Despite the intensive development and refinement of the contemporary protective equipment and algorithms implemented in the working environment and modern vehicles, trauma still represents the “major killing factor” and the main causative for morbidity.

Incidence of moderate spinal cord injury worldwide: a systematic review
Seyed Behzad Jazayeri, Sara Beygi, Farhad Shokraneh, Ellen Merete Hagen, Vafa Rahimi-Movaghar

MANAGEMENT OF THORACO-LUMBAR TRAUMA - EPIDEMIOLOGY

- Neurologic injury complicates 15% to 20% of fracture at the thoracolumbar level.
- 60 – 70% of thoracolumbar fractures occur as a result of motor vehicle trauma or fall from a height.
- 30-40% caused by sport injury and assaults.

MANAGEMENT OF THORACO-LUMBAR TRAUMA – ANATOMICAL POINTS

- The thoracic spine is kyphotic, the lumbar region lordotic - the thoracolumbar region, as a transition zone, is especially prone to injury.
- The thoracic spine is much stiffer than the lumbar spine in flexion-extension and lateral bending, reflecting the restraining effect of the rib cage as well as the thinner intervertebral discs of the thoracic spine.
- The ratio of the spinal canal dimensions to the spinal cord dimensions is smallest in the T2-T10 region, which makes this area prone to neurologic injury after trauma.
MANAGEMENT OF THORACO-LUMBAR TRAUMA – ANATOMICAL POINTS

- The region between T2 and T10 is a circulatory watershed area.

- Most thoracic and lumbar injuries occur within the region between T11 and L1, commonly referred to as the thoracolumbar junction - transition zone between the relatively stiff thoracic spine and the more mobile lumbar spine.

MANAGEMENT OF THORACO-LUMBAR TRAUMA – MECHANISM OF INJURY

- Generally result of high-energy injuries, typically from motor vehicle accident or falls from a height.

- May represent one or a combination of:
  - Flexion
  - Extension
  - Compression
  - Distraction
  - Torsion
  - Shear.

MANAGEMENT OF THORACO-LUMBAR TRAUMA

- Patient assessment: ABCD
  - Resuscitation?
  - Consciousness (GCS)
  - History: mechanism of injury
  - Physical examination
  - Neurologic examination
  - Radiographic evaluation
  - Classification
  - Management plan

- To fix or not to fix?
- How to fix?
MANAGEMENT OF THORACO-LUMBAR TRAUMA

Level I EVIDENCE?
MANAGEMENT OF THORACO-LUMBAR TRAUMA

Level I EVIDENCE?
9 studies on SCI – Bracken, Edwards, Geisler, Quain, Pitts
  MP – controversial/not working
  Gangliosids - not working
3 studies on imaging – Ballock, Gestring, Hauser
  CT scan is the most reliable, rapid, accurate investigation for TL trauma screening.
DEcision making - based on case series, spine expert groups

MANAGEMENT OF THORACO-LUMBAR TRAUMA

Level I EVIDENCE in TL trauma treatment?
1 study on TL treatment – Alanay, Spine 2001
  Bone grafting has no effect on kyphosis in burst fractures
EVALUATION, difficult!
DEcision making - based on case series, spine expert groups

MANAGEMENT OF THORACO-LUMBAR TRAUMA - classification

The mainstay of the thoracolumbar spine trauma management is based on modern comprehensive and easily reproducible classification that is based on:
  - objective clinical and imaging assessment
  - provides standardized grading of the trauma
  - identifying any type of injury
  - facilitates the decision if the fracture is stable/unstable
  - gives the treatment direction – to fix or not to fix.

Unfortunately we are still in search for the ideal classification that will comply in 100% of the cases with the above criteria.

MANAGEMENT OF THORACO-LUMBAR TRAUMA - classification

The first attempt to classify the thoracolumbar trauma is done by Bohler in 1930.
  » Describes 6 type of spinal fractures
  » Realised the importance of the injury mechanism
  » Based on plain X-ray and anatomical dissections.
The first sophisticated classification is the column model classification, with the first 2 column classification designed by Holdsworth in 1962 reviewed 1000 patients:
1. Anterior column – Vertebral body, ALL, PLL
2. Posterior column – Facets, arch, process, ligaments

Stressed the importance of the posterior elements.

The two column classification evolved to a three column classification developed by Denis in 1983 – review on 412 cases:
1. Anterior – ALL plus 2/3 body
2. Middle – Poster 1/3 body, PLL
3. Posterior – All structures posterior to PLL

Unstable when 2 adjacent columns are involved.


The first comprehensive classification of thoracolumbar trauma is the AO classification, published in 1994 and revised in 2012.
- CT based.
- Morphological, descriptive.
- Review of 1445 cases.
- A, B, C types, 53 injury patterns:
  - A – compression
  - B – distraction
  - C – rotation
MANAGEMENT OF THORACO-LUMBAR TRAUMA - classification

Type A: compression (66%)

Group 1: Pure compression
Group 2: Split fracture
Group 3: Burst fracture

A 1 2 3

Type B: Distraction (14.5%)

Group 1: Flexion/distraction injury (disc, liga
Group 2: Flexion/distraction injury (bone, ch
Group 3: Extension injury

B 1 2 3
Classification of thoracic and lumbar spine fractures: problems of reproducibility. A study of 53 patients using CT and MRI.

F. Oner, L. Ramos, R. Simmermacher, P. Kingma, C. Diekerhof, W. Dhert, A. Verbout
European Spine Journal, 2002

- **AO and Denis classification**
- **5 observers**
- **Cohen test**
  - $0 = 0\%$ agreement
  - $1 = 100\%$ Complete agreement

**AO interobserver:**
- CT: 0.31
- MRI: 0.28
- CT/MRI: 0.47

**DENIS interobserver:**
- CT: 0.60
- MRI: 0.52

**AO classification CRITICISM:**
- Not everything could be classified: AS, osteoporosis, children
- Insufficient for the anterior column
- Complex for everyday use
- Intra-/Interobserver variability (0.5 – 07)

**McCormack classification, Spine 1994**
MANAGEMENT OF THORACO-LUMBAR TRAUMA – classification
A new Classification of Thoracolumbar Injuries
The Importance of Injury Morphology, the Integrity of the Posterior Ligamentous Complex, and Neurologic Status

Thoracolumbar Injury Classification
- Injury Morphology
  - Compression
  - Distraction
  - Translation/Rotation
- Integrity of the PLC
  - Not disrupted
  - Disrupted
  - Suspected/Indeterminate
- Neurological Status
  - Intact
  - Nerve root injury
  - Cauda Equina Injury
  - Cord Injury – complete/incomplete
 MANAGEMENT OF THORACO-LUMBAR TRAUMA - classification

Thoracolumbar Injury Severity Score – points

Injury Morphology
- Compression – axial/flexion/burst - 1
- Distraction - 4
- Translation/Rotation - 3

Integrity of the PLC
- Not disrupted - 0
- Disrupted – 3
- Suspected / Indeterminant - 2

Neurological Status
- Intact - 0
- Nerve root injury - 2
- Cauda Equina Injury - 3

MANAGEMENT OF THORACO-LUMBAR TRAUMA - classification

Thoracolumbar Injury Severity Score – points

Injury Morphology
- Compression – axial/flexion/burst - 1
- Distraction - 4
- Translation/Rotation - 3

Integrity of the PLC
- Not disrupted - 0
- Disrupted – 3
- Suspected / Indeterminant - 2

Neurological Status
- Intact - 0
- Nerve root injury - 2
- Cauda Equina Injury - 3

TLISS CRITICISM:

- Mechanism of injury ESTIMATION?
- PLC – needs MRI, not definitive.
- Neurological status needs awake, alert, oriented, cooperative patient
**MANAGEMENT OF THORACO-LUMBAR TRAUMA - classification**

Maximilian Reinhold, Laurent Audigé, Klaus John Schnake, Carlo Bellabarba, Li-Yang Dai, and F. Cumhur

AO spine injury classification system: a revision proposal for the thoracic and lumbar spine.

Based on three group parameters:
- Morphologic classification of the fracture
- Neurological status
- Clinical modifiers

**Revised AO spine injury classification**

Based on three group parameters:
- Morphologic classification of the fracture – based on the old AO classification
- Same three major types – A, B and C
- Type A – compression injury affecting the anterior structures
  - 5 type A subtypes
    - A0 – Minor non-structural fractures
    - A1 – Wedge compression – intact p. wall
    - A2 – Split
    - A3 – Incomplete burst – single endplate
    - A4 – Complete burst fracture
- Type B – failure of anterior/posterior tension band
  - 2 type B subtypes
    - B1 – transosseous tension band disruption – old Chance’s fracture
    - B2 – posterior tension band disruption – ligamentsand the disk
Revised AO spine injury classification

Based on three group parameters:

- Morphologic classification of the fracture – based on the old AO classification
- Same three major types – A, B, and C
- Type C: 3 types
  - C1 – Hyperextension
  - C2 – Translation
  - C3 – Separation
MANAGEMENT OF THORACO-LUMBAR TRAUMA - classification

Revised AO spine injury classification
Based on three group parameters:
- Morphologic classification of the fracture – based on the old AO classification

<table>
<thead>
<tr>
<th>Injury</th>
<th>Conservative</th>
<th>Operative</th>
</tr>
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<tbody>
<tr>
<td>B - Injury</td>
<td>A0</td>
<td>B1, B2</td>
</tr>
<tr>
<td>C - Injury</td>
<td>C</td>
<td>A1 &gt; 15° kyphosis</td>
</tr>
</tbody>
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Treatment Concept
Stabilisation of the Thoracolumbar Spine

- REDUCTION?
- DECOMPRESSION?
- STABILISATION?
- ANTERIOR COLUMN SUPPORT?
MANAGEMENT OF THORACO-LUMBAR TRAUMA

CONCLUSIONS:
- Clarifying the mechanism is important
- Imaging could give information for the mechanism
- Many classification schemes developed – use it wise!
- There is no perfect classification
- Management could vary widely based on institution policy, surgeon and philosophy
- Classification helps for the decision making and communication and documentation.
- Each case should be discussed individually