Spine Trauma and Management

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Disclosures

CPT Rocker and LCDR Doucette have no financial interests to disclose with regard to this subject or the contents of the presentation.
Importance

Non-deployed:
- 3% of blunt trauma patients sustain a spinal column injury
- 1% sustain a spinal cord injury

Deployed:
- 1/5 spinal column injuries has involved the cord
- 1/2 of those are complete
Mechanisms of Injury

Mechanical causes too numerous to list here, but may include:

- Rapid deceleration (e.g. MVC)
- Externally forced rotation (e.g. MVC, Machinery Acc)
- Blunt trauma (e.g. MV vs Ped, FFS)
- Penetrating trauma (e.g. GSW, SW)
Mechanisms

Non-deployed:
- 1/2 from Motor Vehicle Accidents
  - Risk factors: Speeding, ETOH, Unrestrained
  - Rollover $\rightarrow$ Cervical spine injury
  - Falls, sports, violence

Deployed:
- 2/3 Explosive
- 17% GSW
- 3% Falls
- 66% Blunt, 28% Penetrating, 5% Combined
Spinal Anatomy

A BRIEF REVIEW OF NORMAL ANATOMY:

33 BONY VERTEBRAE:
7 CERVICAL
12 THORACIC
5 LUMBAR
5 SACRAL (FUSED)
4 COCCYGEAL (~FUSED)
Cervical Spine: C1-C3
Craniocervical Ligaments: Internal
Cervical Spine Injuries

- Atlanto-occipital dislocation
- Atlanto-axial dislocation
- C1 Burst (Jefferson)
- C1 Posterior Arch
- C2 Pedicle (Hangman’s)
- C2 Odontoid
Atlanto-occipital dislocation
Atlanto-occipital dislocation

Basion-posterior axial line interval (BAI) & Basion-dental interval (BDI)

If either exceeds 12mm, suggests A-O dislocation
Atlanto-axial dislocation
C1 Burst
“Jefferson” fracture
C1 Posterior Arch fracture
C2 Pedicle “Hangman’s” fracture
C2 Odontoid ("dens") fracture
Craniocervical Ligaments: External
Flexion and Extension fractures

Anterior wedge - due forceful forward flexion. Typically stable

Flexion teardrop - also due to forceful forward flexion with compression. Unstable

Extension teardrop - severe abrupt extension avulses anterior corner of spine from rest of vertebral body. Unstable
Burst fractures

Vertical compression due to axial loading

Stable vs unstable
Spinous process fractures

Clay shoveler’s fracture, stable
Laminar fractures

Typically associate with other fractures

The other fracture determines stability
Facet dislocations

Not necessarily a fracture, but...

Bilateral facet dislocation

Very unstable
Facet dislocations

Not necessarily a fracture, but...

Unilateral facet dislocation

Stable
General Vertebral Fracture Patterns

- Anterior Wedge
- Flexion or Extension teardrop
- Spinous Process
- Burst
- Laminar
- Facet
- Ligamentous

Spinal Cord Injury With-Out Radiographic Abnormality (SCIWORA)
Thoracic Vertebrae

- Anterior
- Middle
- Posterior
Thoracic Ligaments

**Note:** The head of a typical rib articulates with the superior costal facet of the thoracic vertebra of the same number (by its inferior articular facet), the inferior costal facet of the vertebra above (by its superior articular facet), and the intervertebral disc between the two vertebrae. The costal tubercle articulates with the transverse process of the vertebra of the same number.
Lumbar Vertebrae
Chance fracture
Spinal Cord: Nerve Roots
Spinal Cord: Protection
Spinal Cord: Blood Supply

Note: All spinal nerve roots have associated radicular or segmental medullary arteries. Most roots have radicular arteries (see Plate 161). Both types of arteries run along roots, but radicular arteries end before reaching anterior or posterior spinal arteries; larger segmental medullary arteries continue on to supply a segment of these arteries.
Spinal Cord: Blood Supply
Mechanisms of Spinal Cord Injury

- Vertebral column injury may result in spinal cord injury through:
  - Transection
  - Compression
  - Contusion
  - Vascular Compromise
Transection

Penetrating or blunt may transect all or part of the spinal cord

Either directly, or by displacing bony fragments into the spinal canal or through disk herniation

https://prod-images-static.radiopaedia.org/images/47636226/659df49efc3fea3fc2d05a9b526b6f_big_gallery.jpeg
https://www.researchgate.net/figure/MRI-sagittal-image-of-included-patient-with-complete-spinal-cord-transection-All_fig1_333294520
Compression

Osteoarthritis

Spondylolysis → spondylolisthesis

Disc Herniation

Trauma:
• Edema
• Hematoma
• Fracture fragments

https://www.merckmanuals.com/-/media/manual/professional/images/spinal_cord_compression_slide_high.jpg
Contusion

Bony dislocations
Subluxations
Fracture fragments

https://radiopaedia.org/images/51203318
Vascular compromise

Causes ischemia

Suspected when discrepancy b/w clinically apparent neurologic deficit and the known level of spinal column injury

Important - Don’t miss

http://www.ajnr.org/content/36/5/825
3 general clinical categories:

1. Patients with complete spinal cord syndromes
2. Patients with an incomplete spinal cord injury
3. Patients with a spine fracture but normal neurological function
Thoracolumbar Spinal Trauma

Three-column concept. If more than one column involved in fracture, then instability of spine usually results.

Lateral view. Note that lateral facet (zygapophyseal) joints in posterior column, with intervertebral foramina in middle column.
Thoracolumbar Spinal Trauma

Spinal Shock
- Transient
- Decreased function
- Is complete when Bulbocavernosus reflex returns

Neurogenic Shock
- Circulatory collapse
- Fluid resuscitation/pressers
Thoracolumbar Spinal Trauma - The Role 1

ATLS/TCCC - Address life threats first

High index of suspicion given MOI

Stabilize and Evacuate

Hemodynamic Goals for Evacuation
Thoracolumbar Spinal Trauma - The Role 2

ATLS/TCCC - Address life threats first
High index of suspicion given MOI
Plain Films Available
Stabilize and Monitor vs Evacuate
Hemodynamic Goals for Evacuation
Thoracolumbar Spinal Trauma - The Role 2

Stable Patterns

- Wedge Fractures
- Transverse Process Fractures
Thoracolumbar Spinal Trauma - The Role 2
Thoracolumbar Spinal Trauma - The Role 2

Radiographic Findings

Stable Patterns

- Wedge Fractures
- Transverse Process Fractures
Thoracolumbar Spinal Trauma - The Role 2

Radiographic Findings

Unstable Fracture Patterns
- Burst Fracture
- Shear Fractures
- Translational distraction

https://www.uptodate.com/contents/images/RADIO/83106/Verteburstfractlumbspine.jpg
Thoracolumbar Spinal Trauma - The Role 2

Flexion Distraction Fracture
- Be concerned for intrabdominal process
- High Likelihood for permanent neurological injury
Thoracolumbar Spinal Trauma - The Role 2

Translational Spinal Fracture
- Fracture dislocation
- Shear Fracture

https://www.uptodate.com/contents/images/EM/61587/Thoracolumbarfracturedislocation.jpg
Thoracolumbar Spinal Trauma - The Role 2

When to EVAC to higher level of care

When to sit on a patient
Thoracolumbar Spinal Trauma - Role 3

- 148 Beds (24 ICU Beds)
- Up to 4 OR tables
- Multiple specialties
- CT Available
Thoracolumbar Spinal Trauma - Role 3

Transverse Process Fracture
Thoracolumbar Spinal Trauma - Role 3

Burst Fracture

No MRI in Role 3
Thoracolumbar Spinal Trauma - Role 3

CHANCE FRACTURE

Thoracolumbar Spinal Trauma - Role 3

WEDGE FRACTURE

https://radiologyassistant.nl/assets/spine-injury-tlics-classification/a548ac011b1f9a_1.jpg
Thoracolumbar Spinal Trauma - Role 3

**Management**

**Medical**

**Handling**

**NonOP vs OP**
- Blunt
- Penetrating
You are the new role 1 PA. Shortly after you arrive 1st PLT Cco was hit with an IED. They are evacuating a 25YOM suffering a blast injury and was thrown 10 feet. The senior medic on the ground relays that the Pt is GCS 14 (1 off for confusion), BP of 90P, HR 110, resp 18. The pt has shrapnel wounds along the anterior BL LE that has achieved hemostasis with pressure dressings. Pt complains of excruciating LBP. The medic was concerned of ecchymoses and exquisite tenderness located at L3/4. But is otherwise neuro intact.

Treatment: BL 18G IV, 20mg Ketamine IV, Spine Board, C-Collar,

He arrives to your aid station:

A - Patent

B - RR 20, 99 RA, Equal rise and fall of the chest, LCTAB

C - BP 100/60, HR 106. LE wounds hemostatic with pressure dressing

D - GCS 14 (1 off for confusion). Neuro Intact. Rectal tone was intact. Bogginess noted midline l spine around L3-4. TTP midline spine at that location.

E - Placed in “blizzard blanket”

Do you evac patient or sit on patient if this is your only patient?

Your EMEDS is located approx. 26 km away (40 min drive) air or ground evac?

Its been two hours since the pt was evaced from POI on a spine board. What should you do?

What should you ensure about his blood pressure?
The Role 1 PA relays that the Pt is GCS 14 (1 off for confusion), BP of 100/60, HR 110, resp 18. The pt has shrapnel wounds along the anterior BL LE that has achieved hemostasis with pressure dressings. Pt complains of excruciating LBP. The PA was concerned of ecchymoses and exquisite tenderness located at L3/4 and paresthesia’s noted in the L3 distribution of the left side. But is otherwise neuro intact.

Treatment: BL 18G IV, 25mg Ketamine IV, Spine Board, C-Collar, Blizzard blanket

He arrives to your role 2:

A - Patent

B - RR 26, 90 RA, Equal rise and fall of the chest, decreased lung sounds left side. JVD noted.

C - BP 100/60, HR 115. LE wounds hemostatic with pressure dressing

D - GCS 14 (1 off for confusion). CN II-XII grossly intact, EOMI sans diplopia Neuro intact.. Rectal tone was intact. Bogginess noted midline l spine around L3-4. TTP midline spine at that location.

E - Placed in “blizzard blanket”

What do you want to do next to address low SPO2?

After Pt is stabilized?
Review questions

YOU SHOOT A CHEST XRAY, C, T, L SPINE PELVIC FILMS

HTTP://1.BP.BLOGSPOT.COM/-NULX78W1HLE/TXD-ODH9DZI/AAAAAAAAL/7-WMBILQVV85/S1600/LEFT+RIBS+2.JPG
Review questions

C-Spine and T spine films are clear. You notice this on L Spine films.

What are you concerned of?

Do you Evac?

Should you consult a Neurosurgeon?
Review questions

WHAT IF YOU PICKED UP ON THIS?

WHAT ARE YOU WORRIED ABOUT?

WHO ELSE SHOULD INVOLVE IN THE PATIENT’S CARE?

WOULD YOU FIND ANYTHING ON FAST EXAM?

https://www.uptodate.com/contents/images/RADIO/83469/Xrayfraclumbartransproc.jpg
Questions?