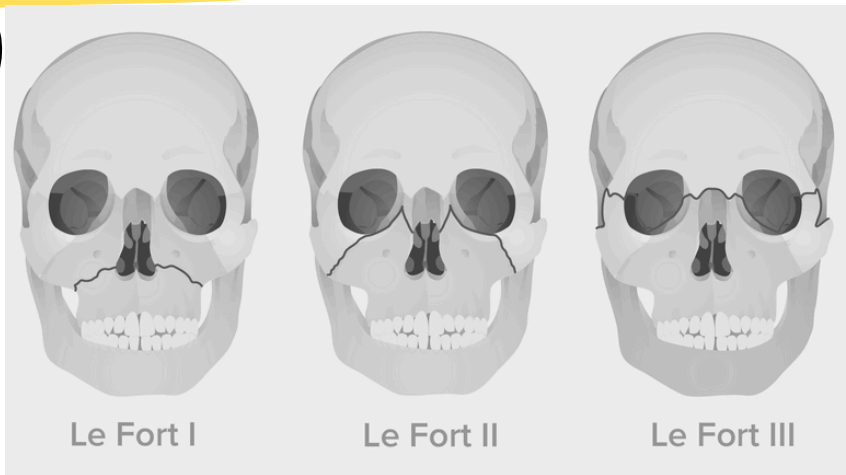


# Facial Trauma



**Le Fort I**  
thru maxilla and nasal septum  
mobile hard palate

**Le Fort II**  
+ through orbital floor/rim  
mobile nose  
CSF leak (abx)

**Le Fort III**  
+ through zygomatic arches  
entire face is mobile  
CSF leak (abx)

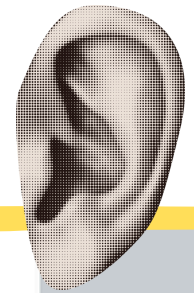
**tripod (ZMC) fracture**  
lateral orbit, zygoma, maxilla

**mandibular fracture**  
tongue blade test rules out open? IV antibiotics

**orbital blowout fracture**  
fracture of inferior or medial wall of orbit  
infraorbital nerve palsy (numbness of cheek/lip)  
inferior rectus entrapment (cannot look up)  
sinus involvement? abx  
teardrop sign

**auricular hematoma**  
<48 hrs, <2 cm - needle aspiration  
>48 hours, >2 cm - I+D (incision along helix)  
>7 days - refer  
consider abx  
pressure dressing, ENT f/u  
can lead to cauliflower deformity

**nasal bone fracture**  
check for septal hematoma  
incision and drainage  
anterior packing, ENT f/u, abx  
can lead to saddle nose deformity



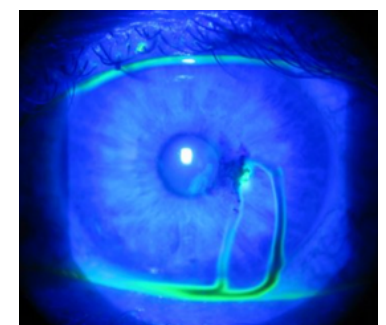
**tooth avulsion**  
Hank's balanced solution, milk, saliva, saline  
rinse, do not touch root  
re-implant ASAP (<60 min), splint (not baby teeth)  
dental follow up  
liquid diet  
abx



**tooth fracture**  
ellis classification  
I - enamel - white - smooth/file  
II - dentin - yellow - CaOH paste  
III - pulp - red - CaOH paste, abx, dentist ASAP  
liquid diet

**tongue laceration**  
repair:  
>1 cm, gaping, tip/anterior split, hemorrhage

**lip laceration**  
start with vermilion border (cosmetic)

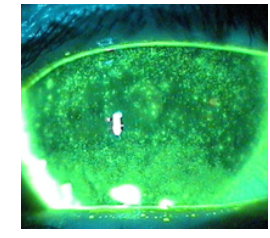


**globe rupture**  
**Seidel sign** - aqueous humor flows thru stain  
avoid US  
teardrop pupil  
elevate HOB, eye shield, abx/tetanus  
ophtho

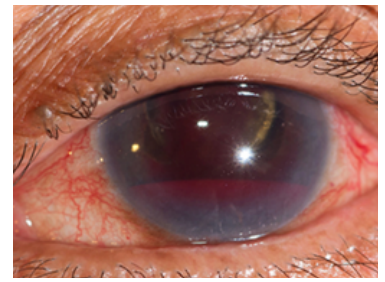
**retinal detachment**  
retina detaches from choroid  
remains anchored to optic nerve  
curtain closing vision loss  
floaters



**UV keratitis**  
welders, skiers, tanning booth  
punctate areas of stain uptake  
cover pseudomonas in lens wearers



**traumatic hyphema**  
blood in the anterior chamber  
graded by size - admit >33% (>grade I)  
ophtho  
elevate HOB, eye shield, pain meds,  
anti-emetics, cycloplegics, treat IOP



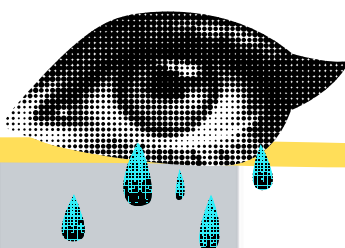
**foreign body**  
evert eyelid  
remove with swab or blunt tip needle  
rust ring - burr or f/u ophtho  
abx

**corneal abrasions**  
fluorescein stain  
abx - cover pseudomonas in lens wearers

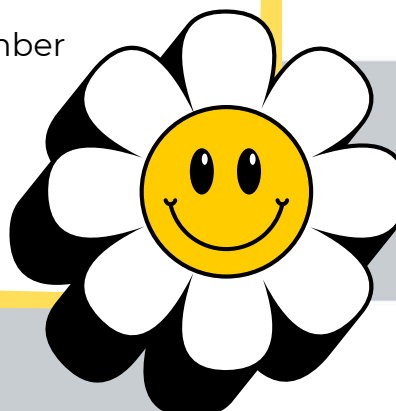
**chemicals**  
acid > alkaline  
acid - coagulative necrosis  
alkaline - liquefactive necrosis  
irrigate for 30 mins (1-3 L)  
until pH is 7.0  
abx

**retrobulbar hematoma**  
blood behind globe - proptosis,  
decreased visual acuity  
orbital compartment syndrome  
US - guitar pick sign  
optic nerve ischemia  
IOP >40 - lateral canthotomy (inf crus first)

**eyelid laceration**  
**needs ophtho repair:**  
exposed fat  
full thickness  
includes lid margin (>1 mm)  
within 6-8 mm of medial canthus (lacrima duct/sac involvement) -  
fluorescein flows thru lac below medial punctum  
ptosis/muscle involvement



**traumatic iritis**  
delayed  
contusion of ciliary body  
limbus injection, consensual photophobia  
sluggish pupil  
low IOP  
cell and flare in anterior chamber  
cycloplegics, steroids



# THORACIC TRAUMA

## pulmonary contusion

delayed onset  
ground glass opacity  
ARDS - low TV, high PEEP  
careful with fluids

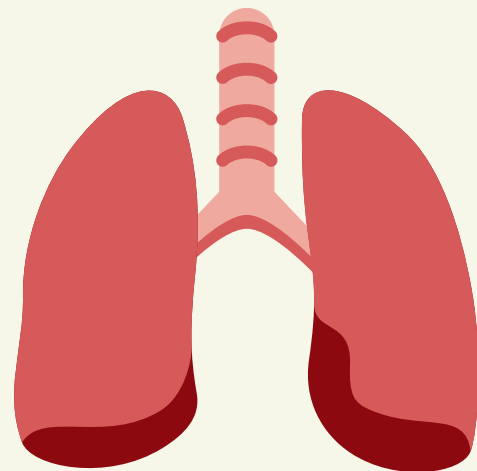
\*persistent hypoxia/air leak - laryngotracheal or bronchial injury

## rib fractures

ribs 1-2 - high impact, vascular, bronchial injury  
ribs 9-12 - worry about spleen/liver lac  
pulmonary contusion  
analgesia, nerve block,  
incentive spirometry  
RIB/SCARF score  
admit: old age, pain not controlled, low volume on IS, pre-existing lung disease

## flail chest

3 continuous ribs with  $\geq 2$  fractures  
segment moves paradoxically with breathing  
intubate early if respiratory failure



## pneumothorax

air in pleural space, collapsed lung

US - no lung sliding, bar code sign

CXR - measure apex to cupola distance  
small - O2, rpt CXR

moderate/large ( $\geq 2-3$  cm) - chest tube or pigtail (4th/5th ICS anterior axillary line)

no flights - 7-14 days

no scuba diving

**open** - three-sided occlusive dressing

## hemothorax

bleeding in pleural space (lung parenchyma)  
pigtail/chest tube

indications for OR thoracotomy:

initial output of  $>20$  mL/kg ( $>1500$  mL)

$\geq 150-200$  mL/kg output in first 2-4 hours

persistently unstable despite resus getting worse

## tension pneumothorax

unstable, absent breath sounds on one side, tracheal deviation, JVD, pulsus paradoxus

air entering but cannot exit

needle thoracostomy

(2nd or 3rd ICS mid clavicular line)

## cardiac injury

RV is MC injured

**valvular injury** - acute MR (systolic), AR (diastolic)  
ventricular free wall rupture

**cardiac contusion** - EKG (sinus tach MC), troponin, echo

**commotio cordis** - blunt trauma to chest during upstroke of T wave  
SCD - v. fib

## cardiac tamponade

blood fills pericardial sac from aortic/cardiac trauma

Beck's triad - distant heart sounds, JVD, hypotension, pulsus paradoxus

EKG - electrical alternans

US - RV diastolic collapse, RA systolic collapse

pericardiocentesis, arrest - thoracotomy

## pericardial inflammation syndrome

pericarditis 2-4 weeks after trauma

## aortic rupture

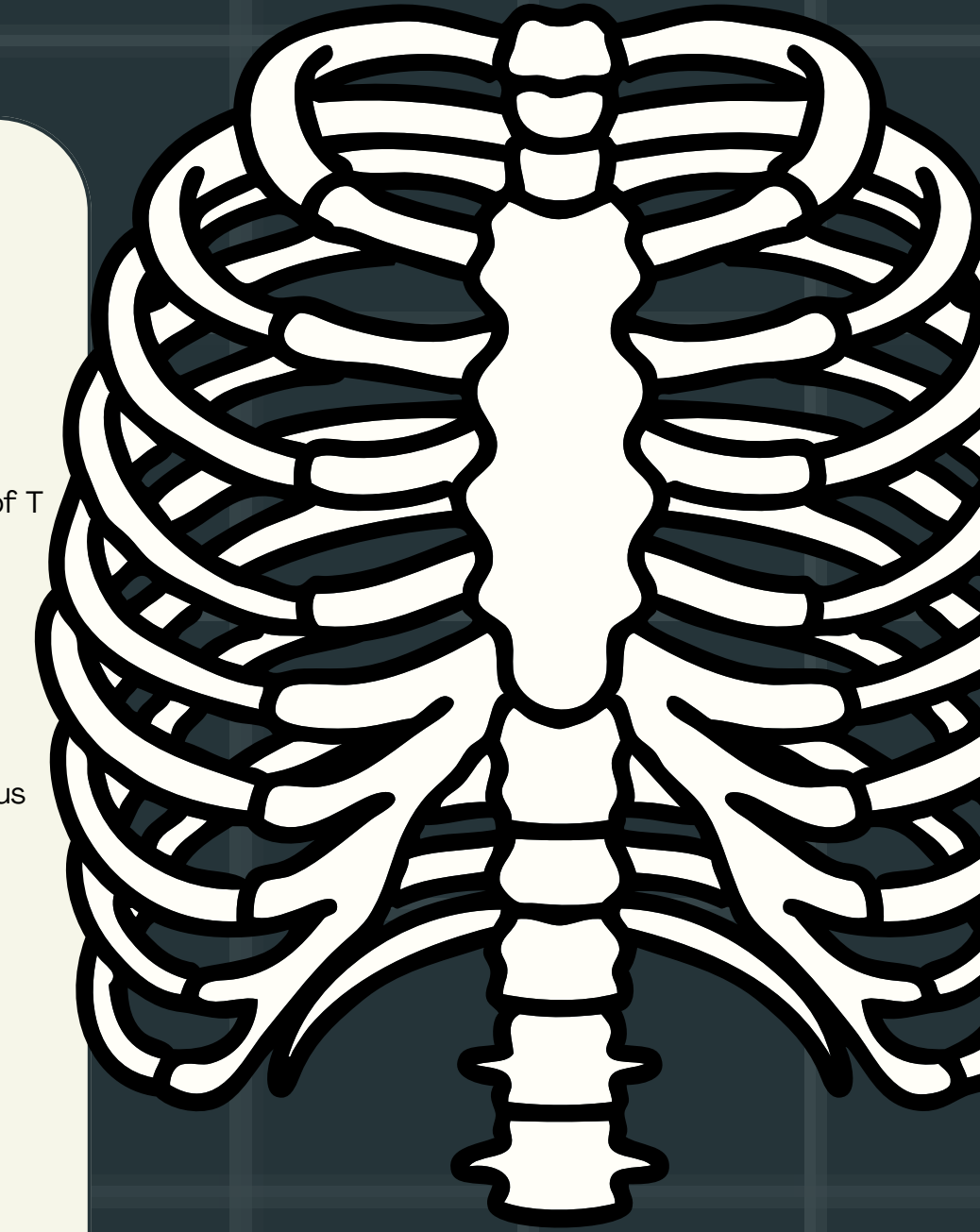
at isthmus, distal to left subclavian  
acute AR murmur  
widened mediastinum, esophagus displaced to R, downward L  
bronchus  
usually die on scene

## sternum/scapula fracture

high energy  
r/o other injuries

## clavicle fracture

**OR:** skin tenting, open, not neurovascularly intact  
middle third - MC  
proximal third - worry about thoracic injury



## thoracotomy indications (West Guidelines):

\*only if surgery available  
(avoid phrenic nerve)

### blunt trauma

$<10$  mins of prehospital CPR

### penetrating trauma

$<15$  mins of prehospital CPR  
 $<5$  mins of prehospital CPR in patients with neck/extremity penetrating trauma

profound refractory shock

# SHOCK

assume all shock is hemorrhagic in trauma

blood loss: street, femur, pelvis, abdomen, retroperitoneal, chest

5 L of blood in body, shock starts when 1.5 L is lost

Shock index = HR/SBP

pulse pressure = SBP - DBP

MAP = DBP - 1/3 (SBP - DBP)

## NEUROGENIC SHOCK

shock caused by a high spinal cord injury

bradycardia, hypotension, warm

(vasodilation)

no sympathetic tone

higher MAP goal - 85-90 (pressors)

## HEMORRHAGIC SHOCK

	CLASS I	CLASS II	CLASS III	CLASS IV
BLOOD LOSS [mL]	UP TO 750	750 - 1500	1500 - 2000	>2000
BLOOD LOSS [% VOL.]	UP TO 15%	15% - 30%	30% - 40%	>40%
PULSE RATE [BPM]	<100	100-120	120-140	>140
SYSTOLIC BP	NORMAL	NORMAL	DECREASED	DECREASED
PULSE PRESSURE	NORMAL OR INCREASED	DECREASED	DECREASED	DECREASED
RESPIRATORY RATE	14-20	20-30	30-40	>35
URINE OUTPUT [ mL/HR]	>30	20-30	5-15	NEGLECTIBLE
CNS/MENTAL STATUS	SLIGHTLY ANXIOUS	MILDLY ANXIOUS	ANXIOUS, CONFUSED	CONFUSED, LETHARGIC

## TRANSFUSION

whole blood is best

transfuse in 1:1:1 (pRBC:FFP:platelets)

FFP contains clotting factors

citrate (preservative in blood) binds calcium

causing hypocalcemia - give calcium when

transfusing

massive transfusion protocol - anticipating

>4 units

consider cordis placement if transfusing

O+ for males, O- for females

tranxemic acid

give within 3 hours for bleeding trauma pts

1 g over 10 minutes, 1 g over next 8 hours

## REVERSE ANTICOAGULATION

warfarin/Coumadin - vitamin K, FFP, PCC (K Centra)

Xa inhibitors (Xarelto/apixaban/rivaroxaban) - PCC, andexanet alfa

heparin - protamine sulfate (anaphylaxis)

direct thrombin inhibitors (dabigatran) - PCC, idarucizumab

anti-platelet (aspirin) - desmopressin (DDAVP)

platelet mapping - analyzes platelet function

TEG/ROTEM - analyzes blood and tells products patient needs

# SPECIAL POPULATIONS



## PEDIATRICS

unstable - transfuse 10 cc/kg of blood

hypotension is a late sign of shock, look for tachycardia first

**Wadell's triad** - ped struck  
femur fracture, c/l head injury, i/l intra-abdominal or intra-thoracic bleed

bones bend before they fracture  
(more likely to have pulmonary contusion than rib fracture)

**spinal injury** - cervical is MC

### non-accidental trauma

MC - neglect

burns - demarcated, cigarettes, stocking/gloves, patterned  
fractures - posterior ribs, multiple stages of healing, bucket handle fx (metaphyseal chip)

**shaken baby syndrome** - retinal hemorrhages

### TEN-4-FACEs

bites, bruises <4 months/walking, bruises on torso, ears, neck, frenulum, angle of jaw, cheeks, eyelids



## PREGANCY

trauma is leading non-OB cause of death  
screen for IPV

need **tocodynamometry for 4-6 hours** to rule out injury after trauma

**placental abruption** - placenta separates from uterus, painful vag bleeding in 3rd trimester

**uterine rupture** - loss of uterine shape, feel fetal parts

trauma also can cause **pre-term labor**

### other considerations:

chest tube 1-2 ICS's higher

do not skip CT if necessary - high rad risk at 2-8 weeks, 10-17 weeks for CNS

higher CO/HR/blood volume (masks hemorrhage)

higher FRC/O<sub>2</sub> requirement - desaturation during intubation

Rh - = rhogam

**Kleihauer-Betke test** - amt of fetal blood in mother's circulation - determines rhogam dose

**maternal shock** - displace uterus to L side to offload pressure on IVC



## GERIATRICS

beta blockers blunt tachycardia  
HTN may mask shock

less reserve

beware volume overload from  
transfusion

on anti-coagulants, polypharmacy  
(Beers criteria)

falls, osteoporosis

elder abuse - finances, lack of  
care, lack of hygiene