Learning Objectives

1. Summarize the basic principles of the primary and secondary survey in trauma victims.
2. Recognize and identify treatment for blunt head trauma.
3. Recognize common injuries associated with child abuse.
4. Evaluate and triage complicated extremity trauma.
5. Develop wound care strategies for common lacerations.
6. Recognize when to administer tetanus prophylaxis.

Trauma Facts

- Leading cause of death: up to age 44
- MVA (31%), Suicide (21%), homicide (14%)
- MVA: 50,000 deaths/yr, 40% intoxicated
- Management: A, B, C's

Airway Pearls:
Tongue is most common cause of obstruction

"A"IRWAY:

1. You come upon the scene of an MVA. The only victim is the driver, who has been extricated from the car and is lying on the ground unresponsive. Onlookers are standing around.

Your first step is to open the airway. In this scenario, the recommended maneuver to open the airway is:

A. Head-tilt chin-lift maneuver
B. The jaw thrust maneuver
C. Turn the head to the side to avoid vomiting
D. Perform a roadside cricothyroidotomy

Opening the Airway: ACLS Recommendation

1. Head-tilt-chin lift —No evidence of trauma
2. Jaw thrust —(+) trauma

Class IIB recommendation
"B"reathing:
2. A 27 y/o male unrestrained driver of car brought to ED after a rollover MVA. On arrival, he is awake, can clearly state his name, but due to severe tachypnea, cannot give more than one-word answers.
Vitals: Pulse=150, RR=48 labored, BP=65/30, O2 sat=81% on 100% O2.
PE: Neck: Trachea deviated to left, (+) JVD
Lungs: Absent breath sounds on right, Right chest tympany
At this point, you should:
A. Perform a rapid sequence intubation (RSI)
B. Insert a 14-gauge needle in right second intercostal space
C. Insert a chest tube on right side
D. Obtain a STAT upright CXR

"C"irculation:
3. A 6 y/o male is rushed to ED after being struck by a car. He is awake and crying. Pale, diaphoretic.
Vitals: BP=65/30, P=160, RR=30
Abdomen: diffusely tender with guarding and rebound. Right femur with diffuse swelling, tender and deformed.
The initial fluid resuscitation in this patient is:
A. 20 mls/kg isotonic saline bolus
B. 20 mls/kg D5 1/2 Normal saline bolus
C. 20 mls/kg 1/2 Normal saline bolus
D. 20 mls/kg 1/4 Normal saline bolus

"C"irculation:
Hemorrhagic Shock
• Hypotension and Pulse >100 does not occur until 20% volume loss
• No tachycardia in patients on B-blockers
• Monitor urine output: > 0.5cc/kg/hr
• Universal donor: Type O negative, try to avoid
• Transfusions can only be given with Normal Saline

Other causes of shock in trauma:
Tamponade, tension pneumothorax, neurogenic

Pediatric Trauma/Fluid Resuscitation
• Initial: 20 mL/kg isotonic saline
• After 3 boluses, if shock persists, Start PRBC 10 cc/kg

"3 in 1 Rule"
ATLS Text, 7th edition, 2004

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4. A 22-year-old male presents to ED after being struck on right side of head with a baseball bat. He walked into the ED, recalled events. Vital signs: stable, GCS=15 Right scalp with large STS. No neurologic deficits. 15 minutes later, the patient is minimally responsive and the right pupil is now fixed and dilated.

STAT CT scan is likely to show:

A. Right side epidural hematoma
B. Right side subdural hematoma
C. A basilar skull fracture
D. An intracerebral contusion

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STAT CT scan is likely to show:

- A. Right side epidural hematoma (64%)
- B. Right side subdural hematoma (31%)
- C. A basilar skull fracture (4%)
- D. An intracerebral contusion (1%)

Head Trauma

Accounts for 50% of all deaths due to trauma

A. Intracerebral hemorrhage
   - Often not seen on initial CT (delayed presentation)
B. Epidural hematoma
   - 80% due to rupture middle meningeal artery
   - Rare in the elderly. Associated with skull fx
   - Lucid interval ("talk and deteriorate")
C. Subdural hematoma
   - Tear of bridging veins between dura and arachnoid
   - Common in elderly, alcoholics

6x more common than epidural
Higher mortality than epidural

Epidural hematoma
Subdural hematoma

Concave
Convex, crescent shape


Common Head Trauma Pitfalls

- Assuming hypotension is due to head injury
- Assuming mental status change is due to alcohol
- Forgetting about the C-Spine
  - 5% of serious head injuries have associated C-spine fractures

5. Which of the following statements is false?

A. Protective helmets reduce head injury and death in motorcyclists
B. Protective helmets reduce head and facial injuries in bicyclists
C. Protective helmets reduce head and facial injury in skiers
D. IV steroids are useful in the management of head injury.
5. Which of the following statements is false?

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6. A 4 y/o male is brought to your ED/office after falling in the garage, striking his forehead. No LOC, he has vomited. On exam: (+) soft tissue swelling of the forehead. No Battle sign, raccoon eyes or otorrhea or rhinorrhea. He is neurologically intact, appears comfortable, playful.

The 2007 AAFP/AAP Guideline on the Management of Minor Closed Head Injury in Children recommends:

A. Observation for 2 hours in a medical professional setting
B. Observation for 24 hours in a medical professional setting
C. Observation for 24 hours either by medical professionals or reliable family
D. The child should undergo CT scanning of the head

The 2007 AAFP/AAP Guideline on the Management of Minor Closed Head Injury in Children

2 - 20 year olds
With isolated head trauma (not multiple trauma)
Normal mental status
No focal neurologic findings
No evidence of skull fracture

No LOC
- Observe for 24 hrs (medical or reliable family)
- No radiology studies

(+) LOC < 1 minute
- Observe is acceptable
- Obtain head CT

And...Avoid Skull x-rays and MRI
The 2007 AAFP/AAP Guideline on the Management of Minor Closed Head Injury in Children

- The rationale for observation alone:
  - Without LOC: < 1:5000 chance of intracranial injury requiring neurosurgical intervention
- What about vomiting, headache or lethargy?
  - These children “may” be more likely to have intracranial injury, but these signs are of limited predictive value

What about children under age of 2 years?

2001 AAP Guidelines for Minor Head Injury in Children < 2 Years of Age

- Literature review says these are clinical predictors of IntraCranial Injury (ICI):
  - Skull fracture (SF)
  - Scalp swelling (80-100% of SF have swelling)
  - Younger the age, greater risk
  - Inflicted injury (abuse)
  - No clear history of trauma
- Not predictors:
  - Loss of consciousness
  - Vomiting

2001 AAP Guidelines for Minor Head Injury in Children < 2 Years of Age

Everything else: Intermediate risk

- Depressed mental status
- Focal neuro deficits
- Signs of skull fracture
- Seizure
- Irritability
- Bulging fontanel
- Vomiting > 5x
- LOC > 1 min

Go to CT

Observation - (no time frame)

OK with reliable parents

Observe 4-6 hrs post-injury

In hospital setting

OR

Radiology testing

Problems with These Guidelines…

- Most of the data (2-20 yrs of age) is extrapolated from adult studies
- The recommendations violate their own rules (eg. vomiting)
- Most importantly… these recommendations have NEVER been tested/validated!!!! GOBSAT rules!!!!

So Why Not CT Scan Them All?

- Risk of sedation
- Costs
- Radiation exposure
  - (radiation = to 100-150 chest x-rays)
- Impairs later (adult) cognitive abilities*


Is There Any Clinical Decision Rule You Can Rely On?

- Canadian rules (Lancet, 2001)
- Scandinavian rules (J Trauma, 2000)
- New Orleans rules (JAMA, 2005)
- NICE (2004)
- NEXUS II (J Trauma-Injury Inf & Crit Care, 2005)

Many have tried… none are reliable enough!!!!
7. A 45-year-old male driver of car involved in MVC at intersection. Struck on passenger side. Wearing seatbelt. No LOC. Not ambulatory at scene. EMS transports pt. to ED on a backboard and hard (Philadelphia) collar in place. On arrival, the patient has no complaints. VS: normal, not intoxicated, no neuro deficits, no significant injuries other than an abrasion on the L hand. No midline posterior neck tenderness. At this point:

A. The cervical collar can be removed.
B. C-Spine x-rays are needed before the collar can be removed.
C. If the C-spine shows no fracture, flexion and extension views should be obtained.
D. Because C-spine x-rays can miss significant injury, a CT scan should be obtained.

At this point:

- **A.** The cervical collar can be removed.
- **B.** C-Spine x-rays are needed before the collar can be removed.
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**NEXUS (C-Spine) Guidelines**

1. No posterior midline cervical tenderness
2. No alcohol intoxication
3. A normal level of alertness
4. No focal neurologic deficits
5. No distracting injuries

*If meets all, no C-Spine x-ray required!!!*

Prospective study: 34,069 pts. at 21 trauma centers ==> 100% Sensitive!!

_Hoffman, JR, et al. NEJM, 2000_

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**Neck Trauma**

*Myth: A soft collar is standard care for whiplash*


4 of 5 studies note increased pain and decreased mobility with collar

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8. A 31-year-old male is brought to the ED after a steel scaffold struck and pinned his left lower extremity for 2 hrs before extrication. On arrival in ED:

VS: stable, A,B,C’s are normal.

Left leg: hip to ankle is swollen, Ecchymotic and tender.

Sensation intact. 2+ DP, PT present

Labs: H/H=13/37, Urine dipstick: (+) blood

Urinalysis: 0-2 RBC’s, 0-2 WBC’s/hpf

This patient should be admitted for the management of:

- **A.** Rhabdomyolysis
- **B.** Compartment Syndrome
- **C.** Renal contusion
- **D.** Hemorrhagic shock

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**Rhabdomyolysis**

- First described in WWII London bombings
- Seen in: Trauma, seizures, burns, drug overdose, exertion, toxin/drug induced
- Urine dipstick positive 50% (myoglobinuria)
- Elevated CPK (> 2-3x reference)
- Complication: Acute renal failure 30-40%
- Treatment:
  1. Crystalloid 500 cc/hr ==> Urine output 200-300 cc/hr
  2. Urinary alkalinization: if CK > 6000, or if acidemic, dehydrated or underlying renal disease (?)

**Compartment Syndrome**

- Can occur in anywhere perfusion pressure falls below tissue pressure in any anatomic space
- > 30 mm Hg***
- Classic: extremities, but any compartment susceptible
- Classic: trauma to extremity - but can occur with exercise
- Clues: Severe pain, decreased sensation, pain on passive stretch, tense extremities
- 4-6 hours before irreversible damage
- Do NOT wait for pallor, pulselessness
- Caution: Open Fractures are NOT immune from developing compartment syndromes

9. A 37-year-old male in good health presents with a 4 cm laceration to the mid-volar forearm after punching a glass window. **His tetanus immunization is up to date.**
Which one of the following statements is true?

**A.** A radial nerve deficit would result in a lack of a pincer grasp

**B.** On neuro-vascular examination, a median nerve deficit would demonstrate inability to spread his fingers against resistance

**C.** Tap water irrigation has been shown to result in lower wound infection rates than irrigation with sterile saline.

**D.** X-rays are only indicated if the glass is known to contain lead

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**Nerve Function: Hand**

**Radial Nerve**

- Sensory: Posterior hand - thumb to radial 1/2 of ring finger
- Motor: Wrist and finger extension
- Test against resistance

**Median Nerve**

- Sensory: Palmer surface from thumb to radial 1/2 of ring finger
- Motor: Flexion of wrist and fingers
- Best test: Make “OK” sign

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Nerve Function:
Hand Ulnar Nerve

- Sensory: little finger and ulnar 1/2 of ring finger
- Motor: innervates interosseous muscles (intrinsic)

Test: Abduction of fingers

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C. Tap water irrigation has been shown to result in lower wound infection rates than irrigation with sterile saline.
D. X-rays are only indicated if the glass is known to contain lead

Can I Irrigate with Tap Water?

- Cochrane Review: 2002
- Meta-analysis of 3 studies tap water vs. normal saline: ***decreased rate of wound infection in adults (RR 0.55, 95% CI 0.31 - 0.97)

Trauma: Wound Care Principles

- Irrigate, Irrigate, Irrigate
  *Pearl: Tap water appears better than saline*
- X-ray if you think any glass is possible
  *Will identify any glass 2mm or greater*
- Do NOT apply iodophor/chlorhexidine into wound
- Do NOT shave eyebrows

Who do you place on prophylactic antibiotics?
High-risk site - (hand, foot); High-risk mechanism - (bites)
High-risk patients (immunocompromised, prosthetic valve)

10. Child abuse should be suspected in all of the following EXCEPT:

A. 7 month old with diffuse cerebral and retinal hemorrhages
B. 2 year old with 3 rib fractures after a fall
C. 6 month old with multiple lower ext bruises from falls
D. 20 month old with spiral fracture of distal tibia
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Child Abuse

- Child abuse - spectrum of injuries are wide
  - Burns, contusions, fractures, head injury

Shaken Baby syndrome: Diffuse cerebral injury with edema, +/- intracerebral bleed, retinal hemorrhages

3 Pearls---

1. “If they don’t cruise, they don’t bruise”
2. Rib fractures - < age 3, 82% are abuse
3. Undiagnosed ==> > 25% mortality in 2 yrs

Toddler’s Fracture

- Most common fx in age 9 mos - 3 yrs that present with a limp (29 of 100)
- Spiral fracture of distal tibia
- Best seen on oblique view
- May be occult
- Below knee walking cast x 3 weeks

Answers

1. B
2. B
3. A
4. A
5. D
6. C
7. A
8. A
9. C
10. D