

ON THE OCCURRENCE OF CLUMPS OF ASBESTOS BODIES IN THE SPUTUM OF ASBESTOS WORKERS.

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(PLATE LXXXV.)

WHEN asbestosis bodies are found in the sputum of asbestos workers or other persons who have inhaled asbestos dust in appreciable amount, they occur singly or in groups of two or three. The number present is usually small and the use of a concentration method may be necessary for their convenient demonstration (Stewart and Haddow 1929, Stewart 1929, Wood and Gloyne 1930, Lynch and Smith 1930, Simson and Strachan 1931, Gloyne 1931). Their significance is clear; they indicate merely that asbestos dust has been inhaled into the lung and has remained there for a certain length of time; they do not show that a diseased condition of the lungs necessarily exists.

The time required for the formation of the bodies is short. They were present in the *lungs* of a patient who had been exposed to dust for two months only (Simson 1929) and of a guinea-pig which had been for three months in an asbestos factory (Stewart 1930). In one of Simson and Strachan's cases the *sputum* was positive after only five months exposure and in Gardner and Cummings' guinea-pig experiments (1931) the first imperfectly formed bodies were noted in the *lungs* after 60 days. In 90 days they had assumed their typical form. We have encountered "bodies" in the sputum of persons whose occupation has only entailed their occasional presence in the asbestos factory and in one instance we found them in the lungs, *post mortem*, in a man who lived close to a factory for many years but who had never been inside it. It may be that quantitative observations will yet show that numbers of bodies above a certain minimum figure are diagnostic (or suggestive) of a condition of pulmonary asbestosis, but certainly no such significance can be attached to their mere presence. One of us (M. J. S.) has now examined the sputum of 24 workers in asbestos and has found bodies in all but 4. Several of these were persons in excellent health, with nothing to suggest that they were suffering from pulmonary fibrosis.

In two instances, however, in addition to single bodies there was found a large clump of some 20 or 30 bodies more or less radially

arranged with their bulbous extremities outwards. The appearance is similar to what is seen in histological sections of the lung in cases of pulmonary asbestosis. Here clumps of bodies occur in two situations, (1) within the lung alveoli, and (2) embedded in fibrous tissue. The alveoli which contain clumps are nearly always those which abut on areas of advanced fibrosis and there is little doubt that the clumps within the latter were originally formed inside the lung alveoli.

The two patients in whom a clump of bodies was found in the sputum were suffering from advanced and moderately advanced pulmonary asbestosis respectively and one of them has since died, the diagnosis being confirmed at autopsy. Following is a resumé of the more important findings.

Case I.

A female aged 31 died on 10th March 1931. The sputum had been examined for tubercle bacilli on several occasions with negative results. Two samples taken within the last few weeks of life and examined by the antiformin method (Stewart 1929) were found to contain abundant asbestosis bodies. From one of the samples the clump shown in fig. 1 was obtained; otherwise all the bodies occurred singly or in groups of two or three.

The patient had worked in an asbestos factory from 1915 until 1923, with a break of two years for child-birth in 1923-1925 (her only child). She ceased work at the end of August 1928, two and a half years before her death. She first complained of cough, dyspnoea and anorexia in October 1925 and again came under treatment in February 1927, when she showed poor air entry all over the chest and some coarse crepitations at the right apex. Radiographic examination showed signs of slight infiltration at the bases. She was regarded at this time as a mild case of pulmonary asbestosis. On 6th July 1929 it was noted that there were more signs of fibrosis at both bases, with pleural friction in the axilla, particularly the left. The apices were emphysematous especially the left and there were post-tussal crepitations at the right apex and elsewhere. There was no sputum. The radiograph (15.7.29) showed diffuse fine striation throughout the lower third of both lungs. The interlobar fissure was well seen on the right side, where also the outline of the diaphragm was much blurred. There was evidence of pleural thickening on the lateral aspect of the left lower lobe. There was more striation than normal in the upper two-thirds of the lungs, the changes here being coarser than in the lower third. The cardiac outline was blurred by the strands of fibrous tissue crossing it. The appearances, in short, were typical of the diffuse basal fibrosis encountered in cases of asbestosis and there was nothing to suggest a tuberculous infection. In January 1931 the patient became acutely ill, with symptoms and signs of bronchopneumonia, first at the right base and then on the left side also. The temperature was only slightly raised (38.3°), but the pulse was very rapid and there were cyanosis, dyspnoea and painful cough. Marked dullness and abundant moist sounds at both bases, with pleural friction in places, continued until her death two months later. It was during this time (13.1.31) that the clump of asbestosis bodies was found in the sputum.

Post-mortem examination. There was notable diffuse fibrosis of the greater (basal) portion of both lower lobes. On the left side, only the extreme apex of the lower lobe was crepitant, on the right approximately the upper third. Both these lobes were very greatly reduced in size. The fibrosed areas showed only a moderate grade of patchy anthracotic mottling, the intervening tissue being

ASBESTOSIS BODIES



FIG. 1.

FIG. 1.—Case I. Clump of asbestos bodies recovered from the sputum of a patient with pulmonary asbestosis. Note the radial arrangement of the bodies with their bulbous extremities at the periphery. Unstained. $\times 680$.



FIG. 2.

FIG. 2.—Case II. A similar clump from another case. Unstained. $\times 680$.



FIG. 3.—Case II. A clump of bodies *in situ* in a lung alveolus. The alveolar wall is well seen and the radial arrangement of the bodies. Prussian blue reaction. $\times 1100$.

gray or pink in colour. A few tiny abscess cavities were seen scattered throughout the fibrosed areas. The upper lobes were mainly spongy and normal, but there were a number of scattered small areas of dense fibrosis mainly beneath the pleura. The non-fibrosed tissue was somewhat emphysematous. The visceral and parietal pleurae on both sides of the chest were markedly thickened and fibrosed. On the right side the sac was almost obliterated by dense adhesions; on the left, adhesions were equally dense but less extensive. The non-obliterated portion of the sacs presented a cake-icing appearance, with some recent sero-fibrinous pleurisy.

Histological examination. I. The solid, non-crepitant portions of lung, constituting the greater part of both lower lobes as above described, and smaller areas, mainly subpleural, in the upper lobes, show changes of two kinds: (a) partialised slight fibrous thickening of alveolar walls, with various combinations of oedema, catarrh, fibrinous pneumonia and patchy purulent bronchopneumonia; and (b) patches of advanced fibrosis, often clearly related to dilated and pus-filled bronchioles. It is in and around these densely fibrosed areas that asbestos bodies are found in greatest profusion. Here they often occur in large radially arranged clumps, both in surviving alveoli abutting on the fibrous patches (fig. 3) and embedded within the fibrous tissue itself. The acutely inflamed, slightly fibrosed portions of solid lung show only scattered asbestosis bodies in small numbers, mainly in the thickness of the alveolar walls, occasionally in the oedematous or inflammatory exudate filling the alveoli.

II. The areas of crepitant lung tissue constituting the major portion of the upper lobes and the smaller, apical portions of the lower lobes show slight patchy fibrosis, again mainly peribronchiolar, with emphysema of the intervening tissue. Asbestosis bodies are present in moderate numbers, mainly in and around the fibrous patches. Much carbon pigment is present in these patches, as in the areas of more grossly fibrosed lung.

III. The visceral pleura is everywhere greatly thickened and densely fibrosed. In one block showing obliterated pleura between lung and intercostal muscle there is an active tuberculous lesion with numerous well formed follicles and giant cells. There is no evidence of tuberculosis of the lungs in any of the blocks cut.

Case II.

A female, age 44 in 1932, commenced work in an asbestos factory 27 years ago and was continuously employed there except for a 6 years break following marriage. She had been mainly employed on mattress making, until four or five years ago an excessively dusty process, but had also been engaged on "rope spinning and warping" for 5 or 6 years. Her health remained good until three years ago when she had "pneumonia" and was off work for three months. She has had two similar attacks since, the last in February of this year. She has had "chesty" each winter since the first attack, with slight cough, mucoid sputum, and gradually increasing dyspnoea. She has lost 10 lb. in weight in four years. Her present general condition is fair, with no cyanosis, but she has a hard chest wall and a chest expansion of one inch. There is an impaired note over the lower half of both lungs. The breath sounds are weak and expiration is prolonged. Scattered dry creaking sounds are heard at both bases. The sputum is consistently negative for tubercle bacilli but asbestosis bodies are present in fairly large numbers. On one occasion (4.4.32) a large radially arranged clump of at least 20 or 30 "bodies" was seen (fig. 2). X-ray examination of the chest shows diffuse fine striation and light mottling of the lower half of both lungs, with some irregularity of outline of the diaphragm. There are no appearances suggestive of pulmonary tuberculosis; the picture is that of diffuse fibrosis, mainly basal, and is typical of moderately advanced asbestosis.

Commentary.

We suggest that the finding of a large clump or clumps of asbestos bodies in the sputum as here described is a clear indication of the integration of lung tissue, whether by a process of simple suppurative bronchopneumonia, as in our first case, or as a result of secondary tuberculous infection. In either case it is reasonable to conclude that there is also a definite underlying asbestosis.

In the concentration method which we employ the sample of sputum is rather roughly treated, and it may be that by a more gentle manipulation of the specimens clumps of bodies would be found more frequently. On the other hand we have never seen portions of broken up clumps such as might be expected to result from rough handling. The radial arrangement of the bodies with their bulbous extremities at the periphery, identical as it is with many of the clumps found in lung sections (fig. 3), clearly shows that we are dealing not with an artefact but with a formation built up *in situ* within the lung alveolus from which it could only escape as a result of some secondary disintegrative process.

Asbestosis bodies are encountered with great frequency in the sputum of asbestos workers, especially those who have been long in the industry. Simson and Strachan (1931), who examined specimens from 50 workers in a South African asbestos mill, found 48 of them positive. In our own series of 24 cases 20 gave a positive result including all who had been at work for 5 years or longer. By contrast clumps would seem to be encountered very infrequently. Simson and Strachan make no mention of their occurrence, and we have failed to find any other reference in the literature. Lynch and Smith (1950) however, figure a typical clump of "asbestosis bodies in sputum concentrate." These authors examined the sputum of four cases of pulmonary asbestosis, of which three were positive. The clump shown was presumably obtained from their first case, where bodies were numerous, whereas cases II and III showed only "sparse bodies" in the spit. It is worthy of note that case I was the subject of active tuberculosis with positive sputum. Ellman (1932) also figures a typical clump of bodies from the sputum (fig. 76). In a personal communication he states that this was obtained from a very advanced case of the disease.

It would appear, therefore, that while individual asbestosis bodies in large or small numbers are present in the sputum of the vast majority of asbestos workers, clumps of bodies are only encountered on rare occasions. Their presence points to disintegration of lung tissue and is therefore of far greater significance than the finding of single bodies however numerous. It may be compared with the presence of elastic tissue in the sputum in phthisis.

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