

often impossible. An antiseptic spray of carbolic acid may be employed. A good plan is for the patient to use over the mouth and nose an inhaler, which may be charged with a solution of carbolic acid or creosote. If the signs of cavity are distinct an attempt should be made to cleanse it by direct injections of an antiseptic solution. If the patient's condition is good and the gangrenous region can be localized, an attempt should be made to treat it surgically. Successful cases have been reported. The general condition of the patient is always such as to demand the greatest care in the matter of diet and nursing.

### VII. ABSCESS OF THE LUNG.

**Etiology.**—Suppuration occurs in the lung under the following conditions: (1) As a sequence of inflammation, either lobar or lobular. Apart from the purulent infiltration this is unquestionably rare, and even in lobar pneumonia the abscesses are of small size and usually involve, as Addison remarked, several points at the same time. On the other hand, abscess formation is extremely frequent in the deglutition and aspiration forms of lobular pneumonia. After wounds of the neck or operations upon the throat, in suppurative disease of the nose or larynx, occasionally even of the ear (Volkmann), infective particles reach the bronchial tubes by aspiration and excite an intense inflammation which often ends in suppuration. Cancer of the œsophagus, perforating the root of the lung or into the bronchi, may produce extensive suppuration. The abscesses vary in size from a walnut to an orange, and have ragged and irregular walls, and purulent, sometimes necrotic, contents.

(2) Embolic, so-called metastatic, abscesses, the result of infectious emboli, are extremely common in a large proportion of all cases of pyæmia. They may occur in enormous numbers and present very definite characters. As a rule they are superficial, beneath the pleura, and often wedge-shaped. At first firm, grayish red in color, and surrounded by a zone of intense hyperæmia, suppuration soon follows with the formation of a definite abscess. The pleura is usually covered with greenish lymph, and perforation sometimes takes place with the production of pneumothorax.

(3) Perforation of the lung from without, lodgment of foreign bodies, and, in the right lung, perforation from abscess of the liver or suppurating echinococcus cyst are occasional causes of pulmonary abscess.

(4) Suppurative processes play an important part in chronic pulmonary tuberculosis, many of the symptoms of which are due to them.

**Symptoms.**—Abscess following pneumonia is easily recognized by an aggravation of the general symptoms and by the physical signs of cavity and the characters of the expectoration. Embolic abscesses cannot often be recognized, and the local symptoms are generally masked in the

general pyæmic manifestations. The characters of the sputum are of great importance in determining the presence of abscess. The odor is offensive, yet it rarely has the horrible fetor of gangrene or of putrid bronchitis. In the pus fragments of lung tissue can be seen, and the elastic tissue may be very abundant. The presence of this with the physical signs rarely leaves any question as to the nature of the trouble. Embolic cases usually run a fatal course. Recovery occasionally occurs after pneumonia.

Medicinal treatment is of little avail in abscess of the lung. When well defined and superficial, an attempt should always be made to open and drain it. A number of successful cases have already been treated in this way.

### VIII. PNEUMONOKONIOSIS.

Under this term, introduced by Zenker, is embraced those diseases of the lungs due to the inhalation of dusts in various occupations. They have received various names, according to the nature of the inhaled particles—*anthracosis*, or coal-miner's disease; *siderosis*, due to the inhalation of metallic dusts, particularly iron; *chalicosis*, due to the inhalation of mineral dusts, producing the so-called stone-cutter's phthisis, or the "grinder's rot" of the Sheffield workers.

The dust particles inhaled into the lungs are dealt with extensively by the ciliated epithelium and by the phagocytes, which exist normally in the respiratory organs. The ordinary mucous corpuscles take in a large number of the particles, which fall upon the trachea and main bronchi. The cilia sweep the mucus out to a point from which it can be expelled by coughing. It is doubtful if the particles ever reach the air-cells, but the swollen alveolar cells (in which they are in numbers) probably pick them up on the way. The mucous and the alveolar cells are the normal respiratory scavengers. In dwellers in the country, in which the air is pure, they are able to prevent the access of dust particles to the lung tissue, so that even in adults these organs present a rosy tint, very different from the dark, carbonized appearance of the lungs of dwellers in cities. When the impurities in the air are very abundant, a certain proportion of the dust particles escapes these cells and penetrates the mucosa, reaching the lymph spaces, where they are attacked at once by the cells of the connective-tissue stroma, which are capable of ingesting and retaining a large quantity. In coal-miners, coal-heavers, and others whose occupations necessitate the constant breathing of a very dusty atmosphere even these forces are insufficient. Many of the particles enter the lymph stream and, as Arnold has shown in his beautiful researches, are carried (1) to the lymph nodules surrounding the bronchi and blood-vessels; (2) to the interlobular septa beneath the pleura, where they lodge in and between the tissue elements; and (3) along the larger lymph channels to the substernal, bronchial and tracheal glands, in which the stroma cells of



the follicular cords dispose of them permanently and prevent them from entering the general circulation. Occasionally in anthracosis the carbon grains do reach the general circulation, and the coal dust is found in the liver and spleen. As Weigert has shown, this occurs when the densely pigmented bronchial glands closely adhere to the pulmonary veins, through the walls of which the carbon particles pass to the general circulation. The lung tissue has a remarkable tolerance for these particles, probably because a large proportion of them is warehoused, so to speak, in protoplasmic cells. By constant exposure a limit is reached, and there is brought about a very definite pathological condition, an interstitial sclerosis. In coal-miners this may occur in patches, even before the lung tissue is uniformly infiltrated with the dust. In others it appears only after the entire organs have become so laden that they are dark in color, and an ink-like juice flows from the cut surface. The lungs of a miner may be black throughout and yet show no local lesions and be everywhere crepitant.

As already mentioned, the particles are deposited in large numbers in the follicular cords of the tracheal and bronchial glands and of the peri-bronchial and peri-arterial lymph nodules, and in these they finally excite proliferation of the connective-tissue elements. It is by no means uncommon to find in persons whose lungs are only moderately carbonized the bronchial glands sclerosed and hard. In anthracosis the fibroid changes usually begin in the peri-bronchial lymph tissue, and in the early stage of the process the sclerosis may be largely confined to these regions. A Nova Scotian miner, aged thirty-six, died under my care, at the Montreal General Hospital, of black small-pox, after an illness of a few days. In his lungs (externally coal-black) there were round and linear patches ranging in size from a pea to a hazel-nut, of an intensely black color, airless and firm, and surrounded by a crepitant tissue, slate-gray in color. In the centre of each of these areas was a small bronchus. Many of them were situated just beneath the pleura, and formed typical examples of limited fibroid broncho-pneumonia. In addition there is usually thickening of the alveolar walls, particularly in certain areas. By the gradual coalescence of these fibroid patches large portions of the lung may be converted into firm grayish-black, in the case of the coal-miner—steel-gray, in the case of the stone-worker—areas of cirrhosis. In the case of a Cornish miner, aged sixty-three, who died under my care, one of these fibroid areas measured 18 by 6 cm. and 4.5 cm. in depth.

A second important factor in these cases is chronic bronchitis, which is present in a large proportion and really causes the chief symptoms. A third is the occurrence of emphysema, which is almost invariably associated with long-standing cases of pneumonokoniosis. With the changes so far described, unless the cirrhotic area is unusually extensive, the case may present the features of chronic bronchitis with emphysema, but finally another element comes into play. In the fibroid areas softening occurs,

probably a process of necrosis similar to that by which softening is produced in fibro-myomata of the uterus. At first these are small and contain a dark liquid. Charcot calls them, as already mentioned, *ulcères du poulmon*. They rarely attain a large size unless a communication is formed with the bronchus, in which case they may become converted into suppurating cavities. The question has been much discussed of late as to what part the tubercle bacillus plays in these cases of pneumonokoniosis with cavity formation. In some instances there is certainly a tuberculous process ingrafted, but that large excavations may occur, or in other instances bronchiectasis without the presence of bacilli, I have convinced myself by the examination of several characteristic specimens.

The *siderosis* induced by the oxide of iron causes an interstitial pneumonia similar to anthracosis. Workers in brass and in bronze are liable to a similar affection.

*Chalicosis*, due to the deposit of particles of silice and alumina, is found in the makers of mill-stones, particularly the French mill-stones, and also in knife and axe grinders and stone-cutters. Anatomically, this form is characterized by the production of nodules of various sizes, which are cut with the greatest difficulty and sometimes present a curious grayish, even glittering, crystalloid appearance.

Workers in flax and in cotton, and grain-shovellers are also subject to these chronic interstitial changes in the lungs. In all these occupations, as shown by Greenhow, to whose careful studies we owe so much of our knowledge of these diseases, the condition of the lung may ultimately be almost identical.

The *symptoms* do not come on until the patient has worked for a variable number of years in the dusty atmosphere. As a rule there are cough and failing health for a prolonged period of time before complete disability. The coincident emphysema is responsible in great part for the shortness of breath and wheezy condition of these patients. The expectoration is usually muco-purulent, often profuse; in a case of anthracosis, very dark in color—the so-called “black spit”; in a case of chalicosis there may be seen under the microscope the bright angular particles of silica.

Even when there are physical signs of cavity tubercle bacilli are not necessarily, and indeed in my experience they are not usually present. It is remarkable for how long a time a coal-miner may continue to bring up sputum laden with coal particles even when there are only signs of a chronic bronchitis. Many of the particles are contained in the cells of the alveolar epithelium. In these instances it appears that an attempt is made by the leucocytes to rid the lungs of some of the carbon grains.

The *diagnosis* of the condition is rarely difficult; the expectoration is usually characteristic. It must always be borne in mind that chronic



bronchitis and emphysema form essential parts of the process and that in late stages there may be tuberculous infection.

The *treatment* of the condition is practically that of chronic bronchitis and emphysema.

### IX. NEW GROWTHS IN THE LUNGS.

**Etiology and Morbid Anatomy.**—While primary tumors are rare, secondary growths are not uncommon.

The primary growths of the lung are either encephaloid, scirrhous or epithelioma. Recent observations show that the latter is the most common form. Sarcoma also is occasionally found as a primary growth, and still more rarely enchondroma.

The secondary growths may be of various forms. Most commonly they follow tumors in the digestive or genito-urinary organs; not infrequently also tumors of the bone. There may be encephaloid, scirrhous, epithelioma, colloid, melano-sarcoma, enchondroma, or osteoma.

Primary cancer or sarcoma usually involves only one lung. The secondary growths are distributed in both. The primary growth generally forms a large mass, which may occupy the greater part of a lung. Occasionally the secondary growths are solitary and confined chiefly to the pleura, as in a remarkable example which came under my observation, in which the disease was secondary to a myelo-sarcoma of the wrist. The tumor mass occupied a large portion of the left side of the thorax. It grew from the pleura and extended only slightly into the lung, which was compressed and airless. The metastatic growths are nearly always disseminated. Occasionally they occupy a large portion of the pulmonary tissue. In a case of colloid cancer secondary to cancer of the pancreas, I found both lungs voluminous, heavy, only slightly crepitant, and occupied by circular translucent masses, varying in size from a pea to a large walnut.

There are numerous accessory lesions in the pulmonary new growths. There may be pleurisy, either cancerous or sero-fibrinous. The effusion may be hæmorrhagic, but in 200 cases of cancer, primary or secondary, of the lungs and pleura analyzed by Moutard-Martin, hæmorrhagic effusion occurred in only twelve per cent. The tracheal and bronchial glands are usually affected, the cervical glands not infrequently, and occasionally even the inguinal.

The disease is most common in the middle period of life. The primary form affects the sexes equally, but secondary cancer is much more frequent in women than in men. The conditions which predispose to it are quite unknown. It is a remarkable fact that the workers in the Schneeberg cobalt mines are very liable to primary cancer of the lungs. It is stated that in this region a considerable proportion of all deaths in persons over forty are due to this disease.

**Symptoms.**—The clinical features of neoplasms of the lungs are by no means distinctive, particularly in the case of primary growths. The patient may, indeed, as noted by Walshe, present no symptoms pointing to intrathoracic disease. Among the more important symptoms are pain, particularly when the pleura is involved; dyspnoea, which is apt to be paroxysmal when due to pressure upon the trachea; cough, which may be dry and painful and accompanied by the expectoration of a dark mucoid sputum. This so-called prune-juice expectoration, which was present ten times in eighteen cases of primary cancer of the lung, was thought by Stokes to be of great diagnostic value.

In many instances there are signs of compression of the large veins, producing lividity of the face and upper extremities, or occasionally of only one arm. Compression of the trachea and bronchi may give rise to urgent dyspnoea. The heart may be pushed over to the opposite side. The pneumogastric and recurrent laryngeal nerves are occasionally involved in the growth.

**Physical Signs.**—The patient, according to Walshe, usually lies on the affected side. On inspection this side may be enlarged and immobile and the intercostal spaces are obliterated. This is more commonly due to the effusion than to the growth itself. The external lymph-glands may be enlarged, particularly the clavicular. The signs, on percussion and auscultation, are varied, depending much upon the presence or absence of fluid. Signs of consolidation are, of course, present; the tactile fremitus is absent and the breath-sounds are usually diminished in intensity. Occasionally there is typical bronchial breathing. Among other symptoms may be mentioned fever, which is present in a certain number of cases. Emaciation is not necessarily extreme. The duration of the disease is from six to eight months. Occasionally the disease runs a very acute course, as noted by Carswell. Cases are reported in which death occurred in a month or six weeks, and in one instance—Jaccoud—the patient died in a week from the onset of the symptoms.

**Diagnosis.**—In secondary growths this is not difficult. The development of pulmonary symptoms within a year or two after the removal of a cancer of the breast, or after the amputation of a limb for osteo-sarcoma, or the onset of similar symptoms in connection with cancer of the liver, or of the uterus, or of the rectum, would be extremely suggestive. In primary cases the unilateral involvement, the anomalous character of the physical signs, the occurrence of prune-juice expectoration, the progressive wasting, and the secondary involvement of the cervical glands are the important points in the diagnosis.