



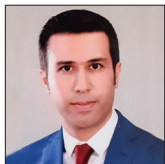
Original Article

Radiological outcome of operative treatment with posterior approach in patients with thoracolumbar junction traumatic injuries: A single-center pilot study in a developing country

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ABSTRACT

Background: The thoracolumbar junction (TLJ) represents a transition zone of the spine that leads to a high incidence of fractures. The treatment of burst fractures remains controversial regarding the ideal management. This study assessed the postoperative radiological outcome of TLJ fixation in patients with TLJ injuries who underwent surgery.

Methods: All traumatic patients with TLJ injuries who were referred to the Khatam hospital of Zahedan between 2015 and 2020, with their thoracolumbar injury classification and severity score (TLICS) of four or more and who underwent surgery, were included in this study. The patients who entered the study were called for a follow-up examination. The degree of kyphosis, proximal junctional kyphosis, and fusion were assessed in these patients.

Results: Among 273 patients, the average age was 43.5 ± 12.3 (21–73) years. One hundred and ninety-eight patients (72.5%) had no neurological symptoms at admission. Based on the above criteria, the kyphosis angle of these patients was calculated before surgery, which in 46 patients (16.8%), the kyphosis angle was more than 25°. Preoperation kyphosis was significantly associated with follow-up kyphosis ($P < 0.001$). Evidence of no fusion was also observed in 22 patients (8.1%). According to the Chi-square test, no association was observed between preoperative kyphosis and postoperative complications, including PJK and fusion ($P > 0.05$).

Conclusion: According to our study, the posterior spinal fixation procedure is a low-complication method with an acceptable radiological outcome. Although kyphosis before surgery is a factor in developing long-term kyphosis, it is not associated with nonfusion and PJK.

Keywords: Posterior spinal fixation, Radiological outcome, Thoracolumbar junction, Trauma

INTRODUCTION

Thoracolumbar spinal cord injuries are often caused by high-energy injuries, most of which are caused by a car accident or falling.^[2,12] Although about 90% of all spinal fractures occur in the thoracolumbar region, only 4.4% of trauma patients who are referred to the first level trauma

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center have a fracture in the thoracolumbar area.^[2,4,11] Spinal fractures are seen in a small percentage of patients with blunt trauma, and they can cause serious injury to patients.^[12] Thoracolumbar junction (TLJ) fractures are the most common traumatic fractures in the thoracolumbar region.^[23] This is where the thoracic spine has the least mobility transformed to the lumbar region, which is the dynamic part of the spine, making this area very vulnerable to injuries due to trauma.^[7]

Fortunately, most spinal fractures are stable, do not require surgery, and are usually cured with proper hyperextension braces.^[23] Surgical treatment has some advantages over conservative treatment, especially in people who cannot tolerate immobility with a brace for several months, including patients with multiple fractures in the limbs or skin lesions and obese patients.^[21]

Several studies have reported the consequences of TLJ fracture surgery compared to conservative treatment and have reported different results.^[16,22,23] This study aims to express the radiological consequences of TLJ fracture surgery in the follow-up of at least 1 year of these patients in the referral center of trauma in southeastern Iran.

MATERIALS AND METHODS

A prospective cohort was performed on the patients with TLJ injuries who were referred to Khatam Al-Anbia hospital in Zahedan (Southeast Iran Referral Center) between 2015 and 2020. Inclusion criteria were age over 18 years, traumatic injury to the vertebrae of the TLJ area including vertebrae T10, T11, T12, L1, and L2, with the thoracolumbar injury classification and severity score (TLICS)^[17] of four or more and who underwent surgery. The patients with a history of malignancy, significant spinal cord injury outside the TLJ, chronic injury to the TLJ, neurological deficit due to injury to other parts of the spine, brain injury, osteoporotic fractures, former fracture of the spine, history of spinal surgery, and defects in files and patient imagings, were excluded from the study.

The patients that enrolled in the study were called for a follow-up examination. It should be noted that all of these patients were examined at least 1 year after surgery. In follow-up studies, all patients were evaluated based on neurological status (ASIA score) and imaging findings (kyphosis angle and fusion status). The 36-inch film long-standing radiography was used to check the kyphosis of the fracture area. The amount of kyphosis was calculated based on the Cobb method of a healthy vertebra above and below the damaged vertebra 00.^[1]

In a study on proximal junctional kyphosis (PJK), the sagittal Cobb angle should be more than 20° between the inferior endplate of the upper instrumented vertebra and the superior

endplate of two vertebrae above the upper instrumented vertebra.^[15]

The following criteria were also used to investigate the presence of fusion:

1. No motion or <3° of intersegment position change on lateral flexion and extension views
2. Lack of a lucent area around the implant
3. Minimal loss of disc height
4. No fracture of the instrument, bone graft, or vertebrae
5. No sclerotic change in the graft or adjacent vertebrae
6. Visible osseous formation in or around the cage.^[13]

All patient data were entered into particular forms based on the hospital files, electronic health documents, and clinical findings during follow-up and were analyzed by SPSS ver 23 software. Chi-square and *t*-test were used to analyze this data.

Written informed consent was obtained from all patients before they participated in the study, and ethical criteria were observed throughout the study.

RESULTS

A total of 273 patients (176 males and 97 females) with an average age of 43.5 ± 12.3 (21–73) years were studied. In 180 cases (65.9%), motor vehicle accidents were the most common cause of injury, followed by falls from heights and assault from other causes of injury [Table 1].

One hundred and ninety-eight patients (72.5%) had no neurological symptoms at admission. According to the TILCS rating, the mean score of these patients undergoing surgery was 5.6 ± 1.1 [Table 2]. Based on the above criteria, the kyphosis angle of these patients was calculated before surgery, and in 46 patients (16.8%), it was more than 25°.

The mean hospitalization in the patients was 7.58 ± 2.35 days. Forty-seven patients (17.2%) had surgery complications during their hospitalization, the most common of which was infection [Table 3]. Patients were re-examined 1 year after surgery. Improvement of the ASIA score was observed in 22 (29.3%) neurological defects patients. At the follow-up,

Table 1: Patients demographic data.

Variable	Frequency	Percentage
Gender		
Male	176	64.5
Female	97	35.5
Mechanism of Trauma		
Motor vehicle accident	180	65.9
Falling	55	20.1
Assault	28	10.3
Sport	3	1.1
Other	7	2.6

Table 2: TLICS score frequency.

TLICS	Frequency	Percentage
4.00	39	14.3
5.00	97	35.5
6.00	80	29.3
7.00	36	13.2
8.00	14	5.1
9.00	5	1.8
10.00	2	0.7

TLICS: Thoracolumbar injury classification and severity score

Table 3: Frequency of complications.

Complication	Frequency	Percentage
Infection	38	13.9
Venus thromboembolism	21	7.7
CSF leak	20	7.3
Neurological deficit	8	2.9
Other	23	8.4

CSF: Cerebrospinal fluid

the mean angles of kyphosis were 14.2 ± 6.1 in all patients, and this angle was 12.9 ± 4.9 and 20.2 ± 7.9 in patients who had $<25^\circ$ and $>25^\circ$ preoperative kyphosis, respectively. This difference was significant based on the *t*-test ($P < 0.001$). Evidence of no fusion was also observed in 22 patients (8.1%). Based on the available evidence and the above definition, 42 patients (15.3%) had some degree of PJK. According to the Chi-square test, no association between preoperative kyphosis and PJK and fusion was observed ($P > 0.05$).

DISCUSSION

The TLJ area refers to the T10 to L2 vertebrae, which is the most common area for fractures in the thoracic spine.^[23] Fractures of the TLJ region are about 90% of thoracic spine fractures.^[6,19] The TLJ is a transition point between the rigid part of the thoracic spine and the flexible part of the lumbar spine.^[20] Since the spinal cord terminates around the L1–L2 surface and the roots of cauda equina fill the space inside the canal, following the fracture of the spine in this area, different patterns of neurological symptoms may develop. Injuries to this area can cause paralysis of the lower limbs, pain, deformity, and decreased function.^[23] Furthermore, 25% of fractures are associated with nerve damage.^[8]

Fortunately, most spinal fractures are stable, do not require surgery, and are often cured with proper braces or hyperextension.^[23] The benefits of spinal fracture surgery include better correction of kyphotic deformity, greater stability, the possibility of direct and indirect decompression of neural elements, less need to use external immobilization, and faster return to work.^[19]

According to the previous studies, surgical indications based on the presence of canal compromise, neurological defects, reduction in body height, and the presence of kyphosis were used relatively.^[19] In a study by Reid *et al.*, the researchers concluded that patients harboring burst fracture with neurological defect or kyphosis angle $>35^\circ$ had to undergo surgery.^[14]

In 2005, Vaccaro *et al.* introduced a new classification for thoracolumbar fractures called TLICS. According to this classification, patients who receive a score of 3 or less do not need surgery; however, patients with a score of 5 or higher must undergo surgery. In cases where the patient's score is 4, the type of treatment is based on the surgeon's judgment.^[17,18]

This study assessed the radiological outcomes of patients with traumatic TLJ who underwent posterior approach fixation surgery. About one-third of patients had a follow-up neurological status assessment based on the ASIA score. In our study, the degree of preoperative kyphosis was directly associated with the follow-up kyphosis; the higher the degree of preoperative kyphosis, the higher the rate of follow-up kyphosis. However, this variable was not related to nonfusion and PJK. So far, few studies have explored the outcome of patients who suffered TLJ injuries. A retrospective study by Kraemer *et al.* showed that patients with kyphosis more than 25° had poorer outcomes.^[9]

Krompinger *et al.* found that about 36% of burst fractures in their follow-up examinations had changed more than 10° .^[10] This study also showed that a significant portion of patients has an increase in kyphosis during follow-up examinations, which highlights the importance of examining patients in the long term. Siebenga *et al.* showed that regardless of the clinical consequences, surgery is more cost-effective than conservative treatment in the burst fractures TLJ.^[16] Based on the long-term follow-up, our study showed that posterior spinal fixation is a safe and effective method for carefully selected individuals and is associated with relatively low complications and more satisfactory outcomes compared to conservative treatment.

Aoife Feeley *et al.* found that anterior approaches led to increase in the rate of complications.^[5] Frank De Stefano *et al.* showed that patients who underwent anterior fixation surgery had more complications and morbidity than posterior approach.^[3] In our study, rate of complications was low and had acceptable results.

CONCLUSION

According to the results of previous studies, in TLJ traumatic injuries, conservative treatment is associated with significant complications such as prolonged immobility, delayed return to work, higher chances of developing kyphosis, and less spinal stabilization. According to the general results and radiological

studies of follow-up in our study, it can be concluded that the posterior spinal fixation procedure is a low complication method and with an acceptable radiological outcome. Although kyphosis before surgery is a factor in developing long-term kyphosis, it is not associated with nonfusion and PJK. Although we evaluated the radiological outcome of these patients in this study, further studies are needed to determine the long-term clinical outcome in these patients.

Declaration of patient consent

Patients' consent not required as patients' identities were not disclosed or compromised.

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Conflicts of interest

There are no conflicts of interest.

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