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INJURIES AND SURGICAL DISEASES OF THE HEAD.

INJURIES OF THE SCALP.

Surgical Anatomy.—The scalp may be described as consisting of five layers :—

1. Skin.
2. Subcutaneous layer, containing fat, blood-vessels and nerves.
3. Occipito-frontalis muscle and tendon.
4. Layer of loose connective tissue devoid of fat.
5. Pericranium. Very often the pericranium is not regarded as one of the layers of the Scalp.

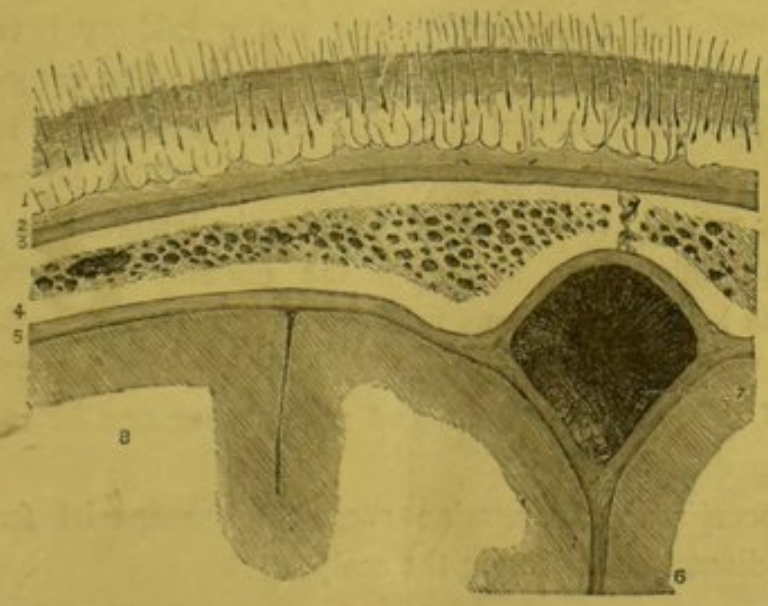


FIG. 1.—Section of Scalp. 1, Subcutaneous layer of fat. 2, Loose connective tissue. 3, Pericranium. 4, Skull, external table, internal table, diploe. 5, Dura mater. 6, Falx cerebri. 7, Longitudinal sinus. 8, Brain.

Surgical Anatomy.—The skin contains numerous hair and sebaceous follicles. It is firmly bound down to the occipito-frontalis muscle and tendon by short interlacing fibres containing in their meshes many particles of granular fat. The blood-vessels and nerves are distributed in this layer. The scalp is abundantly supplied with blood. A stratum of loose connective tissue is found between the aponeurosis and the pericranium. It is fatless, and allows of very free movement of the skin over the bone. The pericranium acts as a periosteum. It is easily detached from the bone, except along the lines of suture, where it assumes a denser character, and is intimately adherent. It is especially adherent in the temporal regions. In lacerated wounds this membrane may be extensively torn off and the skull exposed.

The scalp is very vascular. The supra-orbital artery and nerve pass vertically upwards from the supra-orbital notch at the junction of the middle and inner thirds of the orbital margin. The supra-trochlear nerve and frontal artery ascend nearer the middle line. The temporal artery, and auriculo-temporal nerve behind it, cross the zygoma just in front of the ear. Arteriotomy used to be practised on the anterior branch. The posterior auricular nerve and artery run in a groove between the mastoid process and ear. The occipital artery and great occipital nerve are placed nearly midway between the occipital protuberance and the mastoid process. The emissary veins form a direct communication between the sinuses and the superficial veins, and are of much surgical importance. The largest passes through the mastoid foramen and connects the lateral sinus with the posterior auricular vein. Through the parietal foramen, a vein connects the longitudinal sinus with the scalp veins. The facial vein communicates near the inner angle of the orbit with the ophthalmic, a tributory of the cavernous sinus, and many other smaller veins form similar connections.

These peculiarities determine some of the special features of injury and diseases as affecting the scalp.

CONTUSIONS OF THE SCALP.

Bumps occur in the substance of the skin external to the

aponeurosis. Frequent in children. Move with the scalp. Disappear in a few days. Treatment expectant. Contusion, however severe, rarely causes sloughing, the scalp being very vascular.

Extravasation may occur in the layer of cellular tissue beneath the aponeurosis. This is the most frequent form of swelling after injury. It may be extensive and spread over the whole head.

Cephalhæmatoma is a name applied to a much more rare form of effusion of blood which takes place between the bone and the pericranium, usually over the parietal bone. This is always limited by the lines of suture. Some inaccurately apply the term to extravasations in the layer of sub-aponeurotic cellular tissue as well.

Symptoms, diagnosis, treatment.

Pott's puffy tumour.—A condition following injury, sometimes closely simulating a depressed fracture. It results from contusions, more especially in young subjects. A soft central portion is surrounded by sharply defined margins, which feel like the edge of the fractured skull.

WOUNDS OF THE SCALP.

Varieties.—Scalp wounds are of very frequent occurrence.

Incised wounds of the scalp are rare.

Flap-shaped, lacerated, and contused wounds are common.

Tearing wounds, contused wounds, and lacerated wounds of the scalp may sometimes closely resemble an incised form.

The scalp tears by the sliding of the superficial on the deep layers.

Causes of scalp wound.—Blows inflicted either by cutting or blunt weapons. Falls on the head. Injury by machinery. Scalping.

Characters.—Gaping; bleeding; exposure of the skull either bare or covered by pericranium.

Liability to wound accidents.

Erysipelas. This is not more frequent than elsewhere.

Necrosis of the skull will be superficial, as a rule, or may include both tables. The cranium derives its chief blood supply from the dura mater.

Abscess may be superficial, occur in the loose cellular layer, between the pericranium and skull, suppuration beneath the aponeurosis, or is generally diffuse. Between these different forms it is important, and often difficult, to make a diagnosis. In the diffuse form the effusion will be limited by the attachments of the occipito-frontalis muscle, or a line drawn round the head corresponding to the upper margin of eyebrows, zygoma on the side and superior curved line posteriorly.

Treatment.—Careful purification of scalp wounds is especially needful, and may be difficult to execute. The vascular supply is abundant, the vitality of the margins of a scalp wound is generally

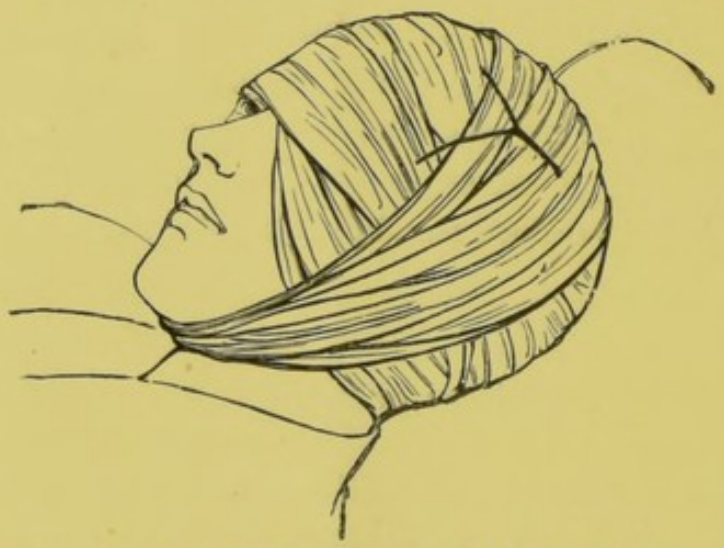


FIG. 2.—An antiseptic dressing for the head.

well maintained, and such wounds unite quickly. Flap wounds, even when attached by a comparatively narrow base, may unite readily, if accurately replaced. For this purpose sutures should be inserted in sufficient number, with one or more drainage tubes between. There is no more objection to the employment of sutures in this region than in any other part of the body.

Mode of dressing. Some variety of the antiseptic method should be employed (fig. 2.)

INJURIES OF THE SKULL.

Surgical Anatomy.—The form of the skull is ovoid. The base is very irregular, and occupied by large foramina. The vault is

uniform in surface, and well calculated from its shape to withstand violence.

The thickness of the normal skull varies within comparatively wide limits. At various places it also differs much in thickness. The average is one-fifth of an inch.

The external and internal tables do not correspond, especially in the frontal and occipital regions, over the pacchionian depressions, mastoid processes, and occipital protuberance.

Weak points: temporal regions, inferior occipital fossæ, cribriform plate.

Strong points: frontal eminence, occipital protuberance, mastoid processes.

The recent skull is elastic to a limited degree. It is capable of a certain amount of compression, chiefly from before backwards, laterally the compressibility is slight; and vertically, there is none at all.

The base of the brain corresponds to a line drawn from the root of the nose along the upper margin of the orbit and zygomatic arch, through the auditory meatus, to the occipital protuberance.

The base of the skull is nowhere very close to the external surface.

Relations of the external surface of skull to the internal parts.

Position of the middle meningeal artery.—The artery crosses the anterior inferior angle of the parietal bone at a point one and a half inches behind the external angular process of the frontal bone, and one and three-quarter inches above the zygoma.

The position of the lateral sinuses is indicated by a horizontal line drawn from the occipital protuberance to a point one inch behind the external meatus. The torcular Herophili lies opposite the internal occipital protuberance. The longitudinal sinus runs backwards in the middle line.

Position of the fissure of Rolando.—This fissure is roughly parallel to the coronal suture, which extends from the bregma, the point of junction of the coronal and sagittal sutures, to the middle of the zygomatic arch. The bregma, when the head is in the usual erect position, corresponds to the mid-point of a vertical line from one external meatus to the other. The lower extremity of the fissure is

half to one inch posterior to the coronal suture, and the upper two inches. The motor centres are found in the convolutions on each side of the fissure.

CONTUSION OF THE SKULL.

This form of injury can only take place in those parts of the skull where the diploë is present. They are not such serious injuries as Pott and others believed, except where there is an external wound. Suppuration and osteomyelitis have, however, been occasionally observed. Contusions are frequently produced by gun-shot.

Necrosis of the part struck; suppuration in the bone, or between it and the dura-mater, followed by pyæmia, may take place. Contusion or laceration of the brain substance, either at the place struck, or the opposite side of the brain, may also occur. Contusions in the temporal and frontal regions are most liable to the dangerous consequences which occasionally follow this form of injury.

FRACTURES OF THE SKULL.

These injuries form 2·78 per cent. of all fractures. They do not present the ordinary symptoms of fracture elsewhere. Mobility, crepitus, deformity, or even much displacement are usually absent. Their serious nature chiefly depends upon the associated injury of the brain.

Fracture of the skull may be simple or compound, may be associated with more or less extensive injury to the brain, and laceration of the dura-mater, or this membrane may be intact.

Fractures are the result of external violence. They are divided into those of the base and those of the vertex. Each variety may present peculiar symptoms.

The nature and causes of the injury and its effects differ in individual cases, as also do the diagnosis, prognosis, and treatment.

FRACTURE OF THE BASE.

These fractures, as a rule, assume the form of fissures, are usually compound, and very often fatal in their consequences.

Causes.—Generally they are produced by indirect violence, occasionally by direct injury through the roof of the orbit, the nose or the mouth; a violent blow on the chin may fracture the glenoid fossa. Other causes are falls on the vertex or feet, from a height, and also very frequently the extension of a fracture of the vertex into the base.

Principal directions taken by fracture of the base.—It is generally more or less transverse, usually across the middle fossa, less frequently antero-posterior, except those in the anterior fossa.

Violence applied to the occiput may fracture the posterior fossa.

Violence applied to the temporal region may fracture the middle fossa.

Violence applied to the frontal region will probably fracture the anterior fossa.

A fall on the vertex may fracture the middle fossa or cause a fracture around the foramen magnum.

Symptoms.—Prolonged hæmorrhage from the mouth, nose or ear, followed by discharge of cerebro-spinal fluid. Subconjunctival ecchymosis. General brain symptoms. Paralysis of the seventh pair of nerves. The nerves supplying the muscles of the eye are frequently implicated. In many cases the fracture implicates more than one fossa, and the symptoms will be more complex.

In cases of fracture through the middle fossa copious hæmorrhage, followed by a prolonged watery discharge from the ear, are prominent symptoms. Facial paralysis usually takes place.

In the anterior fossa, subconjunctival ecchymosis and severe hæmorrhage from the nose are usually noticed.

In fractures through the posterior fossa, bleeding from the mouth, nose and pharynx occurs.

A mastoid fracture is often followed by emphysema.

Diagnosis of fracture of the base is often difficult and obscure.

Prognosis depends on the violence of the injury, the damage done to the brain, by laceration or hæmorrhage, the age and habits of the individual. Septic inflammation may occur, as the fracture is often compound.

Treatment.—Quiet. Cold to the head. Restricted diet. Purgatives. Mercury.

FRACTURE OF THE VAULT.

These fractures may be either simple or compound—the latter is generally produced by violence locally applied ; the former by some diffused force. When a fracture results from external violence, the internal table is always more extensively damaged than the external. In the adult, compound fracture is much more common than simple fracture. The latter is rare, for an injury capable of fracturing the vault is almost certain to divide the thin layer of soft parts covering it.

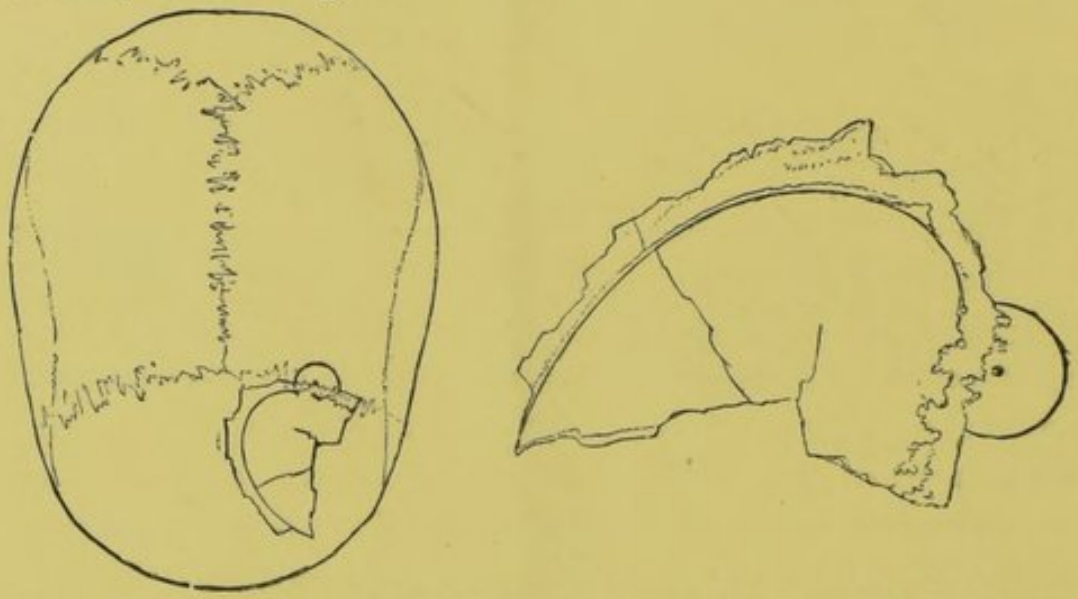


FIG. 3.—Depressed fracture of skull, with more extensive damage to internal table. The portion removed is drawn three-fourths the natural size and its position on the skull is shown. Trephining, followed by recovery, took place.

FIG. 4.—Depressed simple fracture in a child. No symptoms. (From a photograph.)

Simple fracture is vastly more frequent in children than adults. The soft bones of a child's head are easily bent or broken, a species of green stick fracture, without wound of the scalp. In the child fracture is often associated with well-marked depression. This is seldom accompanied by any severe symptoms, or requires active treatment (fig. 4). Symptoms, if present, usually shortly subside, and the bone may even resume its former level.

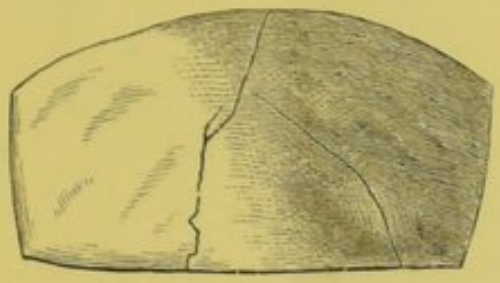


FIG. 5.—Fissured fracture of the frontal bone without displacement; caused by a fall from a horse. There was no external evidence of depression or fracture of the skull, simply a severe contusion on the forehead. The patient, at first insensible, became shortly delirious, in which condition he remained until death, four days after the accident. One fissure passes downwards and outwards through the right frontal eminence, and from the upper portion of this another fissure, involving the external table only, passes nearly at right angles towards the left frontal eminence.—*A.M.M.*, fig. 14.

Simple fracture in the adult is rare and may be difficult to diagnose.

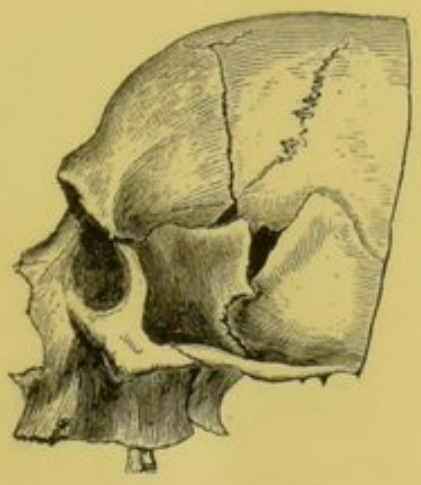


FIG. 6.—Simple fracture of the temporal bone by a blow from a board. Death was instantaneous. The skull was remarkably thin. A vertical fissure through the squamous portion of the temporal, the great wing of the sphenoid, and the frontal bones, extends to the median line. The squamo-sphenoidal suture is separated, and the meningeal artery ruptured

It is impossible indeed to do so in the absence of depression or well-defined symptoms. Figs. 5, 6, 9

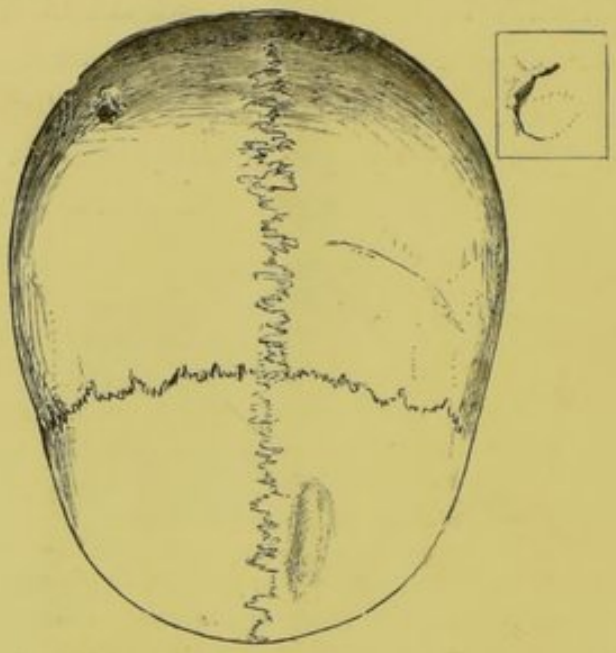


FIG. 7.—Calvaria, exhibiting in the centre of right parietal bone a penetrating wound of outer table and diploe, with considerable depression of the inner table. In the left parietal is a sabre-cut extending through the outer table and diploe, but not affecting the inner, the edges are smooth and rounded. On the left side of the frontal, is a longitudinal depression of the outer table, with slight depression of the inner.—*St. Thomas's Hospital Museum.*

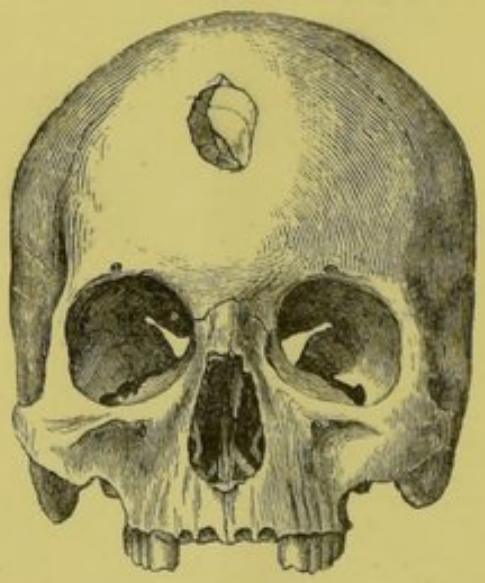


FIG. 8.—Indented fracture of frontal bone. The fragments are adherent by their outer margins. It was believed at first to be caused by a bullet fired from a long range, but was ascertained to be the result of a blow of some blunt weapon.—*A.M.M.*, fig. 89.

Where a doubtful case requires to be cleared up, an incision may in some cases be made at the injured point, and the bone exposed under antiseptic precautions and dealt with as circumstances may direct. This is better practice than to leave probably comminuted fragments of the skull, of the inner table especially, to produce irreparable damage to the brain.

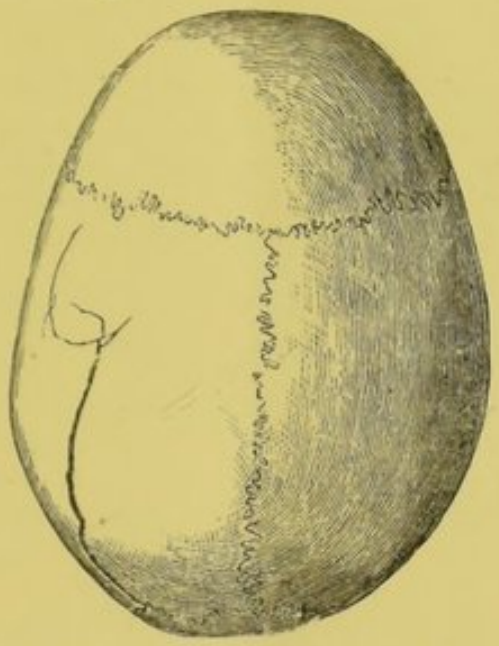


FIG. 9.—Linear fracture of the left parietal by a blow from a blunt weapon. An exploratory incision was made during life, but the fissure in the skull could not be discovered, and the patient died from extravasation between the dura mater and the skull pressing upon the brain.—*A.M.M.*, fig. 16.

Beware of mistaking a natural depression in the skull, or the deceptive sensations communicated by the so-called Pott's puffy swelling, for a depressed fracture.

Causes.—Almost always these fractures are the result of direct violence, or sometimes from extension upwards from the base.

The relative amount of injury inflicted on the two tables of the skull varies, the internal usually suffering most.

Among the reasons for this difference are that the fracture takes

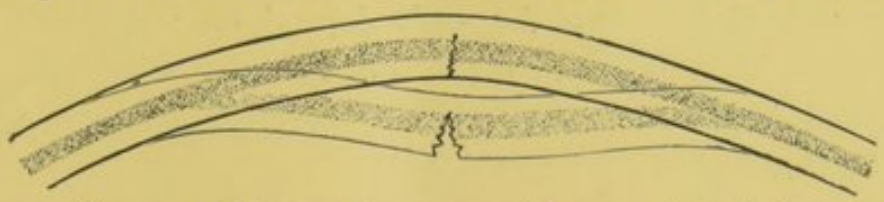


FIG. 10.—Diagram to illustrate the manner of fracture of skull along the line of extension after force has been applied externally.

place along the line of extension, and the force is distributed as it passes onwards. This is well seen in bullet wounds.

FIG. 1*.

FIG. 2*.

FIG. 11.—Diagrams to illustrate the manner of fracture along the surface of extension. As when a stick is bent, the particles along the proximal curve on which the force is applied are compressed, and the atoms along the distal curve are separated, and when the stick breaks the rent begins at that point whereat the extension is greatest, opposite to that at which the pressure is applied, so when pressure is applied to the vault of the skull, depressing the bone sufficiently to cause fracture, the solution of continuity will begin in the inner table opposite the point struck.

Let A B, fig. 1* represent a section of the skull. Draw two parallel vertical lines C E and D F. When pressure is applied at G, depression will take place and the bone assumes the shape of H K fig. 2*. The lines C E and D F are no longer parallel, the distance from I to J is less than that from C to D, but the distance from L to M is greater than that from E to F, signifying that the atoms of bone in the upper surface from I to J have been brought nearer to each other or compressed, whilst the atoms of bone in the lower surface from L to M have been extended or separated from each other, therefore if any fracture takes place it is clear it must do so in the line of extension L M, and at that point in the line where the greatest extension is going on, which is at N, exactly opposite the spot O where the pressure was applied.

Proof.—Take a slightly bent cane, say A B fig. 1*, insert two parallel pins or wires C E and D F projecting at each surface. Exert pressure at G till the cane is made flatter, as in fig. 2*. It will then be found that the wires are no longer parallel, but converge along the upper surface, so that the distance between them from I to J is less than that from C to D, but the distance from L to M is greater than that from E to F, showing clearly that the atoms along the line I J have been compressed and brought nearer to each other, whilst those from L M have been extended, consequently if any fracture takes place it must commence at N. If the pressure on the cane be continued till it breaks, it will be found that it commences to break at the point N.—TEEVAN, *Md. Chi. Trans.*

Varieties of fracture of the vault depend on the nature of the causal force, its degree, and direction. Fracture may be simple or compound, involve the external table only, both tables, or more rarely be confined to the internal table.

Incised wounds of the skull are often associated with extensive fissuring and fracture.

Sabre wounds are rare, and differ greatly in character according to the weapon used. Some possess a sharp cutting edge and slice the bone, producing sharply incised wounds, while the blunt heavy English sabre fractures the bone like any other blunt instrument.

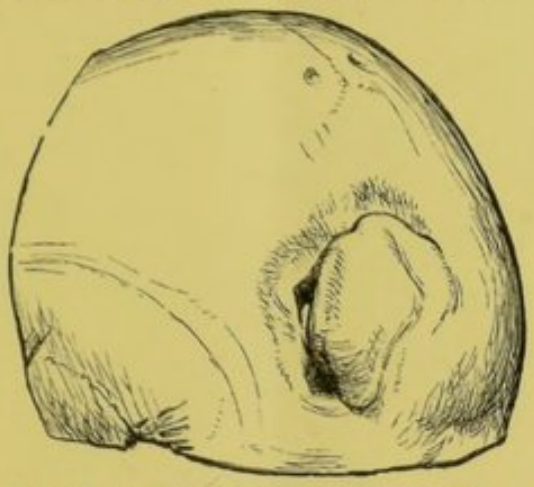


FIG. 12.—Fracture of skull; produced by a sabre wound. A portion of the left parietal bone has been partially detached. The margins are rounded, the injury having been produced long antecedent to death. The wound in the inner table has united through half its extent, a curvilinear gap, two lines across, persists in the remaining portion.—*St. Thomas's Hospital Museum.*

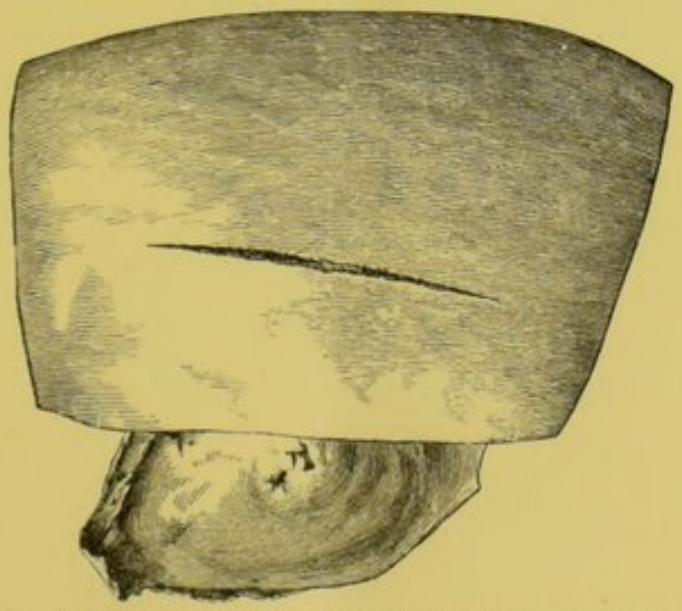


FIG. 13.—Sabre wound of right parietal bones, external surface.

Simple fissure.—Is caused by a widely diffused force applied to the surface of the skull. Fig. 15. Fissures often extend for some distance from the margins of a depressed or comminuted fracture. They often gape at the moment of production, and may contain, when compound, hair and foreign bodies.

Linear and stellate fractures occur from direct violence.
Comminuted fractures are due to the same cause.

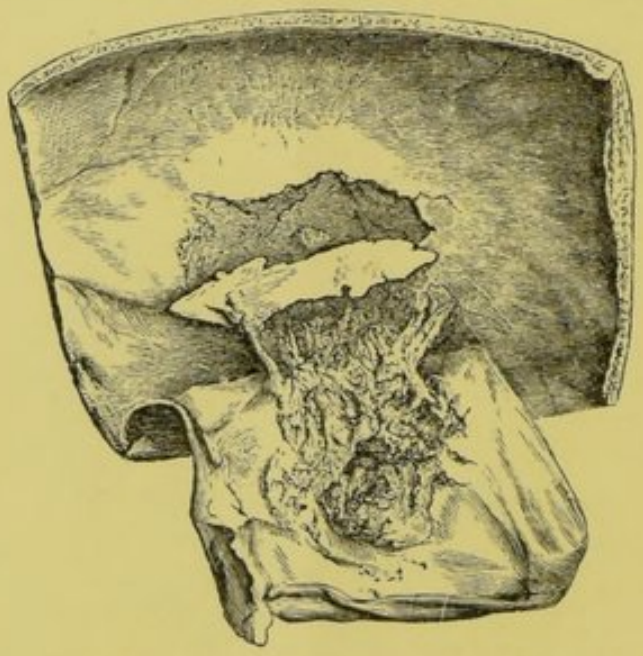


FIG. 13*.—Internal surface of the skull, fig. 13, the subject of a sabre cut of the right parietal bone. The scalp and pericranium on the right side were incised for three inches, and the external table and diploë cut through. The patient died thirty-seven days after the infliction of the injury. After death a long necrosed splinter of the internal table was found, and an abscess in the right hemisphere —*A.M.M.*, fig. 304.

FIG. 14.—Sabre cuts on the back of the skull. Three sabre cuts were inflicted on the left parietal bone. One fissured the inner table and drove a portion of it through the dura mater. The man lived for nine days. A large extravasation of blood was found covering the left cerebral hemisphere.—*A.M.M.*, fig. 5.

Depressed fractures. Depression, without complete fracture, is scarcely possible in the adult. In children these fractures are usually of the green stick character.

Punctured fractures are made by a sharp narrow weapon. The inner table is always more extensively splintered than the outer.

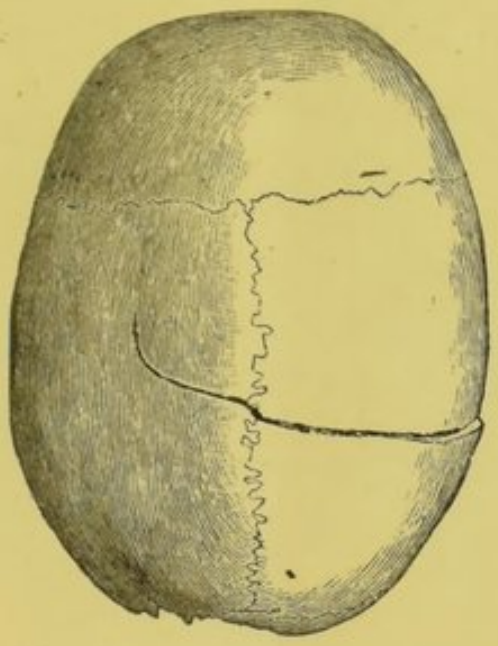


FIG. 15.—Fissure of the vault from a fall from a railway carriage in motion.—*A.M.M.*, fig. 12.

FIG. 16.—Section of cranium fractured by a blow from a musket. There was a wound in the left temple, and a depressed fracture of the lower border of the left parietal and the adjoining portion of the temporal bones. The patient was comatose until death, which occurred in two days. There was voluntary movement in the lower limbs. The pupils were insensible to light and irregular. A hernia of the brain, the size of a walnut, protruded from the wound, and a number of bone fragments were found imbedded in the middle lobe of the left hemisphere.—*A.M.M.*, fig 15.

Cases of this nature are wounds by arrow-heads, which are common in Indian warfare. Dagger and knife injury. Bullet wounds are essentially a punctured form of fracture.

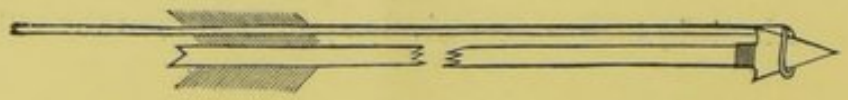


FIG. 17.—Instrument for extracting arrow-heads.

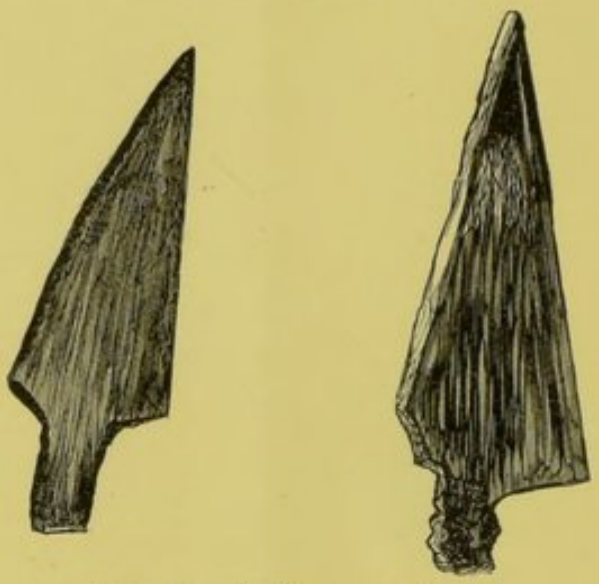


FIG. 18.—Indian arrow-heads.

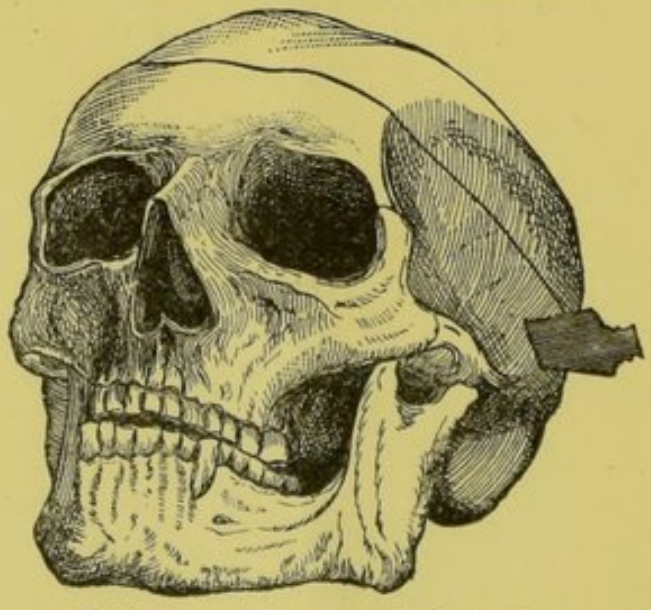


FIG. 19.—Arrow wound of the skull.

Fractures by contre-coup are very rare. The opposite pole of the skull to that on which the force is applied gives way. Fissure is the only kind of fracture which occurs in this manner.

Diastasis or separation at the lines of suture is usually the result of very severe injury compressing the skull.

THE COURSE OF FRACTURE OF SKULL.

Simple fracture.—So far as the mere fracture or damage to the bone is concerned, recovery generally occurs after simple fracture of the skull. There is very little tendency to formation of callus after fracture of the skull. Even fissures may heal by fibrous union only.

The immediate symptoms and the probable termination in any case depend on the amount of damage done to the brain. No injury, however trivial, can be safely disregarded, and almost none is so serious as to be at once despaired of. A fracture associated with a trifling extravasation or contusion of brain, may be promptly recovered from, or prove dangerous or fatal. Very severe forms of injury may, however, be rapidly and completely recovered from, and comparatively slight ones subsequently induce fatal inflammatory changes in the brain. A compression from hæmorrhage may go on increasing till it end in death.

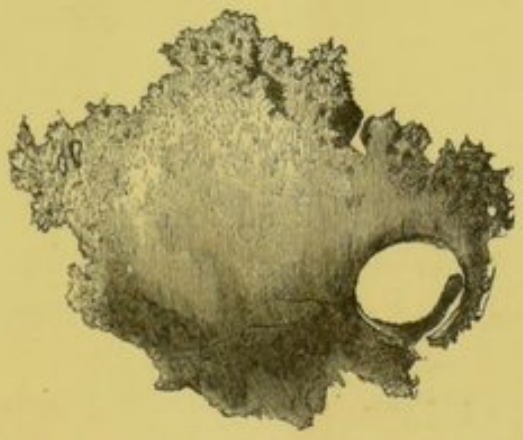


FIG. 20.—Exfoliation of the right parietal bone. A conoidal ball struck the skull very obliquely and produced a slightly depressed fracture. On admission to hospital the patient was insensible, and convulsions shortly after set in. A trephine was applied to the seat of fracture, and the depressed internal table elevated, when the patient soon regained consciousness. The wound was attacked by erysipelas, necrosis ensued, and three months after a portion of bone, 3 by 4 inches, exfoliated, the pulsations of the brain and the trunk of the middle meningeal artery being plainly visible. Cicatrisation then proceeded rapidly, and the man recovered.—*A.M.M.*, fig. 141.

Even after apparent recovery, chronic inflammatory changes frequently follow the injury to the brain. A clot may break down

and an abscess form. Finally, after an injury has been otherwise recovered from, various functional changes may be observed—as headache, loss of memory, alteration in character, epileptic seizures.

Compound fracture.—Its course, if the wound can be kept thoroughly aseptic, may closely resemble that of simple fracture. The wound fills up with granulation tissue and cicatrises, or a portion of bone may subsequently exfoliate. A lost piece of skull is never reproduced (fig. 28).

Should septic changes take place in the wound, they are very likely to excite inflammation in the membranes or brain. The risk to life is always greatly increased when the dura-mater is wounded Erysipelas or pyæmia may occur as they may also do after a simple wound of the scalp. Suppurative osteomyelitis of the diploë especially favours the production of pyæmia with the subsequent occurrence of metastatic abscesses in the lungs and liver. Abscesses, however, in the latter organ are not more common than in pyæmia incidental to wounds elsewhere, while abscess in the lung is almost invariable.

INJURY TO THE CONTENTS OF THE SKULL.

The more diffused the violence the more dangerous the resulting injury is both in its immediate consequences, and also to the subsequent integrity of the brain functions. A localized damage (even involving the complete destruction of a portion of the brain) may have less serious consequences, both immediate as well as remote, than one which, though less intense at any given point, is more widely diffused. Some cases of recovery after gunshot injury of the brain illustrate this.

Forms of brain injury.

A bruising or minute laceration of brain tissue is generally associated with cases of concussion.

Contusion and laceration of the brain substance, after falls from a height, or a severe blow, are most evident on the surface convolutions, and especially in the basal lobes. Injury to the soft brain tissue frequently takes place by contre-coup, and it is often the case that the injury at the opposite pole of the brain is greater than, or as great as, that opposite the point of application of the injuring force.

Extravasation may take place either on the surface or into the substance of the brain. The amount will depend on the nature of the violence, the extent of the damage inflicted on the brain, and the healthy or diseased condition of the vessels.

Extravasation very often occurs between the dura-mater and the skull, either from laceration of the middle meningeal artery, or from laceration of the sinuses of the dura-mater.

Effusion of blood may take place into the cavity of the arachnoid, the ventricles, or a considerable quantity collect in some part of the brain substance. Punctiform extravasations may be diffused through the brain substance.

Symptoms of Brain Injury.—The severity of the primary symptoms does not furnish any exact measure of the extent of the injury. It is not possible to distinguish accurately between those dependent on laceration, contusion, and compression of the brain.

Treatment.—Antiphlogistic for the most part. Complete rest. Render any wound present aseptic, and deal with the symptoms as they arise. The treatment of injury to the skull and its contents by the use of the trephine will be considered later.

Prognosis.—The danger from injury of the brain is not due to the primary damage to the brain so much as to the consequences resulting from it. Intracranial inflammation may follow upon very slight as well as severe injury, and upon the occurrence of inflammation, the fatal consequences usually depend.

TRAUMATIC INFLAMMATION OF THE DURA-MATER.

The dura-mater is a dense fibrous structure, but little disposed rapidly to take on inflammatory changes. It offers an important obstacle to the spread of inflammation from without, and when this is confined to the outer surface of the dura-mater it is comparatively unimportant. Inflammation, however, will often spread to the deeper and more vital structures. It may extend on each side of the dura-mater, and involve both the bone and the brain. Diffuse suppuration outside the dura-mater resembles a suppurative periostitis. It spreads comparatively slowly, may lead to necrosis, or to thrombosis and pyæmia. On the internal aspect of the dura-

mater the inflammation will be associated with acute inflammatory changes in the arachnoid, pia-mater, and brain. It is scarcely possible to distinguish between these affections clinically, as all three structures may be involved at the same time to a greater or less degree.

TRAUMATIC MENINGITIS AND ENCEPHALITIS.

Meningitis is the term generally adopted for inflammation of the arachnoid and pia-mater. These membranes are very vascular, and prone to acute inflammatory changes, which may arise either from inflammation spreading from without inwards, or from direct implication after injury.

Two forms exist, a serous and purulent. Both are associated with a certain degree of superficial encephalitis, or inflammation of the brain cortex.

Inflammation arising soon after injury is apt to be acute and diffuse. That taking place later is generally more chronic and circumscribed.

Serous meningitis may cause much pressure from the effusion which accompanies it, as the pia-mater dips between the convolutions.

In compound fracture suppurative meningitis is a common complication. The disease extends very rapidly. The degree of implication of the cortical portions of brain is greater than in the serous form. It is much more dangerous to life, the affection being almost uniformly fatal. Suppuration, when occurring early, is apt to become diffused; when late, it is probably circumscribed. If pyæmia supervene there are frequent rigors, and rapid irregular variations between high and low temperatures.

Symptoms.—Increase of brain pulsation is visible if the organ be exposed. Gradual rise of temperature takes place, with continued fever, rigor is not usual, the tongue is dry, the pulse small Severe pain occurs in the head in acute cases, and traumatic are nearly always very acute. It lasts from one to three or four days. The pain presently ceases, because complete insensibility comes on, which indicates the spread of the inflammation over the surface of the

hemispheres. There is great unrest, sleeplessness, hyperæsthesia, delirium, general muscular twitching, convulsions in the extremities. The case terminates in complete coma. When more localized the meningitis may produce cross paralysis.

When the base of the brain is involved, the symptoms vary according to the nerves especially engaged. Spasm of the eye muscles is common. Subjective sensations of various kinds are complained of.

Treatment.—Shave the head, and apply cold continuously, by ice-cap or Leiter's tubing. Bleeding, local and general, may be adopted in some plethoric cases. Purge, give a limited amount of food, and place the patient in a darkened room.

Intracranial Suppuration. Three varieties :—

a. Suppuration between the skull and the dura-mater always occurs at the seat of injury.

b. Intrameningeal suppuration is diffused, usually there is an open wound, and pyæmia generally follows.

c. Cerebral suppuration occurs chiefly in the white substance.

CEREBRAL ABSCESS.

Definition.—Abscess of the brain is a localized collection of pus in the brain substance. Usually it is somewhat slow in formation, and more or less chronic in its course.

Causes.—It has been observed in cases of compound fracture. It may depend upon the irritation caused by some foreign body, a contusion of the brain substance, either opposite the wound or by contre-coup, or a traumatic blood effusion. The softening down of a gumma or thrombus may likewise be the starting-point. Abscess is a common complication of gunshot facture.

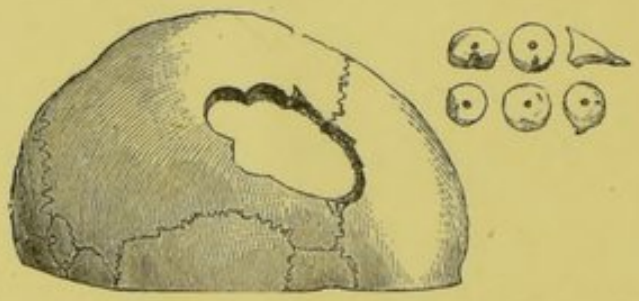
Symptoms.—There is little fever, and often no rigor. Severe headache is a prominent symptom. Paralysis of one extremity, or a group of muscles, may take place.

When there is an open wound, hernia cerebri is frequently present, and on the occurrence of abscess the suppuration in the wound ceases and the pericranium separates from the bone.

The Diagnosis is difficult, as the symptoms are so obscure.

Localized paralysis, paralysis of the opposite side, localized pain in the head of a very severe kind, history of injury, or of some constitutional cause, and a gradually increasing tendency to coma may serve as indications.

Treatment.—If the disease can be localized, trephine the skull, incise the dura-mater, and, if need be, puncture the brain with a fine bistouri, to discover the pus, which should then be evacuated, the cavity drained, and the wound treated antiseptically. Anti-syphilitic remedies should be employed in the first instance, in cases where a history of syphilis exists.



G. 21.—Skull showing five trephine openings made for the evacuation of pus. The pus was found, but the patient died of diffuse inflammation of the brain and arachnoid.—*A.M.M.*, fig. 1.

Sudden acute meningitis, or speedy death from bursting of the abscess, are probable terminations. Recovery has followed in half the reported cases treated by operation.

CONCUSSION.

Definition.—Concussion, stunning, commotio cerebri, or shake of the brain, is a state of more or less complete insensibility and shock, produced by injury, and significant of a temporary abeyance of the brain functions. All voluntary acts are arrested, and the involuntary functions carried on imperfectly. The degree of the concussion (that is, the severity of the symptoms) varies in each case. The symptoms may be extremely severe and prove speedily fatal, or are slight and transient. The amount of brain-damage is difficult to estimate.

Causes.—A fall on the head, or a blow from a blunt weapon, involving, as a rule, a considerable area of the skull, and thus acting on the whole brain mass, is the most common cause.

Symptoms.—In the aggregate these resemble those of shock and collapse. They may vary from transient confusion and faintness, quickly recovered from, to a prolonged loss of consciousness. Partial and irregular paralyses are often associated with both the greater and lesser degrees of impaired consciousness. Loss of muscular power is also well marked. The pulse and respiration are feeble and often irregular. There is retention of urine and, possibly, incontinence of fæces. The pupils may be either dilated or contracted.

In severe cases there are three well-defined stages.

First Stage, Depression.—The vital functions, in well-marked instances, are reduced to a minimum. The surface is pale, cold, and clammy. The temperature falls below normal. The pulse is very feeble and frequent, sometimes quite imperceptible. The respiration is faint and slow. The bowels act involuntarily, while the urine is retained; in some cases there may be incontinence. The pupils are variable in size, and more or less sensitive to light. Sometimes both are contracted, or one may be contracted and the other dilated. Sometimes both are dilated. On being roused by loud speaking or shaking, the patient will faintly respond, and then quickly relapse into his previous condition. The duration of this state varies from a few minutes to several hours or days, and will sometimes terminate fatally.

Second Stage, Rallying.—Reaction and recovery take place more or less quickly. Generally one of the earliest favourable signs is vomiting. The patient shows symptoms of returning consciousness, the pulse and respiration improve, warmth and colour return. This stage of improvement continues about twelve or twenty-four hours, during which sensibility is still incompletely restored.

Third Stage, Reaction.—The reaction corresponds in degree with the intensity of the previous depression. The pulse becomes full and rapid, the surface hot, the face flushed, the head aches, the temperature rises. The patient is often very drowsy. The mind is irritable and confused. Duration three days to ten days.

Pathology.—Commotion, or shaking of the brain mass showing, in fatal cases, no appreciable post-mortem change, is believed to be

the fatal cause in some instances. Various explanations have been given. But in the great majority of cases of concussion there is probably a definite traumatic lesion of the brain tissue. Punctiform extravasations in the brain substance occur, in most cases. and contusion of the basal convolutions of the anterior and middle lobes is very common.

Treatment.—Warmth, by means of hot blankets, hot water bottles, diffusible stimulants, frictions, and rest, are appropriate to the stage of depression. Avoid carefully all over-stimulation.

In the stage of reaction, antiphlogistic measures are required, purgatives, cold to the head,leeches, absolute quiet, a darkened chamber.

A period of complete rest and carefully regulated restricted diet should be enforced for three or four weeks after apparent recovery.

Diagnosis.—This must be carefully made from cases of partial or complete insensibility due to other causes, such as alcohol and different forms of poisoning.

Prognosis and Terminations.—Recovery is the rule, gradual convalescence usually ensues, but sudden death may occur at first from the violent "commotion" of the brain mass, and also from heart failure. Generally recovery is complete. In some cases symptoms of compression supervene from some superadded lesion, or a condition of more or less seriously impaired brain function may become permanent. There may be irritability of temper, partial loss of memory, impairment of vision or of some other special sense.

COMPRESSION.

Definition.—Compression is a condition of complete insensibility produced by severe injury inflicted upon the brain tissue.

Causes.—Rapidly induced pressure upon the surface of the brain will cause it. The term compression has been given because the condition is so frequently associated with depressed fracture, or an extravasation of blood, pressing upon the brain. It is frequently associated with the commencing inflammatory changes in the brain tissue after. It is of indefinite duration.

Extravasation of blood into or upon the brain, the influence of a depressed fracture and its associated brain lesion, also

suppuration in the interior or upon the surface of the brain, are the more frequent causes. Rapidly growing tumours pressing on the brain may sometimes occasion somewhat similar symptoms.

The Symptoms are those of gradually increasing or total insensibility, passing into profound coma and complete paralysis. The respiration is laboured, and in severe cases stertorous. The cheek and soft palate flap, the lips puff to and fro. The pulse is full, and may be frequent at first, but as the insensibility increases, it generally becomes slow and irregular. The face is often natural in colour, sometimes it is flushed. The surface generally is warm. The conjunctivæ are insensible, and the pupils dilated and insensitive to light. Sometimes one is dilated, and the other contracted. Convulsions may occur. If the patient survive for some time, retention of urine is followed by incontinence, the urine dribbles away, and the involuntary discharge of fæces takes the place of constipation.

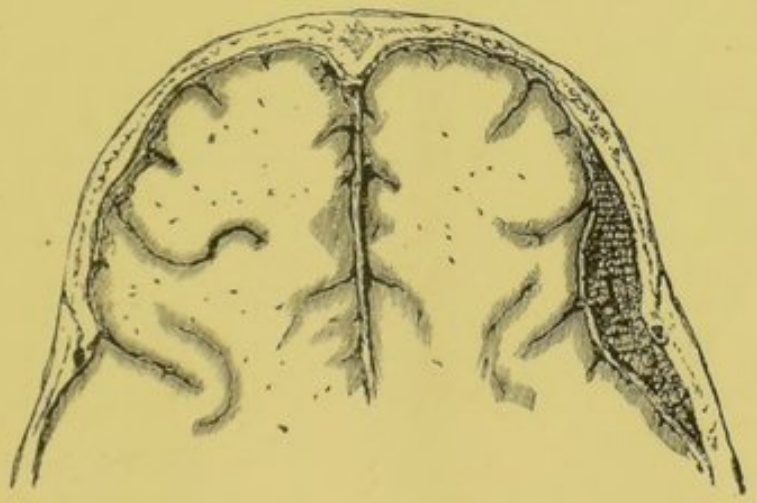


FIG. 22.—Extravasation between the skull and dura mater producing symptoms of compression. The skull has been fractured, and the middle meningeal artery torn through.

Compression due to hæmorrhage, usually from rupture of the middle meningeal artery or its branches, will probably occur before twenty-four hours have elapsed from the time of injury; compression from inflammatory changes or effusion not usually before the third or fourth day.

The condition may become worse and worse, and fatal coma ensue, or gradual amelioration takes place. Convalescence is very

protracted as a rule. Recovery, though very gradual, may be eventually complete, or associated with either temporary or permanent impairment of brain function.

Treatment must be directed to removing the cause, if possible, and relieving urgent symptoms. Ice to head, croton oil purgative, absolute quiet, restricted diet, and later mercury.

Trephining.—Indications for trephining in compression. See p. 31.

The operation properly conducted is not in itself very dangerous. Probably a mortality rate of five to ten per cent. would fairly represent the risk of the operation *per se*.

FIG. 23.—Disk and depressed fragments of bone from right parietal. The patient had sustained a fall of 12 feet on the head. A crucial scalp wound was found over the right parietal eminence. and a depressed fracture. No decided cerebral symptoms appeared for twelve days after the injury, when severe headache, followed by convulsions, occurred. Trephining was then performed, and on removing the bone pus gushed out copiously. Three days after hernia cerebri occurred, the tumour reaching the bulk of a hen's egg. Compression was tried, but caused violent convulsions. Convalescence, however, rapidly occurred, the protrusion spontaneously subsided, and a dense cicatrix formed over the gap. There was no subsequent impairment of the mental or motor power.—*A.M.M.*, fig. 25.

Prognosis will be dependent on the nature of the cause, and the severity of the symptoms.

Diagnosis from other conditions of insensibility, as produced by morphia or alcohol, is very important.

Cerebral irritation is a condition produced in many cases by a contused or lacerated brain. The patient lies curled up upon his side, restless, the eyelids closed, and he resists their being opened. If opened, the pupils are found contracted. The surface of the body is pale and cold. The patient is very irritable. All this is evidence of injury of the cortical tissue.

In cases of contusion and laceration of brain substance, the symptoms vary with the part of the brain injured. These lesions are

often associated with cases of severe concussion, and are a frequent cause of hæmorrhage and subsequent compression.

Wounds of the brain and its membranes may be produced by cutting or blunt instruments; and their treatment and consequences resemble that for brain injury already described.

The probable result will depend on their position and extent.

Treatment of Fractures of the Vault.

The treatment of fractures of the skull cannot be dissociated from the treatment of the injury to its contents, and the motive for active interference depends rather on the condition of the latter, or the probability of subsequent inflammatory changes being set up by the displaced fragments, than on the actual amount of damage done to the bone.

Simple fracture.—As a rule, no active interference with a simple fracture is justifiable. This form is especially frequent in children. In the child well-marked depressions will often disappear after a time. Recovery is the rule. Simple depressed fracture may sometimes require interference in the adult. Mere depression is not by itself a sufficient reason for operative interference, unless it is believed the internal table is extensively splintered. If symptoms set in it may be proper to cut down upon the seat of injury, to discover, and, if possible, remove the cause of the symptoms; if antiseptic precautions be observed, the risks may often be even less than if the fracture had been originally compound.

Compound fracture.—A very careful purification is essential. Shave the head, and thoroughly disinfect the wound and the adjacent parts. See that no hair is wedged in the line of fracture or in fissures of the bone, and that no foreign substance or piece of the weapon causing the injury has been broken off and lodged.

Depressed fracture should in general be elevated, whether symptoms be present or not, and the sooner the elevation is done the better. This is more especially necessary when the internal table is extensively damaged, as is almost invariably the case in cases of punctured fracture, which should never be treated expectantly.

Quite loose and detached fragments of bone should be at once extracted. Fragments of bone, however, which appear capable of

retaining their vitality should not be removed. Pieces of bone only slightly depressed need not, as a rule, be interfered with. In compound comminuted fractures, small portions of bone of various shapes are generally one by one extracted by means of the elevator and bone forceps. When the bleeding is considerable, and cannot otherwise be stopped, it may be desirable to remove a fragment of bone in order to expose the source of the hæmorrhage. It may be sometimes necessary to extract others which are only partially detached, to provide for sufficiently free drainage, as well as to facilitate the purification which is so absolutely needful. This is more especially so where the dura-mater is injured, and also in cases where an interval has elapsed before the patient comes under treatment. All parts of the wound should be most scrupulously disinfected in cases of suspected sepsis. A five per cent. chloride of zinc solution, or a ten per cent. spirit solution of carbolic acid may be used. Corrosive sublimate solution, 2 or 3 parts in 1,000, is also a valuable antiseptic. It is, of course, extremely undesirable to allow the carbolic or any other antiseptic fluid to enter the arachnoid space. Effective drainage should always be provided for.

ELEVATION.

This operation is to be preferred in all suitable cases to the more serious operation of trephining, for which it can very frequently be substituted. The mere diminution in the capacity of the skull by the depression is not the prime motive for interference. A uniform depression, even though considerable, need not interfere with the brain function. The chief reason for elevating depressed fragments is the probability that splintering of the internal table has taken place, and the consequent likelihood of brain inflammation being subsequently set up. The pericranium and dura-mater should first be separated on each side from any fragment about to be extracted. The elevator and strong bone forceps are the instruments required. Luer's gouge forceps, and the parrot-bill forceps, are useful instruments to procure sufficient space when fragments are wedged together, or the chisel may be used. Overlapping of the fragments

may occasion difficulty in the elevation or extraction of the fragments. Trephining may be then needed, to give room enough. Formal trephining is, however, only exceptionally required in cases of fracture. Much can be accomplished by dexterous use of the chisel and mallet, and the various cutting forceps.

FIG. 24.—Holston's chisel.

TREPHINING.

Definition.—Trephining, or trepanning, is an operation for the removal of a circular piece of bone from the skull-cap, without injuring the parts contained within.

FIG. 25.—Application of the trephine.

Operation.—First shave the head and purify the scalp. Make a tongue-shaped flap of scalp, or a crucial incision, or sufficiently enlarge a pre-existing wound. Raise the pericranium with the

elevator together with the rest of the soft parts. The bone having been thus exposed, engage the central part of the trephine on an uninjured portion of the skull, close to the piece requiring to be removed or elevated, till the saw has made a sufficiently deep groove not to slip. Then withdraw the centre-bit, and gradually deepen the groove with a steady to-and-fro motion of the saw. When the internal table is approached use great circumspection, and make frequent examinations, first removing all the bone-dust with a brush or stream of water. As soon as the groove shows that the whole thickness of the bone has been divided at any point of the

FIG. 26.—Completion of the operation of trephining.

circumference, lay aside the trephine for the elevator, and with it prize out the circular bit of bone. The lenticular is an instrument employed to smooth the edges of the opening. Hey's saw is used to divide a neck, projecting angle, or bridge of bone. The *tire-fona* is an instrument employed to screw into the bone to elevate it with. Some of these instruments are obsolete.

The mortality, after operative interference with the skull, was formerly more than fifty per cent. Now it is comparatively speaking a safe operation. To be effective it must be performed early, the risk being that inflammation will be excited by displaced fragments of

bone. Trephining is of little avail when encephalitis or meningitis has occurred. The mortality after late operations is double that of the early ones. Good drainage of the wound is essential to success.

Trephining is indicated—

1. Where the elevation or removal of depressed and comminuted fragments cannot be otherwise effected. (*a*) In cases of compound depressed, and comminuted fractures,

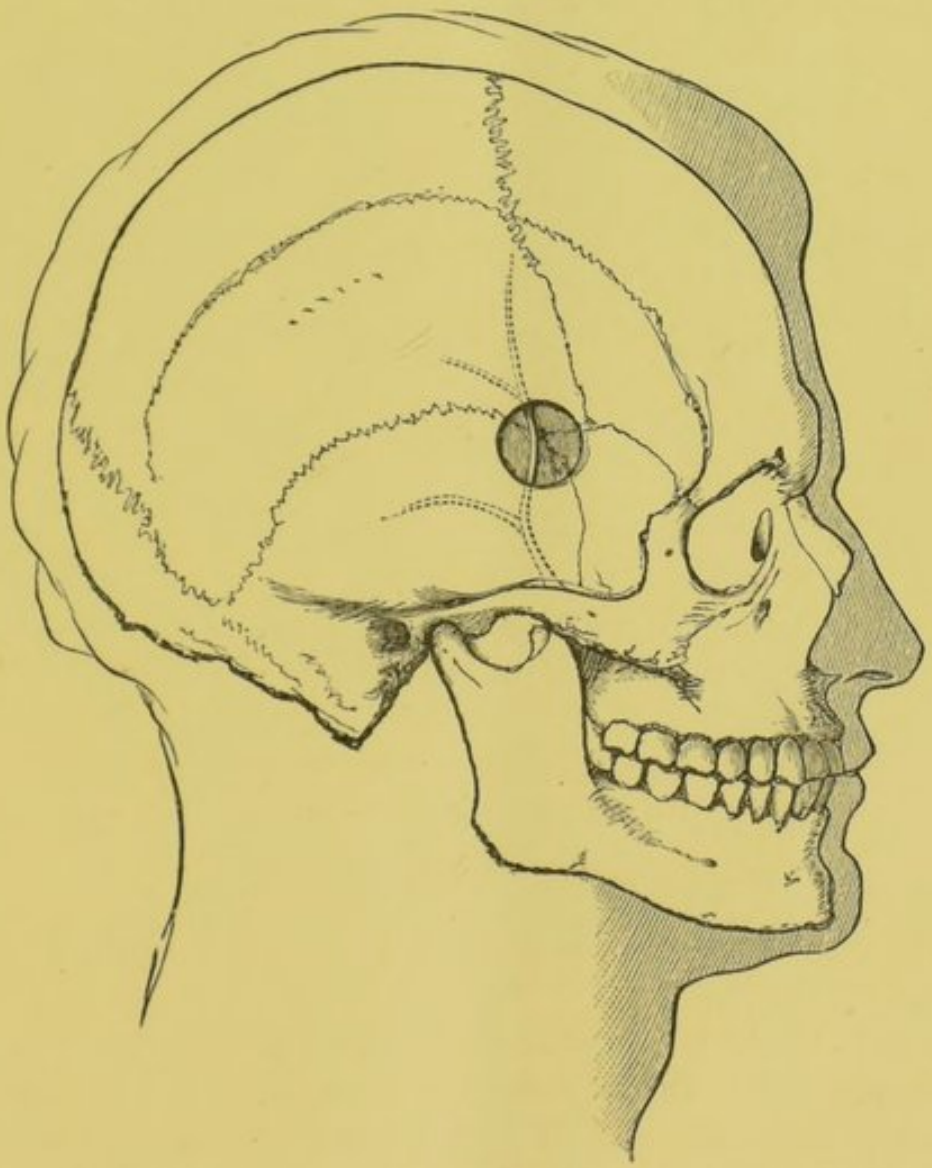


FIG. 27.—Trephining on account of hæmorrhage from the middle meningeal artery. The position of the artery and the place to apply the trephine are indicated.

either with or without symptoms. (*b*) Simple depressed fracture, with symptoms. (*c*) Very rarely can it be indicated in simple depressed fracture without symptoms.

The old rule, however, never to convert a simple into a compound fracture for purposes of exploration or operation, has been greatly modified by the introduction of antiseptic methods of treatment.

2. By the presence of a foreign body in the interior of the skull which cannot be otherwise extracted. A bullet in the brain may thus be searched for, and broken-off knife points, or portions of weapons, detected and extracted.
3. In progressive bleeding from a torn middle meningeal artery.
4. In secondary diffuse suppuration, and in brain abscess. In the former class of cases trephining has sometimes been employed to facilitate the escape of matter, and the application of an antiseptic treatment. The suppuration, however, in these cases is diffused, and but little gain can be effected. In the latter form, where the collection of pus is localized, about half of the cases operated on have been cured in what must otherwise prove a fatal malady.
5. In cases where possibly long after the receipt of the injury serious symptoms of interference with the brain functions set in, or epileptiform seizures occur, and it seems probable that these may depend on thickening of the bone, a bone spicule, or a depressed and comminuted internal table pressing upon and irritating the brain.
6. Trephining has also been performed as a means of removing a tumour of the brain from within the skull.

Prophylactic trephining has become a possible and recognized manner of dealing with cases of fracture, simple as well as compound, where, though there may be no immediate symptoms or only very slight ones, the nature of the injury leads us to expect them at a later date.

Trephining is contra-indicated—

1. In all cases where there is insufficient evidence of the locality of the disease or injury to the brain.

2. In cases of diffused injury to the brain, or diffused inflammation of the brain or its membranes, it is generally useless.

After removal by the trephine or elevator the bone is not reproduced (fig. 28).

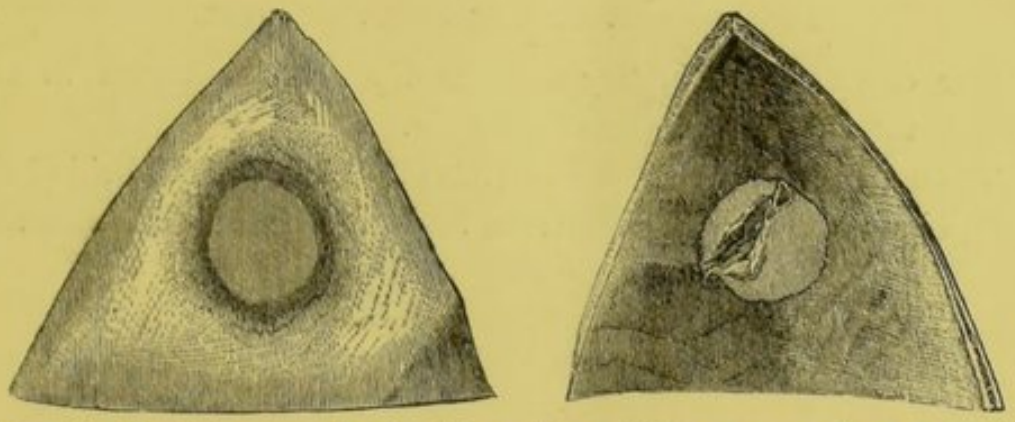


FIG. 28.—Exterior view of a trephine orifice, eighteen years after an operation performed for depressed fracture of frontal bone. The aperture is closed by a thin membrane, and the margins are to some extent absorbed. There is not any reproduction of bone.

From the internal surface a falciform projection of dura mater pressed on the brain.—*Amer. Rep.*, p. 319.

CEREBRAL LOCALIZATION.

Broca in 1861 first pointed out the connection of aphasia with some definite lesion in the posterior part of the third frontal convolution on the left side of the brain. Hitzig in 1870, Ferrier in 1873,

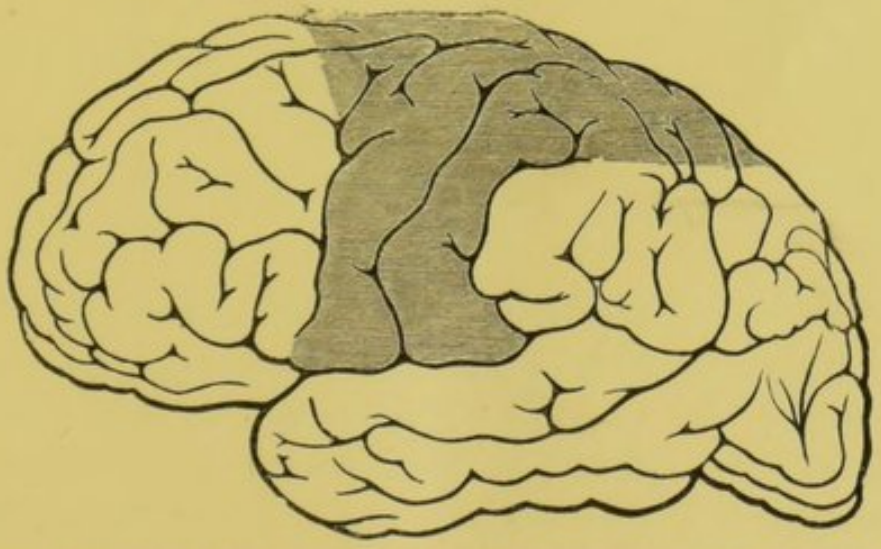


FIG. 29.—The area of the distribution of the motor centres is shown in the shaded portion of the figure.—*Sharkey.*

and in following years Charcot, Bergmann and others, have continued these researches; and we now possess a considerable knowledge of the portions of brain which preside over several of the acts and functions of the body.

LOCALIZATION OF THE BRAIN FISSURES.

The centres for voluntary movement are in the cortex in the neighbourhood of the fissure of Rolando.

The upper end of the fissure of Rolando is half an inch behind the mid point of the vertex, as measured between the root of the nose and

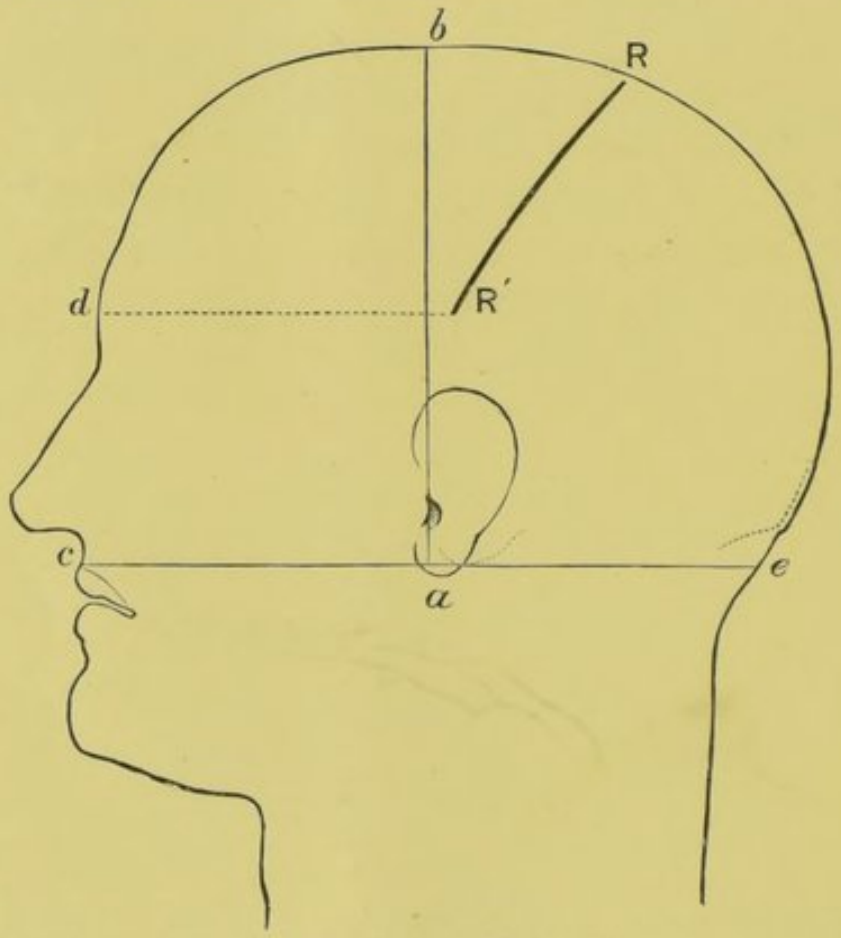


FIG. 30.—Outline of head. R R′, Fissure of Rolando; *b*, Bregma; *c e*, alveolo occipital line; *d*, supra-orbital ridge.

the occipital protuberance; it terminates half an inch external to the median line. The lower end is about an inch behind the bifurcation of the fissure of Sylvius, and the bifurcation of the Sylvian fissure corresponds to a point one inch and a quarter behind, and one quarter of an inch above the level of the external angular process of the frontal bone.

In ascertaining the exact position of the bregma and the fissure of Rolando, the head must be so placed that a line drawn from the base of the incisor teeth in the upper jaw to the lowest part of the occipital bone shall be horizontal. This line is practically identical with one drawn from the superior alveolar margin to the tip of the mastoid process.

In order to ascertain the exact position of the bregma *b*, and fissure of Rolando R R′, the head must be placed so that a line *c e* drawn from the base of the incisor teeth in the upper jaw to the lowest part of the occipital bone shall be horizontal. This line may be taken to be the same as one drawn from the alveolar margin to the tip of the mastoid process *a c*. If this alveolo-mastoid line be taken as a base line, and a perpendicular one be drawn from it *a b*, passing through the external meatus to the vertex, its termination *b* will correspond exactly to the bregma (fig. 30).

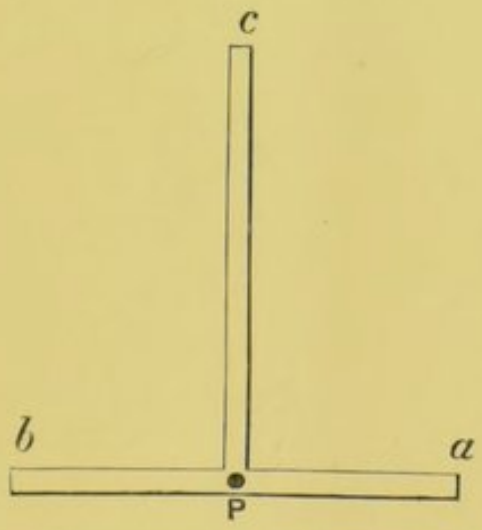


FIG. 31.—Flexible steel square suggested by Broca, to enable the surgeon to fix the position of the fissure of Rolando. A B horizontal limb, P C vertical limb, P plug to fix in the external auditory meatus.

A square of flexible steel (fig. 31) can be adjusted so as to give these measurements. The horizontal limb should be applied from just below the columella of the nose to the tip of the mastoid process, and the vertical one bent over the top of the head. The upper end of the fissure of Rolando is at R, five centimètres or about two inches behind the bregma. The lower extremity, R′, is 0.5 centimètres behind the vertical line *a b*, on a level with the supraciliary ridge *d*,

or eight centimètres above and a little behind the external auditory meatus. The position of the lower extremity of the fissure of Rolando, very nearly corresponds to a point half-way between the external meatus and the bregma.

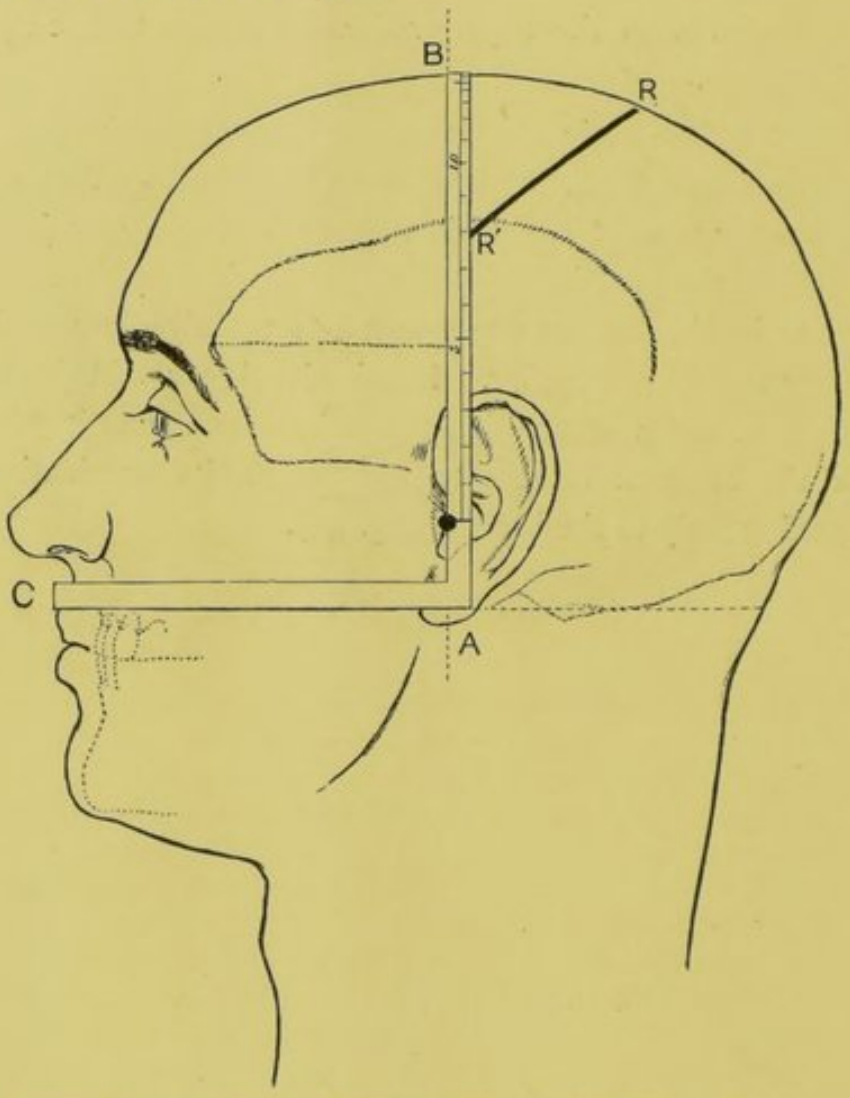


FIG. 32.—Method of applying Broca's square, which may be conveniently arranged in a rectangular form and marked in centimètres (as in fig. 32).

A C, horizontal limb. A B, vertical. R R, fissure of Rolando. R′ is half-way between the external auditory meatus and the bregma B.

The alveolo-mastoid line A C serves as a base line. The horizontal limb A C stretches from just below the columella of the nose to the mastoid, and the vertical A B is bent over the top of the head. The perpendicular limb, passing through the external meatus, to the vertex will fix the position of the bregma B (fig. 32). The square of flexible steel is adjusted so as to give these measurements. The upper end of the fissure of Rolando at R is five centimètres, or about two inches behind the bregma B. The lower extremity R′ is 0.5 centimètres behind the vertical line A B, on a level with the supraciliary ridge, or eight centimètres above and a little behind the external auditory meatus, that is, half-way between the meatus and the bregma.

Aphasia indicates a lesion in the posterior part of the third or inferior convolution of Broca.

Facial Paralysis depends on a lesion of the lower third of the ascending frontal convolution, and the adjacent portion of the poste-

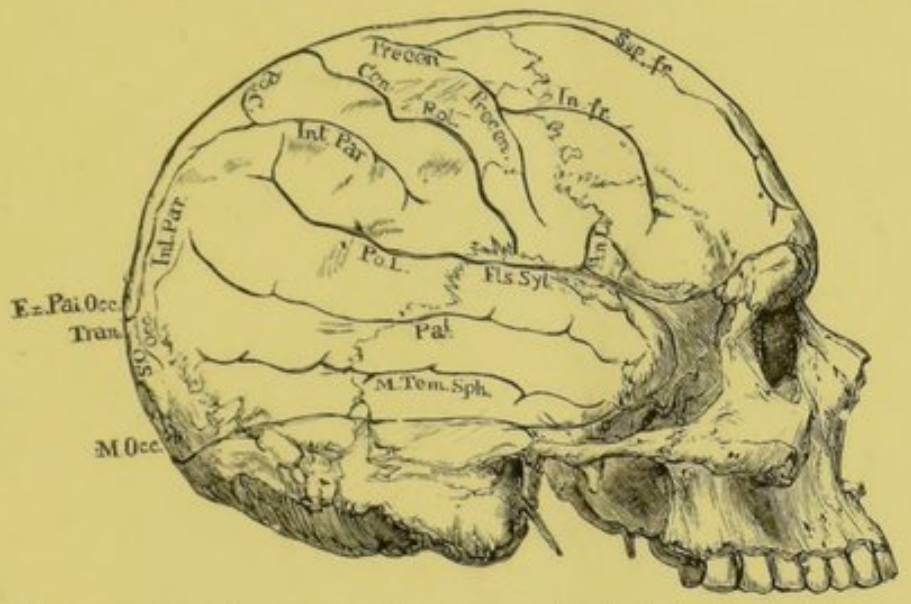


FIG. 33 —Positions of the fissure and sulci of the brain marked on the surface of a skull.

Sup. Fr.	Superior frontal sulcus.	Pal.	Parallel sulcus.
In. Fr.	Inferior frontal sulcus.	M. Tem Sph.	Middle temporo-sphenoida sulcus.
Precen	Precentral sulcus.	Ex. Par. Occ.	External parieto-occipital fissure.
Cen. Rol.	Sulcus of Rolando.	Tran.	Transverse fissure.
Po. Cen.	Post-central sulcus.	S. Occ.	Superior occipital sulcus.
Int. Par.	Intraparietal sulcus.	M. Occ.	Middle occipital sulcus.
Fis. Syl.	Fissure of Sylvius.	Occ.	Occipital sulcus.
An. l.	Anterior limb.		
Po. l.	Posterior limb.		

rior end of the second frontal convolution. The anterior part of this area is concerned with the movements of the upper part of the face; the posterior part, including also the lower third of the ascending parietal convolution, controls the movements of the mouth and lips.

These centres are close to Broca's convolution; hence the frequent association of aphasia with facial palsy.

Paralyis of the Upper Extremity (brachial monoplegia) indicates some lesion of the middle part of the ascending frontal convolution, and the adjacent part of the ascending parietal on the opposite side of the fissure of Rolando.

This centre is immediately above those for the face, and therefore brachial and facial paralysis are often co-existent.

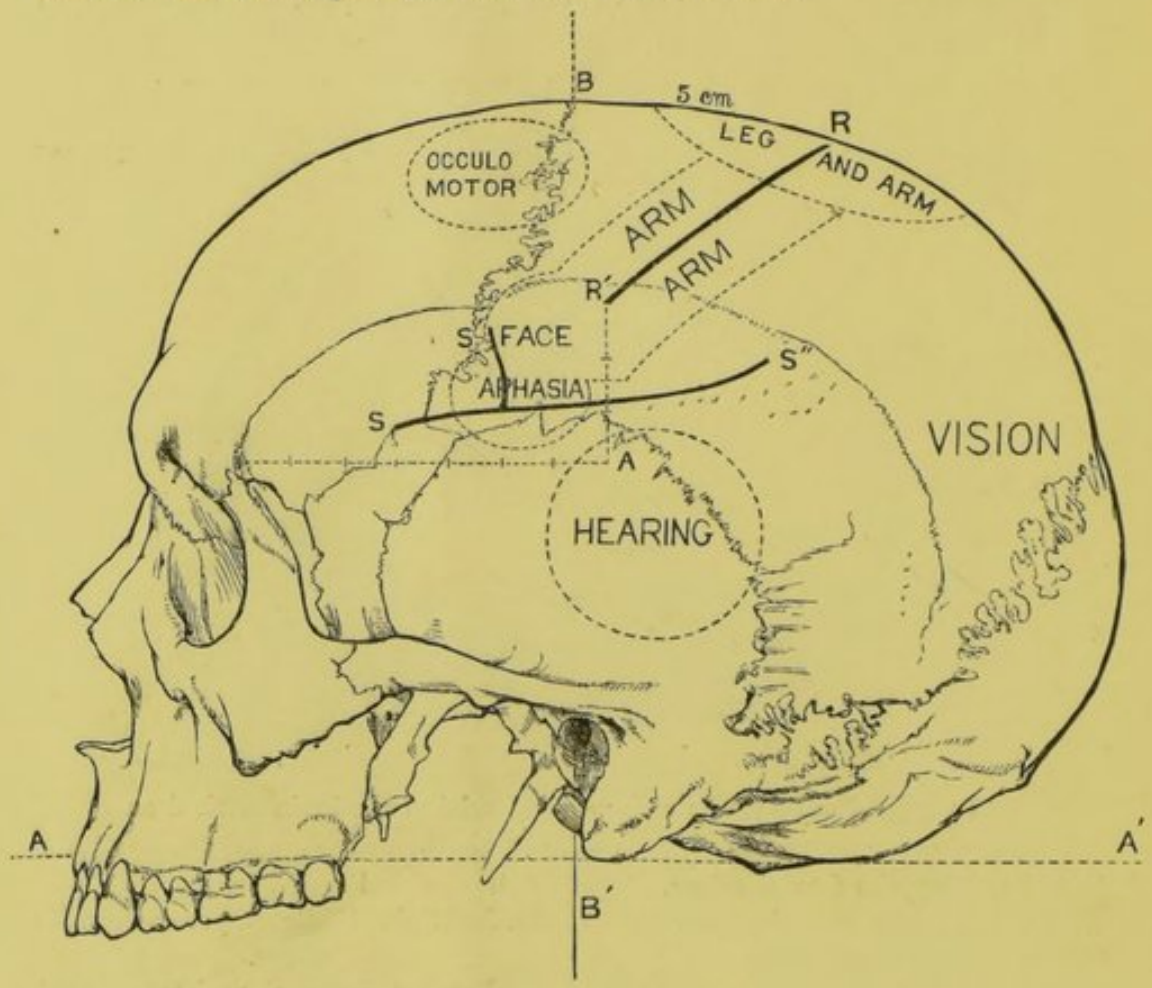


FIG. 34.—Diagram illustrating the position of the fissure of Rolando, and some of the principal cortical centres, the motor areas of the leg, arm, and face, and the centre whose destruction produces aphasia. The oculomotor centre, and those of vision and hearing are also indicated.

B, Bregma. R upper end of fissure of Rolando, 5 *cm* exterior to B. R′ is 3 *cm* vertically above A, which is 7 *cm* behind the external angular process of the frontal bone. s s′ s″ Sylvian Fissure. The bifurcation of the fissure of Sylvius corresponds to a point one inch and three-quarters behind, and half an inch above the level of the external angular process. The first or superior frontal convolution commences 2.5 *cm* behind B, and passes forward near the median line towards the orbit. The second frontal convolution is similarly placed, but more lateral. The third frontal convolution is wholly in front of the auriculo-bregmatic line, about 3 *cm* behind the external angular process of the frontal bone. The motor and sensory regions seem to overlap. The latter are chiefly behind the fissure of Rolando. For the face probably in the lower third, the arm middle third, the leg upper third.

Paralysis of the Lower Limb depends on a lesion in the upper extremity of the ascending parietal convolution, and in the posterior

parietal lobule immediately behind it, as far as the margin of the longitudinal fissure.

Ferrier believes that a centre for the control of the lateral movements of the head and eyes, and for dilatation of the pupil, an oculo-motor centre, is placed in the superior frontal convolution in front of that for the upper limb. This centre extends near to the middle line.

A centre for vision is located by Ferrier in the lower part of the parietal lobe. A centre for hearing in the first or superior temporo-sphenoidal lobe.

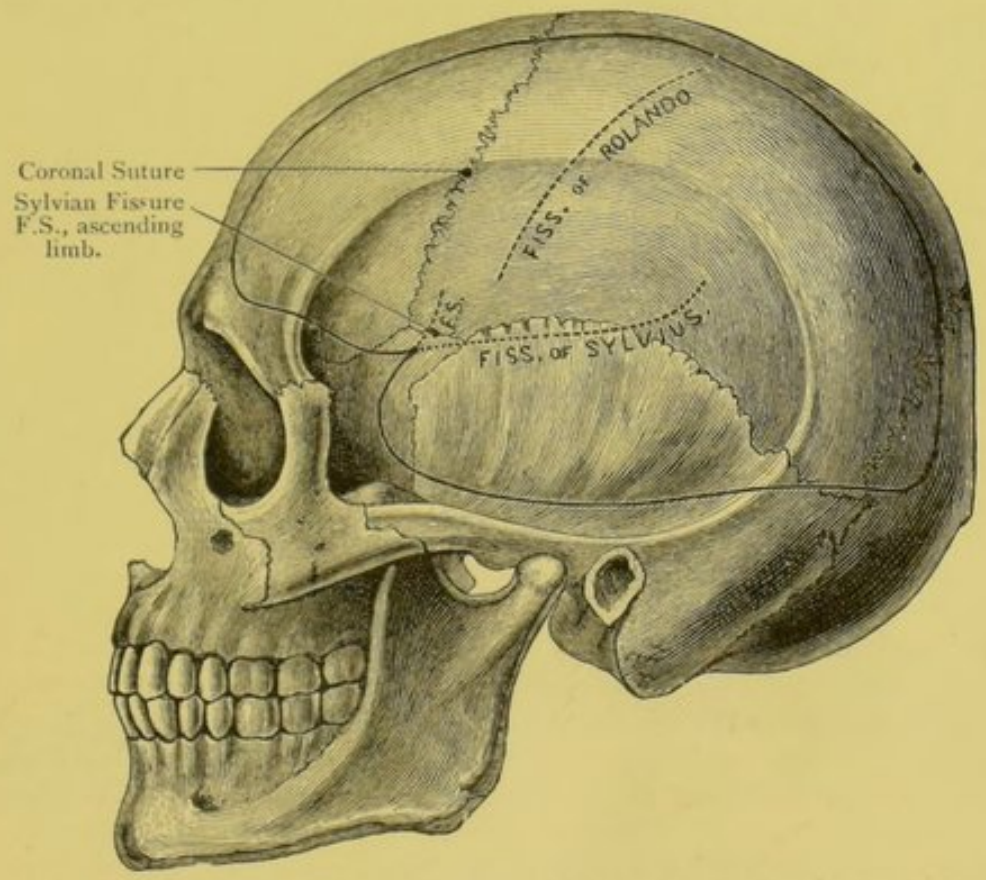


FIG. 35.—Skull showing the outline of the brain, and the position of the two principal fissures.

Lucas-Championnière lays down the following rules for the application of the trephine in cases where the paralysis is localized and well defined. The guide is the line of the fissure of Rolando on the side opposite to that on which the paralysis exists.

Use a trephine of large size, and if need be re-apply it a second, or even a third, time.

1. In general hemiplegia, apply the crown of the trephine over the middle of the fissure.
2. Where one arm or leg is paralysed, trephine near the upper part of the fissure, but not quite at its upper extremity.
3. In brachial monoplegia, trephine slightly in advance of the middle third of the fissure.
4. In aphasia, trephine a little lower down slightly in front of and below the fissure.
5. When both lower extremities are paralysed, trephine near the vertex opposite the superior termination of the fissure.

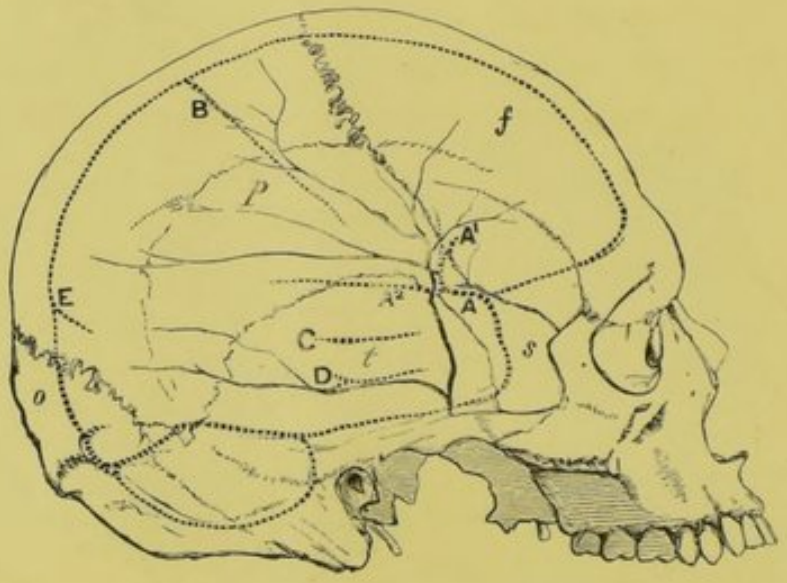


FIG. 36.—The outline, and principal fissures, of the brain are indicated by the dotted lines. The middle meningeal artery and its branches are shown in plain black lines. A, Sylvian fissure. A^1, S.F. ascending limb. A^2, S.F. horizontal limb. B, Fissure of Rolando C, Parallel sulcus. D, Inferior temporo-sphenoidal sulcus. E, Parieto-occipital fissure. *f*, Frontal bone. *o*, Occipital bone. *s*, Sphenoid bone. *t*, Temporal bone.

6. When the upper and lower extremities are paralysed, trephine the middle and upper parts of the fissure.
7. In paralysis of the face and upper extremity, trephine in front of the lower third of the fissure.
8. In facial paralysis with aphasia, trephine in front of the fissure and below its extremity.

SURGICAL DISEASES OF THE HEAD.

INFLAMMATION OF THE BONES OF THE SKULL NOT OF TRAUMATIC ORIGIN.

Syphilitic disease is the most common affection of the bones of the skull, either in the form of nodes, caries or necrosis.

Necrosis is uncommon, except as the result of injury or syphilis. The lost bone, after exfoliation, is not reproduced. No sequestral case is ever formed. It is most frequent in the frontal and parietal bones, rare in the occipital bone. The external table is often the only part affected.

Acute osteomyelitis of the cranial bones is rare.

Caries due to tuberculous infiltration is rare, while it is a common result of syphilis in any part of the skull, but more especially the calvaria. Tubercular caries may occur in the mastoid process, or in any portion of the spongy diploë.

Syphilitic caries and necrosis are generally associated together.

TUMOURS OF THE SCALP.

Cephalhæmatoma: effusion of blood between pericranium and

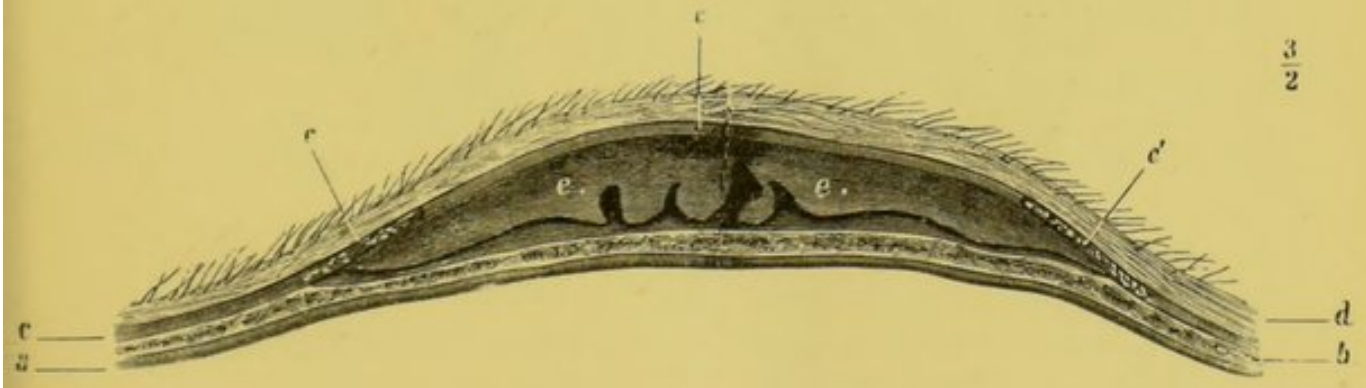


FIG. 37.—Vertical section of a cephalhæmatoma of the right parietal bone. A, Dura mater. B, Parietal bone. C, Periosteum. C', Detached periosteum containing deposit of new bone. D, Skin. E, Coagulated blood.

FIG. 37.—Cephalhæmatoma of the right parietal bone shown on section. The position of the extravasition, in regard to the layers of the scalp, is distinctly seen.—*Hennig.*

A dura mater. B parietal bone. C^1 periosteum. C^1 ossified periosteum. D skin. E blood coagulum.

Cause: injury.

Symptoms: the swelling will be limited by the lines of suture.

Treatment: palliative and expectant.

Pneumatocele.

Causes: f.acture of nasal bones, perforation of frontal sinuses.

Characters: puffy, doughy tumour.

Treatment: expectant.

Dermoid cysts.

Characters: generally single, deeply placed, often closely connected with the bone, skin usually non-adherent.

Most common positions: external angle of eye, root of nose.

Treatment: excision.

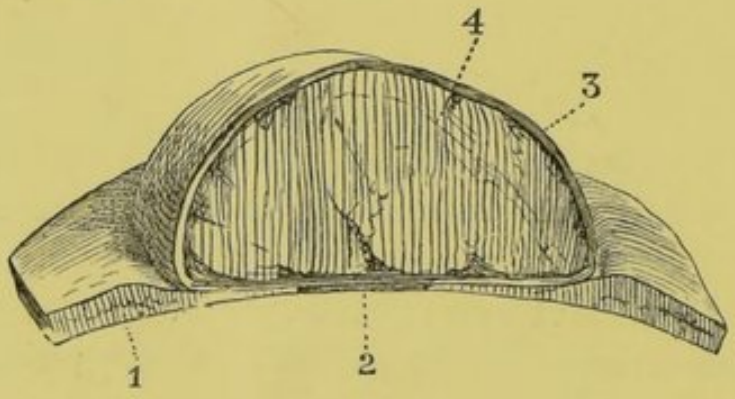


FIG. 38.—Sebaceous tumour of the vertex which had a communicated pulsation from thinning and absorption of the skull, and was mistaken for meningocele. 1. Skull showing the thinning at the margins of the base of the tumour caused by pressure. 2. At the central part of the base the whole thickness of the skull has been absorbed. 3. Cyst wall. 4. Sebaceous contents.

Sebaceous cysts—

Characters: variable in size, single or multiple.

Diagnosis: usually adherent to skin, move with the scalp.

Treatment: excision.

Aneurismal varix has occasionally occurred after accidental wound of the vein in bleeding from the temporal artery.

Cirsoid aneurism occurs in the vessels of the scalp, more especially in the superficial temporal artery.

Pathology: dilatation, pouching and elongation of the arteries.

Symptoms: swelling, pulsation, bruit.

Treatment: palliative and by ligature of main arterial trunk.

Nævus—

Varieties: capillary, venous, mixed.

Methods of treatment: ligature, cautery, excision.

TUMOURS OF THE BONES OF THE SKULL.

Exostosis is of two kinds,

1. Ivory-like osteoma, broad based, or pedunculated.
2. Spongy exostosis, usually flattened; often of syphilitic origin.

Chondroma is of rare occurrence.

Sarcoma is more frequent.

Fibroma of the base of the skull projecting into the pharynx has occasionally been observed. These affections are rarely congenital.

FIG. 39.—Aneurismal varix of temporal vein.

TUMOURS OF THE BRAIN AND ITS MEMBRANES PRESENTING EXTERNALLY.

Encephalocele.

Varieties.

(1.) Congenital.

(2.) Traumatic acquired in connection with injury.

The latter form (Hernia cerebri traumatica, or prolapsus cerebri) is very often fatal. It presents the form of a pulsatile tumour, com-

posed partly of brain tissue, partly of inflammatory exudation, covered by granulations. It projects through the deficiency left in the skull after removal of fractured portions of bone.

The protrusion may slough off, or recede within the skull, and cicatrize over. Inflammatory mischief present in the tumour may extend to the interior of the brain and prove fatal. Abscess of the brain may be often associated with it.

Treatment.—Protect the part, dress antiseptically, treat symptoms as they arise.

Congenital encephalocele consists of a tumour connected with one of the ventricles of the brain. It may appear at those points of the skull where the projections or cornua of the ventricles approach near to the surface. The tumour contains ventricular fluid, over which is stretched a thin layer of brain substance. It protrudes through a defect in the skull, and is covered by the tissues of the scalp and the membranes of the brain.

Meningocele is pathologically similar, except that there is no layer of brain substance covering the tumour. Internal hydrocephalus is often associated with meningocele; that is to say, the cerebro-spinal fluid accumulates in and distends the ventricles at the same time.

The tumours occur chiefly at three points on the skull.

They do not form at, nor have they any relation with, the fontanelles.

1.—**Occipital** encephalocele or meningocele, derived from the fourth ventricle, is exactly median over the occiput.

2.—**Frontal** encephalocele forms at the glabella, and is quite central between the orbital ridges. It corresponds to the anterior cornua of the lateral ventricles.

3.—**Mastoid** encephalocele is connected with the lateral cornu of the lateral ventricle, and projects behind the mastoid process.

No. 1 is by far the most frequent, and attains the largest size.

No. 2 comes next in order, and is never so large as the other.

No. 3 is very rare.

Similar tumours filled with cerebro-spinal fluid may also be present

in the nose, or hang down behind the velum palati from the base of the skull, when they may simulate a mucous polypus or cyst.

Diagnosis.—Position. Congenital origin. Soft fluid consistence. Partial reducibility. The tension is variable; but it is increased on the child crying, and diminished during sleep. Pulsation may be communicated from the brain. The presence or absence of brain substance in the tumour is difficult, often impossible to determine. The opening of communication with the interior of the skull varies much in size. It may be very small, and occasionally it may close altogether and a cure ensue. The tumour is sometimes multilocular.

Treatment.—Stationary tumours of this kind should scarcely ever be meddled with. If the tumour be increasing, a puncture, and subsequent injection with Lugol's solution may be practised. This is composed of

Potassium iodide, gramme 1·00
Iodine, gramme 0·5
Aqua, grammes 30·0.

Or Morton's iodo-glycerine solution may be employed—

Iodine, gr. x.
Potassium iodide, gr xxx.
Glycerine, ℥j.

About thirty minims may be used as an injection.

The best method of injection is to withdraw from the tumour about three grammes of fluid with a subcutaneous syringe, and then to inject a like quantity of Lugol's solution, or somewhat less of Morton's. The syringe should not be introduced through the most projecting part where the skin is thin, but at the side of the swelling, where the tissues are thicker.

This operation may be repeated in eight days. Several injections are needed. The operation is often fatal, and the cure uncertain.

Other methods, such as excision of the tumour, or its removal by ligature applied around the neck, have been attempted, but the edges of the wound do not unite, the ventricular fluid escapes continuously, and death speedily follows. Ligature of the pedicle cannot be recommended, nor excision, except in those cases where the aperture of communication with the interior of the skull has become closed.

Hydrocephalus is a distension of the skull by serous accumulation in the lateral and other ventricles. Only chronic cases, not connected with tubercle, can be treated surgically, and the results in these are very unsatisfactory.

A puncture between the sutures, or through the roof of the orbit, has been practised in cases where the swelling is rapidly increasing in size. The practice has hitherto proved very unsuccessful, and is not to be recommended. Frequently the puncture does not close, the fluid continually oozing away from it. Convulsions and death generally occur soon after.

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