CHAPTER XVI.

DISEASES AFFECTING THE PLEURAL CAVITY.

I. Hydrothorax.

In cases of nephritis or of cardiac weakness due to valvular heart disease a considerable accumulation of serum may take place in both pleural cavities. The physical signs are identical with those of pleuritic effusion (see below, page 336) except that the latter is almost always unilateral, while hydrothorax is usually bilateral. Exceptions to this rule occur, however, especially on the right side or in cases in which one pleural cavity has been obliterated by fibrous adhesions, the results of an earlier pleurisy. The fluid obtained by tapping in cases of hydrothorax is usually considerably lower in specific gravity and poorer in albumin than that exuded in pleuritic inflammation.

The fluid shifts more readily with change of position than is the case with many pleuritic effusions, owing to the absence of adhesions in hydrothorax.

Friction sounds, of course, do not occur, as the pleural surfaces are not inflamed. A few grains of potassium iodide by mouth soon produce a reaction for iodine in the fluid of hydrothorax and not in pleuritic effusion.

II. Pneumothorax.

Pneumothorax, or the presence of air in the pleural cavity, may result from stabs or wounds of the chest wall, but is usually a complication of pulmonary tuberculosis which weakens the lung until by a slight cough or even by the movements of ordinary respiration the pulmonary pleura is ruptured and air from within the lung leaks into the pleural cavity.

If the opening is of considerable size, and the air is not hindered

or encapsulated by adhesions, great and sudden dyspnœa with pain and profound "shock" may result. More commonly the air enters the pleural cavity gradually, the other lung has time to hypertrophy, and the heart and other organs become gradually accustomed to their new situations.

Physical Signs.

1. *Inspection.*—The affected side may lag behind considerably in the movements of respiration. In very marked cases it is almost motionless and the interspaces are more or less obliterated. The diaphragm is much depressed and Litten's sign absent. In right-sided pneumothorax, which is relatively rare, the liver is depressed and the edge can be felt below the ribs.

The heart is displaced as by pleuritic effusion, but usually to a less extent. With left-sided pneumothorax the cardiac impulse may be lowered as well as displaced, owing to the descent of the diaphragm.

2. *Palpation.*—Fremitus is absent over the lower portions of the chest corresponding to the effused air. At the summit of the chest over the retracted lung, fremitus may be normal or increased. In rare cases when the lung is adherent to the chest wall and cannot retract, fremitus is preserved.

The positions of the heart and liver are among the most important points determined by palpation. Not infrequently no cardiac impulse is to be obtained. Sometimes it may be felt to the right of the sternum (see Fig. 167) or in the left axilla, but not infrequently it is so fixed by pleuropericardial adhesions that it is drawn upward toward the retracted lung or remains near its normal situation. The liver is greatly depressed in cases of right-sided pneumothorax, and may be felt as low as the navel.

3. *Percussion.*—Loud tympanitic resonance is the rule throughout the affected side. Even a small amount of air is sufficient to render the whole side tympanitic and often to obscure the dulness which the frequently associated pleural effusion would naturally produce. Indeed, it is the rule that small effusions are wholly masked by the adjacent tympany.

In no other disease do we get such clear, intense tympanitic resonance over the chest.

The only exception to this rule occurs in cases in which the air within the chest is under great tension, making the chest walls so taut that, like an over-stretched drum, they cannot vibrate properly. Under these conditions the percussion note becomes muffled, at times almost dull.

Areas of dulness corresponding to the displaced organs (heart or liver) may sometimes be percussed out.

4. *Auscultation.*—Respiration and voice sounds are usually inaudible in the lower portions of the chest. At the top of the chest, and rarely in the lower parts, a faint amphoric or metallic breathing may be heard, but as a rule the amphoric quality is brought out much better by cough which is followed by a ringing after-echo. Or the air in the pleura may be set to vibrating and made to give forth its characteristic, hollow, ringing sound if a piece of metal (*e.g.*, a coin) be placed on the back of the chest and struck with another coin, while we listen with the stethoscope over the front of the chest opposite the point where the coin is.

The clear ringing sound heard in this way is quite different from the dull chink obtainable over sound lung tissue.

The "falling-drop sound" or "metallic tinkle," and the lung fistula sound are occasionally audible (see above, p. 170).

On the sound side the breath sounds are exaggerated. At the top of the affected side over the collapsed lung the breathing is bronchial and râles are occasionally heard.

In the great majority of cases pneumothorax is complicated by an effusion of fluid in the affected pleural cavity and we have then the signs of

III. Pneumoserothorax or Pneumopyothorax

When both fluid and air are contained in the pleural cavity, the patient may himself be able to hear the splashing sounds which the movements of his own body produce. These are more readily appreciated if the observer puts his ear against the patient's chest and then shakes him briskly. Splashing sounds heard within the

chest are absolutely pathognomonic and point only to the combination of fluid and air within the pleural cavity. One must distinguish them, however, from similar sounds produced in the stomach. By observing the position of maximum intensity of the sounds, this distinction may be easily made. Unfortunately the critical condition of the patient may make it impossible to try succussion, as in the acute cases with great shock it is dangerous to move him at all.

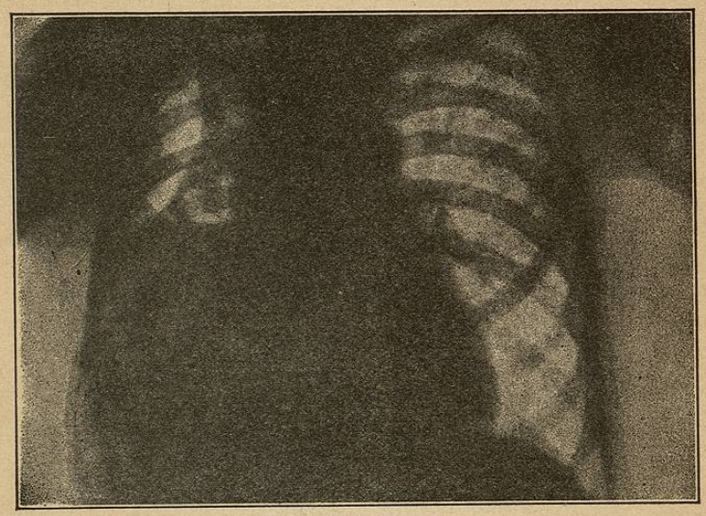

Fig. 167.—Pneumoserothorax Seen from Behind. Note the horizontal line at the surface of the fluid and the retracted lung just above the inner half of this line. Compare Fig. 173. (From v. Ziemssen's Atlas.)

The movements of breathing or coughing may bring out a "metallic tinkle" (see above, p. 332). At the base of the chest, over an area corresponding to the position of the fluid, an area of dulness may be easily marked out by percussion, and this area *shifts very markedly* with change of position. The shifting dulness of pneumoserothorax is strongly in contrast with the difficulty of obtaining any such shift in ordinary pleuritic effusion (see Fig. 168).

(The distinction between "*open pneumothorax*," in which the rent in the lung through which the air escaped in the pleura remains open, and "*closed pneumothorax*," in which the rent has become obliterated—is one which cannot be established by physical signs alone. It is often said that amphoric breathing, and especially an amphoric ring to the voice and cough sounds, denote an

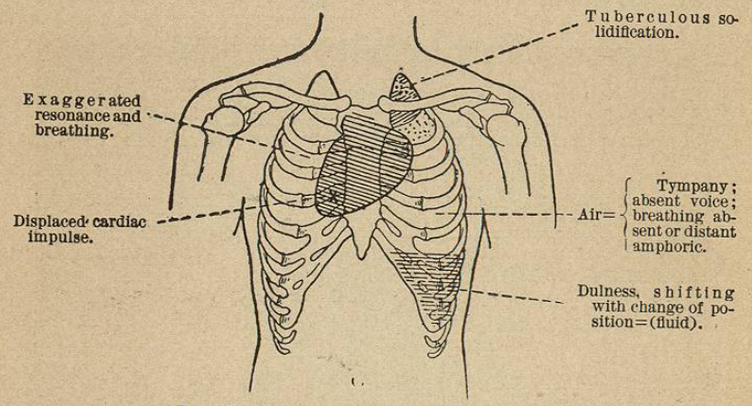

FIG. 168. – Pneumoserothorax with Displaced Heart.

open pneumothorax, but post-mortem evidence does not bear this out. Practically an open pneumothorax is one in which the amount of effused air increases, and closed pneumothorax is one in which the physical signs remain stationary.)

Differential Diagnosis.

The distinction between pneumothorax and emphysema has already been discussed.

(*a*) When the air in the pleural sac is under such tension that the percussion note is dull, the physical signs may simulate pleuritic effusion, but real flatness, such as characterizes effusion, has not, so far as I know, been recorded in pneumothorax, and the sense of resistance on percussing is much greater over fluid than over air. In case of doubt puncture is decisive.

(*b*) Acute pneumothorax, coming on as it does with symptoms of collapse and great shock, may be mistaken for angina pectoris, cardiac failure, embolism of the pulmonary artery, or acute pulmonary tympanites (see above, p. 315).

From all these it can be distinguished by the presence of amphoric or metallic sounds, which are never to be obtained in the other affections named.

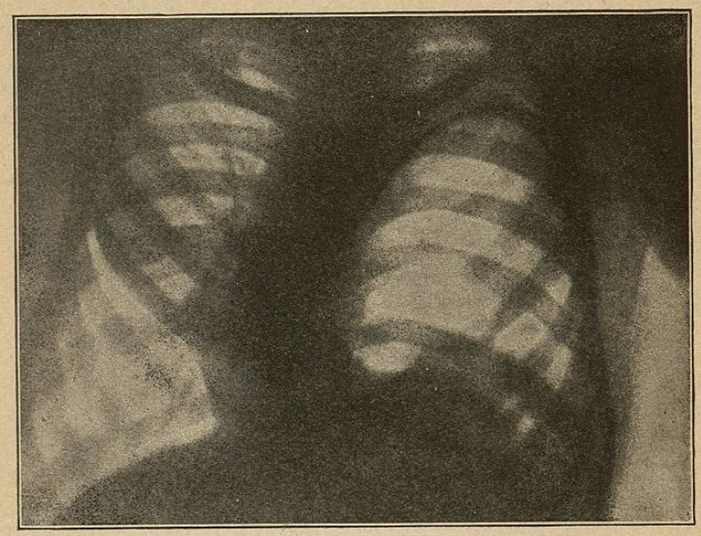

FIG. 169.—Diaphragmatic Hernia. The outline of the displaced diaphragm visible below the left clavicle. Heart displaced to right of sternum. (From v. Ziemssen's Atlas.)

(*c*) Hernia of the intestine through the diaphragm (see Fig. 169) or great weakening of the diaphragmatic muscular fibres, may allow the intestines to encroach upon the thoracic cavity and simulate pneumothorax very closely. The history and course of the case, the abdominal pain, vomiting, and indicanuria, generally suffice to distinguish the condition. The peristalsis of the intestine may go on even in the thorax, and gurgling metallic sounds corresponding to it and unlike anything produced in the thorax itself may be audible.

The distinction between open and closed pneumothorax, to which I have already alluded, is far less important than the presence or absence of

(*a*) Pulmonary tuberculosis.

(*b*) Encapsulating adhesions in which the air is confined to a circumscribed area.

(*a*) The examination of the sputa and of the compressed lung may yield evidence regarding tuberculosis. On the sound side the compensatory hypertrophy covers up foci of dulness or râles so that it is difficult to make out much.

(*b*) Encapsulated pneumothorax gives us practically all the signs of a phthisical cavity, from which it is distinguished by the fact that with a cavity the nutrition of the patient is almost always much worse.

Encapsulated pneumothorax needs no treatment. Hence the importance of distinguishing it from the non-encapsulated form of the disease, in which treatment is essential.

PLEURISY.

Clinically, we deal with three types:

(*a*) Dry or plastic pleurisy.

(*b*) Pleuritic effusion, serous or purulent.

(*c*) Pleural thickening.

(*a*) Dry or Plastic Pleurisy.

Doubtless many cases run their course without being recognized. The frequency with which pleuritic adhesions are found post mortem would seem to indicate this.

It is usually the characteristic stitch in the side which suggests physical examination. The pain and the physical signs resulting from the fibrinous exudation are usually situated at the bottom of the axilla where the diaphragmatic and costal layers of the pleura are in close apposition. Doubtless the pleuritic inflammation is not by any means limited to this spot, but it is here that the two layers of the pleura make the largest excursion while in apposition with each other. In the vast majority of cases, then, the physical signs are situated at the spot indicated in Fig. 170.

Occasionally pleuritic friction is to be heard in the precordial region, and after the absorption of a pleuritic effusion evidences of fibrinous exudation in the upper parts of the chest are sometimes demonstrable. Most rarely of all, evidence of plastic pleurisy may be found at the apex of the lung in connection with early phthisis. In diaphragmatic pleurisy, when the fibrinous exudation is especially marked upon the diaphragmatic pleura, friction sounds may be heard over the region of the attachment of the diaphragm in front and behind as well as in the axillæ. Hiccup often occurs and gives exquisite pain.

Our diagnosis is based upon a single physical sign, *pleuritic friction*. The nature of this sound and the manœuvres for eliciting it have already been described (see above, p. 166), and I will here only recapitulate what was there said. During the first few deep breaths one hears, while listening over the painful area, a grating or rubbing sound usually somewhat jerky and interrupted, most marked at the latter part of inspiration, but often audible throughout the whole respiratory act. After a few breaths it often disappears, but will usually reappear if the patient lies for a short time upon the affected side, and then sits up and breathes deeply. In marked cases the rubbing of the inflamed pleural surfaces may be felt as well as heard, and it is not very rare for the patient to be able to feel and hear it himself. Pleuritic friction may be present and loud without giving rise to any pain. On the other hand, the pain may be intense, and yet the friction-rub barely audible. When heard at the summit of the chest, as in cases of incipient phthisis, pleural fric-

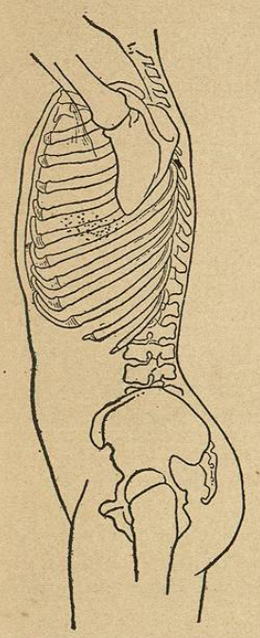

Fig. 170.—Showing the Point at which Pleural Friction is most Often Heard.

tion produces only a faint grazing sound, much more delicate and elusive than the sounds produced at the base of the chest.

Occasionally the distinctive rubbing or grating sounds are more or less commingled with or replaced by crackling sounds indistinguishable from the drier varieties of râles. It is now, I think, generally believed that such sounds may originate in the pleura as well as within the lung. The greatest care should be taken to prevent any shifting or slipping of the stethoscope upon the surface of the chest, as by such means sounds exactly like those of pleural friction may be transmitted to the ear. In case of doubt one should always wet or grease the skin so that the stethoscope cannot slip.

Muscle sounds are sometimes taken for pleural friction, but they are bilateral, usually low-pitched, sound less superficial than pleural friction, and are not increased by pressure. When listening for friction at the base of the left axilla, I have once or twice been puzzled by some low-pitched rumbling sounds occurring at the end of inspiration, and due (as afterward appeared) to gas in the stomach which shifted its position with each descent of the diaphragm.

In children friction sounds and pleuritic pain are much less common than in adults, and the signs first recognizable are those of effusion. In adults the presence of a very thick layer of fat may make it difficult or impossible to feel or hear pleural friction.

The breath sounds over the affected area are usually absent or greatly diminished, owing to the restraint in the respiratory movements due to pain. Not infrequently pleuritic friction may be heard altogether below the level of the lung.

(*b*) Pleuritic Effusion.

Many cases are latent, and the patients consult the physician on account of slight cough, weakness, or gastric trouble, so that the effusion is first discovered in the course of routine physical examination. Since it is usually the results of percussion which first put us on the right track, I shall take up first

Percussion.

1. A *small effusion* first shows as an area of dulness
(*a*) Just below the angle of the scapula.
(*b*) In the left axilla between the fifth and the eighth rib.
(*c*) Obliterating Traube's semilunar area of tympany; or
(*d*) In the right front near the angle made by the cardiac and hepatic lines of dulness (see Fig. 171).

In the routine percussion of the chest, therefore, one should never leave out these areas. A small effusion is most easily detected in children or in adults with thin chest walls, provided our percussion is not too heavy. An effusion amounting to a pint should always be recognizable, and smaller amounts have frequently been diagnosed and proved by puncture.

The amount of a pleuritic effusion is roughly proportional to the area of dulness on percussion, but not accurately. It is very common to find on puncture an amount of fluid much greater than

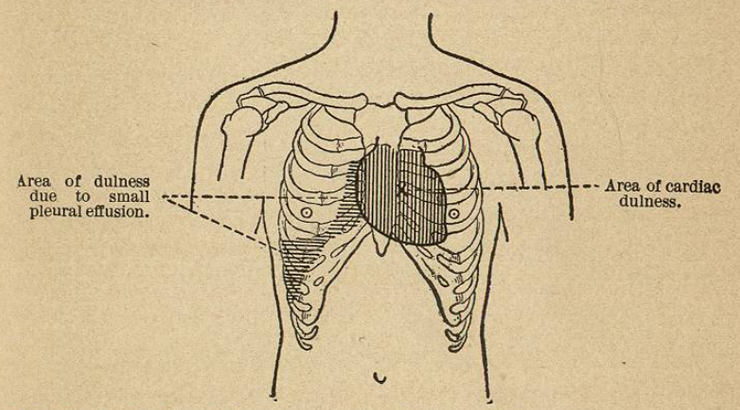

FIG. 171.—Small Pleural Effusion Accumulating (in part) near the Right Border of the Heart.

could have been suspected from the percussion outlines; on the other hand, the dulness may be extensive and intense on account of great inflammatory thickening of the costal pleura, by the accumulation

of layer after layer of fibrinous exudate and its organization into fibrous plates, while very little fluid remains within.

The amount of dulness depends also upon the thickness and elasticity of the chest wall and the degree of collapse of the lung within.

2. *Large Effusions.*—When the amount of fluid is large, the dulness may extend throughout the whole of one side of the chest with the exception of a small area above the clavicle or over the primary bronchus in front. This area gives a high-pitched *tympanitic* note,

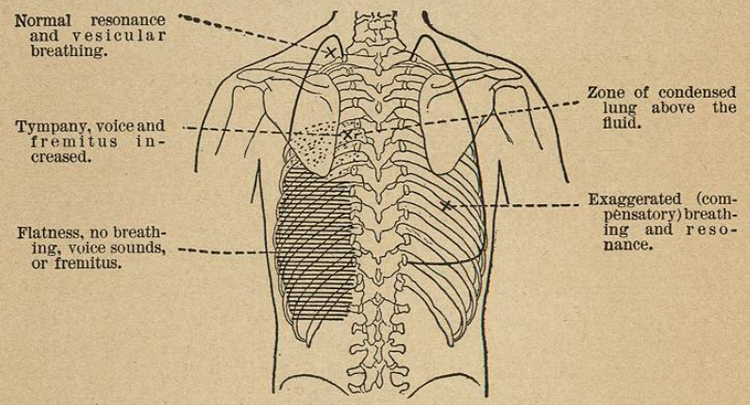

FIG. 172.—Diagram to Illustrate Physical Signs in Moderate-Sized Effusion in the Left Pleura.

provided the bronchi remain open, as they almost always do. This tympany is high-pitched and sometimes astonishingly clear. I recently saw a case in which the note above the clavicle was almost indistinguishable with the eyes shut from that obtained in the epigastrium. Occasionally "cracked-pot" resonance may be obtained in the tympanitic area.

The pitch changes if the patient opens and closes his mouth while we percuss ("Williams' tracheal tone").

The dulness over the lower portions of a large effusion is usually *very* marked, and the percussing finger feels a greatly increased

resistance to its blows when compared with the elastic rebound of the sound side.

3. *Moderate Effusions.*—Three zones of resonance can often be mapped out in the back: at the base dulness or flatness, above that a zone of mingled dulness and tympany, and at the top normal resonance. The lowest zone corresponds to the fluid, the middle zone to the condensed lung immediately above it, and the top zone to the relatively unaffected part of the lung (see Fig. 172). Not infrequently there is no middle zone but simply dulness below and resonance above, as is usually the case in the axilla and front.

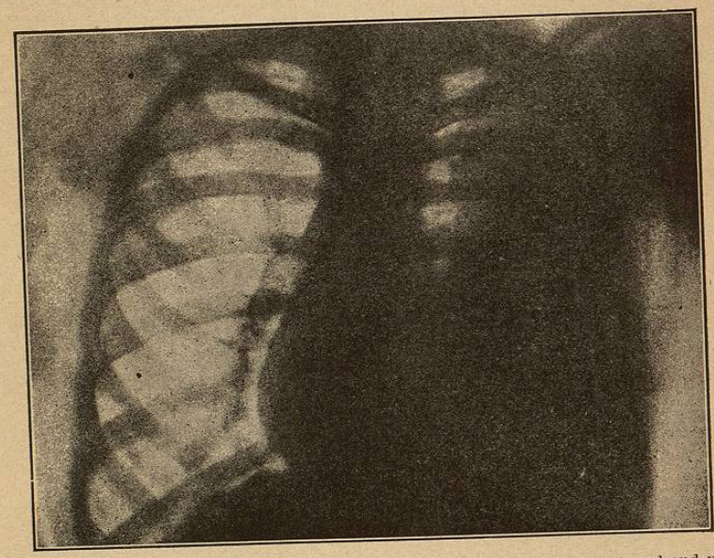

FIG. 173.—Left Pleural Effusion. Note that the surface of the fluid slopes outward and upward from the median line. (From v. Ziemssen's Atlas.)

The position of the effusion depends only in part upon the influence of gravity, and is greatly influenced by capillarity and the degree of retraction of the lungs. Consequently the surface of the fluid is hardly ever horizontal except in very large accumula-

tions. With the patient in an upright position it usually reaches a higher level in the axilla than in the back (see Fig. 173). Near the spine and near the sternum (in right-sided effusions) the line corresponding to the level of the fluid may rise sharply.

The S-curve of Ellis, as worked out so elaborately by Garland, varies still further the uneven line which corresponds to the surface of the fluid (see Fig. 174). This curve can be obtained only after the patient has, by cough and forced breathing, expanded the lung as fully as possible.

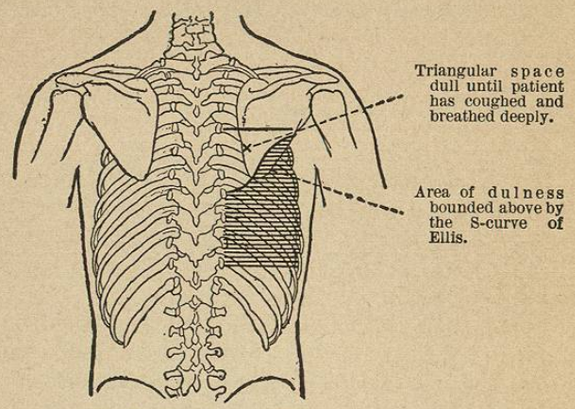

FIG. 174.—The S-Curve of Ellis.

All these curves are to be found with the patient in the upright position. None of them has any considerable diagnostic importance, and the chief point to be remembered is that the upper surface of the fluid, not being settled by gravity alone, is hardly ever horizontal.

With change in the position of the patient the level of the fluid sometimes changes very slowly and irregularly, and sometimes does not change at all. If, for purposes of thorough examination, we raise to a sitting posture a patient who has been for some days or weeks in bed, we should never begin the examination at once, since

it may take some minutes for the lungs and the fluid to accommodate themselves to the new position. It is well also to get the patient to cough and to take a number of full breaths before the examination is begun.

To test the mobility of the fluid with change of the patient's position, mark out the upper limit of the dulness in the back with the patient in the upright position. Then let the patient lie face downward upon a couch, and, after waiting a few minutes, percuss the previously dull area. It may be found to have become resonant.[1]

When the fluid is absorbed or removed by tapping, one would expect an immediate return of the percussion resonance. But in fact the resonance returns very slowly and is wholly unreliable as a test of the amount of absorption which has occurred. Thickened pleura and atelectatic lung may abolish resonance long after the fluid is all gone. We depend here far more upon the evidence obtained by auscultation and palpation and on the general condition of the patient.

To determine the returning elasticity of the lung and the degree of movability of its lower border, percussion is very useful during the stage of absorption. After percussing out the lower border of pulmonary resonance in the back, the patient is directed to take a long breath and hold it. If the lung expands, the area of percussion resonance will increase downward.

Percussion aids us in determining whether neighboring organs are displaced by the pressure of the accumulated fluid. The liver is often pushed down, the spleen *very* rarely. *Dislocation of the heart* is one of the most important of all the signs of pleural effusion, and is often the crucial point in differential diagnosis. It is a very striking and at first surprising fact that a left-sided effusion displaces the heart far more than a right-sided effusion of the same

[1] This test, however, is somewhat fallacious and of very little diagnostic value, since the lungs tend to swing up toward the back when the patient lies prone, *even when no fluid is present*, and increase of resonance in the back with this change of position might, therefore, occur when the dulness was due to thickened pleura and not to fluid.