

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*;

and as these may be inflicted with sharp, clean-cutting instruments, such as daggers and bayonets, or with blunt weapons, such as bullets, they may have the characters either of incised or of contused wounds, and this fact should be expressed by a prefix.

(5) In case of contused and torn wounds it is important to determine whether the tissues have been *injured beyond all recovery*. If, after the patient has recovered from the primary shock, and the general circulation is re-established, there be no signs of circulation in the part, if compression make no alteration in its colour, and if it remain cold and quite senseless, it may be decided that the part is actually dead; but these signs must be unequivocal before such a diagnosis is to be made; where they are not thus plain, time will soon show whether the tissues retain their vitality or not.

(6) If the local or the constitutional effects of a wound are not explicable upon the extent and severity of the wound, it is a *poisoned wound*. The particular symptoms vary of course with the poison; in one case it may be coma from morphia; in another, tetanic convulsions from strychnia; in a third, paralysis from curare; in a fourth, septicæmia; in a fifth, local suppuration with lymphatic inflammation; in a sixth, convulsions from hydrophobia; in a seventh, local induration and the constitutional effects of syphilitic infection.

B. The parts injured.

(1) Injury to the *skin* or *mucous membrane*, as the case may be, is obvious; if the wound extend through the *whole thickness of the skin*, it gapes, and allows the subcutaneous fat to be seen. If muscular tissue, known by its deep red colour, or tendons (glistening white bands) are seen in the wound, the *deep fascia* has been divided. A cut into *muscle* is also obvious. *Complete division of a tendon* is determined by noticing

(a) that the patient is unable to execute the particular movement accomplished by the muscle in question; (b) that he is unable to make the tendon tense; (c) in some cases, that the retracted muscle makes a distinct swelling; (d) and sometimes that the divided tendon, one or both ends, can be plainly seen in the wound, the proximal end being drawn upon when the patient puts the muscle in action.

(2) If there be an oozing of bright blood from the whole surface of the wound it is *capillary hæmorrhage*.

(3) If, in addition to this, there be a rapid continuous flow of dark blood from one or more points of the wounded surface, it is *venous hæmorrhage*. Venous hæmorrhage is not attended with local blanching, nor with interference of the pulse in the arteries beyond, when compared with those of the opposite side; it is lessened or stopped by moderate pressure on the distal side of the wound, and increased by moderate pressure on the cardiac side; firm pressure on the cardiac side, by stopping the arterial flow to the part, of course stops, but not instantly, loss from a wounded vein. If a large vein be opened, such as the axillary or jugular, the blood may spurt from the wound, but the flow, however rapid, is continuous.

(4) If, at the same time that a vein is wounded, a sucking or hissing sound be heard, and the blood be noticed to be frothy, *air has entered the vein*. This only takes place through the veins close to the heart, especially the innominate, jugulars, and subclavians; if the air enter in any quantity it produces sudden death or severe symptoms of cardiac failure, *i.e.* pallor, dyspnoea, very rapid weak pulse.

(5) If there be a rapid flow of bright red blood from a particular spot in the wound, the blood being forced out in a jet and *per saltum*, it is bleeding from a wounded artery, *arterial hæmorrhage*. If the

patient be inhaling ether or nitrous oxide gas, the blood even from an artery will be dark in colour, but will be readily distinguished from that coming from a vein by its remittent flow. Arterial hæmorrhage may, however, lose this character under two circumstances: (*a*) if the blood do not escape directly from the artery, but flow along a more or less narrow or sinuous wound, its jetting flow is lost, and (*b*) in the case of small arteries, where, from loss of blood or from obstruction in the flow above, the arterial tension is considerably lowered, the flow may become continuous; it is, however, distinguished then from capillary oozing by its escape from definite spots in the wound, and from venous hæmorrhage by its colour, its control by pressure above, and the failure of distal pressure to stop it. Where a large artery is wounded, such as the carotid, femoral, or axillary, the blood issues with a distinct hissing noise. In the case of an artery wounded in its continuity, it may be possible to determine what vessel is injured by noticing (*a*) if there be blanching of any part, as *e.g.* of the sole of the foot in division of the posterior tibial artery during tenotomy; (*b*) loss of pulse in the artery beyond; thus, if with a wounded artery at the root of the neck, the pulse in the carotid or facial artery and the brachial or radial is unaffected, it proves that neither the carotid nor subclavian artery is the one injured; similarly, in the case of a stab in the thigh, if the pulse in the tibial arteries is equal in the two sides, it shows that the femoral trunk is not wounded. In many cases the position of the wound is enough to determine what artery is wounded; but in many others it is uncertain until the bleeding vessel is actually found, and its exact relations to surrounding structures are seen.

(6) The division of nerve trunks is best shown by the anæsthesia of parts beyond the wound, and also

by paralysis, but care must be taken to exclude the direct effects of the wounds of muscles when estimating the latter. In such a case as the division of the great sciatic nerve in the buttock, the palsy of the muscles of the toes (quite at a distance from the injury) is very characteristic. A divided or partially divided nerve may be visible in a wound.

(7) Complete division of a bone in a wound is evidenced by the usual signs of *fracture*, *i.e.* mobility in the length of a bone, crepitus, irregularity of the outline of the bone, and one of the fragments may be visible; but where a bone has been only partially severed, a so-called *wound of bone*, the fact can only be detected either by the eye, or by the finger or probe feeling the cut in the bone, while the signs of complete fracture are absent. The association of a fracture of a bone with a wound of the soft parts is a very important one, for if the latter extend down to the broken bone it forms a *compound fracture*. To determine whether this is the case is usually quite easy, as one or other fragment may protrude from the wound, or be visible in it, or the finger introduced into the wound may at once detect the fracture. In other cases it is equally apparent that the wound is quite superficial, perhaps a mere abrasion, or at some distance from the fracture, the latter not being "compound." In a third series of cases the student may be in doubt, and then the amount of hæmorrhage from the wound will be the best indication; bone is a very vascular tissue, and if from a small wound, over and complicating a fracture, there be a free trickle of bright blood continuing for some hours, it is very strong evidence of the fracture being compound; a probe may be carefully introduced to detect the bone, but great care should be used lest the wound be deepened or hæmorrhage renewed.

(8) If a clear tenacious fluid be seen to flow from a wound, either pure or mixed with the blood, which

can be drawn out into "strings," a *synovial cavity has been opened*. If the wound be immediately over a bursa or synovial sheath, and the fluid small in amount, and especially if a tendon be exposed in the wound, it may be diagnosed as a *wound of a bursa, or synovial sheath*; but if the wound be directly over a joint, and the quantity of fluid be more than a drop or two, it is probably a *wound of the joint*. In extensive wounds there is no difficulty in determining whether a joint is injured or not, as the articular surfaces may be exposed, or may project, or portions of articular cartilage may be chipped off and be found free in the wound. It is in the case of small punctured and incised wounds that the difficulty arises. In no case must a probe or any similar instrument be passed into a wound over a joint to determine its depth, as it may actually tear the synovial membrane, and inflict the injury most of all to be avoided. Whenever there is doubt, the case must be treated as a wounded joint, and if the part swell out with effusion into its articular cavity, the diagnosis of a wounded joint may be considered to be established; similarly, where a bursa becomes distended, evidence is afforded of a wound extending into it. The exact position and direction of a wound, together with the amount of synovia escaping, are the best guides in deciding between a wound of a bursa and a wound of a joint.

(9) **Wound of a serous cavity** is only certainly determined by the protrusion of one or other of the contained viscera. A few drops of serous fluid may be seen to escape, but only in the cases where the wound is so small and clean-cut that this cannot have been expressed from a clot of blood will this aid in the diagnosis; where a dropsical accumulation has been opened the amount of the flow may be decisive. Here, again, any attempt to explore the wound to determine its depth is to be earnestly

deprecated, as liable to do great mischief; and in doubtful cases, which are to be treated as injuries of the serous membranes, subsequent inflammation of the membrane confirms the diagnosis of such a wound. In the belly the *omentum* is the viscus that most often protrudes, and it must be distinguished from the subcutaneous or the subperitoneal fat by its peculiar granular appearance and feel, its distinct circumscription, and in some cases its reducibility; or it may be irreducible and strangulated, when its livid colour will be very distinctive; next to it the *small intestine* most often protrudes. In the scrotum, the smooth, glistening *testicles* may protrude. Injury of the serous cavity of the head is in some cases characterised by a continuous flow of the cerebro-spinal fluid, and occasionally by a peculiar symptom, viz. a spurting forth of the cerebro-spinal fluid when the jugular veins are compressed. (See page 83.) Wound of the pleura without wound of lung only rarely occurs, and is extremely difficult of diagnosis unless there be prolapse of unwounded lung. (See page 136.)

(10) The diagnosis of **wounds of viscera** is considered in the chapters devoted to local injuries, as it is impossible to generalise with any advantage the symptoms caused by injuries to the various viscera.

(11) The diagnosis of **wounds of the ducts of glands** rests upon the position of the wounds and the flow from them of characteristic secretion (such as saliva or milk or urine). (See chapters on Local injuries.)

C. **The subsequent progress.**—The constitutional complications attending wounds are considered in chapter iv., and therefore only the local phenomena attending their healing, and their local complications, will now be dealt with.

(1) A wound may be found not to undergo any change whatever, even for many days after its infliction; a little dark blood oozes from it, but the natural appearance of the severed tissues is in no way obscured, and there is no union between adjacent surfaces. This *delayed healing* is only occasionally seen, and arises from severe constitutional debility. As a late symptom, delay in healing, or even the breaking down of union already accomplished, may attend erysipelas, pyæmia, and some other severe constitutional affections.

(2) If it is found that the cut surfaces are in apposition and adhering together by a soft, yellowish material, that there is no purulent discharge, and at the most a thin scab of dried blood or of soft yellowish lymph over the wound; that there is no (or very trifling) redness and swelling about the edges of the wound; that there is no pain, and only slight tenderness, such wound is healing by *first intention*.

(3) If the edges of a wound are found adhering as above described, or have been united by the surgeon, but the skin around shows a blush of redness, sometimes slight and at others deep, with marked swelling and even superficial œdema, and there be severe pricking, stabbing, or throbbing pain, considerable tenderness, with fever, the temperature perhaps ranging as high as 104°, and accompanied with a chill, there is *retained discharge*, a condition of tension; this, if unrelieved, will quickly run on to *abscess*, which will then burst through the softly united edges of the wound, or through the skin, and if the wound be not aseptic may lead to septic poisoning. The retained fluid may be blood or serum, the former accumulating within the first few hours after the dressing of the wound, the latter within the first two days, as a rule.

(4) If the cut surfaces do not directly adhere, but the tissues composing them become obscured by a

translucent layer of coagulated lymph, this state is called the *glazing* of a wound. The lymph becomes opaque, then pink, then florid and uneven on the surface, from the formation of minute conical elevations, and these gradually grow towards the surface, their growth being attended with the secretion of laudable pus, the wound healing, it is said, by *granulation*, or *second intention*.

(5) If opposing granulating surfaces become directly adherent in place of the cavity between them being filled up by the growth of granulating surfaces, it is called healing by *third intention*. This is known by the sudden diminution of the pus secreted, and by direct observation of the union. The diseases of granulating wounds are considered in the chapter on *Ulcers*.

(6) If a wound be wholly or in part filled up with a blood clot, and this clot do not soften and flow away, but remain firm and fixed; and if after several days a thin dry layer of it separate and show a soft delicate cicatrix below, it is called *organisation of, or more correctly in a blood clot*. This is the process which has long been familiar in small wounds as *healing under a scab*. In clots of larger extent, only the deeper part of the coagulum may become organised, the upper part breaking down.

(7) **For gangrene** occurring in a wound see page 345; and for *erysipelas, septicæmia and pyæmia*, see pages 65 *et seq.*

(8) Bleeding recurring from a wound during re-
action, *i.e.* within forty-eight hours of its infliction (most common within the first eighteen hours) is called *intermediary or recurrent hæmorrhage*. But if the bleeding occur later than this, it is *secondary hæmorrhage*. If, while dressing a wound, a little trickle of bright blood be seen to come from the deeper parts of the wound, and if this be not caused by any

movement or manipulation of the wound breaking down some granulations, and especially if it recur spontaneously, it is probably the forerunner of an extensive secondary hæmorrhage.

(9) If with acute febrile symptoms with or without an initial rigor, the parts about a wound implicating a bone are found much swelled, and the soft parts, including the periosteum, retracted, leaving the bone dry and bare; and if in a case of amputation a soft fungous mass protrude from the end of the medullary canal, and the probe passed into this meet with no resistance and possibly liberates some pus, *acute osteomyelitis* is present.

(10) If after the healing of a wound a part below continue insensitve and cold, and especially if its muscles are paralysed and wasted, with loss of irritability to the faradaic current, it indicates that a severed nerve has not united. This has to be distinguished from the immobility of a part from division of a tendon or a muscle. The *position of the scar* (in the one case over a nerve, and in the other over a muscle or tendon); the *extent of the paralysis* (in the one case affecting all the muscles supplied by the nerve below the scar, in the other affecting only the muscles wounded); and the *accompanying electric and sensory phenomena* are sufficient to establish the diagnosis.

If the skin of the affected part be rough and covered with dry, scaly epidermis, the *nerve or nerves are completely divided*. In cases where the skin is smooth, glossy, devoid of hair, with patches of livid red colour, or herpetic eruption, smart burning pain, and the muscles have wasted rapidly, there has been *incomplete division of the nerve*.

(11) If a scar remain painful and tender, the condition is spoken of as *neuralgia of cicatrix*. Of this it is necessary to distinguish two varieties. Where the pain is localised, and is especially excited by pressure

on a particular spot, the neuralgia may be considered to be of *local origin*, and this diagnosis will be confirmed if there be an induration, or adhesion of the scar to a bone at the tender spot. If, on the other hand, the pain is more widely diffused, and especially if it be attended with marked superficial hyperæsthesia, be intermittent in character or attended with spasmodic jerkings of the part, and if the patient be anæmic, or subject to neuralgia in other situations, the disease may be diagnosed as of *constitutional origin*; the latter form is more common in women.

(12) When a cicatrix enlarges, becoming thicker, prominent on the surface, wider, remaining firm, smooth and of a delicate pink or purplish colour, it is called a *keloid scar*. This disease may attack a scar at any time after its formation, and after a certain advance may remain stationary, or the growth may be absorbed. It may attack a large scar in several situations. Its smoothness, firmness, slow growth, and its not ulcerating, together with its spontaneous recession or disappearance, distinguish this disease from epithelioma attacking a scar. (See pages 286, 337.)

CHAPTER IV.

THE DIAGNOSIS OF THE CONSTITUTIONAL EFFECTS AND COMPLICATIONS OF INJURIES AND OPERATIONS.

It is extremely important to recognise with as much accuracy as possible the constitutional condition of patients suffering from injuries or surgical diseases. The importance of and the interest attaching to the diagnosis and treatment of local surgical maladies may tend to concentrate the attention too exclusively upon