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Review Article

Management of burst fractures in the thoracolumbar spine

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ABSTRACT

The most common fractures in the spine take place in the thoracolumbar region. Currently there is no consensus regarding optimum treatment.
Objective: Analyze the current medical literature available regarding treatment of compression fractures of the thoracolumbar spine.
Methods: Research of current literature in medical databases.
Results: Regarding current available literature, we found no consensus in the treatment of compression fractures in the thoracolumbar spine.
Conclusions: Burst fractures of the thoracolumbar junction is a very common condition, treatment of each patient must be individualized. Conservative treatment is recommended for stable fractures without neurological compromise and less than 35° of kyphosis.

1. Introduction

Research of current literature in medical databases such as pubmed was made, using the keywords thoracolumbar spine, compression fracture, burst fracture, neurological deficit, conservative treatment, surgical treatment. 220 articles were found, of which 68 were included. Within these were review articles, systematic reviews, randomized controlled trials, cohort and case–control types.

Fractures of the thoracolumbar spine represent 90% of all spine fractures, followed by cervical and lastly by lumbar spine fractures. This area is made up of T11 to L2 vertebrae, and it is considered biomechanically the weakest point in the spine.[1,2] Vertebral fractures are divided in 3 groups according to (*Arbeitsgemeinschaft für Osteosynthesefrage*) Classification. Type A are those caused by compression and Type B are those caused by flexion and distraction forces accompanied by lesions in the posterior ligament complex. Type C are any type of fracture that is accompanied by displacement in the sagittal or coronal plane.[1,6] Type A are the most frequent. Main causes of fractures in the thoracolumbar spine are: high-energy trauma (young patients) and low energy trauma (older patients). 20–40% of fractures in this segment present neurological compromise. More than 30% of the young patients may develop chronic pain, which leads to lack of work. The proper treatment for these lesions is very important.[2–4,6] Current treatment goals are: preventing neurological damage, establishing adequate stability and fusion, recovering sagittal balance, initiating early rehabilitation and reinstating patient to work. Nonetheless, there is still much controversy over what the ideal treatment represents.[1–6]

2. Anatomy of the thoracolumbar spine

This region represents the transition zone from a rigid segment to a mobile segment, making it very vulnerable to traumatic lesions.[3,4] The thoracic spine is the most rigid segment in the whole spine; this is due to the presence of the rib cage. On the other hand, the lumbar spine is one of the most flexible ones.[3–6] The spinal cord ends approximately at L1–L2, meaning that fractures at this level or below, generally displays as *cauda equina syndrome*. Fractures above L1 can be associated by spinal cord compression symptoms.[3–7]

3. Spine stability

The thoracolumbar region is the most likely to suffer lesions due to its transition from a rigid segment to a mobile one. Stability in this zone depends on the integrity of the ligaments and bony components. Stability in a fracture is determined by its mechanical and neurological status. Denis et al. classify instability into 3 groups:

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mechanical (first degree), neurological (second degree) and mixed instability (third degree).[6]

The integrity of the posterior ligamentous complex defines mechanical stability. In plain X-rays, this can be evaluated measuring the interspinous space (>30°–35° kyphosis) and the loss of vertebral body height (>50%).[8–10] Computed tomography is the best method to evaluate the bony components of a fracture. Magnetic resonance determines the treatment plan allowing us to evaluate the integrity of the ligaments. Many studies have reported high sensibility and specificity in MRI to evaluate these structures, comparing them to the lesions seen during surgery.[6,7,9,10] Neurological stability is determined by the ASIA (American Spinal Injury Association) classification. There are 5 types of neurological status: being "A": patient has complete neurological deficit. "B" and "C" are incomplete lesions and "E" represents no neurological compromise. Any type of lesion not classified as E will be determined as neurological instability. However, this is independent of the mechanical stability, and does not make it an indication of surgery. The only surgical indication dependent of this status is a progressive deterioration of the patient. If a patient presents type A lesion, this should be re-evaluated when spinal shock has resolved. If it does not change, it has very low probability of recovery; therefore, the goal of treatment is only to stabilize the spine and recovering sagittal balance.[11,13–18]

4. AO classification

Boehler proposed the first classification over 75 years ago. The objective was to improve communication between doctors, establish a prognosis and determine the treatment. Denis proposed the 3-column theory, emphasizing that lesions to the middle column should be treated as unstable fractures.[6,14,18] He classified fractures in the thoracolumbar segment in 4 categories: compression, burst, flexion-distraction (seat-belt) and fracture–luxation.[6,19] This classification is important because it integrates neurological status and it is simple. The inter-observer correlation is low and differentiating from unstable and stable in a burst fracture may be difficult. MacAfee et al. emphasize that the posterior ligament complex is very important and states 6 categories due to 3 types of forces that are involved: compression, distraction and translation.[19] According to the trauma mechanism it can be classified as: wedge fracture, stable burst fractures, unstable burst fractures, chance fracture, lesions by flexion or distraction, and translation. However, this is not widely used due to its complexity and its validity has not been verified. AO classifies them into 3 groups: compression, distraction and rotation. "A" to "C", being more unstable as it progresses to "C" (Table 1).

Table 1
Numerical coding for spine in AO is no. 5, sub-classification for segments follows as: 51: cervical, 52: thorax and 53: lumbar. Adding to B and C should be the vertebral body lesions IE. Fracture L2 53–B2 (A3). There are modifiers in cervical spine different to thoracolumbar spine.

AO classification		
A	1	1 endplate affected
	2	Both endplates are involved but not the posterior wall
	3	1 endplate and the posterior wall
	4	Both endplates and posterior wall
B	1	Chance fractures
	2	Lesions to posterior ligaments and vertebral body involvement
	3	Hiperextension lesions
C	Any fractures accompanied by rotational displacement	

This classification has proved high reliability intra- and inter-observer. Still, no definition has been reached regarding fracture stability and it does not take into account the neurological status.[20,21] Vaccaro et al., proposed the latest classification called TLISS (Thoraco-Lumbar Injury Severity Score) and this includes the trauma mechanism, integrity of the ligamentous components and the patients neurological status. These were given individual scoring and then they are added to reach a final score, determining the treatment based on the score. If the score was lower than 3, conservative treatment can be given, if it is more than 5, surgical treatment should be given. This classification has proven good reliability index and intra-observer correlation (kappa, 0.24–0.724) in various studies.[20–23]

5. Imaging

Simple lateral X-rays can identify as much as 80% of the bony lesions in the spine. However, they are not necessary for initial evaluation if a CT scan is avaiable.[19,24]

The MRI is the most sensitive method to evaluate soft tissue. It offers the best imaging of neurologic, ligamentous and disc structures. It is useful in patients that have initial imaging that does not justify the clinical setting. In cases with neurological deficit without structural evidence in X-rays or CT scan (SIWORA), the MRI can help with information of value for diagnostics. Approximately 25% of patients with neurological deficit in the initial evaluation with cervical or thoracic lesion have changes in the treatment plan after the MRI is done.[19,23]

6. Initial medical treatment

6.1. Does NASCIS work?

This scheme has been considered matter of a lot of controversy. There is neither enough evidence to support the policy of treatment nor are there the guidelines of how spinal cord treatment should take place. Subsequent studies have given proof of the ineffectiveness of methylprednisolone (MP) as treatment in the last decade. Currently, high doses of MP cannot be recommended as standard care; however, it is still an option until substituted by future therapies based on clinical evidence. The administration of MP is neither approved as the standard of care nor is it considered as a recommended treatment. The test of efficiency of this pharmaceutical and its effects are weak and could represent effects due to random factors.[25–27]

7. Conservative treatment

7.1. Indications

(1) Compression fractures (A1, A2) without neurological compromise and a kyphosis angle less than 35°. (2) TCLIS score less than 6 points. (3) Patients in whom surgical treatment is not an option due to their general medical conditions.[28,13] However, Daily et al. demonstrated in 22 patients with neurological déficit experienced improvement with average recovery rate of 93%.[15]

7.2. Type of treatment and follow-up

Conservative treatment consists in the postural reduction of the patient, having bed rest and adequate use of the thoracolumbar corset, as well as rehabilitation. Recommendations are bed rest for 8–12 weeks, followed by assisted mobilization. There are some authors that recommend a shorter bed rest period, approximately 4–6 weeks.[16,28,13,32]