

# Acute Spinal Cord Injury

- Every slide has 4 to 5 statements.
- Out of these 1 statement is false
- Identify it

1. SCI is a devastating life threatening event.
2. Currently 2,25000-2,28000 individuals living in U.S. with sequelae of SCI including permanent paralysis.
3. Male: female- 1:4
4. Age: 16-30 yrs majority

## Leading causes-

1. motor vehicle accidents- 47.5%
2. sports-22.9%
3. violance-13.8%
4. Falls- 8.9%

1. Acute SCI: complex, multifaceted .
2. Mechanical trauma cause direct neuronal damage
3. However a small no. of axons are lost as a result of secondary pathophysiological events - hypo perfusion, ischemia, and biochemical and inflammatory changes
4. Salvaging as little as 10% of adult axons can makes walking a potential goal.

## Common Injuries

# C-Spine Flexion Injury

1. Occurs during Cervical flexion with axial loading
2. C5- least commonly injured
3. Anterior wedging +/-
4. retropulsion of bony fragments into spinal canal is present



## Cervical - Facet dislocations

- **Unilateral**

1. Occurs in Flexion/rotation injury, **C5-C6** is most common
2. More likely to be **complete**

- **Bilateral**

1. Occurs in Flexion injury, **C5-C6** is most common
2. More likely to be **complete**

# Cervical hyperextension injury

1. Occurs in Acceleration-deceleration injury
2. Due to Falls, MVCs
3. C4-C5 most common involvement
4. Do not Often results in a central cord syndrome



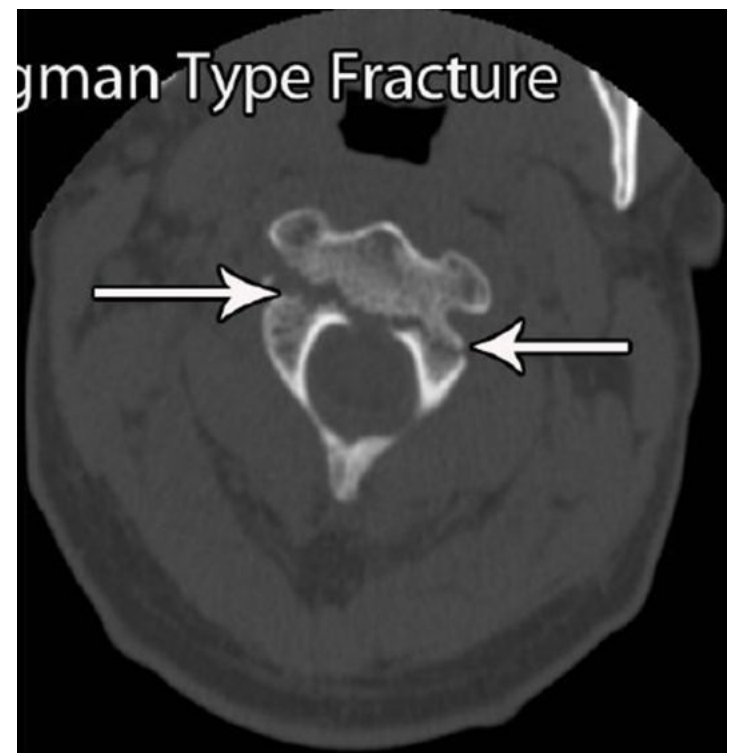
## Jefferson Fracture

1. It is C1 burst fracture
2. Usually UNSTABLE with no neuro findings
3. Due to Axial loading of atlas
4. Common in contact sports



# Hangman Fracture

1. **C1 burst** fracture
2. Bilateral fracture from deceleration injury
3. Common in Head hitting windshield
4. Mostly stable



# Chance Fracture

1. It is T12-L2 transverse fracture through posterior elements and vertebral body
2. Common in lap belt injury
3. Caused by Hyperextension of thorax
4. Degree of injury depends on movement of bony elements



# Management at Injury Site

## Critical factors in recovery:

1. Late pre hospital recognition of injury
2. Prompt resuscitation
3. Stabilization of injury
4. Avoidance of additional neurological injury and medical complications.

# Prehospital management

- 3 to 25 percent of SCIs occur after the initial traumatic insult, either during transit or early in the course of treatment.
- Four responsibilities of prehospital(infield) care are:
  1. initial evaluation
  2. adequate resuscitation
  3. mobilization of the suspected fractured area
  4. safe extrication, and transportation

## Initial Evaluation

Steps of Trauma PRIMARY SURVEY are:

1. **A**irway maintenance with cervical spine control;
2. **B**reathing and ventilation management;
3. **C**irculation with hemorrhage control;
4. **D**isability (neurological status) limitation
5. **E**xposure/**E**nvironmental control (covering the patient while preventing hyper- or hypothermia)



- Secondary survey includes:
  1. a detailed Head to toe evaluation
  2. Quick motor examination : grip strength & a foot dorsiflexion evaluation
  3. Gross sensory examination.
  4. Signs of incontinence, urinary retention, priapism, or loss of anal sphincter tone are usually not found in SCI.

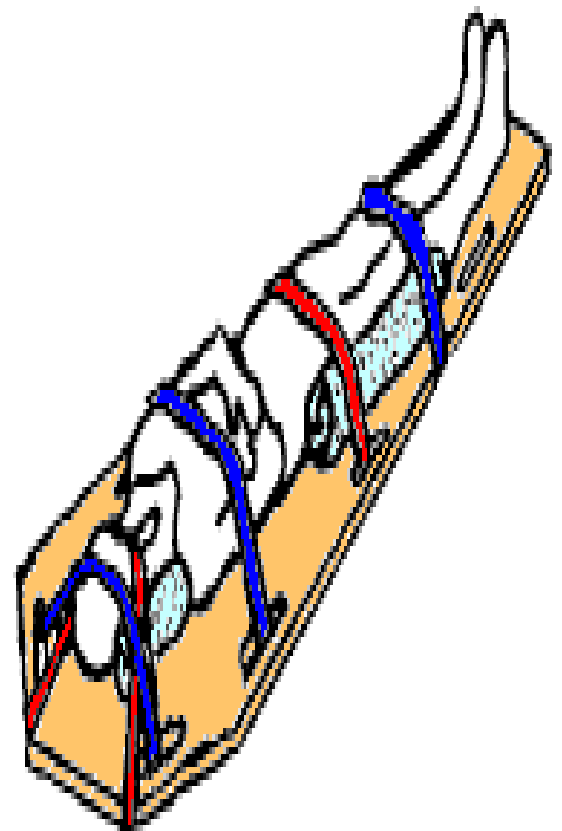
1. All evaluations must take place in full spinal immobilization
2. In an unconscious patient assume that cervical spine is injured until radiography of its entire length prove otherwise.
3. Even in the absence of any of the clinical findings, the patient must be placed in a rigid collar and backboard and immobilize for transport.
4. Resuscitation begins after the secondary survey

# IMMOBILIZATION

1. All major trauma victims must be immobilized
2. Patients complaining of neck pain or neurological symptoms must be immobilized
3. Any patient with altered mental status of uncertain cause must be immobilized.
4. Flexed position of spine is critical to prevent any further damage to the cord.

## Immobilization

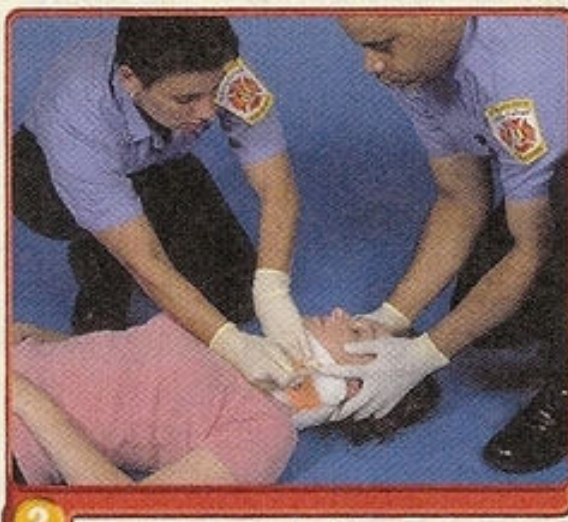
1. Secure the neck first by a cervical collar.
2. When removing a patient from a seated position, a cervical collar is first placed on the patient.
3. Immobilize the entire spine using a soft board.







**1** Apply and maintain cervical stabilization. Assess distal functions in all extremities.



**2** Apply a cervical collar.



**3** Rescuers kneel on one side of the patient and place hands on the far side of the patient.



**4** On command, rescuers roll the patient toward themselves, quickly examine the back, slide the backboard under the patient, and roll the patient onto the board.



**5** Center the patient on the board.



**6** Secure the upper torso first.

## Extrication and Transportation

1. After proper immobilization, a safest method of extrication and transportation should be adopted.
2. After proper immobilization, a fastest method of extrication and transportation should be adopted.
3. Minimum Three persons are required during extrication
4. Scoop stretcher & Kendrick extrication devices(KED) are used for extrication



# Scoop stretcher & KED



Patient on vacuumed mattresses

# Goals of Medical Management in a hospital:

1. Normalize vital signs.
2. Minimizing the neurological damage caused during the primary injury
3. Prevent aspiration
4. Preventing further cord injury secondary to hypo perfusion, ischemia, and biochemical and inflammatory changes

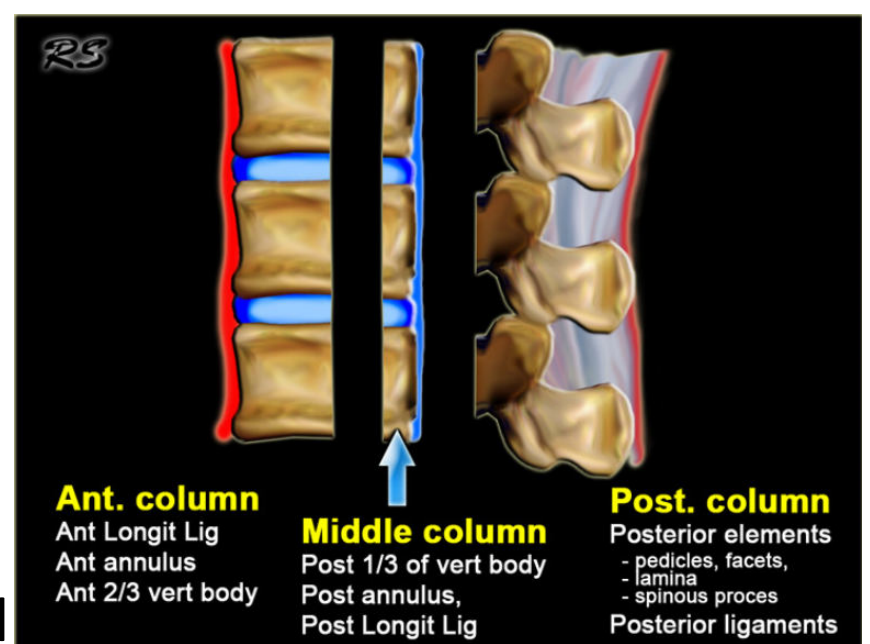
## Management in Hospital

# Spinal Stability- neurological and mechanical:

- Neurologic stability denotes a state in which, under the stresses that are imposed, no further neural damage is caused.
- Mechanical stability refers to the relative motion of vertebral segments under the physiologic loads of everyday activity.

## Spinal Stability

1. To assess mechanical stability: Dennis' 3 column theory used.
2. A column can be disrupted by either fracture or ligamentous disruption.
3. Disruption of three or more columns imparts instability.
4. Flexion & Extension X-ray films are done in conscious patients with no neurological deficits.



# Imaging:

- Computerized tomography (CT):
  1. provides highly detailed axial images of each vertebral segment
  2. inferior to MRI for delineating fractures.
  3. can demonstrate nondisplaced fractures not discernible on plain x-ray.
  4. an excellent method for evaluating and quantifying the degree of spinal canal compromise.

# Imaging

- MRI:
  1. Modality of choice for evaluating the spinal cord and neural elements.
  2. Can reveal edematous soft tissues, in either the anterior or posterior cervical spine.
  3. Do not offer information regarding the integrity of the ligamentous structures
  4. Can detect presence of herniated disc material in the spinal canal or foramina



# Closed Reduction and Immobilization

1. Most mechanically stable thoracolumbar injuries without neurologic deficit can be treated nonoperatively
2. Nonoperative treatment should not be considered in stable injury patterns with limited potential for progressive deformity and neurologic compromise.

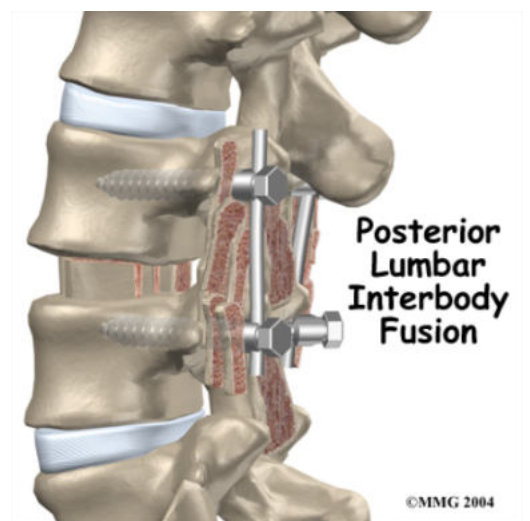
## Operative Treatment

- The indications for surgical intervention of spinal cord injuries depend on
  1. pattern of injury.
  2. alignment and stability of the vertebral fracture.
  3. neurologic status of the patient.
  4. overall medical condition of the patient do not affect decision



## SURGICAL Management:

1. decompress the neural elements by anterior decompression or Posterior decompression
2. spine stabilized by instrumentation.
3. spinal orthosis- for 1 month.



## TREATMENT MODALITIES

### METHYLPREDNISOLONE-

1. stabilize membranes, inhibit lipid peroxidation, suppress vasogenic edema by restoring the blood-central nervous system (CNS) barrier
2. enhance the spinal cord blood flow, inhibit pituitary endorphin release, and attenuate the inflammatory response.
3. Timing of steroid therapy is critical in its ultimate efficacy (8-72 hrs)
4. recommended for penetrating SCI.

## PREVENTION & TREATMENT OF COMPLICATIONS

1. SCI is followed by a series of detrimental hemodynamic and biochemical processes
2. that cannot be prevented by early and aggressive medical management

### Cardiovascular picture following SCI:

1. Spinal shock - loss or depression of all or most spinal reflex activity below the level of the injury
  2. Hypotension- common in lower level of injury, caused by a withdrawal of sympathetic tone.
  3. Neurogenic shock - The vasodilatation, hypotension, decreased peripheral vascular resistance (PVR), decreased preload, and bradycardia.
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# Deep Venous Thrombosis: Prevention and Treatment

- Causes:

1. Immobility
2. vascular dilatation and stasis
3. epithelial damage, and
4. an increase in the level of factor VIII and fibrinogen.

1. Incidence of DVT during acute inpatient stay: 13.6 %.
2. pneumatic devices are applied to the lower extremities for the first 2 weeks after the injury.
3. If thromboprophylaxis is delayed for more than 72 hours, venous doppler to screen for thrombi formation prior to application of above devices are usually not required

# Deep Venous Thrombosis: Prevention and Treatment

1. Anticoagulant prophylaxis with LMWH are initiated after 72 hours
2. It is continued until discharge in patients with incomplete injury.
3. for 8 weeks in patients with uncomplicated complete injury.
4. for 12 weeks or until discharge from rehabilitation in Complicated Complete injury.

## AUTONOMIC DYSREFLEXIA

1. Occurs at Neurological level-T6 and above
2. Characterized by abrupt onset of malignant hypertension & bradycardia
3. Caused by any noxious stimulus
4. Only treatment possible is to give Nifedipine & nitrates
5. Treatment is to Identify & treat noxious stimulus

# Respiratory Management

1. Complete SCI with neurological level C4- ventilator dependent
2. C3 injuries- borderline
3. C2 and above- ventilator dependent
4. Primary Goal- Recruiting and maintaining aeration of alveoli thereby preventing atelectasis and pneumonia.

## Atelectasis & pneumonia:

1. Occur 40-70% of tetraplegics
2. Most commonly occurs in the first 5 to 7 days
3. Often focused primarily in the left upper lobe
4. Chest percussions, postural drainage, assistive coughing, Intermittent positive pressure breathing, Bronchodilators & mucolytic agents(guaifenesin) are used for treatment

# Gastrointestinal Care

1. During spinal shock: gastric dilatation and paralytic ileus leads to distended stomach → vomiting and aspiration.
2. nasogastric tube is used for distended stomach
3. Stress ulcers are rare occurring in the acute phase following SCI
4. Prophylactic therapy with H2 blockers should be instituted for stress ulcers
5. Bowel management program should be established once normal bowel sounds and motility are restored.

# Bladder Care

1. During spinal shock: bladder distension leads to urinary reflux which can result in renal failure
2. A Foley's catheter should be inserted at admission.
3. During subacute phase of injury, use of Clean Intermittent Catheterization (CIC) increases the risk of bacterial infections.

1. The most frequent secondary medical complication reported during the acute care of SCI patients is urinary tract infection.
2. Symptomatic UTI should be treated with appropriate antibiotics for 7 to 14 days.
3. Asymptomatic bacteriuria should be treated routinely

## Skin Care

1. Pressure ulcers are a devastating complication of SCI (40%)
  2. Posture change is required every 2 hourly.
  3. Specially designed foam/air mattresses can reduce the pressure over bony prominences, but will not obviate the need for turning.
  4. Adequate nutrition is not important for pressure ulcer healing
  5. Enteral rather than parenteral nutrition is preferred once patient stabilized
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# Ambulatory training

## Tilt Table





# Strengthening of UL & Trunk



## Standing balance



# Orthotic support



# Robotic-assisted Gait Training (Lokomat)





# Robotic-assisted Upper Limb Training (ARMEFO)



# THANKS