



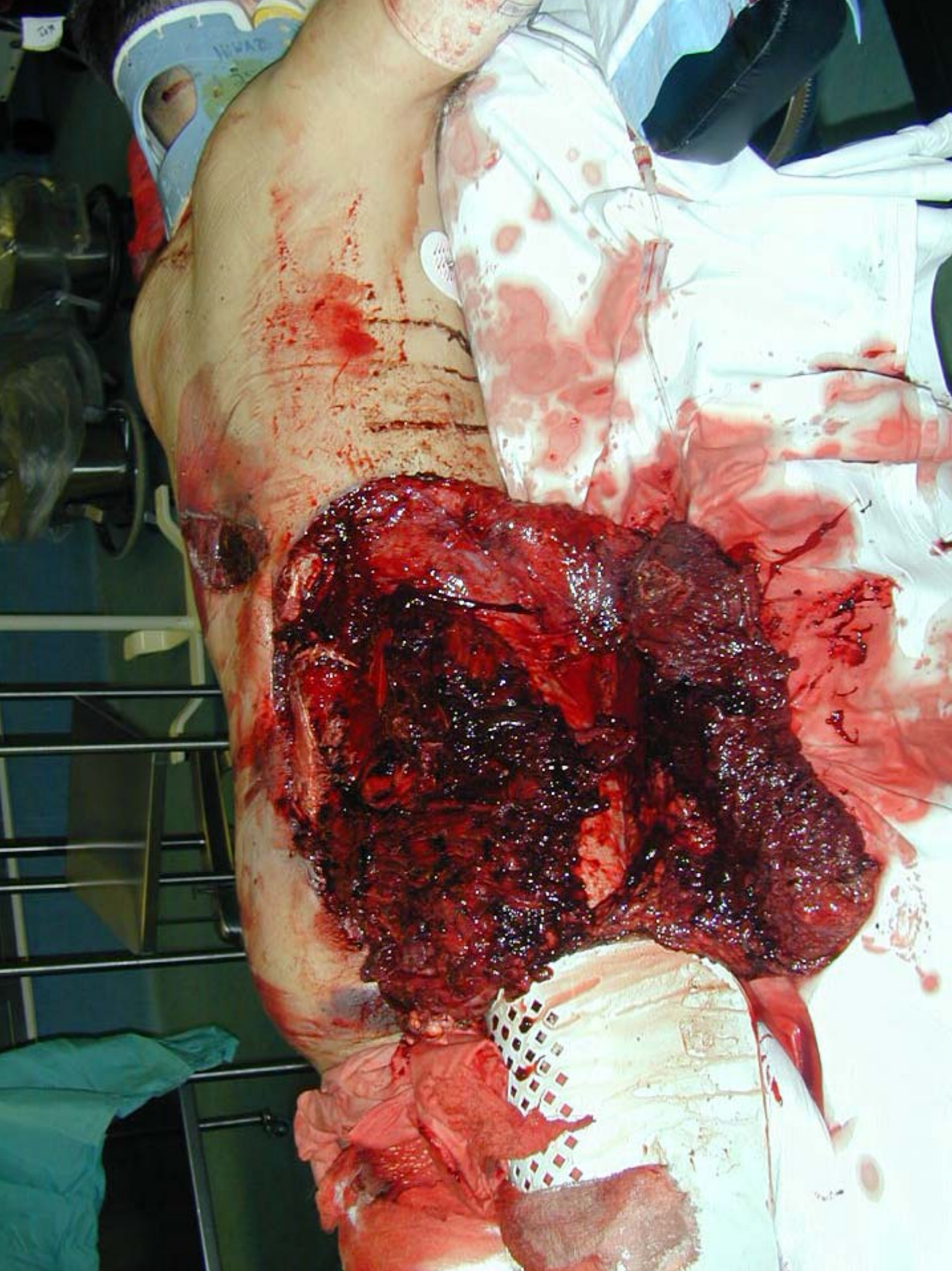
# Anesthesia for Trauma

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## OVERVIEW

- “It’s not the speed which kills, it’s the sudden stop”



# Epidemiology of Trauma

- ~8% worldwide death rate
- Leading cause of death in Americans from 1- 45 years of age
- MVC's leading cause of death
- Blunt > penetrating
- Often drug abusers, acutely intoxicated, HIV and Hepatitis carriers

# Epidemiology of Trauma

- “Golden Hour”
  - First hour after injury
  - 50% of patients die within the first seconds to minutes → extent of injuries
  - 30% of patients die in next few hours → major hemorrhage
  - Rest may die in weeks → sepsis, MOF



# Pre-hospital Care

- ABC'S
  - Initial assessment and BLS in trauma
  - GO TEAM: role of CRNA's at Maryland Shock Trauma Center
    - Resuscitation
    - Reduction of fractures
    - Extrication of trapped victims
    - Amputation
    - Uncooperative patients





















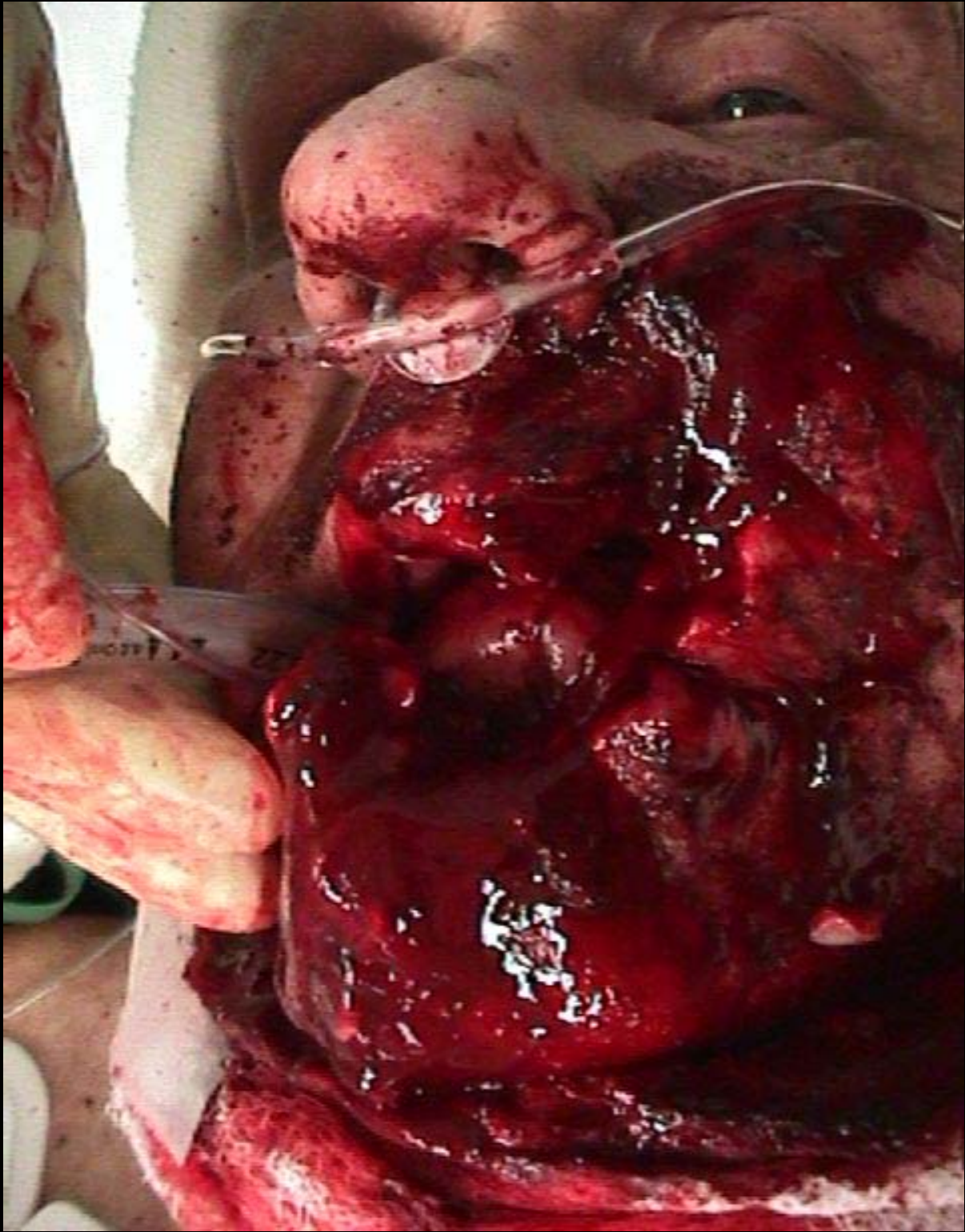




# Initial Management Plan

- Airway maintenance with cervical spine protection
- Breathing: ventilation and oxygenation
- Circulation with hemorrhage control
- Disability
- Exposure





# Initial Assessment

- Primary Survey:
  - AIRWAY
    - ALWAYS ASSUME A CERVICAL SPINE INJURY EXISTS UNTIL PROVEN OTHERWISE
    - Provide MANUAL IN-LINE NECK STABILIZATION
    - Jaw-thrust maneuver

# Initial Assessment

- Airway cont'd:
  - Cervical spine evaluation
    - Cross table lateral and swimmer's view Xray
    - Need to see all seven cervical vertebrae
    - Only negative CT scan R/O injury

# Initial Assessment

- Cervical spine cont'd:
  - Functional assessment of cervical level
    - C5 Biceps Abduct shoulder, Flex elbow
    - C6 Wrist extensors Cock wrist
    - C7 Triceps Extend elbow
    - C8 Finger flexors Grasp finger in palm
    - T1 Finger abductors Spread fingers

# Initial Assessment

ALWAYS ASSUME FULL STOMACH  
PRECAUTIONS → RAPID SEQUENCE  
INTUBATION

- Indications for intubation:
  - Airway obstruction
  - PaO<sub>2</sub> < 80 mmHg or SpO<sub>2</sub> < 90% with O<sub>2</sub>
  - Shock with SBP < 90 mmHg
  - Severe head injury or unconscious (GCS < 9)
  - Anticipated surgery with multisystem injury
  - Combativeness



# Initial Assessment

- Rapid sequence intubation (or modified)
  - Preox
    - Use slow inspiratory flow rates (1-1.5 sec inspiratory time)
    - Avoid stomach distention → gastric inflation occurs when inspiratory pressure exceeds EOP (~15-18 cm H<sub>2</sub>O)
  - “Pent, Sux, Tube”
  - May have to decrease amount of sedative drugs and give appropriate dose of RSI muscle relaxants
    - Succinylcholine: 1-2 mg/kg
    - Zemuron: 1.2 mg/kg
    - Vecuronium: .2 mg/kg

# Initial Assessment

- Airway cont'd:
  - Remove front of C-collar and maintain in-line stabilization
  - Cricoid pressure (Sellick's maneuver) after Pent given
    - 10 # pressure required to seal esophagus
  - MAC vs. Miller debate



## Initial Assessment

- Awake intubation: local, topical superior laryngeal nerve blocks
- Awake fiberoptic: may be too bloody
- Awake cricothyrotomy/tracheostomy
- Gum elastic bougie/LMA
- Know your difficult airway algorithm!

# Initial Assessment

- BREATHING
  - Always verify correct position of ETT, even if arrive intubated !!
  - 100 % O<sub>2</sub>
  - May have Combitube in; change to ETT
  - Nasal intubation: watch with basilar skull fractures

# Initial Assessment

- Circulation
  - Control hemorrhage first!
  - Crystalloids vs. colloids vs. blood products?
  - Alot or alittle?
  - Early or later?

## Secondary survey

- After primary survey complete, attempt to complete a head-to-toe assessment
- Ask pertinent questions if patient able to answer
  - Allergies, PMH//PSH, meds, ETOH/drug use, weight, last meal

## Trauma/preop assessment

- Cardiac: S/S shock, EKG changes
- Respiratory: Breath sounds, crepitus, respiratory patterns/distress, CXR
- Neurologic: GCS, LOC; assume C-spine injury until ruled out → Lateral C-spine Xray, palpate neck
- Renal: monitor urine output, amount and color



# Trauma/preop assessment

- Gastrointestinal: FULL STOMACH!!!
  - Gastric emptying slows or stops at time of trauma
- Endocrine: release of stress hormones (catecholamines and glucose)
- Hematologic: hypovolemic shock; coagulopathies

## Laboratory/diagnostic tests

- CBC, electrolytes, urinalysis, PT/PTT, lactate, baseline ABG (as condition permits); T&C for at least 4 units
- CXR, lateral C-spine, CT/MRI
- 12 lead EKG
- FAST: focused abdominal sonography for trauma
- DPL: diagnostic peritoneal lavage

# Anesthetic management of trauma patient

- Preop: Sedation rarely necessary
  - Versed in small doses (.5-1 mg IV)
  - Bicitra 30 cc preop

# Induction

- Standard monitors
- Preoxygenation
- Basic airway and difficult airway adjuncts
- RSI with cricoid pressure
- Invasive monitors as indicated

# Induction agents

- Thiopental 3-4 mg/kg; reduce doses in unstable patients; most commonly used in trauma
- Ketamine 0.5-1 mg/kg; useful for burn and hypovolemic patients; avoid with head injured
- Etomidate 0.1-0.3 mg/kg; reduce doses with hypovolemia; ?myoclonus effects
- Propofol 1-2 mg/kg in stable patients; reduce doses in hypovolemia

## Muscle relaxants

- Succinylcholine: 1-2 mg/kg; useful for RSI/emergency; contraindicated in burns, spinal cord injury and crush injuries > 24-48 hours after injury
  - May give nondepolarizing dose prior to Sux to inhibit fasciculations (esp. with SCI)

# Muscle relaxants

- Nondepolarizers
  - Vecuronium .28 mg/kg (250-300 mcg/kg) high dose; onset in 80 secs; duration 75-90 min; good cardiovascular stability without histamine release
  - Rocuronium 1.2 mg/kg high dose; onset 45-60 secs; duration 67 minutes

# Maintenance

- O<sub>2</sub>/air/Forane mixture
- Avoid N<sub>2</sub>O if any question of pneumothorax, pneumocephalus, pneumomediastinum, bowel injury
- Fentanyl 1- 10 mcg/kg/hr
- Monitor fluids and administer carefully
- Prepare to give blood products if necessary



# Hypothermia

- Common with traumatic injuries and related procedures
- Warm all IV fluids
  - Level 1: warms IVF and blood to 42°C and delivers at 75-30,000 ml/hr
  - Rapid infusion system (RIS): warms to 42°C and can deliver products as bolus and various rates, up to 3000ml/min; cell saver can be attached to system
- Forced air warming systems
- Heat moisture exchangers

# Emergence

- Normal extubation criteria
- Hemodynamically unstable, elderly with rib and long bone fractures, those who have received massive fluid and blood resuscitation, severe burns, and those with coagulopathies should remain intubated

# Postop

- Monitored and labs followed closely
  - Correct acid-base imbalances and electrolyte disturbances
- Long-acting opioids
- Epidural infusions
- Intercostal blocks
- Complications:
  - Hypothermia, atelectasis, V/Q mismatch, coagulopathy

# Mechanism of injury

- Blunt trauma: caused by high-velocity or low-velocity impact from generally dull objects
- Penetrating trauma: result of sharp objects piercing through tissue, such as stab wounds produced by knives or bullet wounds produced by gunfire
- Impalement injuries: combination of blunt and penetrating trauma
- Falls: vertical high-velocity injuries
- Burns: thermal, electrical or chemical

## Mechanism of injury cont'd

- Airway burns and smoke inhalation injuries: associated with carbon dioxide poisoning
- Environmental injuries: poisonous insects and snakes, animals or consequences of nature
- Biological, chemical or nuclear warfare

# Blunt trauma

- Result of direct impact, deceleration, continuous pressure, shearing, and rotary forces
- Associated with injuries from high-speed collisions and falls from heights
- Motor vehicle crashes (MVC) are classified as head on, rear impact, side impact, rotational impact, and rollover
- Injuries commonly much more severe than penetrating







# Penetrating trauma

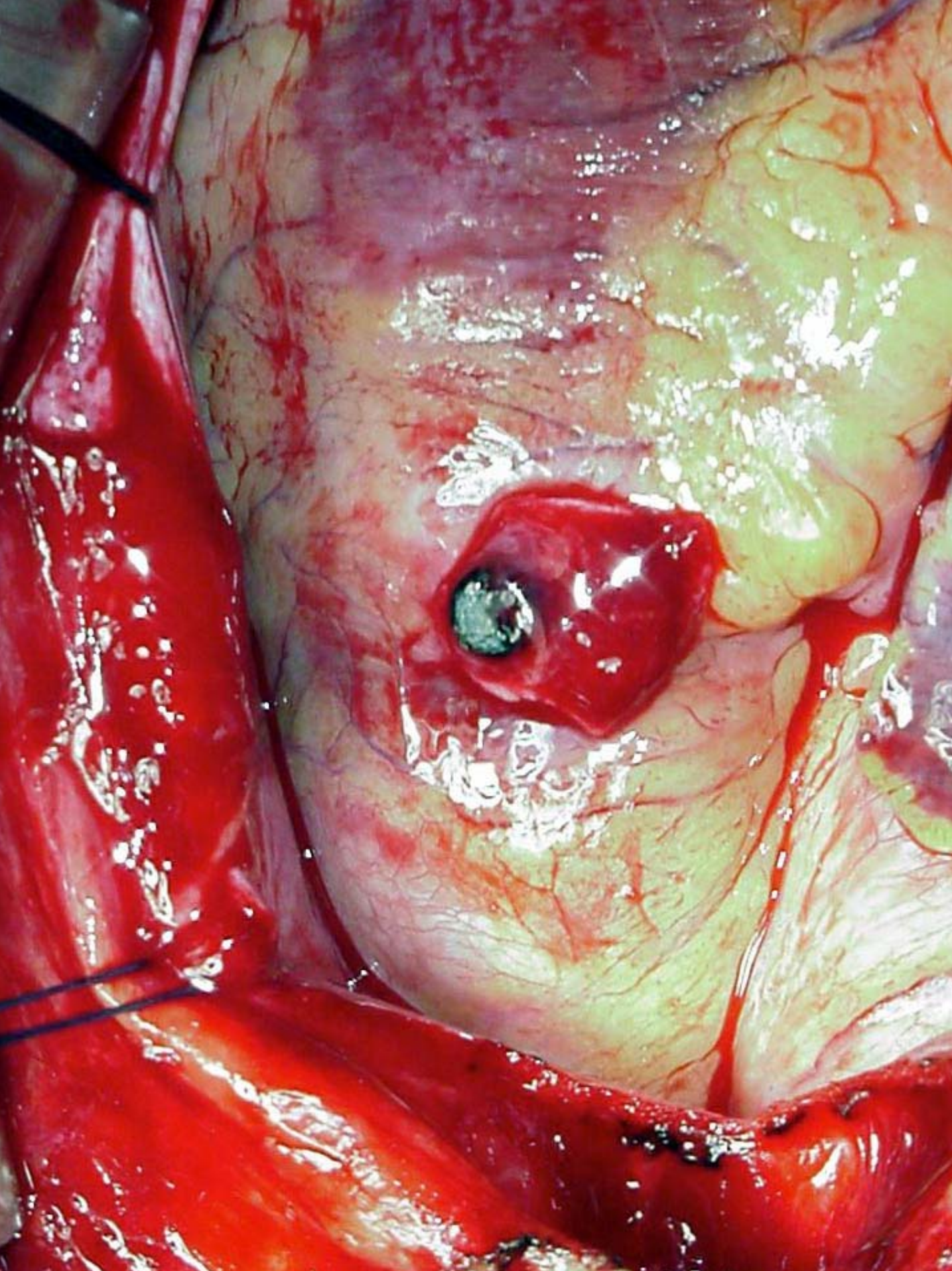
- Often requires surgical intervention
- Damage depends on 3 factors:
  - Type of wounding instrument
  - Velocity of instrument at time of impact
  - Type of tissue that instrument passes through (organs, vessels, nervous tissue, muscle, fat, bone)





## Thoracic injuries

- Blunt or penetrating trauma
- Most ominous sign: hypoxia from tension pneumothorax, hemothorax, flail chest, hypovolemia, cardiac tamponade
- Chest wall trauma can result in above



# Pneumothorax

- Accumulation of air between parietal and visceral pleura
- Results in severe V/Q mismatch and hypoxia
- S/S:
  - chest wall hyperresonant to percussion
  - Breath sounds decreased or absent unilaterally
  - Subcutaneous emphysema
  - CXR confirms
    - Treatment: needle decompression second intercostal space midclavicular line → chest tube 4<sup>th</sup> or 5<sup>th</sup> ICS, midaxillary line

# Hemothorax

- Can be caused from bleeding of heart and great vessels
- Fluid load before chest tube placement
- Differentiated from pneumothorax by dullness to percussion with absent breath sounds

# Tension pneumothorax

- Develops from air entering pleural cavity through a one way valve in lung or chest wall
- With each inspiration, more air becomes trapped in thorax, increasing intrapleural pressure
- Eventually the ipsilateral lung collapses and the mediastinum and trachea shift to contralateral side



# Tension pneumothorax cont'd

- S/S
  - Hyperresonance to percussion of chest wall
  - Ipsilateral absence of breath sounds
  - Contralateral tracheal shift
  - Distended neck veins?
  - Differentiated from cardiac tamponade by hyperresonance to percussion over tension pneumo
- Treatment
  - 14 gauge catheter 2<sup>nd</sup> ICS midclavicular line→ chest tube

# Flail chest

- Results from comminuted fractures of at least three adjacent ribs with associated costochondral separation or sternal fracture
- Accompanied by hemothorax or pulmonary contusion
- Patients with 3 or more rib fractures have greater likelihood of hepatic or splenic injury
- S/S
  - Paradoxical chest wall movement and/or splinting due to intense pain

## Flail chest cont'd

- Chest Xray and ABG confirm diagnosis
- Treatment
  - O2 with humidification
  - Pain meds:
    - IV
    - thoracic epidural
    - intercostal blocks

# Pulmonary contusion

- Intra-alveolar hemorrhage and edema resulting from sudden increase in intra-alveolar pressure and rupture of alveolar-capillary interface
- Difficult to diagnosis; high index of suspicion with thoracic injuries
- Treatment
  - If worsening respiratory failure, intubation with PEEP, frequent suctioning to avoid bronchial plugging and atelectasis, and careful volume resuscitation

# ARDS

- Later pulmonary complication
- Attributed to direct thoracic injury, sepsis, aspiration, head injury, massive transfusion, oxygen toxicity, and fat embolism
- Mortality rate reaching 50%

# Myocardial contusion

- Associated with blunt trauma
- Contusion most often right ventricle since lies directly posterior to sternum
- S/S
  - Dysrhythmias: heart block to Vfib; ST segment elevation
  - Elevated CPK-MB; ? troponin elevation
  - CHF
  - Anginal pain which may or may not respond to nitrates

# Myocardial contusion cont'd

- Treatment
  - Management of dysrhythmias
  - Increase CVP to optimize right ventricular output

# Cardiac tamponade

- Life-threatening emergency
- Bleeding into pericardial space, which restricts cardiac filling during diastole and creates a low cardiac output state
- Initial symptoms
  - Dyspnea
  - Orthopnea
  - tachycardia



# Tamponade cont'd

- Classic symptoms
  - Beck's triad → neck vein distention, hypotension, muffled heart sounds
  - Pulsus paradoxus: > 10 mmHg decrease in blood pressure during spontaneous inspiration
    - May not be evident in hypovolemia
- Treatment
  - Pericardiocentesis: 16 g catheter inserted at the xiphochondral junction toward left scapula at 45\* angle
    - If advanced too far, will see ectopy
    - Requires thoracotomy
    - Fluid load and treat with pressors if necessary
    - Avoid bradycardia; Ketamine useful agent

# Associated thoracic injuries

- Aortic rupture
- Valvular rupture
- Septal rupture
- Diaphragmatic herniation
- Esophageal rupture

# Abdominal and Pelvic trauma

- High risk for exsanguinating hemorrhage and peritonitis
- Results from blunt and penetrating trauma
- Retroperitoneal injuries can damage abdominal aorta, IVC, kidneys, pancreas, duodenum
- Intraoperative injuries can injure spleen, liver, stomach, small bowel, colon, rectum



## Abdominal and pelvic injuries cont'd

- Intraabdominal injuries associated with paralytic ileus and peritoneal irritation (muscle guarding, tenderness to percussion, abdominal distention)
- >1-3 liters of blood can sequester in abdomen/retroperitoneal space with minimal signs
- Diagnosis confirmed with free air on Xray or FAST or CT or by bloody DPL

## Diagnostic peritoneal lavage (DPL)

- Performed when abdominal injury suspected from mechanism of injury
- Not performed routinely now that FAST available
- FAST and DPL can prevent unnecessary exploratory lap
- Can use local with sedation

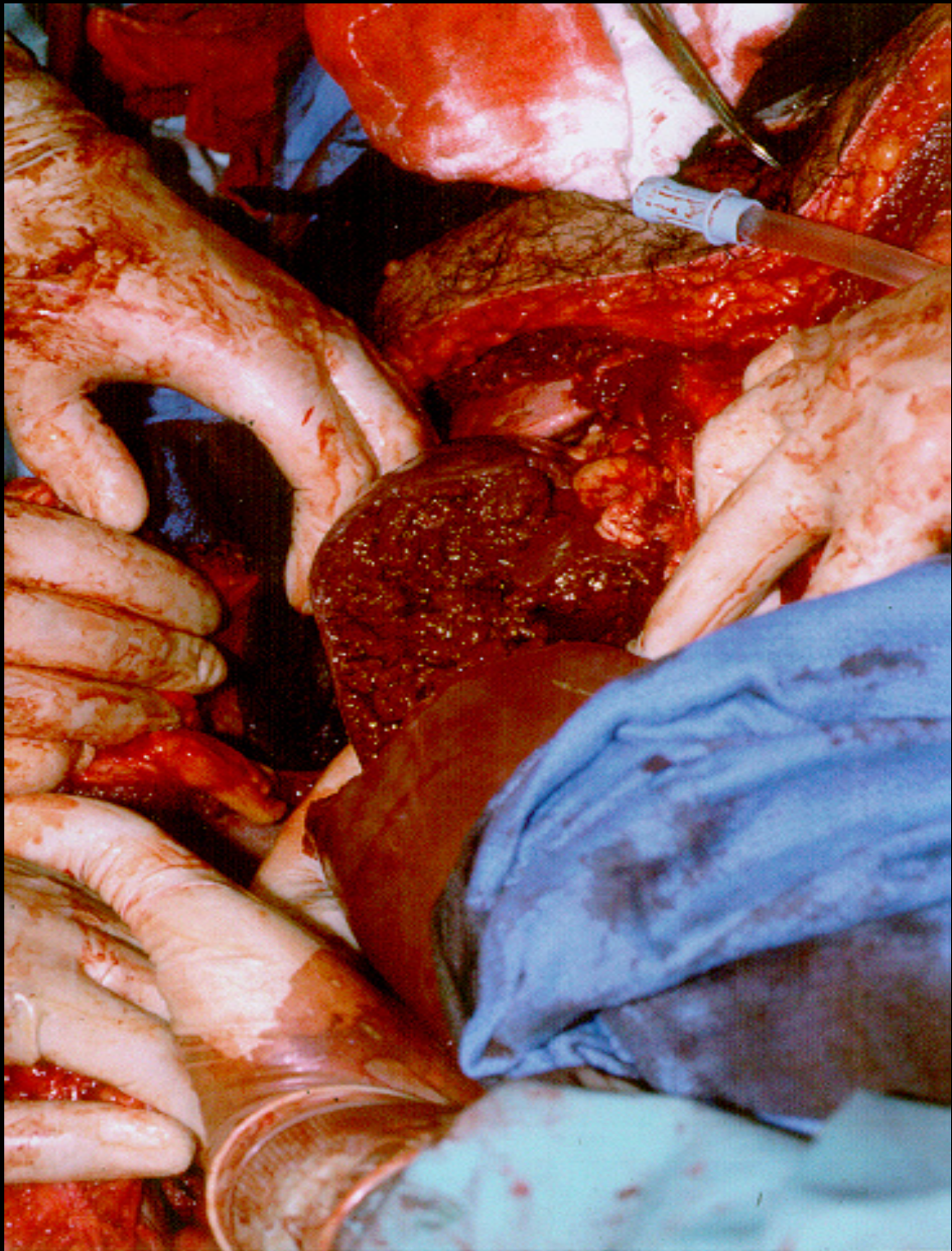
## DPL cont'd

- Peritoneum lavaged with fluid that is then drained by gravity and examined for presence of RBC's, bile, amylase, and WBC's
  - Positive finding: >10 cc gross blood
    - >100,000 RBC's/ml
    - > 500,000 WBC's/ml
    - Amylase > 200 units
    - Bacteria
  - False positive results < 2%

# Splenic laceration

- Most common injury in blunt abdominal trauma and with penetrating wounds of left lower thorax and upper abdomen
- Routine splenectomy rare
- Splenorrhaphy (repairing the spleen) more common
  - Decreases incidence of sepsis
  - Can take to angiography to embolize lac





## Liver laceration

- Second most common injury associated with abdominal trauma
- Exsanguinating hemorrhage can occur
- Majority of liver injuries (85-90%) heal spontaneously and may only require surgical drainage

# Pelvic fractures

- Result in major hemorrhage 25% of time
- Exsanguination 1% of time
- Bleeding results from disruption of veins from bone fragments
- Emergent or elective external fixation can be followed by angiography
  - Arterial bleeding can be embolized
  - Bladder injuries often associated with pelvic fracture
    - Urethrogram should be performed before foley inserted



# Abdominal and pelvic trauma

- Anesthetic concerns revolve around hemorrhage, hypothermia, sepsis/peritonitis and impairment of ventilation
- Warming measures are crucial since large heat loss from open mesentery and shock
- Avoid N2O to prevent bowel distention
- Fluid resuscitation imperative
  - The pelvis can hold up to 3 liters

## Extremity trauma

- Usually not immediately life-threatening and part of secondary survey
- Can be associated with vascular injuries causing hemorrhage, shock, sepsis, fat emboli, and thromboembolic hypoxic respiratory failure



## Open fractures

- Ideal to repair in first few hours post injury so full stomach precautions
- Should repair within 6 hours to lessen incidence of sepsis
- If obvious hemorrhage, hold pressure manually; can have MAST pants applied while in field





# Vascular trauma

- S/S
  - Pain
  - Pulselessness
  - Pallor
  - Paresthesias
  - Paresis
  - Confirmed with angiography

# Compartment syndrome

- Characterized by severe pain in affected extremity
  - Calf pain on dorsiflexion of foot
- Emergency fasciotomy must be done to prevent irreversible muscle and nerve damage
- Diagnosis confirmed by compartment pressures > 40 cm H<sub>2</sub>O

# Long bone fractures

- Commonly lead to thromboembolic hypoxic respiratory failure due to fat globules or fracture debris reaching pulmonary vascular bed
- Fat embolism syndrome:
  - Fever
  - Petechiae
  - Dysrhythmias
  - Fat globules in urine, plasma, retinal vessels
  - Mental deterioration 1-3 days post trauma

## Fat embolism syndrome cont'd

- Diagnosis: elevated serum lipase, fat in urine, and thrombocytopenia
- Treatment: early fracture stabilization is key to prevention
  - Aggressive cardiovascular and pulmonary support

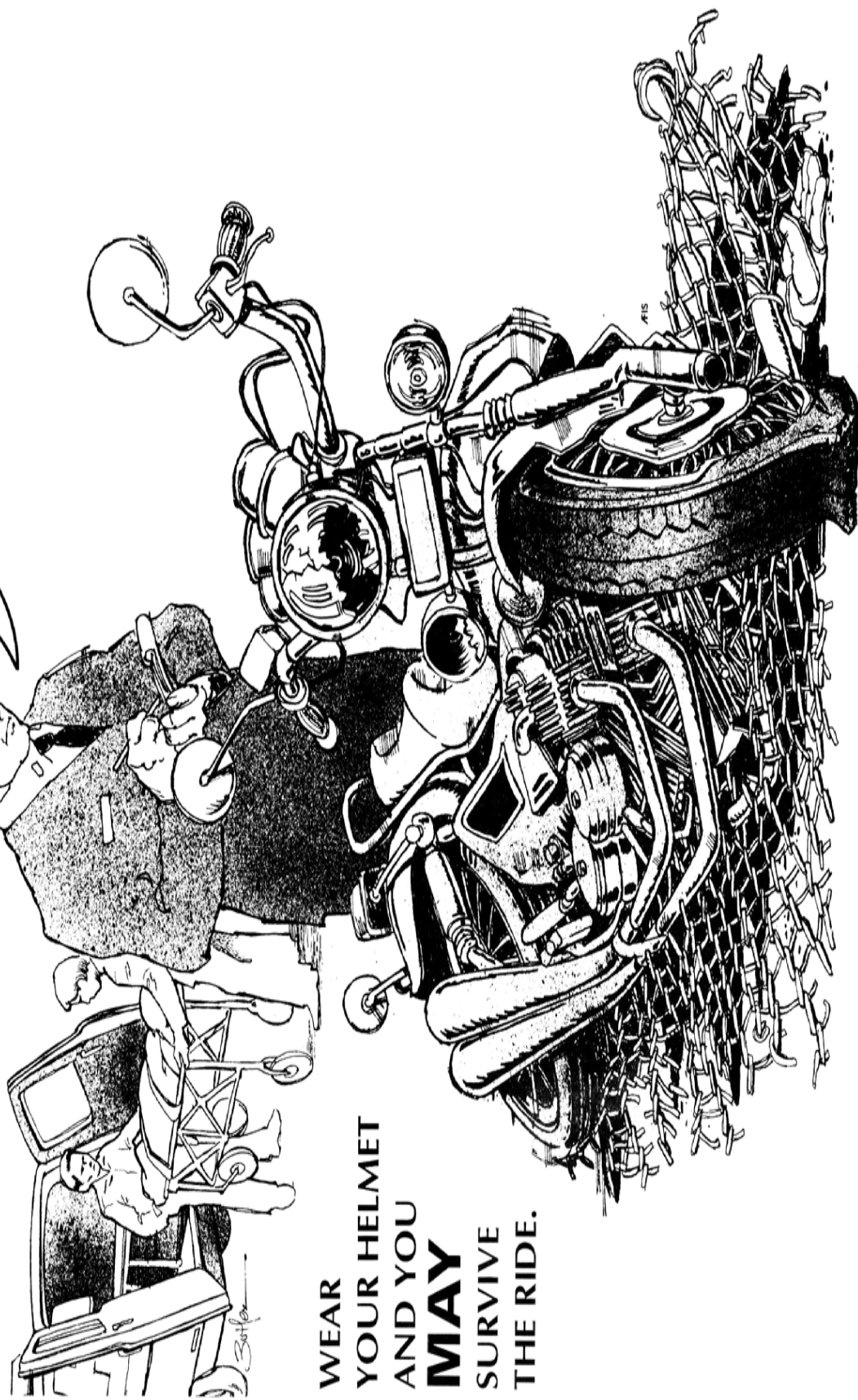
# Anesthetic concerns with extremity trauma

- Positioning
- Associated injuries
- Tourniquets

# Crush injuries

- Can occur with blunt and penetrating trauma
- Increased risk of myoglobinuria, leading to rhabdomyolysis
- Always check urine and document color with trauma patients; inform surgeon immediately if becoming bloody
  - Need to hydrate, osmotic diuretics, alkalize urine to protect kidneys
  - Follow lactate; > 2 can be sign of under resuscitation

WHEN YOU NEED YOUR  
HELMET, YOU WON'T HAVE  
TIME TO GO BACK  
AND GET IT.



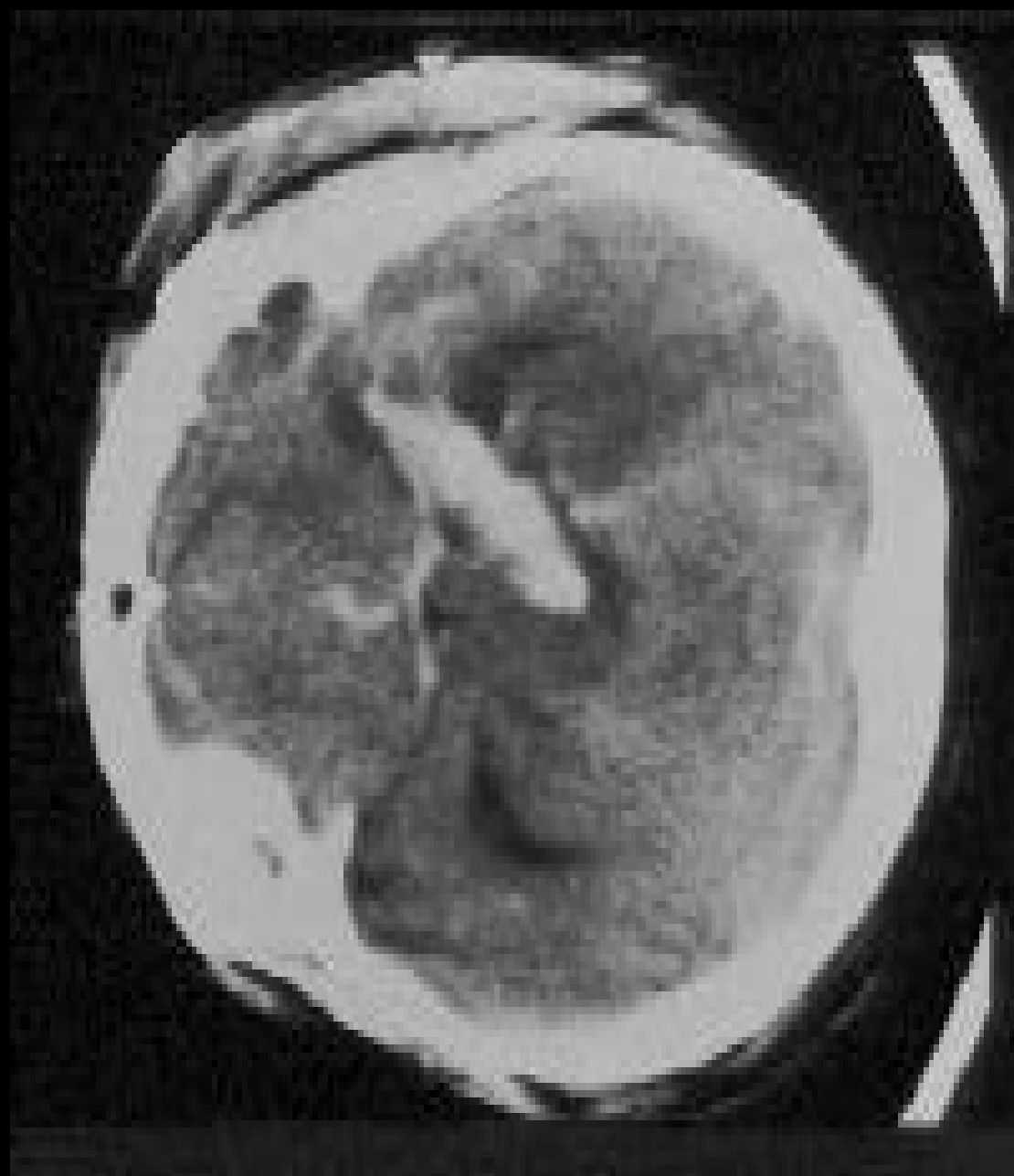
WEAR  
YOUR HELMET  
AND YOU  
**MAY**  
SURVIVE  
THE RIDE.



# Head injury

- Goal is prevention of secondary brain damage resulting from intracranial bleeding, increased ICP, edema
- Management should include early control of airway, cardiovascular stability, and avoidance of increased ICP
- Patients with suspected head injury should be placed head up position to promote venous drainage and decrease ICP; moderate hyperventilation to 30 mmHg





# Spinal cord injury

- High index of suspicion related to mechanism of injury
- Always treat as suspected C-spine injury unless proven otherwise
  - C collar
  - Inline stabilization with intubation
  - RSI/airway adjuncts

# Signs and symptoms related to SCI

- Paralysis
- Pain
- Position: patient holding head upright with both hands may indicate Jefferson (hang man) fracture C1; “hold-up” position with arms above head may indicate C4-5 fracture; “prayer position” with arms folded across chest possible C5-6 fracture



Platanus sp. T. L. ...

2

## S/S of SCI cont'd

- Paresthesias
- Ptosis
- Priapism

# SCI

- Leading cause of death at scene:  
aspiration
- Most injuries occur in males in 20's-30's
- Occur from falls, MVC's, diving injuries,  
penetrating missiles, sports injuries
- Must obtain lateral C-spine Xray
  - C7 most common site of injury



# Anesthetic management with SCI

- Nasal intubation method of choice if patient does not have associated basilar skull fracture/LeFort 2-3 fractures
  - Topical anesthesia
  - Avoid transtracheal block due to increased risk of aspiration and movement of neck with coughing
- Oral intubation: induce patient then remove front of C collar and hold in-line stabilization/RSI

## Muscle relaxants with SCI

- Succinylcholine: do not give to patients > 24 hours post massive muscle or denervation injuries, SCI's, crush injuries or burns
  - Acutely may want to avoid secondary to fasciculations that may exacerbate SCI
  - \Can give curarizing dose of NDMR
  - High dose Vec or Roc good alternative

# Spinal shock

- Hypotension
- Bradycardia
- Hypothermia/poikilothermia (body temperature migrates toward environmental level)
- Results from sympathectomy in SCI patients
- More intensified at T6 level and higher

# Spinal shock

- Patients present with hypotension, bradycardia and warm, pink extremities
  - Hemorrhagic shock tend to be hypotensive, tachycardiac with cold, clammy skin
- Treatment:
  - Careful volume resuscitation
    - Unable to maintain adequate cardiac filling pressures but overaggressive fluid administration can precipitate pulmonary edema (neurogenic)

## Spinal shock cont'd

- May require pressors → Dopamine 4-5 mcg/kg/min
- Avoid using radial arteries for arterial line if paraplegic
  - If arm embolizes, patient at severe disadvantage

# Autonomic hyperreflexia

- Seen in 85% of patients with injuries above T5
- S/S
  - Hypertension
  - Bradycardia
  - Dysrhythmias
  - Cutaneous vasodilation above and vasoconstriction below injury
  - Severe headaches
  - Seizures
  - Loss of consciousness

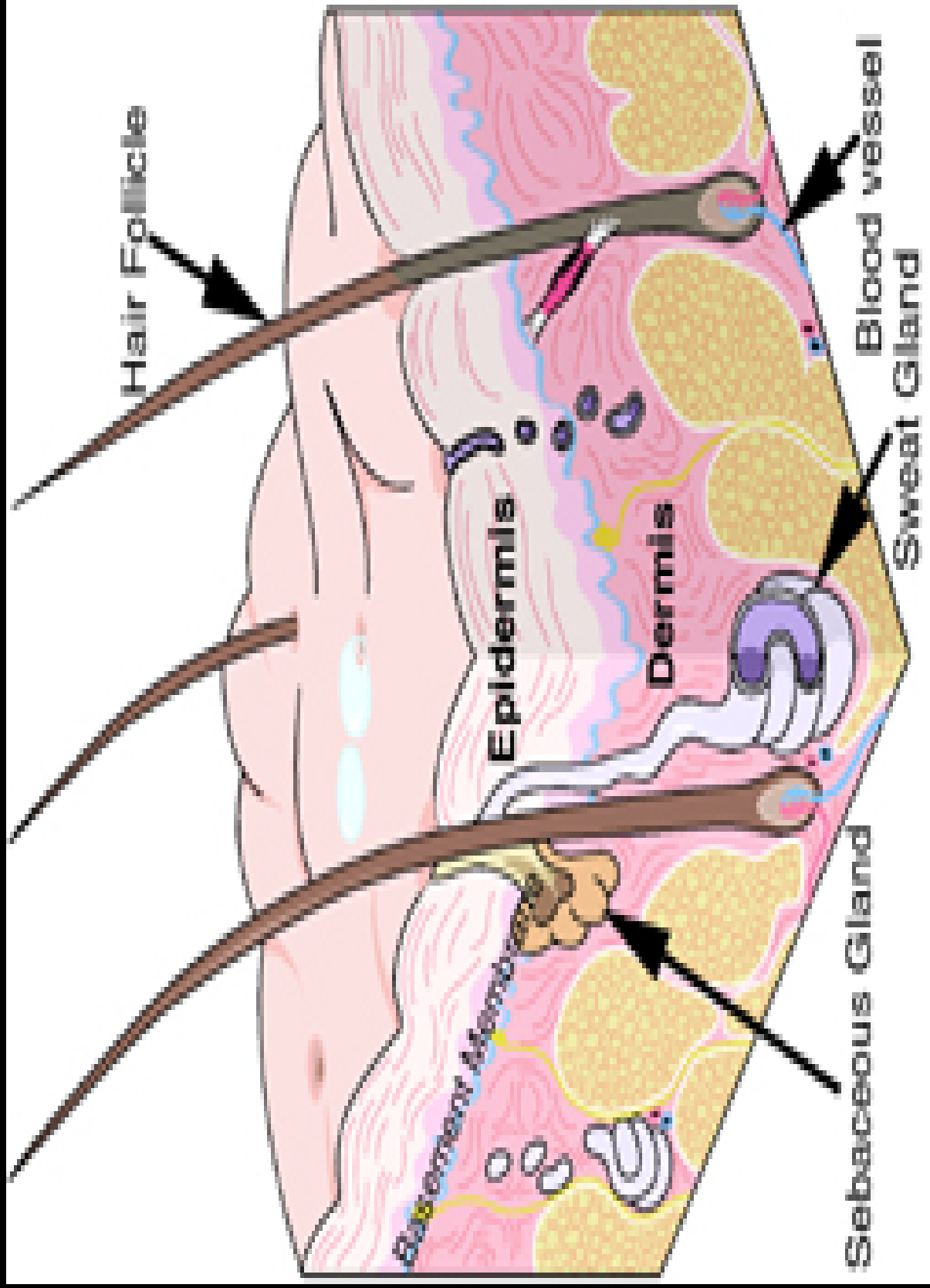
# Autonomic hyperreflexia

- Occurs after spinal shock passed
- Usually seen >24 hours post injury and when patients return to OR for subsequent operations
- Caused by stimulation below level of lesion
- Treatment: stop stimulus; deepen anesthesia; cardiovascular support

# Thermal injury

- > 2 million patients will be brought to trauma centers for burns and associated injuries
- Majority are thermal injuries in children < 5 years
- Electrical burns cause tissue damage by thermal injury and injury to underlying structures and heart
- Chemical burns depend on chemical, concentration, and duration of exposure





## Degree of burn

- First-degree burn: superficial involving upper layers of epidermis; skin red and edematous and painful like sunburn
- Second-degree burn: partial thickness burns extend damage through dermis; regeneration can occur; blisters develop and have white or red areas that are painful

## Degree of burn cont'd

- Third-degree burn: full thickness burn characterized by destruction of all layers of skin, including nerve endings; skin will not regenerate and healing does not occur unless dead tissue debrided and skin grafts placed; skin charred and not painful
- Fourth-degree burn: involve destruction of all layers of skin and extend into subcutaneous tissue, fascia, muscle, and bone

# First degree burn (epidermal burn)



Second degree burn (superficial dermal burn)



# Third degree burn (sub-dermal burn)



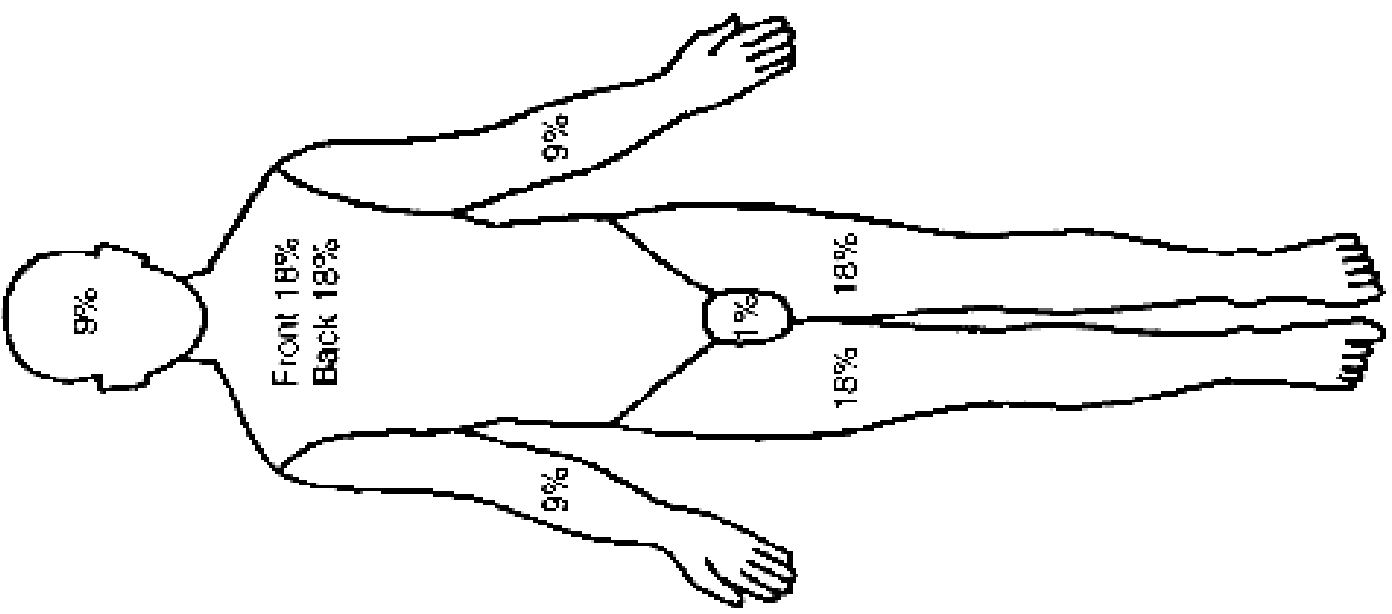
# Fourth degree burn

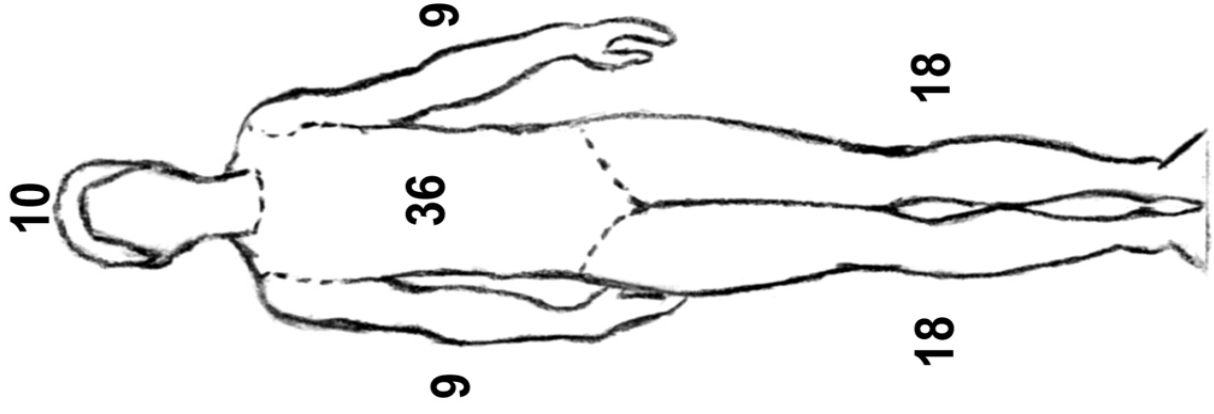


# Rule of Nines

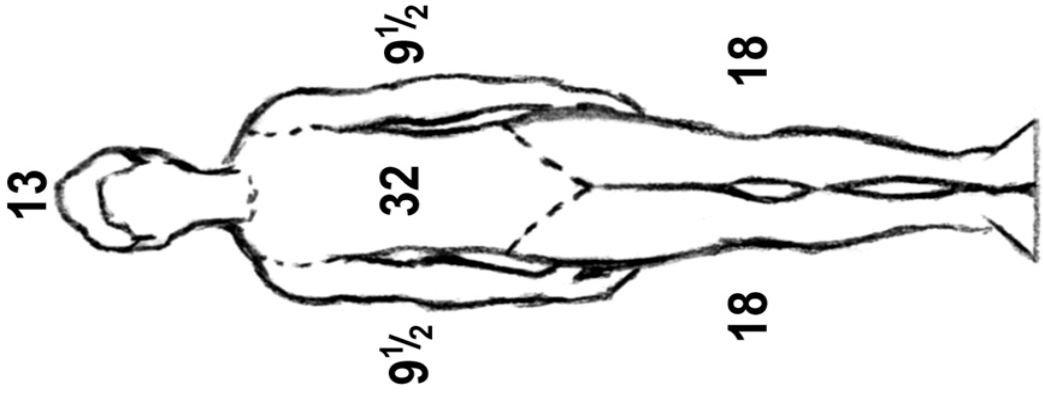
- Size of burn estimation to assess total BSA burned
- Body divided into regions that represent 9% or multiples of 9% of total BSA
- Adults: head/neck 9%; arms/hands 9% each extremity; thighs/legs 18% each extremity; anterior/posterior trunk 18% each side; perineum 1%
- Children calculated slightly different due to large head
- Size of hand roughly equal to 1% BSA



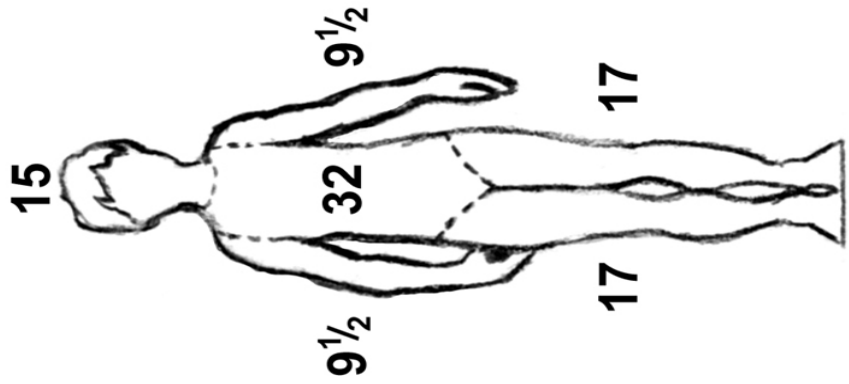




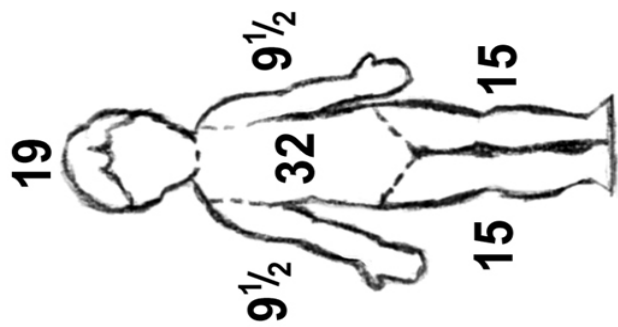
**ADULT  
(RULE OF NINES)**



**10 - 14**



**5 - 9**



**1 - 4**

# Three phases of burn injury

- Resuscitative phase
  - First 24 hours
  - Includes airway management and treating any circulatory and associated injuries
  - Suspicion of upper and lower airway injury is increased with singed eyebrows/eyelashes and black soot around nose and mouth

# Anesthetic management of burn patient

- Early intubation
- Multiple large bore IV access
- Aggressive fluid resuscitation
- Standard and invasive monitors placed early
  - Needle electrodes
- Temperature regulation

# Management cont'd

- Varied drug responses
  - Albumin concentration decreased after 48 hours → albumin-bound drugs (such as benzos and anticonvulsants) have an increased free fraction and prolonged effect
  - Cardiovascular support
  - Require higher than normal doses of NDMR (2-5 times normal dose)
  - Ketamine for dressing changes and escharotomies

# Airway injury

- High index of suspicion if loss of consciousness at scene and if fire occurred in closed space
- S/S of inhalation injury
  - Respiratory irritation (coughing)
  - Sore throat
  - Dysphagia
  - Hemoptysis
  - Carbon-colored sputum
  - Tachypnea, use of accessory muscles, wheezing
  - Crepitus

# Inhalation injury

- Hoarseness demands immediate attention → means airway becoming edematous and can quickly obstruct glottis
- Diagnosis made with carboxyhemoglobin levels
- Should be intubated immediately if any suspicion of injury





# Carbon monoxide (CO) poisoning

- Results from inhalation of CO produced by fires, exhaust from internal combustion engines and cooking and charcoal stoves
- Produces tissue hypoxia by its 200 times affinity for Hgb compared to oxygen
- COHgb formed → pulse oximeter may display higher than actual O<sub>2</sub> saturation
- S/S
  - Tachypnea
  - Cherry red color of blood (only when COHgb >40%)

# Clinical manifestation of CO exposure

CO HgB level (%)	Manifestations
0-5	None
5-10	Mild H/A, confusion
11-20	Severe H/A, blurred vision
21-40	Disorientation, N/V, irritability, syncope
41-60	Tachycardia, tachypnea, agitation
>60	Death

## CO poisoning

- Treatment: 100% O<sub>2</sub> immediately
- Hyperbaric oxygen therapy (HBO) may be initiated if symptoms not abating

# Fluid resuscitation

- Parkland formula
  - 4ml/kg LR per percent BSA burned
  - ½ given over first 8 hours
  - Rest over next 16 hours
  - In addition to maintenance
- Brooke formula
  - 3ml/kg per percent BSA burned
  - ½ over first 8 hours
  - Rest over next 16 hours

# Myoglobinuria

- Occurs following rhabdomyolysis and hemoglobinuria due to hemolysis; affects renal blood flow via damage to renal parenchyma
- FFP may protect renal function since it contains haptoglobin, which binds free hemoglobin
- Aggressive fluid resuscitation
- Maintenance of urine output with osmotic diuretics and sodium bicarb to protect kidneys

## Debridement and grafting phase

- Multiple skin debridements
- Escharotomies
- Amputations
- Grafts
- Tracheotomies

May still be hemodynamically unstable in this phase

## Reconstructive phase

- May continue for rest of life
- Release of contractures
- Multiple plastic surgery

# Skin grafting

