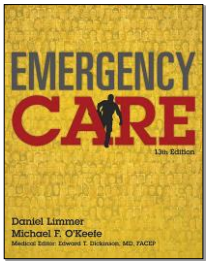
Emergency Care

THIRTEENTH EDITION



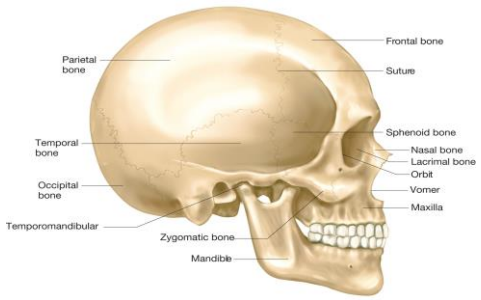
CHAPTER 29

Trauma to the Head, Neck, and Spine

Nervous System

- Controls thought, sensations, and motor functions
- Central nervous system
  - Brain, spinal cord
- Peripheral nervous system
  - Vertebral nerves
  - Cranial nerves
  - Body's motor and sensory nerves

Anatomy of the Head

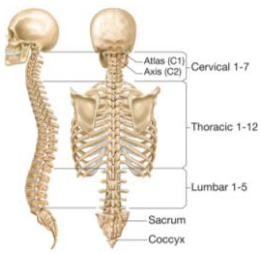


Anatomy of the Head

- Spinal cord
  - Exits base of brain and leaves skull through foramen magnum
- Cerebrospinal fluid (CSF) bathes brain and circulates down the spine.

Anatomy of the Spine

- Vertebrae (s. *vertebra*)
  - Cervical (seven)
  - Thoracic (twelve)
  - Lumbar (five)
  - Sacral (five)
  - Coccyx (four)
  - Each has a spinous process.



Injuries to the Skull and Brain

Injuries to the Skull and Brain

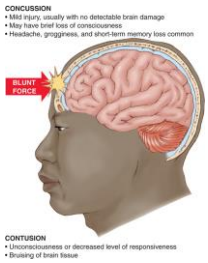
- Scalp injuries
  - Lots of blood vessels
  - Profuse bleeding
- Skull injuries
  - Open head injury
  - Closed head injury

Brain Injuries

- Direct injuries
  - Brain is lacerated, puncture, or bruised by broken bones or by a foreign object.
- Indirect injuries
  - The shock of impact on the skull is transferred to the brain and include concussions and contusions.

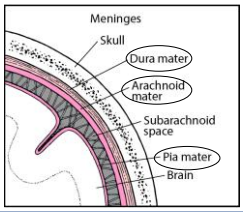
Traumatic Brain Injuries

- An injury that disrupts the normal brain function
  - Concussion
    - May be so mild patient is unaware of injury
  - Contusion
    - Coup or countercoup
  - Laceration

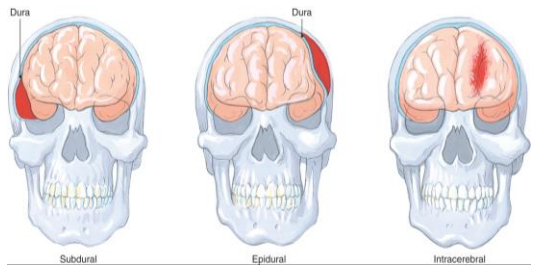


Traumatic Brain Injuries

- An injury that disrupts the normal functioning of the brain
  - Hematoma
    - Subdural
    - Epidural
    - Intracerebral



Cranial Hematoma



Collection of blood between the brain and the dura

Blood between the dura and the skull

Blood pools within the brain

Patient Care

- Take appropriate Standard Precautions.
- Consider possibility of spine injury.
- Open and maintain airway.
- Monitor unconscious patient for changes in breathing.
- If indicated, apply rigid cervical collar.
- Control bleeding.
- Keep patient at rest.

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Patient Care

- Talk to conscious patient and provide emotional support.
- Dress and bandage open wounds; stabilize penetrating objects.
- Manage patient for shock.
- Be prepared for vomiting.
- Transport patient promptly.
- Monitor vital signs every 5 min.

Intracranial Pressure (ICP)

- When a hematoma develops and pressure increases inside the skull
- As intracranial pressure builds and compresses brain tissues, progressive neurological abnormalities develop.
- The time it takes for symptoms to develop depends on rate of bleeding into skull and location of bleed.

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Intracranial Pressure

- Symptoms
  - Rising blood pressure and slowing heart rate
    - Together known as Cushing reflex
  - Altered mental status
  - Sluggish or dilated pupils

Intracranial Pressure

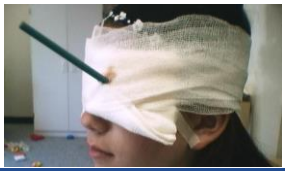
- Symptoms
  - Cheyne-Stokes breathing
  - Central neurogenic hyperventilation
  - Ataxic respirations
  - Decorticate or decerebrate posturing with herniation
  - May be immediate or delayed in onset

Think About It

- Does my patient have a serious or potentially serious head injury? Should the patient be transported to a trauma center?
- Do my patient's complaint and MOI indicate spinal stabilization? Is immobilization warranted?

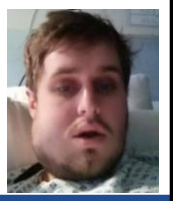
Cranial Injuries with Impaled Objects

- Stabilize object in place.
- Cutting a lengthy impaled object should be done with a tool that will not cause the object to move or vibrate when it is finally severed.



Injuries to the Face and Jaw

- Primary concern
  - Airway
- When possible, position to allow for drainage from mouth.



Nontraumatic Brain Injuries

- Many signs of brain injury may be caused by an internal brain event (hemorrhage, blood clot).
- Signs are the same as for traumatic injury, except no evidence of trauma and no mechanism of injury.

Glasgow Coma Scale

Glasgow Coma Scale		
Response	**Scale**	**Score**
Eye Opening Response	Eyes open spontaneously	4 Points
	Eyes open to verbal command, speech, or shout	3 Points
	Eyes open to pain (not applied to face)	2 Points
	No eye opening	1 Point
Verbal Response	Oriented	5 Points
	Confused conversation, but able to answer questions	4 Points
	Inappropriate responses, words discernible	3 Points
	Incomprehensible sounds or speech	2 Points
	No verbal response	1 Point
Motor Response	Obeys commands for movement	6 Points
	Purposeful movement to painful stimulus	5 Points
	Withdraws from pain	4 Points
	Abnormal (spastic) flexion, decorticate posture	3 Points
	Extensor (rigid) response, decerebrate posture	2 Points
	No motor response	1 Point

Minor Brain Injury = 13-15 points; **Moderate Brain Injury** = 9-12 points; **Severe Brain Injury** = 3-8 points

Glasgow Coma Scale

- Use Glasgow Coma Scale (GCS) and AVPU for neurological assessment.
- Considerations for use of GCS
- Do not spend time on scene calculating score

Wounds to the Neck

- Large arteries and veins close to surface creating the potential for serious bleeding.
- Pressure in large vein is lower than atmospheric pressure.

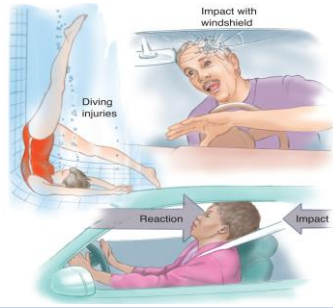
Wounds to the Neck

- Great possibility of air embolus being sucked through
  - Pulmonary embolism
- Treatment
  - Stop the bleeding
  - Prevent air embolism

Patient Care

- Ensure open airway.
- Place gloved hand over wound.
- Apply occlusive dressing.
- Place dressing over occlusive dressing.
- Apply pressure to stop bleeding.
- Bandage dressing in place.
- Immobilize spine if MOI suggests cervical injury.

Spinal Injury



Injuries to the Spine

- Assume possible cervical-spine injury based upon MOI.
- Spinal cord is a relay between body and brain.
- Risk of primary and secondary injuries

High-Risk Mechanisms for Spinal Injury

What are they?

- Falls from greater than 1 meter (roughly 3 feet) or down more than 5 stairs
- Axial loading (compression injuries) such as those that occur in diving injuries
- High-speed motor-vehicle crashes, especially with rollover or ejection of the patient

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Mechanisms of Spine Injury

- Energy that forces movement of the spine beyond its normal range of motion
- Whiplash
- Affected by certain medical conditions

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Mechanisms of Spine Injury

- High-risk
  - Motorized recreational vehicle (ATV) crashes
  - Bicycle collisions
- Maintain a high degree of suspicion if a vehicle was involved.
- Many other mechanisms of injury can cause spinal injuries.

Physical Assessment for Spine and Spinal Cord Injuries

- Pain and tenderness are important findings.
- Dermatome
  - Area of the body surface innervated by a single spinal nerve
  - Can be used to identify loss of function

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Physical Assessment for Spine and Spinal Cord Injuries

- Paralysis of extremities
- Changes in neurological function
- Pain with or without movement
- Tenderness anywhere along midline spine
- Impaired breathing
- Priapism
- Loss of bowel or bladder control
- Deformity
- Neurogenic shock

Geriatric Note

- Keep in mind that fractured spines in older adults are often caused by falls or spontaneous fractures of brittle bones that, in turn, cause falls.

Patient Care

- Provide manual in-line stabilization
- Assess ABC's
- Assess head and neck; apply C-collar
- Assess for sensory and motor function
- Apply appropriate spinal immobilization device
- Reassess sensory and motor function

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The Evolution of Spinal Care

- *Spinal immobilization*
  - Even low-risk patients used to be cared for as though they had a spinal injury.
  - Once taught that the most important care was restricting patient movement
- Secondary injury now known to be caused by hypoxia, shock, and hypoglycemia

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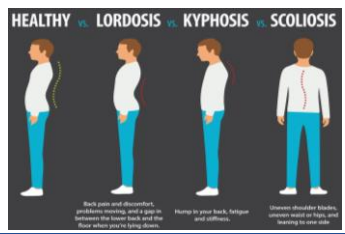
The Evolution of Spinal Care

- *Spinal motion restriction* modern terminology
- Remember the spine is anatomically curved.

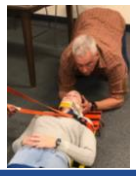


Spinal Motion Restriction—The Cervical Spine

- One of the first steps
- Manually restrict head movement by placing your hands on either side of patient's head.

Spinal Motion Restriction—The Cervical Spine

- Collars must be properly sized.
- Use in conjunction with another immobilization device.
  - No collar completely eliminates movement of the spine.



Spinal Motion Restriction—Immobilization Devices

- Although backboards remain useful, the ambulance stretcher provides appropriate spinal protection.
  - For most EMS systems, the rigid spine board is still commonly used.
- Vacuum mattresses
- Uncertain whether rigid devices necessary in nonmoving situations.

ND EMS Protocols

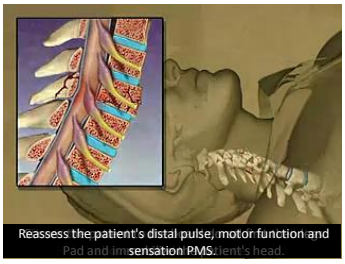
Need for spinal immobilization - consider the following guidelines:

1. Long spine boards (LSB) have both risks and benefits for patients and have not been shown to improve outcomes. The best use of the LSB may be for extricating the unconscious patient, or providing a firm surface for compressions.

Preferred immobilization devices in order of preference are:

1. Cervical collar and strapped to gurney in position of comfort
2. Vacuum Mattress with cervical collar
3. Combi-Carrier/Scoop Stretcher with cervical collar/CID/Spider Straps
4. KED/Clamshell Extrication device with cervical collar
5. Long Spine board with cervical collar/CID/Spider Straps

Spinal Injuries Animation



Click on the screenshot to view an animation on the subject of treating cervical injuries.

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Applying a Cervical Collar

Spinal Motion Restriction Issues

- Patients who may have been subject to spinal injury are found in many different positions.
- Be sure of cervical-collar sizing and application prior to implementing.

Pediatric Note

- For an infant or child, be sure to use a pediatric-sized collar. If you do not have the right pediatric size, use a rolled towel, maintaining manual support of the infant's or child's head.

Adult Pediatric

Special Motion Restriction in a Seated Patient

- Low priority
  - Use a short board or vest-immobilization device.

- High priority
  - Maintain manual stabilization while moving patient.

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Special Motion Restriction in a Seated Patient

- Vest-style extrication device
- Short spine board
- Sequence to follow
  - Torso first
  - Head last
- Assessment of the back, shoulder blades, arms, and collarbones must be done before the device is placed against the patient.

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Special Motion Restriction in a Seated Patient

- The EMT applying the board must angle it, without striking or jarring, to fit between the arms of the rescuer who is stabilizing the head from behind the patient.

Special Motion Restriction in a Seated Patient

- To provide full cervical support, the uppermost holes must be level with the patient's shoulders. The base of the board should not extend past the coccyx.
- Never place a chin cup or chin strap on the patient as it can prevent him from opening his mouth if he has to vomit.

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Special Motion Restriction in a Seated Patient

- Avoid applying the first torso strap too tightly.
- Some buckles have quick-release mechanisms.
- Do not pad between the collar and the board. This will create a pivot point that may cause the cervical spine to hyperextend when the head is secured.

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Special Motion Restriction in a Seated Patient

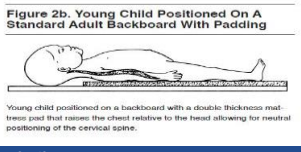
- Never use excessive padding behind head.
- Follow the instructions provided by the manufacturer of the device you are using.

Tips for Applying a Long Backboard

- Log-roll patient.
- Pad voids between board and head/torso.
- Secure head last.
- If pregnant, tilt board to left after immobilizing
- Strap across upper chest, pelvis, and thighs.

Pediatric Note

- When immobilizing children less than 6 y/o, provide padding beneath the shoulders to compensate for the large head.
  - Pad from the shoulders to toes as needed to establish a neutral position.



Pediatric Note

- Practice immobilizing children using adult equipment and lots of padding.
- Immobilizing a child in a child safety seat is no longer recommended because the integrity of a safety seat may have been compromised in the collision.

Tips for Dealing with a Standing Patient

- Rapid takedown
  - Requires 3 providers, c-collar, and backboard

Standing Patient

EMT #1 continues manual stabilization. EMT #2 and the third rescuer maintain their grasp on the spine board and patient. EMT #1 explains to the patient what is going to happen then gives the signal to begin slowly tilting the board and patient to the ground. As the board is lowered, EMT #1 walks backward and crouches, keeping up with the board as it is lowered and allowing the patient's head to slowly move back to the neutral position against the board. EMT #1 must accomplish all this without interfering with the lowering of the board.

Patient Found Wearing a Helmet

- When to leave helmet in place
  - Fits snugly, allowing no movement
  - Absolutely no impending airway or breathing issues
  - Removal would cause further injury.
  - Proper spinal immobilization can be done with helmet in place.
  - No interference with EMT's ability to assess airway or breathing

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Patient Found Wearing a Helmet

- When to remove helmet
  - Interferes with EMT's ability to assess and manage airway
  - Interferes with immobilization
  - Improperly fitted
  - Cardiac arrest

Spinal Immobilization of the Seated Patient Video

Click on the screenshot to view a video on spinal immobilization.

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Chapter Review

Chapter Review

- Central nervous system
  - Brain and spinal cord
- Peripheral nervous system
  - Sensory and motor nerves
- The skull, vertebrae, and cerebrospinal fluid efficiently protect the brain and spinal cord.
- MOI -- High index of suspicion of head and spinal injury

Chapter Review

- You must provide cervical spinal motion restriction before beginning any other patient care when head or spine injury is suspected.
- Altered mental status is an early and important indicator of head injury. Monitor and document your patient's mental status throughout the call.

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Chapter Review

- A traumatic brain injury is any injury that disrupts function of the brain and may include anything from a slight concussion to a severe hematoma.
- Always secure the torso to the backboard before the head.

Remember

- In a closed head injury, the skull remains intact. This is dangerous, for the skull is a closed container with little room for bleeding or swelling.
- Neck wounds are at risk for massive bleeding and air entry, causing emboli.

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Remember

- The spine is injured most often by:
  - Compression or excessive flexion,
  - Extension, or rotation from falls,
  - Diving injuries, and by
  - Motor-vehicle collisions.
- These injuries can interrupt nervous system control of body functions.

Remember

- In-line immobilization of 33 spinal bones is the essential component of spinal injury immobilization.
- Specific procedures apply to different immobilization and extrication situations. EMTs should be proficient in handling the basics of these procedures.

Questions to Consider

- Does my patient have a mechanism of injury that would indicate the need for spinal immobilization?
- Do my patient's potential head or spine injuries require prompt transport to a trauma center?

Critical Thinking

- You are treating a patient with a head injury. He has an altered mental status and a significant MOI to the head. Your partner thinks you should hyperventilate. When should you hyperventilate? What are the signs and symptoms that would indicate this is necessary?