Thoracolumbar spine fractures management: Review article

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Abstract

Background: Spine fractures are prevalent injuries in our society that pose major socioeconomic problems. With thoracolumbar region being the most affected area of the spine, great dispute has been witnessed on how best to manage fractures of this particular region. Different modalities of treatment have been proposed to achieve spinal stability and prevent post-traumatic kyphosis. It is imperative to study these different surgical methods and decide the best approach for each patient.

Objectives: Highlight the different surgical methods for treatment of thoracolumbar spine fractures.

Methods: We have searched literatures in PubMed, google scholar, Egyptian bank of knowledge and science direct from 1994 to 2020.

Conclusion: The posterior short-segment fixation with inclusion of the fracture level has been recently favored for treatment of thoracolumbar spine fractures as it achieves good stability and long-term kyphosis correction.

Keywords: Thoracolumbar spine fractures; Posterior short-segment fixation; Kyphosis correction.

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1. Anatomy and biomechanics of the thoracolumbar region

The thoracolumbar region is an area of transition with specific mechanical conditions attributing to its vulnerability under traumatic loading. The thoracic spine is stiff owing to its attachment to the ribs and the intervertebral disc being less deformable. While the lumbar spine is more dynamic as it is not attached to the rib cage and it is responsible for spine flexion and extension. The thoracolumbar junction is a connection between these two regions creating an area of high stress concentration rendering it weak against high speed dynamic loading **(Wood et al., 2014).**

Spinal stability is defined by White and Panjabi as the ability of the spine under physiological load to maintain its normal movement so that there is no initial or additional neurological deficit, no major deformity and no incapacitating pain. Meanwhile, instability is the loss of the spine's ability to maintain its patterns of displacement under normal physiological loads **(Rudol and Gummerson, 2014).**

2. Thoracolumbar spine fractures prevalence

Thoracolumbar region of the spine has been recognized as the most affected region of the spine in terms of spine fractures. They constitute about 90% of all spinal fractures. These fractures are most common in adults and more in males than females **(Sun et al., 2016).** Trauma is the most common cause of thoracolumbar spine fractures especially fall from height **(Dobran et al., 2016).** However, other causes may include pathologic fractures related to osteoporosis or cancer which are common in the elderly.

2.1. Clinical implications of thoracolumbar spine fractures

The clinical presentation of patients with thoracolumbar spine fractures can vary from mild back pain to complete loss of motor and sensory functions of the lower limbs. In patients with altered sensorium or other major injuries, thoracolumbar fracture diagnosis can be missed or delayed **(Meldon and Moettus, 1995).** Different scales have been described to determine the neurological status of patients; however, American Spinal Injury Association (ASIA) impairment scale is the most commonly used neurological scale by neurosurgeons to determine the neurological status of patients with spinal cord injuries. **(Dimitrijevic, 2012).**

2.2. Thoracolumbar spine fractures classification

Thoracolumbar spine fractures classification systems have been developed over the last century in trial to create a unified identification and method of treatment for these fractures. **(Rajasekaran et al., 2015)**

The emergence of computed tomography (CT) in 1972 paved the way for better classification systems to be presented due to better delineation of posterior vertebral body wall fractures, canal compromise, and occult fractures of the posterior column and status of the spinal cord. **(Rajasekaran, 2017)**

In 2005, Vaccarro put forward a classification and scoring system that can predict the need for surgical intervention. This system was based on fracture morphology evaluated through computed tomography (CT scan), integrity of posterior ligamentous complex evaluated using magnetic resonance imaging (MRI) and the neurological status of the patient by clinical examination. According to this scoring system, scoring more than 4 points warrants a surgical intervention, while 3 points or less were considered stable fractures and no surgical intervention was recommended **(Vaccaro et al., 2005)**. This Thoracolumbar Injury Classification and Severity Score (TLICS) was demonstrated to have acceptable intra-rater and inter-rater reliability and satisfactory validity in terms of treatment recommendation **(Koh et al., 2010).**

2. Conservative vs. Surgical management of thoracolumbar spine fractures:

The management of thoracolumbar fractures is highly controversial. The majorities of these fractures are usually stable and can be managed conservatively **(Savardekar et al., 2017)**.

More authors believe that surgical treatment is better in restoring spinal stability and decompressing the neural elements **(Wang et al., 2017)**.

In general, patients with stable fractures and no neurological deficit are treated in a conservative manner, while patients with unstable fractures with or without neurological deficit are treated surgically **(van der Roer et al., 2005)**.

3. Surgical management of thoracolumbar spine fractures

The surgical management of thoracolumbar fractures is currently favored in order to achieve better anatomic reduction and neural decompression **(Wang et al., 2017)**.

Numerous surgical methods were devised to achieve better results in terms of providing better stability and preventing post-operative kyphosis. The anterior corpectomy and fixation has been shown to have good results but the high risk of morbidity and the technical expertise needed limited its application. However, posterior fixation has shown comparable results to anterior approach and had the advantage being easy and less morbid. **(Zhu et al., 2015)**

Posterior fixation of thoracolumbar spine fractures can be done by way of either long-segment or short-segment. Long-segment posterior fixation has been widely abandoned in favor of short-segment fixation due to significant reduction of vertebral mobility, back pain and implant failure **(Koller et al., 2008).**

Posterior short-segment fixation provided comparable results to the long-segment fixation with preservation of motion segments. Moreover, Posterior short-segment fixation has shown good results in the treatment of thoracolumbar spine fractures in osteoporotic patients **(Girardo et al., 2020)** but on the long term post-operative loss of kyphosis correction and implant failure were serious adverse effects. **(Tezeren and Kuru, 2005)**

Inclusion of the fractured level in the short-segment construct was designed by **Dick et al., 1994** to provide better support to the short-segment construct and decrease stress load on the other screws. This technique was used in many studies and have shown high prospect in achieving acceptable stability and reducing the rate of implant failure seen in standard short-segment fixation. **(Mahar et al., 2007; Guven et al., 2009).**

Minimally invasive techniques as percutaneous vertebroplasty by injecting methacrylate (PMMA) was found to be a safe method in treatment of thoracolumbar fractures in osteoporotic patients **(Costa et al., 2009).** On the other hand, balloon kyphoplasty using calcium phosphate cement secured with posterior short-segment fixation has also shown good results in immediate reduction of posttraumatic segmental kyphosis **(Korovessis et al., 2007).**

Conclusion

Posterior short-segment fixation with inclusion of fractured level is an effective method in treatment of thoracolumbar spine fractures

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