Blunt trauma of the head, neck and torso

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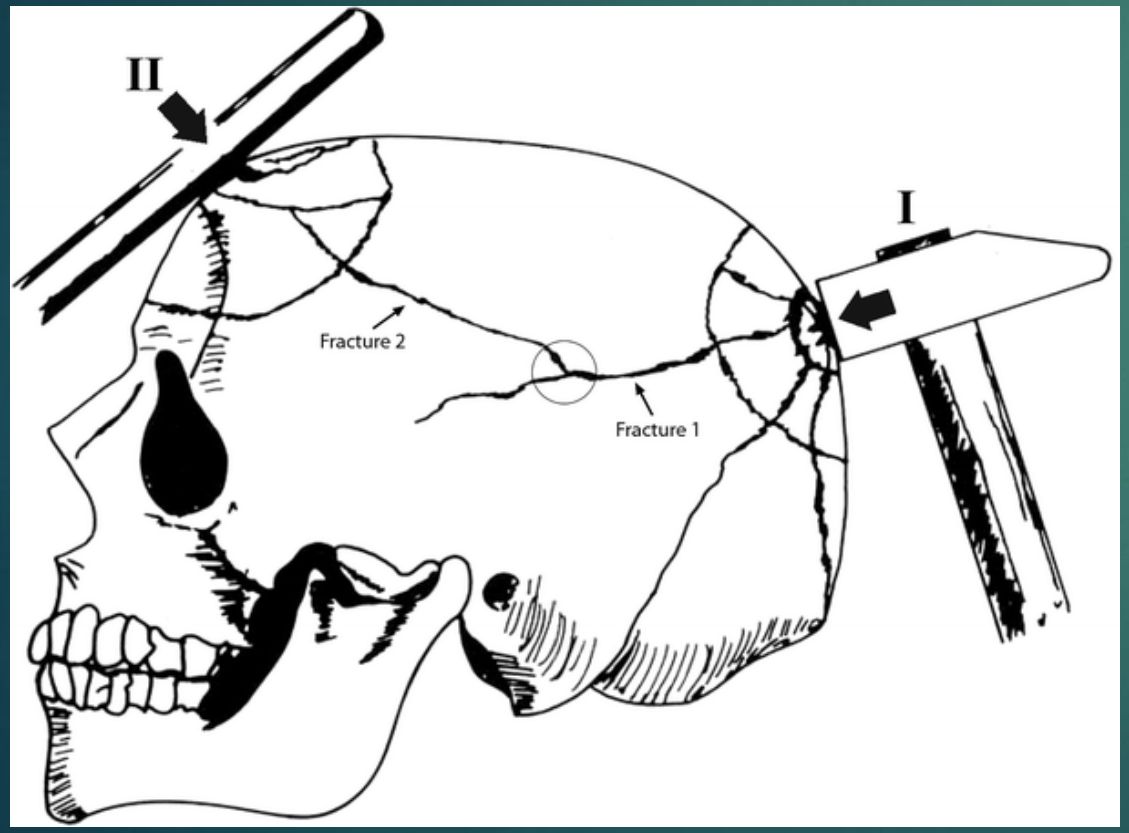
Blunt trauma in general-summary

- Most common, mainly falls, traffic accidents, assaults
- Direct x indirect (transmisson of force)
- Active x passive
- Main terms: contusin, abrasion, laceration, haematoma

Blunt trauma in general-summary

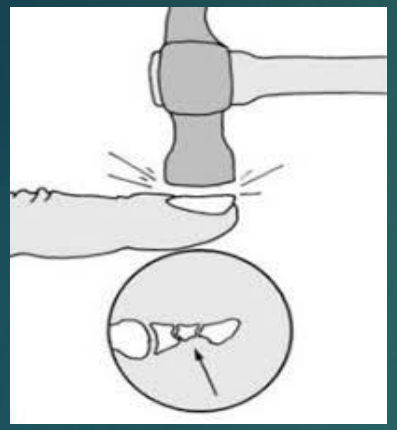
active



passive

Blunt trauma in general-summary

- Direct



- Indirect

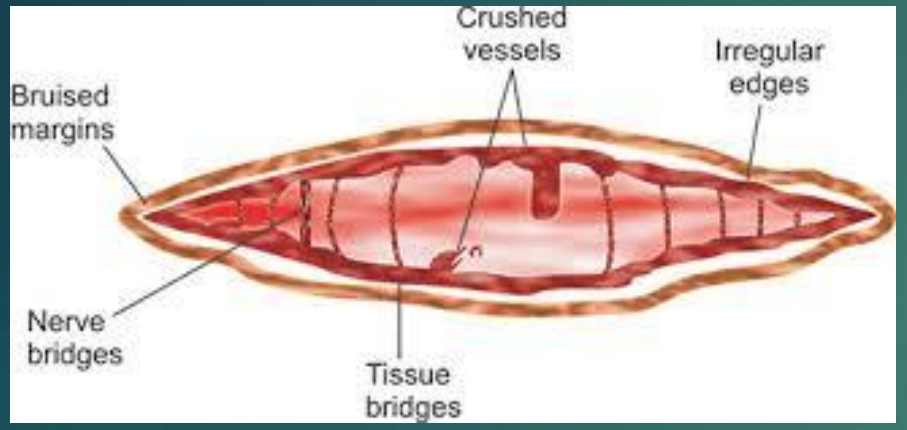
hematoma

- Intradermal (imprint of structur)
- Subcutaneous (usually nonspecific to shape or size, increase in time, slide via gravity)
- Tram-line

abrasions

- Superficial
- Deep
- Direction
- Shape

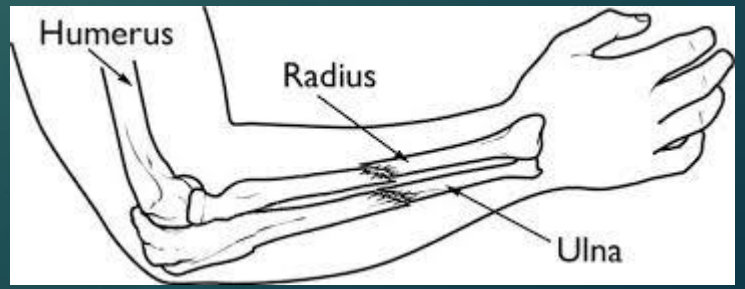
Laceration- lacerated wounds



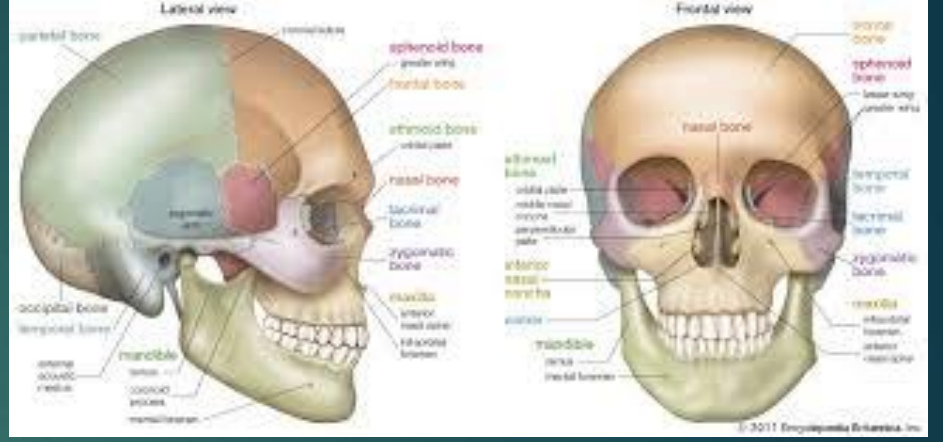
Fractures

- Classification (open/closed, line, number of fragments, position of fragments)
- Comminuted-high energy trauma, falls, transportation accidents
- Transverse, oblique (more often direct)

- Spiral (indirect-torsion)



Blunt trauma of a skull
division



neurocranium x splanchnocranium
neurocranium-extracranium (scalp, skull)

-intracranium –extracerebral (EDH, SDH, SAH)

-intracerebral-focal (contussion)

-diffuse (concussion, DAI)

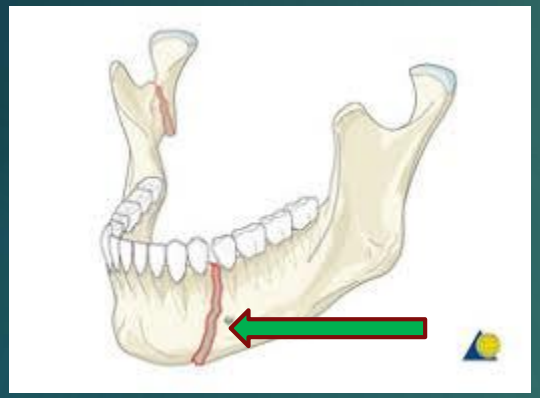
primary x secondary

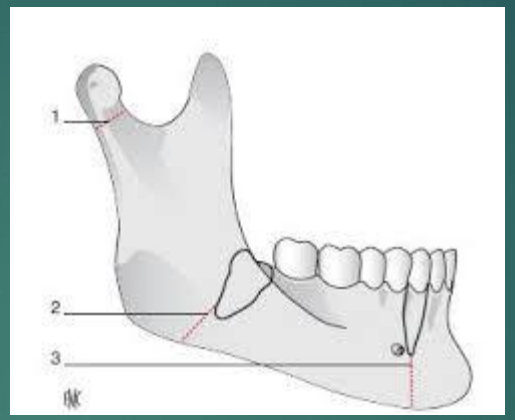
A) Splanchnocranium-facial injuries

- Blows, kicks, falls
- Mainly prominent parts-eyebrows, cheekbones, ears, lips, chin
- Nose-hematoma, crepitus, CAVE severe bleeding and loss of consciousness-aspiration of blood
- Maxillla and mandible-soft tissue damage and bleading, loosened teeth, detached from the base of the skull-trafic accidents (Le Fort)
- Mouth and lips-beating- incidents (bruises, lacerations) due to compression against the teeth or gums, rupure of the frenulum
- Kicking-patterned abrasion of boot soles
- External ear-direct blows, othematoma-subperichondrial hematoma (boxers gloves), detached earlobe, BITES!
- Periorbital hematoma-"black eye"-direct punch/kick into the eye-socket (DFDG-direct violence to the nose, gravitational seepage of hematoma of lacerated scalp or eyebrow, fracture of anterior fossa of the skull!)

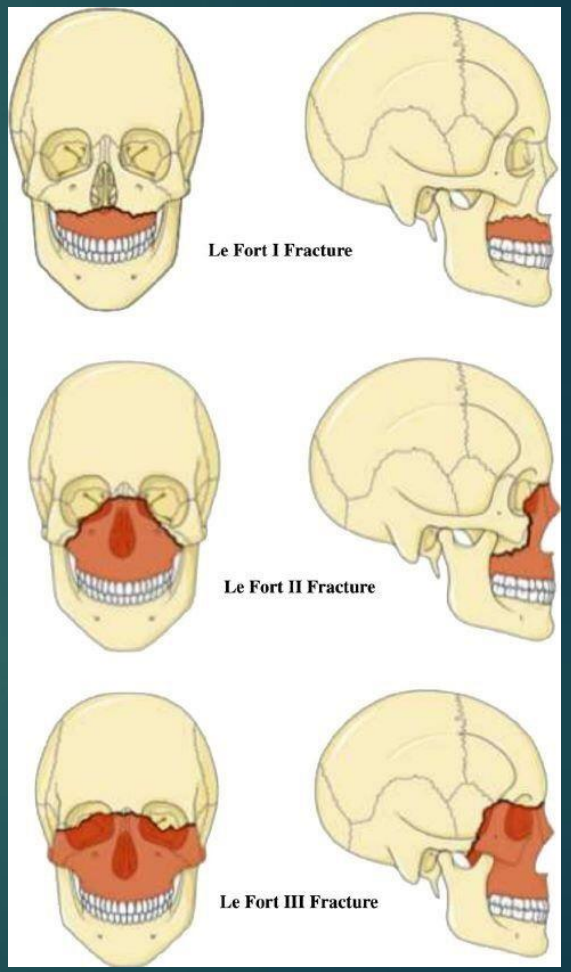
Fractures of the mandible

- Frequent in fights
- direct x indirect





Locus minororis resistenciae:
canine tooth,
behind last molar, h
ead of condylar process



B) Neurocranium-extracranium

Scalp

- All types of blunt trauma
- Due to the hair can be missed-remove!
- Severe truma-scalp thick, swollen, indurated
- Seepage in frontal/temporal region mimicking black eye or primary neck impact
- Laceration-bleed profusely, may reproduce pattern of the inflicting object, but random splitting more often, depressed fractures and crepitus
- Avulsion of a large area-heavy machinery or „flaying“ injury-wheel
- Foreign bodies
- Differentation between incised wound and laceration-in regions with bony support (skull, scapula) violent compression can split the skin in a fashion like slashed wound, but has bruised margins and tissue bridges!
- Falls (occiput) x hits (vertex)

Flaying injury of the scalp

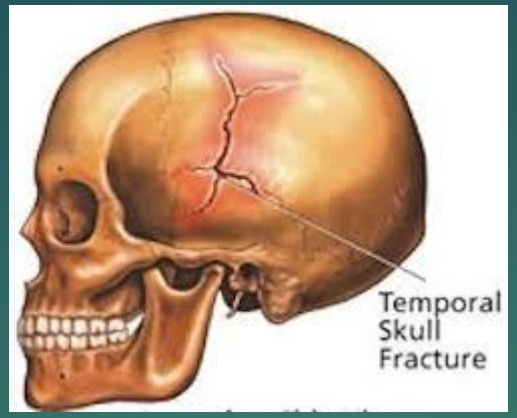
Laceration of the scalp

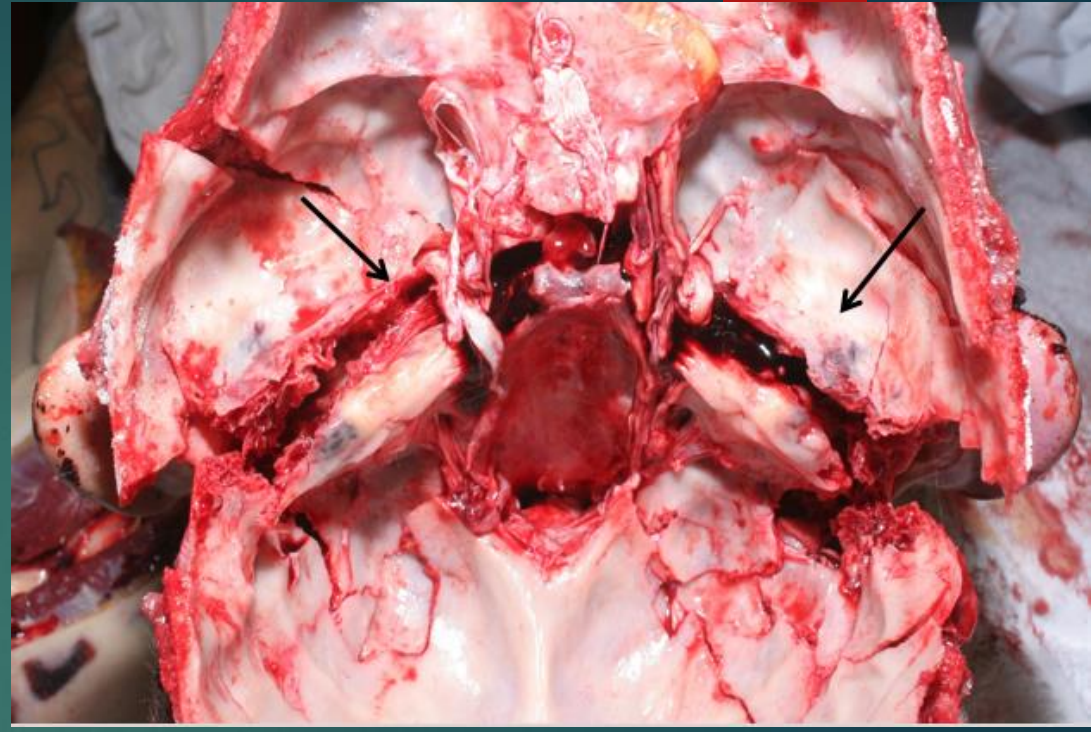
Skull fractures

- Types:
  - Linear
  - Depressed (pond)
  - Cominuted
  - Base-ring, hinge, secondary (anterior fossa floor)

Calve- arise usually direct

Base-arise usually indirect





- Linear fractures

Long, straight or curved

Arise under or at a distance from the impact area

May involve the inner/ the outer or both tables

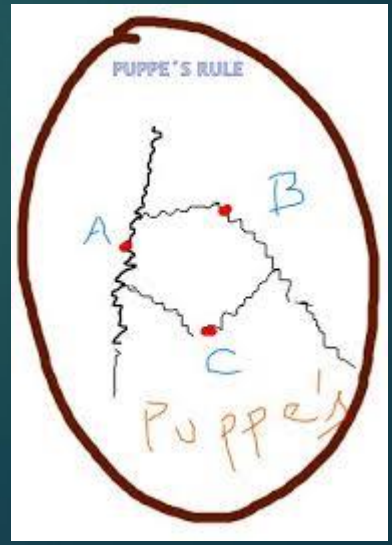
anywhere, but typically in waek plates

Typically –floor of posterorior fossa towards f.o.m. (fall)

- floor of middle fossa-transverse „hinge“or „motocyclist fr.“

Children-diastiasis of the seam, mainly sagittal suture or „stepping“ the suture to the other site, not necessarily in a line (blow or fall onto the vertex)

CAVE rupture of a. meningea media-EDH

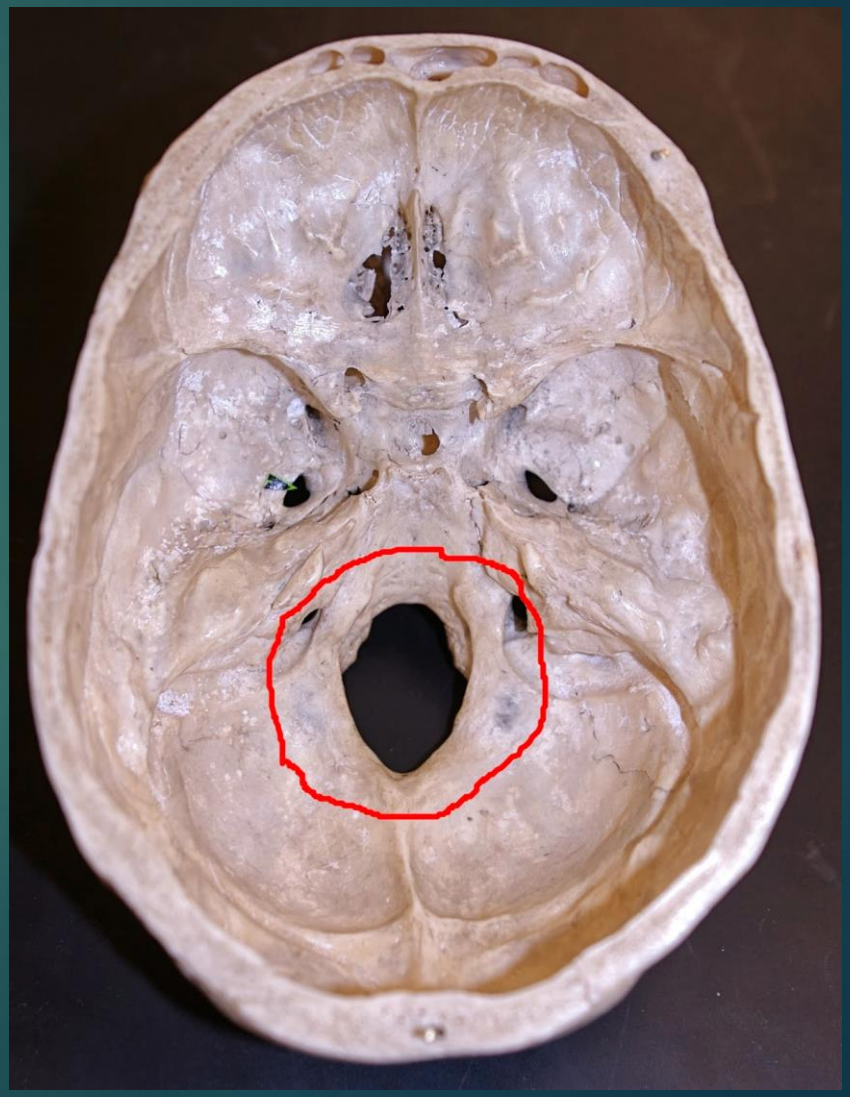


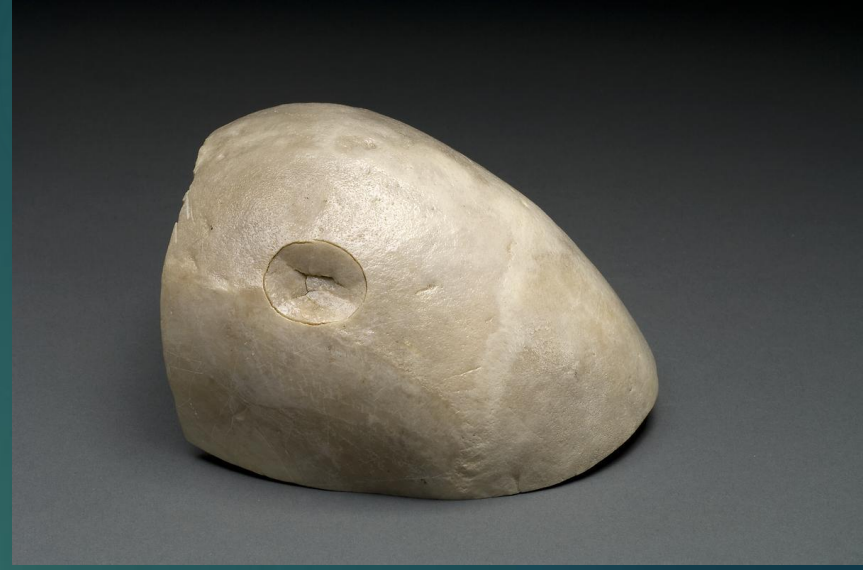
- Ring fracture

Posterior fossa around f.o.m.

Fall from the height on the feet or hit onto the vertex

Transmission of impact





- Depressed fracture
  - Shallow „pond“ like
  - Spider web pattern-minimal or absent depression, radiating lines and concentric circles
  - Outer table driven inwards and inner table intruded into the cranial caviy or brain matter
  - Usually severe impact like hammer
  - The shape of the fracture may or may not follow the shape of the heavy object (strike at an angle)
  - Hair and scalp cusion the effect and may alter the dimension of the skull lesion
  - Rupture of dura mater, subarachnoidal bleeding and contusions of brain – traumatic epilepsy

- Comminuted
  - High energy trauma
  - Falls/accidants

- Dangers of fractures of the skull:

Fracture of a skul = a sign of a substential insult to the head and possible injury to the brain

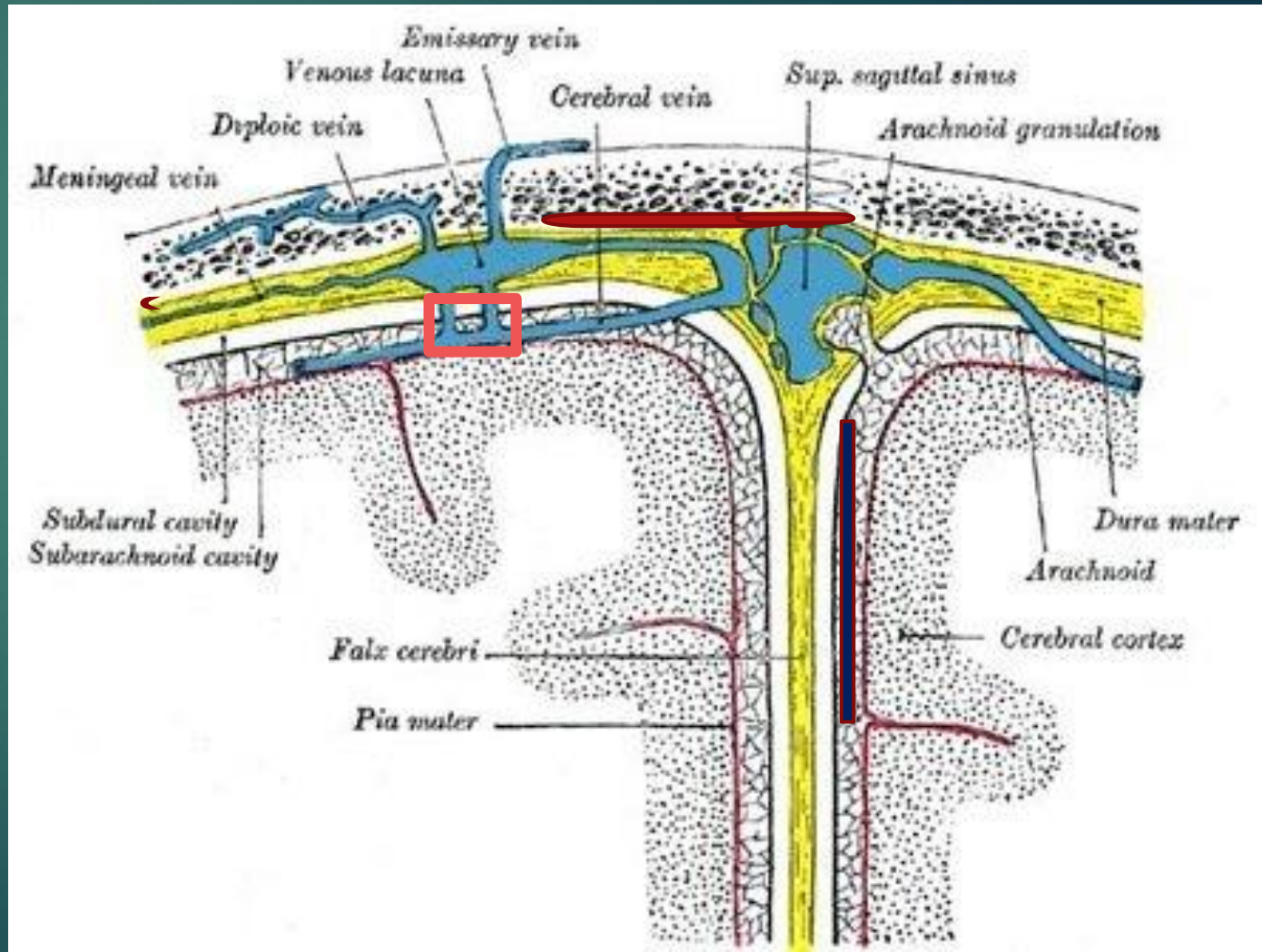
But-crack passing through embeded meningeal artery or impinged fragment causing laceration or penetration of the brain tissue

  - Traumatic epilepsy:
    - mainly depressed frr.
    - tonic and clonic fits
    - parietotemporal area
    - weeks up to 2 years

- Infection following skull fracture
  - By direct spread through a compound fracture-scalp, dirty object
  - By spread from nasal cavity-cribriform plate-“contrecoup“ lesion
  - By spred from paranasal sinuses (F/E/M)
  - CAVE leakage of cerebrospinal fluid from the nose/ear and uncoagulated blood

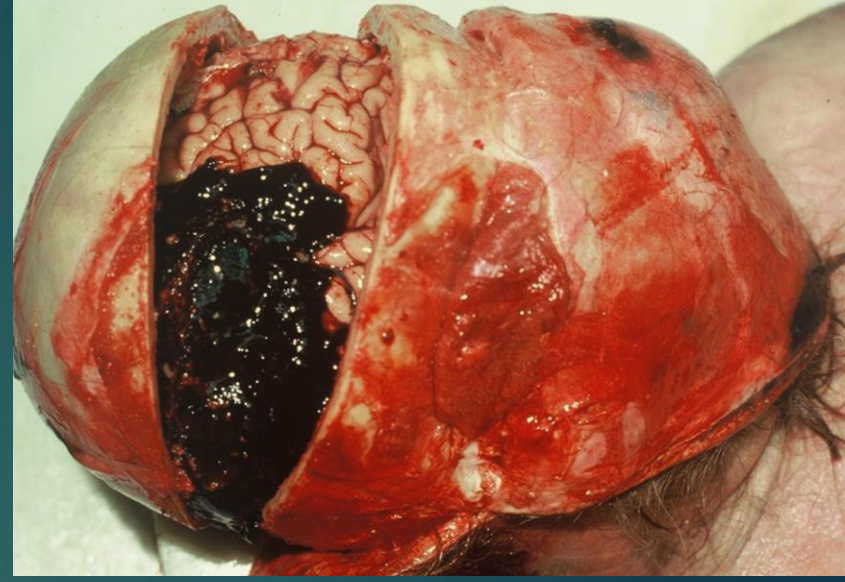
C) Neurocranium-intracranium

- Extracereberal injuries include:
  - **Extradural haemorrhage**
  - **Subdural haemorrhage**
  - **Subarachnoid haemorage**



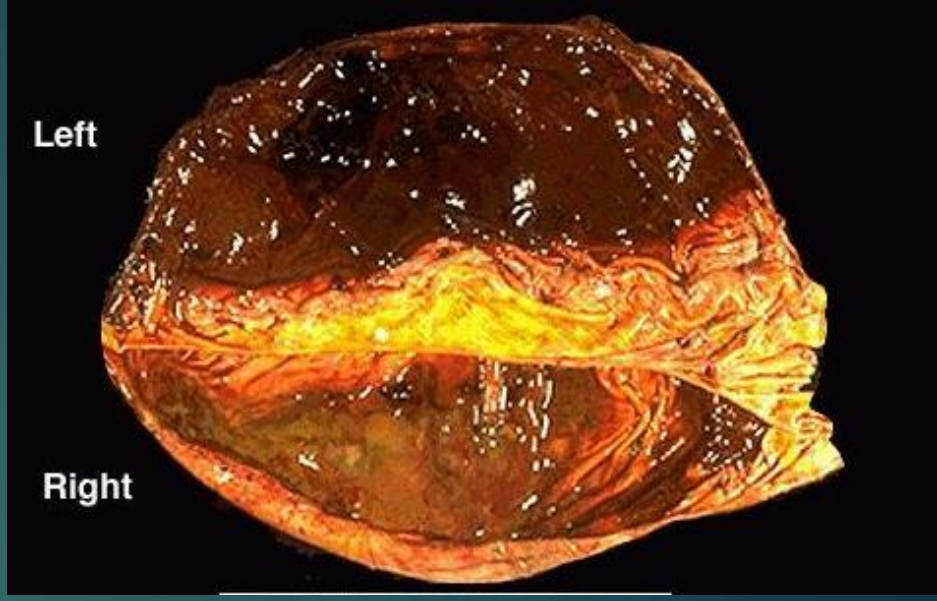
- **Extradural haemorrhage**
  - Inner surface of the skull and the dura mater
  - The least common
  - Most associated with fracures of the skull
  - Mainly arterial, may be also venous (no fractures)
  - Parietotemporal site, may be also frontal or occipital
  - Fatal minimally 100 ml, clinically significant 35 ml
  - Lucid/latent interval may or may not be prerent (concussion), minimally 30 minutes for space occupying lesion, most after 4 hours
  - CAVE premature discharge of pacient of „concussion“
  - Heat haematoma- artefact mimicking EDH (blood is extruded from the diploic veins and venous sinuses, brown and friable), not to be mistaken for criminal asault

- Subdural haemorrhage
  - Bleeding beneath the dura, mainly lateral surface of a hemisphere
  - Less often associated with fractures skull
  - 3 types-acute, subacute, chronic
  - Any age, especially extremes („senile dementia“ or stroke)
  - Due to trauma (except ruptures AV malformations, vascular tumors)
  - Often associaed with traumatic subarachnoid haemorrhage and focal brain injuries an externally typical signs of blunt trauma or nothing
  - Rupture of bridging veins or venous sinuses
  - CAVE Shaken baby syndrom-no signs of impact in scalp or skull

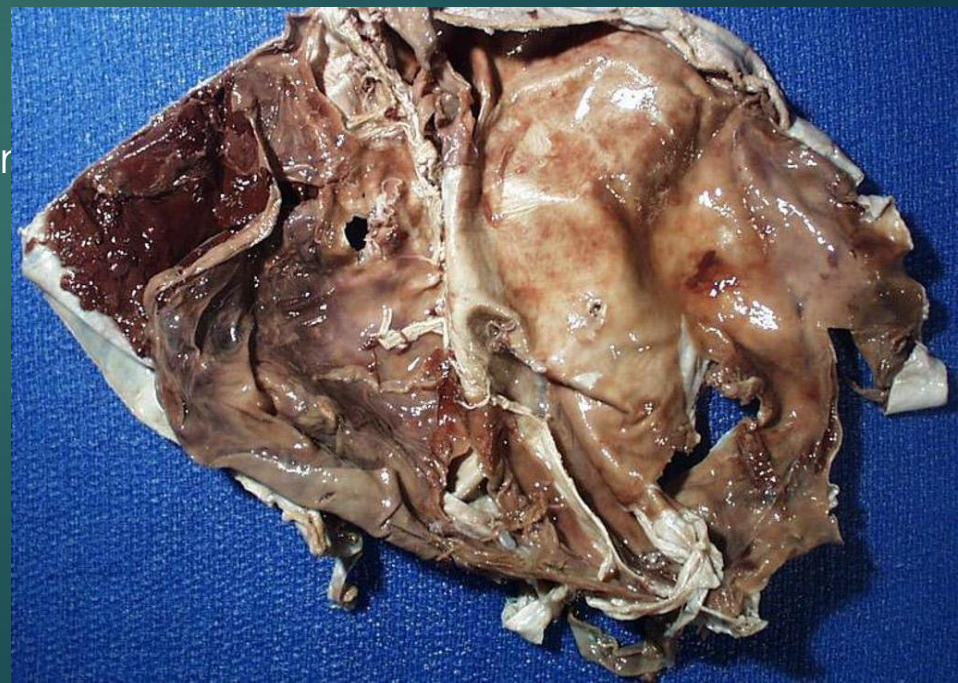


- Acute SDH
  - Arises from shear stress in the upper layers of the cerebrum and elongation/rupure of bridging veins, changes of velocity-acceleration/deceleraton + rotation

    X
  - Blunt impact-not directly under the impact area-mobility of haemorrhage (drain down under the gravity)
  - May or may not be latent interval (other severe damage), if present, may be longer than 4 hours in EDH
  - Thin film-not space occupying lesion, needed 100 ml and more
    - Not necessary cause of death (CAVE DAI macroscopically occult)



- Chronic subdural haematoma „hygroma“
  - Old people, incidental finding at autopsy
  - Red brown with gelatinous membrane-tough membrane brown or straw coloured from altered Hb
  - Compression of hemisphere and midline shift (more than 100 l)
  - Asymptomatic/stroke-like symptoms-unilateral
  - Enlargement-repeated further bleeding due to revaskularizatior
  - Progression to hippocampal and cerebellar herniation
  - Dating –marked variaotions,
  - rooghly brown colour 1-2 weeks,
  - a month-formed capsule,

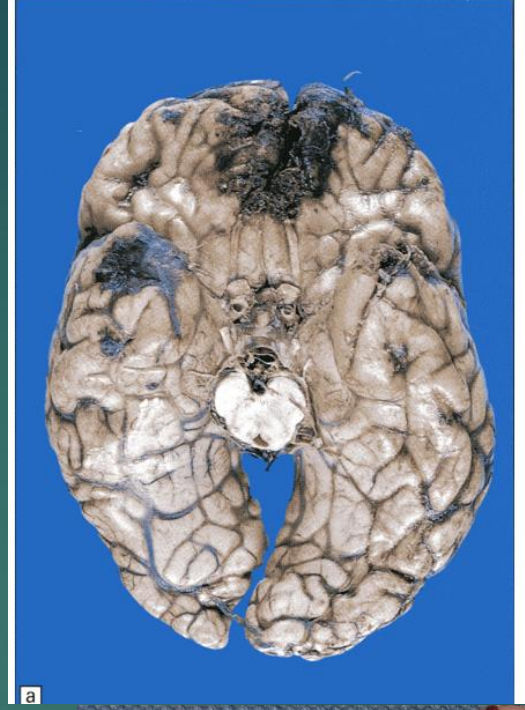


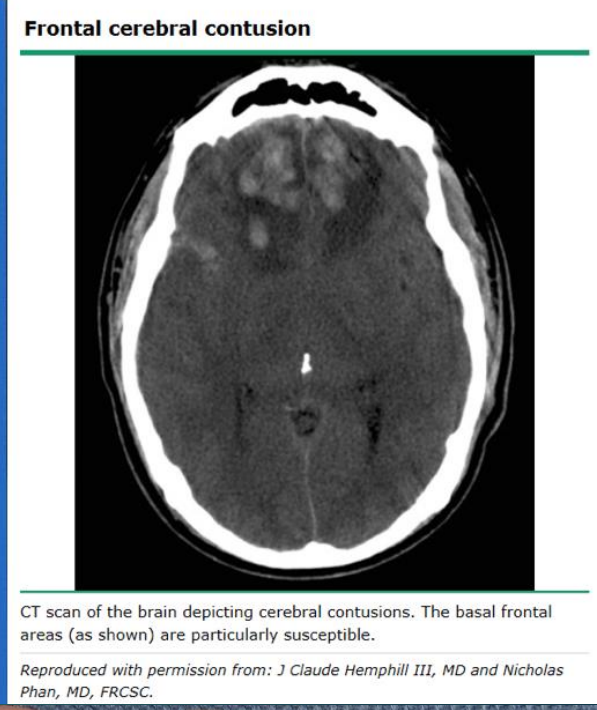
Subarachnoid haemorhage

- Mixed aetiology:
  - Traumatic occur when damage to the cortex with contusions, SDH after trama x or mild impact on a head (MRI survive)
  - nontraumatic natural disease (rupture of berry aneurysm)
- Blood mixes with CF fluid-more mobility
- Source-cortical veins and arteries or intracerebral haemorrhage breaking out through the cortex or due to rupture of vertebral artery (rotational trauma-blow to the head/neck-below the ear)
- Cause of death haemorrhage itself or due to other injuries
- Death may be remarkably rapid „drop dead“
- Brain stem exposed to great volume of blood

D) Intracerebral injuries

- Types of intracerebral injuries:
  - Cerebral contusion
  - Cerebral laceration
  - Traumatic intracerebral haemorrhage
  - Concussion
  - Difuse axonal injury





CT scan of the brain depicting cerebral contusions. The basal frontal areas (as shown) are particularly susceptible.

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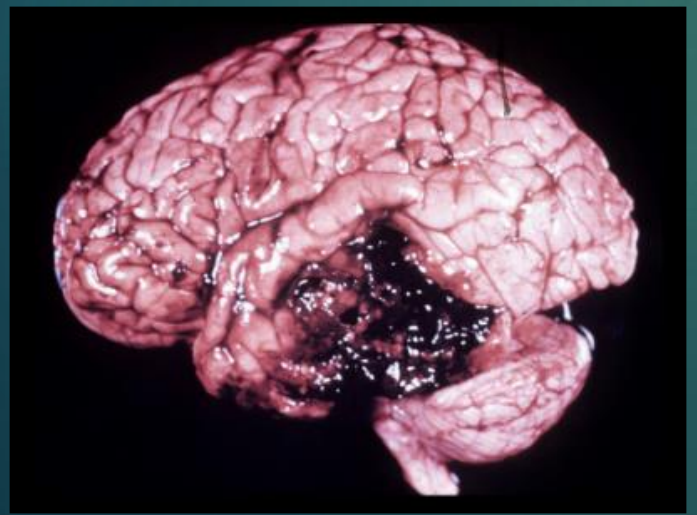
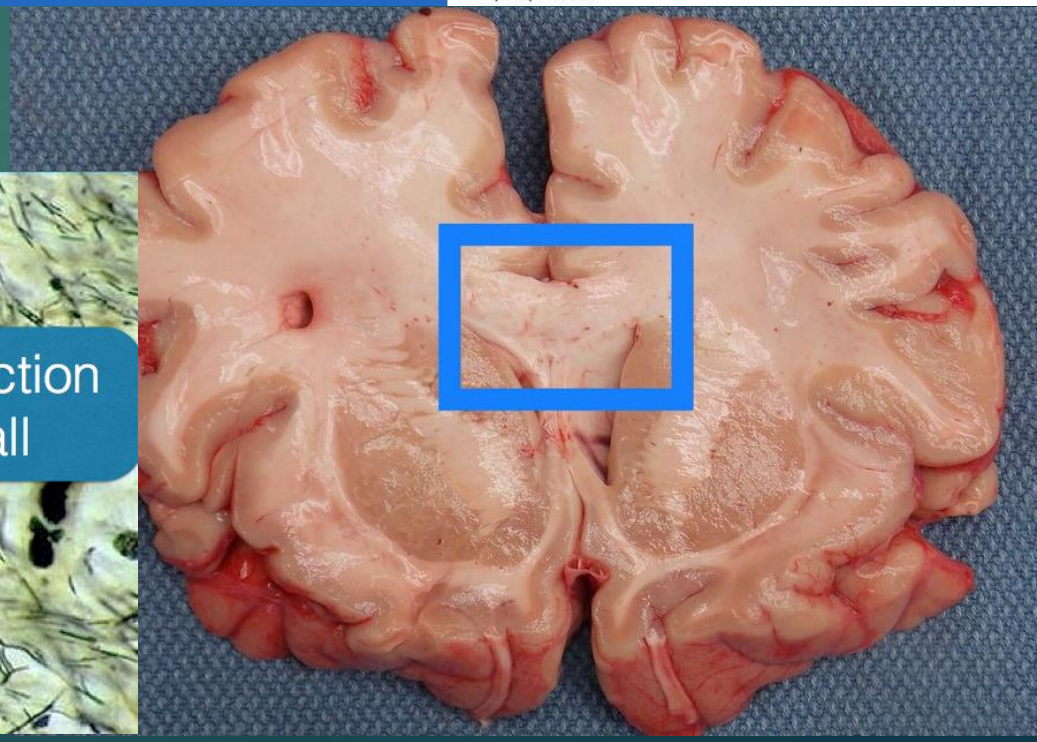


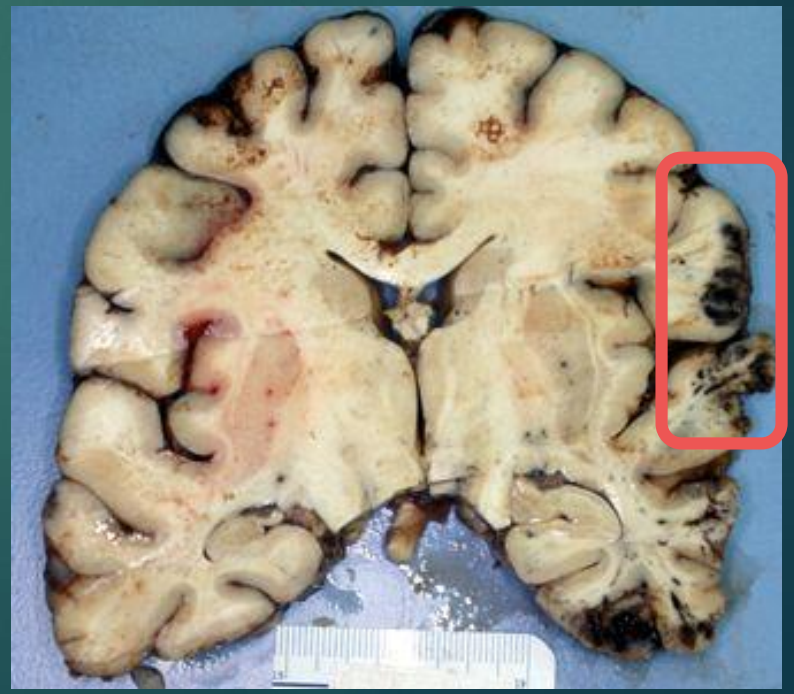


- The brain may be injured:
  - By direct intrusion-fragment of skull in compound fracture, as bullet
  - By change of velocity-akceleation, deceleration+rotation-shear strain/sliding

    (grey and white mater move in a different velocity due to different structure
  - Indirect by the skull deformation (anterior fossa floor)
  - By the pressure gradient

    (Impact area-increase of pressure and opposite decrease leads to suction and cavitation)-contrecoup lesion is greater

- Cerebral contusion
  - Cortex retains its shape x laceration,
  - Cortical contusions-cortex swollen with petechiae, motled purplish red
  - Subcortical contusions-red
  - Wedge-shaped (base on the surface)
- Cerebral laceration
  - Extension in severity of contusion
  - Arachnoid is torn, blood leakage into subarachnoid/ subdural space
  - Torn corpus callosum



- Traumatic intracerebral haemorrhage

Common in severe head injury

Primary at the time of impact and secondary due to increase of inracranial pressure-arteficial ventilation with longer survival

Cerebral hemisphere, part of contrecoup lesion

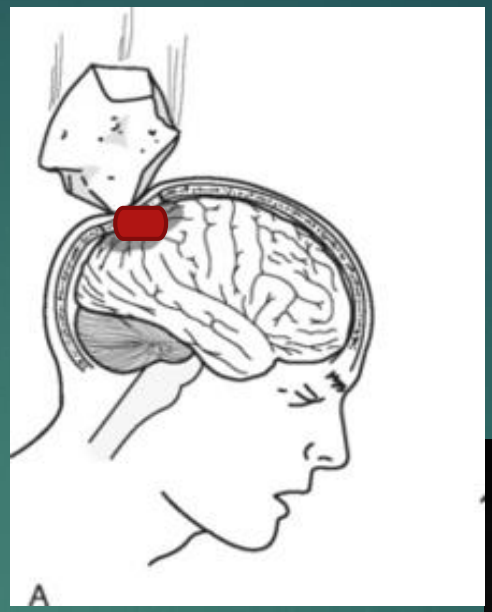
Sometimes pose like „spontaneous“ heamatoma in elderly patients with hypertension, „burst lobe“

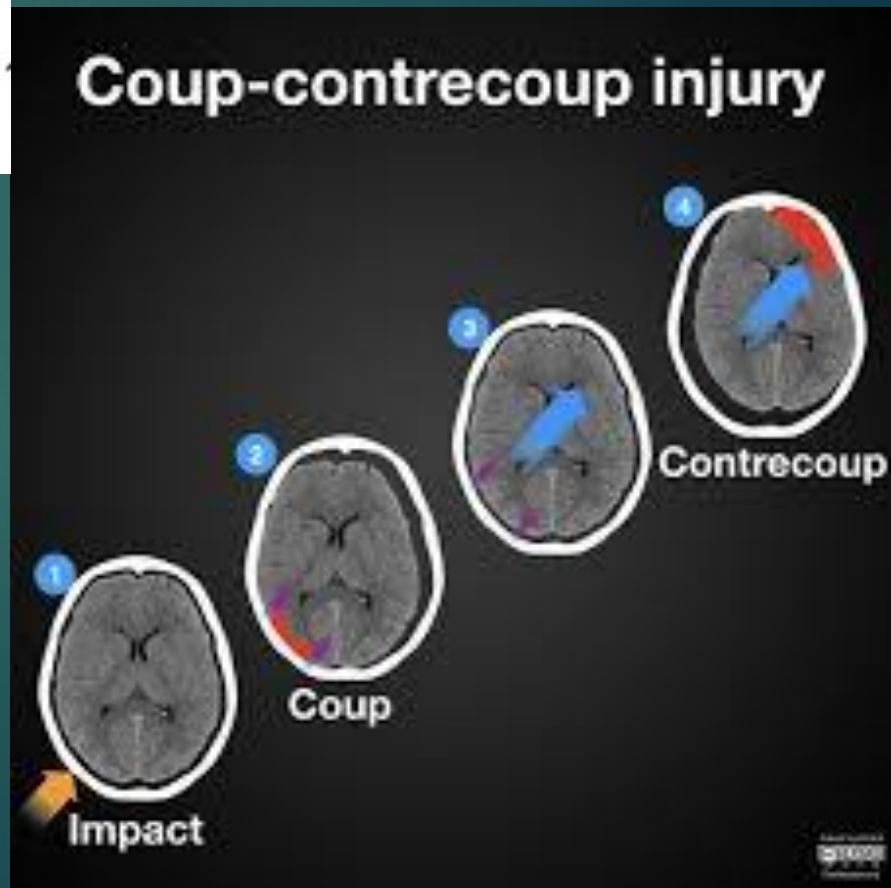
Primary stem haemorrhages-occipital impact,more lateral

Secondary stem heamorrhages-due to brain oedema (Duret)

Hypertensive stem haemorrhages-mainly pons, explosive lesion with swelling

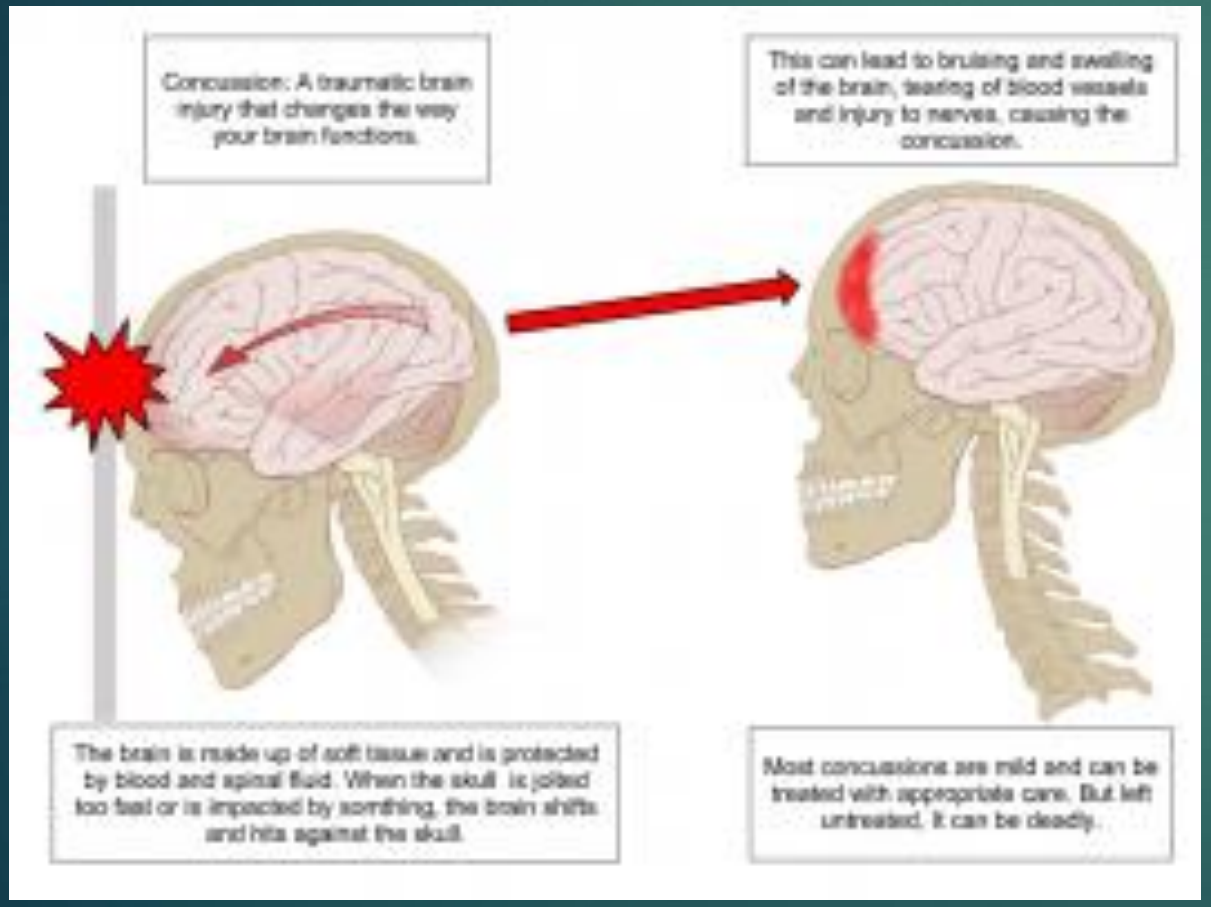
- Coup and contrecoup damage
  - Mobile head is struck with an object
    - Maximal contusions beneath the blow
  - Moving head is suddenly decelerated (fall)
    - Coup lesion on the site of impact/contact
    - Contrecoup lesion on the opposite site





- There may be no coup lesion, only CC
- No need be a fractue of the skull even with severe C or CC lesion
- The most common site of CC injury is the frontal and temporal lobe, at the tips, may be symmetrical (occiput fall)
- The degree o CC damage may be severe, causing blood –filled cavitation in the deep cortex and white matter (F/T lobes)
- In frontal region is occipital CC virtually unknown
  - Frontobasal injury (car accidant)
- Severe CC from fall on the occiput+fractures of floor of anterior fossa, black eye

- In the temporal impact damage of the contralateral hemisphere,
  - may be more severe (but may be also present on the ipsi hemisphere-falx cerebri)



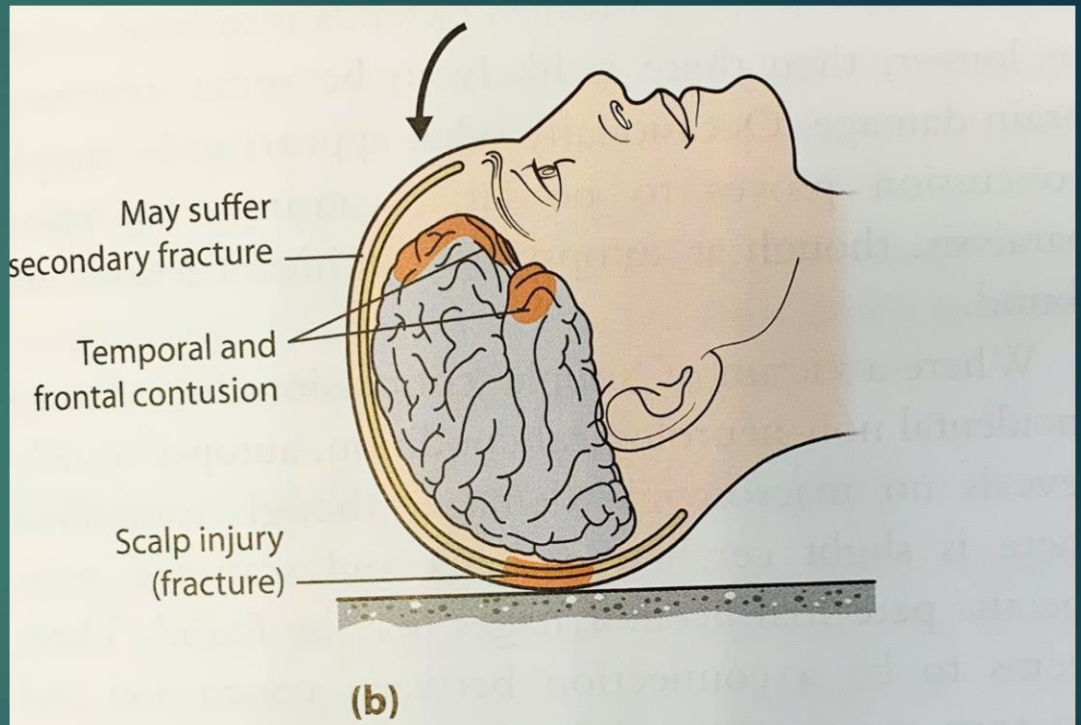


Figure 5.45 (a) 'Coup' brain damage to fixed head. (b) 'Contrecoup' brain damage to moving (decelerated) head.

- Concussion
  - Clinical entity
  - Topic often questioned in court
  - Post-concussion state-headache, unsteadines, anxiety, vasomotor disturbance
  - Last seconds-minutes, prolonged-DAI
  - No macro damage/slight oedema

„disorder of cerebral functions which follow immediately upon the impact of a force to the head“

„A transient paralytic state due to head injury which is of instantaneus onset, does not show any evidence of structural cerebral injury and is always followed by amnesia from the actual moment of the accident“ (retrograde)

- Diffuse neuronal/axonal injury (DAI)
  - Diffuse vascular injury
  - Diffuse axonal injury
  - Hypoxic brain damage
  - Diffuse brain swelling

- Diffuse vascular injury
  - die within 24 hours, multiple small haemorrhages

- Difuse axonal injury
  - rotational A/D, (changes of permeability of axolemma, ionic changes, accumulaion of fluid-axonal swelling, intracellular Ca accumulation, proteolysis, collapse of cytoskeleton), neuronal disruption –clubbed „retraction balls or globes“
  - Disruption of axonal transport-accumulation bAPP positive in 2-3 hours of the insult x axonal bulbs positive 12-18 h in silver stains (common histology)
  - Corpus callosum, capsula interna, cerebellum, midbrain, hippocampus
  - After weeks microglial reaction

- Cerebral oedema/swelling
  - Common, local/generalized
  - Raised intracranial pressure
  - Autopsy: dura is stretched and tense, the gyri are pale and flattened, sulci filled, ventricules reduced, grooving of the hippocampal uncus (temporal) and tonsiles of cerebellum (occipital), necrosis of ischemic traped tissue, mass 1500 g and more
  - Kids-more extreme bulging
  - Self-potentiating-at first result of trauma, than rise of IC pressurethat impairs venous return wit persisting arterial inflow, congestin and swelling which worsen cerebral oedema and hypoxia and lead to brain-detah

CAVE-aspiraon of blood of unconscious victim

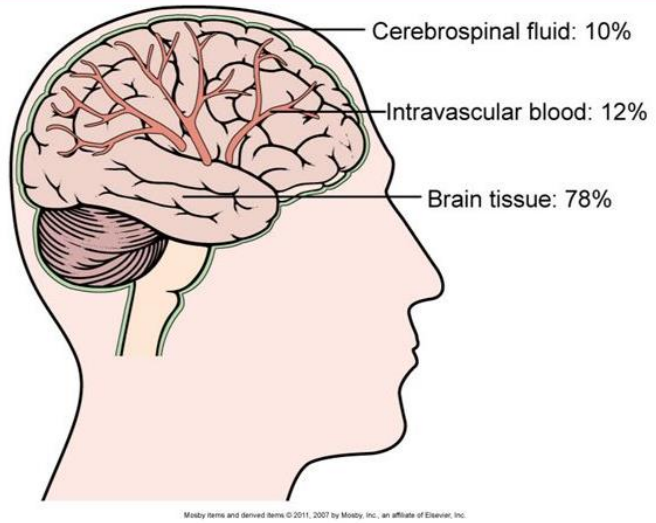
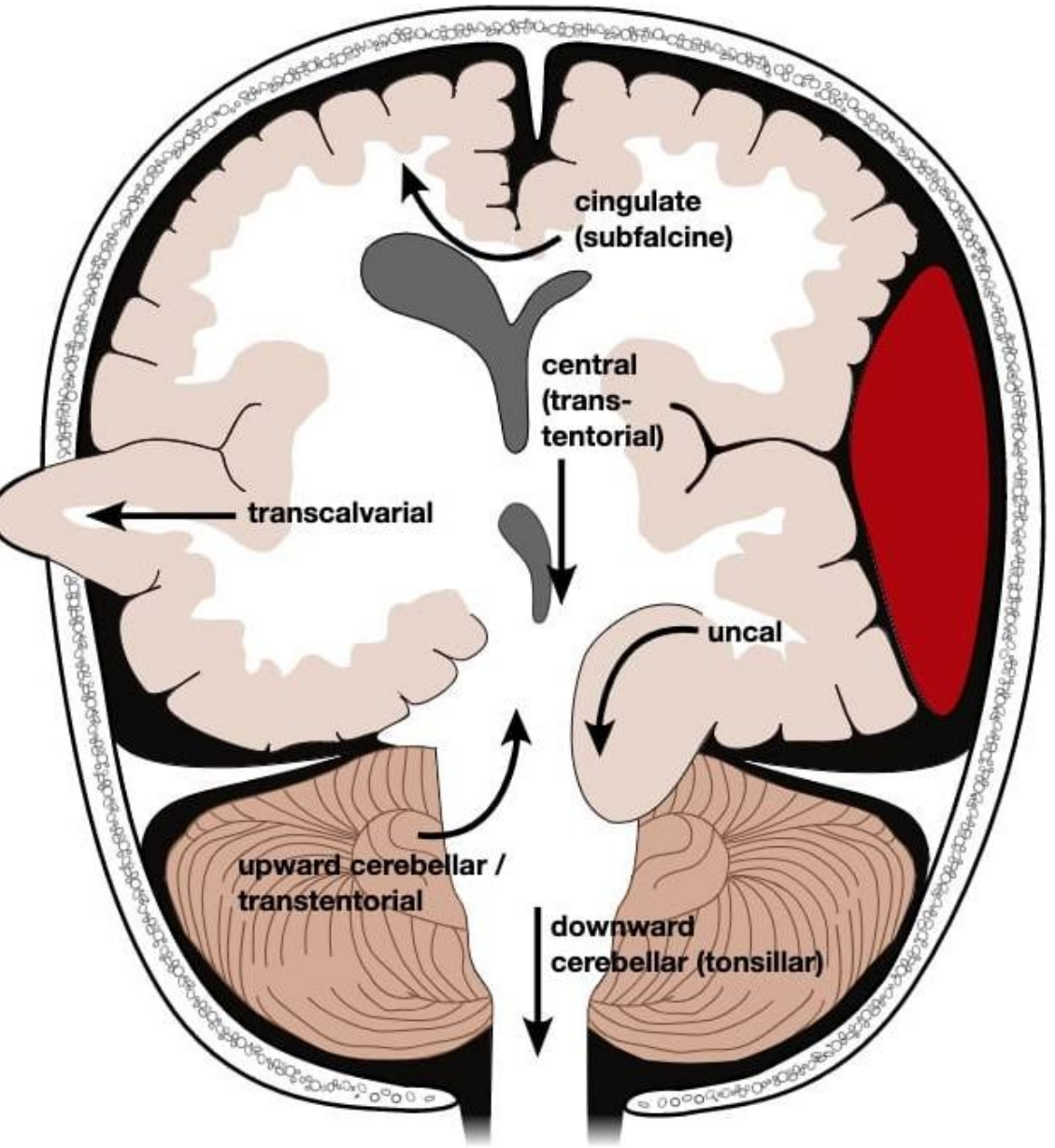


Fig. 57-1. Components of the brain.


cingulate
(subfalcine)
central
(trans-
tentorial)
transcalvarial
uncal
upward cerebellar /
transtentorial
downward
cerebellar (tonsillar)

2) Neck and nape injuries

- Types of injuries:
  - Hyoid bone injury
  - Larynx and trachea injury
  - Thyroid gland injury
  - Injury of the great vessels
  - Oesophagus injury

- Hyoid bone injury
  - Direct-blow or kick to the neck, manual strangulation, fal lon the neck
  - Indirect-avulsion of the great cornua in pressure of the ligature or in contact with the cervical spine

- Larynx and trachea injury,
  - Direct-blow, kick, traffic accidents (run over or fall on the handlebar)
    - Musocal tears up to complete laceration

  - Indirect-intensive antero-retro-lateroflexion, avulsion (strangulation) subcutaneus emphysema
    - CAVE massive bleeding-aspiration

- Thyroid gland injury
  - Blows, wheel roll over, contussion, laceration-massive haemorrhage

- The great vessels injury
  - Carotis arteries
    - Indirect-whiplash, transection-long drop hanging, more often „Amussat intimal tears“
    - Intimal and medial tears-trombosis, brain ischaemia, disection
    - Direct-blow to the neck
  - Vertebral arteries
    - Indirect-trafic accidents, hanging
    - Direct-blows to the nape + fractures of processs transversus atlantis- massive SAH

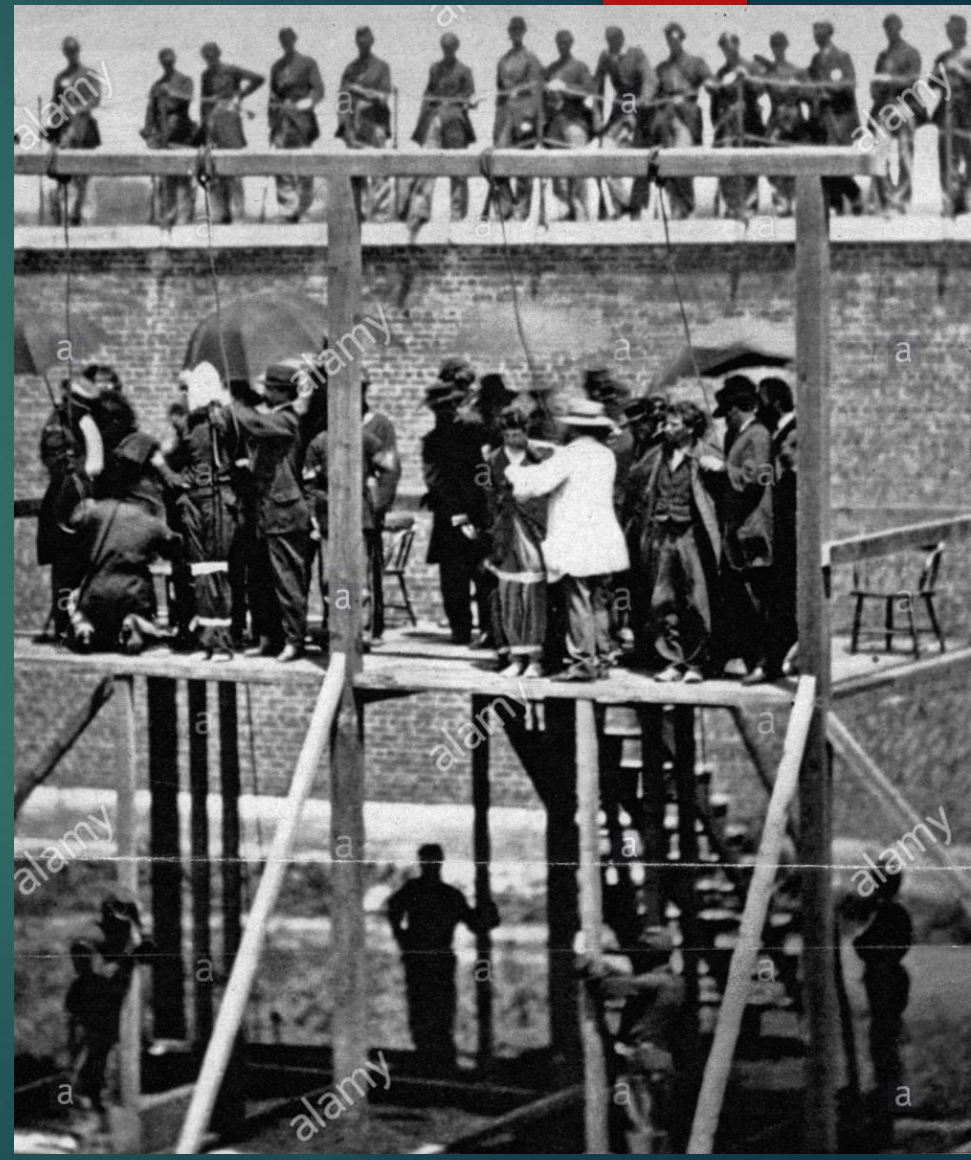
- Oesophagus injury
  - Less often-wall elasticity
  - Indirect-whiplash injury- intensive flexion/extension/rotation
    - Mucosal tears, bruises
    - CAVE endoscopy
    - Risk of massive infection-mediastinitis, septick shock

3) Spinal injuries

- The spine and head should be thought of as a part of the same system in relation to the trauma
- Cervical spine holds the most interest (craniotraumas, vehicular accidents)
- C1, C2 mainly rotation
- C3-C7 flexion/extension
- Types of injuries:
  - Dislocation of C0/C1/C2
  - Compression damage
  - Hyperflexion/hyperextension injury

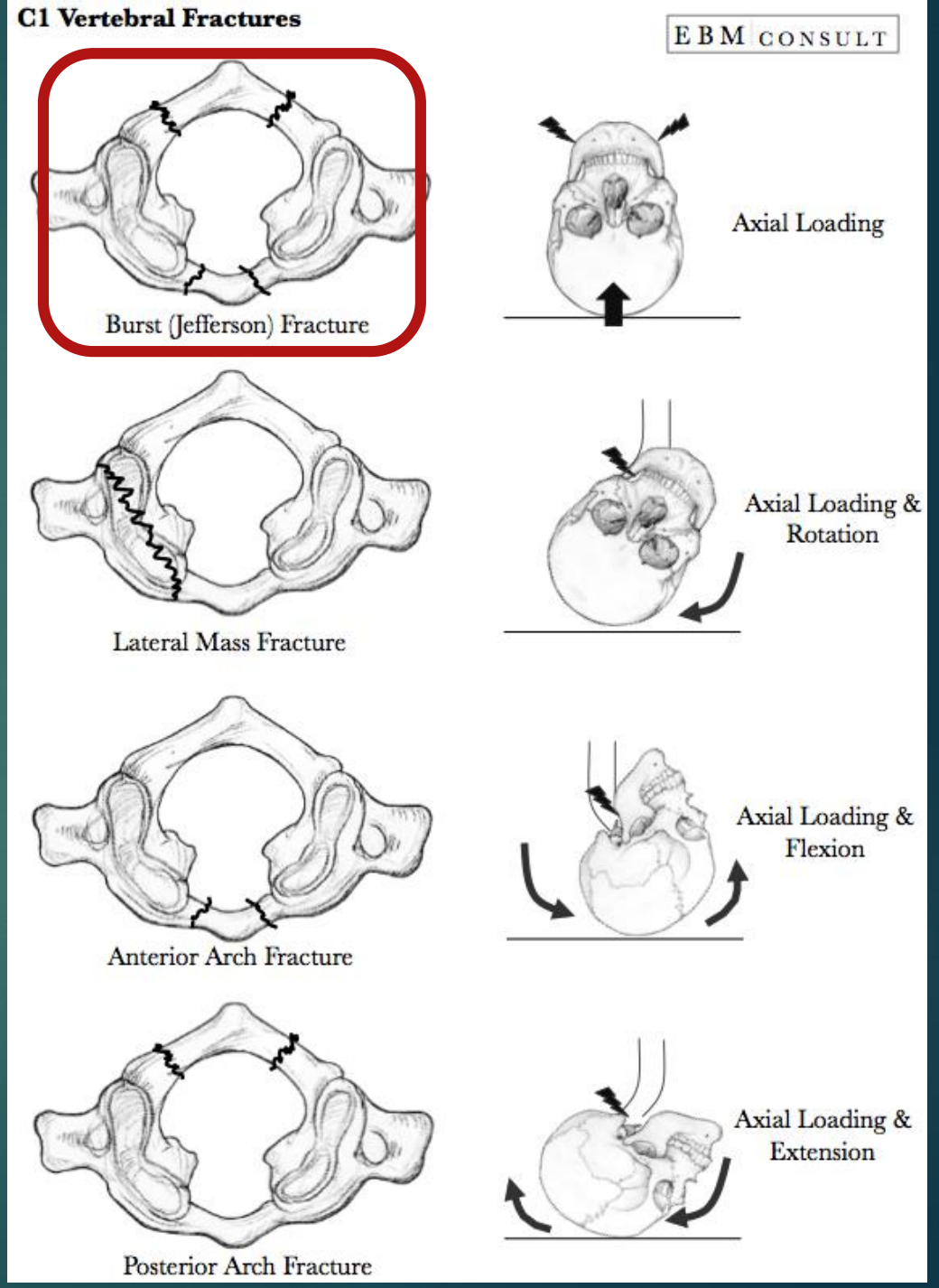
- Dislocation of C0-C2
  - Dislocation of atlanto-occipital joint (vertex strikes-the windshield of the deceleration vehicle
  - Dislocation of atlanto-axial joint
  - Ruptures of the odontoid peg
    - Judical hanging

    = long drop with knot beneath the chin (5 m depth)

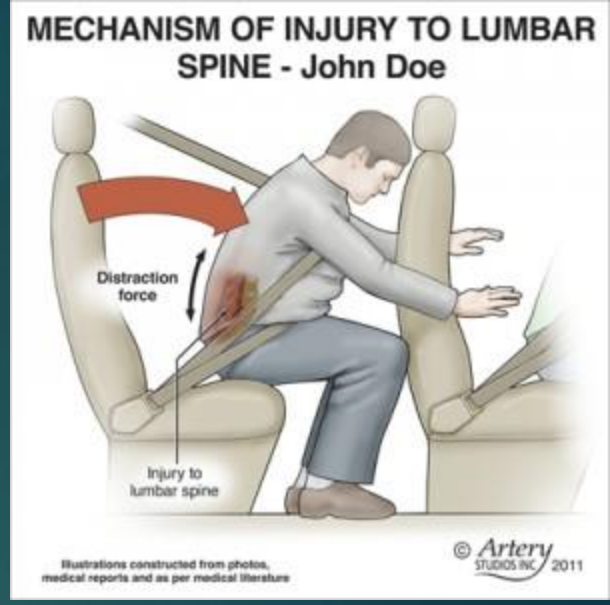


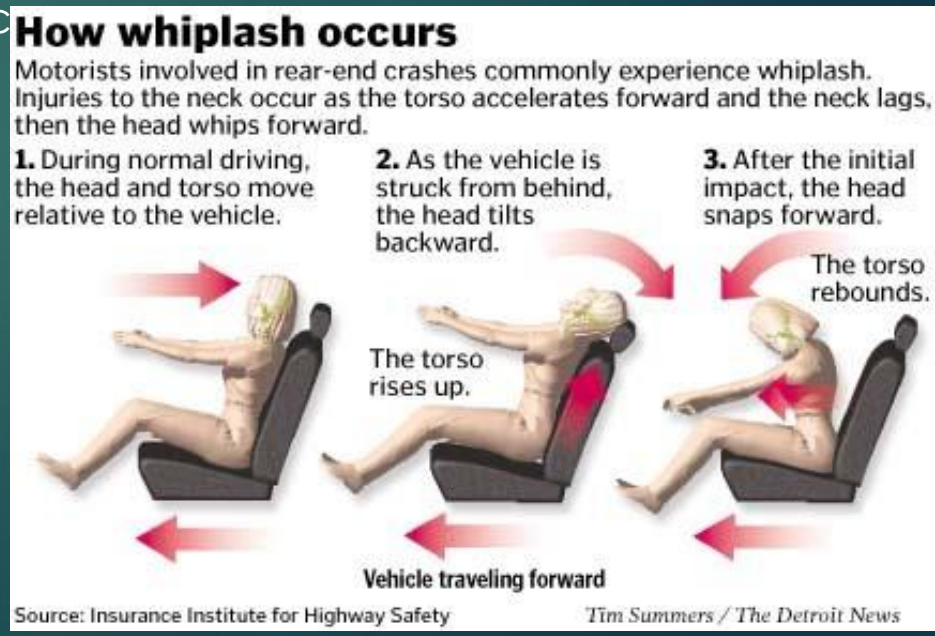
- Compression damage
  - Falls from height on feet/head
  - Most commonly lower thoracic and upper lumbar spine Th12-L1

    CAVE extrusion of a disc or displacement of fragments of vertebral body
  - Fractues of collumn at one/more points,
    - „burst atlas“ injury –Jeffererson type



- Hyperflexion/hyperextension damage
  - Extension more dangerous-weak ligament on the anterior aspect
  - Frontal/rearward motor vehicle crashes
  - „whiplash injury“
    - Bleeding into muscles, rupture of ligaments, tearing disc
    - Tearing nerve roots, narowing spinal canal
    - Compression/haemorrhage/transsetion o spinal cord
    - The thoracic aorta is torn





- Spinal cord injury
  - Mosty intrusion of bony fragment, disc on nukleus pulposus, bleading
    - Contusion
    - Sdh
    - Haemorrhage-haematomyelia
    - DAI

4) Chest injuries

- Chest injuries:
  - To the chest wall
  - Haemorrhage and infection of the chest
  - Pneumothorax
  - Injuries of the lungs
  - Injuries of the heart
  - Haemopericardium, cardiac tamponade
  - Injuries to great vessel

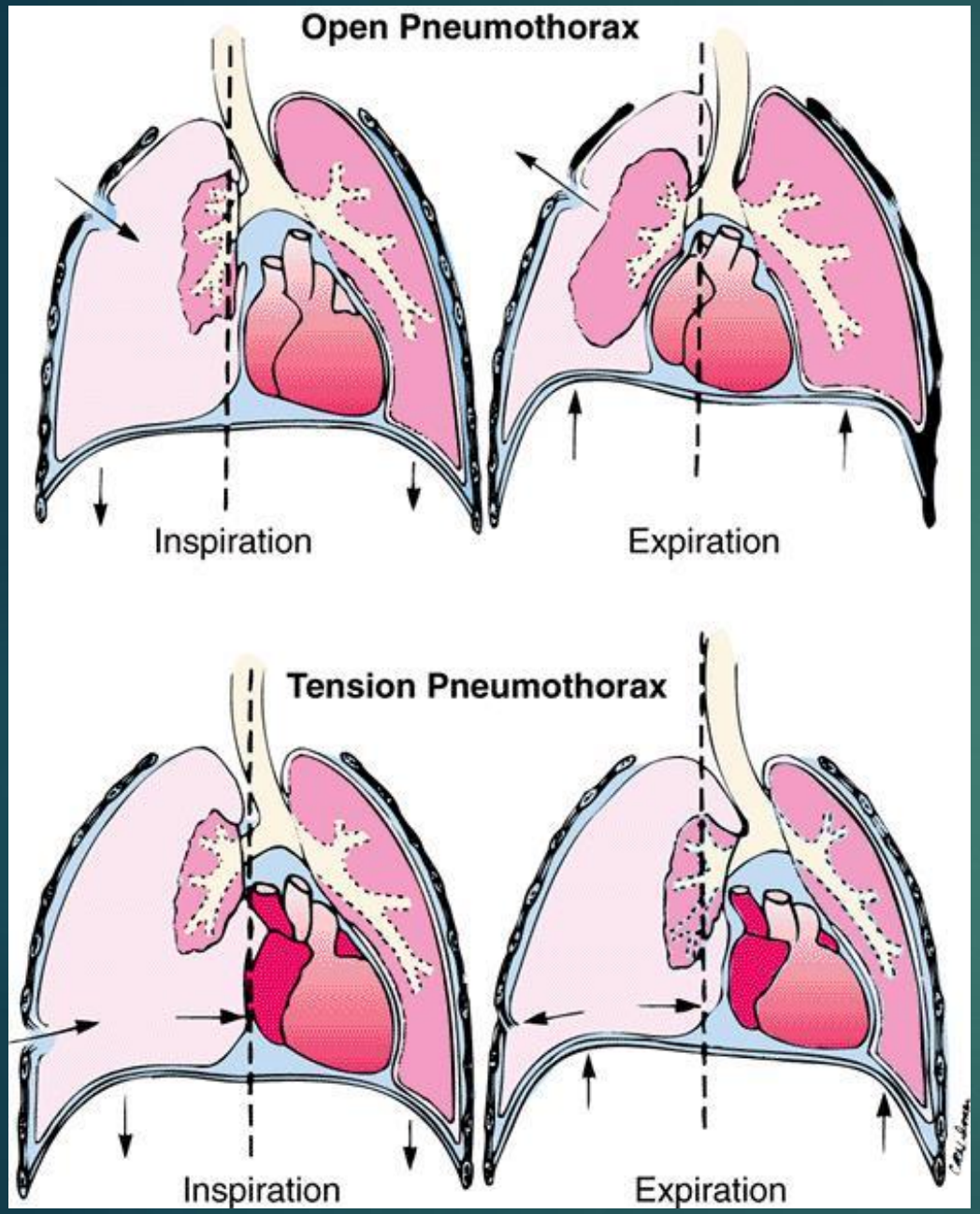
- Injuriess to the chest wall
  - Integrity of the rigid chest wall
  - Rib fracturs
    - A/P axillary line mainly (falls on the side)
    - Upper ribs less often unless kicking, heavy punching, traffic accidents
    - During life-bleeding beneath periosteum or parietal pleura
    - CPR x original trauma hard to differentiate
    - dangerous while numerous, broken ends penetrate pleura or lung, pleural or muscle pain limits respiratory effort
    - Bilateral fractures „flail chest“ more than 3 ribs plus fr. of sternum
      - Paradoxical respiraton, dyspnoea, cyanosis, hypoxia, respiratory failure
      - Motor vehicle accidents-frontal impact to the steering wheel
      - Stamping assault

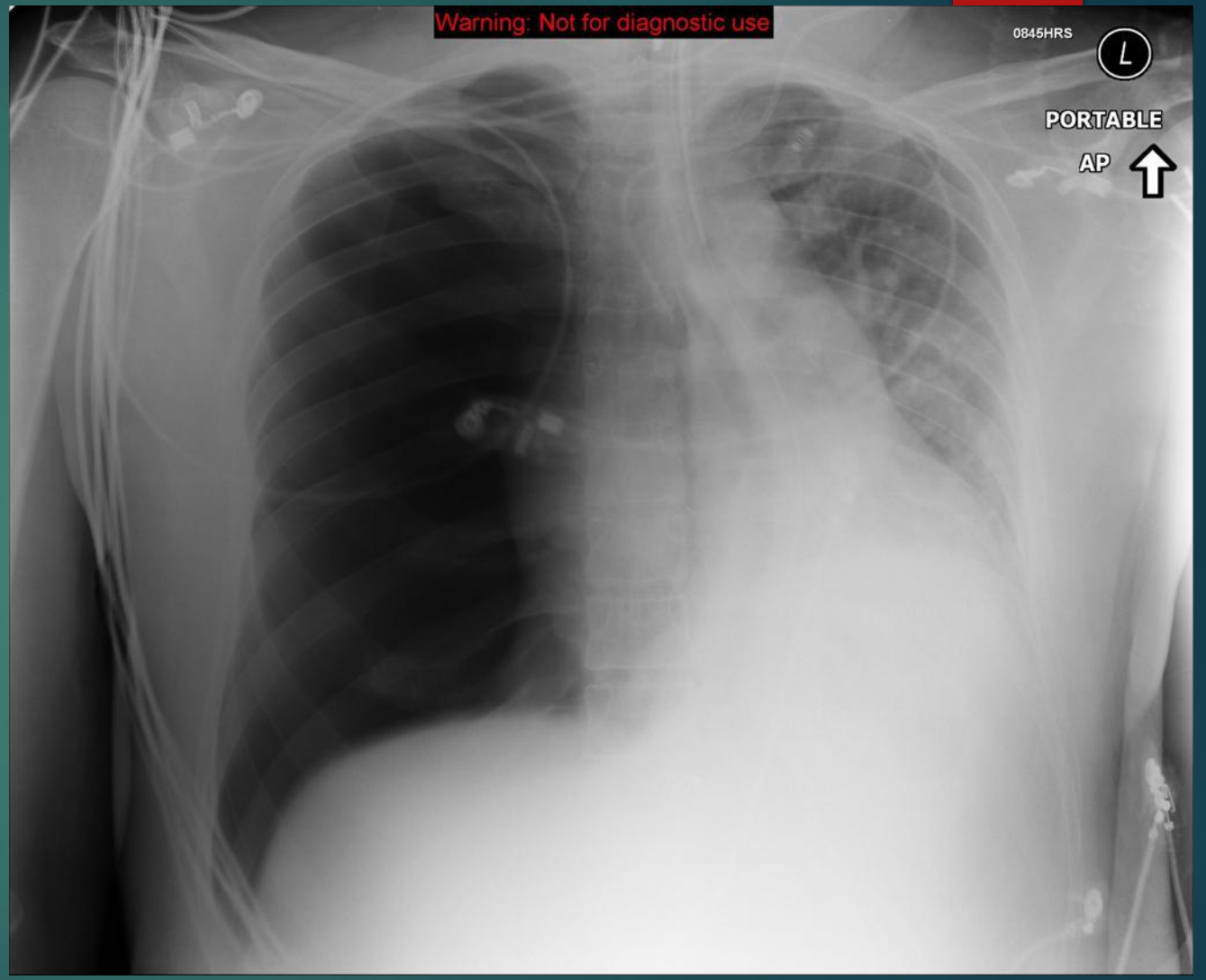
- Infants (abused) rib fractures common – squezzing from side to side -paravertebral frr.-rosary frr-
  - Callus within 2 weeks
  - Pliable –CPR ribs frr are rare and if present, than on anterolateral side

- Sternum fractures
  - Stamping/frontal impact
  - Far more force necessary, unerlying tissue damaged

- Haemorrhage and infection in the chest
  - Infections very uncommon in forensic practice-shor time-dirty weapons/foreign material
  - Haemothorax-any injury to the chest wall, lung surface, pleural lining, intercostal and mammary arteries, most massive large vessels
    - Lung hilum
    - The heart with defect in pericardial sack
    - Death due to loss of circulating blood (external bleedin may be minimal or none)

- Pneumothorax
  - Entry of air into pleural cavity
    - Due to disruption of alveoli
    - Due to penetrating injury (fractured rib)
    - 3 types:
      - Closed-ruptured pleura allows air into pleural cavity and communication closes, air is absorbed
        - if communication remains open –bronchopleutal fistula
      - Leak in pleura/chest wall has a valve-like action-air reach in, but cannot escape „tension pneumothorax“
        - Collpas of the lung, mediastinum shift
      - Open-injury of the chest wall penetrating with pleural cavity „sucking wound“
        - Military surgery


Open Pneumothorax
Inspiration
Expiration
Tension Pneumothorax
Inspiration
Expiration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PORTABLE
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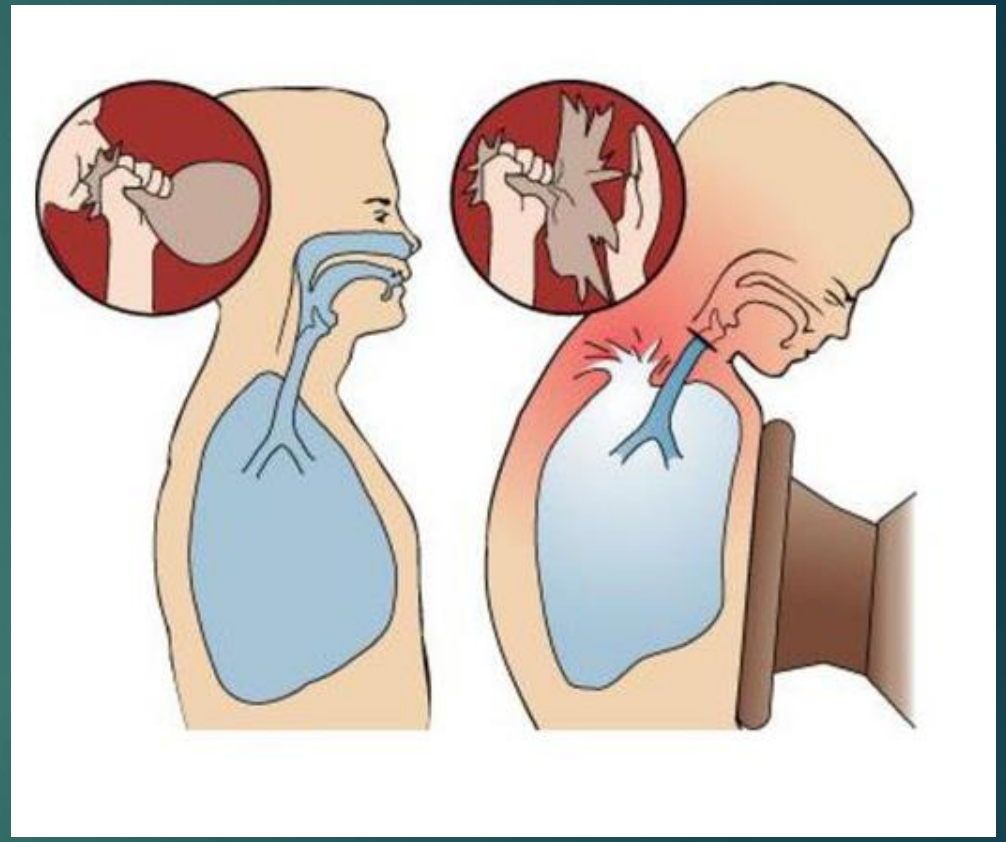
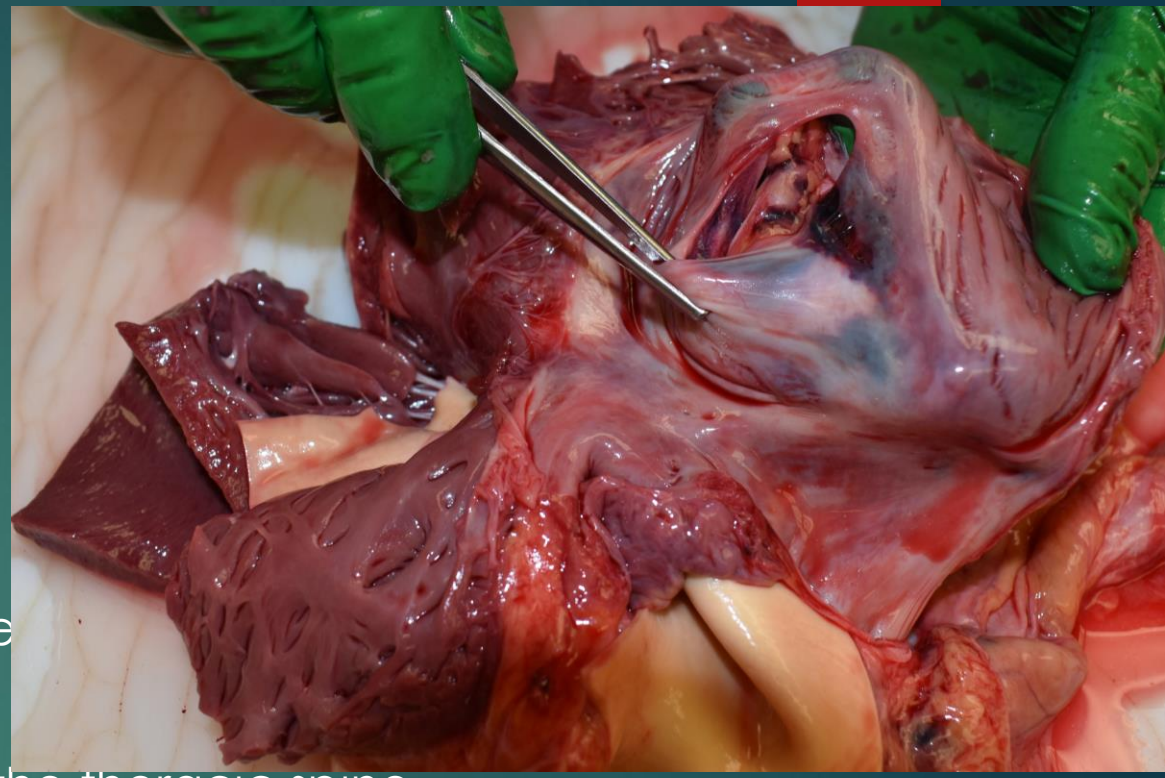
- Traumatic cause
  - A stab wound
  - A paper bag injury
- Natural disease:
  - Tear of pleural adhesion
  - Subpleural abscess ot TBC cavity
  - Burst emphysematous bulla

Cause of sudden death



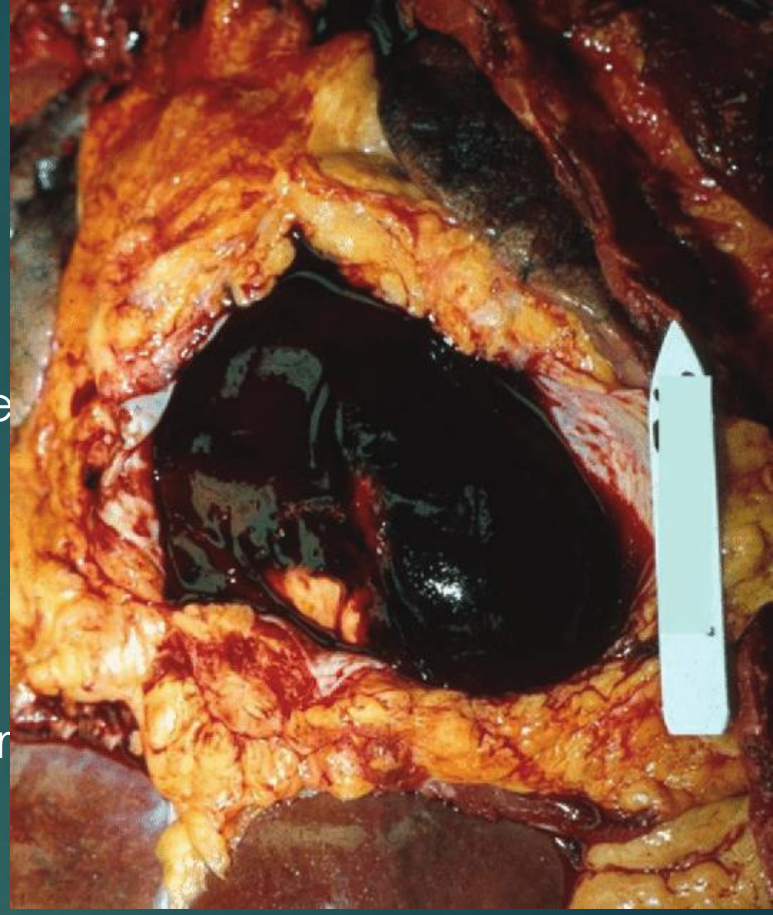
- Injuries of the lungs
  - Contusions „bruising“ of surface/deeper parts
    - Beneath the impact area or contrecoup
    - Decelerations injuries (falls/traffic accidents)-
      - contusions at posterolateral part mainly
    - Severe contusions-subpleural blood bisters/intrapulmonal haematomas
  - Lacerations
    - Tears in hilum, pleura, tissue, detachement of lobes
    - Tears of vessels (pulmonary veins) severe intraplueral/mediastinal haemorrhage
    - Sharp margins of rib fractures
    - Blast injury



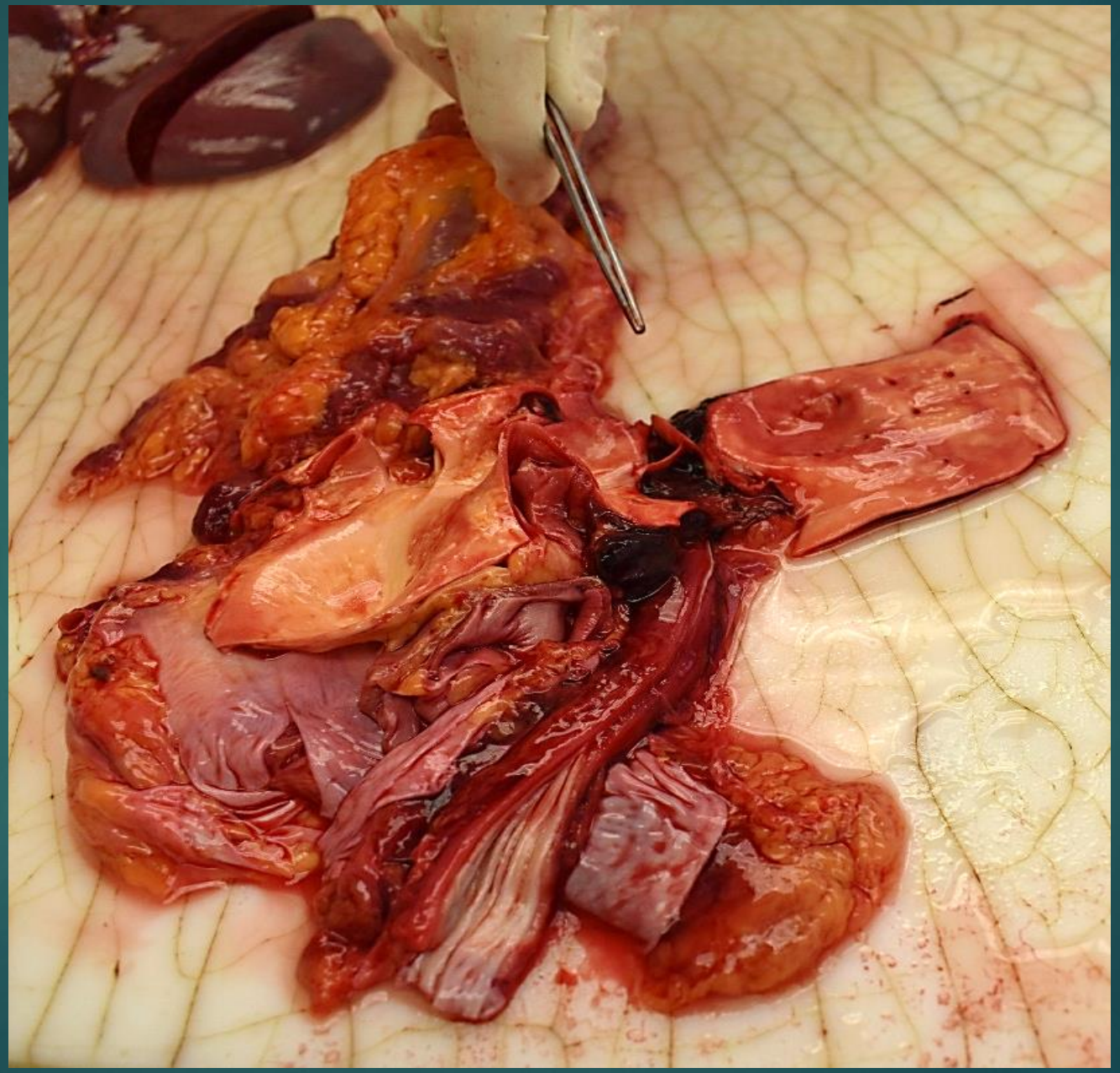
- Injuries to the heart
  - Traffic accidens, falls, stamping assaults
  - Associated with multiple rib/sternal fracture
  - On the front side-right ventricule
  - Posterior side-due to compression againts the thoracic spine
  - Avulsion from the root-airplane crash, falls from height
  - External
    - Bruising of epicardium-laceration opening the ventricular lumen widely
    - Hydrodynamic efffect-bursting of the heart in diastole
  - Internal
    - Rupture of I.V. septum

- Haemopericardium/tamponade
  - Bleeding from the surface, from cavities, from the itrapericardial segme

    of the roots of the great vessels
  - Tamponade= cause of death, 400 -500 ml sufficient
    - Rapidity of accumulaton 200 ml x 1500 ml in uraemic patient
  - Pressure in the sac increases and prevents passive filling of the atria dur diastole, CO and systemic blood pressure fall, venous pressure rises



- Injuries to great vessels
  - Aorta-deceleration trauma (falls, road accidents)
    - Thorax suddenly decelerated-heart mobile and attempts to continue in the original direction-traction and tears
    - constanty 1,5 cm distal to the attachment of the ligamentum arteriosum
    - One or multiple parallel tears „ladder rung“
    - partial (intima and media) or complete rupture
  - Pulmonay artery much less vulnerable, stamping assault, steering wheel impact
    - damaged in th root of the lung-frequent hilat tears



- Causes of death:
  - Severe blood loss-haemothorax,
  - Cardiac tamponade
  - Multiple rib fractures-pneumothorax, fat tissue embolism

5) Abdominal injuries

- Accidens and assaults-kicking stamping, heavy punchin, CAN
- Impact on steering wheel without safety belt
- Crushing between two vehicles or vehicle and wall
- Types of injuries:
  - Injury to the abdominal wall
  - Liver injury
  - Spleen injury
  - Intestine and mesentery injury
  - Kidney injury
  - Pancreas injury

- Injury to the abdominal wall
  - Surface abrasions and discrete bruises most often
  - Kick-scuffed abrasion
  - Fingertips or knuckle bruises-CAN-forcible grip
  - Clothing-no external signs of trauma!
  - Bruising of the skin/muscle/fat tissue
  - Vast bruising-tracking down of blood to the scrotum (haematocele) or labia

- Injury to the liver
  - Often, falls from height, crush injury, traffic accidents, impact on he steering wheel, pedestrians (primary impact, secondary thrown to the ground)
  - CPR
  - Types:
    - tears of the capsule
    - linear cracks,
    - laceration up to complete transection-liver tissue embolisation
    - internal tears (not comunicating with the surface)
    - subcapsular haematomas
      - CAN and childbirth

- Injuries to the spleen
  - Common surgical emergency
  - Impact on the abdominal wall or inferior part of the thorax-ribs IX.-Xi. Frr.
  - Traumatic ruptures, ruptures of enlarged spleen (malaria, glandular fever)
  - Impact/tracion
  - Ruptures:
    - Immediate-symptoms of haemorrhagic shock
    - Delayed-teras and large subcapsular haematoma arode the capsule-days/weeks

- Injuries to the stomach, intestine and mesentery
  - Extensive brusising due to crushing against the lumbar vertebrae
  - Duodenum and jejunum particularly vulnerable to compression-seat belt injury
  - Stomach less vulnerable unless full of foof or fluid
  - Rupture of colon/rectum-foreign bodies, high-pressure air hose

  - Contusion or laceration of the mesentery- accidents/assaults, compression
    - Tears-massive haemoperitoneum,
    - Trombosis-infarction, rupture, peritonitis

- Kidney injury
  - Direct-kicks, heavy blows to the loins
  - Indirect-deceleration
  - Traffic impact-pedestrians
  - Types:
    - Perirenal haemorrrhage-bruises in the fat capsule
    - Rupture of the capsule
    - Laceration up to detachment od poles, fragmentation
    - Damage to the vessels-post-injury infarction

- Injury of pancreas
  - Isolated uncommon
  - kick or heavy blow, stering wheel or handlebars impact (kids)
  - Compression against prominency of lumbal vertebra to the abdomen

  - Tears of capsule and peritoneum- acute peritonitis
  - Tears of ducts- acute pancreatitis
    - If isolated injury, delay of onset of symptoms of A.P.

- Injuries of the great vesels
  - Aorta-traffic injuries-seat belt injury
  - VCI- laceration/transection, retrohepatal region

- Complications of abdominal injury (potentially lethal)
  - Haemorrhage from any of the contained organs the spleen/mesentery
    - CAVE subcapsular laceration and delayed haemorrhage
  - Perforation of gastrointestinal canal
    - Penetration of stomach/duodenum-a chemical peritonitis and and immediate shock
    - Rupture of the small or large intestine- a generalized peritonitis if survival continus
    - Open wounds o abdominal wall- infection
    - Damaged pancreas- acute pancreatitis with fat necrosis in the omentum or mesentery

Complications of the blunt injuries (general)

- Haemorrhages
  - Subendocardial haemorrhages-flame-shaped and congluent-sign of shock (greater blood loss or hypotension)
- Infection
- Pulmonary trombembolism
  - Leg and pelvis injuries, bed rest
- Fat and bone marrow embolism
  - Pulmonary/cerebral-coma, death due to brainstem involvement
  - Contussion of fat tissue (stamping trauma), multiple fractures, also barotrauma, severe burns, mastectomy
- ARDS
  - Gross impact upon thorax, also explosion

- Acute kidney failure
  - Extensive muscle damage or skin burns-“acute tubular necrosis“-myoglobinuria
- Disseminated intracascular coagulation
- Air embolism
  - Venous-neck trauma
  - Arterial-lungs trauama, barotrauma of divers who ascend too rapidly
- Adrenal apoplexy similar to Waterhouse-Friedrichsen syndrome
  - Trauma of all types

Downfalls injuries

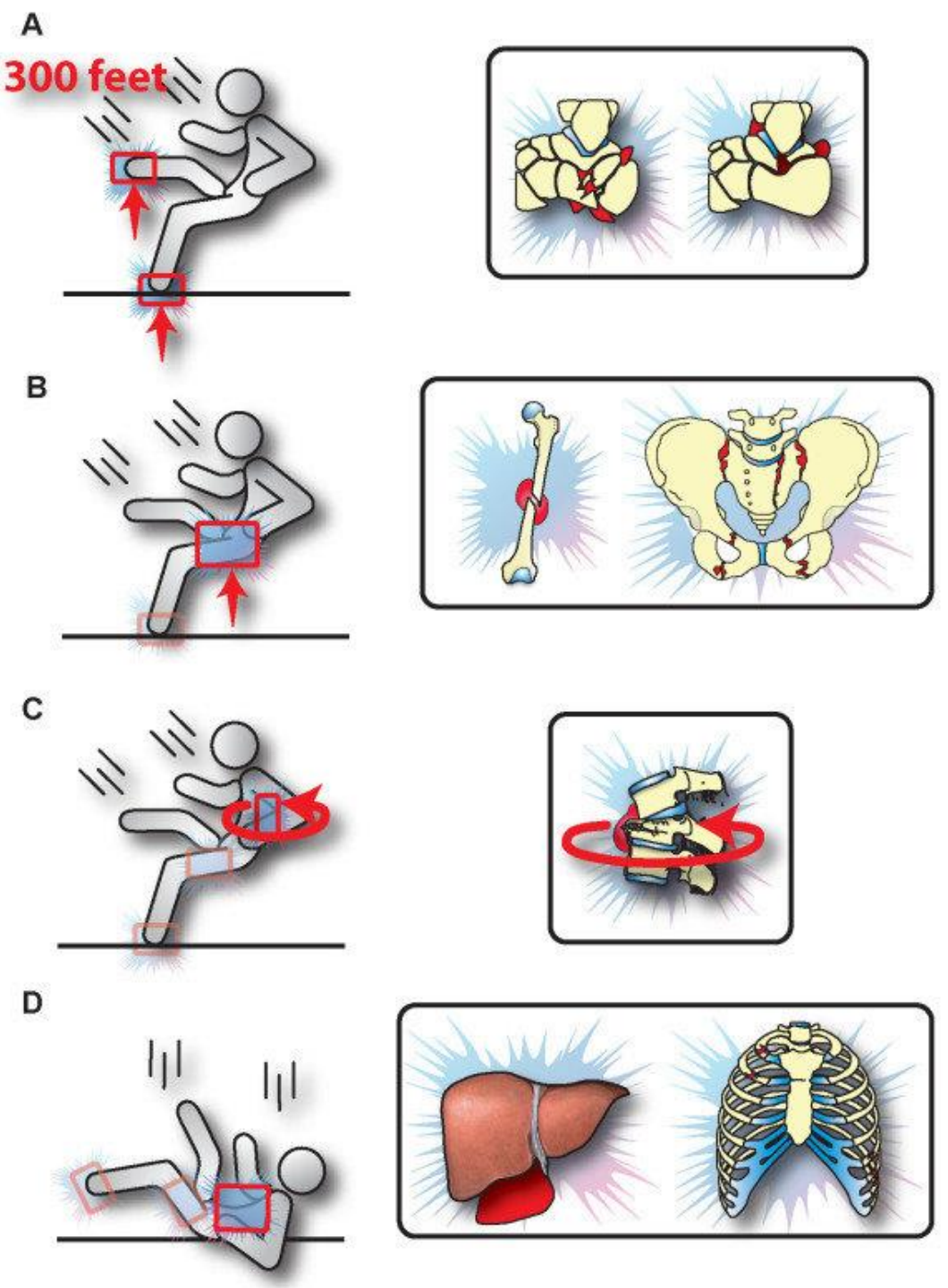
- Body in motion in contact with motionless objects
- Injuries due to contact
- Injuries due to transmission of force (deceleration-organs)
  - Free fall
  - Gradual fall (fom one level to another)

- Important aspects:
  - Height
  - Landing surface
  - Body position at the moment of contact with the ground

- Injuries on the body surface x injuries to the organs
  - Superficial:
    - all types of blunt injuries,
    - patterned injuries,
    - predominant one side
  - Injuries within internal examination
    - Contusions
    - Parenchymal organs lacerations incl. ligaments
    - Tears of mesentery and lung hilus
    - Rupures of the hollow organs (especially heard)
    - Ruptures and lacerations of the great vessels
    - Multiple fractures

- Specific injuries depending on position
  - Head –first position.
    - Comminuted fractures of the skull
    - Severe IC injuries
    - Brain laceratin and extrusion
    - The ring fracture
    - Spinal injuries (flexion/extension) Jefferson
    - Fractures of the sternum
    - Multiple ribs fractures
    - Compression fractures of the thoracic vertebrae

- Feet –first position
  - Open fractures of the calcaneus
  - Ankle distorsion and fractures
  - Fractures of the shin, femur, pelvis
  - Multiple rib fractures
  - Compression fractures of the vertebrae
  - Ring fracture



- Horizontal position
- Buttocks-first positon
- Lateral position
  - Central hip dislocation

High energy trauma

Fall from the height more than 3x stature

An Unconscious Man Falling Down Head First

A Man Dangerously Falls Down From A High Area

A Man Free Falling Down

A Man Falling Down Face First

A Man Falling Down Fast On The Ground

A Man Slipping On His Back

A Man In Panic While Falling Down

A Man Accidentally Falls Down

A Man Slipping And Landing On His Buttocks