



THORACIC AND LUMBAR SPINE FRACTURES: A RETROSPECTIVE STUDY

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ABSTRACT

Purpose: To analyze the existing medical literature on thoracic and lumbar spine fractures.

Material and Method: In this study, 41 patients with thoracic and lumbar fractures who were operated between 2007 and 2017 were retrospectively inspected. Posterior pedicle screw fixation, decompression, vertebroplasty, and fusion were performed in the patients. The patients were evaluated according to their age, gender, type and level of trauma, neurological state, surgery duration, stay duration in the hospital, and kyphosis angles. SPSS 21 was used for statistical analysis. Student's t-test was used to compare different variables. P values less than 0.05 was considered as significant.

Results: A total of 41 patients were enrolled in this study. The mean age was 50.60 ± 19.45 years (range: 15–87 years). Among the patients, 23/41 (56.11 %) were males and 18/41 (43.90 %) were females. The most common cause of thoracolumbar fracture was osteoporosis (14/41 patients, 34.15 %). The most frequently affected vertebra was vertebra L1 (14/41 patients, 34.15 %). Compression was the most common type of vertebra fracture (32/41 patients, 78.05 %). The mean duration of the operation was 189.37 ± 54.89 min (duration range: 125–330 min). The mean time of stay in the hospital was 6.39 ± 5.20 days (range: 3–35 days). Among the patients, 10/41 (24.39 %) had neurologic deficit. Screws were implanted in the fractured segment of 5 patients. Vertebroplasty was performed in 3 patients. The kyphosis angles of the patients at the preoperative stage were 20.1, at early postoperative stage 12.4, and at first postoperative year 13.1.

Conclusion: The major cause of thoracolumbar fracture was osteoporosis mostly affecting the elderly population. The most common type of thoracolumbar fracture was compression and the L1 was the mostly affected region. Our review cumulatively suggests that stabilization with posterior pedicle screw fixation is a surgical technique with good outcomes and minimal complications when performed under favorable conditions.

Key words: thoracic fracture, lumbar spine fracture, osteoporosis

Level of Evidence: Retrospective clinical study, Level III

INTRODUCTION

Thoracic and lumbar fractures constitute 6.9 % of all cases of blunt traumas admitted to the emergency clinic ⁽¹⁴⁾. Unstable thoracic and lumbar fractures are critical reasons for morbidity among cases of spinal fractures ⁽⁴⁾. Thoracic and lumbar fractures occur most commonly in the thoracolumbar (T10–L2) area. These fractures can be caused by high-energy trauma, such as traffic accidents, falls, work accidents, sports injuries as well as minor trauma in patients with

osteoporosis and malignity ⁽¹³⁾.

Stable fractures can be taken under control with the conservative treatment ⁽¹⁶⁾. However, unstable fractures can only be treated with surgery ⁽²⁸⁾. In case an unstable fracture is left untreated, it can progress to neurological damage, immobility, and deformity. The purpose of the treatment is to decompress the neural elements, protect the vertebra corpus heights, correct the deformity, assure stabilization, early mobilization, reduction of pain, facilitation in going

back to work, and improvement in the quality of life. Although the goal of the treatment is to protect the neural elements, no neurological damage has been reported in the majority of the patients⁽¹⁰⁾. Therefore, the goal of the present study was to reduce pain through extended stability and through facilitating daily activities by ensuring mobility. Presently, posterior stabilization is the most common surgical procedure in patients with thoracic and lumbar fractures. Endoscopic and radiological developments have created different alternative surgical routes, such as thoracoscopy and percutaneous stabilization. Methods such as short-segment posterior instrumentation, stabilization without fusion, and posterior fixation including the fractured vertebra have recently gained popularity. The existence of different alternatives makes it difficult to form a consensus about the management of thoracic and lumbar fractures⁽²¹⁾.

MATERIALS AND METHODS

A total of 41 patients with thoracic and lumbar fractures operated during 2007–2017 were retrospectively inspected. Data were collected from the patients' medical records. Posterior pedicle screw fixation, decompression, vertebroplasty, and fusion were applied to the patients (Figures 1–3). The patients were evaluated according to their age, gender, type and level of trauma, neurological state, duration of the operation, time of stay in the hospital, and kyphosis angles.

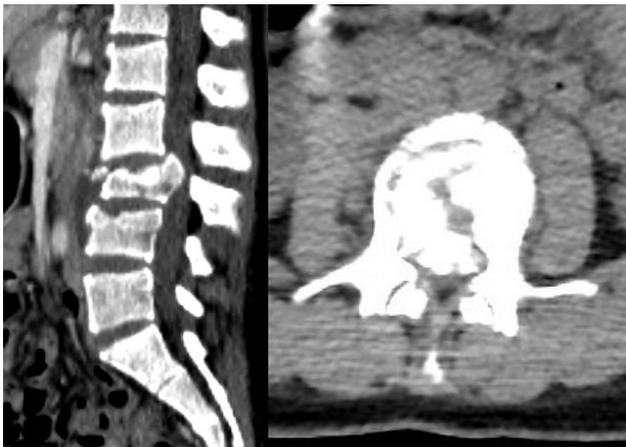


Figure-1. A 16-year-old patient had suffered falling from high. She complained of low back pain and was neurologically intact. Preoperative sagittal and axial computed tomography image of lumbar fracture.

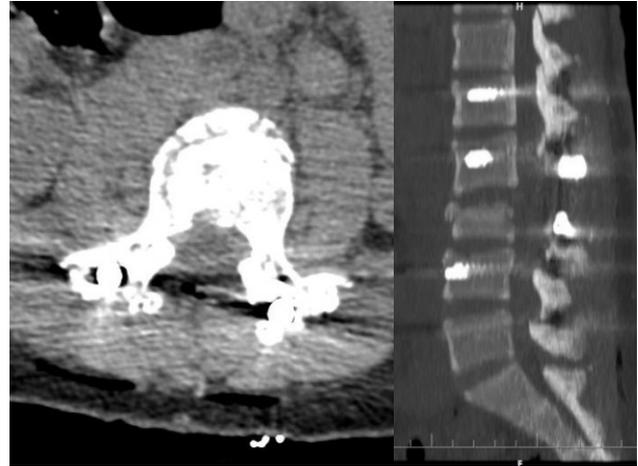


Figure-2. Postoperative sagittal and axial computed tomography image of lumbar fracture.

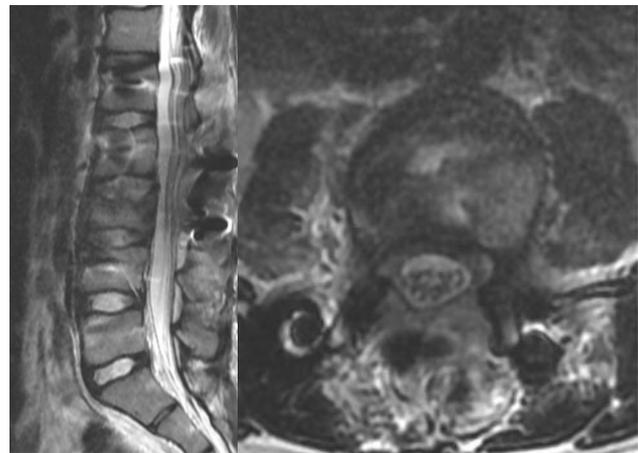


Figure-3. Postoperative sagittal and axial magnetic resonance image of lumbar fracture.

Statistical analysis:

Data was analyzed by SPSS 21 and presented in Mean (SD) and frequency (%). Continuous variables following the normal distribution were compared by independent t-test. Categorical variables were compared by χ^2 /Fisher's exact test. P value less than 0.05 was considered as statistically significant.

RESULTS

A total of 41 patients were enrolled in this study. The mean age was 50.60 ± 19.45 years (range: 15–87 years). Among the patients, 23/41 (56.11%) were males and 18/41 (43.90%) were females. The mean age of the females (57.05 ± 20.60 years) (range: 15–87 years) was significantly higher than the males (45.56 ± 17.30 years) (range: 17–79 years) ($p=0.01$). The most common cause of thoracolumbar fracture was osteoporosis

(14/41 patients, 34.15 %), followed by falls (12/41 patients, 29.27 %). The most frequently affected vertebra was vertebra L1 (14/41 patients, 34.15 %), followed by vertebra L3 (7/41 patients, 17.07 %). Compression was the most common type of vertebra fracture (32/41 patients, 78.05 %), followed by

burst fracture (8/41 patients, 19.51 %), and compression dislocation (1/41 patient, 2.44 %). The mean duration of the operation was 189.37 ± 54.89 min (duration range: 125–330 min). The mean time of stay in the hospital was 6.39 ± 5.20 days (range: 3–35 days) (Table-1).

Table-1. Demographic and clinical characteristics of patients (n=41). Data presented as Mean (SD) and frequency (%).

| Demographic and clinical characteristics of patients (n=41) | |
|--|--------------------|
| Age (Mean \pm SD) | 50.60 \pm 19.45 |
| Gender | |
| Male | 23 (56.11%) |
| Female | 18 (43.90%) |
| Cause of admission | |
| Falling down | 12 (29.27%) |
| Work accident | 6 (14.63%) |
| Traffic accident | 6 (14.63%) |
| Malignancy | 3 (7.32%) |
| Osteoporosis | 14 (34.15%) |
| Level | |
| D4 | 1 (2.44%) |
| D5 | 1 (2.44%) |
| D6 | 3 (7.32%) |
| D7 | 1 (2.44%) |
| D8 | 0 (0%) |
| D9 | 2 (4.88%) |
| D10 | 4 (9.76%) |
| D11 | 1 (2.44%) |
| D12 | 3 (7.32%) |
| L1 | 14 (34.15%) |
| L2 | 3 (7.32%) |
| L3 | 7 (17.07%) |
| L4 | 2 (4.88%) |
| L5 | 3 (7.32%) |
| Type of fracture | |
| Compression | 32 (78.05%) |
| Burst fracture | 8 (19.51%) |
| Compression dislocation | 1 (2.44%) |
| Additional surgery | |
| Screws at the fracture level | 5 (12.21%) |
| Vertebroplasty | 3 (7.32%) |
| Neurologic deficit | |
| | 10 (24.39%) |
| Duration of operation, min | 189.37 \pm 54.89 |
| Time of stay in the hospital, days | 6.39 \pm 5.20 |

The most common cause of thoracolumbar fracture in the females was osteoporosis (10/18 females, 55.56 %) while falls were the most common cause in the males (7/23 males, 30.43 %). Significantly higher number of females (55.56 %) were admitted due to osteoporosis as compared to the males (17.39 %) ($p=0.01$). The most frequently affected vertebra in both females (6/18, 33.33 %) and males (8/23, 34.78 %) was L1. Compression was the most common type of vertebra fracture in both females (15/18, 83.33 %) and males (17/23, 73.91 %). There was no significant difference in the mean duration of operation (186.33 ± 60.13 Vs. 194.44 ± 47.85 min, $p=0.28$) and mean time of stay in the hospital (7.26 ± 6.64 Vs. 5.27 ± 2.29 days, $p=0.06$) between the males and females (Table-2).

Since the most common cause of thoracolumbar fracture was osteoporosis, the patients with osteoporosis were compared with the patients without osteoporosis. Among the patients with osteoporosis, 4/14 (28.57 %) were males and 10/14 (71.43 %) were females. The mean age of the patients with osteoporosis (69.5 ± 13.42 years) was significantly higher ($p<0.0001$) as compared to the patients without osteoporosis (40.80 ± 14.15 years).

Among the patients, 10/41 (24.39 %) had neurologic deficit. The postoperative conditions of these patients with neurological deficit were better. Paraplegic-operated patients did not undergo any change. Screws were implanted in the fractured segment of 5 patients. Vertebroplasty was performed in 3 patients. The kyphosis angles of the patients at the preoperative stage were 20.1, at early postoperative stage 12.4, and at first postoperative year 13.1.

The fractures occurred most commonly by major trauma in the younger patients and by minor trauma in older patients. None of the patients required screw reposition due to malposition. No significant complications developed in

the early period. However, in the late-term, one patient who was operated for osteoporotic fracture had screw loosening. Loose screw and instrument were removed due to fusion in the fractured segment. Instrument was extended to one more segment and the screw system was strengthened with cement in another obese patient with osteoporosis due to pull out in the upper segment screws. In the early and late periods, the patients were examined both clinically and radiologically. The average follow-up duration after the surgery was 5 years, and it ranged from 1 year to 10 years. One patient was lost in the follow-up due to malignancy and two patients of ages 87 and 68 years were lost due to other reasons.

DISCUSSION

Thoracic and lumbar fractures are the important types of injury that affect the movement of patients. Fractures in this area can be classified according to their formation mechanisms as compression, burst, flexion-dislocation, and fracture-dislocation. Radiologically, the kyphosis angle of >30 degrees, the collapse of the vertebral body by >50 %, the contraction of the spinal canal by >50 %, and fractures causing fracture subluxation and dislocation are considered unstable⁽²⁵⁾.

The common treatment option for unstable fractures is surgery⁽²⁴⁾. The purpose of surgery in such cases is to stabilize the spinal system⁽¹⁶⁾. Stabilization with pedicle screw is a common technique that has been used for a long time. Anterior approach became an alternative to the posterior approach or was used in combination^(5,11). In the late period, anterior approach was used less frequently owing to the advantage of applying strengthening with cement and repositioning of the bone fragments via laminectomy and minimal facetectomy as well as due to fewer complications^(16,28).

Table-2. Gender wise comparison of demographic and clinical characteristics of patients (N:41)

| | Males (n=23) | Females (n=18) | p value |
|---------------------------------------|--------------------|--------------------|---------|
| Age (Mean \pm SD) | 45.56 \pm 17.30 | 57.05 \pm 20.60 | 0.01 |
| Cause of admission | | | |
| Falls | 7 (30.43%) | 5 (27.78%) | 0.85 |
| Work accident | 5 (21.74%) | 1 (5.56%) | 0.15 |
| Traffic accident | 5 (21.74%) | 1 (5.56%) | 0.15 |
| Malignancy | 1 (4.35%) | 2 (11.11%) | 0.41 |
| Osteoporosis | 4 (17.39%) | 10 (55.56%) | 0.01 |
| Type of fracture | | | |
| Compression | 17 (73.91%) | 15 (83.33%) | 0.47 |
| Burst fracture | 5 (21.74%) | 3 (16.67%) | 0.68 |
| Compression dislocation | 1 (4.35%) | 0 (0%) | NA |
| Duration of operation | 186.33 \pm 60.13 | 194.44 \pm 47.85 | 0.28 |
| Time of stay in the hospital | 7.26 \pm 6.64 | 5.27 \pm 2.29 | 0.06 |

Some studies have reported how short-segment fixation can give comparably good outcomes than that of long-segment fixation^(1,2,3,7,9 26). However, in the short-segment series, the average age is low and fractures due to osteoporosis are absent or fewer in number. Despite of the 55 % failure rate in the short-segment treatment, the operation is longer and there is more blood loss in the long segment. According to some articles, there is no significant difference in the results between short-segment and long-segment operations⁽²⁶⁾. Short segment can be applied to select cases^(22,27). In fact, a series of cases with screws in the fractured segment have been reported^(12,20). The same studies reported no difference in the results between cases with screws in the fractured segment and in those without screws in the fractured segment. In the present study, screw was put in the fractured segment in five (12.2 %) of the 41 cases. Minimally invasive techniques such as thoracoscopic techniques were used as an alternative^(8,18,23). Bone strengthening has been performed with transpedicular bone graft^(1,17,19). Some studies have described good outcomes with stabilization operations using pedicle screw without fusion but with bone graft⁽⁶⁻⁷⁾.

Majority of the spine fractures are localized to the thoracolumbar region⁽¹⁰⁾. The thoracolumbar region mostly involved is reported to be at T11 to L2 level as these regions are relatively weaker than the other parts of the thoracolumbar region⁽²⁴⁾. In the present study also, it was found that the most commonly affected vertebra was L1 in the patients.

The causes of thoracolumbar fracture depend on patient's age. It has been reported that in younger people, it requires high impact trauma to cause a fracture but in elderly individuals even a very low grade trauma can induce thoracolumbar fractures⁽¹³⁾. Consistent with these reports, in the present study we observed that the fractures occurred most commonly by major trauma in the younger patients and by minor trauma in older patients. These older patients had osteoporosis in common. In the present study, it was observed that the most common cause of thoracolumbar fracture in the females was osteoporosis (10/18 females, 55.56 %) while falls were the most common cause in the males (7/23 males, 30.43 %). The elderly women who have attained menopause are at high risk of developing osteoporosis and consequently are more prone to have thoracolumbar fracture even due to a low impact trauma. This can be explained by the observation that after menopause the hormone estrogen that keeps the bones strong and healthy falls sharply⁽¹⁵⁾. Twenty to forty percent of fractures are associated with neurologic injuries⁽¹⁰⁾. Consistently, in the present study, 24.39% patients had neurological deficit.

A limitation of our study was the small number of cases. Studies on more number of patients are required to provide

better objective results. Stabilization with posterior pedicle screw fixation surgical technique resulted in good outcomes and minimal complications when performed under favorable conditions. Although different methods have been developed, this method using posterior pedicle screw fixation continues to be the most common and reliable method.

CONCLUSION

This study suggests that the most common cause of thoracolumbar fracture was osteoporosis, the most common type of fracture was compression, and the most affected vertebrae was L1. Literature review suggests that stabilization with posterior pedicle screw fixation is a surgical technique with good outcomes and minimal complications when performed under favorable conditions.

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