

I_❤️_NEUROSURGERY INITIATIVE

CRANIO-CEREBRAL INJURIES (1)

*WALID S. MAANI MD., FRCSEd.
PROFESSOR OF NEUROSURGERY
UNIVERSITY OF JORDAN*

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PRELUDE

- *Head injuries are a major cause of morbidity and mortality in the community*
- *Trauma is the 3rd most common cause of death in the Jordan, preceded only by cardiovascular diseases and cancer*
- *Head injuries contribute to over half of trauma related death.*

EPIDEMIOLOGY

- *DEATHS: 9:100.000 in UK. 25:100.000 in*
- *USA. And Jordan 12:100.000*
- *OF ALL DEATHS = 1%*
- *OF TRAUMA DEATHS = 25%*
- *MEN > WOMEN*
- *YOUNG > OLD*

EPIDIMIOLOGY

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- ***CAUSES IN CIVIL LIFE***

- *ROAD TRAFFIC* *60%*
- *DOMESTIC* *30%*
- *INDUSTRIAL*
- *ASSAULTS*
- *SPORTS*

PATHOLOGY

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- *PRIMARY*
 - *CLOSED OR OPEN = SIMPLE OR COMPOUND*
 - *SCALP*
 - *SKULL*
 - *BRAIN*
- *SECONDARY*
- *COMPLICATIONS*
 - *EARLY*
 - *LATE*

CLINICAL PICTURE

- **HISTORY**

- *TIME OF TRAUMA*
- *TYPE OF TRAUMA*
- *HISTORY OF CONVULSIONS*
- *HISTORY OF L.O.C. (LUCID INTERVAL)*
- *POST TRAUMATIC AMNESIA (PTA)*
- *RETROGRADE AMNESIA*

CLINICAL PICTURE (cont.)

- **EXAMINATION**

- *PATENCY OF AIRWAYS*
- *LEVEL OF CONSCIOUSNESS*
 - *GLASGOW COMA SCALE (GCS)*
 - *TRAUMA SCALE (SCORE)*
- *PUPILLARY SIZE*
- *BLOOD PRESSURE AND RESPIRATION*
SHOCK IS RARE EXCEPT IN ENFANTS OR SEVERE SCALP INJURIES

ASSESSMENT OF THE SEVERITY IN HEAD INJURIES

(Glasgow Coma Scale: GCS)

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Points	Eye Opening	Best Verbal	Best Motor
6	Follows commands
5	...	Oriented	Localizes pain
4	Spontaneous	Confused	Withdraws to pain
3	In response to voice	Inappropriate words	Flexion (decorticate)
2	In response to pain	Incomprehensible Sounds	Extension (decerebrate)
1	None	None	None

CLINICAL PICTURE (cont.)

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- *SCALP EXAMINATION*
 - ❑ *SCALP WOUNDS*
 - ❑ *SCALP HEMATOMAS*
 - ❑ *BATTLE'S SIGN*
 - ❑ *RACCOON EYE*
- *NEUROLOGICAL EXAMINATION*
- *EXAMINATION OF OTHER SYSTEMS*



MANAGEMENT

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- *EXAMINATION*
- *MAKE SURE AIRWAY IS PATENT*
- *INSERT I.V. LINE*
- *SKULL X-RAYS: 3 VIEWS*
- *CERVICAL SPINE X-RAYS: 16% ASSOCIATED*
- *CT AS INDICATED*
 - *FRACTURES*
 - *DISTURBED LEVEL OF CONSCIOUSNESS*
 - *NEUROLOGICAL DEFICITS*

MANAGEMENT (cont.)

INDICATIONS FOR CT

- *Patients below 5 and over 65 years of age*
- *In case of drug and alcohol consumption*
- *Concussion more than 5 minutes*
- *Amnesia more than 5 minutes*
- *Glasgow coma score (GCS) of 14 & below*
- *Abnormal neurological signs*
- *The presence of skull fractures*
- *The presence of CSF leak*
- *The presence of epilepsy*
- *Abnormal skull x-rays*

MANAGEMENT (cont.)

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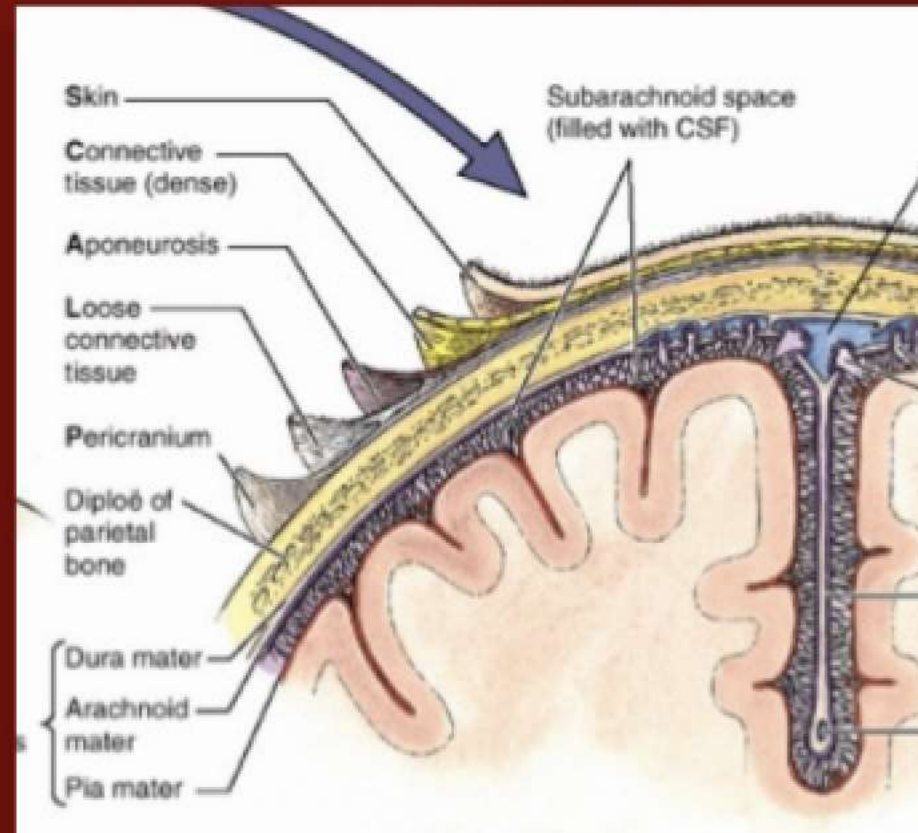
INDICATIONS FOR ADMISSIONS

- *Patients below 5 & over 65 years of age*
- *In case of drug & alcohol consumption*
- *Concussion more than 5 minutes*
- *Amnesia more than 5 minutes*
- *Glasgow coma score (GCS) of 14 & below*
- *Abnormal neurological signs*
- *In multi trauma*
- *Patients with co morbidity*
- *The presence of skull fractures*
- *The presence of CSF leak*
- *The presence of epilepsy*
- *Abnormal CT scan*
- *If you are in doubt*

THE SCALP

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- **S**-Skin
- **C**-Connective tissue
- **A**-Aponeurosis (galea aponeurotica)
- **L**-Loose areolar tissue
- **P**-Pericranium



SCALP INJURIES

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- *TYPES*
 - *ABRASIONS*
 - *CONTUSIONS*
 - *WOUNDS*
 - *AVULSED SCALP*
 - *HEMATOMAS*
 - *SUB-GALEAL HEMATOMA*
 - *SUB-PERIOSTEAL HEMATOMA*

SCALP INJURIES

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ABRASION

- *Clean with antiseptic solution*
- *Apply antibacterial ointment*
- *Cover with gauze.*



SCALP INJURIES

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CONTUSIONS

- *Do not require treatment*
- *Cold compresses*
- *Analgesia*



SCALP INJURIES

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CUT WOUNDS

- *Shave around wound*
- *Inspect wound and feel floor for fractures*
- *Clean wound and remove foreign material*
- *Stop bleeding*
- *Approximate edges*
- *Suture in two layers using a deep inverted suture.*

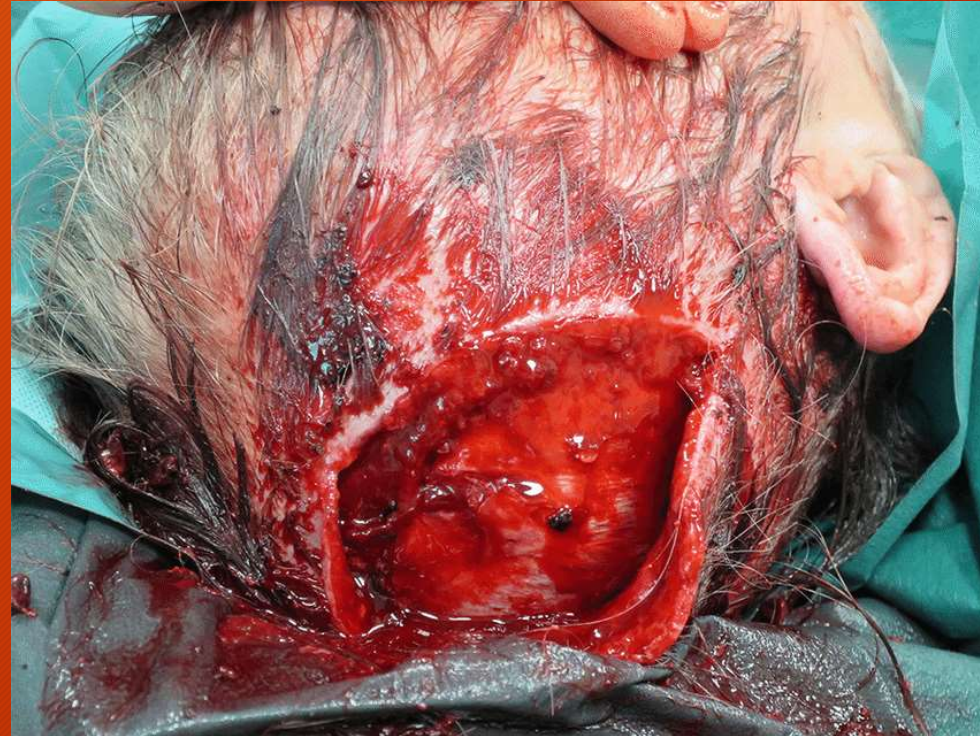


SCALP INJURIES

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LACERATED WOUNDS

- *Shave around wound*
- *Inspect wound and feel floor for fractures*
- *Clean wound and remove foreign material*
- *Stop bleeding*
- *Do **debridement**.*
- *Approximate edges if you can . You may need to rotate flaps or graft.*
- *Suture in two layers using a deep inverted suture.*



SCALP INJURIES

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SCALP AVULSION

- ***PPARTIAL***
 - *Stop bleeding*
 - *Clean with antiseptic solution*
 - *Do debridement.*
 - *Approximate edges if you can . You may need to rotate flaps or graft.*
 - *Suture in two layers using a deep inverted suture*
- ***COMPLETE***
 - *Stop bleeding*
 - *Graft*



SCALP INJURIES

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SUBGALAEAL HEMATOMA

- *A peri-natal injury*
- *Follows vacuum extraction of baby*
- *Due to torn emissary vein*
- *Collects underneath the galea aponeurotica*
- *Could be extensive*
- *May lead to hypovolemic shock*
- *Soft and boggy swelling*
- *Extends across midline*
- ***TREATMENT BY COMPRESSION. TRY TO AVOID ASPIRATION FOR FEAR OF INFECTION. ATTENTION TO BLOOD VOLUME.***

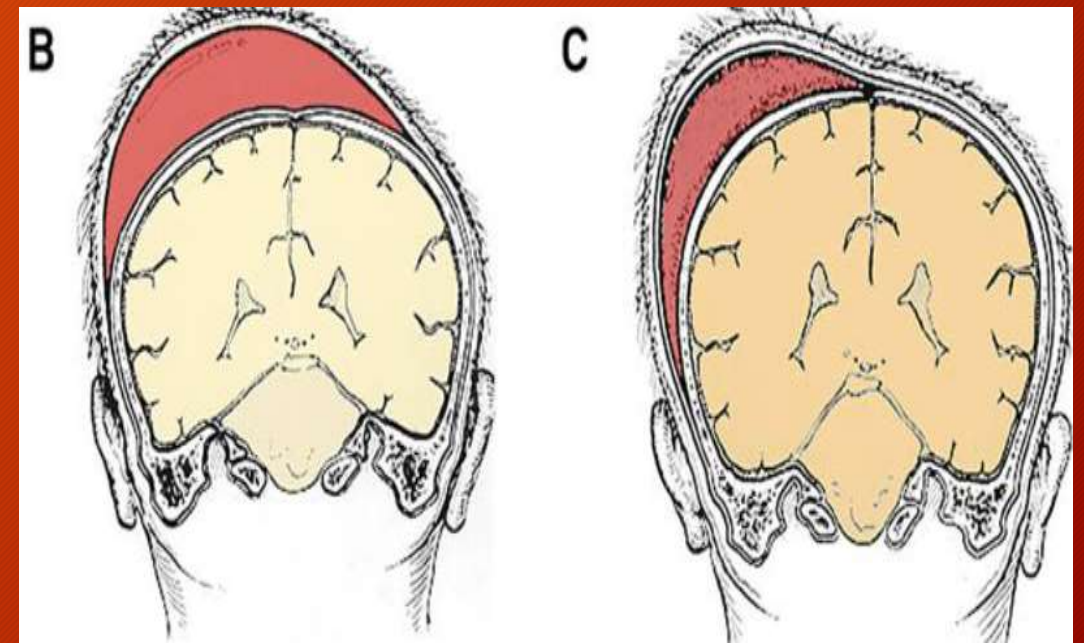
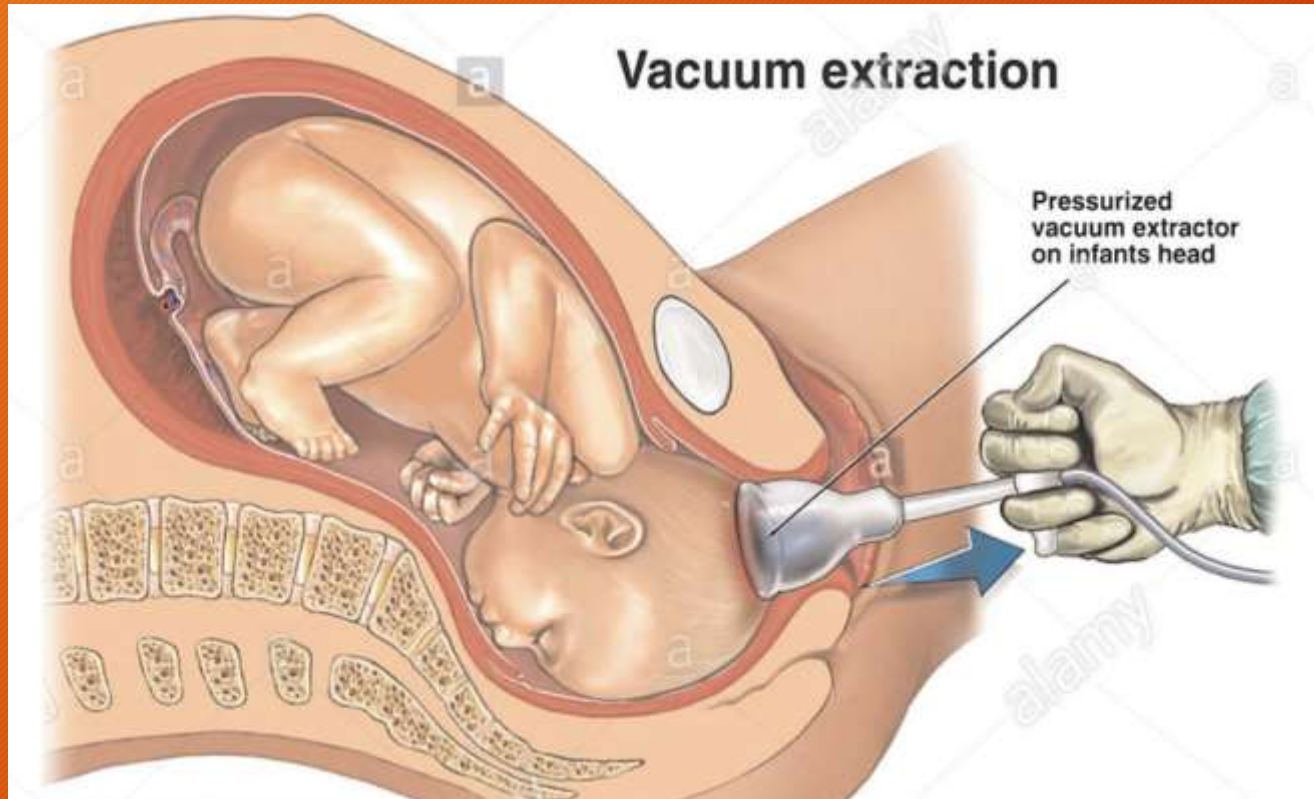
SCALP INJURIES

SUBPERICRANIAL HEMATOMA

- *A peri-natal injury*
- *Follows vacuum extraction of baby*
- *Due to torn emissary vein*
- *Collects underneath the pericranium*
- *Usually limited by skull sutures and do not cross midline*
- *Firm swelling*
- ***TREATMENT BY COMPRESSION. TRY TO AVOID ASPIRATION FOR FEAR OF INFECTION. ATTENTION TO BLOOD VOLUME.***

SCALP INJURIES

SUBGALAEAL AND SUBPERICRANIAL HEMATOMAS



SKULL FRACTURES

- *A FRACTURE IS AN INTERRUPTION TO THE CONTINUITY OF THE SKULL BONES.*
- *THE TRAUMA IS SIGNIFICANT AND MAY PROVIDE AN INDICATION TO THE PRESENCE OF AN EXTRADURAL HEMATOMA OR BRAIN INJURY*
- *THE PATIENT SHOULD BE ADMITTED .*
- *DIFFUSE TRAUMA CAUSES LINEAR FRACTURES*
- *LOCALIZED TRAUMA CAUSES DEPRESSED FRACTURES*

SKULL FRACTURES

- ONLY 2 TYPES
- **LINEAR**
- **DEPRESSED**

LINEAR SKULL FRACTURES

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- *They are divided geographically into:*
 - *THOSE IN THE VAULT OF THE SKULL AND ARE **HAIR-LINE FRACTURES***
 - *THOSE IN THE BASE OF THE SKULL AND ARE **BASILAR FRACTURES***
 - *THOSE WHICH RUN IN SUTURE AND ARE **DIASTATIC FRACTURES***

LINEAR SKULL FRACTURES

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HAIR-LINE TO DIASTATIC



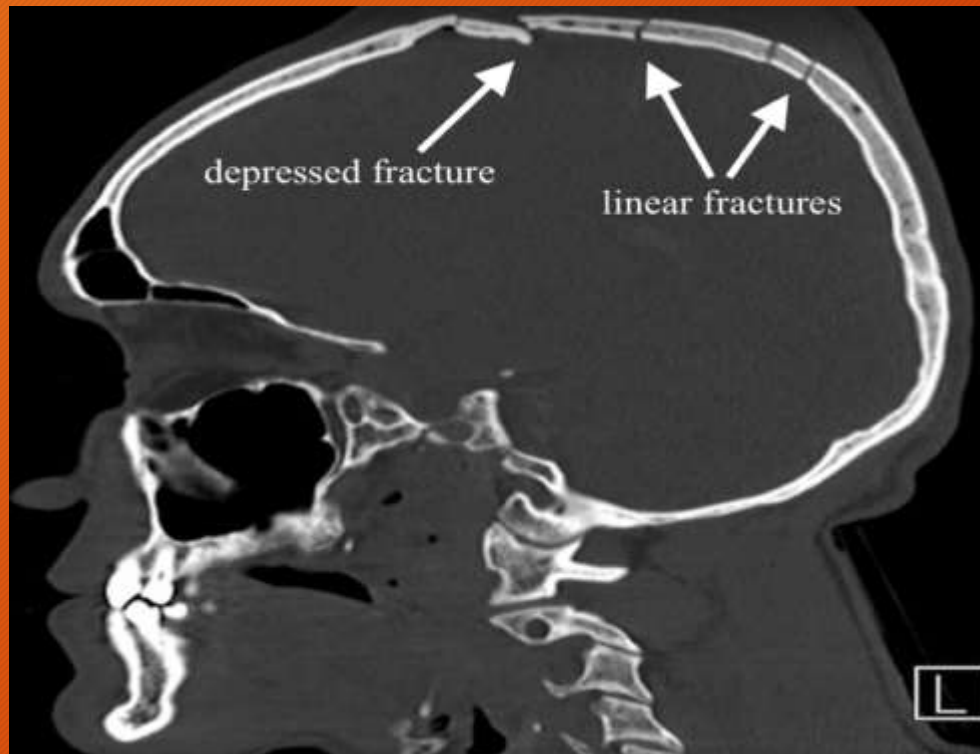
HAIR-LINE



LINEAR SKULL FRACTURES

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LINEAR ASSOCIATED WITH DEPRESSED FRACTURE ON CT BONE WINDOW RECONSTRUCTION



LINEAR SKULL FRACTURES

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BASILAR SKULL FRACTURES

They tend to occur anywhere in the base but usually in the anterior and middle cranial fossae, and therefore, run into the paranasal sinuses.

They will also run along the many foramina in the base leading to nerve and vascular injury.

POST MORTEM SHOWING LEFT TEMPORAL
FOSSA BASILAR FRACTURE



BASILAR SKULL FRACTURES

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- **PRESENTATION IN ANTERIOR CRANIAL**

- **FOSSA FRACTURES IS WITH:**

- *Bruising around the eye called racoon or panda eye.*
- *Subconjunctival hemorrhage*
- *Occasionally nerve and or cranial nerve injury*
- *Occasionally CSF leak*

- **PRESENTATION IN MIDDLE CRANIAL FOSSA**

- **FRACTURES IS WITH:**

- *Bruising behind the ear called battle sign*
- *May be hemotympanum*
- *Occasionally CSF leak*

RACCOON (PANDA) EYES



Bilateral racoon eyes
Left subconjunctival
hemorrhage

BATTLE'S SIGN



MANAGEMENT OF LINEAR SKULL FRACTURES

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- ✓ *There is no specific management for linear skull fractures **unless they are complicated**. They will heal spontaneously within weeks to months*
- ✓ *Just admit for observation and if the patient deteriorates do CT scan to rule out hematomas.*
- ✓ *Basal skull fractures should be covered with antibiotics and the nose and ear should be observed for CSF leak*

DEPRESSED SKULL FRACTURES

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- ❑ ***ARE DEPRESSIONS OF THE BONE OF THE SKULL.***
- ❑ ***THEY COULD BE:***
 - ❑ *SIMPLE WITH SKIN INTACT*
 - ❑ *COMPOUND WITH CUT SKIN*
- ❑ ***EITHER COULD BE:***
 - ❑ *ONE DEPRESSED SEGMENT*
 - ❑ *COMMINUTED*

SKULL XRAY LATERAL VIEW WITH DEPRESSED FRACTURE



MANAGEMENT OF DEPRESSED SKULL FRACTURES

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THEY NEED TO BE OPERATED UPON IF:

The depression is more than the thickness of the adjacent skull.

If they are compound

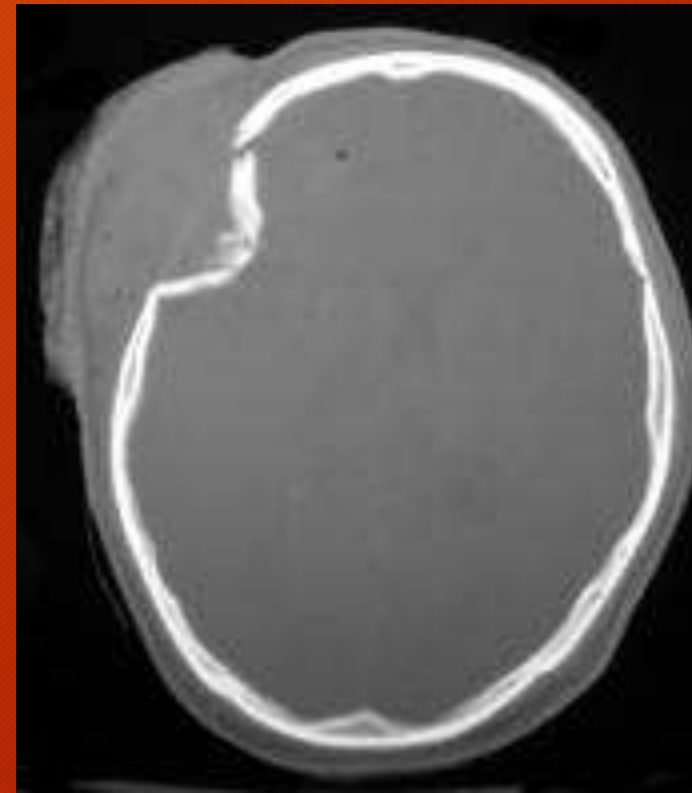
If associated with seizures

If associated with neurological signs.

If they overlie an important area

Cosmetic.

CT bone window showing depressed skull fracture with over lying scalp contusion



MANAGEMENT OF DEPRESSED SKULL FRACTURES

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- **THE OPERATION COULD BE:**
 - *Simple elevation*
 - *Craniectomy, this will need to be repaired by an operation called Cranioplasty, which could be immediate or delayed if the fracture was compound.*

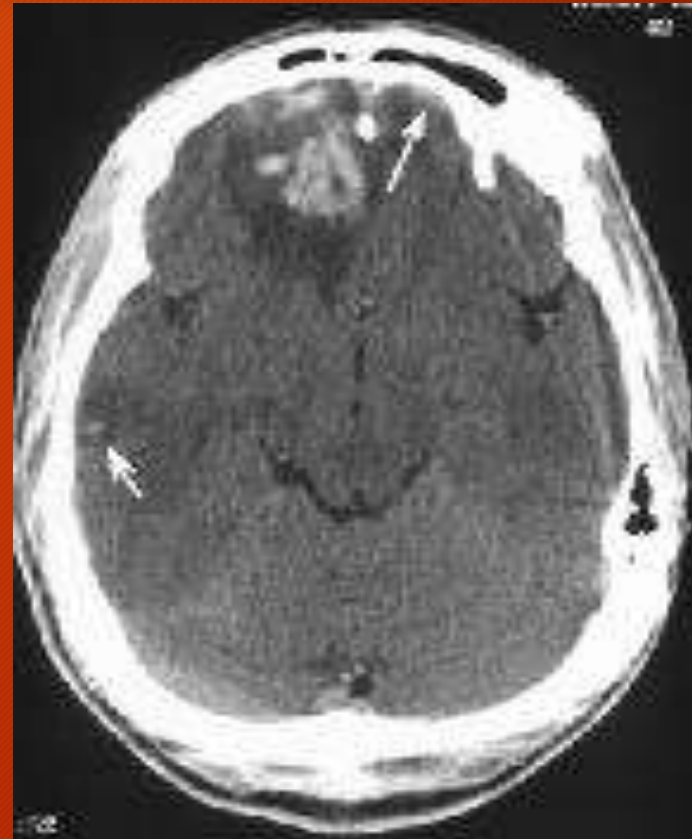


CRANIOPLASTY WITH ACRYLIC MATERIAL

BRAIN INJURIES

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- ***MECHANISMS OF BRAIN INJURIES***
 - *Direct trauma*
 - *Acceleration deceleration injury*
 - *Shearing*

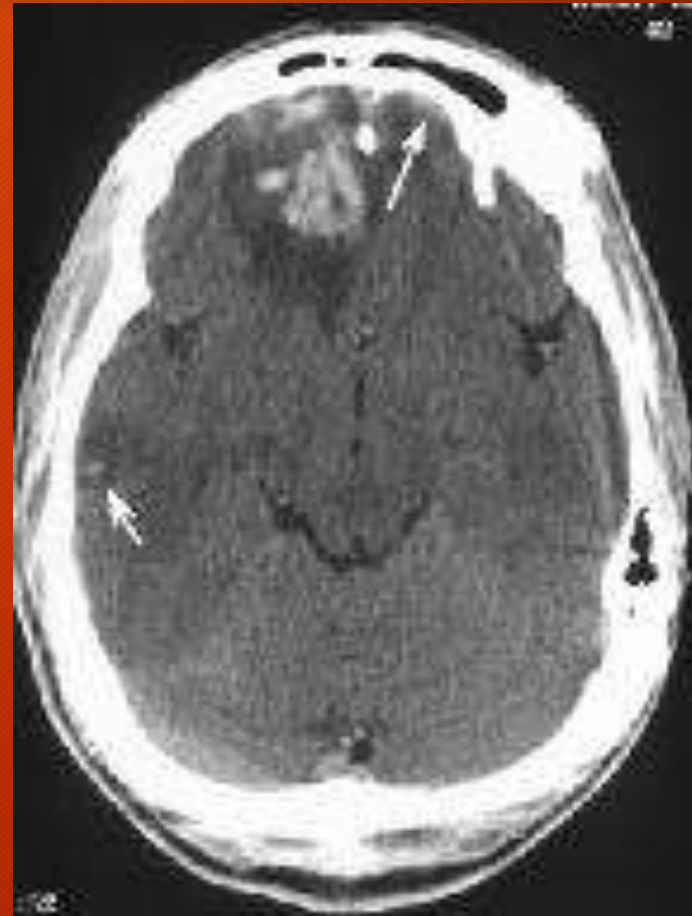


BRAIN CONTUSION WITH EDEMA

BRAIN INJURIES

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- **BRAIN INJURIES**
 - **PRIMARY INJURIES**
 - Concussion
 - Contusion.
 - Laceration
 - Diffuse axonal injury (DAI)
 - SECONDARY EVENTS**
 - Brain edema
 - Hypoxia
 - Ischemia



BRAIN INJURIES

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CONCUSSION

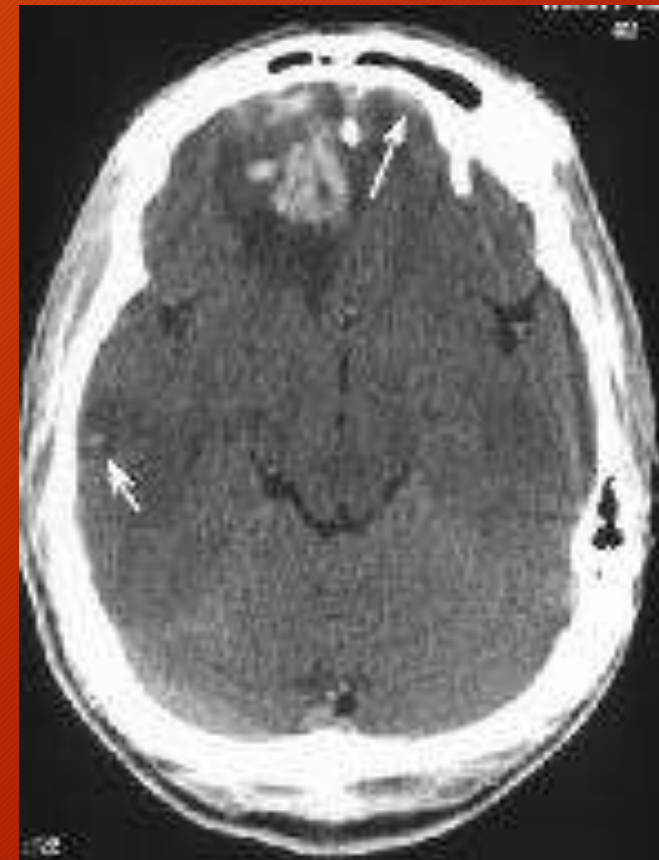
*Here the patient will lose his consciousness for a **brief period of time**. When he wakes up he will be **amnesic**. Examination will show **no abnormality**. **CT scans are usually normal**.*

BRAIN INJURIES

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CONTUSION

Here the brain will suffer from a contused area or areas as a result of the direct trauma or the acceleration deceleration injury. The most common sites for this latter is the under surface of the brain and the tips of the lobes in what is called coup contre-coup injuries. Contusions are notorious for being associated with brain edema which makes their management difficult.



BRAIN INJURIES

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LACERATION

Here the brain will suffer from a lacerated area or areas as a result of the direct trauma especially if penetrating or the acceleration deceleration injury. The neurological deficits which result are usually permanent.

BRAIN INJURIES

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DIFFUSE AXONAL INJURY

Will usually result from shearing injury which acted upon the interface of grey and white matter. If extensive the patient will be in deep coma (3/15) with normal CT and normal ICP.

MANAGEMENT OF BRAIN INJURIES

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- **BRAIN INJURIES ARE DIVIDED INTO 3 CATEGORIES DEPENDING ON THE GCS:**
 - **MILD**
 - **GCS 14 AND 15**
 - **MODERATE**
 - **GCS BETWEEN 9 AND 13**
 - **SEVERE**
 - **GCS 8 AND BELOW**

MANAGEMENT OF BRAIN INJURIES

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- **BRAIN INJURIES**
 - **PRIMARY INJURIES**
 - **CONCUSSION:**
 - *OBSERVE FOR 24 HOURS*
 - **CONTUSION & LACERATION:**
 - *?STEROIDS, DIURETICS,*
 - *ANTICONVULSANTS,*
 - **DIFFUSE AXONAL INJURY:**
 - *AS ABOVE, BUT REQUIRES ALSO ICP MONITORING AND VENTILLATION*

MISSILE INJURIES

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- *THE LINES OF MANAGEMENT ARE SIMILAR TO THOSE OF CIVILIAN LIFE HEAD INJURIES, BUT HAVE CERTAIN SPECIFIC POINTS WHICH REQUIRE SPECIAL ATTENTION.*



MISSILE INJURIES

- *There are usually other associated injuries.*
- *There is increased risk of infection because of the open wound.*
- *Patients of the same kind may arrive in big number which makes management difficult.*

MANAGEMENT OF HEAD INJURIES DUE TO BULLETS

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- *STANDARD EXAMINATION AND EVALUATION*
- *ATTEND TO AIRWAYS*
- *SECURE PROPER I.V. LINES*
- *SKULL X-RAYS AND CT SCANS*
- *MANAGEMENT WILL DEPEND ON THE NEUROLOGICAL STATUS OF THE PATIENT*



SKULL XRAY:
SHRAPNELS



CT BONE WINDOW
BULLET TRACT AND SCATTER



MANAGEMENT OF HEAD INJURIES DUE TO BULLETS

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- *Debridement and closure of scalp wounds.*
- *Craniectomy for comminuted skull fractures.*
- *Craniotomy and excision of contused lacerated edematous superficial brain area.*
- *Removal of accessible bone fragments*
- *Evacuation of life threatening hematomas.*
- *Burr hole for insertion of ICP catheter for monitoring.*



CT: BULLET ENTERING THROUGH THE LEFT SIDE WITH ICH ALONG THE TRACT AND AIR INSIDE THE BRAIN

MANAGEMENT OF HEAD INJURIES DUE TO BULLETS

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- *Mannitol for brain edema*
- *Hyperventilation*
- *Antibiotics*
- *Attention to complications like epilepsy and abscess formation*



BRAIN ABSCESS FOLLOWING
BULLET INJURY

MANAGEMENT OF HEAD INJURIES DUE TO BULLETS

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THE FOLLOWING HAVE HIGH MORTALITY RATE:

- *GCS OF 4 OR LESS ON ARRIVAL*
- *HIGH VELOCITY WOUNDS*
- *TRANSLOBAR PATH OF PROJECTILE*
- *TRANSVENTRICULAR COURSE*
- *IF ASSOCIATED WITH SHOCK*

MANAGEMENT OF HEAD INJURIES DUE TO BULLETS

NOTE

- *REMOVAL OF DEEPLY SITUATED BULLETS OR FRAGMENTS IS NOT REQUIRED.*
- *REMOVAL AT A LATER STAGE, IF THE PATIENT SURVIVES IS ONLY REQUIRED IF COMPLICATIONS ARISE.*

FURTHER READING

- **Neurosurgery Made Easy** by Walid Maani available at [Amazon.com](https://www.amazon.com) in paper and kindle format and at [Lulu.com](https://www.lulu.com) in pdf format
- **Introduction to Neuroimaging** by Walid Maani available at [Amazon.com](https://www.amazon.com) in paper and kindle format and at [Lulu.com](https://www.lulu.com) in pdf format