LECTURES

ON THE

PRINCIPLES OF SURGICAL DIAGNOSIS:

ESPECIALLY IN RELATION TO SHOCK AND
VISCERAL LESIONS.*Delivered at the Royal College of Surgeons of England.*

By F. LE GROS CLARK, F.R.C.S.,

Hunterian Professor of Surgery and Pathology in the College; Surgeon to
St. Thomas's Hospital; and Examiner in Surgery at the
University of London.

LECTURE II.—LESIONS OF THORACIC VISCERA.

*Liability of Chest to Fracture.—Fractures of Sternum and Ribs.—
Various Consequences of Injuries of the Chest-walls.—Shock, Conse-
quent on Injury of the Chest.—Wounds of the Lung; how caused;
their Signs, etc.—Emphysema: Pneumo-thorax.—Pulmonic Hernia.
—Rupture of Lung.—Hydrothorax and Emphyema.—Concussion and
Contusion of the Lung.—Penetrating Wounds of the Lung.*

MR. PRESIDENT AND GENTLEMEN,—In civil practice, traumatic lesions of the thoracic viscera are comparatively infrequent, and even the hospital surgeon has but rare opportunities of witnessing wounds of the heart or lungs, unless in such a form, or of so complicated a character as to involve speedy if not immediate dissolution. The exception to this remark is in the case of such pulmonary lesions as are occasionally entailed by fracture of the ribs or sternum, of which I shall speak presently. That the class of injuries to which I refer is so commonly fatal, is explained by the immediate importance to life of the thoracic viscera, hæmorrhage or suffocation often anticipating the more dilatory, though scarcely less destructive, consequences of inflammation. Yet, remarkable cases present themselves from time to time, in which this expected result is not realised; and although the nature of the lesion is generally well defined, and clearly indicated in most instances by the symptoms or signs which are present; in some exceptional cases the diagnosis is obscure, and a careful analysis of all the circumstances attending the hurt and its consequences is required, in order to form a probable estimate of the actual condition and prospects of the patient. The prolongation of life under necessarily mortal injury is not infrequently of great moment, even in a temporal point of view. The identification of an assassin, the communication of some important information, the arrangement of worldly concerns, may depend on a correct diagnosis and the means employed to delay a fatal issue.

In contrasting the relative liability to injury of the thoracic organs, and those of the head and pelvis, we find that the source of immunity is due to different causes; the arched and vaulted form, and the solid, resisting walls of the latter, constituting that protection which is afforded by the yielding and elastic parietes of the former. Each constituent element in the skeleton of the chest is possessed of this pliant quality, either in its own proper construction or derived from its relation to the other parts. Although the individual vertebræ are rigid, the central column which they collectively compose is flexible, by virtue of the tough fibro-cartilage which binds the several bones together. The flat plates of bone which constitute the sternum are so designed, from their obliquity of relation to the cavity they help to enclose, as to afford protection against the consequences of direct violence; but this attribute is greatly helped by the elasticity derived from the connexion of the breast-bone to the costal cartilages. The ribs themselves are essentially elastic, but are rendered much more so by the interposition of the cartilages between their extremities and the sternum, which is the common bond of their union in front. This property of the chest-walls is physiologically essential, to admit of the varying capacity of the cavity during respiration; but it also subserves, in a remarkable degree, the purpose of securing the viscera from the consequences of external violence.

When the sternum is fractured, it is very rarely the result of direct force: and if such should be the case, the ribs are almost always seriously implicated in the injury, and thus attest the extent and character of the violence which was competent to produce such an effect. Simple transverse fracture of the sternum is caused by forcible flexion of the spine; it is bent in its long axis, and gives way usually near its centre. In many instances the strong ligaments in front and behind are only

partially torn, and then the diagnosis of the fracture is obscure, and its existence is inferred rather from the nature of the causative accident and from the suffering of the patient, than from the presence of the usual signs of fracture. In some instances, however, fracture is produced by direct violence, as occurred in an omnibus-driver recently under my care. Whilst standing on the steps of his vehicle, a cart backed against him, and, as my dresser's report states, he was jammed against a small step above, and quite twisted round. The sternum was broken across in its upper third, and the right clavicle was dislocated forwards at its sternal end. He suffered from some dyspnoea at first, but recovered without any other untoward symptom.

I recently met with the remark, in a modern French author, that this injury (fracture of the sternum) is rare; and that, when it occurs, it is usually attended by serious visceral and vascular complications. The result of my own experience is the converse of this. Fracture of the sternum, though not a very common, is by no means a very rare, accident; but it is in very few instances, where the fracture is simple, that I have seen any visceral complications to excite even uneasiness. Indeed, I may say that, unless the costal cartilages or the ribs themselves give way, it is, mechanically, improbable that any serious organic lesion could result; inasmuch as displacement of the broken bone is prevented by its lateral relations, so long as they retain their integrity. But, it must be admitted that the more complicated form of fracture with organic lesion is not infrequent; torn pleura, wounded and collapsed lung, with their usual concomitants, entailing speedy death. In like manner, simple fracture of the spinal column very rarely injures the heart or lungs, which are protected, in either instance, severally, by the mediastina.

When the ribs are broken the case is different, though only exceptionally so. This injury is, in my experience, far more frequently the consequence of indirect than of direct violence; the bone is bent, as in fracture of the spine, beyond its power of resistance, and then snaps. It is this mode of fracture which is the security, in most cases, against injury of the lung. Fracture from indirect violence may, no doubt, cause laceration of the adherent costal pleura; probably it does so in most instances where there is displacement of the fractured ends; and local pleurisy, with its attendant short cough, is the consequence. But this does not entail wound of the lung; the resiliency of these organs permits them to yield to the encroachment, and secures them from lesion, the adjoining surfaces of the serous membrane soon becoming glued together by plastic deposit. When a rib is broken at the point of impact of an extraneous body, the bone, instead of being fractured outwards, is driven inwards, and the lung is thereby often wounded. This frequently occurs in drunken broils, when a fallen combatant is kicked in the side. The diagnosis of this injury is generally very simple, inasmuch as the escape of air into the areolar tissue is apparent to the touch or sight; and the far more serious extravasation into the pleura is indicated by unmistakable signs and symptoms.

The higher the fracture, the more serious, generally, is the injury. I have a record of several cases in which the first and second ribs were fractured; and these injuries have been mortal, in consequence of the lung being wounded. When the fracture is quite low down, involving the last two or three ribs, the chest rarely suffers; but the abdominal symptoms assume a prominence, which clearly manifests the implication of these viscera in the mischief. This circumstance I shall have an opportunity of exemplifying hereafter.

The experience of civil practice, as I just now remarked, necessarily limits our practical acquaintance with those more formidable injuries of the thoracic viscera in particular, which are the consequence of penetrating wounds by sharp-pointed instruments or shot; for, except in this way, instances of deep wounds of the chest are rare. Thus, hæmorrhage to any alarming extent, from the lung into the pleural cavity or into the tissue of the organ itself is, so far as my observation has enabled me to judge, scarcely ever met with. Limited hæmoptysis is not infrequent, resulting from puncture of the lung by a broken rib; but it is rarely of a character to excite anxiety, except as an indication of the nature of the lesion, and that it entails a local hyperæmia, which may extend. Yet, such topical manifestation of traumatic inflammation is usually limited to the precincts of the injured part; and I have very rarely had to treat pneumonia in these cases. If present, this condition is revealed by the usual stethoscopic signs; and we must not trust alone to the rust-coloured sputa, cough, and febrile excitement, which may, and usually do, accompany inflammation limited to the vicinity of the lesion, and are simply expressive of the salutary effort by which repair of the mischief is inaugurated.

Blood-tinged expectoration is not infrequent, after the lapse of two or three days, and without the presence of any signs of pneumonia. In such cases, lesion of the lung, from contusion or laceration, may be inferred; the extravasated blood is mixed with and dissolved in the mucus,

and thus ejected by coughing. But the presence of frothy and bloody sputa, in any quantity, may reasonably excite suspicion that the lung has been torn more deeply.

I have remarked that profuse hæmoptysis is of very rare occurrence in such injuries of the chest as are encountered in civil practice. The following case was supposed, during the life of the patient, to be one of these exceptional instances; and my reason for quoting it is, that the special feature of the case was delusive, as regards the diagnosis of its source, and that its presence was purely accidental. A carman, of middle age, fell from a high van, the wheels of which passed over his chest. Several ribs of the left side, the upper six as was afterwards ascertained, were fractured; he had external emphysema, and apparently the same condition of the lung, for there was increased resonance, with faulty breath-sounds and slight crepitation. He rallied from the shock, and was going on tolerably well until the eighteenth day, when he suddenly brought up a pint and a half of scarlet blood, which, as it was pure, was supposed to be from the lung. Broncho-pneumonia existed at this time all over the chest. A second loss of blood, two days later, proved fatal. At the *post mortem* examination it was found that this blood was derived from an ulcer in the stomach, opening into the coronary artery.

Wounds of the parietal vessels—the intercostal and mammary—are scarcely ever met with; or, if they occur more frequently than I suppose, it is without the presence of such signs or symptoms as might be expected. Any accumulation of blood within the pleural cavity would be rendered apparent by the attendant dyspnoea and the dulness on percussion, with the absence of respiratory murmur at that part of the chest to which the blood gravitates, and where the lung is consequently displaced; but this complication is of very rare occurrence.

The position of the intercostal nerve renders it probable that it is often, if not usually, pressed upon or injured by the displaced rib, especially when the fracture is far back. I believe that the acute pain, the catching respiration, and short cough, accompanying this accident, are due in a measure to the implication of the nerve in the way described.

The *Shock* which attends the injuries to which I have referred is usually of a transient nature, and referable rather to the general violence or agitation accompanying them than to the local lesion. The reaction is proportionately moderate, and is almost always attended by a short and troublesome cough, which much distresses the patient, and requires tranquillising remedies to palliate. But occasionally contusions of the chest, when severe, though unattended by fracture, may entail the collapse of severe shock. Thus, in a lad under my care, who was crushed under a falling cart, the weight of which rested on his chest, the collapse was profound, although his entire recovery in a few days proved that there could have been no organic lesion. The local pain, with cough and distress in talking, were exclusively referred to the chest. The lungs had been forcibly compressed; and his condition is accounted for by the functional derangement of these organs, consequent on congestion, as I shall presently explain and exemplify.

Wound of the Lung, in fracture of ribs, is the consequence of the penetration of the organ by the depressed and jagged fragment. So commonly is this complication caused by violence applied directly to the seat of fracture, that the character of the accident may be almost certainly predicated from the presence of the unequivocal signs denoting the organic lesion. Thus, a severe blow received on the ribs, a heavy fall on the side, the passage of the wheel of a vehicle over the chest, commonly produce this effect, by forcing the broken bone inwards beyond the resisting capacity of the lung:—a property due, partly, to the natural elasticity and resiliency of the organ, and in part to its compressibility by parting with its air. The blow, therefore, which produces this injury must be sharp and circumscribed, or of a nature to compress forcibly the whole walls of the chest. This explanation accounts for the fact that, when the lung is wounded, we so commonly find two or more ribs broken; or, if the injury be limited to one rib, the displacement, from laceration of the connecting tissues, is more obvious than where such fracture is the consequence of overbending of the rib.

The ordinary and pathognomonic sign by which superficial laceration of the lung is characterised, is the escape of air from its tissue. This may occur in two ways: either by extravasation into the subcutaneous areolar tissue, or by accumulation in the pleural cavity. Although such lesion cannot occur without some laceration of vessels, I have observed that the presence of blood in the sputa is by no means a necessary concomitant of the escape of air. Probably such extravasated blood passes into the pleural cavity; certainly it is rare to find ecchymosis beneath the skin in the neighbourhood of the fracture. The condition which favours one or other form of escape of the air—which determines whether it be emphysema or pleural extravasation—would appear to be purely mechanical; viz., the correspondence or otherwise of the wound in the lung with

the wound in the costal pleura. Such coincidence may be due to the existence of some old adhesion between the adjoining surfaces of the pleura, a circumstance which any one familiar with *post mortem* examination must be aware is very common; or it may be determined by the degree of distension of the lung at the moment that the fracture occurs. If the wounded lung recede from the position it occupied at the time the injury was inflicted, the breach in its texture is valvular in relation to that of the reflected pleura; and the escape of air, if there be any, is into the pleural space. Probably the occurrence of this form of effusion is not infrequent, when to such a limited extent as not to attract attention; and it may, in part, account for the dyspnoea which characterises, more or less, all these fractures; whilst it is not sufficient to be manifested by signs whereby it is readily recognised when more developed. No doubt such limited pneumothorax is favoured by previous adhesions in the neighbourhood of the wound, if they be not an essential condition to its occurrence.

Circumscribed *Emphysema* is common, and creates but little anxiety, either on account of its presence, or of contingent inflammation in the wounded lung. There is no limit to the extension of such extravasation, except the plastic sealing of the lesion, and the consequent arrest of the escape of air. Even more general emphysema is not, by itself, necessarily an alarming symptom; but if it spread rapidly, this sign may be accepted as a measure of the gravity of the injury to the lung. Yet I have seen many instances in which air has been diffused over the trunk, face, and extremities, without the subsequent manifestation of any symptoms of pneumonia.

The peculiar crepitation which, on pressure, is indicative of the presence of air in the subcutaneous areolar tissue may, under certain circumstances, be a source of obscurity, or even of error, in diagnosis. Whenever extravasation is so limited as to have been overlooked until the ear or the stethoscope is applied to the chest, the sound elicited may be mistaken for the crepitation of pneumonia; under any circumstances, superficial emphysema seriously interferes with a satisfactory examination of the lung, until the air is carefully pressed out and excluded from the spot to which the stethoscope is applied. I have realised the embarrassment to which I allude, and, therefore, have mentioned it; probably the obscurity was due to my unpractised surgical ear.

Of accumulation of air in the pleural space—*Pneumothorax*—I have had some few cases under my care where the signs and symptoms were well-marked, and indicated an amount of pressure on the lung which almost entirely suspended its function for a time. The loud resonance of the affected side of the chest with absence of breath-sounds, and accompanied by dyspnoea and a livid tint in the face, indicating imperfect oxygenation of the blood, characterise this condition. The distension of the pleural cavity may even thrust aside the pericardium and displace the heart. I have stood by the bedside, with the instruments ready to perform paracentesis if requisite; but I have never found it necessary in this condition. The fact is that the actual mechanical relations of the affected part, at the climax of the mischief, constitute the essential condition of its relief. When air ceases to enter the lung, it can no longer be pumped into the pleura; the wounded lung has rest; and plastic lymph closes the lacerated opening. The extravasated air is gradually removed; and, *pari passu*, the healed lung resumes its function. The observed condition of the patient coincides with this explanation; viz., increasing dyspnoea to an alarming extent; the continuance of this condition for a period not very prolonged; and then gradual amendment, with the removal of the abnormal signs and symptoms. In other cases, the encroachment on the lung stops short of this extreme compression.

In my experience, emphysema, except to a limited extent around the fracture, does not usually occur with pneumothorax. The mechanical relations to which I have referred, account for the absence of one form of extravasation when the other is present; the following case, however, exemplifies this complication. J. F., aged 43, was admitted under my care about five years since, having fallen from a high cart on to a heap of stones. He did not complain much of his chest at first, having a severe contusion of the hip, which gave him great pain. But in the evening, some emphysema made its appearance over the right side. On the following day, when I saw him, the emphysema had extended over a considerable space, and quickly spread to the neck. The breath-sounds were indistinct towards the lower part of the right side, whereas the resonance on percussion was increased. On the third day, the emphysema had extended still further, but there were no general symptoms to create uneasiness. On the fourth day, the breathing became oppressed, the pulse quickened, and the face flushed. The resonance of the right side had diminished, so as to be less than that of the left, and the breath-sounds were still indistinct, and there was some cough. Dr. Bristowe saw the case with me at this period, and agreed with me in regarding the pneumonia as local. All the symptoms gradually subsided, and the patient ultimately recovered. I find the following rec-

marks in my note-book appended to this case. In this instance the lung was wounded by the broken ribs being driven in upon it; air was extravasated into the areolar tissue; and the increased resonance of the affected side, combined with partially suppressed breath-sounds, indicated the further complication of extravasation of air into the pleura. When pneumonia seemed imminent, the diagnosis was obscured by the lung receding from the chest-wall as air accumulated in the pleural space; and the pneumonic crepitation was masked, and confused with the superficial crepitation in the areolar tissue—a source of perplexity which was in great measure removed by pressing the air away from the part to which the stethoscope was applied. With the dyspnoea and fever came diminished resonance of the affected lung. The absence of coloured expectoration, and the character of the cough, aided the diagnosis in this complex case.

Occasionally in severe injuries of the chest, we have the opportunity of witnessing the state of collapse of the lung produced by pneumothorax; and it is remarkable to what an extent the organ is shrunk from uniform compression; how effectually the air has been pressed out of it, and how shrivelled it appears. I have no recollection of paracentesis for pneumothorax ever having been performed in St. Thomas's Hospital since I have been connected with it; therefore, I conclude it can rarely be demanded. The temporary inconvenience caused by emphysema scarcely ever justifies interference. In one case only do I remember to have observed relief from evacuation of the air; and that was in a child in whom the emphysema was almost general.

What becomes of air thus extravasated? How is it removed? There is no doubt that, whether in the pleura or areolar tissue, it sometimes disappears with surprising rapidity; yet, as far as I can gather, there seems to be but little, if any, accurate knowledge as to the mode in which it is removed. This question would appear to be influenced very much by the nature of the gas which has accumulated, whether it be common atmospheric air which had passed into the tissue from without, or the product of chemical decomposition within. Yet the issue is, in reality, but little affected by these different conditions; for the habits of the gases are so similar in relation to this point, that, whatever their nature, their removal must obviously depend upon exactly the same kind of action, differing only in degree. Absorption is the agency to which such removal is usually attributed; but probably this process is accomplished only after the gas has been gradually dissolved in the fluids of the parts; and both physically and physiologically this view appears to be reasonable. The permanent gases are all of them more or less soluble in water; some to a much greater extent than others, but all are subject to the same law. Gas dissolved in water is so incorporated therewith, that under any ordinary circumstances absorption of the liquid implies absorption of the gas.

According to the circumstances under which they are produced, the gases present may be a combination of oxygen and nitrogen, or of carburetted and sulphuretted hydrogen. The extent to which these gases are soluble in water varies extremely. Thus, 100 cubic inches of water dissolve 300 cubic inches of sulphuretted hydrogen, and only two inches of nitrogen, the relative solubility of the four gases being as 1 to 24, 65, and 120. The low solubility of nitrogen would, according to the supposition named, require a longer period for its absorption; whereas sulphuretted hydrogen should be much more rapidly removed; or, in other words, a much longer time would be required for the absorption of atmospheric air, than that of gas, the product of decomposition; a circumstance which may throw some light on the obscure subject of blood-poisoning, where the conditions for the disengagement of sulphuretted hydrogen are favourable. Yet it would be difficult to erect, out of this comparison, any principle of diagnosis upon which dependence can be placed; for, in the case of atmospheric air, usually the extravasation takes place in a definite time, and is not renewed; whereas, in the case of gas disengaged by decomposition, the producing elements, in the form of disorganised tissue or fetid fluid, being still present, there is no limit to the production of fresh gas, as that which exists is removed.

Before quitting the subject of injury of the thoracic viscera, accompanying fracture of the ribs, I may remark that I have seen one, and but one, instance of wound of the heart from this cause. I shall again refer to this case in a future lecture.

Hernia of the lung may occur, when there is such a breach in the chest, from accident, as to permit it; or if the diaphragm be ruptured so as to allow of the escape of the abdominal viscera into the pleural cavity. This latter form of injury I have seen, *post mortem*, in rapidly fatal cases; but I have never had the opportunity of diagnosing it during life. No doubt, the laceration of the diaphragm is the most serious element in such a lesion: to this I shall again refer. Of pulmonary hernia I had an interesting instance under my care about a

twelvemonth since; and, as the case is a good exemplification of this form of injury, as well as of emphysema, I will quote it.

D. B., aged 39, a salt-hawker, with very defective vision, was knocked down in the street by the pointed shaft of some vehicle striking his chest on the right side at the upper part. He was immediately brought to the hospital. On admission, there was some degree of shock; his respirations being 20, and his pulse 92, in the minute. On examining the seat of injury, a peculiar appearance was witnessed. At each inspiration, a large tumour, of the size of the doubled fist, presented itself below the clavicle; and this disappeared at each expiration, leaving a deep depression, capable of containing a couple of ounces of fluid, at the least. On digital examination, I found that a large gap in the chest wall corresponded to the site of this alternating swelling and depression; and its position indicated that this was due to the absence of the second rib, at or near to its attachment to the sternum. The cartilage of this rib had, in fact, been displaced and driven in. There was no emphysema whatever at this time, and the patient did not suffer from dyspnoea. The chest-sounds were perfectly normal, and there was distinct crepitation in the tumour. On the following morning, the right side of the neck and chest began to show signs of emphysema; and there was a noisy, musical sound, during the filling and collapse of the tumour, which was now reduced to the size of an orange. There was also acute pleuritic pain near the seat of injury, but no sign of effusion into the pleural space. There was some congestion of the face; but the lips were well injected. He began to cough; and his pulse had risen to 112, and his respirations to 26. Temperature normal. The emphysema prevented me from using the stethoscope satisfactorily. A few ounces of blood were taken from the arm. On the third day, there was less congestion of the face; but his pulse was quick, and his cough was troublesome. There was loud rhonchus over the right side of the chest, and friction-sound was audible at the lower part. I ordered that a light pad should be applied over the injured part. The emphysema had by this time extended to the trunk, face, and limbs, reaching to the right forearm and knee. He spoke with difficulty, and was easier when laid on the left side and raised in bed. On the fifth day, he was greatly improved in every respect; and the swelling no longer appeared as previously when the pad was removed, though there was an alternate rise and fall at the injured part, synchronous with each inspiration and expiration. On the eighth day, the friction-sound had disappeared; but there was relative dullness generally over the left (opposite) side of the chest, the right being more resonant. Expectoration scanty, and slightly tinged with blood; emphysema diminishing, though still distinguishable in the groins, arms, and face. Gradually, and with many fluctuations, these symptoms subsided; and, at the end of six weeks, the patient was convalescent. The only abnormal sound to be heard over the chest was some dullness on percussion just below the seat of injury. The gap remained, but presented to the touch more consistence than at first. Some plastic deposit evidently occupied the space; and the impulse of the distended lung during inspiration was scarcely perceptible.

Many points of interest, bearing on the diagnosis, present themselves in considering this case. The alternative of our having to deal with circumscribed emphysema of the areolar tissue naturally suggested itself, but was rejected, on account of the strictly defined limits of the tumour, and the absence of any tendency to diffusion of the air beyond its boundary, until after the lapse of some hours, and then very gradually so. The lesion was followed by an attack of acute pleurisy and some pneumonia. The relative resonance of the two sides suggested to my mind the probability of there being some air in the injured pleura; yet the interval of a week renders such an occurrence very exceptional. The displaced fragment of rib must have retained its abnormal position, for it could not be felt.

I have never seen pulmonic hernia resulting from wound of the thoracic walls; indeed, the foregoing is the only case of external hernia of the lung that has come under my observation.

Rupture of the lung from compression of the walls of the chest is occasionally met with; but I do not remember to have seen this occurrence unaccompanied by fracture of the ribs. Yet the absence of displacement of the broken ends of bone points to compression as the cause of lesion of the lung, as in the following instance. A young man was crushed between the shaft of a cart and a wall, the shaft striking him between the inferior angle of the right scapula and the spine. He was in a state of pulseless prostration when admitted, and continued so during the forty hours that he survived. Dyspnoea was increasingly distressing; and emphysema had extended from near the seat of injury in the back, over the entire trunk. A large rent was found across the right lung; and the corresponding pleura contained a quart of blood. The sixth, seventh, and eighth ribs were broken near to their angles, but had not penetrated the lung.

A similar condition was manifested in a child under my care, who was run over, and survived the injury only a few hours. The lower lobe of the right lung was torn almost across, and the pleura contained nearly a pint of fluid blood. It is a remarkable circumstance that, in this instance, although some ribs were broken, the pleura was not wounded.

The presence of *hydrothorax* or *empyema*, if they occur as sequences of injury of the chest or of its contained viscera, is manifested by the indications which characterise these affections when consequent on inflammation from other causes. Although these conditions have rarely a traumatic origin, the surgeon should be alive to the possibility of their occurrence after acute pleuritis and pleuro-pneumonia; and the disinclination of the patient to lie on one side, the absence of vibration in the walls of the chest on the affected side when speaking, displacement of the heart, loss of symmetry in the chest-walls, and, notably, bulging of the intercostal spaces, would suggest the presence of fluid, even without the aid of the stethoscope. Yet the above signs may be more or less obvious when the pleura is not the seat of mischief, as I shall have occasion to exemplify, in a future lecture, by a remarkable instance in which an enormous cyst was developed below the diaphragm, and in its growth thrust aside all the viscera, both abdominal and thoracic, in its neighbourhood.

May the lung be the subject of *concussion* or *contusion*? I think this inquiry may, in both instances, be answered in the affirmative. Indeed, I have seen instances which might, on first view, be regarded as suggestive of contusion by *contre-coup*, or, at least, of seriously disturbed function in the lung on the opposite side of the chest to that on which the violence to the walls had been inflicted—a result which I shall endeavour presently to explain. It is true that, in many instances, such consequence is due to squeezing of the whole chest, and rending of the suddenly compressed vessels. This would appear to be the explanation of many of those apoplectic clots which are observed in *post mortem* examination of injuries of this class. Yet other cases which have come under my notice compel me to believe that simple functional disturbance of the lung may occur as the consequence of force applied, without mechanical lesion; and also that contusion and other results of the violence inflicted are met with occasionally, as indirect effects of such violence.

I do not believe that bruising of the lung, the chest-walls retaining their integrity, is a frequent accident; for its own resiliency and elasticity are its protection. And, when it does occur, I am unacquainted with any special diagnostic sign by which to recognise it—apart, that is, from the general indications of disturbed function, and possibly local pneumonia; unless we may accept as evidence the secondary expectoration—usually after the lapse of forty-eight hours—of blood-stained mucus, where no pneumonia exists. There is, however, no doubt that such lesions as those I refer to may cause local or even general pneumonia, as a consequence of the excessive action excited in the necessary effort to repair the mischief which has been inflicted.

But contusion of the chest-walls, without puncture or external wound, may entail more serious local consequences. Thus, I am acquainted with a case in which a blow from a fist was succeeded by acute local pneumonia, which terminated in abscess, and proved fatal. Similar consequences may be caused by suppurative inflammation, entailed by injury or operation in close proximity to the pleura, without perforation of that membrane. In these instances, I presume that inflammation extends, by contiguity, to the pleura and lung. I may remark, that a congested state of the lung is a not infrequent sequence of a practice which is now, happily, becoming obsolete: I mean pugilistic encounters, in which the chest is often sorely bruised; and thus the foundation of organic disease is laid, which has frequently proved fatal to those addicted to this practice.

The influence of previous disease or of chronic functional disturbance in the lungs should be taken into account in the diagnosis of these injuries and their consequences, and more especially in the prognosis in this class of cases. Such instances are of every-day occurrence in our hospital practice. For example, a bricklayer, fifty-eight years of age, was admitted under my care, having fallen from a height on to his chest, and fractured three or four of the upper ribs on the left side. He had been the subject of chronic bronchitis for a long time. He survived for a week, suffering severely from dyspnoea and inability to expectorate; and pneumonia, with prostration, supervened shortly before death. Recent pleurisy on the right side, with consolidation of the corresponding lung at its upper part, was found. The heart was large, and the left ventricle dilated. In this instance, the opposite lung to that injured was specially involved in the after-consequences.

How are we to explain the phenomena presented by the following case, which is simply typical of many that I have witnessed? A lad, ten years old, was admitted under my care last year, having been run

over. There was profound shock, and the breathing was difficult and hurried. There were no marks of bruising on the chest, but the movements of the left side were impeded. There was no fracture; but auscultation detected loud bubbling sounds, as of air passing through fluid; the resonance was diminished. On the right side the respiration was puerile; there was no expectoration. The boy was well in a fortnight.

In the first place, I may observe that this case exemplifies my remark, that serious functional disturbance may ensue as the consequence of mechanical violence, whereas a rapid recovery leaves us no alternative but to conclude that the lung has escaped organic lesion. But in this instance there were abnormal breath-sounds, with impaired movement on the left side, and puerile respiration on the right; or, in other words, partially suspended function in the former, and excessive activity in the latter. The explanation would appear to be that the left lung sustained the shock, and thus threw the burden of the work on the right—a partially paralysed state of the former, and congestive hyperæmia of the latter, being the result. It is in this way alone, I think, that we can account for the apparently paradoxical phenomena which we often witness in these injuries; viz., temporary paralysis of one lung entailing engorgement of the other; for, it must be remembered that a retarded circulation through one set of pulmonary vessels does not diminish the column of blood discharged by the right ventricle into the pulmonary artery; and the process of combustion is disproportioned to the quantity of combustible material supplied to one lung, which is thus surcharged with blood; and the labouring heart is also involved in the disturbance. Of course this condition may issue in acute inflammation, where such predisposition exists, but it generally subsides spontaneously, or may be relieved by local depletion.

The following case is one of peculiar interest, from the remarkable condition of the chest which supervened after severe concussion of the whole body.

J. H., a lad 12 years of age, was admitted into the hospital under my care about three years since. He had fallen about forty or fifty feet; but, with the exception of some bruises about the trunk, the only discoverable injury was a fracture, or separation of the epiphysis of the humerus; the shock was moderate. On the day following that on which the accident occurred, I found him with a flushed face, and hurried and oppressed breathing; but, though the dyspnoea was urgent, there was neither lividity nor coldness of the lips or of the extremities. The heart's action was forcible and frequent, but the sounds were normal. Over the left side of the chest there was entire absence of resonance on percussion, and of breath-sounds, and indeed of any sound but the heart's beat, except, perhaps, the feeblest murmur just below the clavicle. The vocal thrill was equally distinct on both sides. On the right side there was normal resonance on percussion, and the respiration was distinctly audible—indeed, puerile. There was neither cough nor expectoration. Four leeches were applied over the upper part of the affected lung, with almost immediate relief. On the following day the boy was breathing quietly; and in less than forty-eight hours all the above symptoms had disappeared, and the respiratory sounds, on auscultation and percussion, as well as the heart's action, were found perfectly normal.

The condition of this patient seemed so anomalous that I sought the assistance of Dr. Clapton, who was in the hospital at the time, and he entirely confirmed the diagnosis, or rather the presence of the signs I have mentioned; although he was at a loss, like myself, to account for them satisfactorily. The absence of pain, and the continuance of the costal movements, showed that there was no consolidation; indeed, the suddenness of the attack forbade that supposition. The entire left lung was the seat of suspended respiration. The extremely excited action of the heart appeared to indicate serious obstruction in the pulmonary circulation; and the result of the treatment points in the same direction. The lung was paralysed from shock, resulting from the violence done to the chest in the fall; and reaction was accompanied by engorgement of the pulmonic capillaries, due, probably, to the still suspended function of the vaso-motor nerves.

The conclusions I draw from these and similar cases are, that serious functional derangement, without organic lesion, may result from concussion or concussion of the chest; that this derangement may occur without any injury to the thoracic walls; and that it may be transient and subside without any ulterior results: but that, on the other hand, the disturbance in the circulation may be succeeded by inflammation, either local or general, of the affected lung. The vascular disturbance to which I refer appears to be a partial arrest, or retarded flow, of blood in the capillaries, giving rise to engorgement or congestion—not as the consequence of excess in the supply, but of a passive condition of the vessels, which fail to carry onward the blood received. This condition being the result of shock, it seems reasonable to conclude that the fault or failing is in nerve-supply to the vessels of the lung; that the vaso-motor nerves are paralysed, and thus permit this distension and conse-

quent engorgement of the capillaries—an inference which is consistent with what is known respecting the influence of these nerves over the vessels to which they are distributed. That the condition I speak of, or one allied to it, is occasionally observed in the lung on the side opposite to that which has sustained the injury, may be explained by the presence of a largely augmented supply of blood, which is thrown into it in consequence of the partially arrested circulation in the injured lung; perhaps something may be due to communicated concussion and to sympathy. However this may be, I certainly have noticed that serious lesion of one lung is accompanied, occasionally, by transient vascular engorgement of the other.

Death sometimes occurs rapidly, or even suddenly, under these circumstances; the patient is, in fact, suffocated from blocking of the air-cells and tubes by vascular pressure and accumulation of mucus. The *post-mortem* condition in such instances is exemplified in the case of a patient of mine who died in strong convulsions, struggling for breath. The first rib was found fractured near its sternal extremities, and the third, fourth, fifth, sixth, and seventh, near their necks. There was a little clear fluid in one of the pleuræ, but they were otherwise healthy. Both lungs were gorged with blood, a considerable part of the left not crepitating, and sinking in water. The trachea and bronchi were deeply injected, and contained thick, dark mucus; the surface of the brain also was deeply congested.

The repair of lacerated wounds of the lung seems to be effected by the deposit of plastic material upon and around the lesion; but I have rarely witnessed this to any extent, even where the patient has survived long enough for the lung to be involved in general inflammation. The following case exemplifies this condition, and likewise a state of the pulmonary arterial circulation which must have been consequent upon its obstruction in the injured lung.

A young man was admitted under my care, over whose chest the wheel of a waggon had passed. Three ribs on the right side were broken; and he was in a state of collapse, with extending emphysema. His lips were dusky; his breathing was laboured and abdominal; the inspirations were catching; and the expirations sudden, brief, and explosive. He survived forty-eight hours; and, shortly before death, his chest became dull on percussion, the vocal thrill exaggerated, and the heart-sounds indistinct. The sputa had been only slightly tinged with blood. There was found a lacerated wound of the upper lobe of the right lung, around which recent lymph was deposited in a rough granular form; the rest of this lung was barely crepitant. Clots were found in the tissue of the left lung, which was collapsed, emphysematous, and congested. The branches of the pulmonary artery in this, the lung which was *not* lacerated, contained fibrinous, cord-like coagula, prolonged from a clot in the right ventricle of the heart.

In a case of compound fracture of the second and third ribs in a child, which occurred recently in St. Thomas's Hospital, air was audibly driven out of the lung at each expiration, and the integument seemed to be sucked in at each inspiration. He survived six hours; and, on examination after death, a large lacerated wound in the upper lobe of the right lung was found to be closed, by the cementing of its adjoining surfaces. There was no pneumothorax.

Penetrating wounds of the lung are, under any circumstances, serious; and their fatality is much enhanced by the retention of any intruding body. Yet, as I have already remarked, it rarely occurs to the civil surgeon to witness such cases, which are almost always consequent upon gun-shot wounds. Of penetrating wounds from pointed weapons I have seen some few instances. Occasionally the costal pleura alone is perforated, as I remember witnessing on one occasion, many years since, in the operation of tracheotomy with a trochar; and also in a case of deligation of the subclavian artery. A similar accident occurred likewise in a patient in whom I had opened the trachea for acute laryngitis. A few hours after the operation, the tube was incautiously removed, in consequence of some obstruction in it, and another substituted. Shortly after this, in the night, the clinical clerk's report states that it was noticed the patient was able to speak, and was breathing by the mouth as well as the tube; air entered the cannula, which was quite pervious, but was not expired through it. Presently he complained of severe pain in the lower part of the chest; and soon afterwards his face, neck, and eyelids, began to swell, and became livid. Cold water was dashed in his face, and artificial respiration was resorted to, but without avail: he died twelve hours after the operation. The symptoms, as reported to me in the morning, perplexed me, for I had left my patient entirely relieved by the operation: I therefore looked to the autopsy with much interest for an explanation. The appearances revealed the fact that the substituted cannula had not entered the trachea, but had been pushed down by its side; and the introduction of a feather to clear away the supposed obstruction in its interior had completed the mischief. The patient died asphyxiated; and the lung was com-

pressed by the presence of air in the pleura. Unfortunately, a double-tube, obviating the necessity of removing the cannula, was not in use at that time.

Local pleurisy, and even pneumonia, may result from injury to the pleura. Thus, a young man was impaled by falling on some spikes, two of which wounded him between the sixth and seventh ribs. The shock was trivial, but he suffered from pain in the side and dyspnoea; yet there were no abnormal chest-sounds during the first week. After this there was pleuritic friction over a limited space, with slight cough, and no expectoration. After the lapse of another week, there was some dulness and indistinctness of breath-sounds over the injured side. He recovered. Probably, in this instance, the lung had receded before the penetrating spike, and was not wounded; and the later physical signs might have been due exclusively to pleural effusion.

The chief danger attending a penetrating wound of the lung from a sharp-cutting instrument seems to be in the early loss of blood: if this peril be survived, the risk of fatal inflammation would appear to be less, under favouring conditions, than might be anticipated. The amount of blood lost varies very considerably; and from this circumstance the direction of the wound may be diagnosed with tolerable accuracy, and the chances of the patient's survival conjectured. The further such wound is removed from the root of the lung, the less serious the mischief inflicted; inasmuch as the bronchial tubes as well as the vessels diminish in size, as they recede from the root and approach the circumference of the lung. A singular instance, exemplifying the rapidly fatal consequence of perforation of the lung near its root, occurred a few years since in a patient brought to St. Thomas's Hospital. A stout woman stumbled in the street, and fell upon the broken end of the handle of her parasol, which pierced the soft parts above the right mamma, and entered the chest between the second and third ribs. It was pulled out by a passer-by, and an increased gush of blood from the mouth proved almost instantly fatal. On examination, the wound was found to extend to the root of the lung, and allowed of the little finger being passed between the pulmonary vein and the bronchus.

The pneumonia which succeeds a wound of the lung does not manifest a tendency to spread far beyond the track of the instrument by which it was inflicted; although, as I shall presently show, this inflammation entails permanent obliteration of the air-cells in the lung-tissue involved. These injuries are not always simple, or confined to the thoracic viscera: the oblique entrance of a pointed weapon, or the position at which the lesion is inflicted, may involve some part of the abdominal contents likewise, thereby complicating the diagnosis. A sea-captain recently under my notice, whose case I may have occasion to refer to again in a future lecture, was the subject, apparently, of such an injury. He was stabbed by a Malay on board his vessel, the knife being thrust backwards and upwards, from the point of entrance four or five inches below the right nipple. The wound was transverse, and an inch and a half wide at its point of penetration. He was exhausted from loss of blood; and, there being no surgeon on board, the wound was closed with a pledget of lint dipped in Friar's balsam, for which adhesive plaister was substituted after two days. He had but little pain, and no subsequent discharge, the healing process being completed in fifteen days. He had neither cough nor hæmoptysis. Five weeks afterwards, when on shore, a swelling which had appeared near the wound was lanced, and a quantity of yellow fluid escaped, which stained his linen of an ochre colour; and this discharge lasted for some time, gradually becoming paler and more limpid. When I examined him, he complained of soreness round the wound, and some oppression, in breathing, low down on that side of the chest. The lower lobe of the right lung was solid, as manifested by the dulness on percussion and total absence of breath-sounds at that part. But for this last sign, and the position and direction of the wound, it might be doubted whether the lung was really wounded; for, it will be observed, there had been neither hæmoptysis nor cough. Probably the breadth of the wound, and the free discharge of blood externally, until syncope ensued, may account for this circumstance, which is certainly unusual. From the other symptoms, I conclude that the liver was implicated in the injury; and of course the diaphragm must also have been included. The permanent consolidation of the lung exemplifies the fact to which I just now referred; viz., that the fibrinous deposit in the lung, from traumatic inflammation, is not absorbed without obliteration of texture, as is the plastic deposit in non-traumatic pneumonia. This, indeed, is what we should expect, in considering and comparing the pathological condition under the different circumstances. There is breach of texture in the former, including the air-tubes and cells, and the inflammation and its consequences extend to and involve all these tissues in the reparative effort. Not so in the latter. There is no necessary disintegration of tissue; and, whether the deposit be interstitial or intracellular, or both,

its absorption leaves the affected textures *in statu quo ante*—in their previous, actual, and functional integrity. I may remark, incidentally, on the very sensible and judicious treatment adopted in the early period of this case. The Friar's balsam (compound tincture of Benzoin) has been much disused of late, but is really an excellent styptic for hermetically closing a wound; and it thus fulfils the, perhaps, not least important function of the modern carbolic acid treatment.

The following case likewise exemplifies the pathological point last referred to in the preceding. J. W., aged 49, became a patient at St. Thomas's Hospital, after the healing of a wound which he received in the following way: A garden-fork, with long, flat prongs, was thrown at him, and one prong entered the back of the chest, immediately below the inferior angle of the scapula; a second prong made a smaller wound lower down. The depth to which the upper prong penetrated is, of course, conjectural; and the patient's assertion that it entered three or four inches is probably an exaggeration. He stated that he did not lose much blood from the wound, but that he afterwards had hæmoptysis. This must have been succeeded by pleurisy and hydrothorax, for there was an abundant flow of serum from the wound two months after the accident: this continued for a few hours only, and soon afterwards ceased entirely. He did not suffer much pain at any time; and the wound was quite healed at the end of three months. On examination with the stethoscope, in conjunction with my colleague, Dr. Clapton, I found that there was neither resonance nor vesicular murmur in the neighbourhood of the wound, and the respiration was bronchial: there was evidence of adhesion between the adjoining surfaces of the pleura at the injured part. As this last examination was made nearly two years after the accident, we may conclude that the condition described represents the permanent state of the lung.

In the College Museum is a representation of a sailor, who was transfixed by the pivot of a heavy trisail-mast, which passed obliquely through his body, entering above and to the inner side of the left nipple, and coming out at the upper part of the loin on the same side: he was otherwise seriously injured. The patient was under Mr. Andrews' care in the London Hospital, and recovered in five months so as to be able to walk about; and he ultimately resumed his sea-faring occupation. Probably the lung was perforated, in this instance, at some distance from its base; and it is doubtful whether the diaphragm could have escaped.

The preparation from our museum, which is on the table, is the anterior wall of the chest of a stout man, who was transfixed, transversely and horizontally, by the shaft of a gig. It entered the thorax on the left side, between the second and third ribs, fracturing the former, as well as the cartilages of the third and fourth; and, crossing the anterior mediastinum, made its exit at a corresponding point at the opposite side, fracturing the third rib. He was fixed in this position till assistance arrived; and, when liberated, breathed deeply and freely, and was not faint until he was prepared for bed, having walked to his house, close by. He survived ten years. The preparation shows the repair of the fracture and the adherent lung.

CARDIFF INFIRMARY.—We mentioned a short time ago (June 10th) that a number of working men had formed a Committee of thirty-five, for the purpose of raising sufficient money to clear off the debt of about £1,100. The Committee have already collected £223. The debt, however, is within a trifle of £1,200, instead of £1,100, which of course necessitates a greater effort, and, at the same time, makes it more praiseworthy.

DONATIONS.—Her Majesty has contributed £100 to University College Hospital; and a donation of £200 has recently been received from the Marquis of Westminster, for the general purposes of the hospital. The Marquis has lately forwarded a further contribution of £100 to the general funds of the British Home for Incurables at Clapham.—Mr. Stead, of Glasgow, has presented £1000 to the Hospital at Yarmouth.—The Ashton Infirmary has received a donation of £5,000 from Mr. Robert Huggin of Liverpool.

THE DOCTORS OF HERAT, IN AFGHANISTAN.—General Ferrier says as in their eyes every European is a doctor, their conversation never ceased running on the healing art, of which they considered themselves distinguished professors. They often brought with them their drugs, in order that I might tell them how to use some chemicals which they had received from India. They gave these chemicals in progressive doses, in all obstinate cases, until they found out the right dose, and in what diseases to use them. Finally, one of them, Mirza Aska, pulled a bottle of cyanuret of mercury from his pocket, and requested to know what devil of a salt that could be. "It has been of little or no use to me," he added, "for of over one hundred patients that I have given it to, all died but one."—*Caravan Journeys.*

THE HYDATID DISEASE IN ICELAND:

A FEW REMARKS ON DISTRICT-PHYSICIAN JOHN FINSEN'S CONTRIBUTION TO OUR KNOWLEDGE OF THE DISEASE.

By JOHN HJALTELIN, M.D.,
Physician-in-Chief, Reykjavik, Iceland.

AN abbreviated translation of Dr. Finsen's contribution may be found in the *British and Foreign Medico-Chirurgical Review*, No. LXXII, April 1868, with some remarks, probably written by the translator. Dr. Finsen seems very little acquainted with the best authorities on helminthology of our time. He freely quotes certain young physicians in Copenhagen, as Christensen, Storch, Aarestrup, and others, but takes little notice of the names of Cobbold, Davaine, or Siebold. Eschricht, Rasmussen, Storch, Aarestrup, and Christensen, have never been in Iceland at all; and of all Dr. Finsen's authorities, Dr. Krabbe alone has been here for a very short time, the greater part of which was spent in making some feeding experiments on dogs, in which he was assisted by Dr. Finsen. It was soon afterwards announced by them that the echinococcus of man was, by their feeding experiments in 1865, demonstrated to produce the *tænia echinococcus* of the dog, and this was put forward in some Danish medical journals without any regard to previous experimenters. The experiments of Krabbe and Dr. Finsen were afterwards made known in Germany through Dr. Kiichenmeister, Leuckart, and others. These experiments and the alleged discoveries of Dr. Krabbe, and perhaps of Dr. Finsen, who is himself an Icelander, became mixed with some curious stories, which were afterwards promulgated by high authorities. This was, no doubt, done without their being aware that they were spreading incorrect statements about a harmless, and by no means stupid little nation; namely, Iceland. One of these statements is to be found in Dr. Spencer Cobbold's little work, *Tape-worms and Thread-worms*, second edition; London, 1867, p. 57. "On the authority of Krabbe, it has been stated by Leuckart, that for every 100 inhabitants of Iceland there are 1,100 head of horned cattle, and every peasant has, on an average, six dogs. In Denmark, there are 180 cattle to every 100 of the people. There are several of the Icelandic doctors who not unfrequently have upwards of 100 patients (afflicted with this disease) under treatment at the same time, the total number of such cases in the island being estimated at 10,000. By far the greater number of those patients, however, are in the hands of quacks, whose influence is the greater because there are in all Iceland but six legally authorised medical practitioners, each of whom presides over a district of about 1,500 square miles (English), embracing a population of about 1,000 individuals. The treatment of the quacks is exactly suited to keep up the epidemic, for, amongst their remedies, the urine and excrement of dogs play a conspicuous part."

It would be difficult to find a statement of equal length which contains more error than this; and I am sorry that medical men of distinction, such as Drs. Cobbold and Leuckart, have been induced to adopt such misstatements. I have the pleasure of knowing Dr. Cobbold personally; and, should he happen to read these remarks, I request him to rest assured of my high esteem, and that I know that he and Dr. Leuckart are not to blame in this matter.

To estimate the value of Dr. Finsen's contributions to our knowledge of the echinococcus disease in Iceland, it will be necessary that the reader should be made acquainted with his proceedings here for ten years as a district physician. Dr. Finsen came here in 1856, when he had just qualified as a physician at Copenhagen, and had no experience of the endemic diseases of Iceland. He possessed, however, much of that self-confidence which sometimes belongs to young practitioners. He was, like the other district physicians, bound by our laws to send to me, as the chief physician in the country, a yearly report on the prevailing diseases in his district. I found that, contrary to custom, his reports were filled with insignificant cases, such as *otalgia*, *odontalgia*, rheumatic pains, and hysteria. The result of this upon his statistics will be presently seen.

Dr. Finsen states that the frequency of the hydatid disease in Iceland, as compared with other maladies, is only as 1 to 26. I must here remark, that this is quite contrary to the experience of every other observer. The late Dr. Thorstensen, who for nearly thirty years was the physician-general of this country, found that about 1 in 7 of the inhabitants was affected with hydatids. According to my own experience of numerous autopsies, I am inclined to think that in native Icelanders traces of echinococci may be found in nearly every *fifth* adult dead body in one or another of the internal organs. About thirty years ago, it was a general custom in this country to register the cause of death; and, by