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PULMONARY ASBESTOSIS.

Radiographic Appearances in Skiagrams of the Chests of Workers in Asbestos.

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> ". . . . my first task shall be to consider such Diseases as arise from the offensive Quality of the matter which tradesmen handle in the Way of their Business. Under this Head I reckon the Diseases which affect Mine-diggers and all Workmen who work upon Minerals."—Ramazzini of Padua. (1746.)

Last year Dr. Leonard Williams, Medical Officer of Health and Tuberculosis Officer of Barking, asked me to see several patients who had been attending a local dispensary. He had noted that though they were suffering from pulmonary fibrosis the condition differed in some respects from that usually associated with chronic phthisis. There was in each case a history of exposure to asbestos dust. In only two instances had tubercle bacilli been demonstrated in the sputum and neither signs nor symptoms were typical of tuberculosis in the fibroid form. Despite the absence of the final proof that only post-mortem examination can supply, a diagnosis of pulmonary asbestosis seemed to be justified in most of the cases. While the present investigation was proceeding two asbestos workers were admitted to the Victoria Park Chest Hospital, while the out-patient department of the same institution supplied four more cases. Fifteen skiagrams of the chests of asbestos workers were thus obtained. It is indeed strange that so little attention has been paid to the ill-effects of silicosis among workers in asbestos, a substance well known in commerce since the days of Hippocrates. I have failed to find any mention of asbestosis in standard works on pulmonary diseases and few references to the condition are to be found in recent medical literature.

Asbestos (ἄσβεστος = unquenchable) has been described by W. E. Cooke [1] as "a physical paradox—a mineralogical vegetable, both fibrous and crystalline, elastic and brittle." It is one of the silicates, but as will be seen later, other minerals enter into its composition. It occurs in veins associated with quartz and similar rocks and is widely distributed. The best known varieties are found in Canada, Italy, Corsica and South Africa, but it is also found in the older rock formations of North Wales and Ireland. The Asbestos Mountains in what was formerly Cape Colony contain a fibrous mineral of rich blue colour and beautiful texture resembling strands of finely spun glass. The veins of asbestos run through slaty rocks mingled with jaspers and quartzites rich in magnetite and brown iron ore [2]. The variety imported from Canada is known as white asbestos and has a silky texture. The fibres are obtained by blasting in open quarries, the fragments of rock being then crushed, screened and pulverised [3]. The crushed product is passed over a vibrating machine and the asbestos is withdrawn by vacuum fans into special chambers. To save the expense of carriage these preliminary stages are usually carried

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out before importation. Carding and spinning of asbestos form an important industry in this country. In these processes silica-laden dust is generated in large quantities.

The heat-resisting properties of asbestos, its low thermal conductivity and partial resistance to the action of acids account for its extensive use in modern engineering processes. It is much used for jacketing boilers and steam pipes and in the packing of joints. Fire-proof sheeting and curtains, feltings for roofs and floors, even firemen's clothes have been manufactured, and its employment in industry is likely to expand with further developments of the machine age.

Dr. W. E. Cooke states that the composition of Italian and Canadian asbestos fibres is as follows:—

	Italian fibre	Canadian chrysolite
Silica	40·30 ..	40·87
Magnesia	43·37 ..	41·50
Ferrous oxide	0·87 ..	2·81
Alumina	2·27 ..	0·90
Water..	13·72 ..	13·55

The high percentage of silica will be noted. In the process of manufacture, iron is as far as possible eliminated, but Mr. T. H. Byrom's analysis of asbestos dust from carding rooms shows that this may be heavily impregnated with it:—

Finished article: Iron (as ferrous oxide) ..	0·1	per cent.
Crude raw material..	2·81	,,
Dust from carding room	18·4	,,

The effects of inhaled silica dust upon the lungs are well known. A concise account of these is given by R. R. Sayers in the *American Journal of Public Health* [4]. Shorter references to the subject will also be found in the well-known textbooks of Norris and Landis [5], and Powell and Hartley [6]. It is doubtful whether the action of silica is purely mechanical, as precipitated silica has been found to produce a similar effect to that of the crystalline forms.

Three deaths occurred among patients of the present series within the last few months. One autopsy was obtained. This provided material for pathological examinations by Dr. S. Roodhouse Gloyne. The results of this and of an investigation of the sputum of asbestos workers will form the subject of a further communication.

Pathology of Pulmonary Asbestosis.

The macro- and microscopical appearances of the lungs of an asbestos worker have been described by W. E. Cooke and Stuart McDonald [7] [8]. The lungs, and particularly the right lung, were the seat of a massive fibrosis with thickened pleura. A large cavity was present on the right side and numerous small areas of caseation, though tubercle bacilli were not demonstrated. The interstitial fibrosis was such as might be expected as a result of a combination of a pneumoconiotic condition and a chronic tuberculous infection.

An account of the histological appearances is given in Dr. McDonald's paper which is illustrated by a series of excellent photo-micrographs. Particular attention is directed to the appearance of certain foreign bodies lying free in the alveoli or within the large mononuclear cells. Of a yellowish-brown colour with narrow segmented bodies and clubbed

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extremities, their resemblance to minute crustacean forms was striking. Dr. McDonald thought they were probably "portions of asbestos fibres in the process of alteration and absorption by hydrolysis either by direct chemical action or by enzymes." On treatment with potassium ferrocyanide and hydrochloric acid the prussian-blue reaction was obtained. In specimens from the lungs of the same patient Dr. Cooke also found particles apparently identical with heavy brittle iron-containing fragments of fibre previously found by him in asbestos dust. He states that the curious bodies referred to above are not found in asbestos itself. Dr. M. J. Stewart [9], however, found enormous numbers of similar golden yellow bodies in the expressed juice from the lungs of a patient who had worked in asbestos. Their presence in catarrhal alveoli and in fibrotic patches in sections from the same lungs was also demonstrated. Dr. Gloyne's sections from the lungs of a patient in the present series (Case 7) showed numerous similar bodies. Careful search failed to reveal any similar forms either in samples of raw asbestos or in the sputum of workers.

Symptoms of Pulmonary Asbestosis.

The cardinal symptom of pulmonary asbestosis, like that of other forms of silicosis, is dyspnœa. The dyspnœa is progressive and in advanced stages of the disease may become extreme. Chest expansion may be reduced to one inch or even less, as in Cases V and VI and also in the case described by H. E. Seiler [10]. The vital capacity of a patient in the present series (Case I) was approximately 1,600 c.c. The dyspnœa may be accompanied by cyanosis and the complexion of most patients has a slightly leaden hue. Wasting is a notable feature and may proceed to emaciation. As patients suffering from fibroid phthisis are often well nourished, the degree of wasting in pneumoconiosis is a point of some diagnostic value.

Cough is a variable symptom, but is seldom excessive and may be slight. Expectoration is usually moderate and may be altogether absent over long periods. Particles of asbestos are apt to penetrate the superficial layers of the skin of the arms and legs of workers. The irritation of these causes keratinisation and "asbestos corns" are produced around a central core of fibre.

Physical Signs.

If pulmonary tuberculosis supervenes the signs and symptoms of this condition will obviously modify the clinical picture. In the absence of such a complication the physical signs are those of a bilateral pulmonary fibrosis chiefly affecting the lung bases. The adventitious sounds have a dry crackling quality and in the axillary regions are often superficial. The latter probably have a pleural origin. A friction rub may be heard over the same area. As the disease affects both lungs, cardiac displacement, if present, is usually slight. Early clubbing of the fingers may occur but is seldom well marked, and when seen is usually represented by slight swelling of the skin surrounding the proximal ends of the nails.

Differential Diagnosis.

Features which serve to distinguish asbestosis from pulmonary tuberculosis, though a combination of the two conditions may be often suspected and sometimes proved, are the leaden or dusky complexion, extreme

dyspnœa, wasting or emaciation out of all proportion to physical signs and the dry quality of the adventitious sounds. These, with an absence of tubercle bacilli from the sputum and a history of prolonged exposure to asbestos dust, indicate the probable diagnosis. In one instance (Case VI) the result of sputum examination suggests that tuberculosis may have supervened some time after the onset of a non-tuberculous fibrosis.

Prognosis.

When the disease is established the prognosis appears to be grave. As noted above, three of the patients of the present series died during the present winter. Autopsy proved that broncho-pneumonia was the terminal event in one case, "bronchitis" was given as the cause of death in another, while in the third it is probable that broncho-pneumonia was the proximate cause.

Duration of Exposure to Asbestos Dust.

In the gold mines of South Africa the average time of exposure to silica dust before the development of pulmonary disease can be recognised is given by R. R. Sayers as seven and a half years [4]. A shorter period, even one of a few months, has resulted in pneumoconiosis where conditions are unfavourable. In the present series of cases the shortest period of working was one year (Case IX) and the longest fourteen years (Case II). One patient (Case XII) was exposed to dust for a period of eight years before the onset of the cough. Another (Case VII) remained in fair health for five years after commencing work, although frequent colds and a tendency to winter cough were apparent. It is significant that a patient may only complain of symptoms of pulmonary distress some time after ceasing work (Cases I and X). A reference to the radiograms will show that in general the density and extent of the lung shadows is proportional to the duration of the exposure to the dust.

Radiological Appearances.

Deductions from a small series of films must obviously be made with caution. Most of the cases described below have only been under my observation for short periods, and though the presence of complicating tuberculosis has been noted in all cases in which the tubercle bacillus was demonstrated, negative sputum or absence of sputum on one or two occasions obviously does not rule out infection of this type. All that is possible at this stage is to draw attention to what appear to me to be the salient features of the films. It is further obvious that reduction in size, absence of illumination and difficulties of reproduction must prevent a convincing demonstration of some details which are present in the original films, as seen in the viewing box.

The most noticeable feature of skiagrams of workers exposed longest to asbestos dust is the presence of shadows suggesting a diffuse fibrosis affecting chiefly the lower two-thirds of the lungs. The fine quality of the shadows is worthy of note. Some of the cases exhibit a "ground glass" appearance, though on close inspection fine mottling is evident. The bronchial striations towards the lung bases are prominent and seem to spread out to form a fine network, giving an appearance like that of a cobweb. As the striations radiate outwards from the lung roots they cut the

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edge of the cardiac shadow, especially on the left side, giving a shaggy appearance as if the heart were encased in coarse felt. When more definite mottling is present it lacks the coarse quality described in the skiagrams of chests showing pneumoconiosis, e.g., in South African coal miners. I have been able to include a typical skiagram of the latter condition kindly lent to me by Dr. F. G. Chandler. Reference may also be made to articles by Sir Thomas Oliver [11] and W. Stenart [12].

Another feature is evidence of basal pleurisy, and the frequency with which the costo-phrenic angle on one or both sides is obliterated will be noted. Many of the cases also exhibit thickening of the apical pleural cap. Annular shadows suggesting possibility of cavitation are only seen in three cases (William H., Barbara L., Violet S.) and in only one of these (Violet S.) tubercle bacilli had been found in sputum. The region of the lungs most apt to show marked changes in pulmonary tuberculosis of the fibroid type is usually spared.

I am indebted to Drs. V. S. Hodson and A. J. Scott Pinchin, for allowing me to see cases under their charge; to Dr. F. G. Chandler for the loan of a skiagram of miner's phthisis; to Dr. J. V. Sparks, under whose supervision the skiagrams were taken; to Dr. Roodhouse Gloyne for helpful suggestions; and particularly to Dr. Leonard Williams, Medical Officer of Health for Barking, without whose cordial co-operation the present series of cases could not have been brought together.

CASE NOTES AND SKIAGRAM REPORTS.

CASE I.

Frederick S., aged 59.—Admitted to Victoria Park Chest Hospital, January 1929, complaining of severe shortness of breath on slight exertion.

Family History.—Two brothers died of phthisis. One brother, a stone mason, died of malignant disease of the chest.

History.—Seven years ago the patient started a factory for grinding up crude asbestos into fibre. He wore a respirator at work, but dust used to cause severe coughing and expectoration. He abandoned work about the end of 1927 for business reasons. After giving up work he remained free from cough till August, 1928, when it returned and "his breath failed him," even walking causing dyspnœa. In November, 1928, he coughed up "quite a pint" of dark blood mixed with phlegm. He had been losing weight since leaving the factory.

Physical Signs.—The patient is a fairly healthy-looking man. Finger nails are curved, but there is no definite clubbing. The face slightly cyanosed. The chest is emphysematous. There is impairment of percussion note at base of right lung and fine fibrotic crepitations are heard at both bases. No T.B. found in sputum.

SKIAGRAM.

The skiagram shows a "ground glass" appearance of both lungs, more noticeable on the right and most marked at the right base. There is some contraction of the right apex where the pleural cap appears to be thickened.

The original skiagram shows fine diffuse granular mottling of the right lung. The costophrenic angle is obliterated and there is a marginal shadow due to thickened pleura at the right base. The periphery of the cardiac shadow is blurred.

CASE II.

William H., aged 46.—Admitted to Victoria Park Chest Hospital, May 31, 1928, complaining of severe shortness of breath and cough.

History.—The patient had worked at an asbestos factory for fourteen years (up to time of admission). He remained under observation in hospital for a period of seven weeks. Expectoration very slight. There had been cough, worse during the winter, for the last three years. Morning cough had occasionally caused vomiting. He attended the

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tuberculosis dispensary at the end of November, 1927, at which time he was suffering from bronchitis, the sputum being negative for T.B. He had suffered from "pleurisy" as a boy.

Family History.—Nothing abnormal.

Physical Signs.—The patient is emaciated. Face cyanosed. Fingers clubbed. Percussion note is poor generally. There is harsh breathing and prolonged expiration at the base of right lung. Fibrotic crepitations are heard all over the lungs and are especially marked at the bases.

SKIAGRAM.

There is thickening of the right apical pleural cap.

Above and behind right clavicle there is a circular area, probably caused by small cavity.

An annular shadow is seen over the anterior end of third rib on the right.

There is a "ground glass" haze over the middle third of each lung field. Fine granular mottling is disseminated over both lungs. Towards the right base there is an aggregation of these shadows leading to fairly dense opacity.

The trachea is slightly displaced towards the right.

The mediastinal shadow is wide.

The edge of cardiac shadow indistinct, and on left side has a "felted" appearance.

The costophrenic angles are obliterated.

CASE III.

Ellen L., aged 29.—First attended tuberculosis dispensary in September, 1925, complaining of cough accompanied by much frothy sputum and shortness of breath.

History.—Asbestos worker, 1919-1923. The patient remained on the books of the dispensary up till November, 1928. The case was diagnosed as pulmonary fibrosis involving both lungs. No definite evidence of T.B. was found, but in 1927 the patient was admitted to sanatorium where she remained for two months. Temperature normal during this period, and she was able to take short walks, but complained of dyspnœa.

Previous History.—Influenza, 1919. No history of pleurisy or pneumonia.

Physical Signs.—Extremely thin (weight 6 st., 3½ lb.) Slight cyanosis. No clubbing. There is some retraction at both lung apices. Percussion note is impaired at both apices and also at left axillary region where breath sounds are weak. Fibrotic crackling crepitations are heard in both infraclavicular regions and at both bases posteriorly. Sputum negative for T.B., 1924, 1925, 1928 (3).

SKIAGRAM.

There appears to be slight thickening of the apical pleural caps.

The upper portion of mediastinal shadow is somewhat widened.

Edge of cardiac shadow shows "felted" appearance, most marked along the left margin.

CASE IV.

Barbara L., aged 40.—First attended dispensary in September, 1926, complaining of cough with a little sputum and occasional shortness of breath. Diagnosis of pulmonary tuberculosis was made, but sputum was negative for T.B.

History.—The patient had originally been a worker on the land, at which time she developed a "tissicky" cough. She worked as a sweeper in an asbestos factory for about ten years, 1917-1927. Cough during this time was never severe but was worse when she was at work. During the last year at the factory she had pain at front of chest, cough and dyspnœa. Increase of these symptoms caused her to give up work. Slight cough without expectoration has persisted.

Previous History.—Nothing abnormal.

Physical Signs.—Patient poorly nourished (weight 6 st., 11 lb.) Not cyanosed. Fingers slightly clubbed. Chest is emphysematous. There is marked retraction of the right apex. Percussion note impaired over left upper lobe. There is also impairment of right base. Bronchial breathing, whispering pectoriloquy over a small area below right clavicle, suggesting cavity in this region.

SKIAGRAM.

This shows some slight scoliosis, with displacement of the trachea to the right.

Right apex is retracted and covered by thickened pleura.

Over the second intercostal space on right side there is an annular shadow, possibly due to a cavity. Internal and external to this is a slight haze.

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At the right base there are some fine linear shadows and fine granular mottling.

The right costophrenic angle is obscure, and there appears to be some thickening of the pleura towards right base.

CASE V.

Mary P., aged 49.—Attended tuberculosis dispensary March, 1927, complaining of cough and shortness of breath of four years' duration.

Family History.—One brother said to have died of pulmonary tuberculosis.

History.—Patient worked in an asbestos factory, 1917-1926. About 1924 she began to have a cough. This was associated with expectoration in 1925 and has continued ever since.

Physical Signs.—The patient is extremely thin and in a very debilitated condition. Fingers slightly clubbed. Chest emphysematous. Some impairment of the percussion note at right apex. Fibrotic râles are heard all over both lungs. Expiration prolonged at right apex. Sputum T.B. negative four times, 1927-1928.

SKIAGRAM.

The cardiac shadow is enlarged transversely and the left auricular region is prominent.

The trachea is slightly displaced to the right.

There is some relative clouding of right apex. In the right mid and lower zones there are numerous rounded opacities of moderate density. Some of these have a diameter of 4 mm.

There are numerous small granular opacities. Some of these towards base of the lung are very dense and probably represent calcifications. Similar changes, but to a less degree, are found on left side. The haziness of the mid-zones is partly accounted for by breast shadows.

CASE VI.

Herbert Hilder H., age 42.—Complaining of spasmodic cough with expectoration.

Family History.—Nothing abnormal.

History.—Patient first attended tuberculosis dispensary in 1924. At that time sputum was negative. Sputum again negative in 1925. T.B. positive 1927. T.B. positive 1928. Patient worked in asbestos factory at intervals from December, 1918, to November, 1928. (Total period in factory about seven years.)

Physical Signs.—Patient is a moderately well-nourished man. Weight 9 st. 12½ lbs. Face slightly cyanosed. Fingers clubbed. Chest expansion barely one inch. Percussion note impaired over both upper lobes, specially on right side. There is also marked impairment of percussion at the base of left axilla. Crepitations are heard all over right lung posteriorly. Breath sounds at base are harsh. Crepitations also heard in left axillary region.

SKIAGRAM.

Trachea markedly displaced towards right.

Cardiac shadow slightly enlarged. Right border merges with mediastinal shadows which are very dense. Left border of heart has a "felted" appearance.

The outer zone of each lung shows a fairly uniform "ground glass" opacity. In the original film this is seen to be partly due to numerous granular opacities.

Upper surface of diaphragm is obscure on both sides and right costophrenic angle is obliterated, appearances suggesting thickened pleura in this area. At the bases some clearer areas are seen which are probably bronchial. There is clouding of right apex.

CASE VII.

Nora C., age 34.—Patient first attended tuberculosis dispensary in July, 1928, complaining of dry cough of three years duration, and marked shortness of breath.

Family History.—Nothing abnormal.

History.—Patient began to work in asbestos factory at the age of 21. During the first five years she remained in fair health except for frequent colds and some winter cough. No respirators were worn at the factory, and as far as she knows, no precautions were taken against dust. After the first five years "her chest began to be stuffy" and she lost appetite for food. She remained at the factory for eight or nine years. The breathlessness was first noticed three years ago about one year after leaving the factory. At the same time she also began to lose weight. At the end of 1928 admitted to Victoria Park Chest Hospital where she remained till death, which occurred on March 1 of this year as the result of an attack of broncho-pneumonia of one week's duration. Whilst in

hospital cough very slight. There was no sputum and temperature normal. The fæces were examined for T.B. eight times with negative results.

Physical Signs.—Patient is emaciated. Face has slightly violet tinge. Fingers very slightly clubbed. Chest expansion barely one inch. There is marked retraction at right apex. Percussion note impaired at right apex and is poor all over left lung. Fibrotic crepitations are heard all over lungs, behind and in front at right base, also all over left front. Pleural friction sounds are heard below angle of left scapula, heard over upper third of chest on right side, front and back. Harsh breathing and prolonged expiration at right apex. Few crepitations also heard at left apex near angle of scapula and under left axilla.

SKIAGRAM.

The trachea is central.

The cardiac shadow is apparently somewhat displaced to the left.

There is marked thickening of right apical cap.

The lower half of right lung is hazy, and numerous small discrete opacities are seen. At the base numerous fine linear opacities radiate outwards from lower end of hilum.

Upper edge of diaphragmatic shadow is obscured, and costophrenic angle is obliterated. Lung generally hazy and in middle third numerous small granular opacities are seen.

Left edge of cardiac shadow obscure and merges into dense haze which occupies whole of lower third of lung.

There is abnormal projection from upper part of left hilum with convex, sharp outer margin.

CASE VIII.

Violet S., aged 20.—Admitted to sanatorium in January, 1929, complaining of cough.

Family History.—Nothing abnormal.

Previous History.—Pneumonia at the age of six months.

History.—Had had cough "off and on" since leaving school in 1922. This had become worse during the last six months. In May, 1928, hæmoptysis of ½ pint, followed two or three days later by second attack (about 1 pint). Shortly after this had convalescent holiday at Bournemouth. No sputum was available for examination till December, 1928, when tubercle bacilli were found. Previous to this, fæces had been negative for T.B. three times. At the age of 16, went to work in an asbestos factory as spinner, remaining eight months. After a years interval, worked for a further year in asbestos factory.

Physical Signs.—Patient a fairly well-nourished girl and looks well. Temperature normal after admission to sanatorium. No clubbing, but finger nails slightly curved. Percussion note impaired over right upper lobe. Numerous crepitations.

SKIAGRAM.

Trachea central. Heart outline well defined.

Mottled fine granular opacities are seen over whole of right lung, producing general hazy appearance.

Below right clavicle band of interlobal thickening is seen.

Behind right clavicle annular shadow suggests possible cavity in this region.

Right costophrenic angle obscured.

CASE IX.

Chrissy M., aged 18.—Attended tuberculosis dispensary, June, 1928, complaining of cough and slight expectoration.

Family History.—Father suffered from phthisis.

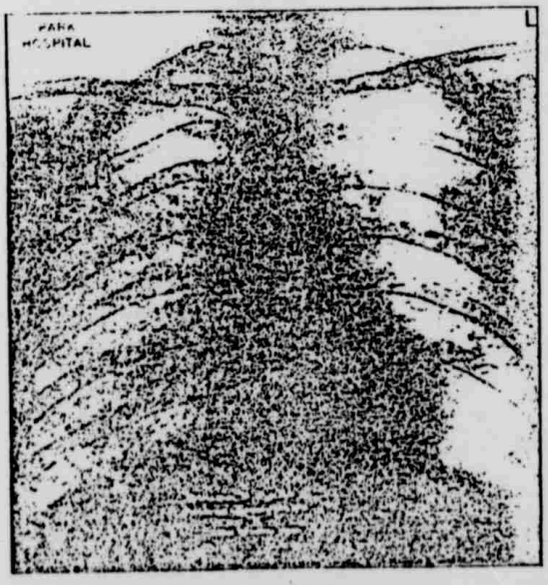
Previous History.—Had a delicate childhood. First attended Barking dispensary, aged 7½ years, and was sent to East Anglian Children's Sanatorium, where she remained for nine months on account of enlarged cervical glands. Discharged in apparently good health. She continued to attend dispensary on account of bronchial catarrh, cervical glands, &c. Later sent to open-air school. In 1925, domestic work at Westcliff. 1926, pneumonia. February, 1927, cough and expectoration, which was sometimes stained, but no abnormal signs found in lungs. October, 1927, commenced work in disintegration department of asbestos factory. About two months after starting work recurrence of cough with slight expectoration. Cough became progressively worse during the year, and she stopped work October, 1928.

Physical Signs.—(January 1929).—Some impairment of percussion note at right apex, where breath sounds are slightly blowing. No adventitious sounds heard.

PLATE I.



CASE I.



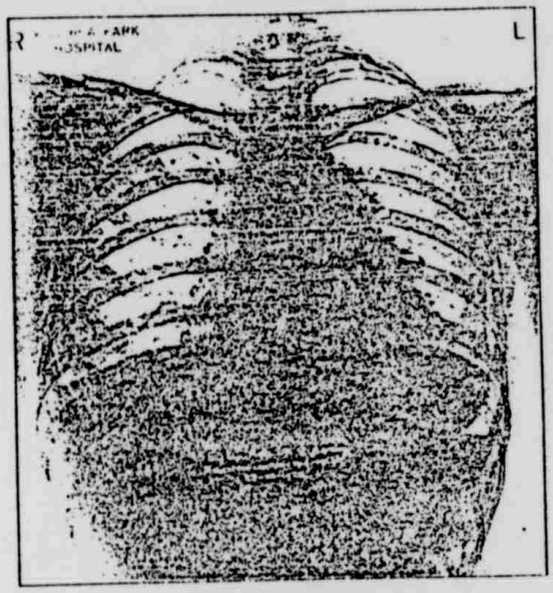
CASE II.

To illustrate article "Pulmonary Asbestosis," by W. BURTON WOOD, M.A., M.D., D.P.H.(Cantab.), M.R.C.P.(Lond.).

Face p. 500.

THE CHARLES DENISON ... UNIVERSITY ...

PLATE II.



CASE III.

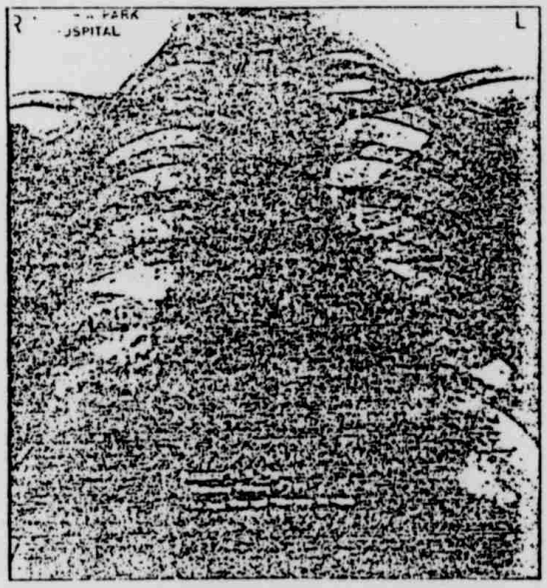


CASE IV.

PLATE III.



CASE V.



CASE VI.

THE CHARLES DENISON

PLATE IV.



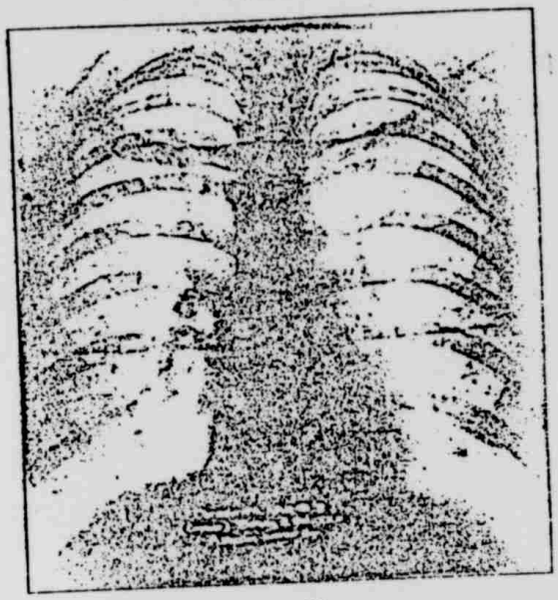
CASE VII.



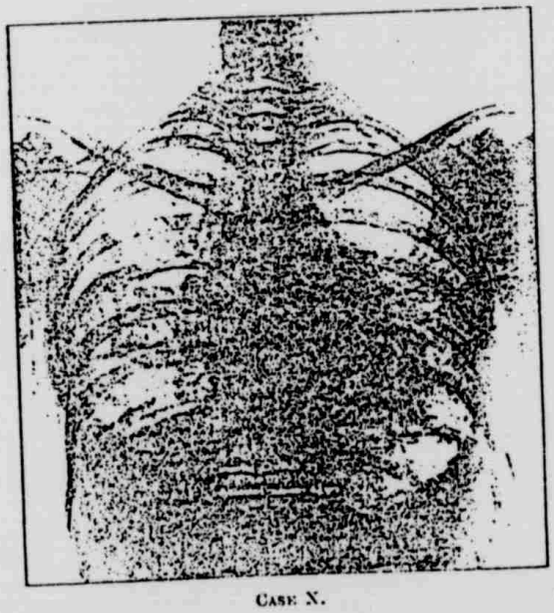
CASE VIII.

PLATE V.

May, 1929.



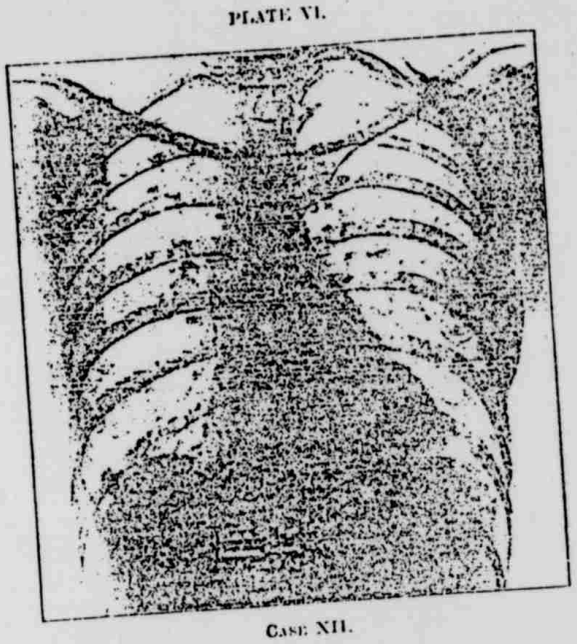
Case IX.



Case X.

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TUBERCLE. PLATE VI.



CASE XII.



CASE XVI.

SKIAGRAM.

Bronchial striations unusually thick and emphasised for a patient of 18 years.

Numerous calcified foci around right hilum and many small opacities in the lower half of right field, some of which appear to represent calcification.

About the middle of right hilum a small triangular shadow projects towards the right, and probably represents pleural adhesion.

CASE X.

Catherine O., aged 27.—First attended tuberculosis dispensary, December, 1928, complaining of shortness of breath and occasional cough and expectoration.

Family History.—Nothing abnormal.

History.—Patient had worked at an asbestos factory for six and a half years continuing till 1924. She was quite well all the time she was at the asbestos works. It was only during the last six months that she had had dyspnœa, slight cough and expectoration. She had, however, been losing weight for the last two years. Weight: 1927, 7 st.; 1929, 5 st. 12 lb.

Physical Signs.—January 10, 1929: Patient is extremely thin and dyspnœic. Not cyanosed. There is no clubbing. Retraction of chest below both clavicles and some flattening at the right base. Breath sounds over the right upper lobe in front are blowing, vocal resonance is increased. There is some impairment of percussion note at right base. Fibrotic crepitations with a dryish quality and squeaky sibili are heard in both lungs, especially towards the bases. T.B. negative five times, 1928-1929.

SKIAGRAM.

Thickening of pleura at both apices.

There is haziness of middle zone of right lung, with marked thickening of interlobar septum. There is fine discrete mottling and some very fine linear shadows at the base.

The hilar glands appear to be enlarged.

Lower half of left lung is cloudy. Fine linear shadows seen similar to these on the right side.

The left edge of cardiac shadow shows very marked "felting."

Upper surface of diaphragm obscure on right, invisible on left.

Right costophrenic angle obliterated.

CASE XI.

Rosetta N., aged 60.—Seen at dispensary on January 10, 1929, complaining of tightness across chest, severe cough without expectoration and marked shortness of breath.

History.—First attended dispensary 1914 for cough with expectoration. In 1916 diagnosis of emphysema with pulmonary fibrosis was made. There is no record of the finding of T.B. in the sputum, and patient has apparently remained in the same condition for many years. About 1912 commenced work as spinner at asbestos works. Cough commenced towards end of first year of working, after which she had recurrent coughs every two or three months. These increased in severity and her doctor advised her that her work was "not doing her any good."

Physical Signs.—Patient is poorly nourished. Chest emphysematous. No clubbing. Sharp post-tussic crackles are heard in both axillary regions and a few at the bases posteriorly.

SKIAGRAM.

Heart is slightly displaced towards the left and there appear to be some adhesions in the region of the cardiac apex.

The right lower lobe is apparently contracted. The interlobar septum occupies a lower position than usual.

The striations at the right base are denser than normal.

Towards lower end of right hilum there are some rounded opacities about 4 mm. in diameter.

CASE XII.

Elsie S., aged 35.—Attended Victoria Park Chest Hospital in November, 1928, complaining of cough, expectoration, shortness of breath, wasting, fever and debility.

Family History.—Sister died of phthisis when patient was 8 years old.

History.—Commenced work as spinner in asbestos factory, aged 20. Worked con-

tinuously for thirteen years. Cough commenced five years before ceasing work and gradually got worse. On entering factory, weight 10 st., now 7 st.

Physical Signs.—Patient extremely thin. Not cyanosed. Slight clubbing of fingers. Slight impairment of percussion note over upper half of right lung. Dry fibrotic cracklings are heard all over right lung. Harsh breath sounds and prolonged expiration below right clavicle. Sputum T.B., negative four times 1928.

SKIAGRAM.

Cervical rib on left. Trachea displaced towards right.

Below centre of right clavicle in first intercostal space there is a dense, rounded shadow about 4 mm. in diameter, apparently due to calcification. A few other smaller calcified areas in same region. There are dense calcifications at upper end of right hilum.

Right interlobar septum very thick. Immediately below inner end of septum is a large oval shadow about $1\frac{1}{2}$ in. by $\frac{3}{4}$ in.

Outside left hilum are a few small calcifications.

There is a rounded opacity above left clavicle and a few small dense spots.

Left edge of cardiac shadow clear-cut except at apex, where it is striated.

CASE XIII.

May H., aged 20.—Attended Victoria Park Chest Hospital, February, 1929, complaining of cough, pains in right side of chest and "terrible shortness of breath."

History.—August, 1925, commenced work as spinner at asbestos factory where she continued till the present time. Cough commenced February, 1928. There had been no spit. Pains in right side of chest. Dyspnœa of eight weeks' duration.

Physical Signs.—Impaired percussion note at right base, with dry friction, rub also heard in right axillary region. Chest expansion, 1 in.

SKIAGRAM.

Bronchial striations slightly more obvious than usual. Otherwise no abnormality seen.

CASE XIV.

Alice M., aged 18.—Attended Victoria Park Chest Hospital February, 1929, complaining of cough and pains round lower part of chest.

Family History.—Nothing abnormal.

History.—Patient has been working at an asbestos factory for one and a half years. Has had no shortness of breath, and is not losing weight. There is no expectoration, but she complains of feeling of phlegm in the throat. Cough worse when she is at work. As far as she knows no precautions against dust taken in the factory.

Physical Signs.—No abnormality detected, but finger tips are slightly shining above nail-base suggesting earliest stage of clubbing. There are asbestos "corns" on the hands.

SKIAGRAM.

Nothing abnormal detected.

CASE XV.

Raymond G., aged 30.—Attended Victoria Park Chest Hospital February, 1929, complaining of shortness of breath, lassitude, cough and expectoration, sometimes streaked with blood.

Family History.—Brother died in 1923 from pulmonary tuberculosis.

History.—1920 worked at asbestos factory as store-keeper. His work necessitated constant visits to the spinning rooms. 1923 patient had attack of "pneumonia," said to be tuberculous, and kept in bed four months. Then attended tuberculosis dispensary. About this time he coughed up a teaspoonful of bright red blood on two or three occasions. Cough has persisted ever since. During the last two years there has been increasing lassitude, and he has been very short of breath since 1923.

Physical Signs.—Patient slightly cyanosed. Round shoulders. No clubbing. Slight impairment of percussion note over both apices. Creaking sounds, fine sibili and crepitations are heard all over both lungs.

SKIAGRAM.

There is indefinite mottling above both apices.

A few small calcifications in region of both hila.

Edge of cardiac shadow is distinct.

CASE XVI.

B.C. (male), aged 51.

Skiagram shows posterior view of lungs of patient who had worked for eleven years in the South African gold mines.

Sputum negative for T.B.

At the right apex, clear area apparently due to cavity.

All over remainder of both lung fields there are numerous discrete dense opacities. The edge of the cardiac shadow is distinct on the left, but at the right base it is partly obscured by interlacing linear striations which extend from hilum to upper surface of diaphragm.

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A STUDY OF THE SEDIMENTATION RATES IN 252 CASES OF PULMONARY TUBERCULOSIS.

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In a review of 100 T.B.+ cases under observation in the Sanatorium between October 1926 and July 1928 it was possible to show by a correlation of the Sedimentation Rates on admission and discharge with the end result of treatment the value of this test as an indication to prognosis and the response to treatment[1]. A study of 200 T.B.+ cases and 52 T.B.− cases discharged to date seems worth recording, as it strengthens the basis of conclusions then reached and is suggestive of others then hinted at.

The technique employed is that described in the former paper :—

> To two volumes of a sterile solution of 3·8 per cent. sodium citrate eight volumes of blood are added. The unit of volume is one drop of blood from a broad-ended glass pipette; the blood is drawn from an ear or finger and mixed in a watch-glass. A column of the diluted blood, 4 in. (=100 mm.) long, is drawn by capillary

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