

Thoracolumbar Spinal Injuries - Evolution of Understanding of fracture Mechanics and Management Options

Shailesh Hadgaonkar¹, Ketan Khurjekar¹

Introduction

This symposium on thoracolumbar fractures is aimed at providing an overview to the reader with respect to evolving trends in fracture diagnosis and management.

There has always been controversies in treating thoracolumbar spine injuries with neurological deficit, but as we know the goal of managing these T-L junction injuries is to maintain the sagittal alignment for mechanical stability and to give additional support for rehab and physiotherapy for neurological recovery. The main aim of thoracolumbar fracture surgery is to give structural support to the spinal column for wheelchair mobilization in cases with complete injury and paraplegia. We have found significant improvement in quality of life in patients who were operated for these severe thoraco lumbar spinal injuries. As we all know the most common level of these injuries is T 12 and L1, sustaining from the high velocity trauma. The flexibility at thoraco lumbar junction, the thoracic rib cage ending at the junctional level, coronal alignment of facet joint in thoracic spine and the changes in the lower thoracic facets to less coronal alignment is likely to cause fracture dislocations. Various transitional zone injuries- between T 11- L2 are approximately 50 - 60 % of all injuries. Most common reason for these injuries - are fall from height and high velocity RTA. There is a significant association of other injuries such as chest, abdominal, vascular injuries and also head injuries with these fracture dislocations.

It is paramount to evaluate these patients in detail, thorough clinical and neurological assessment is mandatory. The standard American Spinal Injury Association (ASIA) guidelines should be followed in neurological assessment. Associated relevant investigations as the X-rays and MRI scans will guide for non-operative Vs operative management. Additional modalities such as CT scans and 3D reconstruction is important clinically unstable and high grade T-L injuries. Primary assessment and medical management is important to stabilize the patient before planning the surgery.

Evolution of classification systems :

Various different classification system have evolved from the World War I and II days, as Bohler in 1930 classified T-L fractures into five categories :-

- 1- Compression fractures
- 2- Flexion /distraction injuries
- 3- Extension fractures
- 4- Rotational injuries
- 5- Shear fractures

Watson Jones in 1938 classified T-L injuries adding instability to Bohler's classification. The most important factor in Watson Jones classification was description of Posterior ligamentous complex (PLC) in spine stability, as they felt the integrity of interspinous ligament is most important stability factor. Nicole in 1949, further classified using anatomical classification with emphasis on interspinous ligament integrity. He described the stability structures as the vertebral body,

disc, intervertebral joint, and interspinous ligament. This classification serves as a foundation for subsequent classifications. Holdsworth in 1963, described Two column theory and he emphasized the spinal stability on posterior ligamentous complex (PLC) stability. Kelly and Whitesides attempted to modify Holdsworth classification, as they specifically mentioned anterior column as solid vertebral body whereas posterior column as posterior elements and neural arch. Also they emphasized the treatment of neurological deficit.

Dennis in 1983, came up with a new concept – Three column theory using the radiological parameters. He provided a new insight in detailing the classification into anterior, middle and posterior column. They described the middle column – osteo-ligamentous complex injury is the primary determinant of mechanical spinal stability.

McAfee et al described the classification based on CT scans of 100 consecutive patients and divided into 6 groups. This was the most detailed classification system in the 1980's. They described the height loss of vertebral body, facet joint subluxation, fragments in the spinal canal, progressive neurological deficit, kyphosis angle because of instability was assessed with the CT scan. As per their criteria translational and flexion/rotational fracture dislocation and posterior ligamentous complex (PLC) injury with kyphosis more than 30 degrees angle should undergo surgery. In 1994 Mc Cormack classified on load sharing concept, which focuses more on location of the fracture in the vertebral body.

Then in 1994, Magrel et al came up with classification based on evaluation of 1445 cases and classified into 3 types and 53 injury models.

In 2005, Vaccero et al came up with Spine trauma study group – Thoraco Lumbar

¹Sancheti Institute for Orthopaedics & Rehabilitation, Pune, India

Address of Correspondence

Dr Shailesh Hadgaonkar
Sancheti Institute for Orthopaedics & Rehabilitation, Pune, India
Email: editor.ijspine@gmail.com



Dr. Shailesh Hadgaonkar



Dr. Ketan Khurjekar

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Injury Classification System (TLICS) which takes a detail note on fracture mechanism, the intact PLC status and the neurological status of the patient.

TLICS points:

Fracture Mechanism

Compression fracture	1
Burst fracture	1
Rotational fracture	3
Splitting	4

Neurological involvement

None	0
Nerve root	2
Medulla spinalis, conus medularis-	
- Incomplete	3
- Complete	2
Cauda equina	3

Posterior ligamentous complex

Intact	0
Possibly injured	2
Injured	3

Surgical indication is for cases with 5 points or more, cases with 4 points are between surgical vs non surgical, and cases with 3 or less points are non surgical. It is quite a comprehensive and popular classification in clinical practice and many centers prefer to

use this classification worldwide.

Recently AO Spine knowledge forum has proposed a comprehensive modified AO classification based on morphology of fracture, neurology status and description of relevant patient specific modifiers

These classifications signify the growth in our understanding of pathomechanics of the spine fracture as well as takes into account our growing expertise in the offering better surgical options to the patients.

Management Options:

Various management options are discussed in the current symposia and most of the options are individualised depending on the etiology and extent of fracture. Few general rules are noted below -

- Cases where there is retropulsion up to 40-50 degrees without neurological deficit with intact PLC we can attempt indirect decompression and distraction in first 5-6 days after the injury.

- Cases with less angulation and wedging with minimal kyphosis can be dealt with short segment fixation.

- Interlink in long construct always adds-up to the stability. Reduction of the dislocation with various maneuvers always beneficial for sagittal profile.

- Role of steroid is controversial post T-L injury with neurological deficit and is rarely used worldwide.

- Role of minimally invasive spine (MIS) surgery is evolving and needs a longer follow up. MIS surgery helps in reducing the bleeding, morbidity in selective cases.

- There is a significant role of rehabilitation post-surgery, in cases of T-L fractures with neurological deficit. Stem cells are promising in animal and Fish models in research labs and we are very hopeful about the same in humans.

Most of the above options are discussed in details in the symposia and we would encourage the readers to go through the articles. Ultimately the clinical evaluation summed with the radiological parameters will decide the management plan as cases with instability, neurological deficit and progressive neurological worsening cases will need surgical intervention. A lot of cases can be conserved with careful monitoring.

We thank all the authors and contributors for participating in the symposia and invite interested readers to participate as symposium editors or authors. Please write to us by email and provide your suggestions and comments.

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