

Thoracolumbar Trauma

Dr. Mesfin A. Lemma
Johns Hopkins Medical Institutions
Division of Spinal Surgery
Baltimore, Maryland



General Concepts

Pathophysiology

- Combined forces of compression, distraction and rotation exceed strength of the spine column.
- The predominant force determines the nature of the fracture dislocation.

Outline

- General concepts
- Axial load injuries
- Flexion-distraction injuries
- Fracture-dislocations

General Concepts

Pathophysiology

- Mechanism of Injury
 - MVA:
 - Higher-energy forces.
 - Rotational and distractive injuries are common.
 - Falls:
 - Lower-energy forces
 - Compressive injuries are common

General Concepts

Etiology

- MVA 45% CTQ
- Falls 20%
- Sports 15%
- Acts of violence 15%
- Misc. 5%

General Concepts

Clinical

- Treatment based on:
 - Stability of the spine
 - Neurologic injury

General Concepts Clinical

- Most upper thoracic fractures are stable.
- Injuries occur most frequently at the **thoracolumbar junction**. CTQ
 - 50% of all vertebral body fractures
 - Decrease in rib restraint is primary reason
 - Change in facet orientation and disc size and shape (increased stiffness in flexion and axial rotation)

General Concepts High Dose Steroids

- Reduces formation of O₂ free radicals.
- For neurological deficits associated with a **cord** lesion only.
- Not applicable for lesion below L2. CTQ

- Grade 0 – No contraction
- Grade 1 – Muscle contraction
- Grade 2 – FROM, no gravity
- Grade 3 – FROM, against gravity
- Grade 4 – Against resistance
- Grade 5 – Normal strength

General Concepts Clinical

- 15% - 20% of all thoracolumbar injuries associated with neurologic deficit.
- Deficit adversely affects long-term survival.
 - 86% 10-year survival patient younger < 29 yrs
 - 50% older than 29 yrs

General Concepts High Dose Steroids

- **Load**
 - 30 mg/kg methylprednisolone bolus over 1 hr
- **Infuse**
 - 5.4 mg/kg for 23 hrs if within 3 hours
 - 5.4 mg/kg for 48 hrs if between 3 and 8 hours



CTQ

General Concepts Clinical

- Initial Evaluation – ABC !!! CTQ
- Primary and secondary survey.
- Imaging as necessary.

General Concepts Neurogenic vs Spinal Shock

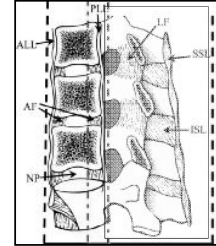
- **Neurogenic shock**
 - SCI to lower cervical or upper thoracic
 - Loss of sympathetics → venous pooling, arteriolar dilation
 - Hypotension **WITHOUT** tachycardia
 - Minimal response to fluids
 - Treat with pressors CTQ
- **Spinal shock**
 - Initial period after SCI (can last 24-48 hrs)
 - Unable to assess if SCI is complete or incomplete
 - Bulbocavernosus signals end of spinal shock CTQ

General Concepts Classification

- Many classification systems to assess stability
 - **Denis classification** (most common)
 - Ferguson and Allen classification
 - AO/ASIF classification

General Concepts Denis Three-Column Classification

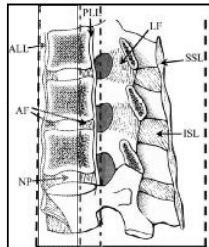
- **Anterior column**
 - ALL and anterior portion of vertebral body.
- **Middle column**
 - Posterior vertebral body to PLL.
- **Posterior column**
 - Everything posterior to PLL.



CTQ

General Concepts Denis Three-Column Classification

- **Anterior column**
 - ALL and anterior portion of vertebral body.

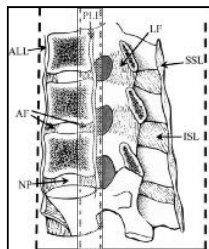


General Concepts Denis Fracture Classification

- Primarily axial load
- Flexion-distraction injuries
- Fracture subluxation and/or dislocation

General Concepts Denis Three-Column Classification

- **Anterior column**
 - ALL and anterior portion of vertebral body.
- **Middle column**
 - Posterior vertebral body to PLL.



General Concepts Denis Fracture Classification

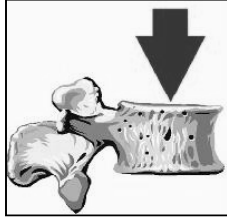
- Mechanism of failure of the middle column further differentiates fracture types:
 - **Middle column spared:** Compression fractures
 - **Middle column failure:** Burst fxs, distraction/seatbelt injuries, shear/rotational injuries.
 - Fracture dislocations always unstable

CTQ

Compression Fractures

- Most common fracture pattern (75% of all thoracolumbar fractures).

CTQ



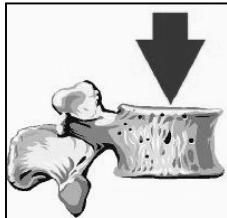
Compression Fractures

- Treatment options: **Non-operative**
 - Medical management
 - Extension bracing
 - TLSO (eg Boston brace). Limited to injuries from T7 distally.
 - CTLSO for upper thoracic fractures. Poorly tolerated by patients.

Compression Fractures

- Most common fracture pattern (75% of all thoracolumbar fractures).

- Vertical compression force.



Compression Fractures

- Treatment options: **Surgical**
 - Somewhat controversial
 - No clear indications
 - Posterior spine fusion (historical)
 - Vertebral cement augmentation
 - Vertebroplasty
 - Kyphoplasty

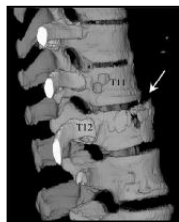
Compression Fractures

- Most common fracture pattern (75% of all thoracolumbar fractures).

- Vertical compression force.

- Anterior column injury only – **STABLE**.

CTQ



Compression Fractures

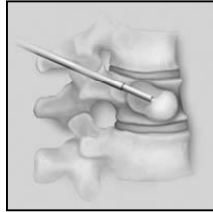


L3 Compression Fracture

Compression Fractures



L3 Compression Fracture



Kyphoplasty

Burst Fractures



2 Column injury with retropulsed bone

Burst Fractures

- Higher energy forces involved.
- **Anterior AND middle column involvement.**
- Posterior retropulsion of bone is common (35-60%).

CTQ

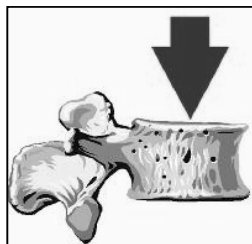
Burst Fractures

- 50% neurologic injury rate.
- In cases where burst extends to a 3 column injury – watch out for dural tears!

CTQ

Burst Fractures

- A continuum of compression fractures.
- Mechanism: axial compression.



Burst Fractures

- 50% neurologic injury rate.
- In cases where burst extends to a 3 column injury – watch out for **dural tears!**



CSF Leak: Bright signal anterior to thecal sac.

Burst Fractures Treatment

- Area of debate.
- Benefits of early surgery:
 - Earlier mobilization/return to function
 - More pain relief
 - Better correction of kyphosis

Burst Fractures Treatment

- Surgical Management: Approach controversial
 - Anterior corpectomy
 - Posterior spinal fusion
 - Pedicle screws vs hooks
 - Relies on ligamentotaxis for indirect reduction
 - Post-operative CT scan to evaluate reduction
 - Laminectomy alone is always the wrong answer !

CTQ

Burst Fractures Treatment

- Recent studies show no benefit to early surgery as long as posterior column intact.
- Residual kyphosis is seen in non-op group, but no correlation with patient's pain or function.

Burst Fractures Treatment

- Surgical Management: Approach controversial
 - In general, screws preferred over hooks due to better preservation of lordosis.
 - Pedicle screws – parallel distraction of vertebral bodies.
 - Hooks/claws – posterior distraction > anterior distraction.

Burst Fractures Treatment

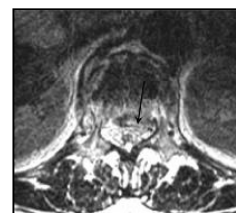
- What you need to know for the boards:
 - >50% loss of anterior column height
 - >20% focal kyphosis
 - >50% canal compromise
 - Incomplete neurologic deficit

CTQ

Burst Fractures Case Example 1

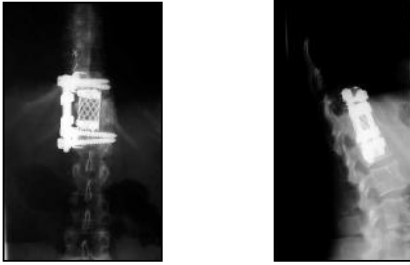


L1 Burst Fracture



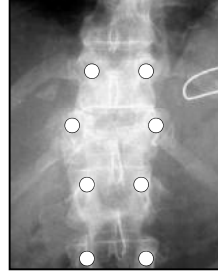
Note: CSF Leak

Burst Fractures
Case Example 1



S/p L1 corpectomy

Burst Fractures
Case Example 2



Widened interpedicular distance



Retropulsed bone, lamina fracture

Burst Fractures
Case Example 2



Note: Widened interpedicular distance

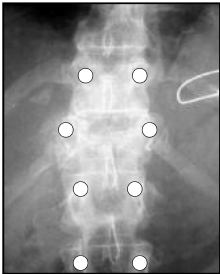
CTQ

Burst Fractures
Case Example 2



S/p PSF, decompression

Burst Fractures
Case Example 2

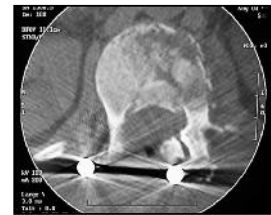


Widened interpedicular distance

Burst Fractures
Case Example 2



S/p PSF, decompression

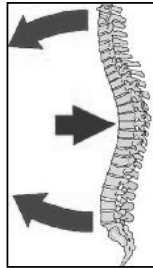


Post-op CT Scan

CTQ

Flexion-Distraction Injuries

- A spectrum of injury patterns.
- Fracture pattern based on energy and position of fulcrum.



Flexion-Distraction Injuries Chance Fracture

- Fulcrum **anterior** to spinal column
- Predominantly distractive injury
- Injury occurs through the bone

CTQ

Flexion-Distraction Injuries

- Anterior ligament remains intact.
- Middle and posterior columns are disrupted.



Flexion-Distraction Injuries Chance Fracture

- Usually lower thoracic or upper lumbar
- Posterior ligament rupture
- Minor anterior compression usually occurs

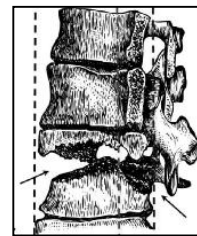
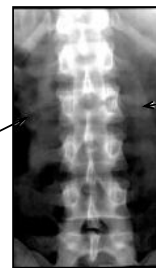
CTQ

Flexion-Distraction Injuries

- 50% will have rupture of:
 - Interspinous ligament
 - Ligamentum flavum
 - Facet capsule
 - Posterior annulus
 - Thoracodorsal fascia



Flexion-Distraction Injuries Chance Fracture



Note: Horizontal plane through body and transverse processes

3 Column Injury

Flexion-Distraktion Injuries "Seat-belt fractures"

- Fulcrum located **within** the vertebral body.

CTQ

Flexion-Distraktion Injuries Treatment

- Non-operative treatment:
 - Bony injury only
 - Focal kyphosis < 25 degrees
 - Hyperextension brace

CTQ

Flexion-Distraktion Injuries "Seat-belt fractures"

- Fulcrum located **within** the vertebral body.
- Usually results in minor compression fracture.



Flexion-Distraktion Injuries Treatment

- Surgical treatment:
 - Any injury pattern involving the posterior ligaments
 - Approach is usually posterior (preserve intact anterior column)
 - Do NOT use distraction techniques !

Flexion-Distraktion Injuries "Seat-belt fractures"

- Fulcrum located **within** the vertebral body.
- Usually results in minor compression fracture.
- A true 3-column injury.



Case example:
38 yo male s/p MVA. Xray - Compression fracture L1.
Plan? Answer: MRI to evaluate soft tissue disruption.

CTQ

Fracture-Dislocations

- Result in disruption of all **3 columns**
- Neurologic injury nearly universal
- 50% complete lesions

CTQ



Fracture-Dislocations

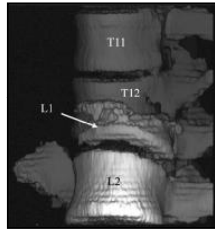
- Result in disruption of all 3 columns
- Neurologic injury nearly universal
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Results in vertebral body
TRANSLATION.

Fracture-Dislocations

- Main objective of surgical intervention is solely to provide stabilization facilitating early mobilization and rehab.
- Usually requires spanning 2-3 levels and below the injured segment.



Thank You.