

diagnosing hysterical pains, and may then usually be corroborated by finding that when the patient's attention is engaged elsewhere he permits of pressure, manipulations, and movements, which when his attention is directed to the part he would have described as "distracting," or "intense," or "unbearable," or by some similar term. This correspondence of all the facts about a given pain is a point which may enable the surgeon to give an opinion even in otherwise very difficult cases.

CHAPTER II.

THE GENERAL DIAGNOSIS OF INJURIES OTHER THAN WOUNDS.

It is important to remember that more than one lesion may be produced by a single injury or accident, and that it is the duty of the surgeon not only to determine that a certain lesion, *e.g.* a fracture, has been produced, but also to exclude every other, *e.g.* a ruptured artery, severe sprain, and so on. Errors, sometimes of grave consequence, are made by failing to make a *complete* diagnosis. In conducting an investigation for this purpose it is best to examine each structure separately and in succession, beginning with the skin and subcutaneous tissue.

1. Examine the skin and subcutaneous tissue, noticing especially discoloration and swelling.

(a) If the skin be discoloured dark-red or reddish purple, and the colour be unaffected by pressure, there has been an escape of blood from several small vessels, a *bruise*. This effused blood goes through the well-known colour changes, and if seen late may cause

merely a yellow stain. If the dark-red discoloration appear at some interval after an injury it points to a *deep bruise*, the blood escaping from deep vessels gradually reaching and staining the superficial tissues; this phenomenon is sometimes witnessed in fractures of the neck of the femur.

(b) If immediately or very rapidly after an injury a distinct fluctuating swelling be formed in the skin and subcutaneous tissue, and if the circulation in the part be not interfered with, the blood has escaped from torn vessels in such a manner as to form a blood tumour or *hæmatoma*. Two forms of hæmatomata are met with, the *circumscribed* and the *diffuse*. In the former the swelling is circumscribed and tense; in the latter the swelling is much less tense and involves a larger area, and is due to the detachment of the skin from the deep fascia with effusion of blood between them; in such a case the blood can be pressed from one part of the injured region to another. Thus, the author treated a case in which the whole scalp was separated from the pericranium without any wound; blood was effused between these structures, and when the man lay on his back it all collected in a soft loose swelling at the back, but could be easily pressed forwards on to the forehead, or laterally as far as the attachment of the scalp. Hæmatoma is generally combined with a certain amount of superficial bruising. The collection of blood may long *remain fluid*, or it may *coagulate*, and the presence or absence of fluctuation will determine this point; occasionally such a swelling *suppurates*, or, more strictly, the tissues around it become inflamed and suppurate. This has to be distinguished from simple inflammatory œdema following the tissue laceration, and is recognised (α) by increased and progressive swelling; (β) by surrounding œdema; (γ) by great heat and redness of the part; (δ) by severe pain of a throbbing character;

(e) by pyrexia of a suppurative form, the temperature curve rising and falling daily; sometimes there are chills or even a rigor, and sweating.

(c) The presence over a bruised part of superficial blebs containing serum, which is usually stained deep red or brown in colour, is an important sign of fracture of a subjacent bone. These blebs are often extensive, and to the uninitiated have a threatening look; they do not really add materially to the gravity of a case. They must be distinguished from the blebs caused by burns, in which the clear serum quickly coagulates, and from those of gangrene, which are accompanied by other signs of tissue-death.

2. Next examine the bone or bones of the injured part.

This should be done systematically and carefully. First compare it with the uninjured part, and look if there is any obvious deformity; if there is, ascertain that the two limbs or parts were symmetrical before the injury. Next measure the length of the two opposite bones, being careful to take exactly the same points on the two sides, and to place the uninjured limb in the position assumed by the injured one. It has been shown that perfect symmetry in the limbs is not so general as was formerly believed; and useful as is the detection of a difference in length between the two limbs, this sign alone must not be taken to prove the existence of a fracture or dislocation. Then run the fingers along the most superficial surface of the bone on the two sides (a) to compare the outline of the bones, and (b) to observe whether there be any very tender point in the injured bone; a fracture may cause so much displacement that the break in the line of the bone as compared with the sound side is at once apparent, as in the case of the common fracture of the clavicle; on the other hand, there may be no

displacement at all. The line of a fracture is generally the seat of *pain and acute tenderness*, and the detection of a spot in a bone that is acutely sensitive is strong presumptive evidence of a fracture in that situation, but it may be due to a bruise of the periosteum. Lastly, *examine for mobility* in the length of the bone; in so doing grasp the limb firmly with one hand close above, and with the other close below the supposed seat of the lesion, and first very gently attempt to move one hand independently of the other; if any movement or crepitus is detected, it is enough, but if not, then more force may gradually be used, and the whole length of the bone explored, until it is ascertained that no part of it is movable on the rest. In different cases reliance is chiefly placed upon one or other of these signs of fracture, as will be pointed out in the diagnosis of individual fractures.

THE INJURIES OF BONE ARE :

Bruise.

Fissured fracture	} (simple compound comminuted multiple.
Incomplete fracture	
Impacted fracture	
Complete fracture	
Separation of epiphysis.	

If there be severe pain and marked local tenderness in a part of a bone that has received a direct injury, and if there be no alteration in the axis of the bone, no irregularity in the outline of the bone, no shortening, no mobility in its length, no crepitus, it is a *bruise of the periosteum and bone*, or a *fissured fracture*. The distinction between these conditions is a matter of great difficulty; but the more diffused and dull the pain the greater the probability of its being only a *bruise*; the more severe, and the more precisely localised the pain and tenderness, and the longer these severe symptoms last, the

greater the probability of its being a *fissure of bone*. (See also page 228.)

If in a child, after an injury a bone be found bent and the direct distance between its two ends shortened, but there be no mobility at the bend, and no crepitus, it is an *incomplete fracture*, or *greenstick fracture*. This is most common in the forearm and the clavicle, but is seen in other long bones; it must be distinguished from a rickety curve in the bone, which is chronic, gradually produced, and symmetrical. Rickets and incomplete fractures may be associated together.

When, as the immediate result of direct violence to a bone, there is found to be some alteration in its contour and length, but no mobility at the seat of the supposed fracture and no crepitus, it is an *impacted fracture*. It is distinguished from incomplete fracture by the age of the patient and the deformity (when this can be clearly made out) not being a round curve in the bone. The lower end of the radius and the upper end of the femur are the most frequent seats of impacted fracture, and the means of exactly distinguishing these injuries are detailed elsewhere.

Where there is found mobility in the length of a bone, a *complete fracture* has been sustained; the examination of such a case also shows some or all of the following signs: alteration in length, if there be overriding or separation of the fragments; alteration of the contour of the bone at the seat of fracture, if there be any displacement of the fragments; rough crepitus on movement, if these fragments are in contact; localised pain and tenderness at the seat of fracture, at once greatly increased by any movement of the fragments; and swelling. As bones are very vascular structures, their fracture is followed by a good deal of hæmorrhage, and in a few hours this is succeeded by a free serous exudation. These facts explain

the occurrence of the blebs mentioned above. In many cases the patient hears the sharp snap of the breaking bone at the time of the injury. If there is no wound of the soft parts associated with the fracture, or if there is a wound which does not lead down to the fracture, it is a *simple fracture*; but if, on the other hand, there is a wound leading down to the fracture, whether it be through the skin or mucous membrane, it is a *compound fracture*. (See Wound of bone, page 43.) The *direction of the fracture* may be recognised by the deformity present, and by noticing the plane in which mobility is obtained. If mobility is obtained with great ease, and is accompanied with marked and readily-elicited crepitus, suspect a *comminuted fracture*; and if manipulation shows that the bone is broken into more than two fragments (if, for instance, other fragments are felt separate from and movable upon the two main ones), this suspicion is converted into a certainty. If, however, the fragments are broken off by distinct fractures, it is called a *double fracture*; this accident is rare except at the lower end of the femur and humerus. Comminution is generally easily detected in compound fractures when the fragments can be felt, but is often overlooked in simple fractures, especially when small splinters or fragments are detached from the deep aspect of the bones. When a sharp-pointed fragment, not including the whole thickness of a bone, is detached, it is spoken of as a *splintered fracture*.

If a fracture occur in the position and direction of the junction of an epiphysis with a diaphysis, in a person under twenty years of age, and if the crepitus be softer and less distinct than in a common fracture, and the projecting points of the fragments be smooth and rounded, or at least less sharp and angular than in ordinary fractures, it is a *diastasis* or *separation of an epiphysis*. This is most commonly seen at the lower

end of the radius and femur, and the upper or lower end of the humerus. It is a grave injury, as it is liable to arrest permanently the growth of the bone.

3. Then examine carefully into the condition of the joint or joints.

This examination should be systematic, and should determine (a) whether there is any displacement of the articular ends of one or other bone, and if so, to what extent; (b) whether there is any fracture of either bone at the joint; (c) whether there is any laceration of ligaments, or (d) effusion into the joint.

(a) Compare carefully the same joints of the two sides of the body and determine whether the articulating bones retain their normal relative position; any modification of this is a *dislocation*, which may be *complete* or *incomplete*. The two signs of dislocation which are unmistakable are the absence of an articular end of bone from its normal situation, and its presence in an abnormal position; and the student must not forget that the diagnosis should be made to rest upon these phenomena, and not upon mere alterations in contour and measurement, which, although depending directly upon the displacement, may yet be simulated by other conditions. For example, finding the glenoid cavity empty, and the head of the humerus resting on the ribs just below the coracoid process, are absolute signs of a subcoracoid dislocation of the shoulder, and are of more value than a number of such observations as "flattening of the shoulder," "alteration of the axis of the arm," certain limitations of movement, and so on. These indirect evidences of dislocation are by no means unimportant, and it is not intended to disparage them, but, in view of the number of the indirect signs given by some authors, and the stress laid upon them, it is necessary to insist upon the primary importance and value of the two great essential signs of dislocation. For purposes of

diagnosis, what I have called the "essential" signs of dislocation are alone sufficient, and it is only where, from special conditions, they cannot be clearly and directly elicited, that their indirect evidences have to be relied upon.

(b) The mode of investigating, and the signs of a *fracture* of the articular ends of bones, are those which have been already given in the previous section, and it is only necessary to add the special and characteristic features of *fractures into joints*, by which they may be distinguished from *fractures near joints*; these are (a) the position of the fracture, *e.g.* all complete transverse fractures of the patella must be into the knee joint; (b) the size and shape of the detached fragment: by this we can determine whether there is an extra-articular fracture of the internal condyle of the humerus, or whether the trochlear surface is broken off; or similarly, finding that an entire condyle is movable on the rest of the femur demonstrates a fracture into the knee joint; (c) effusion of blood into the neighbouring joint, recognised by the position and shape of the swelling, and by its appearance quickly after the injury: this sign is somewhat equivocal, as the extra-articular swelling may conceal that within the joint, and the joint may be swelled independently of the fracture extending into it; (d) subsequently, inflammation of the joint; (e) the nature of the fracture; some fractures are frequently complicated with fissures reaching into the adjacent joint, as *e.g.* those of the lower end of the humerus; and in wounds of bones from conical bullets extensive fissuring frequently occurs; (f) in compound fracture synovia may be seen to escape from the wound.

(c) If, after a sudden wrench or strain to a joint, it becomes swelled and painful, and movement is limited and very painful, while examination shows that there is neither fracture nor dislocation of the bones, nor

rupture, nor displacement of muscles and tendons, it is a *sprain of the joint*. These sprains vary much in their intensity. If there be an unnatural degree of mobility in a joint, as of lateral motion in the knee joint, it indicates *rupture of the ligament* normally limiting that movement; if, on the other hand, without this unnatural extent of movement, a particular movement causes acute pain, it indicates a *stretching and partial laceration of the ligament* that is put on the stretch by the movement in question. When, however, slight movements, not extensive enough to stretch any ligaments, elicit sharp pain, and when there is effusion into the synovial cavity, as shown by a fluid swelling having the outline of that cavity, it indicates that the chief stress of the injury has been upon the synovial membrane, and that it is to be regarded rather as a *bruise and laceration of the synovial membrane*. These lesions are variously combined in different cases, and it is often impossible to arrive at an exact diagnosis of the injury sustained; but in all cases great care should be taken to determine that there is no displacement of any of the structures entering into or immediately surrounding the joint,—bones, interarticular cartilage, or tendons.

4. **Examine the muscles and tendons of the injured region.**—The injuries these structures may sustain are :

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| (a) Bruise of muscle. | (c) Rupture of tendon. |
| (b) Rupture of muscle. | (d) Displacement of tendon. |

(a) When, after a blow, strain, or prolonged and violent contraction, a muscle is found somewhat swelled, tender to pressure, with a sense of stiffness and weakness, and acute pain is produced on attempting to put it into action, the injury is a *bruise or strain of a muscle*; when produced by a blow it is called a *bruise or contusion*, and when caused by

over use it is called a *strain*. This injury is most common in the deltoid, pectoralis major, biceps, pronator radii teres (lawn-tennis arm), adductor muscles of the thigh (rider's sprain), hamstrings, muscles of the calf, and the extensors of the spine.

(b) When, during some sudden and powerful contraction of muscle, there is experienced a sudden and sometimes very severe pain, followed by a notable sense of weakness, and on examination there is found a more or less marked gap in a muscle, with swelling from effused blood, a *rupture of a muscle* has occurred. Its production may be attended with an audible snap, and attempts to put the muscle into use are painful and futile. Subsequently the two ends of the ruptured muscle remain widely separated.

(c) When, with symptoms exactly like those attending a rupture of a muscle (sudden pain and an audible snap, with sudden loss of power), there is not found any gap in a muscle or swelling over its fleshy part, unless it be some fulness produced by its retraction, and yet it is impossible to make its tendon tense or produce its particular movement; or if a distinct gap can be felt in the tendon, as in the case of rupture of the tendo Achillis, *rupture of a tendon* may be diagnosed.

(d) When, as the result of some sudden strain or wrench, there is acute pain, with tenderness in the course of a tendon, swelling and ecchymosis, and contraction of one or other of the muscles of the part excites severe pain, while its tendon is found not to occupy its normal position, a *dislocation of a tendon* has occurred. This is most frequently seen at the ankle, in connection with the peroneus longus tendon, which starts forwards over the malleolus, or at the knee, where the patella with its tendon is displaced on to the outer side of the joint, or one or other hamstring tendon is displaced. It is said also to be frequent

in connection with the long tendon of the biceps, causing the arm to be locked in the abducted position until set free by flexion of the shoulder and rotation of the limb. When this injury is of old standing it is more easy of diagnosis, as there is no swelling and ecchymosis to conceal the displaced tendon.

5. **Examine carefully the condition of the vessels of the part.**—Compare on the two sides the pulse in the arteries beyond or at the seat of the lesion, note the temperature of the part, and by compression of a superficial vein determine the freedom and rapidity of the venous circulation.

(a) If there be no pulsation in the arteries below an injured part, and the limb become pale and cold, while the pulse in the superficial arteries of other parts of the body be plainly felt, and the colour and temperature of the injured part be normal, and there be no notable swelling or displacement of a bone compressing an artery, it is a case of *partial laceration of an artery, with occlusion*, the torn inner and middle coats, together with blood clots, having blocked up the lumen of the vessel. In such a case it may be possible to trace the pulse down to the seat of the injury, and there note its sudden disappearance.

(b) Where, with similar symptoms, there is a fracture or dislocation, and the reduction of the displaced bone is followed by a return of pulse in the arteries below, the injury has evidently been *compression of the artery*.

(c) Where, immediately after an injury, a fluid swelling is very rapidly developed, with œdema of the parts below, and impeded circulation, there has evidently been a *rupture of a large vessel*. If the arteries beyond the injury are quite pulseless, and the part notably cold, the swelling tense, with or without expansile pulsation, thrill and bruit, it is a *ruptured artery*; it must be remembered that when the rupture of the

vessel is complete, and there is no form of sac around the effused blood, there is no pulsation and no thrill. Where, on the other hand, there is a pulse in the arteries beyond the swelling, and the part is not notably cold, while the tumour is without pulsation, bruit, or thrill, a *ruptured vein* may be diagnosed.

(d) Where at some interval after an injury pulsation is suddenly found to be lost in an artery, the vessel at this part feeling solid and firm, the parts beyond being at first pale, cold, and pulseless, although they may subsequently recover, there has been a *secondary occlusion of the artery*, and where embolism may be with certainty excluded, owing to the absence of any source of an embolon, *arterial thrombosis from contusion or inflammation* may be diagnosed.

(e) Where at some interval after an injury a vein is found to be occluded, forming a solid, round, firm cord, the veins opening into which are distended, *thrombosis of a vein from contusion* may be diagnosed. This must be distinguished from thrombosis due to a general enfeeblement of the circulation, which is characterised by its wide extent. (See page 347.)

6. **Examine the nerves of the injured part.**—Nerves may be *contused, lacerated, or compressed* by subcutaneous injuries, and later on may be *inflamed*, or become the seat of *tumours*. The history of the case will determine whether the lesion be contusion from a direct blow, laceration from over-stretching, or compression from the displacement of a bone, the formation of callus, or the extensive effusion of blood or other fluid. Where the injury is due to contusion, laceration, or displacement of a bone, as in a dislocation, the symptoms come on at once; but where they are dependent upon the pressure of effused blood, or of an abscess, or to the implication of a nerve in callus, they come on later, at a time corresponding to the occurrence of these phenomena. Where there

is any reason to suspect an injury to a nerve, the surgeon should carefully test the patient's power of contracting all his muscles, and the acuteness of the sensibility of the skin, comparing together the sound and the injured limbs. By noting the intensity of the paralysis, and of the anæsthesia or paræsthesia, the intensity of the lesion may be judged of, while the exact distribution of the motor and sensory paralytic phenomena will indicate the nerve or nerves that are involved. As already hinted, the symptoms vary with the intensity of the nerve lesions. But it is to be noted that motor paralysis is more frequent and more marked than are changes in sensibility.

When, after an injury, there is found to be weakness or paralysis of certain muscles, which are not themselves injured, and, in addition, there is numbness or insensibility of a certain area or areas of skin, with a sense of tingling, formication, and weakness, there is an injury of the nerve or nerves supplying the affected muscles and skin. Later on the affected muscles waste, and the skin and other tissues may undergo the changes to be mentioned in reference to wounds of nerves. (See page 42.)

Subcutaneous injuries of viscera are considered in the chapters devoted to the diagnosis of the various regions of the trunk.

CHAPTER III.

GENERAL DIAGNOSIS OF WOUNDS.

In this chapter will be considered the signs by which we are able to determine the nature of a wound, the parts that have been injured and the subsequent progress

of the lesion. It will be convenient to take these points one by one.

A. The nature of a wound, by which is meant the kind of injury which has been inflicted on the tissues; the features of recent wounds only will be here spoken of.

(1) If the wound be a simple clean cut through the skin or other tissues, bleeding freely from its whole surface, the appearance of the skin quite up to the edge of the wound being unaltered, and the surface of the cut being smooth, showing the different structures cut through, it is an *incised wound*.

(2) If the wound have been inflicted with some blunt instrument, do not bleed freely from the whole surface, the skin for a varying distance from the cut-edge being livid, ecchymosed, more or less cold and numb, and the cut surface dark in colour and uneven, it is a *contused wound*.

(3) If the surface of the wound be extremely irregular, with long shreds of tissue adherent to it, with very little hæmorrhage, or none at all, it is a *lacerated wound*.

Contusion and laceration are often combined, and the wound is then spoken of as a *contused lacerated wound*. Incised wounds are much the most painful, the pain being of a sharp stinging or burning character; in contused and in lacerated wounds, the pain, much less severe, is of a dull, aching, or benumbing character.

(4) The shape and superficial extent of wounds may vary within the widest limits; but only two varieties require notice here, and one is where a distinct flap of tissue has been cut or stripped up. Such a wound is to be called a *flap wound*, "incised" or "lacerated" being added as a prefix, according to circumstances. The other is where the depth of a wound is out of all proportion to its superficial extent, a *punctured wound*;