

Head & Spinal Trauma

Optional, EMR



Lesson Goal

- Learn assessment of patients with head or spinal injuries and how to treat those injuries

Lesson Objectives

- State nervous system components
- List central nervous system (CNS) functions
- Define structure of skeletal system as it relates to nervous system
- Relate MOI to potential head & spinal injuries

Lesson Objectives

- Explain implications of not properly caring for potential spinal injuries
- State signs & symptoms of potential spinal injury
- Describe method of determining whether a responsive patient may have a spinal injury

Lesson Objectives

- Relate airway emergency medical care techniques for a patient with suspected spinal & head injuries
- Describe how to stabilize the cervical spine
- Discuss indications for immobilizing the spine using various devices (e.g., cervical immobilization device, spine board)

Lesson Objectives

- Identify different types of helmets and indicate when to remove and when to leave on patient
- Explain preferred and alternate methods for removing a helmet
- Demonstrate how to open the airway in a patient with suspected spinal cord injury

Introduction

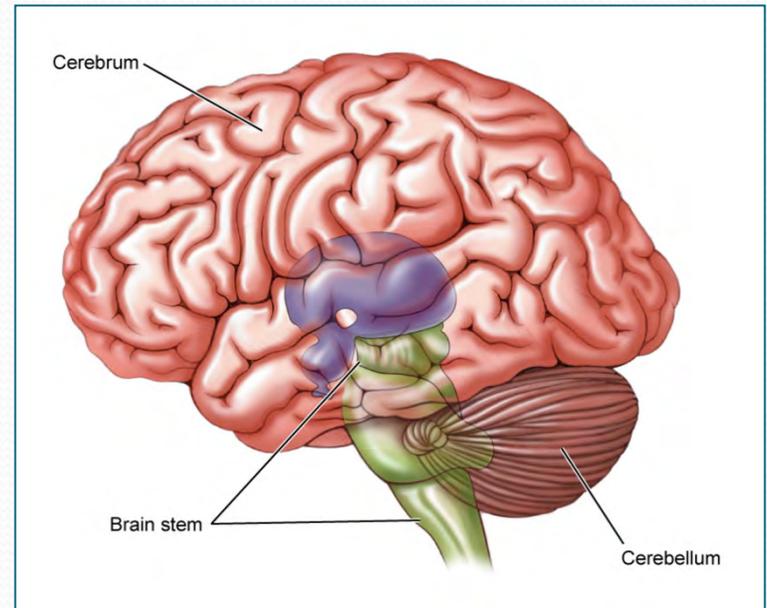
- Thorough and proper assessment and treatment can have a positive affect on the outcome for a patient with a head or spinal injury

Nervous System Review

- Seat of control of body functions
- Major function—communication between body & environment
- Well protected by skull & vertebral column
 - Significant forces can result in injury

Nervous System Review

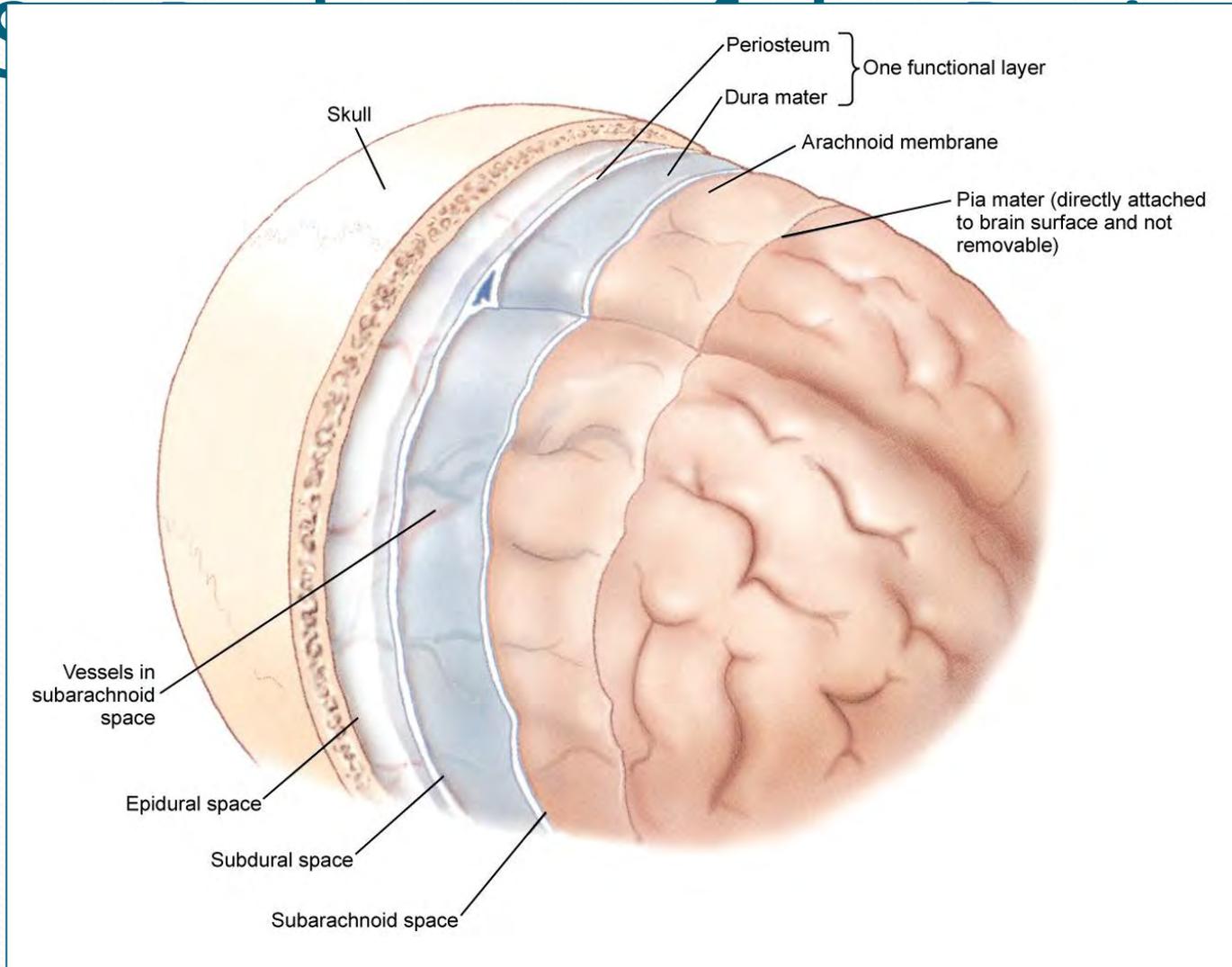
- Central nervous system
 - Brain
 - Spinal cord
- Peripheral nervous system
 - Motor & sensory nerves outside brain & spinal cord



Central Nervous System (CNS)

- Cerebrum controls
 - Vision
 - Speech
 - Balance
 - Emotion
- Cerebellum coordinates fine motor skills
- Brainstem—controls vital vegetative functions

CNS



Central Nervous System

- Spinal cord
 - Extends from brainstem, through opening in floor of skull, into spinal column
 - Continues to level of L2



CNS

- Nervous tissue cannot regenerate if damaged
- Brain is protected by several layers of tissue
- Muscle underlies scalp, covering skull
- Meninges
 - Dura mater
 - Arachnoid
 - Pia mater
- Cerebrospinal fluid

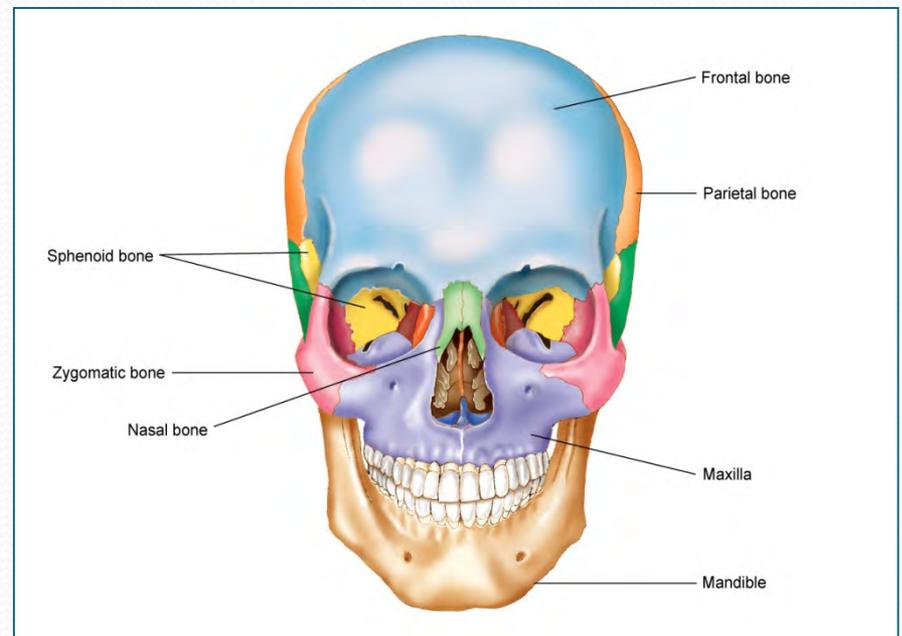
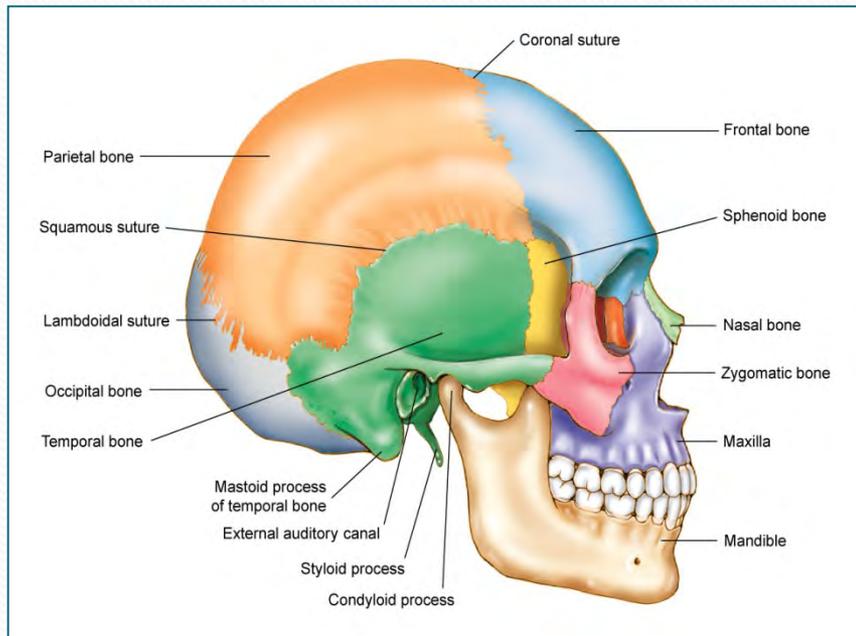
Peripheral Nervous System (PNS)

- Cranial & spinal nerves
- Somatic (voluntary) nervous system
- Autonomic (involuntary) nervous system

Peripheral Nervous System

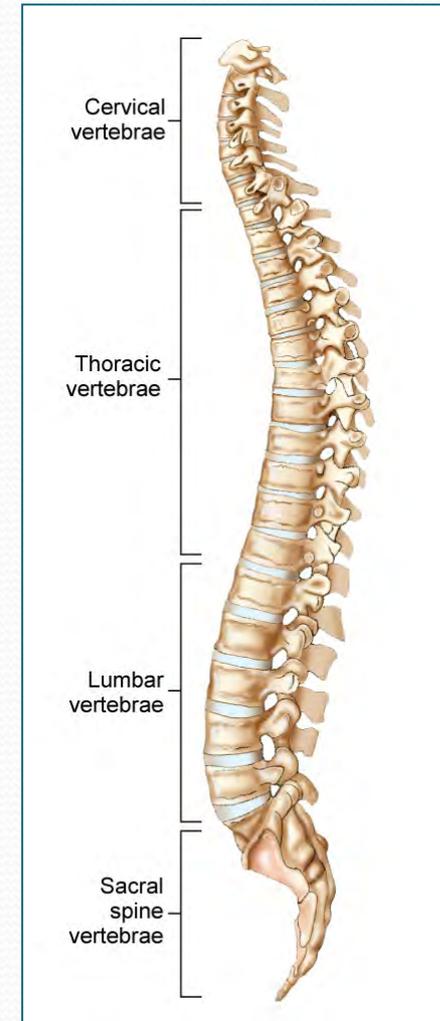
- 12 Pairs of cranial nerves
- 31 Pairs of spinal nerves
 - Sensory impulses
 - Motor impulses
 - Reflex arc

Skeletal System Review



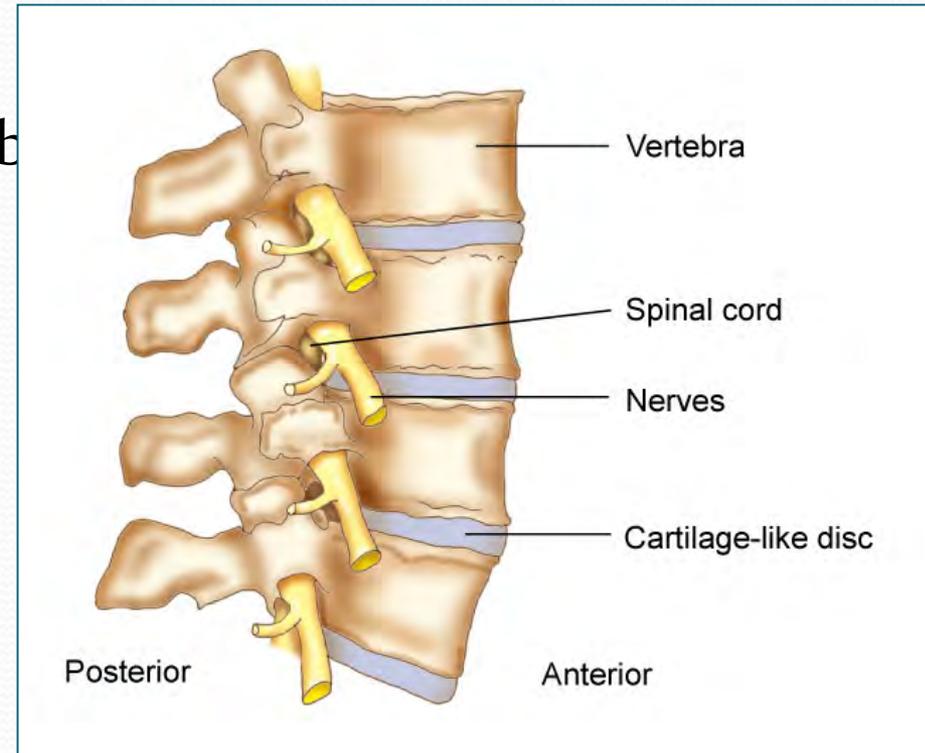
Skeletal System Review

- Spinal column



Skeletal System Review

- 33 vertebrae
 - Separated by intervertebral disks
 - 7 Cervical
 - 12 Thoracic
 - 5 Lumbar
 - 5 (fused) Sacral
 - 4 (fused) Coccygeal



Injuries to the Spine

- Activities with significant energy can lead to injury
 - MVCs
 - Contact sports
 - Falls

Injuries to the Spine

- Mechanisms producing injury:
 - Axial loading
 - Hyperflexion
 - Hyperextension
 - Excessive lateral bending
 - Hyperrotation
 - Distraction

Axial Loading

- Compression of the spine
 - Shallow water diving
 - Jumping from height
- Injuries
 - Ruptured disks
 - Vertebral fractures

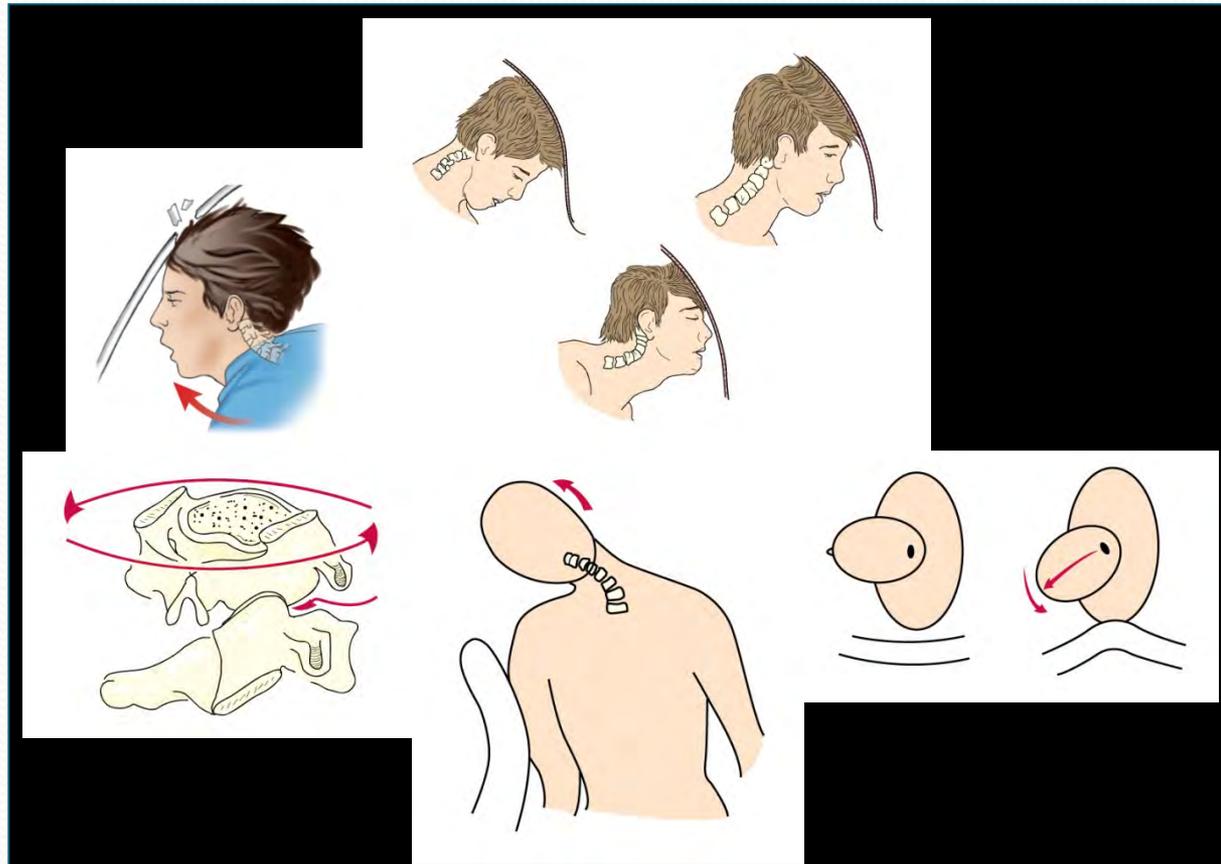
Excessive Range of Motion

- Hyperflexion
- Hyperextension
- Hyperrotation
- Lateral bending

Distraction Injuries

- Mechanism pulls head and body in opposite directions
- Separation of vertebrae may occur
- Spinal cord may be stretched or torn

Injuries to the Spine



Suspicious Mechanisms

- Significant force to head, neck, torso, pelvis
- Vehicle or motorcycle crash
- Pedestrian-vehicle crash
- Sudden acceleration, deceleration, or lateral bending forces
- Fall from significant height

Suspicious Mechanisms

- Fall in which one part of the body is suddenly stopped
- Unrestrained victim in rollover, ejection
- Explosion
- Shallow water diving
- Blunt or penetrating trauma to head, neck, or torso

Suspicious Findings

- Unconscious trauma victim
- Head injury with LOC changes
- Significant helmet damage
- Legs and hips fractures
- Injuries to spinal area

Assessment

- Assessment begins as you approach scene and patient
- Evaluate MOI
- Assess ABCs and intervene as needed
- Determine patient's mental status

Assessment: Specific Questions

- “Does your neck or back hurt?”
- “Do you know what happened?”
- “Where does it hurt?”
- “Can you move your hands and feet?”
- “Do you feel me touching your fingers?”
- “Do you feel me touching your toes?”

Assessment

- DCAPBTLS
- Check for symmetry
- Obtain information from family and/or bystanders

Assessment: Complications

- Paralysis
- Loss of sensation
- Incontinence
- Impaired breathing

Spinal Immobilization

- When spinal injury is suspected, immobilize body from head to foot
 - Long backboard
- Begin with neutral, inline, manual stabilization

Helmet Removal

- Two types
 - Open anteriorly
 - Full face
- Helmet removal
 - Is patient able to breathe adequately with helmet in place?
 - Can I access and control patient's airway without removing helmet?
 - Does helmet fit well enough to ensure that patient's head will not move inside it?

Skill 29-1: Motorcycle Helmet

1. EMT 1 takes position above patient's head and stabilizes helmet, head, and neck in as close to a neutral inline position as helmet allows
EMT 2 kneels at patient's side, opens or removes face shield, if necessary, and undoes or cuts chin strap



Skill 29-1: Motorcycle Helmet

2. EMT 2 grasps patient's mandible between thumb and first two fingers at angle of mandible. EMT's other hand is placed under patient's neck, on occiput of the skull, to take control of manual stabilization. EMT's forearms should be resting on floor, ground, or his/her thighs for additional support



Skill 29-1: Motorcycle Helmet

3. EMT 1 pulls sides of helmet slightly apart, away from patient's head, and rotates helmet with up-and-down rocking motions while pulling it off patient's head. Helmet is moved slowly and deliberately, and care is taken as helmet clears patient's nose.



Skill 29-1: Motorcycle Helmet

4. Continue manual stabilization after removing helmet.
Place padding behind patient's head to maintain a neutral inline position and apply properly sized cervical collar

NOTE: 2 key elements in helmet removal:

- At no time should both EMTs be moving their hands (while one EMT maintains manual stabilization of the patient's head and neck, the other EMT moves)
- EMT must rotate helmet in different directions, first to clear patient's nose and then to clear back of patient's head

Skill 29-2: Bicycle Helmet

1. While EMT 1 stabilizes head and cervical spine, EMT 2 releases chin strap



Skill 29-2: Bicycle Helmet

2. EMT 2 supports back of head and chin so that EMT 1 can remove helmet



Skill 29-2: Bicycle Helmet

3. After helmet is removed, EMT 2 continues to support patient's head and neck. EMT 1 applies cervical collar and uses padding to stabilize head and neck



Skill 29-3: Football Helmet

1. While EMT 1 stabilizes head and neck, EMT 2 releases face piece by unscrewing clasps or cutting them
2. After face piece has been cleared, EMT 2 supports head and neck so EMT 1 can remove helmet



Skill 29-3: Football Helmet

3. After helmet is removed, EMT 1 stabilizes head and neck while EMT 2 provides padding and applies cervical collar



Spinal Immobilization

- Before applying cervical collar (C-collar):
 - Assess distal neurovascular function
 - Assess neck
- Select properly sized collar
- C-collar limits movement but does not immobilize neck



Spinal Immobilization

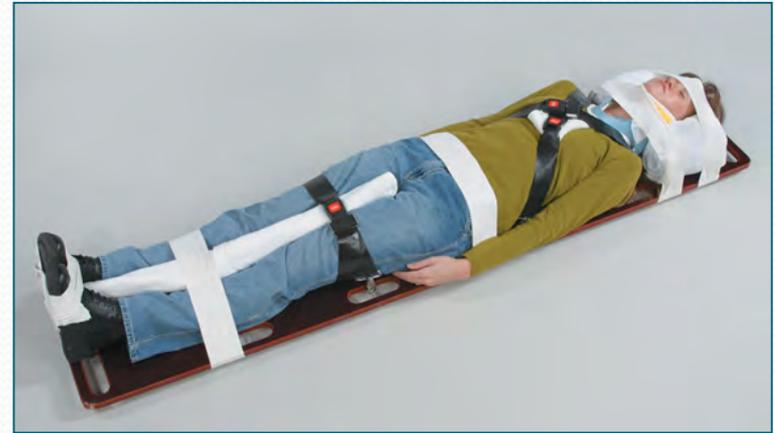
- Improperly sized C-collar can do more harm than good
- C-collar must not restrict breathing or mouth opening

Spinal Immobilization

- Log roll
 - EMT positioning:
 - Head, shoulders, waist, knees
 - EMT at head directs moves

Spinal Immobilization

- Secure the patient:
 - Torso
 - Legs
 - Head
- Reassess distal neurovascular status



Skill 29-4:

Log Roll—Suspected Spinal Injury

1. While EMT 1 stabilizes head & neck, EMT 2 applies C-collar



Skill 29-4:

Log Roll—Suspected Spinal Injury

2. EMT 1 stabilizes head & neck; EMTs 2 and 3 take position at patient's side placing their hands in position to evenly distribute patient's weight



3. Patient is rolled onto side on 3-count by EMT

1

Skill 29-4:

Log Roll—Suspected Spinal Injury

4. While patient is in this position, an EMT should examine patient's back



Skill 29-4:

Log Roll—Suspected Spinal Injury

5. EMT 4 moves backboard into position; patient is lowered onto board on 3-count



6. Patient is strapped to board in this order: chest, pelvis, legs, head



Skill 29-4:

Log Roll—Suspected Spinal Injury

7. Head & neck are stabilized by placing head blocks or rolls to maintain proper position



Skill 29-5: Log Roll— Suspected Spinal Injury from Prone Position

1. While EMT 1 maintains manual inline stabilization of head & neck, two beside patient and position hands at patient's shoulder, hip, and upper & lower leg



Skill 29-5: Log Roll— Suspected Spinal Injury from Prone Position

2. On EMT 1's count, patient is rolled toward other two EMTs as single unit
3. On EMT 1's count, patient is rolled farther onto back as single unit; manual stabilization of head and neck is continued throughout



Spinal Immobilization

- Pad voids between body and backboard
- Adult patients—may need to pad beneath head
- Pediatric patient—pad beneath shoulders



Spinal Immobilization

- Seated patients
 - Noncritical—short immobilization device
 - Critical—rapid extrication

Skill 29-6: Short Spine Board

1. Don BSI; manually immobilize spine and apply C-collar; assess pulse, motor function, and sensation in all extremities; document findings



Skill 29-6: Short Spine Board

2. Slide immobilization device behind patient. Position device so that top is level with top of patient's head. If device has body flaps, fold them toward front of patient and lift device to fit securely in armpits. Minimize patient movement as much as possible.



Skill 29-6: Short Spine Board

3. Secure patient's torso to device using board straps. If device has leg straps, secure at this time. Verify that device is securely fastened to torso by checking tightness of all straps without excessive movement of patient



Skill 29-6: Short Spine Board

4. Pad behind patient's head as needed to maintain neutral inline position; secure patient's head to device

Note: Always secure head last



Skill 29-6: Short Spine Board

5. Prepare to move patient to long backboard. Place end of backboard under patient's buttocks. Using short immobilization device, rotate and lay patient down on backboard. If unable to slip backboard under patient's buttocks, lift patient to backboard using short immobilization device



Skill 29-6: Short Spine Board

6. Reassess patient's pulse, motor function, and sensation in all extremities. Compare results with previous ones and document findings. Forward information to receiving facility

Spinal Immobilization

- Ambulatory patients
 - Standing immobilization

Skill 29-7: Standing Long Board

1. Ensure BSI precautions are taken. EMT 1 applies manual inline stabilization by approaching patient from front and placing hands on each side of patient's head.



Skill 29-7: Standing Long Board

2. EMT 2 assesses patient's pulse, motor function, and sensation in all extremities. EMT 2 also sizes patient for C-collar, assesses neck & spine for injury, and applies collar



Skill 29-7: Standing Long Board

3. EMT 2 positions long board behind patient, between EMT 1's arms, while EMT 1 continues holding patient's neck inline. Additional EMTs place arms under patient's armpits and grasp board. Board then is placed against patient's back



Skill 29-7: Standing Long Board

4. Patient is informed that EMTs will be leaning her backward; EMT in back gives order to lean patient back and onto ground
5. Patient's pulse, motor function, and sensation are reassessed; patient is secured to board as previously described



Common Pitfalls of Immobilization

- Not securing patient adequately to prevent movement
- Not immobilizing head in neutral position
- Readjusting torso straps after head is secure

Injuries to the Brain & Skull

- May or may not be obvious
- Suspect injuries to brain & skull based on MOI
- All head injuries considered potentially serious

Scalp Lacerations

- Scalp lacerations may be indications of more serious underlying injury
- Bleeding from scalp can be significant
- Most bleeding from scalp can be controlled with direct pressure

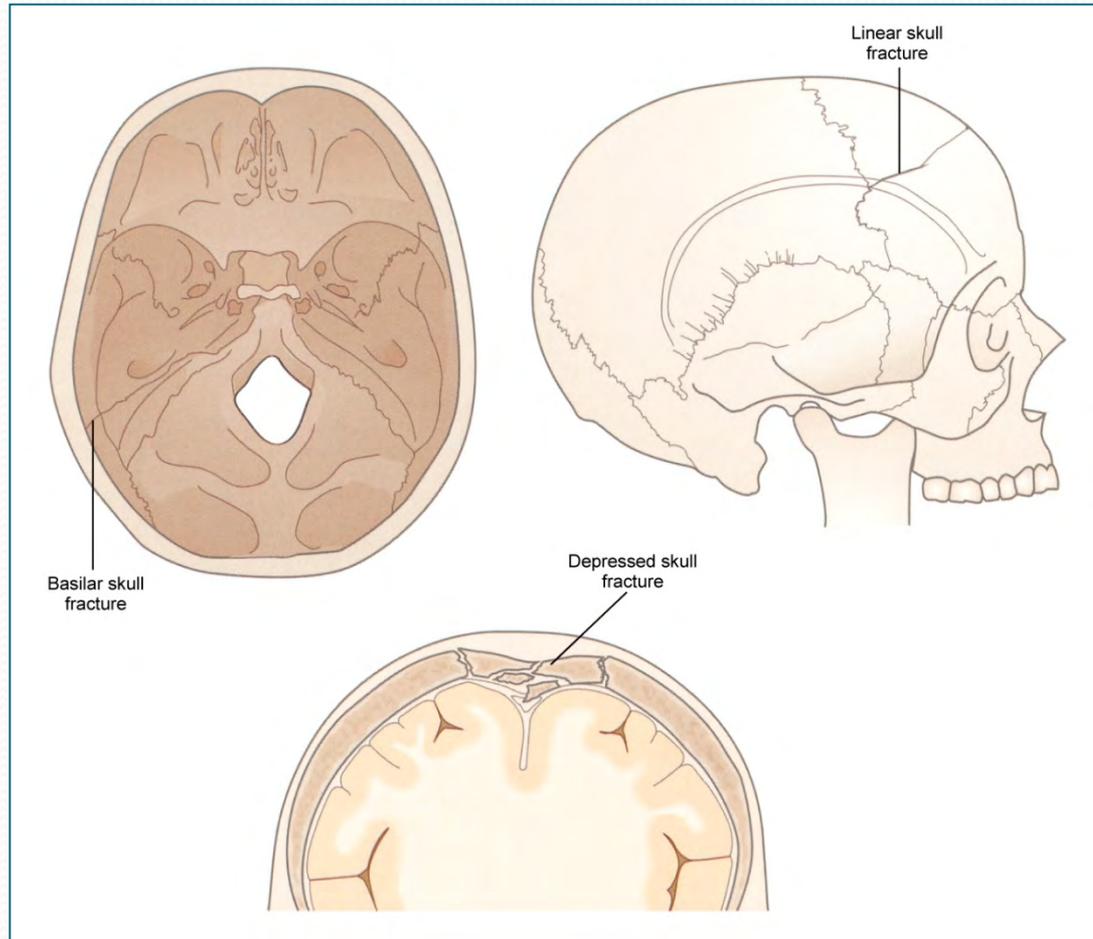


Skull Fractures

- May be open or closed
- Caused by blunt or penetrating mechanisms
- May or may not show gross deformity
- Check for bruising around eyes & behind ears



Skull Fractures



Brain Injuries

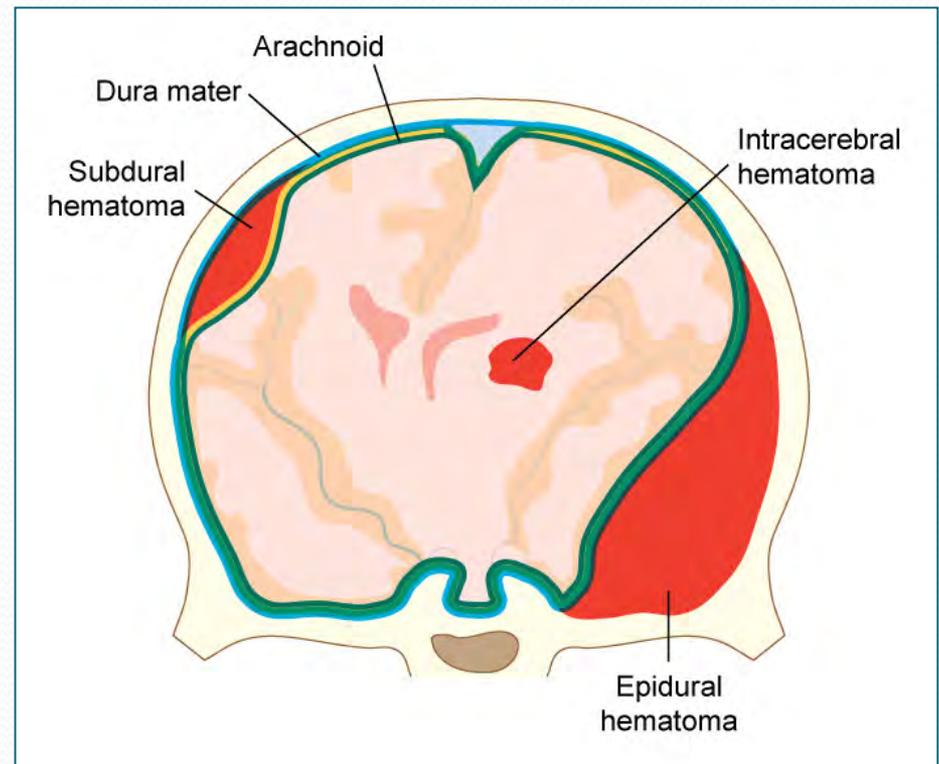
- Direct
 - Laceration by bone fragments
 - GSW
- Indirect
 - Contusions
 - Concussions

Brain Injuries

- Concussion
 - Temporary disruption in brain function without physical damage
 - May see stars, have amnesia
- Contusion
 - Bruising of brain tissue
 - Swelling can cause an ↑ ICP

Intracranial Bleeding

- Collection of blood within the skull; ↑ ICP
 - Epidural
 - Subdural
 - Intracerebral



Epidural Hematoma

- Between dura mater & skull
- Rapid development
- Signs & symptoms
 - Initial loss of consciousness
 - Lucid interval
 - Secondary loss of consciousness
 - Weakness on opposite side of body
 - Fixed, dilated pupil on same side

Subdural Hematoma

- Collection of blood beneath dura mater but outside brain
- May be slower than epidural bleeding
- Signs & symptoms
 - AMS or personality change
 - Severe, persistent, or recurring headache
 - Changes in vision
 - One-sided changes in body function
 - Nausea and/or vomiting
 - Slurred speech

Intracerebral Hematoma

- Blood collects within brain tissue
- Signs & symptoms vary
- Seizures—not uncommon

General Signs & Symptoms of Head Injury

- Altered LOC
- Changes in pupil size, equality, reactivity
- MOI
- Irregular breathing patterns
- Scalp injuries
- Deformed skull
- Soft or depressed areas of skull
- Exposed brain tissue

General Signs & Symptoms of Head Injury

- Open skull fx
- Blood or CSF fluid from ears and/or nose
- Bruising under eyes or behind ears
- Nausea and/or vomiting
- Seizure activity
- ↑ BP with ↓ pulse rate

Nontraumatic Conditions

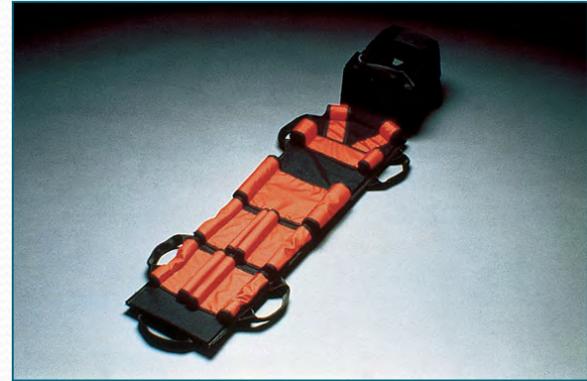
- Medical conditions (e.g., stroke) may present similarly to head injury
- History of trauma is absent
- Treat patient's signs & symptoms
 - Airway
 - Breathing
 - Circulation

Management of Head Injury

- Provide manual stabilization of C-spine
- ABCs
- Transport without delay
- Obtain baseline VS and LOC; reassess every 5 min
- Transport

Infants & Children

- Immobilization of pediatric patients requires adjustments



Skill 29-8: Rapid Extrication

1. EMT 1 holds manual immobilization of head & neck while EMT 2 applies C-collar
2. Manual stabilization is maintained, patient's upper torso, lower torso, and legs are rotated in a series of short, controlled movements until patient is positioned such that manual stabilization can no longer be maintained



Skill 29-8: Rapid Extrication

3. Patient is rotated until he/she can be lowered from vehicle and onto long board
4. Patient is moved onto long board and secured



Summary

- Injuries to the spine & head can have devastating consequences
- Recognition requires an understanding of anatomy & physiology and MOI

Summary

- Proper immobilization is important in preventing further injury to a patient with spinal injury
- Recognize and appropriately manage patients with head injuries, paying particular attention to ABCs and spinal immobilization