

being drawn into the mediastinum and thence passing to the pleura.

An extremely rare form of pneumothorax has been recently proved to result from the action of gas-forming bacteria, particularly the bacillus capsulatus aerogenes. Cases of this nature have been recorded by Levy and A. G. Nicholls.

Communication between one of the hollow abdominal viscera and the pleura is occasionally set up by suppurative processes, or by the ulceration of malignant growths, especially of the colon or stomach. Ulcers of the œsophagus, simple or malignant, occasionally open into the pleura and allow of the entry of air. A remarkable case has been recorded by Laache in which a fish bone, accidentally swallowed, induced a pneumothorax by penetrating the œsophageal wall. The condition is most frequent between the ages of twenty and thirty, thus corresponding with the greater incidence of tuberculosis in young adults. It is again more common in the male than in the female sex, and is about twice as frequent on the left as on the right side.

MORBID ANATOMY.—In the majority of cases the whole pleural cavity is affected, with perhaps the exception of a few adhesions at the apex. To determine the presence of pneumothorax a small opening in the thorax may be made; a rush of escaping air is a sure sign of the condition, but this occurs only with a positive pressure. Fowler advises the removal of the intercostal muscles over one or more interspaces. If the parietal pleura is not thickened, the visceral layer can be seen through it; if it is, a small opening is made and there is no difficulty in determining if the two pleural layers are separated by an air space. The lung is collapsed and flattened against the spine, while the diaphragm with the liver and spleen is depressed and the mediastinum displaced to the opposite side. The opening in the lung is usually of small size, and if not apparent is readily discovered by blowing air through the bronchus, the lung being held under water. Exceptionally the opening is large and may attain the size of 2 or 3 cm. In most instances the perforation is situated in the upper lobe, more particularly its mid-lateral aspect, and in a few instances two or more openings are present. The opening in the pleura is usually found at autopsy, even after a period of weeks or months. Exceptionally it closes, and it has even been found obliterated in the course of a few days.

The condition of the pleura varies considerably. In a few instances, when death occurs in a few hours, it is normal, but most commonly it becomes infected and is covered by a layer of lymph of varying thickness. Although fluid is absent in a few cases, there is usually a sero-purulent or purulent exudate, varying in quantity from 100 c.c. to several litres. In traumatic cases there is pure blood. In 30 cases examined post mortem, 11 were purulent, 17 sero-fibrinous, 1 hemorrhagic, and 1 putrid (Weil). Rose, however, found a preponderance of purulent cases, 10 out of 19 being of this character, 7 serous, and in 2 fluid was absent.

SYMPTOMS.—The onset is abrupt, and usually marked by intense catching pain in the side together with dyspnoea. Troublesome and incessant cough is sometimes present, and is usually the result rather than the cause of the malady. The symptoms may come on spontaneously or even during sleep, but are sometimes the result of cough or other straining effort. Occasionally a feeling of something giving way is experienced at the onset.

The pain is often of an extremely violent character. It is increased by the respiratory movements, and is often accompanied by fainting sensations, profuse sweating, and a small, thready pulse. Giddiness, syncopal attacks, and even loss of consciousness are occasionally seen.

Dyspnoea sets in with the pain. There is a feeling of oppression and breathlessness, while the respirations are short and increased in rate, sometimes rising to 60 or 80 to the minute. There is frequently an increasing dyspnoea owing to increasing pressure of air admitted by a valvular opening. The face is anxious and pallid and

there are signs of cyanosis in the lips, cheeks, and extremities.

The onset is not always so dramatic in character. The initial pain and dyspnoea may be less severe and in a few instances entirely absent.

Breathlessness is usually marked on exertion, and may increase as fluid collects in the thorax. In advanced tuberculosis the onset may be latent, owing either to obliteration of a large part of the sac from adhesions, or to extensive disease of the lung having destroyed its respiratory function.

In rare instances double pneumothorax has occurred, and Rose has collected fourteen instances from the literature (Rose, *Deut. med. Woch.*, 1899). It is inevitably immediately or rapidly fatal, although in one instance the patient survived for a week. Recurrence of pneumothorax has been recorded by West and others.

With severe dyspnoea the patient is sometimes obliged to assume a raised position in bed, often lying obliquely on the healthy side, a posture which affords some relief to pain.

The temperature often falls at the onset, especially when the symptoms of shock are severe. Subsequently its course is influenced by the secondary pleurisy, or by the underlying tuberculosis.

An accumulation of fluid follows rapidly at the onset in by far the greater number of cases, although in a few instances it is entirely absent.

The presence of fluid depends on infection of the pleura, and in a number of those rare instances resulting from emphysema, in which infection is least likely to occur, its absence has been noted.

With serous fluid the quantity may remain moderate in amount, but more often, if the patient survive for any length of time, it gradually increases in quantity and requires removal owing to increasing dyspnoea. This procedure in chronic cases may be repeated a number of times as the exigencies of the case require. During the intervals there may be periods of comparative health, and, should the fistula heal, the lung expands and cure results. Unfortunately, it is only in rare instances that such a fortunate termination is attained.

When the fluid is purulent the course is more rapid, death resulting from sepsis and exhaustion. In a few cases the symptoms become quiescent and the patient can get about and attend to light duties.

Hæmopneumothorax is seen particularly in traumatic cases. In a recent case of Pitt's a fatal issue resulted from the rupture of an emphysematous bleb with probable tearing of pleural adhesions.

PHYSICAL SIGNS.—These are very striking and in most instances unmistakable. Inspection reveals a marked fulness of the affected side of the chest, seldom seen to the same extent in other conditions. The infraclavicular fossa and mammary region are distended and the intercostal spaces are full and wide, while expansion is entirely absent or greatly diminished. The extraordinary muscles of respiration are called into play, the veins of the neck are full and distended, and a transient œdema of the hand on the affected side has been occasionally seen.

Palpation reveals marked diminution or absence of fremitus, a point of some importance in the distinction from a large cavity. Although the liver or spleen is depressed, according to the side affected, the organ is seldom felt below the costal border.

Percussion gives a full, deep, resonant, and drum-like note, often having a tympanitic or even an amphoric character, and extending beyond the normal limits of the lung, particularly anteriorly, where fluid is less likely to be present. This note extends to the opposite sternal border; on the right side it may reach the costal border, and on the left side it replaces the area of cardiac dullness. Posteriorly a similar note is heard, becoming dull on reaching the level of fluid. In some instances, Osler states that a dull note is present over the lung, due to greatly increased pleural tension. This is certainly rare, and both Fowler and West state they have never heard it. The level of dullness at the base alters readily with

change of posture, and much more noticeably than in pleurisy. Owing to the large space at the base of the thorax occasioned by the descent of the diaphragm, a large collection of fluid may be present with a very limited area of dullness.

Auscultation reveals greatly enfeebled or absence of respiratory sounds, or there is a marked amphoric or metallic character. The amphoric character may be heard over only a small area, and may be present at one examination and disappear at the next. It is heard both with closed and with open fistulae, and is consequently not due to air entering and leaving the pleura, but rather to a modification of the sound generated at the glottis and transmitted through an air-containing chamber.

A series of signs, known as metallic phenomena, are very characteristic. Râles when present have a tinkling metallic quality, and the voice sounds and cough have a hollow echoing character. The coin test, brought out by percussing anteriorly with two coins, one of which is used as a pleximeter, and at the same time listening with the ear or stethoscope on the back, yields a ringing and metallic sound.

Hippocratic succussion is the splashing sound induced by shaking the patient. In order to hear this sound it is usually necessary to place the ear against the chest, but it is sometimes heard at a short distance from the patient, and is distinctly heard by the affected individual. This sound is present only with air and fluid in the thoracic cavity and is never heard in an ordinary pleurisy.

Marked displacement of the organs is important evidence of the disease. The heart is displaced toward the opposite side, the organ being seen and felt to the right of the sternum with left-sided disease, and beyond the left nipple when the right lung is perforated. The liver and spleen are displaced downward, but can seldom be felt below the costal border.

DIAGNOSIS.—The physical signs of a well-marked case are so distinctive that their significance is usually obvious. Fulness and immobility of one side, the altered percussion note, the feeble and amphoric breathing, metallic phenomena, succussion, and cardiac displacement make up a very characteristic combination of physical signs.

A sudden onset with dyspnoea and pain frequently suggests the nature of the disease, especially when evidence of previous pulmonary tuberculosis is obtained. Localized cases are readily overlooked and here the diagnosis rests chiefly on the physical signs. Very exceptionally a large quantity of fluid may mask the presence of air, which is recognized only after aspiration and withdrawal of fluid. Large cavities, particularly those rare cases of almost total excavation of the lung, sometimes cause difficulty in diagnosis. The percussion resonance, however, is often dull, the vocal resonance is increased rather than diminished, the coin sound is heard only in rare instances, there is flattening rather than fulness of the affected side, the heart is not displaced, and succussion is very seldom present.

After severe injuries rupture of the diaphragm with the escape of the abdominal viscera into the thorax may precisely simulate the signs of pneumothorax and render a correct diagnosis impossible. In pyopneumothorax subphrenic tympany, metallic phenomena, and succussion may all be present. The tympanitic note is, however, present in the lower costal region, and is limited above by a line curved upward, representing the line of the diaphragm. Pulmonary resonance, often of tympanitic character, but differing in tone from that from the cavity below, is present at the upper part of the thorax, while vesicular breathing is also audible at the apex.

A history of gastric ulcer or of other abdominal disease is also suggestive of a subdiaphragmatic origin.

Rupture of a subdiaphragmatic abscess into the pleural cavity renders recognition of the primary condition difficult or impossible. In one such case under my care the difficulty was still further increased by the lower part of the pleura, which communicated with a subdiaphragmatic cavity, being shut off by a circular ring of adhesion.

PROGNOSIS.—The immediate prognosis is based on the degree of dyspnoea and the characters of the pulse. According to West the mortality is about seventy per cent. Saussier's figures give the higher rate of ninety per cent. The greater number of deaths occur within the first few days of the disease, nearly one-half dying within the first week. Of the cases fatal during the first fortnight, one-third succumbed on the first day (West: *Med. Soc. Trans.*, vol. xxi., *Lancet*, 1897).

Death usually results from suffocation and may occur within a few minutes of the onset. Rare cases have been recorded as proving immediately fatal from shock. When the patient survives the danger of the earlier stage, the exhaustion resulting from empyema or from advancing tuberculous disease frequently proves eventually fatal. It has been estimated that from ten to twenty per cent. of the cases terminate in recovery.

Among conditions which render the outlook favorable are good general strength, an absence of disease in the opposite lung, and the failure of fluid to collect in the affected pleura. The cause of the disease must be taken into consideration. Tuberculous cases are usually the most serious, while those resulting from empyema or injury frequently run a more favorable course.

TREATMENT.—The immediate treatment of pneumothorax consists in the hypodermic injection of morphine. By this measure pain, cough, and dyspnoea are alleviated and the anxiety and distress of the patient greatly lessened. Local applications of hot fomentations or poultices will also give some relief.

To combat shock and feeble cardiac action hypodermics of ether are useful, and they may be followed by the administration of strychnine and alcohol. The inhalation of oxygen has also proved of benefit.

When dyspnoea is a marked symptom, withdrawal of air through a small needle may be tried. Owing to the fistula in the lung remaining open this usually proves of only temporary benefit, and in such instances the needle may be left in for some days, covered with an aseptic dressing. There is sometimes an escape of air into the subcutaneous tissues along the track of the needle, and in withdrawing it pressure should be kept up for a few minutes over the site of puncture to avoid this accident. When fluid collects, an exploratory puncture should be made to determine its character. If serous it may be removed when the quantity is so considerable as to cause dyspnoea.

When pus is present, considerable difference of opinion exists as to the best method of procedure. When it is due to trauma or empyema there can be no doubt that free draining should be established.

In tuberculous cases, when the symptoms are not urgent, a waiting policy is often more satisfactory than active interference. If, however, the quantity of fluid is large and dyspnoea becomes marked, something must be done for its relief. Aspiration may be tried first, and should the fluid rapidly collect, a free incision and drainage should be established. Excellent results have followed in a few cases, and it is surprising in these how the lung may expand and the cavity gradually close. When the pus is fetid free evacuation is imperative, offering as it does the only chance of improvement.

Frederick G. Finley.

LUNGS, DISEASES OF: SYPHILIS. See *Syphilis*.

LUNGS, DISEASES OF: TUBERCULOSIS.—**ETIOLOGY.**—There are two factors in the causation of pulmonary tuberculosis which have a practical bearing on the subject, namely, the tubercle bacillus and the resisting power of the lung tissue with which it comes in contact. The bacilli are essentially the cause, and, if in sufficient numbers, of marked virulence, and properly introduced, the result would be tuberculosis in practically every case. Fortunately these conditions rarely obtain, and so the resisting power of the individual becomes the more important clinical element as compared with the bacilli to which we are nearly all exposed. How the

bacilli enter the body is still an open question, but authorities are generally agreed that the main channel is via the respiratory tract, less commonly through the blood and lymph channels, the skin, alimentary canal, etc. Direct hereditary transmission can occur, but is rare unless we grant that in many cases it remains latent for a very long time. Of 15,400 calves killed at the Berlin abattoir there were only 4 instances of tuberculosis (Osler). Hereditary predisposition cannot be doubted. In 1,000 cases collected by Dr. Theodore Williams we find that 12 per cent. showed tuberculosis in the parents and 48 per cent. in some member of the family. House infection is also a cause, especially if the bacilli are not exposed to light and air and are allowed to be scattered as dust throughout the rooms. There is some evidence, necessarily incomplete, which shows that direct transmission from man to wife or mother to child has occurred where carelessness concerning the disposal of the sputa existed. The contagiousness of the disease has, however, of late, been overrated and has caused undue alarm and much inhumane separation of relatives. It is a wonder that the coincidences of one case following another have not been more frequent when we consider the prevalence of the disease.

Among the predisposing causes may be mentioned a run-down condition which follows some of the acute infectious diseases, such as measles, typhoid, and influenza, also frequent pregnancies, prolonged lactation, excessive worry, and diabetes. Improper nourishment, chronic alcoholism, lack of sunlight and fresh air, occupations which expose the lungs to injury, such as glass-blowing and stone-cutting, are also undoubted predisposing factors. Sex seems to have but little influence on the general mortality, although we find that in females the tendency is manifested earlier. Dr. Wilson Fox gives the following table from Dr. Ogle's statistics (quoted by Fowler and Godlee):

	Males.	Females.
Under 1 year	1,034	993
5 years	432	491
10 "	616	1,061
15 "	2,088	3,008
20 "	3,676	3,798
25 "	3,941	4,165
35 "	4,067	3,826
45 "	3,850	2,812
55 "	3,274	2,075
65 "	2,112	1,332
75 " and upward.....	730	523
All ages	2,418	2,428

PATHOLOGY.—No organ in the body undergoes such manifold changes from tuberculosis as do the lungs. Hence any classification must be either too burdensome or in part unsatisfactory. It must be remembered that clinically these forms may be associated. Although the general pathology of tuberculosis is described more fully elsewhere, we must pay some brief attention to its effects in the lungs along with the different clinical pictures.

Acute miliary tuberculosis is caused by an invasion of the tubercle bacilli into various organs—the lungs, pia mater, lymph nodes, spleen, kidney, bone marrow, etc. This invasion may be primary, but more often is due to some older focus of tuberculous inflammation not always discovered. In the lungs we find a general distribution of miliary tubercles which are softer or harder, larger or smaller, gray or yellow, in accordance with the acuteness of the process. They are distributed in the parenchyma of the lung, in the septa, in the walls of the bronchi and blood-vessels, and on the pulmonary pleura.

These tubercles may quite replace the lung tissue, or still leave visible the outlines of the air vesicles. If the walls of the bronchioles or air passages become infiltrated the adjacent air vesicles soon become affected. These nodules caseate in the centre as time goes on. The lungs are increased in size and are hyperæmic, while the bronchi are congested and coated with mucus. The bronchial glands are swollen and may caseate. The other organs

show changes described elsewhere, and of course greatly modify the clinical picture.

The onset of the disease varies; it is generally a gradual one but sometimes is very acute. The patient becomes languid, feels ill, suffers from anorexia, nausea, or vomiting. The tongue is coated, the bowels are generally constipated, less often diarrhoea is present. The spleen enlarges. Fever increases and assumes the remittent, intermittent, or continuously high type. Sometimes an exanthematous rash appears. Cough, cyanosis, dyspnoea, emaciation, and anæmia precede the stupor and delirium which are closely followed by death, generally within a month from the onset of the severe symptoms. The disease may be fatal within a few days or may last a few

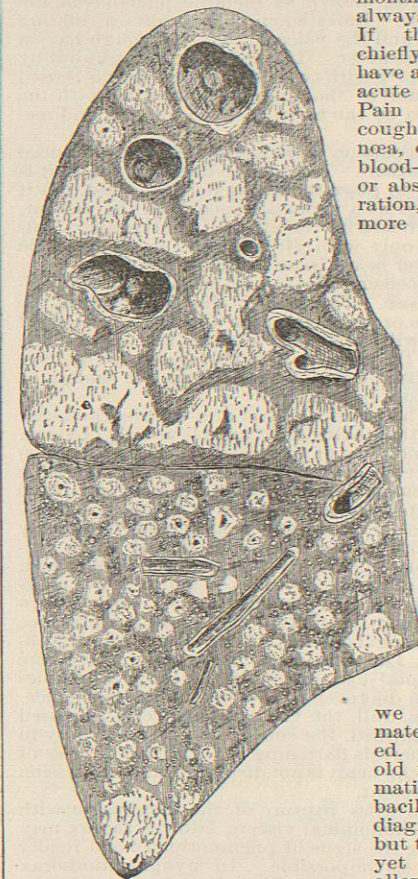


FIG. 3254.—Section of Left Lung from a Case of Rapid Pulmonary Tuberculosis. The upper lobe contains large patches of caseous pneumonia, some of which have softened, resulting in the formation of cavities. In the lower lobe smaller areas of caseation are found, generally with an occluded bronchus in the middle and, around these, miliary tubercles. The infection of the lower lobe is secondary to that of the upper. (One-half natural size.) (From W. T. Councilman.)

typhoid fever, a pulse which is rapid in proportion to the fever and seldom dicrotic. Rarely is there any nosebleed. Tuberculosis of the choroid if detected is of course decisive.

Treatment is symptomatic. Food should be light and

months, but probably always ends in death. If the lesions are chiefly in the lungs we have a resemblance to acute pneumonia. Pain in the side, cough, cyanosis, dyspnoea, expectoration of blood-streaked mucus, or absence of expectoration, all point to the more common disease and may easily lead us astray.

The physical signs are not definite and are dependent upon the old or recent consolidation, the inflamed bronchi and pleura. There may be no discharge of bacilli in the sputa to confirm a diagnosis. Often the accompanying meningitis (*q. v.*) makes us suspect the disease or so completely masks all other symptoms that

we think the pia mater alone is affected. Sometimes an old focus of inflammation will discharge bacilli and render a diagnosis possible, but the tubercles not yet softening do not allow their escape. The special points leading to an interpretation are the cyanosis, the irregular fever, often with normal temperature in the morning, absence of marked roseola, diarrhoea, and other intestinal symptoms such as occur in typhoid fever.

abundant, stimulants should be given in accordance with the weakness, and baths administered for the purpose of reducing temperature. In the meningeal forms iodide of potassium and mercury with iodoform inunctions are employed. The prognosis is absolutely poor.

Subacute Miliary Tuberculosis of the Lungs.—The lesion varies in extent, being confined to a portion of one lobe, or scattered throughout both lungs. It is generally located near the apex where it may be limited, or it may extend, particularly to the apex of the other side or to the apex of the lower lobe. The tubercles are like those of the acute form, but are harder and smaller. Due to the irritation of their presence a local catarrhal bronchitis, less often a pleurisy,

and rarely an exudative pneumonia, accompany the specific inflammation. The lesion may heal, remain latent, or progress. The severity of the symptoms varies with the extent of the lesion and the activity of the process. In the milder cases the patient feels languid, is ill disposed to exertion, tires readily, loses appetite, and becomes somewhat anæmic. In women amenorrhœa may attract attention first. There is a little cough, which persists, and is accompanied by a scanty expectoration of mucus. Sometimes it is only a dry cough. The bacilli may be found in the sputa of some but not all of these cases. Hemoptyses of varying amounts are often noticed, but are also often absent. Gradually emaciation and asthenia ensue, and the disease progresses more or less rapidly, or tends to recovery, or goes on to the chronic type. Night sweats and afternoon fever increase as the disease goes on. Pain in the side, dyspnoea, on exertion especially, cyanosis, and increased expectoration may also be noticed later. The duration may be months or years, the course may be continuous or intermittent.

The physical signs are to be specially sought at the apex. They may be entirely absent or indefinite. A few localized râles, slight dullness, and incomplete expansion may be demonstrated. The vesicular murmur is changed in character, being diminished in intensity or harsher, or with prolongation of the expiration. It may assume the cogwheel type. In other words, what changes are produced are due to the loss of elasticity in the affected area, to the pleurisy, bronchitis, and the consolidation.

Chronic Miliary Tuberculosis shows changes which are modified by the chronicity of the process. The miliary tubercles are harder and may form the sole lesion. They are more apt to undergo cheesy degeneration due to the lack of blood supply and the specific poison of the bacillus. They may be scattered irregularly throughout the lungs, but the lesion is usually most marked at the apices. These tubercles coalesce and form caseous masses, which break down and form cavities. The walls of the bronchioles inflame and become partially destroyed, allowing the formation of bronchiectatic cavities. Bronchitis is present at the diseased portions. In parts there may be connective-tissue changes, involving the pleura, the lungs, or both. Portions not directly affected may show dilated air spaces. The symptoms, physical signs, etc., of this form will be considered along with chronic phthisis.

Acute Pulmonary Phthisis.—By the term "phthisis" we mean that a non-tuberculous inflammation accompanies the specific process. The acute form is often found in children and young adults with a marked tuberculous predisposition. The areas of consolidation are peribronchial and surrounded by congested portions. If the process extends rapidly, we have a general involvement of the lung tissue from the smaller areas running together. The microscope shows miliary tubercles together with the filling of the air vesicles with the prod-

ucts of exudation. This is noticed particularly in the walls of the bronchi and in the air spaces about them. These areas may undergo cheesy degeneration and death, with a casting off of the diseased portion, thus forming ragged cavities with but little tendency to form an organized wall. Over the affected parts the pleura is in-

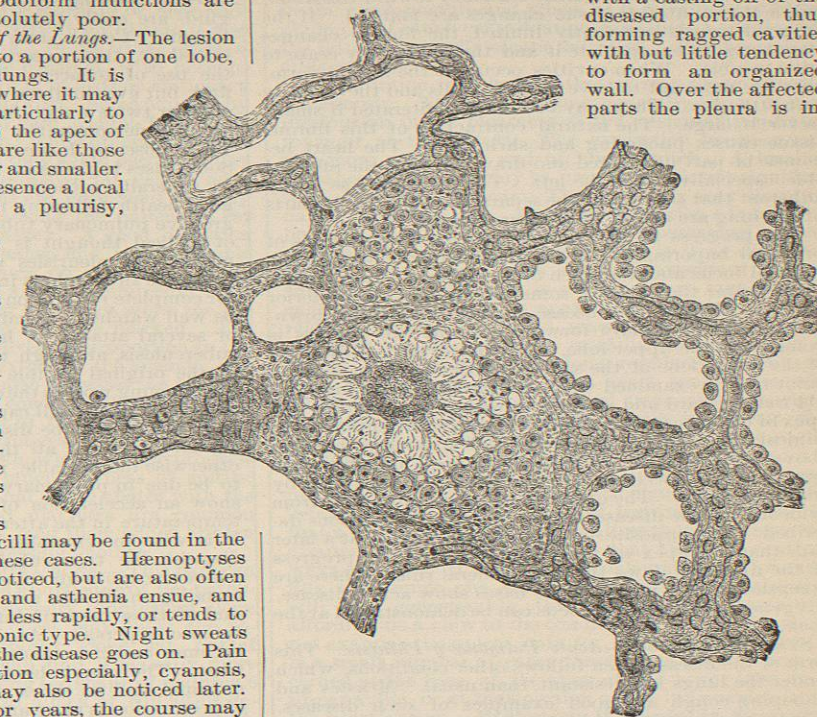


FIG. 3255.—A Miliary Tubercle Involving only Two Air Vesicles, of which the Walls are Infiltrated and the Cavities Filled with Tubercle Tissue. X 300 and reduced. (From Delafield and Prudden.)

flamed and coated with fibrin or recent adhesions. The bronchi show the changes of a catarrhal inflammation and may dilate and open into the cavities. The bronchial glands are often caseous.

Subacute Pulmonary Phthisis.—The process being less acute, confluence of the affected areas is less apt to occur, and time for some fibrous changes is allowed. Complete calcification or encapsulation may be noted. The area may be converted into a fibrous mass which may or may not give future trouble. The symptoms are not so acute. There is cough with expectoration which may be accompanied by blood. Tubercle bacilli are rarely absent. Anæmia, anorexia, emaciation, asthenia, fever, and night sweats are present. The cases progress steadily, intermittently, or heal, or become chronic in type. Under examination the lungs will be found to show dullness, subcrepitant râles, and increased tactile fremitus at their apices. The voice and breathing become gradually more bronchial in character, although if the bronchi are occluded we get incomplete and diminished breath sounds. The pleurisy, bronchitis, fibrous tissue, and cavities give their appropriate signs.

Chronic Phthisis.—The lesions resemble those of the more acute forms, but the chronicity of the process allows greater time for the formation of connective tissue and of large cavities. The pleura may be firmly adherent. The fibrous changes in the lung may extend to the point of causing the lung to appear a mass of dense tissue with cavities interspersed. The cavities may be walled by the ulcerating lung tissue or by fibrous tissue, and extending through them are cords formed by obliterated blood-

vessels and trabeculae of lung tissue. In the vessels of the cavity wall may be seen aneurismal dilatations, from which the larger hemorrhages are apt to occur. In the fibroid form there is but little tendency toward caseation, while the connective-tissue changes are marked. If the original area is sufficiently limited, the fibrous changes may serve to encapsulate it and the lesion may cease to give trouble. When cavities occur in the fibroid form, they are more apt to have smooth walls and they secrete but little pus. They may be almost obliterated if small, never if large. The natural contraction of this fibrous tissue causes puckering and shrinkage. The heart becomes in part uncovered and drawn toward the affected side, especially if it is the left. The pleurae are so firmly adherent that they cannot be separated. The sound parts of the lung are apt to be emphysematous.

The progress of the lesions in a case of phthisis is of practical importance. In the vast majority we find the original focus about an inch or so below the apex, sometimes nearer the anterior, sometimes nearer the posterior portion. Thence the disease spreads backward, downward, and less rapidly forward. While this process is going on in the upper lobe, the posterior part of the apex of the lower lobe of the same side becomes affected at a point readily examined when the patient draws his scapula well forward and slightly upward, thus exposing the apex of the lower lobe. Fowler has drawn attention to the clinical importance of examining this area when the signs above are doubtful. Subsequently areas of infiltration appear in the lower parts of the lobes, but separated by crepitan tissue. The extreme bases are quite free from evidences of the disease as compared to the portions described. The opposite lung is affected usually at a later date than the apex of the lower lobe, and the progress of the disease follows the same general rule. There are exceptional cases in which the bases show active disease, but generally an original focus can be demonstrated at the apex.

SYMPTOMATOLOGY.—Acute Pulmonary Phthisis. This form of the disease often follows other conditions, which render the lungs less resistant than usual. Measles and whooping-cough are good examples of such diseases. It may be apparently primary or may follow a limited tuberculosis of a chronic character elsewhere in the body. The onset is often acute and may resemble an acute lobar pneumonia. Chill, stitch in the side, fever, rapid pulse, cough, dyspnoea, and prostration naturally might be a group of symptoms which would be taken for the more common disease. The lungs give the signs of consolidation, dulness, bronchial breathing and voice, and crepitations. The accompanying bronchitis and pleurisy give their appropriate signs. Hæmoptyses of varying extent often usher in the disease. Unlike a pneumonia, however, the expected crisis does not occur. The patient has sweats which later are profuse. Emaciation is quite rapid and asthenia is marked. The sputa become mucopurulent and ordinarily contain tubercle bacilli after softening has begun. Elastic tissue may be demonstrated as the disease becomes advanced. Cavities form, generally at the apex, and possibly a pneumothorax may add to the distress of the disease. Death after a few weeks or a couple of months is the ordinary termination. Rarely do these patients last for as long a time as four months except in the few cases in which the disease gradually subsides and assumes the chronic type. "If the inflammation is limited to the lower lobe, the quantity of the tubercular inflammation small, with no areas of coagulation necrosis or bronchiectasiae, then the inflammatory products may be absorbed, the lung return nearly to its normal condition, and the patient recover" (Delfield).

Chronic Forms of Pulmonary Tuberculosis.—The disease may begin in various ways. Possibly without any impairment of the general health the first symptom noticed is the expectoration of blood. There are certainly patients who deny that any other change from normal has been noticed, and in whom nothing can subsequently be detected. They may, in fact, become per-

fectly healed. In these hæmoptœic cases we must realize that the tuberculosis preceded and was not the effect of the hemorrhage. On the other hand, the majority show a lowering of the general health. They feel languid, are easily tired, have no appetite, and have lost weight. Cough may have been noticed but is ascribed to other reasons, such as pharyngeal catarrh or the use of tobacco. Expectoration may be absent at first, but eventually a small amount of mucus is raised once or twice a day, and in it tubercle bacilli may usually be demonstrated and thus settle the diagnosis. Their absence, however, must not lull our suspicions. Some cases begin as an apparently simple pleurisy, with or generally without effusion, and, after an interval of good health following recovery, go on to a chronic progressive pulmonary tuberculosis. The general tendency of medical thought is toward believing that the great majority of pleurisies which have no definitely known cause are tuberculous in origin, but with a good chance for complete restoration to health. These patients should be well watched. Again, some cases furnish an attack, or several attacks, of laryngitis as the first evidence of tuberculosis, although the lung is nearly always the site of the original trouble if we could but detect it. In many young women the development of anæmia, and later of amenorrhœa, will cause them to seek medical advice, and then it will be discovered that tuberculosis is the primary cause of all the trouble. Digestive disorders, otherwise inexplicable, may, in some instances, be found to be due to pulmonary trouble. As a rule, most cases show an acceleration of the pulse and a slight rise of temperature in the afternoon or evening. In old people it is wise to remember that emphysema may serve to disguise the tuberculosis, and it is a safe rule to examine the sputa for tubercle bacilli as a routine measure, certainly in all who are losing flesh. The same may be said of those cases of influenza in which the respiratory symptoms persist. As the disease progresses the picture becomes easier to understand, but far more difficult to treat. The cough becomes more persistent, often paroxysmal, and at times accompanied by vomiting. The expectoration is more and more abundant and in it bacilli are more easily demonstrated. The amount may reach a half pint or more in twenty-four hours, in the advanced cases. The sputa are rarely offensive in odor when fresh, unless bronchiectasis or gangrene exists. Elastic fibres may be demonstrated. In the fibroid form of tuberculosis the bacilli are sometimes absent at intervals. Hemorrhages, so much dreaded by the patient, vary in extent from blood-streaked sputa to one or more pints. These may come on after exertion or when the patient is at rest. They occur in about half the cases. The origin of the blood is at the congested areas or from the branches of the pulmonary artery which undergo erosion. They would be more frequent were it not for the occlusion of these vessels by thrombosis. Small aneurismal dilatations of these arteries may also burst and cause bleeding. If the hemorrhage is followed by an increase in fever, it is generally due to a further invasion of the lung. Fever is regularly present; even in the almost latent form some rise at some time can be shown by the thermometer. In the fibroid form the temperature is often subnormal. The fever may be intermittent, remittent, or of the inverse type, *i. e.*, higher in the morning than in the evening. It is a very good index of the activity of the disease, although toward the end we fail to obtain any high readings of temperature; but the evident increasing exhaustion will serve to show that the fever's decrease is not due to improvement. The weakness of the patient regularly varies with the acuteness or the duration of the disease. In the sharp attacks the lesions may be indefinite, yet the patient is far sicker than in the chronic form, in which there are fairly well-marked signs. Of course the steady progress of the disease is accompanied by a commensurate asthenia, and eventually the patient becomes bedridden. Chilliness, more rarely a rigor, may be noticed as the fever rises daily. Night-sweats are present in nearly all the advanced

cases and in some of the earlier ones. They occur with the fall of temperature, and by some are ascribed to the accumulation of CO₂ in the blood, from disturbance of respiration during sleep, and by some to the toxæmia. They occur generally in the early morning or near midnight. A good index of the activity of the disease is also to be found in the loss of weight. In the usual progressive case it is gradual but fairly constant, with perhaps intervals of quiescence, allowing it to become stationary or even at intervals to increase slightly. Some patients by careful feeding may be made to gain weight for a time, yet the disease appears to go on; while others who have become apparently cured, when they again become active workers, lose some of their accumulated fat, yet are none the worse. Digestive symptoms are prominent in many cases, anorexia and vomiting causing the patient to eat so little that semi-starvation ensues. A good digestion gives the patient a fighting chance and is a favorable element in prognosis. Dyspnoea on exertion is very common and in advanced cases always prominent. It is remarkable how little air hunger is present when the patient is at rest, even when the lesion is marked. The respiration rate is hurried, however, in proportion to the amount of lung involved, the extent of the anæmia, and the degree of asthenia. Fever also increases the rapidity of the breathing. The mental condition of the patient is often sanguine in the early part of the disease, although not always. The later hemorrhages, vomiting, sweats, and, in intelligent patients, the knowledge of the progress of the trouble, often lead to much lowness of spirits. Neuritis may be present. Sexual desire abates with the strength. Pleuritic pains and diarrhœa are common symptoms. The complications lend their added burden to a disease which alone is distressing enough.

RESULTS OF PHYSICAL EXAMINATIONS.—This part can best be treated separately, but a knowledge of the pathological changes is absolutely necessary to interpret them properly. On inspection the chest may show the so-called paralytic form. The thorax looks flat, but if we measure it carefully we shall find it actually more rounded than normal, approaching the shape of children's chests and possibly being due to a lack of full adult development. The scapulae are carried forward, a condition that is due largely to the rounded posterior portion which affords a poor resting-place for them. The chest index, according to Woods Hutchinson's measurements, is about 79.5, while in the normal adult chest it is 71. This index is found by dividing the antero-posterior diameter by the transverse. Above and below one or both clavicles we may find retraction and insufficient expansion. The whole of one-half of the chest may expand but little; especially is this marked in the fibroid forms. By studying Litten's diaphragm phenomenon we also obtain evidence of adherent pleura or a loss of elasticity in the lung. Owing to the fact that the heart is somewhat uncovered in disease of the left lung, we discover that the cardiac motions are transmitted to the chest over an abnormally large area. Often the heart is displaced markedly.

Palpation serves to substantiate the points shown by inspection. We should test the tactile fremitus, which is increased over areas of consolidation and over cavities, while diminished when the pleura is thickened to any extent.

In percussion we have a most valued test of the physical condition of the lungs. In those cases in which but a few miliary tubercles exist there is sufficient air in the lung to give good resonance, but sooner or later their increased number, the occurrence of partial or complete consolidation, and pleural thickening cause a distinct comparative dulness, generally recognizable at first in the clavicular and supraspinous regions. This may be best demonstrated by percussing from below upward and comparing the corresponding interspaces of the two sides. We must make due allowance for the physiological dulness found normally at the right apex, where also the tactile fremitus is more distinct and the breathing more broncho-vesicular. Cracked-pot and amphoric notes are

generally indicative of cavities. There may be a change in pitch in the note obtained over a cavity when the patient alternately opens and shuts the mouth, and a similar difference may be noticed when the patient is percussed in the erect posture and when he is percussed while reclining. If much consolidation surrounds a small cavity the latter may easily escape detection. Emphysema also adds confusion.

Auscultation may be negative or may alone afford us a diagnosis. The early lesions generally show a slight diminution in the clearness of the vesicular inspiratory murmur at the apices. The expiration becomes more and more prolonged and of higher pitch. A localized cogwheel breathing may be present, but is not significant if no other signs appear. The breathing may simply be harsher than normal. As the consolidation advances, the bronchial quality in the voice and breathing becomes more and more manifest, yet rarely is it as distinct as in lobar pneumonia. Râles, chiefly subcrepitan, mucous, squeaking, and rubbing in character, are highly significant when confined to an apex. As softening begins the râles become moister, and when cavities are present, gurgling sounds and even metallic tinkle may be detected. The pleuritic adhesions, regularly present, give their appropriate signs. The heart sounds are often transmitted through consolidated areas with remarkable clearness. Cavernous breathing, with its hollow character and low-pitched expiration, shows the presence of an antrum, while whispered and spoken voice also indicate a reverberating cavity. Cardio-respiratory murmurs are often present, and can be distinguished by their being better heard at the end of inspiration, by the fact that a change in position often alters them or causes their disappearance, and by the fact that they are nearly always systolic. It must be remembered that, as a cavity fills with muco-pus and then empties itself, the signs will vary considerably, this very changeableness often affording us a clue to the condition present. We should not examine the apices only for signs of the disease, for in a small number of cases these signs may be best discerned at the base, at the apex of the lower lobe, in the upper axilla, or at that portion of the lung which is near the heart's apex. Radioscopy is helpful in determining the excursion of the diaphragm, the shadows of consolidation, and the light areas of excavation.

DIAGNOSIS.—This is often rendered possible only by the detection of tubercle bacilli in the sputa. On the other hand, the bacilli may be absent, or we may be unable to obtain the sputa, and yet a true clinical diagnosis can be made. In doubtful cases the expectoration should be stained and examined; and if only negative results are obtained after several trials and yet tuberculosis is suspected, we should inject a guinea-pig with some of the sputum and watch for a following tuberculosis in this most susceptible animal. We should inquire for symptoms of tuberculosis in unexplained anæmias, in chronic dyspepsia, in persistent bronchitis, in atypical pneumonias, in pleurisies, and in emphysema where there is loss of weight. On the other hand, we should not allow the physical signs and general symptoms of malignant pulmonary growths, bronchiectasis, and gangrene to lead us astray.

The exact value of the tuberculin reaction is not settled, but it may at present be considered a valuable but possibly not harmless aid in diagnosis. As a means of securing a positive or a negative proof it is not above doubt. All cases with afternoon fever, emaciation, recurrent hoarseness, or apical physical signs, however slight, should be carefully watched. The administration of potassium iodide is recommended by some authors for the purpose of making râles more evident, while others claim that in some cases this procedure will cause an extension of the disease.

TREATMENT.—In this age it is the physician's duty to prevent as well as to cure, and in tuberculosis of the lungs we have warnings in the family history and healed lesions elsewhere which warrant our taking special precautions. Children who inherit a tendency to lung dis-