

# Blunt Trauma: Spinal Fractures

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RAD 4001

Dr. Bosserman, ER

# Clinical History

- 23-year-old F presenting after MVC. Patient is developmentally delayed and unable to give a history. Patient was a passenger in high-speed MVC with a rollover, currently complaining of RUE pain.
  - PMH: developmentally delayed
  - PSH: unknown
  - PE:
    - GCS 15
    - No focal neural deficits
    - Dried blood on forehead w/o obvious laceration
    - Back: No step-offs palpated on back, diffuse spinal and paraspinal tenderness noted
  - Vitals
    - P- 81
    - RR-18
    - SpO2-99%
    - BP: 124/66

# Differential Diagnosis

- Possible RUE injury
  - Fracture
  - Dislocation
  - Soft tissue injury
- Possible head laceration
  - Epidural hematoma
- Blunt trauma
  - Bowel, liver, splenic laceration
  - Spinal fracture

**Variant 2:** Major blunt trauma. Hemodynamically stable. Not otherwise specified. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
CT whole body with IV contrast	Usually Appropriate	⊕⊕⊕⊕
Radiography trauma series	Usually Appropriate	⊕⊕⊕
US FAST scan chest abdomen pelvis	Usually Appropriate	○
CT whole body without IV contrast	May Be Appropriate	⊕⊕⊕⊕
Fluoroscopy retrograde urethrography	Usually Not Appropriate	⊕⊕⊕
MRI abdomen and pelvis without and with IV contrast	Usually Not Appropriate	○
MRI abdomen and pelvis without IV contrast	Usually Not Appropriate	○

**Variant 4:** Major blunt trauma. Hemodynamically stable. Suspected extremity trauma. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
Radiography extremity	Usually Appropriate	Varies
CT whole body with IV contrast	Usually Appropriate	⊕⊕⊕⊕
Radiography trauma series	Usually Appropriate	⊕⊕⊕
US FAST scan chest abdomen pelvis	Usually Appropriate	○
CT extremity without IV contrast	May Be Appropriate	Varies
CT whole body without IV contrast	May Be Appropriate (Disagreement)	⊕⊕⊕⊕
CTA extremity with IV contrast	May Be Appropriate (Disagreement)	Varies
CT extremity with IV contrast	Usually Not Appropriate	Varies
CT extremity without and with IV contrast	Usually Not Appropriate	Varies

# Relevant Imaging



Mild Cardiomegaly  
No pneumothorax  
No effusion noted

Supine CXR

# Relevant Imaging



Humerus



Forearm



Wrist

Lateral shoulder, medial elbow soft tissue swelling

# Relevant Imaging



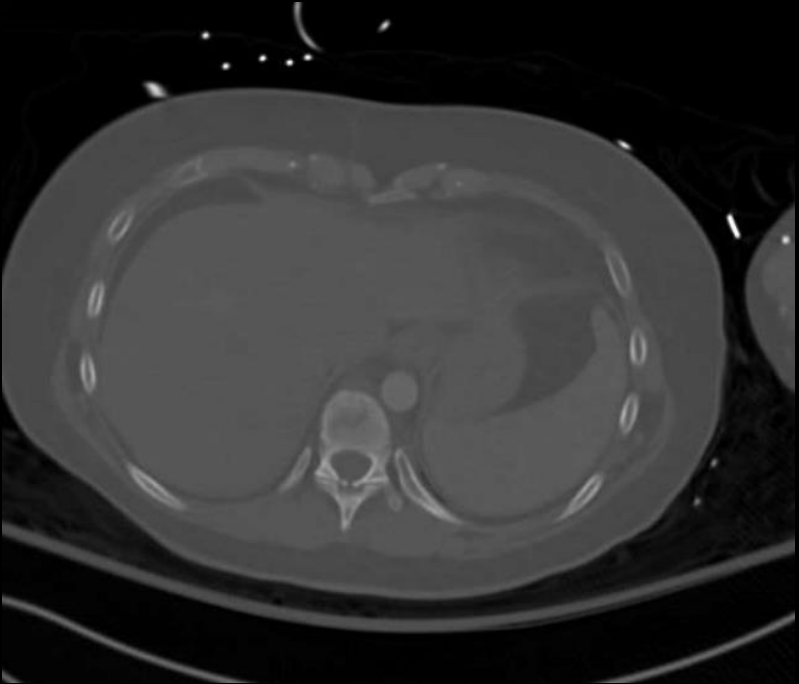
Traumatic C-Spine w/o Contrast CT  
No Acute abnormality

# Relevant Imaging

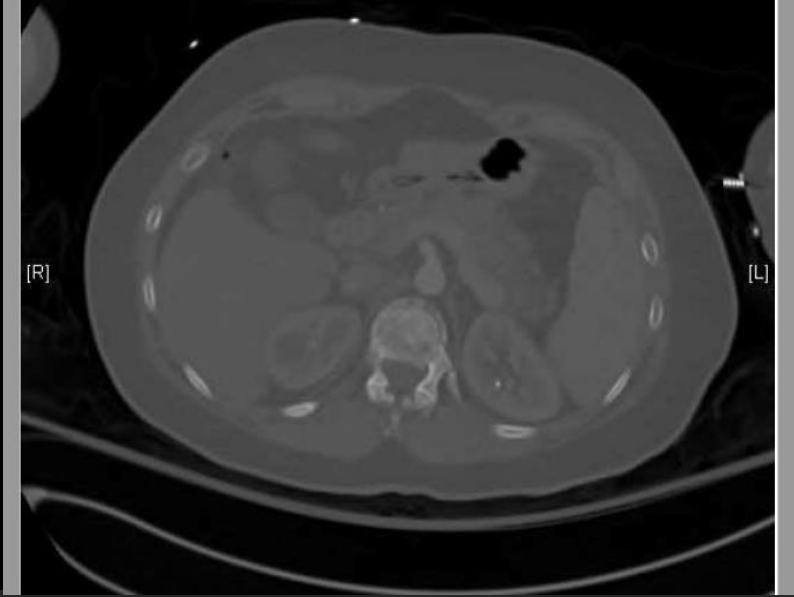
Trauma  
Chest/ABD/Pelvis  
with Contrast CT

T9- wedge  
compression vs  
incomplete burst  
T10-12- incomplete  
burst  
T12 most severe  
with 40% height loss





Green



Red





## Thoracic XR with TLSO (thoracic-lumbar-sacral orthosis)

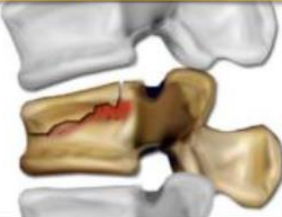


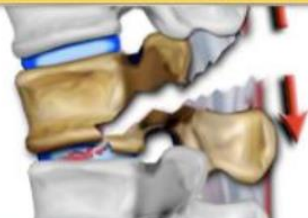
T9-T12 incomplete burst  
fractures, no interval changes



Normal anatomy  
from Radiopaedia

# Thoraco-Lumbar Injury Classification and Severity score (TLICS)

*Radiology Assistant* Abdomen Breast Cardiovascular

Compression 1 pnt	Burst 2 pnts
	
<ul style="list-style-type: none"> <li>- Simple compression</li> <li>- Wedge deformity</li> </ul>	<ul style="list-style-type: none"> <li>- Compression with retro-pulsion of superoposterior body fragment</li> </ul>
Translation/rotation 3 pnts	Distraction 4 pnts
	
<ul style="list-style-type: none"> <li>- Rotatory / shearing</li> <li>- Anterior or lat displacement</li> <li>- Facet joint displacement</li> </ul>	<ul style="list-style-type: none"> <li>- Horizontal fracture of posterior elements</li> <li>- Separation of posterior elements</li> </ul>

*Radiology Assistant* Abdomen Breast Cardiovascular Chest Head/Neck Musculoskeletal Neuroradiology Pediatrics More Q

### TLICS 3 independent predictors

1	<b>Morphology</b> immediate stability	- Compression	1	- Radiographs - CT
		- Burst	2	
		- Translation/rotation	3	
		- Distraction	4	
2	<b>Integrity of PLC</b> longterm stability	- Intact	0	- MRI
		- Suspected	2	
		- Injured	3	
3	<b>Neurological status</b>	- Intact	0	- Physical examination
		- Nerve root	2	
		- Complete cord	2	
		- Incomplete cord	3	
		- Cauda equina	3	
<b>Predicts</b>		- Need for surgery	0 - 3 4 > 4	- nonsurgical - surgeon's choice - surgical

The TLICS consists of three independent parameters:

1. Injury Morphology
2. Integrity of the Posterior Ligamentous Complex
3. Neurologic status.

A parameter can be scored 0-4 points and the total score is the sum of these parameters with a maximum of 10 points.

The total score predicts the need for surgery as is shown in the TLICS algorithm. A total of more than 4 points indicates surgical treatment.

The integrity of the posterior ligamentous complex plays an important role in the TLICS. Sometimes it will be possible to determine PLC injury on CT, but MRI may be necessary.

When there are several fractures, each level has to be scored separately.

The level with the highest TLICS score will determine the type of treatment.

Morphology and PLC are scored separately.

For example, in a translation/rotation injury, the PLC is always involved, making a total of 3+3=6 points.

When there is a distraction on the posterior side, the PLC is always involved, making a total of 4+3=7 points.

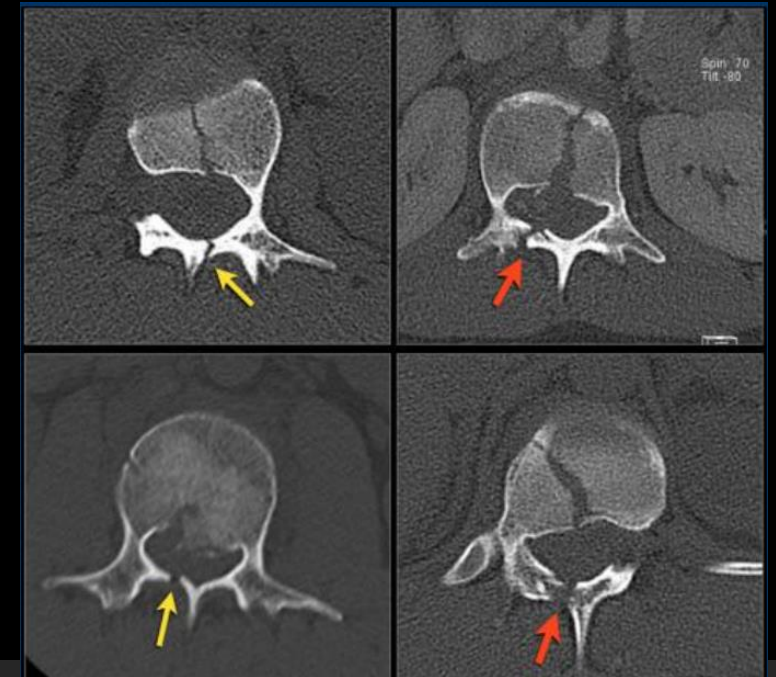
In case of a distraction on the anterior side, however, the PLC may or may not be involved, i.e. it will be either 4 or 4+3= 7 points.

# Discussion

- TLICS
  - Morphology- incomplete burst fractures (2)
  - PLC- no MRI done, cannot fully assess
  - Neurological status- intact on physical exam (0)
- Important considerations for this case
  - Focus on any spinal cord injuries that may need surgical intervention
  - Need to ensure proper blunt trauma imaging is done with little history available
- Patient was discharged with TLSO to follow-up with NSGY outpatient
  - A CT head without contrast was done- no acute abnormalities found

# Continued discussion

- Burst fractures
  - Retropulsion of superiorposterior segment of vertebral body
  - Posterior displacement of this segment differentiates burst from compression fractures
  - MRI recommended to assess PLC to decide on conservative or surgical intervention



# Continued discussion

- Incomplete Burst Fractures
  - A Literature review on incomplete burst fractures found that treatment for this type of injury is varies widely and is on a case by case basis
  - Surgical Intervention
    - Anterior stabilization
    - Posterior stabilization
    - Combination
  - Non-surgical
    - Braces
    - Early mobilization and extensive exercises
    - Follow-up
- Considerations
  - Location, Degree of kyphotic malposition, Degree of spinal canal stenosis, Degree of vertebral disc lesion, Bone quality.

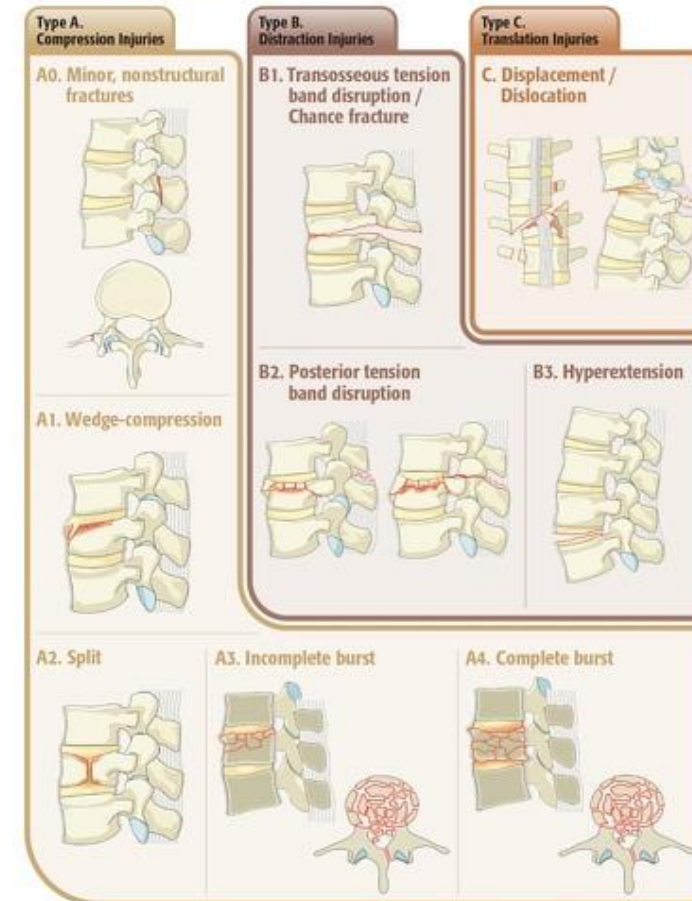
# Continued discussion

- AO Spine thoracolumbar Classification System

- Does not determine treatment, just describes injuries
- Components include
  - Morphology (compression, distraction, translation)
  - Neurological signs
  - Ligamentous injuries or comorbid conditions



## AOSpine Thoracolumbar Classification System



Contact: [research@aospine.org](mailto:research@aospine.org)

Further information: [www.aospine.org/TLclassification](http://www.aospine.org/TLclassification)



# Continued discussion

## Compression

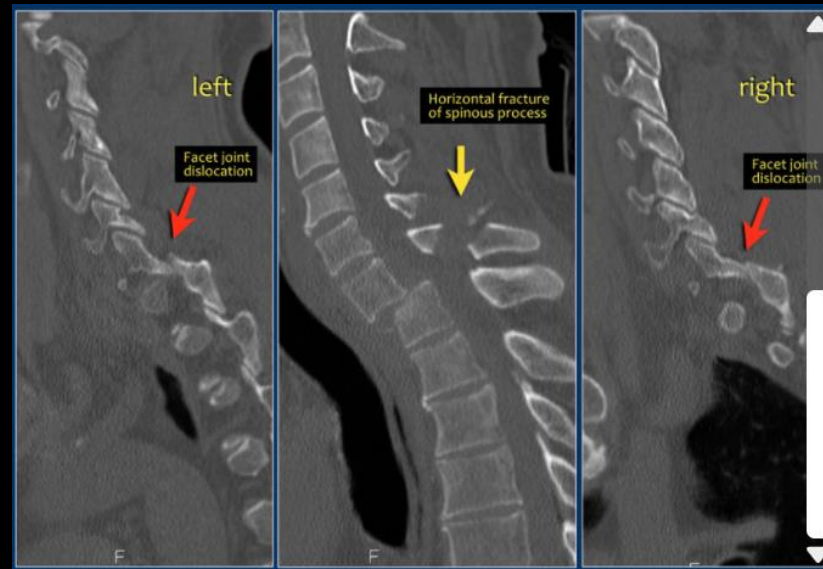
Most common, loss of height of anterior vertebral body or disruption of endplate, posterior segments intact, axial force with flexion



TLICS Morphology score- 1

## Translation/Rotation

Displacement of horizontal line, likely causes PLC injury too



TLICS Morphology score- 3

## Distraction

Pulling apart of vertebrae, high chance of spinal cord injury, vertical line displacement



TLICS Morphology score- 4

# Final Diagnosis

- Thoracic Incomplete Burst Fractures with no focal neurological deficits



# ACR appropriateness Criteria

- Radiography extremity- done
- CT with contrast chest/abd/pelvis- done
- Trauma series
  - Chest XR-done
  - Pelvis XR- not done
  - C spine XR- CT without contrast done
- No FAST scan done

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# Take Home Points

- Blunt Trauma ACR criteria
- TLICS Criteria vs AO Spine thoracolumbar Classification
- Proper treatment and follow-up given imaging and physical exam for spinal fractures

# References

- <https://radiologyassistant.nl/musculoskeletal/spine/tlics-classification>
- [https://acsearch.acr.org/list?\\_ga=2.163148916.991424154.1602560293-381383306.1602560293](https://acsearch.acr.org/list?_ga=2.163148916.991424154.1602560293-381383306.1602560293)
- <https://radiopaedia.org/articles/thoracic-spine-ap-view-2?lang=us>
- Spiegl, U. J., et al. "Incomplete burst fractures of the thoracolumbar spine: a review of literature." *European Spine Journal* 26.12 (2017): 3187-3198.
- <https://radiopaedia.org/articles/ao-spine-classification-of-thoracolumbar-injuries?lang=us>



Questions?