PLEASE CLICK ON THE FOLLOWING LINK TO WATCH THE LECTURE ONLINE:-

HTTPS://WWW.YOUTUBE.COM/WATCH?V=LDJHLZ_4E4C&LIST=PLUBRB5B7FA_EMBZP8JWG_HG8_O1JXLEEO

THORACOLUMBAR SPINE FRACTURE

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Orthopaedic Department.JRMS.
KHMC

Introduction

- Spine fractures are common musculoskeletal injuries (640/ million)
- 70%-90% (Thoracolumbar junction)
- L1, T12
- Anatomy
  - Pure Thoracic : T1-T9
  - Thoracolumbar : T10- L2
  - Low lumbar : L3-L5

Introduction

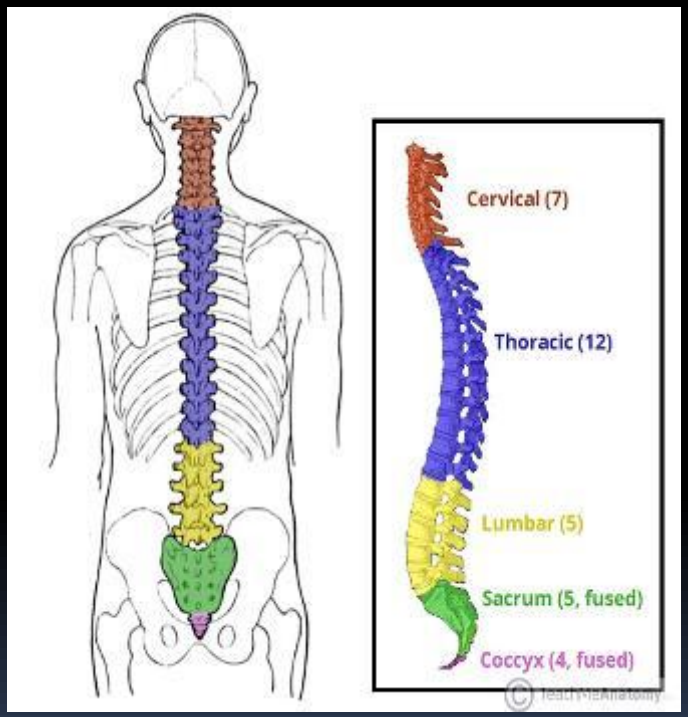
- 30% of polytrauma patients
- Delayed diagnosis in 20%-25%
- CT scan in polytrauma patient
- Concomitant injuries

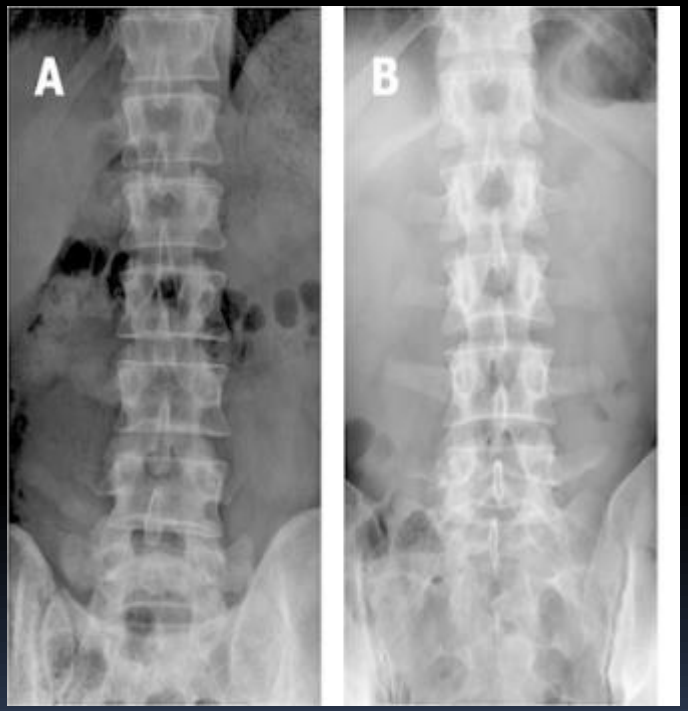
  - Head injuries 26%

  -Chest injuries 24%

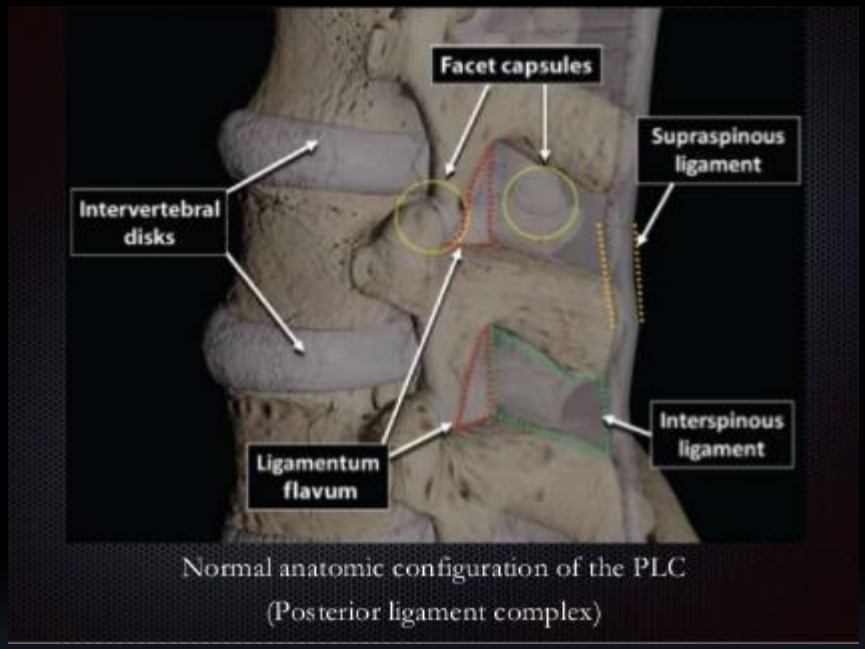
  - Long bone injuries 23%

Anatomy

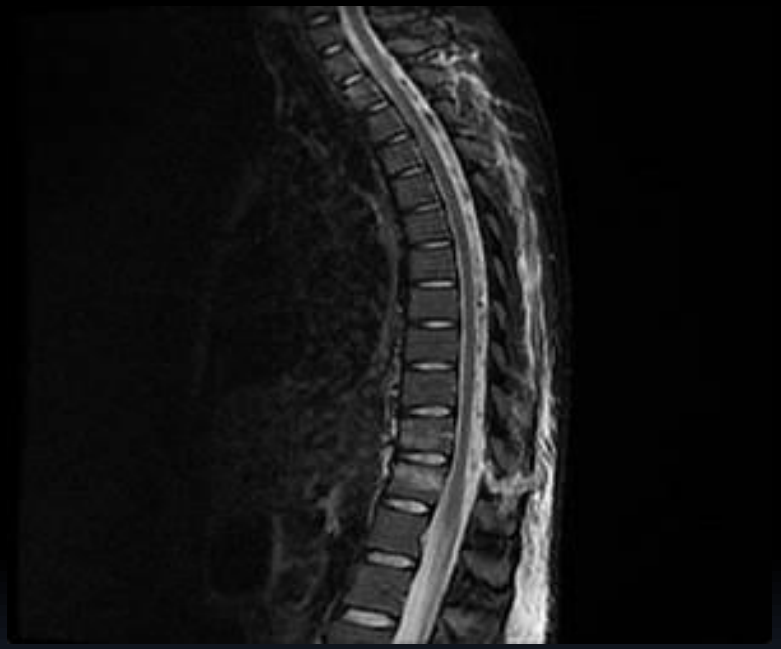

Cervical (7)
Thoracic (12)
Lumbar (5)
Sacrum (5, fused)
Coccyx (4, fused)


A
B

Anatomy (PLC)



Normal anatomic configuration of the PLC
(Posterior ligament complex)



PLC

Radiological finding of PLC injury

Classification of TL Fractures

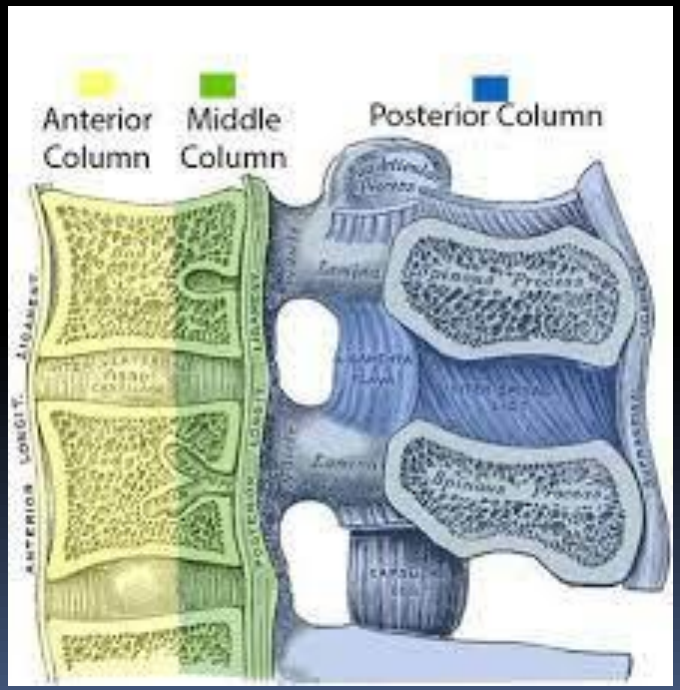
Three column concept (Denis)

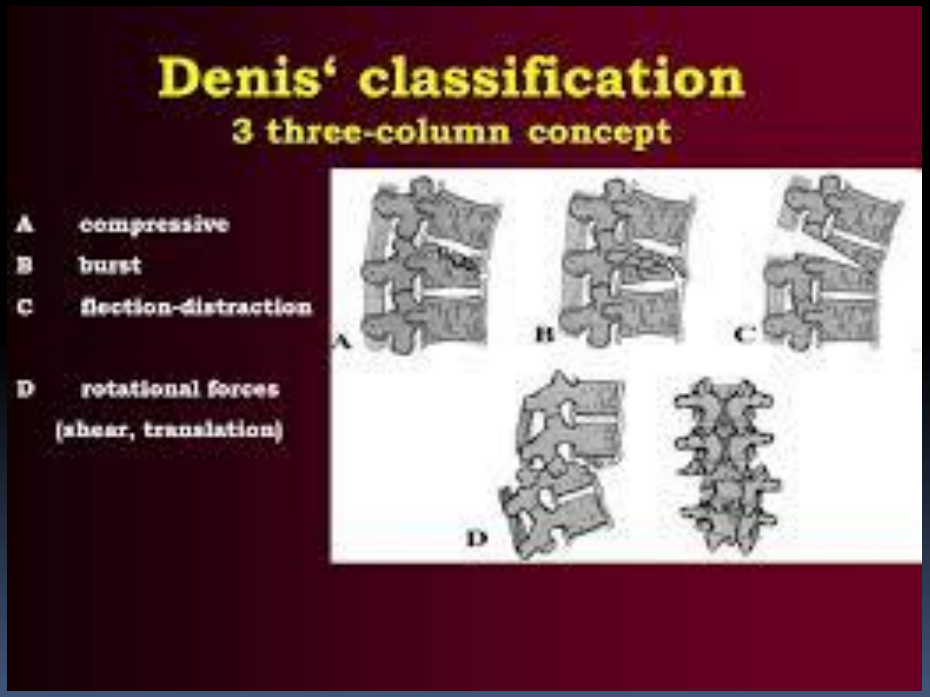
AOSpine Thoracolumbar Spine Injury Classification System

Thoracolumbar Injury Classification and Severity (TLICS) Scale

Classification of TL Fractures

Three column concept (Denis)

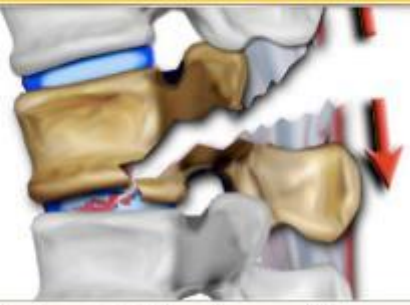




TLICS

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

TLICS

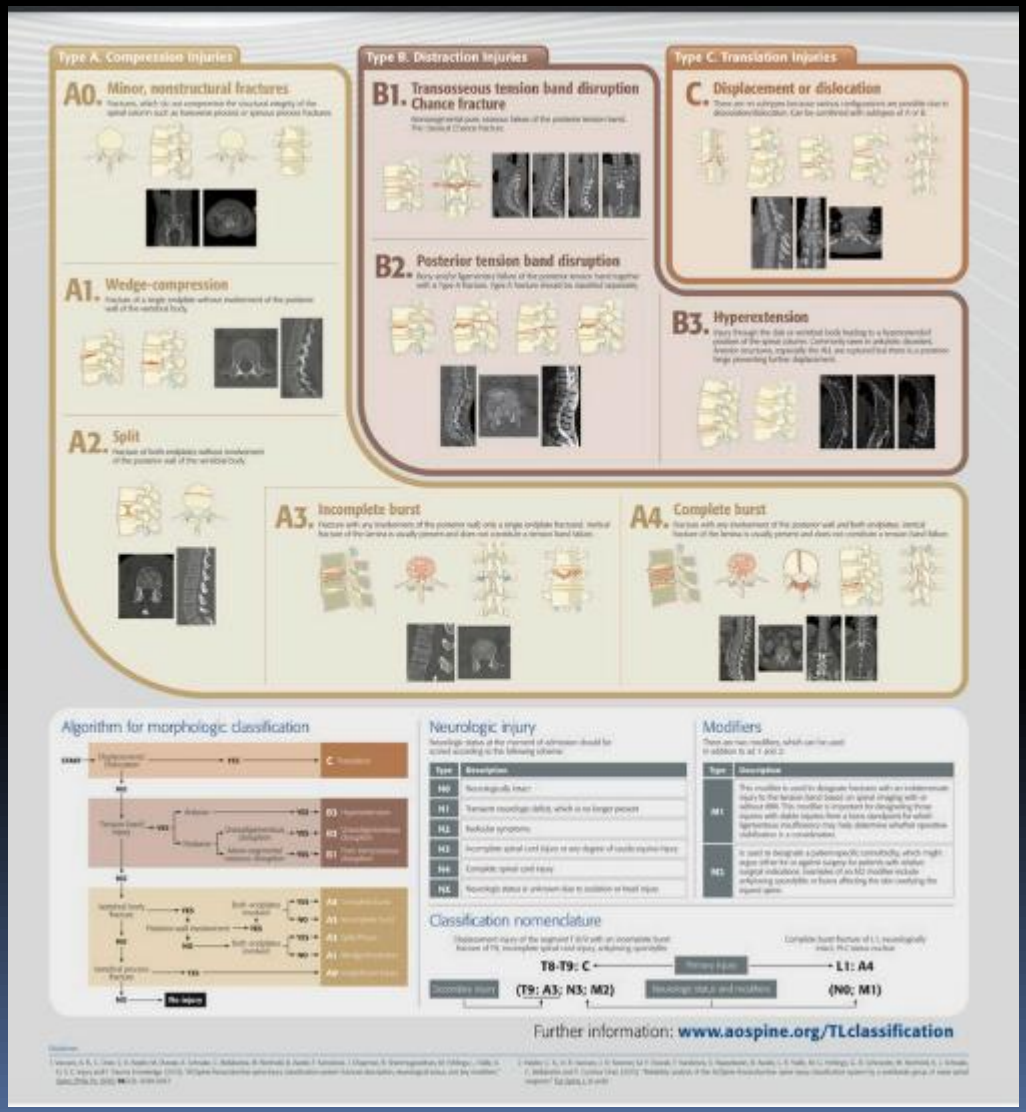
Compression 1 pnt	Burst 2 pnts
	
- Simple compression - Wedge deformity	- Compression with retro-pulsion of superoposterior body fragment
Translation/rotation 3 pnts	**Distraction 4 pnts**
	
- Rotatory / shearing - Anterior or lat displacement - Facet joint displacement	- Horizontal fracture of posterior elements - Separation of posterior elements

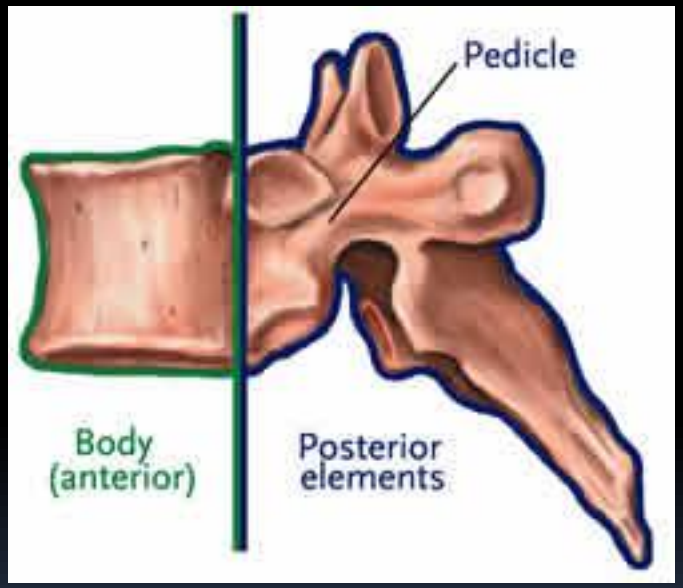
TLICS

- More than one injury
- Surgical approach

Systemic factors (RF . AS. Osteoporosis)

AO TL Classification



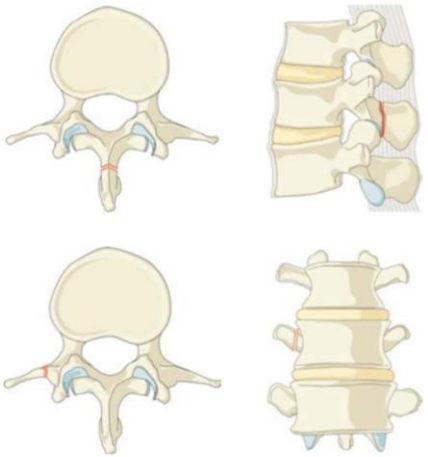


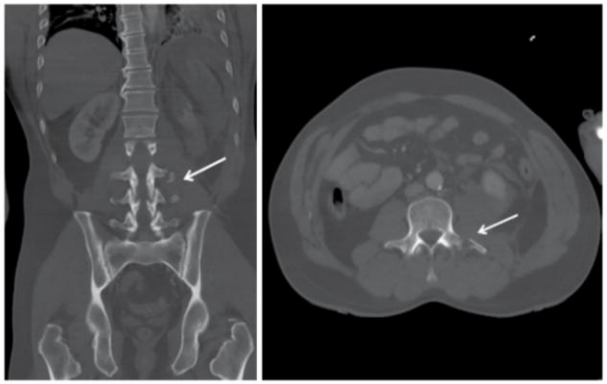
AO TL Classification

Type A

AO. Minor, nonstructural fractures

- Fractures, which do not compromise the structural integrity of the spinal column such as transverse process or spinous process fractures.



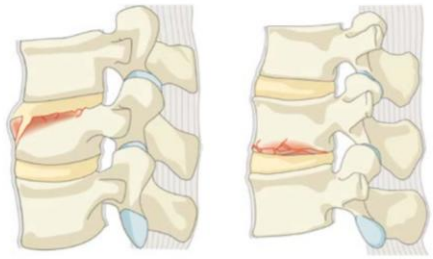


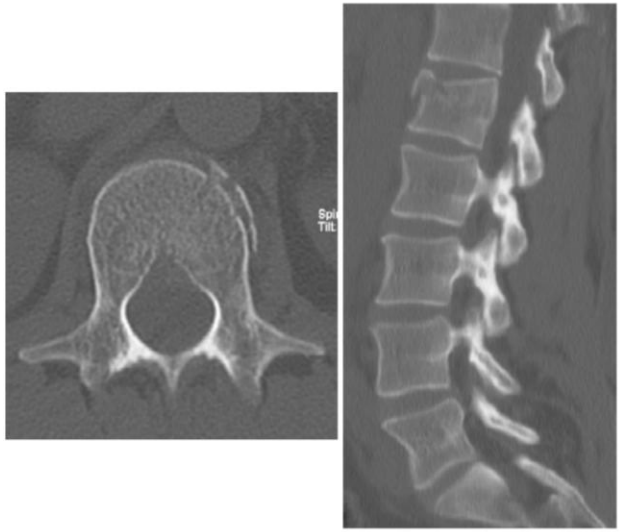
AO TL Classification

Type A

A1. Wedge-compression

- Fracture of a single endplate without involvement of the posterior wall of the vertebral body.



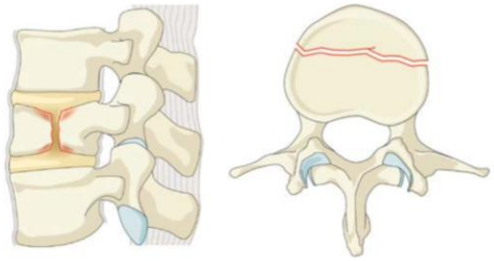


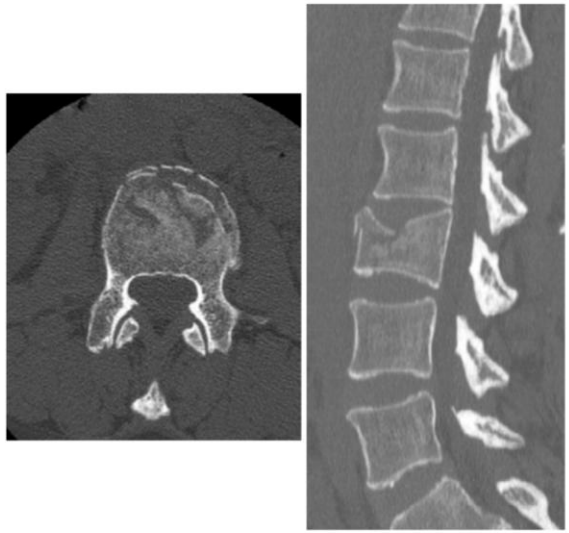
AO TL Classification

Type A

A2. Split

- Fracture of both endplates without involvement of the posterior wall of the vertebral body.



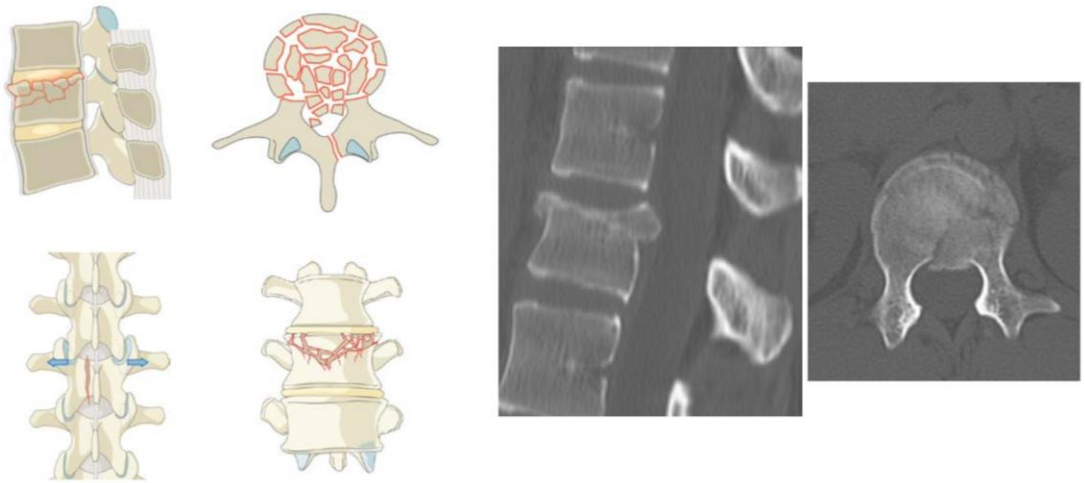


AO TL Classification

Type A

A3. Incomplete burst

- Fracture with any involvement of the posterior wall; only a single endplate fractured. Vertical fracture of the lamina is usually present and does not constitute a tension band failure.

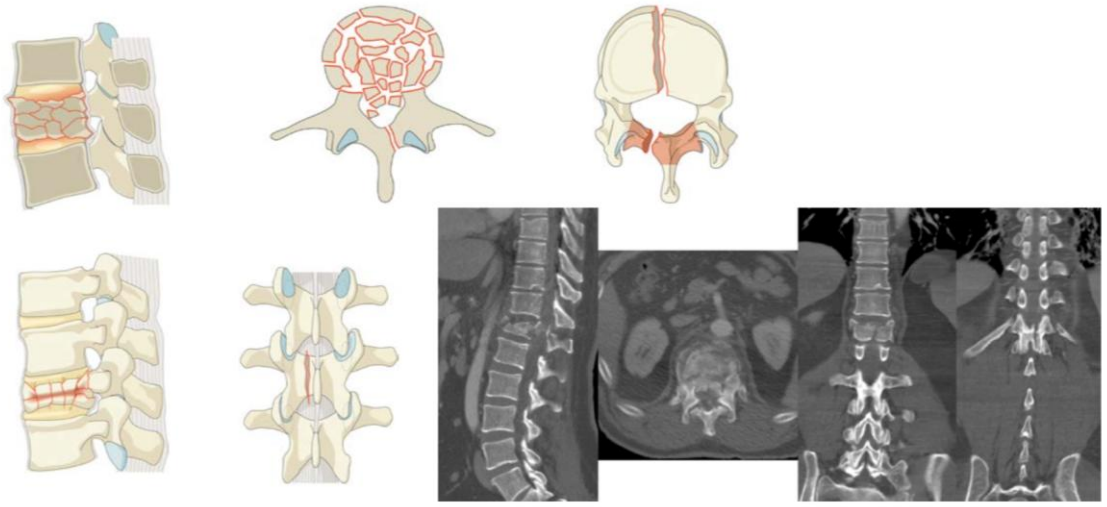


AO TL Classification

Type A

A4. Complete burst

- Fracture with any involvement of the posterior wall and both endplates. Vertical fracture of the lamina is usually present and does not constitute a tension band failure.

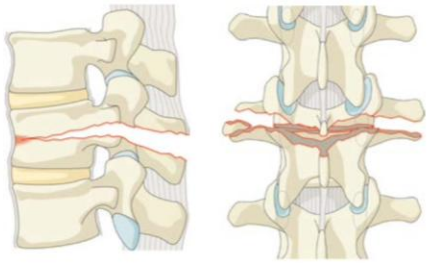


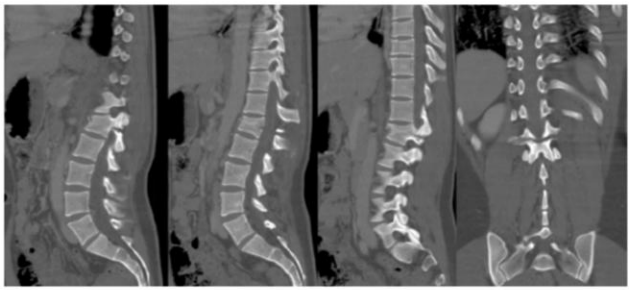
AO TL Classification

Type B

B1. Transosseous tension band disruption/Chance fracture

- Monosegmental pure osseous failure of the posterior tension band. The classical Chance fracture.



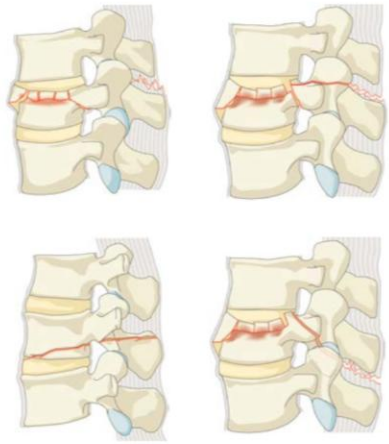


AO TL Classification

Type B

B2. Posterior tension band disruption

- Bony and/or ligamentary failure of the posterior tension band together with a Type A fracture. Type A fracture should be classified separately.



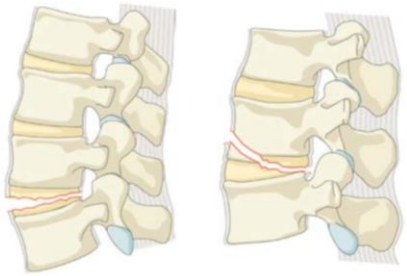
Example: This should be classified as: T12-L1 Type B2 with T12 A4 according to the combination rules.

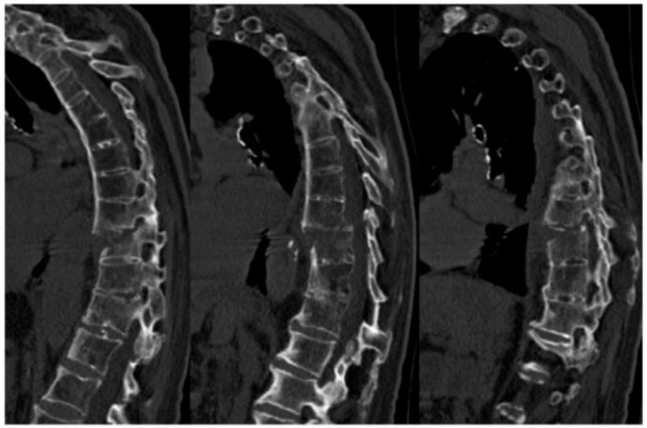
AO TL Classification

Type B

B3. Hyperextension

- Injury through the disk or vertebral body leading to a hyperextended position of the spinal column. Commonly seen in ankylotic disorders. Anterior structures, especially the ALL are ruptured but there is a posterior hinge preventing further displacement.



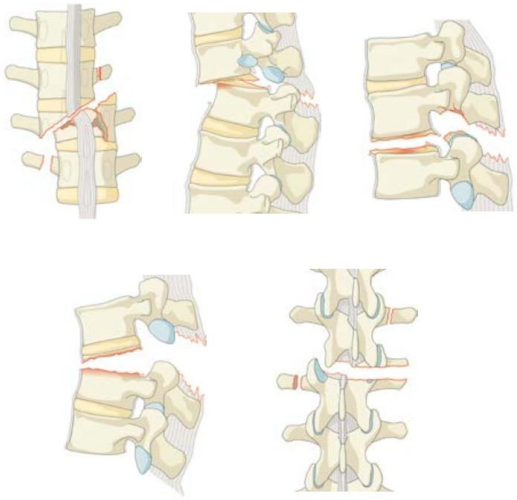


AO TL Classification

Type C

C. Displacement or dislocation

- There are no subtypes as because of the dissociation between cranial and caudal segments various configurations are possible in different images. Is combined with subtypes of A if necessary.



AO TL Classification

2. Neurologic injury

Neurologic status at the moment of admission should be scored according to the following scheme:

Type	Description
N0	Neurologically intact
N1	Transient neurologic deficit, which is no longer present
N2	Radicular symptoms
N3	Incomplete spinal cord injury or any degree of cauda equina injury
N4	Complete spinal cord injury
NX	Neurologic status is unknown due to sedation or head injury

AO TL Classification

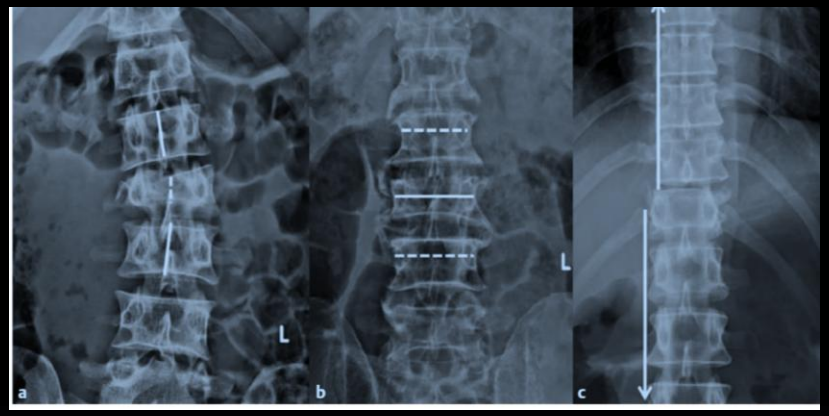
3. Modifiers

There are two modifiers, which can be used in addition to ad 1 and 2:

Type	Description
M1	This modifier is used to designate fractures with an indeterminate injury to the tension band based on spinal imaging with or without MRI. This modifier is important for designating those injuries with stable injuries from a bony standpoint for which ligamentous insufficiency may help determine whether operative stabilization is a consideration.
M2	Is used to designate a patient-specific comorbidity, which might argue either for or against surgery for patients with relative surgical indications. Examples of an M2 modifier include ankylosing spondylitis or burns affecting the skin overlying the injured spine.

Images

- Xray



Images

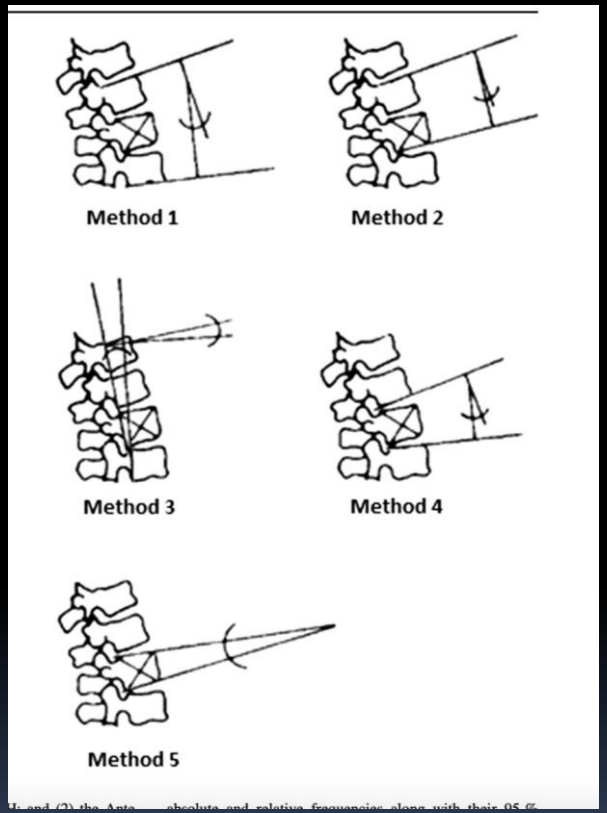
- Xray

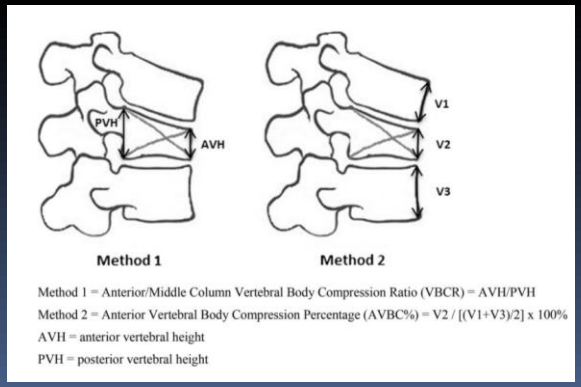
  Kyphosis >30 ,Loss of Hight > 50%....> PLC injury

Images

- Xray

Post traumatic kyphosis and vertebral body height loss measurement





Images

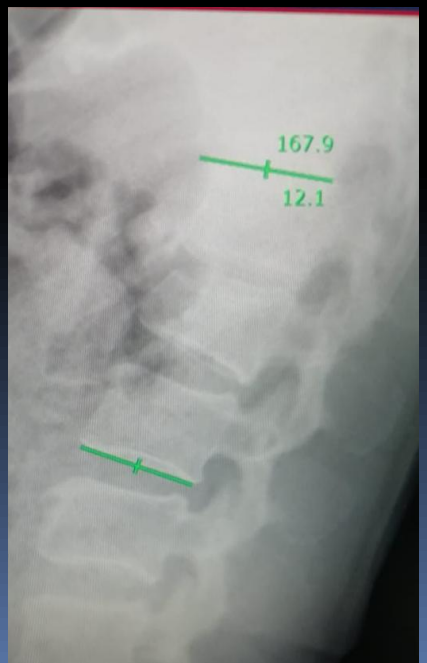
Eur Spine J
DOI 10.1007/s00586-016-4716-9

CrossMark

ORIGINAL ARTICLE

Measurement of kyphosis and vertebral body height loss in traumatic spine fractures: an international study

Said Sadiqi[1] · Jorrit-Jan Verlaan[1] · A. Mechteld Lehr[1] · Jens R. Chapman[2] · Marcel F. Dvorak[3] · Frank Kandziora[4] · S. Rajasekaran[5] · Klaus J. Schnake[6] · Alexander R. Vaccaro[7] · F. Cumhur Oner[1]



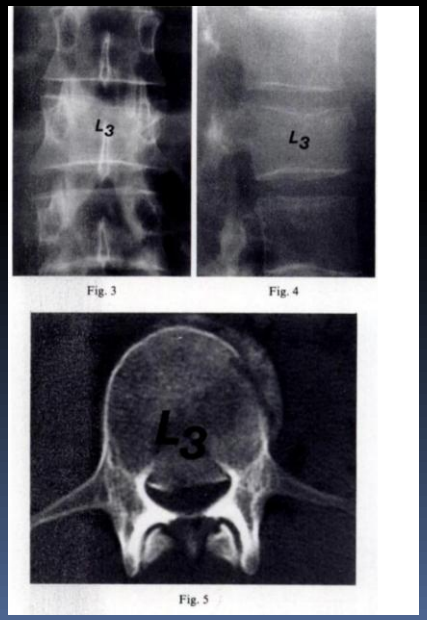
Imaging

- CT Scan
  - Finer details
  -Occult posterior element fracture
  - Compression vs Burst fracture ???

CAN BURST FRACTURES BE PREDICTED FROM PLAIN RADIOGRAPHS?

R. TRACY BALLOCK, ROBERT MACKERSIE, JEAN-JACQUES ABITBOL, VINICIO CERVILLA, DONALD RESNICK, STEVEN R. GARFIN

From San Diego Medical Center, University of California



Imaging

- CT
- Is Visceral CT enough?

J Trauma. 2006 Aug;60(2):315-20.

Visceral torso computed tomography for clearance of the thoracolumbar spine in trauma: a review of the literature.

Inaba K[1], Munera F, McKenney M, Schulman C, de Moya M, Rivas L, Pearce A, Cohn S.

Author information

CONCLUSION: The evidence to date demonstrates the superior sensitivity of reformatted visceral CT for detecting thoracolumbar spine injury. With no further patient movement, radiation exposure, cost, or time, trauma patients undergoing visceral CT can have their thoracolumbar spine promptly evaluated. Further prospective evaluation of the CT protocols to optimize visualization of both the viscera and the bone is warranted.

J Trauma. 2010 Aug;69(2):437-45. doi: 10.1097/TA.0b013e3181e481c8.

A comparison of the diagnostic performances of visceral organ-targeted versus spine-targeted protocols for the evaluation of spinal fractures using sixteen-channel multidetector row computed tomography: is additional spine-targeted computed tomography necessary to evaluate thoracolumbar spinal fractures in blunt trauma victims?

Kim S[1], Yoon CS, Byu JA, Lee S, Park YS, Kim SS, Lee YH, Suh JS.

CONCLUSION: Sixteen-channel multidetector row CT images reconstructed using a soft algorithm and a wide display FOV that cover the entire abdomen using a visceral organ-targeted protocol with 1.5-mm collimation are sufficient for the evaluation of spine fractures in trauma patients, given that multiplanar-reformatted images are provided.

Imaging

- MRI
  - Spinal cord
  -Paraspinal soft tissue
  - IVD
  -PLC
  - Traumatic or Pathological fracture ??

Imaging

- MRI

Imaging

- MRI

  - Respiratory distress?
  - Unstable hemodynamic status?
  - Active bleeding wound?
  - Obtund mental status ?

Imaging

- MRI

1 - Penetrating injury + retained metallic piece?

2 - Retained bullet fragment ?

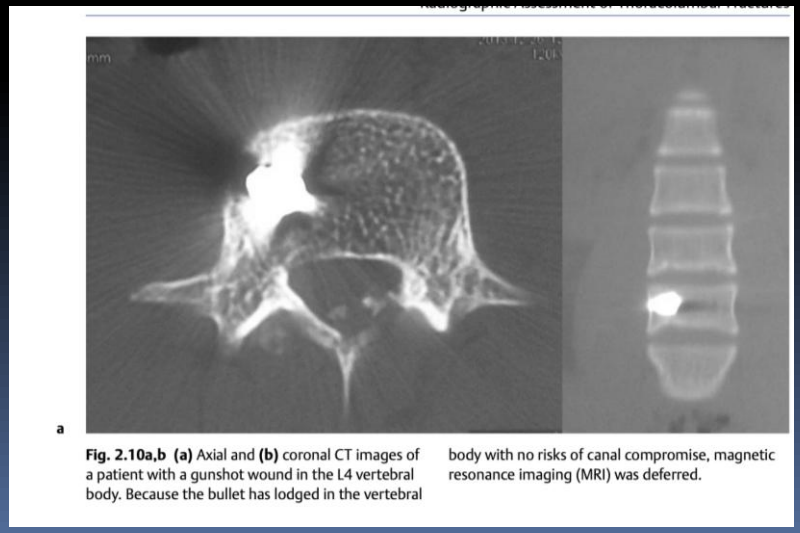


Fig. 2.10a,b **(a)** Axial and **(b)** coronal CT images of a patient with a gunshot wound in the L4 vertebral body. Because the bullet has lodged in the vertebral body with no risks of canal compromise, magnetic resonance imaging (MRI) was deferred.

Imaging

- MRI
- Combined CT and MRI

Eur Spine J. 2011 Aug;20 Suppl 3:398-6. doi: 10.1007/s00586-011-1913-4. Epub 2011 Jul 21.

Impact of magnetic resonance imaging on decision making for thoracolumbar traumatic fracture diagnosis and treatment.

Pizones J[1], Izquierdo E, Alvarez P, Sánchez-Marscal F, Zúñiga L, Chimeno P, Beriza E, Castillo E.

RESULTS: Thirty patients (15 males, 15 females) with an average age of 39.9 years were studied. Forty-one fractures were initially diagnosed using plain X-rays and CT scans, while MRI diagnosed 50 fractures and 9 vertebral contusions. MRI modified our diagnosis in 40% of our patients (discovering 18 occult injuries), the classification of fracture pattern in 24% of the fractures (mostly upgrading type A to type B patterns) and the therapeutic management in 16% of our patients.

CONCLUSIONS: MRI seems to be a useful tool in the evaluation of thoracolumbar acute fractures, as it allows a better visualization of the posterior complex integrity and of the levels involved, offering additional information compared to traditional diagnostic tools.

Magnetic resonance imaging frequently changes classification of acute traumatic thoracolumbar spine injuries.

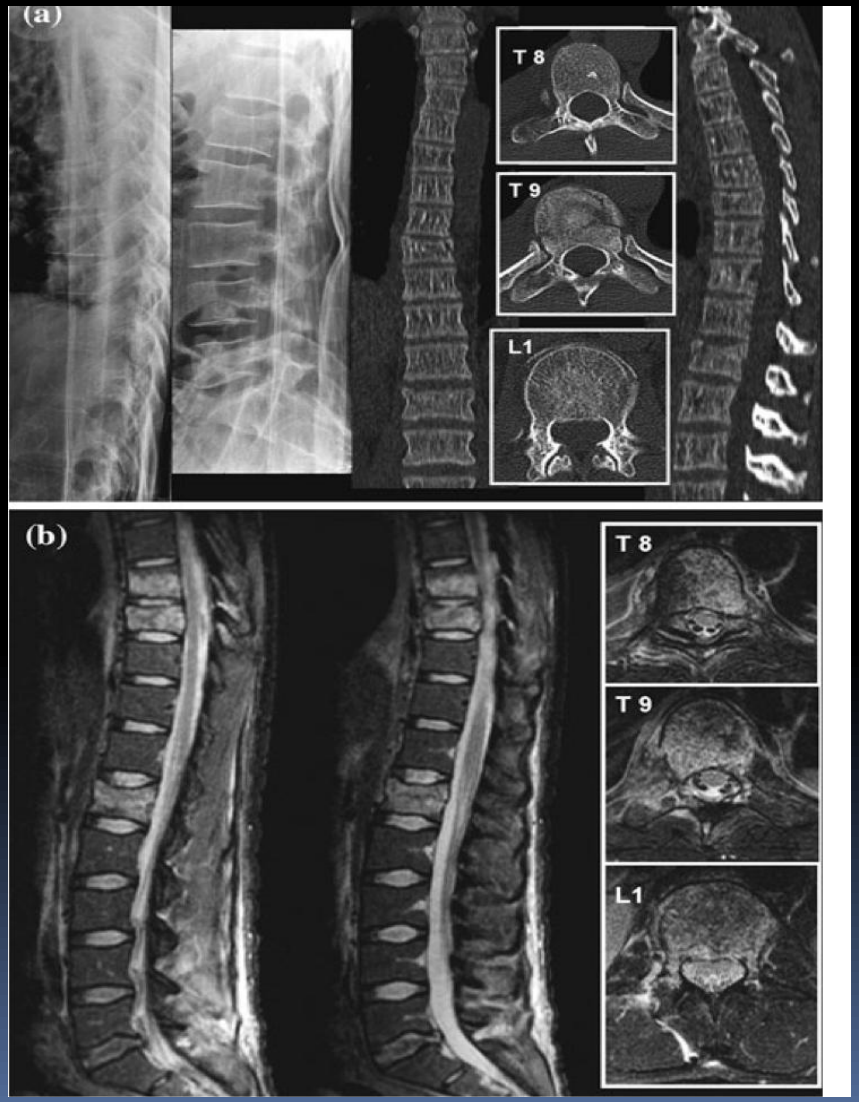
Winklhofer S[1], Thekkumthala-Sommer M, Schmidt D, Rufibach K, Werner CM, Wanner GA, Alkadhi H, Hodler J, Andreisek G.

RESULTS: CT and MRI together revealed a total of 196 fractures (CT alone 162 fractures). The AO classification changed in 31 %, the TLICS classification changed in 33 % of the patients compared with CT alone. Based on CT and MRI together, the TLICS value changed from values <5 (indication for conservative therapy) to values ≥ 5 (indication for surgical therapy) in 24 %.

CONCLUSION: MRI of patients with thoracolumbar spinal trauma considerably improved the detection of fractures and soft tissue injuries compared with CT alone and significantly changed the overall trauma classification.

Imaging

- MRI



Imaging

- MRI STIR

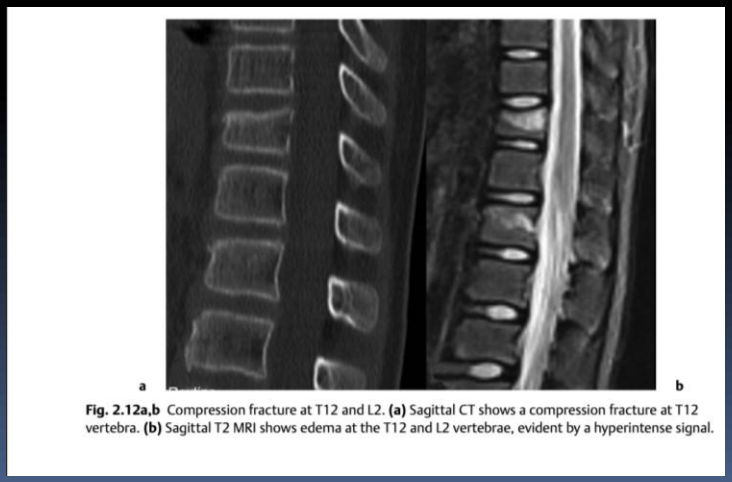


Fig. 2.12a,b Compression fracture at T12 and L2. **(a)** Sagittal CT shows a compression fracture at T12 vertebra. **(b)** Sagittal T2 MRI shows edema at the T12 and L2 vertebrae, evident by a hyperintense signal.

M. Qaiyum
P.N.M. Tyrrell
I.W. McCall
V.N. Cassar-Pullicino

MRI detection of unsuspected vertebral injury in acute spinal trauma: incidence and significance

Received: 17 April 2000
Revision requested: 19 June 2000
Revision received: 6 September 2000
Accepted: 27 November 2000

M. Qaiyum · P.N.M. Tyrrell (✉)
I.W. McCall · V.N. Cassar-Pullicino
Department of Diagnostic Imaging,
The Robert Jones,

Abstract *Objective*. Multilevel spinal injury is well recognised. Previous studies reviewing the radiographs of spinal injury patients have shown an incidence of 15.2% of unsuspected spinal injury. It is recognised that magnetic resonance imaging (MRI) can identify injuries that are not demonstrated on radiographs. The objective of this study was to determine the incidence and significance of spinal injuries using MRI in comparison with radiographs. *Design and patients*. The radiographs and MR images of 110 acute spinal injury patients were reviewed independently of each other and the findings were then correlated to determine the incidence of bone bruises (occult injury) in 41.8% of spinal injury patients which were not seen on radiographs. These bone bruises were best appreciated on sagittal short tau inversion recovery MR sequences and seen at contiguous and non-contiguous levels in relation to the primary injury. *Conclusion*. This level of incidence of bone bruises has not previously been appreciated. We recommend that patients undergoing MRI for an injured segment of the spine are better assessed by MRI of the entire spine at the same time to exclude further injury.

Keywords Spine · Trauma · MRI ·

TREATMENT

- 1- stability
- 2- relief pain
- 3- restore function
- 4-reduce deformity

- Conservative (Orthosis)
- Surgical (fixation)

TREATMENT

- Orthosis

TREATMENT

- Orthosis

TREATMENT

- Orthosis

- Level of injury

1- T8-L4 > TLSO

2- T7 and proximal > cervical extension

3- L5 > thigh cuff

TREATMENT

- Orthosis

- Contraindications

1- Unstable fractures

2- Incomplete neurological deficit

3- Polytrauma

4- Morbid obesity

5- Impaired skin sensation

6- Impaired mental status

TREATMENT

- Surgical fixation

- Dr. Berthold Ernest Hadra

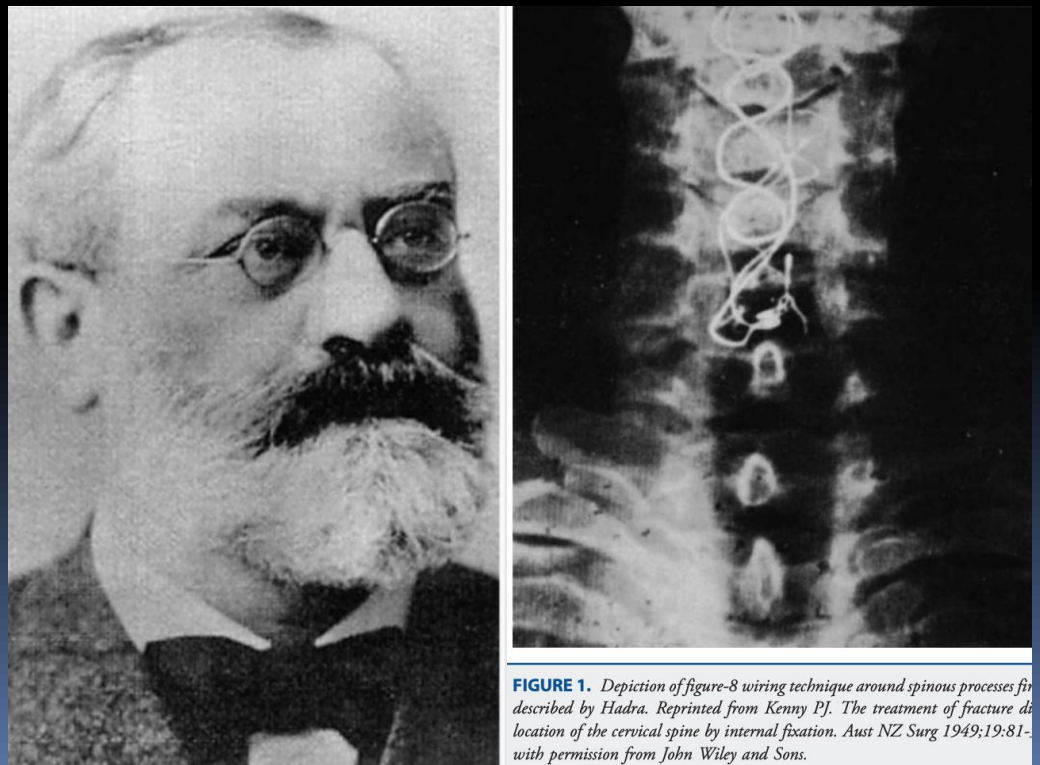


FIGURE 1. *Depiction of figure-8 wiring technique around spinous processes fir described by Hadra. Reprinted from Kenny PJ. The treatment of fracture di location of the cervical spine by internal fixation. Aust NZ Surg 1949;19:81- with permission from John Wiley and Sons.*

TREATMENT

- Surgical fixation

TREATMENT

- Surgical fixation
  -Mono segmental fixation .
  - Short segmental fixation.
  - Long segmental fixation .

- Anterior approach
- Posterior approach

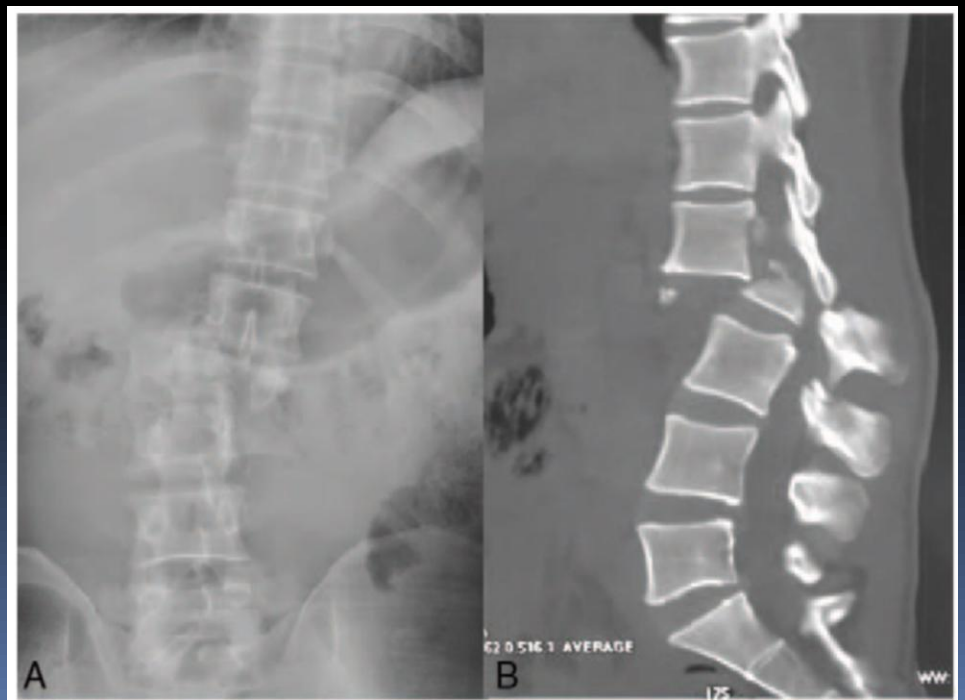


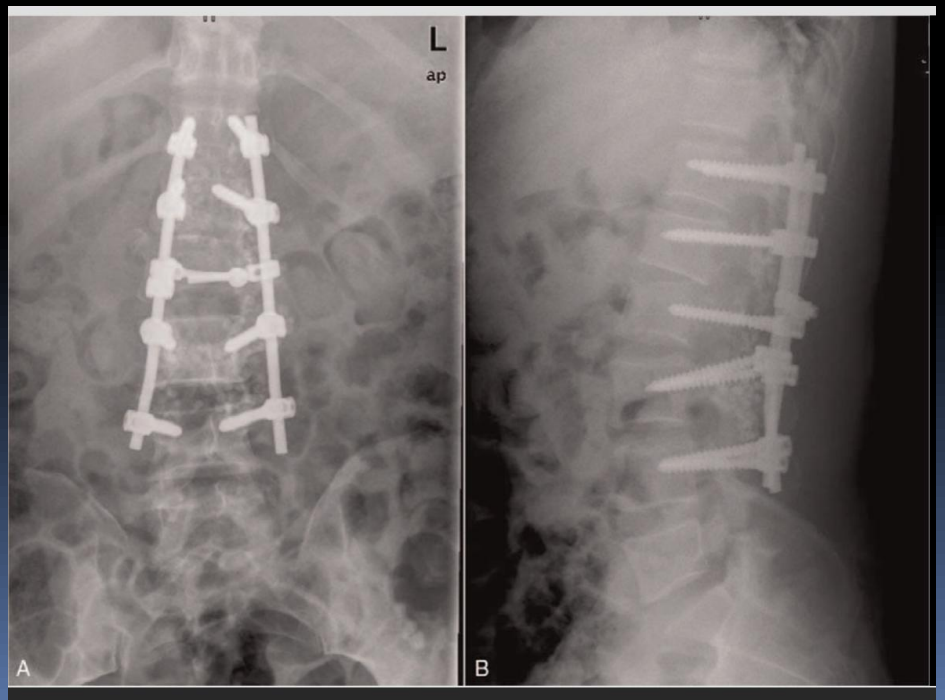
TREATMENT

- Dislocation
  - Unstable
  - PLC injury
  - TILICS >5
  - Posterior Long segmented instrumented fusion

TREATMENT

- Dislocation
  - A 35 Y male, Complete SCI





TREATMENT

- Distraction injuries

  - Separation of bony or ligamentous structures

  -Functional spinal unit destruction

  -Unstable

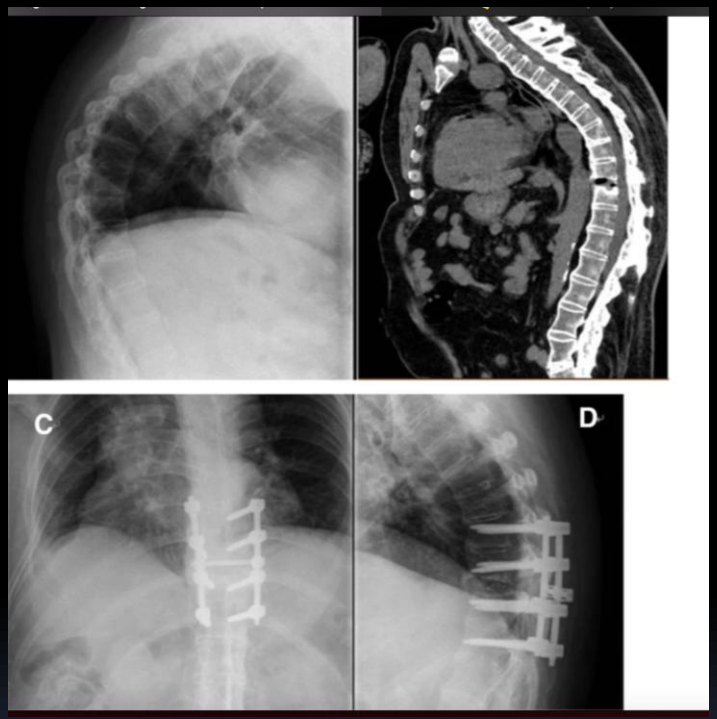
  - Long segment fixation or short

TREATMENT

- Distraction injuries

  - B3 Hyper extension injuries

  -Long segment fixation

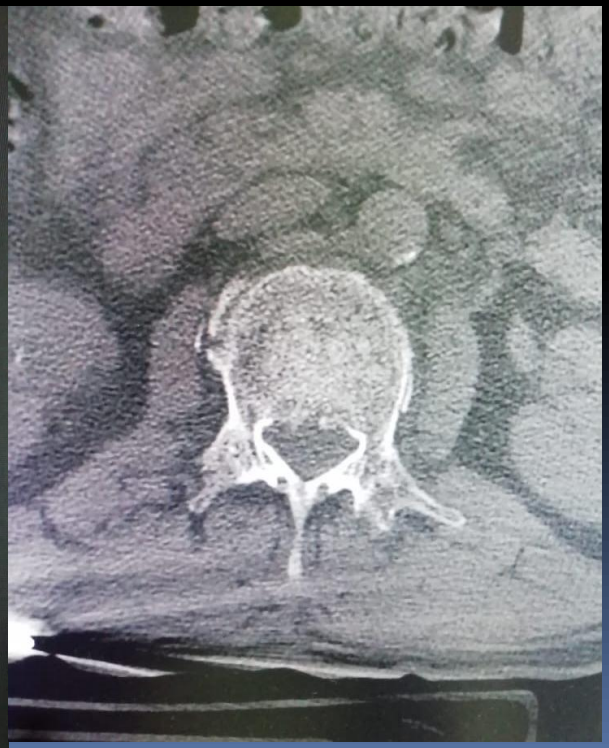


TREATMENT

- Distraction injuries
  - B2
  - short segment fixation or
    mono segment fixation

TREATMENT

- Distraction injuries
  - L2 #, No neurological deficit


TREATMENT

- Distraction injuries
  - B1 (Chance fracture)
  - short segment fixation
    or mono segment fixation

TREATMENT

- Distraction injuries
  - L2 #, No neurological deficit

TREATMENT

- Distraction injuries
  - B1 (Chance fracture)
  - Extension brace?
  - kyphosis? pain? functional out come

TREATMENT

- Compression fractures
  - Stable
  - Conservative Tx (intact PLC, no neurological deficit)
  -Bracing for fractures cranial to T11??
  - Mixed evidence

TREATMENT

- Burst Fracture

  - Burst fracture +PLC injury > surgical treatment

  - Burst fracture + neurological deficit > surgical treatment

  - Stable burst fracture

  - <20% loss of height or 20% local kyphosis

    Non surgical treatment.

TREATMENT

- Stable Burst Fracture
  - Guidelines suggest non surgical Tx
  - Most surgeons prefers surgical Tx
  - L1 # Intact PLC , No neurological deficit

TREATMENT

- Stable Burst Fracture
  -is bracing effective ???

Randomized Controlled Trial > Spine J. 2014 Nov 1;14(11):2557-64.
doi: 10.1016/j.spinee.2013.10.017. Epub 2013 Oct 31.

Orthosis versus no orthosis for the treatment of thoracolumbar burst fractures without neurologic injury: a multicenter prospective randomized equivalence trial

Christopher S Bailey [1], Jennifer C Urquhart [1], Marcel F Dvorak [2], Melissa Nadeau [1], Michael C Boyd [2], Ken C Thomas [3], Brian K Kwon [2], Kevin R Gurr [2], Stewart I Bailey [1], Charles G Fisher [4]

Affiliations + expand

PMID: 24184649 DOI: 10.1016/j.spinee.2013.10.017

Conclusions: Treating these fractures using early ambulation without a brace avoids the cost and patient deconditioning associated with a brace and complications and costs associated with long-term bed rest if a TLSO or body cast is not available.

Signs of Instability

- Fracture dislocation type c)
- Type B
- Sternal fracture
- Loss of height >50%
- Sagittal angulation >30%

Ankylosing Spondylitis

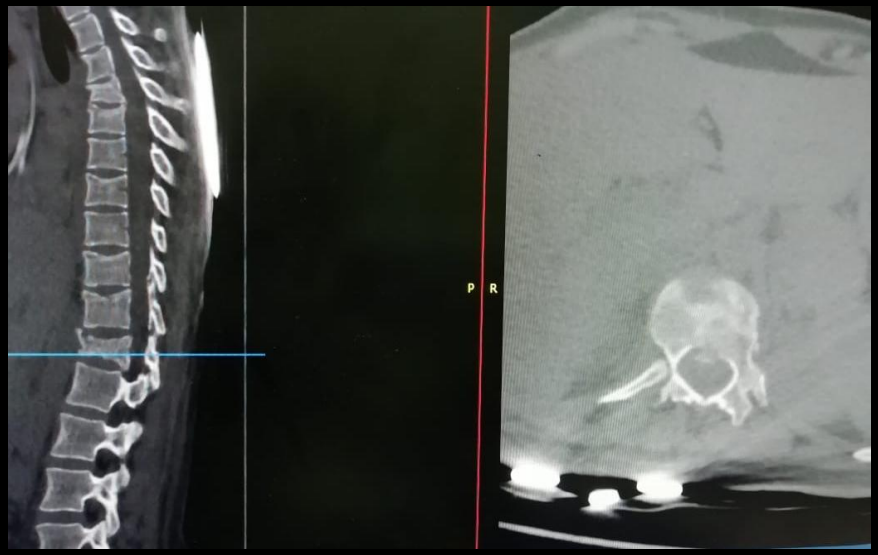
- Whole Spine images
- Unstable
- Immobilize in normal physiological position
- Bracing?
- Close monitoring

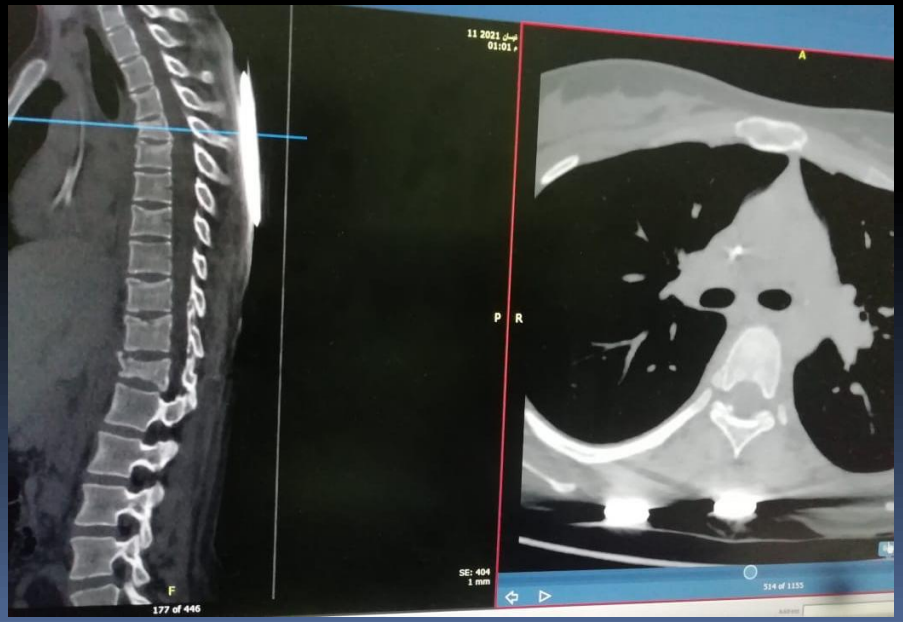
Spine Fracture Case

- 27 y female . RTA

  Spine fracture, No SCI

Spine Fracture Case

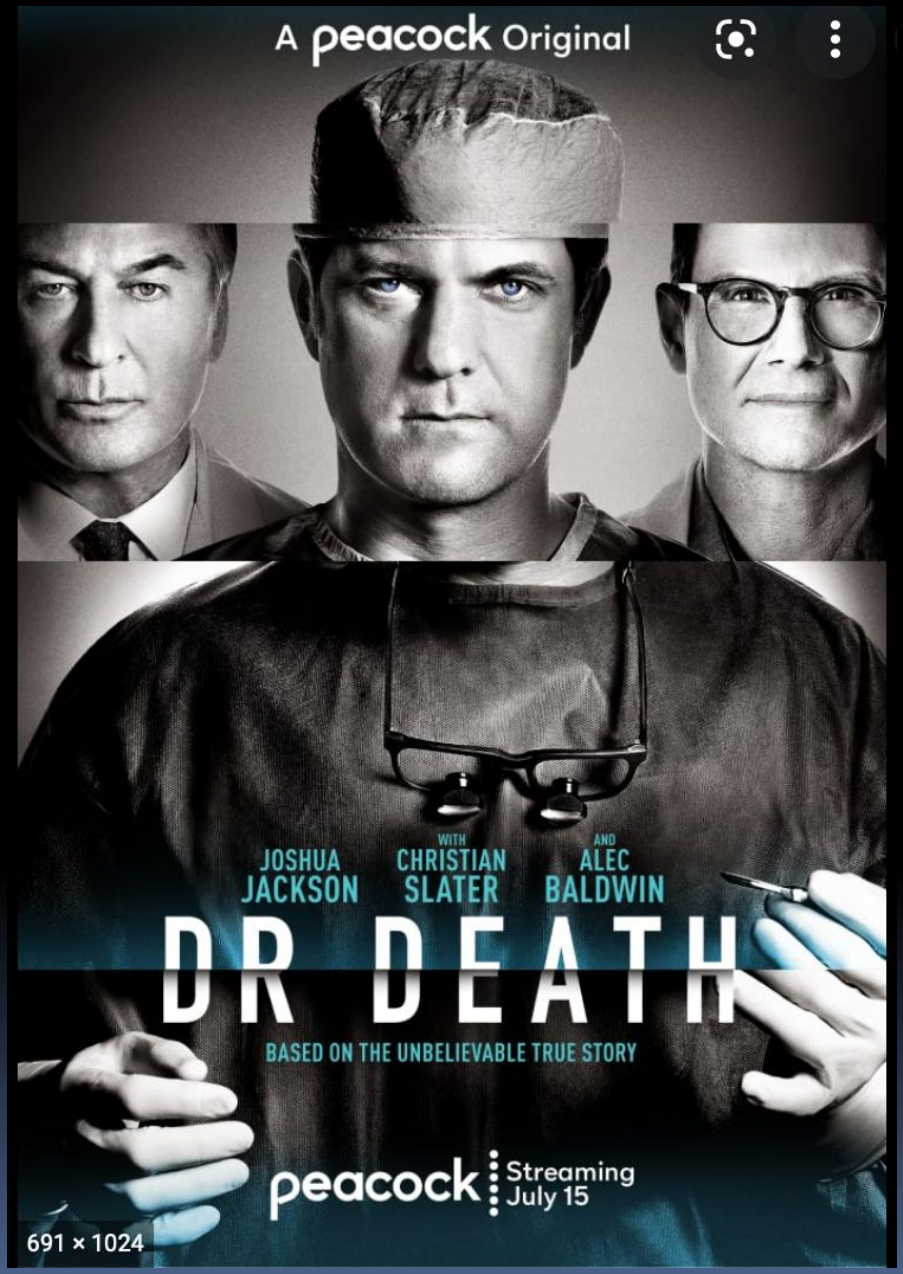




Spine Fracture Case

Spine Fracture Case

Spine Fracture Case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