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Spinal Trauma

Advanced Care Paramedicine

Module: 08

Section: 07b

Introduction

- Spinal cord injuries can:
  - Threaten life
  - Result in lifelong disability
- 1347 admissions to hospital with spinal cord injuries (1998-1999)
  - Commonly young people 15 to 34 years
  - MVCs 43%
  - Falls 36%

Introduction

- Spinal cord consists of highly specialized neural tissue
  - Does not repair itself
  - Injury interrupts communication pathways
  - Paraplegia, quadriplegia
  - Affects control over internal organs and internal environment
- Lifelong care for spinal cord injury victim exceeds $1 million
- Best form of care is public safety and prevention programs

Mechanisms of Injury

- Extremes of motion
  - Flexion, extension, rotation, lateral bending
- Stresses along the axis of the spine
  - Axial loading, distraction
- Directly from blunt or penetrating trauma
- Indirectly from an expanding mass that compresses the cord
  - Hemorrhage or edema

Extremes of Motion

- Hyperextension and hyperflexion
  - Bend the spine forcible
  - Commonly at cervical and lumbar regions
- Hyperextension
  - Rear end MVC, upper torso moves forward, head move backward
- Hyperflexion
  - Frontal impacts, upper torso restrain, head continues to move forward

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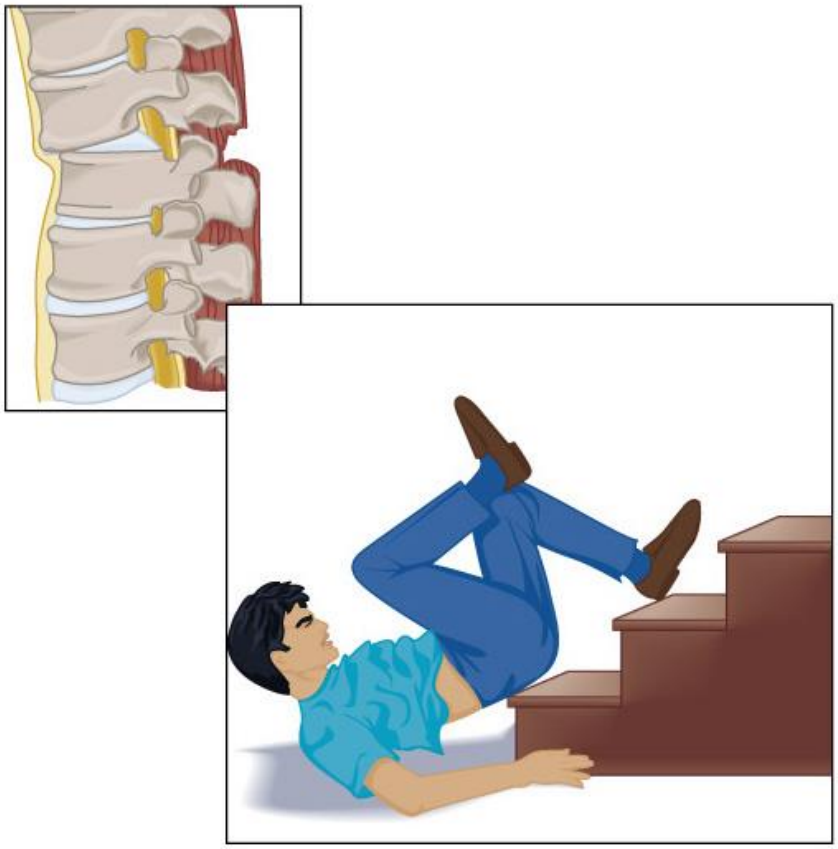
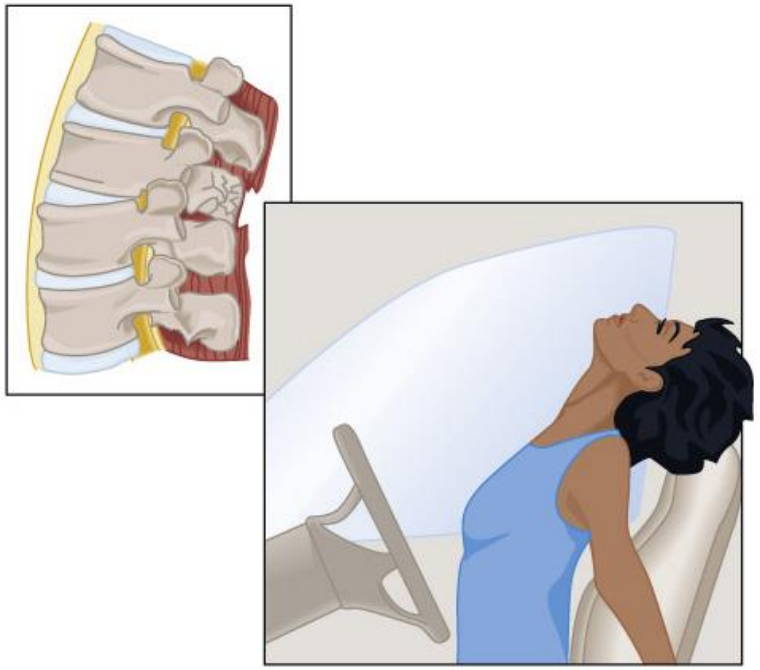
Extremes of Motion

FLEXION INJURY



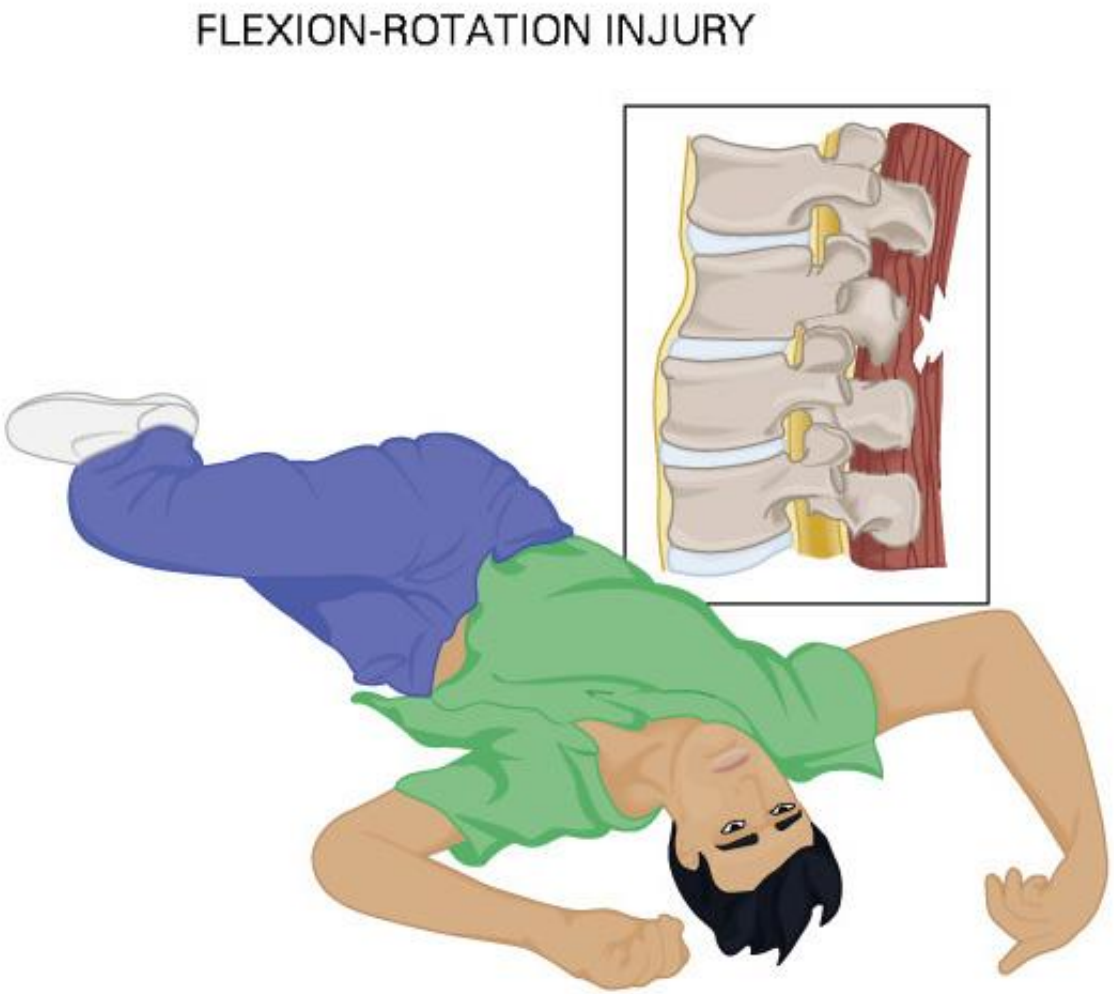
HYPEREXTENSION INJURY



Extremes of Motion

- Rotation
  - Usually affects upper cervical spine
  - Lateral impact
- Lateral bending
  - May take place along entire vertebral column
  - Generally less forces needed to induce injury

Extremes of Motion

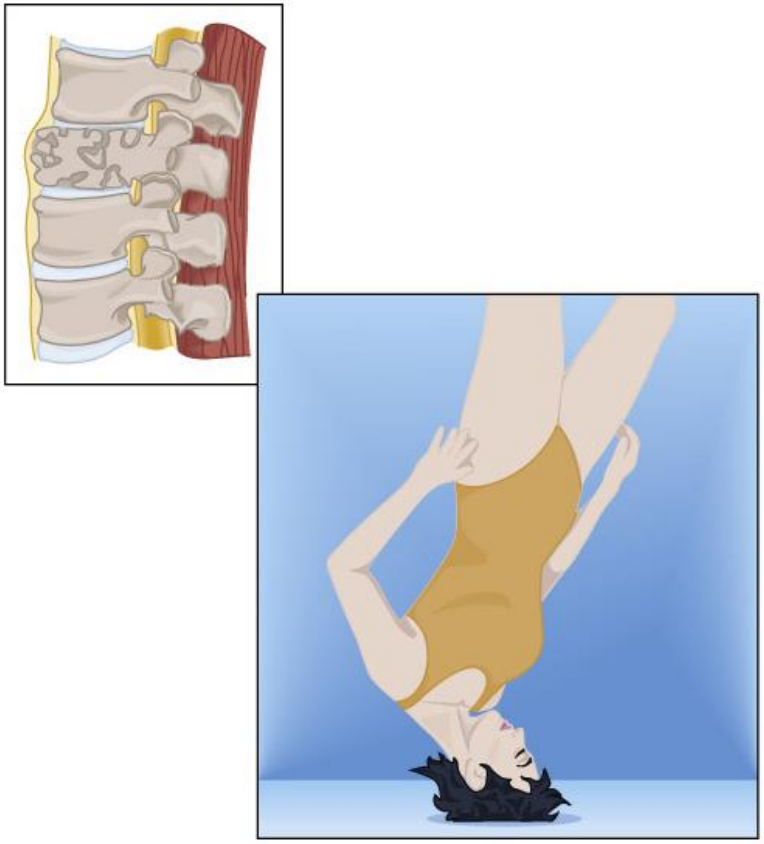


Axial Stress

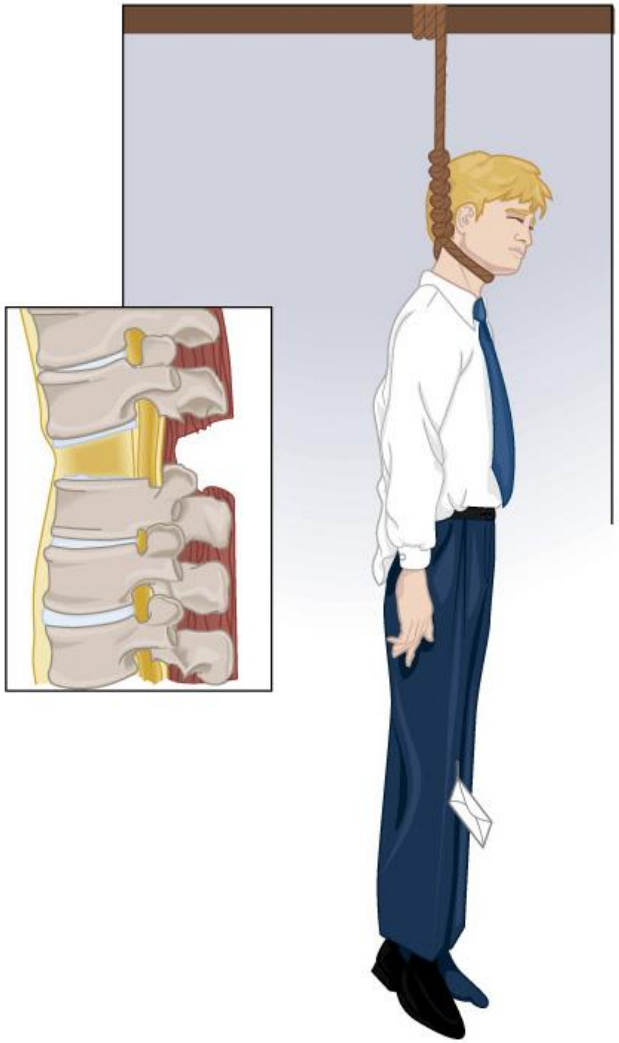
- Axial loading
  - Compressional stress along axis of spine
  - Transmitted up or down spine
  - Dive into shallow water
- Distraction
  - Opposite of axial loading
  - Force that stretches spinal column
  - Hanging, bungee jump
- Combinations
  - Distraction/rotation, compression/flexion

Axial Stress

COMPRESSION INJURY

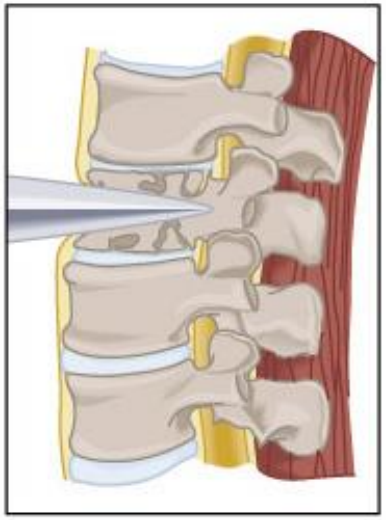


DISTRACTION INJURY



Other Mechanisms

- Blunt or penetrating trauma
  - Direct effects of trauma
- Indirect mechanisms
  - Hemorrhage or edema may compress circulation
  - Ischemia and compromise of function
- Electrocution
  - Result of extreme muscle contractions



Column Injury

- Movement of vertebrae from normal position
  - Subluxation or Dislocation
- Fractures
  - Spinous process and transverse process
  - Pedicle and laminae
  - Vertebral body
- Ruptured intervertebral disks
  - Common sites of injury:
  - C-1/C-2: Delicate vertebrae
  - C-7: Transition from flexible cervical spine to thorax
  - T-12/L-1: Different flexibility between thoracic and lumbar regions

Cord Injury

- Concussion
  - Similar to cerebral concussion
  - Temporary and transient disruption of cord function
- Contusion
  - Bruising of the cord
  - Tissue damage, vascular leakage and swelling
- Compression
  - Secondary to:
  - Displacement of the vertebrae
  - Herniation of intervertebral disk
  - Displacement of vertebral bone fragment
  - Swelling from adjacent tissue

Cord Injury

- Laceration
  - Hemorrhage into cord tissue, swelling and disruption of impulses
  - Caused by:
  - Bony fragments driven into the vertebral foramen
  - Cord may be stretched to the point of tearing
- Hemorrhage
  - Associated with contusion, laceration, or stretching

Transection

- An injury that partially or completely severs the spinal cord
- Complete transection
  - No impulses below site of injury
  - Cervical spine
    - Quadriplegia
    - Incontinence
    - Respiratory compromise
  - Thoracic spine
    - Paraplegia
    - Incontinence

Incomplete Cord Transection

- Anterior cord syndrome
  - Anterior vascular disruption
  - Loss of motor function and sensation of pain, light touch, and temperature below injury site
  - Retain motor, positional and vibration sensation
- Central cord syndrome
  - Hyperextension of cervical spine
  - Motor weakness affecting upper extremities
  - Bladder dysfunction

Incomplete Cord Transection

- Brown-Sequard's syndrome
  - Penetrating injury that affects one side of the cord
  - Ipsilateral sensory and motor loss
  - Contralateral pain and temperature sensation loss

Signs and Symptoms of Spinal Injury

- Extremity paralysis
- Pain with and without movement
- Tenderness along spine
- Impaired breathing
- Spinal deformity
- Priapism
- Posturing
- Loss of bowel or bladder control
- Nerve impairment to extremities

SIGNS OF SYMPTOMS OF POSSIBLE SPINAL INJURY

- PAIN Unprovoked pain in area of injury, along spine, in lower legs.
- TENDERNESS Gentle touch of area may increase pain.
- DEFORMITY (rare) There may be abnormal bend or bony prominence.
- SOFT TISSUE INJURY Injury to the head, neck, or face may indicate cervical spine injury. Injury to shoulders, back, and abdomen may indicate thoracic or lumbar spine injury. Injury to extremities may indicate lumbar or sacral spine injury.
- PARALYSIS Inability to move or inability to feel sensation in some part of body may indicate spinal fracture with cord injury.
- PAINFUL MOVEMENT Movement may cause or increase pain. Never try to move the injured area.
- ALSO: Loss of bowel or bladder control, priapism, impaired breathing.

Spinal Shock

- Temporary insult to the cord
- Affects body below the level of injury
- Affected area
  - Flaccid
  - Without feeling
  - Loss of movement (flaccid paralysis)
  - Frequent loss of bowel and bladder control
  - Priapism
  - Hypotension secondary to vasodilation

Spinal Shock

- Temporary form of neurogenic shock
  - Hypotension
  - Bradycardia
  - Signs of cord injury

Neurogenic Shock

- Injury to the spinal cord disrupts the brain's ability to control the body
- Loss of sympathetic tone
  - Dilation of arteries and veins
  - Expands vascular space
  - Results in relative hypotension
  - Reduced cardiac preload
  - Reduction of the strength of contraction
  - Frank-Starling Reflex

Neurogenic Shock

- ANS loses sympathetic control over adrenal medulla
  - Unable to control release of epinephrine & norepinephrine
  - Loss of positive inotropic & chronotropic effects
- Signs and symptoms:
  - Bradycardia
  - Hypotension
  - Cool, moist and pale skin above the injury
  - Warm, dry and flushed skin below the injury
  - Priapism

Autonomic Hyperreflexia Syndrome

- Associated with the body's resolution of the effects of spinal shock
- Commonly associated with injuries at or above T-6
- Presentation:
  - Sudden hypertension
  - Bradycardia
  - Pounding headache
  - Blurred vision
  - Sweating and flushing of skin above the point of injury

Other Causes of Neurologic Dysfunction

- Any injury that affects the nerve impulse's path of travel
  - Swelling
  - Dislocation
  - Fracture
  - Compartment syndrome

Assessment

- Scene assessment
  - Special emphasis on mechanism of injury
  - When in doubt, assume cord injury
    - Head injury
    - Intoxicated patients
    - Injuries above the shoulders
    - Distracting injuries
- Primary assessment
  - Immediate manual immobilization
  - Maintain neutral alignment if possible

FIGURE 24-2 Often, the mechanism of injury will suggest the possibility of spinal column injury.

Assessment

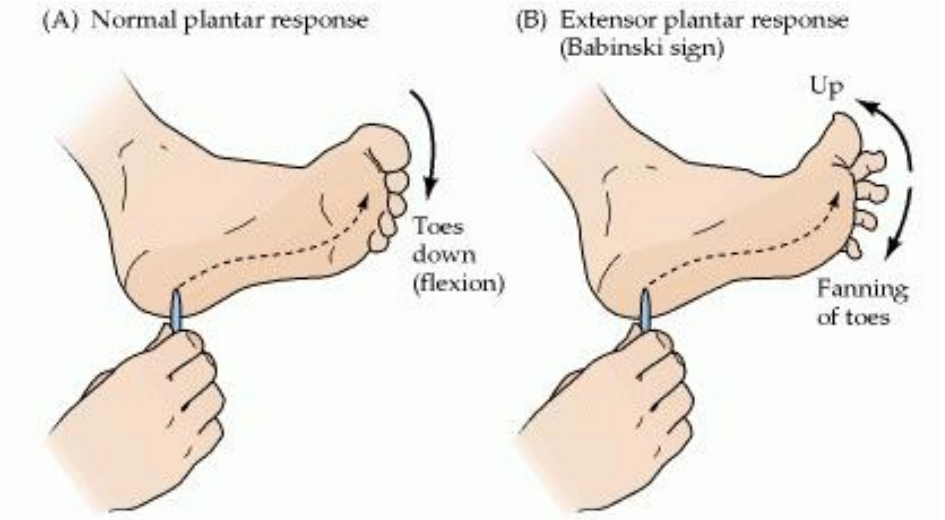
- Neck
  - Deformity, pain, crepitus, warmth, tenderness
- Bilateral extremities
  - Finger abduction/adduction
  - Push, pull, grips
  - Motor and sensory function
- Dermatome and myotome evaluation
- Babinski sign test
- Hold-up position

FIGURE 24–4 Compare grip strength bilaterally.

FIGURE 24–5 Compare lower limb strength bilaterally.

Babinski's Sign

- Stroke lateral aspect of the bottom of the foot
- Evaluate for movement of the toes
- Fanning and flexing (lifting)
  - Injury along the pyramidal (descending spinal) tract



Vital Signs

- Caution with patients with bradycardia
  - Especially in suspected hypovolemia and shock
- Potential for spinal cord injury increased with
  - Low blood pressure
  - Absent, diaphragmatic or shallow respirations

FIGURE 24-7 Repeat the ongoing assessment every five minutes with seriously injured patients.

Management

- Spinal alignment
- Manual cervical immobilization
- Cervical collar
- Immobilization and movement

Spinal Alignment

- Move patient to a neutral, in-line position
  - Position of function
  - Hips and knees should be slightly flexed
  - Place a rolled blanket under the knees
- Always support the head and neck
- Contraindications to neutral position
  - Movement causes a noticeable increase in pain
  - Noticeable resistance met during procedure
  - Increase in neurological deficits occurs during movement
  - Gross deformity of spine
- Less movement is always best

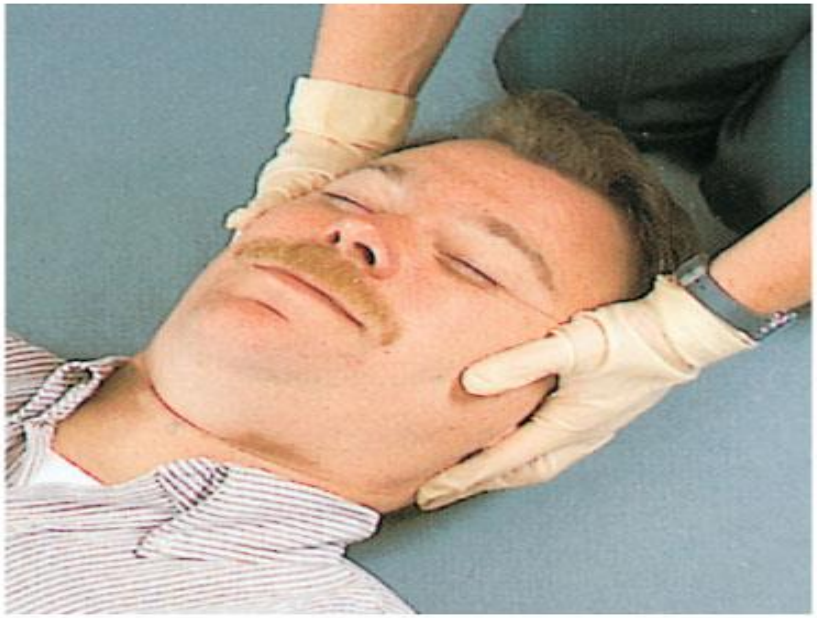


FIGURE 24–8 Bring the head to the neutral, in-line position, and maintain manual immobilization until the head, neck, and spine are mechanically immobilized.

Manual Cervical Immobilization

- Seated patient
  - Approach from front
  - Assign a care giver to hold gentle manual traction
    - Reduce axial loading
  - Evaluate posterior cervical spine
  - Position patient's head slowly to a neutral, in-line position
- Supine patient
  - Assign a care giver to hold gentle manual traction
  - Adult
    - Lift head off ground 1-2": neutral, in-line position
  - Child
    - Position head at ground level: Avoid flexion

FIGURE 24-9 When you cannot access the patient from behind to apply manual immobilization, use alternative hand placement.

Cervical Collar Application

- Apply the c-collar as soon as possible
- Assess neck prior to placing
- C-collar limits some movement and reduces axial loading
- Does not completely prevent movement of the neck

Cervical Collar Application

- Size and apply according to the manufacturer's recommendation
  - Size collar before application
  - Collar should fit snug
  - Collar should not impede respirations
  - Head should continue to be in neutral position
- Do not release manual control until the patient is fully secured in a spinal restriction device

FIGURE 24-10 Properly place and secure the cervical collar on patients with suspected spinal injury.

Standing Takedown

- Minimum 3 rescuers
- Communicate with patient and partners
- Have patient remain immobile
- Rescuer provides manual stabilization from behind
- Assess neck
- Size and place c-collar
- Position board behind patient
- Grasp board under patient’s shoulders
- Lower board to ground
- Secure patient

The standing takedown

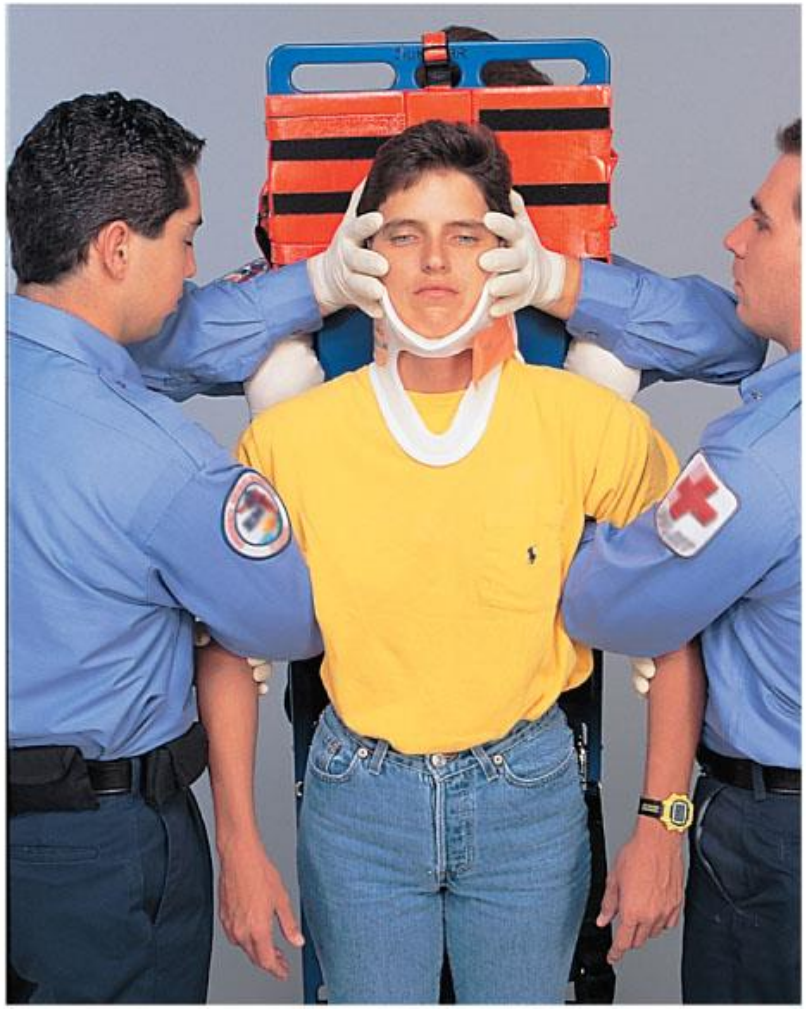


FIGURE 24-11 The standing takedown.

Helmet Removal

- Indications:
  - Helmet does not immobilize the patient's head within
  - Cannot securely immobilize the helmet to the long spine board
  - Helmet prevents airway care
  - Helmet prevents assessment of anticipated injuries
  - Present or anticipated airway or breathing problems
  - Removal will not cause further injury

Helmet Removal

- 2 Rescuers
- Have a plan and communicate
- Remove face mask and chin strap
- Immobilize head
  - Slide one hand under back of neck and head
  - Other hand supports anterior neck and jaw
- Remove helmet
  - Gently rock head to clear occiput
  - All actions should be slow and deliberate
- Transport the helmet with patient

Helmet Removal

FIGURE 24-12 Helmet removal.

Movement

- Any movement must be coordinated
  - 4 count is a desirable cadence
- Move patient as a unit
  - Avoid lateral pushing
  - Move patient up and down to prevent lateral bending
- Rescuer at the head calls all moves
- All moves must be slowly executed and well coordinated
- Consider the final positioning of the patient prior to beginning move

Types of Moves

- Log roll
- Straddle slide
- Rope-sling slide
- Orthopedic stretcher
- Vest-type immobilization
- Rapid extrication
- Final patient positioning
- Long spine board
- Diving injury immobilization

FIGURE 24-13 The four-person log roll.

FIGURE 24-14 A vest-type immobilization device.

FIGURE 24-15 The vest-type immobilization device is not intended for lifting the patient but for pivoting him.

FIGURE 24-16 Rapid extrication of a patient with a spinal injury.

FIGURE 24-17 Immobilization of a spinal injury patient to a long spine board with a cervical immobilization device in place.

Medications

- Steroids
  - Reduce the body's response to injury
  - Reduce swelling and pressure on cord
  - Administered within 1st 8 hours of injury
- Methylprednisolone (Solu-Medrol)
  - Reduce capillary dilation and permeability
- Dexamethasone (Decadron, Hexadrol)
  - Reduce capillary dilation and permeability
  - Five times more potent than Solu-Medrol

Medications

- Neurogenic shock
  - Fluid challenge
  - Dopamine
  - Atropine
- Combative patients
  - Consider sedatives to reduce anxiety and calm patient
    - Prevents spinal injury aggravation
  - Alters LOC
  - Medications
    - Meperidine (Demerol)
    - Diazepam (Valium)
    - Consider paralytics