Title | Fractures of the base of the skull
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Qualification | MD
Year | 1888

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Thesis for the diploma of M.D.

by

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Cullerneuki.

April 30th
1880.
In dealing with fractures of the base of the skull, we have to deal with a subject in which positive diagnosis is not always possible, and the probabilities of the case are all that can be asserted.

The uncertainty of diagnosis is sometimes for wisely impressed on us, where the case is one of medico-legal inquiry, and we are required to give a definite opinion. The following case is an example: T. C., aged 35, while engaged in a street brawl, received a blow in the face and temples which caused him to fall, falling on the back of the head, by another. He was picked up insensible, with bleeding from the ear and nose. When brought to the hospital, he was insensible, bleeding from the nose, with recent evidence of
Leading from this case he recovered consciousness shortly after admission, but eventually died six days afterward from septic meningitis. Post mortem a fissure fracture of the ethmoid bone with rupture of the dura mater, a fissure extending from the septum through the frontal bone, without rupture of the dura mater was found. The source of septic meningitis was evidently from the fracture of the ethmoid.

When giving evidence the day after the accident, I could only state, that there was probably a fracture of the pelvis bone, and possibly accompanied by a fracture of the sphenoid. After a post-mortem examination was enabled to state that the fracture of the ethmoid was the cause of death; and in this evidence one person was sentenced for more severely than the other.

Another example of the importance of medical evidence...
In such cases as the following: W. B., aged 50, was brought into the hospital by the police in an unconscious state. A friend who accompanied him, states that during a fight he was seen to stagger and fall. When picked up he was unconscious. On investigation bruising on the left cheek and back of the head was found but no evidence of fracture. His face was livid, with dilated veins of forehead covered with perspiration. The pulse was slow and full, the breathing shallow. The pupils were dilated, the left being larger than the right, and did not respond to light. He kept his head turned to the right side, and the right side of the body was stiff, the arm and hand being flexed. He remained in this condition for upward of eight hours, paralysis supervening on the rigidity of the right side. The coma increasing until death.

Permission for post mortem was obtained after death.
differently, the coroner stating that in his opinion the evidence of death by violence was insufficient. However, it was found that there was no fracture and that the cause of death was the rupture of a small aneurism in a branch of the middle cerebral artery. At the inquest no evidence of a blow causing the person to fall could be adduced. From this fact, together with the medical evidence the jury returned a verdict of death from natural causes, namely the rupture of the aneurism.

Fractures of the base of the skull can best be classified according to the cause, rather than the position of the fracture.

They may be divided into: Direct and Indirect Fractures.
Slight fractures result from pointed objects being thrust into the orbits or nose, causing fractures of the orbital plate of the frontal and ethmoid plate of the ethmoid bones. They may also result from impact of the condyle of the lower jaw against the base.

In many extraordinary cases of death, resulting from pencils, pens, sticks, and other objects being thrust into the brain through these bones are related.

Slight fractures may be divided into three groups.

1. Fracture the result of falls or blows on the vertex; a fracture extending from the front of the head.
2. Fractures of the base, the result of impact of the spine against the condyles of the occipital bone.
3. Fracture—result of Contusions.

1. The first group includes the majority of fracture—
   fracture of the skull. The fracture is generally the result of a
   violence, resulting from the point-blown, across the base of
   the skull, and may be associated with a simple
   fracture or a compound depressed fracture of the vertex.
   If the skull be divided into 3 zones—  Fig. I

Fig. I.

1. An anterior, formed by the frontal,
   upper part of the sphenoid, & the
   præ-ethmoid;

2. A middle zone formed by the parietal,
   the sphenoid, the anterior surface of
   the sphenoid posterior of the temporal,
   with part of the basis sphenoid;

3. A posterior zone including the
   occipital, the mastoid, & the fascia

4. The articular surface of the sphenoid is
   by the sphenoid bone of the
   sella turcica, & the
   foramen spinosum.

[Diagram of the skull with labeled zones]
surface. The frontal portion of the temporal, with a small part of the body of the sphenoid.

I found that slight fractures are generally limited to one of these areas; some fractures spread from one to another. The middle zone is most frequently fractured. Holmes found that was the case in fifty-three out of sixty-five cases.

Injuries in the occipital often result in fractures which run through the posterior zone, striking at the margin of the fracture line of the occipital fracture, extending into the middle zone, causing its pelvis portion of the temporal bone, and fracturing the sphenoid, ending at the sphenoidal fissure. These fissures as a rule extend through the
middle sizes, and they give rise to no pain. The lateral
stems with profuse Lawrence from the ears.

On looking at the base of the skull it will be seen that the
bone surrounds the prominen magna, and that after
the body of the sphenoid base-crest is very strong,
whereas on each side of these the bone is thin & brittle.

Consequently most pircures run in a longitudinal
direction through the thin bone, and rarely across
the base-

Transverse foci are sometimes found extending
across the base, and even from one margin of
prominen magna to the other. They are the result
of the splitting of the skull between two opposing
forces, namely the force applied to the water and
the resistance of the spinal column.
2. The second variety of indirect fractures are those produced by impact of the spine against the occipital bone.

They may be caused by:
(a) falling head foremost on to soft ground, the body being projected against the base of the skull
(b) as a consequence of alighting on the feet after jumping from a height
(c) from the resistance of the spinal column when the vertebra has been struck, the latter yielding, but the base being rigidly fixed and fractured. A fracture of the base, with a fracture running across the base is usually the result. Fractures which are produced by the resistance of the spinal column are usually severe, though the base may only be slightly pierced. The important nervous centers that lie directly in it are injured, and the cranial nerves and blood vessels torn.
In other cases, the brain may be much extensively Communicated & driven inward. Septic meningitis is a common sequel.e, very often due to malacia the brain being readily torn by the irregular surface, and to the various sinuses at the base of the skull, opened.

The following case is a good example of this injury:

Isabella Bally, aged 38, while crossing the street, was knocked down by a runaway horse. When admitted to the hospital, she was in an unconscious collapsed condition, bleeding profusely from both ears and from the mouth. Her face was pale, and the breathing shallow; the pulse was quick, regular & small. The temperature was 97° F. The eyelids were closed, the pupils fixed moderately, contracted, and Conjunctivitis present downward & to the right was well.
marked. The blood flowed in a steady stream from the left ear, it was dark and of a brown, yellowish tint. Flowing from the right ear was arterial, and much less in quantity. There was a large jagged scalp wound situated on the left side of the occipital protuberance, and extending to the pterion, which was intact, and no fracture was discernible.

While the head was being dressed she recovered partially from the collapse, and left-sided facial paralysis, and spasm of the muscles at the back of the neck were observed. The bleeding from the right ear ceased, but that from the left continued steadily. Pressure on the left jugular vein increased his fleshy from the ear. On placing a plug of wool in the left ear the bleeding was stopped, but the student's breathing soon became worse with the pulse markedly slower. The plug was therefore
with bruise, and the bleeding immediately commenced, with the result that the symptoms of compression again diminished. Slight hoarseness from the nose and pharynx was noticed during the night. She died at 5.30 am, nine hours after the accident. Shortly before death the temperature recorded was 101.4°F.

At the post-mortem an extensive layer of blood was found covering the whole surface of the brain. It was thickened over the lower part of the left frontal lobe and spread, and it extended down the posterior surface of the head. This hemorrhage was due to special cerebral arteries for the superior part of the muscles of the back of the neck, and shoulders, observed during life. The tips of the frontal lobes were contused and necrotic. The optic nerves were small and translucent on section. (Total blindness had been present during life.)
The base of the skull was extensively comminuted; fig. 11.
The fissure started from the internal occipital protuberance, extended downward a short distance, and then divided. The left lesser branch ran down the ridge of the occipital sinuses, and

Fig. 11

A. Central part of middle fossa raised 1/3 inch above level of the other parts
B. Line of fracture on left side
C. Remains of left meningeal sinus
D. Ridge of fracture on right side
E. Andes of left middle ear
F. Line of anterior fissure

Crossing over the inferior occipital fossa, a fracture lateral sinus, between the mastoid process and internal.
regular process, passed on to the pterygoid portion of the temporal bone. It ran through the centre of the hinder part which was fully exposed. The apex of the pterygoid bone. The inner margin of the fracture was raised a quarter of an inch above the external.

To the right the process ran along the margin of the pterygoid process, which was comminuted. It then extended outward, terminating in the temporal region about one inch above the ear. D.

A separate process extended across the anterior part of the middle fossa, from the apex of the left pterygoid bone across the junction of the basi-occipital body of the sphenoid to the squamous portion of the right temporal bone. Thus the whole of the middle fossa to the right of the left ear was separated as one piece and displaced upwards.
the left lateral sinus was ruptured, where the fasciae crossed it. The cavity of the middle ear on the left side, was completely divided, and the sympathetic meningeal rupture as seen in the diagram. C. The right sympathetic was also divided, but the sympathetic membrane, when exposed by dissection, had only given way at the foramen of Rivini.

This specimen well illustrates how the base of the skull may be broken inward by the resistance of the spinal column.

3. Fractures the result of centre-crips.

These are of doubtful occurrence. They are said to result from blows on the forehead and sides of the skull, the farthest bones spreading its greatest violence on, and fracturing the base. It is probable that the bones of the vertex fracture is caused by the bones of the vertex yielding to the blow, but the base being more brittle and
unyielding is fractured between the two opposing forces, namely, the force of the blow, and the force of resistance from the spinal column.

The third bone forming the basisphenoid and basis-occipital, together with the condyles of the occipital bone, act as resistant buffers, while the thin plates of bone on each side give way. A fracture of the base may thus occur to oppose the seal of injury better and, without any intermediate fissure.

Also in the perpendicular plate of the frontal bone at its upper part, may give rise to fracture of the orbital plate of this bone, without any intermediate fissure, what some being perceptible in the intervening osseous tissue. Of this an example is reported by Holmes as having occurred at St. George's Hospital in the year 1849.
The fracture is considered to have resulted from the brain impinging against the plate. No... that a wave of concussion can be transmitted through the brain causing it to impinge violently against the bone opposite the point struck as shown by the following case:--

Mr. A., aged 40, was admitted to the Newcastle Infirmary on Sept. 24, 1875, in an unconscious state. He had fallen from a considerable height on to the back of the head, there was a bruise on the scalp over the occiput, but no further signs of injury. When admitted he was totally unconscious, lying flat on his back with the head turned to the left side. The eyes were closed, the pupils equal, moderately dilated, reacting very slightly to light. The breathing was shallow, deep, the pulse was quick and bounding. The temperature was 97.9° F. General cyanosis was present. He remained in this condition until death, the temperature rising to 104.7° shortly beforehand.
At the post-mortem examination, no fracture was discernible, but an extensive haemorrhage had completely destroyed the parietal part of the left frontal lobe. The bleeding was almost entirely confined to the centre of the lobe, very little blood being found on the grey matter, which however was much bruised at parts. No other lesion in the brain was discovered.

As in fracture of the skull, so also in those of the base, the condition of the dura mater is of great importance. The dura is a tough elastic membrane, and its relation to the cranial bones may well be compared to the relation of the inner membrane of an egg to the shell. The shell may be extensively broken and the membrane escape intact, such as in case with dura mater
A good illustration of this is seen in the following case:

John Thomas Davidson, adult, was admitted to the neurosurgical
injury on February 24th, 1886. He had fallen from a
wall on the back of the head, and had been unconscious
since the accident. On admission to the infirmary half
an hour after the accident, he was suffering from the combined
effects of shock and compression. The posterior inferior
part of the right parietal bone was a small scalp wound,
leading down into a fissure of the bone, which
could be traced for about three-quarters of an inch on each
side of the wound. Over the right parietal protuberance
was a bruise on the scalp. Hemorrhage, with the characteristic
lobe of depressed bone and the ragged hard margin.
The pulse was beating 50 to the minute, very laboured,
seemed labored, complete, at times, often beginning to beat
a little quicker. The respiration was shallow.
the pupils were equal moderately dilated, breathing slowly. Right-sided facial paralysis was well marked. There was a little bleeding from the right ear, none from the left. After the shock passed off signs of cerebral laceration appeared. The limbs became flexed rigid, markedly so on the right side; facial paralysis more marked, and the breathing quickened, but still accompanied with elector. The palatal reflex was exaggerated, the other reflexes were absent. He lay persistently on the left side, and tossed about, much agitated, if interfered with in any way. The right side always remained rigid.

The diagnosis made at the time was that of a passed fracture passing from the point struck through the right petrous bone, and complicated with cerebral laceration. At seven p.m. she died a half hour after the accident. The following notes were made...
The temperature was 101° F. Pulse 100. Respiration 20

Patient semi-conscious. He was lying on his back, with the head turned to left side. Right pupils contracted, left dilated. Pupil reactions sluggishly to light. The condition of the left pupil was distinctly protrusant, but there was constant

Miosis on compression. The skin was hot and flushed, covered with perspiration. The left side of the body was flaccid, the left arm responded to pinching of the skin. The right arm was flaccid, the fingers clenched, and was continually moved on the chest from above downward. Both legs were flaccid and did not respond to pinching of the skin. The respiration continued gradually increased, the rigidity of the right side gave place to paralyses.

At 2 p.m. the temperature rose to 105° F. and he died shortly afterwards.

Post mortem examination was made twenty-four hours afterward. No other external injuries than those already described were found.
The cerebral wound led to a fissure, situated over the upper part of the right hemisphere of the brain, which was caused by a downward curve forwards backwards. This was clothed between the skull and dura mater, which was continued along the expanse of blood vessels over the whole of the left hemisphere of the brain, thickest posteriorly, extending over the base, where it compressed the cavernous sinus and left ophthalmic vein. After removal of the brain, the uplifit of the dura mater could be found. Outside this, there was a membrane in the pteraline fossa on the left side, was situated over the lateral sinus. The base was found extensively pierced. The line of fracture extended backwards through the right superior occipital fossa, and along the line of the postero-occipital sulci to the apex of the sphenoid bone. From this point it extended backwards and downwards across the superior surface of the sphenoid bone, took
junction with the ophthalmic portion of the temporal and
the maxillary and backwards to join the fissure.
The posterior cranial fossa is formed by the occipital bone and the superior nuchal line of the parietal bone. The transverse sinus runs along the inner aspect of the occipital bone, just above the transverse foramen. The superior nuchal line is a ridge that runs horizontally along the posterior aspect of the skull, between the occipital bone and the parietal bone.
normal. By the time post mortem it will be seen that the compression which was present for some hours after the accident was due to the bleeding which took place from the lacerated left hemisphere of the brain. This necessarily was combined with signs of cerebral laceration, which became more marked as the compression passed off. The disappearance of the signs of compression would be due to a cessation of bleeding. Accommodation of the brain to the increased contents of the cranium by the passage of fluids down the cerebrospinal canal.

The protrusion of the contents of the left orbit was due, not to hemorrhage, but to the pressure caused by the presence of blood clot in the left cavernous sinus of the brain. It is remarkable that though the left petrous bone was displaced in any implication of the left C. o. sympathetic nerve was apparent. The marked ipsilateral palsy of the side of the body, in some explanation by the laceration of the motor area in the left hemisphere. It is worthy of note that
The injury to the brain was on the side opposite the seat of previous violence. Due to the brain impinging on the left side of the skull, it was evident that the principal part of the fracture was due to the bone being driven forcibly against the spinal column. This is clearly shown by the manner in which the left pupil was drawn into the pupil cavity; the paresis of vision on such an extensive fracture is remarkable. The bleeding from the right ear was very slight; and there was none from the left, showing that the quantity of hemorrhage from the ear is not a reliable indication of fracture of the base. The entire escape of the hemorrhage from the right tear and what was already been stated with regard to relation to the cranial bone and the possibility of it being caused in a very extensive fracture of the base. If we exclude the signs of injury to the brain, then our few symptoms left by which we could have recognized such an extensive fracture during life.
Out of 15 cases, having evident signs of fracture, 10 died and 5 recovered.

In 7 cases, the inner table was torn, being found so at the post-mortem examination in 75 cases. In the other 2, which recovered, there was copious discharge of cerebrospinal fluid, proving the existence of a rupture in the dura mater.

In the other 8 cases, which recovered, it is probable that the dura mater was not torn, for in 4 of them there was copious bleeding from the ear, without leaking fluid; in the other 4, though there was much fluid, it was slight. The question of the situation is that of the point where clearly shows that there was a rupture of the probably the dura remained unruptured.

The absence of symptoms of extra-cranial hemorrhage, showing that the fluid was not from rupture of the dura mater.

The symptoms of fracture of the base of the skull are by no means definite.
the symptoms depend upon.

1. The escape of the contents of the skull.
2. The injury to the cranial nerves.
3. Injury to the brain, these injuries causing accessory symptoms, for they are not in themselves signs of fracture.

The contents which may escape from the skull early in fracture of the base are blood, watery fluid, and brain substance.

The escape of blood may be into the orbit, nose, ears, muscles, soft parts, or down the spinal canal. Bleeding into the orbit is one of the most significant signs of fracture of the base. It occurs very frequently in injuries to the head, for the roof of the orbit is thin and brittle in many fractures.

The effusion of blood occurs at the back of the orbit, and gradually filters forward through the loose cellular tissue, so that when this effusion reaches the lids, it is uniform, and pale. It appears under the ocular conjunctiva.
first, opposite to the insertion of one of the muscles
indolent globe along whose sheath it forms an easy
passage with Tenons capsule - the staining fluid
appears in the lower lid first. The bloody effusion under
the ocular conjunctiva is always deepest at the back,
diminishing towards the corneal margin, having
a wedge shape, with base backward. This is an
important characteristic distinguishing this form of
bleeding from hemorrhage. The result of indirect-
injecting both eyes, which is deepest around the corneal
margin & disappears towards the back of the globe.

If hemorrhage has
been extensive the globe of the eye may be proptosed by
came towards by the blood behind Tenons capsule -
these characteristics distinguish whilst hemorrhage the
result of fracture. Markedly, clearly, result if indirect-
traction of the anterior zone, clearly definitely from
hemorrhage. No result of edema of the eye as a cycle.
If the root has been the seat of injury of post-operative
staining appears, it is diagnostic of fracture of the base,
but fracture of the superior maxillary alveolar bone may
give rise to this form of staining. Absence of orbital
herniation is not proof of the absence of fracture, for a
slight fracture without rupture of the dura mater may occur
without sufficient herniation to give rise to staining.

Bleeding into the orbit has resulted in a traumatic chemo.

Bleeding from the nose or mouth, or vomiting of blood is a
much less valuable symptom. Either orbital herniation
owing to the great vacuolation of the nasal mucus.

If the bleeding is copious, or continuous, or lasts in a
steady stream, it becomes a symptom of great value,
especially if the nose has not been directly injured
this sometimes followed by a watery discharge,
as was proved in the case of J. Stenman, record on page 448.
Blushing from the ears, when oppression and constriction is the case. I have seen a case of Practice implicating the petrous bone when the blood is forced in channels, it comes from the lateral sinus, as occurred in Bell's case, already named. A slight flow of blood from the ear, may result from an injury to the internal auditory canal, as when the condyle of the lower jaw is driven against it, or that blood may come from rupture of the membrana tympani, without fracture of the skull as occurred in the case. From the cases observed, if the hemorrhage is sufficient to fill the ear it trickle down the side of the neck, or even for a short time, it is certain the result of rupture of the base. As in the case of fracture of the orbit.
...which may explain the small amount of bleeding, or of the passage of the blood down the Eustachian tube, if the tympanic membrane is not ruptured.

Rupture of the membrane tympani is constantly associated with bleeding from the ear.

The rupture usually extends from the antrum around the handle of the malleus to the area of the plate, see page 32. The rupture may consist in a fissure running across the membrane or a complete tear, see figs. 1 and 2.

When the rupture is complete, which is usually the case, the remnants of the membrane are seen as a narrow strip and around the sides of the incision. Often...
Membrana tympani of left ear, closing a separation extending across it. Taken from the case of John Shillingham, who was admitted to Newcastle Infirmary May 19, 1886. Suffering from a fracture of the left pelvic bone, caused by a fall on the back of the head. The bleeding from the ear continued for some hours, oozing away very slowly. Symptoms of central evacuation were also present. He made a good recovery.

Fig. 2.

Complete rupture of Membrana tympani, as occurred in the case of James Jackson, who was admitted to the Newcastle Infirmary on Oct 16th 1886. Suffering from a fracture of the base, extending through the left pelvic bone. There was no discharge of cerebrospinal fluid. He made a good recovery.

Fig. 3.

Central rupture of Membrana tympani, as occurred in the case of Ralph Thompson, admitted to the Newcastle Infirmary on 22nd 1885. All the signs of a fracture of the left pelvic plate, bleeding across the sphenoid plate through the right pelvic bone were present. The cause of the fracture was a blow on the left side of the head.

He made a complete recovery. The hearing was much impaired in the right ear for a long time after the accident.

Fig. 4.

The rupture is represented too small.

Central rupture of Membrana tympani, taken from the case of James Henry, aged 7, who was admitted to the Newcastle Infirmary on April 19th 1886. Suffering from a fracture of the left pelvic bone caused by a fall. The bleeding from the ear continued for 2 hours after admission and was of a bright arterial colour. There was no discharge of cerebrospinal fluid. The rupture in the Membrana tympani appeared to be slight central, no signs of evacuation of fluid. The side being apparently
external auditory meatus. See fig. 2. (Fig. 2, Bull. Case p. 13).

A central rupture is occasionally met with, appearing as a small fistula or hole from the other. The rupture of the membra. See figs. 3 & 4. It is then probably caused by the handle of the malleus being driven outward through the membrane.

A box on the inner ear with the hand may cause a rupture of the membrane tympani, without any fracture of the skull. This is associated with vertigo, pain, and noises in the ear. The symptoms being much like those of acute concussion. A case of this nature recently came under my notice. E. G. R. B. went. Aug. 13, received a box on his ear from his school master. The blow made him reel over and feel his legs tremble. He had sharp pain in the ear followed by a buzzing noise, which lasted some days.
after the operation of the injury. Her hearing was much impaired in the ear, and loud noises increased the pain. She had not observed any bleeding from the ear. On examining a small clot of blood filled the lower part of the auditory canal; when on removing it, by careful sequestration the membrane tympani was seen to be completely torn across, forming a narrow light band round the posterior and inferior margin of the internal auditory meatus.

The bleeding from rupture of the membrane tympani was at once very profuse, and insufficient to be mistaken for that resulting from fracture.

Extensive fracture of the pelvis bone may occur without any rupture of the membrane tympani, as exemplified by the case of J. T. Davidson, already recorded, where there was extensive fracture of the left pelvis bone without any rupture of the membrane tympani. This known
Bathing into the cellular tissue of the recipient and donor.

Explosions when the recipient's function surpasses that of the donor. Problems arise when the donor's function surpasses that of the recipient.

In an exceptional occurrence, a normal rule prevails.

My technique, though complex, is accurate. My immunosuppressant, my immunosuppression, keeps life in the patient.

In the event of transplant failure, my precautions are followed.
No evident wound being present he found had simply put him to bed. On the following day he was delirious, and his state continuing, they had brought him to the infirmary. On admission he was suffering from haemorrhage. A slight bruise could be seen on the occipital protuberance, and there was well marked blood staining of the skin over both mastoid processes. A clot of blood filled his left ear. Coagulated blood was found over the neck and left shoulder. Exclusively of any waxy discharge was obtained. A complete effusion of the meninges lymphatic was present. Under the usual treatment, after seven or eight days of cerebral irritation he made a complete recovery.\[\text{Healing of the left ear, remained unimpaired for sometime.}\]

Returning the skin over the mastoid processes and back through the neck and maintained always the result of a bullet's place, as it may result from a missile scalpel. This sign blunting, as would other signs of practice.
base, must only be considered as one of the indications

The nature of the injury, which helps us at arriving at a correct opinion of its severity.

Herniation into the spinal canal occurs in practice implicating the mammae aequanimis - the symptoms it gives rise to during life, are, spasm rigidly of muscles of neck, often complete immobility of joints, and usually associated with this will be found spasm of muscles of arms, back generally of the patient is conscious, pain in complaint of, being felt in the back and arms.

Respiration is interfered with, being excited or depressed according to the amount of existing herniation. The pupils are widely dilated - Aprismatic restlessness.

The arms begin to extens for a time, being followed
by paralysis, as the compression of the cord proceeds.

2. The second great symptom of fracture of the base of the skull is the escape of watery, cloudy fluid. This fluid has been observed to flow from the ear, nose, rectum, 

It has been considered the result of:

1. Elevation of the serum of the blood
2. Secretion of liquor collium from the membrane of the labyrinth.
3. Centrally specialized fluid passing through a leak in the membrand.

The theory that the discharge was due to the filtration of the serum of the blood was first put forward in 1834. Laennec considered it due to extravasation of serum from blood clot from the margin of the broken bone. At the present time Charcot also thinks that the fluid is due to the
term of the blood, and that it passes through a partition of the new membrane or some one of the large venous sinuses at the base of the skull.

These theories cannot be sustained for two reasons; in the first place, the flow is much quicker and quicker than could possibly take place from dilatation; and in the second place it differs widely in chemical composition from the rest of the blood, containing a very small amount of albumen and a large quantity of chloride of sodium; in fact it has the same chemical composition as cerebro-spinal fluid.

That the watery discharge may at times, in part at least, due to lypsis of laminae is very probable. There are several recorded cases recorded with a discharge of watery fluid in which the fracture did not include the internal auditory meatus and with no injury to the
sheath of the medullary nerve, and therefore the fracture has no direct connection with the cerebrospinal cavity.

In such cases, the discharge is slight and of short duration; and though in the case of a continuous taporous flow, as recorded as having occurred in Dr. Fraser's book, the occurrence is very exceptional. Thus it is not certain that the posterior column may produce a temporary slight discharge of cerebrospinal fluid but cannot give rise to the continuous flow observed in typical cases.

The fact that the cerebrospinal fluid which occurs in certain cases of fracture of the base has the same composition as cerebrospinal fluid, that it occurs in such large quantities, that it has been known to pulsate regularly with the heart, and that it occurs from various situations in the skull, where the cavity of the subarachnoid space has been opened, determines its identity with cerebro-
spinal fluid.
The cerebrospinal fluid flows from the ear to accelerate a fracture cutting across the mastoid internus communicating with the tympanum, also a laceration of the internal sheath of the cerebral membranes which surround the several pairs of nerves, and a laceration of the membrana tympani. According to what is stated in Holme's Table, there are three or as is known 3 Class of cases of the watery discharge from the ear.

In the first class, when the fluid from the ear is plentiful, of a decided watery character, occurring immediately after the accident due to cerebrospinal fluid flowing through a fracture of the petrosal bone, implicating the internal auditory canal and its membranes.

In the second class of cases, characterized by a Copious prolonged bleeding from the ear, followed by watery discharge, a fracture of the petrosal bone may
safety be diagnosed, but its particular cause cannot—

be indicated. The espume bleeding, rather than the

bony discharge is the symptom relied on for

diagnosis.

In the 3rd class of cases, there is first a discharge

of blood, neither frequent nor prolonged, followed by

a watery discharge, varying as the time of its

appearance and to its quantity.

These are the cases in which the diagnosis will be

doubtful, and we must take into consideration

other sources of evidence, as the character of

violence causing the injury, and the point of

impact

A discharge of fluid from the mouth, or pharynx

negate a fracture of the roof of the cavities
and a laceration of the membranes at the central part of the base. And here the anatomical disposition certainly predisposes their rupture, here also we have the pituitary glands in the cella turcica, connected by the hypophysevisulum with the 3rd ventricle. Torn at this point, watery fluid discharged from the ventricles might be the result of direct escape of fluid from the third ventricle of the pituitary glands. Hypophysevisulum was lacerated. A watery discharge from the mental and phrenic, may occur in fracture of the posterior bone, when the fluid passes along the metatraceal line.

The 2\textsuperscript{nd} class of symptoms of fracture of the base
are that of injury to the cranial nerves.
One or more cranial nerves may be injured, compressed, or torn across in fractures of the base.
The seventh pair are the ones most frequently injured, and paralysis of the facial or aecetesnic nerves has been looked upon as a valuable sign of fracture for ages.

The paralysis may be due to pressure from blood clot; and the clot becoming gradually absorbed the paralysis also disappears.

The 2nd or ophthalmic nerve may be torn across by direct or indirect fracture. The third ventricle plate is torn liable to contusion or compression by blood clot. Consideration has frequently been paid to the brain and the extent of injury from impinging on the floor of the anterior fossa. In remarkable

less few cases an involved injury to the ophthalmic nerves.
The 2nd or optic nerves may be injured in any part of their course within the skull or orbit. They are liable to injury in their passage through the foramen Hasse, which is the meatus for an injury when fracture occurs. This generally occurs with Hasse's fracture into the orbit, and accounts for the loss of sight which may follow Hasse's fracture into the orbit, when the pressure has not been great enough to account for paralysis of the nerves, and when some other nerve or nerves in the orbit are paralyzed. It is a lesion which should always be borne in mind, when subsequent changes in the disc appear after fracture of the acute from the skull. The 3rd nerve is less frequently injured.
Thus, the precedingtwo, but it is liable to pressures from blood clot as it passes through the cavernous sinus of the frontal sinus. Prolapse of the orbit is sometimes observed often head injuries, without implication of the other branches of the nerve. The dilated pupil of compression of the contractile pupil of central origin, due to increased compression of the orbit by compression or irritation.

Paralysis of the 7th nerve is one of the most common features of fractures of the base of the skull. Fractures of the base of the skull, close to the pterygoid bone, are frequently torn across in fractures implicating this region. Facial paralysis may be slowly returned, and yet pass off in a few minutes. In such cases, the injury has probably consisted in an extravasation of blood within the tubular sheath of the
arachnoids, which surround the trunks of the nerve before entering into the pelvic bone.

Saying the wound here is sometimes observed causing paralysis of one side of the face. Paralysis of the cranial nerves can only be considered as corroborative evidence of fracture of the base; for the paralysis may result from compression by blood clot or erosion of the nerve center.

In the 3rd class of symptoms are those of injury to the brain, and as far as we have evidence of fracture of the base, they give an indication of an amount of force which has caused the injury. The injuries of the brain associated with fractures of the base are concussion, compression, cerebral laceration, and subsequently inflammation of the meninges of the brain.
The violence necessary to cause fracture of the base is generally so great that concussion of the brain is caused at the same time. This may be followed by compression from a ruptured meningeal artery or by palsy of locomotion of the brain.

A fracture of the orbit, or cul-de-sac plate, may occur with but little force as will fail to produce brain symptoms, as occurred in the following case: A. Stevenson aged 40, received a blow on the nose from the fist of his antagonist, which did not

...thin hair which causes a concealed fracture of the nasal and frontal bones. He came to the hospital next day in a dream of severe headache, feeling ill, there was retraction of both eyelids of post-contractural stenosis. A thin bloody fluid was oozing from the nose. He had had several injuries since the accident.
The fluids continued to flow from the ears all day, but stopped after bailing for about 24 hours from the time of the accident. He died two days afterwards from multipleæmphysia. At the post-mortem examination a comminuted fracture of the anterior cribiform plates with laceration of the front sinus was found.

The distinction between the various injuries to the brain already mentioned is not always possible, thus crying for two or more effects being present at the same time. Between a mild case of concussion and a severe case of cerebral laceration a well marked distinction exists. But the extent two may into one another so closely that it is impossible today when concussion and laceration begin.
What constitute concussion has not yet been definitely settled.

Simpson defines concussion as, "A shock communicated to the head from the application of such external violence as will produce concussion in the substance of the brain, or interfere with the circulation through it; in consequence of which the functions are suspended, usually in a transient degree, but occasionally lasts in an extent that the patient does not rally for many hours, but depressed state into which he is thrown, perhaps sinks without recovery; for there exists that few people die from concussion, that in many cases remained unaltered for an hour or two; and in some cases, it is practically the same thing as very slight cerebral laceration.
The symptoms of Cerebral Haemorrhage which I have observed in unconscious cases are the following:

1. The patient may be entirely or partially unconscious. Slightly partially, he can be wakened by a shake or when spoken to in a loud voice; he may then open his eyes and seem freshly touched upon. Apparition of adult vague manner.

2. The surface is pale & cold, the temperature subnormal.

3. The pulse is small, soft, frequent.

4. The respiration are slow, shallow, voiceless.

5. The pupils are generally contracted, but may dilate, acting sluggishly to light.

6. Muscular relaxation is always present, and the recollection passed unconsciously.

The symptoms of cerebral laceration are:

1. The patient is entirely unconscious. Partially as

2. The surface is cold, pale, death-like, the pulse

& respiration are feeble & slow.
Optimisation: the urine being passed reflexly, or

The eyes are tightly closed, the pupils contracts
and there is marked avoidance of light.

The condition as a whole is one of extreme irritability.

The symptoms may continue for days, accompanied
by lassiness, violent delirium, and then gradually

disappear; sleep being the best indication of approaching
recovery. The irritability gradually disappears,
and is often followed by great restlessness and delirium.

This was a most striking feature in two of the

Cases recorded e.g. Barnes's case page 35 of Robson's case

page.

In fatal cases, the signs of deeper meningitis

less compression came on, the flexed
Condition rigidity of the limbs gradually disappears; the patient may not the arms loosely about, or may cry out, and gradually become more emaciated & collapsed dies.

From the foregoing list of symptoms, it will be seen that in both Concussion & Central Laceration many of the symptoms are those due to profound shock, after which the symptoms of Concussion are those of nervous depression, while those of central laceration are indications of nerve irritability & irritation.

Central laceration in always preceded by concussion, so that we have a gradual transition of one state into the other.

The symptoms of concussion are distinct
from either of the preceding states. They may follow closely or either of them, when the two conditions will be combined. Nevertheless, though lacereation & compass
are both present, one can only tend to obscure the other, yet some of the symptoms of each can always be recognized, which will enable us to determine, whether the compression is due to compression from the brain, or whether the compression, whether it is due to some other cause as meningal laceration, and the cerebral lacereation is only an accompan
iment; for in a clear recognition of their distinction the line of treatment, in many cases, must
depend.
Signs of compression are the following:

1. Unconsciousness, partial or complete according to the degree of compression.

2. The surface of the body is hot and perspiring. At the commencement the compression follows closely on the accident; the surface of the body may be cold and pale from shock, but ultimately becomes flushed as the shock passes off.

3. The pulse is slow, full and laboured.

4. The respiration is slow, deep, and laboured, the cheeks often flapping.

5. The pupils are dilated, insensible to light, when compression is very marked, the conjunctival reflex is absent.

6. Muscular relaxation is present, and there may be extensive or limited paralysis.
4. The main i retained, may be paralysed if

Compression following immediately after the injury is due to central haemorrhage or to meningeal haemorrhage associated with rupture of the dura-

The proposal on fractures of the base Mitchell is not so unfavourable as is generally supposed. Formerly, fracture of the base was considered almost universally fatal. This was probably owing to the fact, that in those cases in which the signs of fracture were very marked, consequently the base much injured, were considered as fractures.
Out of fifteen cases which have come under my care, in which the opus was such as to justify a diagnosis of fracture of the base, five proved fatal; ten recovering.

Two of the cases had copious and continuous discharge of cerebro-spinal fluid, and one of them had meningitis, which was probably traumatic and not septic; see Robson's case, page 64.

The most fatal fractures are those produced by the force of resistance of the spinal column. In these circumstances the transverse process and interarcual process penetrate the medulla and end in most fatal results.
Fracture - Mort coulée plate of the skull, or also very fatal if the dura mater should be torn, as epidemic meningitis or almost sure tetanus.

In fractures of the parietal bone, antiseptic treatment can be carried out. Consequently, the prognosis is more favourable.

In the treatment of these injuries, it must always be borne in mind, that when bleeding occurs externally, the fracture is Compound, and decompensation of the discloses, with consequent septic meningitis forms one of the principal dangers. In a large proportion of cases, the dura
water is intact. Consequently the danger is greatly diminished.

Then are these two indications for treatment:

Firstly, the preservation of decompression in the fracture

Secondly, the treatment of apparent or probable injury to the brain or its results.

In fracture fractures extending from wounds of the head the wound must be treated with any antiseptic preparation.

Fractures of the ethmoid and sphenoid bones cannot be treated antiseptically; though an attempt may be made to diminish the chances of septic infection.

The fracture should be thoroughly syringed out with corrosive sublimate solution in 10,000, and a piece of wool impregnated with eucalyptus or some other volatile antiseptic, placed in each nostril.
Large piece of the same material, between two layers of gauze should be placed near the mouth. If this
band is not too thick so that air easily passes
through it, patients are quite willing to wear it.
In this way by causing respiration to be carried
on directly through the mouth filling the air passages
with an antiseptic suffusion putrefaction may be
even more be prevented.
Dr. B. adopted this method in two cases, when
a septic discharge of bloody fluid
was oozing from the nose. Though modifying the
putrefaction it did not prove successful, as
septa meningitides had already begun.
In fractures implicating the tympanum with
septum the membrane tympani the presence
of decomposed in more hopeful, although
The eustachian tube causes some degree of uncertainty. Yet, in small calibre, closed Eustachian, except in the act of swallowing, and also the presence of ciliated epithelium leading downwards and to prevent the spread of suppuration through it.

In any fracture of the implicating the tympanum

The ear should at once be carefully syringed with corrosive sublimate solution in 10,000 and a piece of antiseptic wool placed in the meatus, with a large pad often smeared over the ear. This dressing should be changed as often as necessary.

By this means septic meningitis may entirely be prevented, and accounts for the large proportion of recoveries of the 75 cases already mentioned.
As to the treatment of the appearance of probable injuries to the brain, I have nothing 

\*\*\* injuries to the brain, I have nothing 

loosed to what is so well advocated in modern text-books, more especially in Richeson.

For the deliriums and deliriums which accompany subacute meningitis and cerebral effusion following cerebral laceration there have been large doses of 

Bromide of potassuin, so far as one or another injects into the gutter, and injections of a valuable relative. In cases where concussion had been complete, or there had been any region of cerebral laceration.

\*\*\* the lacer, probable injuries here used to indicate - the effect which may follow concussion or cerebral hemorrhage, or the occurrence of

inflammation - effusion, or inflammation of the meninges, which may follow within some days of the injury. For the prophylactic treatment of these affections is by far the most important.
a mild mercurial course was adopted until
convalescence was thoroughly established.

The mercurial used was Calomel, given in
1 or 2 grain doses, night and morning, until
a thin white line appeared on the joints, when
the dose was diminished, so as not to exceed
her effect.

The results under this treatment were unsat-
sifying; secondary inflammation of the
brain membranes being present. Rapid
disappearance of signs of compression obtained
in one case only out of fifteen cases of
fracture of the base, of which I have notes,
were deemed any symptoms complained of for
any length of time. In this case, which was one of pressure of the anterior masses, extending from the posterior pericranium part of the frontal bone, continued headache, with gradual diminution in the center of vision, were associated with compression of the optic discs. These symptoms continued intermittently for four months, subsiding under treatment, but returning when the patient went back to work.

The central result I have not been able to follow up to the disappearance of the patient.
A case of fracture of the base of the skull, with concussion of cranial circulation, and discharge of watery fluid from the ear.

Thomas Robin, aged 41, was admitted to the hospital on Feb 22 1885, having fallen from a height. He was unconscious when admitted, and there was a copious hemorrhage from the right ear. The bleeding continued for six hours after admission, and during this time, the fluid discharged was of a clear, serous, character, and partly being cerebral spinal fluid tinged with blood. There was no facial paralysis. During the rest of the day, he remained partially unconscious, with symptoms of compression of central irritation.

On Feb 23rd, the following day, he lay curled up on his side, was drowsy, unconscious of what was said to him, and very irritable if disturbed.

The pulse was moderately full, and feeble, but there were no inspirations.
Throat troubleless.

Temperature 101°.

Facial paralysis on the right side had developed during the night.

The ear was filled with a copious quantity of blood, and there had been no mucous discharge.

He suffered from exposure lasting for some hours during the early morning, and continued to vomit at intervals during the day.

On Feb. 25th the condition remained much the same, but he was rather more restless, and several times tried to get out of bed.

The vomitus was passed at intervals, into the bed.

There was some tendency to delirium. He kept his limbs firm and rigid, and turned away, groaning or shrieking when spoken to.

The morning temperature was 100° 7, the pulse 70, clear and feeble.

Feb. 25th the notes were as follows: Temp. 101° 7, pulse 70.

Slow, laboured, from stroke sudden. Has been speechless since illness.

Pupils dilated; built sound.
The fluid is present, but not so estimable. The symptoms are more those of confinement. The next
late observations were taken in March 1827. The temperature and pulse have gradually improved. The
symptoms of irritability are less, but are still active, coming
of what is said, but very freely. The pulse is 70, regular,
and of a very dirty character.

March 10: Better gradually improved up to the last two
days, since then he has been more drowsy. The
feet are less, pulse 80. 4 intermittent 4 or 6 times during
the minutes. Right-pupil dilated.

He was bleeding + gangrene. V2 leech applied behind the ear.

March 11: Temperature and pulse have improved. The temperature
reaching 103° in the evening. He lies in a perfectly,
quiet sleeping state. The forehead is covered with perspiration.
Three stools passed unconsciously.

March 12: He is lying perfectly quiet. The facial paralysis
is more marked. The pulse very quick and weak. Ted 987.

Two leadpoisons of Brand were given from 3 times.
March 9th. Decidedly better. nor emaciated.

March 21st. Mind improving. The general condition is better. The pulse is quiet. Weak.

March 29th. Pupils are equal for the 1st time. The facial paralysia is imperceptible. The right ear examined with speculum, and the meninges tympani was found repletes. Venetius against the posternum trachem marquis.

The pulse still remains quick. Weak. Intemperies were 2°.

From this time his condition gradually improved. The pulse remained quiet for some time.


Observations taken at A.M. and P.M.
Administration of brandy of potassa as a sedative, 4
three daily snips of calomel until the purges became
affected, when only one purg was given each night.
At the commencement of the secondary inflammation
on the 16th day after the injury, acute pressure
to some superficial and mesial from inflammation
induction, 2 leeches were applied over the mastoid process.
The nepe of the neck was well bloomed, and the bowels
well played with calomel pharma.

The interesting feature in the case are, however;
the prevention of septum meningitis, the
difficult stage through which he passed before complete
recovery. At first there were well marked signs of Concussion
hemiplegia. Tactile, followed by signs of
Concussion which gave place again to signs of cerebral
inflammation. Development during the progress of the case.
Symptoms of meningitis developed. From this time, until he was discharged, his pulse was abnormally rapid, being usually over 110 to the minute. Constipation often would be severe. It gradually subsided after taking 12 bromide days. He was discharged completely cured, with the exception of deafness in the left right ear.

The other case referred to in the foregoing discourse is that of H. H. Bampoh age 56, admitted to the General Hospital on July 24th 1896. He had fallen over some stairs when picked up was quite unconscious. On admission both pupils. It was found that he was suffering from a fracture of the right thigh, and bleeding from the left ear. He was in a state of almost concussion showing all ordinary symptoms.

The ear was carefully syringed, taking a piece of salve into wool placed in it with a large pad on the out
side. The dress was put up in the usual manner and care was taken to keep the head of the woman comfortable. The following day, all symptoms of concussion had passed off and he was quite comfortable and understood what was said to him. Temperature 99.5°, pulse 108.

The cotton wool on the gun had to be changed twice due to the bloody discharge which flowed from the ear.

Next day, on the 3rd from the date of the accident, the fluid was still oozing from the ear, it was now of a pale straw colour, having lost its red tint.

Post cranial edema in the left eye was well developed.

The fluid started leaking from the ear on the 4th day from the accident, and he made an excellent recovery.

The highest temperature recorded was 99.5° F.

The left meningeal sympathetic was completely torn.