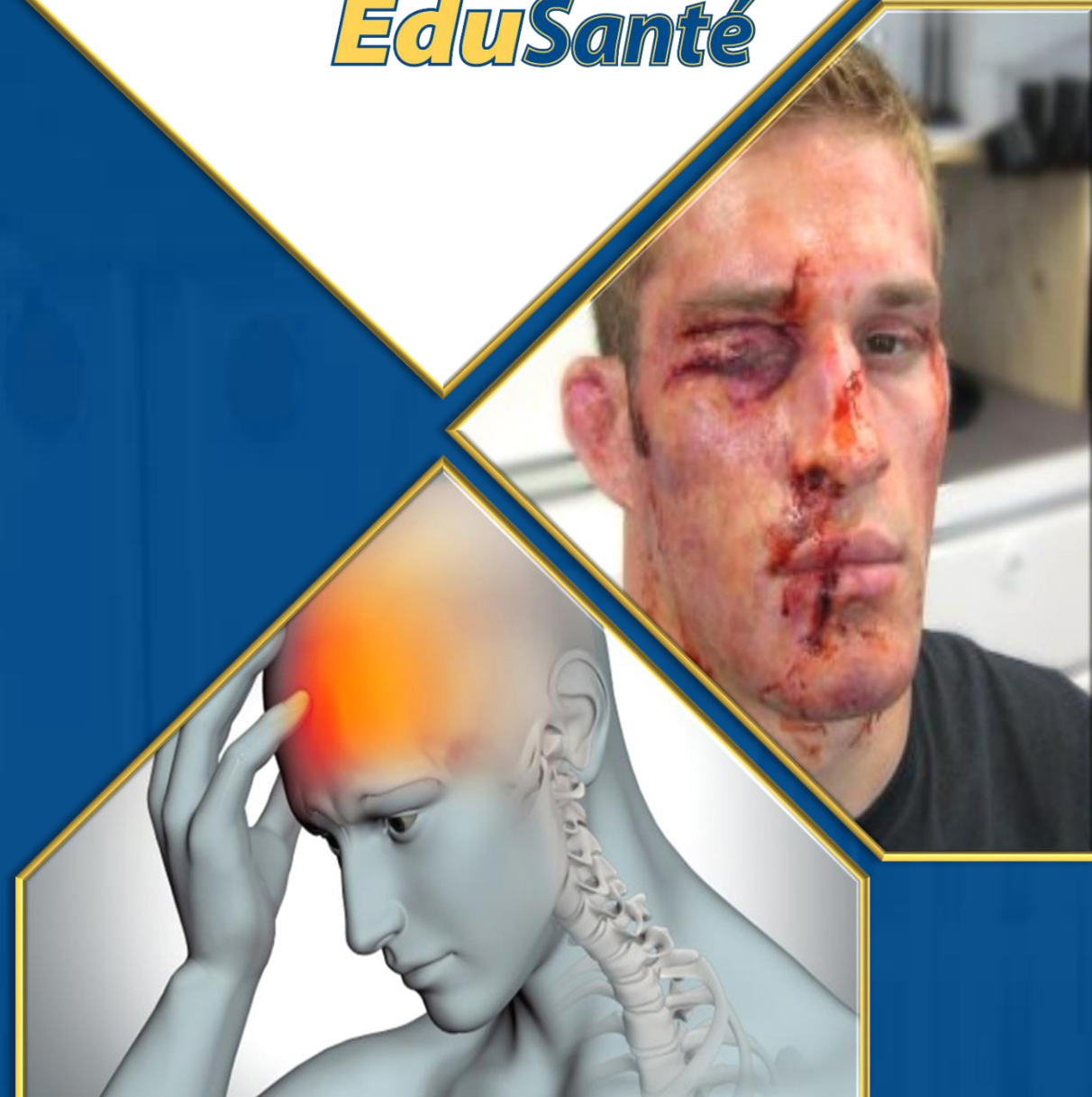


HEAD, NECK AND FACIAL TRAUMA

Primary Care Paramedicine

Module: 13
Section: 05



- Introduction
- Pathophysiology
- Assessment
- Management

- Common with major trauma
- 170 000 Canadians incur a brain injury annually (465/day)
- 34 000 people admitted to hospital each year with brain injuries in Canada
- 11 000 die each year
- Leading cause of death and disability under 44 years old.

Source: Brain Injury Association of NS

- Males 15 - 24
- Infants
- Young children
- Elderly
- Education initiatives have resulted in a great reduction in incidence



- Time becomes the critical consideration once an injury occurs
- Intracranial hemorrhage and progressing edema
 - Advancing intracranial pressure (ICP)
 - Increasing hypoxia
 - Permanent damage
- Severity is difficult to recognize
 - Subtle signs
 - Improve differential diagnosis/anticipate problems

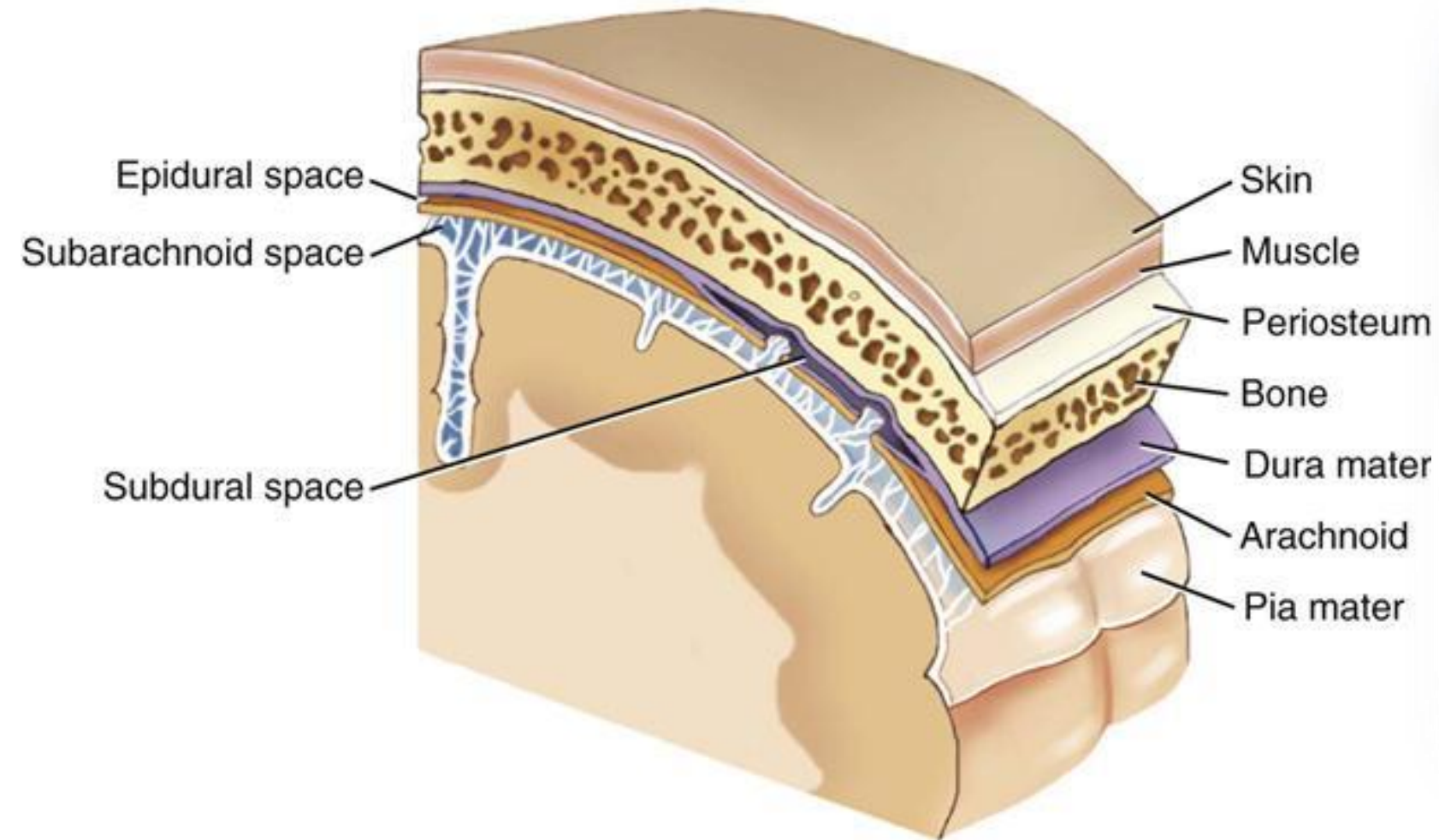
- Risk Factors:
 - Alcohol intake
 - Substance intake
 - Anticoagulants
 - Not using/incorrect wearing of safety restraints
 - Not wearing a helmet
 - Not using proper safety equipment

Blunt Injury

- Motor vehicle collisions
- Assaults
- Falls

Penetrating Injury

- Gunshot wounds
- Stabbing
- Explosions (shrapnel)
- Pointy objects





- By itself tends to be a minor injury
 - May be the only overt indication of a more serious injury
- Scalp overlies the firm cranium and is very vascular
 - Tend to bleed heavily
 - Route for infection
 - May produce shock, especially in kids

- Often difficult to assess
 - Contusion often expands outward
- If no skull fracture present apply direct pressure and dressing
- If skull fracture is present, apply dressing but NO direct pressure
- Scalp Avulsion
 - Cover the open wound with bulky dressing
 - Pad under the fold of the scalp
 - Irrigate with NS to remove gross contamination



- Cranial injury is a skeletal injury that will heal
- Forces required to fracture the skull are extreme
 - Likely to cause injury within
 - Often sufficient to induce brain injury

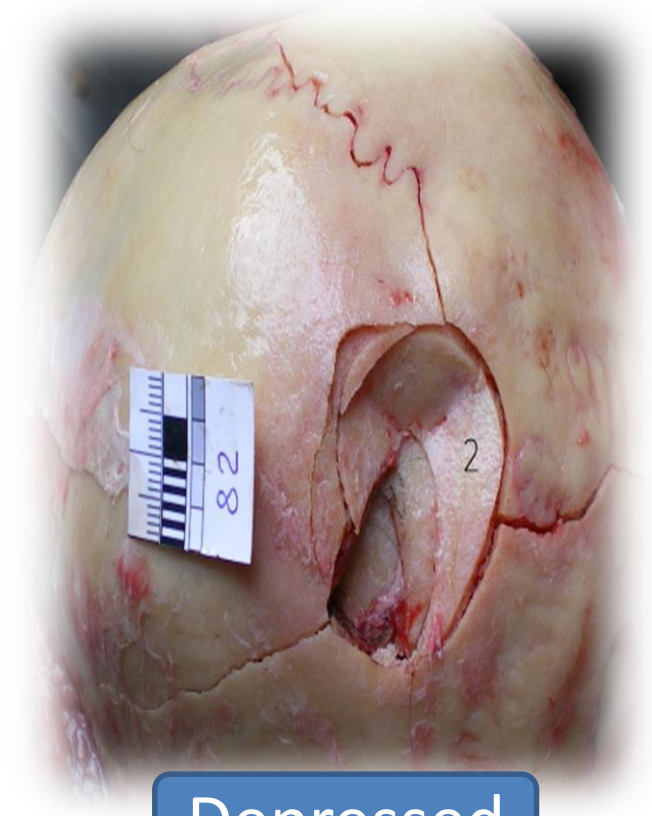
- Forces must be severe to fracture the skull



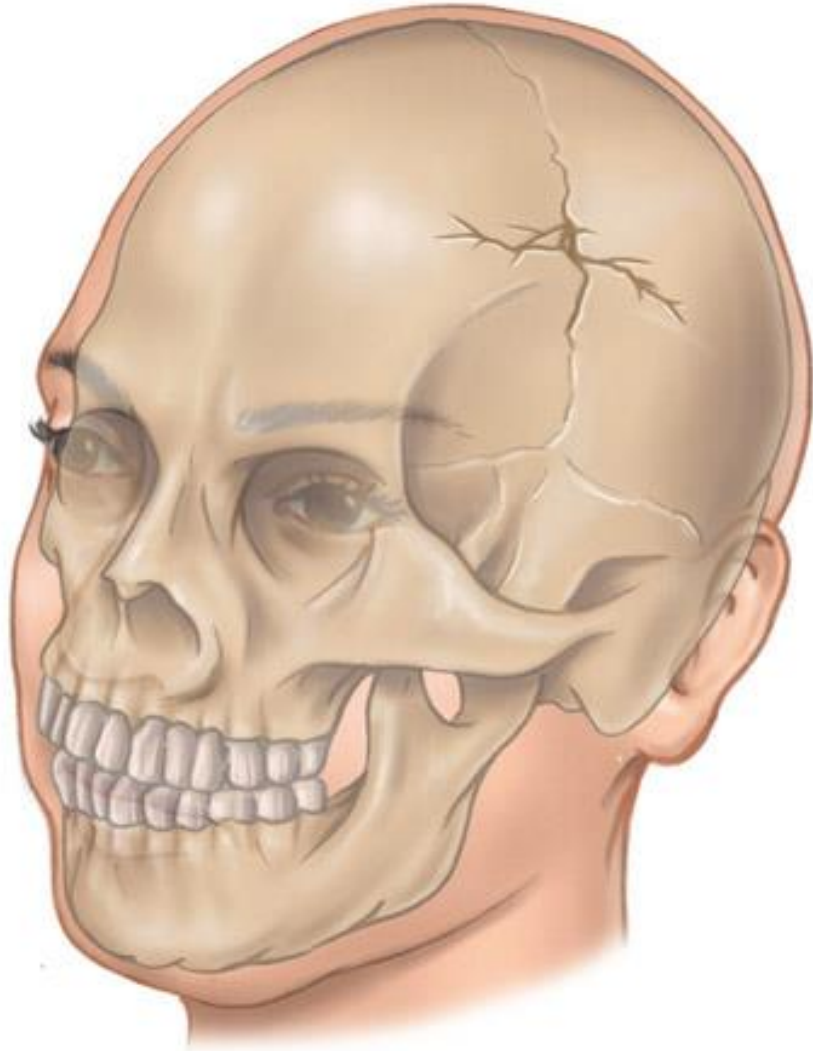
Linear



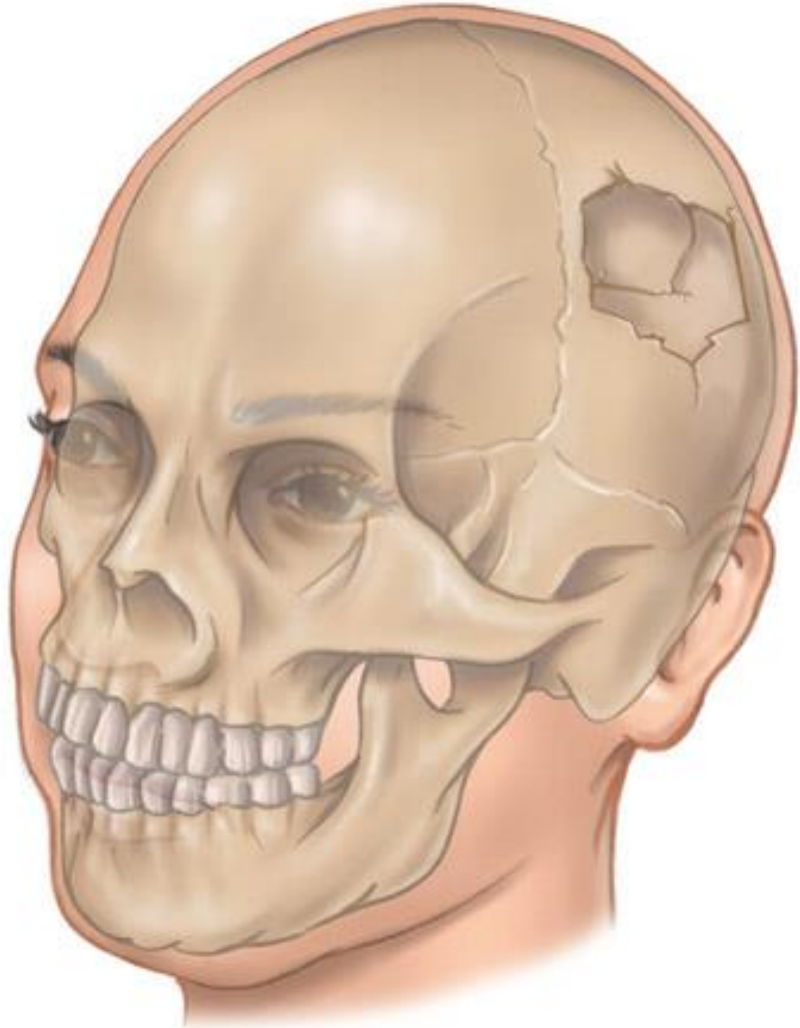
Basilar



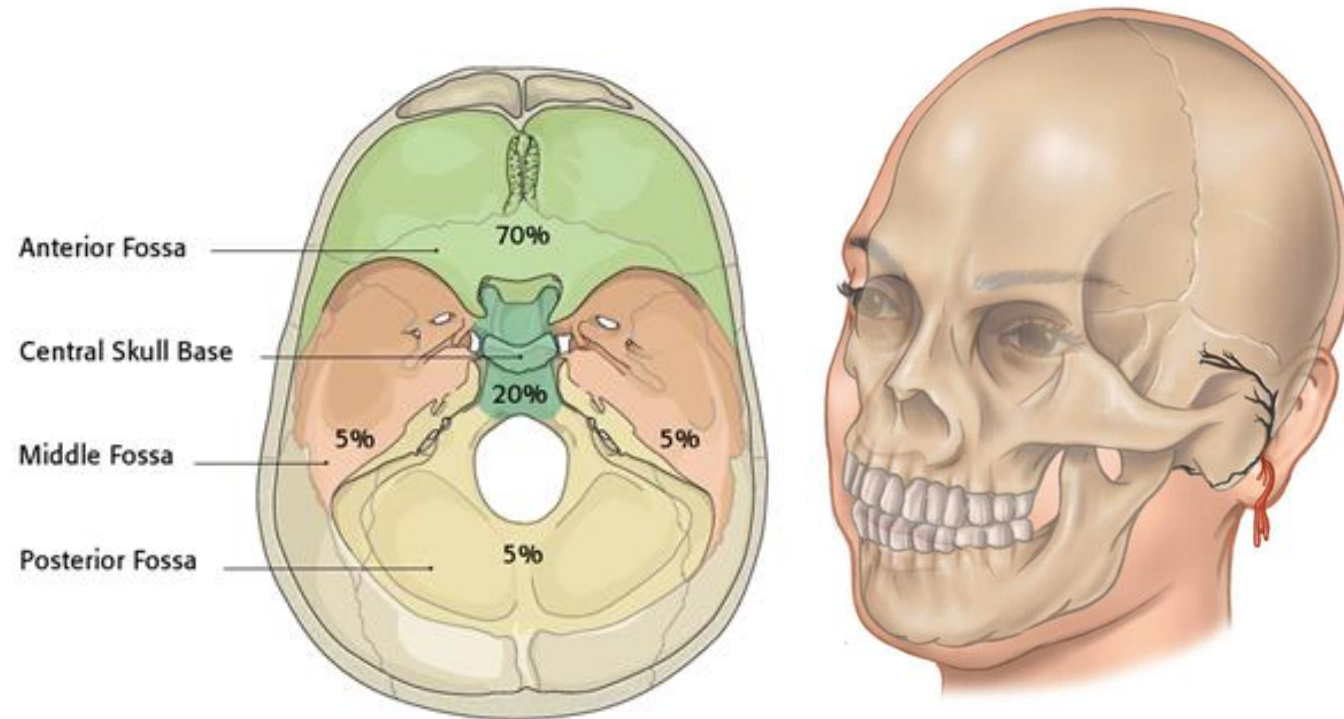
Depressed



- Nondisplaced skull fractures
- Most common (80%)
- Small cracks in the cranium
- Bone is non-displaced
- 50% occur in temporal-parietal region (thinnest)
- If there are no intracranial injuries, poses very little danger to patient



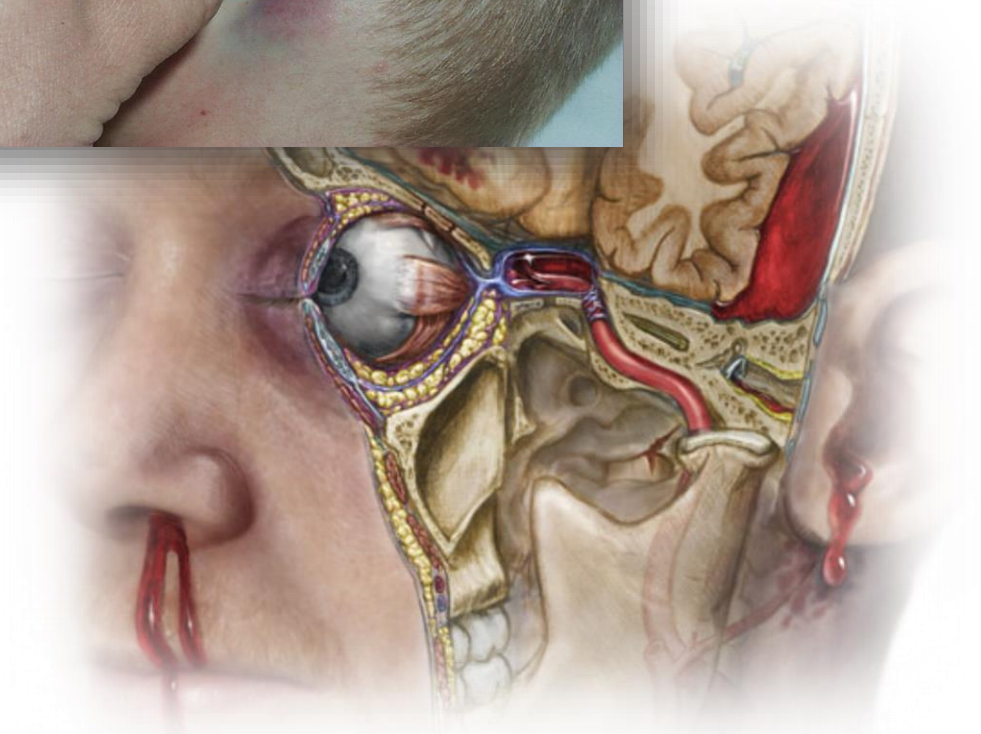
- Inward displacement of skull's surface
- Greater likelihood of intracranial damage
- Comminuted fracture
 - Multiple skull fragments
 - May penetrate meninges and underlying structures



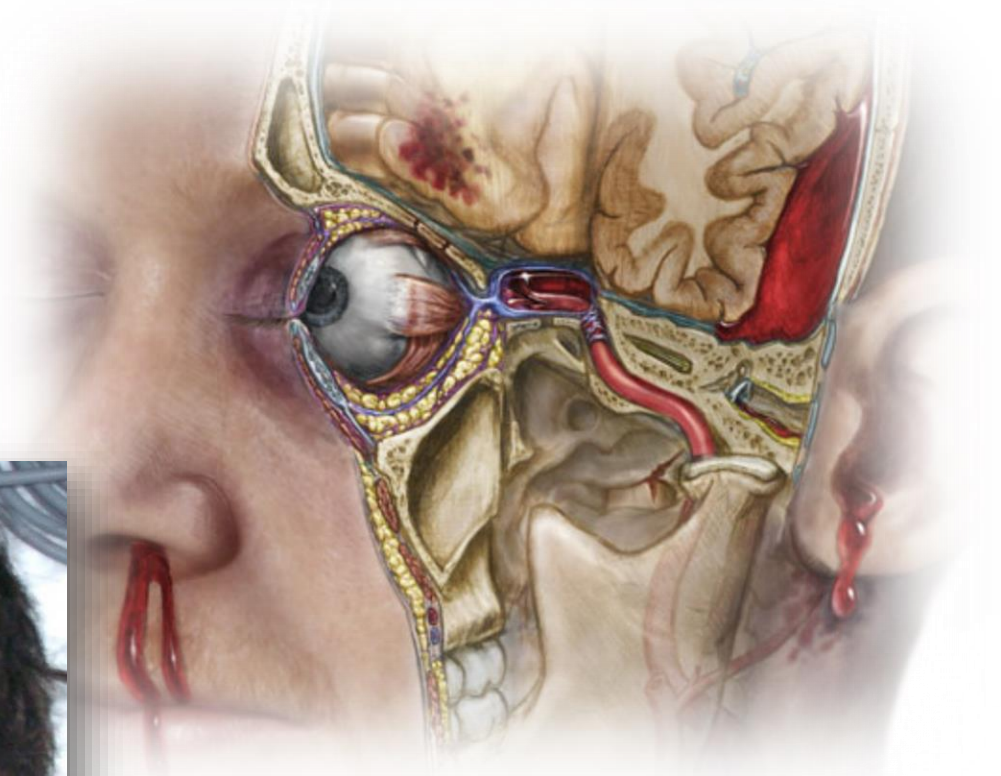
- High-energy trauma, occur following diffuse impact (falls)
- Structure of the basilar skull
 - Permeated with foramina (openings)
 - Several hollow or open structures
 - Weaker and very prone to fracture

- Presentation varies with location of injury
- Associated signs:
 - Battle's signs
 - Raccoon eyes
 - Halo sign
- May take time to develop and may not be seen prehospital

- Battle's Signs
 - Retroauricular Ecchymosis
 - Associated with fracture of auditory canal and lower areas of skull
 - Hemorrhage migrates to mastoid region

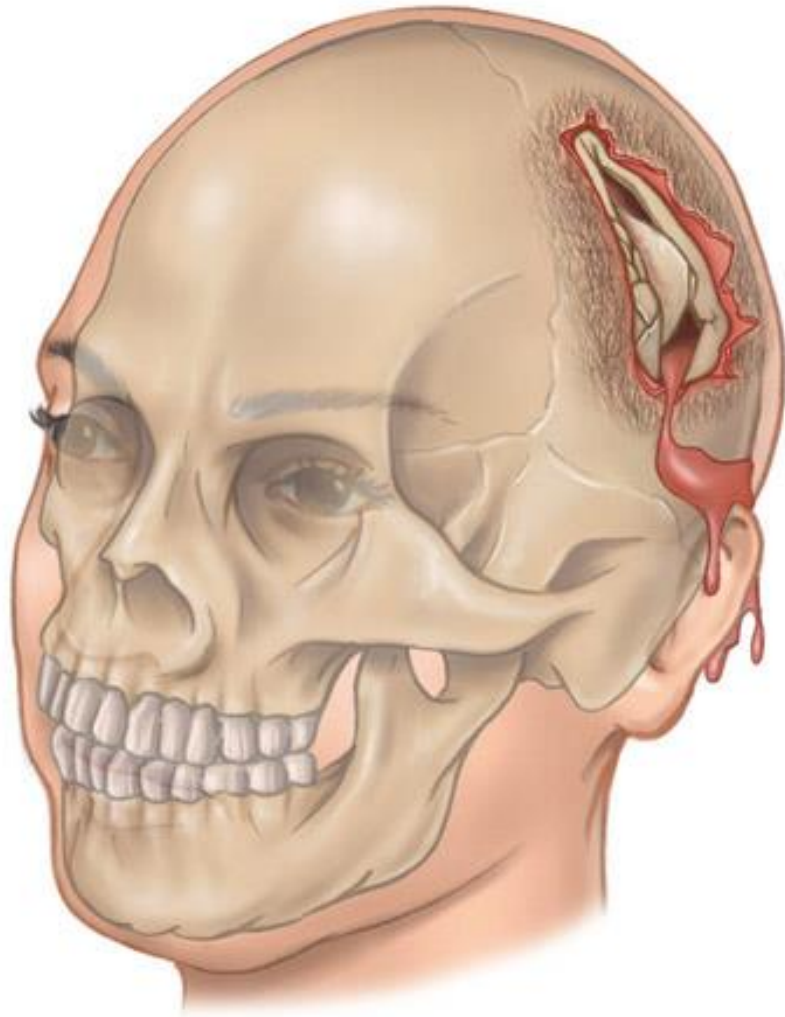


- Raccoon Eyes
 - Bilateral Periorbital Ecchymosis
 - Associated with orbital fractures



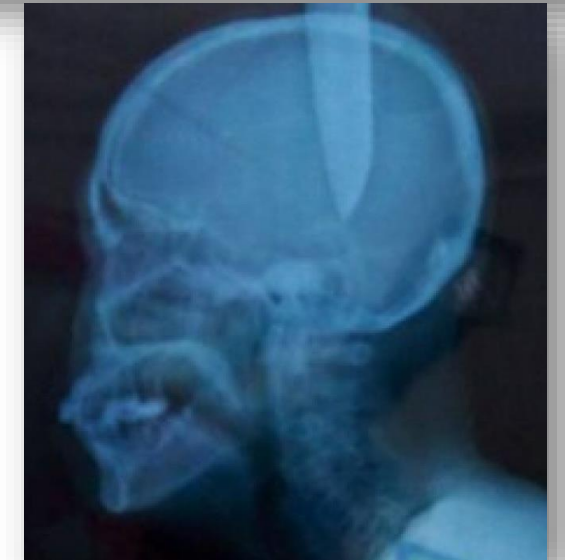
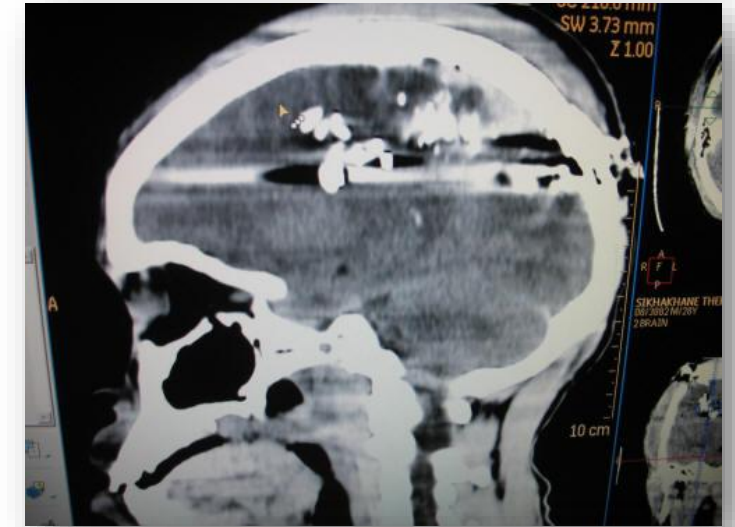
- A tear dura mater
 - Open wound between brain and body's exterior
- Permits CSF to seep out
 - Provides possible route for infection
 - May also provide escape for CSF, limiting ICP
- Produces Halo sign
 - Blood mixed with CSF from nose, mouth or ears
 - Target sign on sheet or 4x4





- Severe forces applied to head
- Often associated with multi-trauma
- Brain tissue may be exposed.
- High infection rate
- High mortality rate

- Bullet impacts
 - Entry wound creates comminuted fracture
 - May create another fracture on exit
 - Bullet's path creates a large cavitation wave
- Impaled objects
 - Further motion may cause significant/devastating injury
 - Brain tissue does not immobilize objects as well as other tissues (objects move more)





“A traumatic insult to the brain capable of producing physical, intellectual, emotional, social and vocational changes.”

(National Head Injury Foundation definition)

- Caused by:
 - Rapid acceleration/deceleration or collision
 - Blunt/penetrating forces
- Two broad categories of brain injuries
 - Primary: results instantaneously from impact
 - Secondary: consequence of primary injury
 - Cerebral edema, intracranial hemorrhage, increased ICP, cerebral ischemia and hypoxia, hypoglycemia, hypotension, and infection

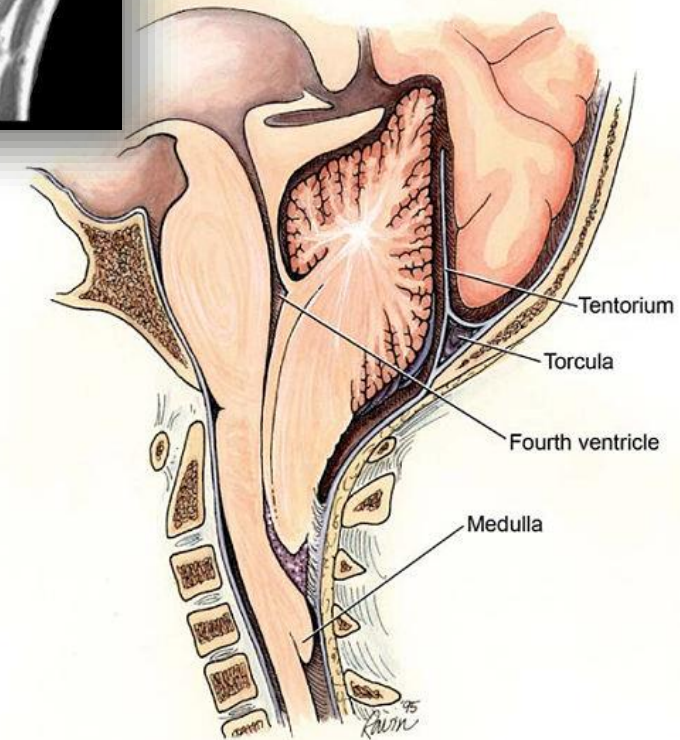
ICP: Pressure in Cranial Vault

- No room for expansion in cranium
- Underside of skull surface irregular and hard
- Normal ICP (adults) 5 to 15 mm Hg
- Increased ICP decreases brain perfusion.
- The brain needs a constant supply of oxygen.

Cerebral Perfusion Pressure (CPP)

- Increased blood flow increases ICP.
- ICP increase forces CSF out of brain.
- Displaced CSF moves to spinal cord.
- Autoregulation leads to fatal ICP increase.
- CPP decreases—brain ischemia results.

- Herniation
 - Portion of brain structure pushed through opening (foramen magnum)
 - Pressure on upper brainstem
 - Vomiting, decreased LOC, pupil dilation
 - Pressure on medulla oblongata
 - Disturbances in respirations, blood pressure and heart rate



Signs and Symptoms

- Dependent on pressure inside skull
- Extent of brainstem involvement
- Early signs and symptoms:
 - Vomiting
 - Headache
 - Altered level of consciousness
 - Seizures
- Later signs
 - Cushing triad
 - Pupil changes
 - Coma
 - Posturing
 - Decorticate (flexor)
 - Decerebrate (extensor)

Decorticate

- Problem within cervical spinal tract or cerebral hemisphere



Decerebrate

- Problem within mid brain or pons



Both dilated (Mydriasis)



- Nonreactive: brainstem
- Reactive: often reversible

Eyelid Closure



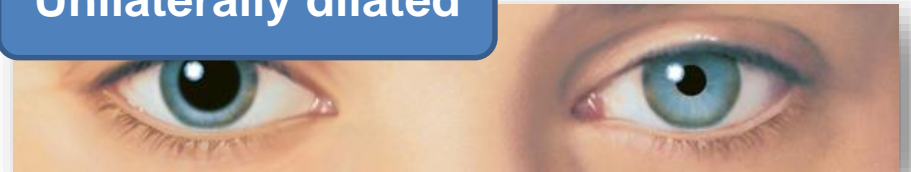
- Slow: cranial nerve III
- Fluttering: often hysteria

Unequal Pupils (Anisocoria)

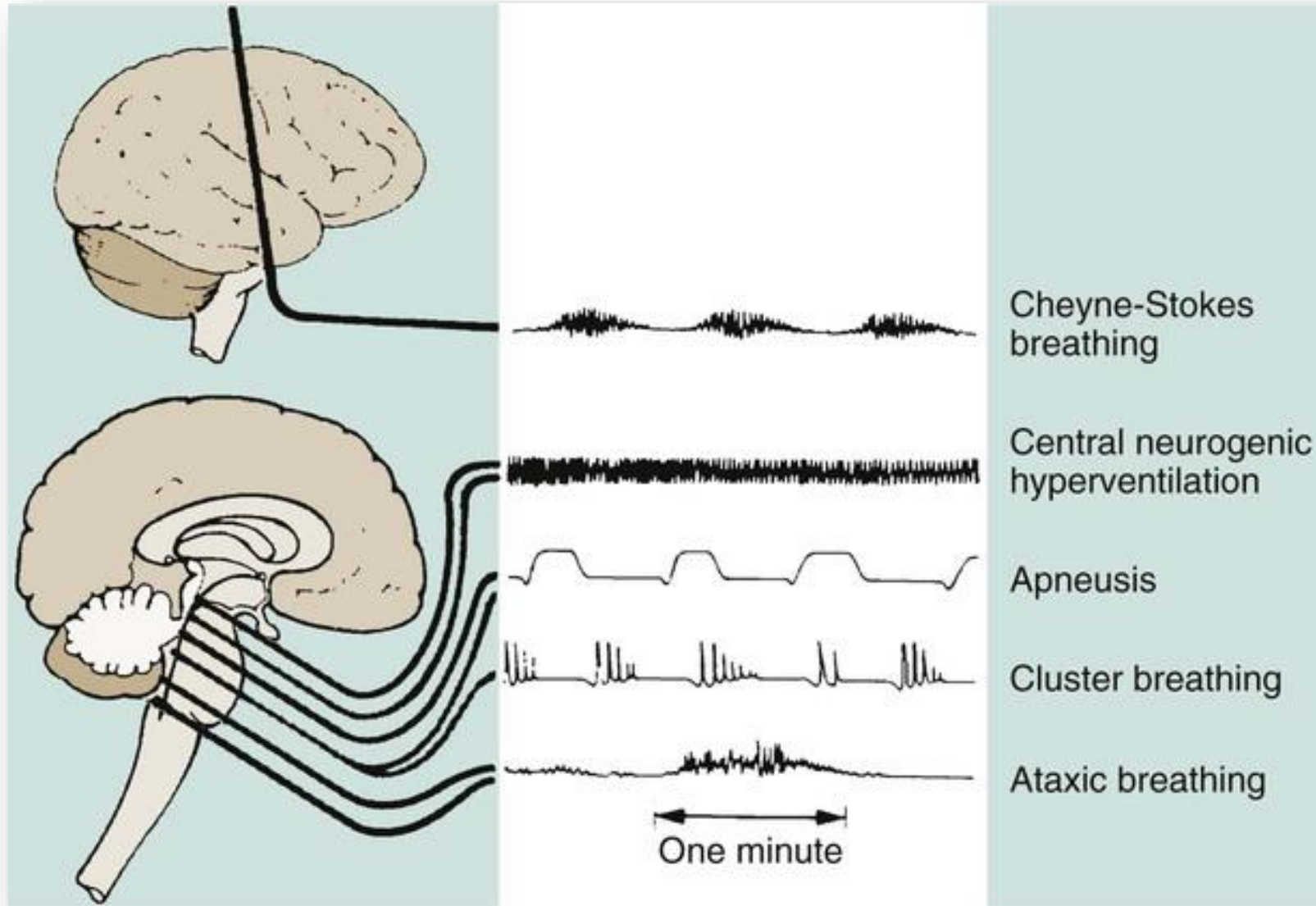


- Naturally occurs in 20% of population
- Cranial nerve III injury
- > 1mm (or more) difference

Unilaterally dilated



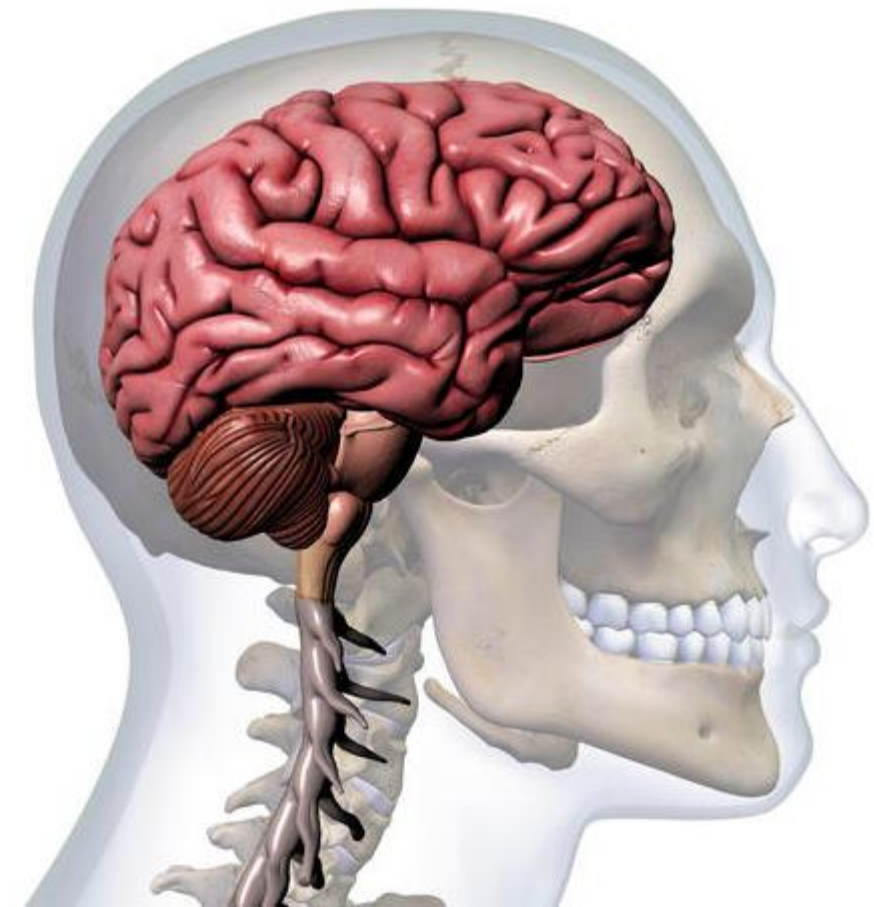
- Reactive: ICP increasing
- Nonreactive (altered LOC): increased ICP
- Nonreactive (normal LOC): not from head injury



- As a portion of the cerebral cortex is impaired
 - The activity it controls is affected
- Frontal lobe injury
 - Alterations in personality
- Occipital lobe injury
 - Visual disturbances



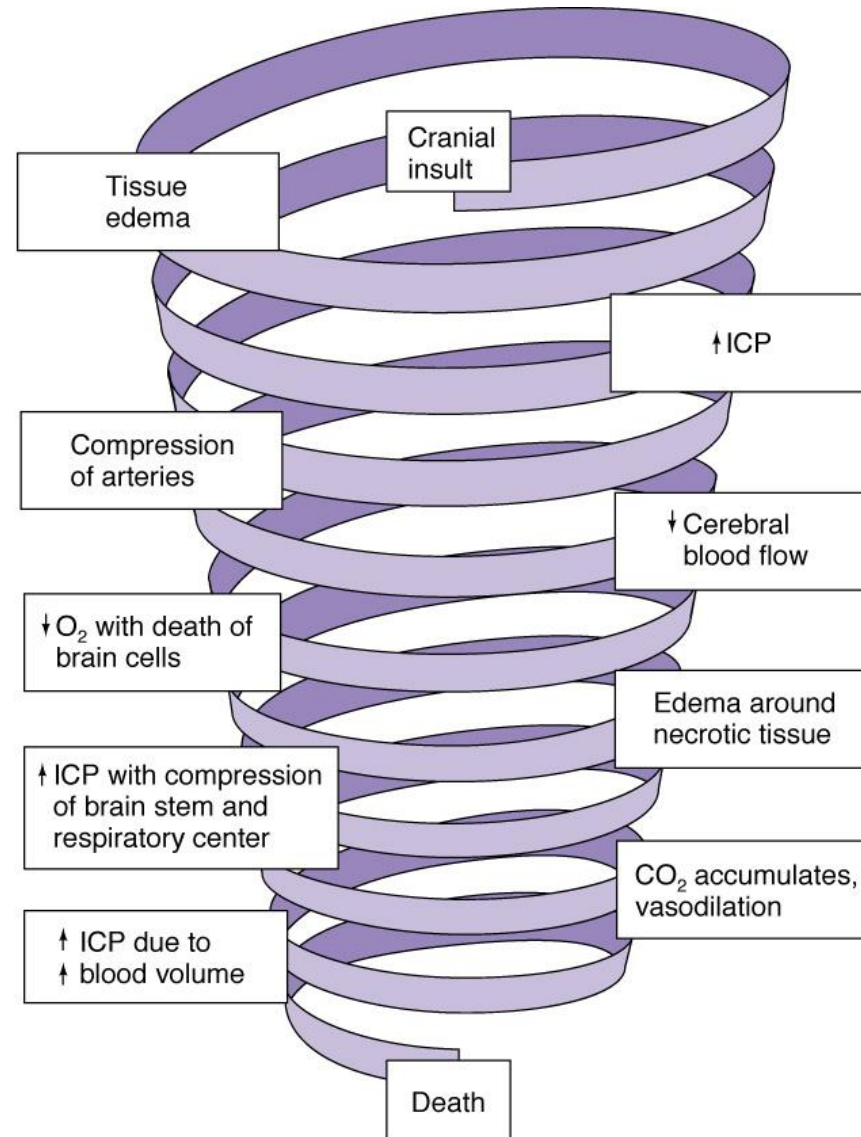
- Large scale cortical disruption
 - Reduce mental status or amnesia
 - Retrograde
 - Unable to recall events before injury
 - Antegrade
 - Unable to recall events after trauma
 - Repetitive questioning
- Focal Deficits
 - Hemiplegia, weakness or seizures

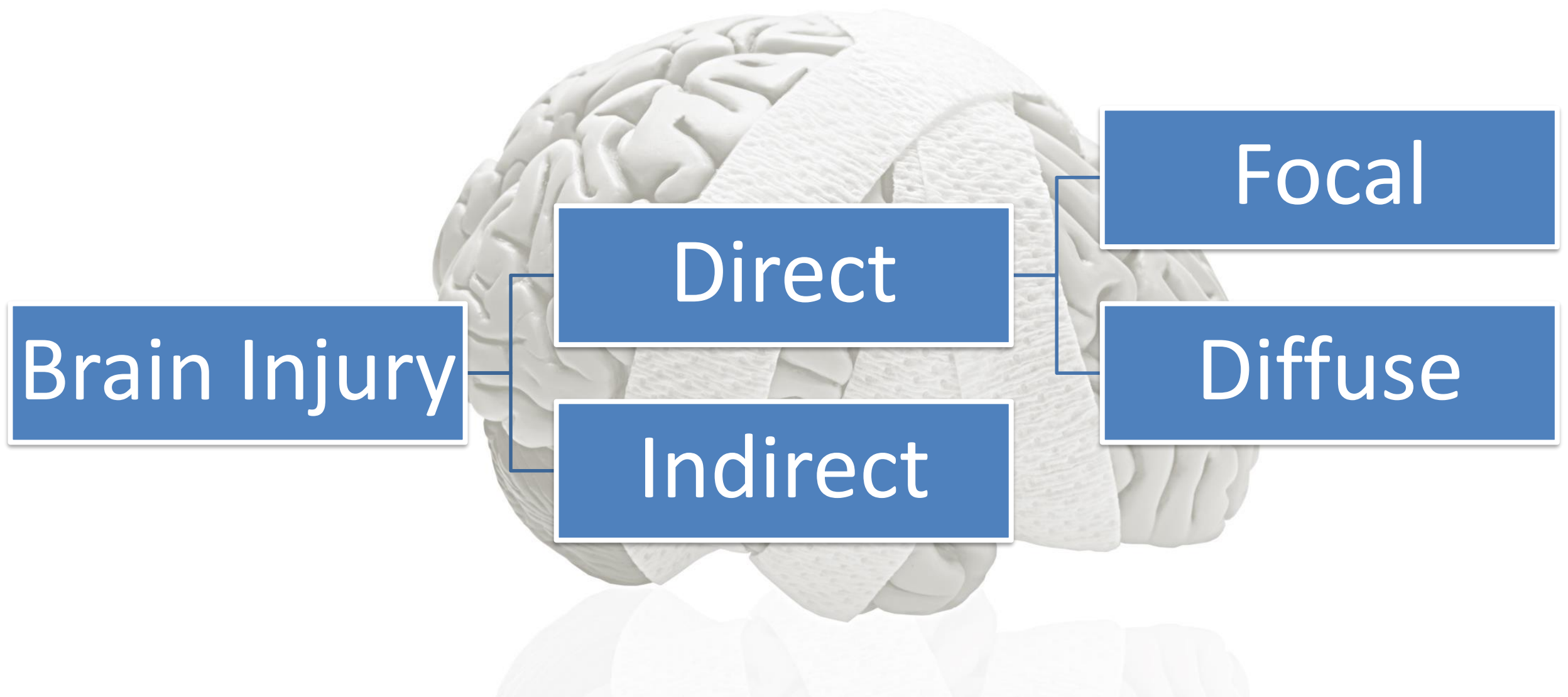


- Increasing blood pressure
- Reflex bradycardia
 - Vagus nerve stimulation
- Cheyne-stokes respirations
- Pupils become small and reactive
- Decorticate posturing
 - Neural pathway disruption

- Widening pulse pressure
- Increasing bradycardia
- CNS hyperventilation
 - Deep and rapid
- Bilateral pupil sluggishness or inactivity
- Decerebrate posturing

- Pupils dilated and unreactive
- Ataxic respirations
 - Erratic with no pattern
- Irregular and erratic pulse rate
- ECG Changes
- Hypotension
- Loss of response to painful stimuli





Focal:

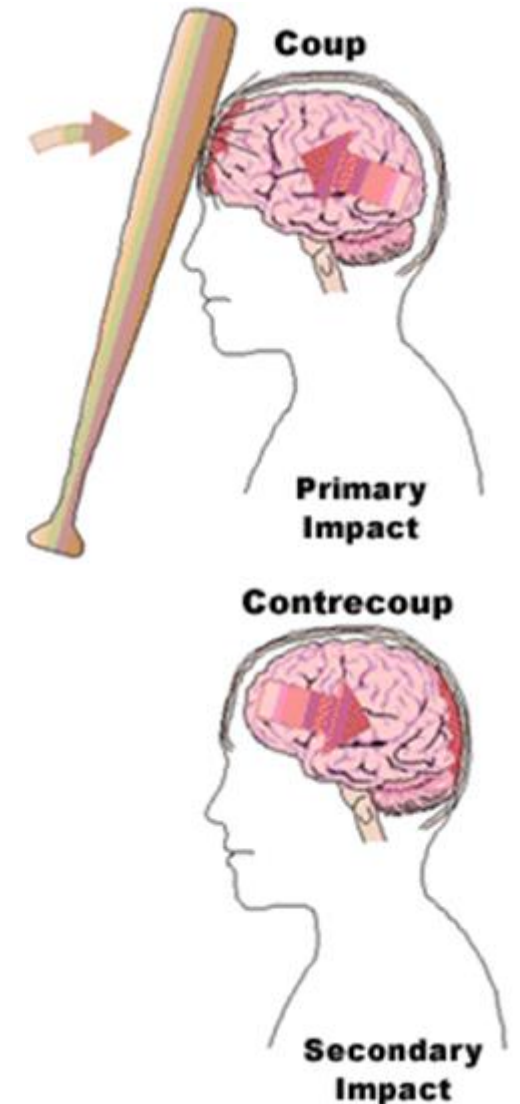
- Cerebral contusion
- Intracranial hemorrhage
 - Epidural hematoma
 - Subdural hematoma
 - Intracerebral hemorrhage

Diffuse:

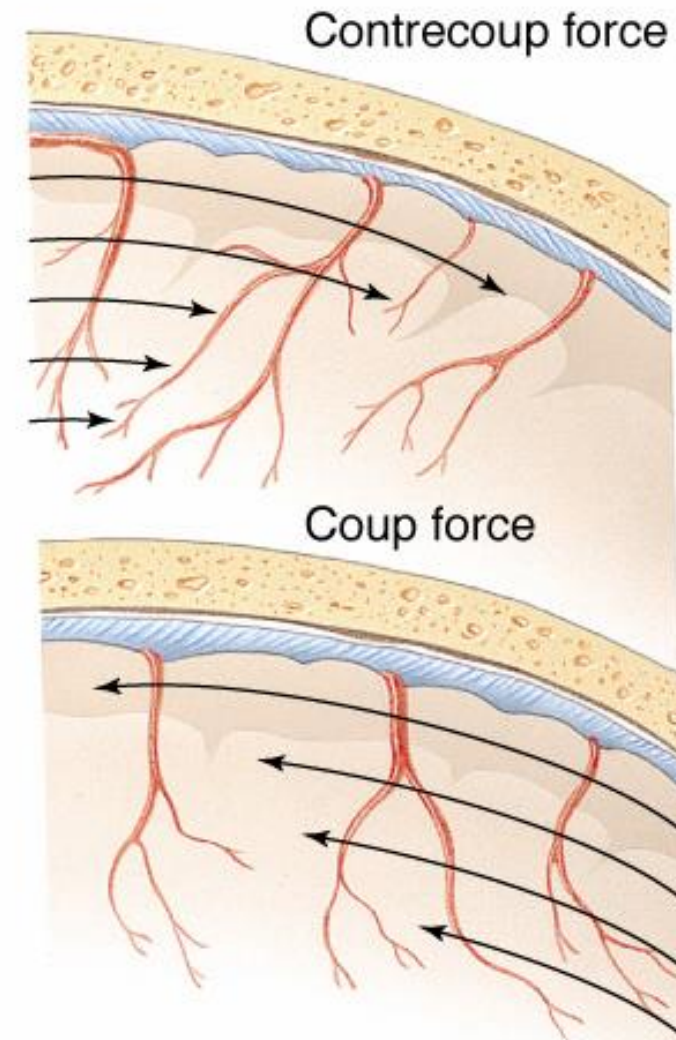
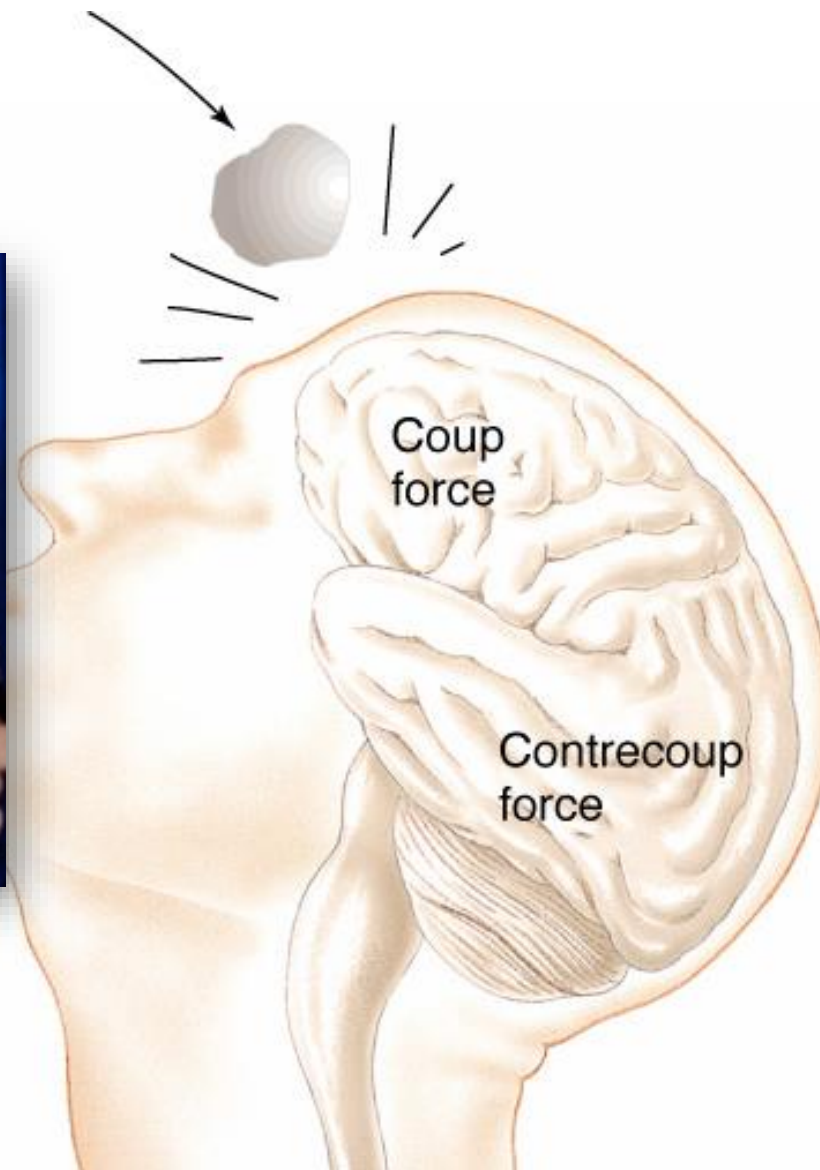
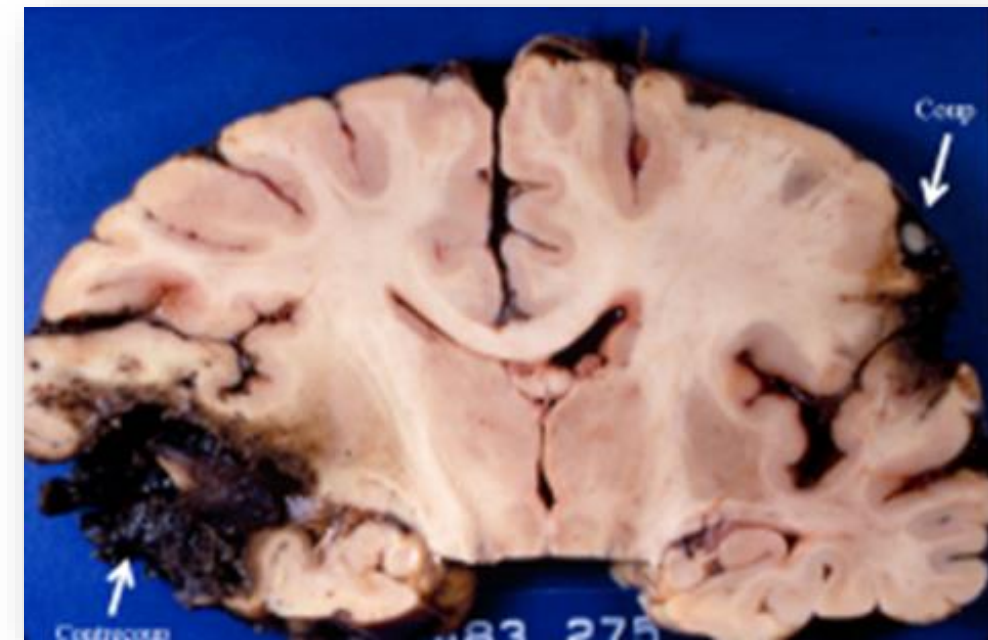
- Mild to moderate diffuse axonal injury (concussion)
- Moderate diffuse axonal injury
- Severe diffuse axonal injury

Caused by the forces of trauma

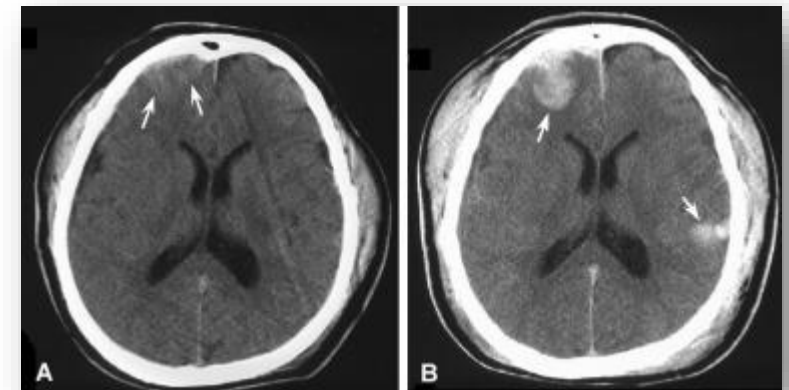
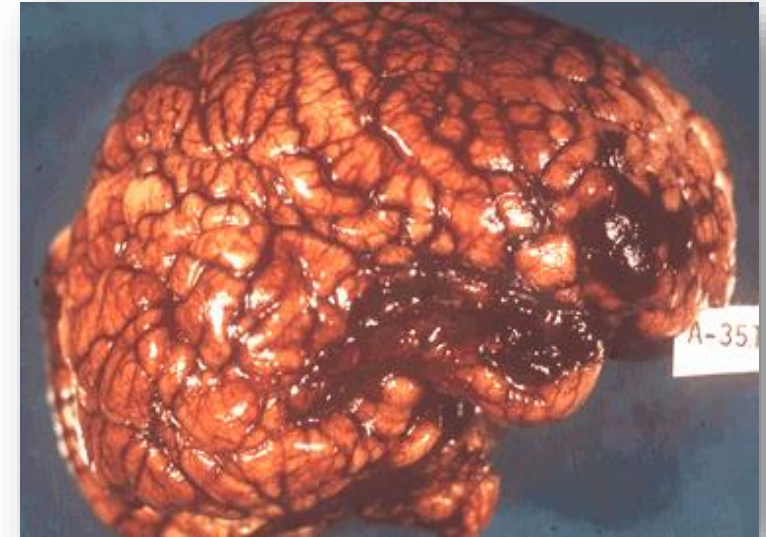
- Coup injuries
 - Injury at the site of the impact
 - Injuries inflicted as brain displaces towards the impact surface
- Contrecoup injuries
 - Produce tissue damage away from the impact point
 - Brain sloshes toward then away from impact point



Coup and Contrecoup Movement of the Brain

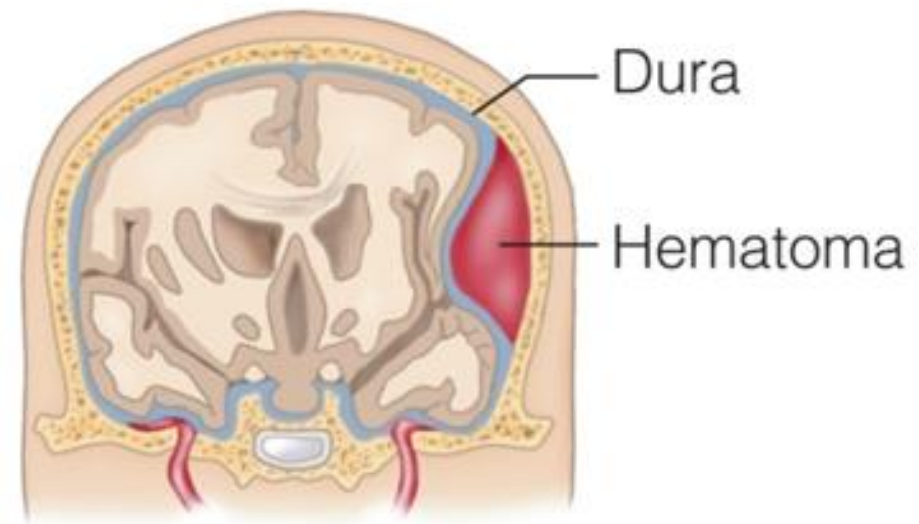
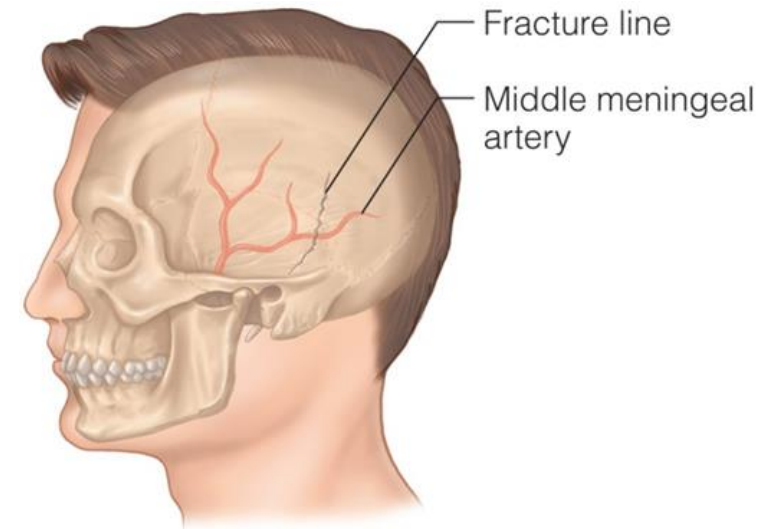


- Blunt trauma produces capillary bleeding
- Common with blunt head trauma
- Often produces
 - Confusion and/or neurological deficit
 - Personality changes (frontal lobe most commonly injured)
- Generally a coup-contrecoup injury



Epidural Hematoma

- 0.5–1.0% of all head injuries
- Usually blow to head with linear fracture
- Bleeding between dura mater and skull
- Common at temporal bones (thinner)
- Involves arterial bleed
 - Middle meningeal artery in temporal lobe

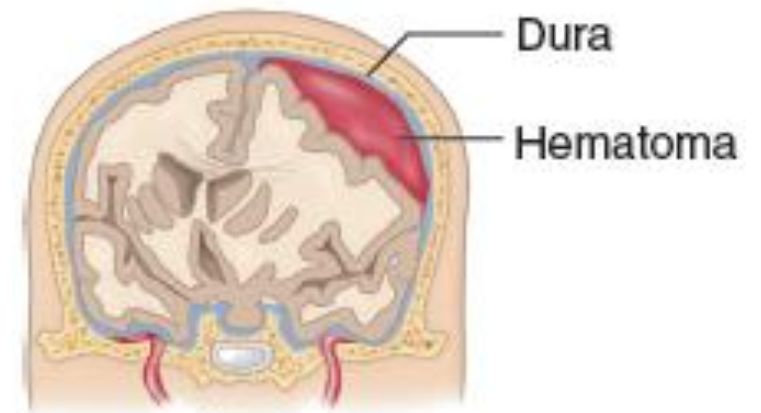
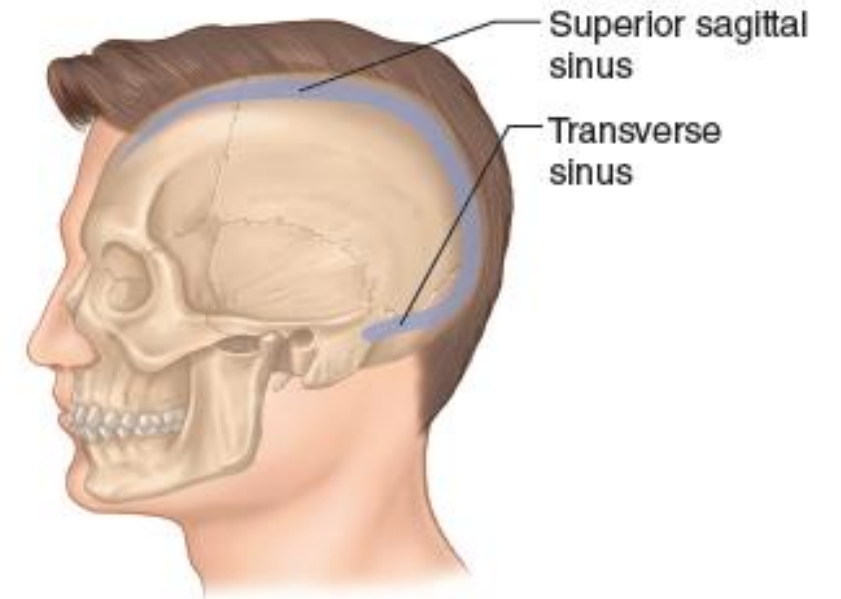


Signs and Symptoms

- Level of consciousness
 - Loss of consciousness, lucid interval, unresponsiveness
 - ICP builds rapidly
- Pupil changes
 - Pupil on side of hematoma fixed/dilated
 - Oculomotor never compressed
- Death if pressure not relieved surgically

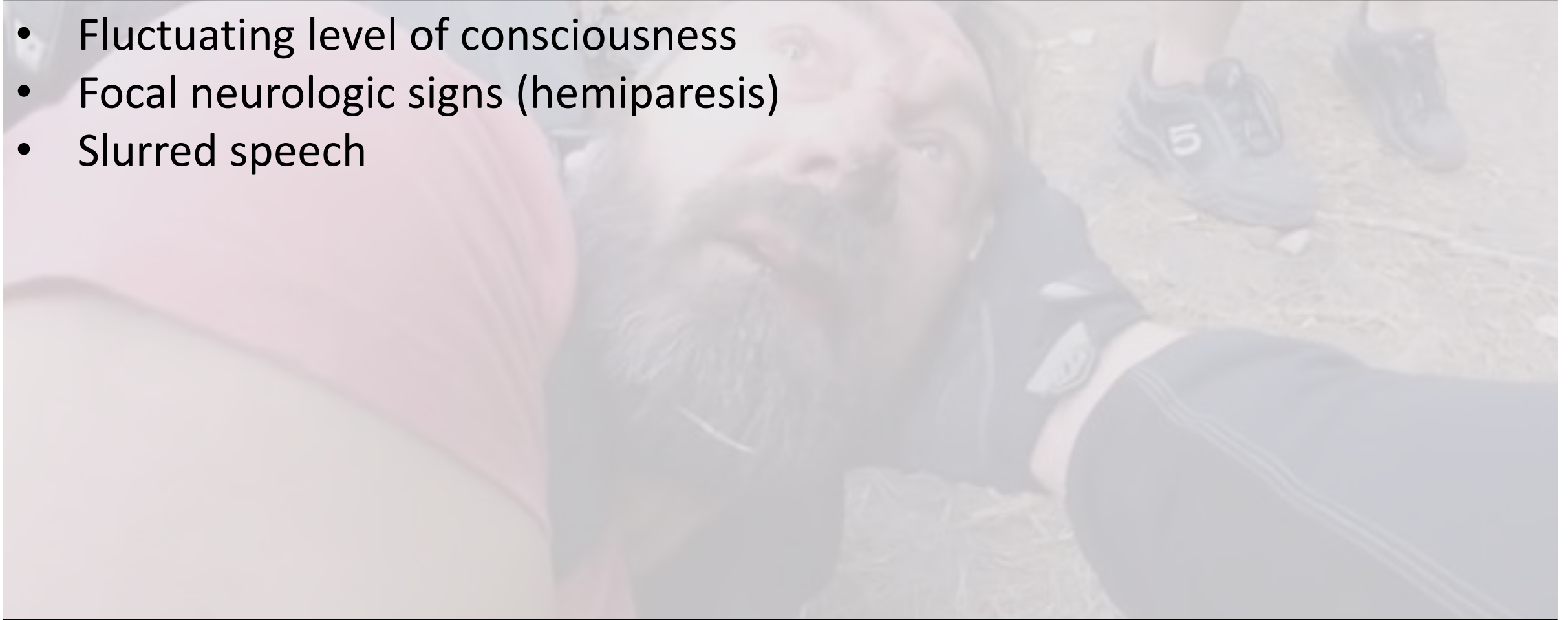
Subdural Hematoma

- 5% of all head injuries
- Bleeding within meninges
 - Beneath dura mater and within subarachnoid space
- Usually a venous bleed
 - Bridging veins
 - Signs progress over hours to days
 - Slow deterioration of mentation



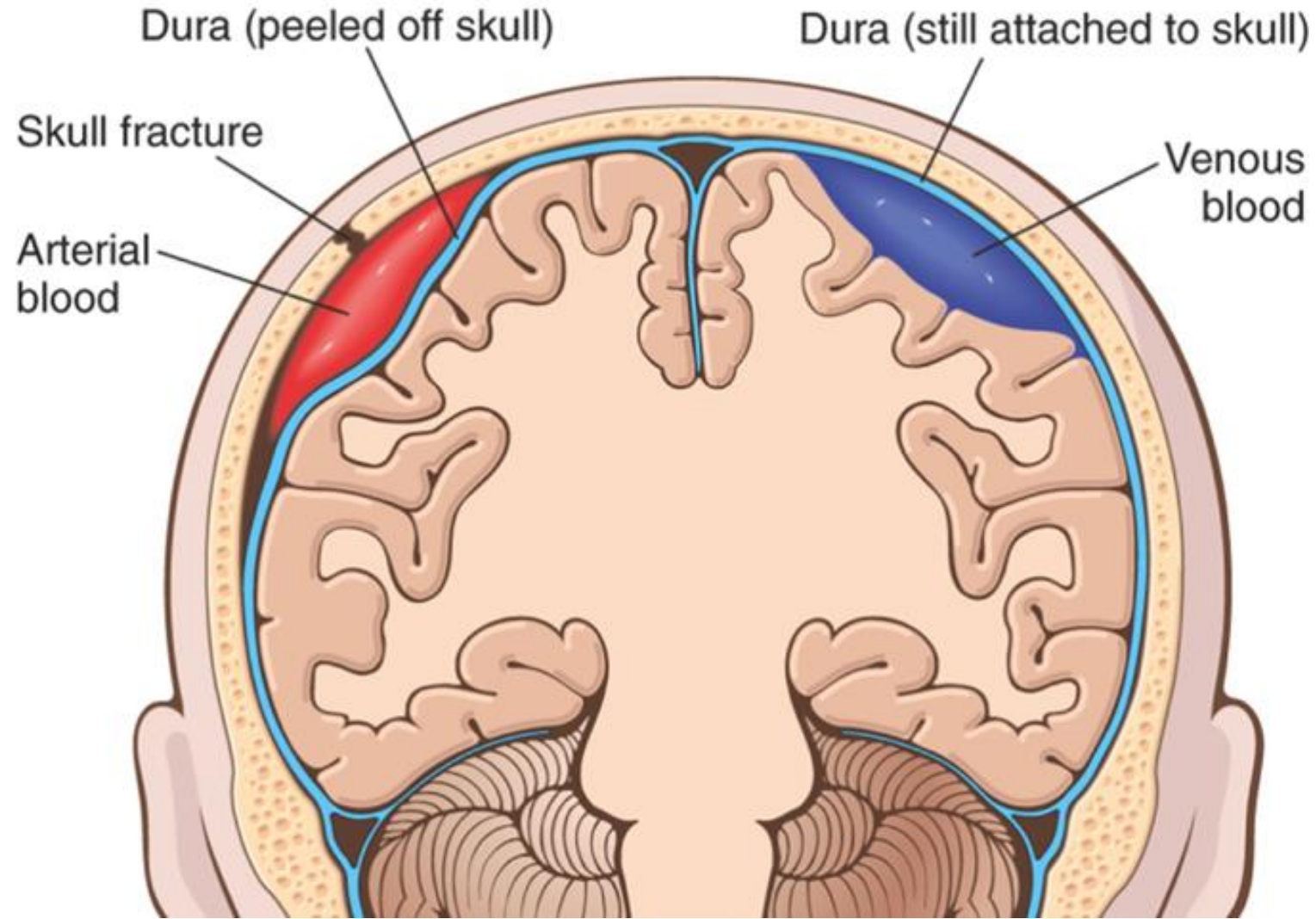
Signs and Symptoms

- Fluctuating level of consciousness
- Focal neurologic signs (hemiparesis)
- Slurred speech



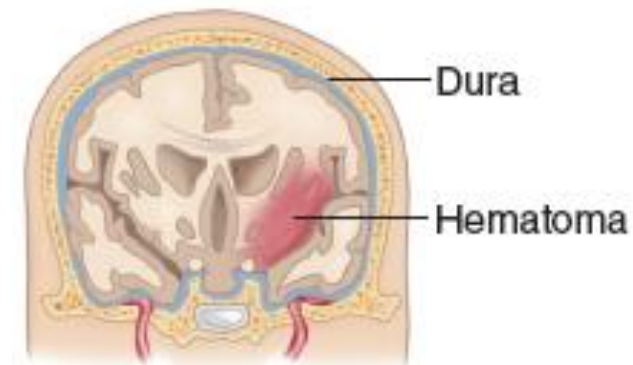
EPIDURAL HEMATOMA

SUBDURAL HEMATOMA

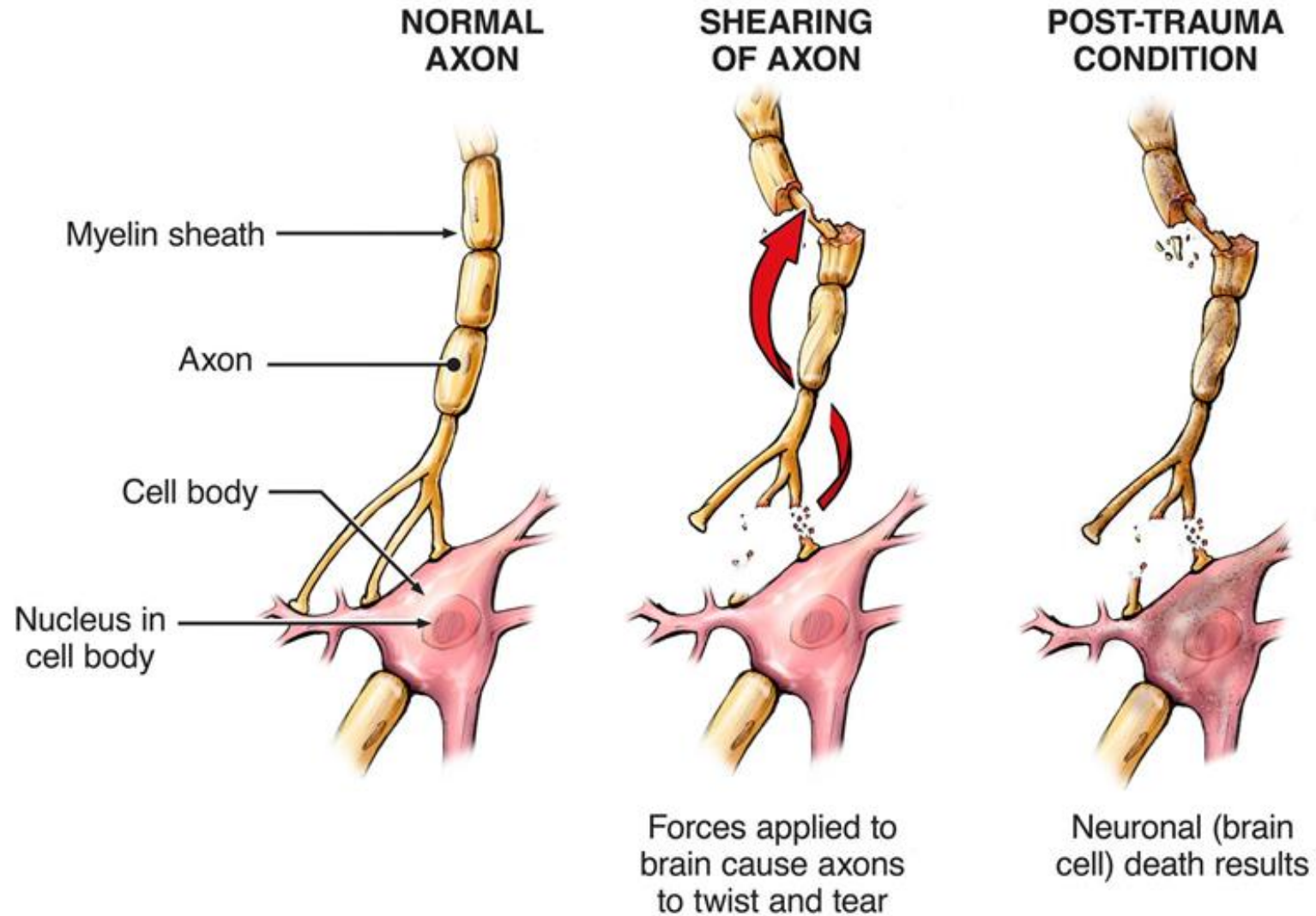


- Bleeding into where CSF circulates
 - Bloody CSF
- Sudden, severe headache
- Later diffuse headache
- Increased ICP
 - Decreased level of consciousness
 - Pupil changes
 - Posturing, vomiting, seizures
- Sudden, severe subarachnoid hemorrhage usually results in death.

- Penetration injury, rapid deceleration
- Can occur with DAI
- Frontal and temporal lobes most affected
- Once symptoms occur, patient deteriorates quickly.
- High mortality rate



- Shearing, stretching or tearing of nerve fibres with subsequent axonal damage
 - Communication pathways of the nerve cells
 - Pathology distributed through brain
- Common in MVCs
- Range from mild to severe



Type of DAI	Pathophysiology	Incidence	Signs and Symptoms	Prognosis
Mild DAI	Temporary neuronal dysfunction; minimal axonal damage	Most common result of blunt head trauma; for example, concussion	Loss of consciousness (brief, if present); confusion, disorientation, amnesia (retrograde and/or anterograde)	Minimal or no permanent neurologic impairment
Moderate DAI	Axonal damage and minute petechial bruising of brain tissue; often associated with a basilar skull fracture	20% of all severe head injuries; 45% of all DAIs	Immediate loss of consciousness; secondary to involvement of the cerebral cortex or the RAS of the brainstem; residual effects: persistent confusion and disorientation; cognitive impairment (eg, inability to concentrate); frequent periods of anxiety; uncharacteristic mood swings; sensory/motor deficits (such as altered sense of taste or smell)	Survival likely, but permanent neurologic impairment common
Severe DAI	Severe mechanical disruption of many axons in both cerebral hemispheres with extension into the brainstem; formerly called brainstem injury	16% of all severe head injuries; 36% of all DAIs	Immediate and prolonged loss of consciousness; posturing and other signs of increased ICP	Survival unlikely; most patients who survive never regain consciousness, but remain in a persistent vegetative state

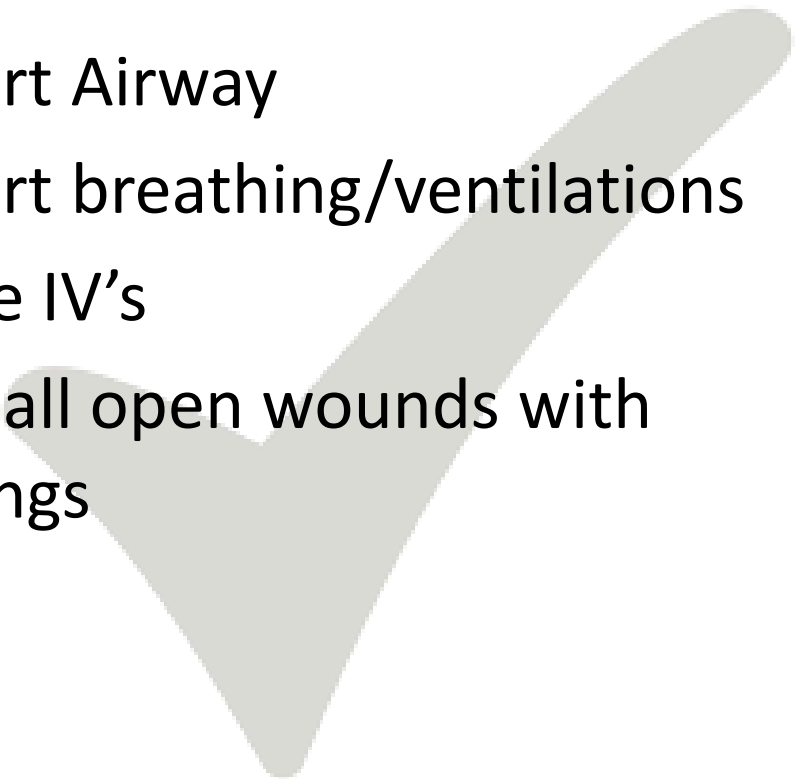
Abbreviations: DAI, diffuse axonal injury; ICP, intracranial pressure; RAS, reticular activating system
© Jones & Bartlett Learning.

- Common concurrent injuries:
 - Cervical
 - Facial
- Depending on type of trauma and MOI, concurrent injuries could involve any and all other body systems.

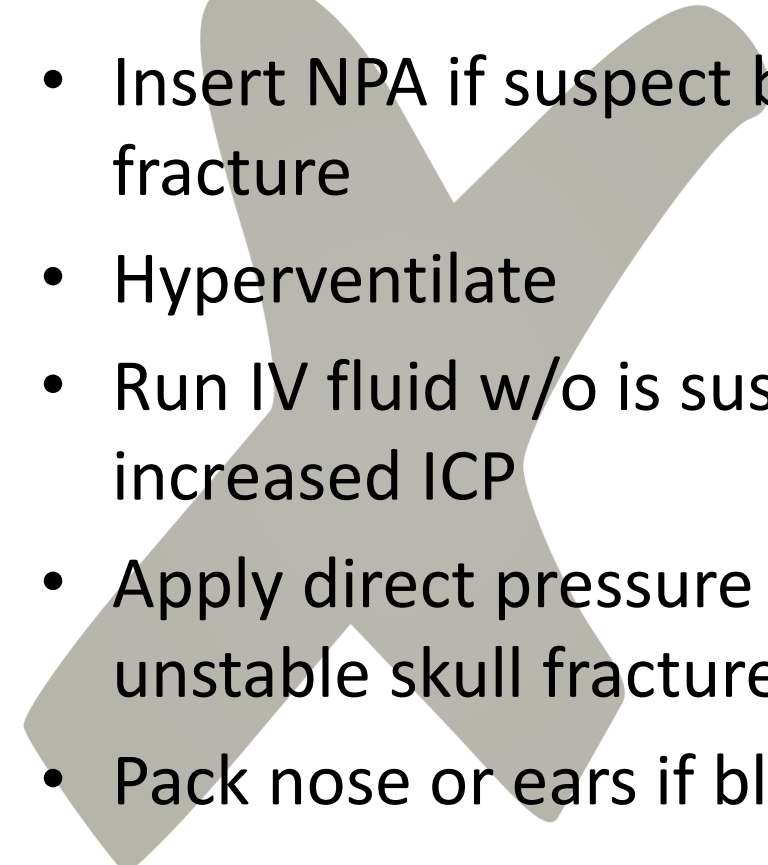


- Focused History
 - Any loss of consciousness/how long?
 - Complaints?
 - Any impact to head?
 - Amnesia?
 - Anterograde – No recollection after injury
 - Retrograde – No recollection prior to injury
 - Headache?
 - Nausea/vomiting?
 - Drug or alcohol use?
 - Previous brain injury or seizure disorder?

Do's

- Support Airway
 - Support breathing/ventilations
 - Initiate IV's
 - Cover all open wounds with dressings
- 

Don'ts

- Insert NPA if suspect basilar skull fracture
 - Hyperventilate
 - Run IV fluid w/o is suspected increased ICP
 - Apply direct pressure over unstable skull fractures
 - Pack nose or ears if bleeding
- 

- Result of factors that occur as a result of but after the initial injury
- Progressive
- Pathological processes
 - Diminishing circulation to brain tissue due to increasing ICP
 - Pressure against brain tissue secondary to an expanding mass

- Skull not fully formed at birth
 - Distort with impact and transmit force more directly
 - Permits some intracranial expansion
- Increases direct injury associated with head trauma
 - Slows progression of ICP
- Proportionally larger head
 - Intracranial hemorrhage contributes to hypovolemia

- Obligate nasal breathers
 - Must have a patent nasal passage and pharynx to clear airway
- Avoid hyperextension of head
 - Tongue pushes soft pallet closed
 - Ventilate through mouth and nose

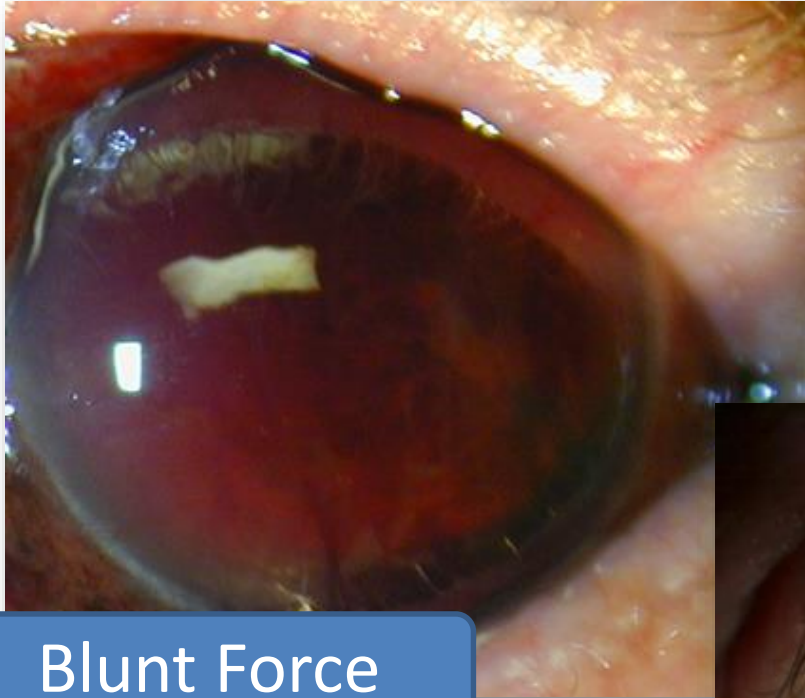
- Serious trauma complication
- Cosmetic importance
- Vasculature
- Location of initial airway and alimentary structures
- Sense organs
- Associated head and spinal injuries



- Highly vascular tissue
- Contribute to hypovolemia
- Airway effects
 - Deep injuries can result in blood being swallowed and endanger the airway
 - Soft tissue swelling reduces airflow
 - Superficial injuries rarely involve the airway
- Consider likelihood of basilar skull fracture or spinal injury



- Very specialized body tissue
- Can indicate problems with:
 - CN-II, CN-III, CN-IV and CN-VI
 - Perfusion associated with cerebral blood flow
- Surface of eye is highly dependent on good perfusion and lacrimal fluid flow
 - If perfusion diminished, eyes lose luster quickly
- Quick, highly visible signs of patient's demeanor
 - Anxiety, fear, anger, etc.



Blunt Force



Foreign Body



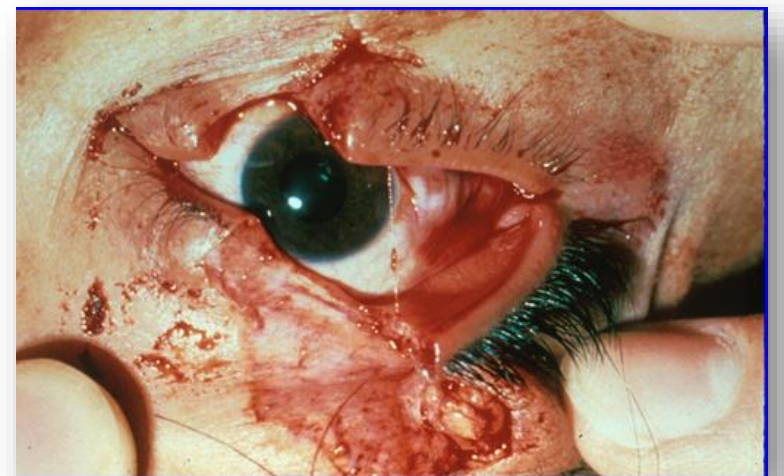
Penetrating

- Penetrating trauma
 - Can result in long term damage
 - Suspect small foreign body if patient complains of sudden eye pain and sensation of something on the eye
 - Do not remove
- Corneal abrasions and lacerations
 - Common and usually superficial

- Hyphema
 - Blunt trauma to the anterior chamber of the eye
 - Blood in front of iris or pupil
- Sub-conjunctival hemorrhage
 - Less serious condition
 - May occur after strong sneeze, severe vomiting or direct trauma



- Retinal detachment
 - Traumatic origin
 - Complaint of dark curtain/obstruction in the field of view
 - Possibly painful depending on type of trauma
- Soft tissue lacerations
 - May disrupt lacrimal gland function



- Pupil size and reactivity can indicate underlying problems
- Reduced pupillary responsiveness
 - Depressant drugs or cerebral hypoxia
- Fixed and dilated
 - Extreme hypoxia
- Expanding cranial lesion
 - Ipsilateral pupil becomes sluggish, dilated then fixed

Hx

- Corrective/contact lens
- Contact lens currently in place
- Prosthetic eye
- Eye sight affected
- Change in vision
- Blurred vision
- Complete vision loss
- Visual field defect
- Onset of changes start

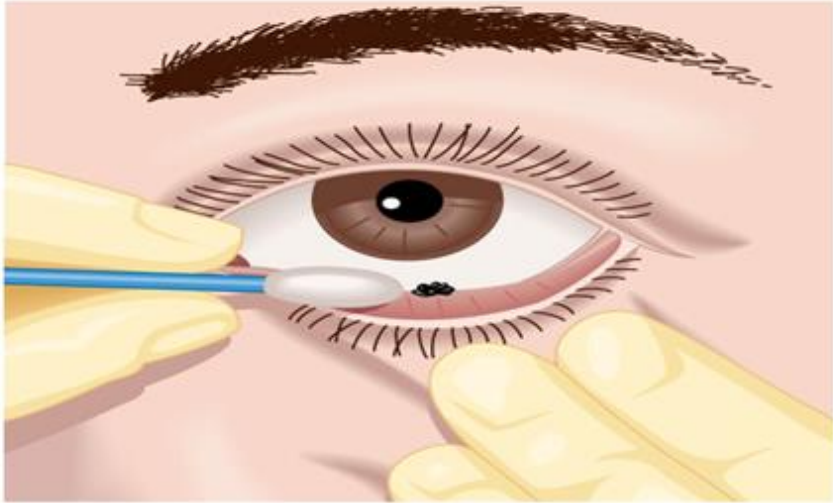
O/Ex

- Periorbital trauma
- Global rupture
- Redness
- Swelling
- Blood or purulent discharge
- Foreign body
- Papillary size
- Papillary abnormalities

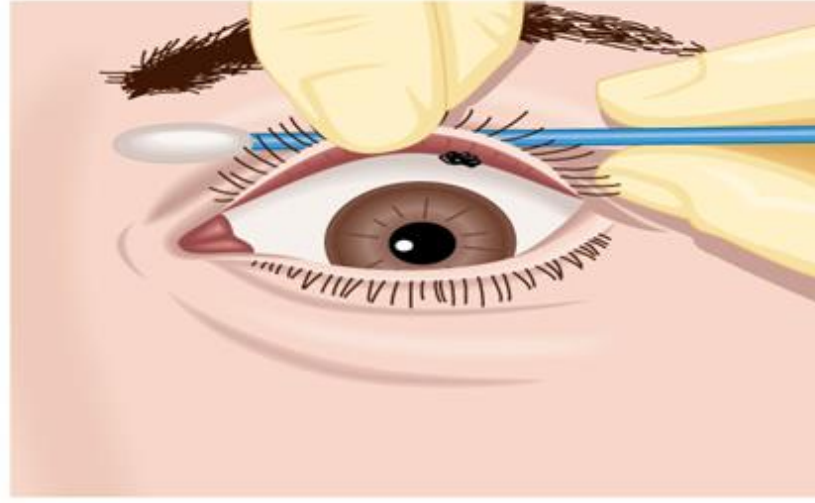
Management

- General Approach
 - Limit damage, cover both eyes
 - Avoid increase in intraocular pressure (vomiting), dimenhydrinate 25 mg IV , no direct pressure
 - Consider analgesics
- Penetrating
 - Immobilize object in place
- Blunt
 - Secure and immobilize to prevent movement
- Avulsed Eye
 - DO NOT attempt to put back in socket
 - Secure and immobilize to prevent movement

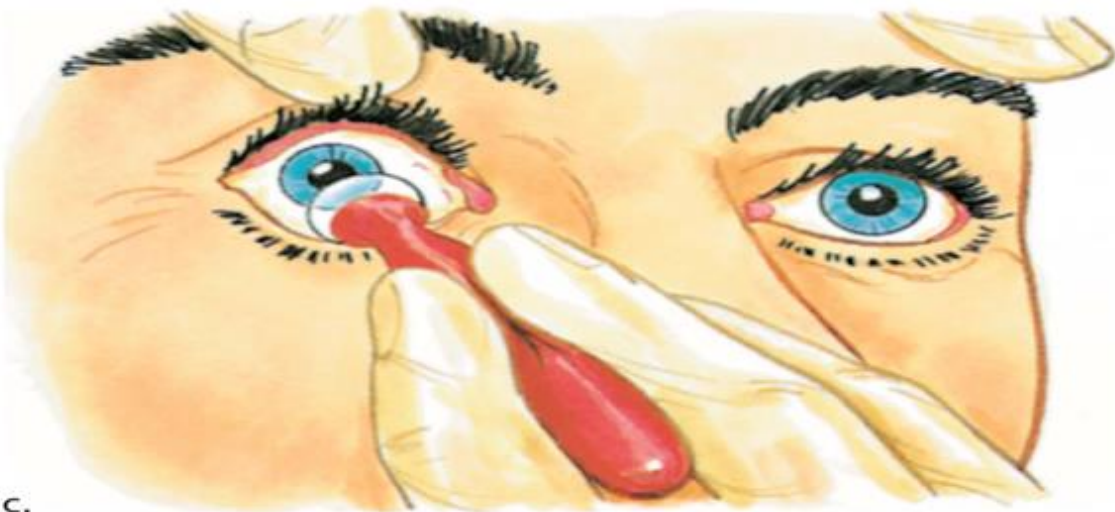
Removing Particles From the White of the Eye



a.



b.



c.

- a. Pull down the lower lid while the patient looks upwards, or
- b. Pull up the upper lid while the patient looks downward
- c. Use a moistened suction cup to remove contact lenses

Classification

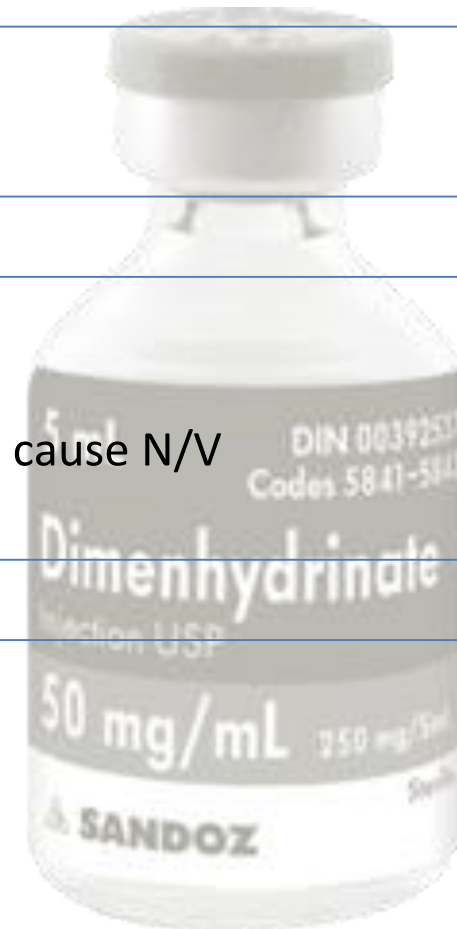
- Antiemetic, Antihistamine, Anticholinergic

Mechanism of Action

- Blocks histamine and ach receptors in the vomiting center
- Blocks the pathway between the inner ear and vomit center that can cause N/V
- Similar to chemical composition of diphenhydramine

Indications

- Nausea and vomiting associated with Meniere's disease
- Nausea/Vomiting
- Relief or prevention of motion sickness and Vertigo

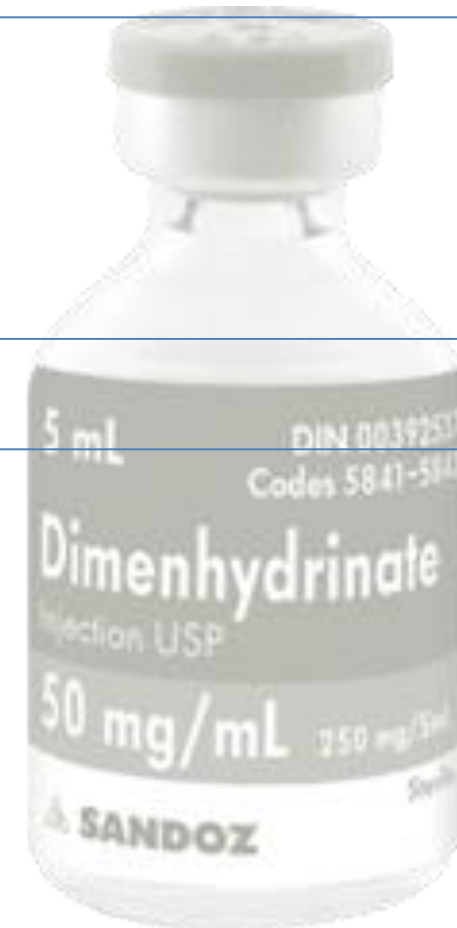


Contraindications

- ALOC
- Hypersensitivity

Dosage

- Adult:
 - 25 – 50 mg IM q 4h PRN
 - 12.5 – 50 mg IV q 4h PRN (over 30 seconds)
- Pediatric:
 - 1.0 mg/kg IV/IM max of 25 mg



Classification

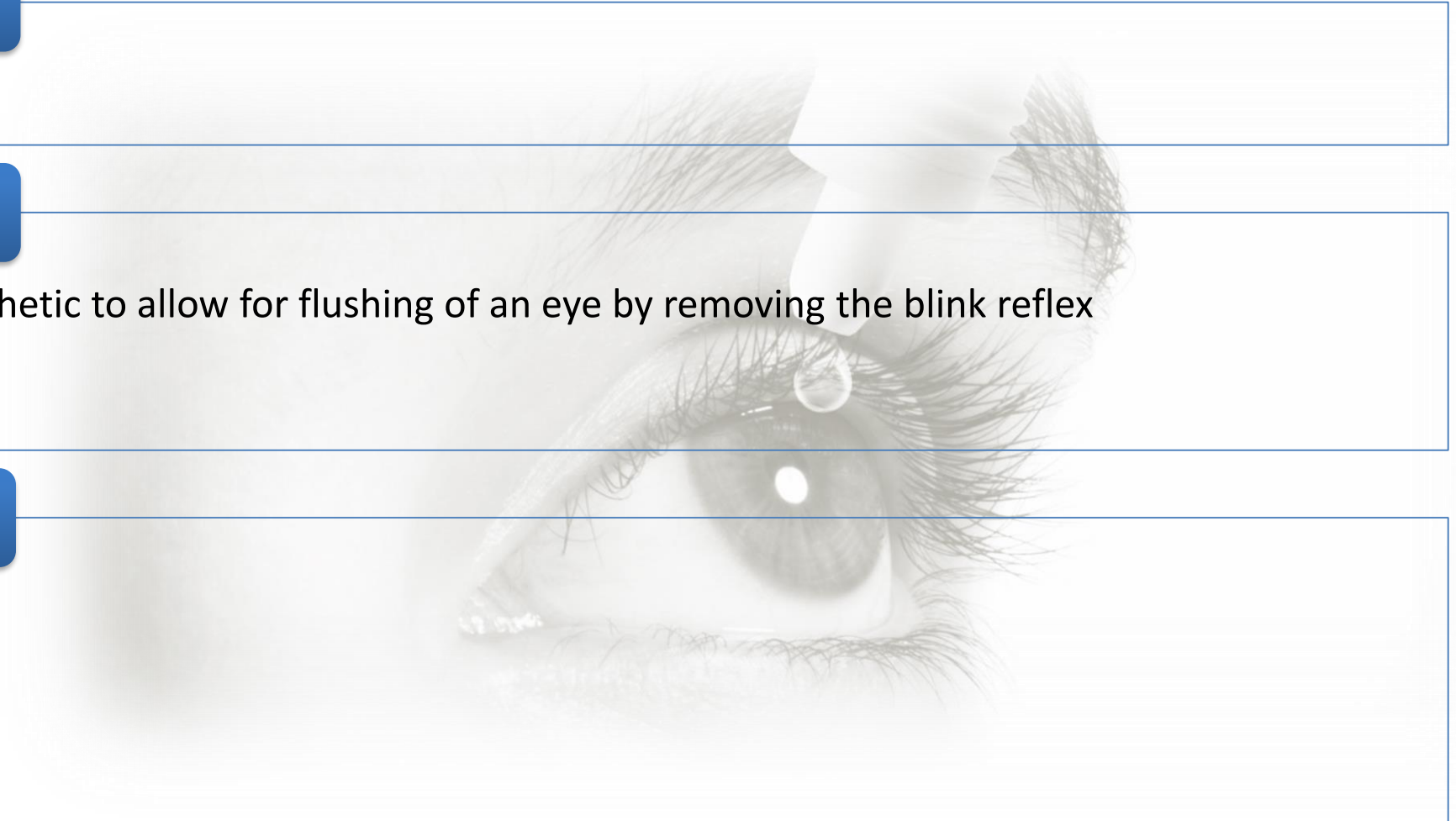
- Topical anesthetic

Mechanism of Action

- Topical ophthalmic anesthetic to allow for flushing of an eye by removing the blink reflex

Indications

- To facilitate eye flushing

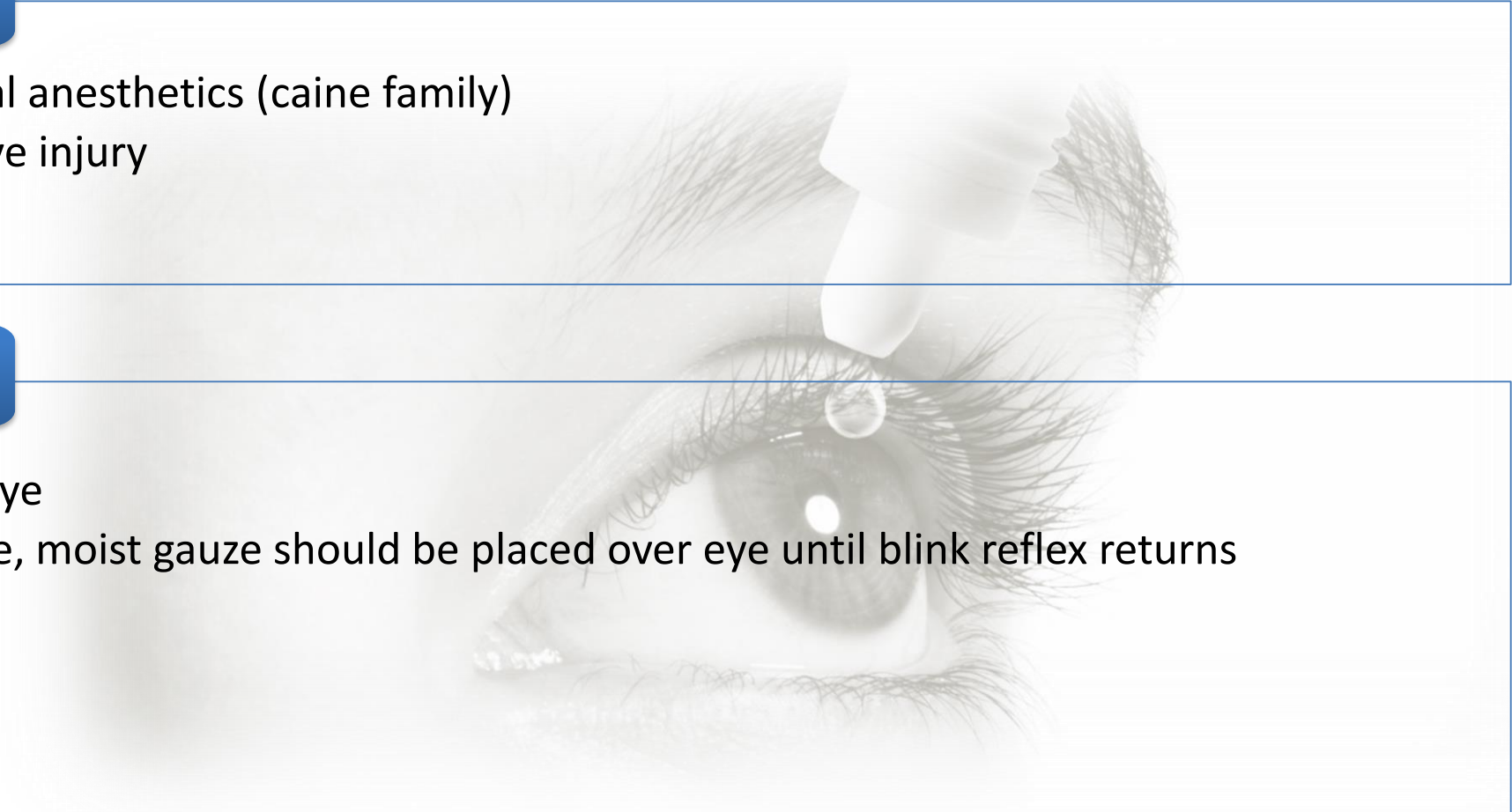


Contraindications

- Hypersensitivity to local anesthetics (caine family)
- Possible penetrating eye injury

Dosage

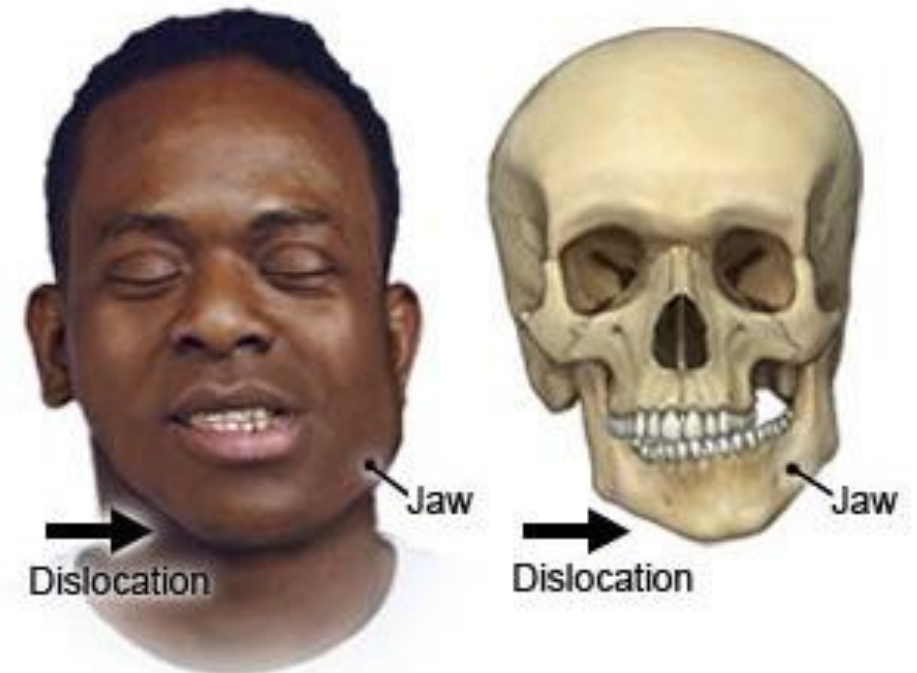
- 2 -3 drops in affected eye
- Once treatment is done, moist gauze should be placed over eye until blink reflex returns



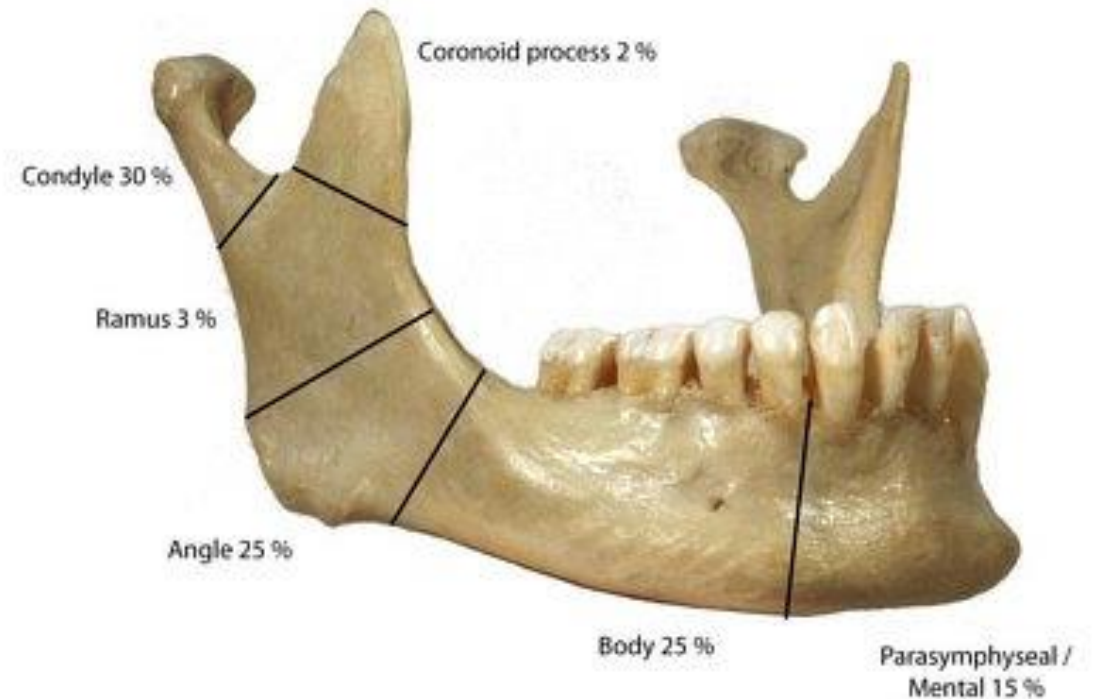
- Most common causes:
 - Assault
 - MVC
 - Falls
 - Contact sports
- S/Sx
 - Pain
 - Bruising
 - Deformity
 - Asymmetrical facial features



- Mandibular dislocation
 - Displaces from the TMJ
 - Results in malocclusion of mouth, misalignment of teeth, immobility of jaw
 - Rarely a threat to airway or breathing



- Mandibular fractures
 - Deformity along jaw and loss of teeth
 - Possible airway compromise if patient placed supine
 - Evaluate for multiple fracture sites



- Maxillary fractures

Le Fort I

- Slight instability, involving maxilla alone
- No associated displacement



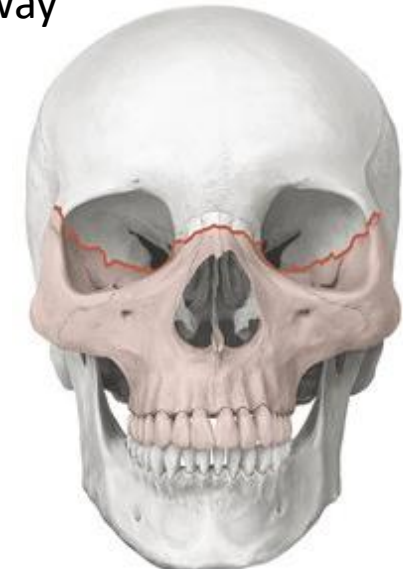
Le Fort II

- Fracture of both maxilla and nasal bones

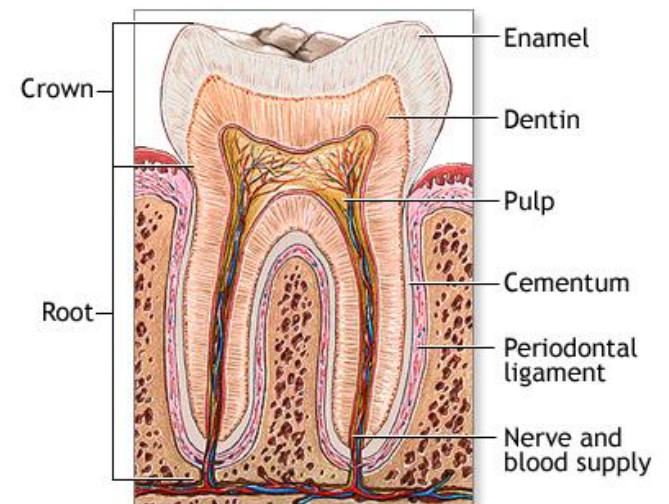


Le Fort III

- Entire facial region below brow ridge
- Le Fort II and III usually result in CSF leakage and endanger patency of airway



- Dental injury (tooth avulsion)
 - Commonly associated with blunt facial trauma
 - May become foreign objects drawn into airway
 - Broken teeth may be reimplanted if fully intact
 - Handle by crown, avoid handling root
 - Do not rinse/scrape tooth
 - Cover in gauze
 - Keep tooth moist
 - Transport in milk, saliva or saline if possible. Not tap water.



- Orbital fractures
 - Involve zygoma, maxilla and/or interior shelf
 - Reduction of eye movement
 - Possible diplopia
 - Limitation of jaw movement



- Nose Fracture:
 - Painful and often create grossly deformed appearance
 - Rarely life threatening
 - Swelling and hemorrhage may interfere with breathing
- Epistaxis
 - Most common problem
 - Anterior
 - Comes from septum, usually self-limiting
 - Posterior
 - May be severe and cause blood to drain into patient's throat

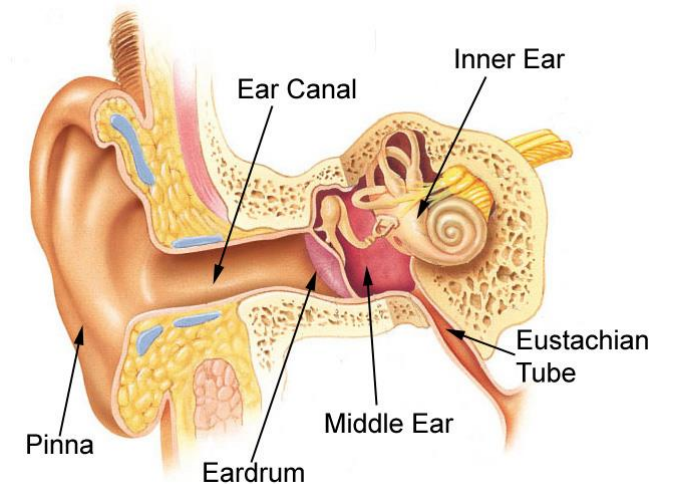


Management

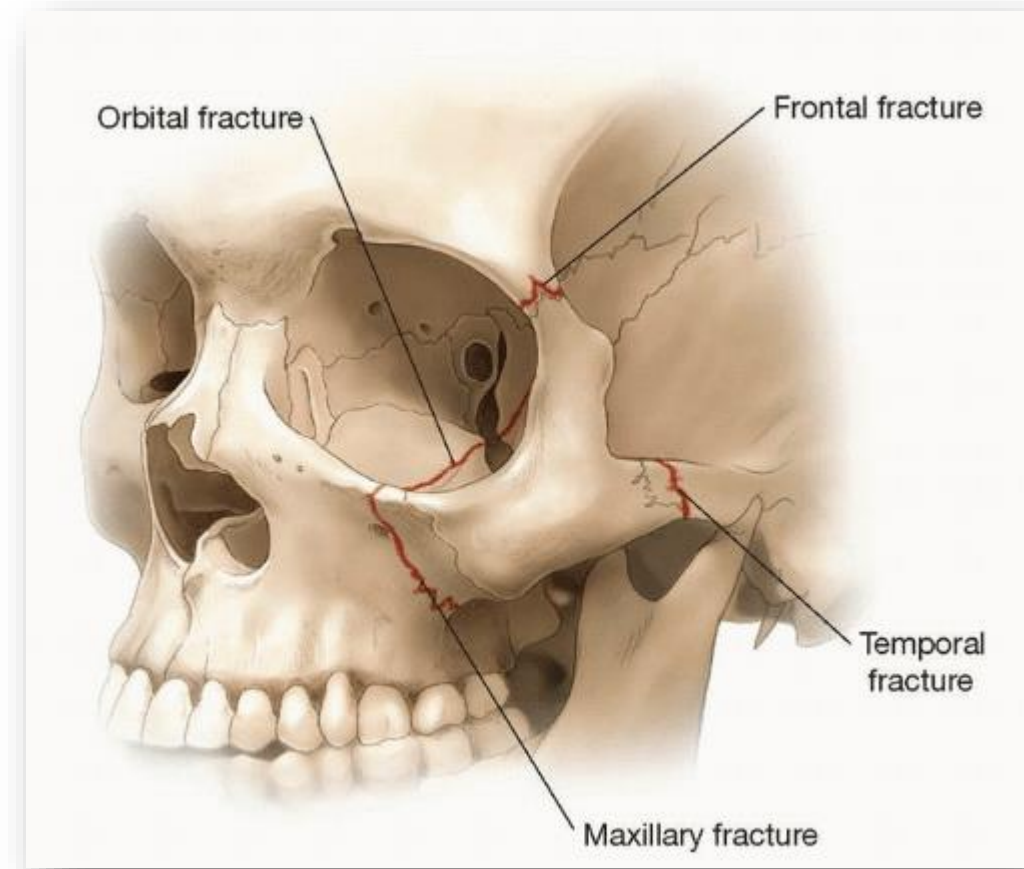
- Conscious/no c-spine issue
 - Advise patient to gently blow nose to express clots
 - Position patient to lean forward
 - Maintain continual firm pressure on bilateral nares
 - Do not apply pressure to bridge or boney part of nose
- Unconscious/c-spine
 - Place in recovery position
 - Suction PRN
- Other considerations
 - If nauseated, give dimenhydrinate
 - Pt with bleeding disorders or taking anti coagulant meds may require IV fluid challenge



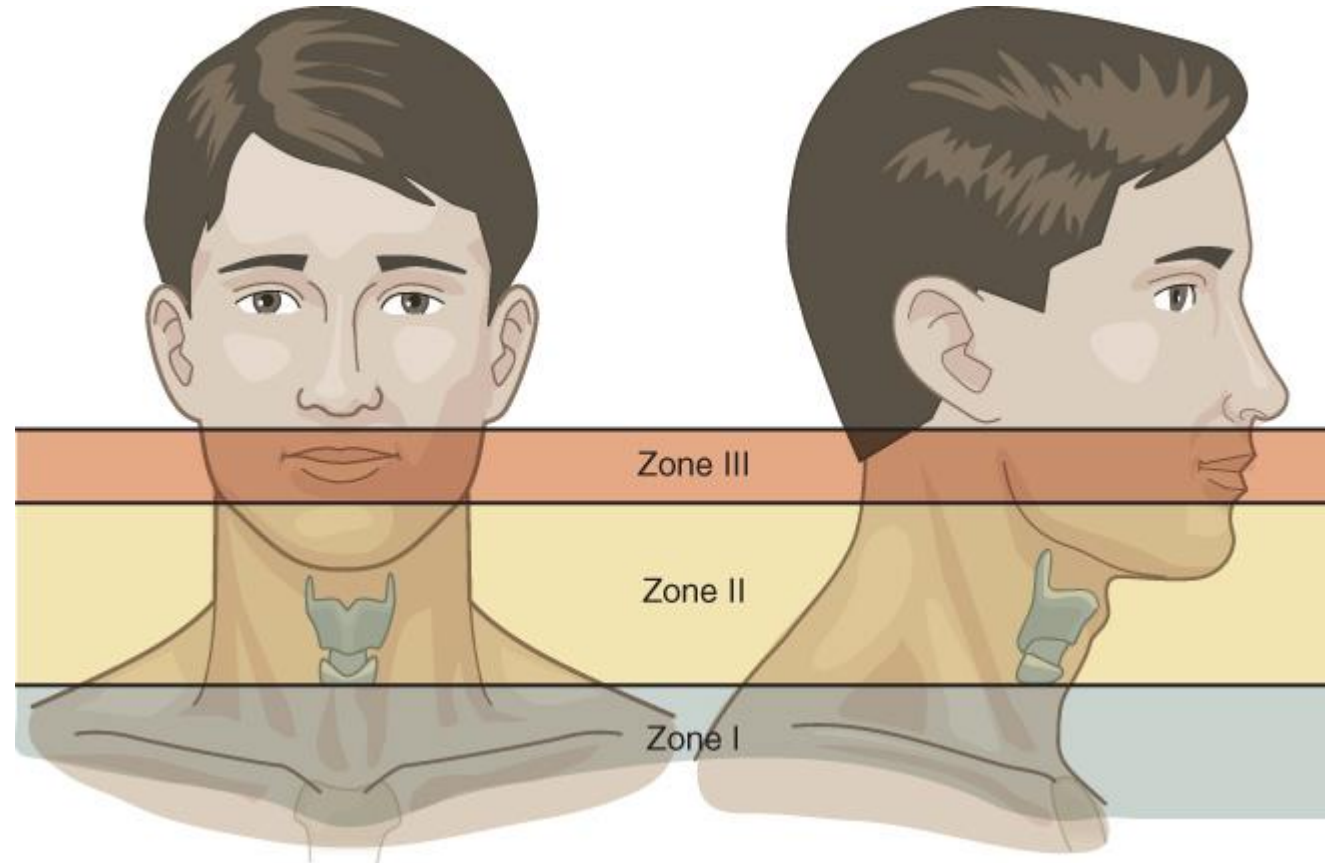
- External ear
 - Pinna is frequently injured due to trauma
 - Poor blood supply
 - Poor healing
- Pinna Injury
 - Place in close anatomic position as possible
 - Dress and cover with sterile dressing
- Internal ear
 - Well protected from trauma
 - My be injured due to rapid pressure changes
 - Diving, blast, or explosion
 - Temporary or permanent hearing loss
 - Tinnitus may occur



- Fractures of the cheek bone
- Commonly result from
 - Blunt trauma secondary to motor vehicle collisions and assaults
- Signs and symptoms
 - Side of patient's face appears flattened
 - Paraesthesia or loss of sensation over the cheek, nose, and upper lip
 - Paralysis of upward gaze



- Critical portions of airway (larynx, trachea)
- Major blood vessels to/from head
- Spinal cord
- Muscles, nerves, glands, and esophagus
- Consider the injury.
- Divide the neck into zones to assist in classification of neck injuries.



- Mechanism of Injury:
 - Blunt
 - Compression/ruptures of AW, esophagus, blood vessels
 - Penetrating
 - Knives, GSW, debris
 - Involve other body systems
 - Strangulation/near hanging
 - Suicide/homicide
 - “Clothes line injury”



- Dyspnea/tachypnea
- Airway obstruction
- Subcutaneous emphysema
- Hoarse voice
- Difficulty swallowing
- Impaled object
- Bubbling at open wound
- Bruising
- Swelling

BEWARE OF

**Concurrent Injuries
in
Neck Trauma**

- Subcutaneous emphysema
 - Sign of developing tension pneumothorax
- Penetrating trauma
 - May involve esophagus
 - Allow gastric contents to escape into mediastinum
- Deeper penetrating trauma may involve vagus nerve disruption
 - Tachycardia and GI disturbances
- More anterior injuries may affect the thyroid and parathyroid glands

- Airway trauma
 - Tracheal rupture or dissection from larynx
 - Airway swelling and compromise
- Cervical spine trauma
 - Vertebral fracture
 - Paresthesia, anesthesia, paresis or paralysis beneath the level of the injury
 - Neurogenic shock may occur

- Blood vessel trauma
 - Blunt trauma
 - Risk of serious expanding hematoma
 - May restrict jugular veins
 - Laceration
 - Large blood vessels may result in serious hemorrhage
 - Entraining of air may result in embolism
 - Cover with occlusive dressing
 - No bilateral pressure to neck

- Limit external stimulation
 - Can increase ICP
 - Can induce seizures
- Cautious about air transport
 - May save time
 - Increased risk of seizures

- Have friend or family provide constant reassurance
- Provided constant reorientation to environment if required
 - Keeps patient calm
 - Reduces anxiety

- Pathophysiology
- Assessment
- Management