Thoracolumbar Trauma Diagnosis and Treatment

Cristian Gragnaniello MD, PhD

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Disclosures

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Overview

1. When and Where
2. Classifications
3. Radiological evaluation
4. Clinical evaluation
5. Medications, BP and DVT management
6. Treatment Goals
7. Non operative
8. Timing of surgery
9. Operative
10. Cases

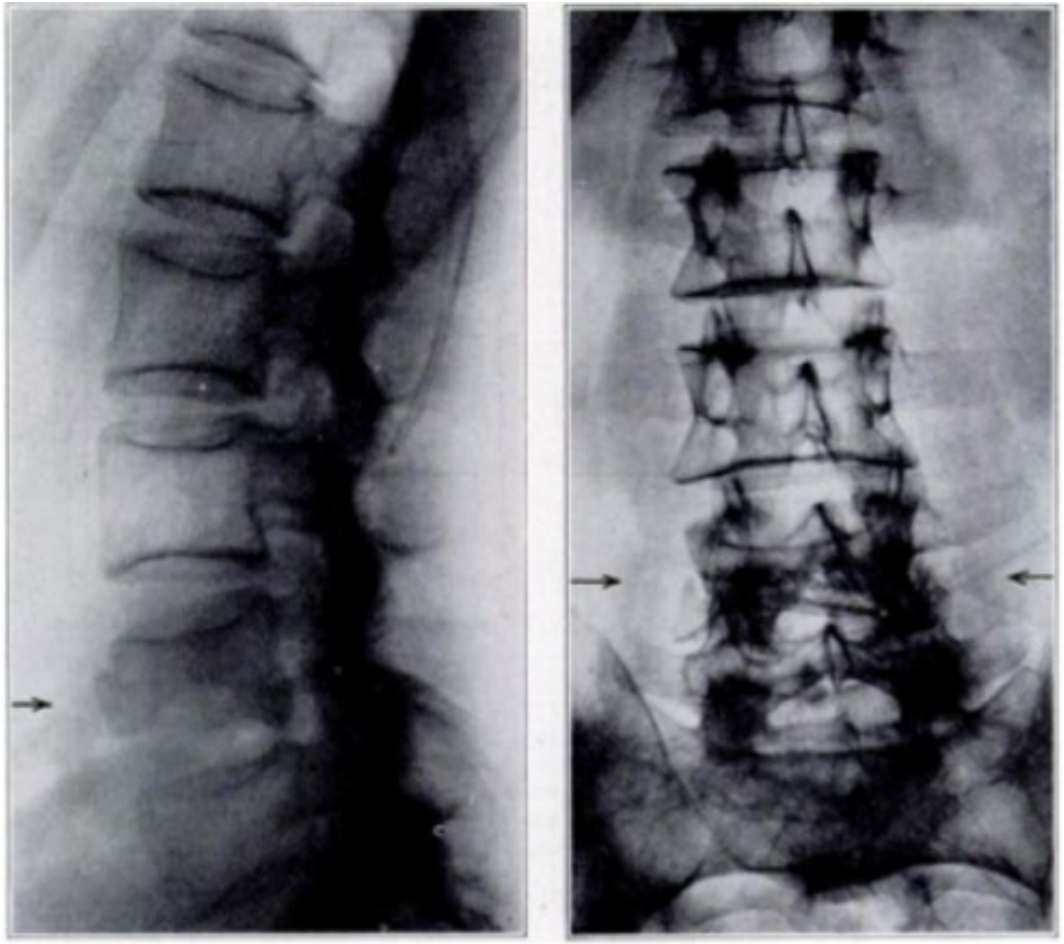

FIG. 2-A FIG. 2-B

Spontaneous fracture of the spine in senile osteoporosis.

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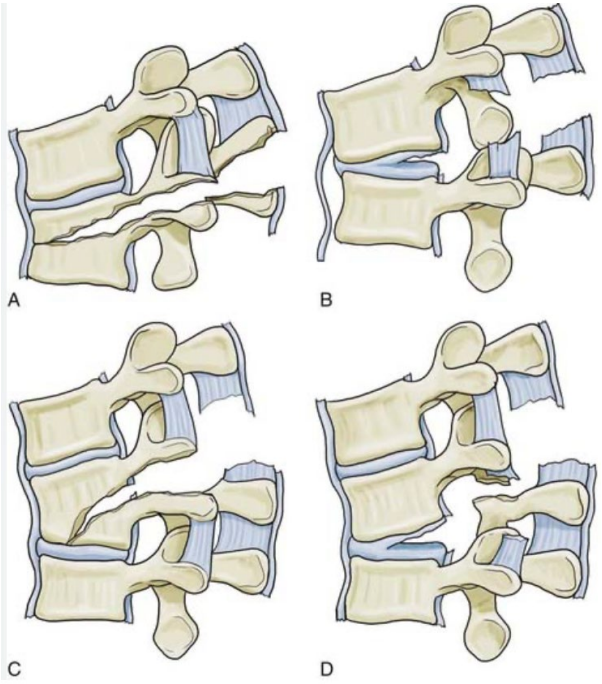
Prevalence

- 7% of all blunt trauma
- 50-90% of yearly 200,000 spinal fractures in the US
- 25% have SCI
- A great number has other visceral and bony injuries

- Rigid T1-T10 + junctional T10-L2 + flexible L3-L5



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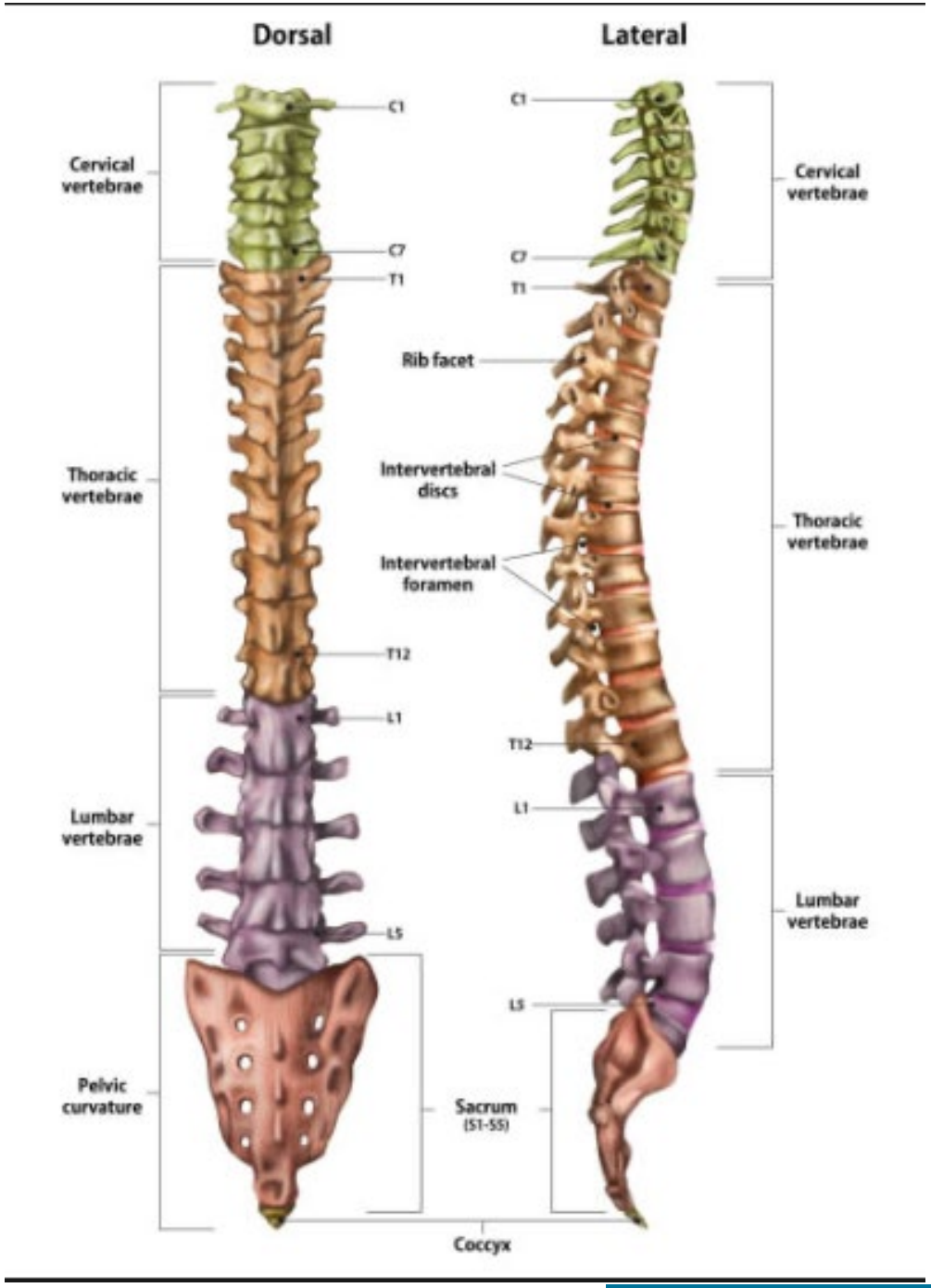
Thoracolumbar Spine - Basics

Three biomechanical regions

T1-T8:
- relatively rigid (ribcage)
- kyphosis
- flexion injury pattern predominates

T9-L2:
- transition: immobile – mobile
- transition: kyphosis – lordosis
- most injuries occur here

L3-sacrum:
- mobile, lordosis
- axial load Injuries predominate



Role of classifications

1. Improve communication amongst physicians
2. Assist in decision making
3. Expected outcomes

100 years of Classifications

- 1938 Sir Watson Jones
- Chance 1948
- 1949 Nicoll
- 1963 Holdsworth
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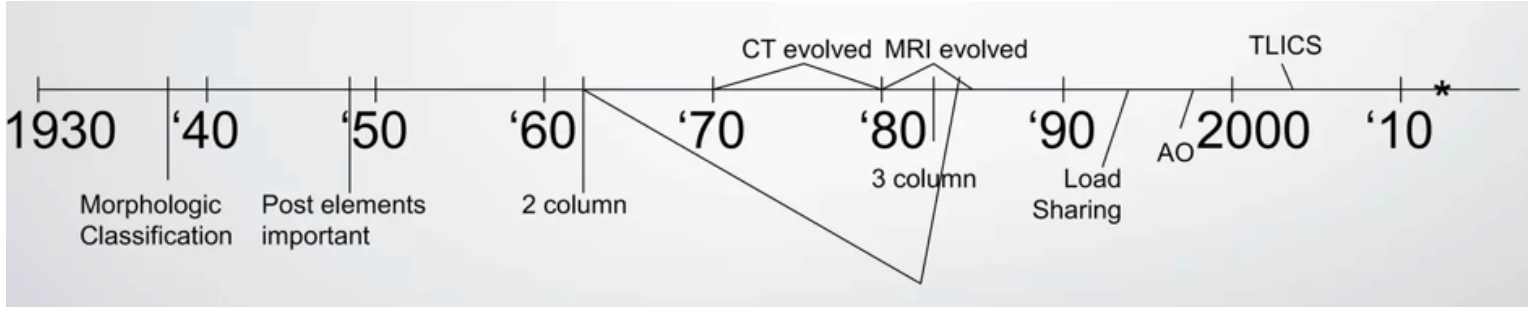

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Why so many?

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The perfect classification…

- Validity
- Reliability (intra- and inter observer)
- Accurate
- No Ambiguity
- Easy to use
- Morphology vs biomechanical injury Mechanism
- Neurological compromise

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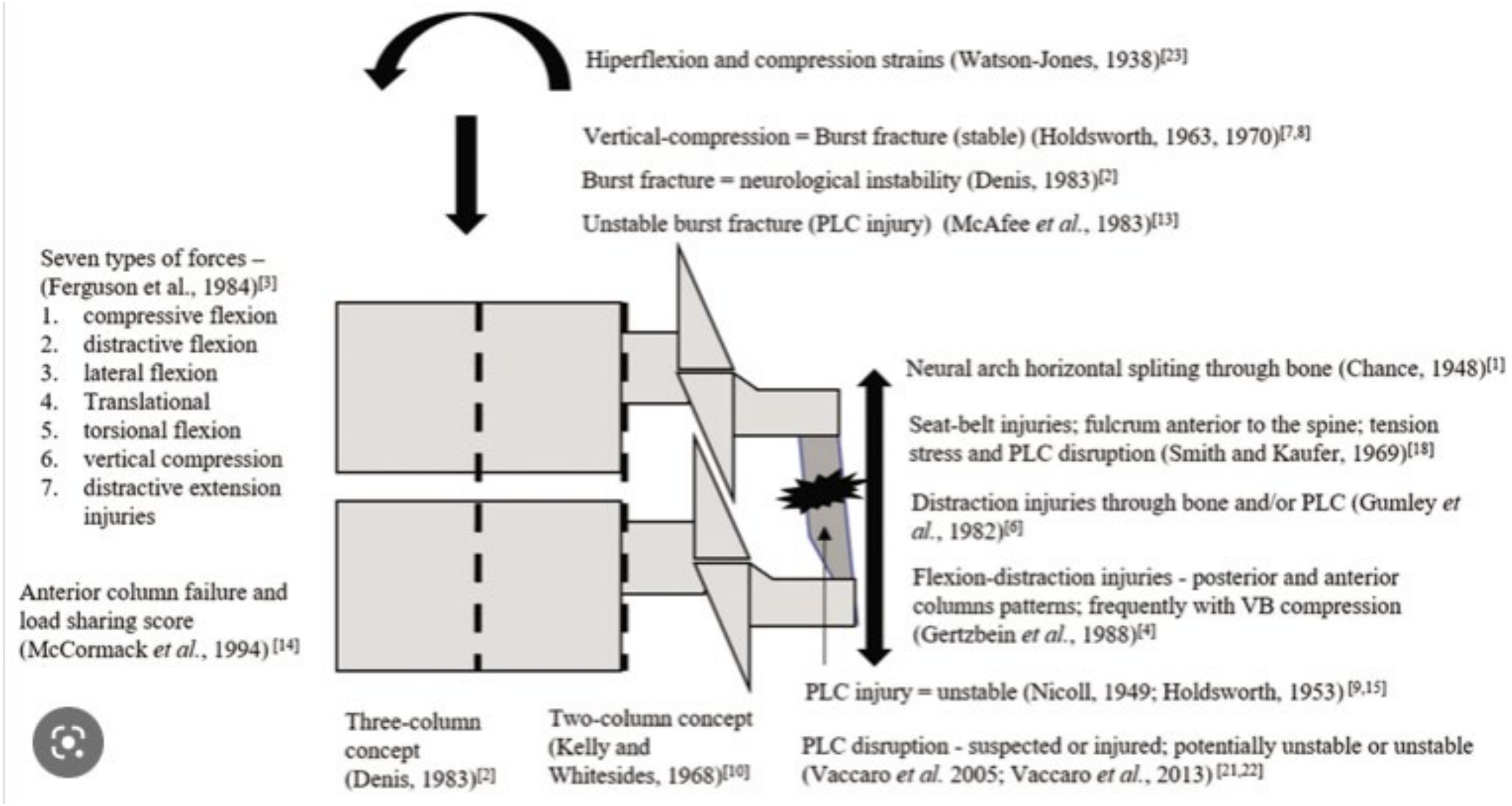

Review of best classification systems for diagnosing and treating thoracolumbar spine trauma

Alecio Cristino Evangelista Santos Barcelos[1], Franz Jooji Onishi[2], Andrei Fernandes Joaquim[3], Ricardo Vieira Botelho[4]

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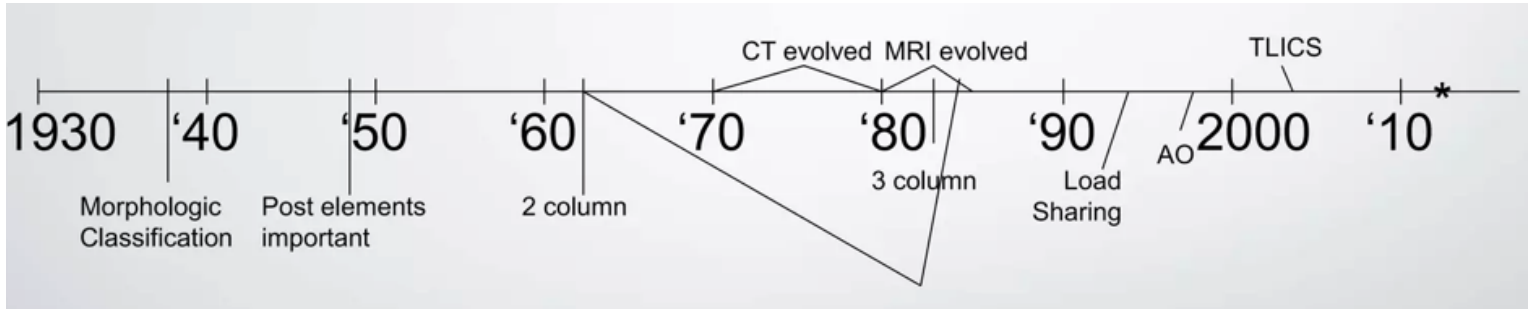

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Sir Watson-Jones

- 252 fractures
- 7 types based on XR morphology
- - simple wedge
- - comminuted fracture
- - fracture-dislocations
- Tx: hyperextension cast for all but dislocations for which there was open reduction followed by casting

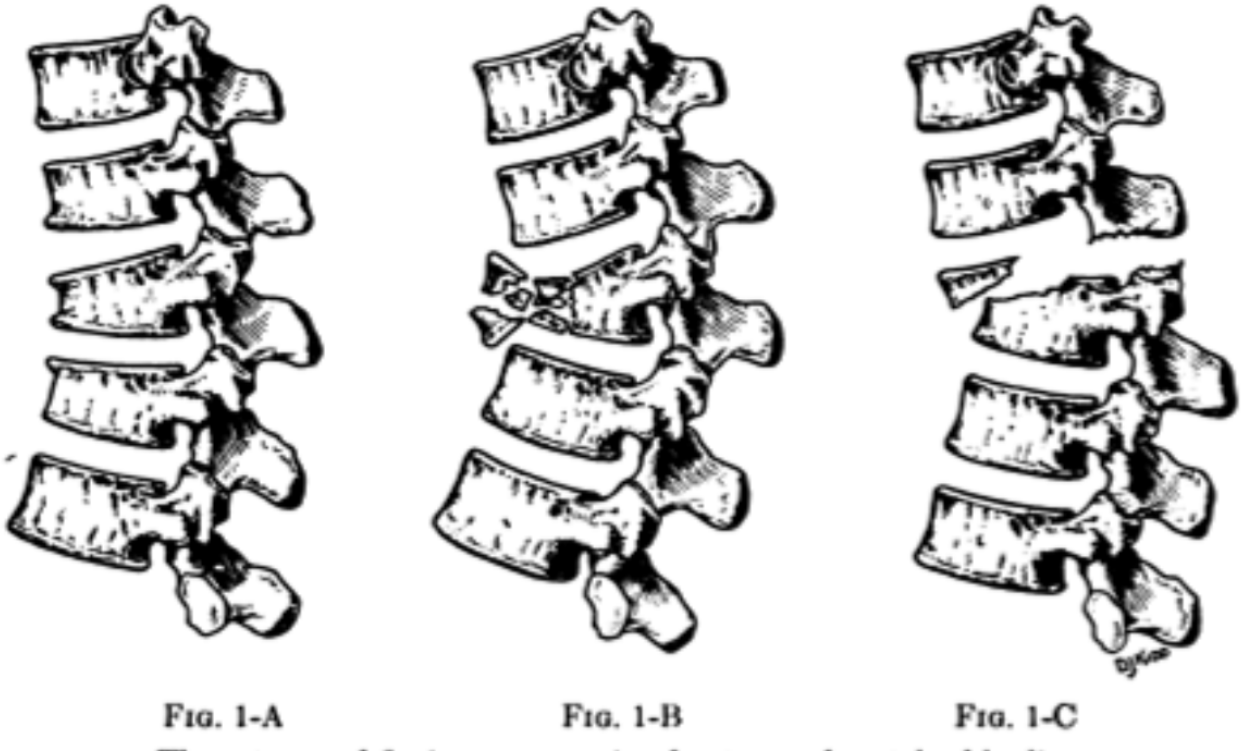

FIG. 1-A FIG. 1-B FIG. 1-C

Watson-Jones R. The results of postural reduction of fractures of the spine. J Bone Joint Surg Am 1938;20:567-58

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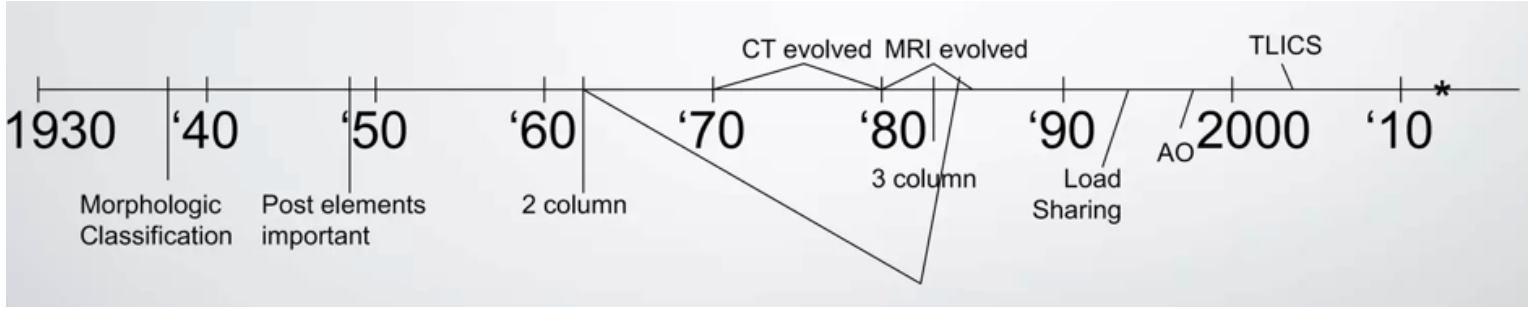

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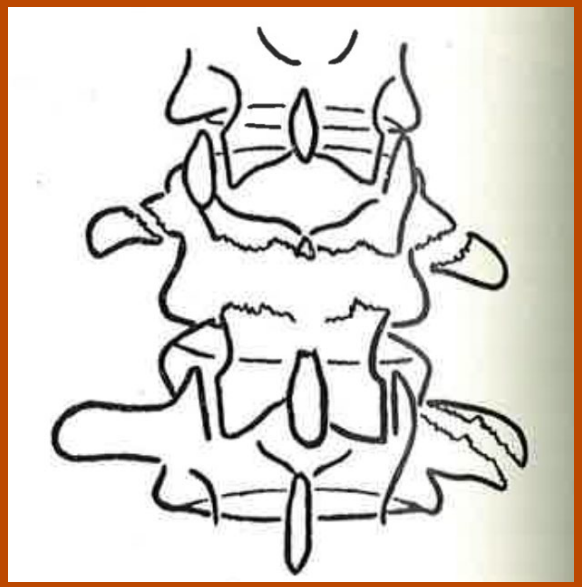
NOTE ON A TYPE OF FLEXION FRACTURE OF THE SPINE

By G. Q. Chance, M.B., B.Ch., B.A.O., D.M.R.E.

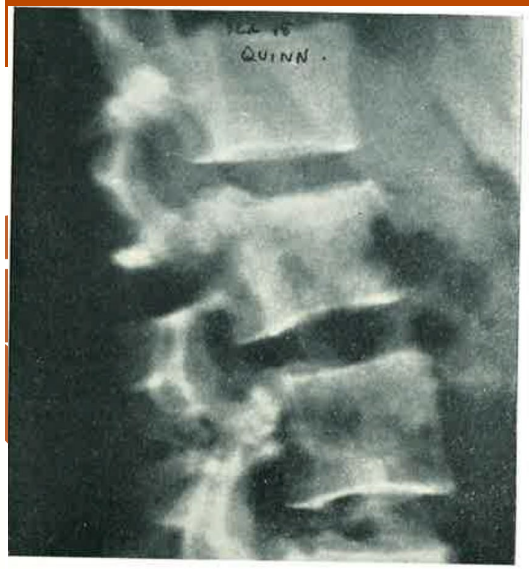
Derbyshire Royal Infirmary, Derby

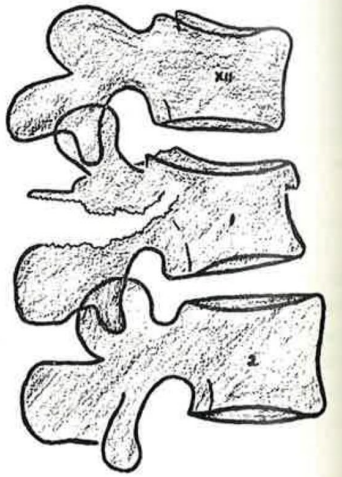


It consists of a horizontal splitting of the neural arch…

Note on a type of Flexion Fracture of the Spine

The fracture which I illustrate is a true flexion fracture, though of a rarer type. It consists of a horizontal splitting of the spine and neural arch, ending in an upward curve which usually reaches the upper surface of the body just in front of the neural foramen. In good radiographs its recognition is easy. In my three cases there has been very little wedging of the vertebral body, no dislocation of the apophyseal joints, nor has there been any cord damage. I cannot think of any anatomical explanation of the peculiar site and direction of the fracture. The importance of the recognition of this fracture lies in the fact that its treatment and prognosis are constant and clear. As there is no major ligamentous damage, the upper half of the fractured neural arch is firmly fixed to the normal arch of the vertebra above, and similarly the lower half is fixed to the vertebra below. The outline of these halves, in a horizontal plane, is therefore still undisturbed, so that a simple hyperextension of the spine must inevitably bring the two halves into perfect anatomical apposition, and give a near 100 per cent. prognosis.





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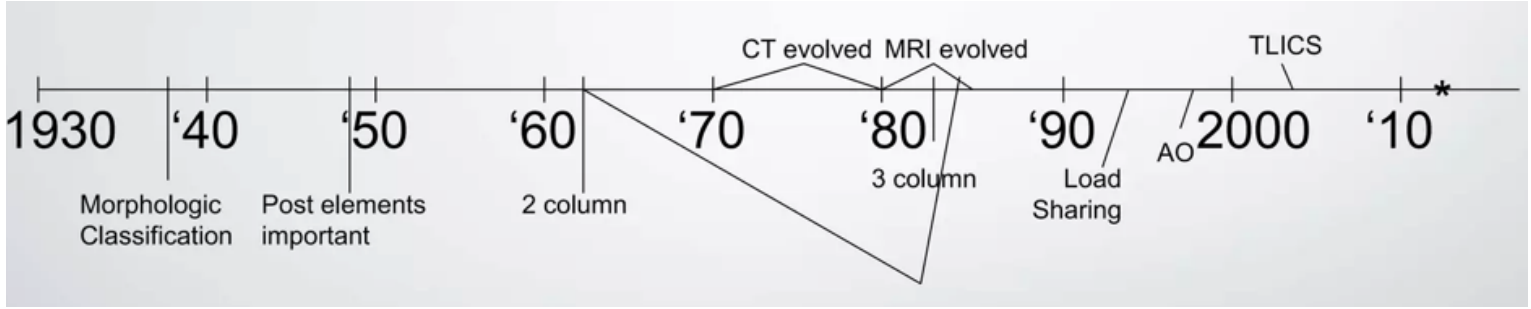

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FRACTURES OF THE DORSO-LUMBAR SPINE

E. A. NICOLL, MANSFIELD, ENGLAND

From the Orthopaedic and Accident Service of the Mansfield General Hospital

Same 3 categories as Sir Watson-Jones:

- Simple wedge
- Comminution
- Fracture-dislocation

-He added Dr. Chance's flexion injury from the year prior

TABLE II
TYPES OF FRACTURE

	Number of cases	Percentage
Anterior wedge fracture	88	58
Lateral wedge fracture	21	14
Fracture-dislocation	29	19
Isolated fractures of the neural arch	14	9
Total	152	100

FIG. 18
The owner of the spine whose radiographs are depicted in Fig. 19.

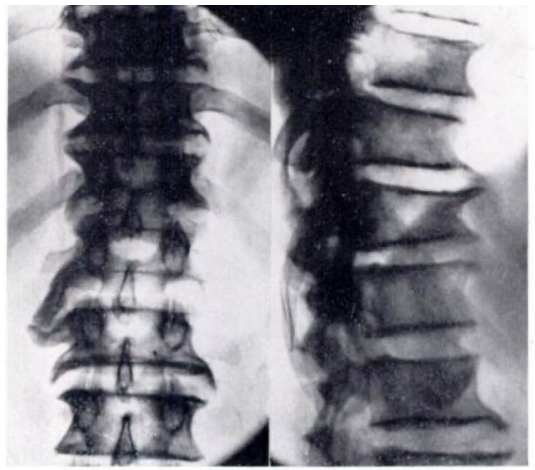

FIG. 19
Ability to touch the toes does not mean that the lumbo-dorsal spine is mobile.

LEVEL OF INJURY IN 166 FRACTURES OCCURRING IN 152 PATIENTS

Level of fracture	Number of cases	Percentage of total	
Dorsal 10 and above	7	4·2	
Dorsal 11	12	7·2	
Dorsal 12	34	20·5	66·4
Lumbar 1	49	29·6	
Lumbar 2	27	16·3	
Lumbar 3	17	10·2	
Lumbar 4	12	7·2	
Lumbar 5	8	4·8	
Total	166	100·0	

Number of cases with multiple fractures = 14 (9%)

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FRACTURES OF THE DORSO-LUMBAR SPINE

E. A. NICOLL, MANSFIELD, ENGLAND

From the Orthopaedic and Accident Service of the Mansfield General Hospital

- Really interested in outcomes
- His patients were mostly coal miners
- Perfect result was going back to mining full time
- He suggested that some fractures were unstable and there was a risk of increased deformity and possible cord injury with functional activity
- Stable fractures bedrest for 3-4 weeks
- Unstable fractures bedrest in plaster for 4 months

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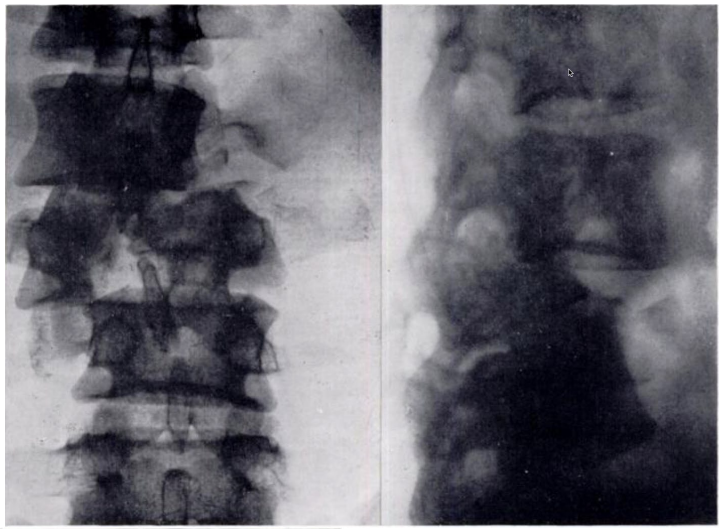

G. 22

re deformity and incomplete paraplegia. The spinal cord escaped complete section only by the gap would have been dangerous and overmight have ended in disaster.

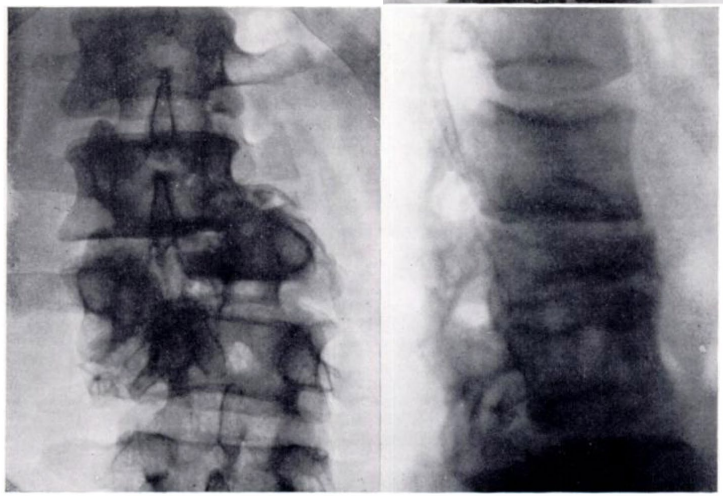

FIG. 23

Same case as shown in Fig. 22, three years later. Spontaneous fusion with marked deformity. The paraplegia recovered and the patient went on to achieve a perfect functional result. He is now working as an underground ripper.

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FRACTURES OF THE DORSO-LUMBAR SPINE

E. A. NICOLL, MANSFIELD, ENGLAND

From the Orthopaedic and Accident Service of the Mansfield General Hospital

- 152 patients
- 30% returned to full mining (50/152)
- 50% of those who returned to full mining had deformity (24/50)
- Good functional result did not require good alignment
- Early mobilization for stable, extended bedrest for unstable

can occur. In practice, spontaneous anterior fusion with deformity gives a better functional result than surgical fusion. Of ten fracture-dislocations treated on these lines, seven returned to full work at the coal-face; all had spontaneous anterior fusion with deformity and they represent the best results of any group in the present series. No patient whose fractured spine has been treated by surgical fusion has ever returned to coal-face work. The advantages of spontaneous anterior fusion are that it is both stronger and more localised. Posterior fusion is mechanically less sound because the graft is under tension instead of compression. Moreover, undamaged vertebrae are usually included in surgical fusion so that four instead of two become fixed.

FIG. 24

Fracture-dislocation of the lumbar spine with locked facets in which stabilisation was achieved spontaneously in the unreduced position. The patient gained a perfect functional result. This radiograph was taken five years after injury.

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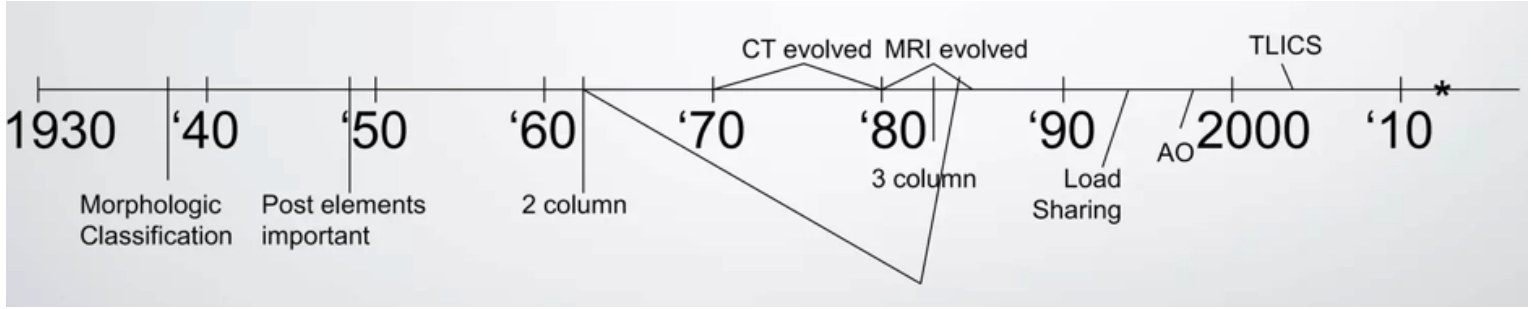

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DOI: 10.2106/00004623-197052080-00002 • Corpus ID: 19698902

Fractures, dislocations, and fracture-dislocations of the spine.

F. Holdsworth • Published 1 February 1963 • Medicine • The Journal of bone and joint surgery. American volume

Sir Frank Wild Holdsworth (1904-1969) was an English Orthopaedic Surgeon.

Eponymously affiliated with the Holdsworth fracture

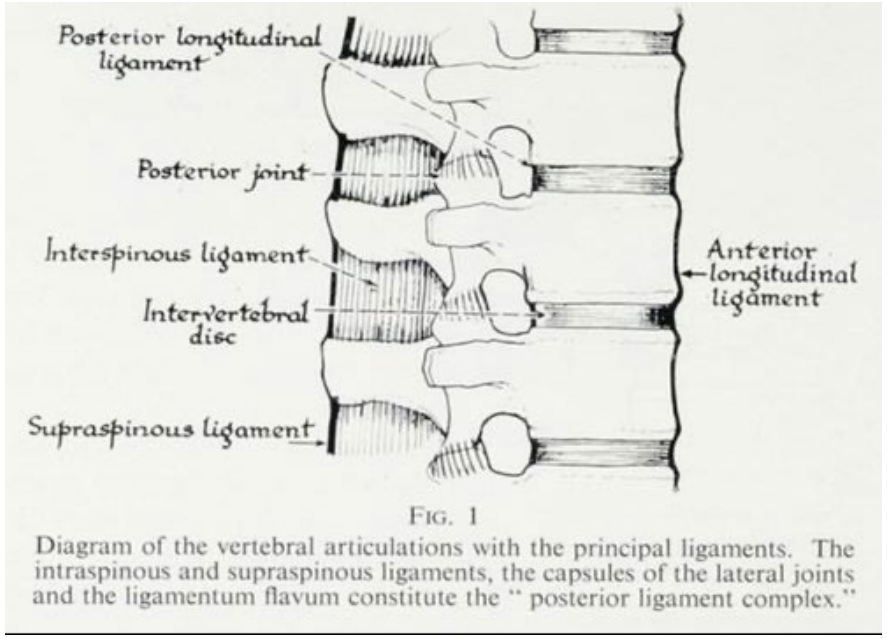


FIG. 1

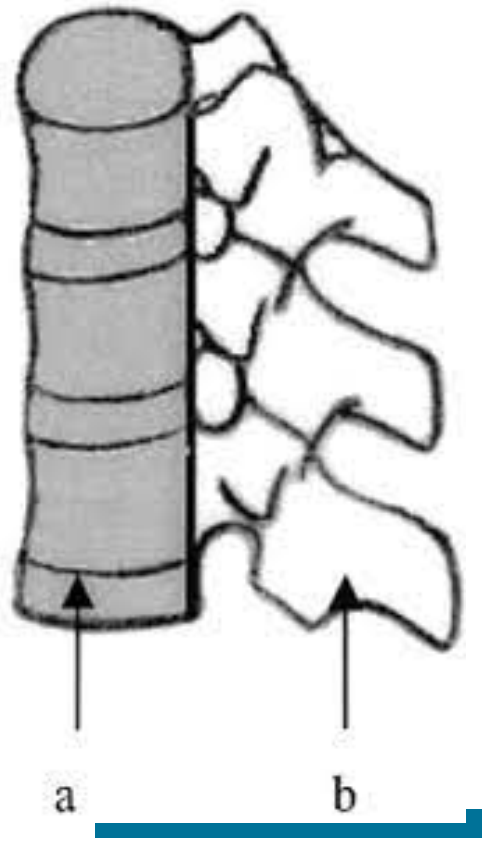
Diagram of the vertebral articulations with the principal ligaments. The intraspinous and supraspinous ligaments, the capsules of the lateral joints and the ligamentum flavum constitute the " posterior ligament complex."

- Separated spine into two columns: anterior weight bearing and posterior tension-bearing column

- Stressed the importance of posterior elements.

- If destabilized, consider surgery

- Patterns of neurological deficits and prognosis for recovery



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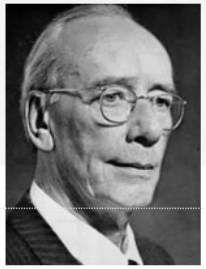
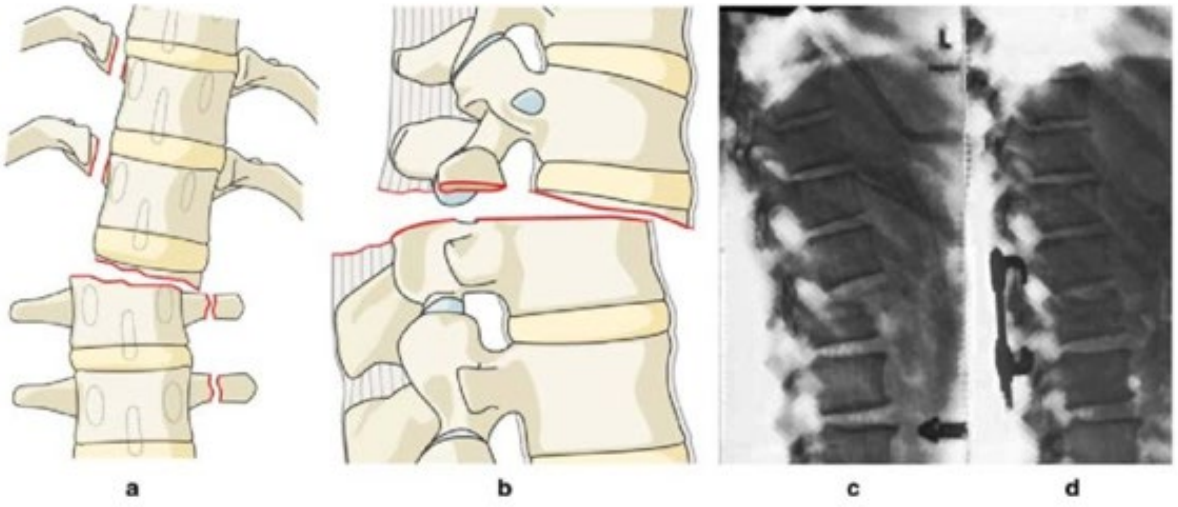


Medical Eponyms

Holdsworth fracture (1963)

Unstable fracture dislocation of the thoraco-lumbar junction of the spine

Slice fracture



1. Pure flexion which causes a wedge fracture which is stable.
2. Flexion-rotation which produces an unstable fracture-dislocation with rupture of the posterior ligament complex, separation of the spinous processes, a slice fracture near the upper border of the lower vertebra, and dislocation of the lower articular processes of the upper vertebra.
3. Extension which causes rupture of the intervertebral disc and the anterior common ligament along with avulsion of a small bone fragment from the anterior border of the dislocated vertebra. The dislocation almost always reduces spontaneously and is stable in flexion.
4. Vertebral compression which results in a fracture of the end plate as the nucleus of the intervertebral disc is forced into the vertebral body and causes it to burst with outward displacement of fragments of the body. Since the ligaments remain intact this comminuted fracture is stable.
5. Shearing which results in forward displacement of the whole vertebra and an unstable fracture of the articular processes or pedicles.

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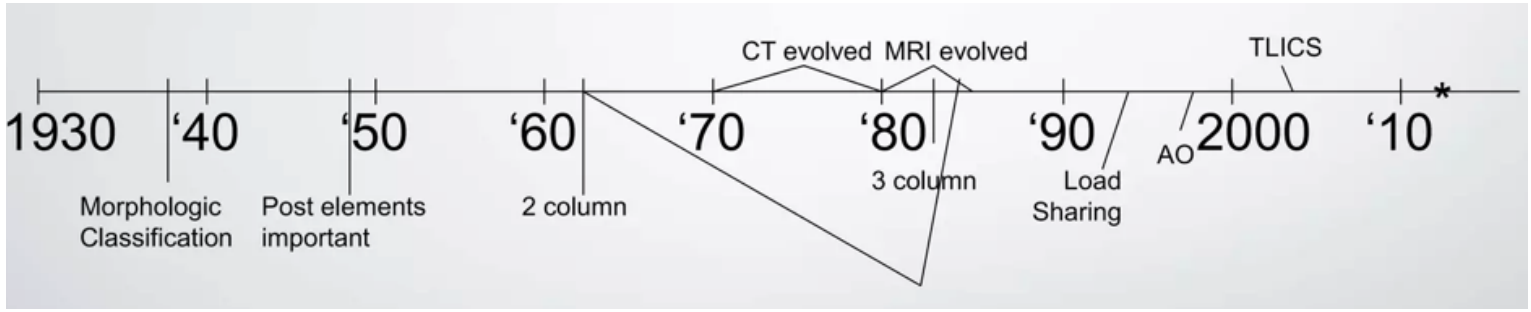

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Treatment of Lumbodorsal Fracture-Dislocations

ROBERT P. KELLY, M.D., THOMAS E. WHITESIDES, JR., M.D.

From the Joseph B. Whitehead Department of Surgery (Orthopedics), Emory University School of Medicine, Atlanta, Georgia

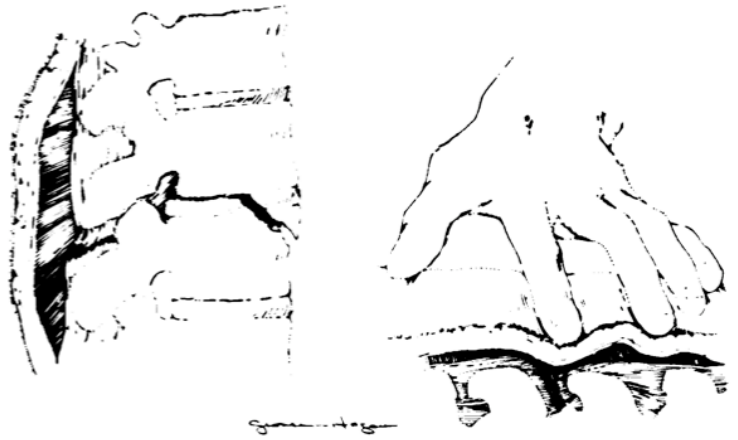

FIG. 4. A slice injury has produced the usual tear in the posterior spinous ligament along with hematoma overlying the injured area. The index finger of the palpating hand appreciates the resulting gap between the spinous processes at the affected level.

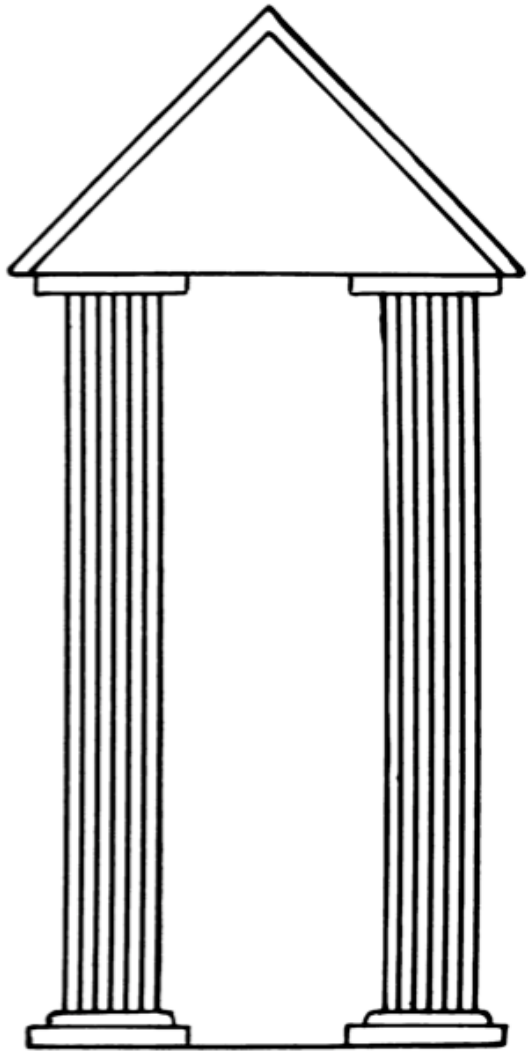

FIG. 1. Schematic representation of the two-column weight-bearing function of the spine: One column, e.g., on the right, represents the hollow column of the neural canal; that on the left, the solid column of the vertebral bodies.

- Only the junction
- No neurological damage unless posterior elements involved
- Two columns: Vertebral body and Canal
- Laminectomy makes injury worst by destabilizing further
- Stable (wedge and stable burst)
- Unstable (posterior element dislocation)
- If unstable operative approach of stabilization (posterior)
- If anterior column grossly unstable, reconstruct
- 11 cases

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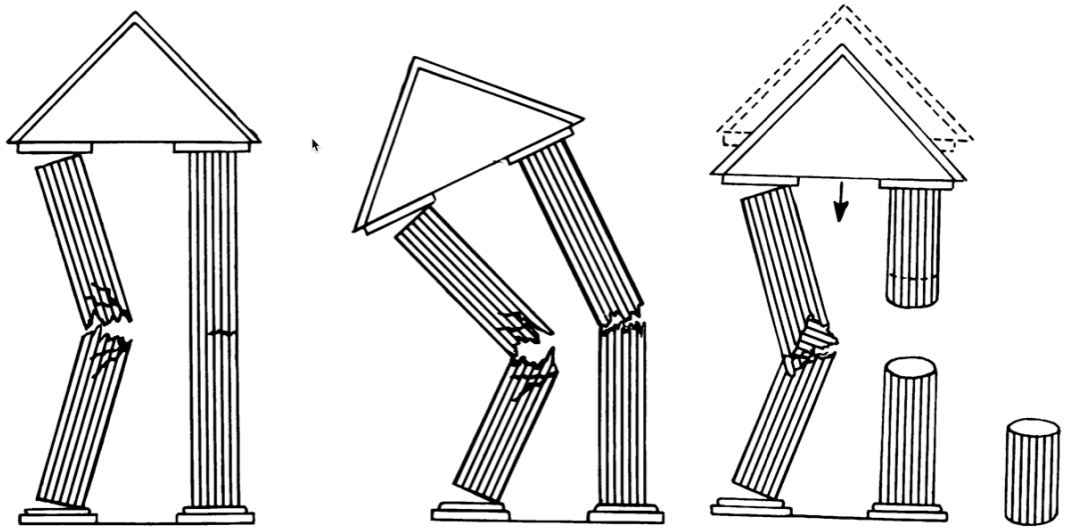

FIG. 20A. The two-column concept of the spine as a weight-bearing structure. With residual stability in the posterior column, anterior collapse is incomplete. B. Loss of posterior column permits pronounced anterior collapse. C. With laminectomy posteriorly and destruction by trauma anteriorly, no stability remains in the spine.

- Two columns: Vertebral body and Canal
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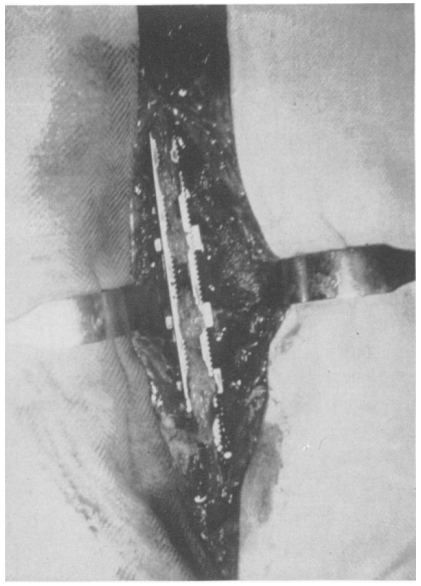

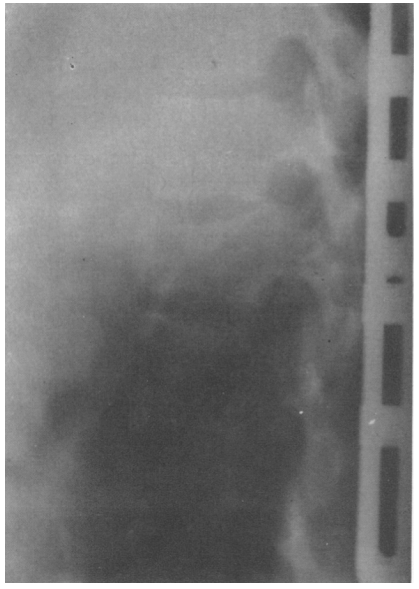

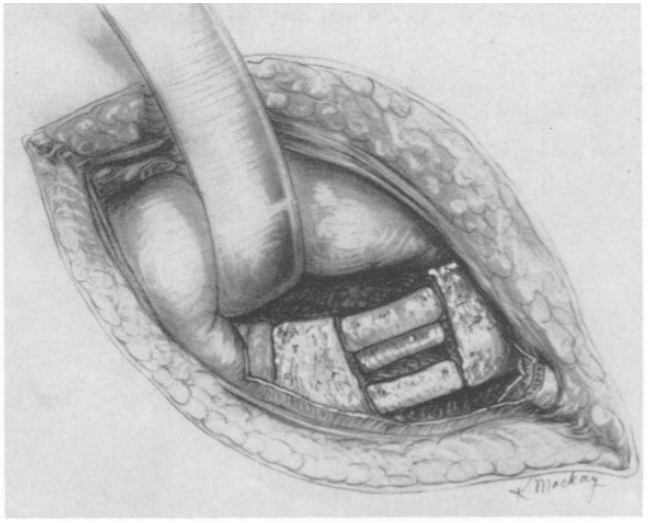

FIG. 15. Dimensions of the D_{12} body reconstructed by bone grafts.

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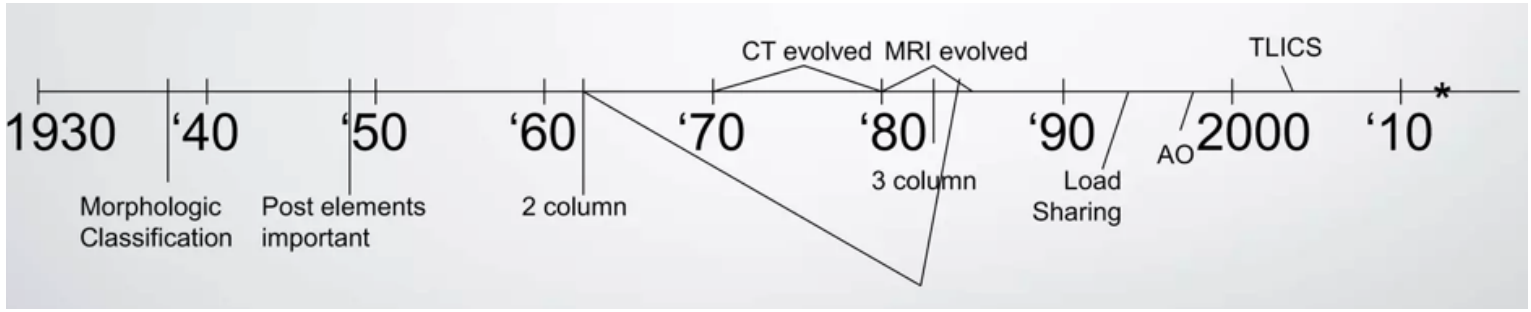

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The Three Column Spine and Its Significance in the Classification of Acute Thoracolumbar Spinal Injuries

FRANCIS DENIS, MD, FRCS(C)

Table 1. Basic Modes of Failure of the Three Columns in the Four Major Types of Spinal Injuries*

TYPE OF FRACTURE	COLUMN		
	Anterior	Middle	Posterior
Compression	Compression	None	None or distraction (severe)
Burst	Compression	Compression	None
Seat-belt type	None or compression	Distraction	Distraction
Fracture dislocation	Compression rotation shear	Distraction rotation shear	Distraction rotation shear

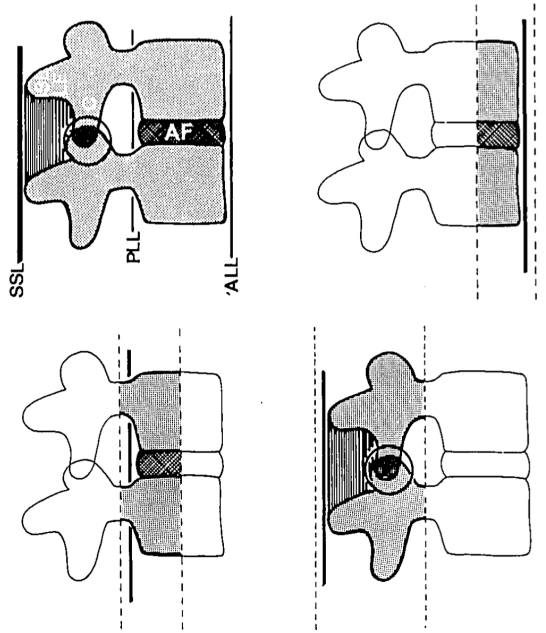
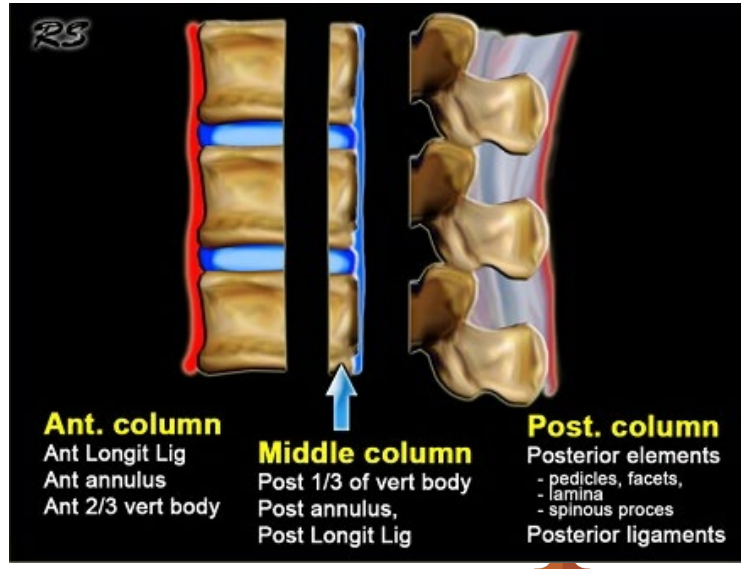


Fig 1. The anterior, middle, and posterior column are illustrated.



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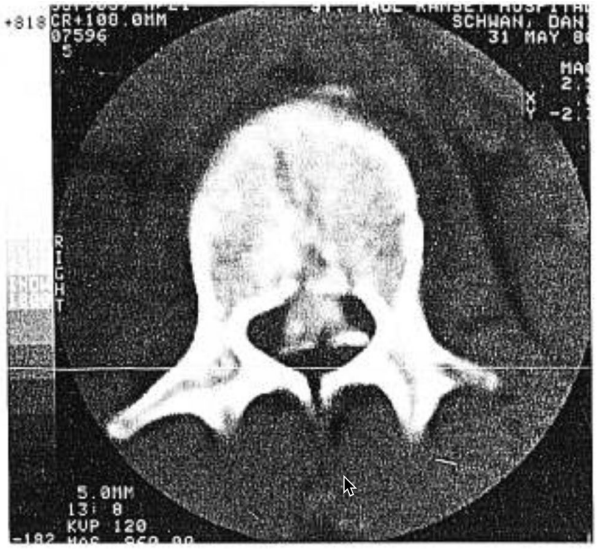

Fig 9. Computerized axial tomogram of a burst fracture. Note the large fragment of bone retropulsed from the posterior wall.

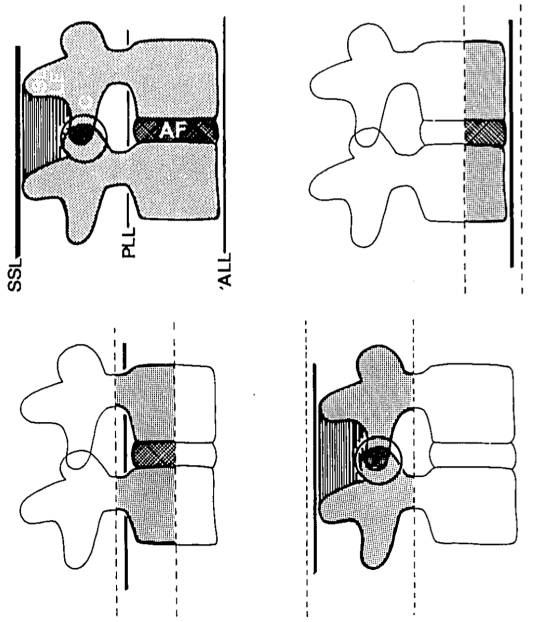

Fig 1. The anterior, middle, and posterior column are illustrated.

- He thought that posterior elements injury alone does not cause instability
- Disruption of middle column (PLL and annulus) make the fracture unstable
- Three degrees of instability: mechanical, neurological, both
- First to use CT to classify injuries
- Surgery is the treatment of choice for ALL burst fractures

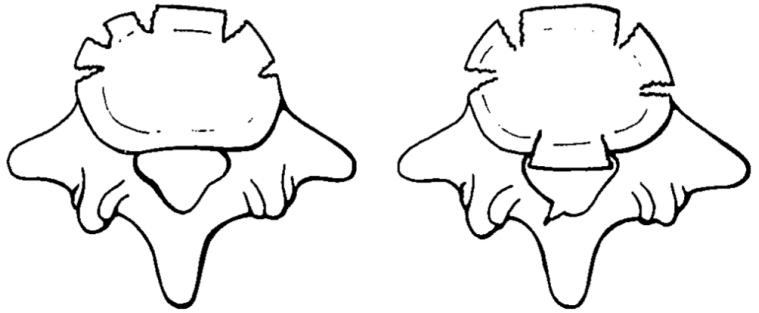

Fig 7. The basic difference between the compression and the burst fracture resides in the middle column. It is intact in the former and fractured in the latter. Note the fracture of the posterior wall as well as the fracture of necessity of the lamina (related to the increased interpediculate distance.)

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100 years of Classifications

- 1938 Sir Watson Jones
- Chance 1948
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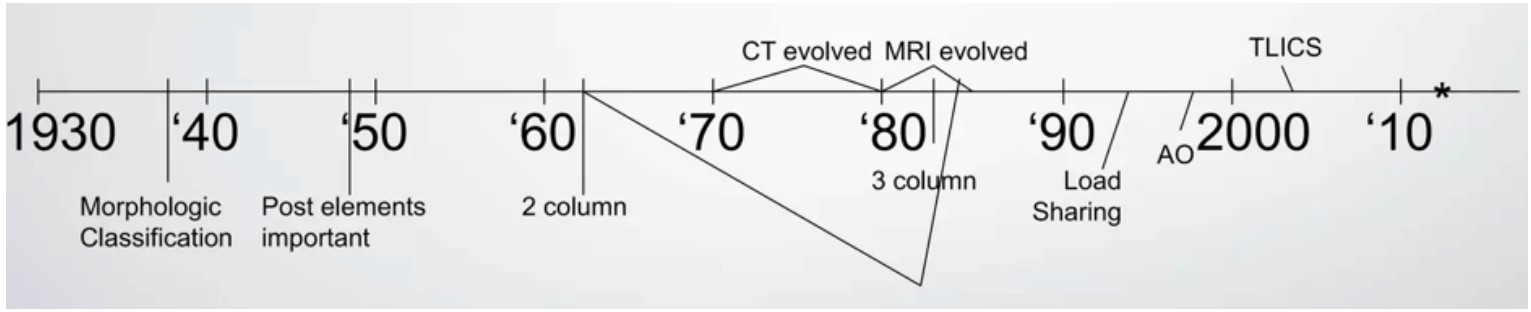

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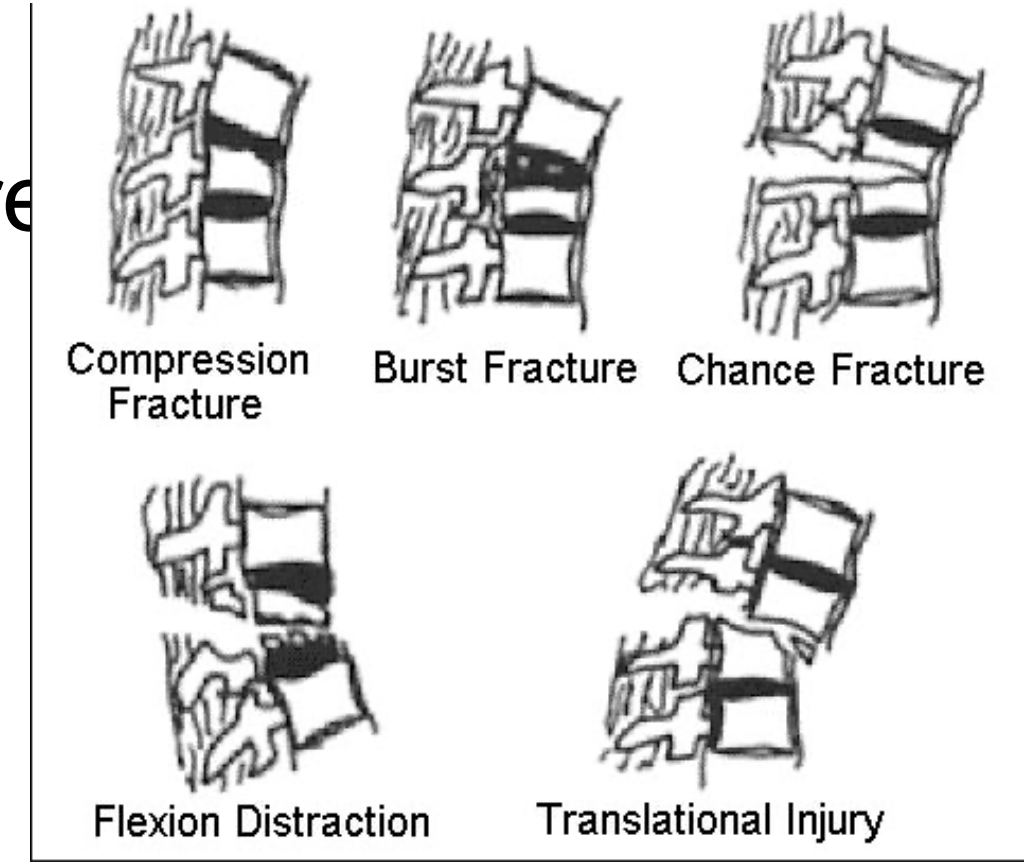
McCafee et al.

Six injury patterns:

- Wedge-compression fracture
- Stable burst
- Unstable burst
- Chance
- Flexion-distraction
- Translational



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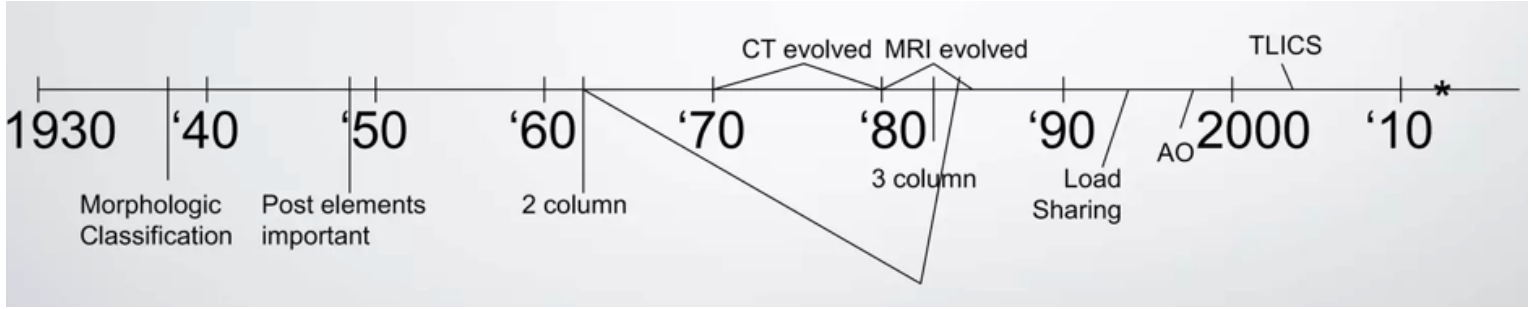

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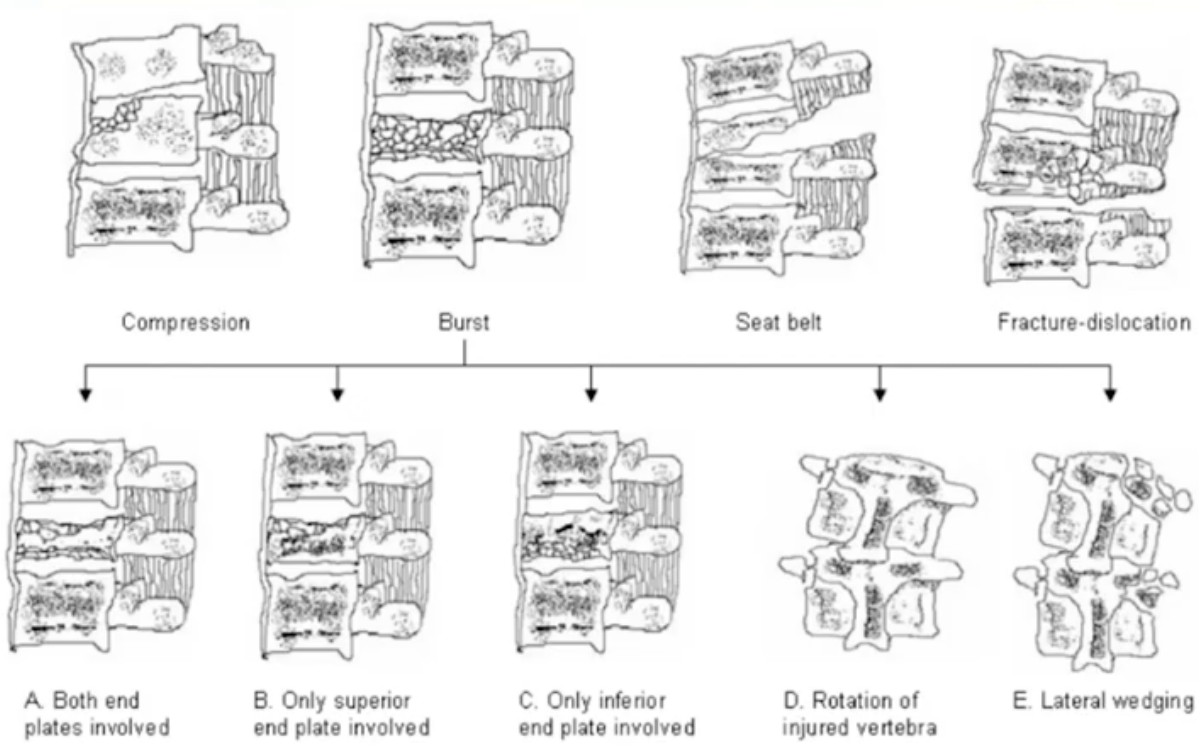
Ferguson and Allen

- **Ferguson and Allen Combines the work of Denis and McAfee and et al.**
- **Mechanistic classification to clarify pattern**
- **Most injuries are result of:**

  Compression

  Tension
- Torsion
- Translational forces



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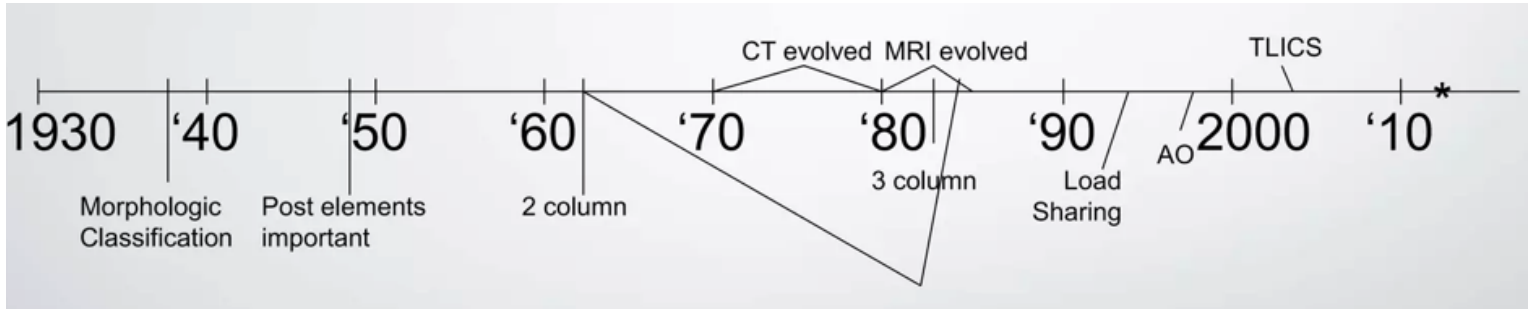

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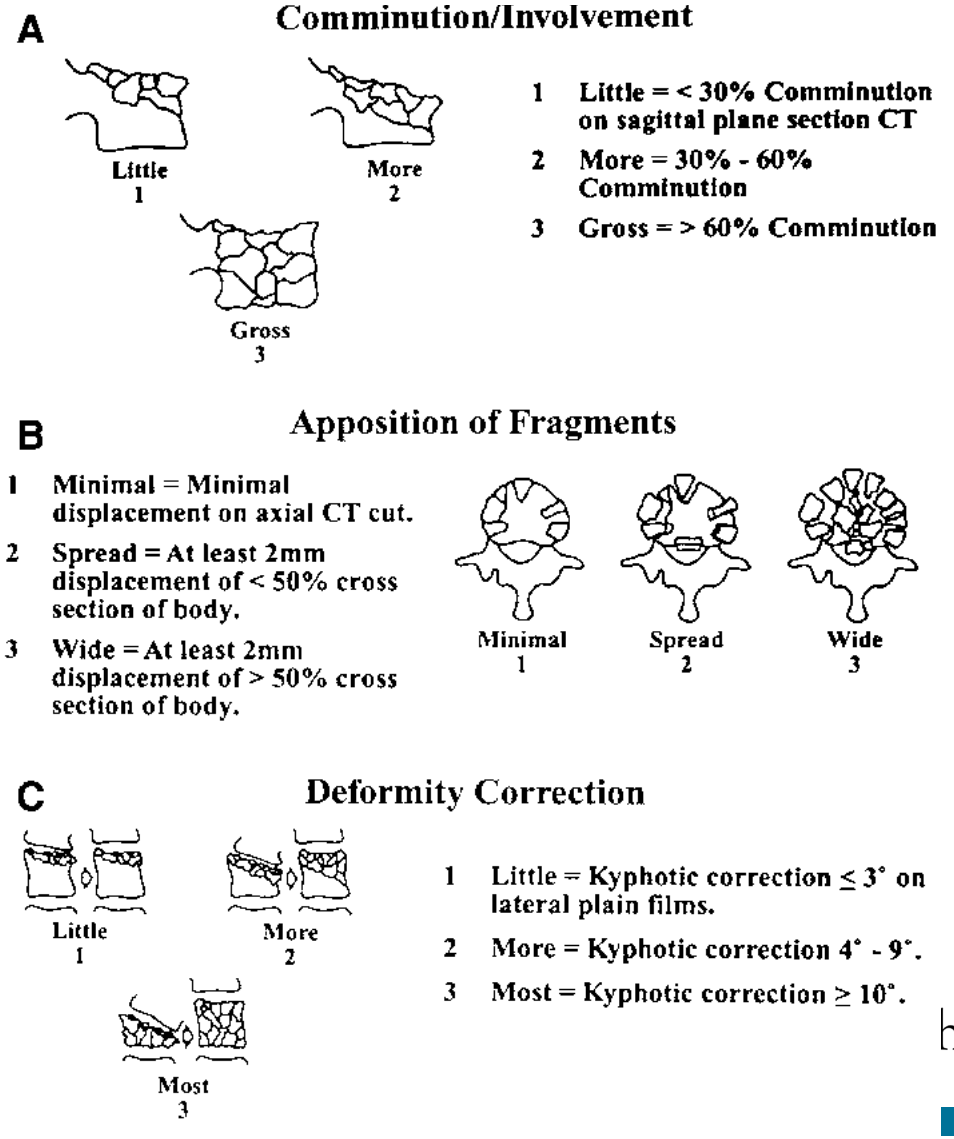
Load Sharing Classification

Devised method of predicting posterior failure

- 1-3 points assigned to the variables below
- Sum the points for a 3-9 scale
  - <6 points posterior
  - >6 points anterior



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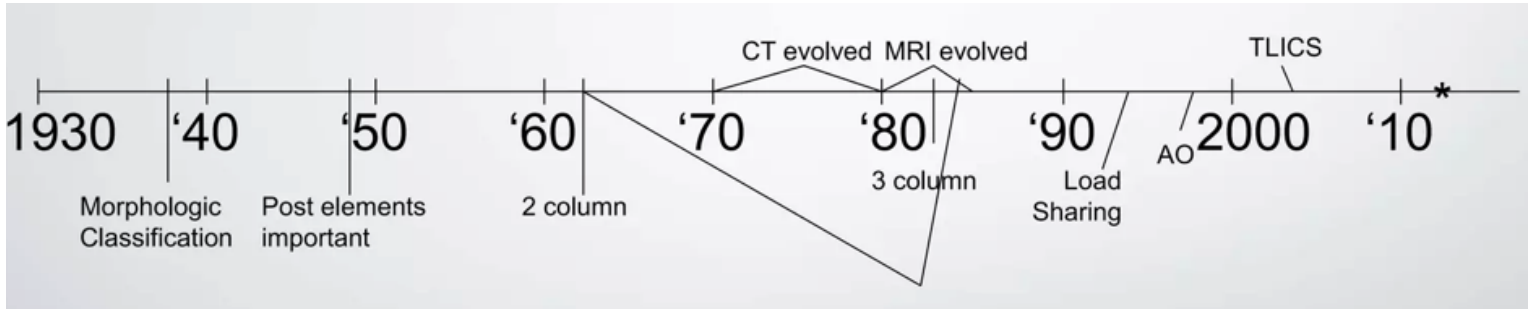

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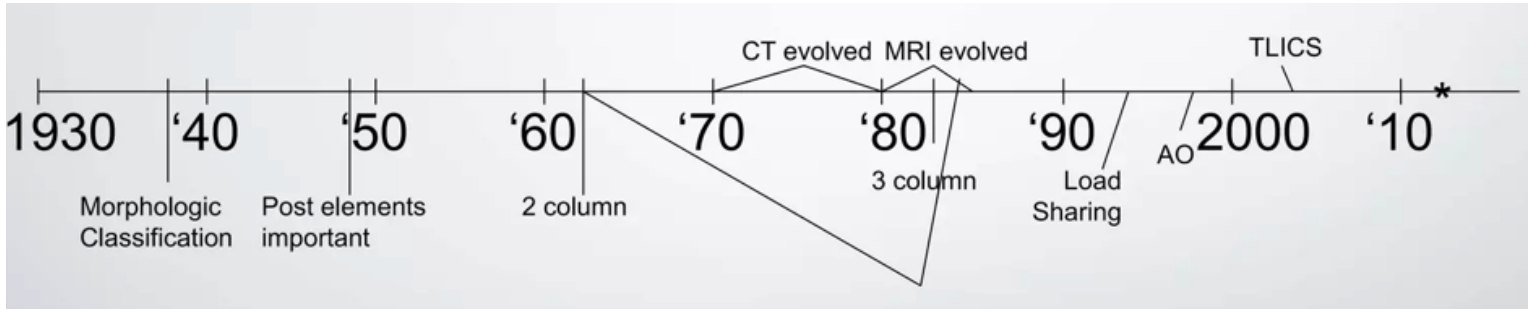

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Original articles

European Spine Journal

Eur Spine J (1994) 3 : 184–201

A comprehensive classification of thoracic and lumbar injuries

F. Magerl[1], M. Aebi[2], S. D. Gertzbein[3], J. Harms[4], and S. Nazarian[5]

[1] Klinik für Orthopädische Chirurgie, Kantonsspital, St. Gallen, Switzerland
[2] Division of Orthopaedic Surgery, McGill University, Montreal, Quebec, Canada
[3] Texas Back Institute, Crawford, Texas, USA
[4] Rehabilitationskrankenhaus, Karlsbad-Langensteinbach, Germany
[5] Hôspital de la Conception, Marseille, France

Type A. Vertebral body compression

A1. Impaction fractures
- A1.1. Endplate impaction
- A1.2. Wedge impaction fractures
  - 1 Superior wedge impaction fracture
  - 2 Lateral wedge impaction fracture
  - 3 Inferior wedge impaction fracture
- A1.3. Vertebral body collapse

A2. Split fractures
- A2.1. Sagittal split fracture
- A2.2. Coronal split fracture
- A2.3. Pincer fracture

A3. Burst fractures
- A3.1. Incomplete burst fracture
  - 1 Superior incomplete burst fracture
  - 2 Lateral incomplete burst fracture
  - 3 Inferior incomplete burst fracture
- A3.2. Burst-split fracture
  - 1 Superior burst-split fracture
  - 2 Lateral burst-split fracture
  - 3 Inferior burst-split fracture
- A3.3. Complete burst fracture
  - 1 Pincer burst fracture
  - 2 Complete flexion burst fracture
  - 3 Complete axial burst fracture

Table 2. Type B injuries: groups, subgroups, and specifications

Type B. Anterior and posterior element injury with distraction

B1. Posterior disruption predominantly ligamentous (flexion-distraction injury)
- B1.1. With transverse disruption of the disc
  - 1 Flexion-subluxation
  - 2 Anterior dislocation
  - 3 Flexion-subluxation/anterior dislocation with fracture of the articular processes
- B1.2. With type A fracture of the vertebral body
  - 1 Flexion-subluxation + type A fracture
  - 2 Anterior dislocation + type A fracture
  - 3 Flexion-subluxation/anterior dislocation with fracture of the articular processes + type A fracture

B2. Posterior disruption predominantly osseous (flexion-distraction injury)
- B2.1. Transverse bicolumn fracture
- B2.2. With transverse disruption of the disc
  - 1 Disruption through the pedicle and disc
  - 2 Disruption through the pars interarticularis and disc (flexion-spondylolysis)
- B2.3. With type A fracture of the vertebral body
  - 1 Fracture through the pedicle + type A fracture
  - 2 Fracture through the pars interarticularis (flexion-spondylolysis) + type A fracture

B3. Anterior disruption through the disc (hyperextension-shear injury)
- B3.1. Hyperextension-subluxations
  - 1 Without injury of the posterior column
  - 2 With injury of the posterior column
- B3.2. Hyperextenion-spondylolysis
- B3.3. Posterior dislocation

Table 3. Type C injuries: groups, subgroups, and specifications

Type C. Anterior and posterior element injury with rotation

C1. Type A injuries with rotation (compression injuries with rotation)
- C1.1. Rotational wedge fracture
- C1.2. Rotational split fractures
  - 1 Rotational sagittal split fracture
  - 2 Rotational coronal split fracture
  - 3 Rotational pincer fracture
  - 4 Vertebral body separation
- C1.3. Rotational burst fractures
  - 1 Incomplete rotational burst fracture
  - 2 Rotational burst-split fracture
  - 3 Complete rotational burst fracture

C2. Type B injuries with rotation
- C2.1 – B1 injuries with rotation (flexion-distraction injuries with rotation)
  - 1 Rotational flexion subluxation
  - 2 Rotational flexion subluxation with unilateral articular process fracture
  - 3 Unilateral dislocation
  - 4 Rotational anterior dislocation without/with fracture of articular processes
  - 5 Rotational flexion subluxation without/with unilateral articular process fracture + type A fracture
  - 6 Unilateral dislocation + type A fracture
  - 7 Rotational anterior dislocation without/with fracture of articular processes + type A fracture
- C2.2 – B2 injuries with rotation (flexion distraction injuries with rotation)
  - 1 Rotational transverse bicolumn fracture
  - 2 Unilateral flexion spondylolysis with disruption of the disc
  - 3 Unilateral flexion spondylolysis + type A fracture
- C2.3 – B3 injuries with rotation (hyperextension-shear injuries with rotation)
  - 1 Rotational hyperextension-subluxation without/with fracture of posterior vertebral elements
  - 2 Unilateral hyperextension-spondylolysis
  - 3 Posterior dislocation with rotation

C3. Rotational-shear injuries
- C3.1 Slice fracture
- C3.2. Oblique fracture

53 types

- Last in the descriptive era
- Highly detailed
- Based on 1445 cases
- Based on 2 column concept
- Compression
- Distraction
- Axial torque
- Intrarater
- Interrater
- no data on stability
- No treatment decision

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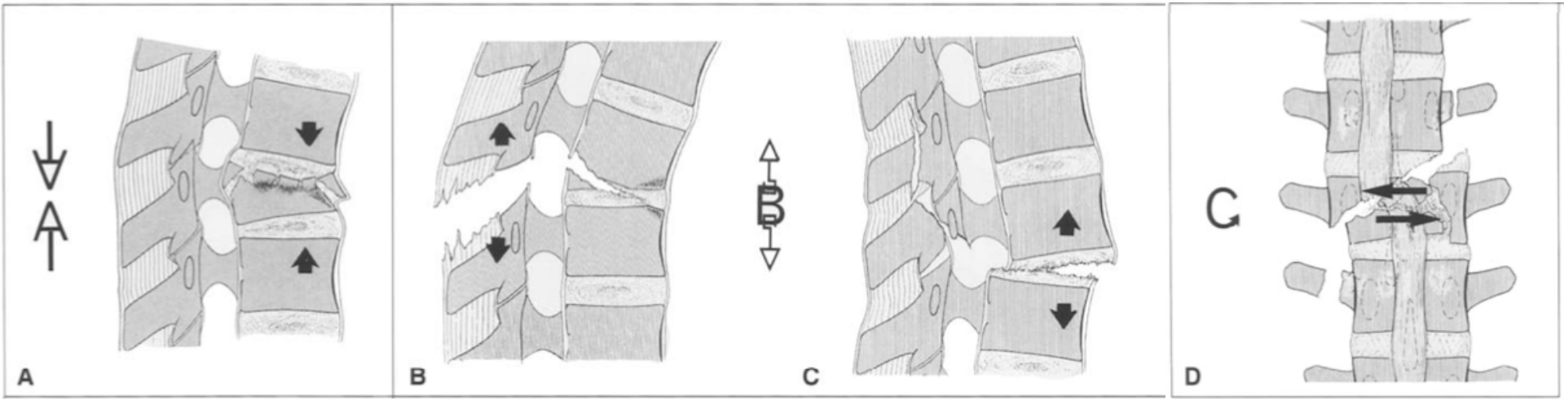

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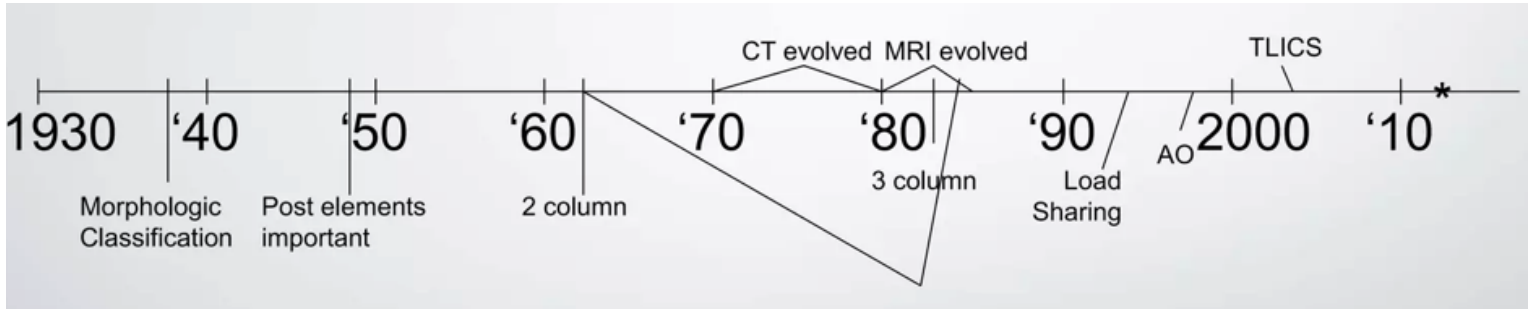

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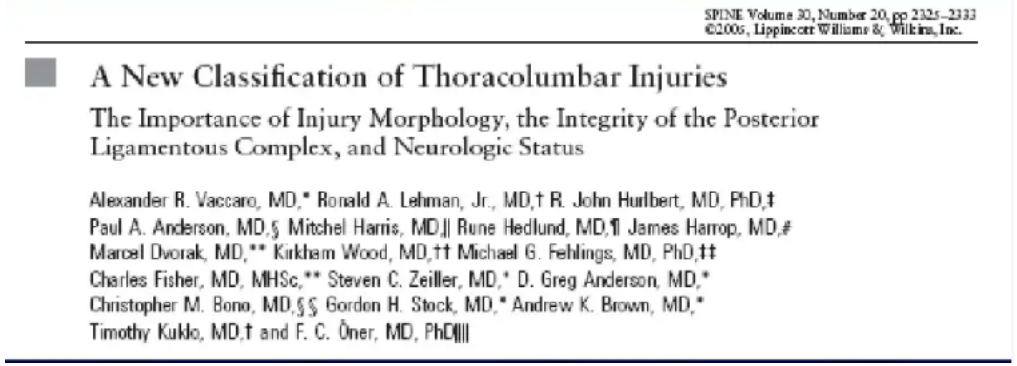

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A New Classification of Thoracolumbar Injuries

The Importance of Injury Morphology, the Integrity of the Posterior Ligamentous Complex, and Neurologic Status

Alexander R. Vaccaro, MD,* Ronald A. Lehman, Jr., MD,† R. John Hurlbert, MD, PhD,‡
Paul A. Anderson, MD,§ Mitchel Harris, MD,‖ Rune Hedlund, MD,¶ James Harrop, MD,#
Marcel Dvorak, MD,** Kirkham Wood, MD,†† Michael G. Fehlings, MD, PhD,‡‡
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Christopher M. Bono, MD,§§ Gordon H. Stock, MD,* Andrew K. Brown, MD,*
Timothy Kuklo, MD,† and F. C. Öner, MD, PhD¶‖

- 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.

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

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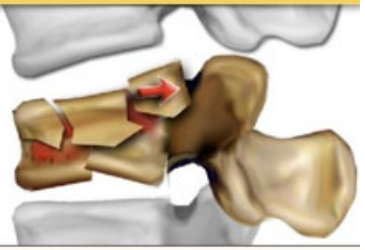
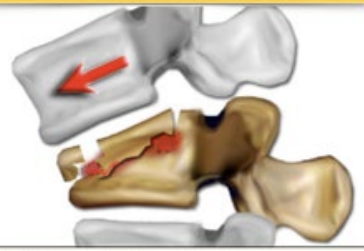
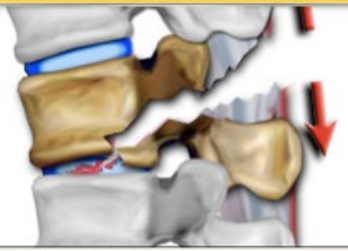
Morphology not mechanism

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 3 independent predictors				
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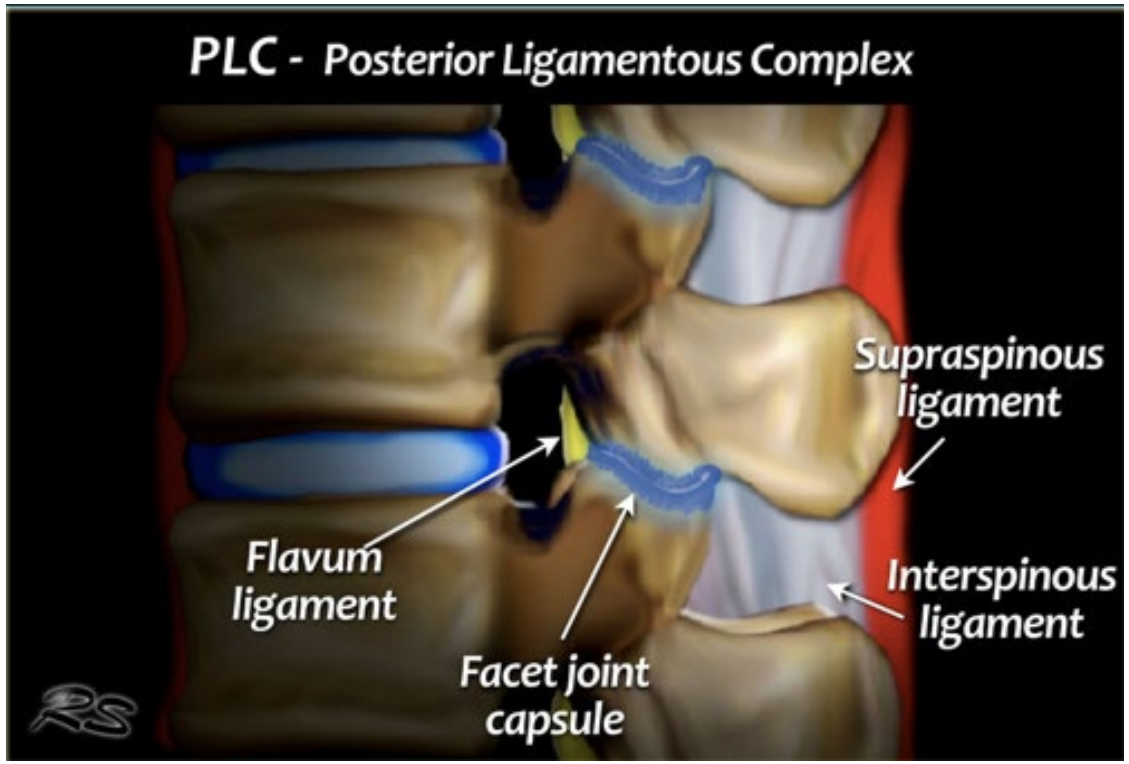
2	**Integrity of PLC** longterm stability	- Intact - Suspected - Injured	0 2 3	- MRI



CT features of PLC pathology are:

- Widening of the interspinous space.
- Avulsion fractures or transverse fractures of spinous processes or articular facets.
- Widening or dislocation of facet joints.
- Vertebral body translation or rotation.

When the PLC is definitely injured on CT, it can already be scored as 3.

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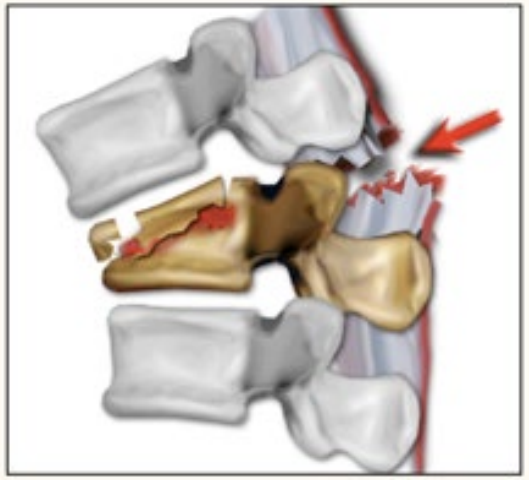
2	**Integrity of PLC** longterm stability	- Intact - Suspected - Injured	0 2 3	- MRI

If no dislocations or disruption on CT

Integrity of Posterior Ligamentous Complex

- Intact 0 pnt
- Suspected injury 2 pnts
- Injured 3 pnts



3 points

Loss of normal low signal intensity of the ligamenta flava or supraspinous ligaments on T1 and T2.

Indeterminate: 2 points

Edema without clear rupture; high signal intensity of the interspinous ligaments or along the facet joints on T2 STIR.

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- Better interobserver reliability AO
- First to inform about patient care
- Practical
- Comprehensive
- Drawback is the feasibility of MRI for PLC
- Generalized recommendations

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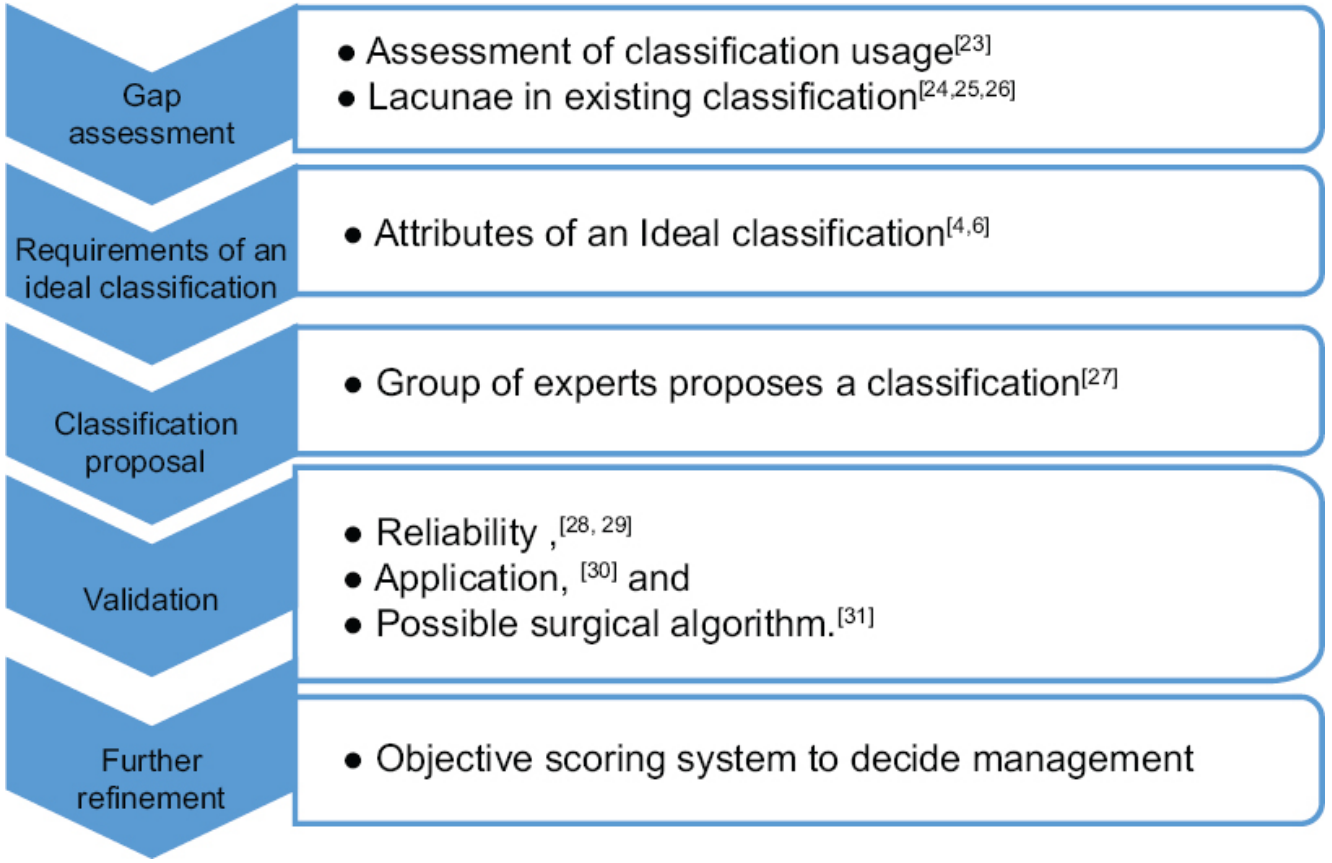

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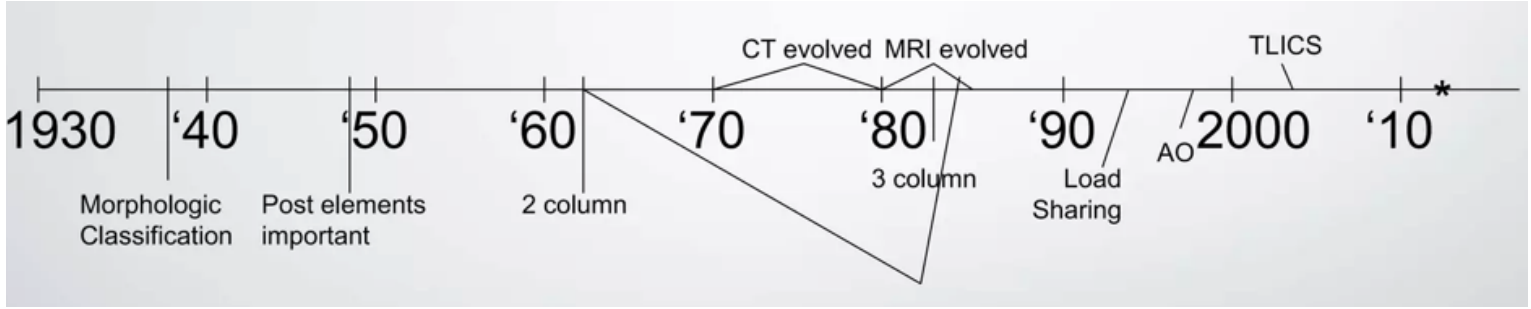

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Spine
SPINE Volume 38, Number 23, pp 2028-2037

DIAGNOSTICS

AOSpine Thoracolumbar Spine Injury Classification System

Fracture Description, Neurological Status, and Key Modifiers

Alexander R. Vaccaro, MD, PhD,* Cumhur Oner, MD, PhD,† Christopher K. Kepler, MD, MBA,*
Marcel Dvorak, MD,‡ Klaus Schnake, MD,§ Carlo Bellabarba, MD,¶ Max Reinhold, MD,‖
Bizhan Aarabi, MD,** Frank Kandziora, MD, PhD,§ Jens Chapman, MD,††
Rajasekaran Shanmuganathan, MD, PhD,‡‡ Michael Fehlings, MD, PhD,§§ Luiz Vialle, MD, PhD,¶¶ and for
the AOSpine Spinal Cord Injury & Trauma Knowledge Forum

- AO Spine Trauma Knowledge Forum
- Improve upon AO/Magerl and TLICS
- Based on 3 parameters: fracture morphology, Neurological status and clinical modifiers
- Morphology simplified Magerl scheme
- Multilevel classified by individual spinal level (i.e. L1-L2 type B2 with L3 A4)
- From 53 types to 9
- Case specific modifiers
- Reliability studies k 0.64 and k 0.77
- Initially did not include treatment recommendations
- After validation 74 Spine Surgeons established a hierarchy of severity
- TL AOSIS in 2015
- TLISS 2015

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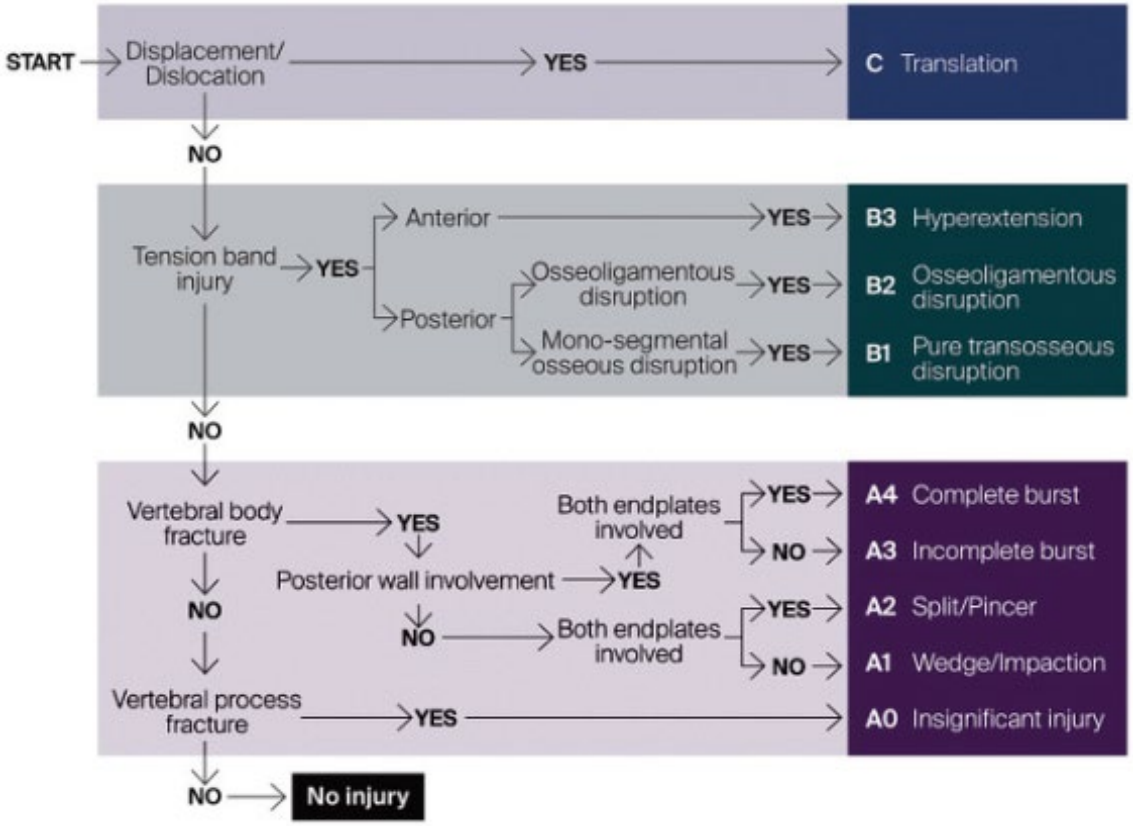
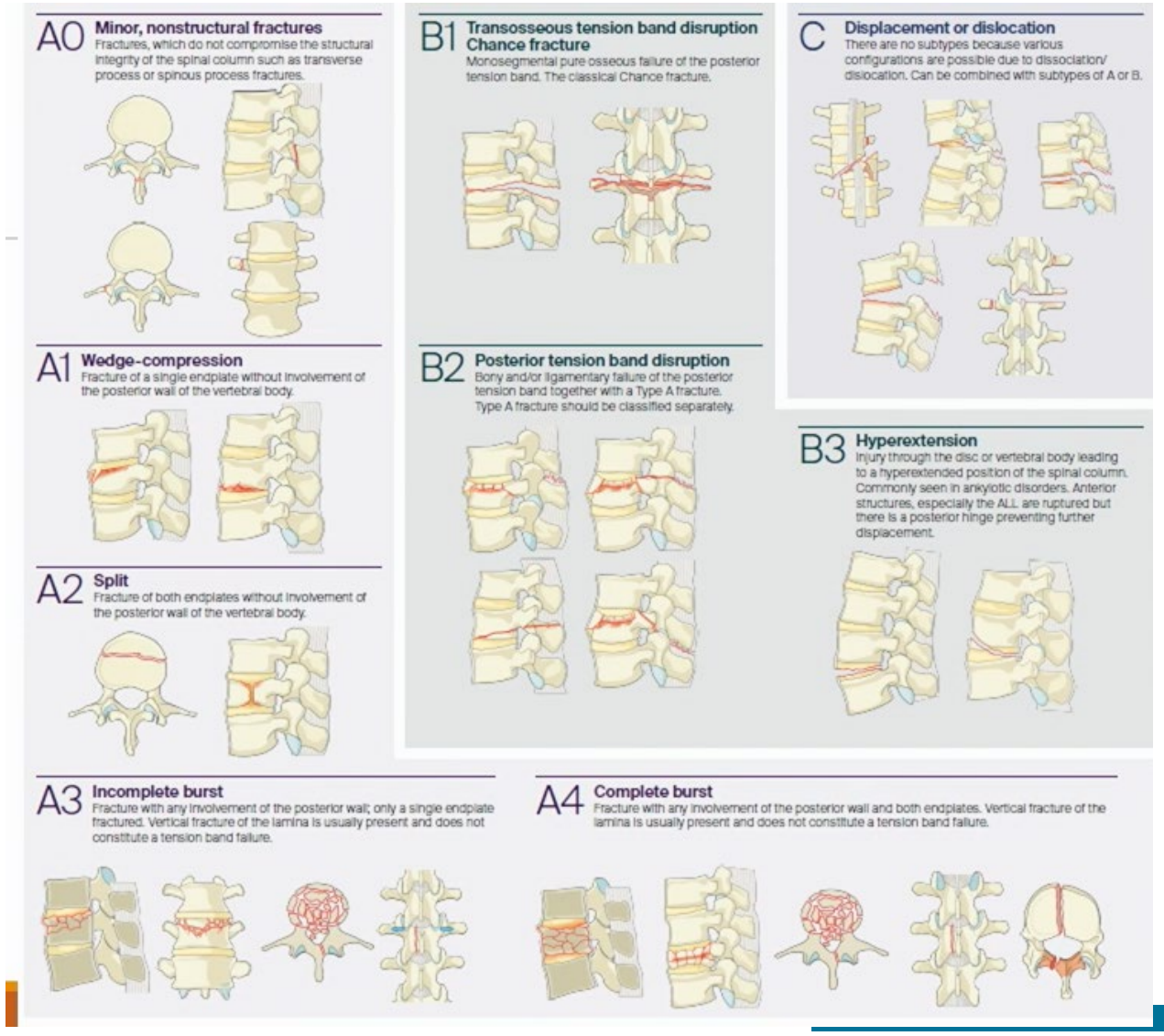
AO Spine Thoracolumbar Injury Classification System





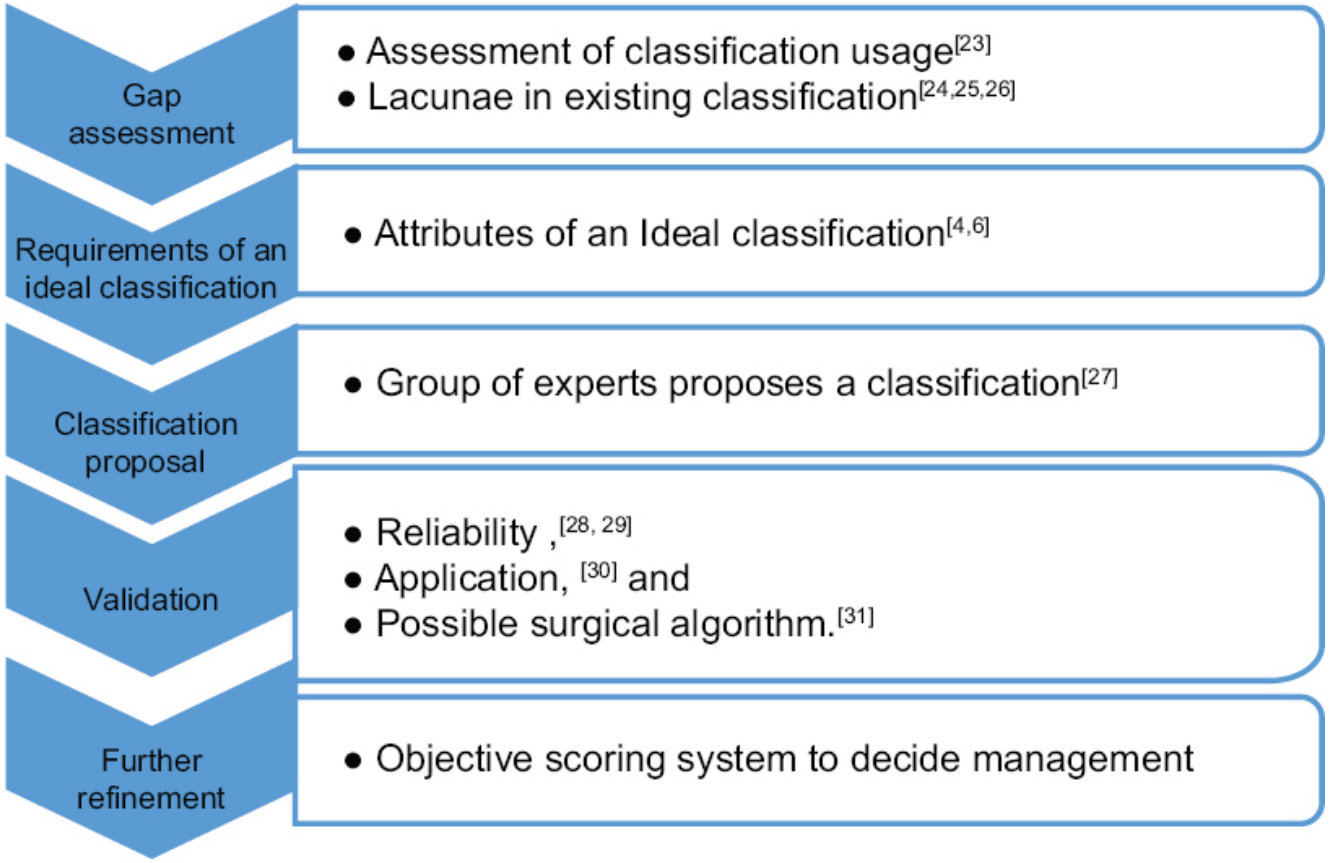
AO Spine Thoracolumbar Injury Classification System

Neurology

Type	Neurological
N0	Neurology intact
N1	Transient neurologic deficit
N2	Radicular symptoms
N3	Incomplete spinal cord injury or any degree of cauda equina injury
N4	Complete spinal cord injury
NX	Cannot be examined
+	Continued spinal cord compression

Modifiers

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.



Spine
SPINE Volume 38, Number 23, pp 2028-2037

DIAGNOSTICS

AOSpine Thoracolumbar Spine Injury Classification System

Fracture Description, Neurological Status, and Key Modifiers

Alexander R. Vaccaro, MD, PhD,* Cumhur Oner, MD, PhD,† Christopher K. Kepler, MD, MBA,* Marcel Dvorak, MD,‡ Klaus Schnake, MD,§ Carlo Bellabarba, MD,¶ Max Reinhold, MD,‖ Bizhan Aarabi, MD,** Frank Kandziora, MD, PhD,§ Jens Chapman, MD,†† Rajasekaran Shanmuganathan, MD, PhD,‡‡ Michael Fehlings, MD, PhD,§§ Luiz Vialle, MD, PhD,¶¶ and for the AOSpine Spinal Cord Injury & Trauma Knowledge Forum

- TL AOSIS in 2015
- 100 surgeons from around the world

Table 1 Demographics of respondents

Region of reviewer	*n*
Europe	14
Asia Pacific	21
Latin America	18
Middle East	11
North America	9
Africa	1
Experience of reviewer (y)	
1–10	21
11–20	34
21+	19

Global Spine Journal
Volume 6, Issue 4, June 2016, Pages 329-334

https://doi.org/10.1055/s-0035-1563610

SAGE journals

Original Article

The Thoracolumbar AOSpine Injury Score

Christopher K. Kepler, Alexander R. Vaccaro, Gregory D. Schroeder, MD, John D. Koerner, Luiz R. Vialle, Bizhan Aarabi, Shanmuganathan Rajasekaran, Carlo Bellabarba, Jens R. Chapman, Frank Kandziora, Klaus J. Schnake, Marcel F. Dvorak, Max Reinhold, and F. Cumhur Oner

Table 2 Average injury severity score for each variable in AOSpine Thoracolumbar Injury Classification System

Type	*n*	Mean	SD
A0	74	5.09	5.07
A1	74	14.78	7.74
A2	74	29.81	14.41
A3	74	44.68	16.99
A4	74	59.7	18.77
B1	74	54.88	18.41
B2	74	69.09	17.66
B3	74	71.49	15.94
C	74	94.8	10.18
N0	72	1.08	3.13
N1	72	19.19	17.14
N2	72	33.57	16.9
N3	72	79.79	19.07
N4	72	91.36	14.48
NX	72	66.96	28.42
M1	72	50	23.67
M2	72	62.4	24.18

Abbreviation: SD, standard deviation.

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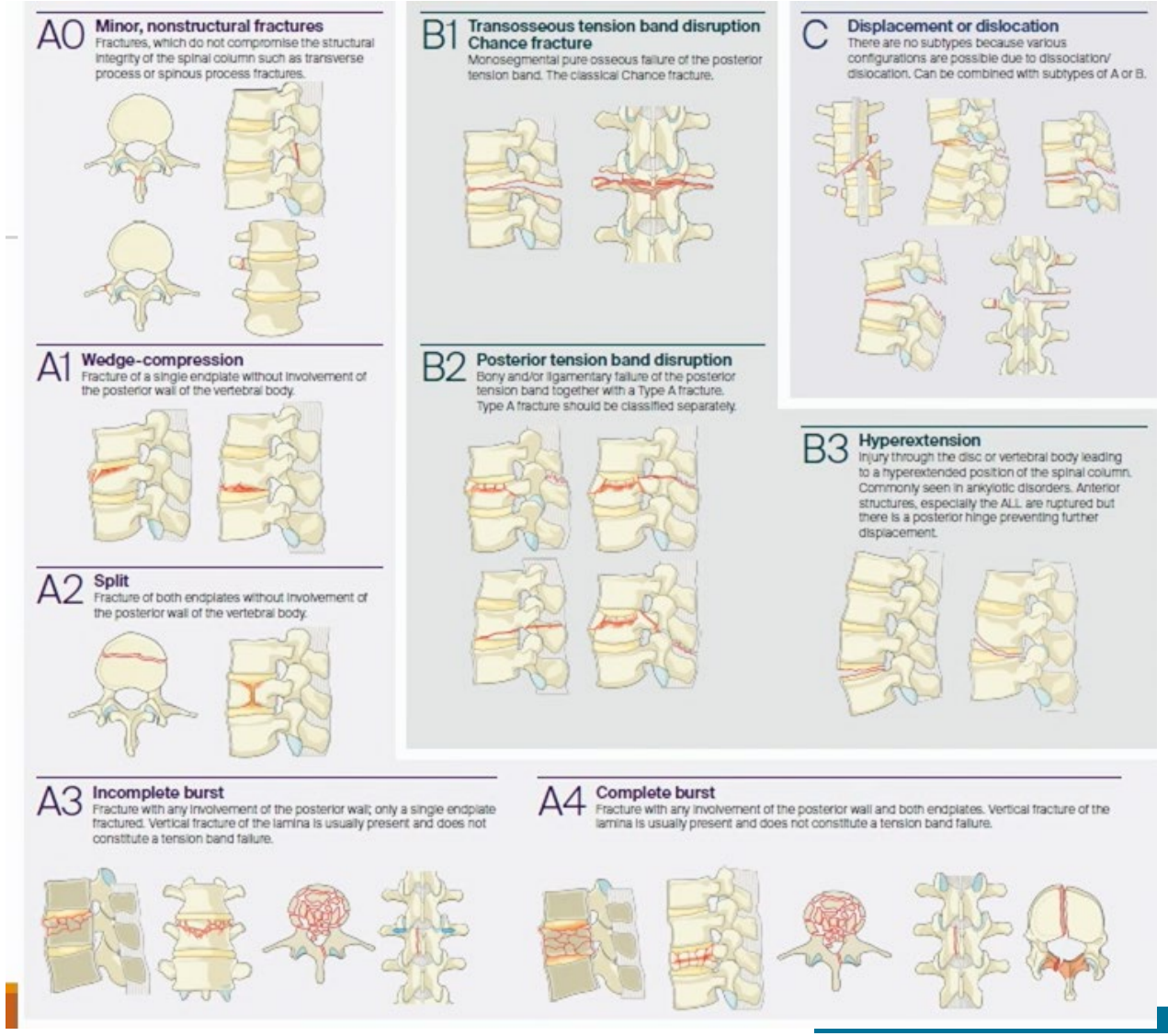
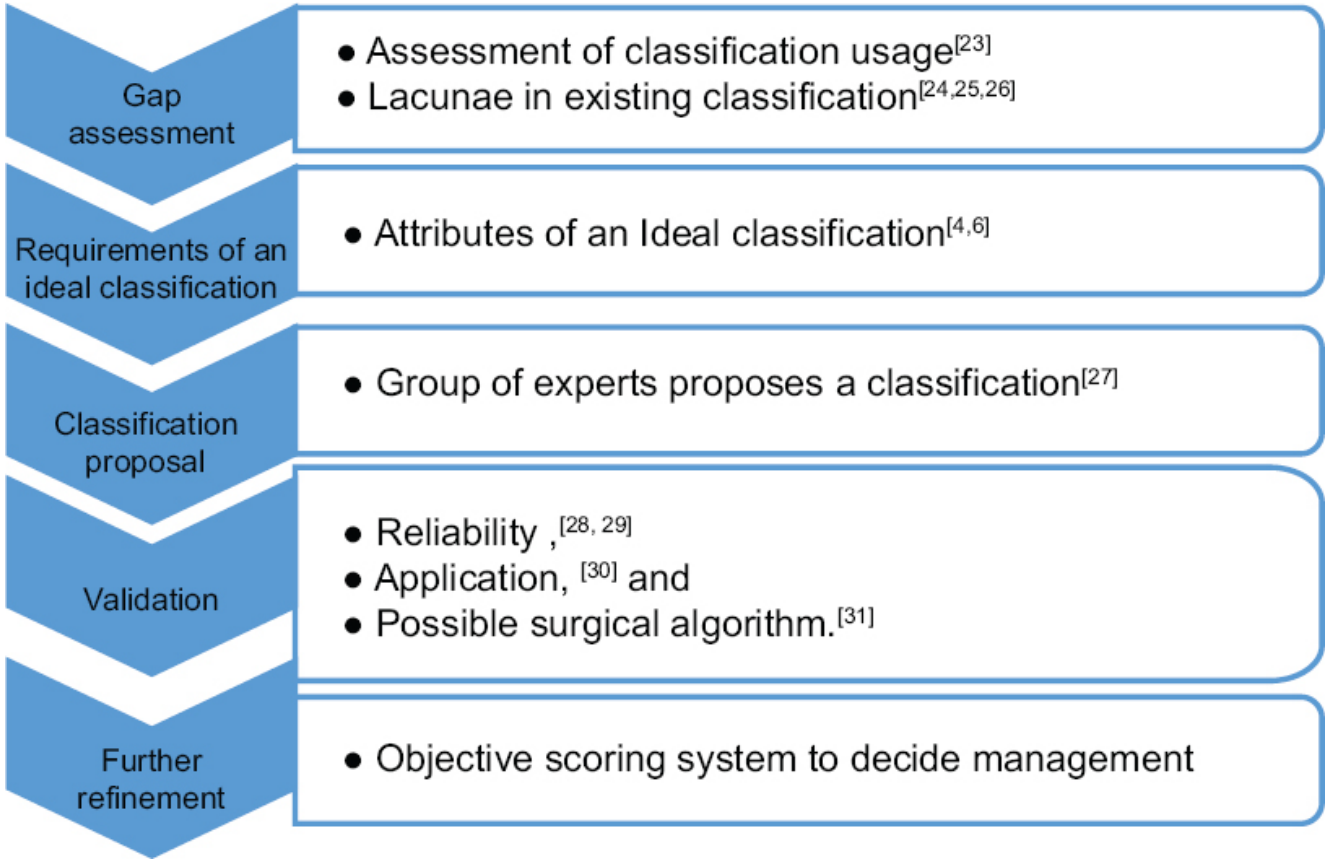
Table 3 Point allocation for morphologic groups

Subgroup	Points
Type A—compression fractures	
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

TL AOSIS in 2015
100 surgeons from around the world





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100 surgeons from around the world

Table 4 Point allocation for neurologic status and modifiers

Subgroup	Points
Neurologic status	
N0	0
N1	1
N2	2
N3	4
N4	4
Nx	3
Patient-specific modifiers	
M1	1
M2	0

Neurology

Type	Neurological
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Eur Spine J (2016) 25:1087–1094
DOI 10.1007/s00586-015-3982-2

ORIGINAL ARTICLE

The surgical algorithm for the AOSpine thoracolumbar spine injury classification system

Alexander R. Vaccaro[1] · Gregory D. Schroeder[1] · Christopher K. Kepler[1] · F. Cumhur Oner[2] · Luiz R. Vialle[3] · Frank Kandziora[4] · John D. Koerner[1] · Mark F. Kurd[1] · Max Reinhold[5] · Klaus J. Schnake[6] · Jens Chapman[7] · Bizhan Aarabi[8] · Michael G. Fehlings[9] · Marcel F. Dvorak[10]

- <4 Trial non operative
- >5 Early operative intervention
- 4 or 5 either treatment based on modifiers and surgeon's preference

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
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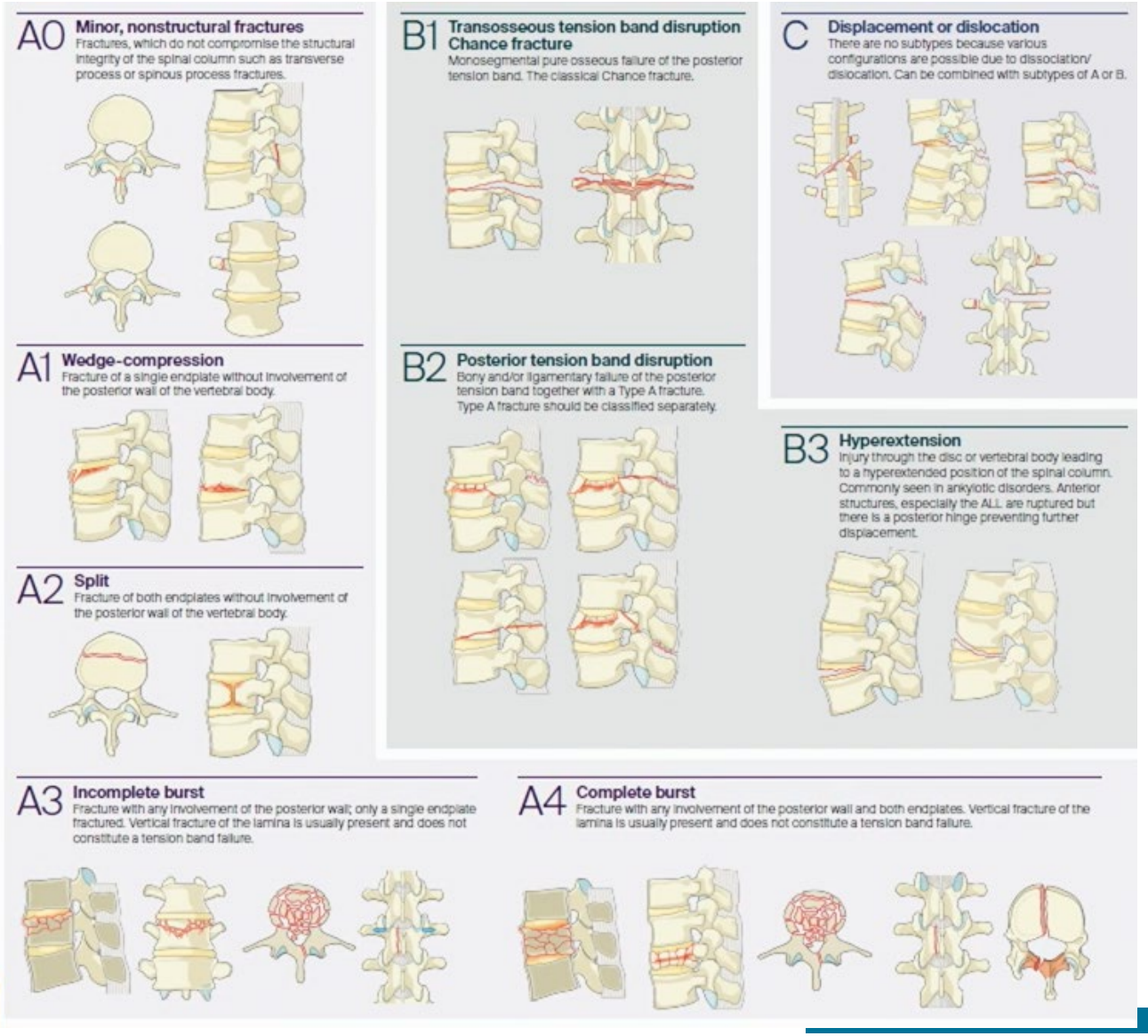
M1	1
M2	0

TL AOSIS in 2015
100 surgeons from around the world



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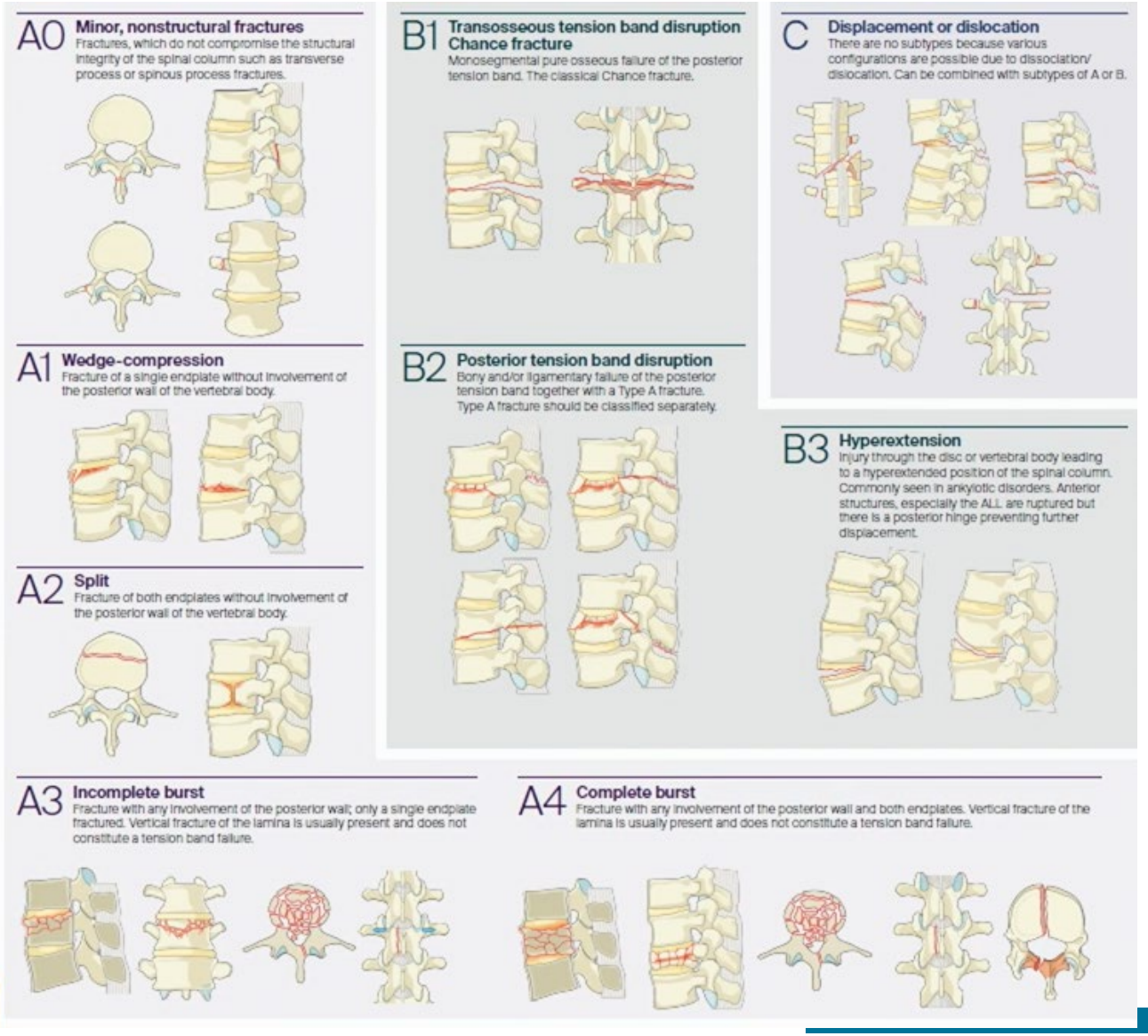
Turn non-operative case to surgical case and vice versa

- Open fractures
- Overlying bums
- Inability to brace
- Ankylosing spondylitis / DISH1 Metabolic bone disease
- Sternal fracture
- Multiple rib fractures at same or adjacent levels as fracture
- Multiple trauma
- Coronal plane deformity
- Severe closed head injury
- Age/ General health

TL AOSIS in 2015
100 surgeons from around the world



Classification of Fractures

An ideal classification would be:

- Simple
- Include vast majority of injuries
- Reflect mechanism of injury
- Correspond to anatomic pathology
- Determine treatment options
- Determine prognosis

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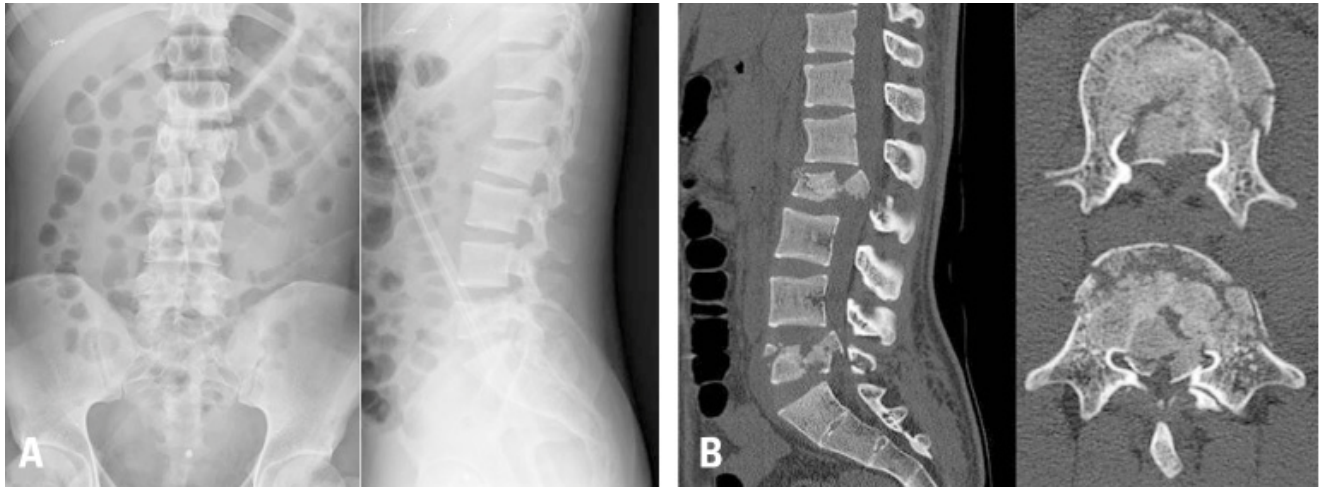
How to Treat Thoracolumbar and Lumbar Fractures

<u>Compression Fractures</u>

- No Brace for majority
- Brace vs Posterior instrumentation for multilevel ?

<u>Stable Burst Fractures</u>

- No Brace for majority, brace for minority
- Surgery (usually posterior) for multilevel or concomitant injuries



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Thank you!

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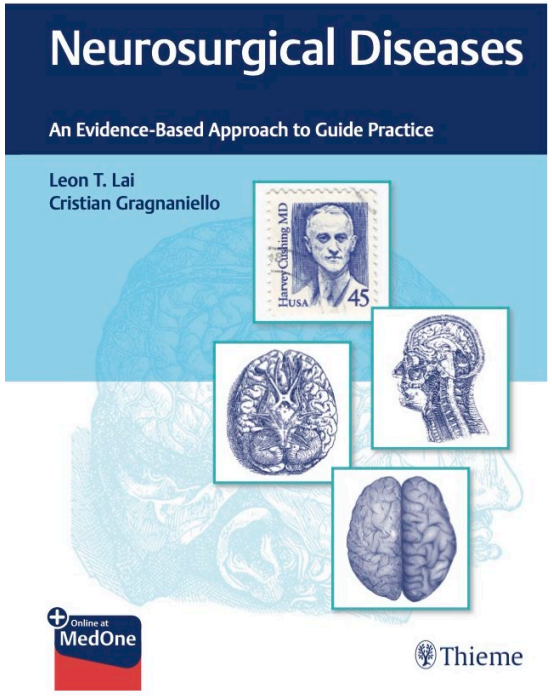
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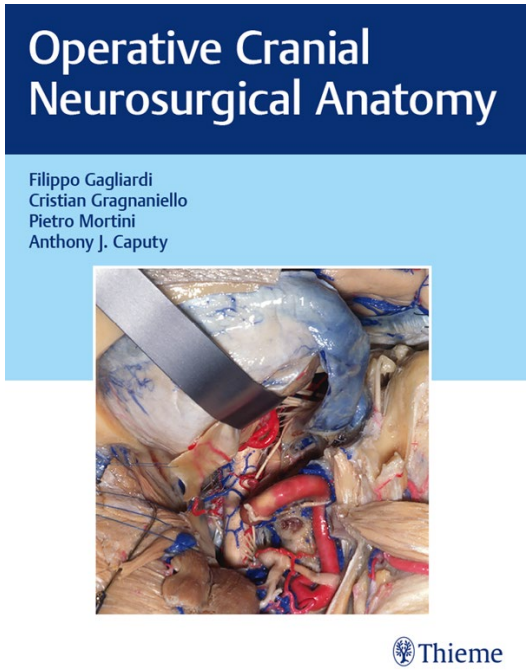
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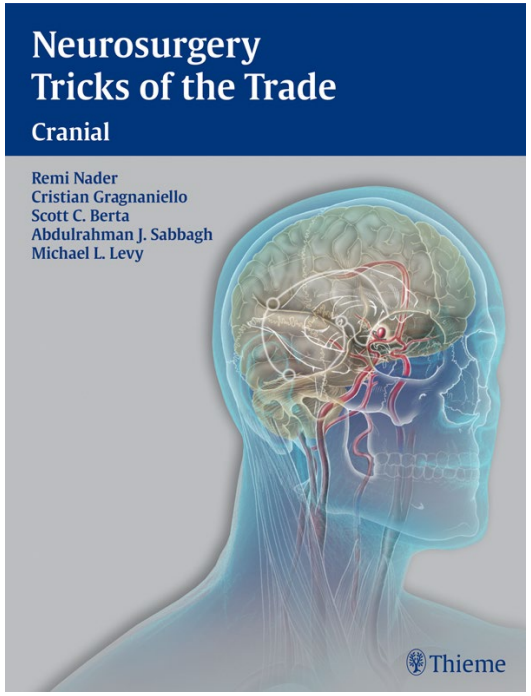
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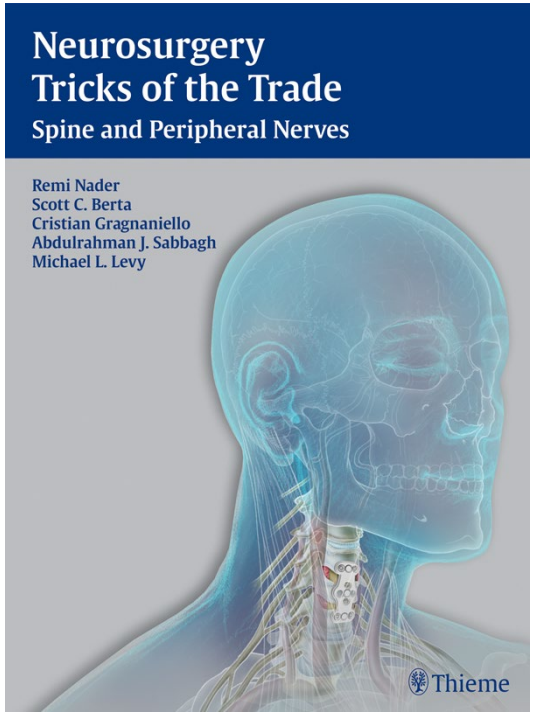
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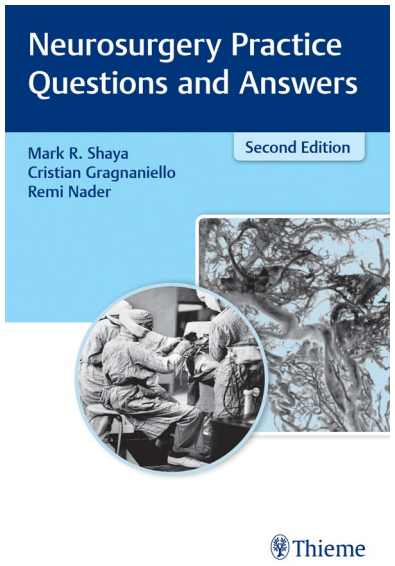
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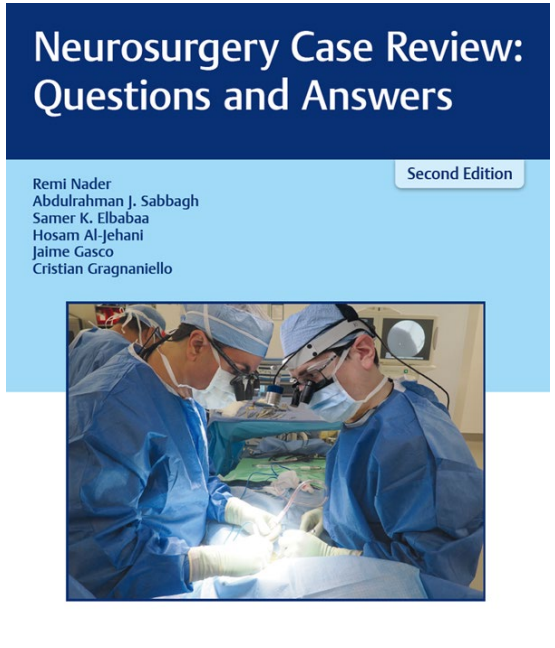
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