SEMINAR: TRAUMATIC HEAD INJURIES

34484 Pathology of the nervous system

Neurosurgery

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Subjects to discuss

- Concept
- Relevance
- Incidence
- Etiology
- Predisposing factors
- Brain lesions
- Evaluation and staging in the emergency room
- Intracranial hematomas
- Repeated concussion

What is a traumatic head injury or TBI?

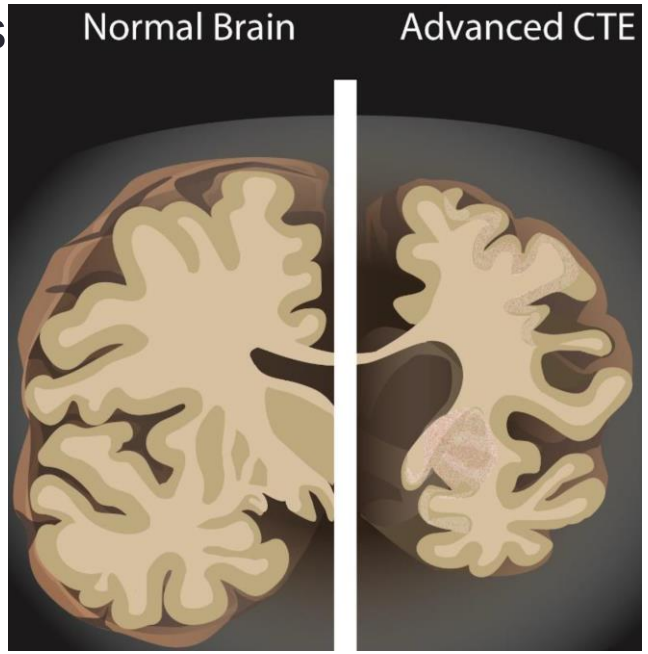
It is the result of the traumatic action on the brain and / or its coverings

REMEMBER?

What really matters is the damage to the central nervous system

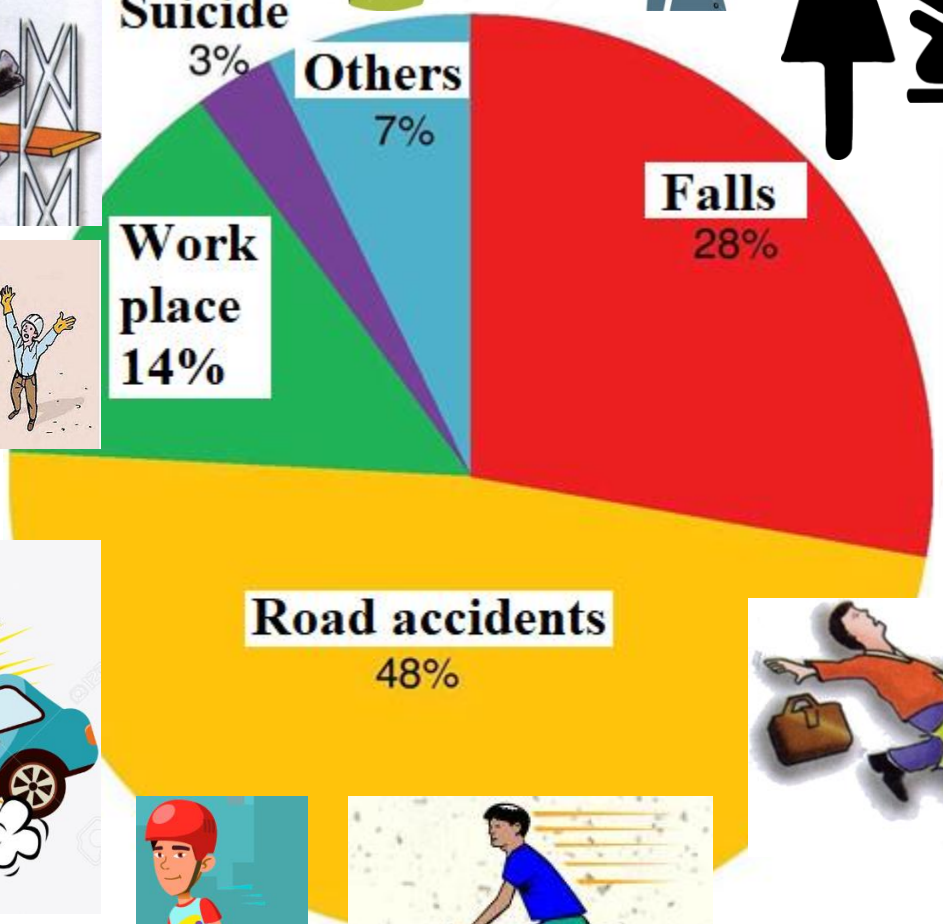
Traumatic brain injury importance

- **First cause of loss of consciousness in the general population**
- Mortality
  - Third cause of death in developed countries
  - Behind cardiovascular disease and cancer
  - First cause of death between 15-45 years
  - Cause of death in 70% of polytraumatized
- Sequelae
  - Very high among survivors
  - Some very serious
  - Common cause of epilepsy at 18-35 years
  - Possibility of long-term organic brain deterioration



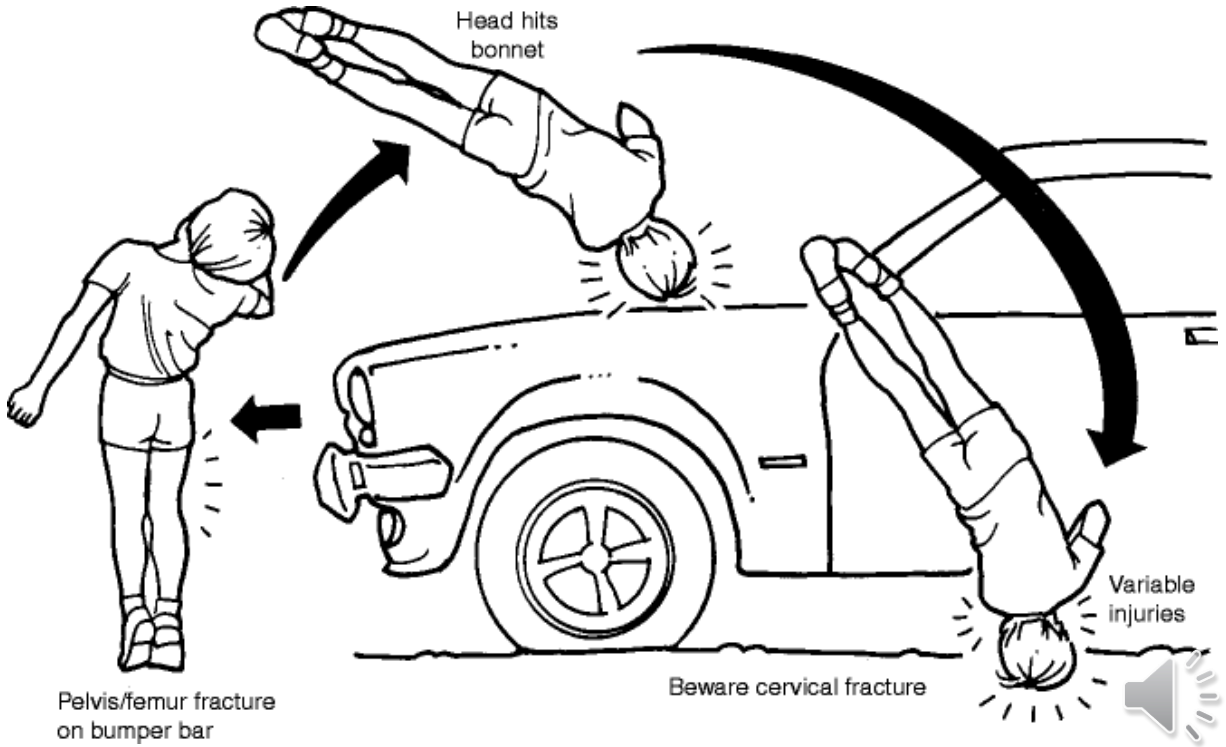
Etiology

REMEMBER?



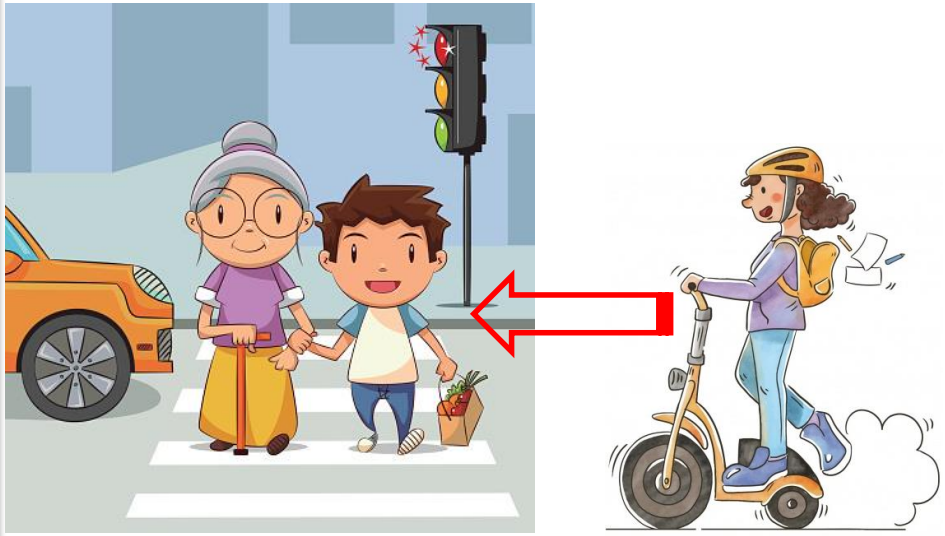
Pedestrians run over

- Injuries
  - 1st leg injury
  - 2nd head injury
- Pavement invasion
- Car or motorbike racing
- Pedestrians who do not respect traffic lights



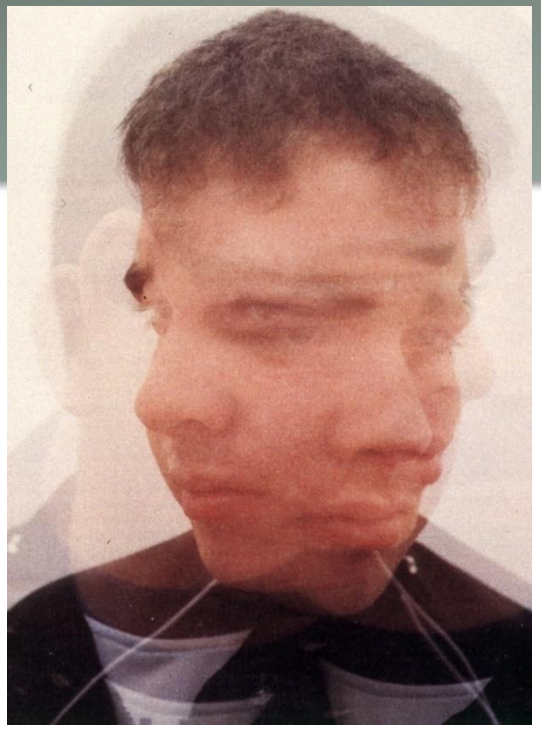
Bicycle falls: especially dangerous if NO helmet

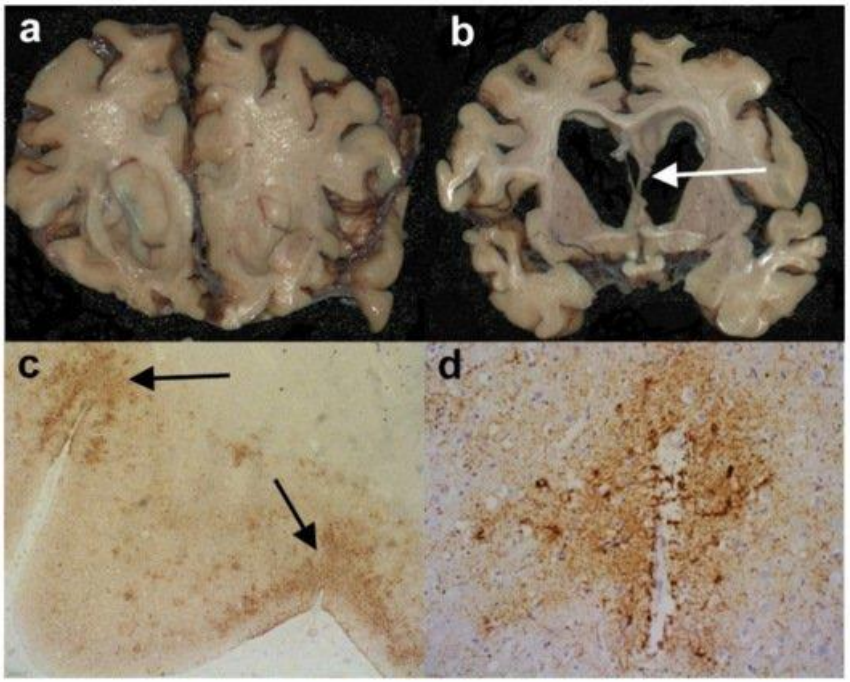
- Can even cause death
- Cervical spine injuries not uncommon
- New danger: electric scooters



Boxing

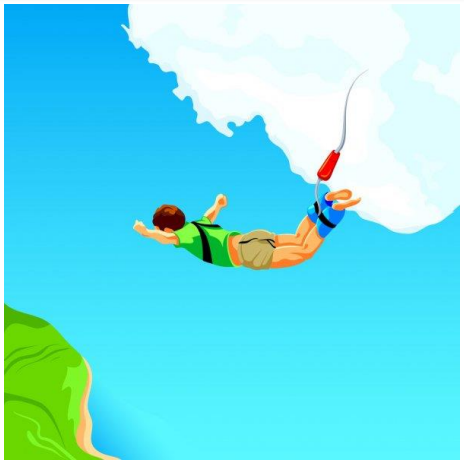
- Goal = concussion of opponent
- Over the years = brain damage with early dementia

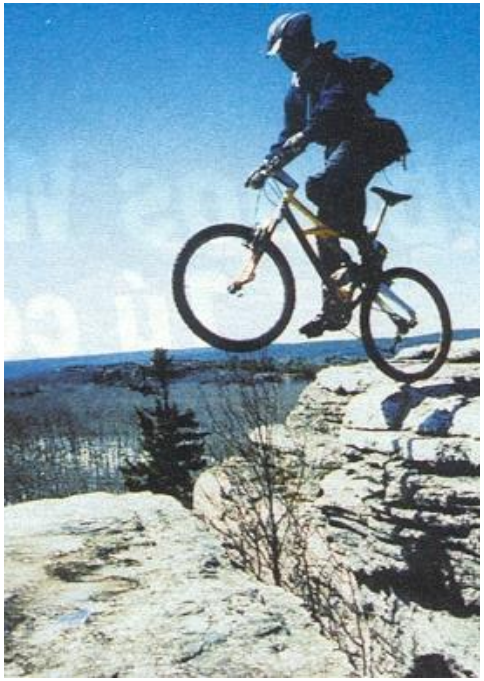


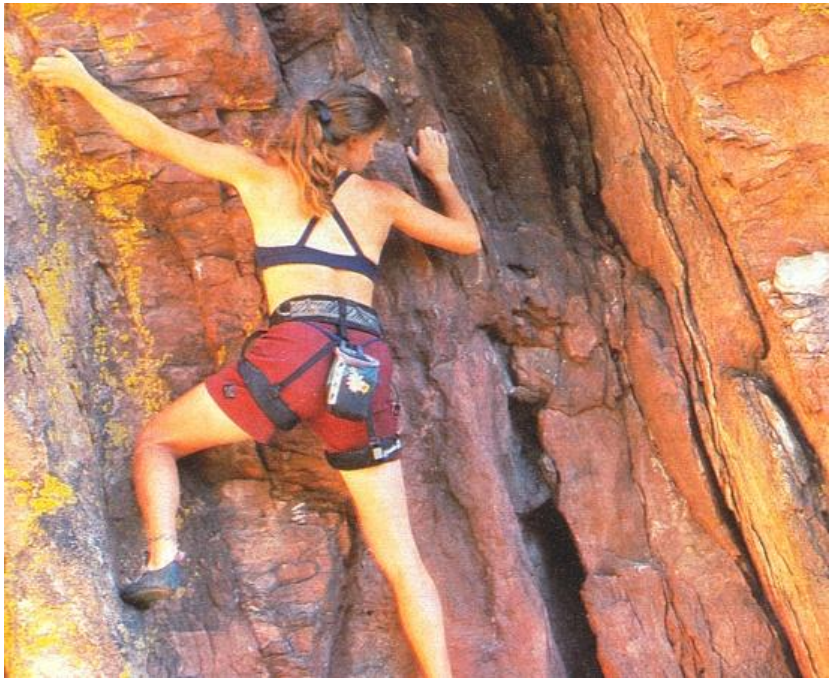


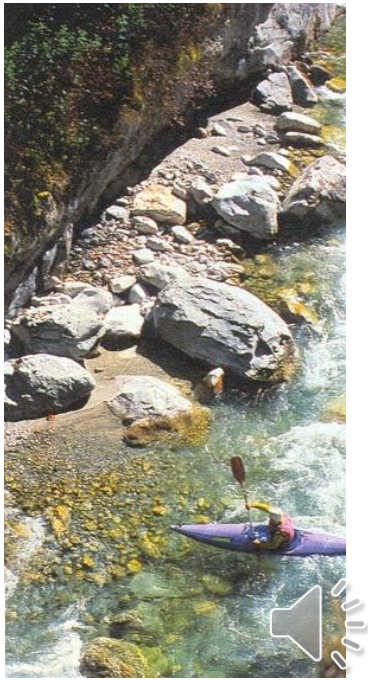
High-risk sports

- Risk often disregarded
- Repetitive brain “shaking” in bungee jumping not innocuous





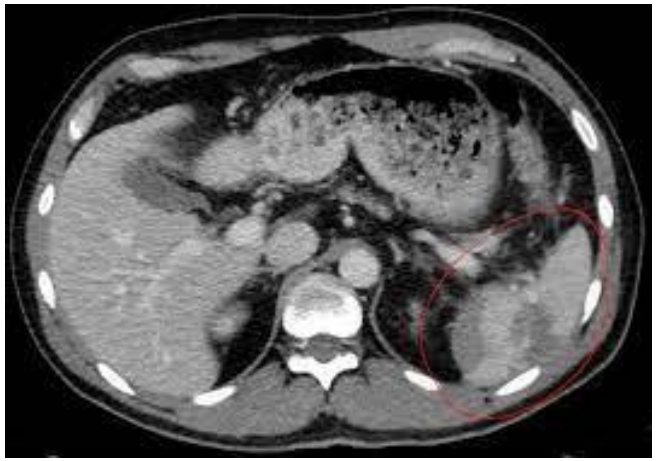


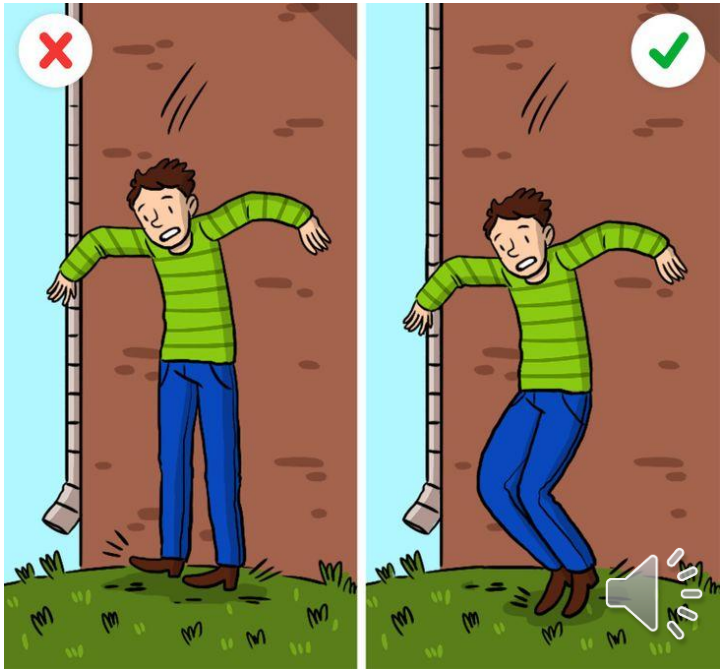


Casual falls: ↑frequent anti-coagulated and / or anti-platelet medication in elderly people

Falls from height

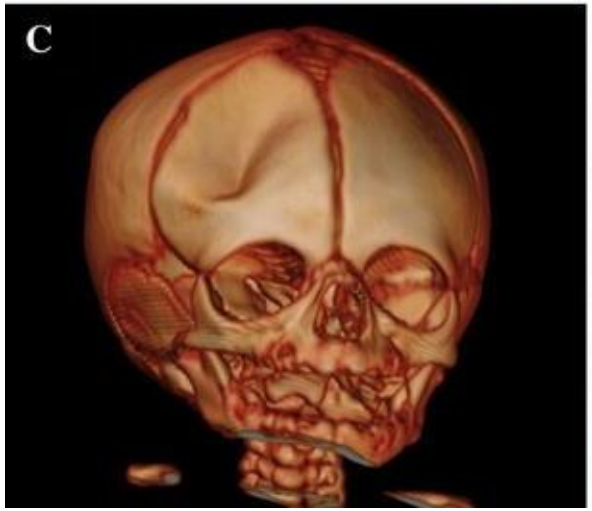
- Often internal organ laceration = massive in body blood loss
- Pelvic or femur fractures
- Spinal cord injuries
  - Heel & T_{11}-L_1 compression fractures





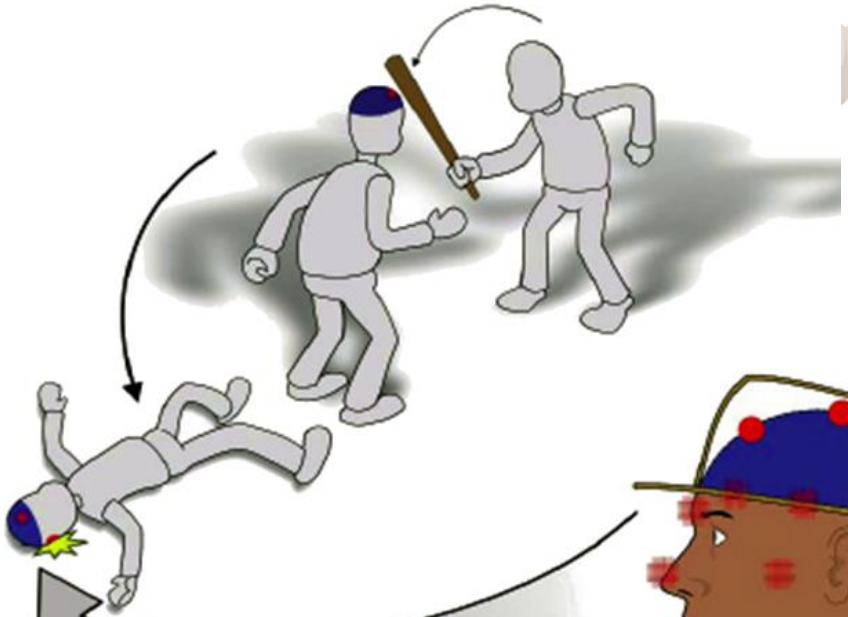
Falls from diaper changing station: toddlers 2-6 months old

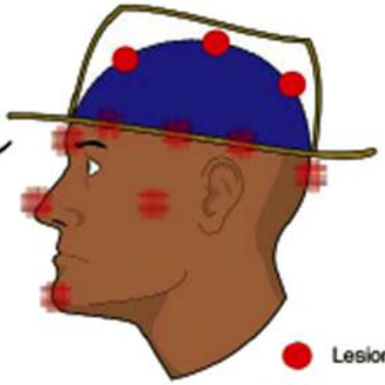
- Skull cartilaginous = brain contusion
  Prevention: design change in diaper changing station



Assaults

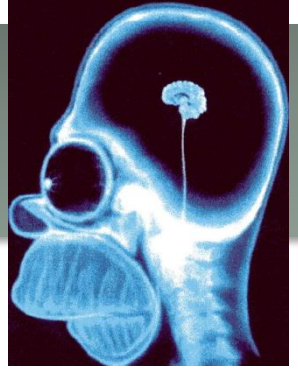
- Often accompanied by other injuries



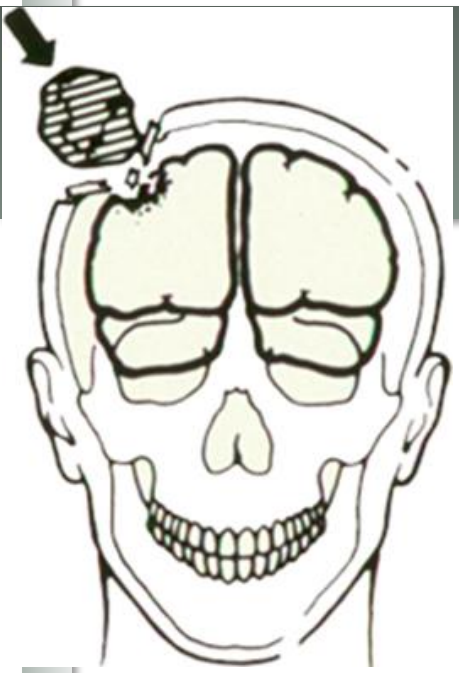


Predisposing factors

- Traumatic habitus
- Alcohol, drugs
- Nighttime activities
- Age
  - ⇑ in young & old people
- Sex: ⇑ frequent in ♂
  - Even small boys!
- Environmental conditions
  - Weather
  - Road condition
  - Other accidents in the road (people get distracted while passing by)

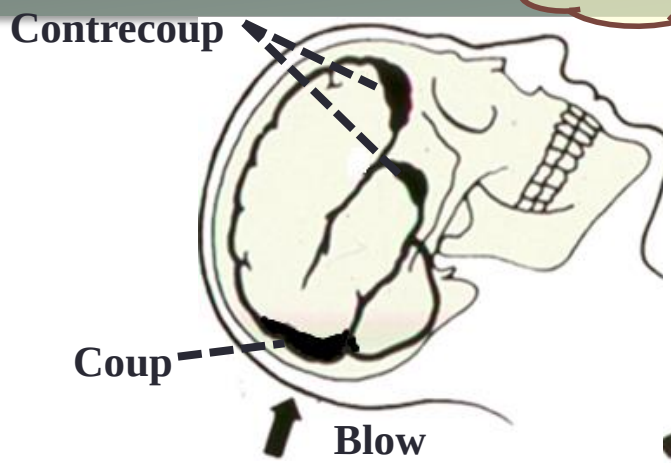


Basic mechanisms head injuries

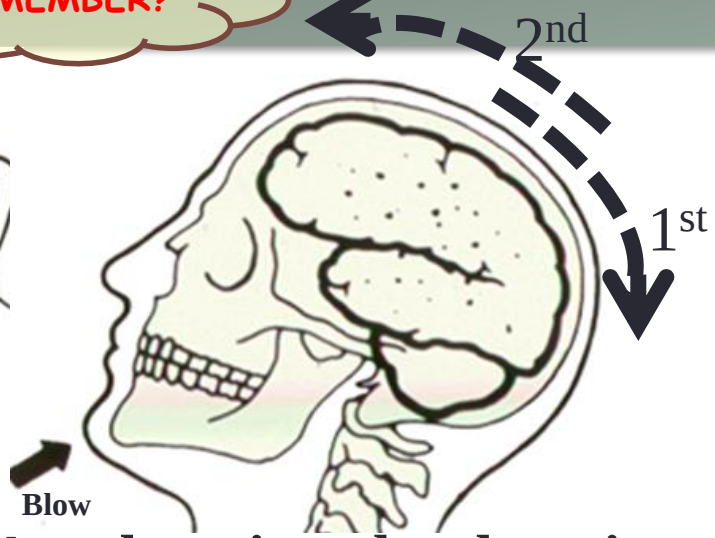


Collision

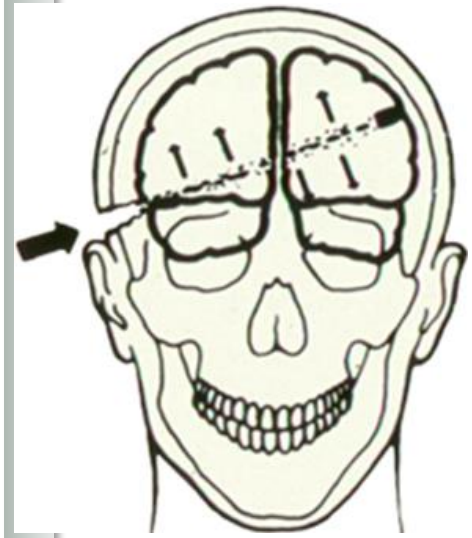
REMEMBER?



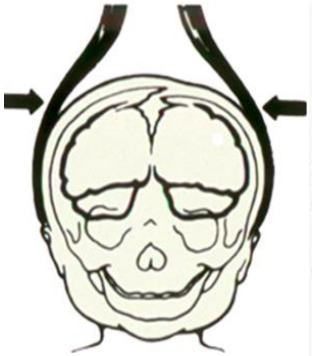
Coup-contrecoup

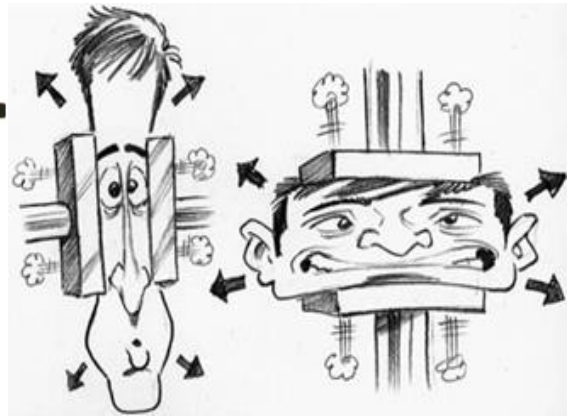


Acceleration-deceleration

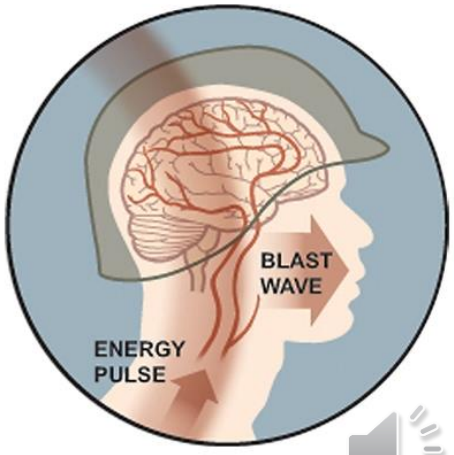


Perforation





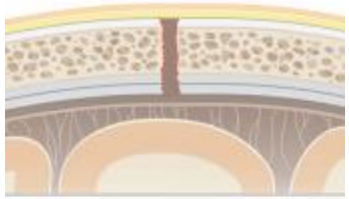
Compression

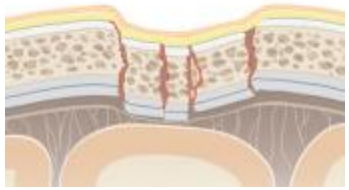


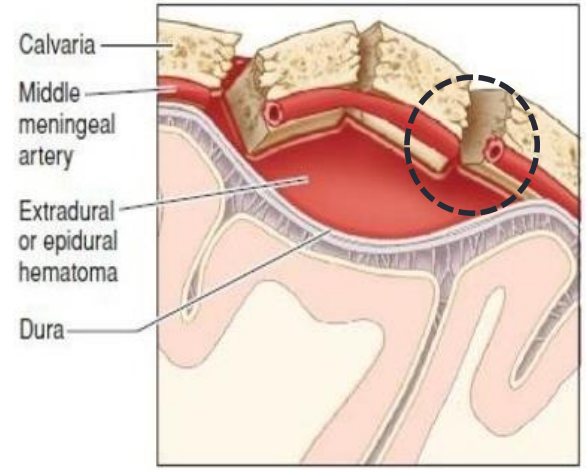
Blast injury

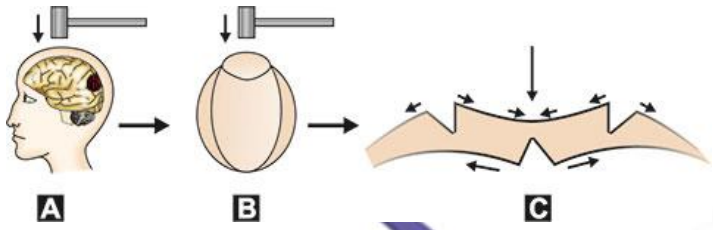
Direct hit injury = inelastic collision = skull fractures

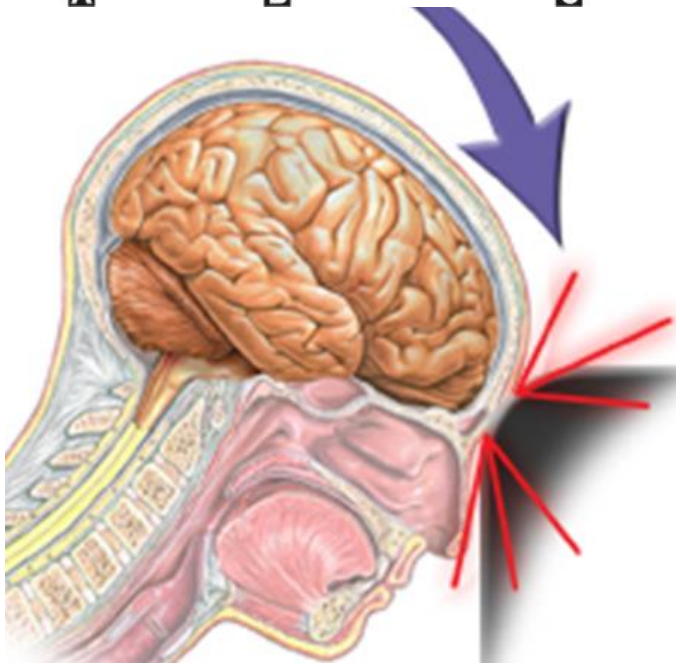
- Brain contusion possible
- Bone fragments can rupture meningeal arteries

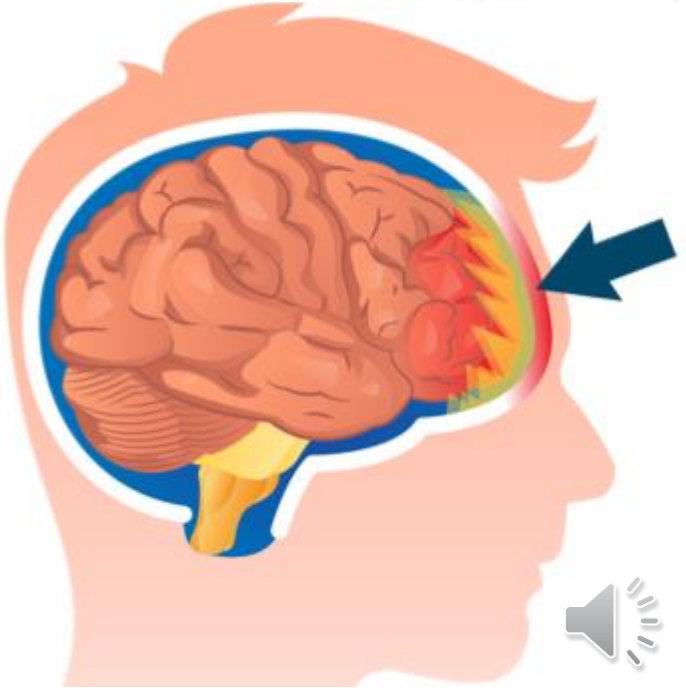






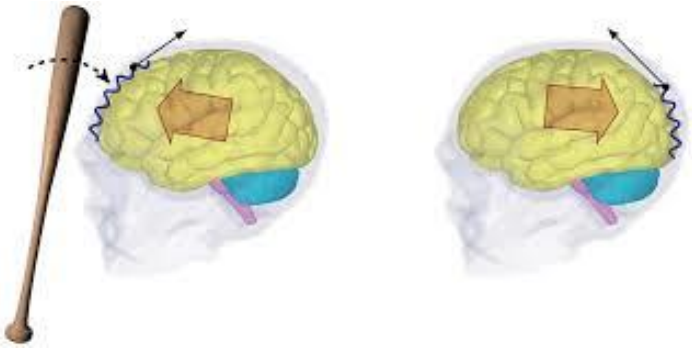


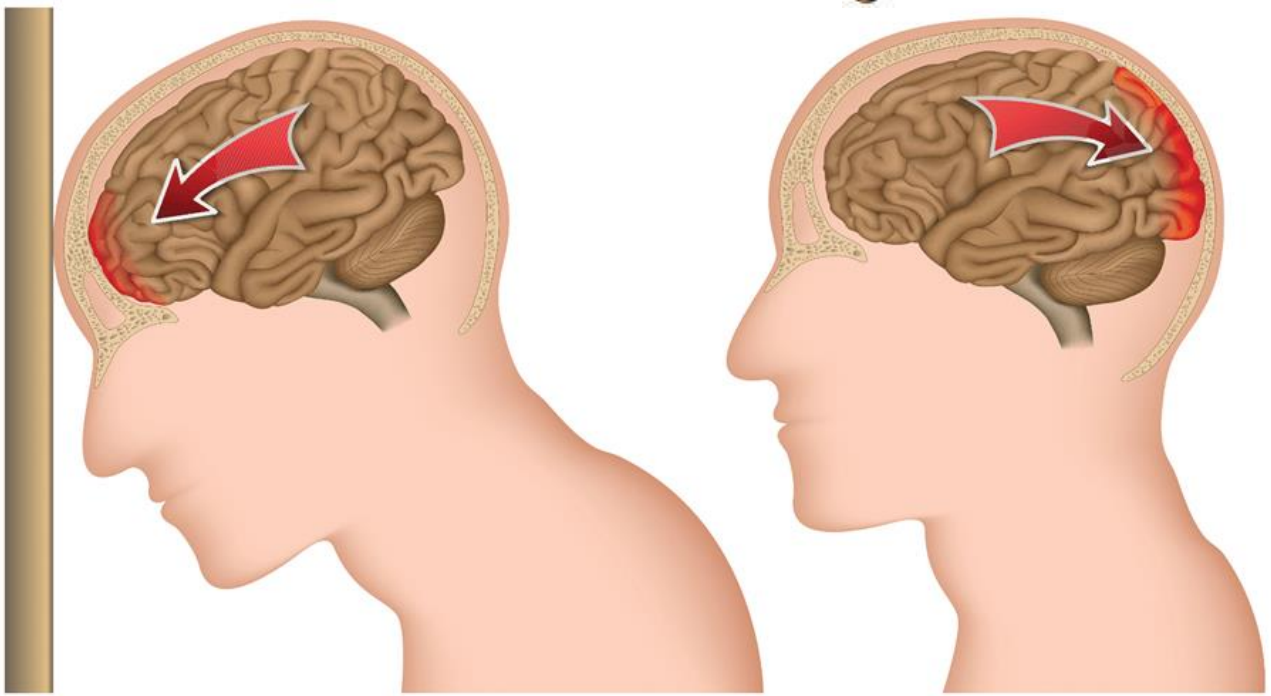




Coup & contrecoup injury = elastic collision = brain injuries

- No skull fractures
- Brain contusion
- More extensive brain damages



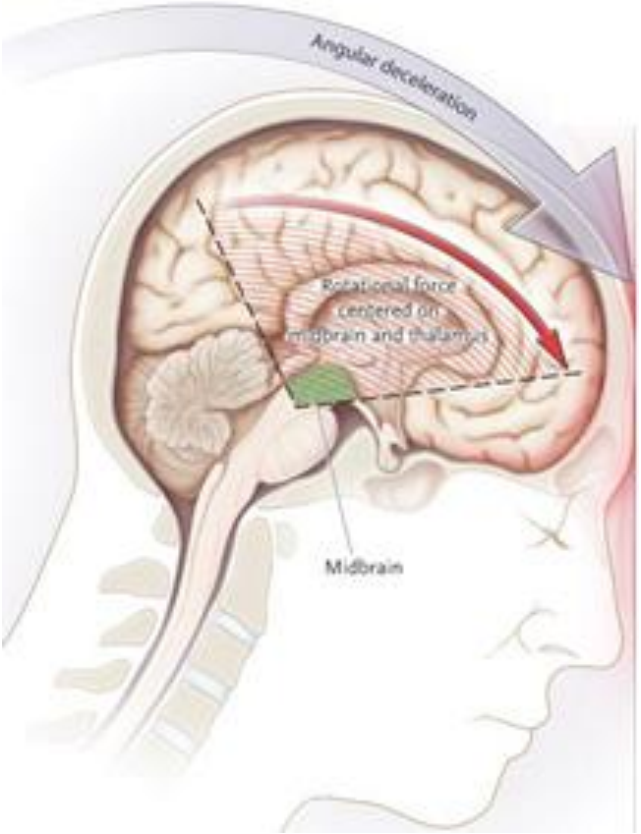


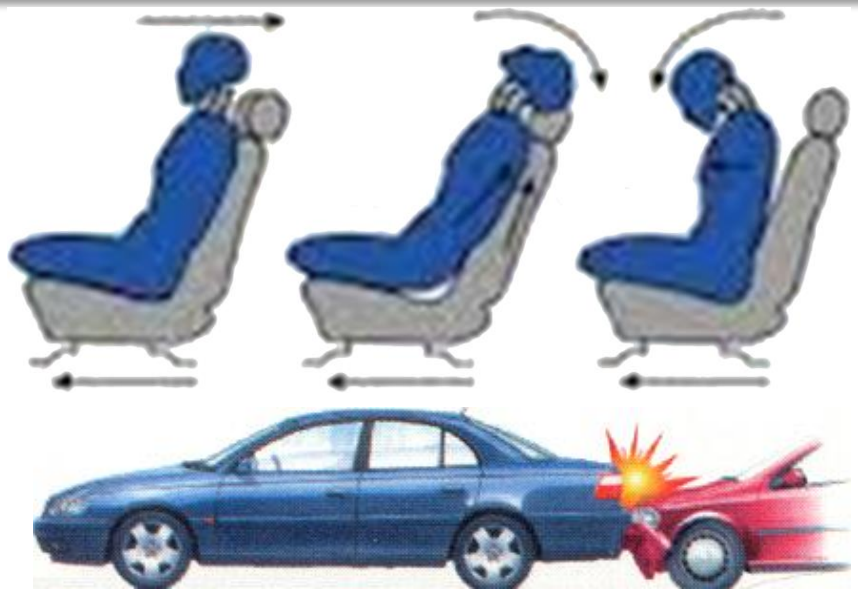
1. Primary Impact - Coup
The brain strikes the skull on the side of impact.

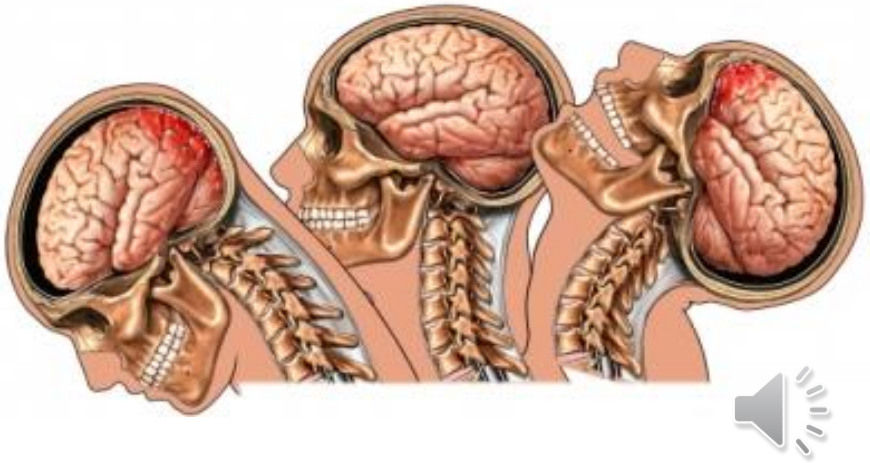
2. Secondary Impact -
Contrecoup Impact posterior area of skull.

Whiplash flexion-extension injury

- Brain stem suddenly shocked
- Accompanied by cervical spinal column/cord injuries

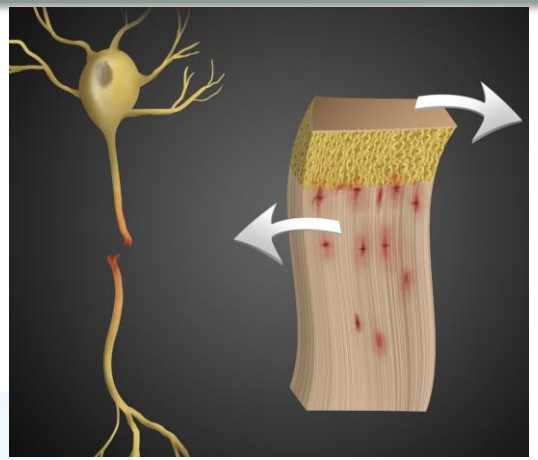


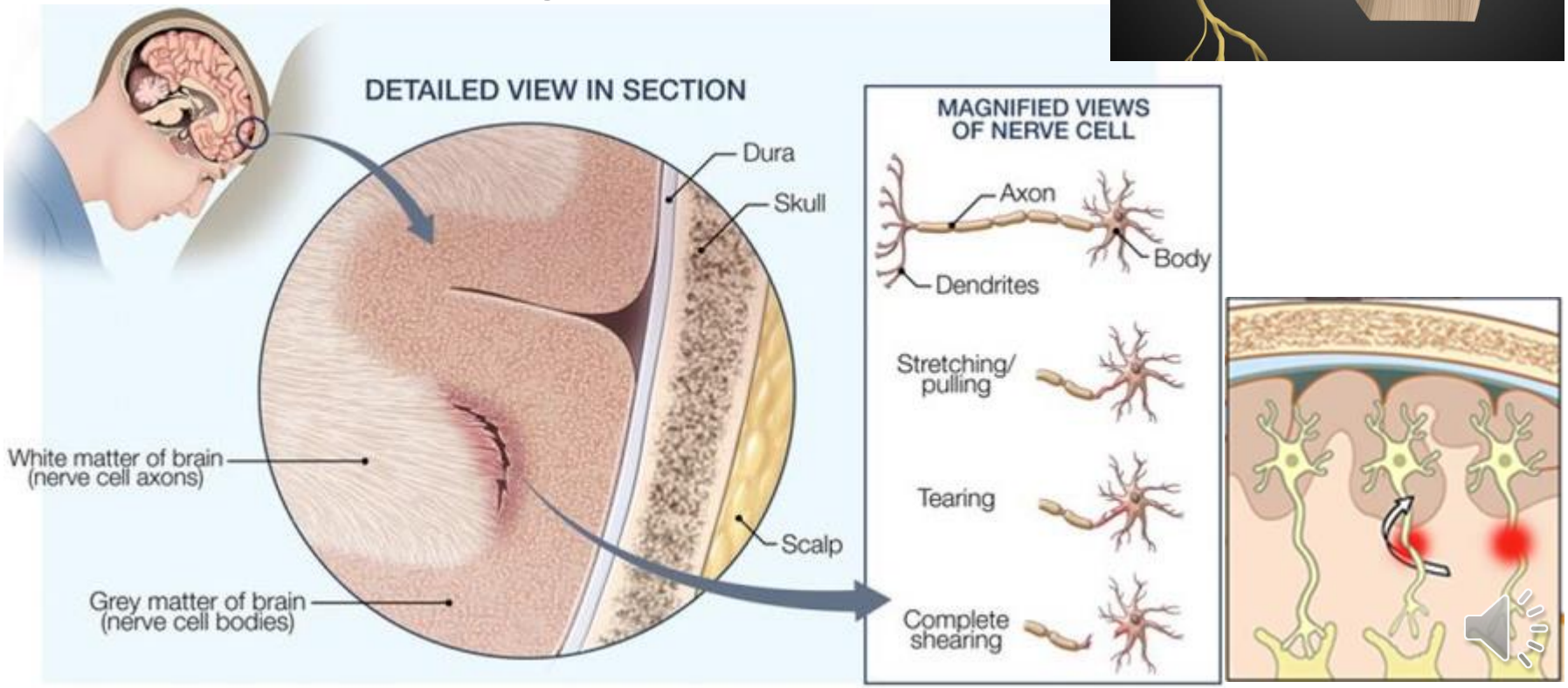




Diffuse axonal injury (1)

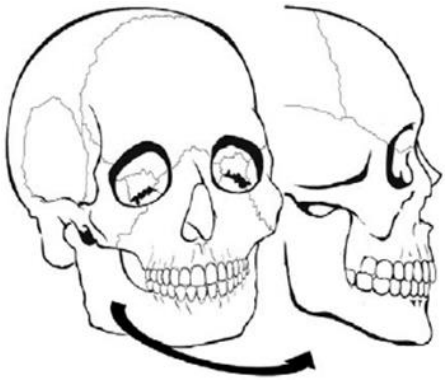
- Shear between white & grey matter = brain decortication
- Minor lesions on CT scan & MRI
- Cause of chronic vegetative status

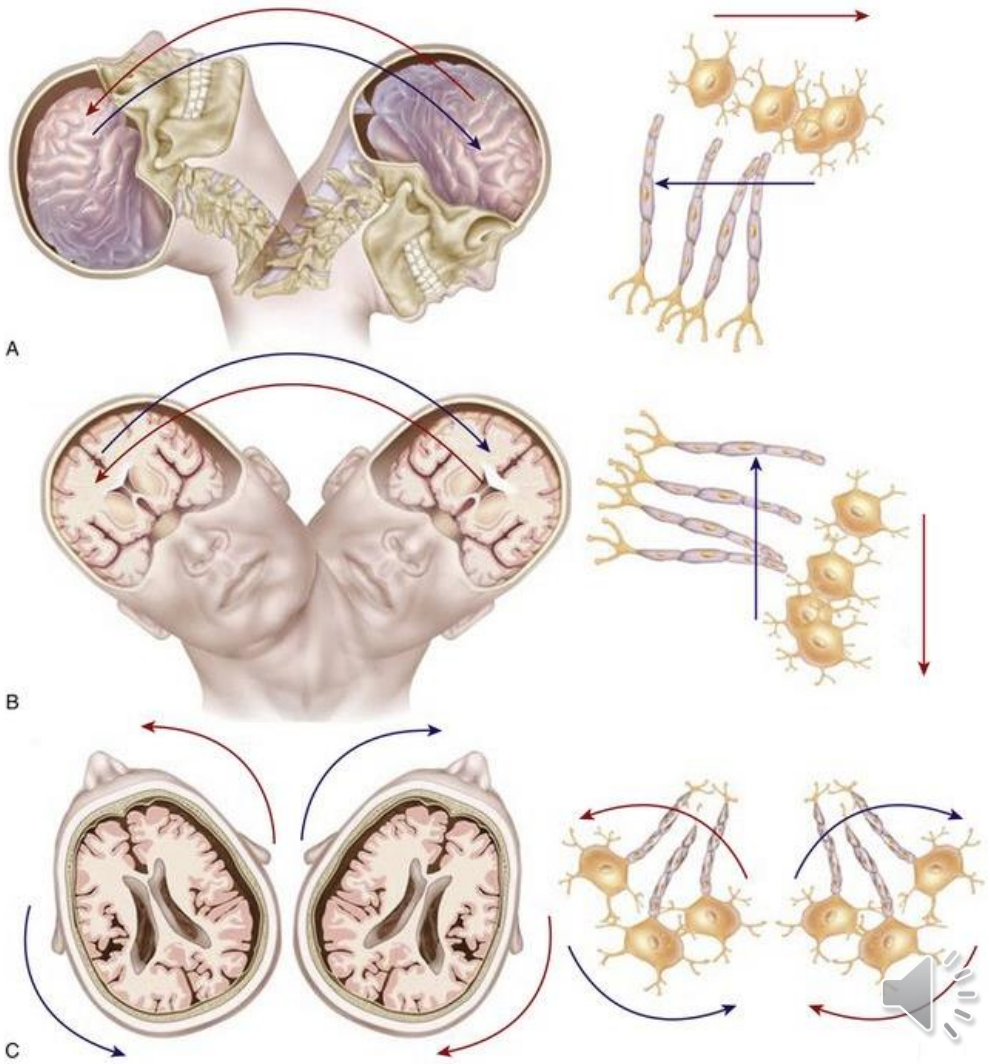




Diffuse axonal injury (2)

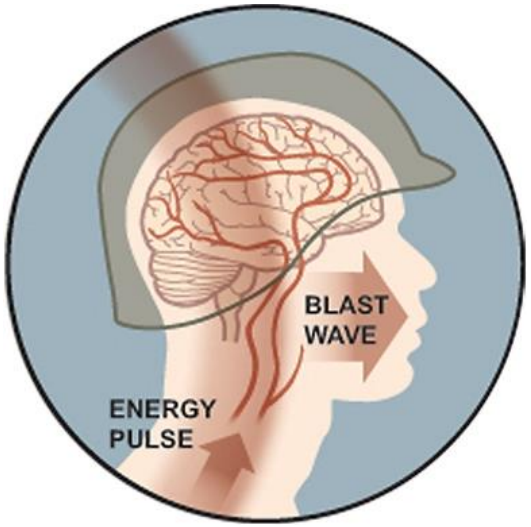
- Several modes of action

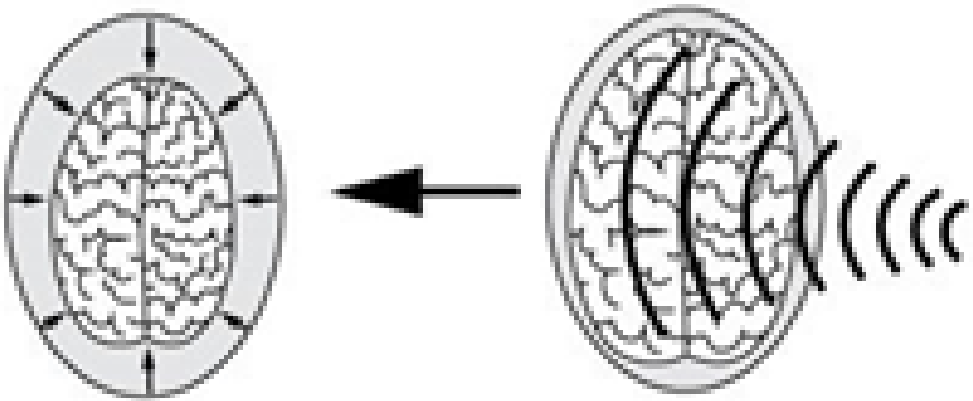


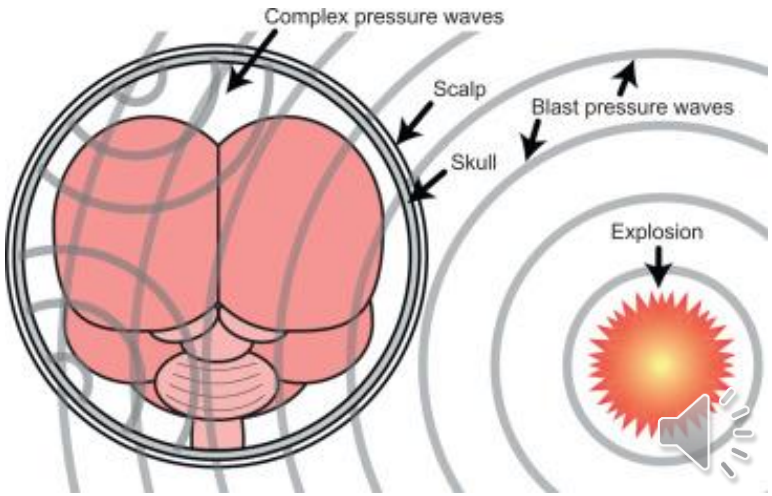


Brain blast injuries

- Due to pressure shock waves
- Common in military & terrorists attacks



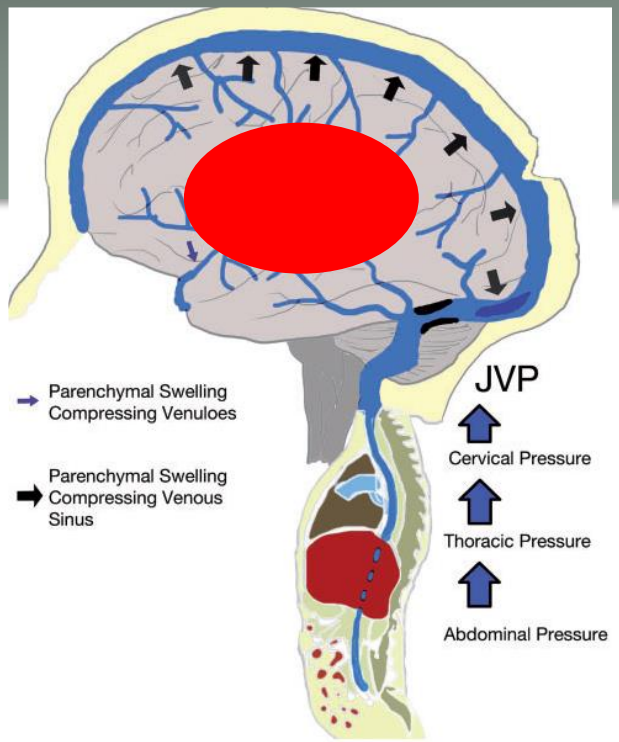


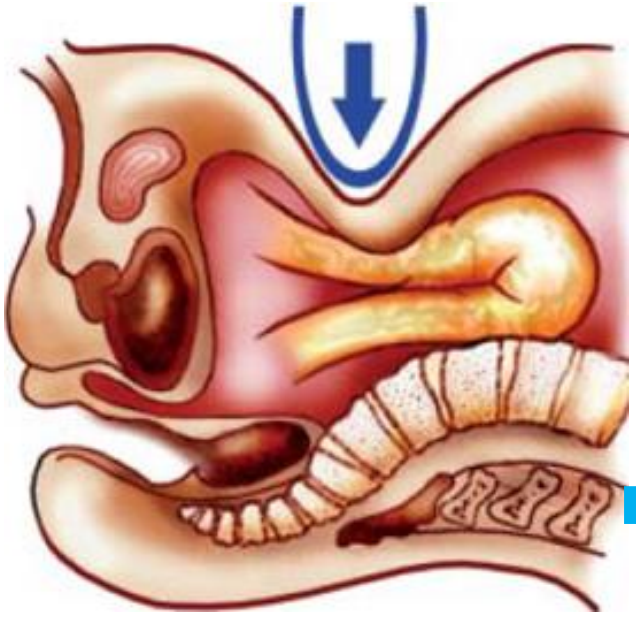


The brain is compressed inside the skull

Due to thoraco-abdominal compression

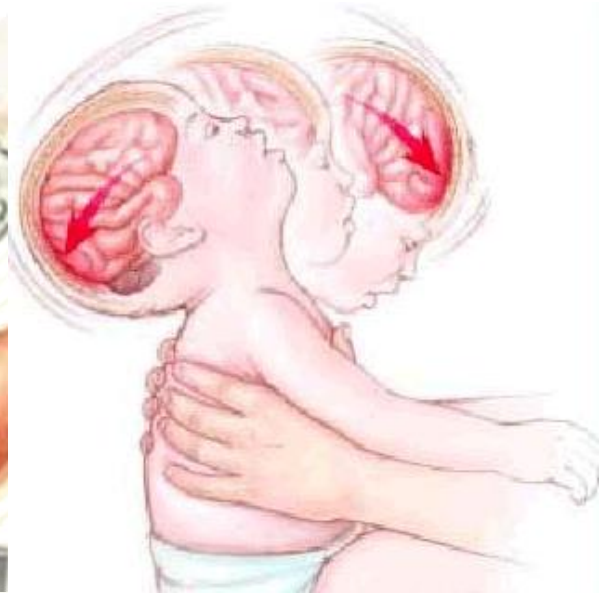
- In building collapses
- Head bleeding often AFTER the patient is freed from the rubble

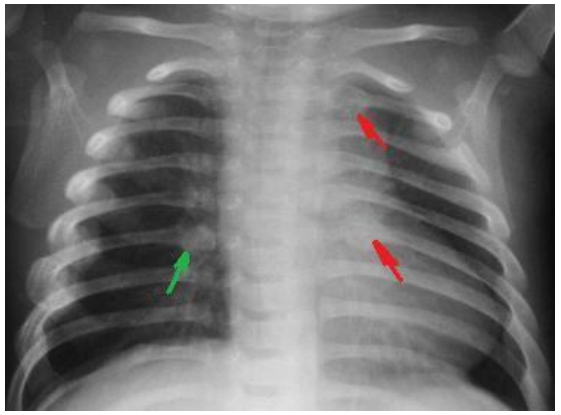




Child abuse: shaken baby syndrome

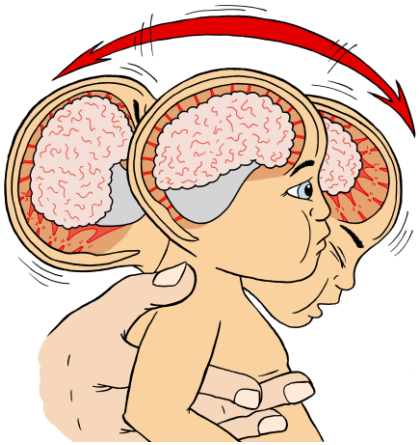
- Suspicion
  - Multiple or repetitive injuries
  - Partially consolidated fractures
- Usually subdural haematomas
- Diffuse axonal injury possible

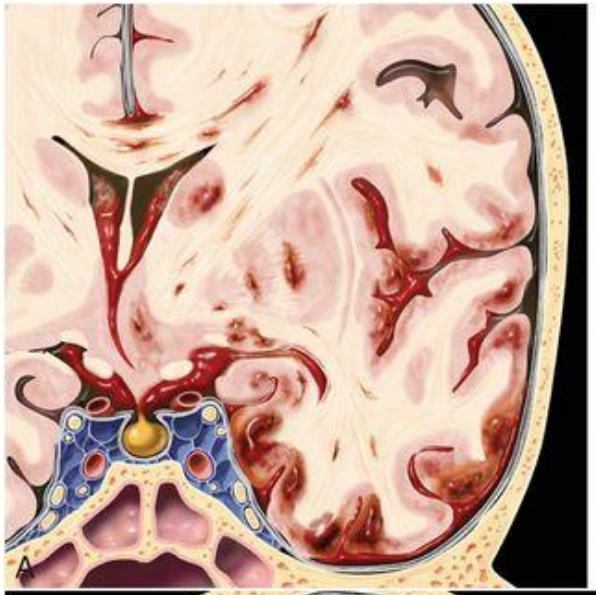


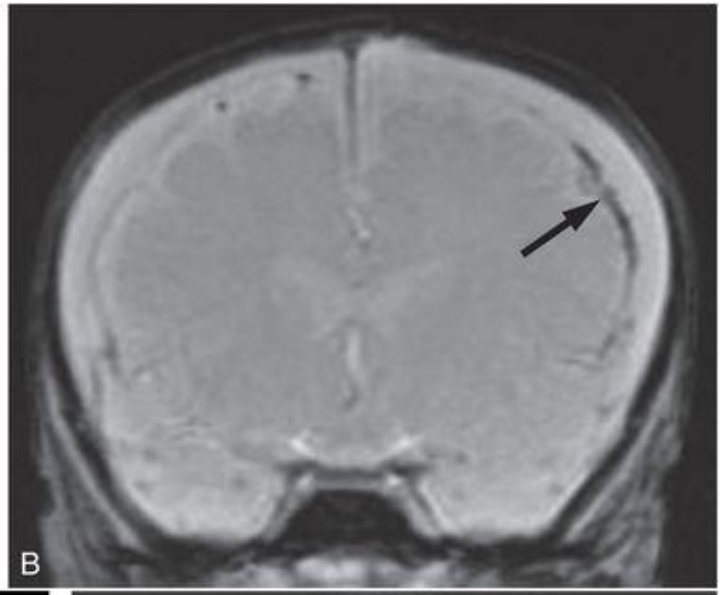


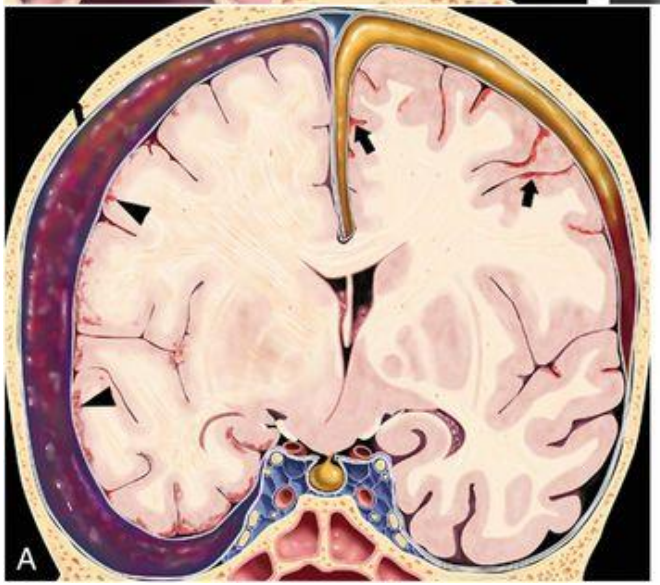
Child abuse syndrome

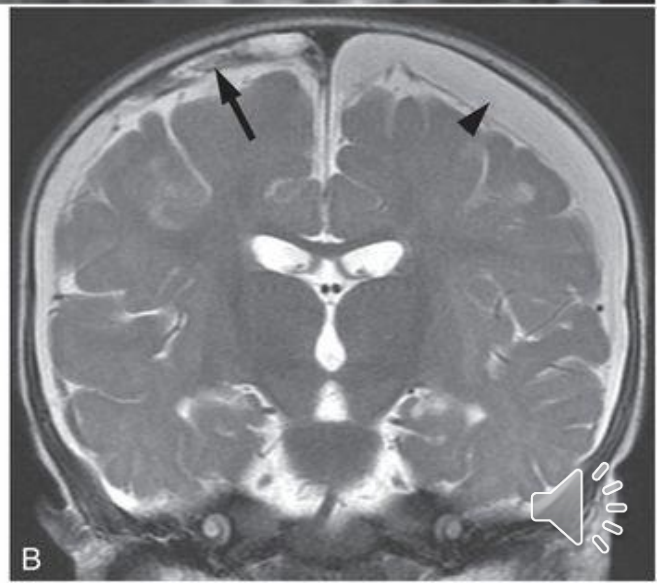
- Subdural hematoma often bilateral
- Areas of contusion-small brain haemorrhages





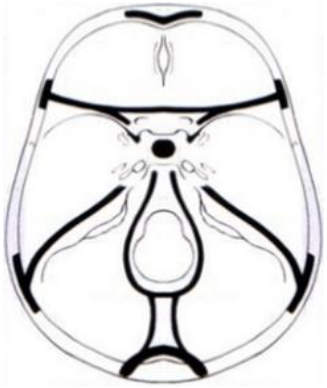


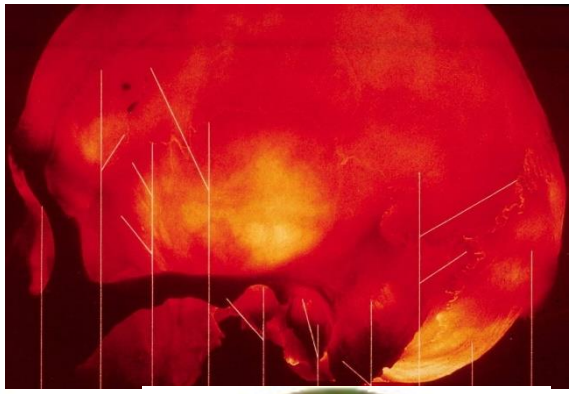


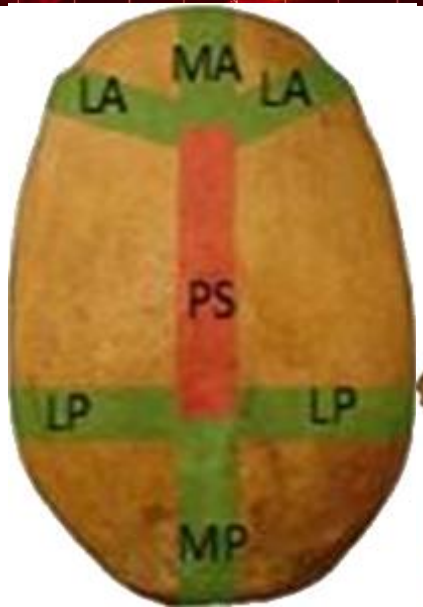


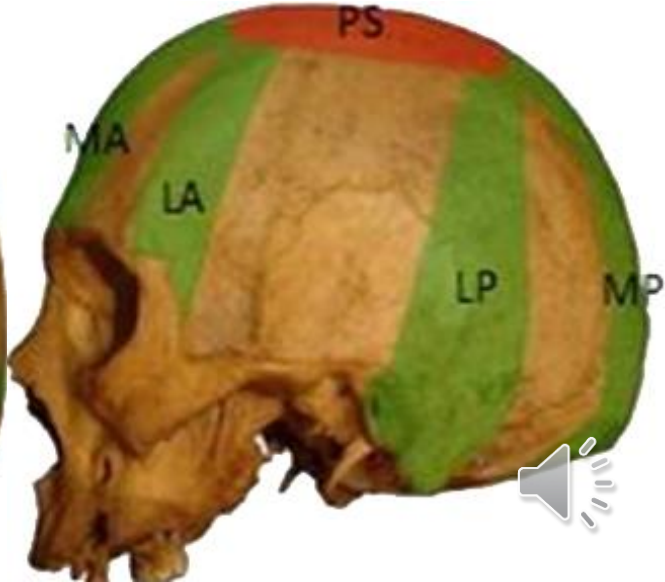
Skull buttresses

- Dictate the direction of fractures and the likelihood of skull sinking or penetration



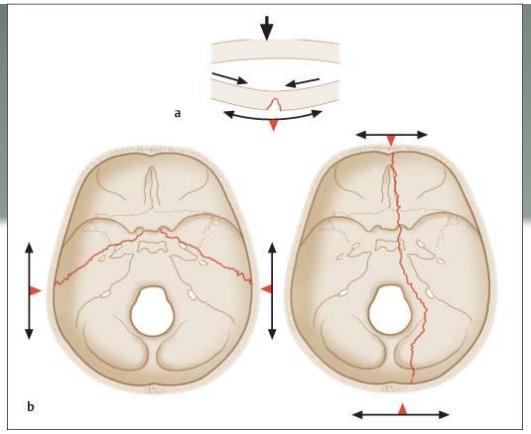


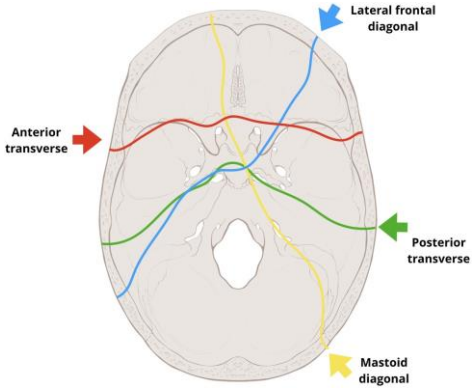


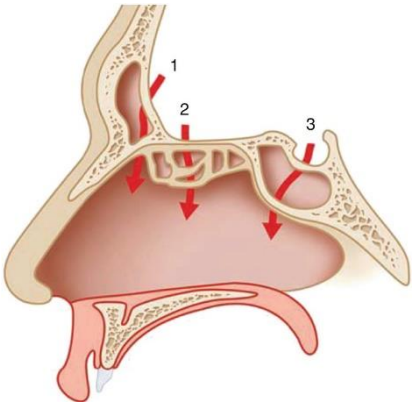


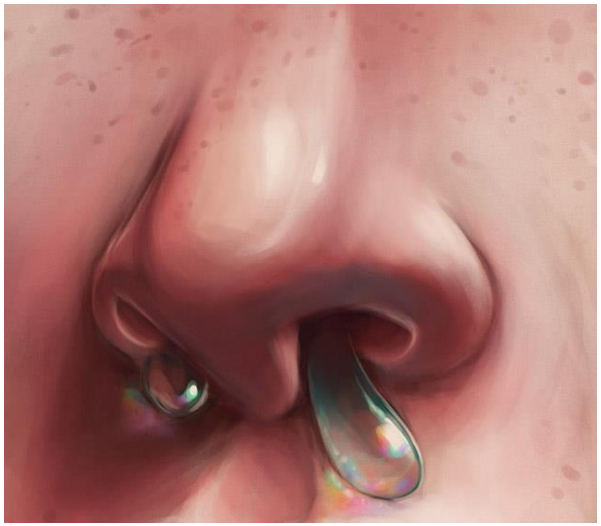
Skull base fractures

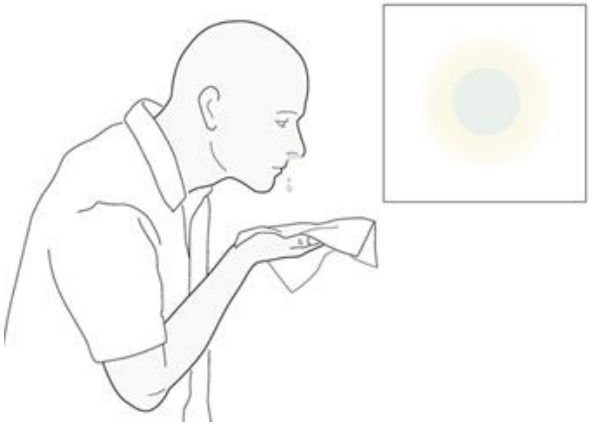
- Danger = bacterial meningitis
- CSF leak usually resolves spontaneously
- Surgery if persistent CSF leak or bacterial meningitis

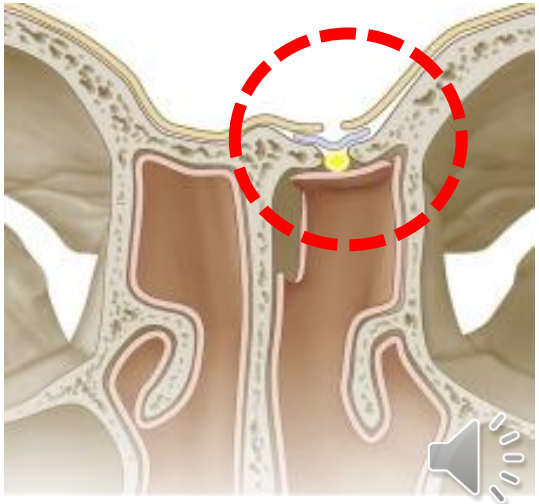




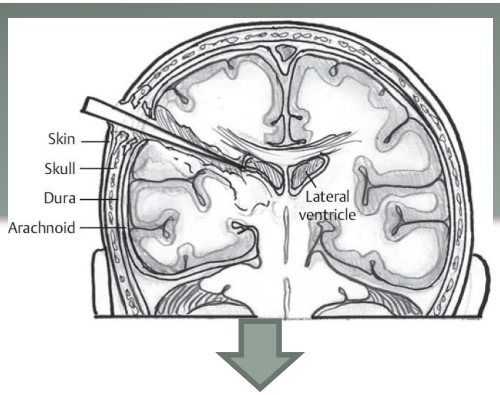




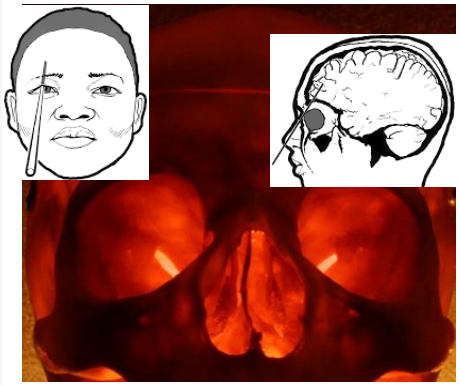


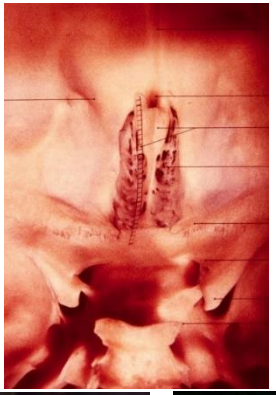


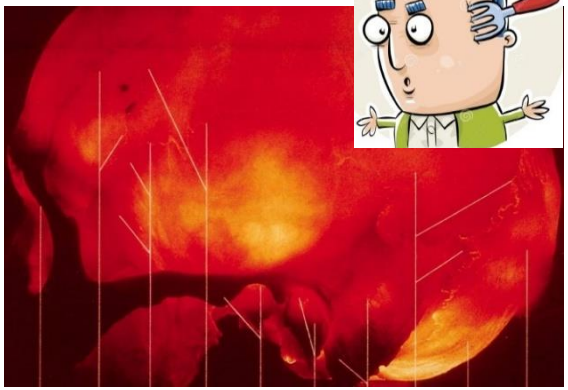
Stab wounds: ↑ frequent where skull is thinner

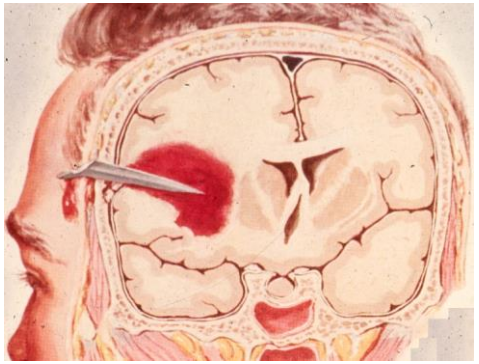


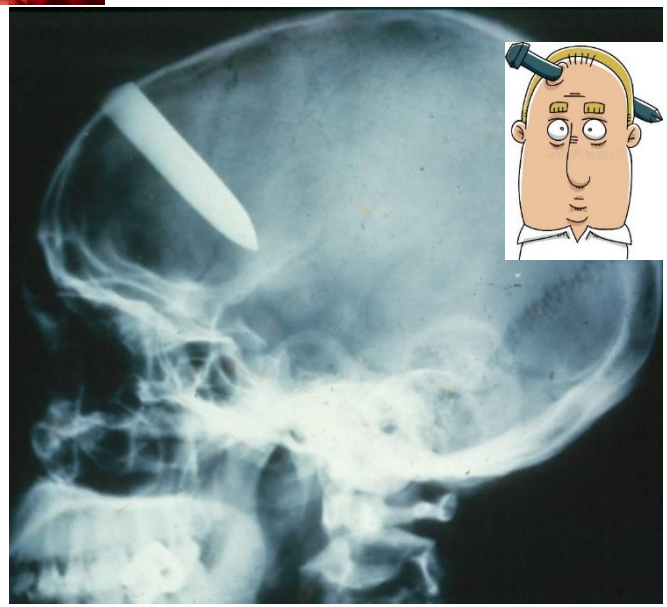
- Possible intracranial vessel laceration

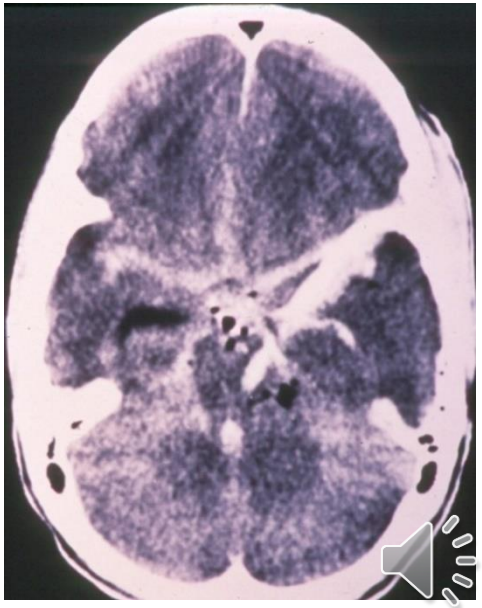






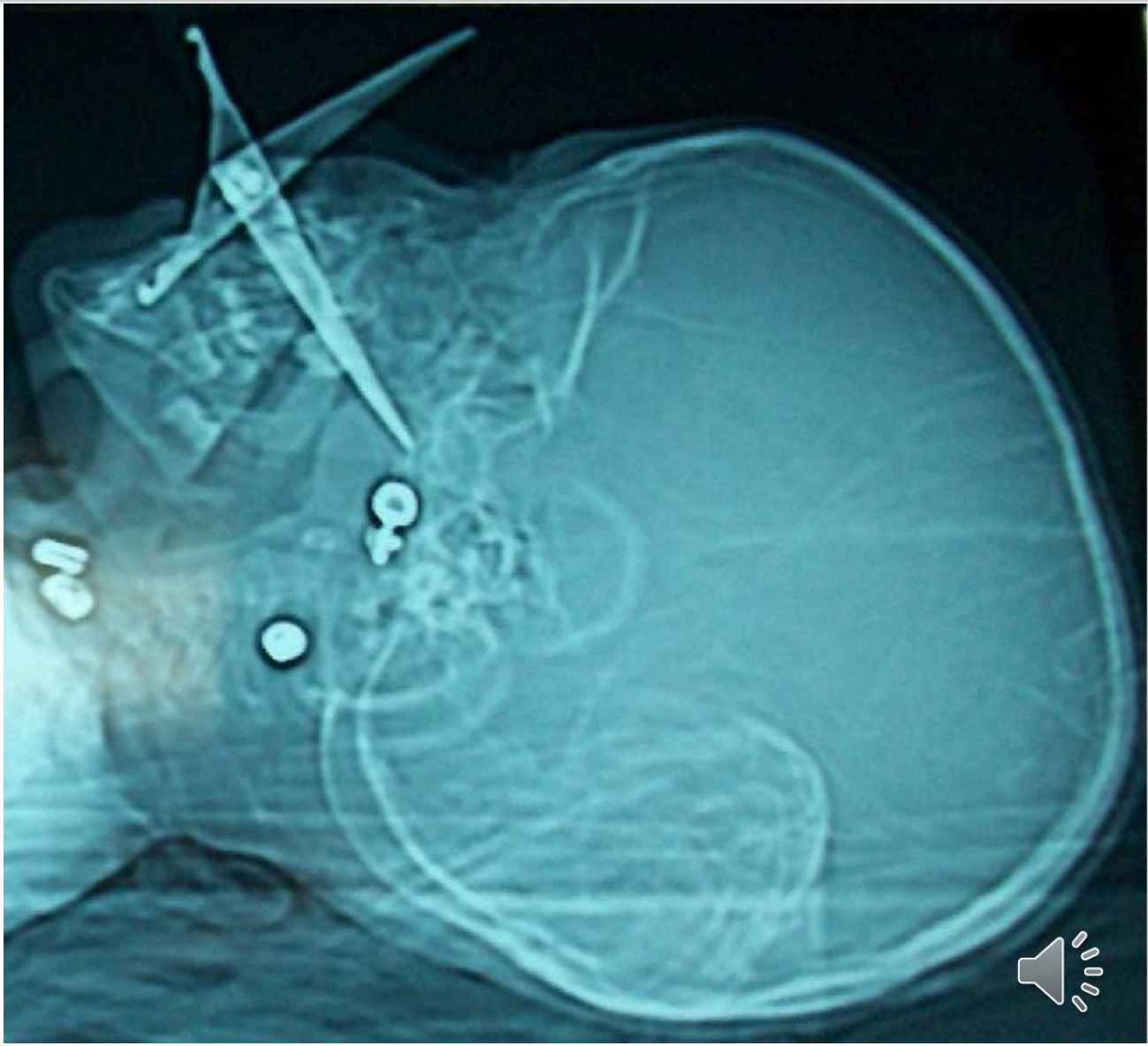






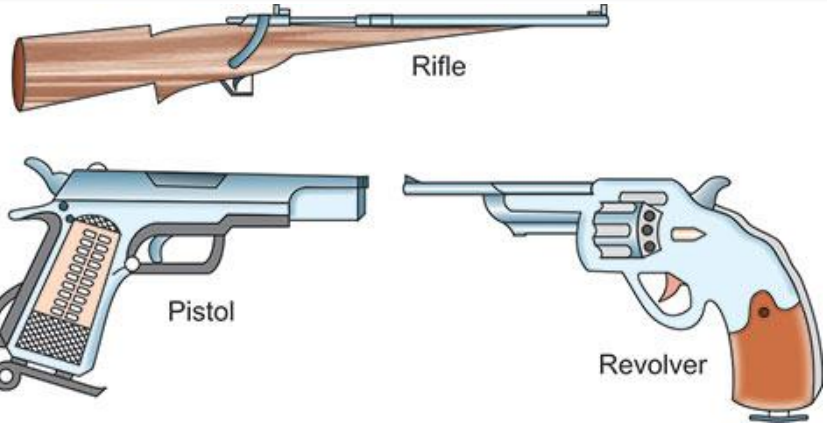
Stab wounds: skull base

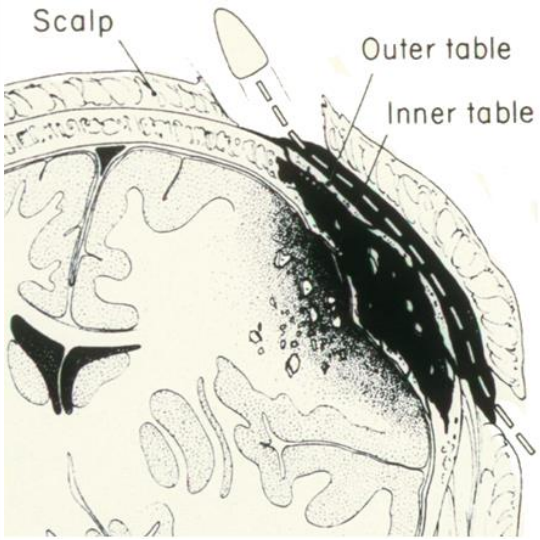
- Sharp weapons or miscellaneous objects can also occur induce stab wounds at the level of the skull base



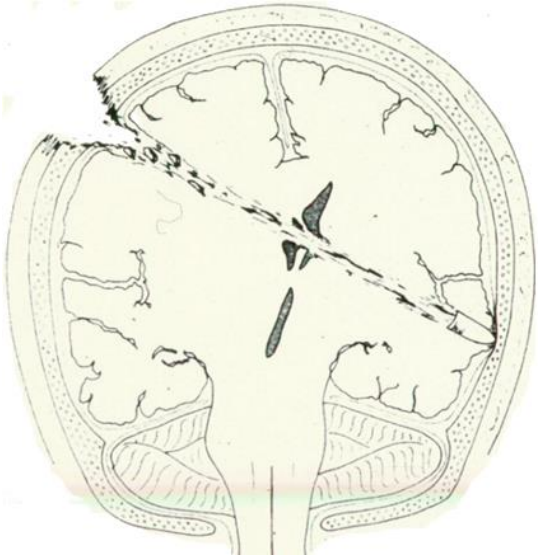
Gunshot wounds: lethality factors

- Weapon type
- Ammunition type
  - Cartridge manufacturing time
- Shot distance
- Does it cross ventricles or not





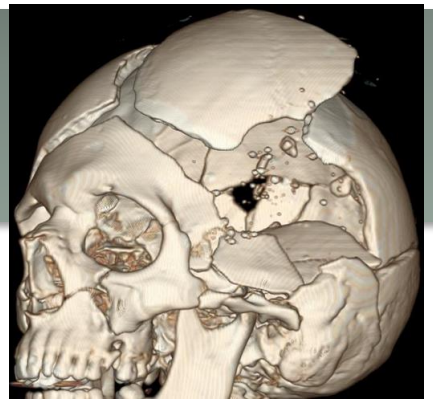
Tangential wound

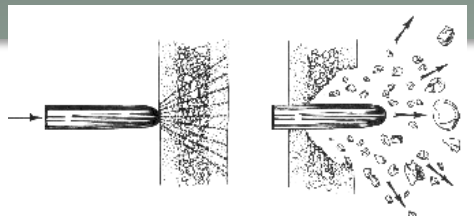


Penetrating wound

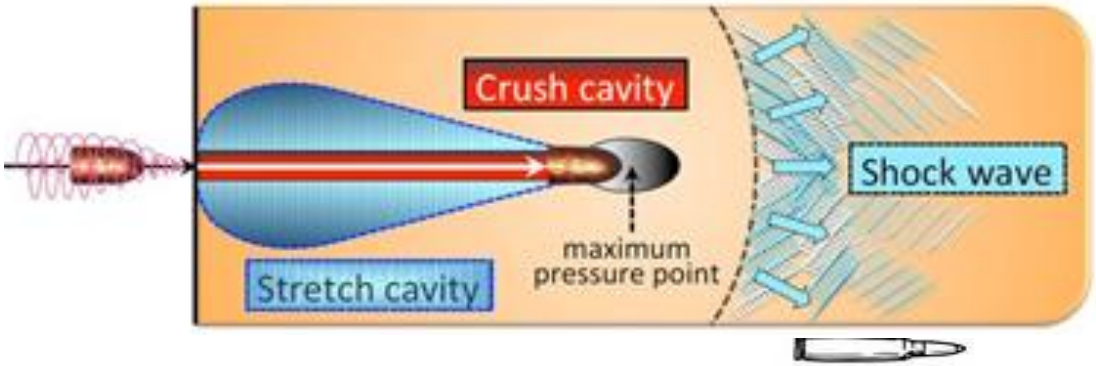
Perforating wound

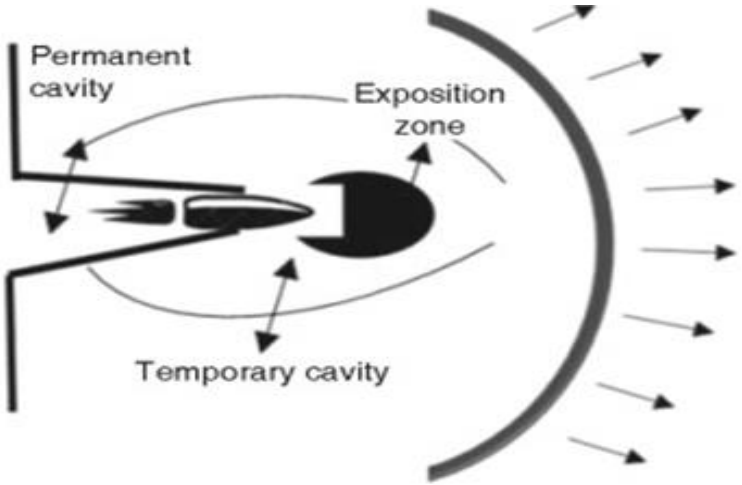
Head gunshot wounds (1)

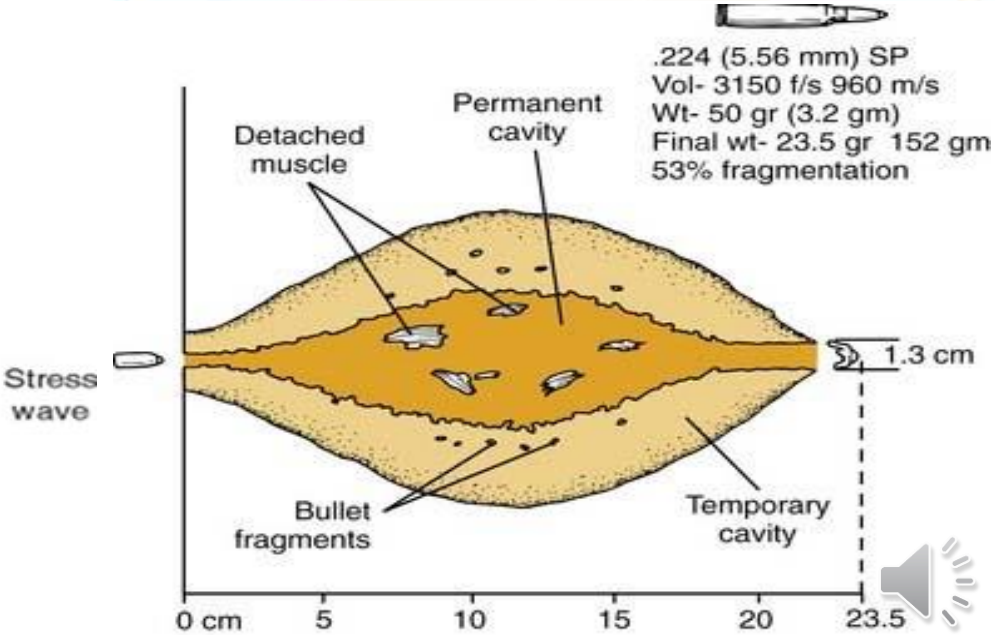




- Skull burst
- Bone fragments acting as secondary projectiles
- Shock wave gases
  - Particularly point-blank wounds

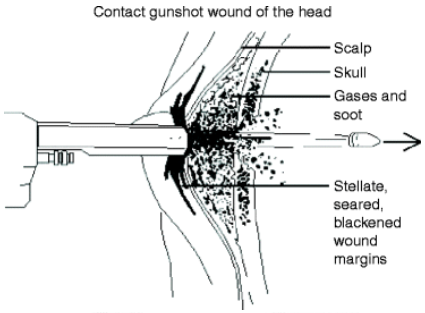


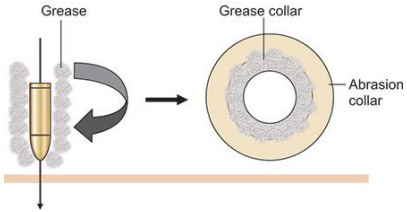


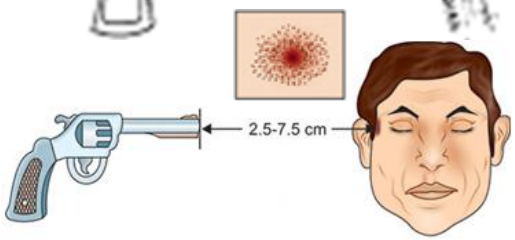


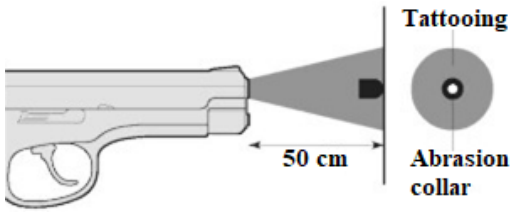
Head gunshot wounds (2)

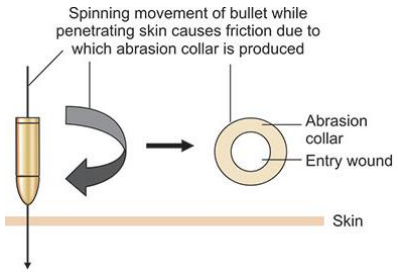
- Mostly lethal, 20% survivors with severe sequelae

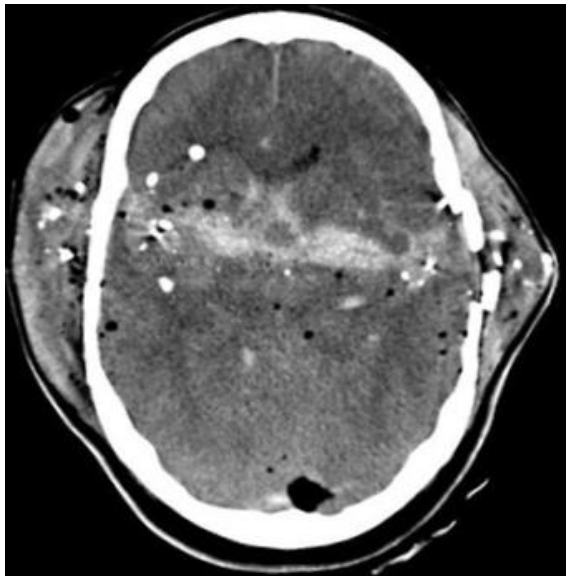


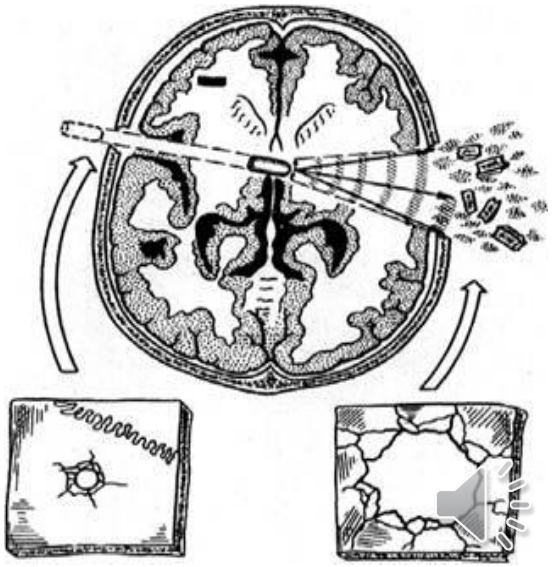






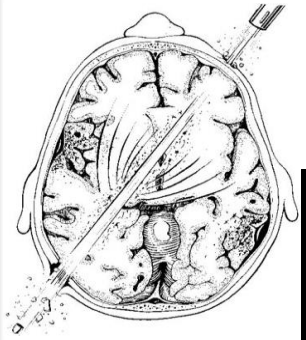


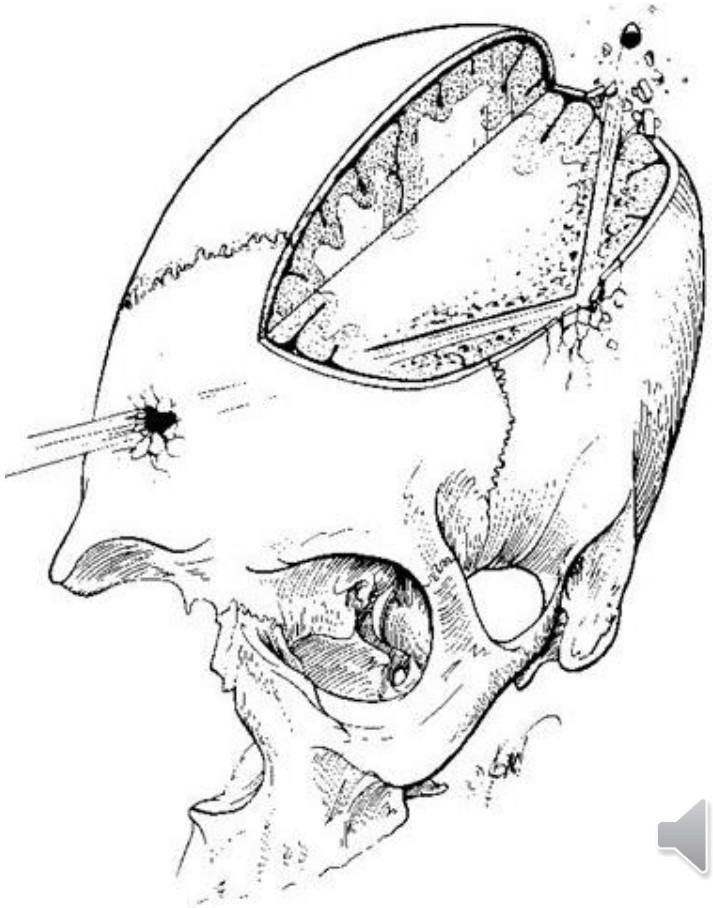




Head gunshot wounds (3)

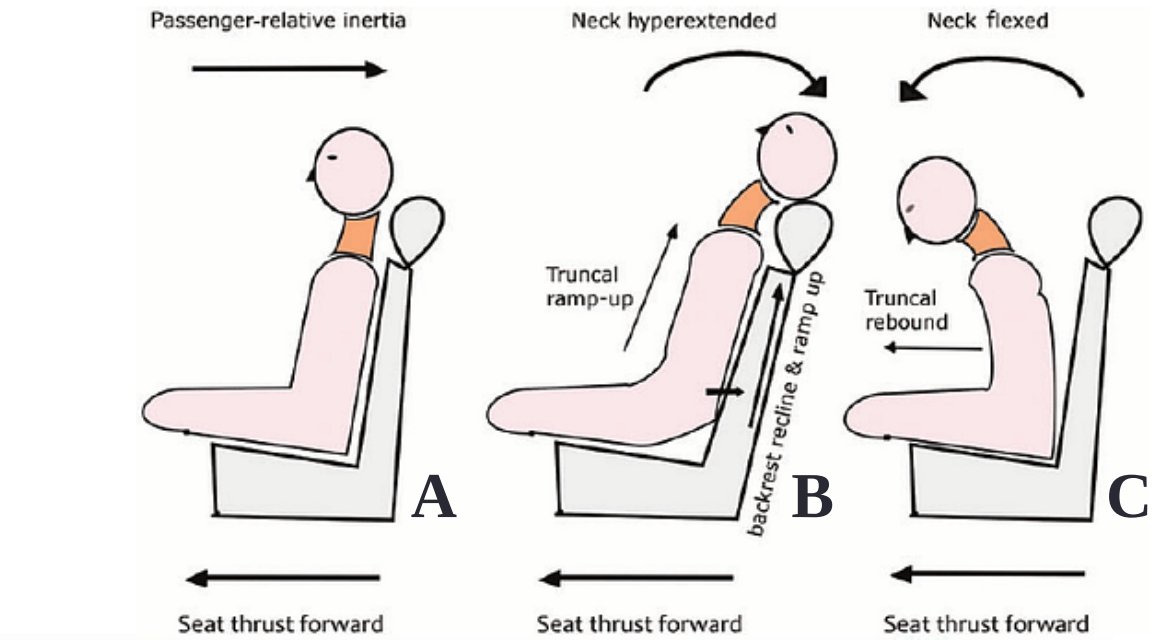
- Crossing the ventricles ≅ death
- Possibility ricocheting inside skull

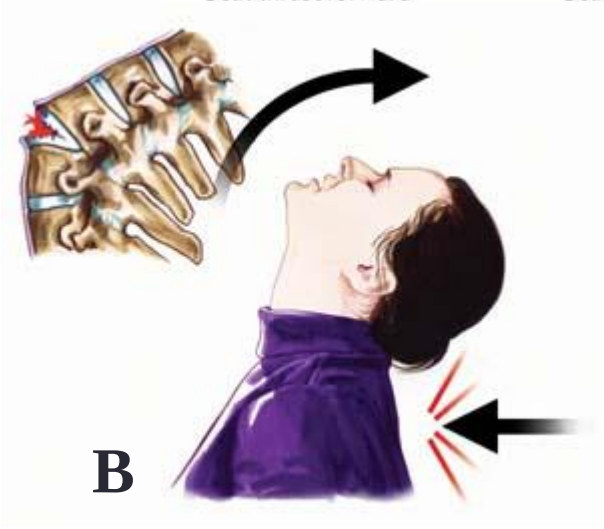


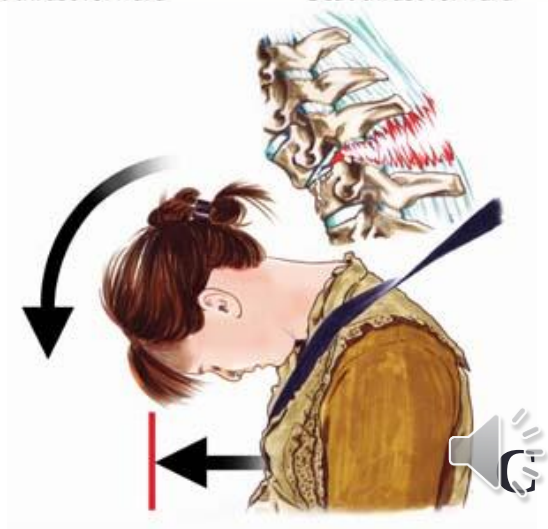


Whiplash injury

- Common in road accidents
- May accompany head injuries
- Danger: spinal cord injury

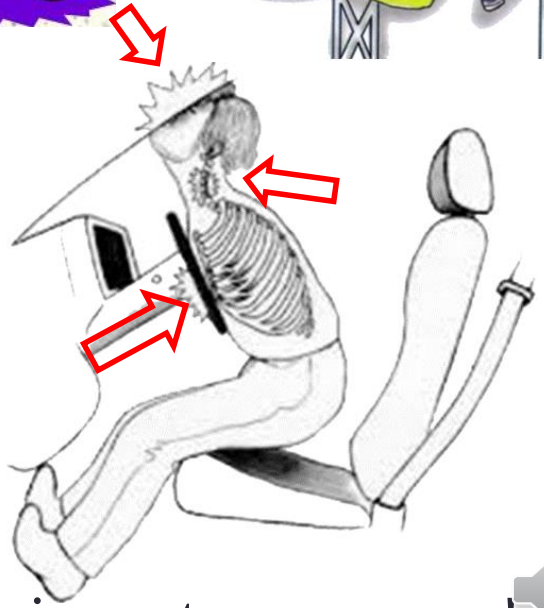






FIRST ANALYSIS

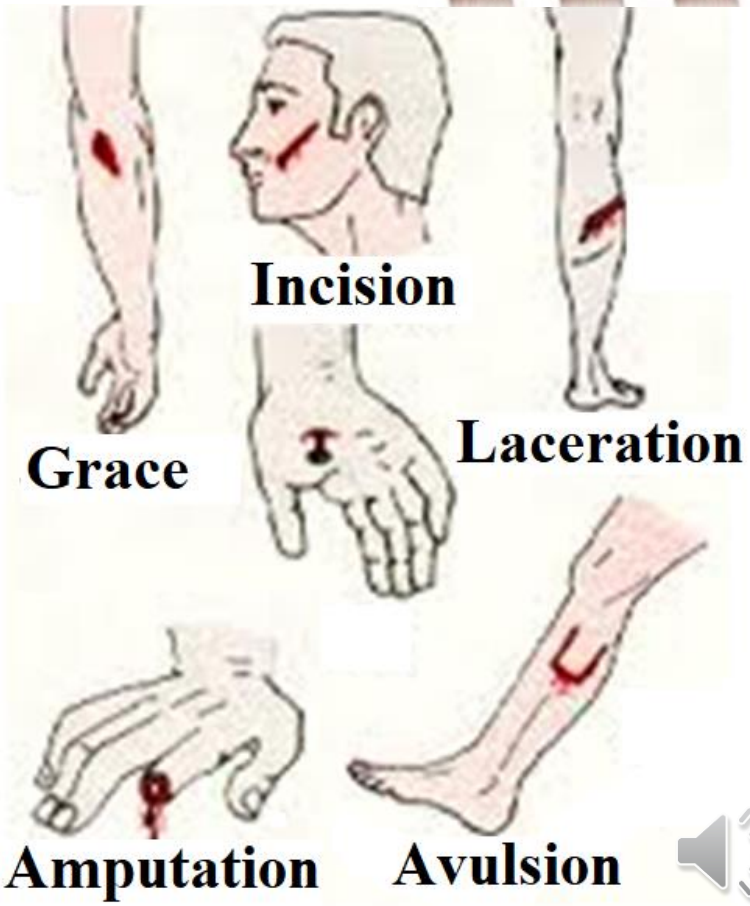
- **What happened?**
  - Run over
  - Driver
  - Driver's companion
  - Backseat passenger
  - Car / motorcycle / bicycle / bus
  - Precipitation
  - Sports accident
  - Aggression
  - Self-aggression
- **Other injuries?**
- **Just had dinner?**
- **Full bladder?**
- **Alcohol?**
- **Other drugs?**



Multiple injuries not uncommon!

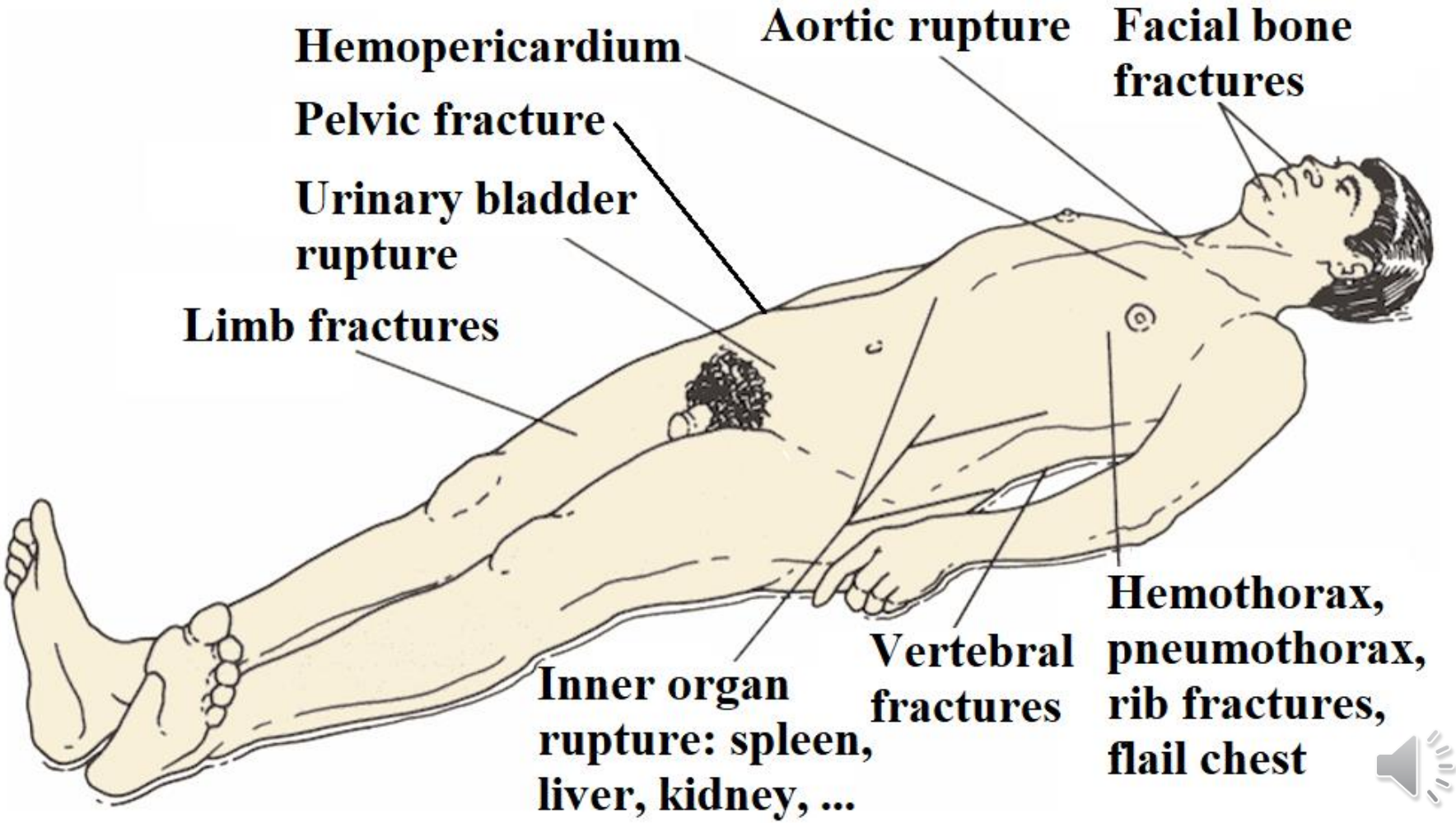
Complete review: looking for OTHER INJURIES

- Patient MUST be fully undressed
- Clothes are CUT with scissors not removed
  - To avoid secondary lesions

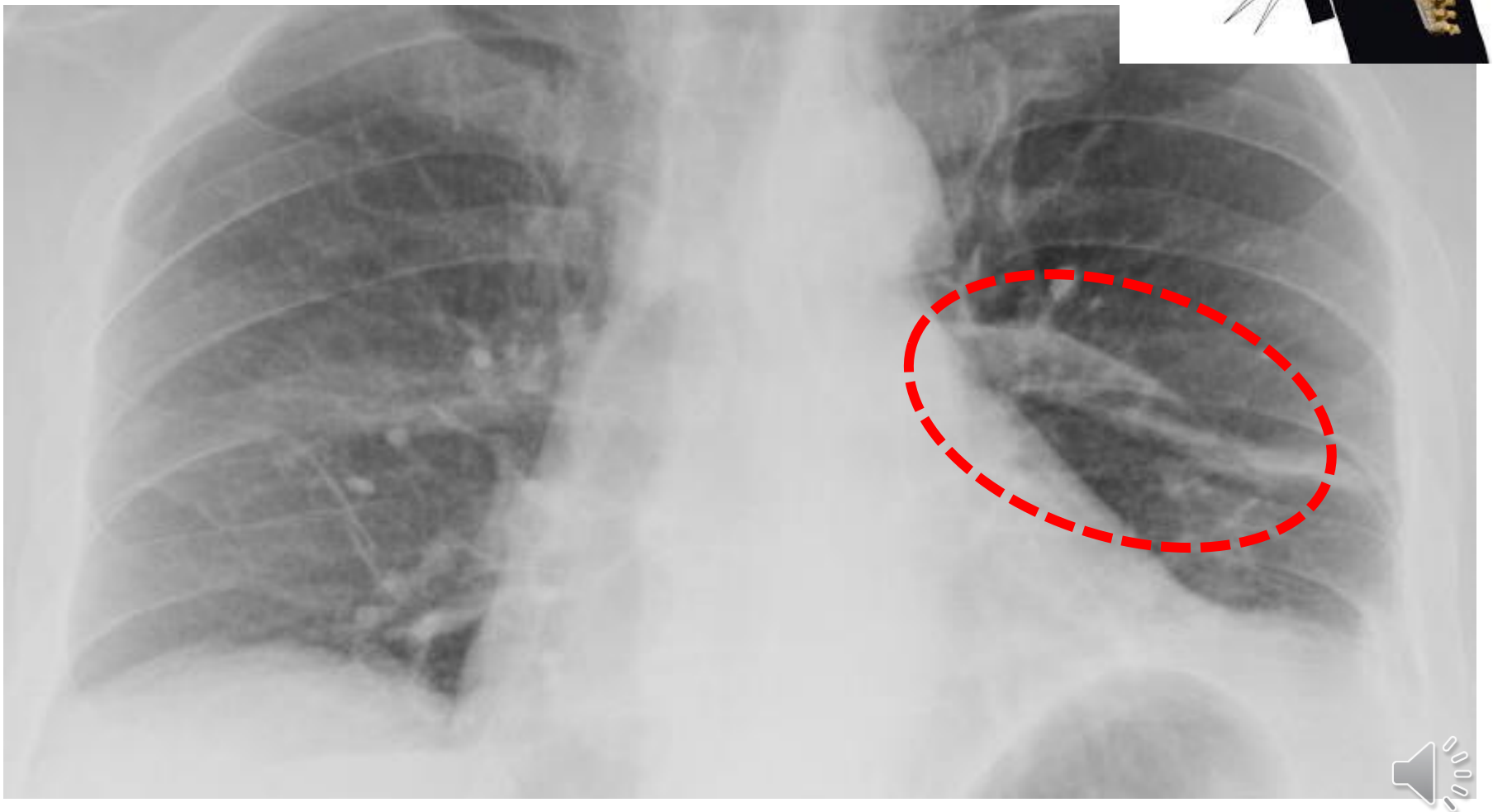


Other injuries of the polytrauma patient

- Look for them - don't be surprised by them!

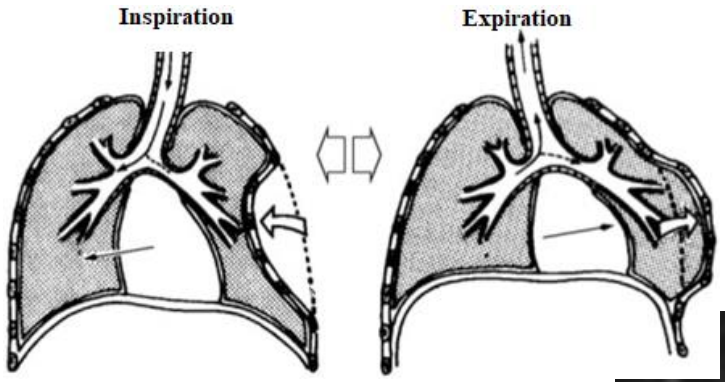


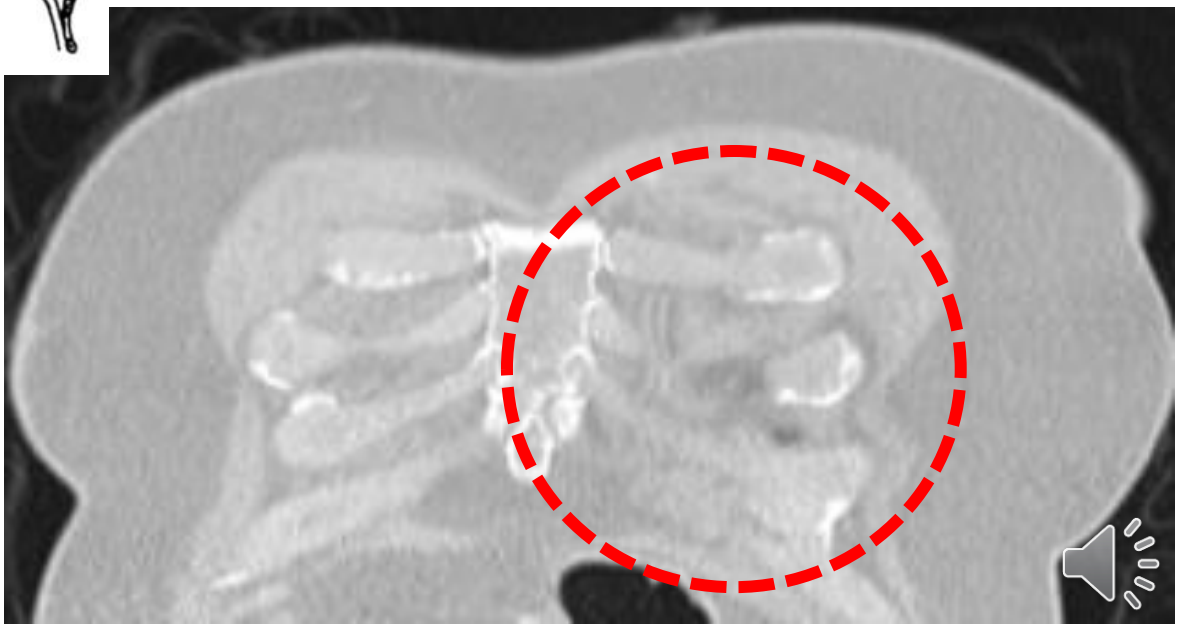
Rib fractures



Flail chest

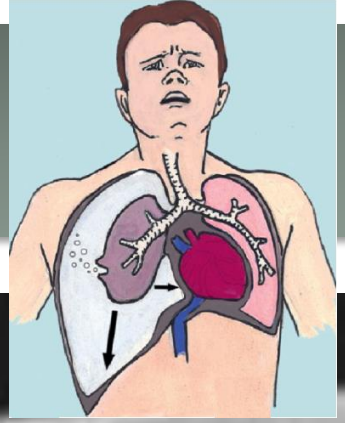
- Poor lung ventilation = brain inadequate oxygenation

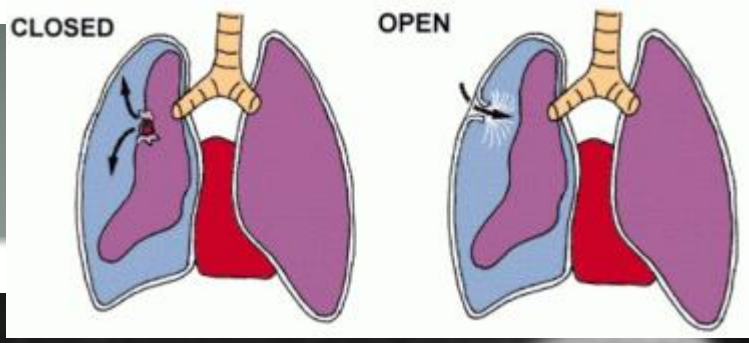




Pleural effusion

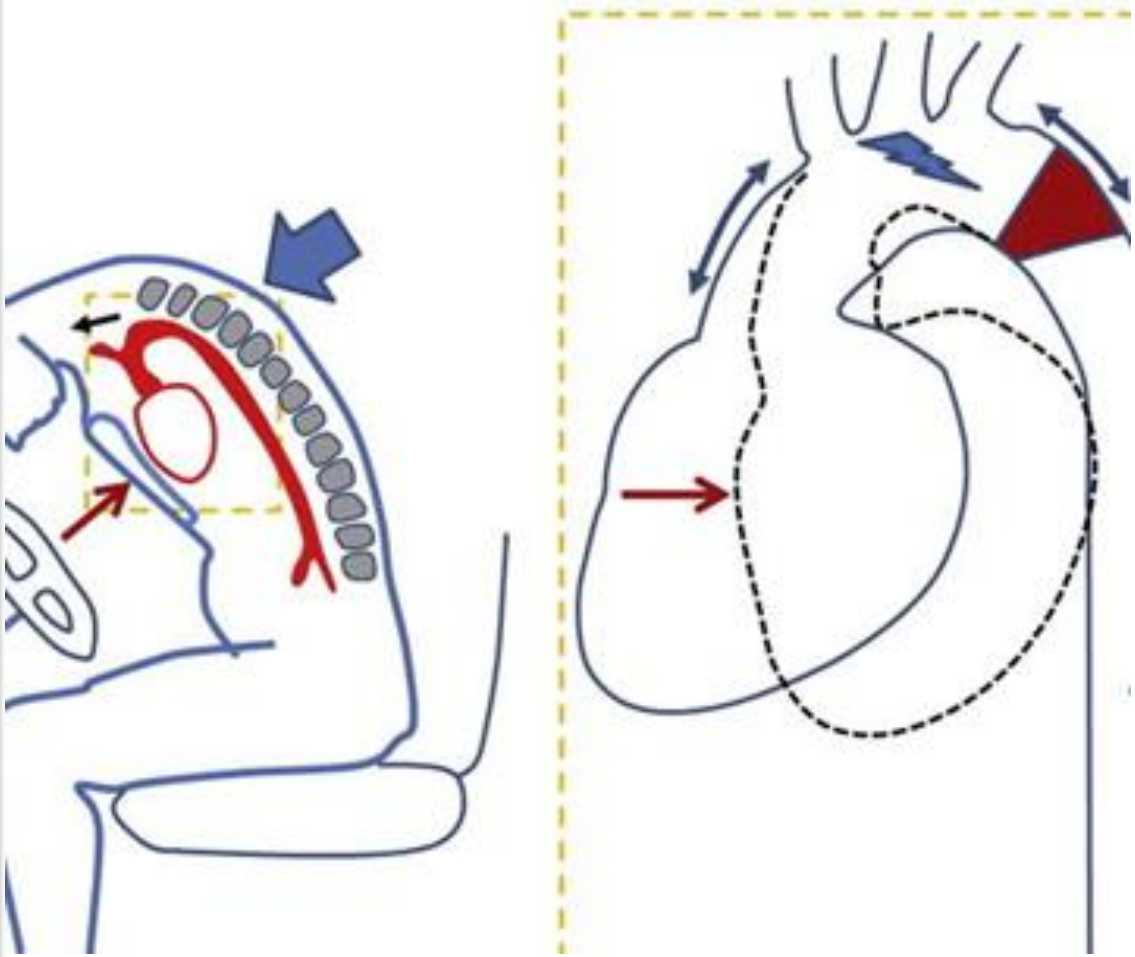
Pneumothorax



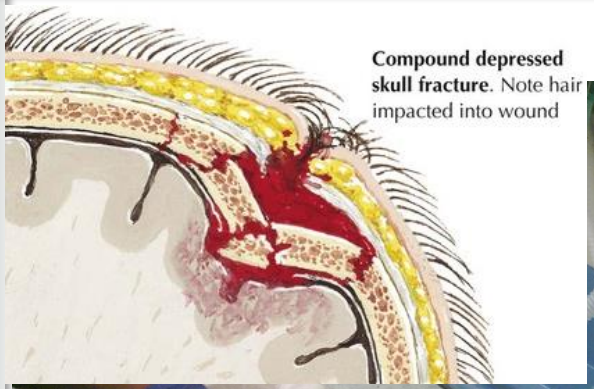


Ruptured aorta

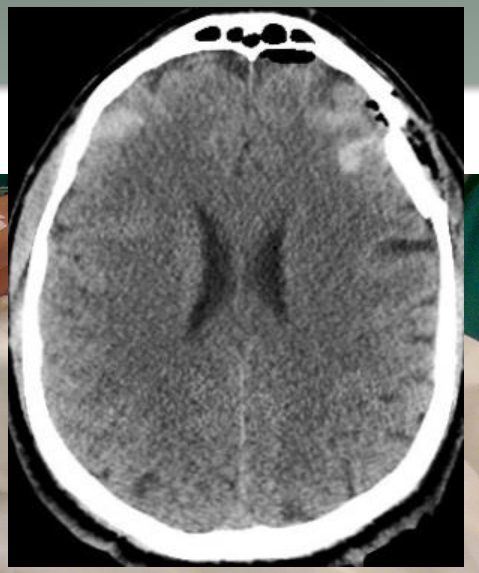
- Mostly fatal



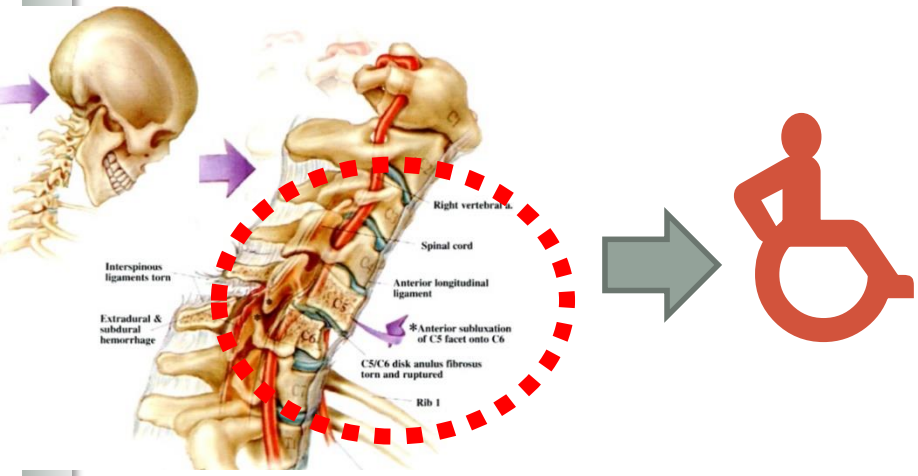
Seat belt contusion + compound skull fracture

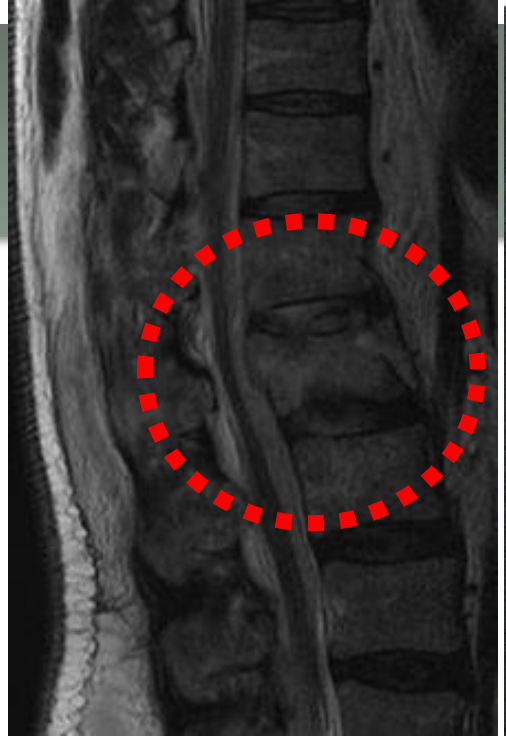


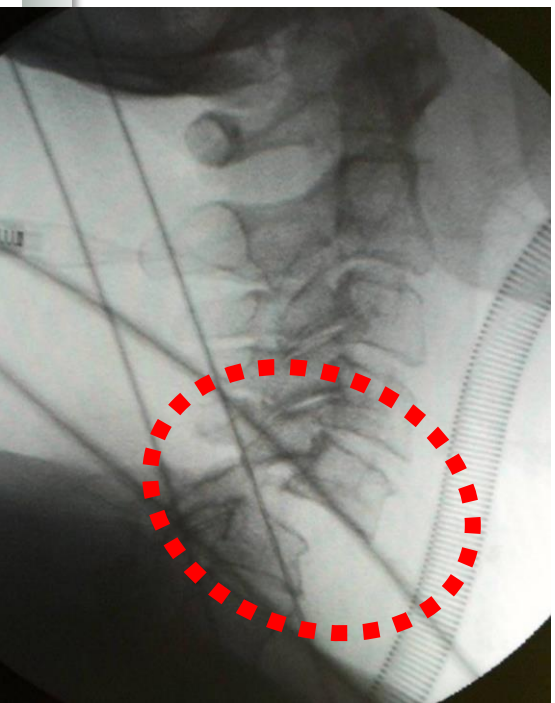
Compound depressed skull fracture. Note hair impacted into wound

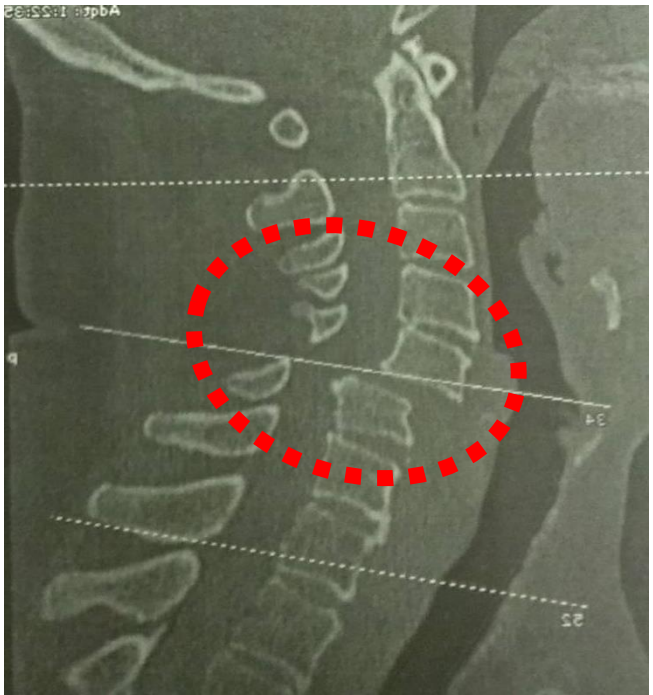


Spinal cord injury?

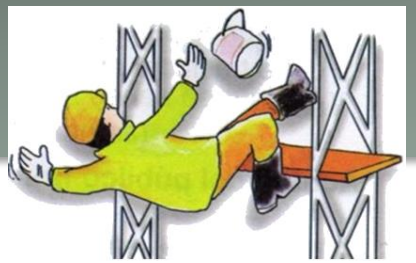


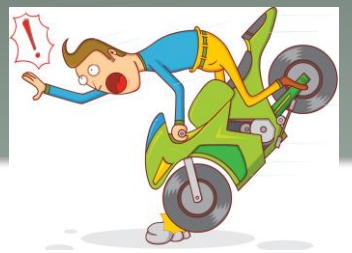




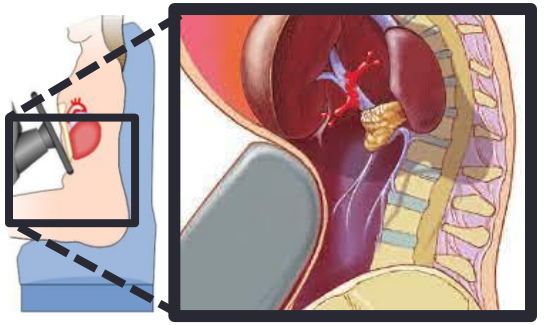


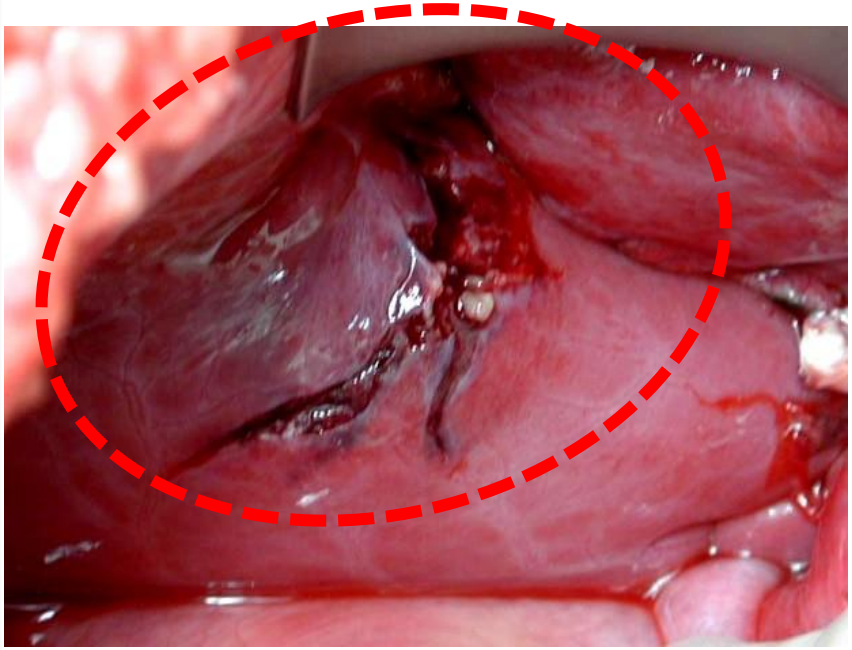
Inner organ laceration: spleen, liver, kidney, etc.



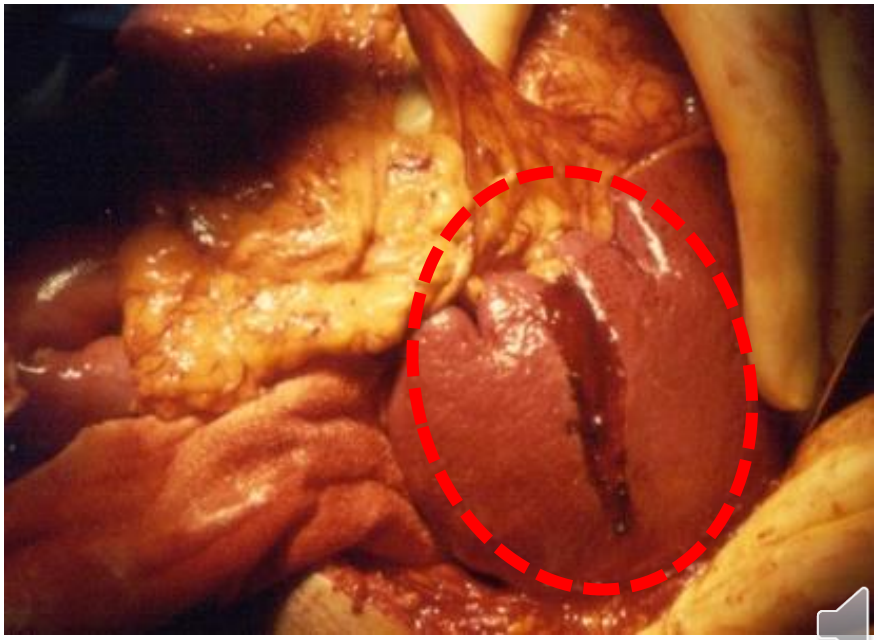


- The rule in falls from heights
- Frequent in motorcyclists
- Thrown against steering wheel
- If thrown from vehicle (NO seat belt!)





Liver laceration



Spleen laceration

Other injuries

- Nose or ear bleeding / fluid leakage
- Hemotympanum
- Ruptured eardrum
- Limb amputation
  - Ears = explosion with irreversible lung injury

CSF leak

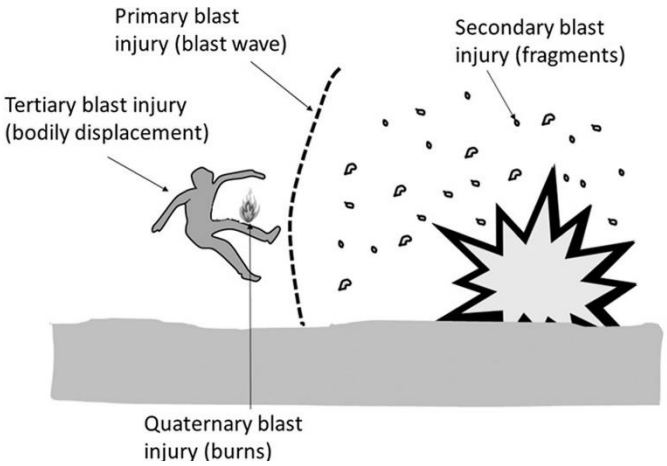
Hemotympanum

Ruptured eardrum

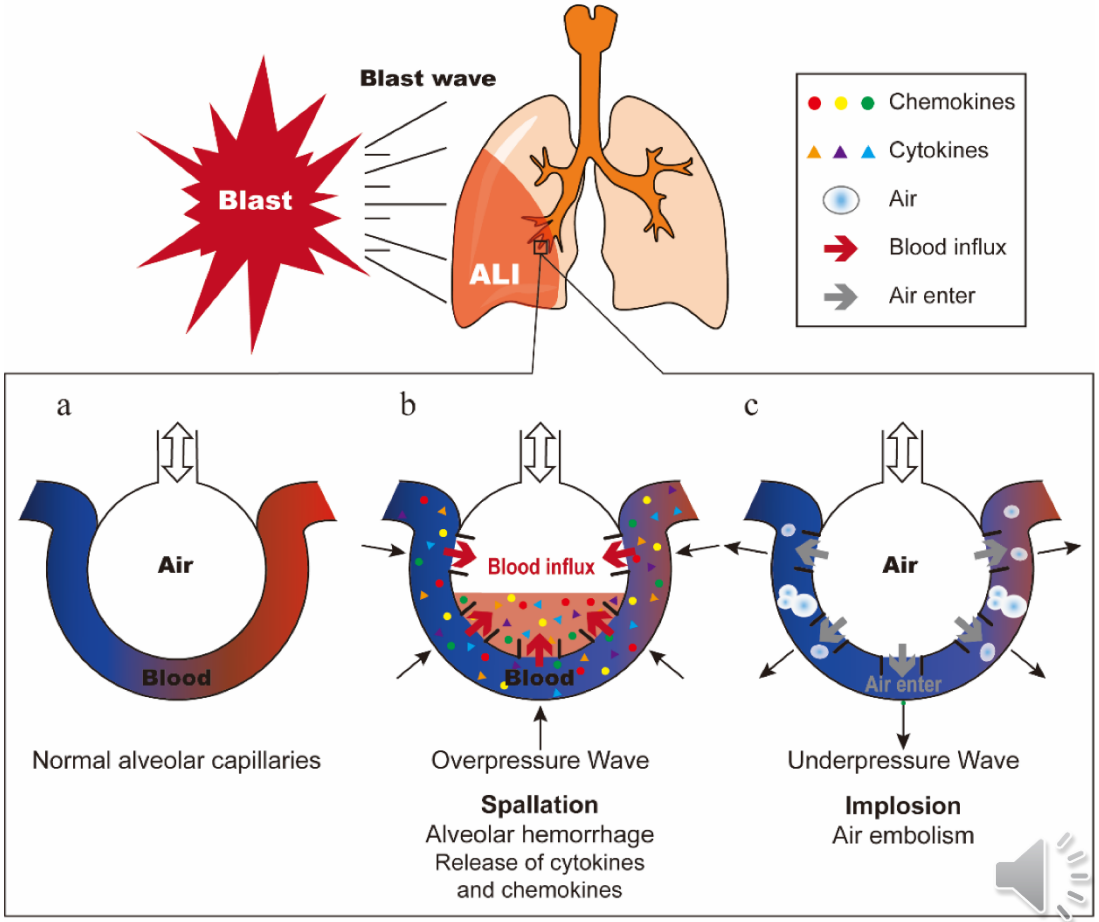
Ear amputation

Blast injury: lung lesions

- Fatal combination for head injuries

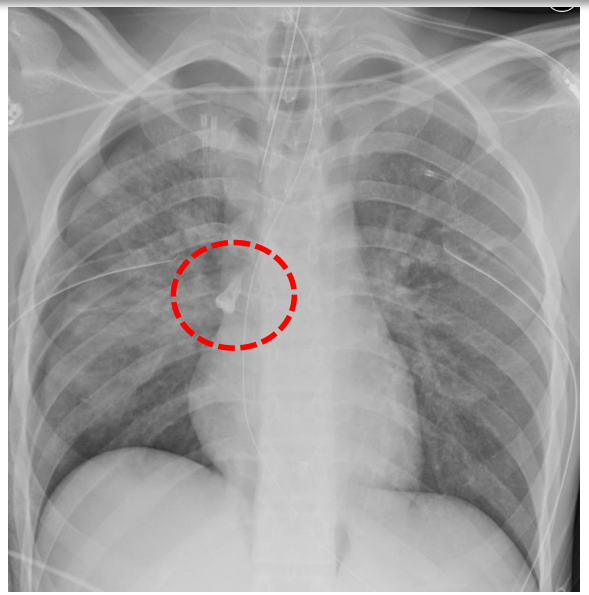


Colon blast injury

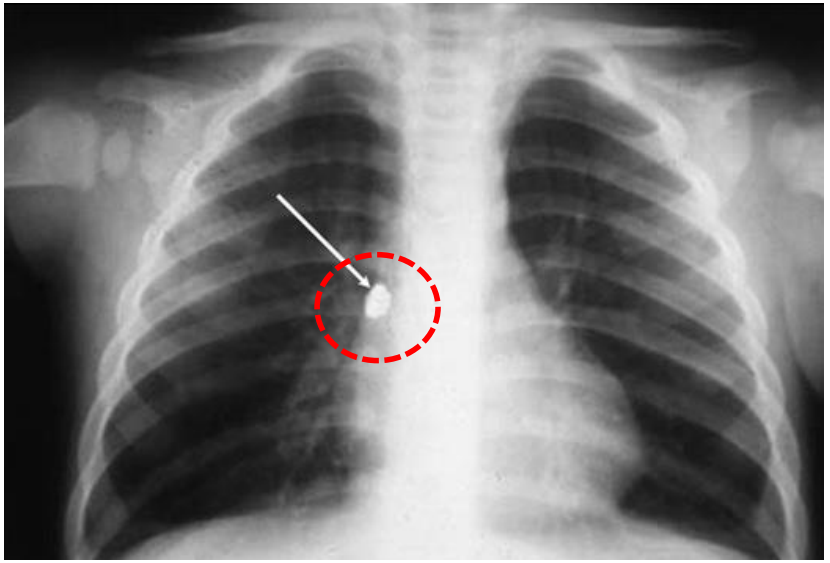


Step One: Cardiopulmonary Resuscitation

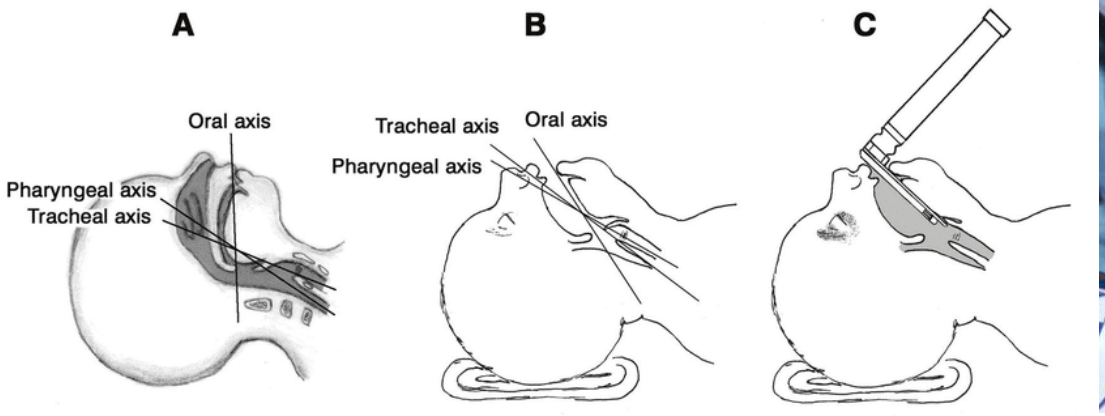
Second step: INTUBATION? Look for chewing gum / food / cigarette / teeth in the airway



Tooth

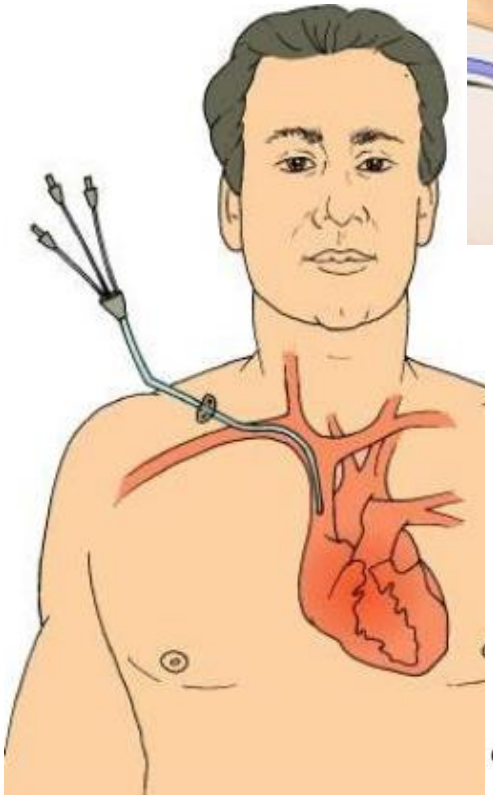


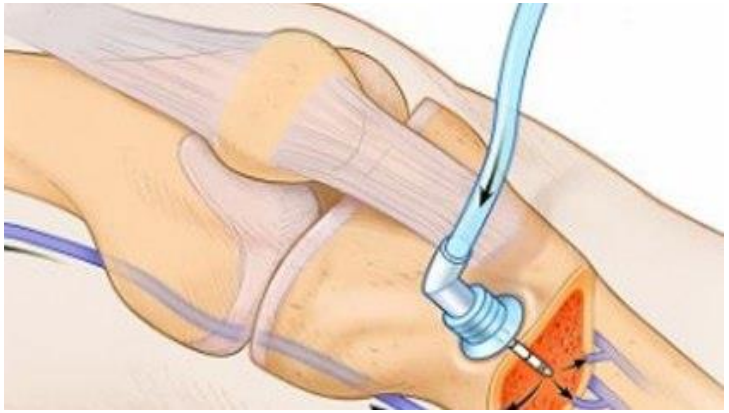
Chewing gum

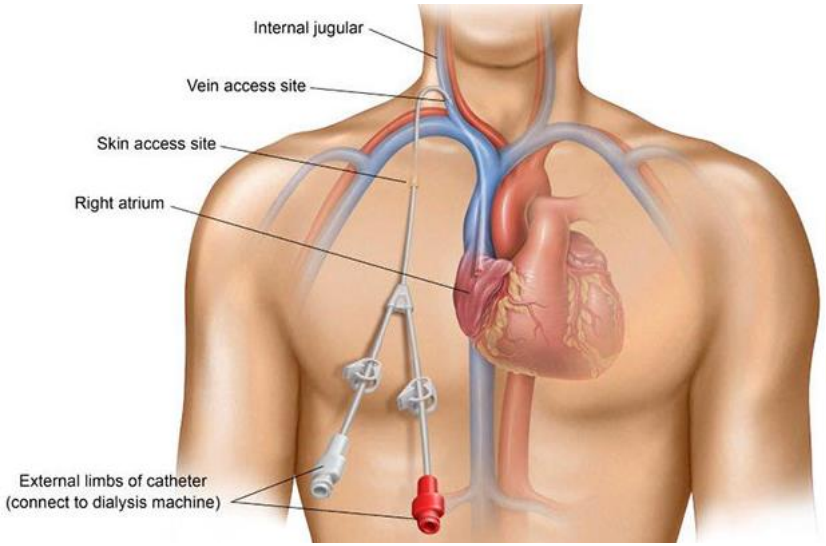


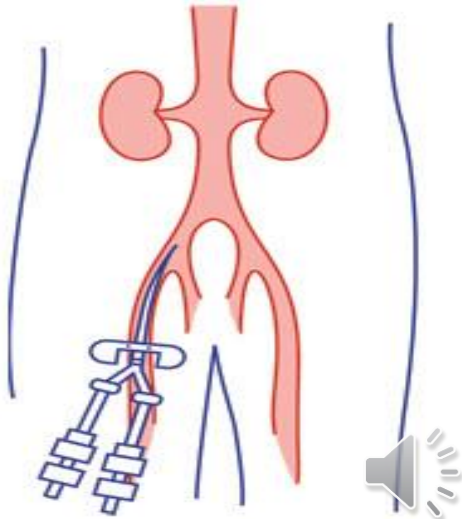
Third step: SHOCK?. Venous line-fluids / transfusion?

- Maintaining the mean arterial pressure is vital to have an adequate brain perfusion pressure

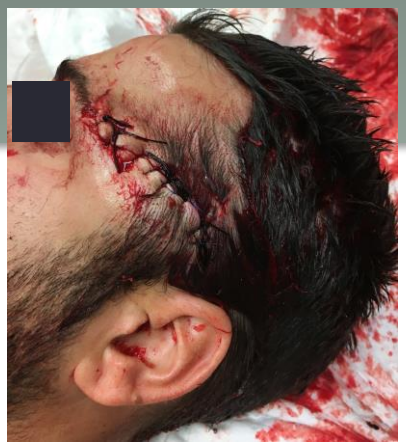








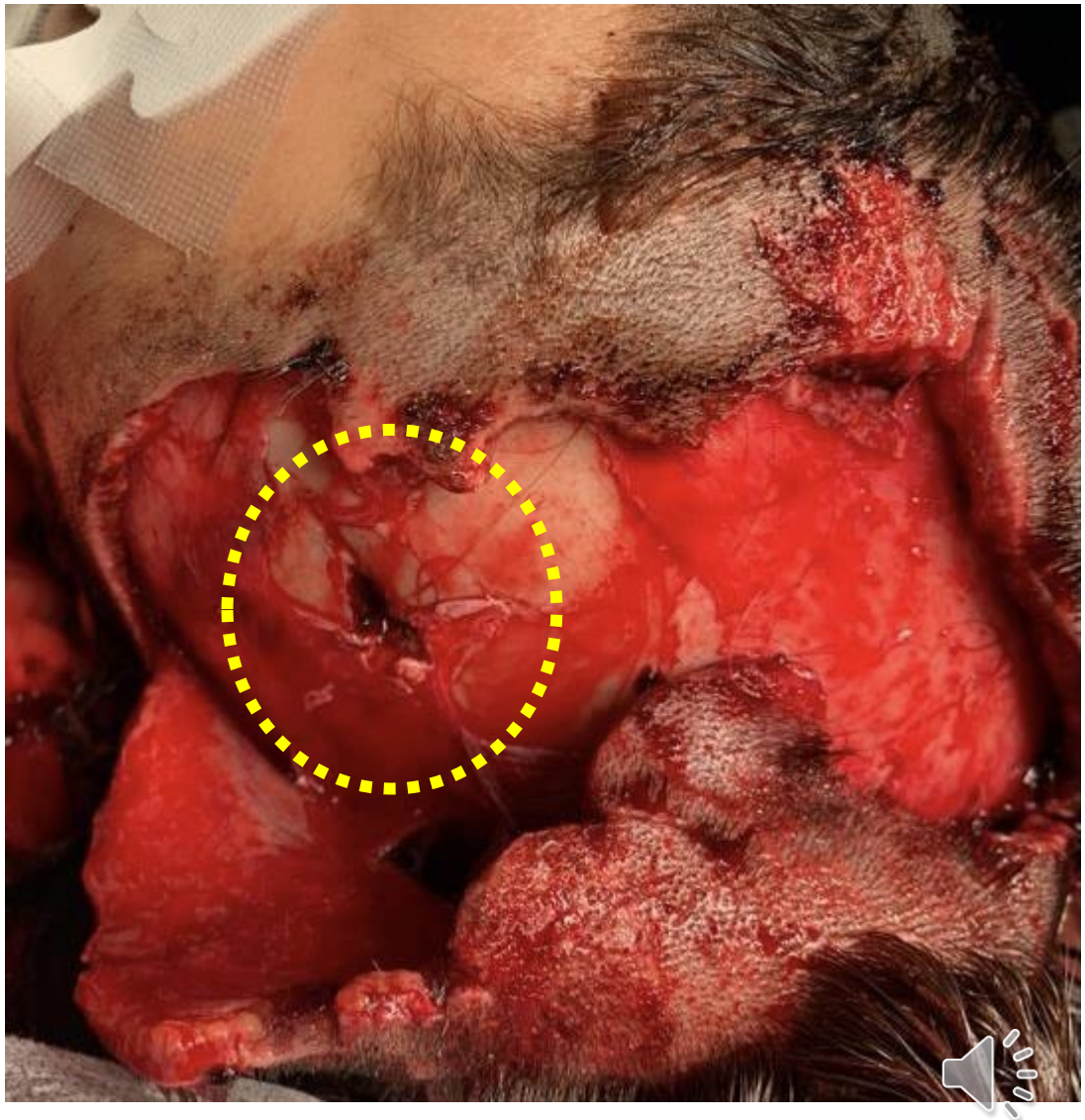
Step four: scalp laceration



- Not always accompanied by brain injury
- Heavy bleeding = hypovolemia with shock
  - Particularly in children
- Treatment: if bone & dura intact = cleaning & suturing
  - Remove remains of soil, hair, and debris to avoid infection
- **Temporary suture at first care point** to stop bleeding

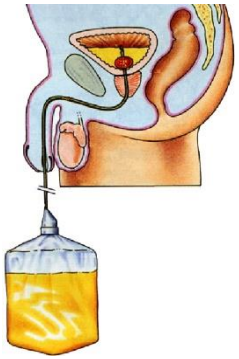
Scalp laceration (2)

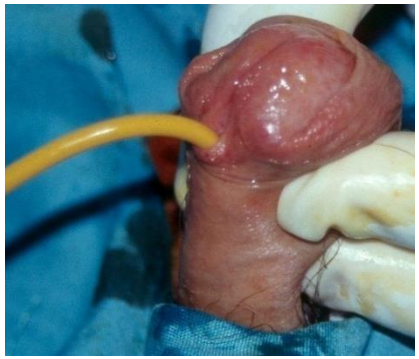
- Rule out possible underlying skull fracture

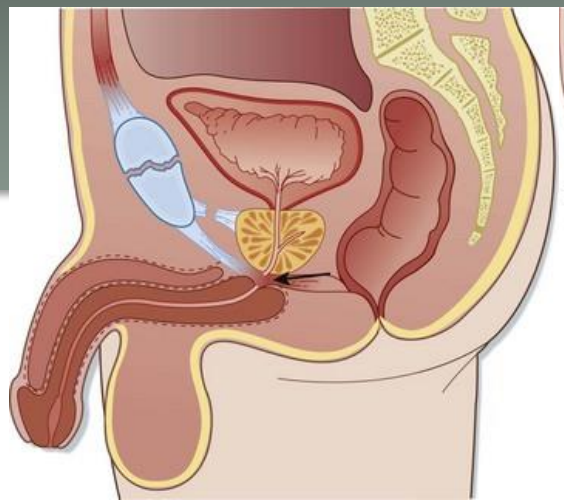


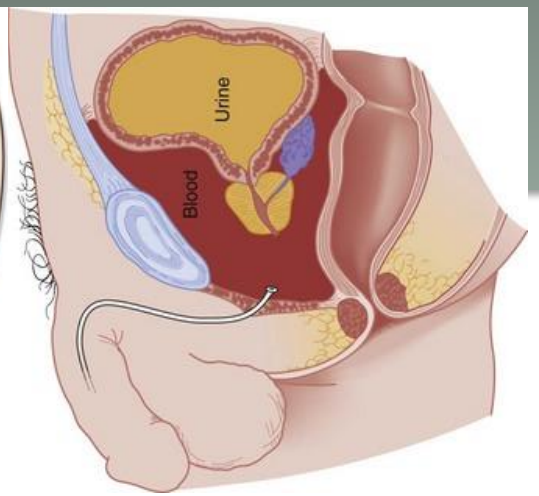
Gastric emptying / nasogastric tube? = avoid vomiting with aspiration into the airways (Mendelson syndrome)

Urinary catheter?

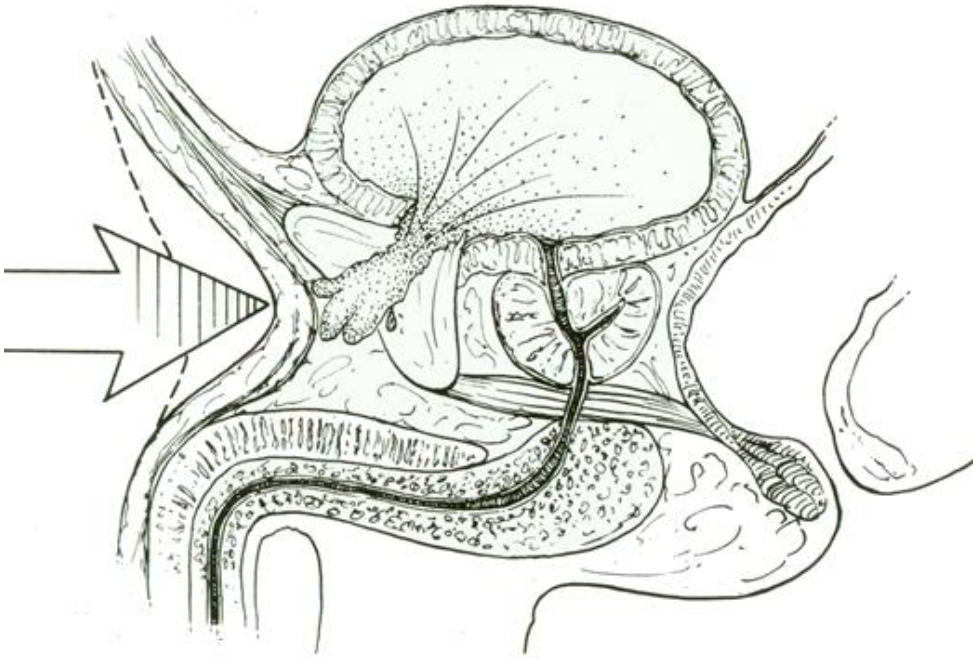


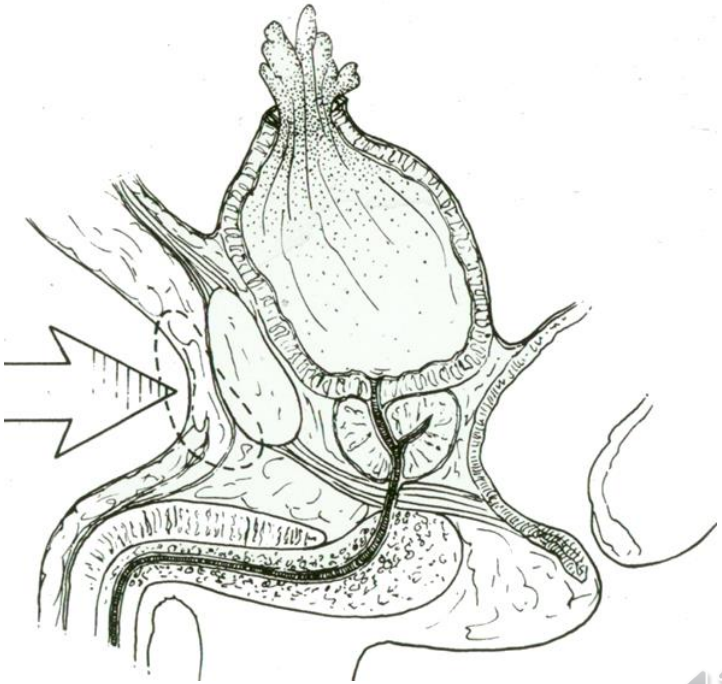






Urethra rupture

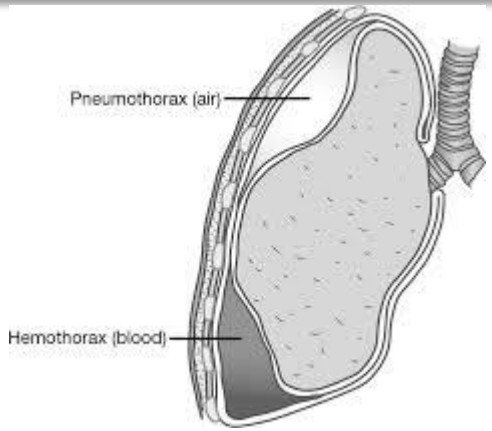


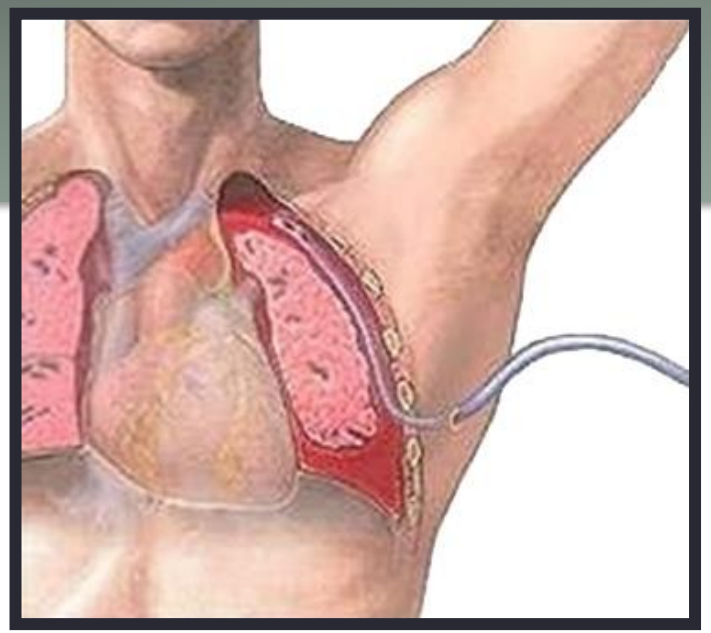


Bladder rupture with urine leakage into the peritoneal cavity!

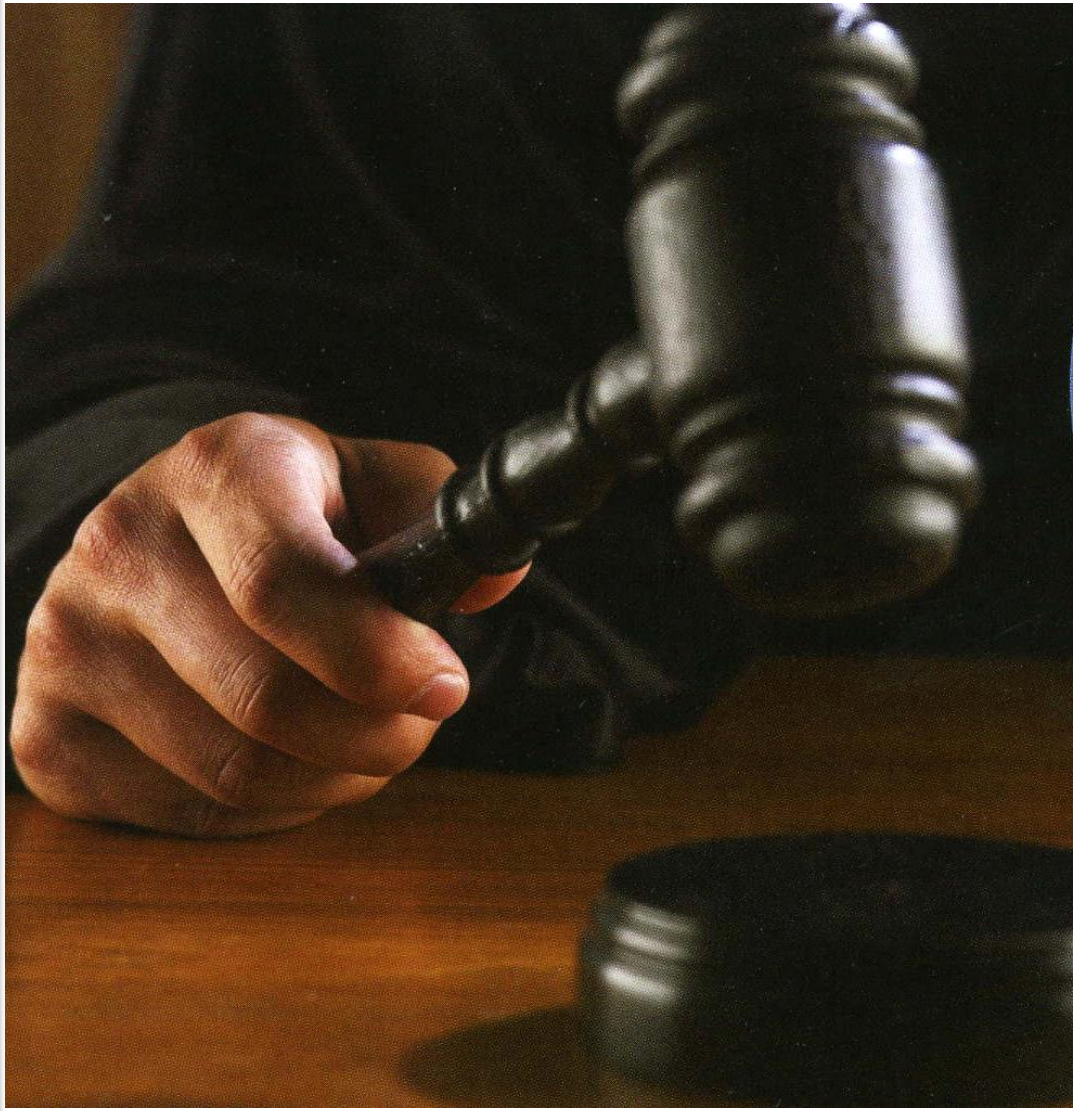
Pleural drainage

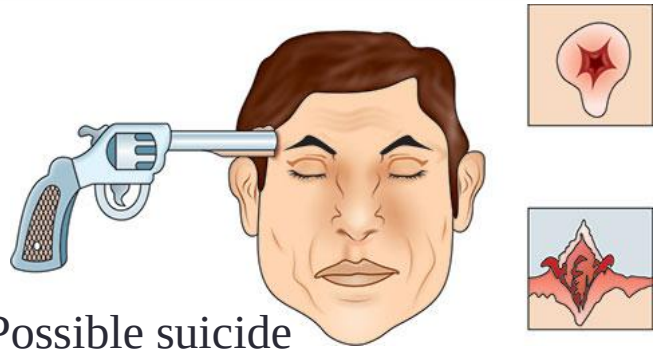
- Hemothorax
- Pneumothorax
- Brain craves for O_2



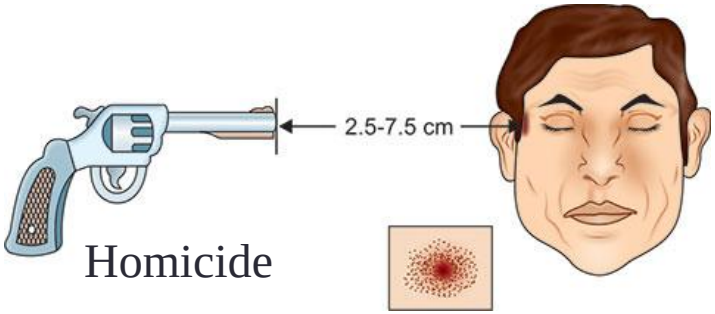


Suspected assault / abuse wounds?





Possible suicide

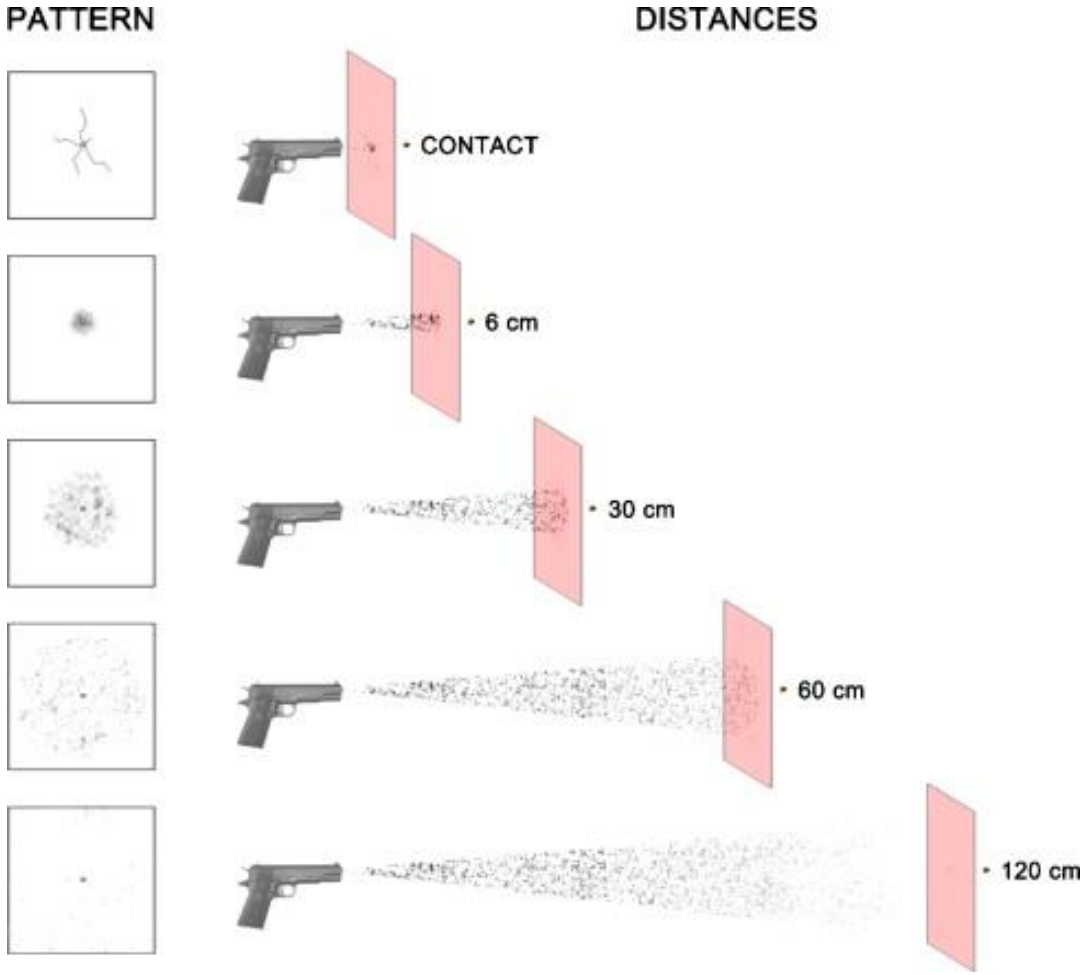


Homicide

Cigarette burns

Gunshot wounds

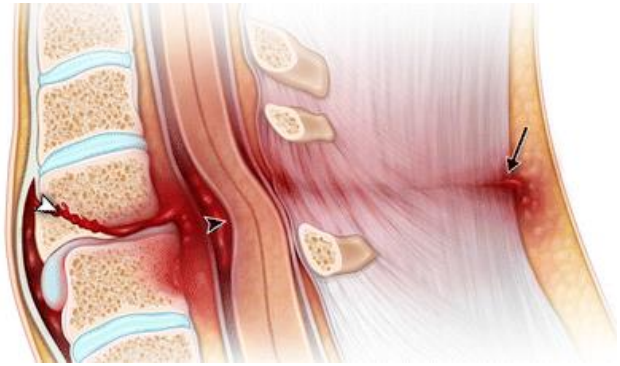
- REMEMBER = take photo BEFORE Friedrich and wound suture. DO NOT CONCEAL A CRIMINAL ACT



AIDS can cross your path. Protect yourself

Cervical collar?

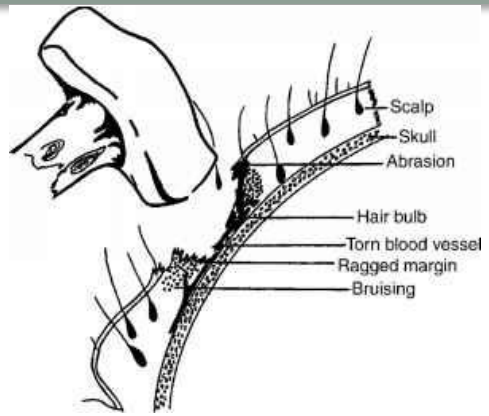
- Most often not needed but essential to prevent worsening cervical spinal cord injury
  - No harm in a useless collar, but a disaster when needed and not provided



PRIMARY / SECONDARY INJURIES

- **Primary**: occur at the time of trauma and are prevented by legislation
  - Scalp lacerations
  - Skull / facial fractures
  - Brain contusion / laceration

REMEMBER?



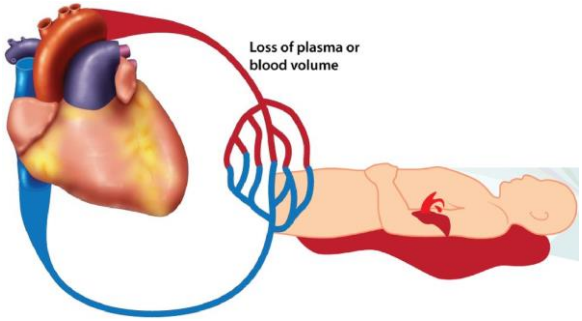
- **Secondary**: occur during transport, emergency room, pharmacy, ICU, ward, ... THEY ARE OUR RESPONSIBILITY
  - Scalp haemorrhage
  - Intracranial hematomas
  - Hypoventilation with cerebral hypoxia
  - Hypovolemia with cerebral ischemia
  - Brain edema
  - Brain hernias

Signs on arrival at the emergency room

Headache

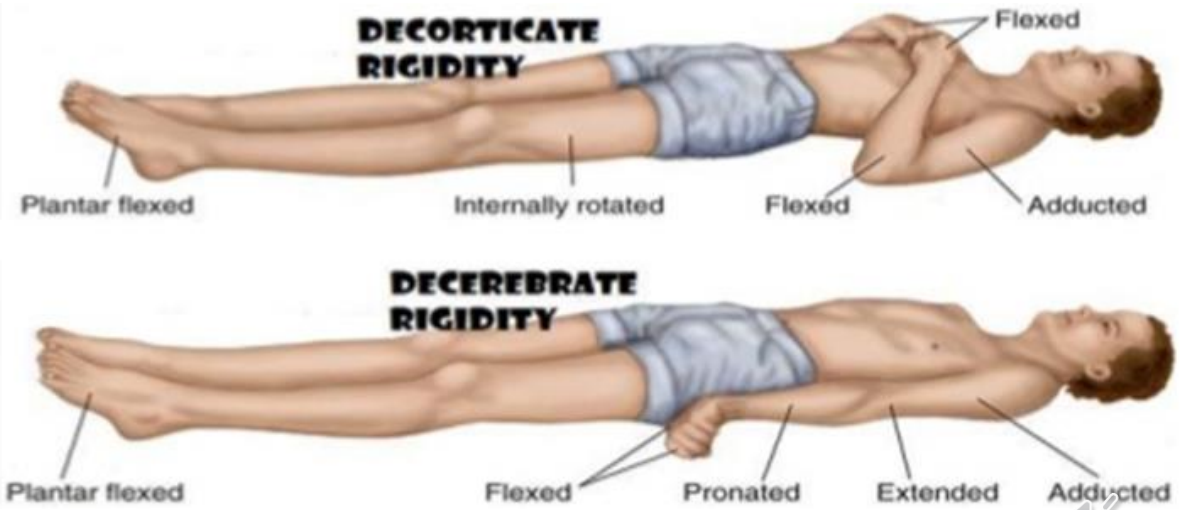
Vomiting

Confusion



Hypovolemic shock

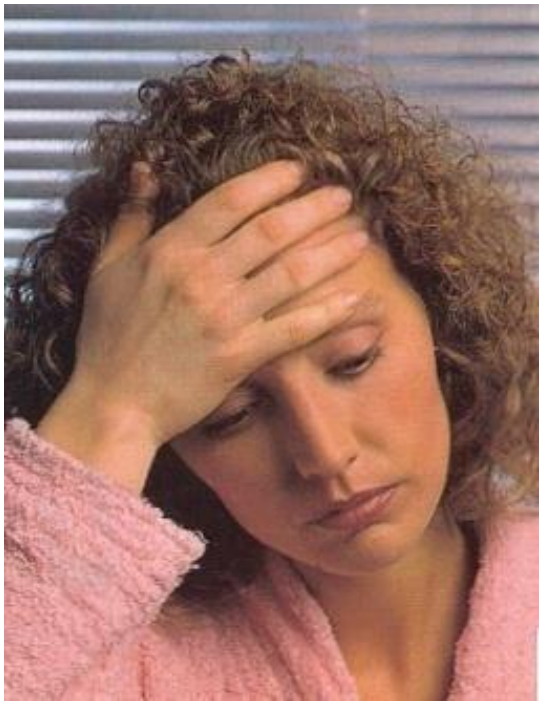
Mydriasis

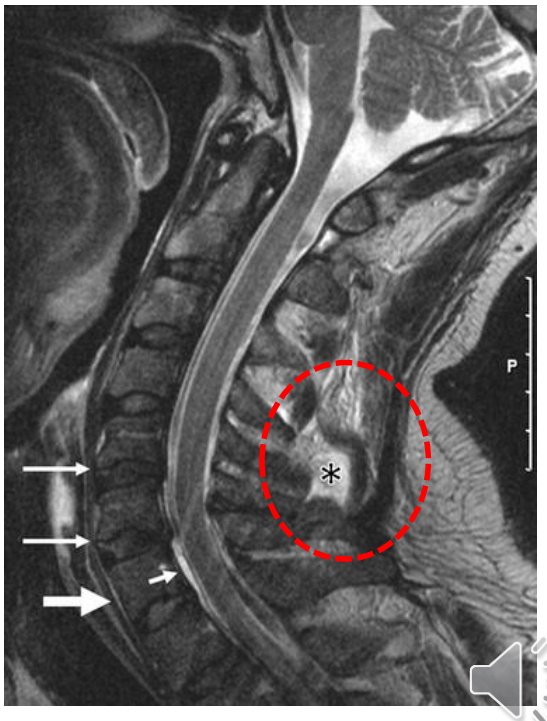


Coma

Headache / neck stiffness

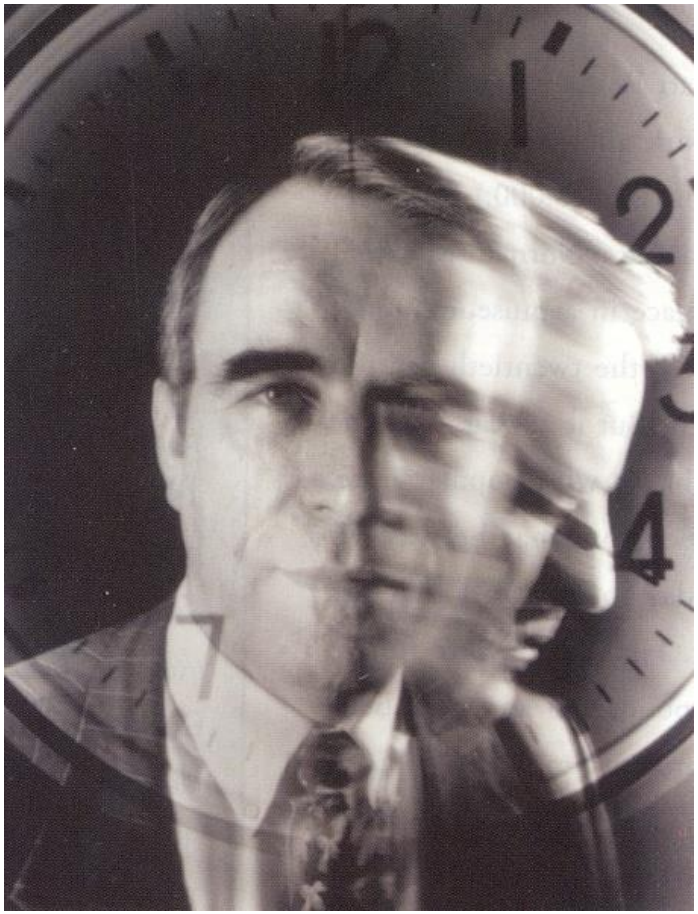
- Plain x-rays useful in fracture or fracture-dislocation
- Head CT scan essential
  - Neck CT scan provides less information
- Cervical MRI will show spinal cord / ligamentous injuries





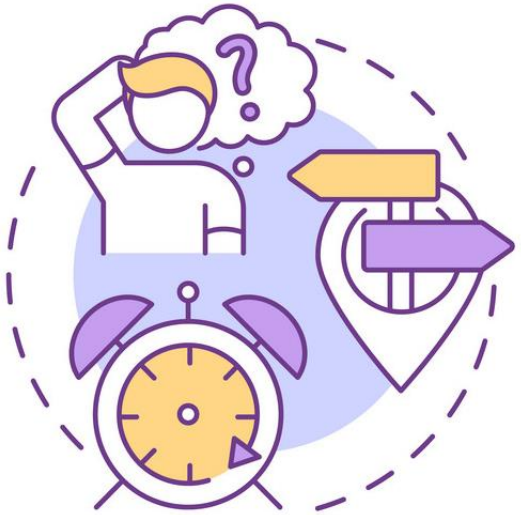
Amnesia of what happened

- Patients repeatedly ask what happened as they cannot remember the incident nor what they are told.

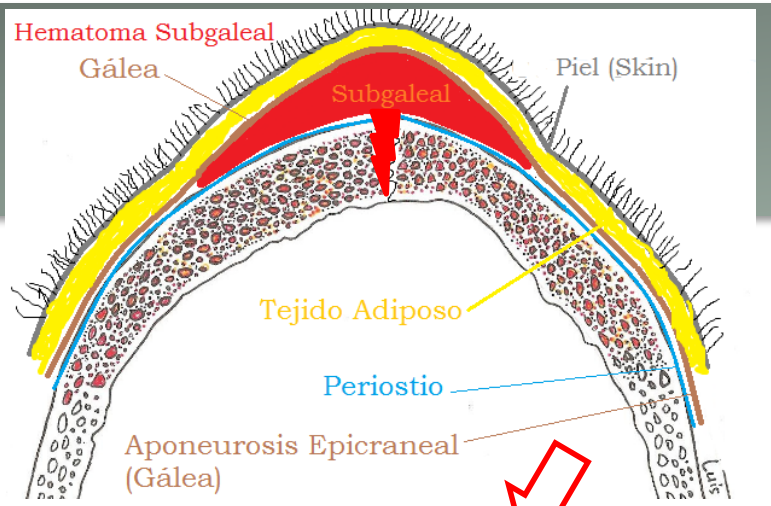


Temporospatial disorientation

- Don’t know where they are nor the time and date

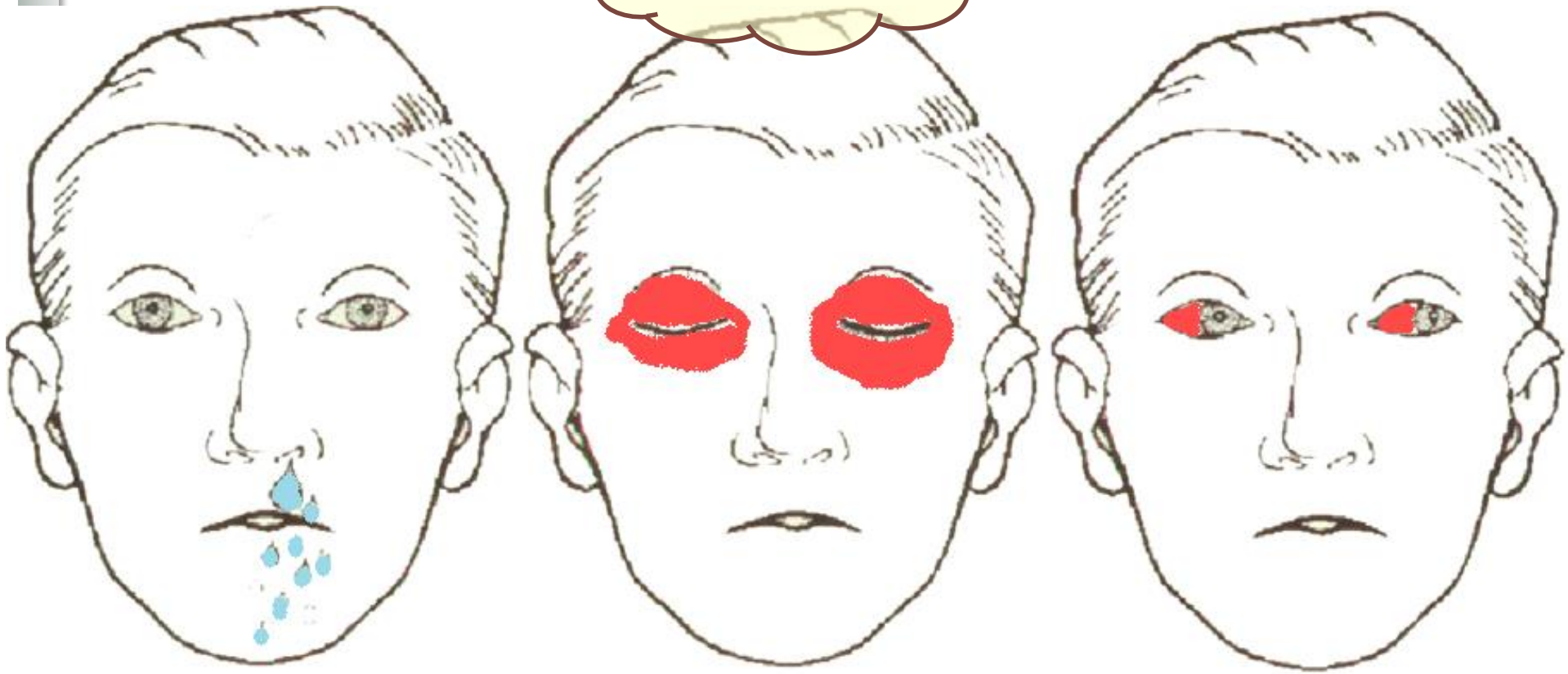


Cephalohematoma ≅ skull fracture



Signs of anterior skull base fracture

REMEMBER?

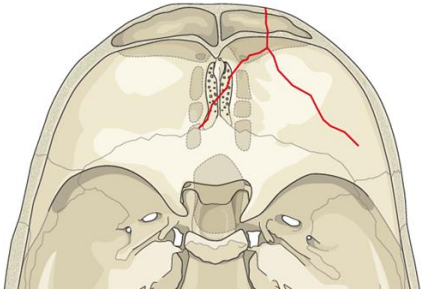


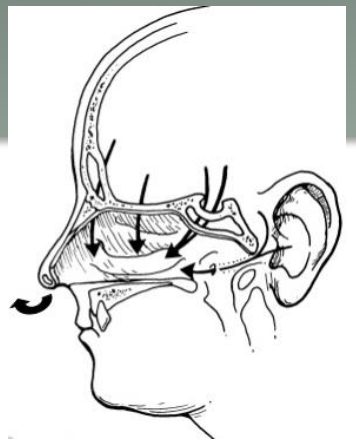
Rhinorrhoea

Raccoon eyes

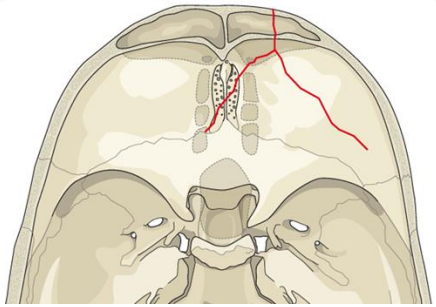
Subconjunctival haemorrhage

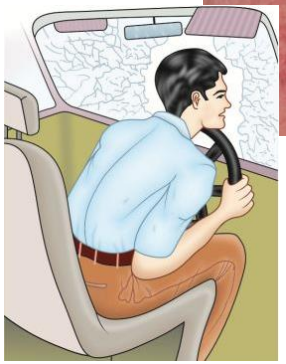
Rhinorrhoea

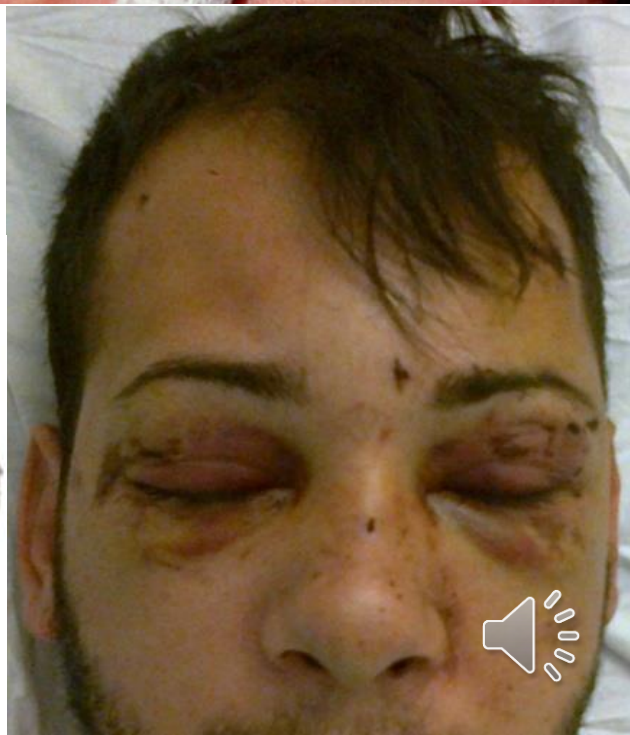




Raccoon eyes: anterior skull base fracture

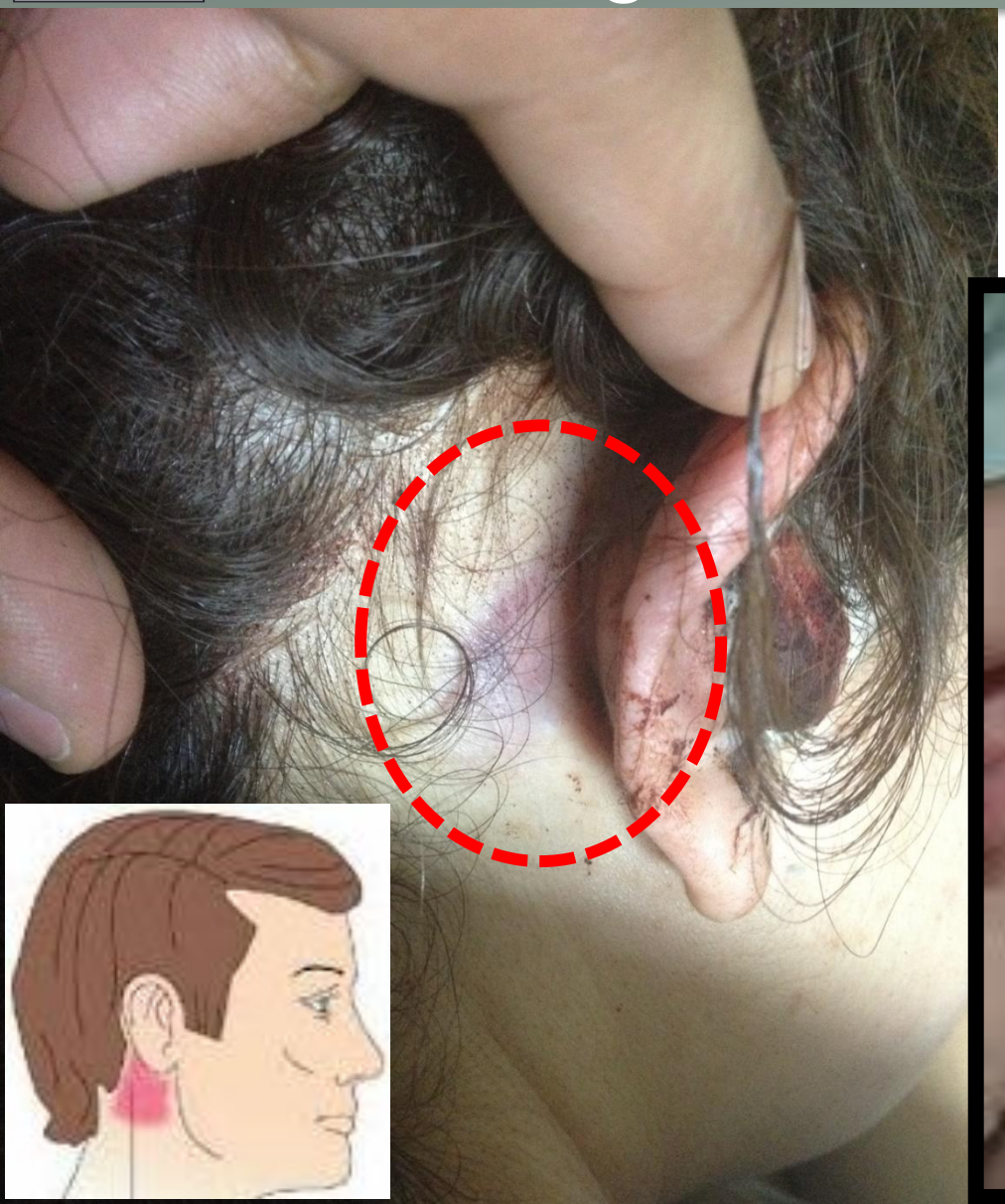






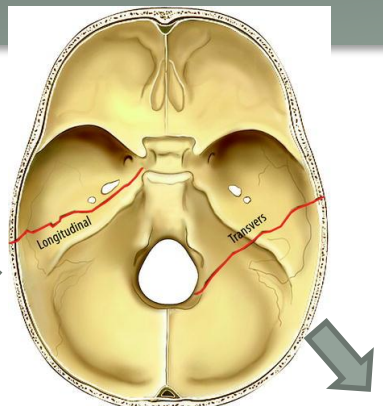
Subconjunctival haemorrhage: anterior skull base fracture

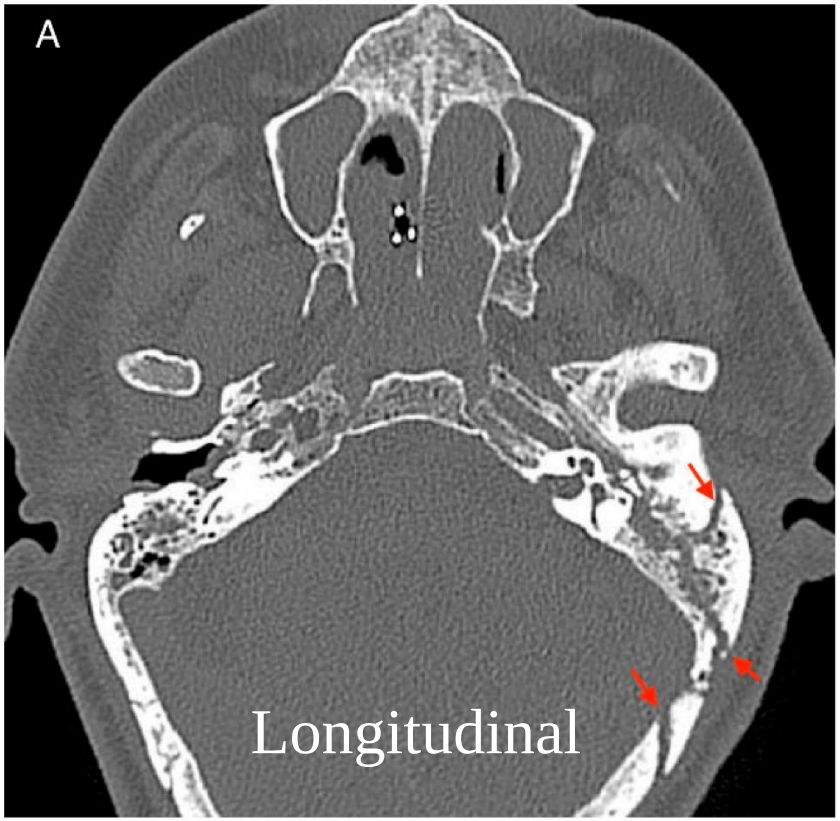
Signs middle fossa skull base fracture: Battle's sign

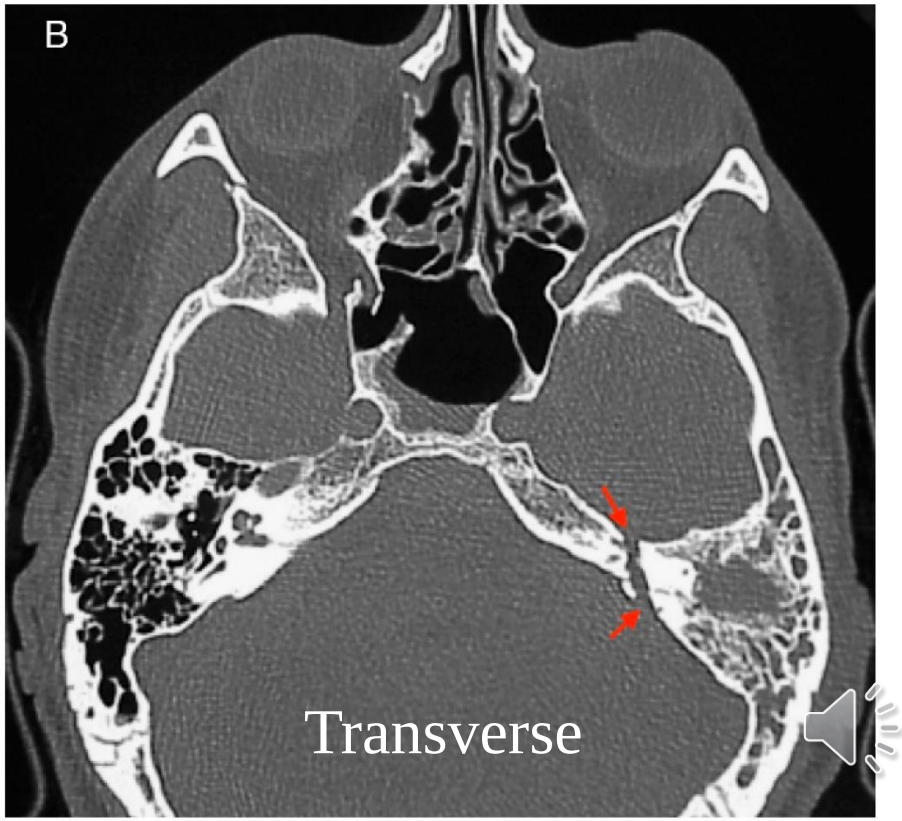


Types of petrous bone fractures

- Transverse = facial nerve palsy ± deafness
- Longitudinal = CSF leak

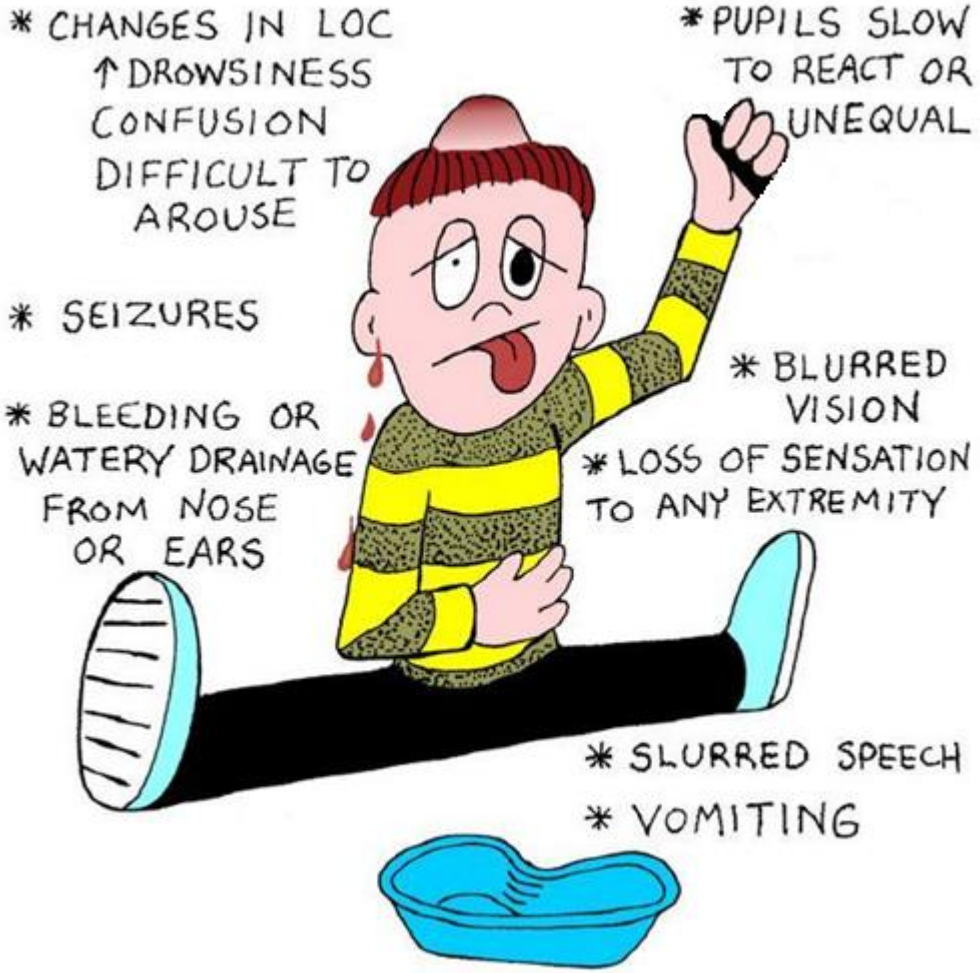


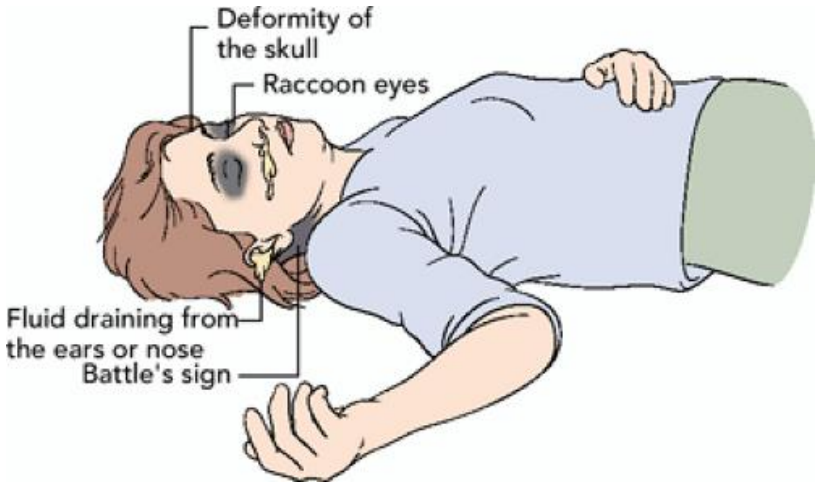


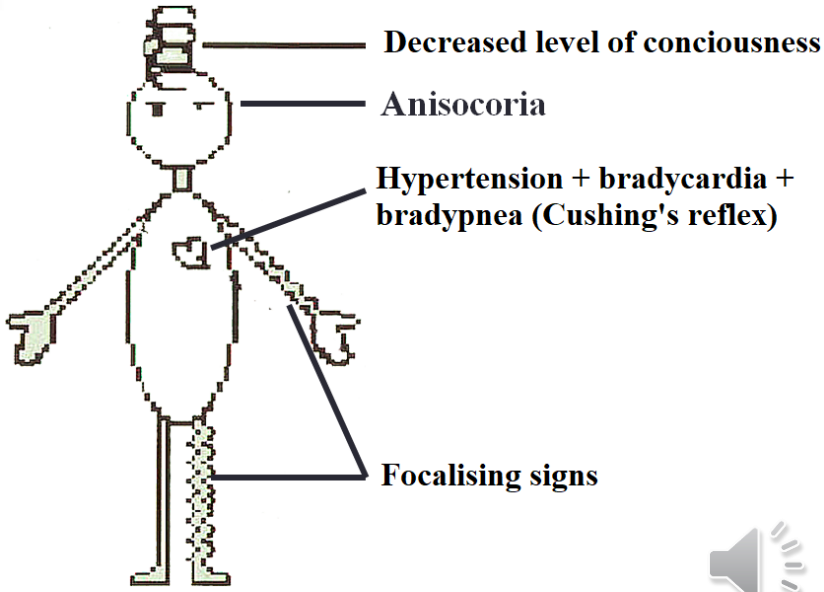


Eye injuries = possibility of brain injury crossing roof of the orbit

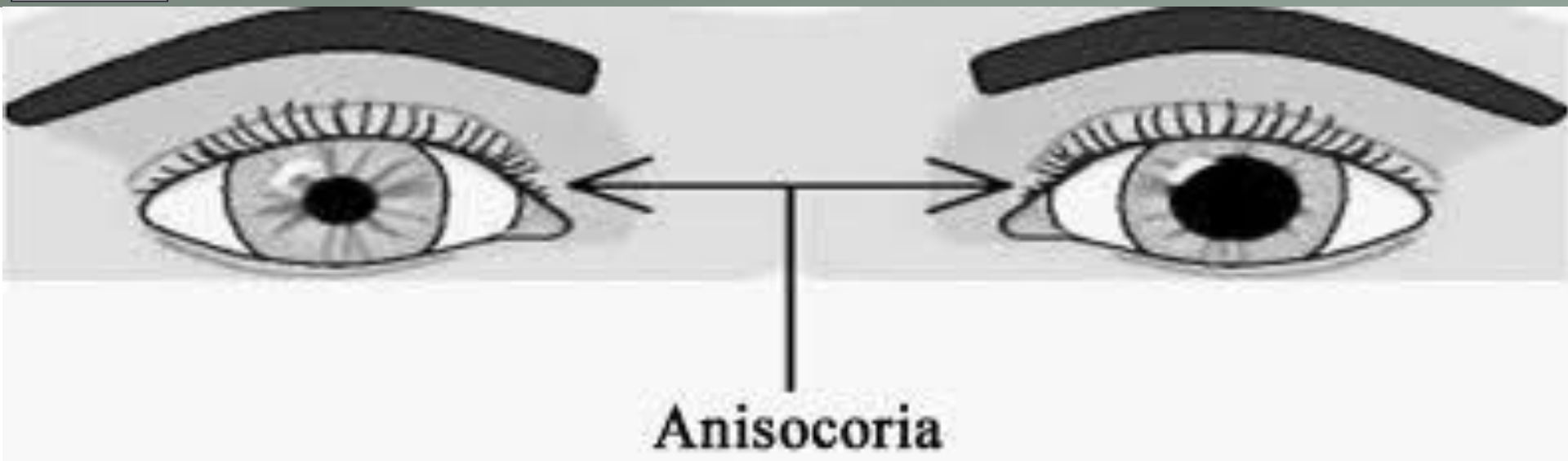
Red flag signs



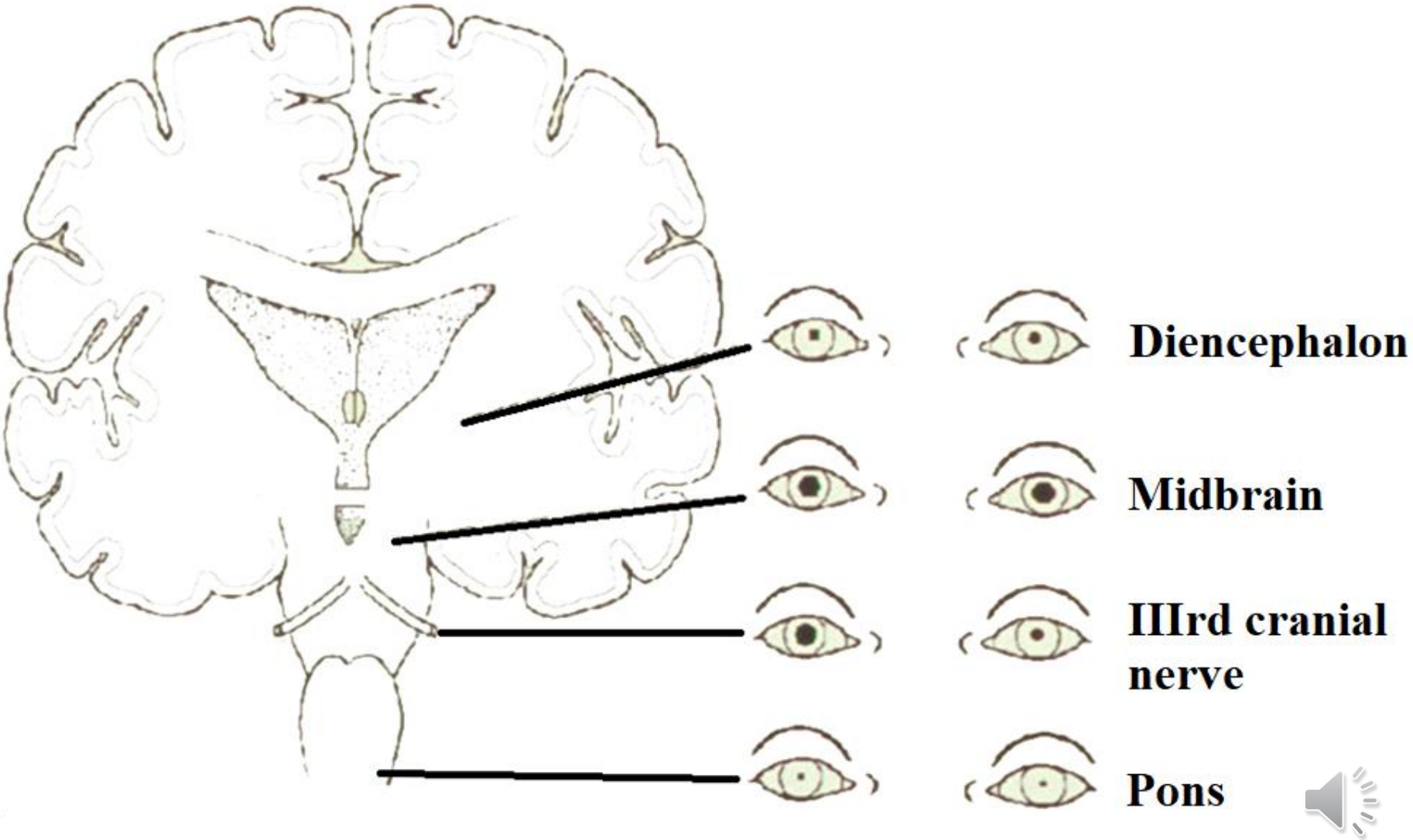




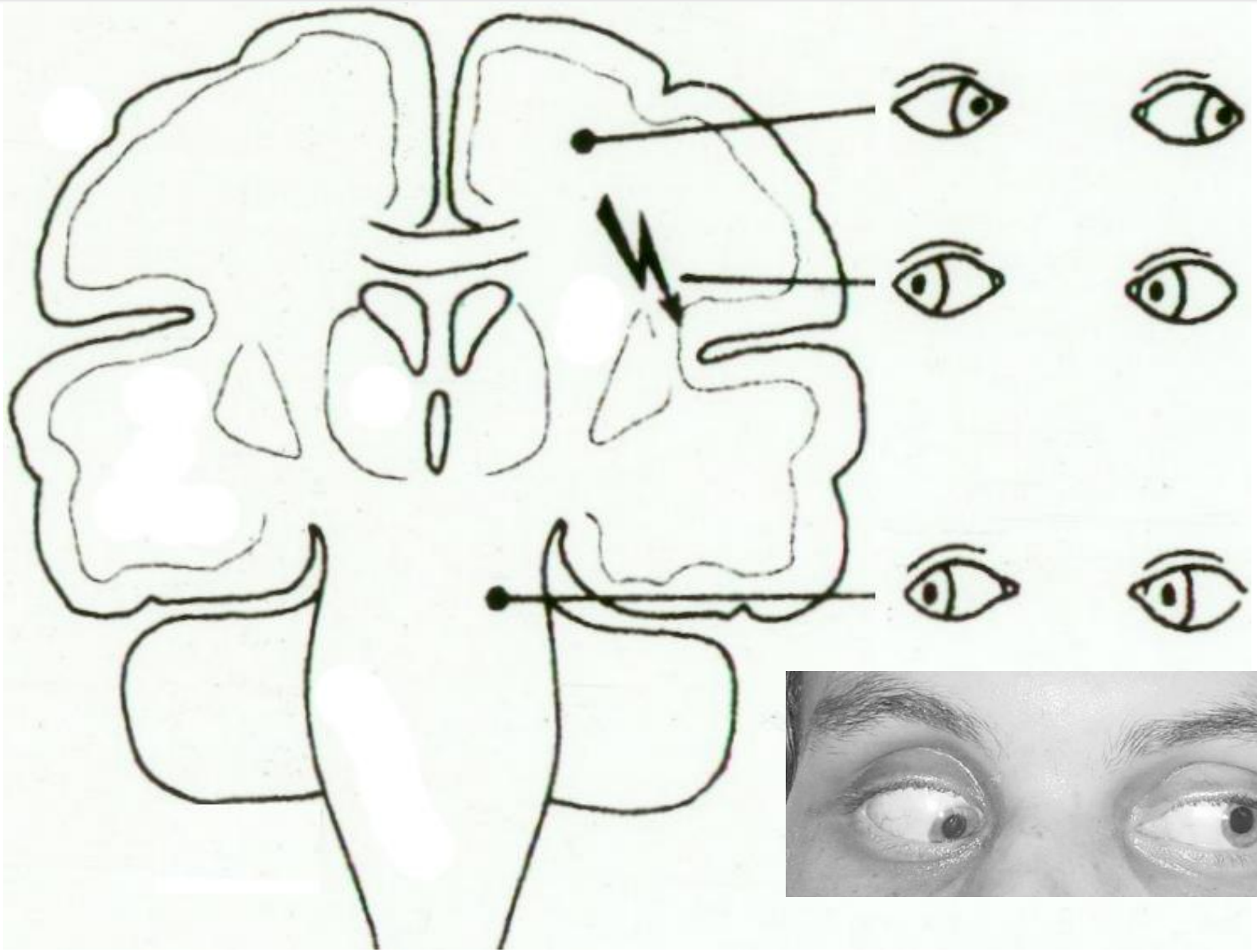
Anisocoria



Examination of the pupils

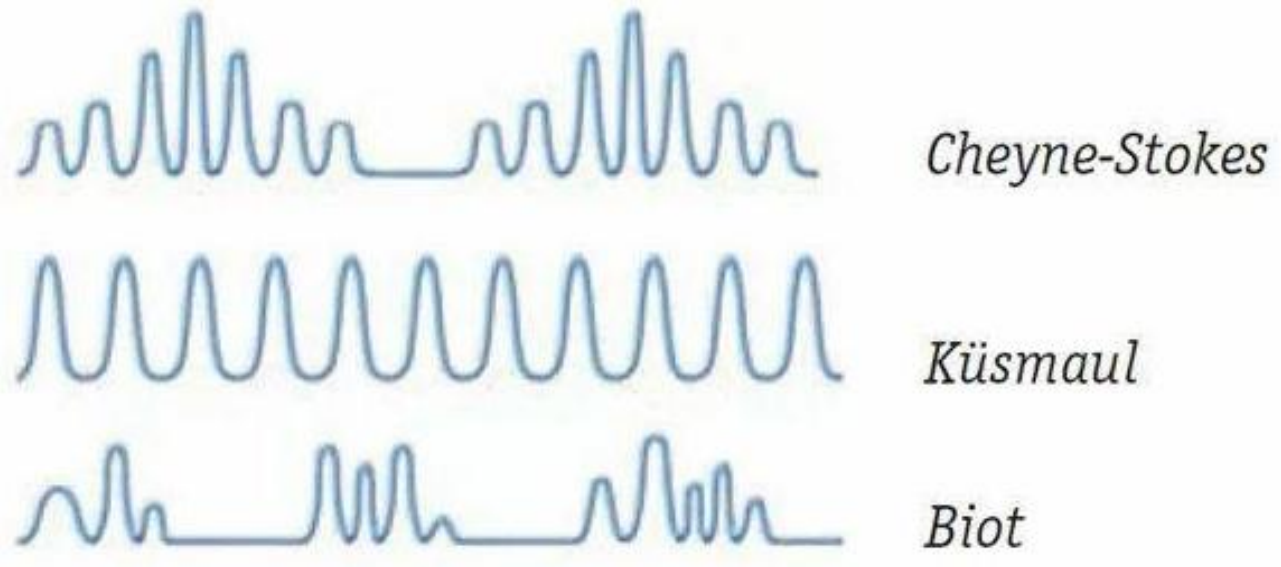


Conjugate eye deviation



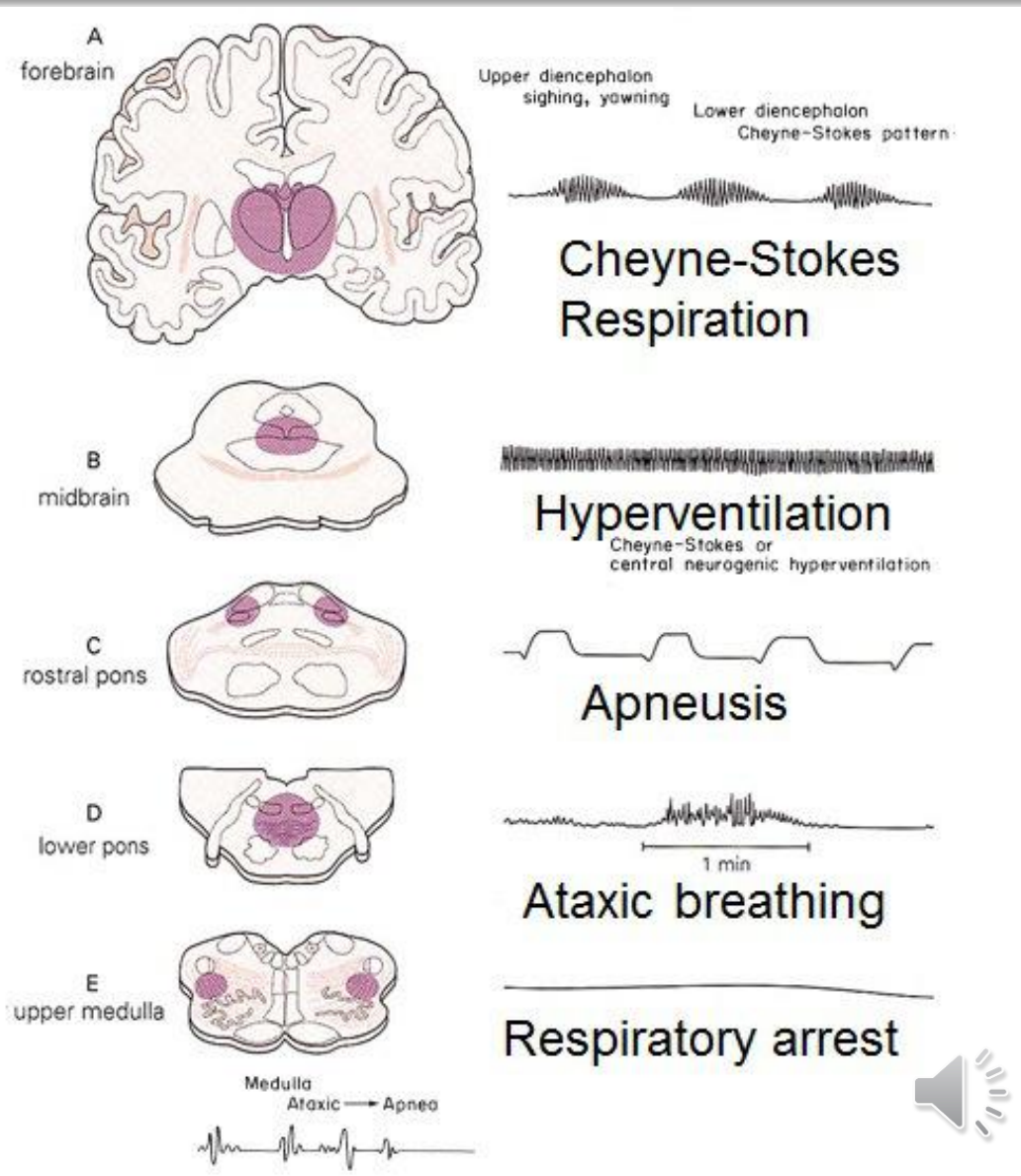
Baseline neurological examination

- Respiratory patterns
  - Kussmaul, Cheyne-Stokes, ...
- Brainstem reflexes
  - Oculovestibular
  - Oculocephalic (Doll's eyes sign)



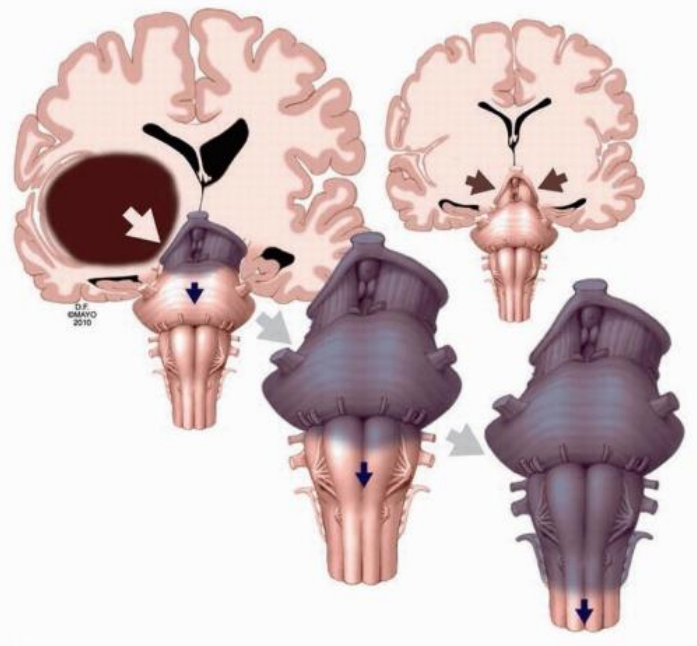
Respiration type according to injury level

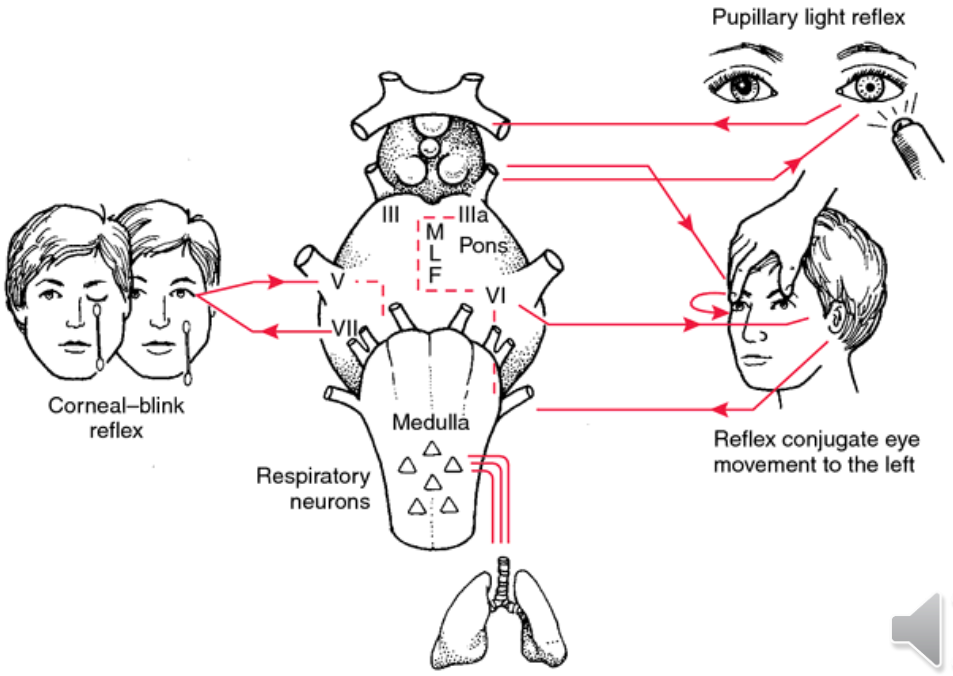
- Ominous sign = brainstem damage
  - Death expected soon



Baseline neurological examination

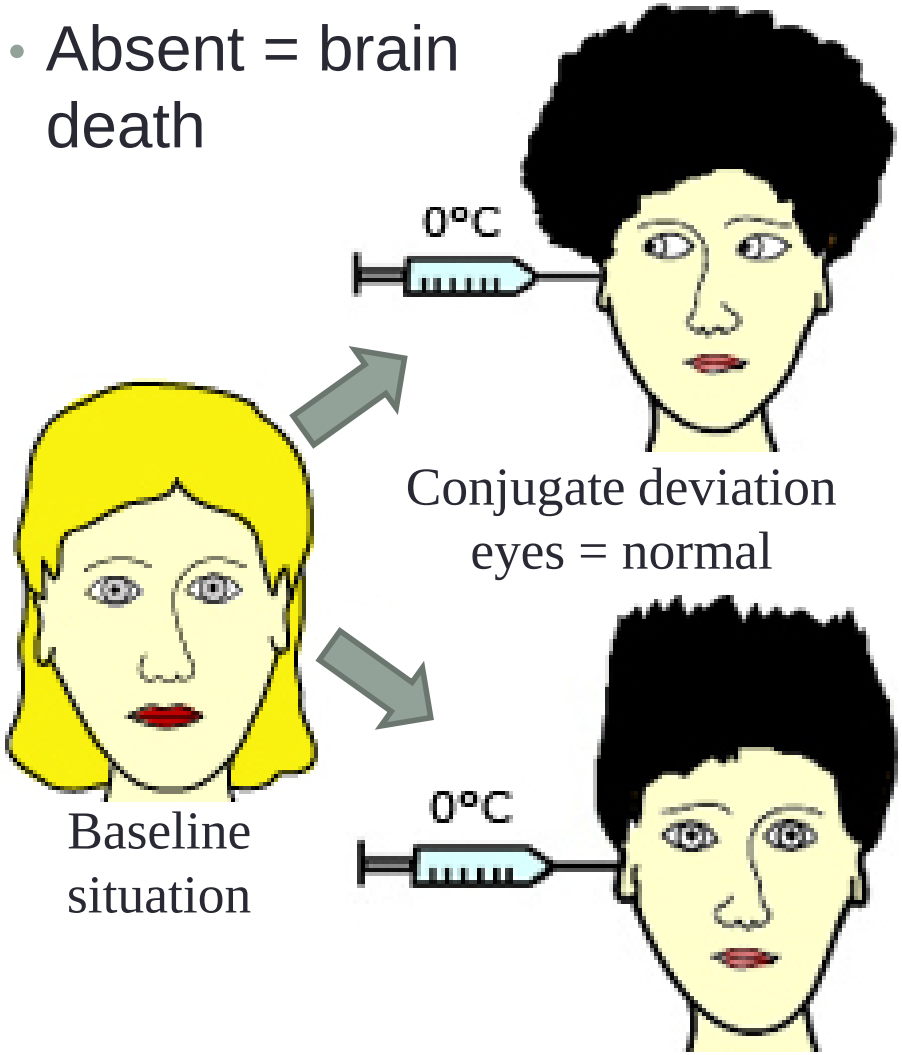
- Respiratory patterns
  - Kussmaul, Cheyne-Stokes, ...
- Brainstem reflexes (useful to diagnose brain death)
  - Oculovestibular
  - Oculocephalic (doll's eyes sign)





Oculovestibular reflexes

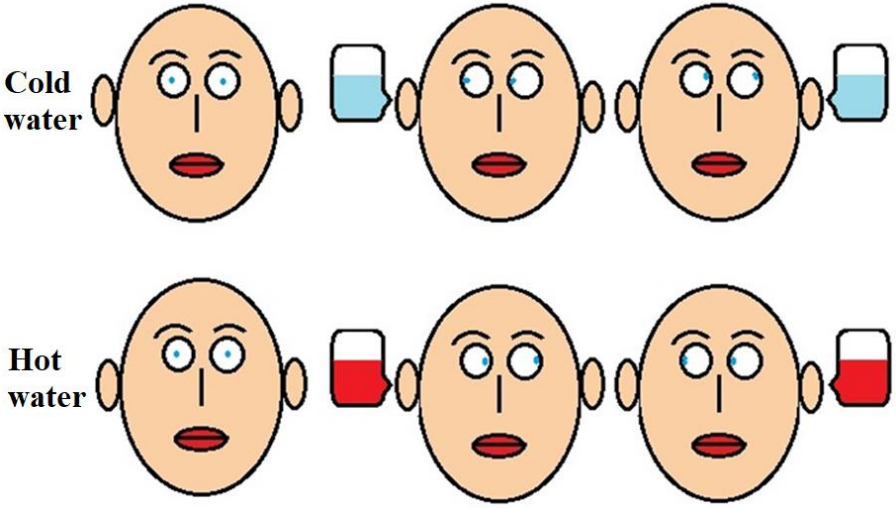
- Absent = brain death



Baseline situation

Conjugate deviation eyes = normal

NO eye deviation = brain death

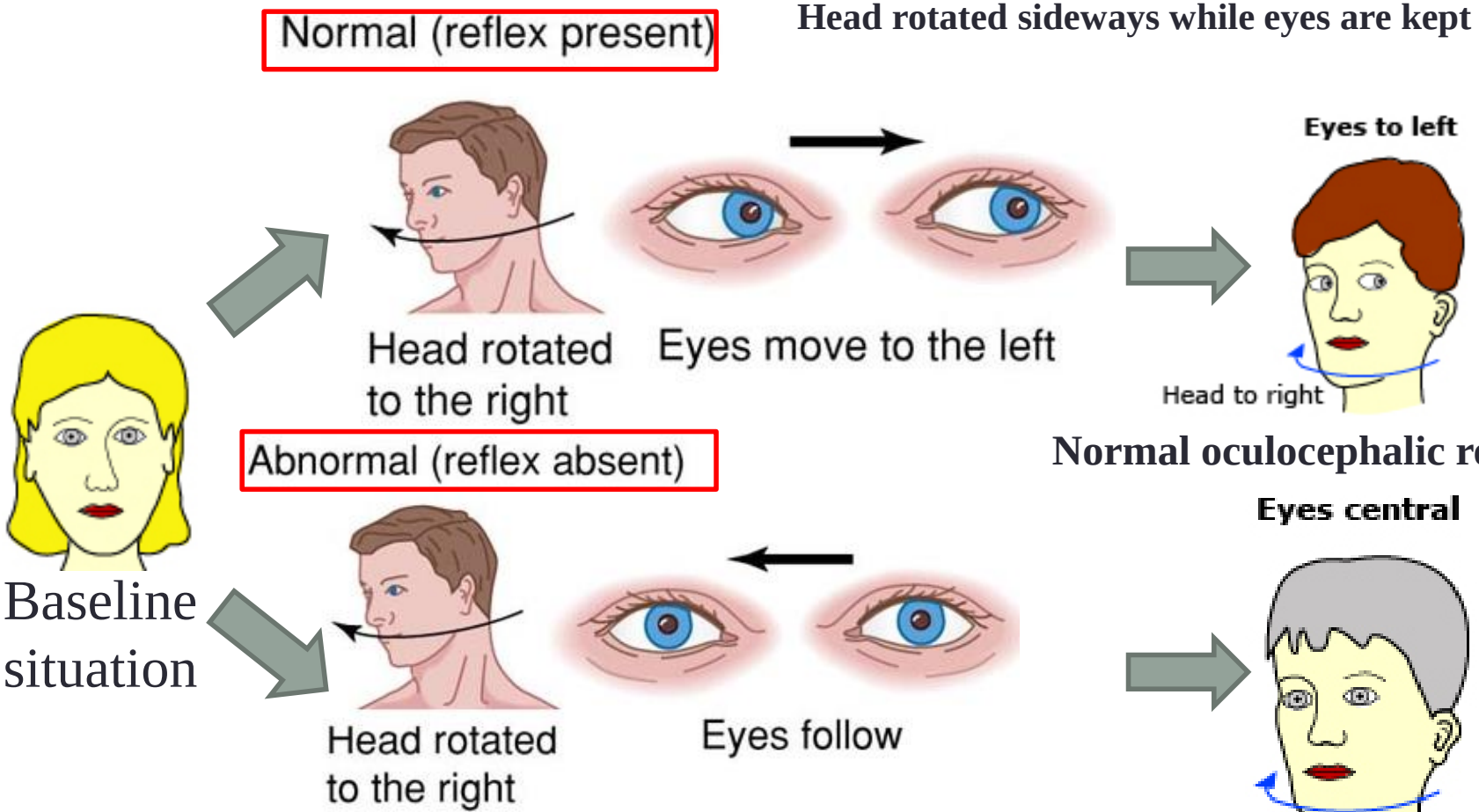


Normal oculovestibular reflexes (can be done with hot or cold water)

Oculocephalic reflexes

- Absent = doll's eye sign = brain death

Head rotated sideways while eyes are kept open



Normal oculocephalic reflex

Doll's eye sign: when the head is passively rotated the eyes stay facing ahead

Brain death

Glasgow Coma Scale (GCS)

- Universal communicating language = MUST be accurate and never guessed

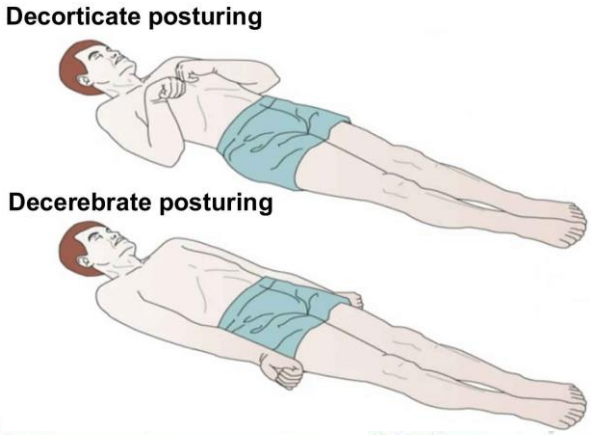
REMEMBER?

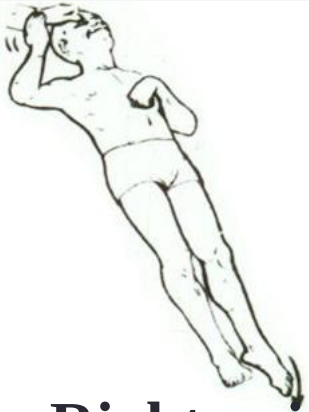
EYE OPENING			VERBAL RESPONSE			MOTOR RESPONSE		
								
Spontaneous	>	4	Orientated	>	5	Obey commands	>	6
To sound	>	3	Confused	>	4	Localising	>	5
To pressure	>	2	Words	>	3	Normal flexion	>	4
None	>	1	Sounds	>	2	Abnormal flexion	>	3
			None	>	1	Extension	>	2
						None	>	1

GLASGOW COMA SCALE SCORE		
Mild	Moderate	Severe
13-15	9-12	3-8

Score:
Max. 15
Min. 3

Response to painful stimuli



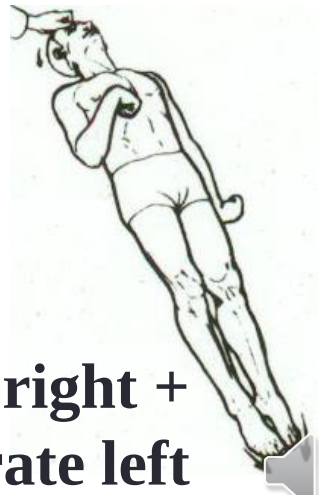


Right pain localisation + decorticate left

Right pain localisation + decerebrate left

Decortication

Decerebration



Decorticate right + decerebrate left

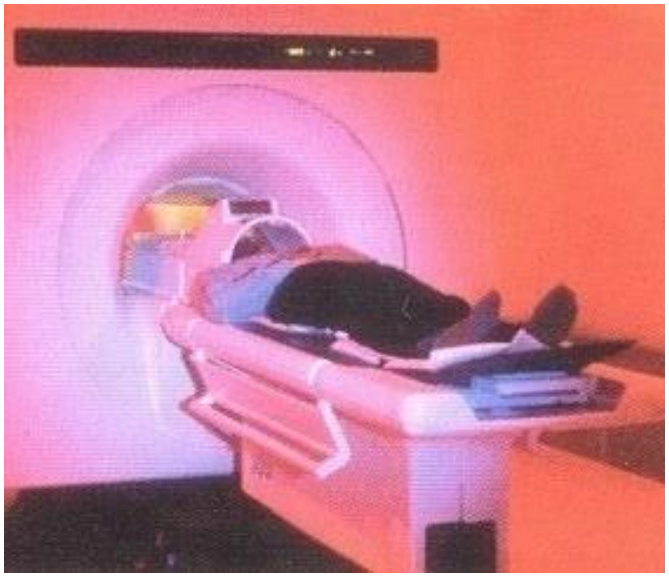
Glasgow coma scale: prognosis

- Important not only GCS on hospital admission but its evolution over time = MUST be accurate never guessed

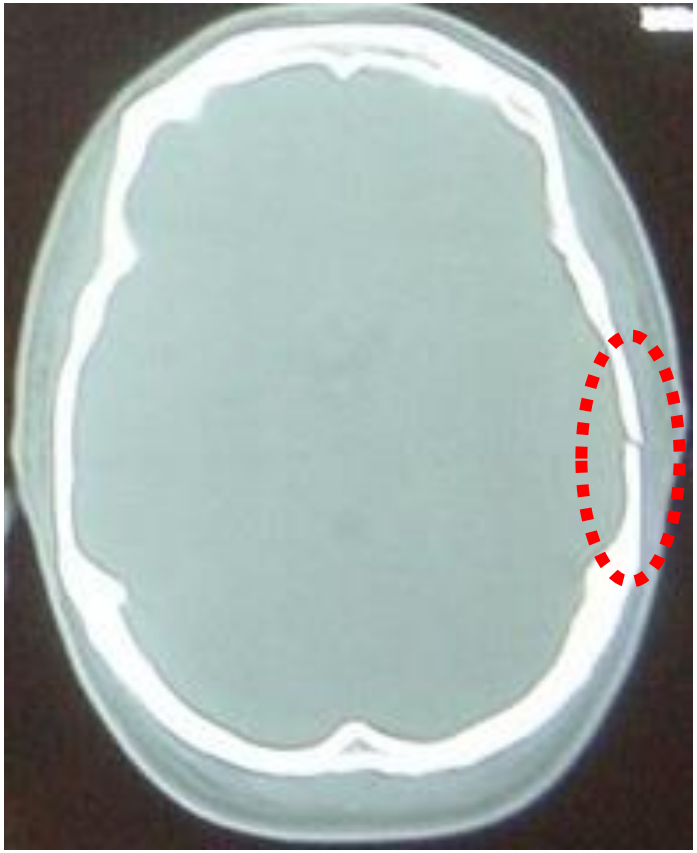
Score	Eye Opening	Verbal Response	Motor Response
13 - 15	Mild Injury		
9-12	Moderate Injury		
3 - 9	Severe Injury		

NEUROIMAGING: head + cervical + thoracic + abdominal + pelvic CT

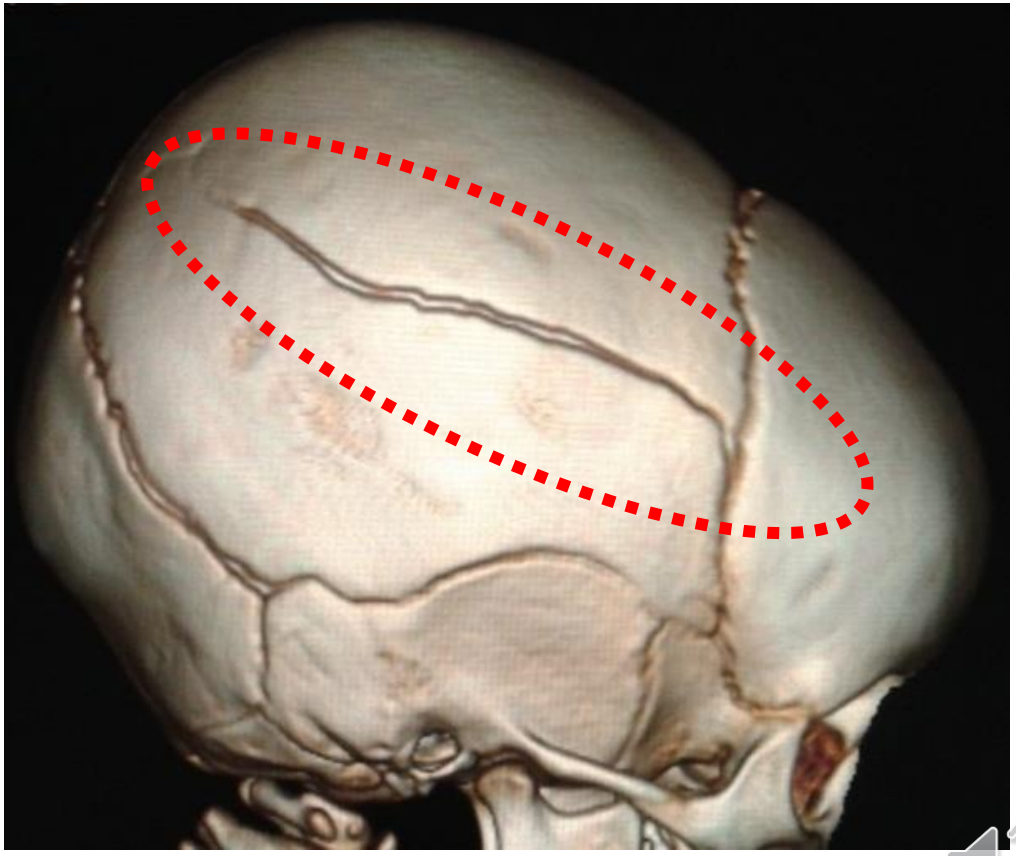
- Best & swift way to rule out polytrauma
- Can be done any time
- Images are recovered in seconds = can be used in restless patient
- Even limbs can be scanned if needed without need of additionally mobilising the patient



Temporal squama skull fracture = risk epidural hematoma

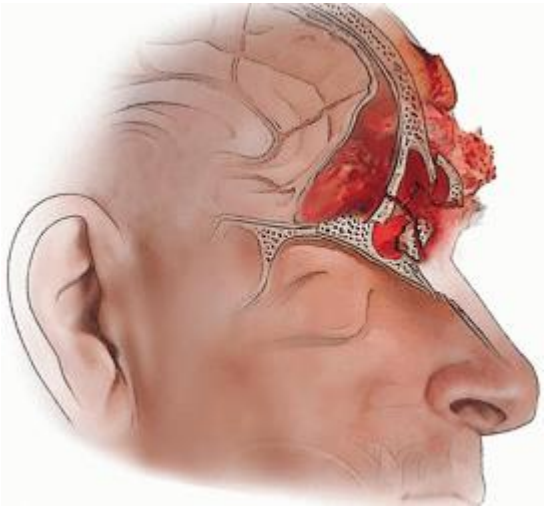


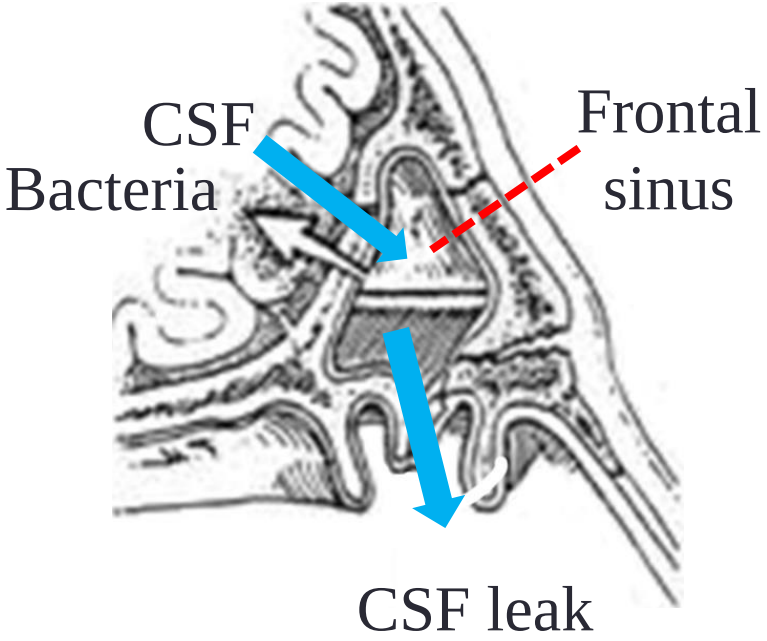
CT scan slice



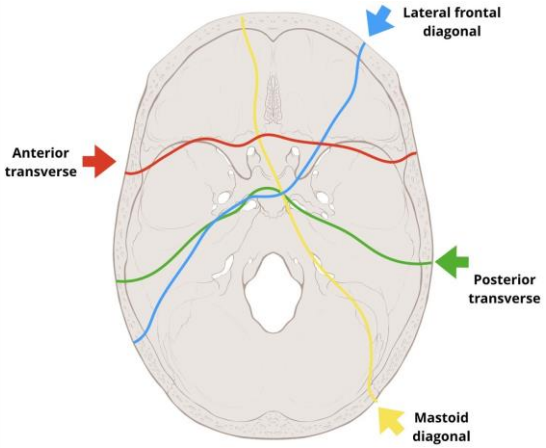
CT scan 3D reconstruction

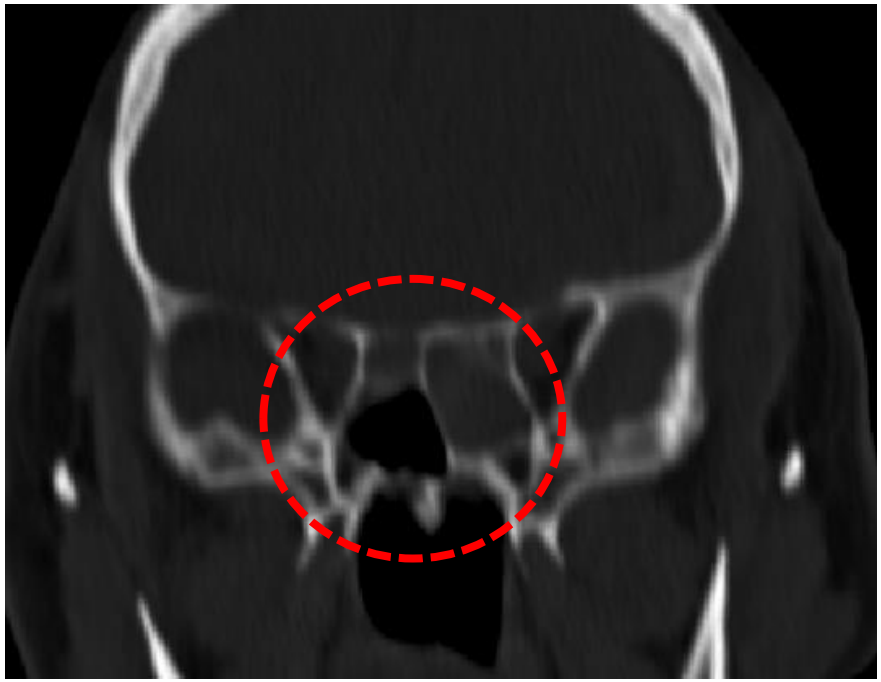
Skull base fracture = possible CSF leak = bacterial meningitis risk

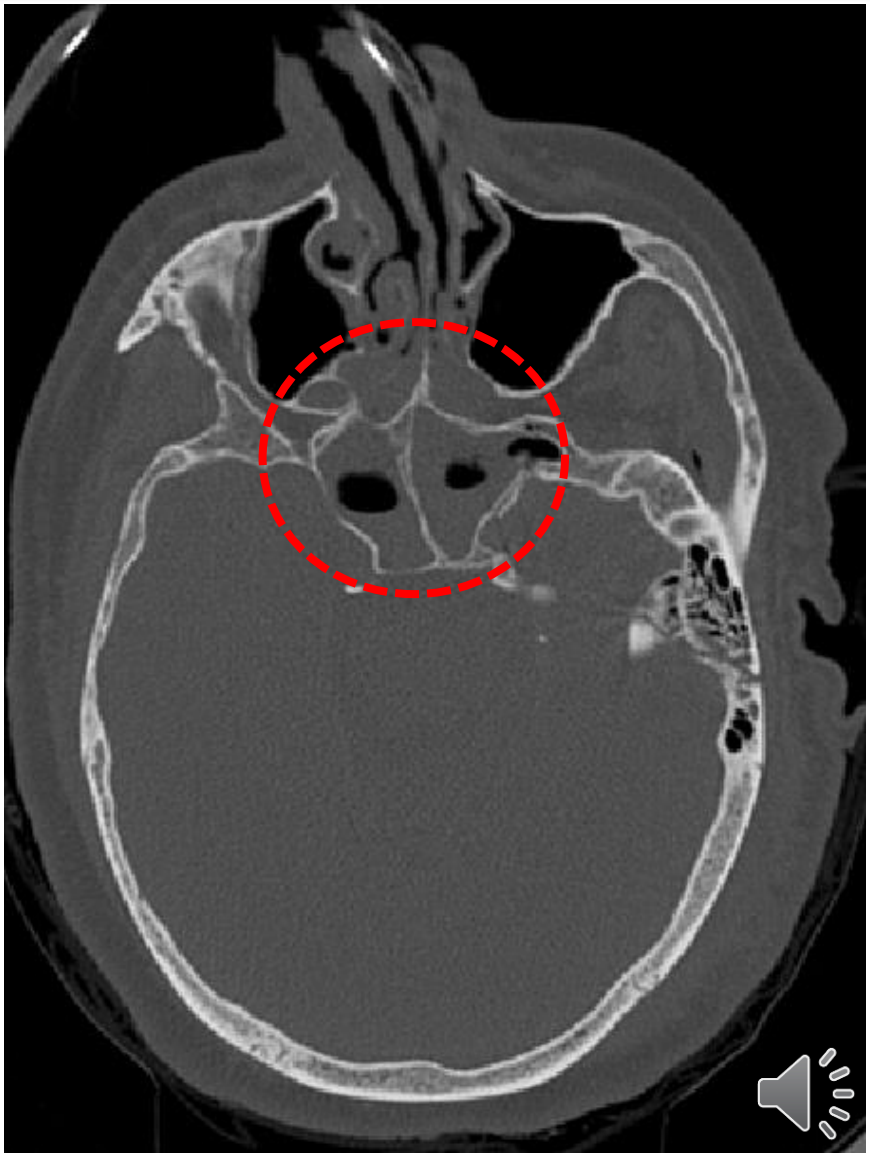




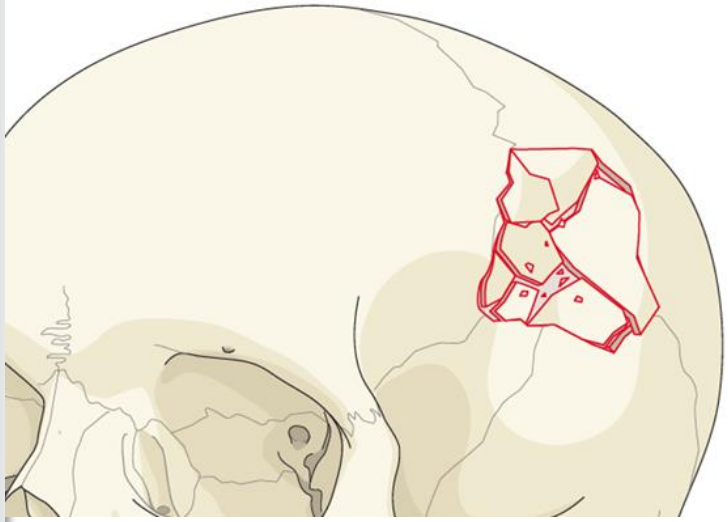
Sphenoid sinus fluid + ethmoid cells = skull base fracture

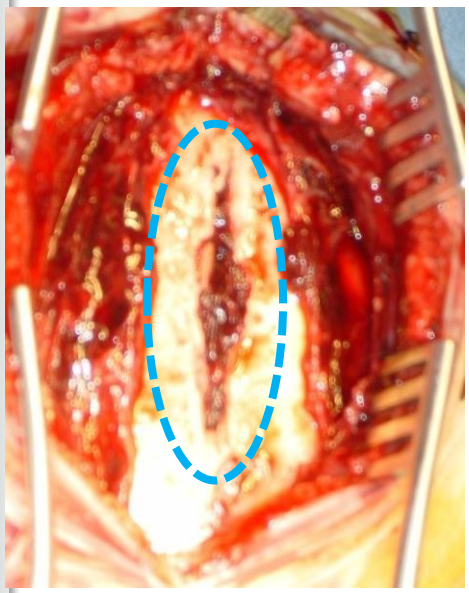


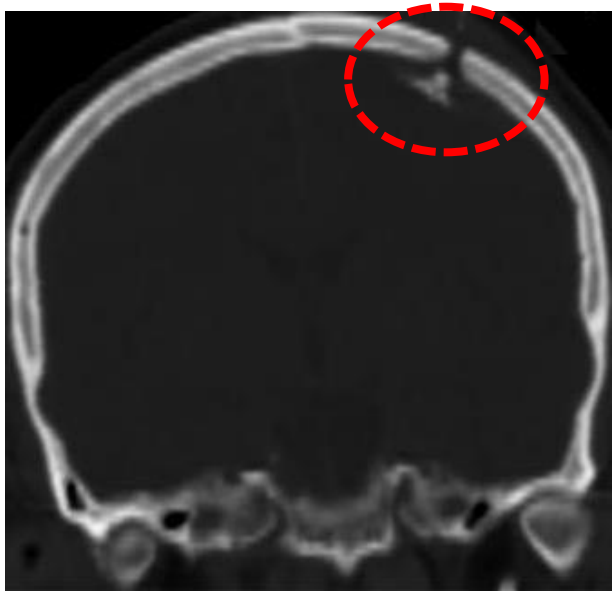


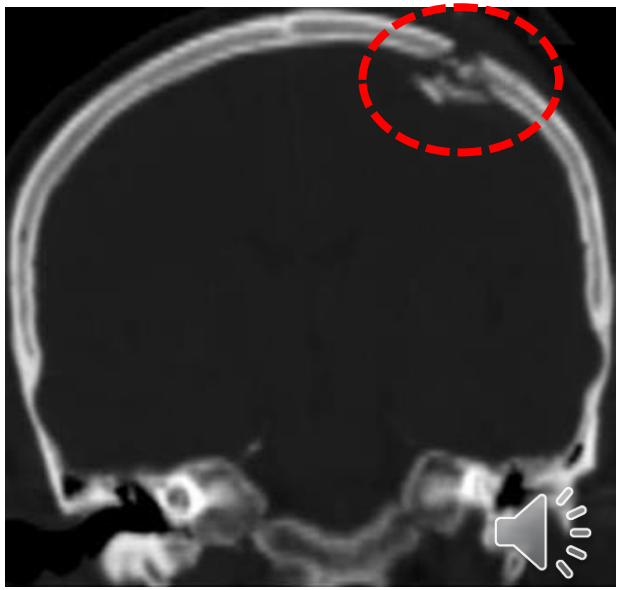


Depressed skull fracture

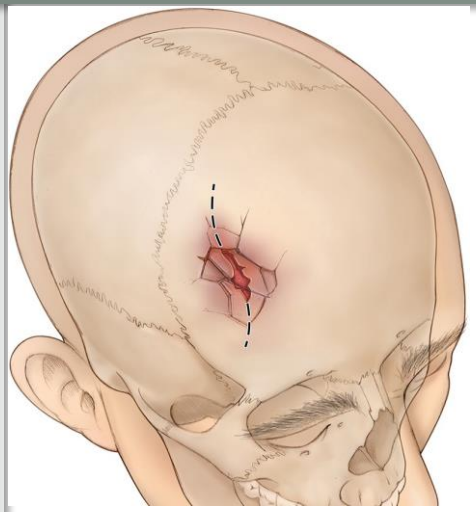




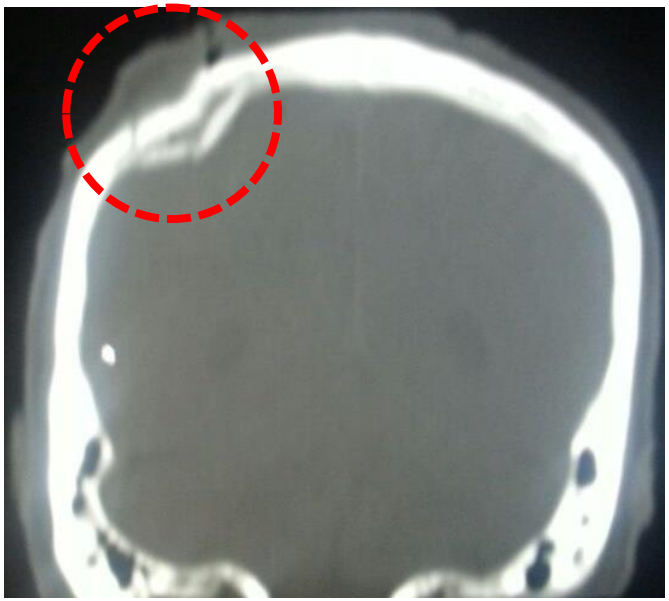




Compound depressed skull fracture



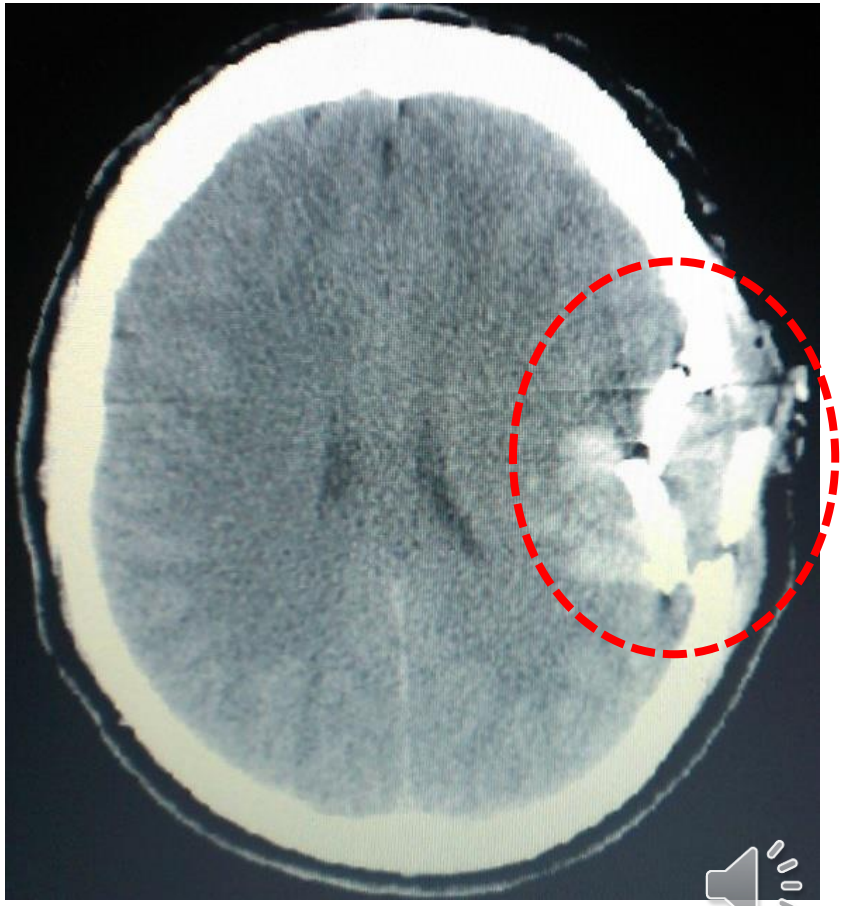


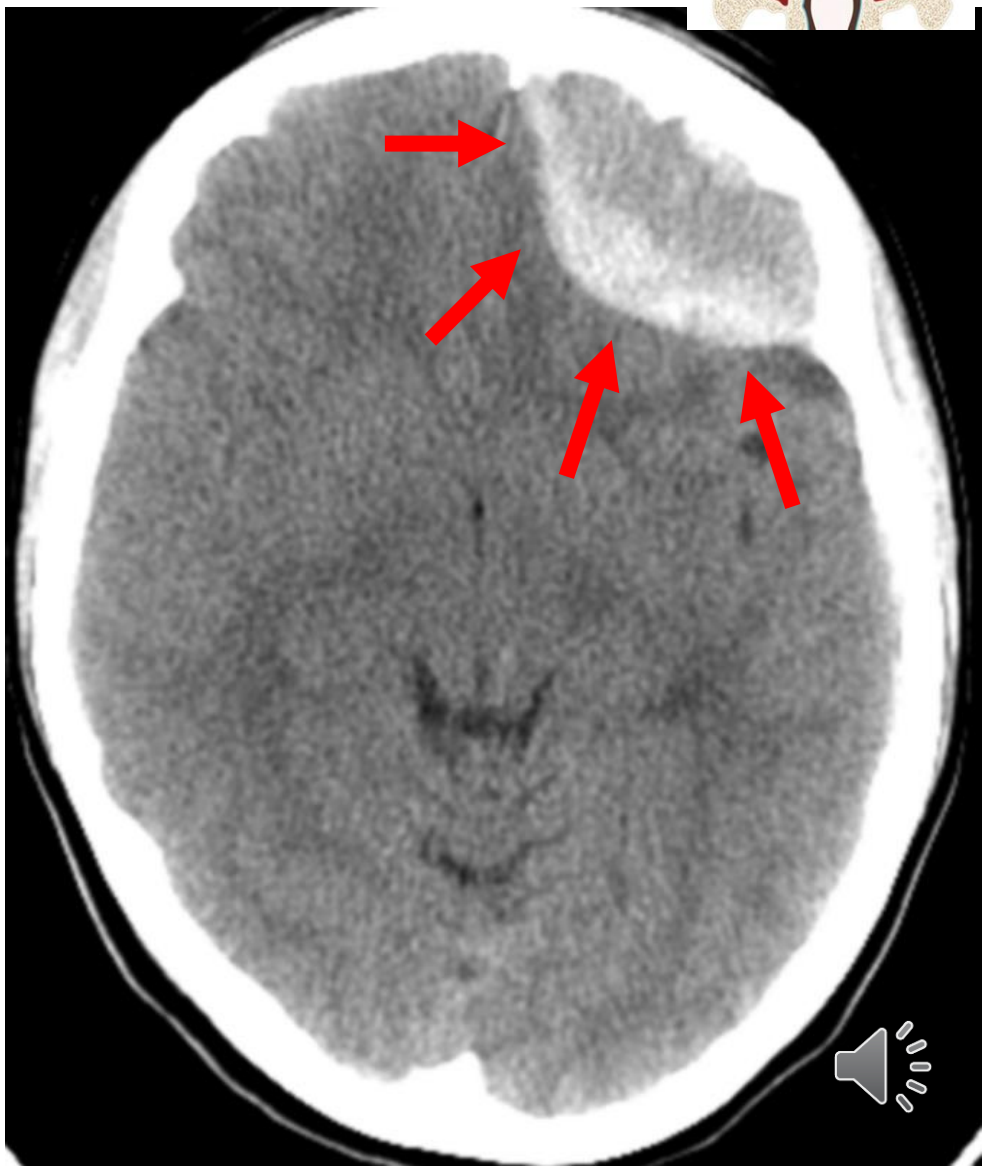

Depressed skull fracture

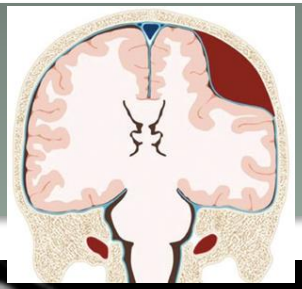
Brain contusion

Compound depressed skull fracture + severe brain contusion

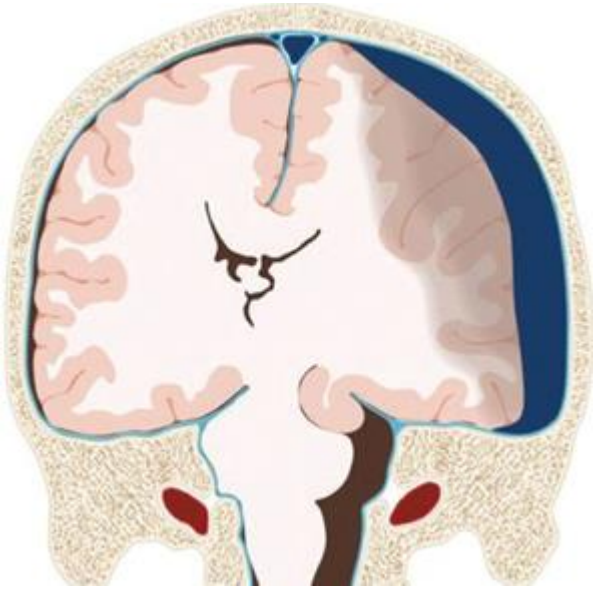


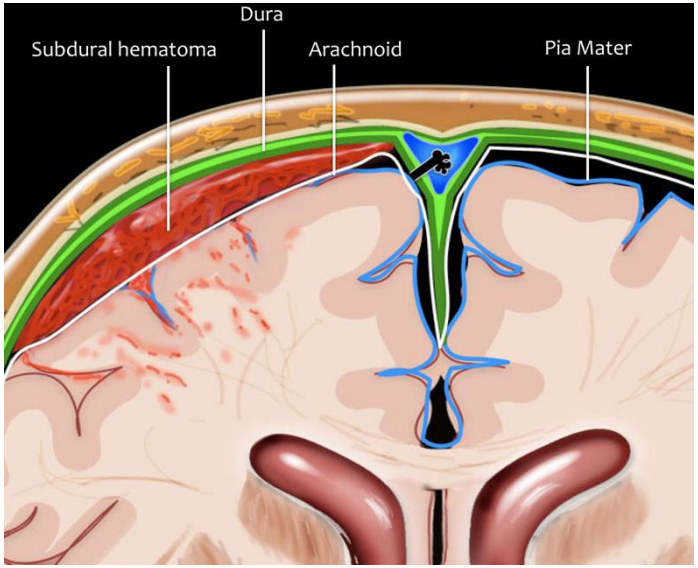
Epidural hematoma

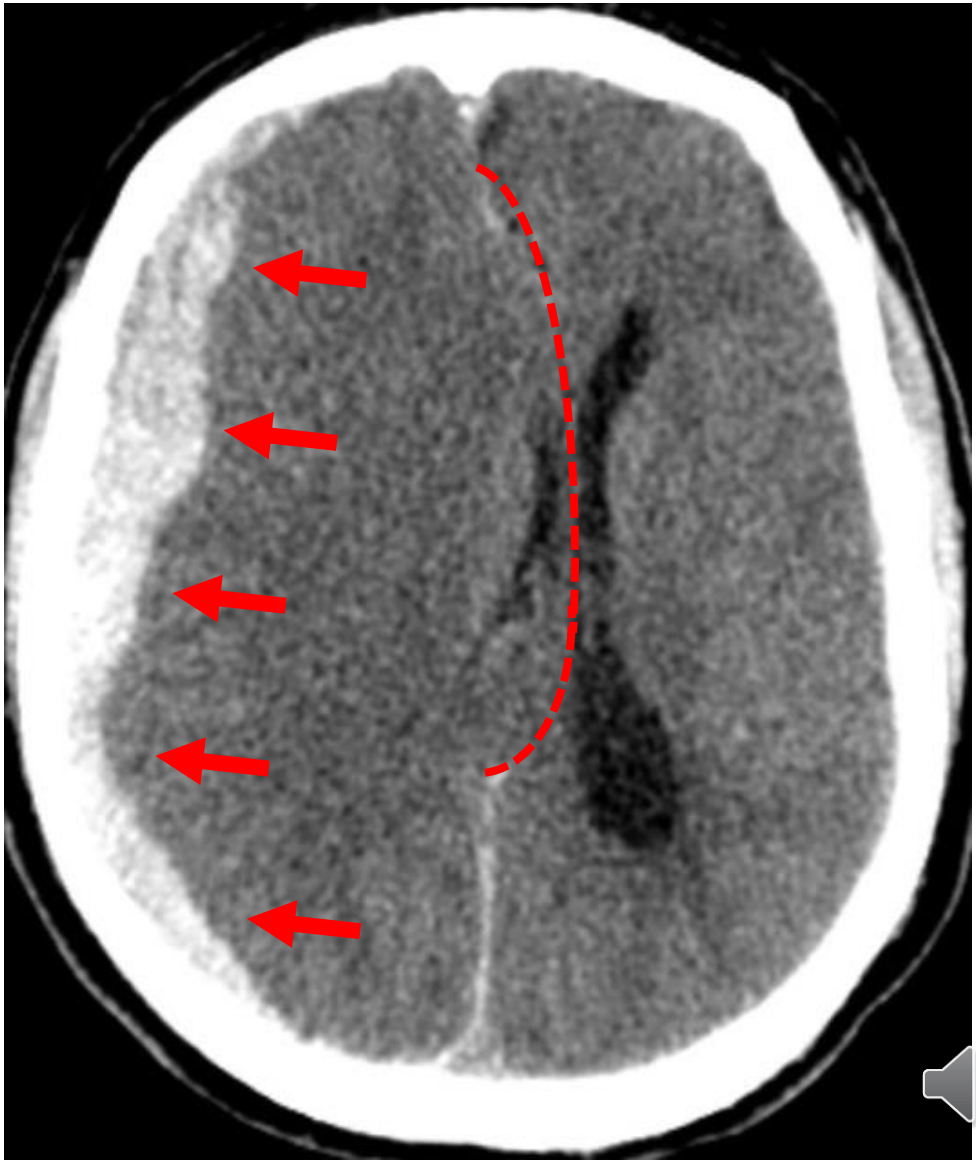




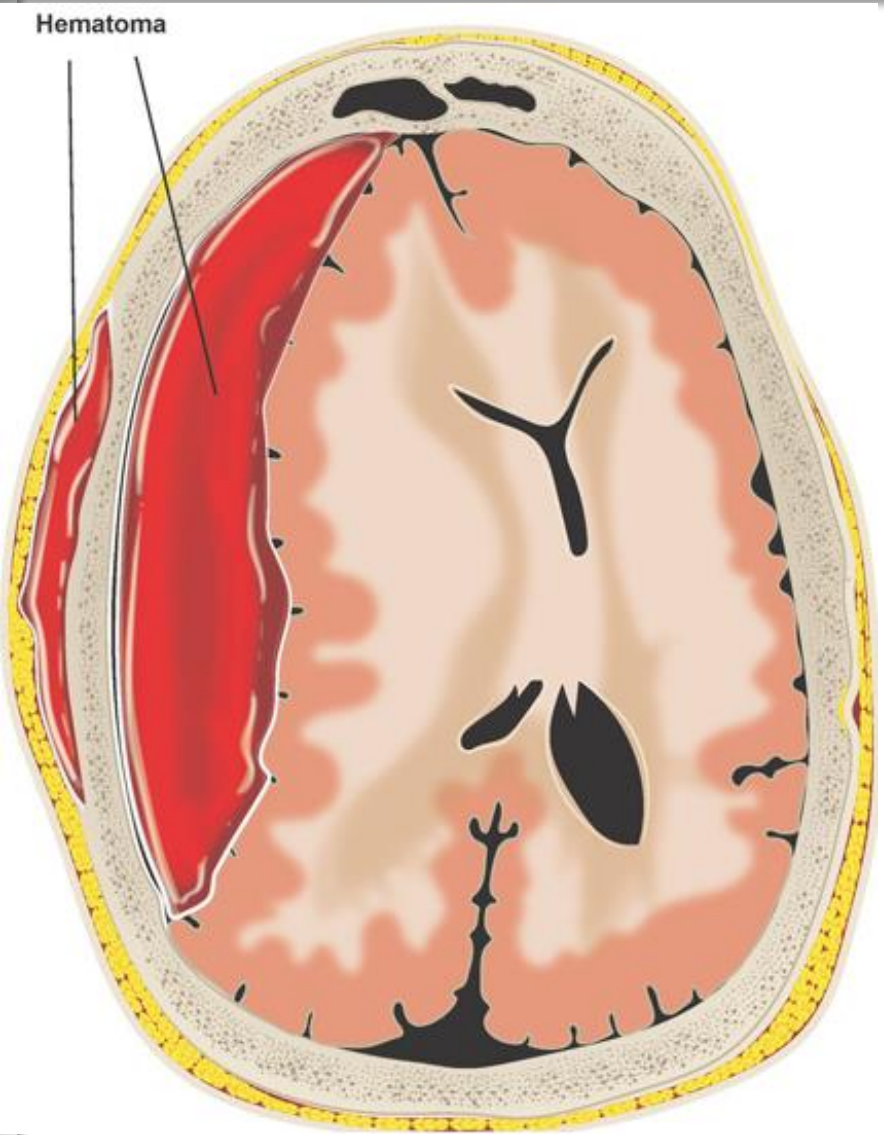
Acute subdural hematoma

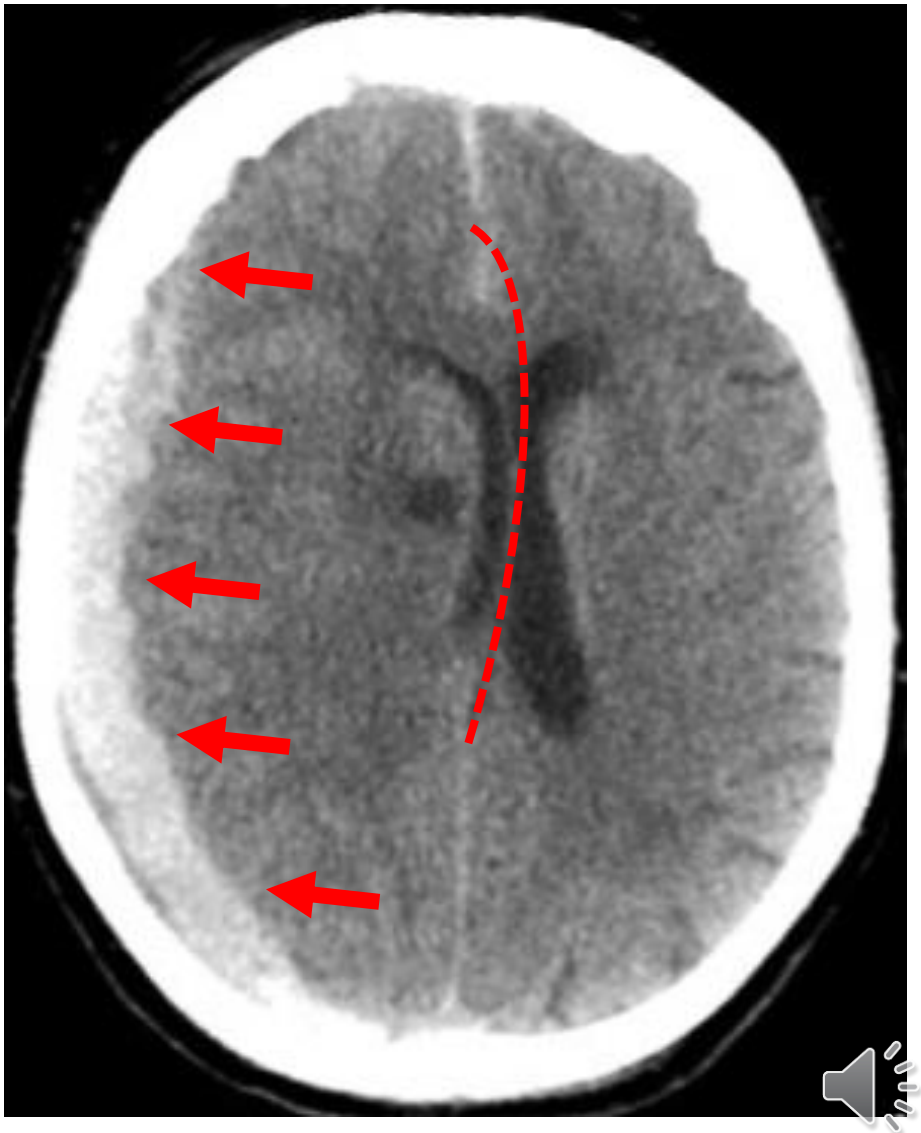




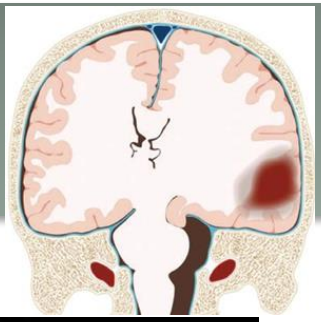


Subdural haematoma + cerebral edema



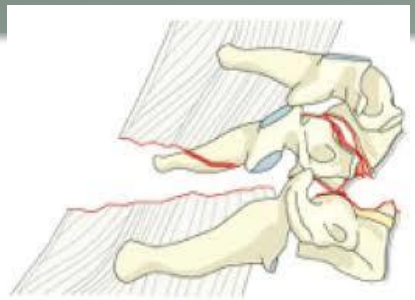


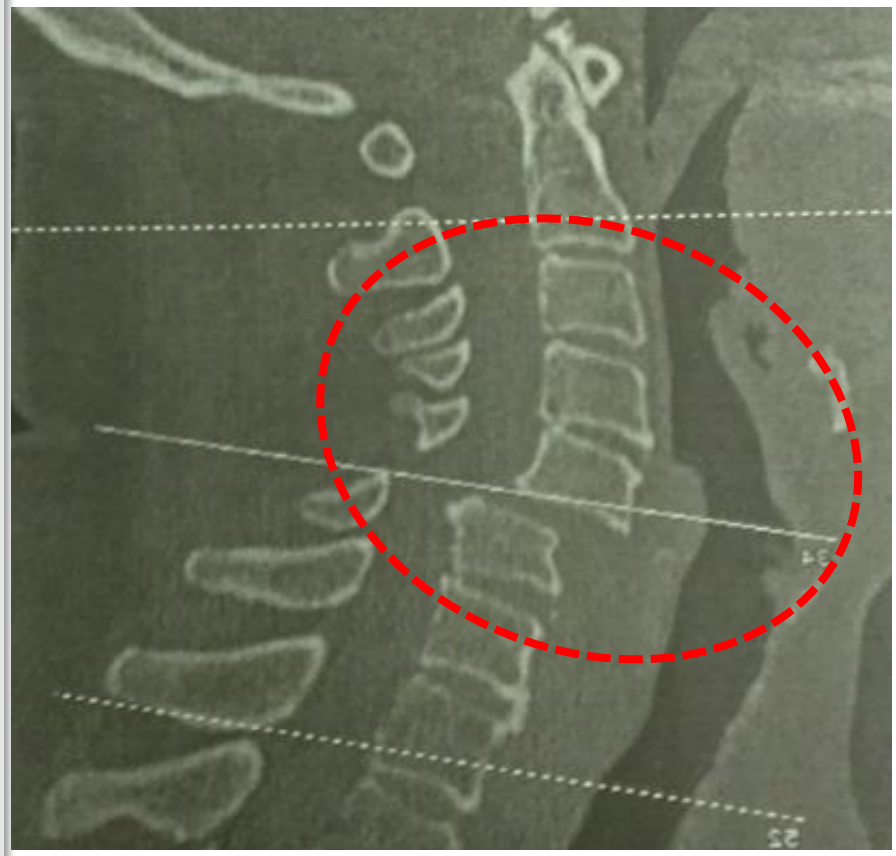
Intracerebral haematoma

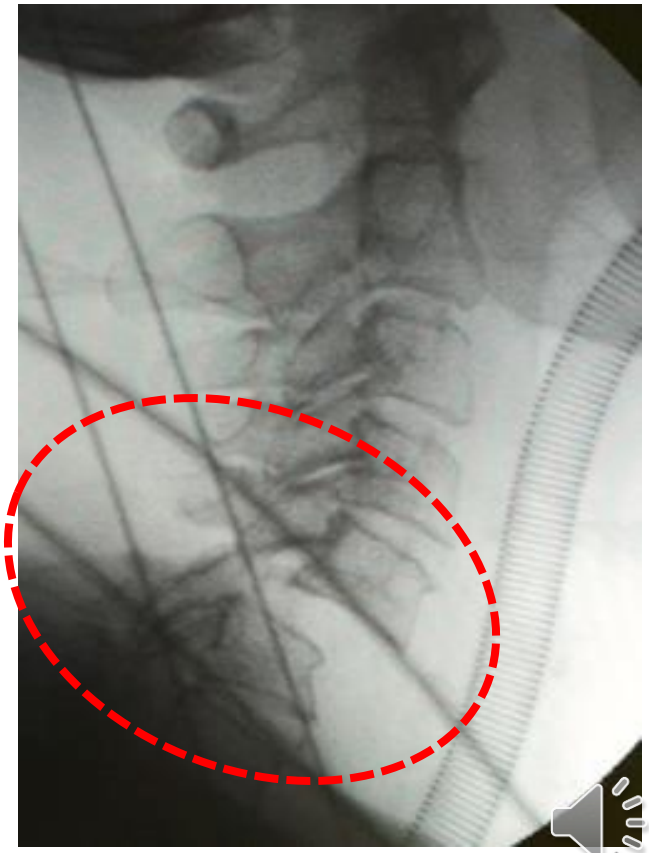


Plain x-ray: C_5-C_6 dislocation

- Can be done with portable x-ray equipment = no need to mobilise the patient

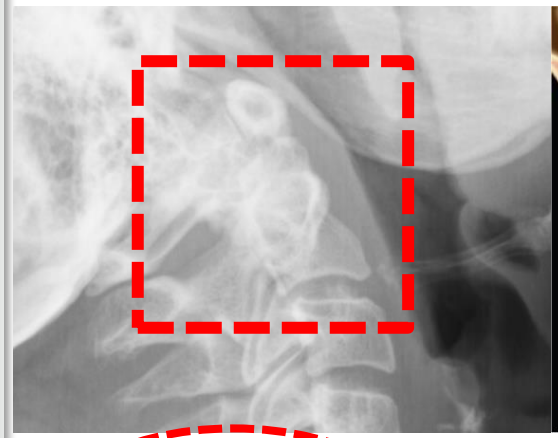


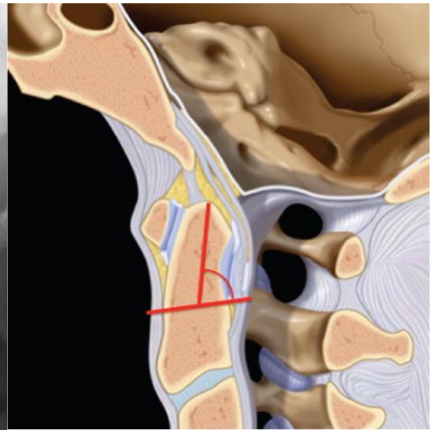


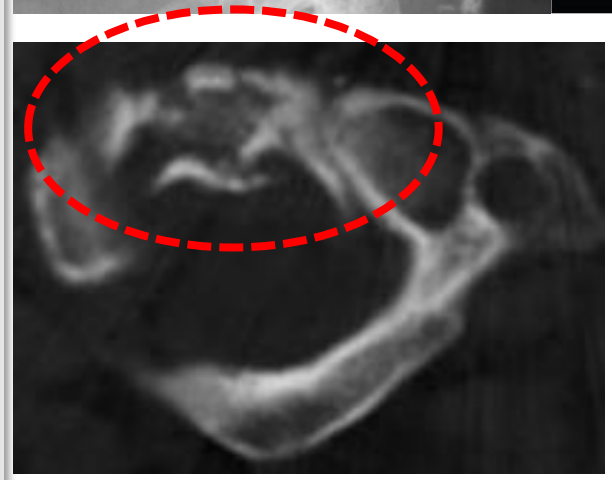


CT scan: odontoid fracture

- Common in old people
- Suspected if nuchal pain



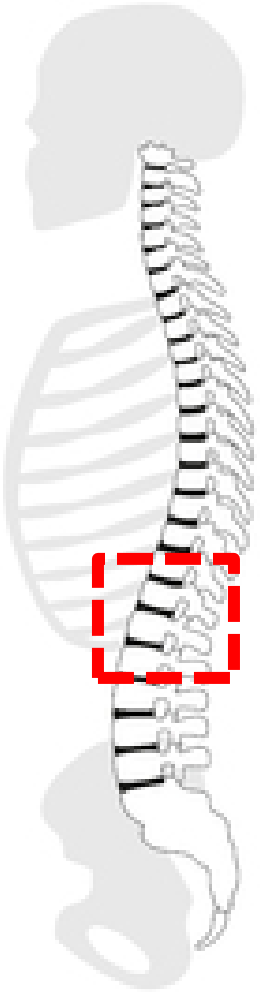


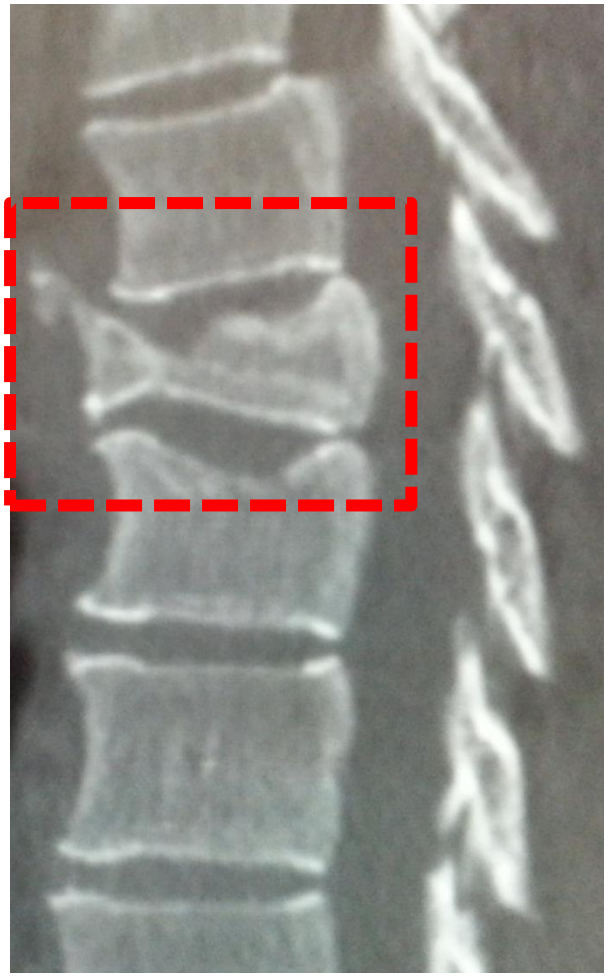


CT scan: C_1 fracture: Jefferson fracture

CT scan: thoracolumbar spine fracture

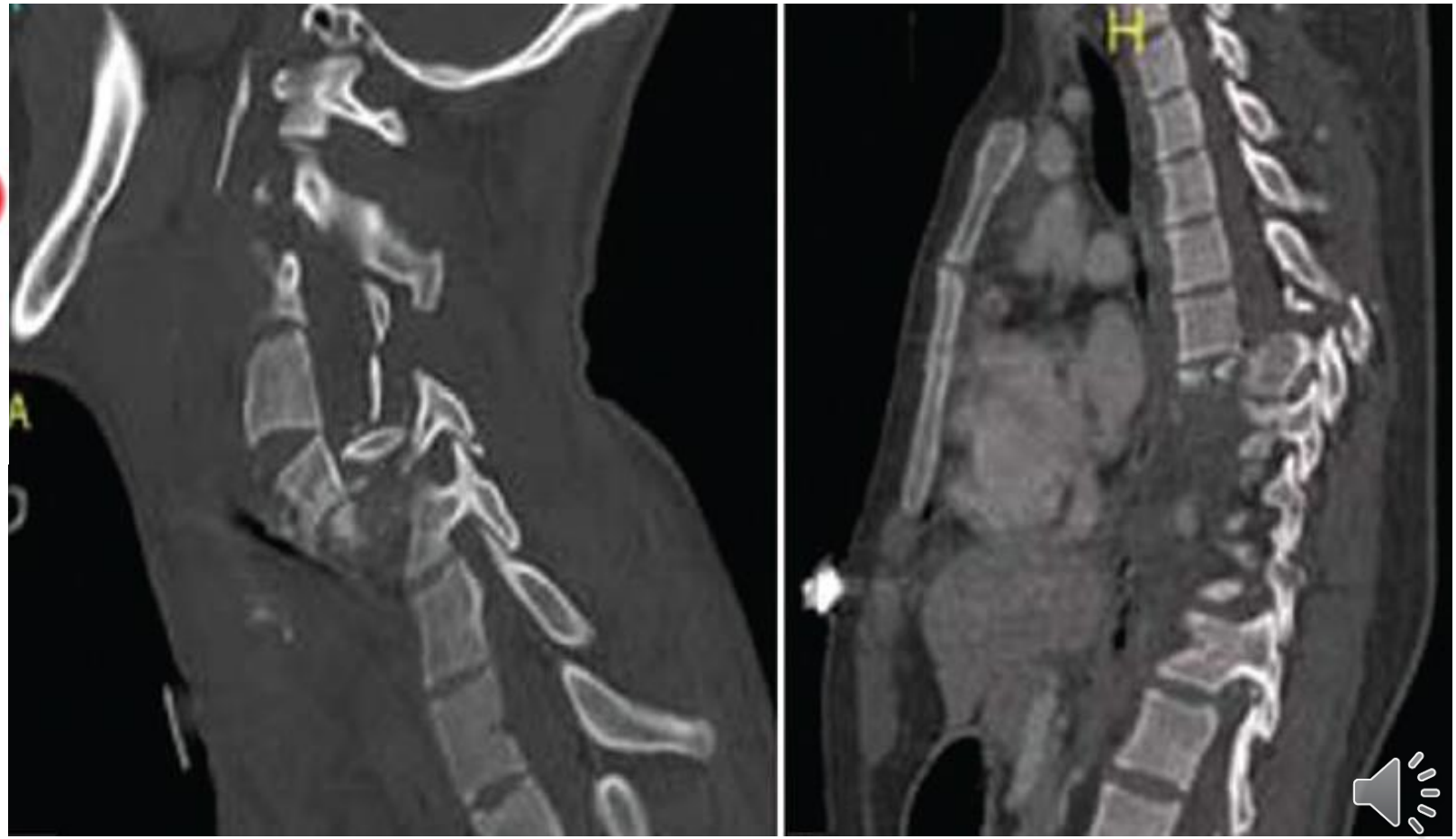
- Common in people falling on their feet



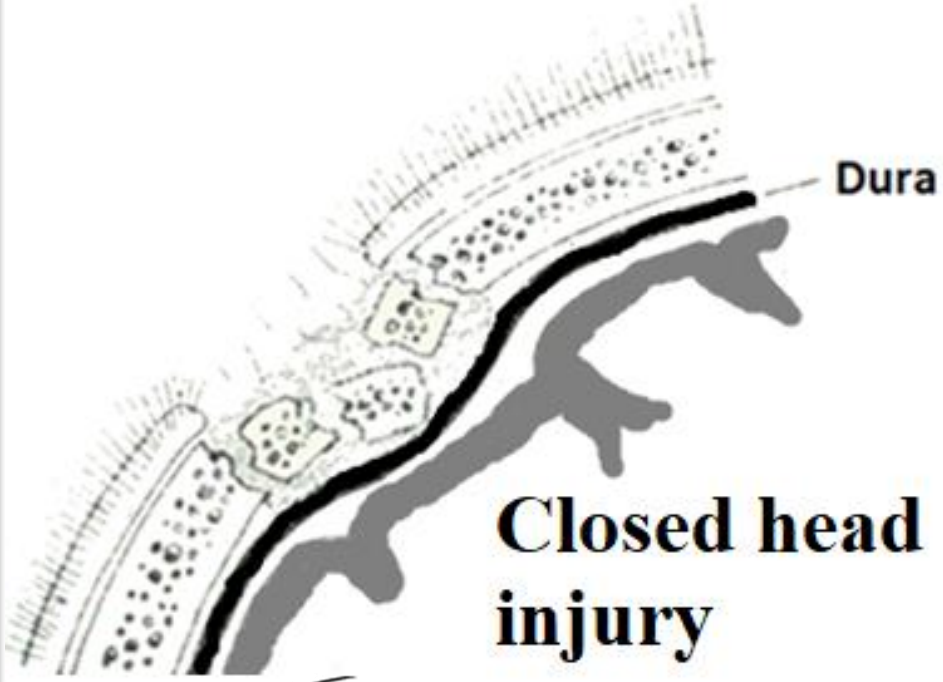


CT scan: vertebral fractures can be multiple

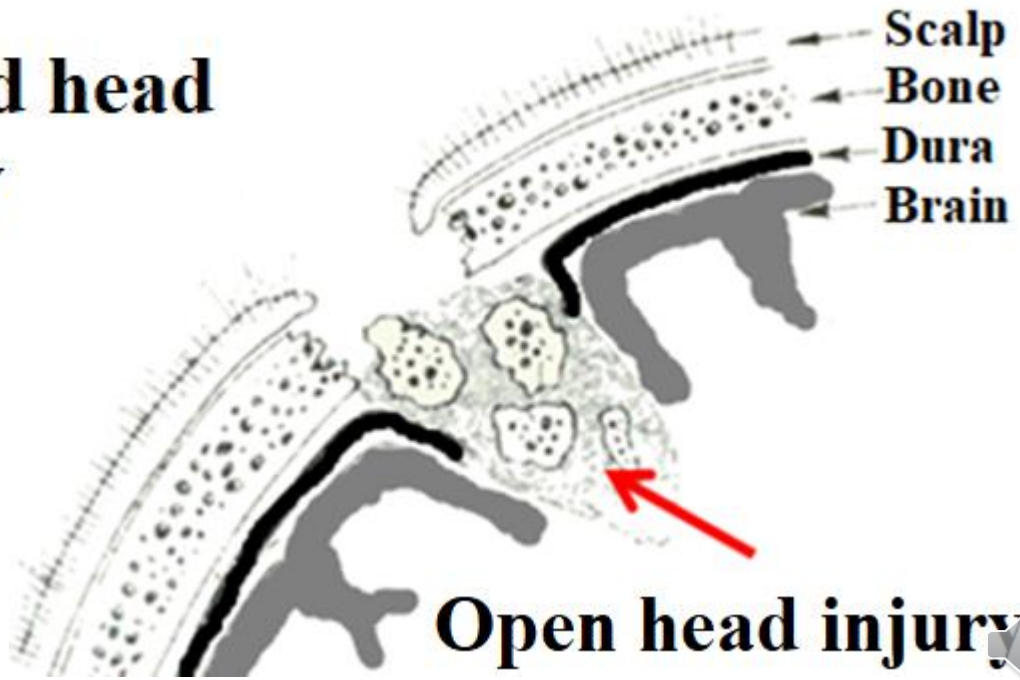
- You will never find what you don't look for!
  - Particularly in polytrauma patients



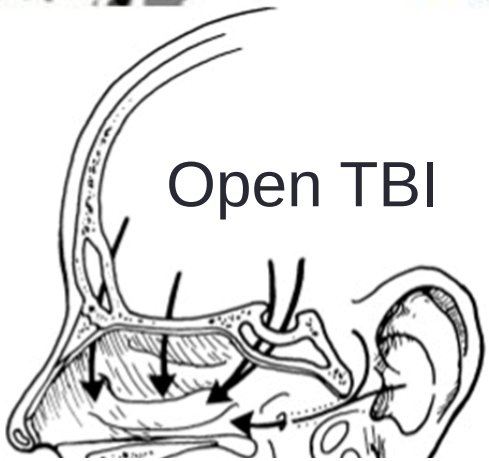
Traumatic head injury: closed = intact dura, open = lacerated dura



REMEMBER?



Open TBI

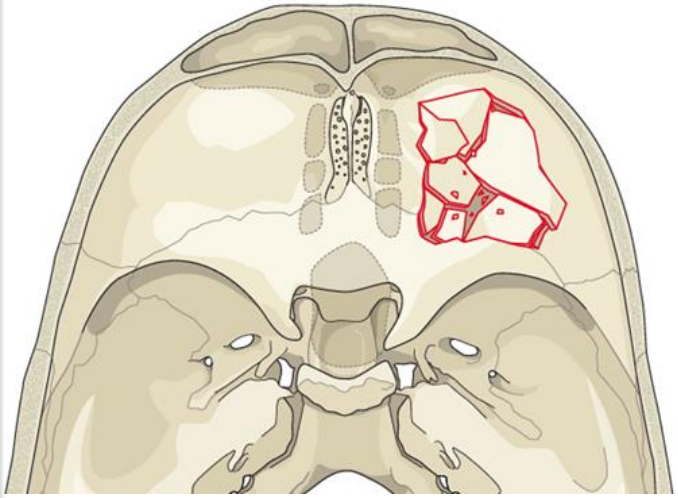


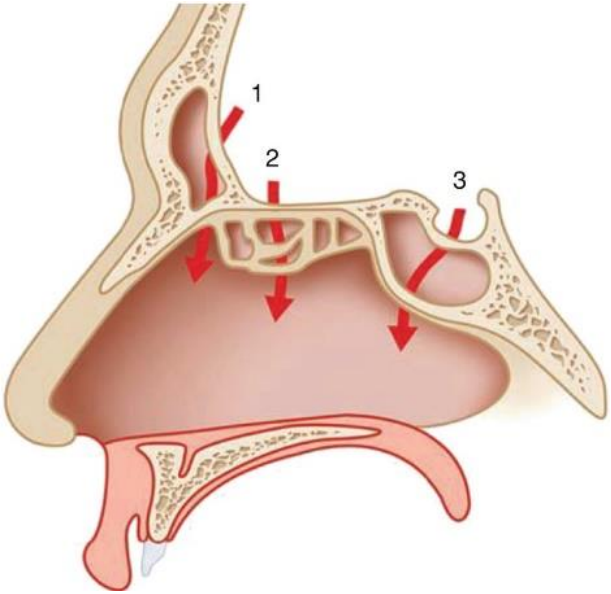
Closed traumatic brain injury (TBI)

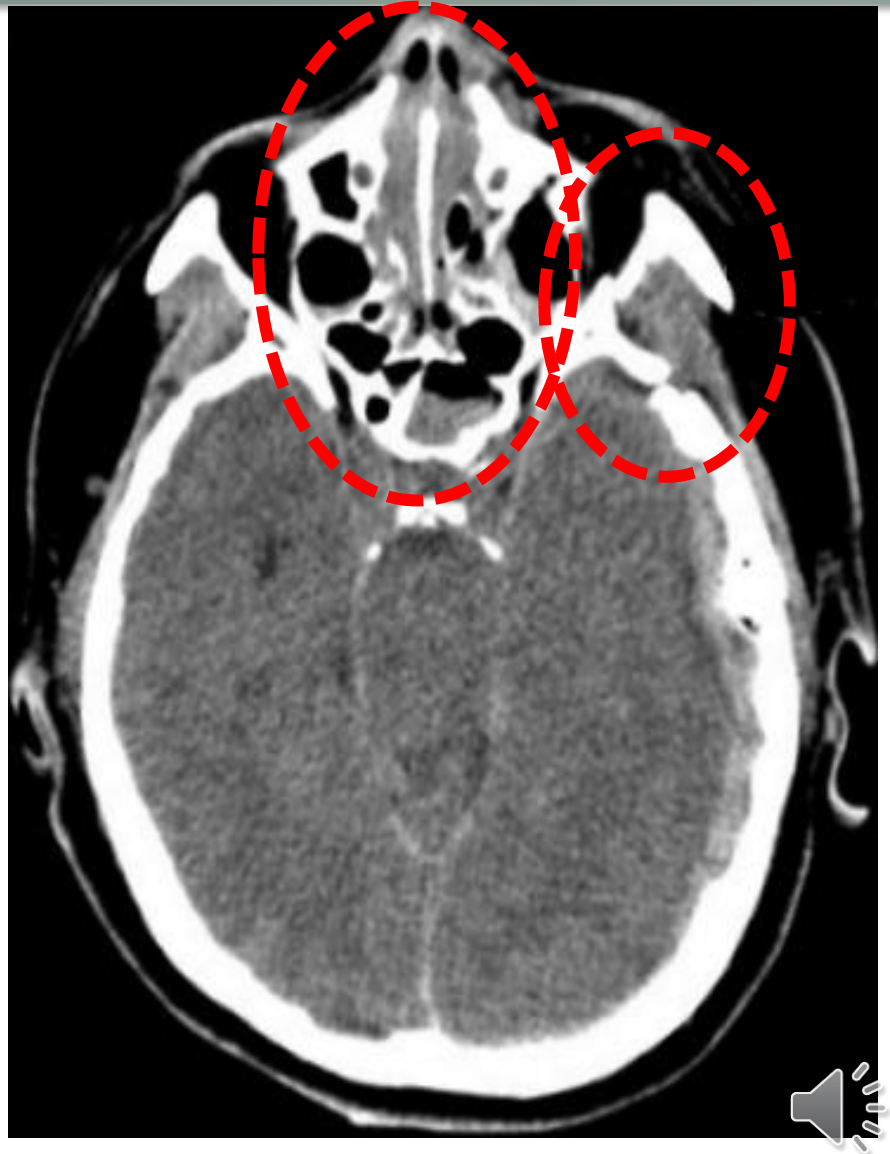
Ping-pong ball fracture

Blunt head trauma

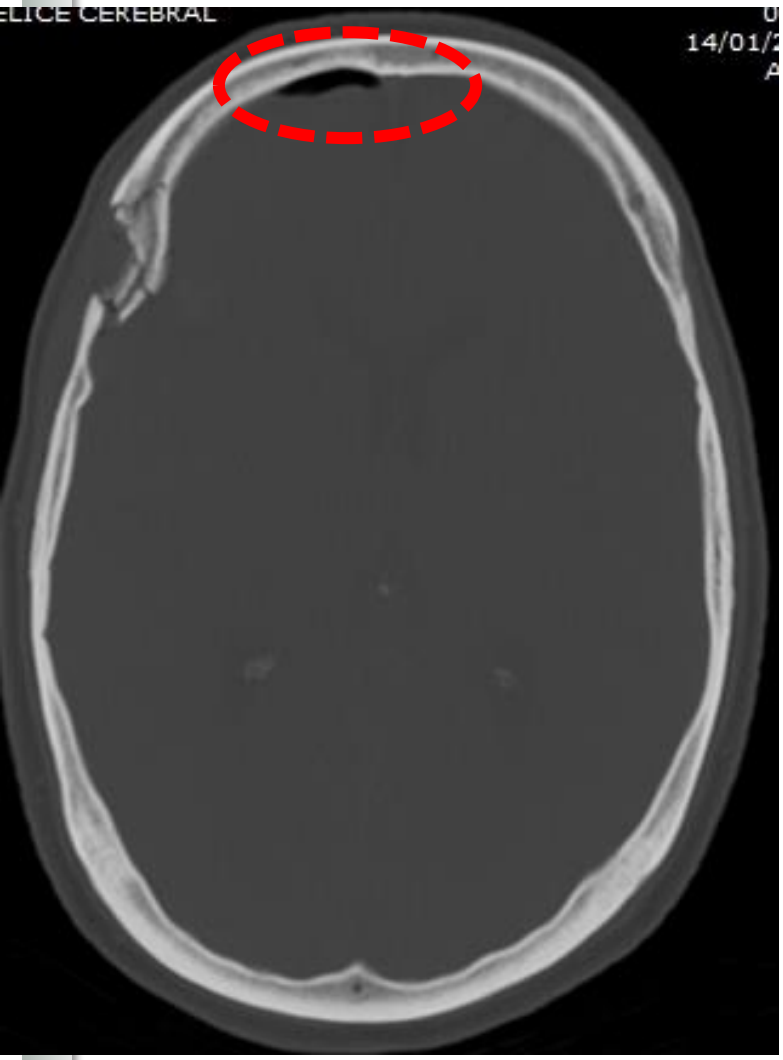
Skull base fracture ≅ open head injury

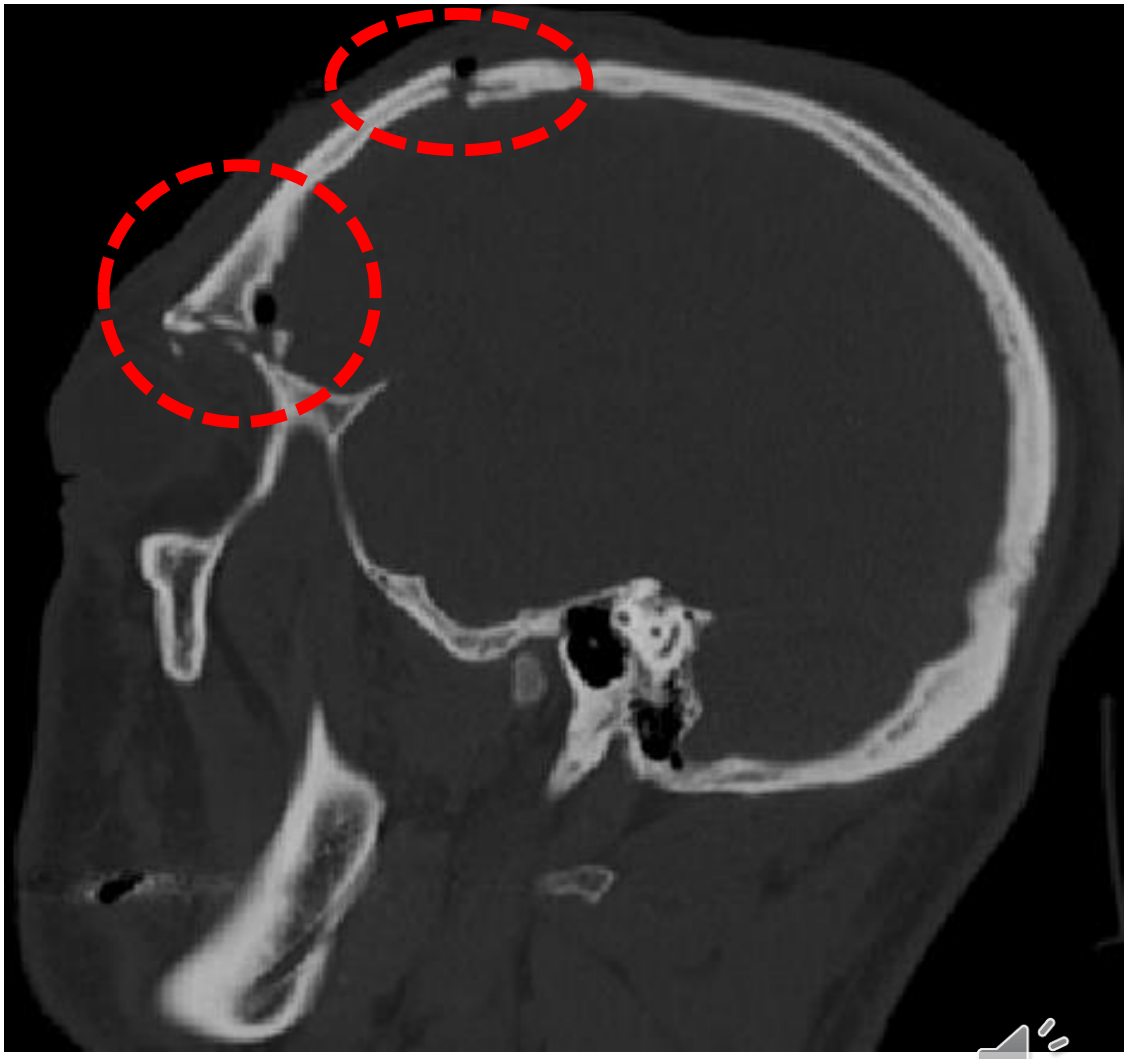




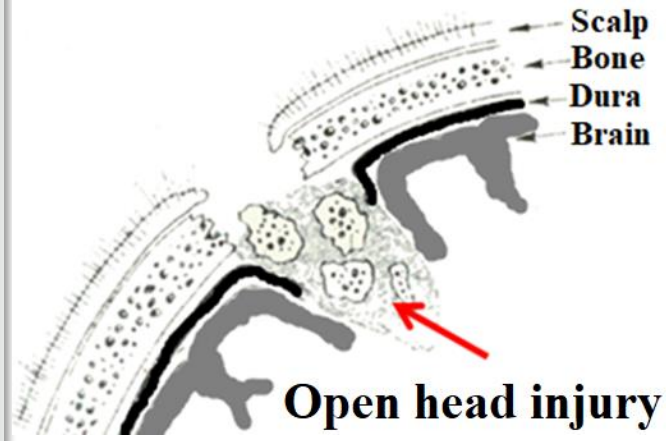


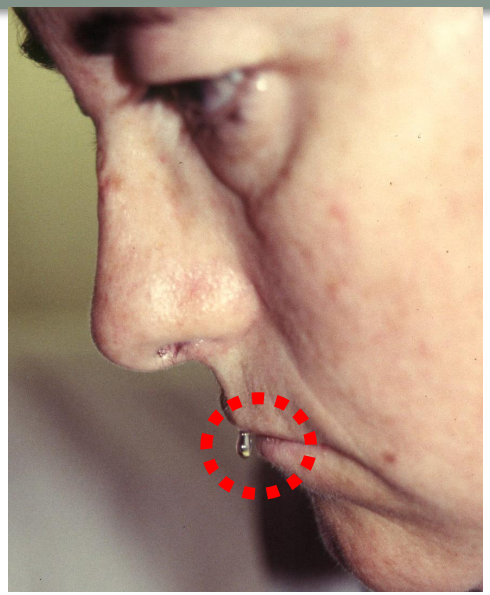
Pneumocephalus = open TBI

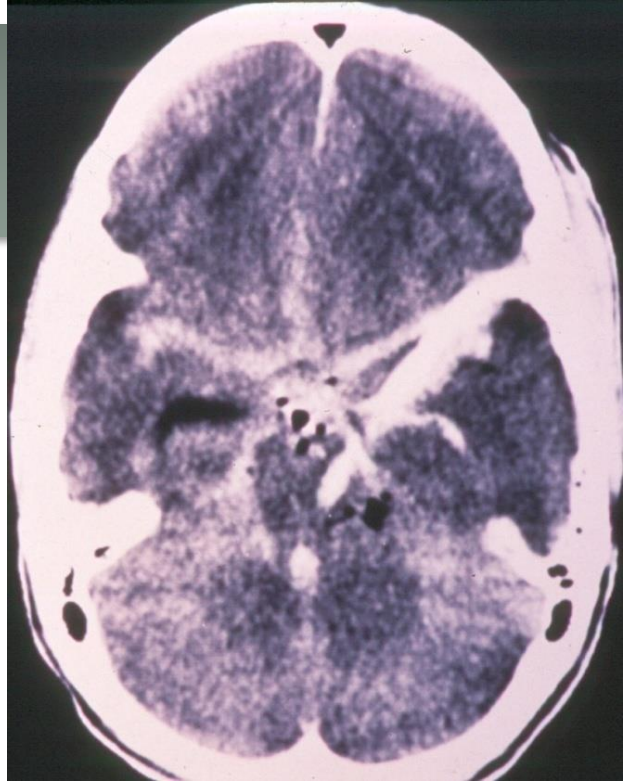




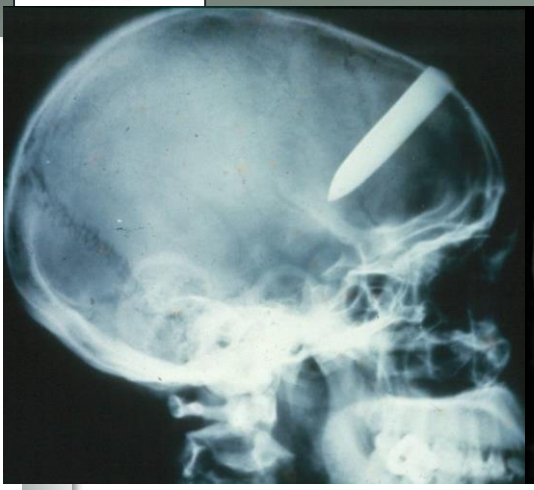
Open traumatic brain injury



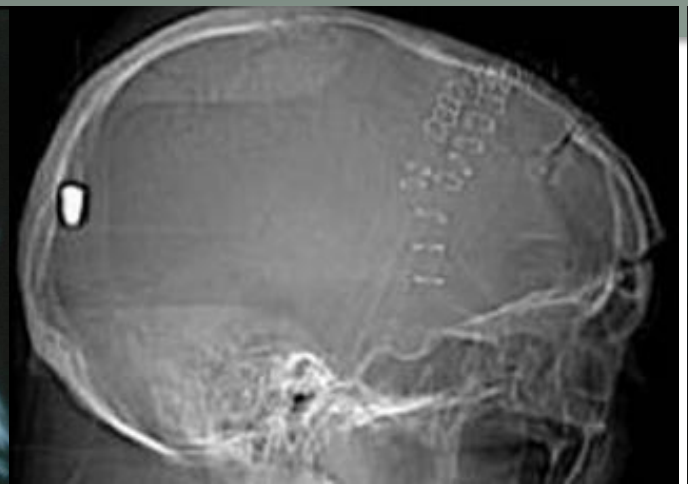




Plain x-ray: visualisation metallic objects



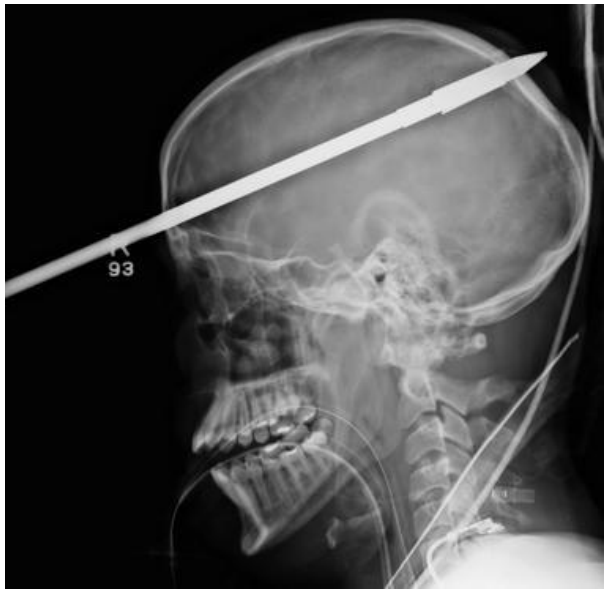
Knife



Bullet

Bullet

Nail gun

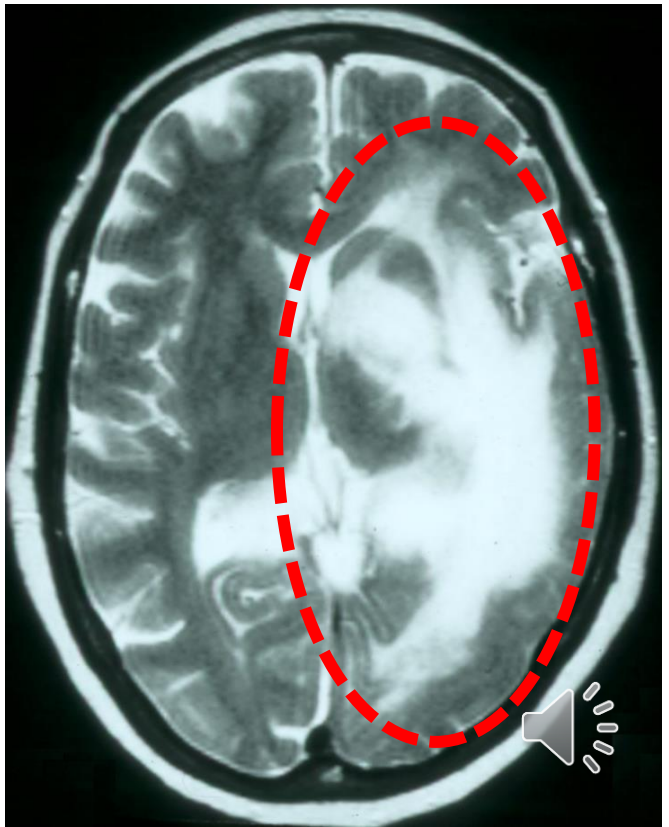


Fishing harpoon

Bird shot

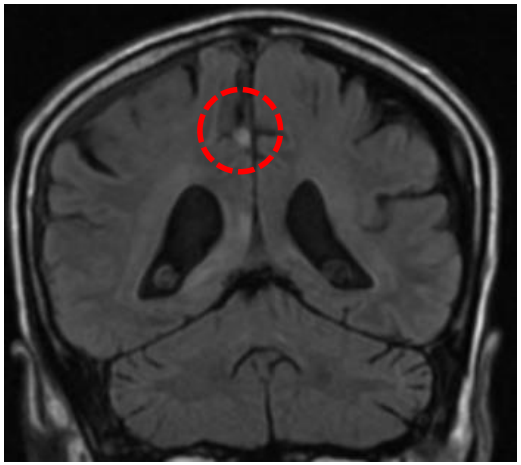
Brain / spinal MRI

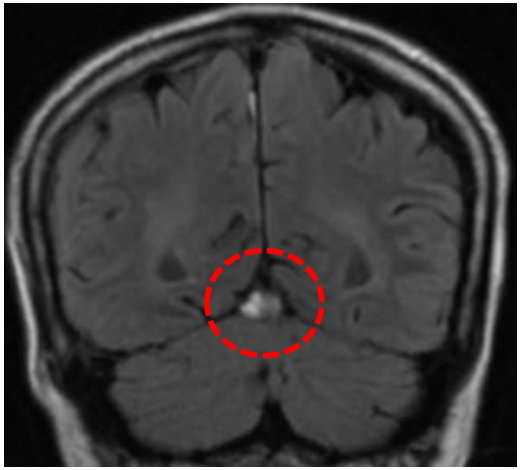
- Not always available on an emergency basis
- Vital in spinal cord injuries
- Needed to rule out brainstem injury = irreversible coma
- Select patients to avoid therapeutic carnage
- Confirms severity of hemispheric injuries

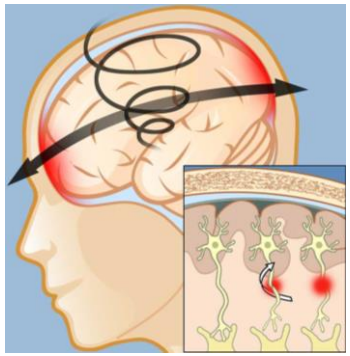


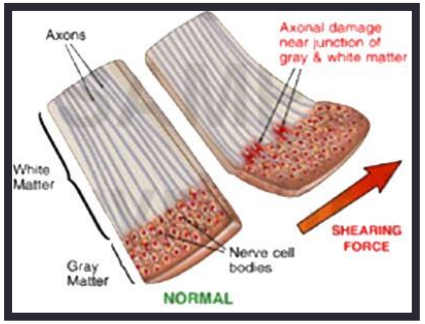
MRI chronic phase diffuse axonal injury

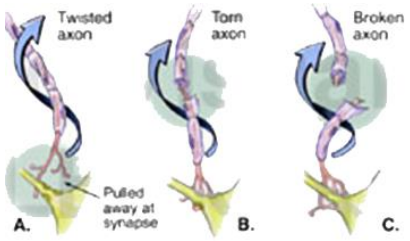
- Only way to confirm the lesion
- Not done on an emergency basis (patients too ill!)

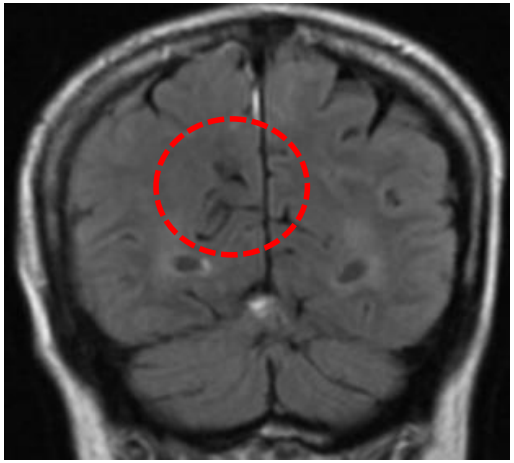


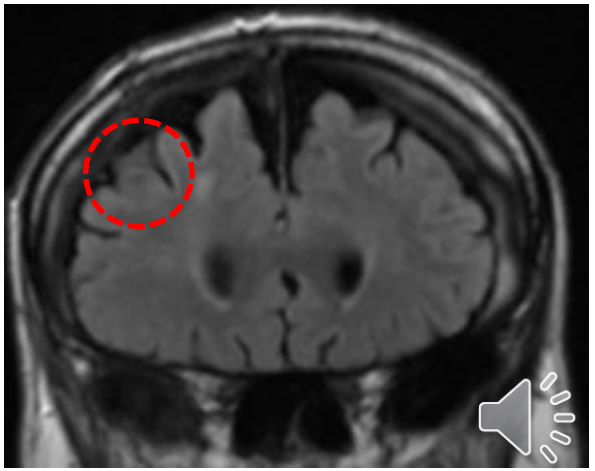






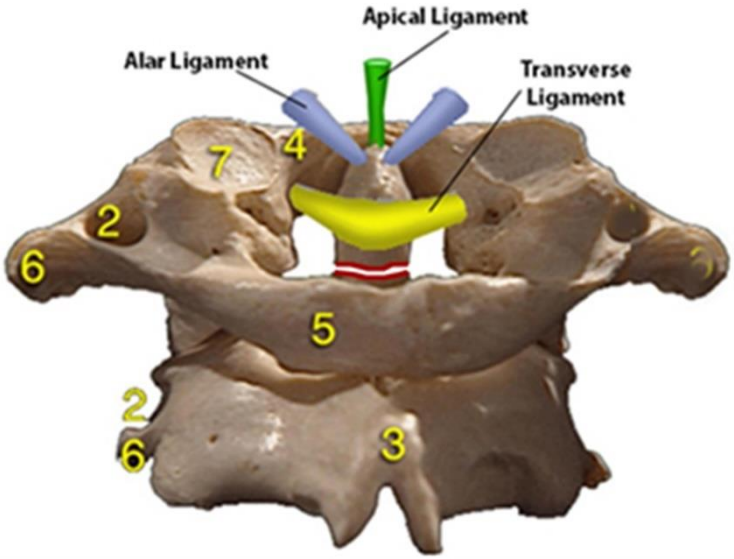


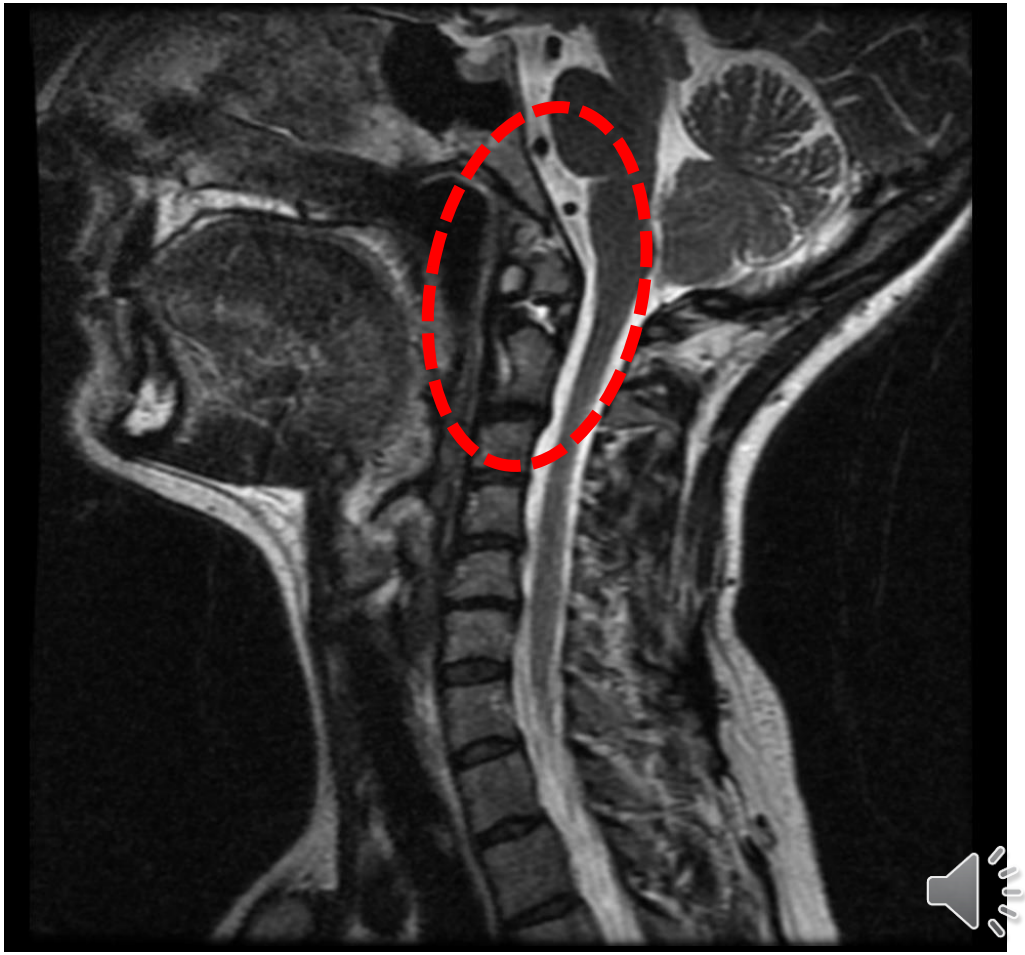




MRI odontoid fracture

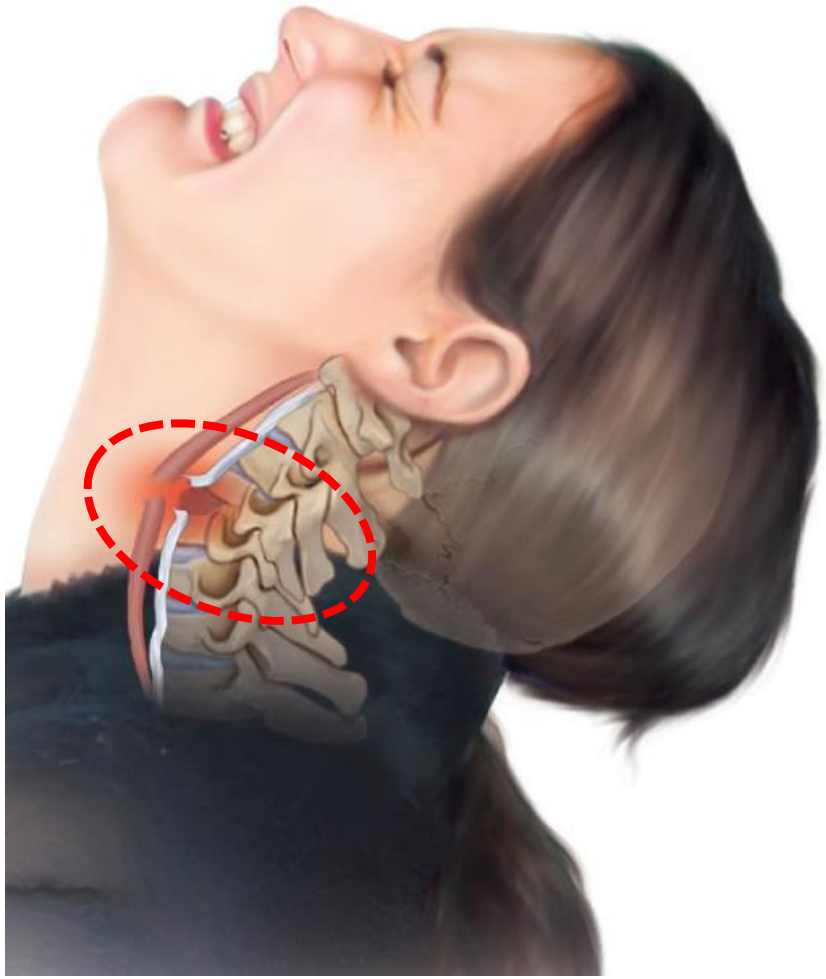
- Allows identification of injured ligaments
  - If so, the fracture is unstable = Surgical treatment needed

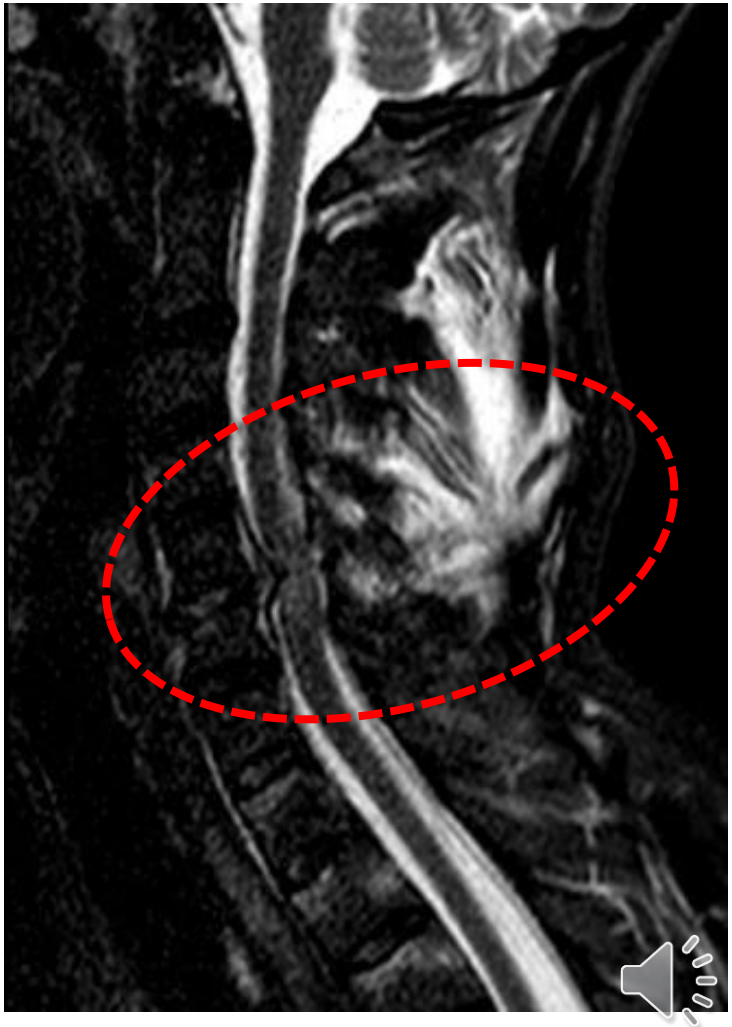




Cervical MRI: disc rupture C_3-C_4

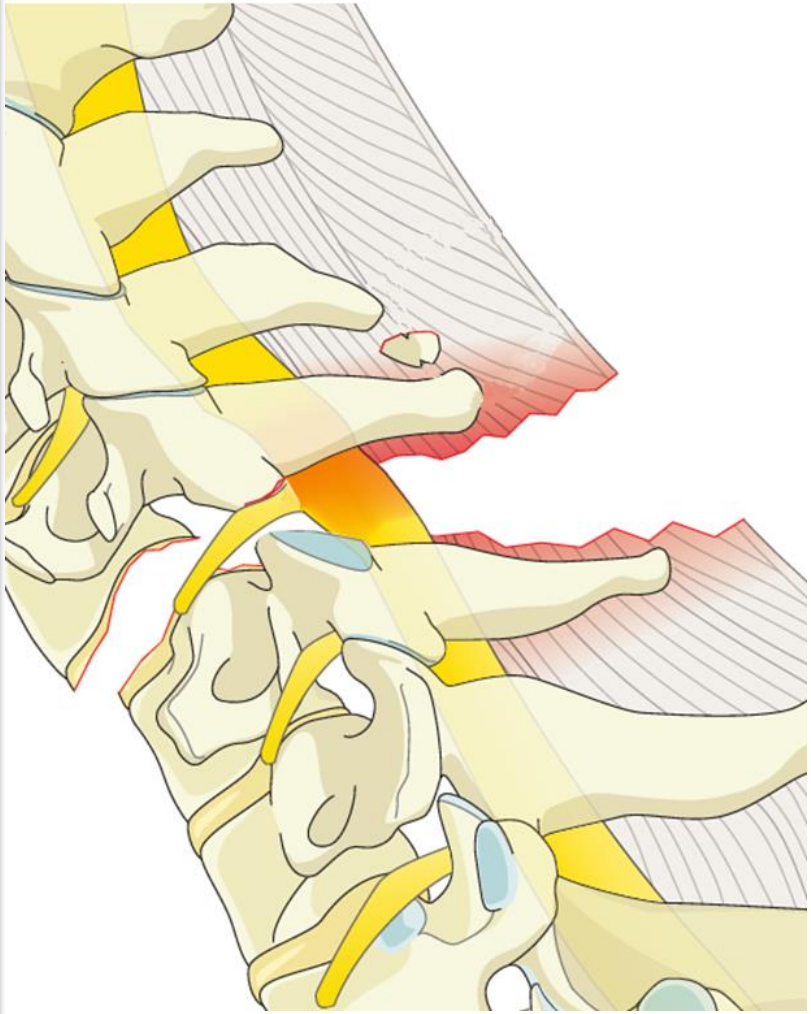
- Allows to see soft tissue + spinal cord injures

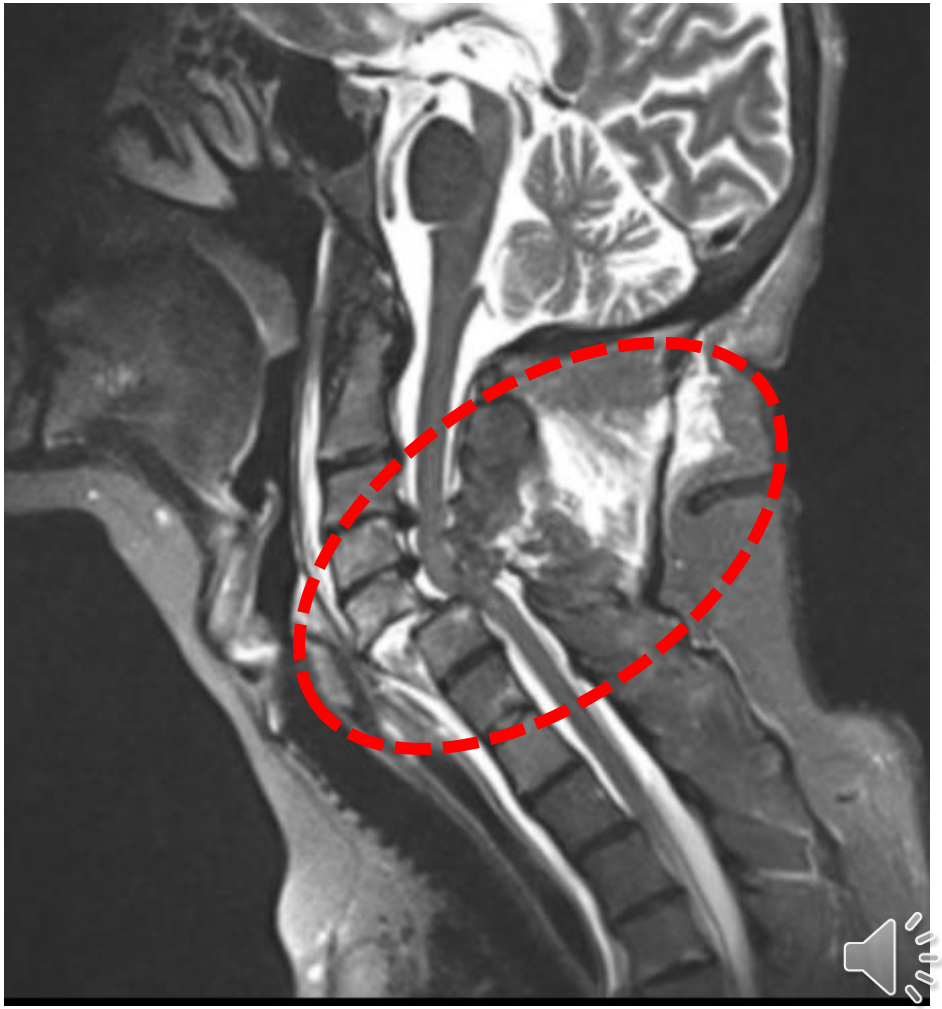




Cervical MRI: fracture-dislocation C_5-C_6

- Allows identification of soft tissues and spinal cord injuries



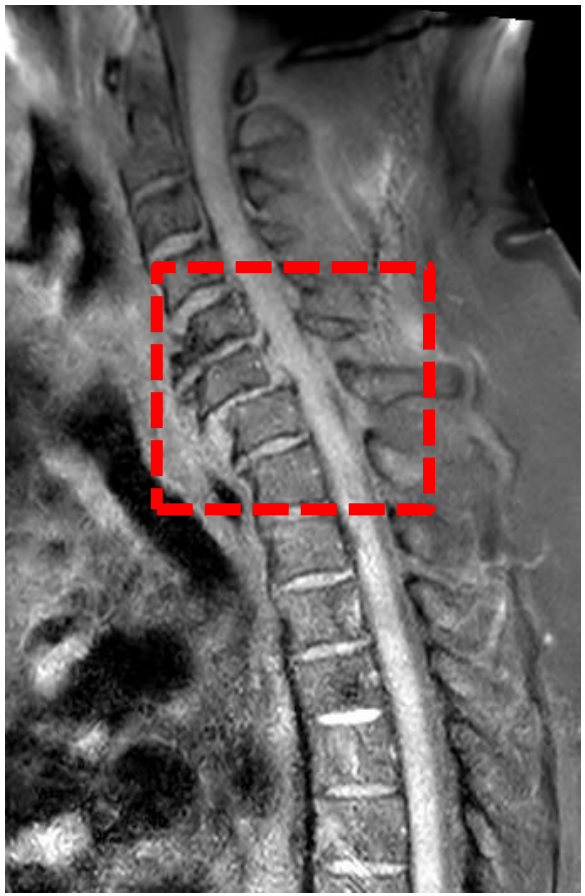


MRI: cervical epidural hematoma

- Rare but demands urgent surgery

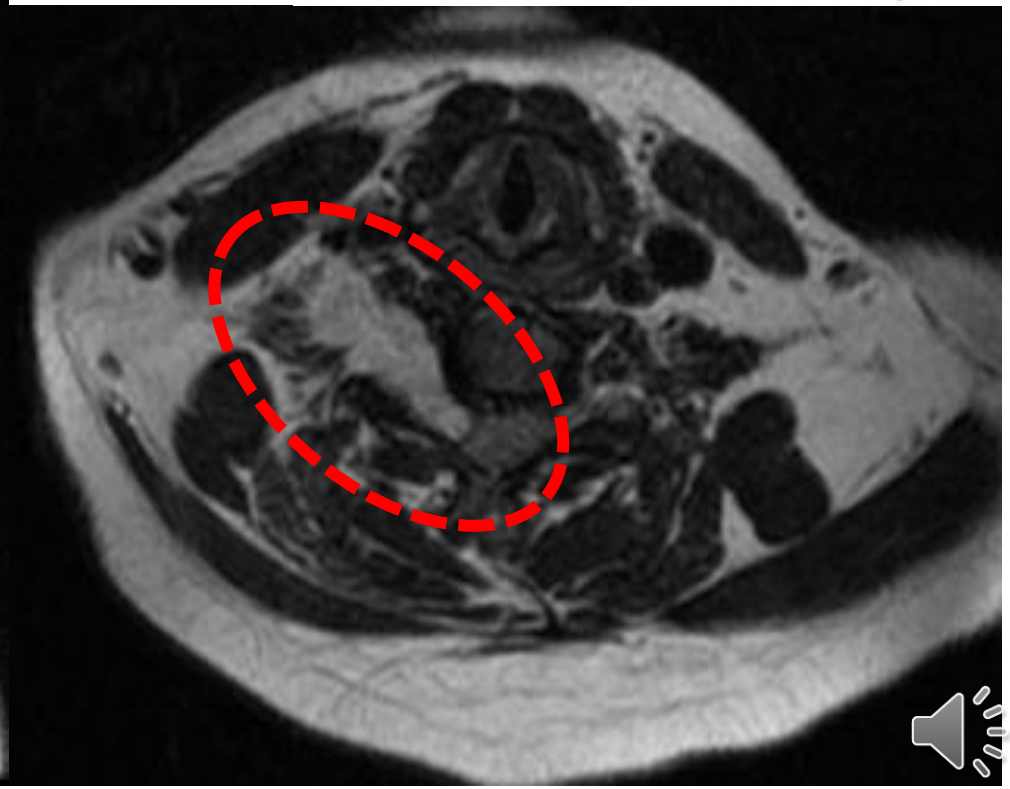
MRI spine: vertebral fractures

- Can be multiple
- Patients must be haemodynamically stable

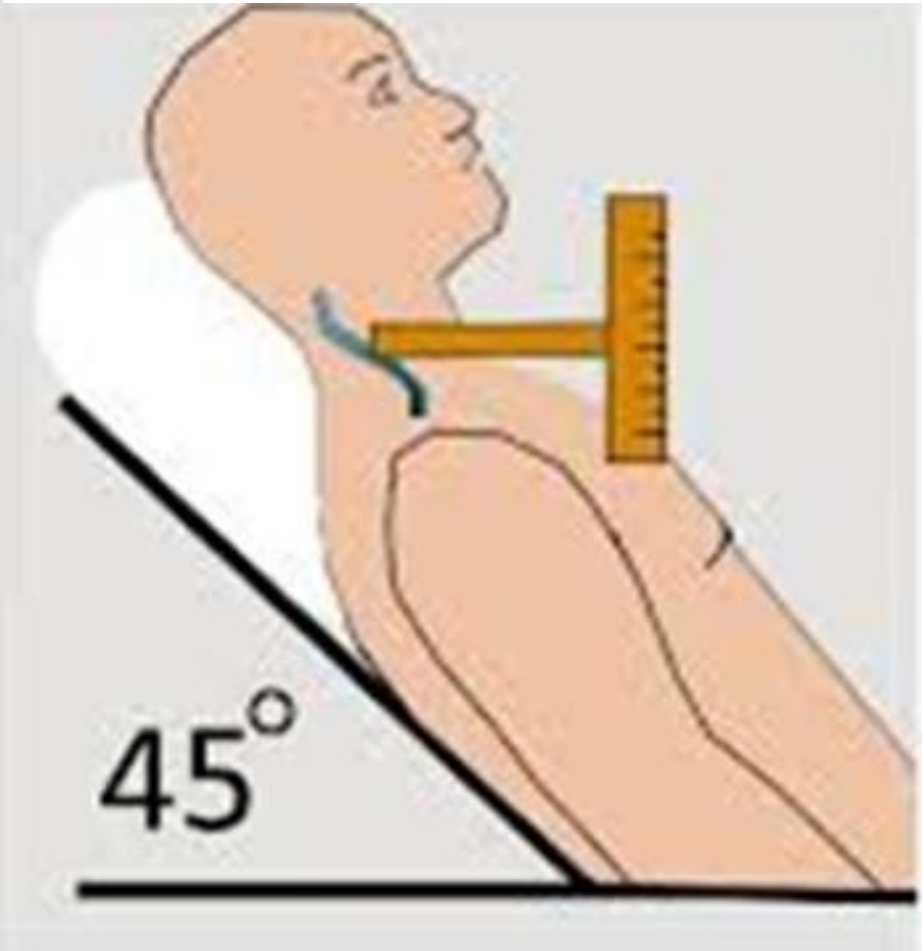


MRI brachial plexus avulsion

- Can explain an upper limb paresis



TREATMENT IN ICU



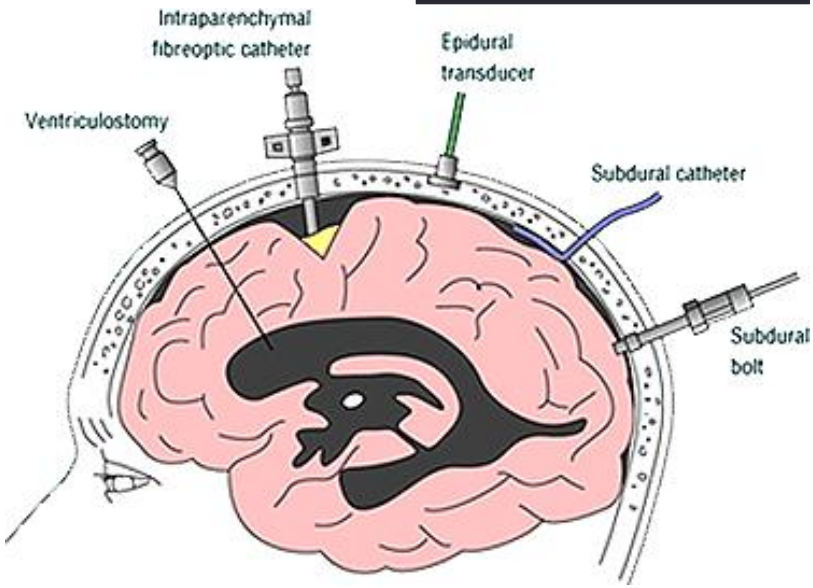
REMEMBER?

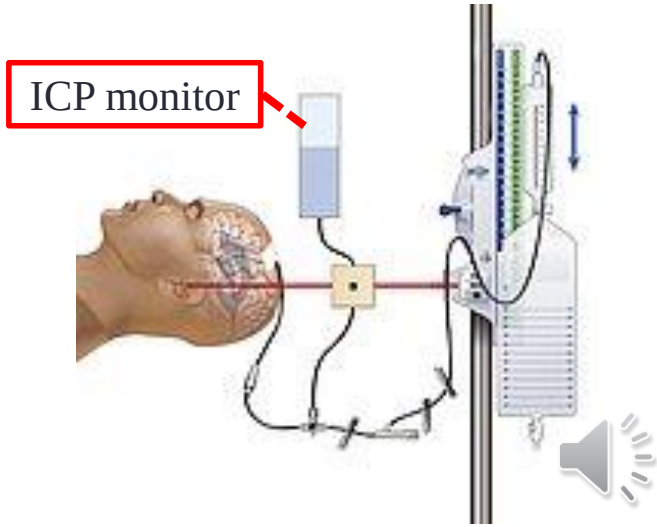
- **Maintain cerebral perfusion pressure**
- **Reduce ICP**

Basic measures

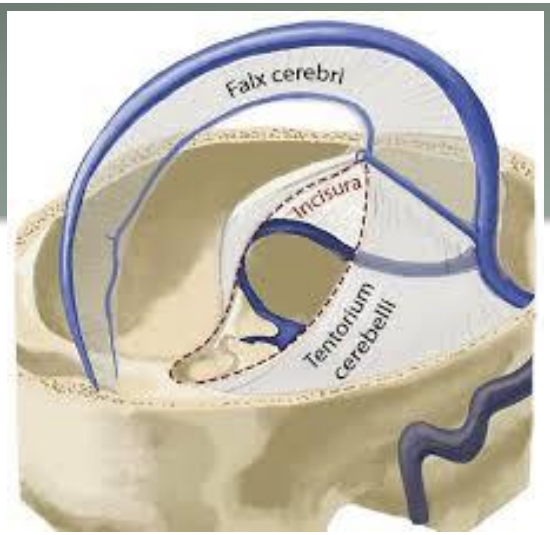
REMEMBER?

- Secure the airway ⇨ **intubation**
- Raise head from bed 30º
- Maintenance of
  - Systemic blood pressure
  - Euvolemia
  - **Brain perfusion pressure 60mmHg**
  - Normothermia
- **PIC monitoring**
  - Assess response to treatments
  - Ventricular CSF drainage
  - Indicate surgery
- **Anticonvulsant prophylaxis**



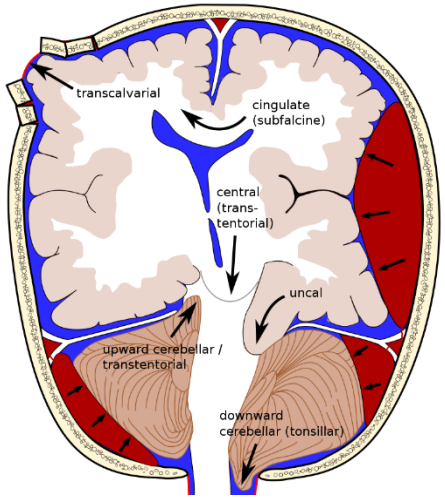


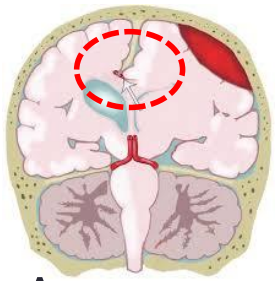
Brain herniations



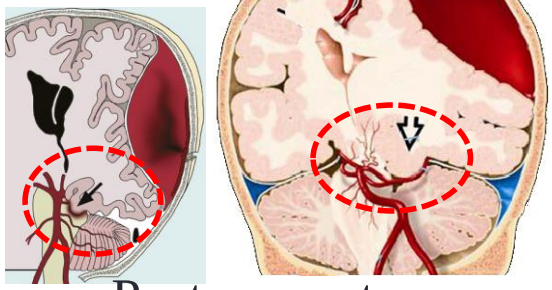
REMEMBER?

- Rigid partitions: falx and tentorium
- ↑↑ ICP in a compartment = nervous tissue displacement
- Brain hernias
  - Compression against rigid falx / tentorium edges = vascular occlusion = infarct nervous tissue
  - Nervous tissue ischemia = neurological deficits + cerebral edema

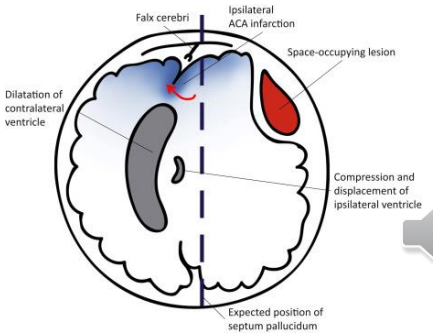




Ant cer. art.

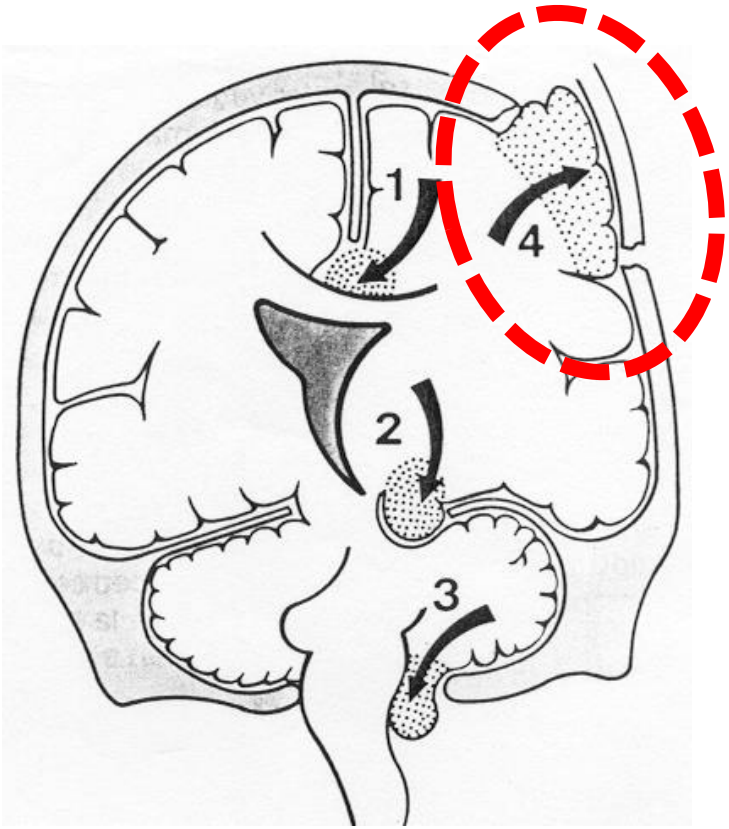


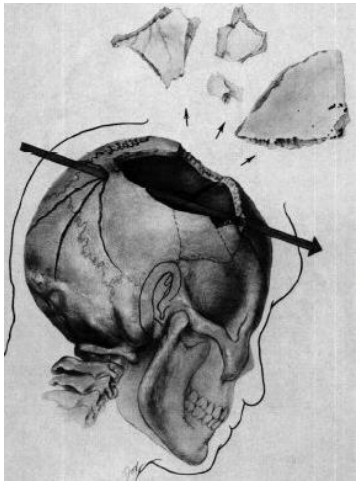
Post. cer. art.



Open TBI = external cerebral hernias possible = ↓PIC but loss of brain tissue

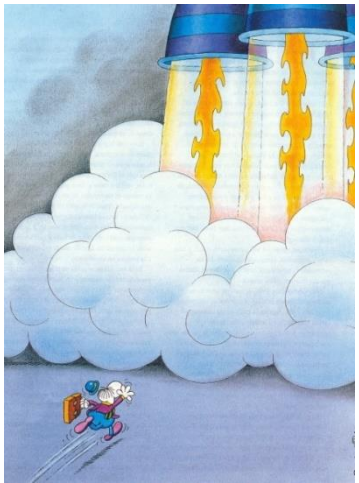
- Typical of head shot wounds





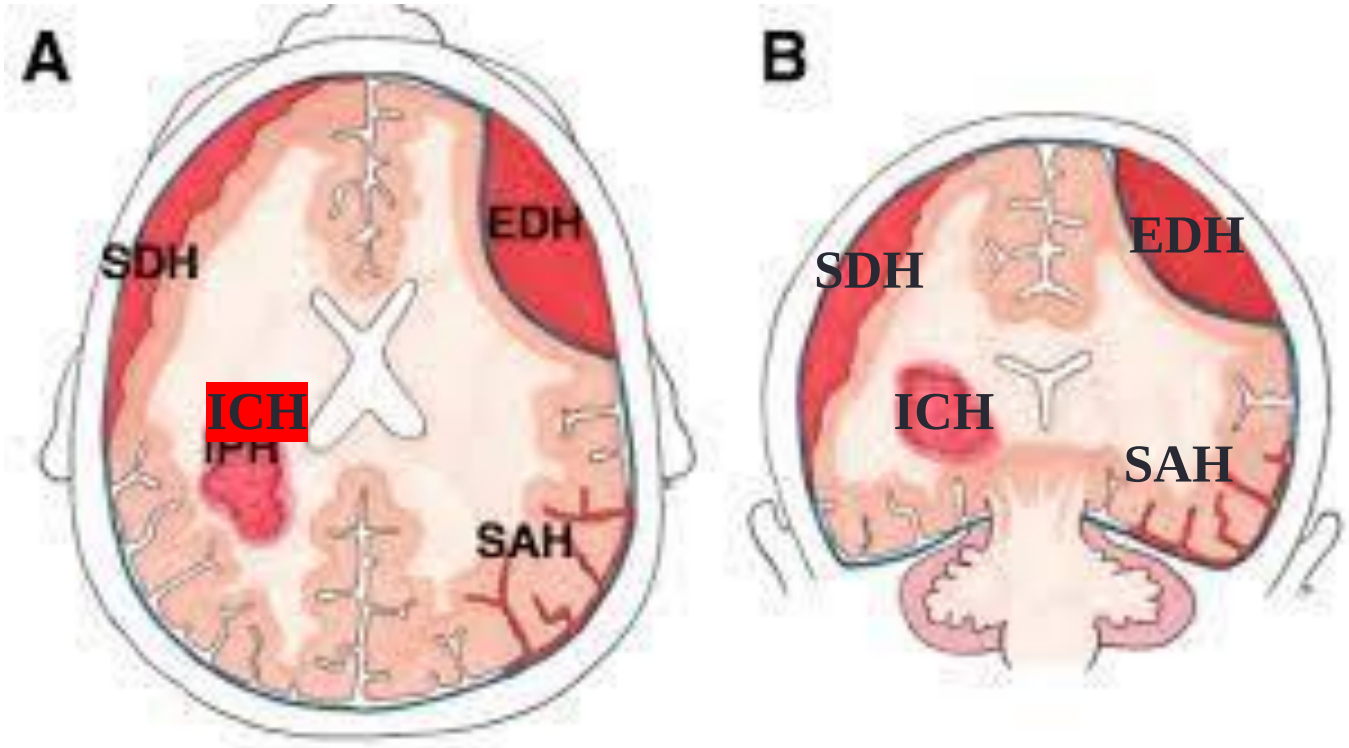
SURGICAL TREATMENT

- Repair of dural, cranial & scalp defects
- Haematoma removal
- Hydrocephalus drainage
- Brain contusion excision with mass effect
- Decompressive craniectomy to control ICP
  - NEVER as last option
  - Waiting too much = patients in a chronic vegetative status



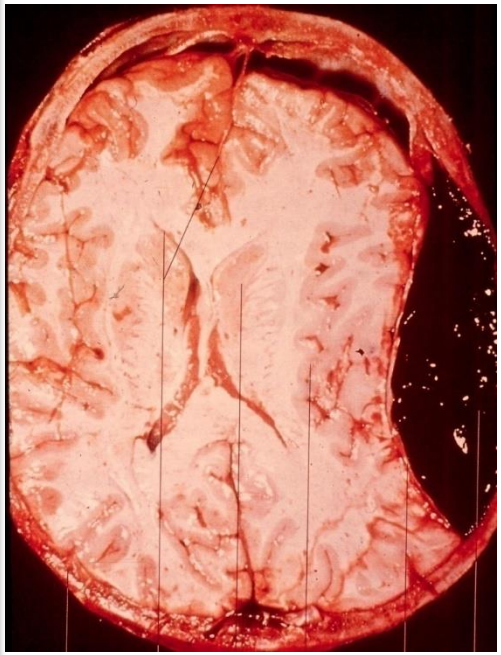
INTRACRANIAL HAEMATOMAS

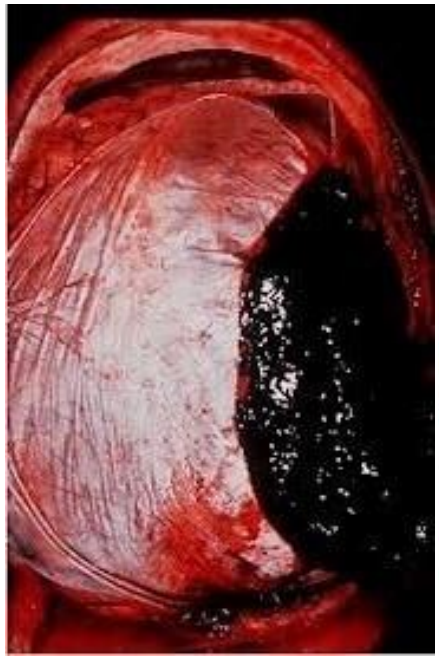
- Epidural (EDH)
- Subdural (SDH)
- Intracerebral (ICH)
- Subarachnoid haemorrhage (SAH)

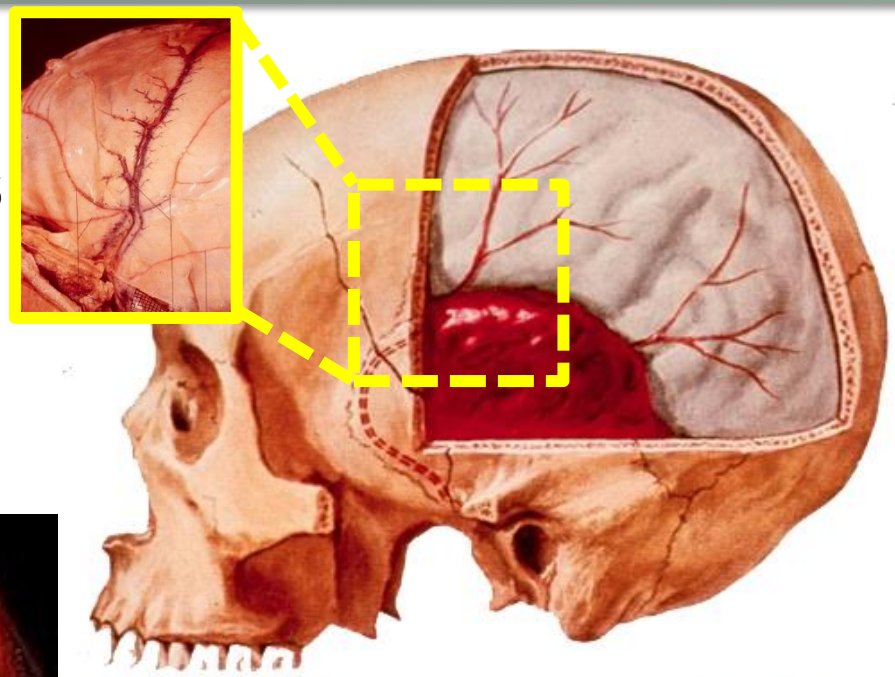


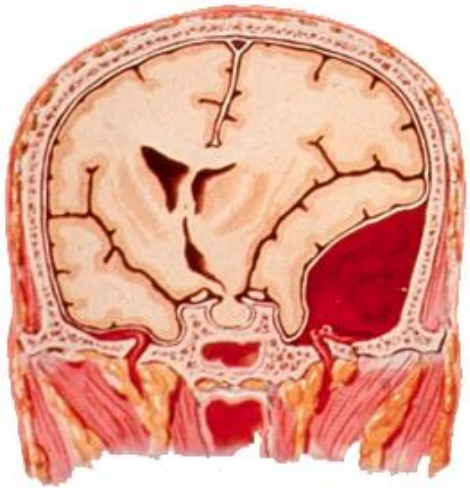
Epidural hematoma: blood collection blood between dura and bone

- Associated with temporal fossa fractures
- Arterial almost always
- Venous occasionally



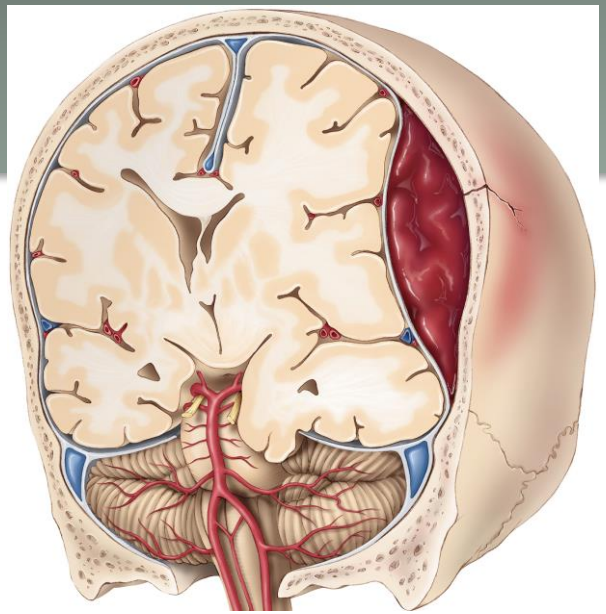




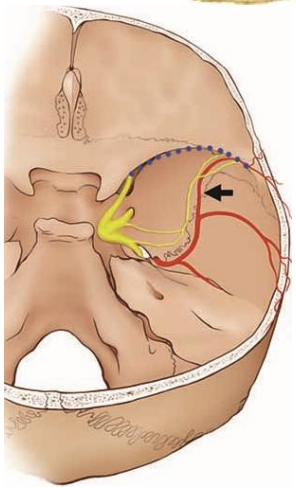


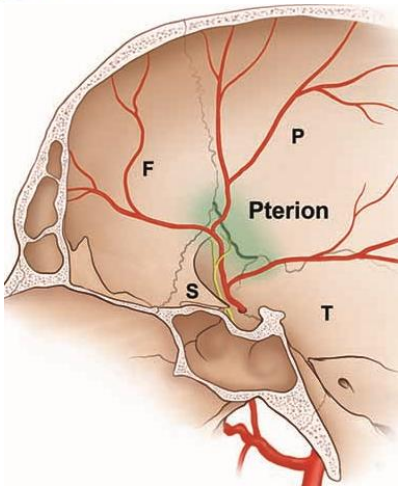
Epidural hematoma

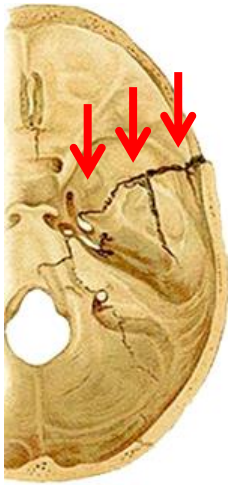
- Arterial over 80%
- Venous due to sinus injury

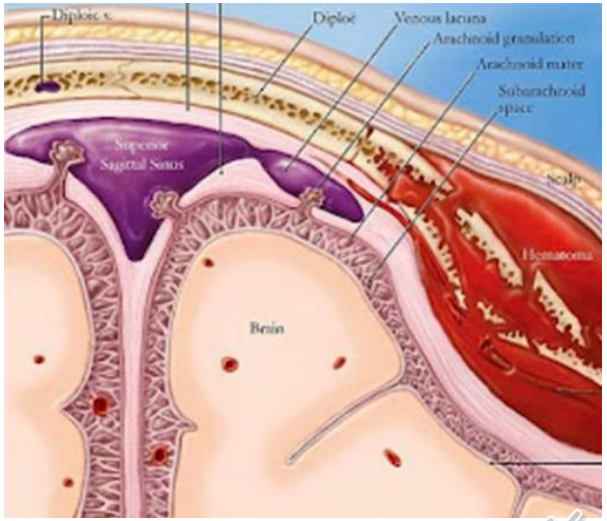


Arterial epidural haematoma





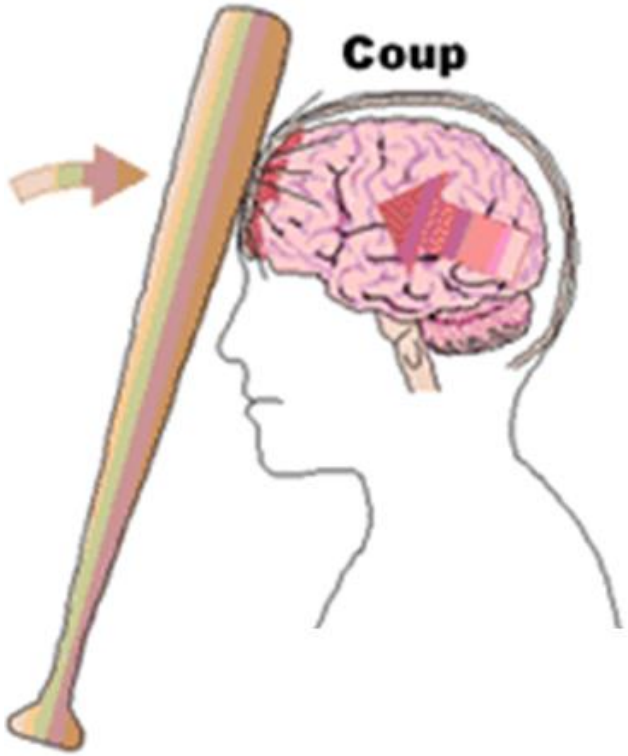




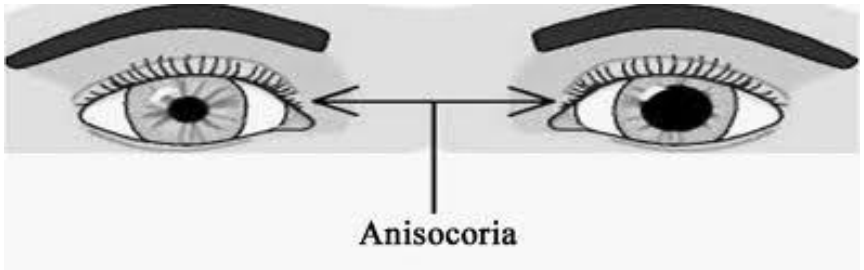
Venous epidural haematoma

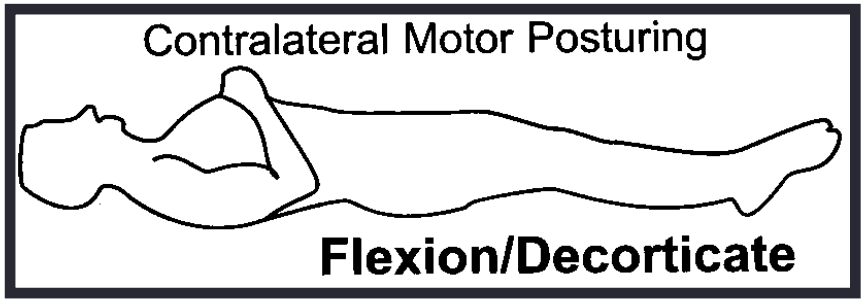
Epidural haematoma

- Typical in construction works (> if no helmet)
- Rare in road accidents
- Sometimes in assaults by blunt and heavy objects

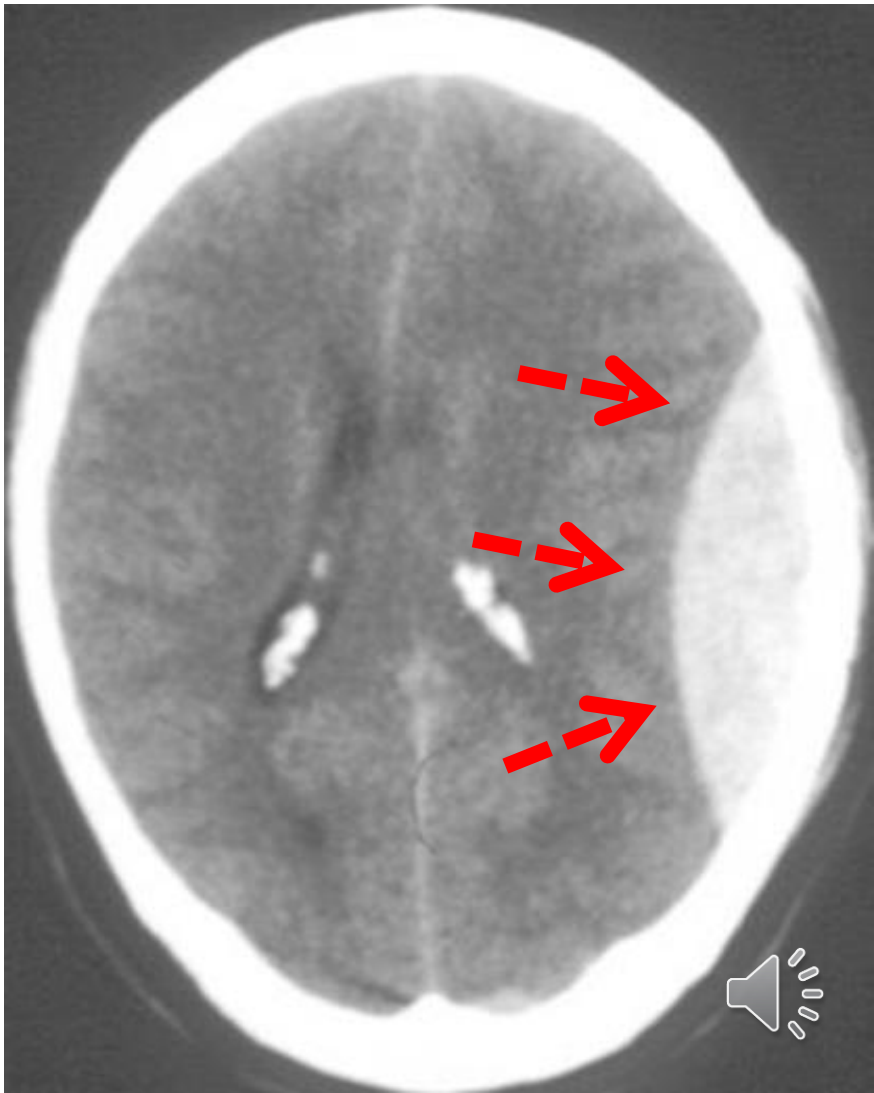


Arterial epidural hematoma: CT scan

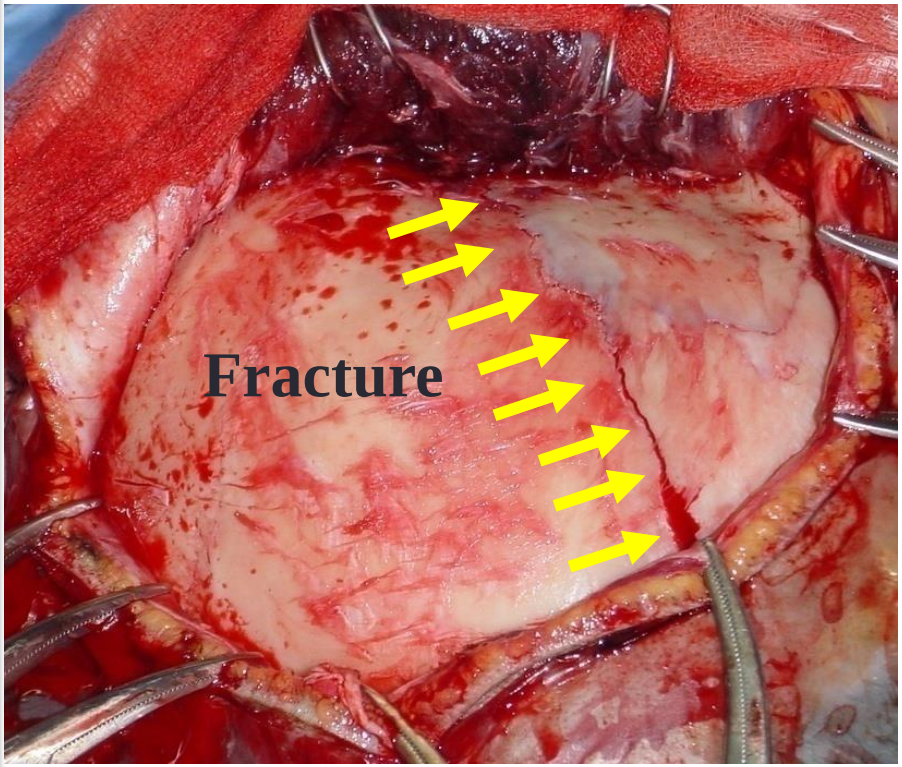


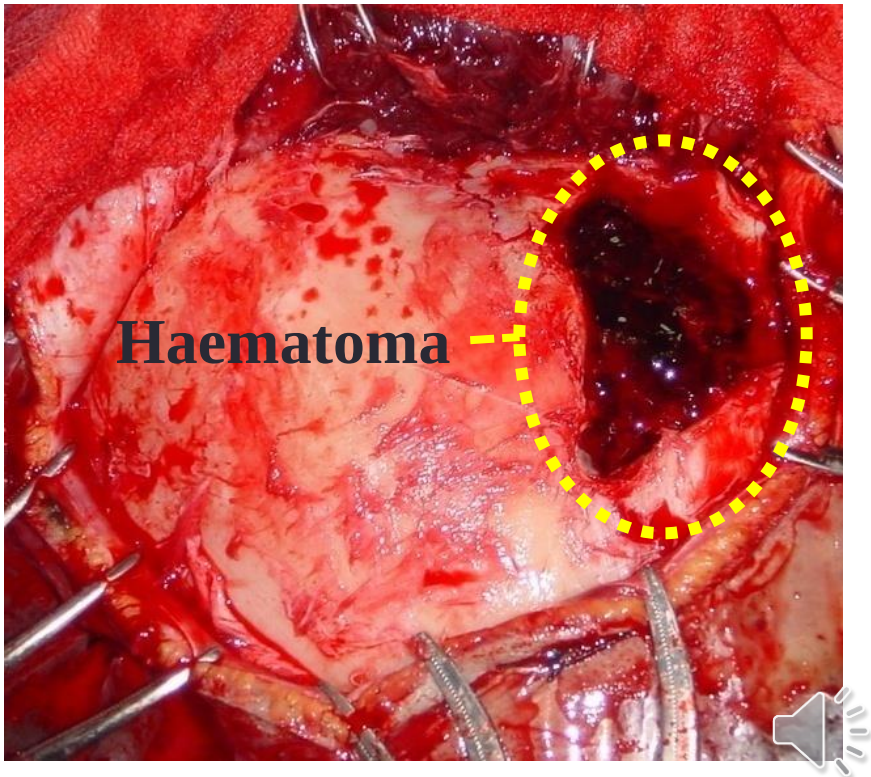


Arterial epidural hematoma: CT scan

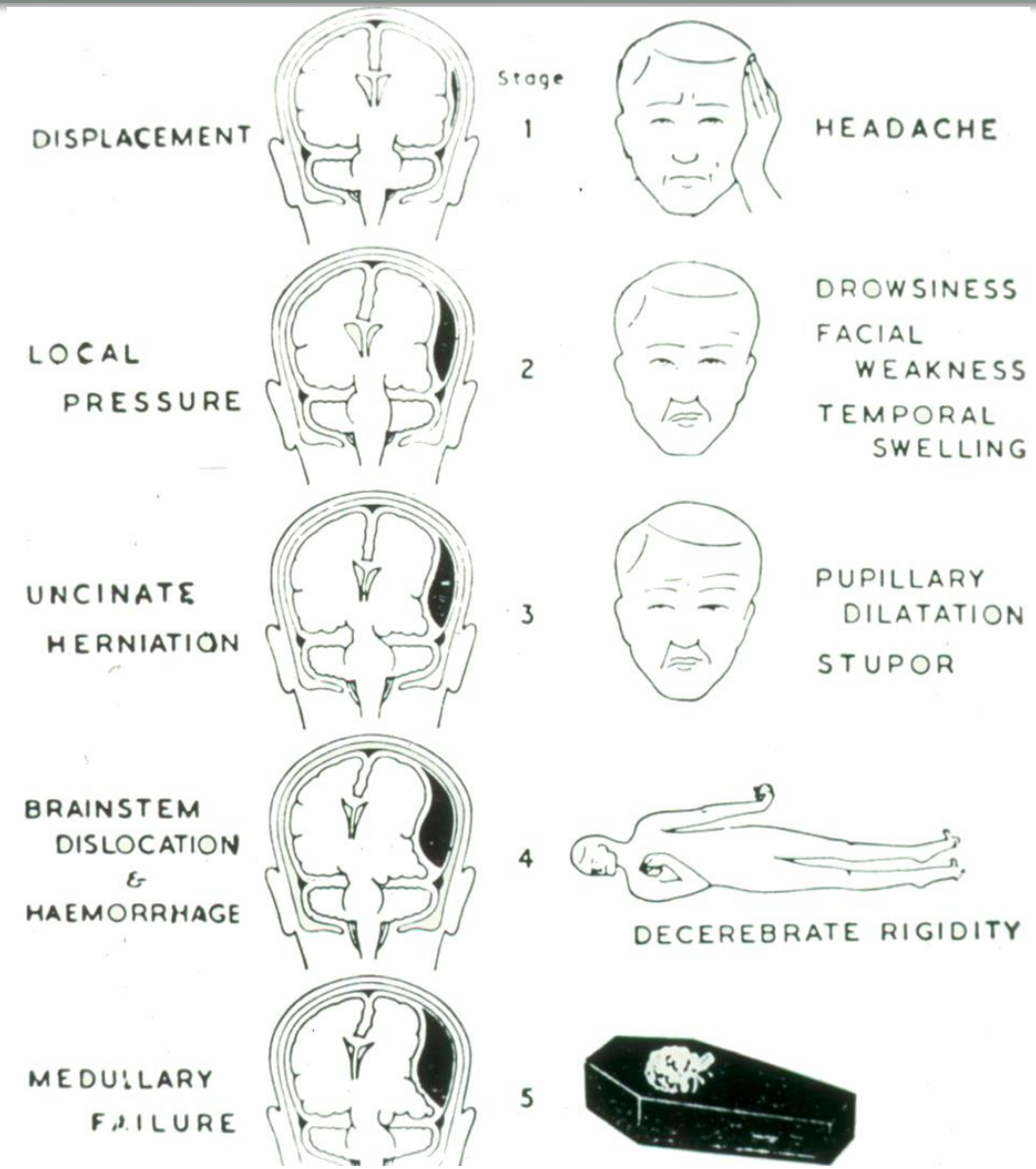


Epidural hematoma drainage: speed to avoid irreversible deterioration

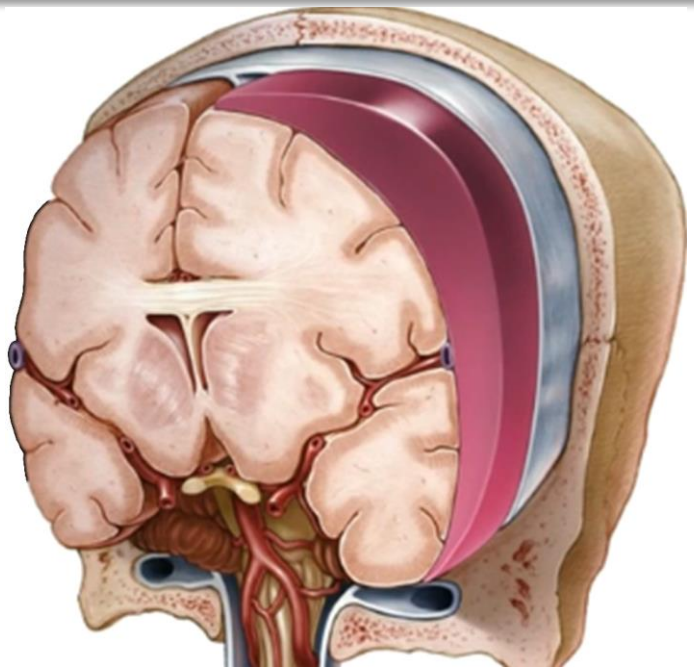


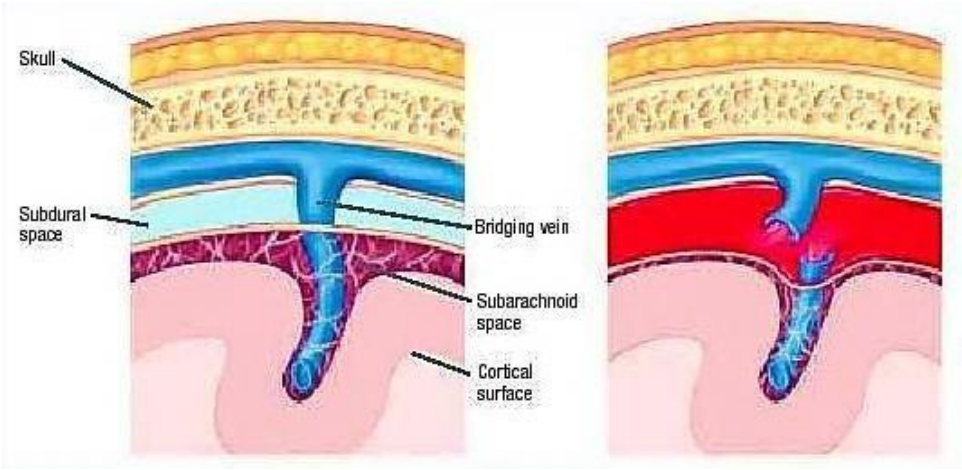


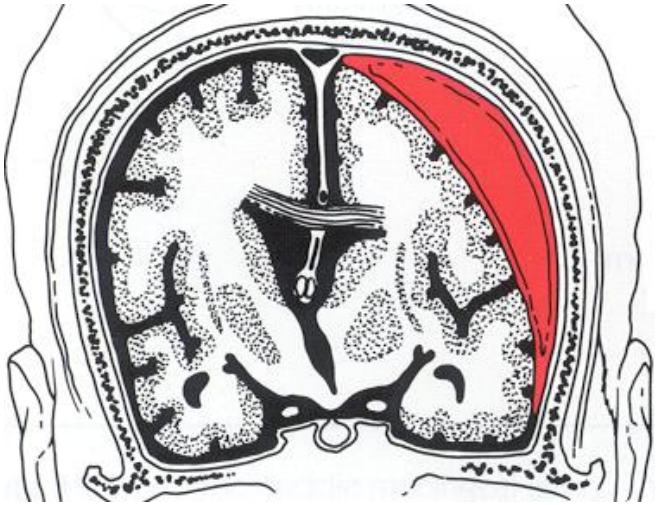
Evolution of epidural hematoma NOT treated

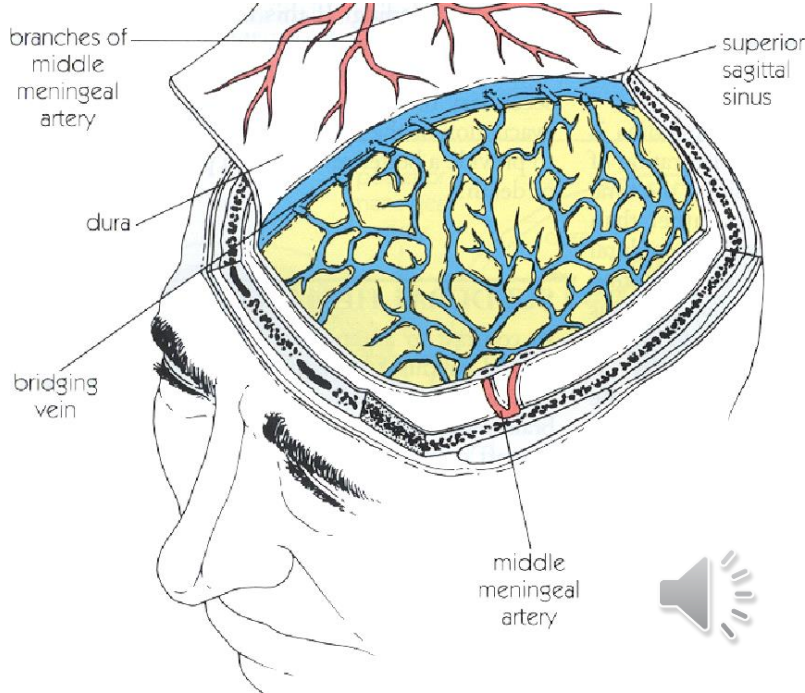


Subdural hematoma: collection of blood between dura mater and brain



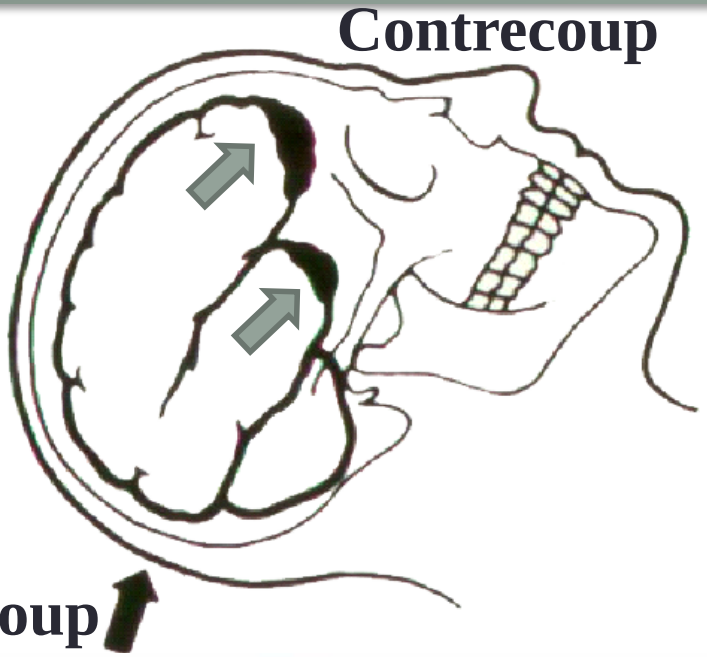


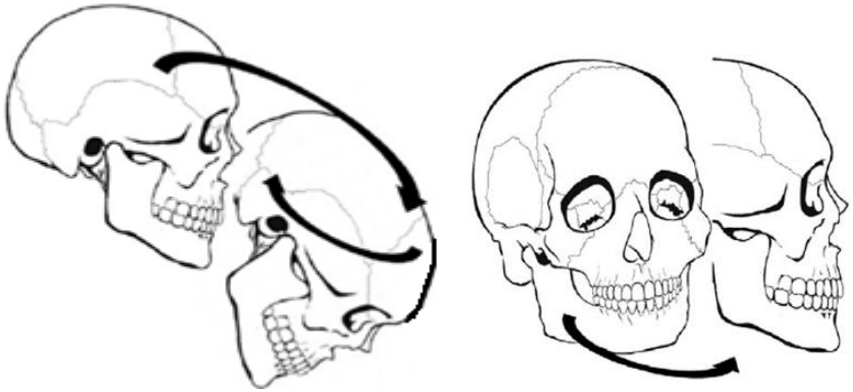




Acute subdural hematoma

- ⇑ road accidents even if wearing helmet
  - ⇑ in motorcyclists with helmets (protection against impact but not against deceleration)
- ⇑ old people + falls
  - ⇑ if anticoagulation or antiplatelet medication

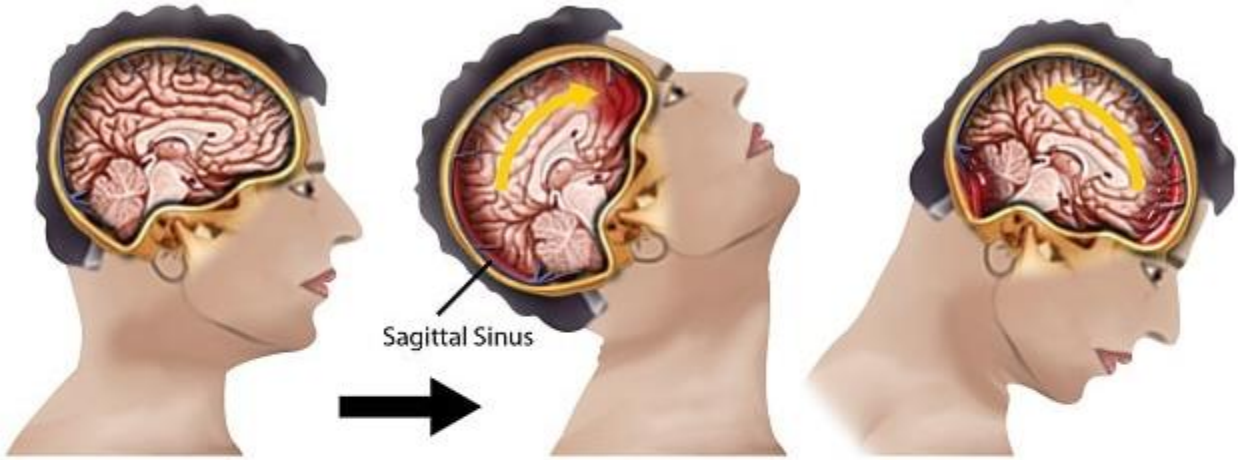




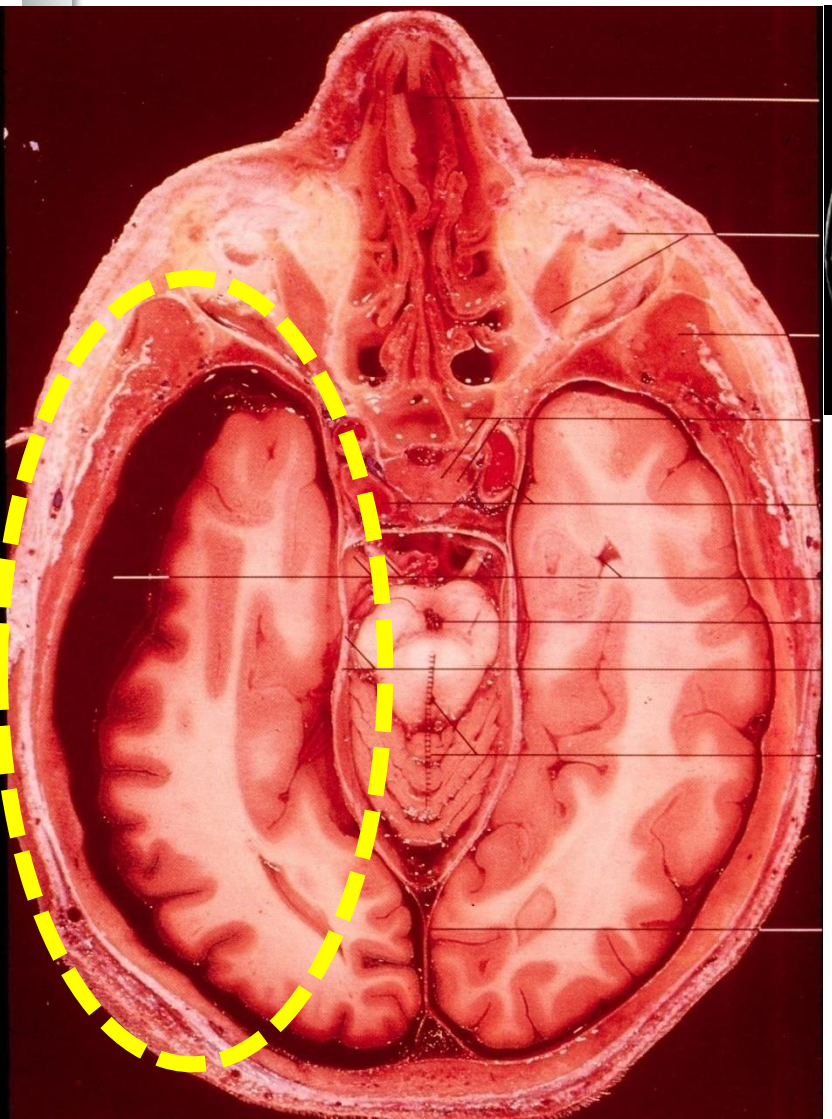
Acceleration/deceleration

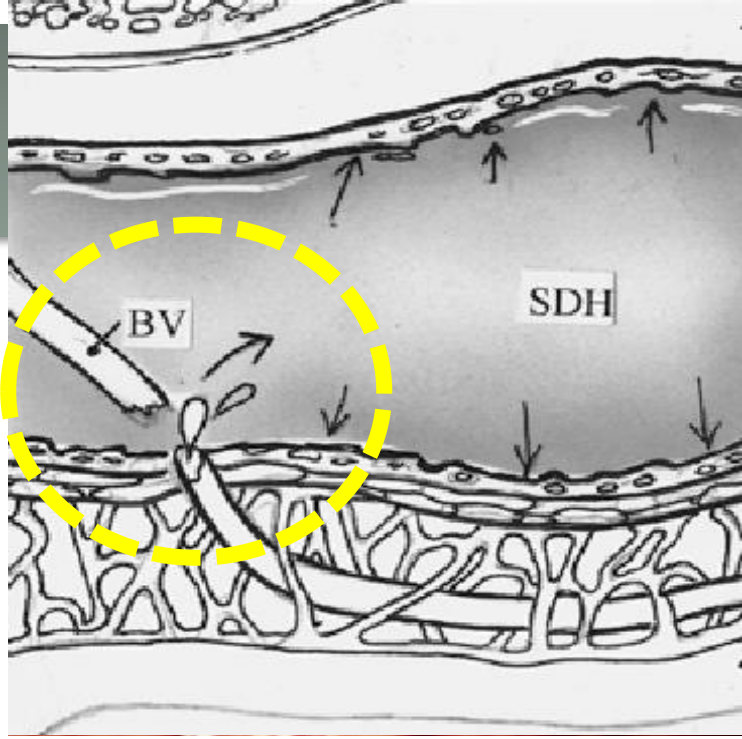
Acute subdural hematoma: bridging vein rupture

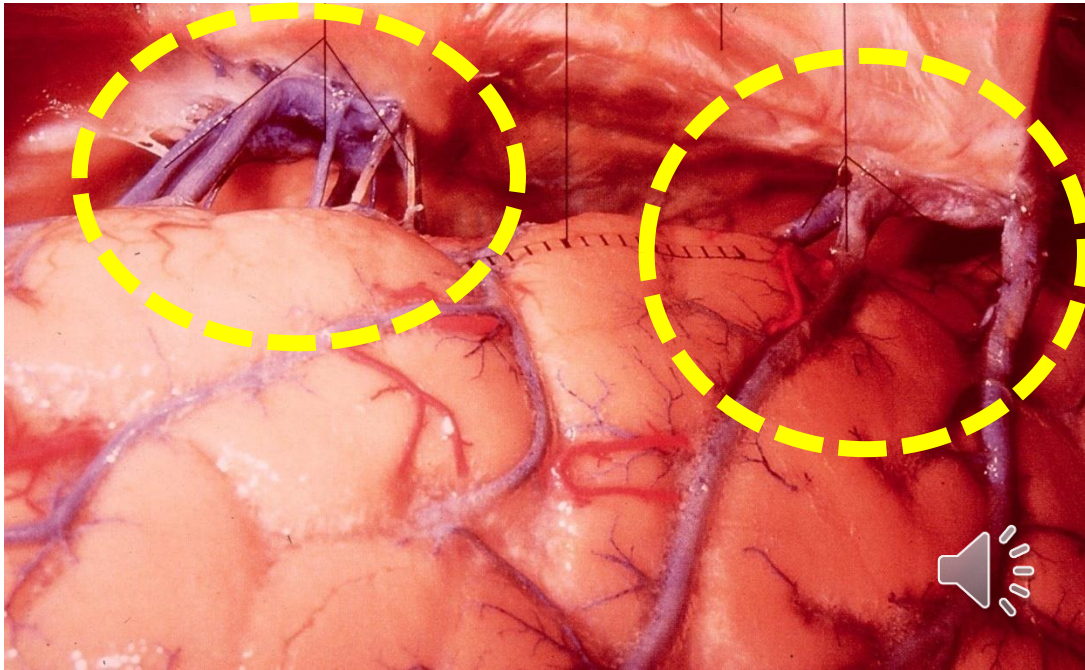
- The inertia of the brain in the sudden flexion-extension movement causes the rupture of the bridging veins
-



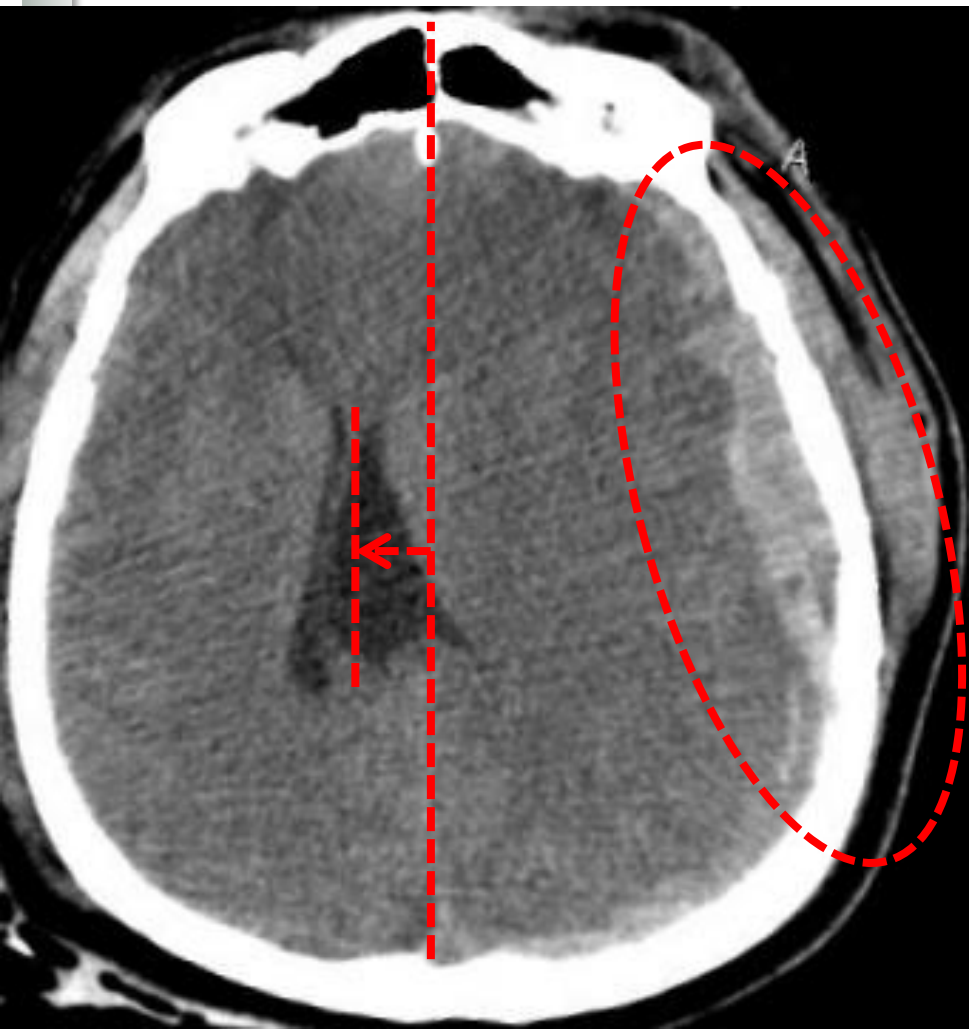
Acute subdural hematoma: bridging vein rupture



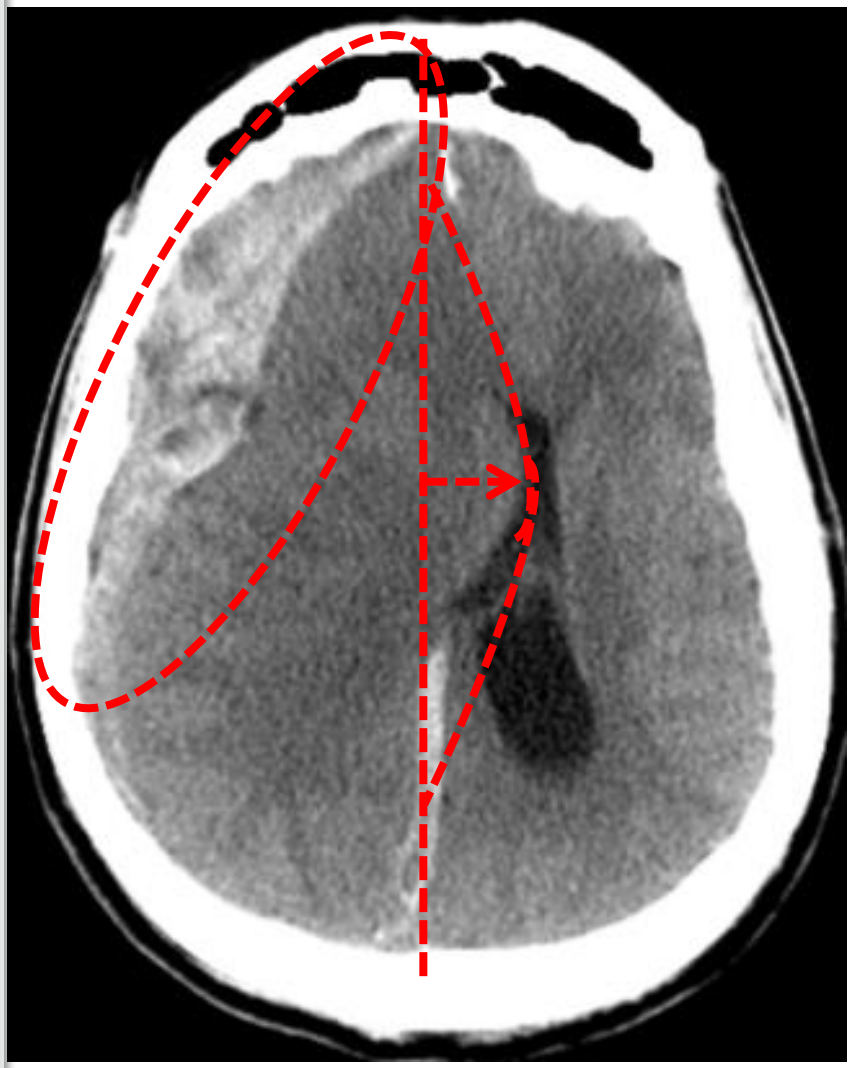




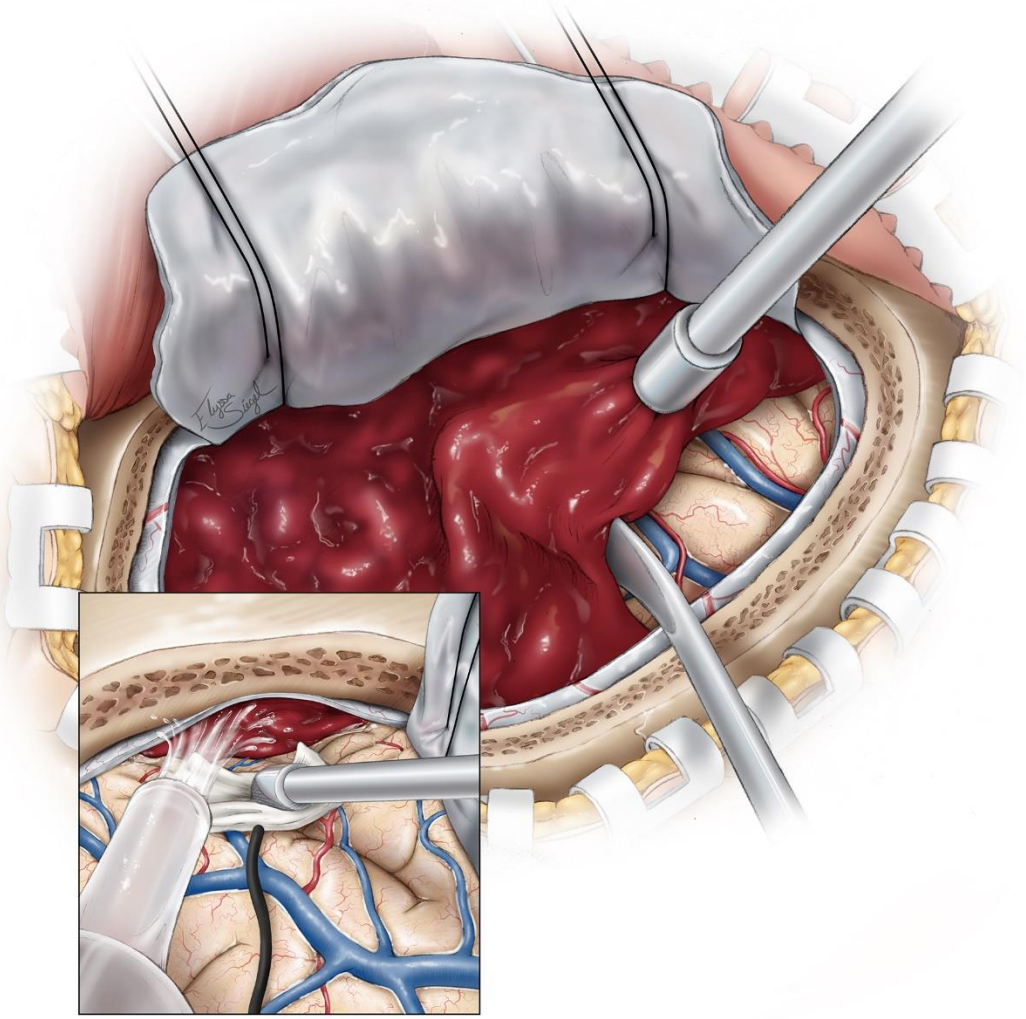
Subdural hematoma often minimal but associated with massive brain swelling



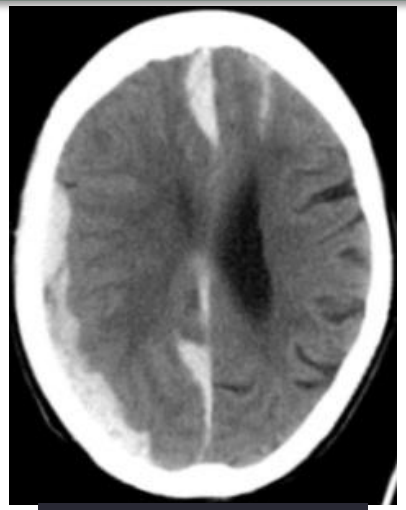
Subdural hematoma often minimal but associated with massive brain swelling



Acute subdural hematoma drainage: ineffective due to massive brain oedema

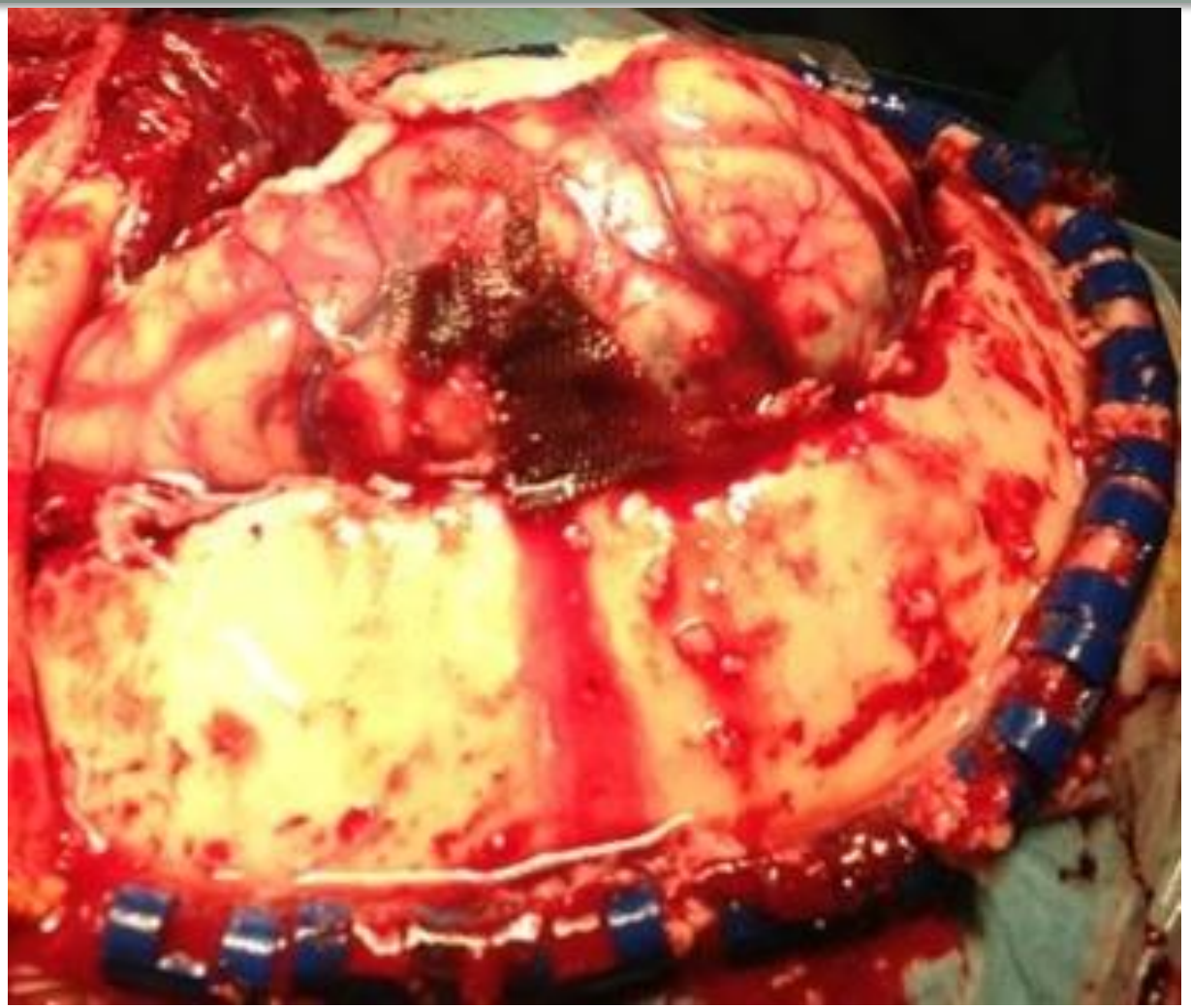


Acute subdural hematoma + cerebral oedema = brain herniation



Admission

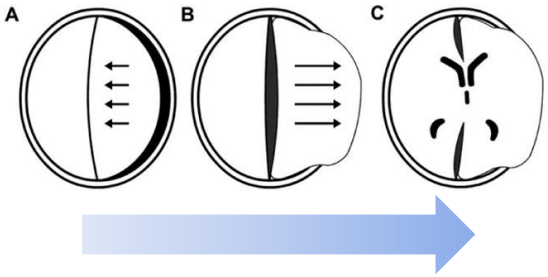
12 h post

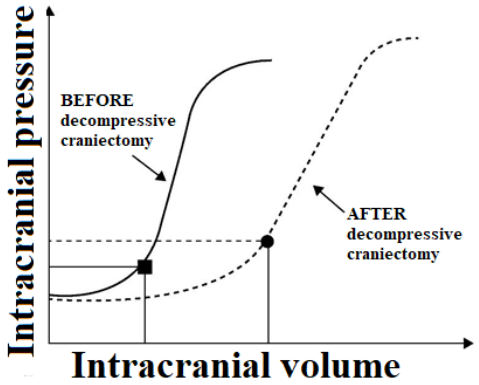


Intraoperative brain herniation through craniectomy

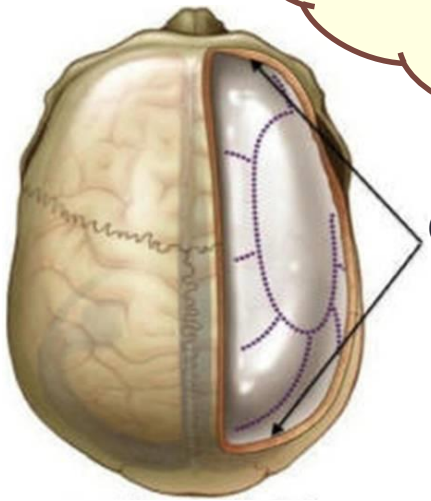
Treatment acute subdural hematoma: decompressive craniectomy

- More survivors but with sequelae

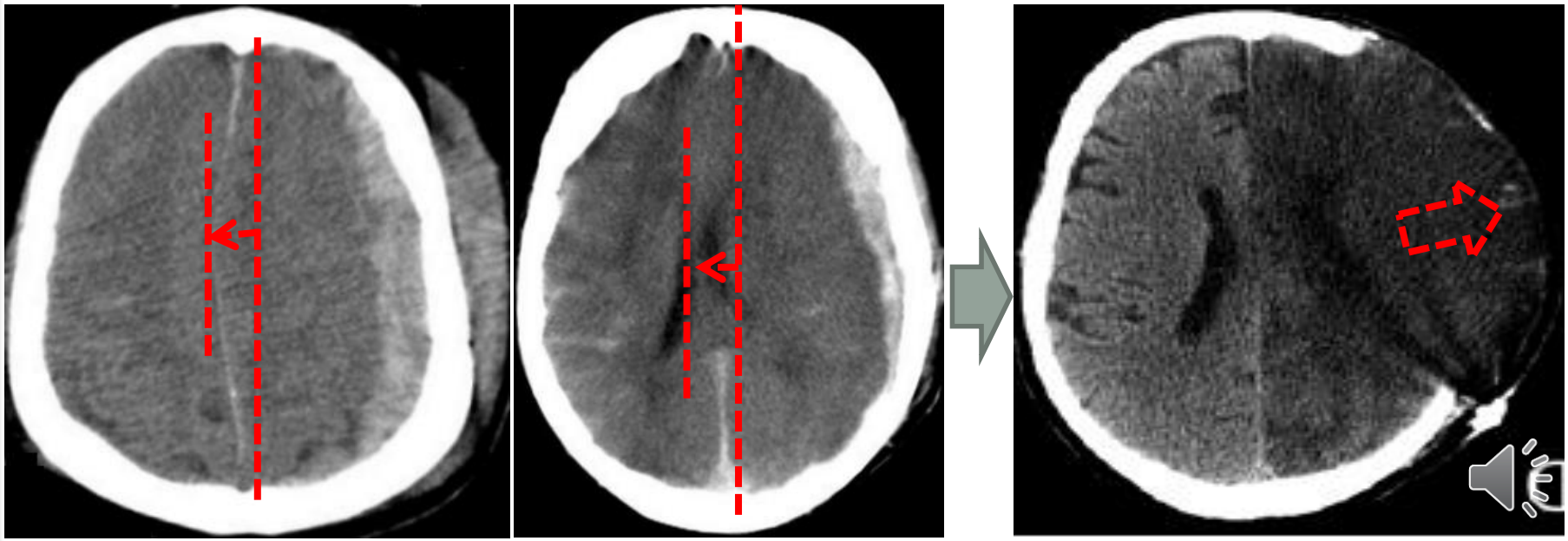




REMEMBER?

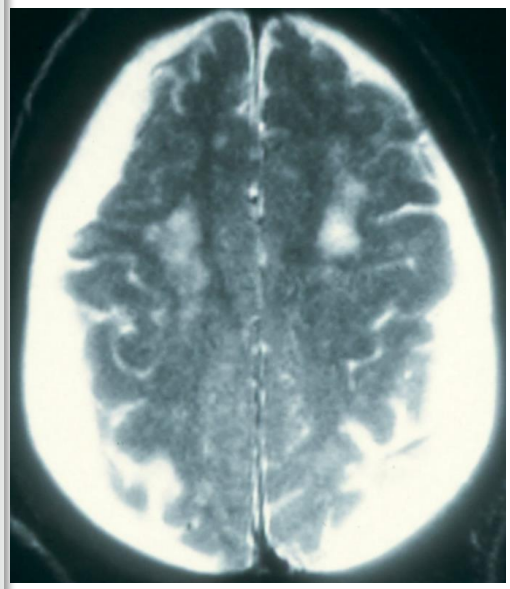


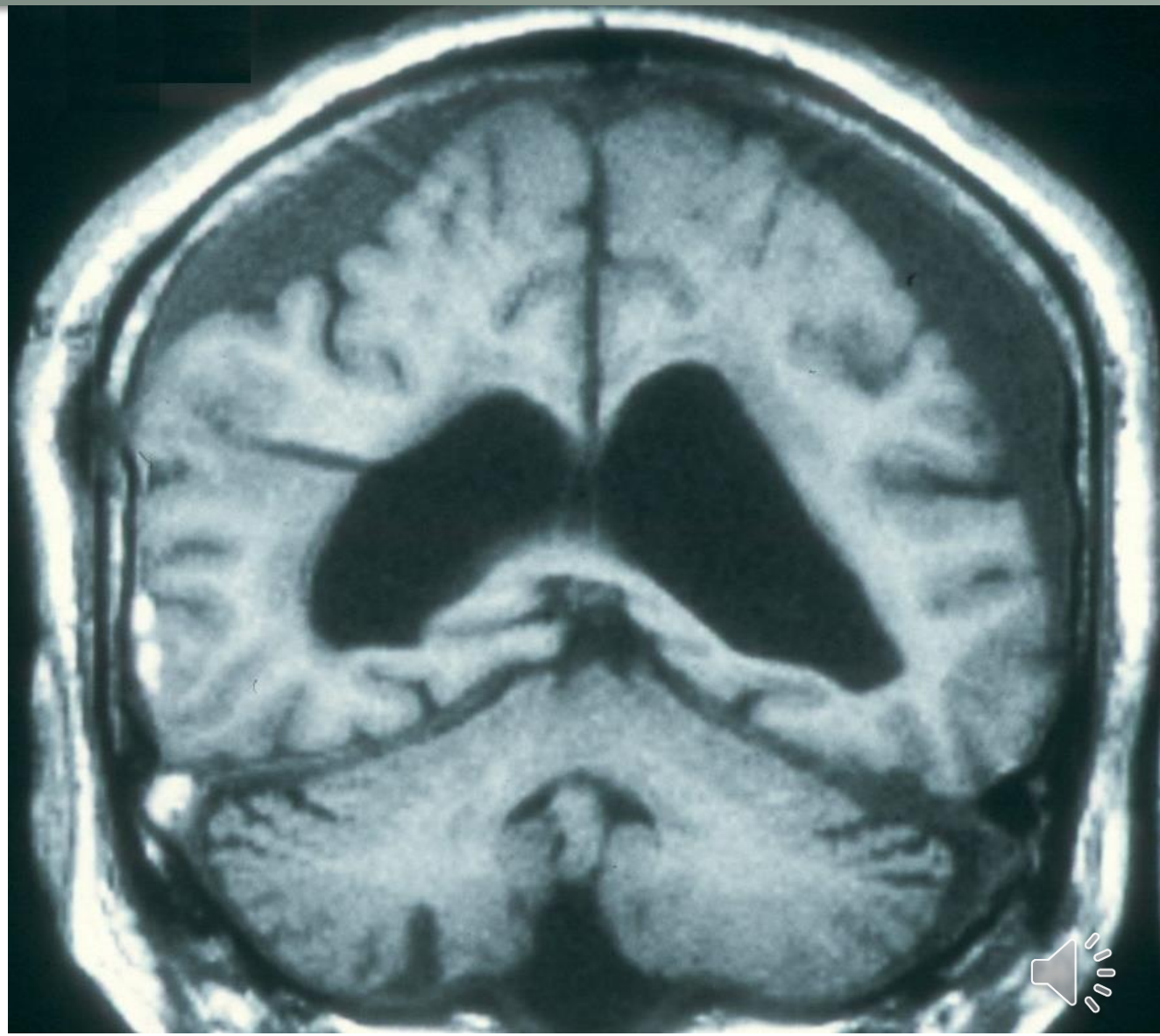
Craniectomy + dura opening



If acute subdural hematoma is not drained ⇒ chronic subdural hematoma

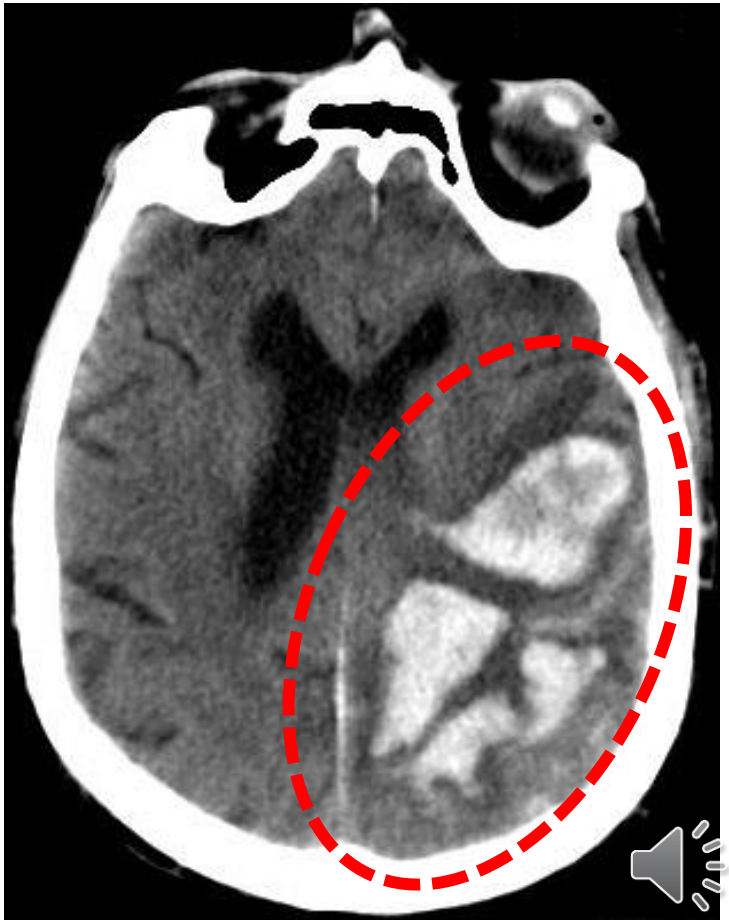
Chronic bilateral subdural hematoma in the elderly with trivial head trauma





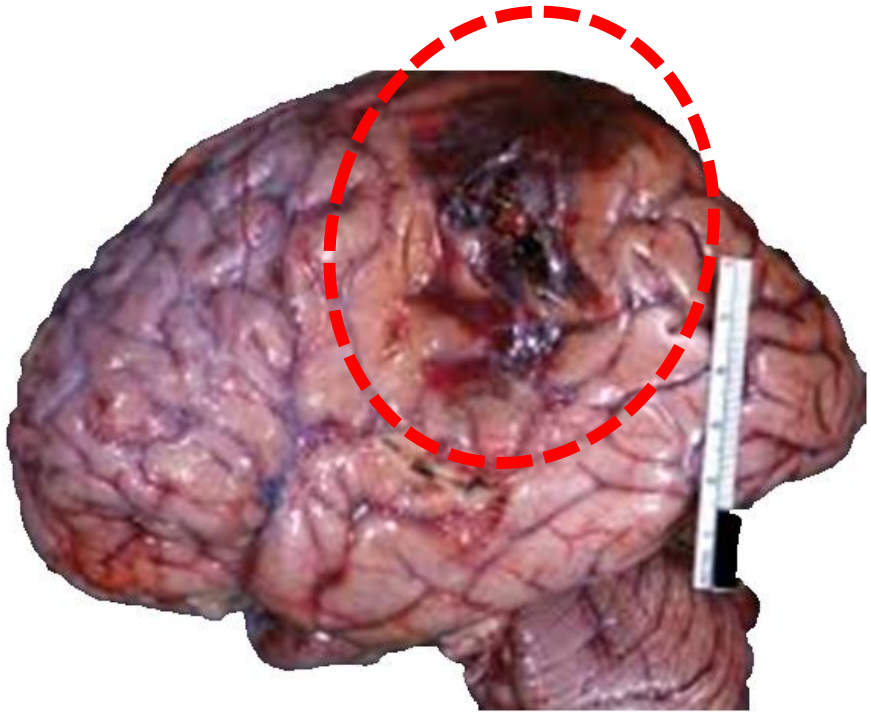
Intracerebral haematomas

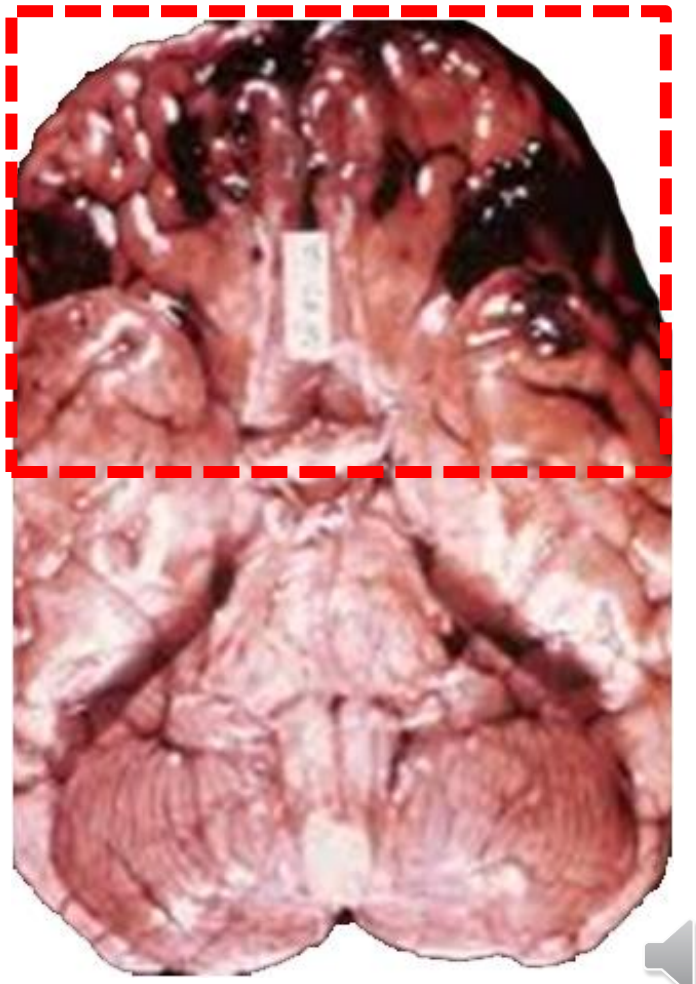
- Severe traumatic head injury needed
- Associated injuries = brain contusion + edema
- Nerve tissue compression ⇒ ischemia
- CSF obstruction ⇒ hydrocephalus
- Dismal prognosis



BRAIN CONTUSION

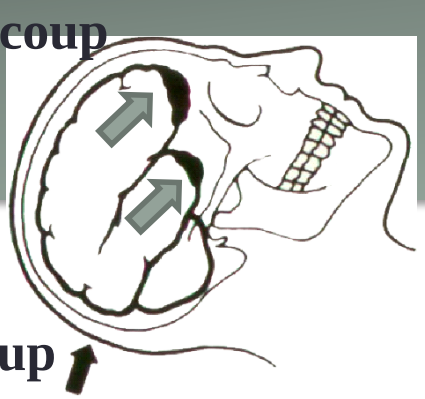
- Areas of contused nervous tissue + hematoma + edema in different proportions
- Mass effect
  - Excision to avoid ⇑ PIC?

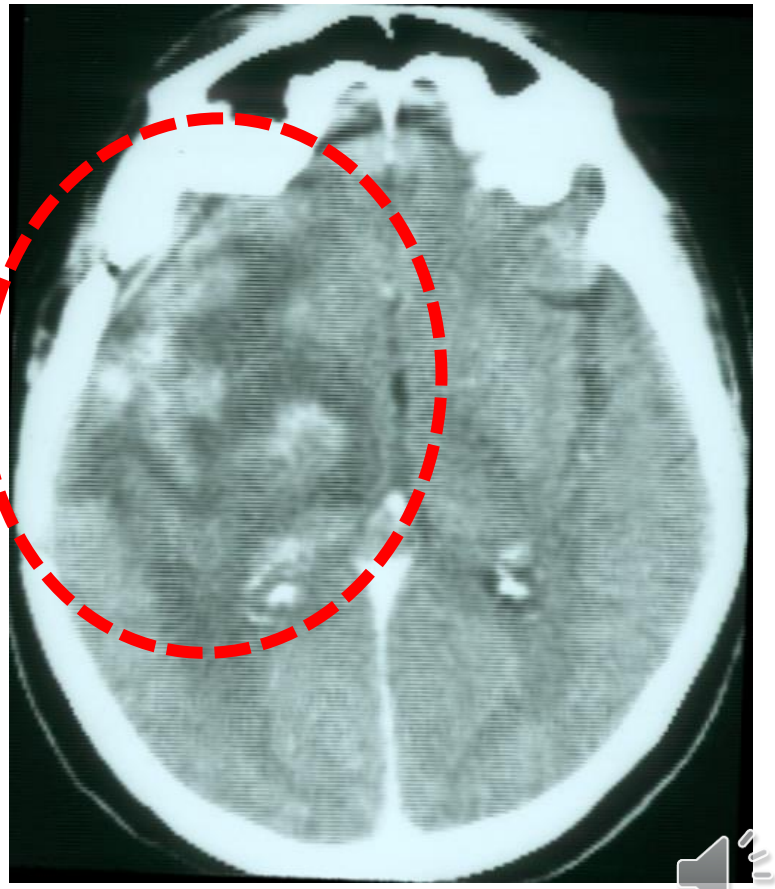




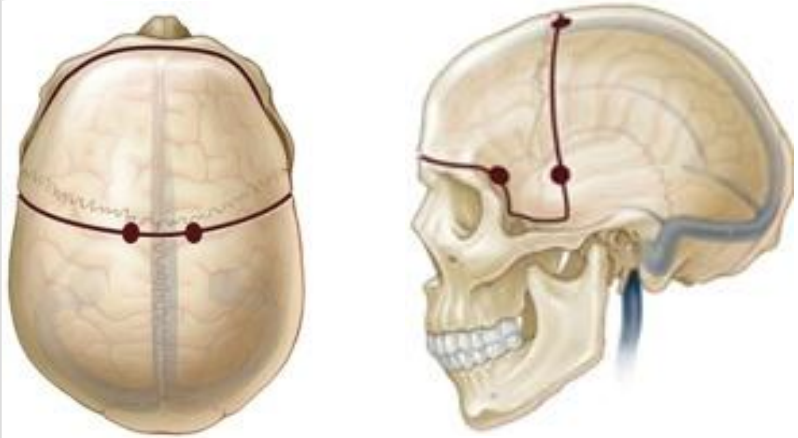
Frontal & temporal lobes mostly affected

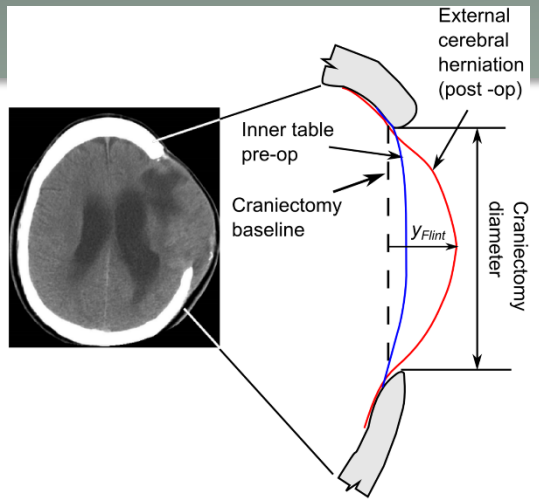
- Significant ICP increase
- Neurocognitive sequelae expected

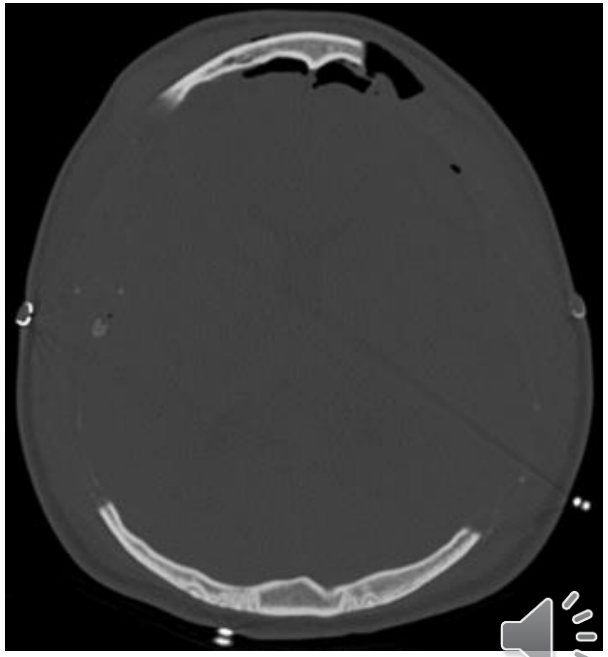




Massive cerebral edema bifrontal decompressive craniectomy

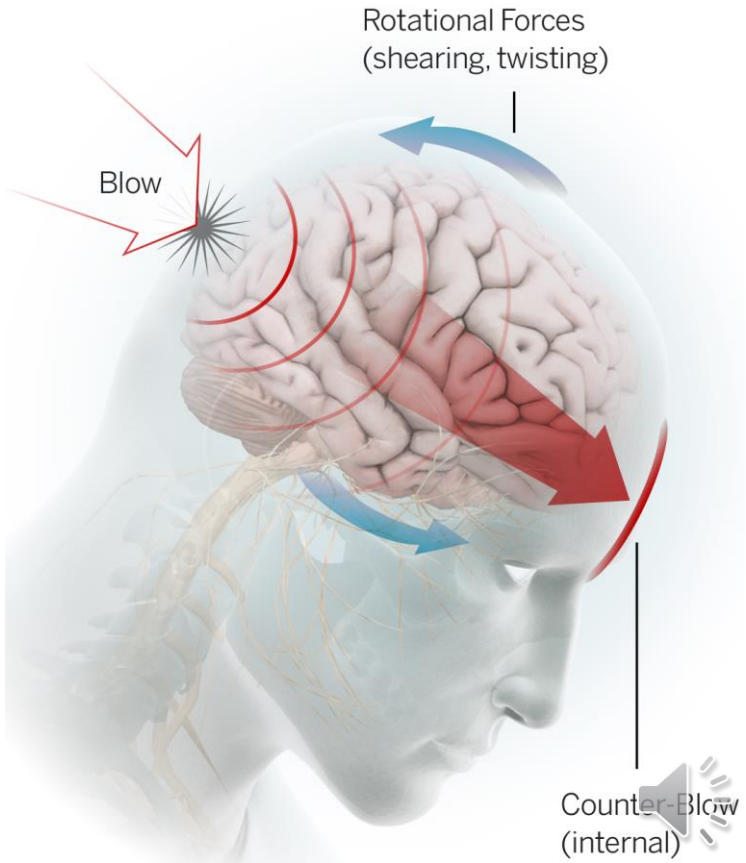






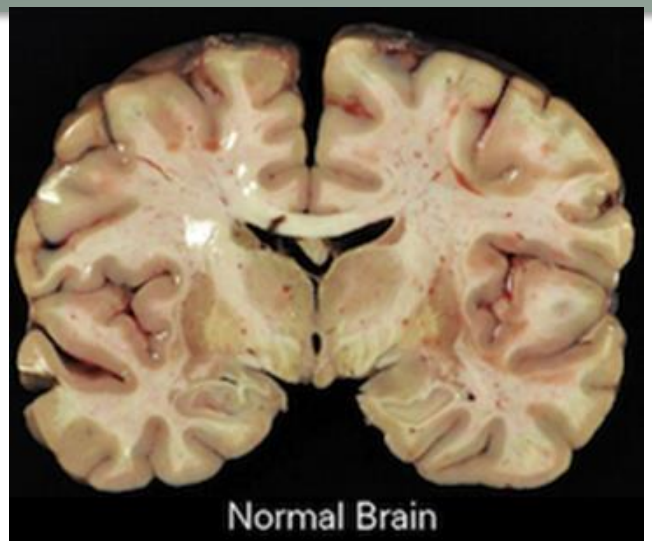
CONCUSSION = retardation of protective reflexes

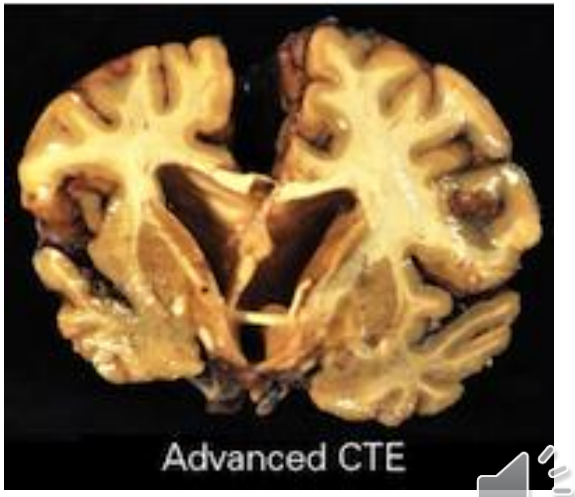
- First concussion
  - Six weeks without boxing or rugby
- Second concussion
  - No play for the rest of the season
- No driving vehicles for six weeks
- Abstinence from alcohol
- No CNS depressant drugs



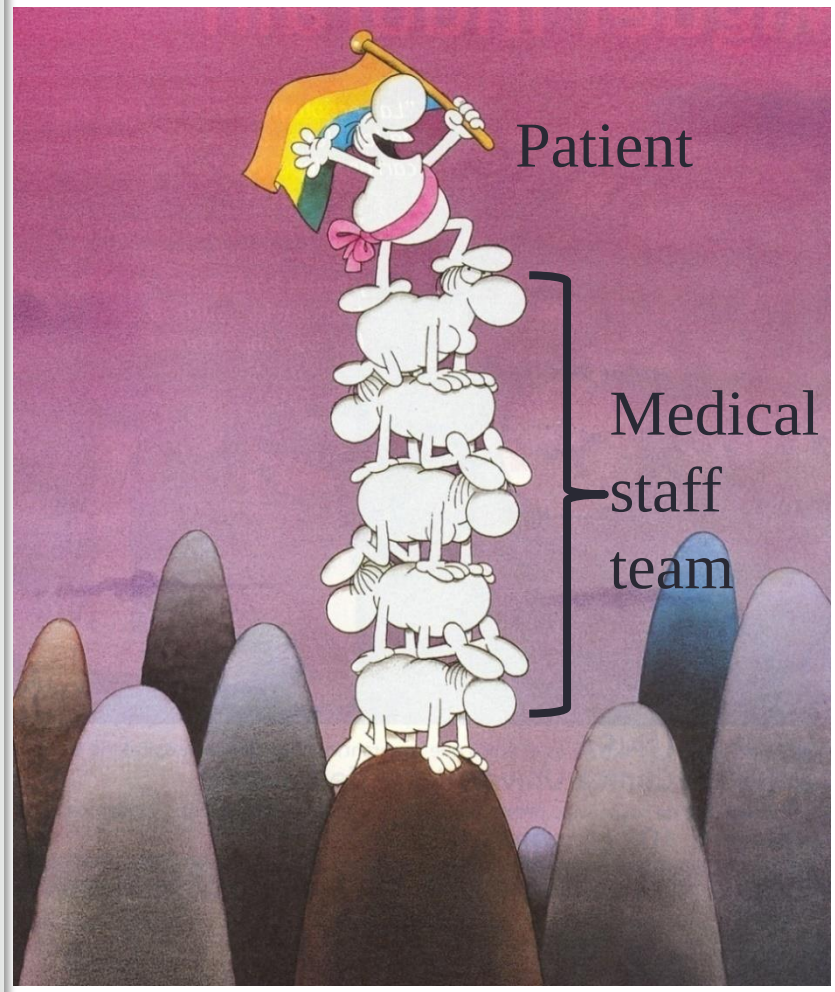
SEQUELAE?

- MRI = structural injuries
- Neurological examination = deficits
- Neuropsychological tests: attention, memory, mental coordination, cognitive impairment, social behaviour
- Antiepileptics
  - For how long?
- EEG?
- No definitive lesions up to two years post-TBI
- Post-traumatic epileptic seizures possible up to ten years post TBI





Treatment traumatic head injuries: vital teamwork



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