

tal pleura, and a fistulous communication be opened up externally, the pus draining off, a cure being ultimately effected, or the prolonged suppuration may lead to tubercular deposit or to amyloid degeneration of the organs. A fatal peritonitis is in rare instances lighted up by the passage of ichorous matters through the agency of the lymphatics of the diaphragm. In other cases a fistulous communication is established, and the pus dissects downward along the psoas muscle, pointing under Poupart's ligament, or opens about the umbilicus, etc. Again, the pus may ulcerate into the mediastinum, into the pericardium, or into the great veins, but these are excessively rare accidents.

*Chronic pleurisy* differs only in time and extent from the acute form. In *pleuritis deformans* the exudations are of great thickness and extent, and, by adhesion and subsequent contraction, extensive deformity of the lung may result. The space left between the ribs and the lung will be filled with fluid, and, as the pleura is damaged so that absorption can not take place, encapsulation may hold the fluid months, even years. Often, indeed, the false membrane which has become organized possesses the power of pus-forming (pyogenic membrane), fistulous communications are established, and matter is discharged for years even. The chest becomes greatly deformed by shrinking, the shoulder depressed, the spine curved, and the heart pushed aside and permanently fixed in its new position.

**Symptoms.**—The symptomatology of pleurisy varies with the form. As *dry pleurisy* is the simplest form, it will be best to consider it first. This may set in with chilliness, fever, pain in the side, and dyspnoea, but more frequently there is little or no fever, no respiratory disturbance, only the pain in the side to indicate the nature of the attack. If the former symptoms are present, they do not continue longer than thirty-six to forty-eight hours; if the latter, the symptoms rarely necessitate confinement to bed. The physical signs of dry pleurisy are as follows: On inspection, the extent of the inspiratory movement is seen to be lessened by the pain—is arrested midway by a sudden start, and the body is curved a little to the affected side to avoid pressure on the inflamed membrane. On percussion, there is no change in the sonority from the normal minimum, because of the limited movement in inspiration, and if the pain is slight there will be no change in the normal maximum. On auscultation, the respiration will be feeble on the affected side, because of the pain elicited by the expansion in inspiration; and, if the pain is severe, the inspiratory murmur is rather suddenly arrested before completion, but if the pain is slight there will be no change in this respect. During the first two or three days, there will be audible on auscultation a sound due to the rubbing together of the roughened surfaces of the pleura—a *friction* or *to-and-fro rubbing sound*—synchronous with the respiratory movements, and ceasing when they are arrested. If strong and loud, this friction-

sound produces a vibration of the chest-walls, or *fremitus*, which is recognizable on palpation. Dry pleurisy terminates in two ways—by resolution, or by adhesion. When resolution takes place, the pain and fever subside, and the friction murmur gradually lessens, and finally disappears. At the apex, the friction murmur modifies into a leather-creaking sound, persists, and may be confounded with the crackling *râles* which accompany the first stage of tubercular deposition—a mistake all the more likely, since pleuritic attacks are invited to the apex by the irritation of tubercle. Dry pleurisy occurs at the side and base of the thorax. This is the origin of the adhesions found after death, consisting of firm, strong bands of connective tissue, and which excited no symptoms that attracted attention. These bands often do serious mischief by limiting the movements of the lung.

*Acute pleurisy with effusion*, the ordinary form, sets in as any other acute inflammation, with chill, general *malaise*, and fever, with pain in the side; or there is in other cases, for several days, a daily paroxysm of fever, but without any local symptom for the first few days; or, again, there are cases in which pain in the side and effusion have preceded the febrile movement. Less often than pneumonia is pleurisy announced by a decided chill; more frequently there is chilliness recurring irregularly for the first few days. The fever which follows is a continued fever, with an evening exacerbation, and continues up to the beginning of the effusion, or about eight days, with little variation. If there are rigors occurring every day, although irregularly, and persist, it is probable that the effusion is purulent, or that the pleuritis is tubercular. The type of fever is not peculiar to the disease, and is not therefore diagnostic; the temperature does not often exceed 104° Fahr., and ranges from 101° to the former point. The pain is usually acute, lancinating, circumscribed, and is increased by breathing, coughing, or abrupt movements of the body. It is felt in the outer and inferior portion of the mammary region, sometimes at the base of the thorax, occasionally in the lumbar and iliac junction, and over a space which may be covered with a finger or two. It is commonly designated “a stitch in the side.” Instead of being circumscribed, it may be diffused and ill-defined. The duration of the pain is variable; it may cease in three or four days; it may reappear after having ceased for a time; it may persist throughout the attack, and so long as it is present it affords evidence of the persistence of the inflammation. The severity and tenacity of the pain indicate the violence of the disorder. Dyspnoea is also a prominent symptom in pleuritis. Several factors are concerned. When the pain is severe, the inspiration is suppressed, shallow, and frequent; hæmatisis is accordingly impaired, and respiration is embarrassed from this cause. Fever, by increasing the waste of tissue and the excretion of carbonic acid, augments the necessity for oxygen. When effusion occurs, the

respiratory field is narrowed, and mechanical difficulties are created by the pressure. The *decubitus* of the patient is highly characteristic. Before effusion has taken place, the position on the sound side is easier, for, as Traube has pointed out, the blood gravitates from the diseased side, and thus relieves the nerves of pressure; but, when the effusion begins to compress the lung, the position on the diseased side becomes the easier. When there is extreme pressure, the patient can not lie down, and hence seeks rest in the semi-erect posture. More or less *cough* is present in pleuritis, and from the beginning. It is a suppressed cough, and is arrested in the act of inspiration by the catching pain in the side, and is again suddenly arrested in the explosion on account of the pain given by the shock. When effusion comes on, the cough declines, but when there is considerable effusion cough is induced by the attempt to take a full inspiration, or by change of position. The *expectoration* consists only of a little frothy mucus, unless bronchitis coexists, which is not unusual. As there are anorexia and more or less interference with digestion in all febrile diseases, the waste of tissue proceeds rapidly—on one side insufficient supply, on the other increased oxidation. Emaciation, loss of strength, with the accompanying depression of the nervous system, are prominent among the objective symptoms in pleuritis. The countenance has an expression of weariness, anxiety, and exhaustion, and may be pale or cyanosed. The cyanosis is present if there is much orthopnoea; but there may be more or less pallor, possibly significant of hæmorrhagic pleuritis, especially if it occurred suddenly. The urine is scanty, high-colored, has high specific gravity, and deposits urates abundantly.

Although the rational symptoms of pleuritis are very significant, they are not so precise and definite as the physical signs. Having described the former, we will now take up the latter. On *inspection*, the movements of the affected side are seen to be restricted, to be suddenly arrested, and with an expression of pain. When effusion is present, an enlargement of the affected side is discerned; the intercostal spaces are less concave, are elevated to a level of the ribs, even rise above them, and no movement takes place in respiration, while the healthy side is abnormally active. On *palpation*, the absence of vocal fremitus is a very important and significant symptom. The fremitus of the voice is lessened as the effusion rises, to be entirely absent when the chest is distended. On the sound side the vocal fremitus is exaggerated. When the effusion is large, on palpation there may be fluctuation detected in thin subjects; by tapping one side smartly, a wave traverses the liquid and is felt on the opposite side. The character of the *percussion-note* is much affected by the quantity of liquid present. When there is a moderate amount of effusion, the tension of the lung is increased and consequently the note is high-pitched, rather hard, and having a distinct tympanitic quality. The tympanitic and high-

pitch quality of the note is particularly evident on percussion of the infra-clavicular region, while the note becomes deeper and harder over the inferior and dependent parts where the effusion gravitates. So different are the pitch and quality of the percussion-note in the infra-clavicular region of the diseased and the healthy side, that, if the examination be carelessly made, the latter region, having none of the tympanitic quality, will appear to be diseased. When the fluid accumulates so that the lung is covered by a layer of fluid, two inches in depth, the percussion-note will be dull all over the chest, except at the sterno-clavicular articulation, where the note will still be high-pitched and tympanitic, although somewhat dull. There will be absolute dullness over the whole of the affected side, except posteriorly over the root of the lung, when the cavity is full and the lung flattened against the spinal column. Exception should also be made of a point corresponding to the junction of the second rib with the sternum, where a tympanitic note—*le bruit de pot fêlé*—indeed, is obtained by vibration of the column of air in the primary bronchus and trachea; but in both situations a high pitch and hard quality are the characteristics, if the lung, is entirely flat provided the percussion be lightly made, so as not to develop the tympanitic quality obtained from the trachea and bronchus. The value of the percussion-note is increased by the absence or presence of a *sense of resistance*. When there is fluid in the thorax, the sense of touch receives a different impression from that produced by the normal condition. The diagnosis of effusion in the left thoracic cavity is much facilitated by an attentive examination of the character of the dullness in the left hypochondrium. Owing to the shelving margin of the lung, but especially to the proximity of the stomach and large intestine, the inferior portion of the left lung returns a rather higher pitched and tympanitic note on percussion than the portion above. This space is about two to three inches in width at the lateral border of the chest, narrowing to nothing at either extremity. When fluid forms, the diaphragm descends by pressure, and this space is gradually encroached on, and in the case of large effusion disappears. In the first stage of pleuritis the respiration is jerking, and on the affected side the lung is imperfectly filled with air. On *auscultation* these

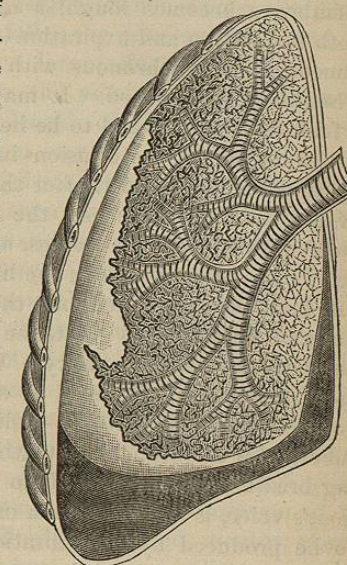


FIG. 27.—Limited Effusion and much Fibrinous Exudation. (Da Costa.)

characteristics of the breathing are ascertained—inspiration has a catching or jerking impulse, and hence the inspiratory vesicular murmur is feeble, because the lung can not be filled with air. When the membrane becomes rough, a rasping, grating murmur, audible with both inspiration and expiration—a to-and-fro friction murmur—is produced; it is synchronous with the respiratory movements and ceases when they are arrested. It may be so loud and strong as to produce a friction fremitus, and to be heard away from the chest-wall. It becomes feeble as the effusion increases, and then disappears, to recur again for a short period after the fluid is absorbed. With the increase of the fluid in the chest, the vesicular murmur becomes more and more feeble and then ceases, and, when it is no longer audible at the base, may be heard above the line of effusion and of dullness. When the lung is compressed but the bronchi are still permeable, and the body of fluid not too great, the breathing has the bronchial character, and has no vesicular quality. When the lung is flattened against the spine, no breathing-sounds of any kind remain. Similarly, *bronchial voice*, or *bronchophony*, is audible from the still pervious bronchial tubes, as is the bronchial breathing, but this ceases as the corresponding breath-sound does, and no voice-sound remains. *Ægophony*, or goat's voice, is a modification of bronchial voice supposed at one time to be produced by the vibrations of a rather thin stratum of fluid, interposed between the chest-wall and the lung, but it is now regarded as a simple modification of bronchophony. With the disappearance of the effusion the lung expands, and there is a gradual diminution of the dullness, until the percussion-note becomes normal and the resistance declines correspondingly. The vocal fremitus is restored in the same order. The voice and breath sounds are at first bronchial, then gradually become vesicular. As the bronchial voice and breath-sounds become audible, the friction-sound appears and continues up to the full restoration of the vesicular. Besides the friction to-and-fro sound, there are often heard, after the disappearance of the liquid effusion, coarse, creaking, grating sounds, which appear to be produced by the stretching of bands of adhesion, or the rubbing together of the large masses of solid exudation yet remaining for absorption. The author has witnessed the development and gradual disappearance of these sounds, during many months after recovery. Besides these sounds, *râles*, rather coarse, sub-mucous, and sub-crepitant, are audible during the process of absorption, and were supposed to be due to changes in the pulmonary parenchyma, but are now known to be produced by the opening up of tubes long compressed. Besides these, *râles* are present in cases of acute pleuritis, because of an accompanying bronchitis.

**Course, Duration, and Termination.**—Pleurisy does not pursue a defined course, nor does it terminate in crisis, which is the normal mode for pneumonia, but under favorable circumstances the develop-

ment is gradual, and the return to health is by slow stages. Beginning in some one of the modes described, the fever regularly increases for the first four or five days, and then continues for eight or nine days pretty constantly at a uniform height. Then comes the period of effusion, when the temperature falls, the pain subsides, and the dyspnoea diminishes unless there is a large effusion, when the difficulty of breathing is proportional to the amount of compression to which the lung is subjected. The length of the time the effusion continues at its maximum varies from one day to five. The absorption may take place quite rapidly at first, but it does not continue at the same rate after the first two or three days. The reason is, probably, because the liquid part of the exudation is more easily disposed of, the solid portion needing to undergo a fatty transformation to fit it for absorption. The rate of absorption is measured by the gradual return of the normal sounds, by the diminution of the dullness, and by the movement of displaced organs to their proper positions. The changes in the condition of the inflamed parts are represented in the improved appearance, better appetite, and increasing strength. A marked change takes place in the urinary secretion, which becomes more abundant, less highly colored, and contains for a brief period cast-off epithelium and a trace of albumen. The absorption of the last part of the exudation is exceedingly slow, and months, even a year or two, may elapse before the physical signs indicate complete restoration. The return toward health is often interrupted by fresh attacks of inflammation, by a new outpouring of effusion, by an accession of fever and respiratory disturbance. Additional inflammation of the pleura and of the neo-membranes arrests the process of absorption, depresses the vital forces, and prepares the way to the chronic state, yet it sometimes happens that the new excitement awakens renewed activity in the process of absorption, which goes on more rapidly afterward. If, after the twenty-fifth to the thirtieth day, there is no appreciable diminution in the state of the effusion, the acute stage ends and the chronic begins. It may be that the effusion remains stationary, and the general condition continues good; in other cases grave symptoms may arise, the temperature may increase, and in a day or two attain to the maximum of the first two weeks, or pass beyond it; rigors may occur irregularly, followed by paroxysms of fever and sweats; the countenance becomes anxious; the tongue dry; the depression great—without there being any change in the extent of the effusion or any new complication. This grave change in the condition of the patient is due to the purulent transformation of the exudation. It has already been indicated that the exudation may be purulent from the beginning, and that under these circumstances the symptoms have at the outset the septicæmic character above described. The termination is in *resolution*; in the *chronic form*; in *death*. The

average duration of an acute, uncomplicated case is two to four weeks. Death may occur within the first two weeks, in the so-called fulminant form, or, when there is a very extensive sero-fibrinous effusion causing fatal syncope, most probably by compression of the great venous trunks, especially of the ascending vena cava, which may be twisted and its lumen obstructed by displacement of the heart. Again, œdema of the sound lung may suddenly ensue as a result of compression of its fellow, and cause death. An early recovery from pleuritis with effusion signifies that the effusion must have been of small extent. Any large inflammatory effusion, especially if the solid portion of it is considerable, must require a long time, months certainly, to dispose of it entirely.

*Chronic pleurisy* is an outcome of the acute disease, or it occurs primarily. It differs from the acute merely in the severity and chronicity of the symptoms. The fever is slight, the pain is not severe, but yet extensive changes will take place in the pleura. When the characteristic anatomical alterations have been effected, there will be fever of the septicæmic type. The rational and physical signs are the same as those of the acute form. The duration of the cases varies from two or three months to several years. Attempts at absorption going on favorably may be stopped by a new inflammation of the pleura, and of the neo-membranes with more effusion. An effusion that has remained stationary for a long time may, unexpectedly, undergo absorption by reason of the development of vessels in the new formations. But a cure by absorption is rare; there are usually incomplete absorption, retraction and deformity of the chest, and permanent displacement of organs, or an external fistula, occurring spontaneously or resulting from an operation, may produce a favorable result comparatively. Without the operation of paracentesis, chronic pleurisy usually proves fatal by tuberculosis, by purulent infection, or by penetration of the pus into neighboring cavities, etc.

**Complications.**—The inflammation may extend by contiguity, and attack the pericardium—a not uncommon complication. There will occur a fibrino-serous exudation, often of considerable extent. The lung may be involved, but pneumonia is rather a coexisting disease—pleuro-pneumonia—than a complication. It is important to note that the lung on the sound side may be affected by œdema, a complication which adds immensely to the gravity of the case. Not only is the organ œdematous, but it usually presents patches of commencing pneumonic infiltration. The importance of pleuritis as a cause of phthisis is hardly sufficiently recognized, in inducing tubercular deposit, and by adhesions limiting the movements of the organ, thus inviting disease.

**Diagnosis.**—The most important difficulties in diagnosis are experienced in the differentiation of pleurisy with effusion from conditions

in which the lung is solidified or is displaced by tumors, cysts, etc. Pleurisy is distinguished from *croupous pneumonia* by reference to the rational and physical signs. Pleurisy begins by chilliness, which persists for several days—pneumonia by a severe rigor, rarely two; the pain in pleurisy is a stitch, a lancinating pain, which can be covered by the finger—pneumonia by a sense of soreness and pain much more diffused; the fever in pleurisy is continuous—in pneumonia there is a distinct crisis or lysis, somewhere from the fifth to the eleventh day; the duration of pleurisy is indefinite—of pneumonia self-limited; the expectoration in pleurisy is simply frothy mucus—of pneumonia, rusty or bloody; in pleurisy the vocal fremitus is absent—in pneumonia it is not only present but exaggerated; in pleurisy there is a friction-sound, no crepitant *râle*, and the bronchophony is not so well defined—in pneumonia there is no friction-sound, the crepitant *râle* is present, and bronchophony is loud and clear; in pleuritis there is more decided dullness, the intercostal spaces are pushed out, the thorax enlarged—in pneumonia the percussion-note is not so flat, the intercostal spaces and the size of the thorax remain normal; in pleuritis the organs are displaced; in pneumonia the relation of the organs is unaffected. Finally, the subsequent behavior of pneumonia and pleuritis leaves no room for doubt. An abscess of the liver pushing up the diaphragm, or an echinococcus-cyst growing in the same direction, of sufficient size to displace the lung in the same way, will cause the physical signs of an effusion into the thorax, and the diagnosis is possible only by a careful study of the history, which is entirely different in the two affections. A tumor or cyst of the chest will produce dullness on percussion, displace organs, and, by compressing the lungs, cause the disappearance of the voice and breath sounds. The differentiation is to be made by reference to the history of the cases, by the situation of the dullness toward or about the central and superior parts of the chest in tumor—the inferior part of the chest in effusion; by the general and symmetrical bulging of the chest-walls in effusion, the circumscribed and irregular bulging caused by tumor; by the absence of vocal fremitus in pleuritis—its exaggeration in cases of tumor.

Although the withdrawal of the fluid is the only certain means of arriving at the nature of the effusion, there are signs by which we may approximate with considerable accuracy to a correct diagnosis. If, during the acute stage, the fever running high, the effusion pouring out rapidly, there suddenly ensue great pallor, weakness, and depressed temperature, followed after some hours by rise of temperature even higher than before, a hæmorrhage has probably occurred; or, if during the chronic stage there are recurrent attacks, and the above-described symptoms occur, the case is not only hæmorrhagic, but the underlying morbid process is tuberculosis. If the case is characterized from the beginning by repeated rigors, occurring irregularly, and followed by

paroxysms of intense fever and sweats, the exudation is purulent; if, during the course of an ordinary attack of sero-fibrinous pleuritis, the same septicæmic symptoms arise, the exudation has been transformed into the purulent.

**Treatment.**—As soon as the pleuritic inflammation begins, and the pain is a good indication, the patient should receive a full dose of quinine and morphine (℥j quinine and gr. ss. morphine for an adult), and the effect of this should be maintained by the repetition of smaller doses (gr. v quinine,  $\frac{1}{4}$  gr. morphine) every four hours. If the stomach is irritable, the morphine can be administered subcutaneously, or, if the pain is very acute, this mode of administration is more effective than by the mouth. Besides the power of morphine to relieve pain, it is an effective remedy in serous inflammation. The combination which was so much employed formerly (calomel, and opium) owed its virtues to the opium. If constipation is a feature of the case, especially if nausea accompanies it, and if there be evidence of congestion in the portal circulation, the most important results may follow the exhibition of a sufficient dose of calomel. The dose should be, as my experience goes, from three to five grains, and the reasons for its use, are that calomel has a distinctly sedative effect on the liver, lessens the physiological activity of its constructive apparatus, lowers the temperature of the blood passing through the hepatic veins into the general circulation, and it depletes, by its purgative action, the portal system. In consequence of these effects the whole system experiences a sense of relief, and the local morbid process is much ameliorated. That calomel has germicide powers, of itself, or by the conversion of some part of it into the corrosive chloride, we may accept, also, as a part of its singular efficiency under the conditions mentioned. If there be much fever—a strong pulse and elevated temperature—the stomach not irritable, and the subject be plethoric, a dozen cups or leeches, drawing six ounces of blood, can be applied with advantage. The old plan of bleeding *ad deliquum animi*, or until the pain ceased, was a powerful and certain means of relieving pain which has been rightly abandoned, but the local bloodletting is of service and not unfrequently general venesection is useful. The blood-pressure can be reduced also by active purgatives, of which the salines are best. When the exudation is poured out, a different plan will be necessary. The only agents which possess the property of dissolving an exudation are the alkalis, and the most efficient of these is ammonia. Carbonate of ammonia can be best given in a solution of the acetate (gr. v—x in ℥ ss.—℥ j). They should take the place of the quinine and morphine. Absorption will be much aided by keeping up free outward osmosis through the intestinal mucous membrane by saline laxatives. The same process can be carried on through the skin by the use of pilocarpine. This should be administered, as a rule, once a day, but its action on the

heart should not be forgotten, and care exercised if there be displacement of this organ, especially if there be a twist in the vena cava. The best mode of administering pilocarpine is the hypodermatic injection, pilocarpine— $\frac{1}{4}$  of a grain of any of the salts. As the pouring out of so much fluid, the waste of tissue produced by a high temperature, and the interference with assimilation caused by the disordered digestion, rapidly impair the vital forces, it is important, by proper food-supply and the judicious use of stimulants, to obviate the asthenia. When, however, a large effusion exists, especially if purulent, it becomes necessary to remove it by the operation of thoracentesis. Even if absorption may eventually succeed in disposing of the fluid, there is great danger that the lung will not be in a condition to expand again fully, and retraction and deformity of the chest will be the result. If the effusion be purulent, absorption can not take place, and hence thoracentesis is indispensable. The question of how early shall thoracentesis be performed has been much discussed. It ought not to be undertaken within a few days after effusion, nor unless the symptoms of compression are urgent while the exudation is going on. It ought not to be performed if the natural powers are equal to the task of removing the fluid early enough to save damage to the organs concerned. These rules apply to the sero-fibrinous form of pleuritis. Thoracentesis ought to be performed in the purulent form as soon as the nature of the case is evident, for nothing is to be gained by delay. The point of election when the choice may be made is underneath the inferior angle of the scapula, but the needle may be inserted at any place with due regard to the position of the heart and great vessels. As regards the method of procedure, nothing has been added practically to the method of Bowditch (the real inventor of the *aspirateur*), which consists in exhausting the chest by the pump and attached needle. Although the admission of air does not seem to be very important, yet it is better to avoid it in cases of the sero-fibrinous, for, if subsequent operations are necessary, the effusion will become more and more purulent. If this is the case, the tincture of iodine or a diluted compound solution can be injected with great advantage after removing the fluid (liq. iodinii comp. ℥ j—aquæ ℥ iv). This iodine injection is highly useful in empyema.\* Precautions to avoid air are usually regarded as unnecessary in the case of purulent effusion. In those cases requiring repeated tapping, late experience has shown that the best results are obtained by establishing free drainage. If a sufficient opening for the drainage-tube can not be obtained in the intercostal space, excision of the rib is then necessary. The simplest of these operations should be performed with antiseptic precautions. If the pus of an empyema undergo decomposition and become foul, the cavity should

\* A warm solution of chlorate of potassa (℥ j or 3 ij—0 j) or of salicylic acid and borax (3 j of each to the 0 j), may also be used to wash out the cavity in empyema.