

## Foundations Curriculum-Stable Spinal Fractures

### Oral Board Review Cases

#### Case: Back Pain

##### ❖ Pre-reading:

Denis, Francis; Spinal Instability as Defined by the Three-column Spine Concept in Acute Spinal Trauma, Clinical Orthopaedics and Related Research: October 1984 - Volume 189  
(Link [here](#) to original text)

##### ❖ Pre-Questions:

Q: True or false. Regarding the Denis three column concept of spinal fracture stability, column III fractures are considered stable.

A: False. Column III fractures are always considered unstable.

Q: True or false, Burst fractures are considered unstable.

A: True. Burst fractures involve the anterior and middle columns and are associated with neural injury.

Q: True or false, Wedge fractures involve more than one column

A: False. Wedge fractures are isolated to the anterior column and are considered stable. Wedge fractures are the most common type of lumbar fracture.

##### ❖ Chief complaint

➤ 46-year-old male brought in by EMS with chief complaint of back pain following MVC in which the patient was a restrained driver.

##### ❖ Vital signs

➤ BP: 128/80 HR: 95 RR: 16 T: 36.4°C Sat: 100% on RA Wt: 75kg

##### ❖ What does the patient look like?

➤ Patient is in moderate pain, sitting up on stretcher.

##### ❖ Primary survey

➤ Airway: patent, speaking full sentences

➤ Breathing: no apparent respiratory distress, no cyanosis, bilateral breath sounds present

➤ Circulation: warm and dry skin, normal capillary refill centrally and peripherally

##### ❖ Action

➤ Place patient on monitor, C-collar placement

## ❖ History

- Source: Patient
- HPI: 56-year-old male truck driver brought in via ambulance following MVC after falling asleep and driving off the highway into a tree at ~55 mph. Patient was restrained and an airbag was deployed. Patient denies LOC at the time of injury and denies alcohol/intoxication. Patient is primarily complaining of headache, neck pain and back pain. Otherwise ROS is negative.
- PMHx: T2DM, HTN, HLD
- PSHx: none
- Allergies: none
- Meds: metformin, metoprolol, atorvastatin
- Social Hx: non-drinker, non-smoker
- FHx: no relevant history
- PMD: none

## ❖ Secondary survey

- General: alert, oriented × 3, uncomfortable due to back pain
- HEENT: tenderness to palpation left paraspinal, no midline tenderness
- Lungs: normal
- Chest: normal
- Abdomen: normal
- Rectal: normal tone
- Urogenital: normal external genitalia
- Extremities: normal, neuro as below, 2+ DP, PT pulses bilaterally
- Back: midline tenderness of the lower thoracic and upper lumbar region , tenderness to palpation in bilateral lumbar paraspinal musculature
- Neuro: GCS 15
  - CN II-XII grossly intact as tested
  - Reflexes: +2 patellar bilaterally; +2 ankle jerk bilaterally
  - Sensory: intact throughout
  - Strength: 5/5 right big toe, ankle plantar flexion; 5/5 quadriceps; 5/5 strength on left
- Skin: normal

## ❖ Action

- Instructor prompt: learners should discuss differential diagnosis
  - Learners may initially consider traumatic injuries s/p MVC including spinal fracture, herniated disk, intracranial hemorrhage, cord compression, scapular

fracture, paraspinous muscle strain, ; other non-traumatic causes of back pain should also be considered including epidural abscess, etc.

- Discuss the [Canadian CT Head Rule](#) for clearing head injury without imaging. Consider concussion as a sequelae of this accident.
- Briefly discuss the [NEXUS Criteria](#) for clearing the C-spine without imaging (this will be covered in depth in a separate case). Consider back pain as a distracting injury. Place the patient in a C-collar.
- Place peripheral IV line
- Order Labs
  - CBC, BMP, coagulation studies, blood type and screen, UA
- Order Meds
  - Pain control- consider Ketorolac, Morphine
  - Discuss avoiding Ketorolac if concerned for intracranial hemorrhage.
- Order Initial Imaging
  - Gold standard: CT of the cervical, thoracic, and lumbar spine
  - If CT unavailable, plain films of the cervical, thoracic, and lumbar spine.
  - Consider plain films of the chest.
  - Consider MRI L spine if there are focal neurologic deficits on examination (not in this case).
- Consult
  - Not necessary at this time
- Reassess
  - Pain improved after analgesia, vitals stable, exam unchanged

#### ❖ Results

- **Lab Results Table** (Figure 1): Normal
- **X-ray L spine** (Figure 2): Anterior wedge fracture of L1
- **CT C/T/L spine**: No cervical/thoracic fractures or acute process. Confirms L1 wedge fracture with associated height loss.
- **MRI L Spine** (Figure 3): Wedge compression fracture of L1 vertebra (about 40% anterior height reduction), associated with diffuse marrow edema signal, No retropulsed bone fragments. Intact posterior column. Reduced signal of L1/2 intervertebral disc. L2/3 mild dorsal annular disc bulge.

#### ❖ Action

- Pain control in ED
- Consider subsequent non-emergent MRI L spine to evaluate for ligamentous injury ➤  
Establish outpatient follow-up with spine specialist

### ❖ **Diagnosis**

- Anterior wedge compression fracture of L1 vertebra

### ❖ **Critical actions**

- C-collar placement
- Pain control
- Complete neurological examination, rule-out cord compression
- Imaging such as spinal films, CT/MRI
- Identification of anterior wedge fracture as stable fracture, no requirement for immediate spine consult

### ❖ **Instructor Guide**

➤ This is a case of a wedge fracture of the vertebral body, an example of a stable spinal fracture. Thorough physical examination and secondary survey is key in this case to identify the lower back pain to lead the provider towards obtaining imaging of the spine. When asked for the neurological examination, the instructor should inquire what part of the examination specifically the learner is interested in (mental status, sensory, reflexes, motor, cranial nerve, cerebellar). Labs should be sent due to the traumatic nature of the injury and the possibility of organ injury or hemorrhage. Adequate pain control should be administered as needed for patient comfort. XR or CT should be ordered up front but the instructor should emphasize the utility of non-emergent MRI in this case to evaluate for ligamentous involvement.

### ❖ **Case Teaching Points**

- Wedge compression fractures are the most common type of lumbar fractures.
  - Wedge fractures result due to isolated failure of the anterior column.
  - Mechanism of injury: hyperflexion and axial load.
  - These fractures are rarely associated with neural injury.
  - The main differential is Burst fracture (fracture of the anterior and middle columns with or without posterior column fracture, usually associated with neural injury)
  - It is important to differentiate between compression and burst fractures as there lies a higher frequency of neurological deficits associated with the latter.
  - The Three-Column Concept can help to differentiate stable and unstable spinal fractures:

This concept evolved from a retrospective review of 412 thoracolumbar spine injuries and observations on spinal instability.

I: Anterior column

-Anterior longitudinal ligament

-Anterior 1/2 of the vertebral body and disk

II: Middle column

-Posterior 1/2 of the vertebral body and disk

-Posterior longitudinal ligament

III: Posterior column

-Facet joints

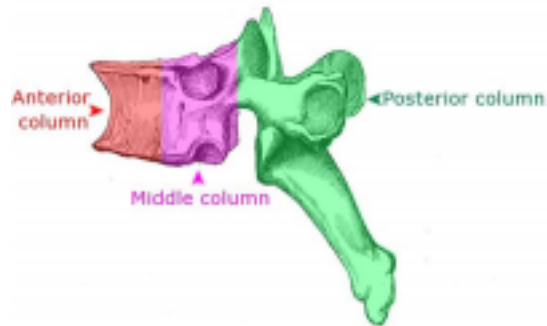
-Ligamentum flavum

-Posterior elements

I: Always stable

II: Possibly unstable

III: Always unstable



➤ Only anterior column involved = stable

➤ Two or more columns involved = unstable

➤ Treatment of stable spinal fractures including wedge fractures is typically nonoperative with pain control and modified physical activity. An extension lumbar brace to prevent flexion also may lessen pressure from the fractured vertebrae.

➤ Consider using the thoracolumbar injury classification and severity scale ([TLICS](#)) to help determine treatment recommendations. In this case, the patient's TLICS score is 1.

➤ Traditionally, it has been taught that fractures with vertebral body height loss >50 % is predictive of instability. However, [more recent studies](#) are suggesting that translation (greater than 3.5mm) is more predictive of posterior ligamentous and neurological injury and height loss does not correlate to instability.

## ❖ References

➤ **Original Case Source:** Original case

➤ **Primary Editor:** Tyler Jackson, MD

➤ **Additional Editors:** Will Denq, MD CAQ-SM

➤ **References**

- Images courtesy of <https://radiopaedia.org/cases/wedge-compression-fracture>
- Denis, Francis Spinal Instability as Defined by the Three-column Spine Concept in Acute Spinal Trauma, *Clinical Orthopaedics and Related Research*: October 1984 - Volume 189 - Issue - p 65-76
- Kifune, M., Panjabi, M.M., Arand, M. *et al.* Fracture pattern and instability of thoracolumbar injuries. *Eur Spine J* 4, 98–103 (1995). <https://doi.org/10.1007/BF00278920>

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- Radcliff, Kristen MD\*; Su, Brian W. MD\*; Kepler, Christopher K. MD, MBA\*; Rubin, Todd MD\*; Shimer, Adam L. MD†; Rihn, Jeffrey A. MD\*; Harrop, James A. MD‡; Albert, Todd J. MD\*; Vaccaro, Alexander R. MD, PhD\* Correlation of Posterior Ligamentous Complex Injury and Neurological Injury to Loss of Vertebral Body Height, Kyphosis, and Canal Compromise, Spine: June 01, 2012 - Volume 37 - Issue 13 - p 1142-1150 doi: 10.1097/BRS.0b013e318240fcd3

**Figure 1: (Lab Results)**

WBC 11.2 x 10 <sup>3</sup> /uL
Hb 12.4 g/dL
Hct 44.7%
Plt 316 x 10 <sup>3</sup> /uL
Na 135 mEq/L
K 3.9 mEq/L
Cl 102 mEq/L
CO <sub>2</sub> 27 mEq/L
BUN 51 mEq/dL
Cr 1.4 mg/dL%
Gluc 189 mg/dL
PT 12.2 sec
PTT 25 sec
INR 1.0

**Figure 2: XR (radiopaedia.org)**



Figure 3: MRI (radiopaedia.org)



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