

SURGICAL OUTCOME OF TRANSPEDICULAR FIXATION IN THORACOLUMBER FRACTURES

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Background: Development of transpedicular screw fixation techniques and instrumentation systems has brought short-segment instrumentation (fixation of one normal vertebra above and below an injured segment) into general clinical practice. The purpose of this study is to report the surgical outcome of thoracolumber fractures treated with short-segment pedicle instrumentation. **Methods:** A retrospective review of all surgically managed thoracolumbar fractures during two years was performed. The 84 surgically managed patients were instrumented by the short-segment technique. Patients charts, operation notes, preoperative and postoperative radiographs, computed tomographic scans, magnetic resonance imaging (MRI) was done. Neurological findings (Frankel functional classification), and follow-up records up to 6 months were reviewed. **Results:** Transpedicular fixation was performed in 84 cases including 52 male and 32 female with male to female ratio 1.6:1. Mean±SD of age was 40±13.75 years (range15–60). The level of injuries was different in different age groups. Outcome was assessed on Frankle grading. No patient showed an increase in neurological deficit. Most of the patients showed improvement to the next grade. Screw breakage occurred in 8 cases, bed sores in 16 cases and deep vein thrombosis in 3 cases. Misplaced screw in 5 cases. Eight cases got wound infection. **Conclusion:** Although long term follow-up evaluation needs to be verified, the short term follow-up results suggest a favourable outcome for short-segment instrumentation.

Keywords: Pedicle screw instrumentation, Thoracolumbar fracture, Short-segment, Fixation.

INTRODUCTION

Development of transpedicular screw fixation techniques and instrumentation systems has brought short-segment instrumentation (fixation of one normal vertebra above and below an injured segment) into general clinical practice.¹ After King² initially reported vertebral body screw fixation through the transfacet approach to the lumbar spine in 1944, Boucher³ introduced the way to place screws into the vertebral body through the pedicle in 1958. Since pedicle screw fixation became widespread, as described by Roy-Camille⁴ and others in 1963, pedicle screws have been used widely in diseases of the lumbar spine.⁵ The optimal management of thoracolumbar fractures continues to be a matter of controversy.^{6,7} The transpedicular short-segment construct represents an attempt to restore the anterior column without the need for anterior strut grafting or plate fixation, avoiding extensive arthrodesis of the motion segments. The use of pedicle screws, which can minimize the range of spinal segments to reduce damage to soft tissues and increase the rate of synostosis better than fixation using hooks and wires, expands the excellent functionalities of pedicle screws reported by studies.⁸ To date, various unfavourable results have been reported with this method.⁹⁻¹¹ Those who suggest temporizing treatments insisted that they could achieve satisfactory results only by treatments using postures and long-term relaxations.¹¹⁻¹⁴ However, others who suggest surgical treatment, patients could expect to become mobile early, perform rehabilitative remedies,

and improve, in most cases, nervous functions by using decompression and fixation.^{9,15} After temporizing treatments, there were many reports on degrading nervous functions, worsening spinal stenosis, increasing pressure on the vertebral body, increasing kyphosis and causing radiculopathy, and pain.^{10,16} This study evaluates surgical outcome from short segment pedicle screw fixation in 84 thoracolumbar spine fractures.

MATERIAL AND METHODS

A retrospective review was performed in all surgically managed thoracolumbar fractures on various clinical parameters such as age, sex distribution, and cause and levels of injury. Patients with thoracolumbar fractures from January 2007 to December 2008 were admitted in Neurosurgery Department, Lady Reading Hospital Peshawar. The short-segment transpedicular fixation was performed in 84 patients. Charts, operative notes, preoperative and postoperative radiographs, CT scans, MRI and follow-up records up to 6 months period were reviewed. Fractures were classified according to Denis¹⁰ (3-column classification). Neurological status was assessed using the Frankel grading for spinal cord injury. Indication for surgical intervention like decompression and fixation were: thoracolumbar fractures with neurological deficit, kyphosis of more than 20 degree, vertebral collapse more than 50% of body height, canal compromise more than 50%. Follow-up assessment was done by radiographs. Simple X-ray was performed to check the fractures. Computed

tomography and MRI were done for every patient to ensure accurate diagnosis of damage to the vertebra.

RESULTS

Transpedicular fixation was performed in 84 cases including 52 male and 32 female with male to female ratio 1.6:1 as shown in Figure-1. Mean±SD of age was 40±13.75 years (range15–60). The level of injuries were D11, 4 cases, D12 fractures 8 cases, L1 fractures 37 cases, L2 fractures 18 cases, D12 & L1, 14 cases and L3 only 3 cases Figure-2. Outcome assessed on Frankle grading was: grade A, 30 cases, grade B, 18 cases, grade C, 15 cases, grade D 20cases, grade E one case (Table-2).

The surgical procedure was fixation with decompression of neural elements. All patients were monitored and followed up to 6 months. Post operatively patients were assessed on Frankle grade as follows shown Table-2. Screw breakage occurred in 5 cases, Bed sores in 16 cases. DVT in 2 cases, misplaced screw in 8 cases and wound infection in 8 cases.

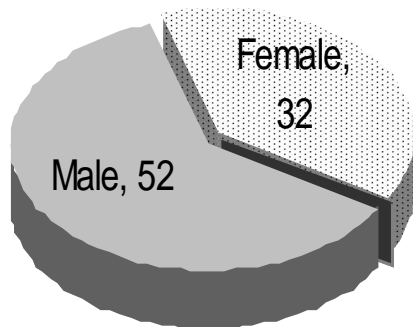


Figure-1: Shows incidence of male and female

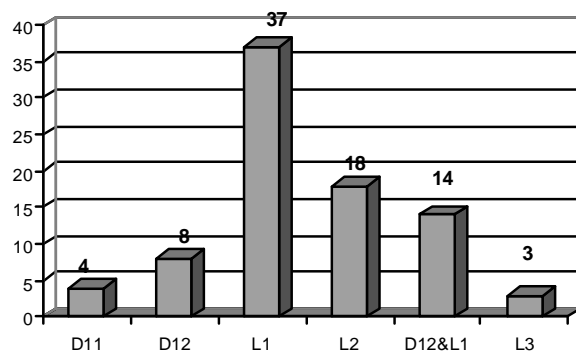


Figure-2: Level of Fractures at different levels

Table-1: Preoperative Frankle Grading of Patients

Frankle Grade	Nos.	%
A:	16	19.0
B:	18	21.4
C:	25	29.7
D:	17	20.2
E:	8	9.5

Table-2: Postoperative Frankle Grads of Patients

Frankle Grade	No.	%
A	30	35.7
B	18	21.4
C	15	17.8
D	20	23.8
E	1	1.1

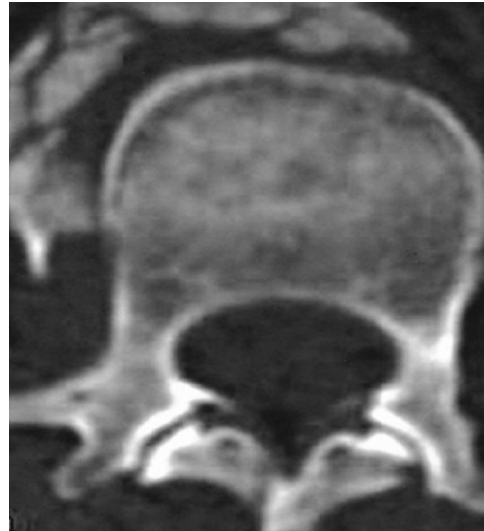


Figure-3: L1 fracture (unstable spine) preoperative

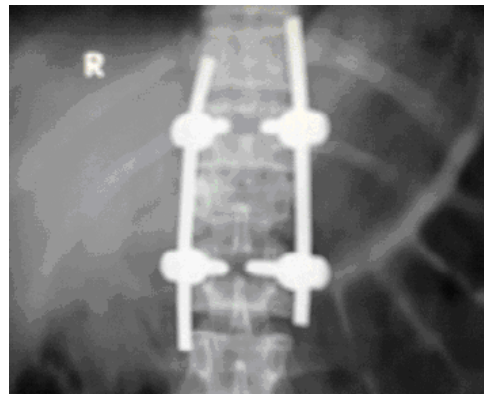


Figure-4: L1 compression fracture (Post Operative)

DISCUSSION

The purposes of treating vertebral fractures are to achieve early neurological restoration, overcome damaged spinal segments anatomically and accomplish firm and stable fixation for early rehabilitation¹⁷. Pedicle screw fixation of spinal fractures is performed as a basic treatment for thoracic and lumbar vertebral fractures and posteriorlateral synostosis in many hospitals.^{9,13,14,18,19} Sasso *et al* did clinical comparisons and analyses among Harrington rods, hooks, Luque rods, sublaminar wires and pedicle screws with 70 patients and found that pedicle screw fixation was a posterior fixation which could be applied to shorter segments than could other posterior fixation tools²⁰. Therefore, pedicle screw fixation is a good posterior fixation method suitable for this purpose.^{21,22} The main advantages of the dorsal approach in short segment fixation are that it preserves the motion segment, and is simple and familiar to spine surgeons but a recognized disadvantage is the difficulty in restoring the anterior column. Failure to restore the anterior column support can lead to secondary kyphosis, instability, pain and late onset neurologic deficit, depending primarily on residual load transfer capacity of the fractured vertebral body.^{16,22} Some reports have indicated that sagittal plane kyphosis was incurable using pedicle screw fixation in thoracic and lumbar fractures due to bone breakdown by the follow-up examination at 6 months.²⁰ However, this study demonstrated satisfactory results with no patient worsened neurologically after pedicle screw fixation.

Pedicle screws can be used both in the lumbar and thoracic vertebrae and are useful in severe fractures such as fracture dislocation. Documented reports indicated the infection rate as approximately 6%²³ after posterior fixation and synostosis, however, no infection was seen in this study. Humford *et al* reported that temporizing methods showed good results for patients with thoracic and lumbar segmented fractures without nerve damage.²⁴ However, Denis *et al.* found that patients with thoracic and lumbar segmented fractures without nerve damage could better return to their daily livings when they underwent surgical spinal fixation¹⁰, but these findings were not related to the radiographic findings. Significant bending of screws or hardware breakage were not encountered. Initial progressive osseous collapse was noted in a paraplegic patient, but without increasing pain.

Major advantages of surgical internal fixation over temporary treatments that early fixation make the patients mobile early, preventing nerve damage by stabilizing the spine.^{7,20} It protects

damaged structures from external forces while increasing the possibility of restoration of neurological disorders and to replace the damaged structures' with appropriate internal fixation tools.¹⁵ Frankel *et al* reported that treatments using postures would be enough and that it would be possible to make patients mobile after restoring their stability by long-term relaxation.²⁵

Jacobs *et al.* performed comparative studies between surgical methods and temporizing methods, and found that surgical methods were better than temporizing ones at overcoming fractures, restoring nervous functions, moving patients and decreasing complications.¹⁴ Burst fractures typically involve violation of the inferior and/or superior endplates, and therefore the deformity may progress by gradual settling of the discs into the fractured endplates and vertebral body. Farcy *et al* proposed that if the sagittal index exceeds 15 degrees, the biomechanical environment favours the progression of kyphosis)²⁶. There was one case of loss of kyphotic correction in an elderly osteoporotic patient. Therefore, in osteoporotic patients, certain principles should be considered, such as multiple segment fixations, accepting lesser degrees of deformity correction, and avoiding the instrumentation length within the kyphotic segment.^{22,27} Individual patient characteristic may affect the occurrence of adjacent segment degeneration.²⁸ Age was likely related to the decreased ability of the aged spine to accommodate the biomechanical alterations imposed by a fusion.²⁹ Aota *et al* observed that the incidence of adjacent segment degeneration was much higher in patients older than 55 years of age.^{1,30}

CONCLUSION

Transpedicular fixation is safe, technically easy and effective technique. Patients showed satisfactory synostosis and successful healing in virtual anatomic alignment without any complications. But, this study is limited by its short follow-up period.

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