

Spinal Injuries

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Spinal Injuries

- Incidence 30-40/ 1,000,000 person
- The mortality rate 40-50%
- Most common in the cervical region (55%)
- The peak incidence in the young age group (15-25 year-old)
- Motor vehicle accidents accounts for 50% followed by falls (25%), athletic accidents (15%), and penetrating injuries (10%)

Acute evaluation and ER management

- **Strict spine precautions (immobilization)**
- **Emergency resuscitation (ABC..)**
- **Comprehensive approach**
- **Always expect multiple trauma (neuroexam, chest, abdomen, musculoskeletal...)**
- **Differentiate hypotension from neurogenic shock**

Neurological and radiological evaluation

- **In awake patients, both motor and sensory examinations in all extremities**
- **Unconscious patients: muscle tone, reflexes, rectal sphincter tone, priapism**

Radiological evaluation

Lateral C.S. Xray:

- Accuracy 70-80%
- check alignment, bone and disc space pathology
- Prevertebral soft tissue at C2-C4:
(retropharyngeal $< 7\text{mm}$)
and at C5-C7:
(retrotracheal $< 20\text{mm}$)



Radiological evaluation

Dorsal spine Xray:

-Not accurate

**-Lumbar Spine Xray:
70% accuracy**



Radiological evaluation

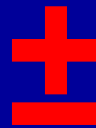
**CT scan and
MRI in case of
clinical suspicion
or abnormal Xray**

Spinal Injuries

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graph TD; A([Spinal Injuries]) --- B[/Spinal Column Injuries/]; A --- C[/Injuries to Neural Structures (spinal cord, nerve roots)/]; B --- D[+]; C --- D;
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Spinal Column Injuries

Injuries to Neural Structures (spinal cord, nerve roots)



Neural injury

secondary injury

- **local swelling at the site of injury which pinches off blood (hypoperfusion and ischemia)**
- **Excessive release of glutamate and excitotoxicity of neurons and oligodendrocytes at the site of injury**
- **Infiltration by immune cells (microglia, neutrophils)**
- **Free radical toxicity**
- **Apoptosis/necrosis**

General Management Guidelines

Role of steroids

- **The North American Spinal Cord Injury Study (NASCIS) showed definite benefit of I.V. high dose methylprednisolone**
- **Given for complete and incomplete injuries**
- **Should be given within 8 hours of the injuries**
- **Dose: 30mg/kg over 1 hr loading dose then 5.4mg/kg/hr for 23 hrs or 48 hrs**

Spinal Shock

Transient loss of all neurological function (motor, sensory, and autonomic) below the injury level for 1-2 weeks

Spinal Injuries

Injury level

	R	L	KEY MUSCLES
C2	<input type="checkbox"/>	<input type="checkbox"/>	
C3	<input type="checkbox"/>	<input type="checkbox"/>	
C4	<input type="checkbox"/>	<input type="checkbox"/>	
C5	<input type="checkbox"/>	<input type="checkbox"/>	Elbow flexors
C6	<input type="checkbox"/>	<input type="checkbox"/>	Wrist extensors
C7	<input type="checkbox"/>	<input type="checkbox"/>	Elbow extensors
C8	<input type="checkbox"/>	<input type="checkbox"/>	Finger flexors (distal phalanx of middle finger)
T1	<input type="checkbox"/>	<input type="checkbox"/>	Finger abductors (little finger)
T2	<input type="checkbox"/>	<input type="checkbox"/>	
T3	<input type="checkbox"/>	<input type="checkbox"/>	
T4	<input type="checkbox"/>	<input type="checkbox"/>	
T5	<input type="checkbox"/>	<input type="checkbox"/>	
T6	<input type="checkbox"/>	<input type="checkbox"/>	
T7	<input type="checkbox"/>	<input type="checkbox"/>	
T8	<input type="checkbox"/>	<input type="checkbox"/>	
T9	<input type="checkbox"/>	<input type="checkbox"/>	
T10	<input type="checkbox"/>	<input type="checkbox"/>	
T11	<input type="checkbox"/>	<input type="checkbox"/>	
T12	<input type="checkbox"/>	<input type="checkbox"/>	
L1	<input type="checkbox"/>	<input type="checkbox"/>	
L2	<input type="checkbox"/>	<input type="checkbox"/>	Hip flexors
L3	<input type="checkbox"/>	<input type="checkbox"/>	Knee extensors
L4	<input type="checkbox"/>	<input type="checkbox"/>	Ankle dorsiflexors
L5	<input type="checkbox"/>	<input type="checkbox"/>	Long toe extensors
S1	<input type="checkbox"/>	<input type="checkbox"/>	Ankle plantar flexors
S2	<input type="checkbox"/>	<input type="checkbox"/>	
S3	<input type="checkbox"/>	<input type="checkbox"/>	
S4-5	<input type="checkbox"/>	<input type="checkbox"/>	

0 = total paralysis
 1 = palpable or visible contraction
 2 = active movement, gravity eliminated
 3 = active movement, against gravity
 4 = active movement, against some resistance
 5 = active movement, against full resistance
 NT = not testable

☐
Voluntary anal contraction (Yes/No)

Spinal Injuries

ASIA IMPAIRMENT SCALE:

A =Complete: No motor or sensory function is preserved

B =Incomplete: Sensory but not motor function is preserved

C =Incomplete: Non-useful motor function is pre-served below the neurological level

D =Incomplete: Useful motor function is pre-served below the neurological level

E =Normal: Motor and sensory func-tionare normal.

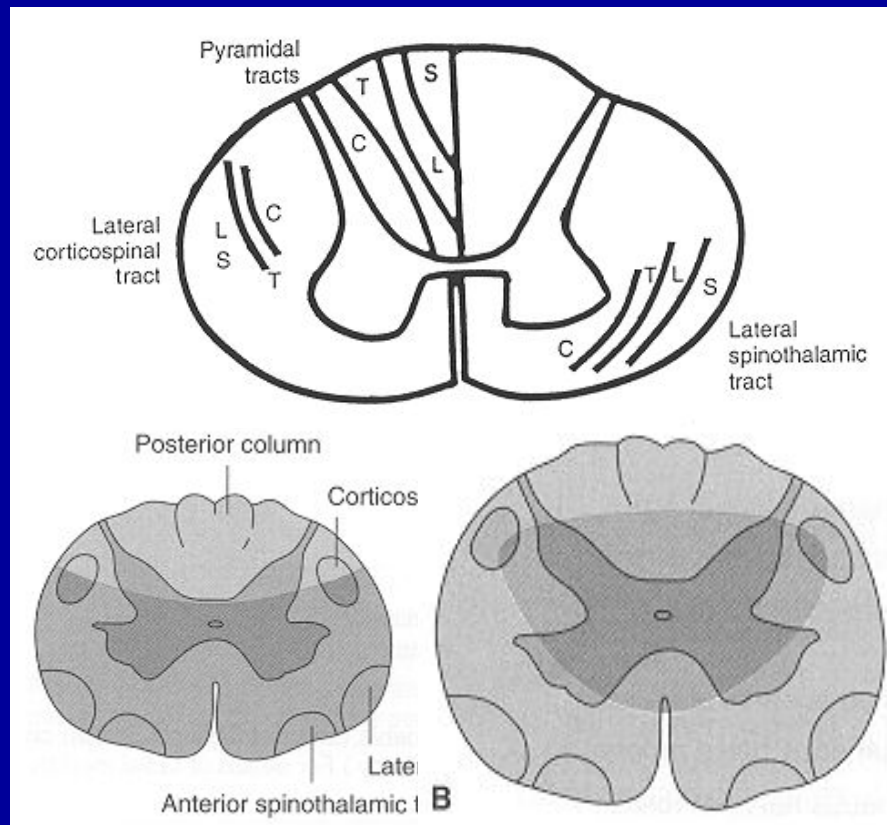
Incomplete Spinal Injuries

CLINICAL SYNDROMES:

Central Cord: greater motor deficit in the upper extremities

Brown-Sequard: dissociated sensory loss, ipsilateral paralysis

Anterior Cord: paraplegia, quadriplegia



Incomplete Spinal Injuries

CLINICAL SYNDROMES:

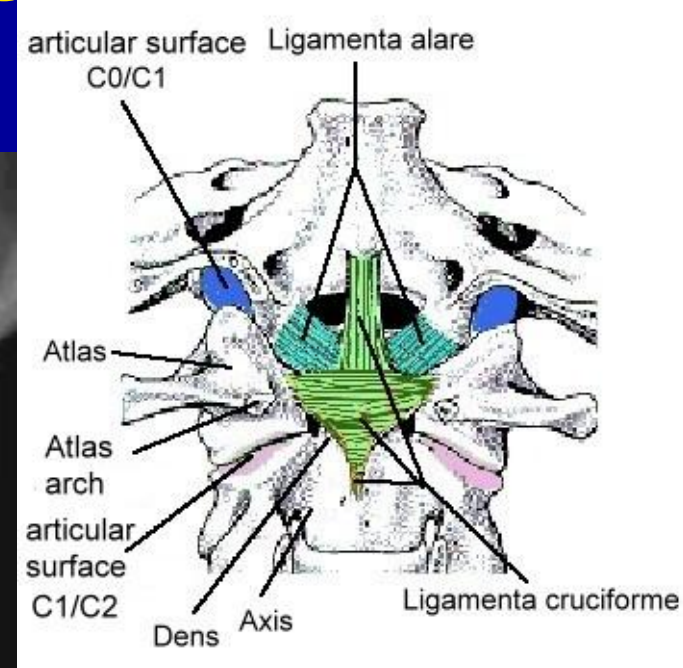
Conus Medullaris: saddle anesthesia, incontinence (painless, symmetrical)

Cauda Equina: saddle anesthesia, incontinence (painful, asymmetrical)

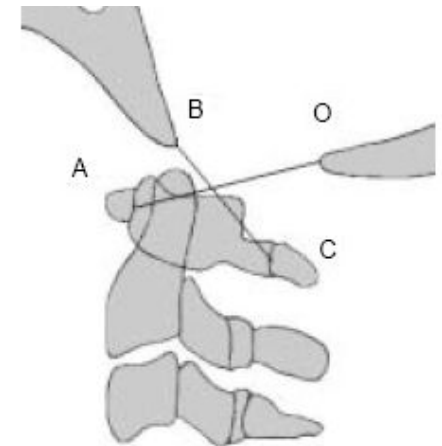
Spinal Column Injury

Atlanto-occipital dislocation

- Atlanto-occipital dislocation (AOD) is a devastating condition that frequently results in prehospital cardiorespiratory arrest
- accounts for 1% of spinal trauma.
- AOD occurs 3 times more commonly in children than adults,
- hyperextension.
- Unstable



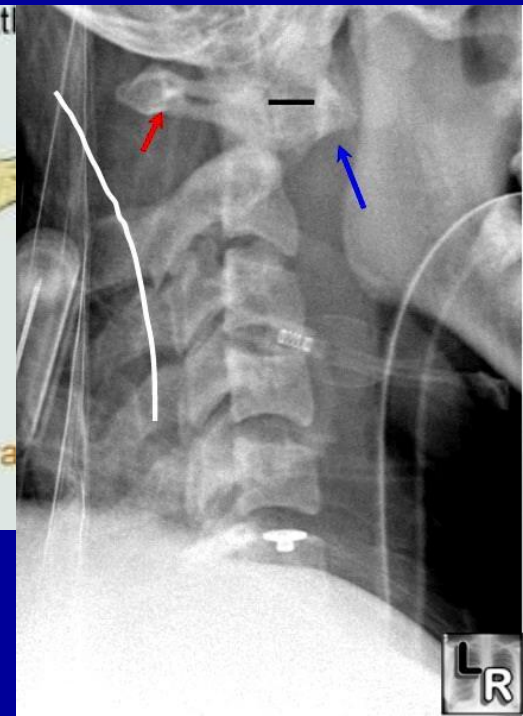
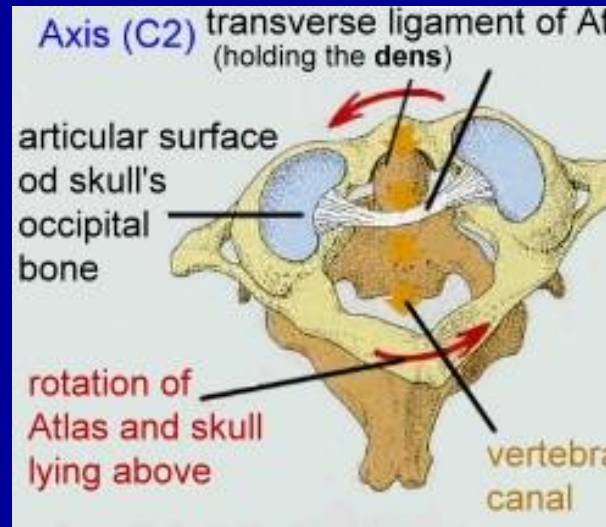
Power's ratio = $BC/OA < 1$



Spinal Column Injury

Atlanto-Axial dislocation

- Lower mortality than Atlanto-occipital dislocation
- 1/3 of patients have deficit
- Transverse ligament injury
- AAD occurs more commonly in children than adults
- Non-traumatic in downs syndrome and Rheumatoid arthritis
- Unstable

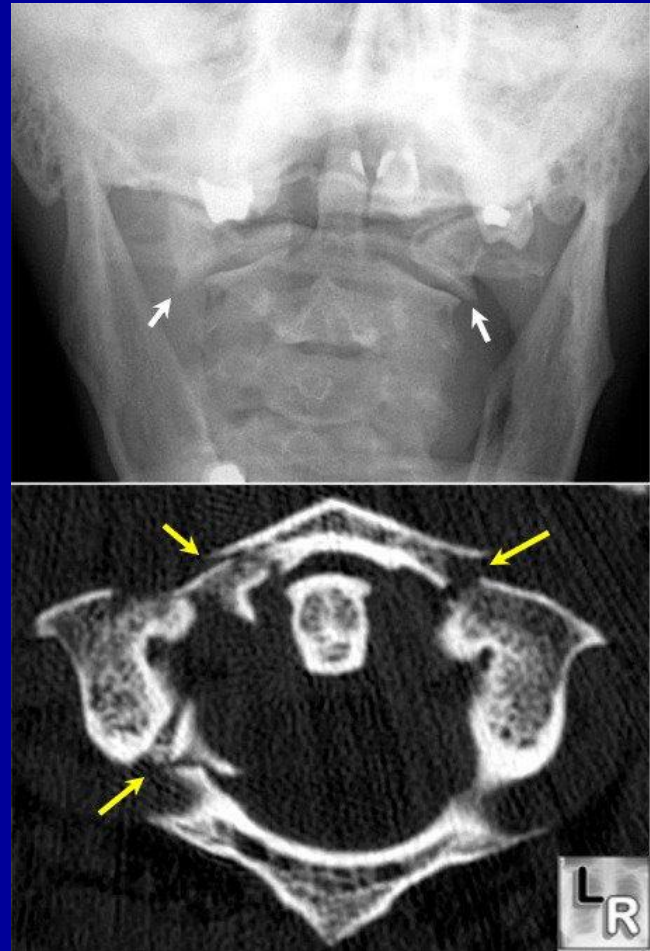


ADI > 5mm

Spinal Column Injury

Atlas (C1) fractures

- Described as Jefferson #
- Axial load
- Usually no neurological deficit
- 1/3 have C2 #
- Usually stable



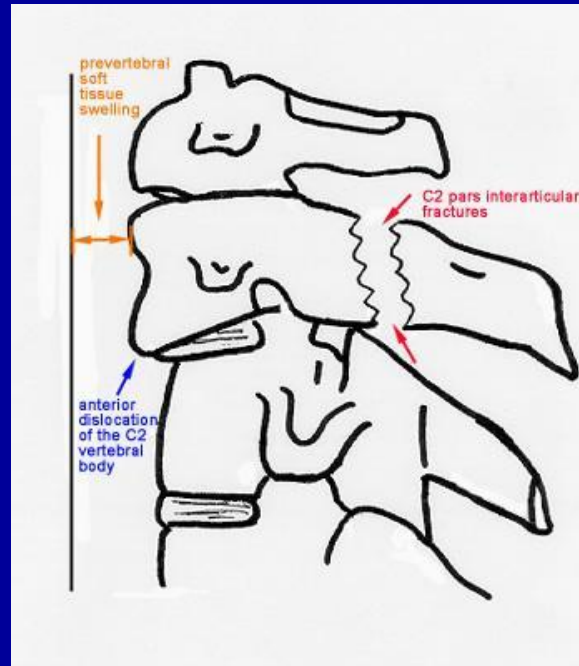
Spinal Column Injury

Axis (C2)

- Includes Hangman's # and Odontoid process #

HANGMAN'S

- Bilateral # of the isthmus of the pedicles of C2 with anterior subluxation of C2-C3
- Hyperextension and axial loading
- Usually stable



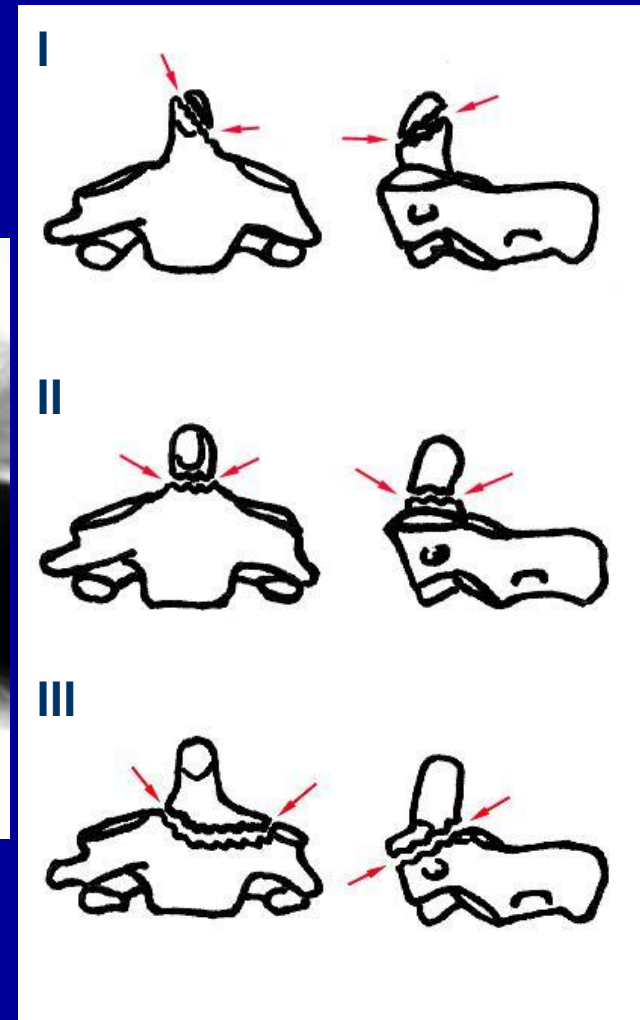
Spinal Column Injury

Axis (C2)

- Includes Hangman's # and Odontoid process #

Odontoid

- Flexion injury
- 15% of all cervical injuries
- II unstable, I & III stable

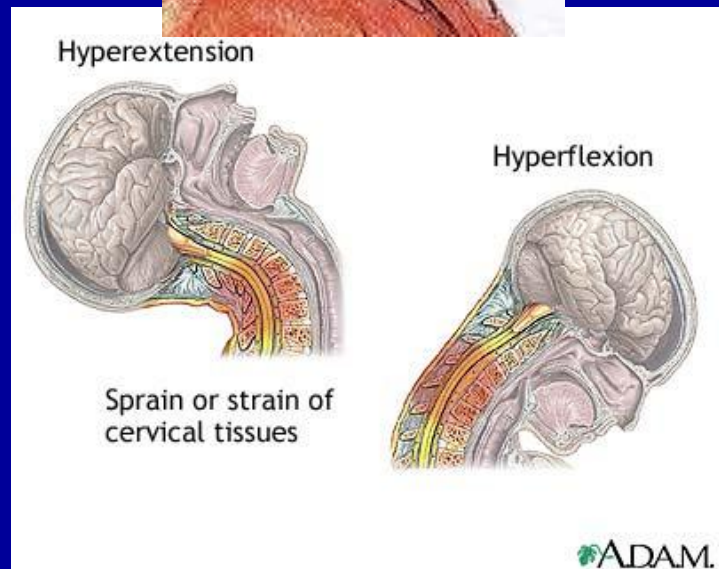


Spinal Column Injury

Subaxial (C3-C7)

Whiplash injury:

- Traumatic injury to the soft tissue in the cervical region
- Hyperflexion, hyperextension
- No fractures or dislocations
- Most common automobile injury
- Recover 3-6 months



Spinal Column Injury

Subaxial (C3-C7)

Vertical compression injury:

- Loss of normal cervical lordosis
- Burst #
- Compression of spinal cord
- Unstable
- Requires decompression and fusion

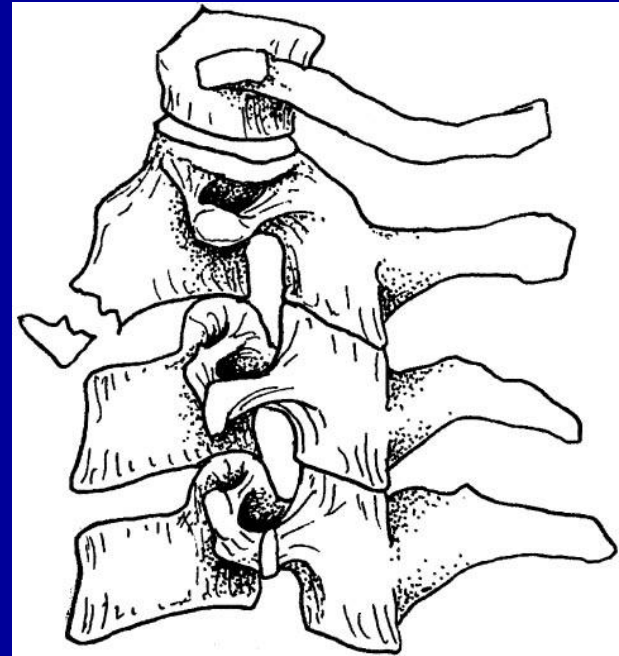


Spinal Column Injury

Subaxial (C3-C7)

Compression flexion injury (teardrop #)

- Classical diving injury
- Posterior elements involved in >50%
- Displacement of inferior margin of the body
- Unstable
- Requires stabilization

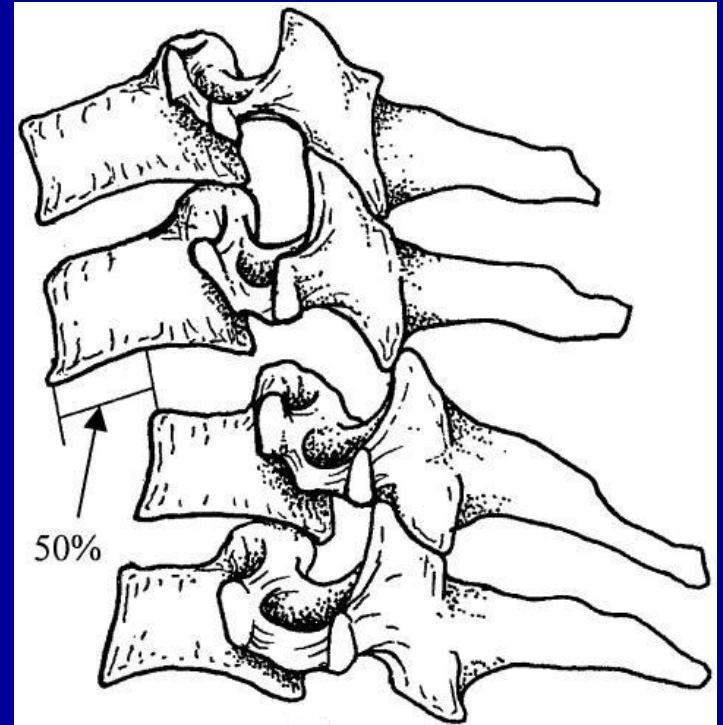


Spinal Column Injury

Subaxial (C3-C7)

flexion distraction injury (locked facet)

- >50% displacement
- Unstable
- Requires reduction and stabilization

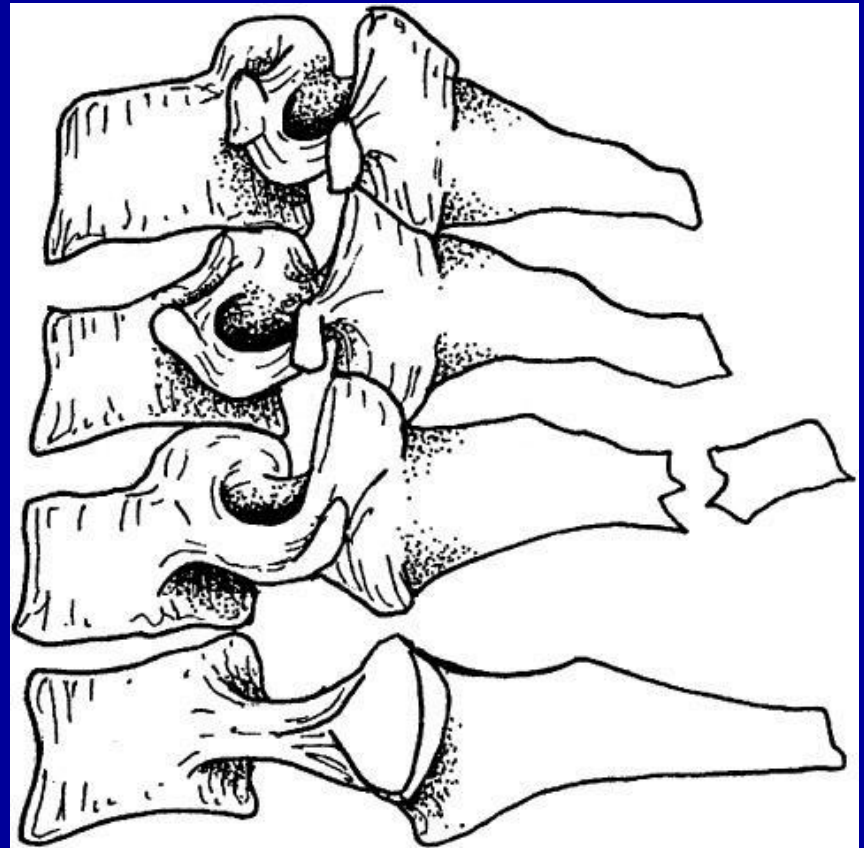


Spinal Column Injury

Subaxial (C3-C7)

extention injury (# posterior elements)

- # lamina, pedicles or spinous process
- With or without ligamentous injury
- Usually stable

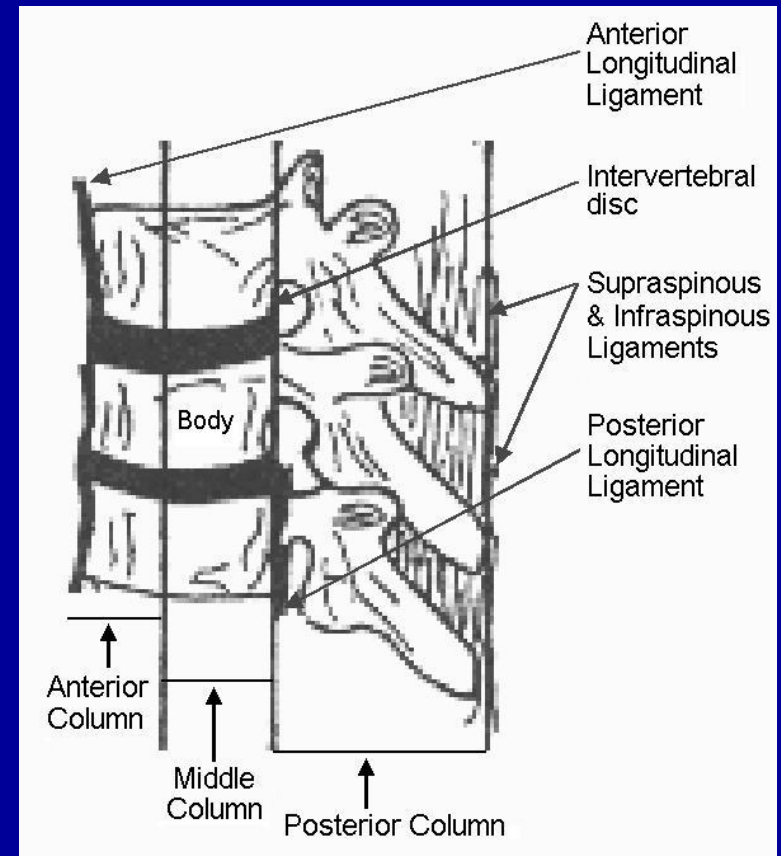


Spinal Column Injury

Thoracic and lumbar

Stability (three column model of Denis)

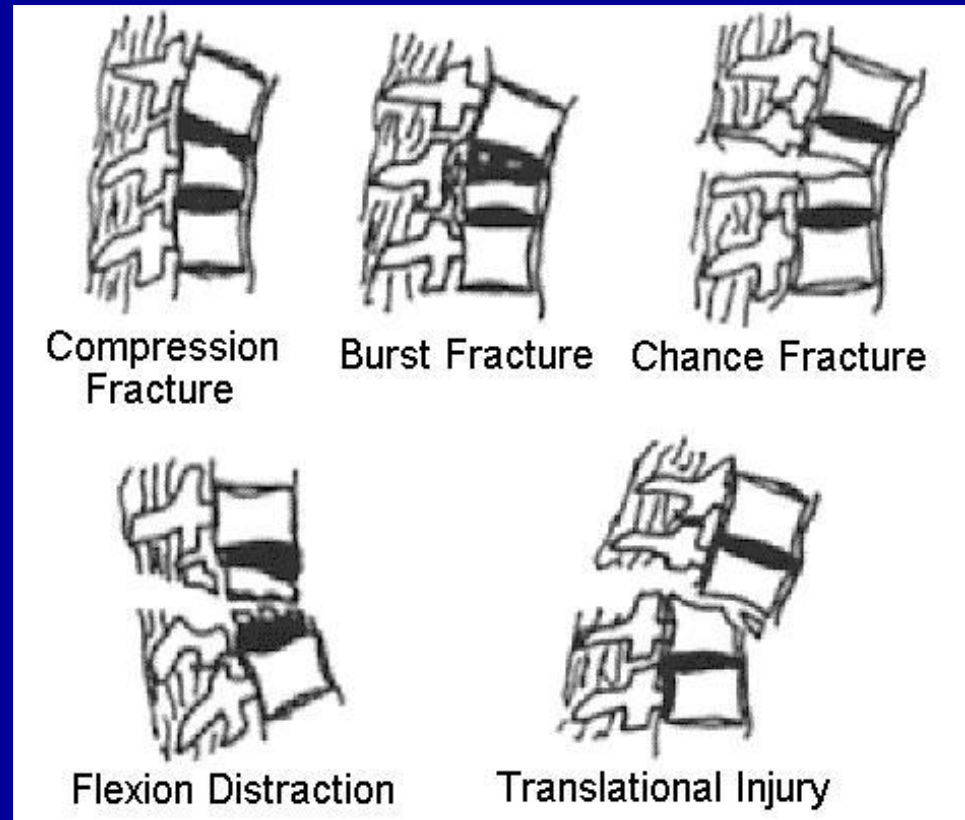
- Injury affecting two or more column is unstable



Spinal Column Injury

Thoracic and lumbar

- **Compression #**
- **Burst #**
- **Chance # (seat belt)**
- **Flexion distraction**
- **Fracture dislocation**



General Management Guidelines

- **Strict spine precautions (immobilization)**
- **Emergency resuscitation (ABC..)**
- **Comprehensive approach**
- **Neurological and Radiological assesment.**
- **Always expect multiple trauma (neuroexam, chest, abdomin,muskuloskeletal...)**
- **Differentiate hggic from neurogenic shock**

General Management Guidelines

External vs Internal stabilization

