Chapter 30
Injuries to the Head and Spine

Overview
- Review of the Nervous and Skeletal Systems
  - The Nervous System
  - The Skeletal System
- Devices for Immobilization
  - Cervical Spine
  - Short Backboards
  - Long Backboards (Full-Body Spinal Immobilization Devices)

Overview
- Injuries to the Spine
  - Mechanism of Injury
  - Assessment
  - Complications
  - Emergency Medical Care of the Spine-Injured Patient
- Injuries to the Brain and Skull
  - Head and Skull Injuries
  - Emergency Medical Care of the Head-Injured Patient
Overview

- Special Considerations
  - Rapid Extrication
  - Helmet Removal
  - Infants and Children
  - Geriatric Patients

The Nervous System

- Function
  - Controls the voluntary and involuntary activity of the body
The Nervous System

- Central nervous system
  - Brain
  - Spinal cord

- Peripheral nervous system
  - Sensory
    - Impulses carry information from the body to the brain and spinal cord
  - Motor
    - Impulses carry information from the brain and spinal cord to the body

The Skeletal System

- The skeletal system is the scaffolding of the body
- Gives the body shape and rigidity
- Protects the vital internal organs
- Enables movement
**The Skull**
- Skull
  - Houses and protects the brain
- Orbit
- Nasal bone
- Maxilla
- Mandible
- Zygomatic bone

**Spinal Column**
- Cervical (neck)—7 vertebrae
- Thoracic (upper back)—12 vertebrae
- Lumbar (lower back)—5 vertebrae
- Sacral (back wall of the pelvis)—5 vertebrae
- Coccyx (tailbone)—4 vertebrae

**Devices for Immobilization**
- Cervical spine
  - Indications
    - Any suspected injury to the spine based on mechanism of injury, history, or signs and symptoms
    - Use in conjunction with short and long backboards
Sizing

- Sizing is based on the specific design of the device
- An improperly sized immobilization device has a potential for further injury
- Do not obstruct the airway with the placement of a cervical immobilization device
- An improperly fit device will do more harm than good
Devices for Immobilization

- When the cervical collar is properly sized and placed, it will help to immobilize the head in a neutral position.

Devices for Immobilization

- Technique for sizing

Devices for Immobilization

- Precautions
  - Cervical immobilization devices alone do not provide adequate in-line immobilization.
  - Manual immobilization must always be used with a cervical immobilization device until the head is secured to a board.
Devices for Immobilization

- Short backboards
  - Several different types of short board immobilization devices exist
    - Vest-type devices
    - Rigid short board
  - Provides stabilization and immobilization to the head, neck, and torso
  - Used to immobilize non-critical sitting patients with suspected spinal injuries

Devices for Immobilization

- Long backboards (full-body spinal immobilization devices)
  - Several different types of long board immobilization devices exist
  - Provide stabilization and immobilization to the head, neck and torso, pelvis, and extremities
  - Used to immobilize patients found in a lying, standing, or sitting position
  - Sometimes used in conjunction with short backboards
Injuries to the Spine

- Mechanism of injury
  - Compression
    - Falls
    - Diving accidents
    - Motor vehicle accidents
  - Excessive flexion, extension, rotation
  - Lateral bending
  - Distraction
    - Pulling apart of the spine
    - Hangings

- Maintain a high index of suspicion
  - Motor vehicle crashes
  - Pedestrian-vehicle collisions
  - Falls
  - Blunt trauma
  - Penetrating trauma to head, neck, or torso
  - Motorcycle crashes
  - Hangings
  - Diving accidents
  - Unconscious trauma victims
Injuries to the Spine

- Mechanism of injury may lead you to suspect spine injury

Assessment

- Signs and symptoms
  - Tenderness in the area of injury
  - Pain associated with moving
    * Do not ask the patient to move to try to elicit a pain response
    * Do not move the patient to test for a pain response

*Ability to walk, move extremities, or feel sensation or the lack of pain to spinal column does not rule out the possibility of spinal column or cord damage.*

Assessment

- Signs and symptoms
  - Pain independent of movement or palpation
    * Along spinal column
    * Lower legs
    * May be intermittent
Assessment

- Signs and symptoms
  - Obvious deformity of the spine on palpation
  - Soft tissue injuries associated with trauma
    - Head and neck to cervical spine
    - Shoulders, back, or abdomen—thoracic, lumbar
    - Lower extremities—lumbar, sacral

Assessment

- Signs and symptoms
  - Numbness, weakness, or tingling in the extremities
  - Loss of sensation or paralysis below the suspected level of injury
  - Loss of sensation or paralysis in the upper or lower extremities
  - Incontinence

Assessment

- Considerations in the responsive patient
  - Mechanism of injury
  - Questions to ask
    - Does your neck or back hurt?
    - What happened?
    - Where does it hurt?
    - Can you move your hands and feet?
    - Can you feel me touching your fingers?
    - Can you feel me touching your toes?
Assessment

- Considerations in the responsive patient
  - Inspect for contusions, deformities, lacerations, punctures, penetrations, swelling
  - Palpate for areas of tenderness or deformity
  - Assess equality of strength of extremities
    - Hand grip
    - Gently push feet against hands

Assessment

- Considerations for the unresponsive patient
  - Mechanism of injury
  - Initial assessment
  - Inspect for:
    - Contusions
    - Deformities
    - Lacerations
    - Punctures/penetrations
    - Swelling
    - Palpate for areas of tenderness or deformity

Assessment

- Considerations for the unresponsive patient
  - Obtain information from others at the scene to determine information relevant to mechanism of injury or patient mental status prior to the EMT-Basic’s arrival
Complications of Spine Injury

- Inadequate breathing effort
- Paralysis

Emergency Care of Spine Injury

- Body substance isolation
- Establish and maintain in-line immobilization
  - Place the head in a neutral in-line position
  - Maintain constant manual in-line immobilization until the patient is properly secured to a backboard with the head immobilized

Video Clip: In-line Cervical Spinal Immobilization
Emergency Care of Spine Injury

- Perform initial assessment
  - Whenever possible, airway control must be done with in-line immobilization
  - Whenever possible, artificial ventilation must be done with in-line immobilization
- Assess pulse, motor, and sensation in all extremities
- Assess the cervical region and neck

Emergency Care of Spine Injury

- Apply a rigid, cervical immobilization device
  - Properly size the cervical immobilization device
- Spinal immobilization

Video Clip: Application of a Cervical Spinal Immobilization Device
Emergency Care of Spine Injury

- Spinal immobilization
  - Stabilize the head
  - Log-roll patient onto the board
  - Immobilize torso to the board
  - Immobilize the patient’s head to the board
  - Secure the legs to the board
  - Reassess pulses, motor, and sensation and record

Emergency Care of Spine Injury

- Spinal immobilization
  - Pad voids between the patient and the board
    - Adult
      - Under the head
      - Voids under torso. Be careful of extra movement
    - Infant and child
      - Pad under the shoulders to the toes to establish a neutral position

Emergency Care of Spine Injury

- Log-roll the patient
Emergency Care of Spine Injury

- Immobilize the torso

Video Clip: Immobilization of a Lying Patient on a Long Back Board
Emergency Care of the Spine-Injured Patient

- Seated patient
- Immobilize with a short spine immobilization device
- Exception
  - If the patient must be removed urgently
    - Use rapid extrication

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Emergency Care of the Spine-Injured Patient

- Seated patient
  - Position device behind the patient
  - Secure the device to the patient’s torso
  - Evaluate torso fixation and adjust as necessary without excessive movement of the patient
  - Secure the patient’s legs to the device
  - Evaluate and pad behind the patient’s head as necessary to maintain neutral in-line immobilization
  - Secure the patient’s head to the device
  - Reassess pulses, motor, and sensory in all extremities and record

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Emergency Care of the Spine-Injured Patient

- Seated patient
  - Maintain manual stabilization of the spine

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Emergency Care of the Spine-Injured Patient

- Seated patient
  - Position the device

Emergency Care of the Spine-Injured Patient

- Seated patient
  - Secure the device to the patient’s torso

Emergency Care of the Spine-Injured Patient

- Seated patient
  - Secure the patient’s legs
Emergency Care of the Spine-Injured Patient

- Seated patient
  - Secure the patient’s head to the device

Emergency Care of the Spine-Injured Patient

- Seated patient
  - Transfer the patient to a long spine board
Video Clip: Immobilization of the Seated Patient with a Short Rigid Back Board

Video Clip: Immobilization of the Seated Patient to the Kendrick Extrication Device (KED)

Emergency Care of the Spine-Injured Patient

- Standing position
  - Immobilize the patient to a long spine board
Emergency Care of the Spine-Injured Patient

- If the patient is critically injured, perform a rapid extrication
- Transport the patient immediately
  - Bring body into alignment
  - Transfer to long board without short spine board

Video Clip: Immobilization of a Standing Patient

Injuries to the Brain and Skull

- Injuries to the scalp
  - Very vascular, may bleed more than expected
  - Control bleeding with direct pressure
Injuries to the Brain and Skull

- Injury of brain tissue or bleeding into the skull will cause an increase of pressure in the skull

Injuries to the Brain and Skull

- Signs and symptoms
  - Altered or decreasing mental status is the best indicator of a brain injury
    - Confusion, disorientation, or repetitive questioning
    - Conscious—deteriorating mental status
    - Unresponsive
  - Irregular breathing pattern

Injuries to the Brain and Skull

- Mechanism of injury
  - Deformity of helmet
  - Starred windshield
  - Deformity to the skull
Injuries to the Brain and Skull

- Signs and symptoms
  - Blood or fluid (cerebrospinal fluid) leakage from the ears or nose
  - Bruising (discoloration) around the eyes
  - Bruising (discoloration) behind the ears (mastoid process)
  - Neurologic disability
  - Nausea and/or vomiting
  - Unequal pupil size with altered mental status
  - Seizure activity may be seen

Injuries to the Brain and Skull

- Additional signs of open head trauma
  - Contusions, lacerations, hematomas, bruises to the scalp
  - Penetrating injury
    - Do not remove impaled objects in the skull
  - Exposed brain tissue if open
  - Bleeding from the open bone injury
Injuries to the Brain and Skull

- Related nontraumatic conditions
  - Nontraumatic injuries to the brain may occur due to clots or hemorrhaging
  - Nontraumatic brain injuries can be a cause of altered mental status
  - Signs and symptoms parallel those of traumatic injuries with the exception of evidence of trauma and a lack of mechanism of injury

Emergency Care for Head Injuries

- Body substance isolation
- Maintain airway/artificial ventilation/oxygenation
- Initial assessment with spinal immobilization should be done on scene with a complete detailed physical exam en route
- With any head injury, the EMT-Basic must suspect spinal injury; immobilize the spine

Emergency Care for Head Injuries

- Closely monitor the airway, breathing, pulse, and mental status for deterioration
- Control bleeding
  - Do not apply pressure to an open or depressed skull injury
  - Dress and bandage open wound as indicated in the treatment of soft tissue injuries
Emergency Care for Head Injuries

- If a medical injury or nontraumatic injury exists, place patient on the left side
- Be prepared for changes in patient condition
- Immediately transport the patient

Special Considerations

- Rapid extrication
  - Indications
    - Unsafe scene
    - Unstable patient condition warrants immediate movement and transport
    - Patient blocks the EMT-Basic’s access to another, more seriously injured patient

  *Rapid extrication is based on time and the patient, not the EMT-Basic’s preference.*

Special Considerations

- Helmet removal
  - Special assessment needs for patients wearing helmets
    - Airway and breathing
    - Fit of the helmet and patient’s movement within the helmet
    - Ability to gain access to airway and breathing
Special Considerations

- Types of helmets
  - Sports
    - Typically open anteriorly
    - Easier access to airway
  - Motorcycle
    - Full-face
    - Shield
  - Other

Special Considerations

- Indications for leaving the helmet in place
  - Good fit with little or no movement of the patient’s head within the helmet
  - No impending airway or breathing problems
  - Removal would cause further injury to the patient
  - Proper spinal immobilization could be performed with helmet in place
  - No interference with ability to assess and reassess airway and breathing

Special Considerations

- Indications for removing the helmet
  - Inability to assess and/or reassess airway and breathing
  - Restriction of adequate management of the airway or breathing
  - Improperly fitted helmet allowing for excessive patient head movement within the helmet
  - Proper spinal immobilization cannot be performed due to helmet
  - Cardiac arrest
Special Considerations

- General rules for removal of a helmet
  - The technique depends on the type of helmet
  - Remove eyeglasses before removal of the helmet

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Special Considerations

- Helmet removal
  - Manually stabilize the helmet and the spine
  - Cut or remove the strap

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Special Considerations

- Helmet removal
  - Stabilize the spine
  - Slide the helmet halfway off the head

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Special Considerations

- Helmet removal
  - Reposition hands to maintain spinal immobilization

Special Considerations

- Helmet removal
  - The helmet is removed completely

Video Clip: Removal of a Motorcycle Helmet
Special Considerations

- Infants and children
  - Immobilize the infant or child on a rigid board appropriate for size (short, long, or padded splint)
  - Special considerations:
    - Pad from the shoulders to the heels of the infant or child, if necessary to maintain neutral immobilization
    - Properly size the cervical immobilization device
    - If it doesn't fit, use a rolled towel and tape to the board and manually support head

- Child with padding
- Child without padding
Special Considerations

- Geriatric patients
  - Immobilize geriatric patients on a rigid board
  - Special considerations
    - Arthritis
    - Osteoporosis
    - Abnormal curvature
      - Pad as necessary to maintain neutral immobilization
      - Properly size the cervical immobilization device
        - If it doesn’t fit, use a rolled towel and tape to the board and manually support head

Summary

- Review of the Nervous and Skeletal Systems
  - The Nervous System
  - The Skeletal System
- Devices for Immobilization
  - Cervical Spine
  - Short Backboards
  - Long Backboards (Full-Body Spinal Immobilization Devices)
Summary

- Special Considerations
  - Rapid Extrication
  - Helmet Removal
  - Infants and Children
  - Geriatric Patients