

### III. Brain Injuries

#### I) Concussion:

\* **Pathology:** Mild trauma to the head → slight movement of the brain → generalized neural stretch in CNS → microscopic changes in the neurons without any gross structural damage → temporary loss of function followed by complete recovery .

\* **Clinical picture:**

1. The patient suddenly falls **unconscious**.

2. **Eye:** Closed

3. **Pupils:** Dilated.

4. **Pulse:** Rapid and weak.

5. **B.P.:** Low.

6. **Temperature:** Subnormal

7. **Respiration:** Slow and shallow.

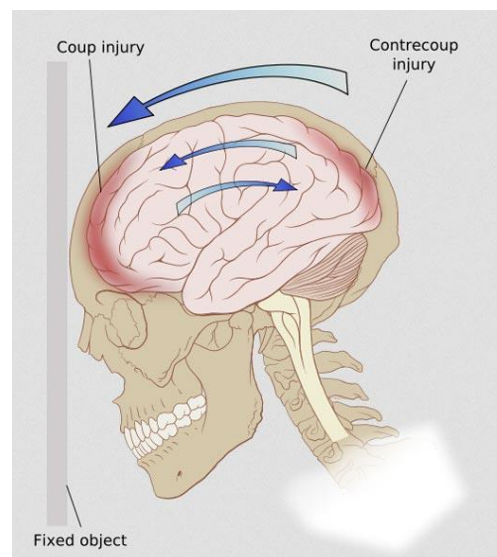
8. **Muscles:** Relaxed.

9. **Reflexes:** Lost

10. **Sphincters:** Incontinent.

11. **Uncomplicated** cases usually recover completely within minutes & rarely hours.

12. **Post-concussion syndrome:** (P.C.) after recovery, the patient is still suffer from headache and amnesia.



**P.C.**



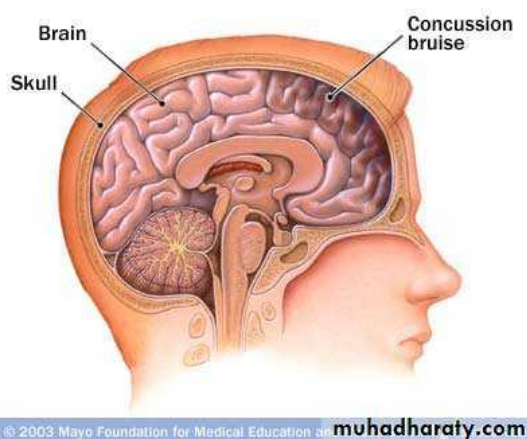
- \* **Treatment:** Hospitalization & observation for at least 24 hours to detect early manifestations of complications.

## II) Cerebral contusion:

- \* **Pathology :** There are areas of bruising and swellings with intact pia & arachnoid matter → localized or generalized oedema and haemorrhage due to tear of minute blood vessels .
- \* **Clinical picture :**
  - 1- State of prolonged unconsciousness with evidences of focal brain damage which appear from the start of injury.
  - 2- On recovery of consciousness , there is headache , photophobia and confusion .

**III) Cerebral irritation** is characterized by general irritation phenomenon without localizing signs due to diffuse brain oedema and hyperaemia.

**IV) Cerebral laceration :** The pia & arachnoid matter are torn with gross brain tear and bloody effusion in CSF .



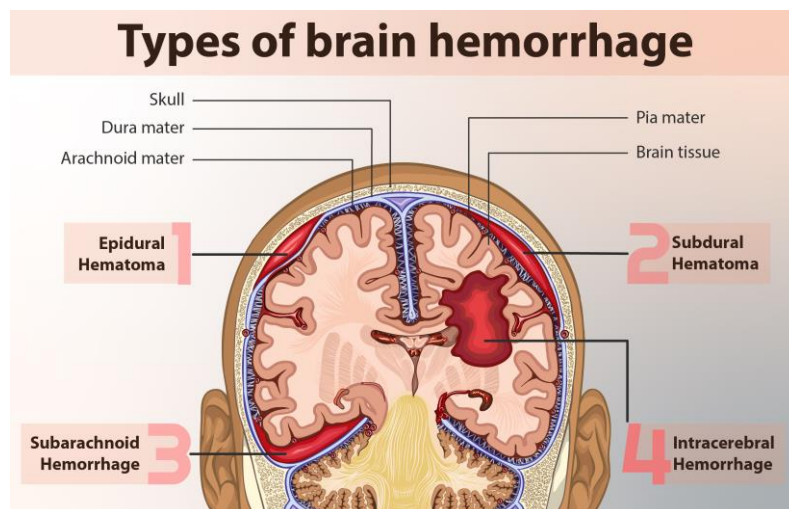
**Cerebral contusion**



**Cerebral laceration**

## V) Compression :

- \* **Definition:** Increased intracranial tension sufficient to disturb brain function.
- \* **Aetiology:**
  - 1- Intracranial haemorrhage: Extradural, subdural, subarachnoid, intracerebral & intraventricular.
  - 2- Depressed fracture.
  - 3- Foreign body.
  - 4- Diffuse cerebral oedema due to cerebral contusions and lacerations.
  - 5- Accumulation of inflammatory products.



## \* **Clinical picture :**

- 1- Progressive **headache**.
- 2- Blurring of vision & **papilloedema**.
- 3- Repeated projectile **vomiting** without nausea.
- 4- Progressive irritability, confusion, drowsiness passing to **coma**.
- 5- **Cushing triad** : Arterial **hypertension**, **Bradycardia** & **respiration** changes due to :

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## TRAUMA 3

- ♣ Ischemia & Pressure on the brain stem .
- ♣ Cerebral ischemia → loss of upper inhibitory impulse on the brain stem centers ( VMC and vagal centers)

### 6- Hyperpyrexia.

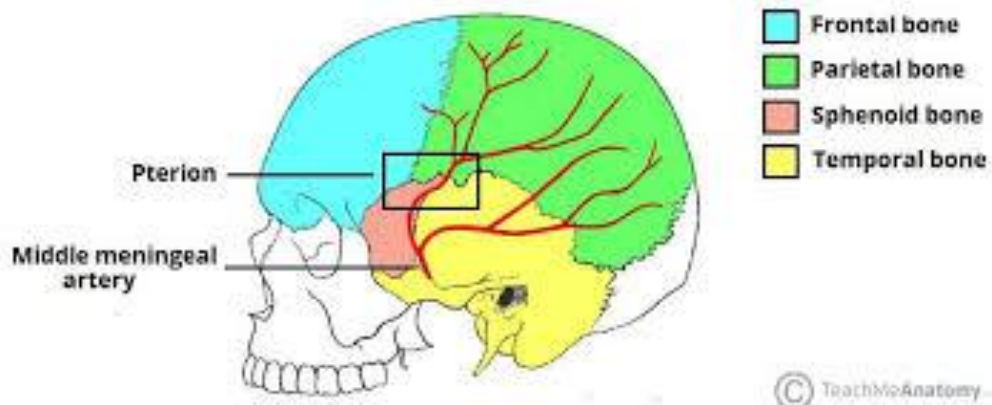
7-**Pupils:** Constricted then dilated, at first on the ipsilateral side of the lesion then on the contralateral side.

8- Contralateral **hemiparesis**.

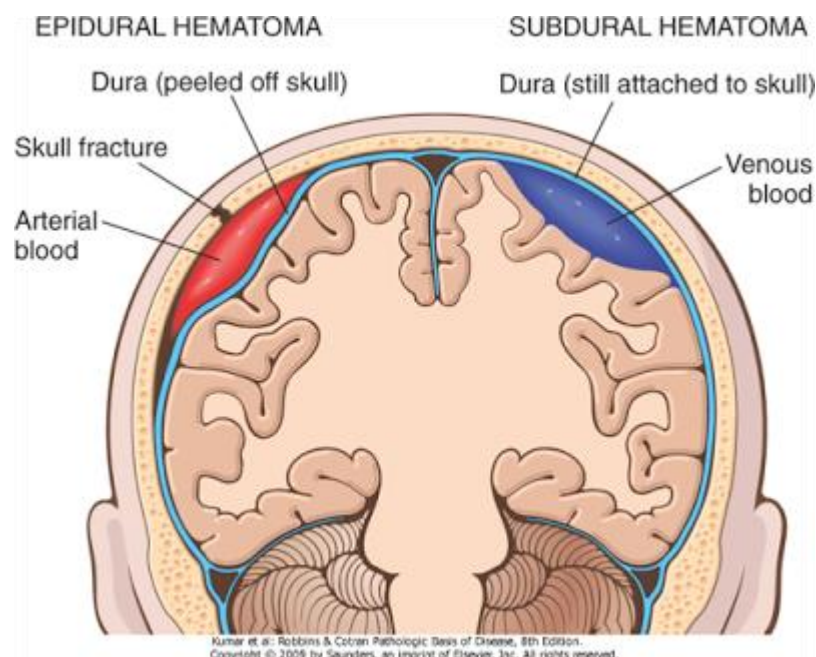
9-Decerebrate **rigidity** in terminal cases.

### \* Treatment of the cause

#### Acute Extradural Haemorrhage

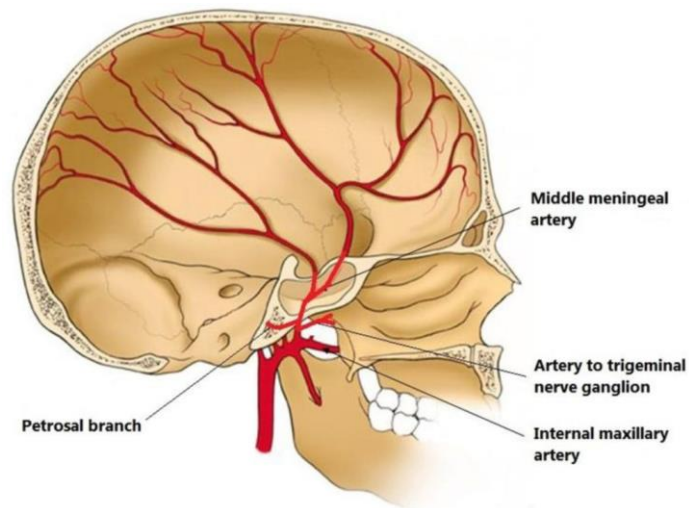


#### Pterion



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## TRAUMA



- \* **Definition:** Bleeding & collection of haematoma between the dura & the cranium.
- \* **Incidence:** The injury usually affects the anterior branch of middle meningeal Vessels because the temporal bone is thin and easily fractured and the artery lies in a bony canal at the pterion.
- \* **Aetiology :** A blow on the side of the head may cause:
  - a - Fracture of temporal or parietal bone on the same side (coup injury ).
  - b - Separation of dura from bones on the opposite side during recoil of brain (conter-coup injury).
- **The bleeding may be:**
  - 1. Arterial bleeding:** Due to injury of middle meningeal artery.
  - 2. Venous bleeding:** More **common** because veins have a thin wall . It is due to injury of a diploic vein, middle meningeal vein or a venous sinus.
- \* **Pathology:** The condition passes through the following stages:
  - A) Concussion stage :**
    - With inhibition of the vasomotor center → low B.P. → no bleeding occurs in spite of the tear in the artery.

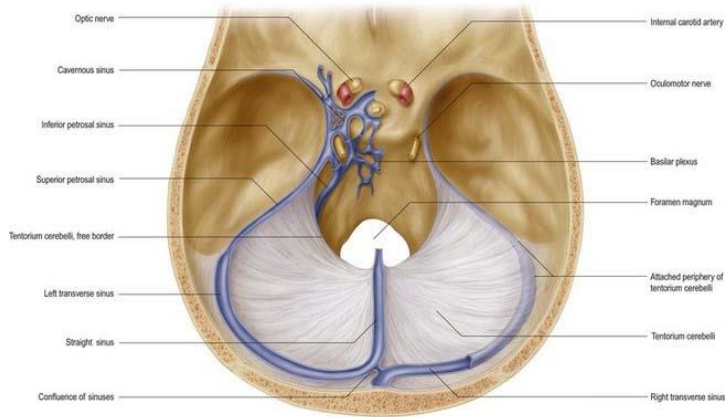
## **B) Lucid interval stage :**

- It is **interval between** the regain of consciousness and the onset of brain compression.
- It is the **time needed for** the collecting haematoma to strip the dura from bone & to disturb venous drainage of the brain .
- **Recovery** from concussion occur → rise of B.P. → **Bleeding occur.**
- Blood escape from the injured anterior division **in 3 directions:**
  - **Outwards** → haematoma deep to temporalis.
  - **Downwards:** To the middle cranial fossa.
  - **Upwards:** Over the parietal regions & motor cortex.

## **C) Compression stage:**

- **Early** compression → congestion and oedema of the brain → brain irritation.
- **Late** compression : occur due to
  - 1-Interfere with arterial supply of brain .
  - 2-**Herniation:**
    - **Temporal lobe** herniate through **tentorial hiatus** → cone formation → compression of midbrain and 3rd cranial nerve → paralysis of all cerebral functions and pupillary changes.
    - **Cerebellar** herniation through the **foramen magnum** → compression of vital centers in the lower part of medulla.
- **Terminal** compression: destruction of midbrain → decerebrate rigidity → death.

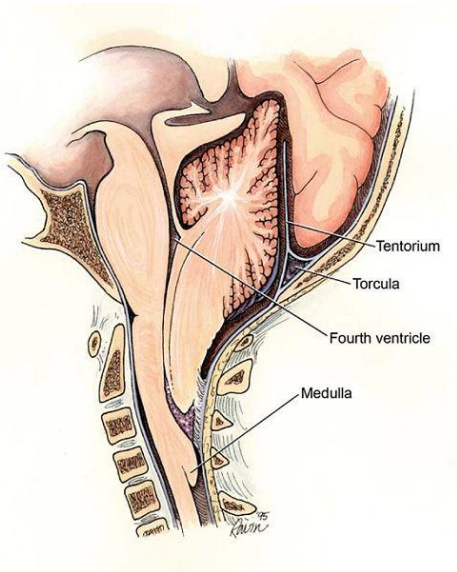
## TRAUMA



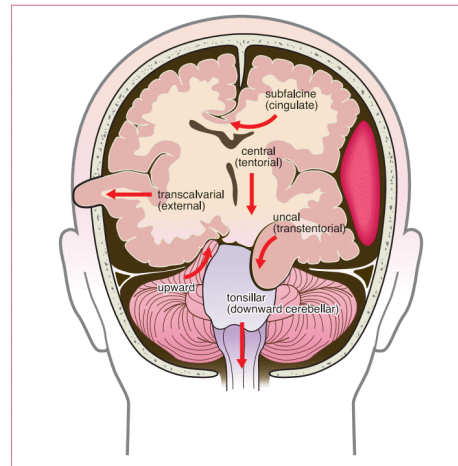
**Tentorial Hiatus**



**Hematoma deep to temporalis**



**Cerebellar herniation**



**Temporal lobe herniation**

\* **Clinical picture:** 3 Clinical stages:

**A. Concussion:** With or without signs of skull fracture.  
(mention in short).

**B. Lucid interval:**

- 1- The patient regain consciousness for few hours (longer in venous bleeding).
- 2 – The patient confused with amnesia.

**C. Compression:**

- 1 - Progressive headache , vomiting, blurring of vision & papilloedema.

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2 - Progressive irritability & confusion followed by drowsiness → coma.

3 - **Pulse:** At first slow and full but later on become rapid and weak.

4 - **B.P:** At first rise then falls.

5 - **Respiration:** At first deep & slow then shallow & rapid and finally irregular with gasping before it stops completely.

• **N.B :3, 4 & 5 are called Cushing Triad**

6 -**Temperature:** At first there is subnormal temp. but later on the temp. generally raised and may be higher on the injured side.

7 - **Pupils:** Constricted then dilated, at first on the ipsilateral side of the lesion then on the contralateral side. Pupillary changes indicate late compression ( **tentorial herniation** affect first the oculomotor nerve on the ipsilateral side followed by oculomotor nerve on the contralateral side) .

8- **Contralateral hemiparesis** due to compression of ipsilateral cerebral cortex.

•In late cases, tentorial herniation push the midbrain against the edge of the tentorium on the opposite side → ipsilateral hemiparesis.

9- **Localization of the side of the lesion:**

- **Trauma & fracture** on the same side of the haematoma.
- **Pupil** constrict and dilated first on the side of the lesion.
- **Temperature** may be higher on the side of the lesion.
- **Hemiparesis** occur first in the contralateral side.



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- **X-ray:** May show a fracture or shifting of the calcified pineal body.
- **C.T.scan** is diagnostic.

\* N.B: The classical picture is only found in a minority of cases .

### \* **D.D:**

1. **Pure concussion:** Detected by follow up.
2. **Compression by depressed bone:** Paralysis & compression occur immediately after the accident without a lucid interval.
3. **Cerebral oedema:** Signs of irritation without localization.
4. **Pressure due to infection:** Longer interval between injury and infection with high fever and leucocytosis.
5. **Acute subdural:** (Mention the table in subdural hge).

\* **Investigations:** C.T. scan. (mention).

### \* **Treatment:**

**1- Urgent operation** under general endotracheal anaesthesia.

**2-Position :**Put the patient with the site of haematoma upper most & the head is raised to reduce venous bleeding.

### **3-Exposure:**

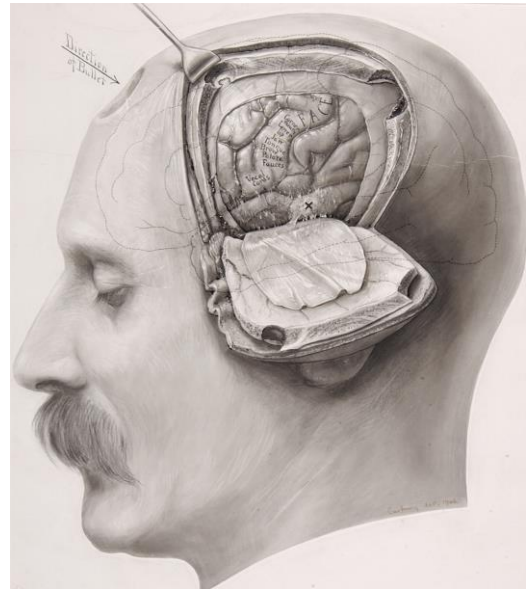
**A.** After localization of the intra-cranial haematoma by C.T scan , osteoplastic flap is done .

- 4-5 burr holes connected by a saw are done , with raising the flap which include the skin , temporalis and part of skull .
- The skin and temporalis are not dissected from the bone .
- The osteoplastic flap is turned down to expose the dura .

## TRAUMA



**Position**

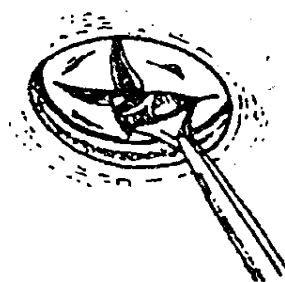


**osteoplastic flap**

**4- Suction** of the extra-dural haematoma .

**5- Control of bleeding** :The bleeding middle meningeal vessels are coagulated or underrun stitches. Rarely, if control of bleeding fails, packing of the foramen spinosum by bone wax .

**6-** If there are evidences of **subdural haemorrhage** (swelling and dark colour) , open the dura by cruciate incision ,evacuate the subdural haematoma , absolute haemostasis and close the dura.



**Cruciate division of the dura**

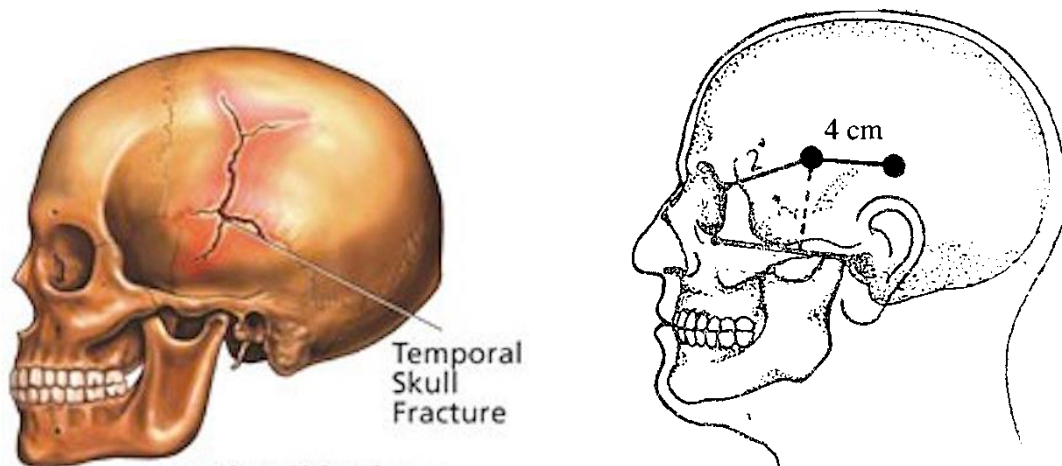
**7-** A **drain** is inserted and the **flap is returned** to its place and fixed by suturing temporal fascia and skin .

**8-** Prophylactic **anticonvulsant** drugs for 6 weeks

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### \* **N.B:**

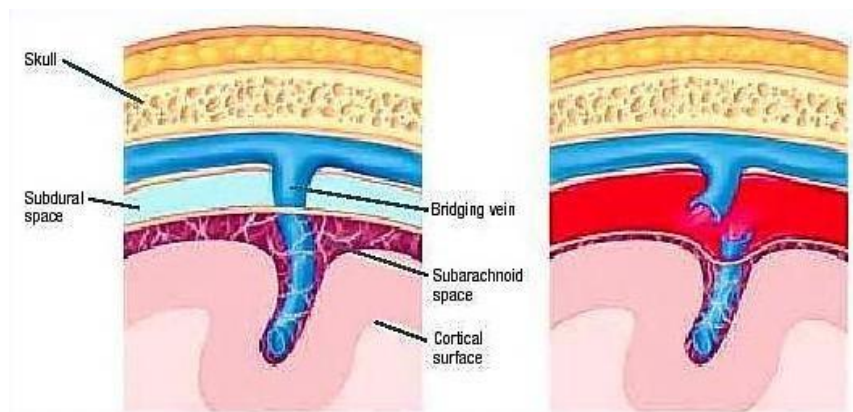
- ♣ **Exposure of anterior division of middle meningeal artery** at the pterion is 2 inches above the middle of the zygomatic arch and 2 inches behind the fronto-zygomatic suture .
- ♣ **Exposure of posterior division of middle meningeal artery** : 2 inches above the base of mastoid process .



### **Exposure of middle meningeal vessels**

### **Acute Subdural Hemorrhage**

- \***Aetiology:** Severe blow to the skull leading to rupture of cerebral veins as it crosses subdural space to reach dural venous sinuses or rarely due to cerebral laceration.



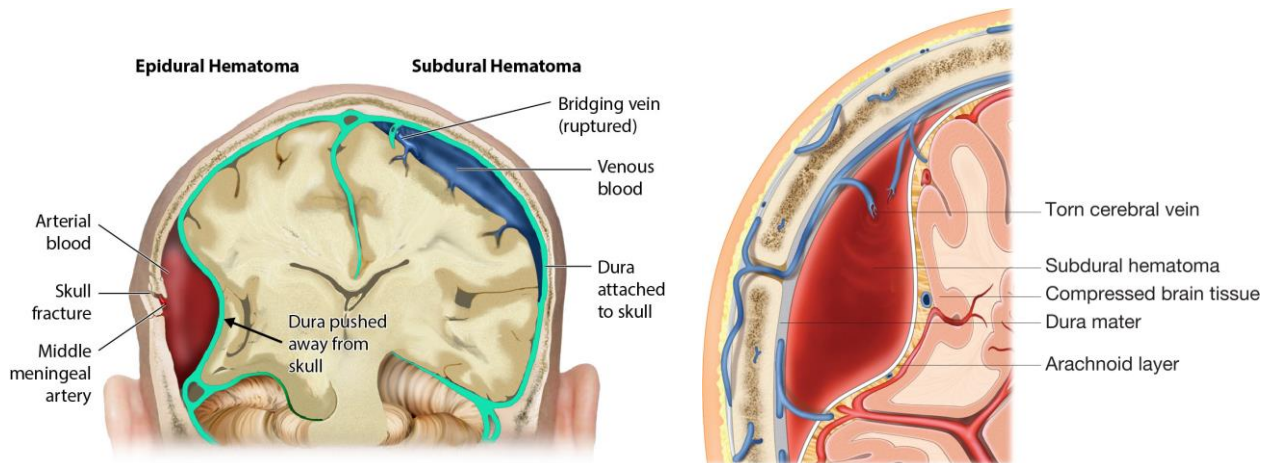
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\* **Clinical picture:** brain compression without lucid interval (Mention in short )

\* **D.D :**

Acute extra-dural hemorrhage	Acute sub-dural hemorrhage
• Usually mild trauma	• Usually severe trauma.
• Lucid interval is present	• No lucid interval → persistent coma
• Usually with mild brain damage.	• Usually with severe brain damage.
• Usually unilateral.	• Usually bilateral & extensive.
• Early surgery is successful.	• Due to serious brain injury & oedema in addition to haematoma → mortality rate is at least 50% .



\* **Investigation:** The most important is C.T. scan (Mention in short).

\* **Treatment: Urgent operation**

- In case of subdural haematoma (swelling & dark colour under the dura), the dura is opened in a cruciate fashion to allow rapid decompression of the brain followed by evacuation of haematoma and absolute haemostasis.

## MANAGEMENT OF

### HEAD INJURY

#### **I- First aid & dealing with life saving priorities: (A,B,C,D,E).**

1. Keep patent **airway & cervical** control
2. Maintain adequate **breathing**: (Mention in short).
3. **Circulation**:
  - ♣ Stop external **bleeding** from any wound
  - ♣ **Anti-shock measures** (mention). Presence of shock in patient with head injury is usually due to internal hemorrhage in the thorax or abdomen.
4. **Disability** ( mention )
5. **Exposure and environment** .
6. Record the **history** of the accident is essential for follow up.
7. Immediate **transfer** to the hospital with the head up if the patient is conscious or on his side if he is comatosed.

#### **II- Immediate clinical examination:**(Base level for subsequent observation).

1. **Vital signs:** Pulse, temperature, B.P. and respiration ( Mention **Cushing triad** ).
2. Assessment of the level of consciousness and evaluate the severity of head injuries by **Galsgow coma scale** ( see medicine ) which is based on 3 parameters & for each parameter a certain score is given.
  - ♣ The **parameters** are eye opening, best verbal response & best motor response.
  - ♣ The higher the score, the better the prognosis .

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- ♣ According to the scale case of head injury are **classified into** mild (13 - 15), moderate (9 - 12) or severe (8 or less).

### 3. Head examination:

a – **Scalp** : Wound or haematoma.

b - **Skull** for palpable fracture.

c – **Eye** :

- ♣ Pupil for size (most important) & reaction to light.

- Dilated pupil immediately after trauma , usually due to direct injury of oculomotor nerve ( fracture base of skull)

- Constricted pupil on initial exam. and later dilated is a sign of lateralization due to supratentorial haematoma .

- ♣ Subconjunctival hemorrhage and its D.D .

- ♣ Ophthalmoscopy for papilloedema.

d - **Orifices**: Nose, ear & mouth for escape of blood & CSF in case of fracture base.

e - **Posture**: For neck rigidity & head retraction in fracture posterior cranial fossa.

### 4. Complete neurological examination:

a – Cranial nerves (in fracture base ).

b - Examine the limb for muscle power, reflexes especially Babinski's as a sign of lateralization and sensations.

- Hemiplegia immediately after trauma indicates primary cerebral damage .

5. Careful examination for manifestations of **brain injury** .

6. Complete **chest** exam. for pneumothorax , haemothorax or fracture ribs .

7. **Abdominal** exam. for internal haemorrhage .

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8. Examination of the **limbs** and **back** to detect any fracture , dislocations or vascular injury .

### III) Indications for hospital admission :

1. History of loss or altered **consciousness** .
2. **Skull fracture** .
3. **Swelling** deep to temporalis muscle .
4. Progressive **headache** and persistent **vomiting** ( early signs of increase IC tension ) .
5. Presence of **focal neurological sign**

### IV) Investigations :

- Once the patient is resuscitated with stabilization of vital signs , the surgeons should order the necessary investigations .

#### a- Laboratory investigations :

- Blood gases (  $PO_2$  &  $PCO_2$  ) and electrolytes .
- Urine and blood for sugar .
- Blood urea and creatinine .
- Liver functions .

#### b- Radiological investigations :

##### 1. **Skull plain X-ray:** Show the followings

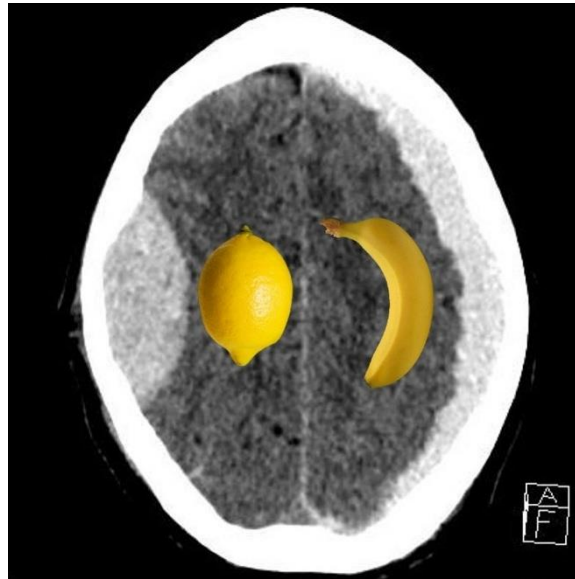
- Type, site & size of skull fracture.
- Foreign body in the cranial cavity .
- Pneumocranium .
- Possible side of haematoma by shifting of pineal body .

##### 2. **C.T. scan** is the **most important** investigation nowadays for any head injury as it diagnose fracture base or vault of skull, brain oedema, laceration, contusion and site, size ,type & progress of intracranial haematoma

- Extra-dural hematoma is lentiform like a lemon

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- Subdural hematoma is sickle shaped like a banana



- If the patient on clinical grounds, is in ***urgent need for surgery, to evacuate intracranial haematoma, no time should be lost*** in doing investigation and ***surgery should be done immediately***.

### **VI) Conservative measures ,continuous care and observations :**

- **Aim :**

- Give the patient the **maximum care** until spontaneous recovery occurs .
- Early detection of **complications** which may need urgent surgery .

- **Methods :**

- 1- Respiration :**

- If normal ventilation is inadequate to maintain normal level of  $PO_2$  &  $PCO_2$  or GCS equal or less than 8 , **endotracheal intubation and mechanical ventilation** are indicated .
- Endotracheal intubation can be left for **7 days** only after which **tracheostomy** is indicated .



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- 2-** Insert **Foley's catheter** to evacuate the bladder and estimate urine output .
- 3- GIT:** Insert **nasogastric tube** for feeding and **enema** every 2 days .
- 4- Place :** dark quite room .
- 5- Posture :**
  - **Conscious :** Semi-sitting position
  - **Unconscious:** Lie on his side to prevent inhalation of secretions
- 6- Pyrexia :** Antipyretics and ice backs .
- 7- Back :** Prevent bed sores by frequent change of position , massage with alcohol and talc powder .
- 8- Physiotherapy :** to prevent joint stiffness and massage of muscles .
- 9- Drugs :**
  - Reduce brain oedema by mannitol 20% or as alternative frusemide and corticosteroids .
  - Antibiotics for coma , open injury and fracture base of skull .
  - Tetanus prophylaxis .
  - Anticonvulsant drugs .
- 10-** Repeated **observations for**
  - Level of **consciousness** ( most important ) and **GCS** .
  - **Pupils** & reflexes .
  - **Vital signs:** Pulse, temperature, B.P. and respiration

### **VII) Urgent surgery :**

#### **A- To evacuate acute intra-cranial haematoma :**

##### **• Indications :**

- Clinical manifestations of increase intra-cranial tension ( mention

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) which may be due to brain oedema or acute haematoma . Sure diagnosis of hematoma by CT scan .

- **Method** : ( mention the operation for extr-dural haemorrhage ) .

### **B- Depressed fracture :**

- **Indications** : ( see depressed fracture )
- **Method** : ( mention the operation for depressed fracture )