TRAUMATIC HEAD INJURY

Head injury comprises a large proportion of emergency neurosurgical practice.

Severity can range from a **minor** concussive injury to **severe**

craniocerebral trauma associated with high-velocity motor vehicle accidents

The head injury may be associated with scalp or face injury, and may be penetrating (open) or non-penetrating (closed). Management aims to minimise secondary brain injury.

THE BRAIN INJURY

The primary brain injury

1. Results from the trauma.
2. It may be diffuse or focal and of varying severity
3. Is essentially irreversible.

Secondary brain injury

1. Occurs after the primary trauma as a result of hypotension, ischaemia, hypoxia, pyrexia, infection and raised ICP.
2. Secondary brain damage can have a devastating effect even in patients with relatively minor injuries
3. Can often be prevented.

ASSESSMENT

Glasgow Coma Score

The GCS is a measure of conscious level that facilitates objective management of head-injured patients.

It is used internationally and records the best verbal, motor and eye-opening responses to stimulus.

The obtainable score ranges between 3 and 15.

Changes in GCS over time are more informative than the reading at a single time point.

The verbal component of the GCS **can be modified** for assessment in children.

The best post-resuscitation GCS is used to classify the severity of head injury. **Mild** injury is GCS 15–13; **moderate** 12–9; and **less than 8** is classified as severe.

Coma is defined as a GCS of 8 or less.

OTHER SYSTEMS

Patients with head injury often have **extracranial** injuries.

Head injury alone **does not** cause hypovolaemic shock, except rarely in young children from scalp bleeding.

Management of systemic complications such as chest injury or intra-abdominal haemorrhage is a priority, since these can lead to hypoxia, cerebral ischaemia and hypoxia, and thus secondary brain damage.

MANAGEMENT

As with all injured patients, management commences with **Airway, Breathing and Circulation assessment and management.**

The **neck should be immobilised** until a cervical spine injury has been excluded.

The GCS should be documented on arrival and following resuscitation, and the findings of a neurological survey recorded.

Patients may be **under the effects** of alcohol and other drugs that affect conscious level. **If in doubt,** assume that depressed consciousness is due to brain injury.

MANAGEMENT

Continued monitoring of conscious level over time by means of GCS is a key aspect of management, and sedatives must be avoided.

In general, patients with **a GCS of 8 or less are intubated** and **ventilated** to prevent hypoxia and aspiration pneumonitis, and to allow moderate hyperventilation, which reduces the PaCO2 to 30–35 mmHg. This lowers ICP through cerebral vasoconstriction.

Following resuscitation, stabilisation and prioritisation of injuries, **a head CT is performed** to detect intracranial haematoma, brain contusions (bruises), depressed bone fragments, intracranial air and associated maxillofacial fractures.

MANAGEMENT

Mass lesions such as extradural or subdural haematomas and haemorrhagic contusions **may cause** brain swelling and shift, and are often surgically evacuated.

Indications for clot evacuation include >5-mm **midline shift,** significant **impairment of GCS**, or **protracted headache or vomiting**.

Compound cranial wounds need to be **surgically explored, dead tissue and foreign bodies removed, and depressed bone fragments elevated.**

Depending on the age of the wound**, bone fragments may be cleaned** and replaced or discarded

MANAGEMENT

Brain injury **evolves** over several days and the principal aim of management is to limit secondary damage.

ICP is often severely elevated following neurotrauma **because of** oedema, haematoma, contusions, engorgement of the brain vasculature, hydrocephalus or even infection.

A **sustained ICP that exceeds 25** mmHg is associated with a poorer outcome.

Severely brain-injured patients are **kept sedated and ventilated,** and their ICP is measured with a ‘bolt’ (pressure transducer).

Hyperventilation, mannitol or hypertonic saline are used to reduce ICP, and the systemic blood pressure may be raised using fluids and inotropes.

Many neurotrauma patients require **rehabilitation**

SKULL FRACTURE

The presence of a skull fracture is **an important pointer** to the likelihood of significant primary and/or secondary brain injury, especially if accompanied by a depressed GCS.

However, the absence of a fracture **does not exclude** life-threatening brain injury, particularly in young children.

CT is the investigation of choice after head injury, and certainly should be performed if there is a skull fracture.

EXTRADURAL HAEMATOMA

This is usually the result of a skull fracture **with tearing** of a meningeal vessel .

It is most common in the middle fossa after a temporal fracture and **middle meningeal artery or vein tear.**

The **primary** brain injury is often **minimal,** with a typical 'lucid' interval followed by **rapid deterioration** as the haematoma enlarges.

The haematoma has a **classic biconvex** or lenticular appearance on CT.

The prognosis after treatment is **usually good**.

SUBDURAL HAEMATOMA

This is more common than extradural haematoma and **results from** laceration of vessels (especially small cerebral veins) on the brain surface, or 'bursting' of the brain.

CT shows a **haematoma that is concave** on its inner surface and whose extent is not limited between the cranial sutures, unlike extradural haematomas .

Morbidity and mortality are often high, because of the severity of the primary brain injury

CHRONIC SUBDURAL HAEMATOMA

An increasingly common problem in the ageing population is **chronic subdural haematoma** (CSDH).

The initial acute bleed, which can occur apparently spontaneously or after relatively minor head trauma, is rarely symptomatic.

Patients with cerebral atrophy, or who are on antiplatelets or anticoagulants, are at greater risk of CSDH.

The acute haematoma dissolves, and the CSDH collection varies in viscosity from dissolving clot to blood-stained fluid.

TREATMENT

Treatment involves **drainage** of the subdural collection through burr holes or minicraniotomy.

Evidence from an RCT suggests that placement of a drain in the subdural space for 24-48 hours after surgery significantly reduces CSDH recurrence.

Patients with mild symptoms may be offered a short course of steroids (without surgery) for symptom management; there is not yet any quality evidence for this strategy, but clinical trials are ongoing.

INTRACEREBRAL HAEMATOMA AND CONTUSIONS

Trauma can cause **focal intracerebral haematoma** or, more commonly, **foci** of contusions or **small areas** of brain bruising.

Such lesions **can cause** cognitive and focal deficits in the longer term, but acutely can be associated with severe pericontusional brain oedema and raised ICP.

DIFFUSE AXONAL INJURY

This type of injury is **caused by** rotational head movements.

It is common after **high-speed motor** vehicle accidents.

The GCS is usually **low**.

Paradoxically, the CT may appear **normal,** or there may be only small punctate brain contusions.

The ICP may be normal, at least initially. However, because of the diffuse nature of the brain injury, **severe neurological deficits** are common.

Treatment is **supportive** and it may be some time before the prognosis is known.

NEUROLOGICAL EXAMINATION

Routine assessment includes **pupil size** and **reaction;**

A search for **CSF leaks** from nose, mouth and ears;

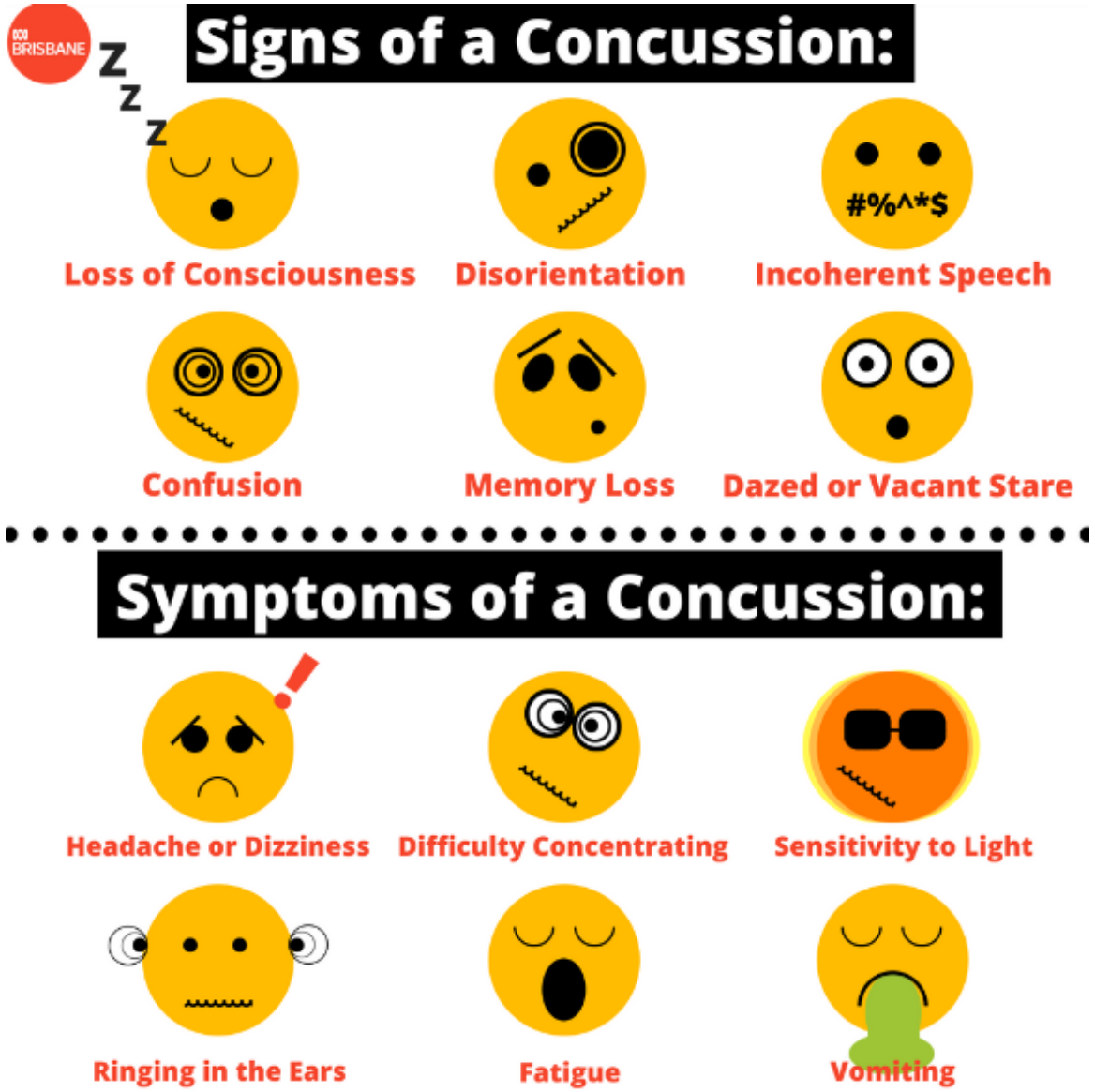
A survey of the **scalp** for penetrating injuries;

Signs of a **basal skull fracture** (Battle's sign, raccoon eyes);

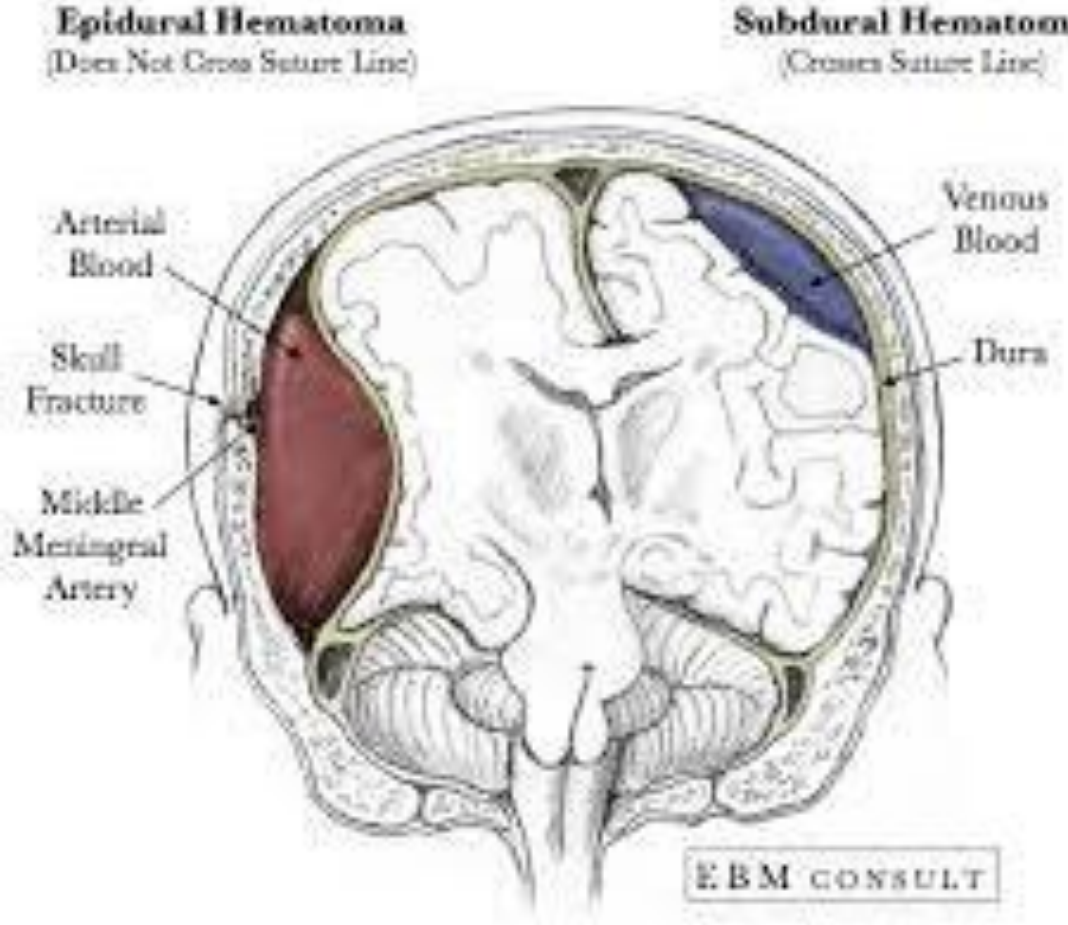
An assessment of the **maxillofacial skeleton**.

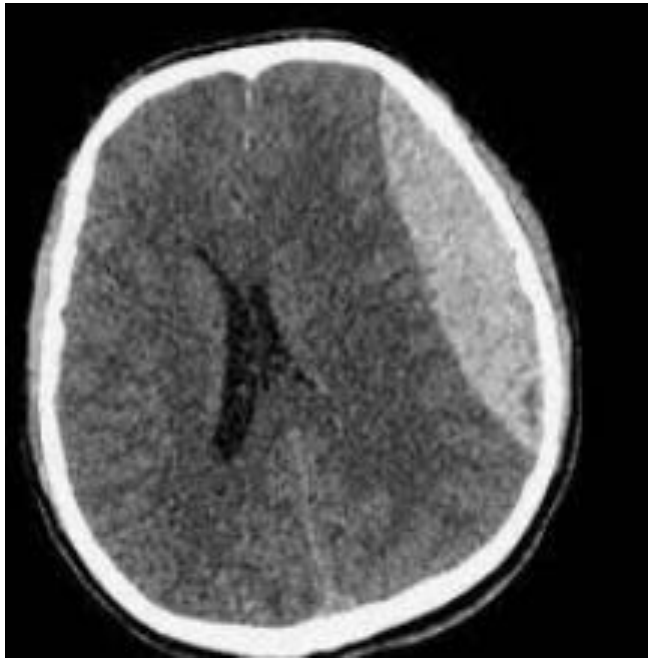
Peripheral neurological examination will give a guide to focal brain injury, spinal injury or peripheral nerve injury.

CLINICAL SIGNS

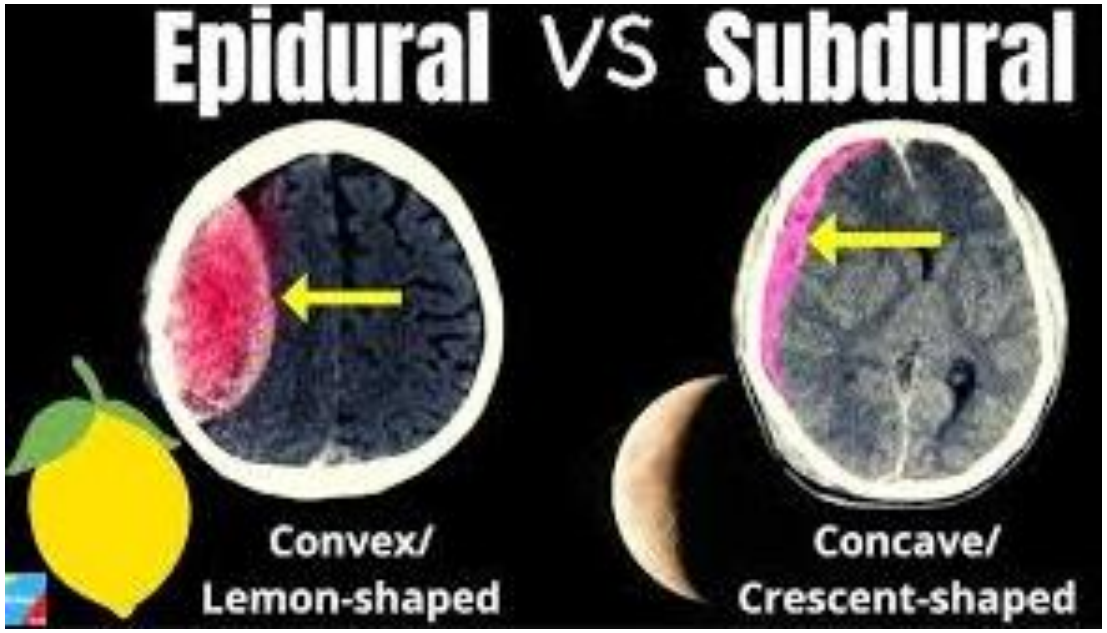


TYPES OF INJURIES



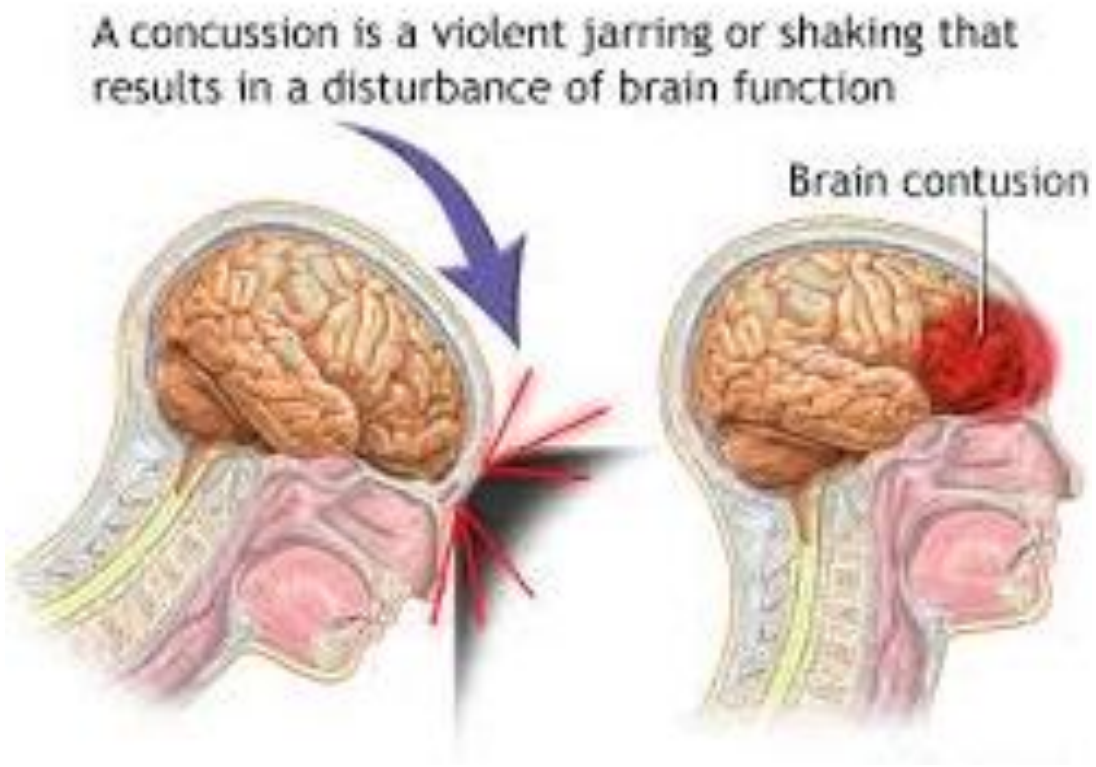


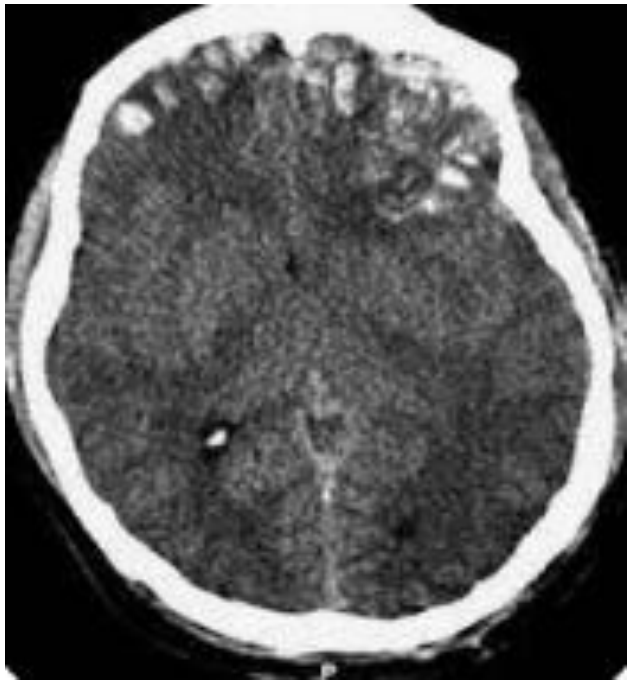
EPIDURAL VS SUBDURAL



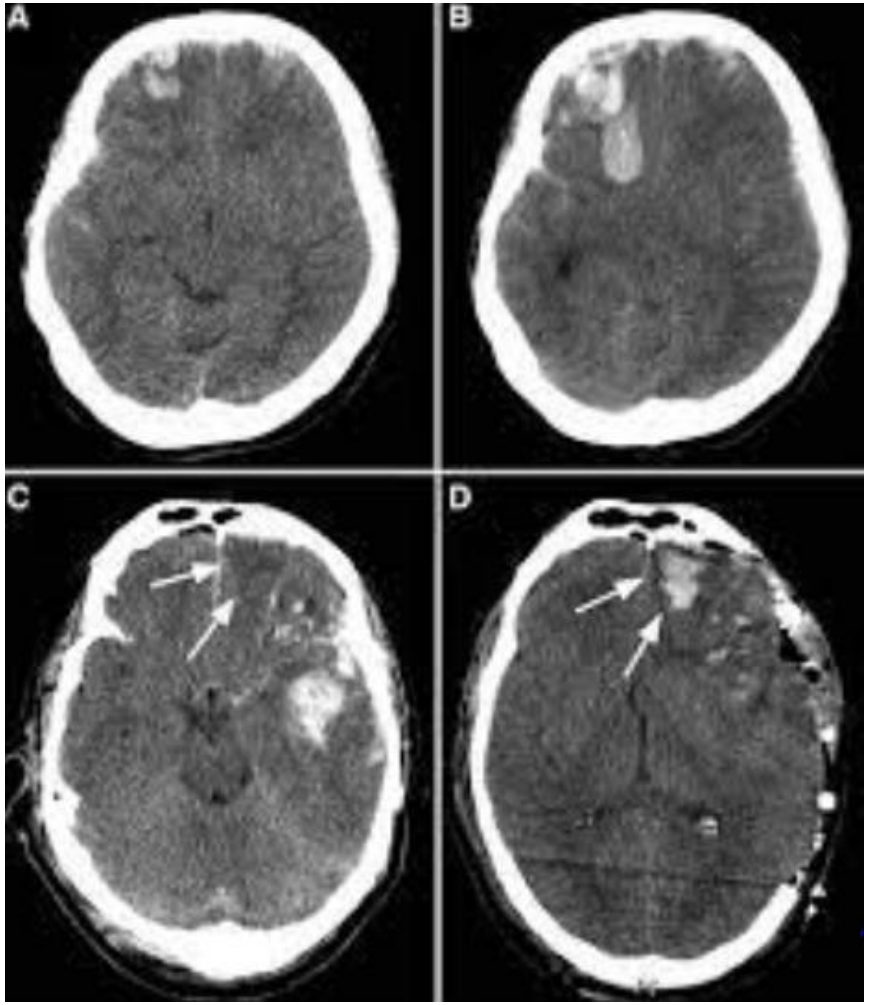
CEREBRAL CONTUSION

A cerebral contusion is bruising of brain



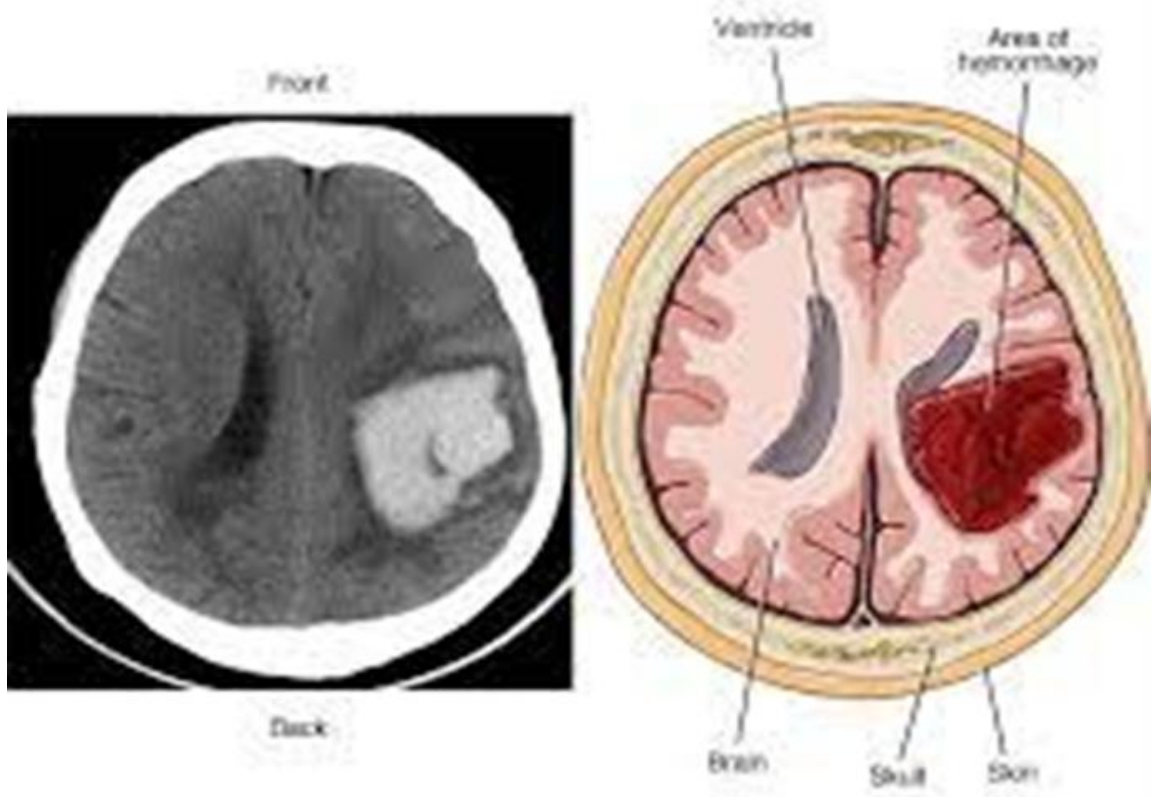


CEREBRAL CONTUSION

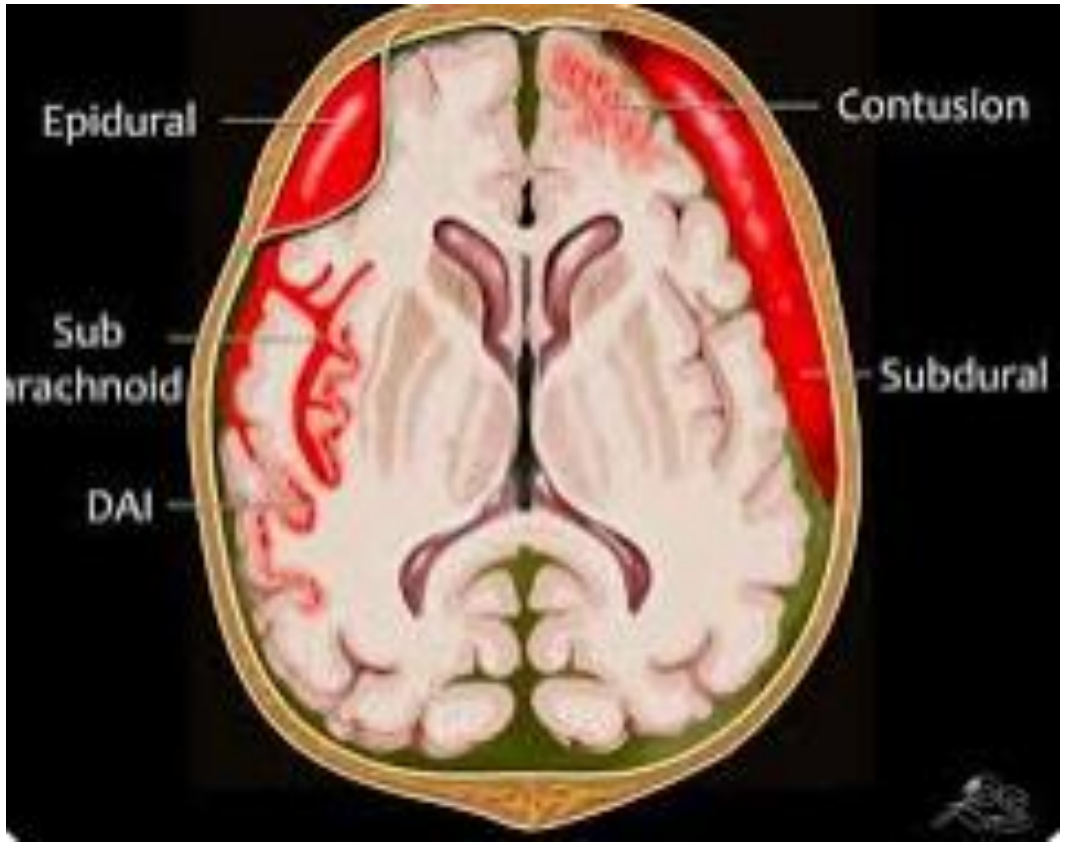


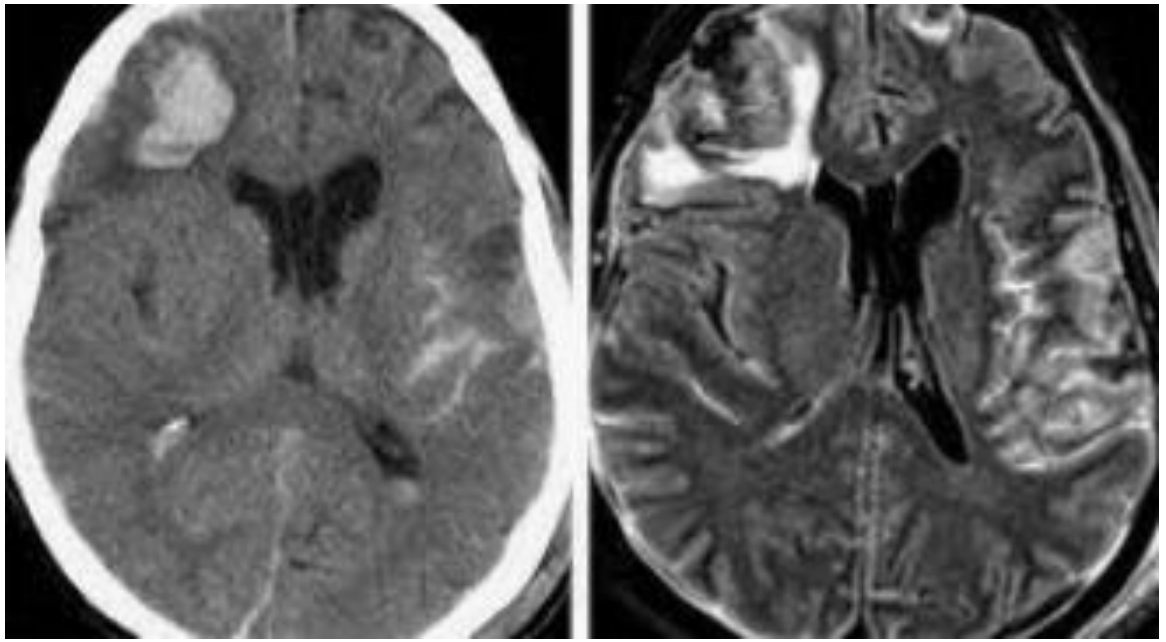
INTRACEREBRAL HEMORRHAGE

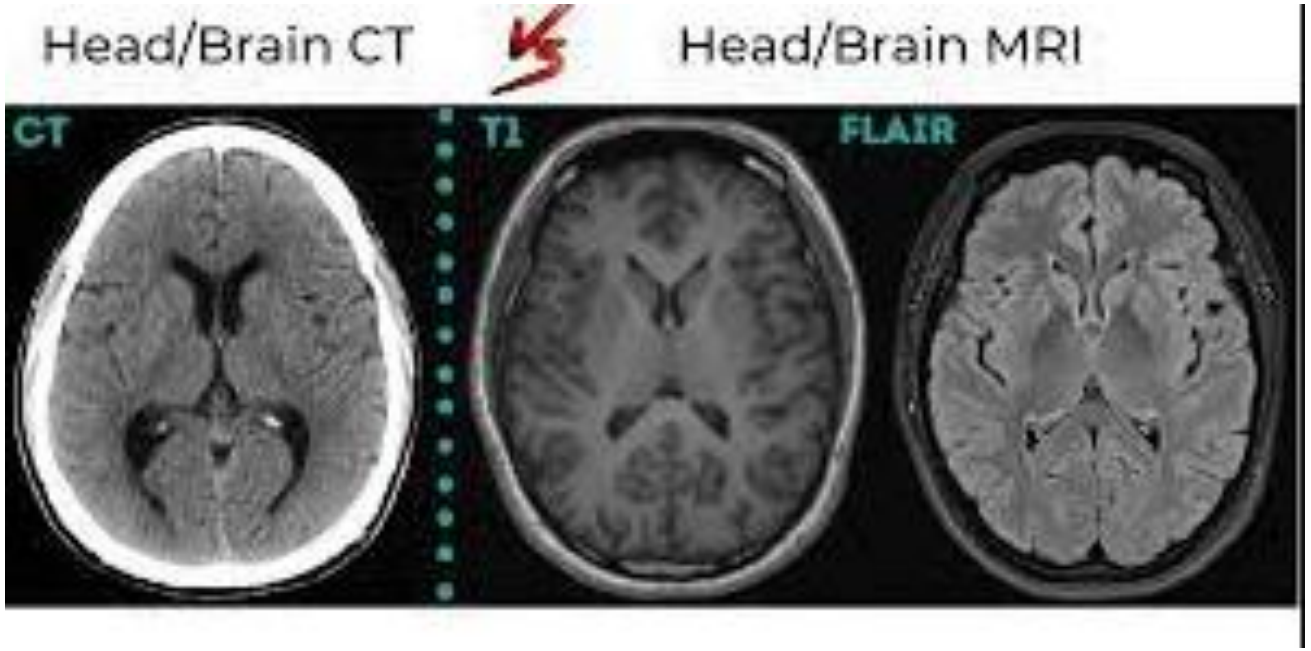
Intracerebral Hemorrhage: An intracerebral hemorrhage (ICH) describes bleeding within the brain tissue.



SUBARACHNOID HEMORRHAGE






Head/Brain CT
VS
Head/Brain MRI
CT
T1
FLAIR

SKULL FRACTURES