection of a sample of urine from each is necessary to determine whether one or both kidneys are involved. These specimens are also injected into

guineapigs. While catheterising the ureters the opportunity is obtained for a cystoscopic examination of the bladder wall and ureteric orifices.

To summarise, for the diagnosis of phthisis history, physical signs and radiological examination are necessary, with, if possible, sputum examination. For the diagnosis of surgical tuberculosis, radiology will suffice, but culture and innoculation of suspected material are advisable if possible.

C A S E S.

The material was obtained over a period of six months in a hospital with 500 beds devoted to phthisis and surgical tuberculosis. A total of 256 patients showing signs of surgical tuberculosis in some form or other was reviewed and then subjected to radiological examination. The term 'surgical tuberculosis' was taken to include bone and joint disease, abdominal, genito-urinary, and glandular infection. These 256 cases were entirely unselected, being those available in the wards at the time of the investigation. Some few patients only were rejected owing to inaccuracy of details. The cases were divided into two main sections, A and B. Section A consists of cases with no evidence of pulmonary involvement, clinically or physically. Section B was composed of those with symptoms or clinical evidence of chest involvement.

104 cases were assigned to Section A,
and 152 cases were assigned to Section B.

To give some basis for comparison, 50 patients admitted to the hospital for non-tubercular troubles were X-rayed and designated as normals. Of these 50, twenty-eight were admitted as septic cases to the puerperal

fever ward and eight as abortions to another ward. The remaining 14 were classified as follows:-

Case No.	264,	Female,	23 yrs.	Carcinoma of glands of neck.
" "	284,	Female,	24 yrs.	Asthenia.
" "	285,	Male,	39 yrs.	Asthenia.
" "	286,	Male,	42 yrs.	Mitral stenosis.
" "	287,	Female,	61 yrs.	Rheumatoid Arthritis.
" "	288,	Male,	19 yrs.	Juvenile Coxa Vara.
" "	289,	Female,	68 yrs.	Carcinoma of Pancreas.
" "	290,	Female,	46 yrs.	Pyelitis (non-tubercular).
" "	291,	Male,	37 yrs.	Hydronephrosis.
" "	292,	Female,	42 yrs.	Tertiary Syphilis.
" "	293,	Female,	18 yrs.	Spinal Injury.
" "	294,	Male,	23 yrs.	Osteomyelitis.
" "	295,	Male,	19 yrs.	Spinal Injury.
" "	296,	Female,	19 yrs.	'Debility'.

Table A was drawn up to give some idea of the types of tubercular affections reviewed.

TABLE A.

Lesion.	No. of Cases.			
	Section A.	Section B.	Total.	
Spine,	30	46	76	
Multiple,	5	25	30	
Hip,	15	11	26	
Abdomen,	9	17	26	
Knee,	9	8	17	
Sacro-iliac,	5	8	13	
Genito-urinary (alone),	3	12	15)	17
Genito-urinary (plus),	1	1	2)	
Glands,	5	5	10	
Foot,	6	2	8	
Ankle,	5	3	8	
Rib,	0	5	5	
Wrist,	2	1	3	
Hand,	2	0	2	

Lesion.	No.of Cases. Section A.	Section B.	Total.
Abscesses,	0	2	2
Pelvis,	0	2	2
Shoulder,	1	1	2
Lupus,	1	1	2
Femur,	1	1	2
Elbow,	1	1	2
Scapula,	1	0	1
Tibia,	1	0	1
Clavicle,	1	0	1
Total,	104	152	256

In this list those cases with more than two separate sites of disease were designated as being 'multiple'. Where only two lesions were evident, the case was allotted to the primary site. If, by chance, both lesions developed together, the more active lesion was taken for nomenclature. The number of cases with double lesions in Section A was 7, and in B, 15, giving a total of 22 altogether. In this number are included cases in which two entirely different areas of the spine were affected simultaneously. The genito-urinary cases have been divided into two groups: firstly, where this was the only surgical lesion ('genito-urinary (alone)'), and secondly, where some other surgical lesion, e.g. bone or joint disease, was present ('genito-urinary (plus)').

From Table A it would seem that spinal cases are by far the most common; but it should be taken into account

that cases admitted to hospital do not usually contain ambulatory types - at least on admission. For incidence of site affection dispensary records would be more suitable from which to draw conclusions.

For classification of the cases under the radiological findings the following limits were observed.

Group I - No abnormality detected.
Group II - Enlarged root shadows on one or both sides.
Group III - Pleurisy, adhesions, interlobar pleurisy, or elevation of the diaphragm (including obliteration of the cardio-phrenic or costo-diaphragmatic angle).
Group IV - Bronchial thickening or fibrosis from a root or roots.
Group V - A focus of disease evident.
Group VI - Disease of one apex.
Group VII - Disease of one lobe, or both apices, or several separate foci.
Group VIII - More extensive disease than in Group VII.

For the avoidance of personal error in the examination of the plates these were read independently by a radiologist, expert in radiological tuberculosis, as well as by the author. Where there was a difference of opinion on the diagnosis of a plate, it was subjected to the scrutiny of a third party also expert in the reading of such plates.

The following age groups were selected for classification:-

(1) 15 yrs. and under; (2) 16-22 yrs. (3) 23-26 yrs.
(4) 27-35 yrs. (5) 36-45 yrs. (6) 46 yrs. and over.

While these age groups may not be those usually selected for such investigation, it seemed that the cases as studied tended to fall most easily into this grouping.

In Section A (i.e. where no evidence of chest disease was made out clinically or physically) the cases fall into the following age and radiological groups:

Table B.

Ages	-15	16-22	23-26	27-35	36-45	46+	Total	%	
Group I	1	20	3	1	-	2	27	29.2)	
II	2	10	2	2	1	-	17	18.3)	
III	-	2	-	3	1	-	6	6.5)	77.8
IV	4	9	6	3	-	-	22	23.8)	
V	-	3	1	1	1	1	7	7.6	
VI	-	1	1	-	-	1	3	3.2	
VII	-	3	2	1	2	-	8	8.6	
VIII	-	5	3	4	-	2	14	15.1	
Total	7	53	18	15	5	6	104	100.	
%	6.7	51	17.3	14.2	4.8	5.8	100		

From this table it may be seen that the 16-22 years age group is that in which there is least likelihood of finding any chest signs. Secondly that the type of disease most easily missed is that where there is bronchial thickening (i.e. Group IV). 77.8% of the total cases are found to have actually no parenchymal involvement although only 29.2% are entirely free from evidence suggesting affection by tuberculosis.

The cases in Section B were divided into similar age and radiological groups:

TABLE C.

Ages	-15	16-22	23-26	27-35	36-45	46+	Total	%
Group I	1	11	4	4	-	2	22	13.2
II	-	6	-	2	-	1	9	5.9
III	2	8	1	3	-	3	17	11.2
IV	2	9	4	1	2	1	19	12.5
V	-	3	-	4	-	1	8	5.3
VI	1	2	-	1	-	-	4	2.7
VII	-	4	1	3	1	1	10	6.6
VIII	-	21	10	16	8	8	63	41.4
Total	6	64	20	34	11	17	152	100.
%	4	42.1	13.1	22.4	7.2	11.2	100	

If these two tables, B and C, are combined, Table D is formed showing the findings for all cases under review.

TABLE D.

Ages.	-15	16-22	23-26	27-35	36-45	46+	Total	%
Group I	2	31	7	5	-	4	49	19.1
II	2	16	2	4	1	1	26	10.2
III	2	10	1	6	1	3	23	9
IV	6	18	10	4	2	1	41	16
V	-	6	1	5	1	2	15	5.9
VI	1	3	1	1	-	1	7	2.7
VII	-	7	3	4	3	1	18	7.
VIII	-	26	13	20	8	10	77	30.1
Total	13	117	38	49	16	23	256	100.
%	5.1	45.7	14.8	19	6.25	9	100	

At this stage it is convenient to insert the tabulated results of the 'normal' cases and compare them with Tables B and D.

TABLE E.

Ages	-15	16-22	23-26	27-35	36-45	46+	Total	%
Group I	-	4	6	6	4	-	20	40
II	-	2	1	4	1	2	10	20
III	-	-	1	2	2	-	5	10
IV	-	1	-	3	1	-	5	10
V	-	2	1	2	2	1	8	16
VI	-	-	-	1	1	-	2	4
VII	-	-	-	-	-	-	-	-
VIII	-	-	-	-	-	-	-	-
Total	-	9	9	18	11	3	50	100
%	-	18	18	36	22	6	100	

Percentages in each group in Table E compared with percentages in Tables B and D for same groups:

Groups:	I	II	III	IV	V	VI	VII	VIII	
E	40	20	10	10	16	4	-	-	%
B	29.2	18.3	6.5	23.8	7.6	3.2	8.6	15.1	%
D	19.1	10.2	9	16	5.9	2.7	7	30.1	%

The most notable comparison, apart from that in Group I, is that in Group V. This, and other findings from the table, will be discussed later.

Age Incidence.

The age incidence of the tubercular cases may be found from Table D. From this table 45.7% of cases in hospital are seen to be in the 16-22 age group. But it must be remembered that no cases under 15 years were admitted to

the hospital. To come to a more accurate reckoning of the ages of incidence it was thought advisable to re-divide the cases into groups according to the age at which the symptoms of the surgical lesion were first evident. Naturally all cases in Section B which did not give a definite history of the appearance of the surgical lesion before that of the pulmonary system, had to be rejected. In all there were 208 cases where it could be definitely established that the surgical lesion was primarily in evidence. These 208 cases were divided into similar age groups as previously.

TABLE F.

Ages	-15	16-22	23-26	27-35	36-45	45+
No.	63	86	20	17	9	13
%	30.4	41.5	9.7	8.2	4.3	6.3

If the 15 years' age group is added to the 16-22 group in both Tables D and F, it shows a total of 50.8% in the former and 71.5% in the second.

Age Incidence - male and female.

Taking those cases in which the surgical lesion was the first known focus it is found that the corrected ages of incidence in male and female are as in Table H.

TABLE H.

Ages	-15	16-22	23-26	27-35	36-45	46+	Total
Male	39	47	10	9	5	7	117
Female	24	39	10	8	4	6	91
Total	63	86	20	17	9	13	208

Giving % as in Table I.

TABLE I.

Ages	-15	16-22	23-26	27-35	36-45	46+	Total
Male	33.3	40.2	8.5	7.7	4.3	6	100
Female	26.4	42.9	11.	9.	4.4	6.7	100
Total	30.3	41.3	9.6	8.2	4.3	6.3	100

In a review of these two tables the groups from 23-26 to 46 upwards are seen to vary but little. In the first two age groups comparison shows a tendency for an earlier incidence in males than females. The young adult period is once more emphasised as being the most dangerous and most liable to affection by the Koch's bacillus.

Genito-urinary Tuberculosis.

Since the hospital from which the cases were taken was a centre for genito-urinary tuberculosis, it may be of advantage to review these cases more particularly. Twenty-six cases in all, they are tabulated as in Table J.

TABLE J.

Case No.	Age	Sex	Col. A.	Col. B.	Col.C.	Col.D.
48	30	F	Kidney	Spine	III	G.U.
65	44	M	Kidney	Spine	III	G.U.
66	17	M	Kidney	Spine	II	G.U.
94	34	F	Kidney	Spine	VIII	G.U.
105	61	M	Orchitis	Lupus	VIII	Chest
112	35	M	Epididymitis	Spine	VIII	Chest
115	23	M	Kidney	Knee	VIII	Chest
116	27	M	Kidney	Multiple	VIII	Chest
119	52	M	Kidney	Spine	VIII	Chest
122	35	M	Kidney	Rib	VIII	Chest
123	40	M	Epididymitis	Nil	VIII	Chest
124	38	M	Epididymitis	Nil	VIII	Chest
127	28	F	Kidney	Abdomen	VIII	Chest
134	27	F	Kidney	Multiple	VIII	Chest
138	17	F	Kidney	Multiple	VIII	Chest
142	28	M	Orchitis	Spine	I	Spine
144	18	M	Epididymitis	Abdomen	VI	Chest
145	42	M	Epididymitis	Nil	VIII	G.U.
149	53	M	Kidney	Multiple	VIII	Chest
152	24	M	Epididymitis	Nil	VIII	Chest
166	31	M	Epididymitis	Sacroiliac	I	Sacroiliac
171	28	M	Orchitis	Nil	V	G.U.
173	51	M	Epididymitis	Nil	III	G.U.
174	38	M	Kidney	Nil	VIII	G.U.
207	54	F	Kidney	Spine	VIII	Spine
242	19	F	Kidney	Nil	III	G.U.

(Column A - Genito-urinary lesion.)
(Column B - Other site involved, if any.)
(Column C - Radiological group.)
(Column D - Most important lesion.)

COLUMN A. SUMMARISED - TABLE K.

	Epididymitis	Orchitis	Nephritis	Total	
Male	8	3	8	19)	
Female	-	-	7	7)	26

These genito-urinary cases may be divided into similar groups, according to the radiological findings of the chest, as in Tables B, C and D.

TABLE L.

	G.U.(alone) Male	G.U.(alone) Female	G.U.(plus) Male	G.U.(plus) Female
Group I	-	-	2	-
II	1	-	-	-
III	2	1	-	1
IV	-	-	-	-
V	1	-	-	-
VI	-	-	1	-
VII	-	-	-	-
VIII	5	1	7	4
Total	9	2	10	5

Here again G.U. (alone) signifies a case where the only surgical manifestation was genito-urinary in type, whereas G.U. (plus) denotes a case with some other site of affection, e.g. bone or joint.

Cervical Adenitis.

In the present series 11 cases are noted as suffering from glandular tuberculosis of the cervical type. To these may be added one case of Spinal disease, where the cervical tuberculosis (glandular) was the primary lesion, making twelve cases in all. These cases are summarised in Table M.

An interesting case in the twelve is one in which the cervical adenitis did not appear to be the primary lesion but an abdominal infection four years previous to evidence of cervical involvement.

TABLE M.

Case No.	Age	Sex	Radio-logical Group	Duration of Glandular Disease.	Other Lesion (if any)
13	21	M	IV	4 years	Phalanges
17	17	F	II	4/12 yrs.	
42	24	F	VII	4 years	
53	21	F	V	3 plus yrs.	
*57	16	F	VIII	Years.	
80	20	F	VIII	3 years	Spine
106	18	M	VII	1 2/12 yrs.	
189	19	F	IV	2½ years.	Abdomen
199	16	F	I	2 years.	
214	16	F	VI	6/12 years.	
229	22	F	I	Years.	
18	19	F	II	1 6/12 yrs.	

* Glands removed surgically some years previously.

Culture of Organisms.

In some cases where pus was being aspirated from closed abscesses, culture of the organism, as detailed previously, was made and then the culture was injected intravenously into rabbits. The weight method of standardising the physiological solution containing the suspension was used. .01 mgm. of the bacilli in suspension was injected into a

vein in the ear of the rabbit. Two months after innoculation the rabbits were killed and examined. Detailed description of the cases follows:

Case No.210. Mrs. McG. 22 yrs. Shirt-folder.

Patient was admitted on 12/9/36 with complaint of a swelling in the back which had commenced two months previously. There was contact history with a cousin having phthisis. This woman resided with patient for two years.

General Condition was fair.

Local Condition. The patient complained of pain over the right sacro-iliac region. In this region there was a fluctuant swelling 3" to right of and above the sacro-iliac joint. Pain was elicited in the right sacro-iliac region in compressing the pelvis or pressure over the joint.

Chest Examination. Inspection - The chest is fairly well nourished and moves equally and well on both sides during respiration.
Palpation - Ribs are well and equally spaced on both sides. Vocal fremitus appears diminished all over the left side.
Percussion - Note is resonant throughout. Kroenig's areas are equal and undiminished on both sides. Expansion at bases on inspiration is good and equal.
Auscultation - Respiratory murmur has a roughness at left lower lobe. Few rhonchi are to be heard scattered throughout chest.
X-ray of chest - Enlarged root glands evident on both sides.

X-ray of Spine. Disease of lumbar spine.

Culture of Organisms from abscess is smooth in type.

Animal Innoculation. Rabbit innoculated on 31/8/37 and killed on 2/11/37.

Post-mortem Findings:

Lungs - Well marked emphysemata of both lungs, with widespread tuberculosis in right lower lobe with areas of caseation.
Heart - Nil.
Liver - a few tuberculous nodules present on the surface.
Spleen - a few tuberculous nodules present in the substance.
Mesenteric Glands - no involvement.

Conclusion. This is a case of infection by the bovine bacillus.

Case No.195. F.G. 17 yrs. At home. Admitted 21/4/37.

In November 1936 the patient developed a pain in the right side of the chest which was worse on coughing and deep breathing. After a short period this disappeared, but she was admitted to a hospital as a case of right-sided pleurisy Since dismissal she has felt easily tired and disinclined for food. On 17th April, 1937, she felt a pain on the right side of her abdomen which was followed by diarrhoea and swelling of the abdomen.

General Examination. Although pale, the patient is well developed.

Local Examination. The abdomen appears well nourished but is very protuberant and swollen. On palpation no masses are felt but tenderness was elicited in both iliac fossae and a fluid thrill obtained.

Chest Examination. Inspection - Chest is well developed and well nourished. Movement is diminished on the right side and it appears more full than the left.
Palpation - Movement is diminished on the right side. Intercostal spaces on the right are broader and more bulging than the left. Vocal fremitus is greatly diminished on the right side.
Percussion - Percussion note is very dull on the right side posteriorly from angle of the scapula downwards. Anteriorly there is only slight impairment. Grocco's triangle is definable on the left side.
Auscultation - Respiratory movement is greatly diminished at the right base. Skodaic resonance elicited

at level of the angle of the scapula posteriorly. Breath sounds are exaggerated anteriorly. Bronchial breathing with aegophony is heard at similar level to the skodaic resonance.
X-ray of chest - Shows large right-sided pleural effusion.
Heart - This is slightly displaced to the left.

Culture of Organism - Smooth growth.

Animal Innoculation - Rabbit innoculated on 13/9/37. Rabbit killed on 18/11/37.
Lungs - There is widespread tuberculosis, showing caseation. Caseation is most evident in the right lower lobe.
Heart - nil.
Spleen - nil.
Right Kidney - Numerous tuberculous nodules present.
Left Kidney - Nodules found mainly on the surface.
Mesenteric Glands - nil.

Conclusion - This appears to be a case of bovine infection.

Case No. 63. R.McC. 17 yrs. No occupation. Admitted 27/3/37.

Six months before admission the right forearm became swollen. This was incised and a sinus formed. Four months before admission a swelling developed on the left side of the neck which ultimately burst. In February 1937 he first noticed a swelling in the middle of his chest posteriorly.

Past History - Was treated as a case of dementia praecox in 1935.

General Condition - Good: nourishment fairly good: mentally unsound.

Local Condition - Spine - boarding of muscles in dorsal region but no deformity is to be made out. There is a large fluctuant abscess over the lower dorsal spine and communicating with a further pocket below, which is appearing in the triangle of Petit.

Right Forearm - Evidence of numerous recently healed sinuses.

Neck - Left side recently healed sinus.

Chest Examination.- Well nourished: moves well and equally on both sides.
Palpation - Chest moves freely: intercostal spaces unaltered. Vocal fremitus equal on both sides.
Percussion - Note is unimpaired throughout.
Auscultation - Respiratory murmur is vesicular throughout. Vocal resonance is unimpaired.
X-ray of Chest - No disease detectable.

X-ray of Spine. - Disease of dorsal vertebrae 3, 4, and 5, with abscess formation.

Culture - Rough.

Animal Innoculation - Rabbit innoculated 30/7/37.
Rabbit killed, 29/9/37.
Heart - nil.
Lungs - Some small circumscribed areas of tuberculous affection.
Liver - A few nodules present.
Spleen - A few nodules present.
Kidneys - Nodules in both kidneys.
Mesenteric Glands - Enlarged.

Conclusion - A case of human type.

Case No.200. E.A. 21 yrs. Clerkess. Admitted 29/10/36.

In May 1935 patient had a right-sided pleurisy. On wakening on 3/9/35 the patient felt a severe pain in the lower part of the back, especially on the left side. She found she could not move her legs. After three weeks in bed the pain became much easier and movement returned to her legs.

Past History - Nothing of note.

General Condition - It is very good, the patient being well nourished.

Local Condition - (On admission). No obvious deformity of the spine is noted and there is no marked rigidity of the spinal muscles. No evidence of psoas abscess is to be made out, but movement of the right hip causes slight pain at the joint. (On 11/5/37) Patient was found to have a right-sided psoas abscess, and radiological examination showed tuberculosis of the 9th, 10th and 11th dorsal vertebrae and 2nd and 3rd lumbar vertebrae.

Chest Examination. - Chest is well nourished and moves freely and equally on both sides.
Palpation - Nothing of note made out. Vocal fremitus is unimpaired.
Percussion - The percussion note is resonant throughout and the expansion at the bases is equal and good. Kroenig's area is similar and undiminished on both sides.
Auscultation - The respiratory murmur is harsh at both apices, otherwise no other abnormality detected.
X-ray of Chest - There is fibrous disease in both subclavicular regions. No sign of the previous pleurisy is to be made out.
Heart - nil.

Central Nervous System - Both knee jerks are exaggerated. Babinski's response is doubtful.

Culture - Rough.

Animal Innoculation - Rabbit innoculated 9/8/37.
Rabbit killed on 29/9/37.
Lungs - nil.
Liver - A few tubercle nodules made out.
Kidney - A few tubercle nodules made out.
Mesenteric Glands - As above.
Spleen - nil.

Conclusion - Affection by the human tubercle bacillus.

Case No. 218. G.K. 24 yrs. Mill worker. Admitted 12/12/35.

History - In November 1934 the patient felt a pain in the left leg. This gradually became worse and the leg

became stiff. In January 1935 patient was admitted to a hospital for one year. Extension was applied to the leg for 4 months. She was then allowed up but the stiffness returned and the extension was reapplied.

General Condition - Is good.

Local Condition - Patient has severe pain on movement of the left hip and movements in all directions are limited. There is 1" actual shortening and ½" apparent shortening. No wasting of muscles is to be made out. X-ray showed active disease of the head of femur and of the acetabulum. On 23/3/37 an abscess was noticed in the left side of the neck, and X-ray showed disease of cervical vertebrae 1 and 2. The left ankle then became swollen and painful. Radiological examination showed disease of the lower end of the tibia and of the astragalus.

Chest Examination. Inspection - Chest is well nourished and moves freely and equally on respiration.
Palpation - No abnormality is found. Vocal fremitus is of equal intensity on both sides.
Percussion - Note is resonant throughout. Expansion at bases is good and equal.
Auscultation - Respiratory murmur is somewhat impaired at the right base, otherwise no abnormality.
X-ray - There is enlargement of root glands on both sides, with spread of disease into the lung tissue.

Culture - Rough.

Animal Innoculation - Rabbit innoculated 16/8/37.
Rabbit killed on 12/10/37.
Lungs - Miliary tuberculosis : no cavitation or caseation noted.
Liver - A few nodules present.
Kidneys - Nodules present in both kidneys and found mainly on the surface.
Spleen - One or two nodules.
Mesenteric Glands - Enlarged.

Conclusion - A case of human tubercle affection.

Case No. 103. D.F. 24 yrs. Labourer. Admitted 29/7/37.

History - At 11 years of age the patient developed a fistulo-in-ano. In November 1934 the patient developed a pain in the middle of the back and in the right loin. This pain was dull and aching in type and worse on lifting weights. Apart from the summer of 1936, it was persistent. In January 1935 and January 1937 the patient had attacks of influenza. One year ago the patient noticed a swelling in the right loin which gradually increased in size. For two years previous to admission the patient was treated with drugs and massage.

General Condition - Good.

Local Condition - There is slight prominence of dorsal vertebrae 10 and 12 with boarding of the muscles on either side. No tenderness was elicited. An abscess the size of a hen's egg was present in the right lumbar region.

Central Nervous System - Reflexes are all present and normal in movement. Sensation is unimpaired.

Chest Examination - Inspection - Chest is quite well nourished and moves freely and equally on respiration. There is no evidence of muscular wasting.
Palpation - Intercostal spaces are equal on both sides. Vocal fremitus is unimpaired and equal in intensity on both sides.
Percussion - The note is resonant throughout.
Auscultation - Respiratory murmur is of good quality throughout. Vocal resonance is equal and well heard on both sides.
X-ray - There is old tuberculous disease in the left upper third and the right upper half.
Cardiovascular System - Nothing of note.

Culture - Rough.

Animal Innoculation - Rabbit innoculated on 17/9/37. Rabbit killed, 18/11/37.
Lungs - Miliary tuberculosis with no sign of caseation or cavitation.

Heart - nil.
Liver - nil.
Spleen - nil.
Kidneys - Nodules present on the surface of both kidneys.
Mesenteric Glands - nil.

Conclusion - Infection by the human tubercle bacillus.

Case No. 256. W.C. 16 yrs. Occupation nil. Admitted, 14/6/37.

History - In February 1937 the patient felt a dull aching pain in the left ankle. On 5th April 1937 he consulted a doctor because of a pain in the back. On 20th May 1937 the ankle was noticed to be swollen and was aspirated on 31st May. Swelling in the back was first noticed about the same time as that in the ankle. There was no history of contact.

General Condition - Good.

Local Condition - There is an abscess just above the lower end of the left fibula. The skin is reddened over it. There is an abscess on the right side of the chest, close to the spine at the level of the 9th dorsal vertebra. Some irregularity of the thoracic spine is evident at the level of the 3rd dorsal vertebra.
X-ray shows disease of 3rd and 4th dorsal vertebrae.

Chest Examination. - Inspection - Nourishment is only fair, but chest movement is unimpaired.
Palpation - Intercostal spaces are not narrowed. Vocal fremitus is of equal intensity on both sides.
Percussion - Note is resonant throughout.
Auscultation - There is prolongation of the respiratory murmur at the left apex with presence of a few râles. Vocal resonance is of good quality.
X-ray - There are enlarged root glands with some bronchial thickening on both sides.

Culture - Rough.

Animal Innoculation - Rabbit innoculated on 24/8/37. Rabbit killed on 20/10/37.

Heart - nil.
Lungs - Many small circumscribed nodules with miliary spread.
Liver - nil.
Spleen - nil.
Kidneys - One or two nodules in each.
Mesenteric Glands - Enlarged.

Conclusion - Human tubercle bacillus is the infecting organism.

The above cases are summarised in the table drawn up below:

TABLE N.

Case No.	Sex	Age	Surgical Lesion	Chest Group	Type of Affection
1	F	22	Spine	II	Bovine
2	F	17	Abdomen	III	Bovine
3	M	17	Multiple	I	Human
4	F	21	Spine	IV	Human
5	F	24	Multiple	IV	Human
6	M	24	Spine	VIII	Human
7	M	16	Spine	IV	Human

Special Case.

Case of J.R.B. 66 yrs. Admitted 18/2/37. Died 12/3/37. Occupation: retired.

The above patient gave the following history on admission. In July 1936, following a tooth extraction from the lower jaw on the right side, a swelling appeared below the right lower jaw. This swelling extended and gradually involved the whole of the neck like a collar. The swelling broke down and discharged in several places. In November 1936 a cough with sputum developed. This sputum was thick and frothy in type. No bleeding had taken place.

There was nothing of note in the past history.

Examination - The general condition was poor, the patient being thin and pale.
Glands - All glands of the neck were greatly swollen and discharging through many sinuses extending from above the clavicle to the lower jaw. There was brawny infiltration with keloid formation around the sinuses. The glands in the axillae were palpable and felt shotty and hard.

Chest Examination - Inspection - Nourishment of the chest is poor, and movement is not good though both sides appear to move equally. Skin is dry and intercostal spaces are noticeable.
Palpation - Chest is poorly nourished. Interspaces are similar on both sides. Expansion is not good, but appears equal on both sides. Vocal fremitus is diminished at the left apex.
Percussion - There is dullness extending to the left of the upper mediastinum.
Auscultation - The respiratory murmur is vesicular all over the chest, but is diminished in intensity at the left apex. Vocal resonance is also diminished here.
Cardio-vascular System - The pulse is regular in time and of good quality. The heart dullness is enlarged to 1" to the right of the mediastinum and is prolonged into the area of dullness to the left of the upper mediastinum as already noted. The heart sounds are pure.

Genito-urinary System - The left testicle appears enlarged, but is soft.

Alimentary System - Nothing of note. Spleen not enlarged.

Nervous System - Nothing of note.

X-ray of Chest - 24/2/37. There is very definite enlargement of the heart and mediastinal shadow.

Sputum Examination - 27/2/37 - No tubercle bacilli found.

Blood Examination - 27/2/37 -

Red Blood Corpuscles,	4,573,000
White Cells,	8,000
Haemoglobin,	65%
Differential Count:	
Polymorphs,	52%
Basophils,	0%
Eosinophils,	7%
Lymphocytes,	19%
Mononuclears,	2%

Urine Examination - 27/2/37 - Straw-coloured, with deposit of phosphates. Specific Gravity 1020, neutral in reaction. No blood, pus, sugar, albumen or bile found.

Pus Examination - 27/2/37.- Negative for filaments.

Blood Test - 5/3/37. Wassermann negative.

At this stage arose the question of diagnosis. It lay between the following:-

(1) Tuberculosis
(2) Hodgkin's Disease
(3) Lympho-sarcoma
(4) Actinomycosis
(5) Syphilis
(6) Leukaemia.

By the previously recorded laboratory investigations the latter three diseases were eliminated. Hodgkin's disease seemed unlikely from the age of the patient, and the glands were not so discrete as usually found in this condition. Ulceration is rare, as is reddening of the skin with brawny infiltration. This left lymphosarcoma and tuberculosis. Although the signs as found suggested tuberculosis, this did not seem probable, from the 'acute' type of the disease. It was thought unlikely to get such an illness in a patient of sixty-six years who had spent all his life in town.

Further Notes on the case.

1/3/37. Discrete glands were detected in the groins.

3/3/37. Slight redness of the right side of the face, involving the ear, which is most affected, noted.

4/3/37. Edges of redness seen to be raised. T.103°. Pulse 100. Patient also complains of pain in the right side of the chest. On auscultation pleural friction is detected over the site of the pain. Sulphanilamide was administered for erysipelas.

7/3/37. Erysipelas appears healed, prontosil stopped.

9/3/37. Erysipelas returned and prontosil recommenced. Dullness detected at the right base - pleural effusion.

12/3/37. Patient suddenly collapsed and died.

Post-mortem Examination:

General Appearance - The body was that of a well developed but thin man. There was much swelling and brawniness of the front and sides of the neck and the remains of several sinuses.

Body Cavities - A large amount of fluid was present in the right pleural cavity which was cloudy and contained pieces of yellow lymph-like exudate. The left pleural cavity contained a small excess of clear fluid. Fibrous adhesions were present in both pleural cavities. The pericardial sac was distended with fluid. On the visceral and parietal surfaces of the pericardium, a thick yellow lymph-like exudate was found. Little excess of fluid was found in the abdominal cavity.

Lungs - The right lung showed considerable collapse, owing to the large amount of fluid in the cavity. Its substance was flabby as was that of the other lung.

The Heart - It was of average size and the cardiac muscle was brownish in colour. No valvular lesions were present. The coronary arteries showed little change for a man of his age.

Mouth, Neck and Mediastinum - The tissues of the neck were brawny and there was a considerable amount of firm white fibrous tissue. The tongue and fauces showed no ulceration. The superficial glands and the deep were swollen and firm. The mediastinal lymphatic glands were also swollen and although many were discrete, a mass of white tissue was occupying the left side of the mediastinum. Although some of the lymphatic glands were necrotic, the necrosed material was whiter than is normal in tuberculosis.

No ulceration of the oesophagus, trachea, or bronchi had occurred.

Other Organs - The abdominal organs showed the changes associated with advancing years, but these were less marked than is usually the case in a man of the patient's years. The cranium and contents were not examined.

Commentary - after Post-mortem examination.

The four most probable conditions are tuberculosis, Hodgkin's disease, lymphosarcoma and actinomycosis. The sinuses in the neck are suggestive of actinomycosis. Against this there is the lack of filaments (as already noted), and the absence of pulmonary involvement at this stage, with the widespread affection of the lymphatic glands. The discharging sinuses in the neck might suggest tuberculosis, but would one expect such a widespread affection of the glands? The appearance of the mass in the mediastinum favours lymphosarcoma.

Microscopical Examination - The lesions in the tissue at the root of the lungs and in the lymphatic glands are tuberculous.

Sections of the pancreas show some increase in the interstitial fibrous tissue but this is only of a degree compatible with the age and general condition of the patient.

Diagnosis - Tuberculosis.

D I S C U S S I O N.

Reisner (46) of America affirms that the lung is by far the most frequently involved organ in tuberculosis. To what extent is it involved in conjunction with surgical tuberculosis? The above author reviewed a series of 240 cases of surgical tuberculosis which were divided as follows:

TABLE O.

	Reisner's %		Present Series, %	
Skeletal lesions (single foci).	46.2			
Skeletal lesions (multiple)	20.5	66.7		82.2
Genito-urinary (alone)	18.4		6.2	
Genito-urinary (plus)	9.1	27.5	.8	7.
Abdominal (alone)	3.3			
Abdominal (plus)	2.5	5.8		10.2

The writer's figures for the present series are also inserted for comparison. 48.3% of Reisner's cases may be consigned under the author's radiological groupings I, II and III, already described, and 51.7% in groups IV to VIII. In the present series the corresponding percentages are 38.3 for I, II and III, and 61.7 for IV to VIII. Yet another writer's figures may be quoted.

Duncan (91) in 555 cases found 51.7 with no demonstrable pulmonary lesion, i.e. Groups I to III. In both quoted references the percentage of cases recorded as being under Groups I to III is somewhat higher than that of the writer. This may be explained by the fact that every case in the hospital which had a surgical lesion was brought into the scope of the examination, whether the patient was actually admitted, or under treatment as a surgical patient or a phthisical patient. Actually if those who were being treated as surgical cases are considered alone the percentages are respectively 47 and 53, which figures approximate fairly closely to those of Reisner.

TABLE B.

Ages.	-15	16-22	23-26	27-35	36-45	46+	Total	%	
Group I	1	20	3	1	-	2	27	29.2)	
II	2	10	2	2	1	-	17	18.3)	77.8
III	-	2	-	3	1	-	6	6.5)	
IV	4	9	6	3	-	-	22	23.8)	
V	-	3	1	1	1	1	7	7.6	
VI	-	1	1	-	-	1	3	3.2	
VII	-	3	2	1	2	-	8	8.6	
VIII	-	5	3	4	-	2	14	15.1	
Total	7	53	18	15	5	6	104	100	
%	6.7	51	17.3	14.2	4.8	5.8	100		

TABLE C.

Ages.	-15	16-22	23-26	27-35	36-45	46+	Total	%
Group I	1	11	4	4	-	2	22	13.2
II	-	6	-	2	-	1,	9	5.9
III	2	8	1	3	-	3	17	11.2
IV	2	9	4	1	2	1	19	12.5
V	-	3	-	4	-	1	8	5.3
VI	1	2	-	1	-	-	4	2.7
VII	-	4	1	3	1	1	10	6.6
VIII	-	21,	10	16	8	8	63	41.4
Total	6	64	20	34	11	17	152	100
%	4	42.1	13.1	22.4	7.2	11.2	100	

TABLE D.

Ages	-15	16-22	23-26	27-35	36-45	46+	Total	%
Group I	2	31	7	5	-	4	49	19.1
II	2	16	2	4	1	1	26	10.2
III	2	10	1	6	1	3	23	9.
IV	6	18	10	4	2	1	41	16.
V	-	6	1	5	1	2	15	5.9
VI	1	3	1	1	-	1	7	2.7
VII	-	7	3	4	3	1	18	7.
VIII	-	26	13	20	8	10	77	30.1
Total,	13	117	38	49	16	23	256	100
%	5.1	45.7	14.8	19	6.25	9	100	

What conclusions, if any, may be drawn from the tables B, C and D?

(1) That of the cases under review the 16-22 years group forms considerably the largest group of material - in fact, almost half the total (45.7%).

(2) That, in general, the older the sufferer from surgical disease the greater is the liability to phthisis.

(3) Of the total 256 cases in only 19.1% was the observer unable to detect signs of chest involvement. 'Chest' is taken to represent the lungs, pleura and glands within the thorax, as well as the mediastinum.

Discussions of the various radiological groupings may now be undertaken.

Group I. These cases may be taken definitely as cases where no evidence of pulmonary or potential pulmonary disease may be detected.

Group II. This comprises those cases with enlarged root glands on one or both sides.

Here it may be assumed that apart from the radiological evidence of enlarged root glands there is no evidence clinically or radiologically of pulmonary disease; but the presence of the glands shows that there is probably Koch's infection in the immediate neighbourhood. Therefore there is a liability at some time for infection to spread (47) though Dunham (92) states that as far as he is concerned adults with normal lung markings and heavy deposits of calcium in the hilum are regarded as healthy. For 15 years he has been recommending such applicants for the

most favourable consideration of a large life insurance society and the company find that the investments are sound. Constantini (93), indeed, maintains that a localisation of tuberculosis in the region of the pulmonary hilum in the adult is more frequent than is generally supposed. Indeed it is found from the 'normals' table (E) that 20% of these cases showed evidence of such a site of infection. It is to be noted in this connection that enlarged lymph nodes can only be seen on the X-ray plate if they are situated along the trachea. But the bifurcation glands lie behind the heart shadow and therefore may escape detection (23) (105).

Group III. Pleurisy, adhesions, etc.. This group is that in which there has been at some time a small focus of infection giving rise to a pleurisy etc., or, according to some French views (71), the infection has spread along the lymphatics to the pleura and is at the stage immediately preceding actual lung substance disease. This view would imply that the disease spread along the lymph vessels against the lymph flow (31).

Group IV. Bronchial thickening, etc.. Here one may assume that the disease is spreading in the lung field along the peribronchial lymphatics. Again there are views

(71) that the disease spreads into the lung field by way of the lymphatics, and is here just at the stage previous to actual parenchymatous involvement. As Davies (47) says, bacilli may enter the mucosa of the upper respiratory tract through a small lesion and find their way to the mediastinal lymphatics and thence to the lung, probably by the lymphatics. The common site of infection is at the hilum. Tuberculosis spreads then as a peribronchial infiltration, especially to the mesial and lower part of the upper and middle lobes.

Groups V and VI, VII and VIII are those in which the lung parenchyma is actually diseased in varying extents.

In the IInd group it is, of course, more or less impossible for the physician to detect an abnormality. But in the remaining groups, why the percentage of error, at times considerable? This fact was also noted by Reisner in his series of cases (46). As he says - Both the lack of subjective symptoms and scarcity of physical findings frequently presented a striking contrast in comparison with the widespread objective changes as revealed by the X-ray. First let Group III be considered. Primarily let the type in which there are adhesions in the pericardiodiaphragmatic or costo-diaphragmatic angle be considered.

Without a radiograph it is most difficult to detect any such abnormality. Apart from the X-ray plate or fluoroscopy, the examination which would seem most likely to give positive results is comparison of the limits of resonance at the bases on full inspiration. But this examination will only give valuable results in the most severe cases - because it cannot be carried out with a sufficient degree of finesse. Interlobar pleurisy comes next. Here again the physician has no method of examination which may allow him to detect this lesion satisfactorily. Finally there is the series where there is some thickening of the pleura, visceral or parietal. Once more errors are due in many instances to the inexactitude of examination possible, clinically - a natural inexactitude because we cannot expect the human to be able by the methods of percussion and auscultation, etc., alone, to detect the finer degrees of thickened pleura. In conclusion, all cases which come under consideration in Section A which are in Groups I, II and III may be taken as cases in which it is very probable all the subjects could be passed as A.1 on clinical examination.

Group IV, may now be considered. That is the group in which there is some bronchial thickening or fibrosis

extending out from the root. Here, it is seen, is to be found the greatest percentage of error (23.8%). In assuming the normality or abnormality of bronchial thickening as evidenced by the radiographic plate, the plate reader has to be very careful because opacity of the bronchi has been found to vary with individuals, age, and respiratory movement (94) (25). In this connection it may be found useful to compare one side with the other.

Let us consider those cases in which the diagnosis of bronchial thickening was made before the chest was photographed. How was this diagnosis made? In other words, what signs are to be looked for where this condition is suspected? They are (1) Inspection - nil: (2) Palpation - there may be a lag in inspiration in the affected side and may be some increase in vocal resonance: (3) Percussion - there may be relative dullness especially if the bronchial thickening extends to the apex: (4) Auscultation - here it is that one is most likely to detect the abnormality either by a certain degree of prolongation of expiration or by a roughness or harshness of the respiratory murmur.

Taking auscultation alone, it is true that finer degrees of harshness and prolongation of expiration will be

difficult to detect and even more so to the relatively 'untrained' ear of the private practitioner, to whom the patient first goes for advice. It would seem also that different individuals have a different type of respiratory murmur, some having a harsher murmur than others, and some having a longer expiration (8). Where a lesion is one-sided, it may be easier to detect a relative abnormality; but if there is a bilateral bronchial thickening spreading out from both roots it becomes difficult to detect normal from abnormal respiratory murmur. It is said to be the type of abnormality most 'dumb' to auscultation (71). To illustrate further the above and also the difficulties of diagnosis, material from several cases is quoted below.

Case No. 168. Apices both dull to percussion anteriorly and posteriorly. No other abnormality detected.
Radiological findings - Bronchial thickening extending from both roots.

Case No. 175. Expiration prolonged and harsh over both upper lobes. No other abnormality detected.
Radiological findings - Peribronchial thickening at both apices (Plate VIII).

Case No. 213. Respiratory murmur harsh and expiration prolonged at the left apex. No other abnormality detected.
Radiological findings - Peribronchial thickening at left apex. (Plate X).

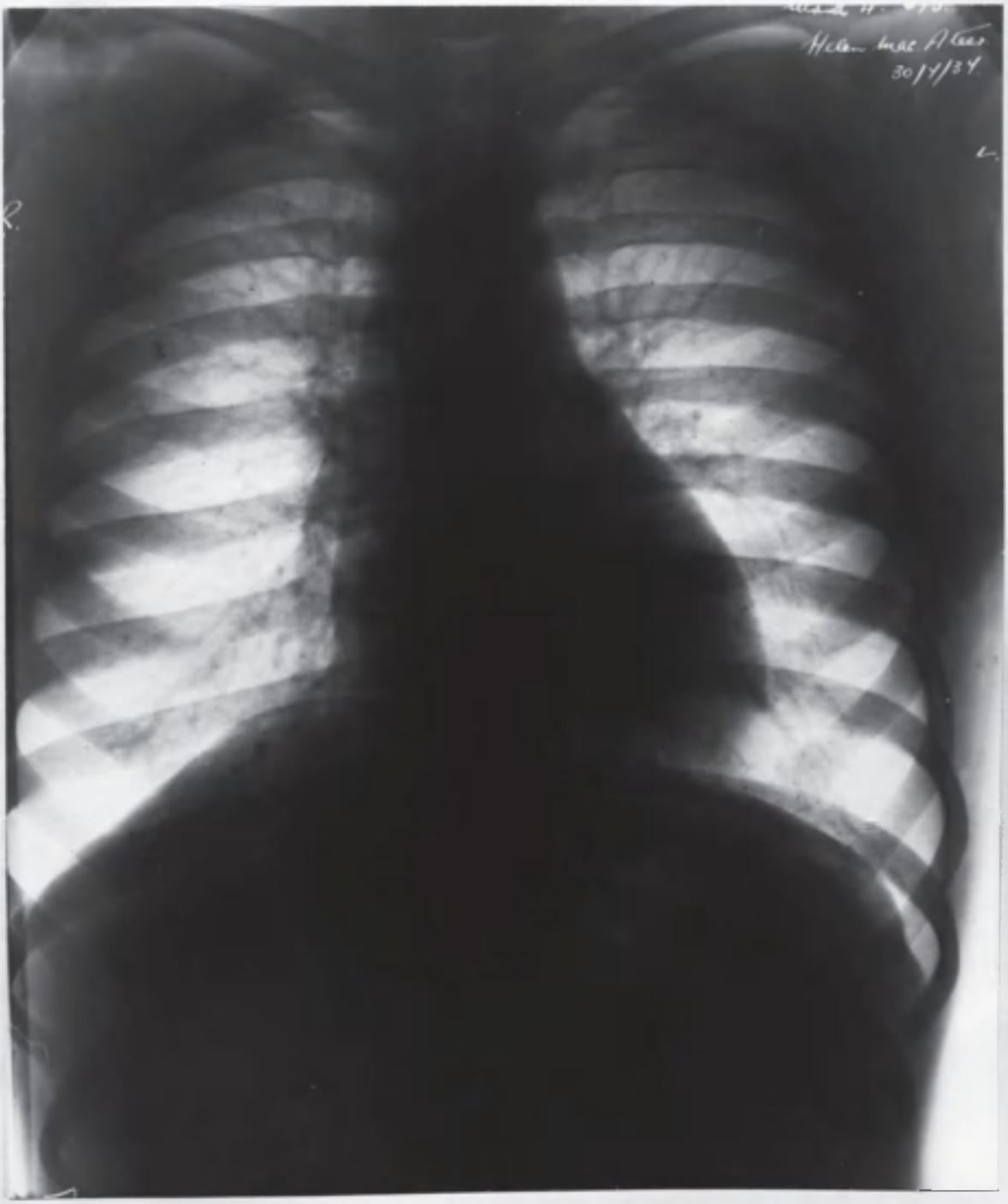
PLATE No. VIII.

Radiograph of chest of Case No.175, showing peribronchial thickening at both apices.


Robert Black
23/4/31

PLATE No. IX.

Radiograph from Case No.52, showing peribronchial thickening extending to both apices.


Helen MacAlan
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L.
R.

PLATE No. X.

Radiograph of chest of Case No.213, showing peribronchial thickening at the left apex.

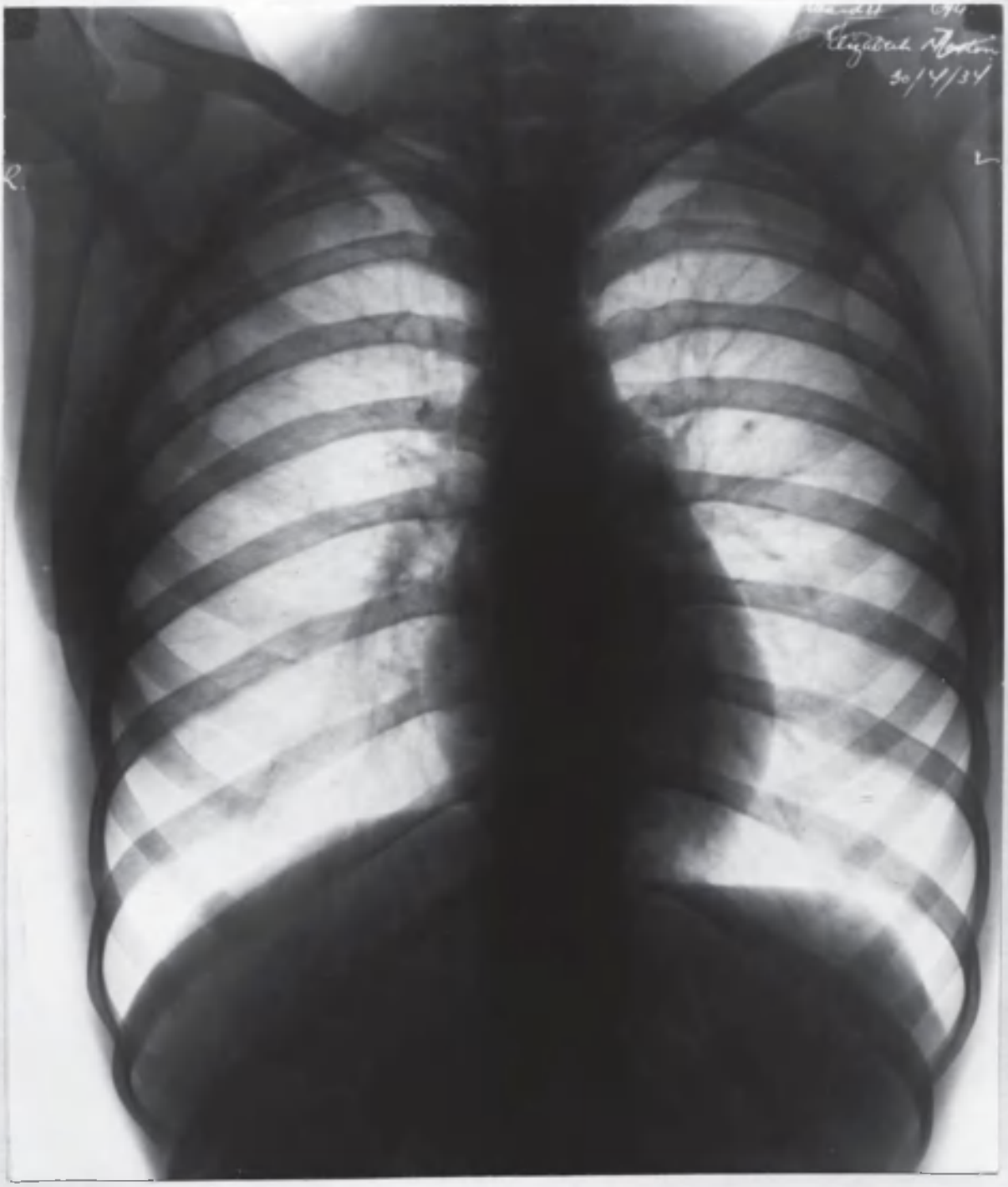
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PLATE No. XI.

Radiograph of chest of Case. No.241, showing bronchial thickening extending from right root to right base.

Case No. 52. Respiratory murmur vesicular throughout. No abnormal signs detected.
Radiological findings - Bronchial thickening extending to both apices (Plate IX).

Case No. 241. Respiratory murmur diminished at right base and left apex. No other abnormality detected.
Radiological findings - Bronchial thickening extending from right root to right base only. (Plate XI).

Case No. 251. Expiration prolonged at left base. No other abnormality detected.
Radiological findings - Bronchial thickening extending outwards from both roots.

Group V. Early pneumonic lesions seen very well and easily on a film are often not evident on auscultation. It is difficult to say why (71). Apart from the early pneumonic type of single focus, where the focus is small it might be said that, where a sufficiently minute examination of the lung field had been made it should be possible except in the smallest, to detect an abnormality - especially by the stethoscope. Once more lack of finesse is encountered, and contributes to failure on the part of the examiner. This is adding evidence to the fact that the beginning of tuberculosis is often rigorously silent - 'Lorsque l'auscultation decouvre une lesion, la radiographie la double, et l'autopsie la treble' (71). Geer

(95) affirms that this silent parenchymal lesion should be made a major objective in the anti-tuberculous campaign.

Groups VI, VII and VIII are those in which there is definite evidence of more than limited disease. It may be noted however that of these cases very few, 5 in fact, were active.

Comparison of Surgical Tubercular Cases with the 'Normal' Cases.

The percentage of cases in each radiological group is again set down with the corresponding percentage for cases from Section A as depicted in Table B, i.e. those cases in which no chest disease was suspected.

Groups:	I	II	III	IV	V	VI	VII	VIII
% ('Normals	40	20	10	10	16	4	-	-
(Section A.	29.2	18.3	6.5	23.8	7.6	3.2	8.6	15.1

The most notable comparison, apart from Group I, is that of Group V. On reviewing the 'normal' cases in Group V it was found that practically all cases allotted to this group had primary foci and many of these with the

corresponding enlarged root glands in evidence.

Expectation of an increased percentage of 'normal' cases in Group I is realised - but only by approximately 10%. It is an interesting fact that of the 60 cases reviewed only 20 could be passed as showing no sign, clinically or radiologically, of infection of the lung or its surrounding connective or lymph tissues at some time or other.

But the percentage of 'normal' cases allotted to Groups I to III compared with the surgical cases is 70 to 38.3 (or 47 for those cases being treated or admitted as surgical cases.)

Deutschmann (97) separated 78 surgical cases (of bone and joint disease) into two groups.

> Group I - where evidence of disease did not date longer than three years. This comprised 36 of the 78.
>
> Group II - where disease had been evident longer than three years - the remaining 42 patients.

In Group I he stetes that he found evidence of pulmonary disease in 84%, of which 28% was demonstrable alone radiologically. 81% of the 42 patients in Group II showed active disease. In the writer's series 143 cases were found to fall into Group I and 65 into Group II - i.e. as

far as could be judged accurately.

No. cases showing	active	disease in Group I: 21 or 14.7%)	95.4%
"	inactive	" " I: 113 or 80.7%)	
"	active	" " II: 8 or 12.3%)	86.2%
"	inactive	" " II: 48 or 73.9%)	

This calculation is again based on the author's radiological groupings and taking the radiological Group I as being the only collection of cases entirely free from disease.

Genito-Urinary Cases.

White and Gaines (98) in America state that all cases of genito-urinary tuberculosis reviewed by them were found to be secondary to a pulmonary focus. In Rohrer's (99) series of 25 cases 40% had pulmonary disease. Bucher and Fetter (100) agree in essence with White and Gaines, believing that the primary lesion is most often pulmonary. In the present series 25 out of 26 cases showed some sign of a lung lesion - and the one which had no evidence of a lung lesion had disease elsewhere. Also approximately 50% of the cases had some other surgical lesion as well as the chest affection. In this connection it may be mentioned that Reisner (46) found that one third of the genito-urinary cases in his series of 240 surgical cases showed

some extrapulmonary focus.

Cervical Adenitis.

Reid and Williamson (101) in a review of 119 cases state - 'in no case was the disease found to exist beyond the lymphatic system, and no case has shown secondary lesions such as pulmonary or bone tuberculosis'. This is even considering that the cases dealt with were consecutive and unselected. Fishberg (57) too declares that scrofula confers immunity against phthisis. The writer's findings do not agree with those of Reid and Williamson as study of Table M will show. Exactly three quarters of the cases showed some actual pulmonary involvement. But in these authors' series it is to be noted that seventy of the 119 cases were between the ages of 6 and 15 years and altogether 85 were below 16 years, whereas in the writer's cases not one was under 16 years, the average age being 19 years.

TABLE M.

Case No.	Age	Sex	Radiological Group	Duration of Glandular disease	Other Lesion (if any).
13	21	M	IV	4 years	Phalanges
17	17	F	II	4/12 yrs.	
42	24	F	VII	4 years	
53	21	F	V	3 plus yrs.	
*57	16	F	VIII	Years	
80	20	F	VIII	3 years	Spine
106	18	M	VII	1 2/12 yrs.	
189	19	F	IV	2½ years	Abdomen
199	16	F	I	2 years	
214	16	F	VI	6/12 years	
228	22	F	I	Years	
18	19	F	II	1 6/12 yrs.	

*Glands removed surgically some years previously.

With reference to the case of cervical adenitis in which the primary lesion appeared to be abdominal four years previously, is it to be assumed that this is a case of re-infection? This then raised the question whether all cases of adult disease are cases of re-infection. Schick (23) believes that this super-infection may be either exogenous or endogenous; but according to Stephani and Marechal (71) the infection is not exogenous but arises rather from the transport of bacilli from an old focus to a new one. This may take place (1) by transportation by metastasis in groups around the original lesion - eux memes l'accident primitif - (especially, of course, is this so in the case of the lung itself), or (2) by transport from some focus exogenous to the lung (i.e. some other surgical site). But in this quoted case the most probable route of infection of the cervical glands would appear to be from without. This tends to strengthen the view that cases of adult infection are probably of exogenous origin.

Innoculated Cases.

TABLE N.

Case No.	Sex	Age	Surgical Lesion	Chest Group	Type of Affection.
1	F	22	Spine	II	Bovine
2	F	17	Abdomen	III	Bovine
3	M	17	Multiple	I	Human
4	F	21	Spine	IV	Human
5	F	24	Multiple	IV	Human
6	M	24	Spine	VIII	Human
7	M	16	Spine	IV	Human

The number of cases investigated in this way was not nearly sufficient to draw conclusions of any importance. It must first be noted that even this method of investigation is open to considerable fallacy. The amount of culture injected into the animal has to be very carefully measured, and probably the weight method, as used in this instance, is not the best (80). A slight fallacy in this direction may make considerable difference to the post-mortem findings in the animal. As the material from all the cases was obtained from 'closed' cold abscesses, there was no necessity for attenuation and therefore it was fairly easy to obtain a pure culture. In spite of the drawbacks, some results may be noticed though not taken as conclusive evidence of any weight. It is to be noted that of the seven cases, two were bovine and five human in type, and that the chest involvement of the two bovine cases was only minor whereas four of the five human types had more severe degrees of affection (See Table N).

Case of J.R.B.

By the record of this case it is seen how difficult it was to arrive at an ante-mortem diagnosis. It was only after microscopical examination of post-mortem material that a definite diagnosis was possible. Then it was proved

to be one of tubercular origin. The infection would seem to be like that expected from a primary infection; but it is unusual for a man who has lived nearly all his life in a large industrial city to get his primary infection at 66 years of age (18). The only explanation seems to be that the man suffered an infection of exceptionally severe magnitude while in a state of much lowered resistance. It would seem that this infection gained entrance into the body by way of the tooth socket and then to the regional lymph glands from whence it spread throughout the body.

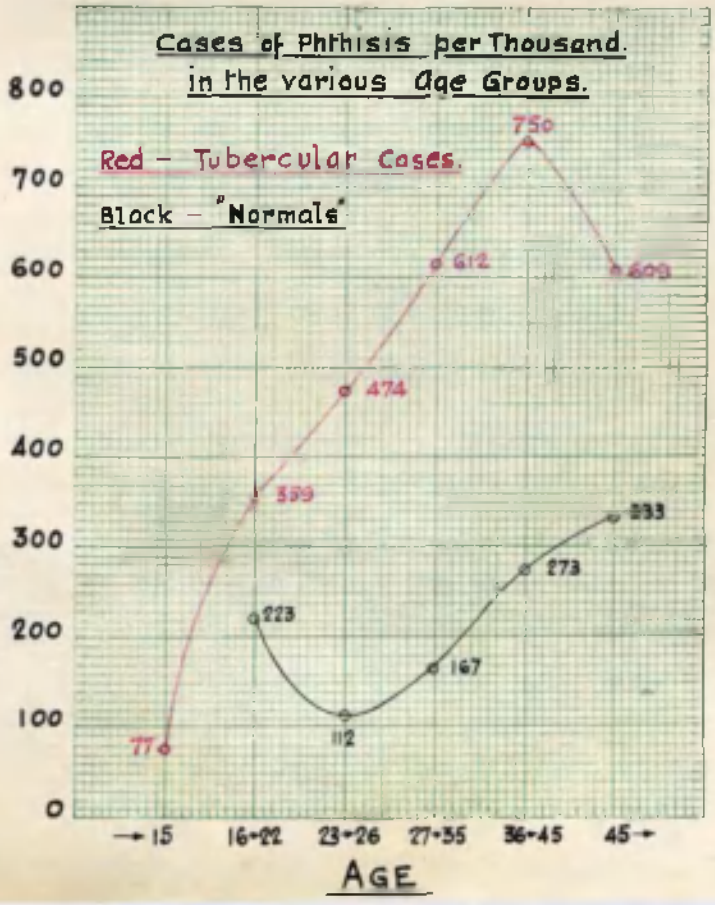
It is to be seen from the whole investigation that in surgical tuberculosis there is a large percentage of phthisis and that frequently this phthisis is undetectable by the ordinary methods of clinical examination; that in many cases indeed this detection is impossible without the help of radiography, and again that the lack of subjective symptoms and scarcity of physical findings frequently present a striking contrast to the changes revealed at X-ray (46). Childerhose affirms that 400 of 1000 cases would be missed if no radiological examination is used (102). Therefore the author is in agreement with all who seek to make this examination more easily available, and if necessary compulsory, not only for people showing evidence of tubercular infection, and contacts, but for the whole general population

(6) (73). And it would appear that the people must be made to co-operate in such schemes. In 146 deaths from tuberculosis, Korns(103) found:

(1) 20 had an early diagnosis with adequate treatment.
(2) 25 had a late diagnosis (physicians' fault).
(3) 45 had a late diagnosis (patients' fault).
(4) 56 had early diagnosis but did not co-operate in treatment.

Altogether there were 101 deaths from Sections (3) and (4).

In general, also, the older the patient who is affected by the disease surgically, the greater is the liability of finding some chest infection.



The graph showing this tendency has been compiled from the figures obtainable in Table D, and also the 'normal' table for comparison. Even in supposedly normal individuals, it will be seen, unsuspected phthisis is to be found and the likelihood of its discovery is again increased by age. It will be noted in the graph the fall in the number of surgical cases over 45 years of age affected by phthisis. Is one to attribute this to an increased resistance? Only these patients who have a good resistance survive to this period of life and owing to this increased resistance are less liable to develop phthisis.

SUMMARY and CONCLUSIONS.

The clinical and radiological findings of the chests of 256 patients showing signs of surgical tuberculosis are reviewed. Fifty 'normal' patients are similarly investigated to act as controls. Surgical tuberculosis is taken to include cases of bone and joint disease, abdominal disease, glandular and genito-urinary disease. The cases are reviewed without selection.

The etiology, pathology and diagnosis of phthisis and surgical tuberculosis are discussed and the clinical findings elaborated.

To facilitate the classification of the cases, certain radiological groups are defined and the cases allotted accordingly. Material from a few cases was submitted to laboratory examination and innoculation into animals. One case of special interest is fully described and discussed. Finally, all the findings are discussed and compared with those of other workers on similar lines.

From the investigation the following conclusions are obtained:

Phthisis often accompanies surgical tuberculosis.
The type of phthisis found in surgical tuberculosis is often difficult to detect, especially clinically.
In many cases the phthisis can only be detected radiologically.

The type of phthisis most difficult to detect is that which manifests itself as bronchial thickening.
The phthisis is usually of a chronic nature.
In general, the older the sufferer from surgical disease, the greater is the liability to phthisis.

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