Thoracolumbar Spine Injuries

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Epidemiology

- Affect young men mainly (15-29 yrs)
- 2/3 occurs at thoracolumbar junction (T11 – L2)
- Neurologic injury in 50%
- Intra-abdominal injury in 30%
- Incidence in North America: 12 to 50 million patients annually.

Mechanism

- Motor Vehicle Accidents (MVAs)
- Falls
- Occupational injuries
- Sport injuries
- Wartime-related injuries
- In Gaza: Tunnel Accidents, PSI

Clinical Evaluation & initial management

- See Management of Spinal Cord Injury

Imaging

Radiography

- Significantly low sensitivity & specificity
- Largely replaced by CT for diagnosis
- Useful in:
  - OR (Level, reduction, screws position)
  - Surveillance (inexpensive, less radiation)

Imaging

CT

- As soon as the primary survey is completed
- Whole spine & Brain (if GCS <15)
- Spiral, thin cuts, 3-D reconstruction
- Could be false negative in osteoporosis or ankylosing spondylitis → Ask for MRI here

Imaging

MRI

- Shows: Disc herniation, hematoma, ligaments & cord inj.
- Obtained for every patient at many centers
- The most sensitive in diagnosing PLC injury (↑ T2 signal), which increases the chances of instability

Classification

- Several classification systems
- Early ones: fracture morphologies
- Modern ones: fracture morphologies + clinical factors + the likelihood of a patient's need for surgery
- Aid in standardizing patients for prospective studies

Classification
Minor & major injuries

Minor injuries: (usually stable)

- Transverse process #
- Spinus process #
- Articular process #
- Lamina #

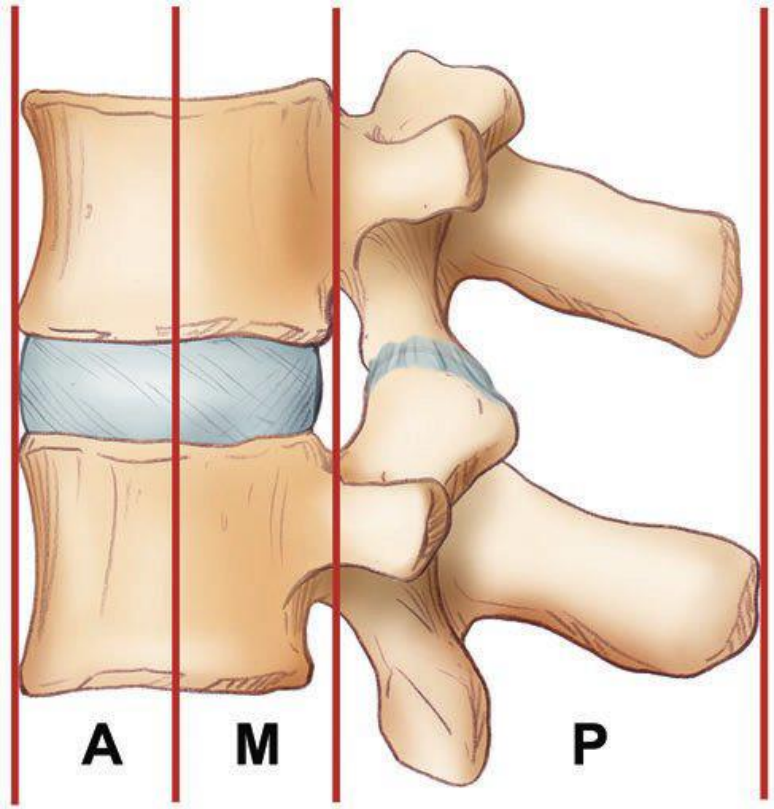
Classification
Minor & major injuries

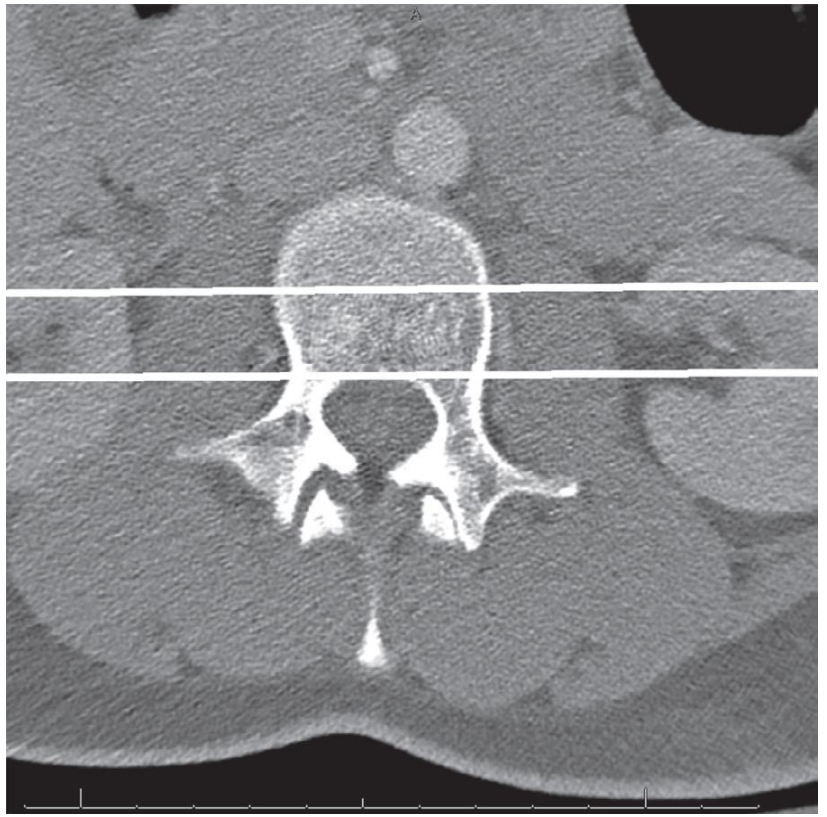
Major injuries: (4 types)

- Compression #
- Burst #
- Seat-belt #
- Fracture-dislocation

Denis Classification 1983

Injury to ≥ 2 columns usually unstable





4 major TL fracture types based on Denis classification

Fracture type	Column		
	Anterior	Middle	Posterior
Compression	Compression	Intact	Intact or distraction
Burst	Compression	Compression	Intact
Seat-belt	Intact or minimal compression	Distraction	
Fracture-dislocation	Compression, rotation, tear	Distraction, rotation, shear	

Anterior Column Injury (Compression Fracture)



Old healed compression fracture with anterior wedge deformity.



Anterior Column Injury (Compression Fracture)

Usually stable & treated by:

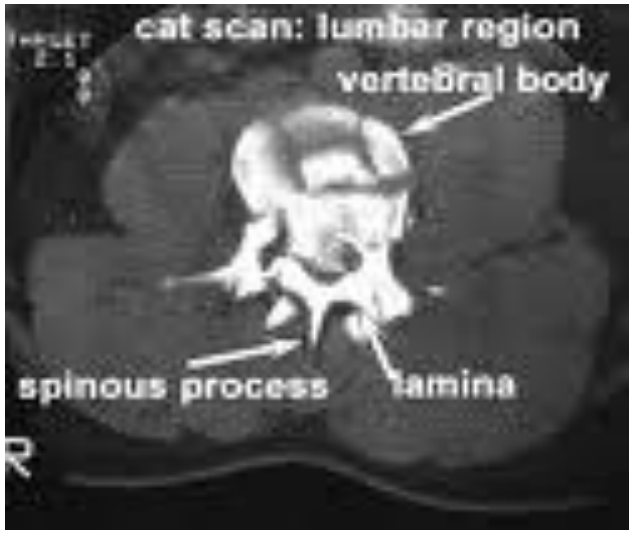
- Analgesics & bed rest 1-3 wks
- When pain decreases, ambulate in brace (12 wks)
- F/U with serial X-rays to rule out progressive deformity

Anterior Column Injury (Compression Fracture)

Unstable & requires surgery if:

- Loss > 50% of the height (one vertebra)
- Kyphotic angulation at one segment > 40°
- ≥ 3 contiguous comression fractures
- Neurologic deficit
- Disrupted posterior column
- Progressive kyphosis

Burst Fracture





Burst Fracture

Surgery recommended with any of the next:

- Anterior height ≤ 50% of the posterior height
- Residual canal diameter ≤ 50% of normal
- Kyphotic angulation ≥ 20°
- Increased interpediculate distance
- Neurologic deficit
- Progressive kyphosis

Burst Fracture

Can be treated conservatively esp. if:

- Above T8
- Below L4
- Minimal Middle Column Failure

Seat-belt fracture





Seat-belt fracture

- No immediate danger of neurologic injury
- Treat most with hyperextension brace
- Fractures through the bone (Chance fracture) mostly heal well in brace
- Fractures through the ligaments might need surgical fixation later

Fracture-dislocation






Fracture-dislocation

- Unstable

- Surgical decompression & stabilization usually needed

Magerl Classification System 1989 (Old AOSpine)

- Type A (Compression)
  - A1, A2, A3, A4
- Type B (Distraction)
  - B1, B2
- Type C (Translation)
  - C1, C2, C3

TLICS System (Vaccaro 2005)

TLICS	Management
≤3	Nonoperative candidates
4	Grey zone
≥5	Surgical candidates

Drawbacks:

- Oversimplified
- MRI-dependent

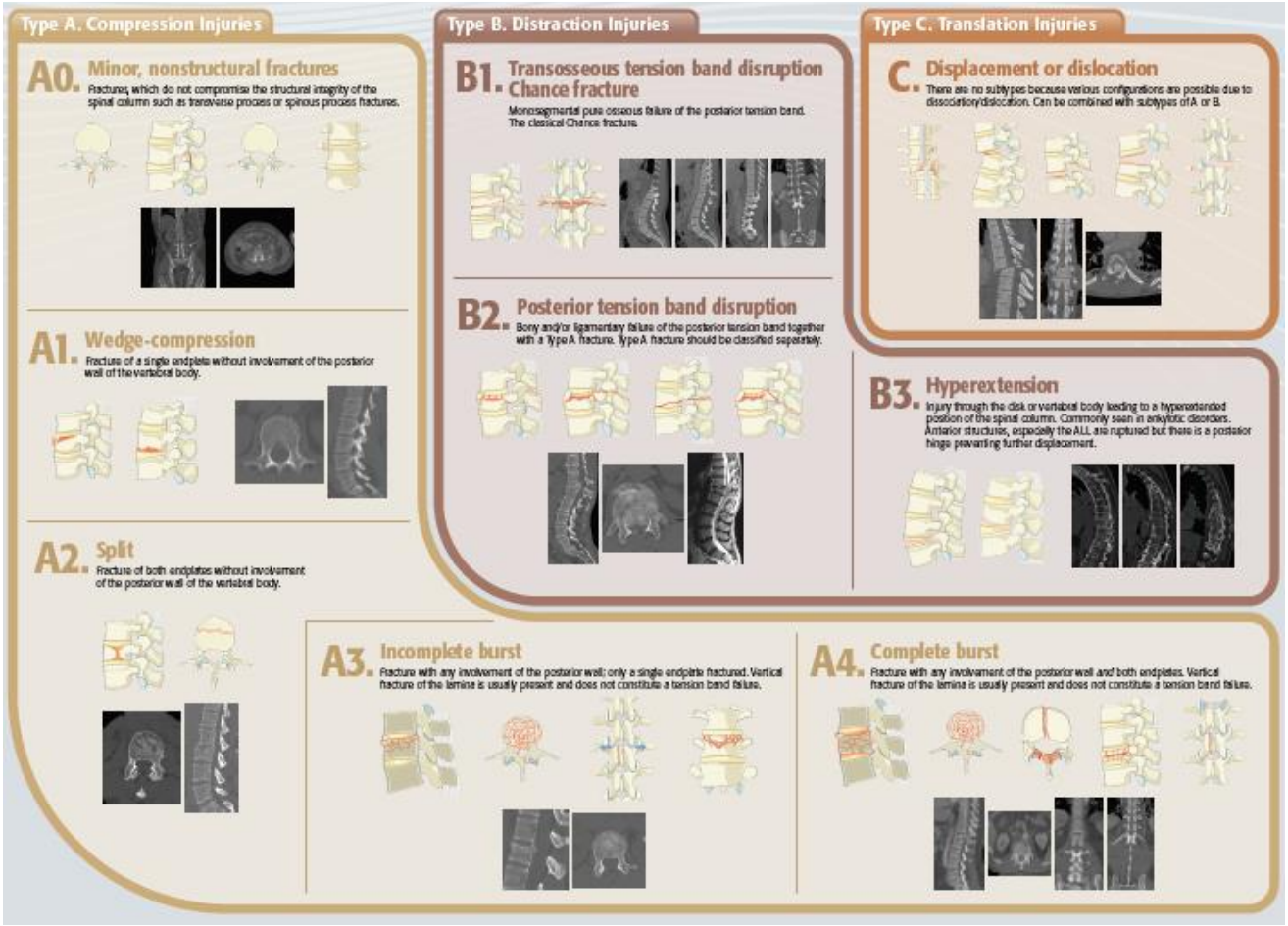
Category	Finding	Points
Radiographic findings	Compression #	1
	Burst #	2
	Distraction injury	2
	Fracture-dislocation	3
Neurologic status	Intact	0
	Root Injury	2
	Complete SCI	2
	Incomplete SCI	3
	CES	3
Posterior ligaments	Intact	0
	Undetermined	2
	Definite injury	3
Total points		

Updated AOSpine TLICS 2013

Spine (Phila Pa 1976). 2013 Nov 1;38(23):2028-37. doi: 10.1097/BRS.0b013e3182a8a381.

AOSpine thoracolumbar spine injury classification system: fracture description, neurological status, and key modifiers.

Vaccaro AR[1], Oner C, Kepler CK, Dvorak M, Schnake K, Bellabarba C, Reinhold M, Aarabi B, Kandziora F, Chapman J, Shanmuganathan R, Fehlings M, Vialle L; AOSpine Spinal Cord Injury & Trauma Knowledge Forum.



Updated AOSpine TLICS 2013

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

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.

AOSpine injury score (TL AOSIS)

- ≤ 3 for conservative
- ≥ 6 for surgery
- 4 or 5 either option

Classification	Points
Type A—compression injuries	
A0	0
A1	1
A2	2
A3	3
A4	5
Type B—tension band injuries	
B1	5
B2	6
B3	7
Type C—translational injuries	
C	8
Neurologic status	
N0	0
N1	1
N2	2
N3	4
N4	4
NX	3
Patient-specific modifiers	
M1	1
M2	0

AOSpine TLICS:
CT dependent
Validation is required

Surgical Approach?

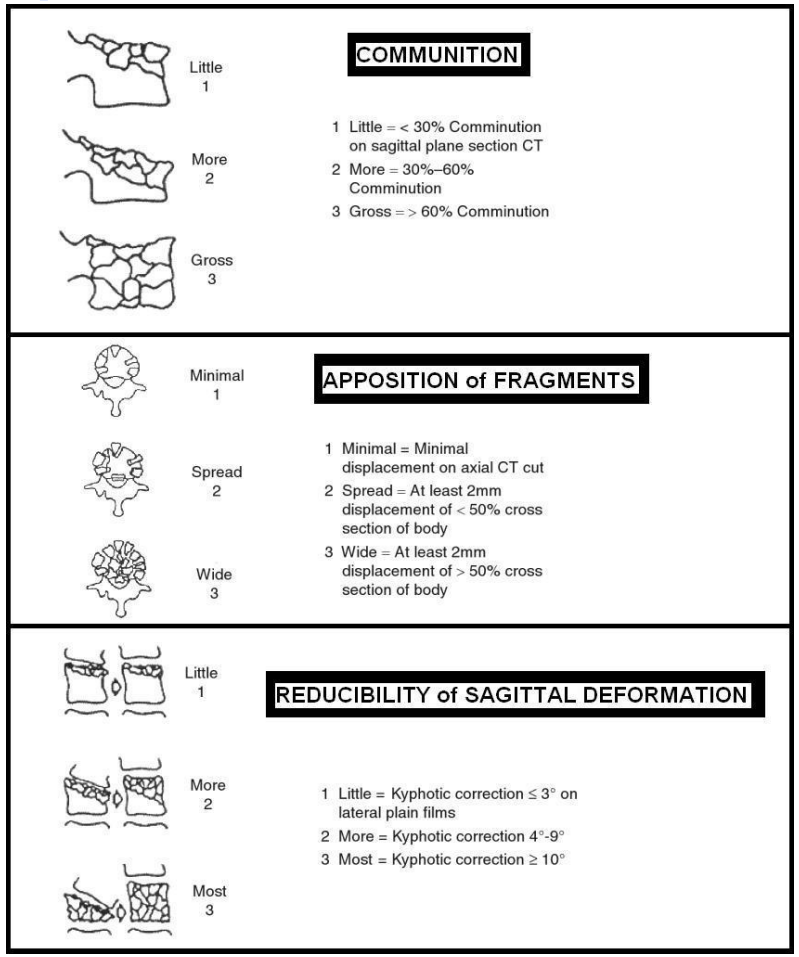
Posterior approach

Vs

Anterior approach

- Only Load-sharing classification “McCormack” provides surgical guidance for approach

McCormack Load-Sharing Classification (1994)



- 6 points or less can be successfully repaired from the posterior approach with pedicle screw implants.
- 7 points or more must be repaired by an anterior approach with vertebrectomy and strut grafting.

Surgical Approach?

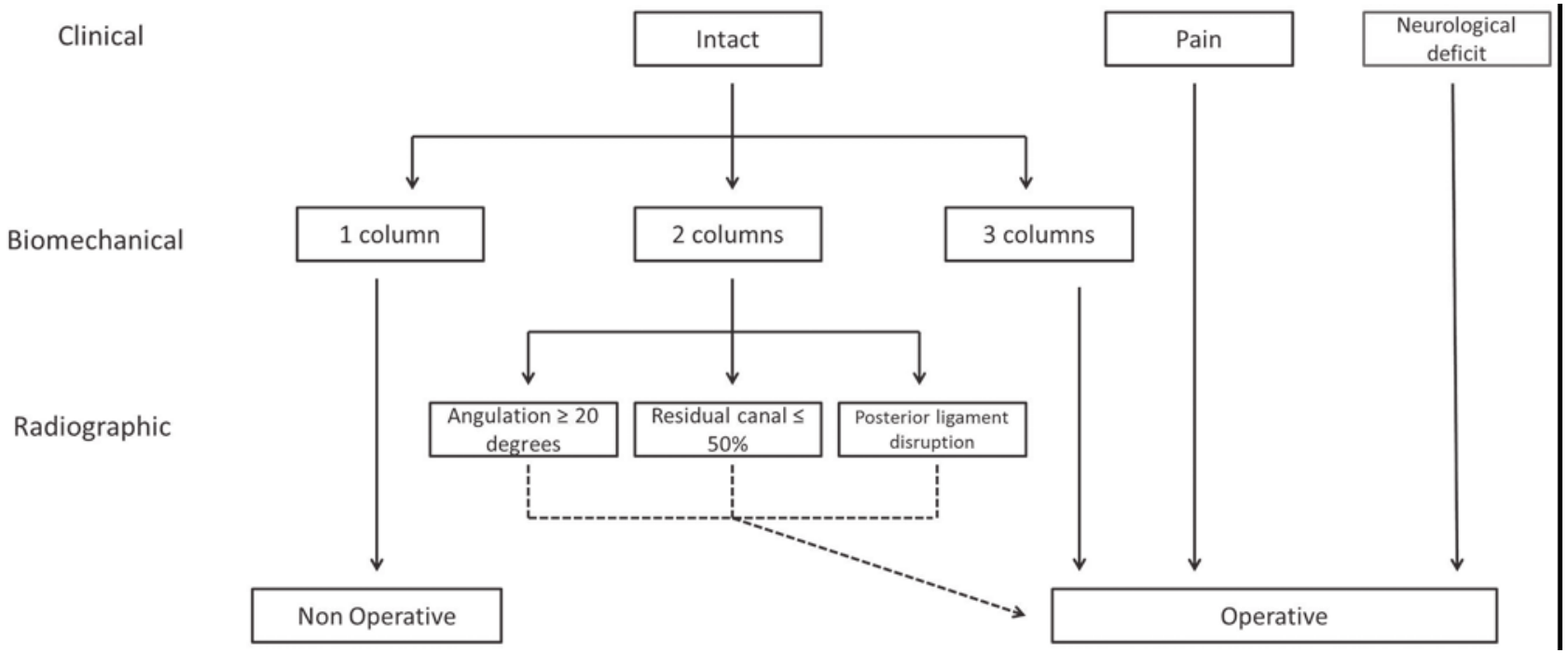
Posterior approach	Anterior approach
Less invasive Easier More commonly used Assumed to be the standard treatment	Sometimes indicated (McCormack1994) More invasive Challenging

However, modern techniques allow for all three columns to be addressed by the posterior approach

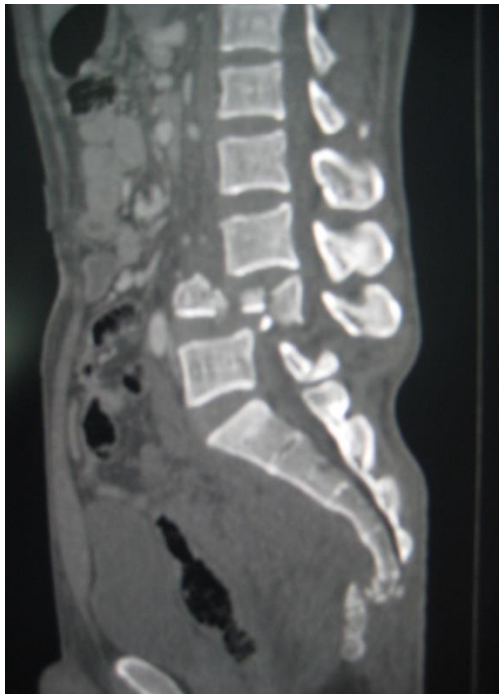
Lin B, Chen ZW, Guo ZM, et al. Anterior approach versus posterior approach with subtotal corpectomy, decompression, and reconstruction of spine in the treatment of thoracolumbar burst fractures: a prospective randomized controlled study. *J Spinal Disord Tech*. 2011 Jun 1 [Epub ahead of print].

Conclusion: Both are options. Less intraoperative blood loss and complications, shorter operative time, and better pulmonary function after operation are the significant advantages of posterior surgery.

Management Guideline
Hitchon's group 2006



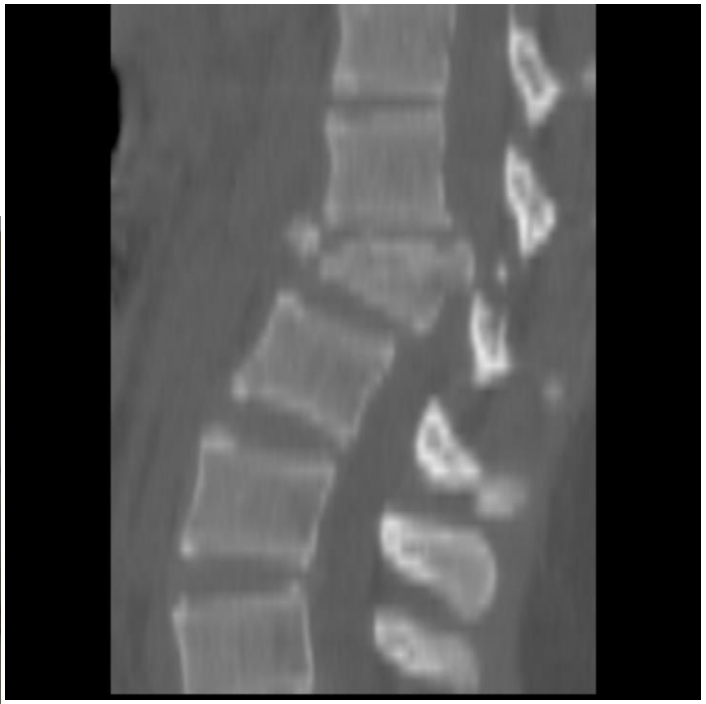
L4-L5: C; N3; M2
8+4+0=12


L1: A3; N3; M2
3+4+0=7



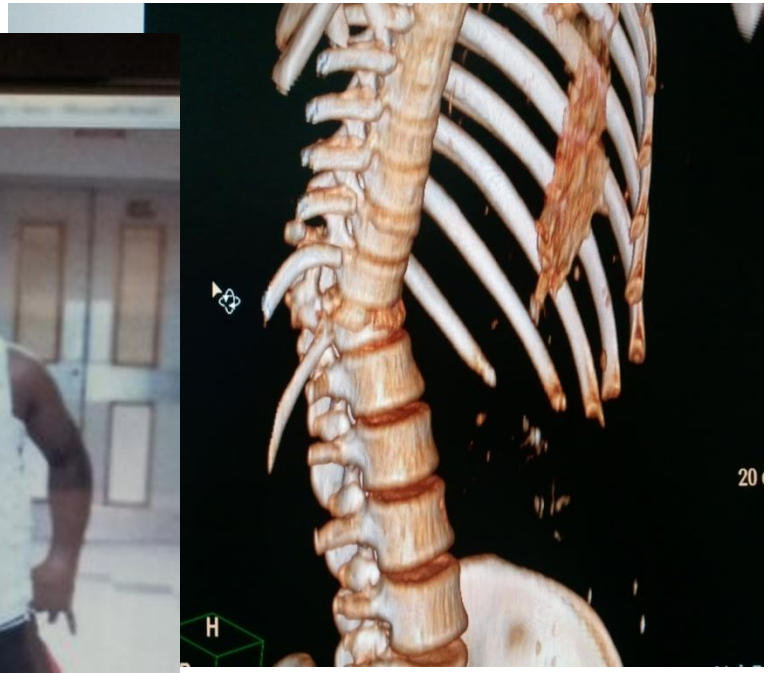




T12: A3; N3; M2
3+4+0=7





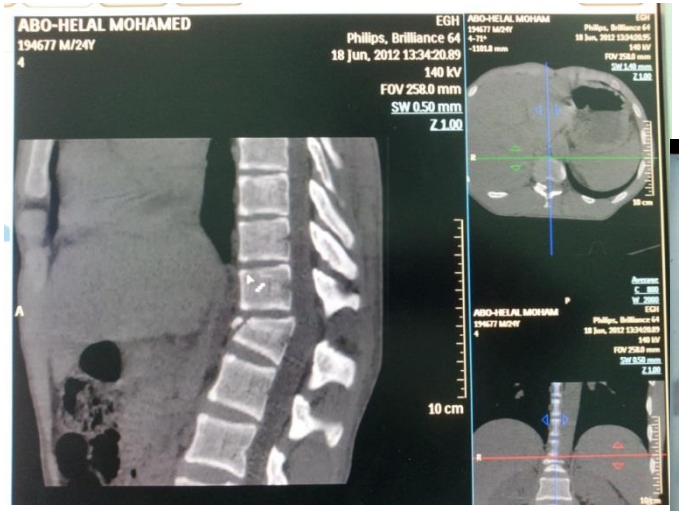






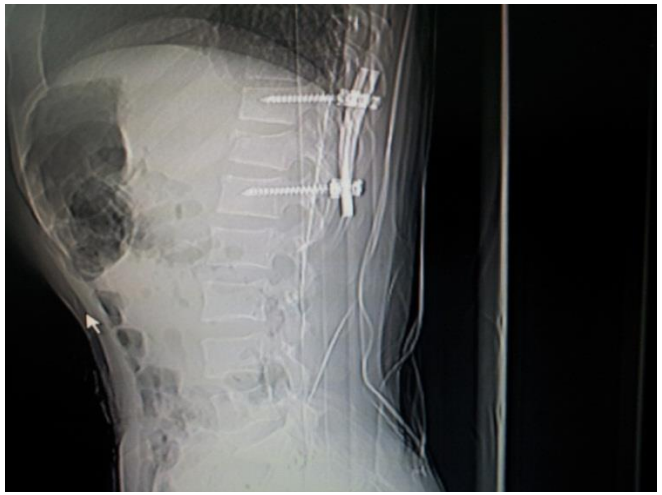
T11-T12: B2; N0; M2
6+0+0=6

Preoperative





Postoperative

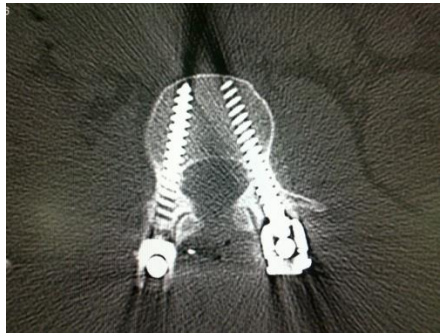


T12-L1: B2; N0; M2
6+0+0=6



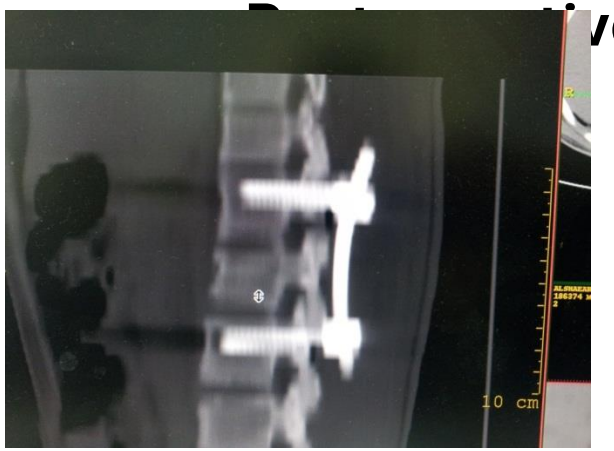






T12-L1: C; N0; M2
8+0+0=8







L1: A4; N3; M2
5+4+0=9

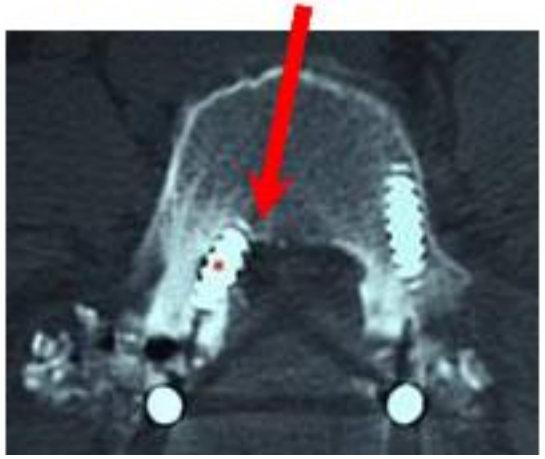




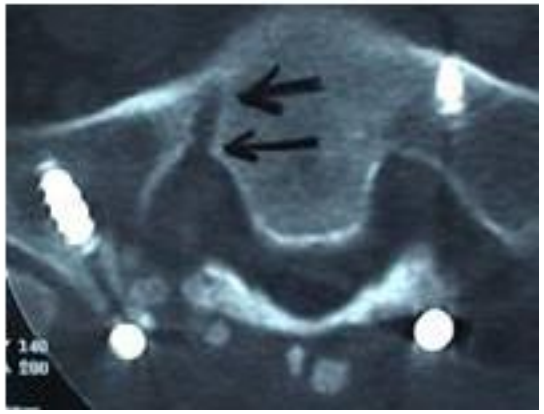


Misplaced Pedicle Screws

Misplaced Pedicle screw

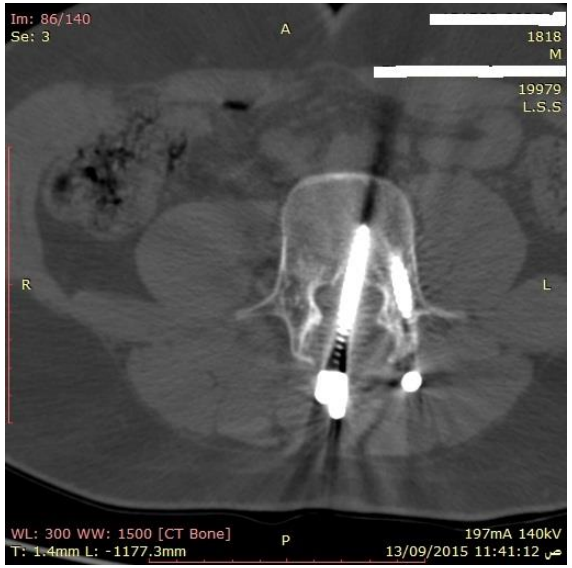


Revision





Misplaced Pedicle Screws







Posterior Approach
Pedicle Screws Fixation
Types of screws











Anterior Approach



Proper equipment is a must






Neurosurgery OR at EGH



- TPSF started at EGH in Sep. 2011
- More than 80 cases

Medtronic
SOFAMOR DANEK

CD HORIZON® LEGACY™ 5.5
Spinal System–Deformity Surgical Technique

Thanks



Any Questions?