---TRAUMA---

Time of death
- Immediate: laceration of brain, brainstem, spinal cord, heart, major vessels
- Mins-hours: major hemorrhage of head, chest, abdomen, or mult. injuries
- Days-weeks: sepsis, mult. organ dysfxn synd (MODS)

Initial assessment

---Primary survey (and resuscitation)

ABCDE

Breathing:
- resp rate, cyanosis, air mvmt, equal chest rise, acc muscle use, JVD, tracheal deviation, open chest wounds, subq emphysema
- r/o: airway obstxn, tension PTX, open PTX, hemoTX, flail chest, card tamponade

O2 to all pts

agitated / belligerent pts – r/o hypoxia

needle cricothyroidectomy
- temporary airway b/c hypercarbia develops
- emergency airway of choice in kids

oropharyngeal or nasopharyngeal airway

definitive airway: orotracheal or nasotracheal (conscious pts) intubation

Circulation:

femoral/carotid pulse = BP >60mmHg

radial pulse = BP >80mmHg

inadeq. cerebral perfusion: anxiety→confusion→lethargy→unconsciousness

IV access
- saphenous v. cutdown
- kids <6 y.o. interosseous (IO) in tibia

LR #1 for resuscitation (physiologic concentrations)

NS #2 (can cz hyperchloremic met acidosis)

fluid bolus of 1-2L (20ml/kg in kids); if no response, transfuse

neurogenic shock: hypotension w/o tachycardia; give pressors and atropine

cardiogenic shock: d/t myocardial contusion or cardiac tamponade (rarely MI)

level of consciousness: AVPU (alert, responds to voice/pain, unresponsive)

GCS (10T highest if intubated)

---Secondary survey

AMPLE hx: allergies, meds, PMHx, last meal, events around injury

Assess for: dental malocclusion, neck crepitus, trach deviation, JVD, bruit, chest / pelvis compression

continuous EKG monitoring

XRay: lat cervical, AP chest and pelvis

NG tube (if no facial fx) to decrease gastric dilation (which can cz vasovagal response)

Rectal exam (tone, blood, prostate), perineum exam

Foley – if no blood at meatus and no abnl findings on prostate exam (if so need RUG)

---Definitive care

prioritize injuries

further imaging

Thoracic injuries

---Immediately lethal

Airway obstruction

Tension PTX; Rx: chest tube (4th intercostal @ ant/mid axillary line)

Open PTX; Rx: impermeable dressing – tape 3 sides; chest tube

Massive hemothorax; Rx: chest tube; if >1500ml total or >200ml/hr, thoracotomy required

Cardiac tamponade (Beck's triad: hypotension, JVD, muffled heart sounds)

- Rx: IVF bolus, pericardiocentesis w/ EKG or U/S guidance
- needle 1-2cm to left and inferior to xiphocondrial jxn, 45 deg toward L shoulder

Flail chest (2 or more fxs per rib) w/ pulmonary contusion

- injury + hypoventilation leads to resp failure
- Rx: analgesia, PEEP

---Potentially lethal

Pulmonary contusion (hemorrhage + atelectasis)

- Rx: ventilation, PEEP

Blunt cardiac injury

- usu R ventricle
- need EKG to assess for dysrhythmias (if nl BP and nl EKG, no further tests)
- Rx: antiarrhythmics or inotropic support

Blunt aortic injury – shearing at fixation points

- at ligamentum arteriosum in horizontal deceleration (MVA)
- at aortic arch in vertical deceleration (fall)
- at diaphragmatic hiatus (T12) in ant-post compression inj (MVA)
- Dx: contrast CT or TEE
- Rx: prevent HTN; surg

Diaphragm rupture

- 90% on left
- Dx: NG tube – will see in chest on Xray
- Rx: surg

Tracheobronchial tree or esophageal injury

- crepitus, PTX, hemoptysis
- may quickly lead to sepsis
- Dx: bronchoscopy, esophagoscopy
- Rx: ET tube, esophageal resection and diversion

---Nonlethal

- simple PTX, hemothorax, rib fx, mandible fx (dental malocclusion)

Abdominal injuries

unrecognized intraabdominal hemorrhage is a leading cz of death

4 zones: 1. upper abd; 2. lower abd; 3. pelvis; 4. retroperitoneum

remember to palpate iliac crests, pubic symphysis, check rectal tone

Dx: FAST good for hemo- pericard/ thorax/peritoneum

- DPL: 1st decompress bladder and stomach
- if >10ml blood, need laparotomy
- infuse 1L LR/NS: laparotomy if bacteria, bile, >500 WBC, 100K RBC/ mm3
- can't r/o retroperitoneal bleed
- CT if pt stable (may miss SB injury)

Spleen

#1 injured organ w/ blunt trauma
Rx: may require transcatheter embolization
1% develop OPSI (high mortality); give vaccines 2 weeks after splenectomy

Stab wound
in flank or back – require triple contrast CT (IV, PO, rectal)
diaphragm laceration requires laparoscopy

Pelvic fractures
1st r/o abd bleed
stabilize pelvis w/ external fixation (or at least wrap tightly)
do not enter pelvic hematoma (usu venous, allow to tamponade)
if bleeding continues, perform arteriography, embolization

Head injuries

#1 cz of trauma death
goal of Rx: prevent secondary brain injury
scalp lac can cz major hemorrhage b/c vessels held tightly in subQ tissue
Temporal lobe uncal herniation
compresses CN III = I/L pupil fixed + dilated
sometimes compresses corticospinal tract = C/L weakness
CBF=CPP/CVR; CPP=MAP-ICP; ICP nl<10
if ICP >20 Cushing reflex (↑BP, ↓HR, ↓RR) B/L dilated pupils; Rx needed
monitoring ICP: ventricular cath (lat vent) or subarach bolt
combatative / somnolent pt: assume hypoperfusion
Basilar skull fx: 1.raccoon eyes, 2. battle sign, 3. hemotympanum, 4. CSF oto/rhino-rhea
Risk of meningitis
cribiform plate fx
raccoon eyes, "target sign" on paper to test for CSF, avoid putting NG tube into cranium
C spine XR in all head trauma pts – 15% w/ fx
Concussion: brief LOC, 60% of all head inj
Diffuse axonal inj (DAI): grey white jxn inj, coma for weeks; in 45% of severe head inj
Contusion: focal inj, 15% of all head inj
Epidural hemorrhage: 0.5% of head inj, good Px
temporal skull fx, lucid interval, lens shape on CT, I/L blown pupil
Rx: burr hole, craniotomy
Subdural hemorrhage: 30% of head inj, worse Px
accel/decel inj, DAI; crescent shape on CT
acute, subacute, or chronic
Rx: open dura, craniotomy
Subarachnoid hemorrhage (SAH)
no mass effect
d/t trauma > berry aneurysm
Rx: anticonvulsants, EVD, observe
Head injury Rx
reverse trendelenberg
intubate / hyperventilate – keep PaCO2 30-35mmHg
mannitol
hypothermia
sedation – phenobarbital, propofol
enteral nutrition w/ in 24-48 hours

Other injuries

---Neck injuries
zone 1: sternal notch to cricoid – hi mortality d/t vessels, trachea; need CTA
zone 2: cricoid to mandible – lower mortality d/t easy exposure; CTA or U/S
zone 3: mandible to skull base – difficult exposure; CTA
violation of playsma requires further workup
---Spine and spinal cord injuries
assume C spine fx w/ inj above clavicles and w/ priapism
spinal shock: completely flaccid for days to weeks, then spastic
    Rx: methylprednisolone within 8 hours
---Peds trauma
keep child warm
no nasotracheal intubation
nl SBP = 80+2(age); nl DBP =2/3 SBP
IV access: IO into tibia
    IVF bolus: 20mg/kg up to 3 times
    if still unstable, transfuse 10ml/kg
    child's blood volume =8% (80ml/kg)
---Elderly
meds may mask Sxs (e.g. B blockers prevent tachycardia)
meds may make problem worse (e.g. coumadin, ASA)
---Pregnant women
No vasopressors!
keep patients in left lateral tilt position
early NG tube decrease aspiration
uterine rupture = fetal extremities palpable
---Extremity trauma
limb threatening: crush inj, major dislocation, open fx, vascular inj, compartment synd
check Doppler pressures
tetanus prophylaxis
better Px for replantation if sharply severed or if distal inj
reduce dislocations ASAP (reduces risk of AVN)
open fx: STAT ABX, irrigation, reduction
compartment synd: >35mmHg
    1st sign = decreased sensation; pain w/ passive stretch (pulses may still be present)
myoglobin induced ARF possible w/ severe muscle inj
    maintain UOP at >1ml/kg/hr