

ORIGINAL RESEARCH

Evaluation of Effectiveness of Pedicle Screw Fixation for Thoraco-Lumbar Injuries

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ABSTRACT

Aims: To evaluate the effectiveness of pedicle screw fixation for thoraco-lumbar injuries.

Methods: In this prospective study thirty-eight patients of thoraco-lumbar spine injuries treated with pedicle screw fixation with or without laminectomy were evaluated. In all patient's posterior midline approaches were used for pedicle screw fixation. Pedicle screw inserted by free hand technique or by fluoroscopy visualization assistance. Functional outcome was assessed by Oswestry disability index (ODI).

Results: Out of thirty-eight patients, ten patients were caused by road traffic accidents, twenty patients caused by fall from height, and three patients caused by slip on floor. Majority of cases operated within 5 days of trauma. Duration of hospital stay was 5 to 15 days. Out of 17 patients in which laminectomy done for neurological loss, 13 patients were completely recovered without residual neurological deficit. Incomplete recovery in two cases. No neurological improvement in two cases of complete paraplegia. No cases of dural tear and post operative infection.

Conclusion: Pedicle screw fixation for thoracolumbar injuries achieved satisfactory results.

Key Words: Thoracolumbar Spine Injuries, Pedicle Screw, Rod.

INTRODUCTION

Pedicle screw fixation is currently well established and widely accepted modalities of internal fixation for thoraco-lumbar spine stabilization. It was first described by Boucher in 1950, used more extensively by Roy-Camille et al in 1960 & 1970. Although segmental fixation with wires, bands and hooks still plays a significant role, the biomechanical advantage of the pedicle screw fixation leads to an increased use of pedicle screw over time with or without trans-pedicular bone grafting.^{1,2}

Biomechanics- Pedicle screw fixation was designed to provide immediate stability, rigid immobilization, short segment fixation, early mobilization.³ Pedicle is the strongest site accessible through the posterior approach to perform three-dimensional rigid fixation of the vertebra using the pedicle screw. Transpedicular screw fixation provides high mechanical stability, correction maneuvers, does not require external immobilization. The possibility of a short, rigid stabilization overcomes the disadvantage of distraction type

implants like Harrington rod, which necessitate the inclusion of two or three segments above and below the injured vertebra.⁴

Now there is a tendency to perform a percutaneous pedicle screw insertion to reduce the soft tissue injury and to lower the chance of infection as compared to open technique. Accuracy of pedicle screw placement is a critical issue.⁵ Misplacement of screws can cause a variety of problems with minor or major consequences like motor weakness (paresis or paraplegia), radicular pain, sensory loss, vascular injury etc. Regardless of technique used for screw insertion, the surgeon should have a perfect understanding of spinal anatomy and insertion technique. Preoperative radiograph is perfectly evaluated for any deformity of spine.^{6,7}

MATERIALS & METHODS

This prospective study was conducted in the department of Orthopedics, S.K. Govt medical college, Sikar, from Nov. 2019 to April 2022. Total thirty-eight cases of thoracolumbar injuries treated with pedicle screw fixation with or without laminectomy were evaluated in this study.⁸ Surgery was performed in general or in spinal anesthesia. Posterior midline approaches were used in all cases. Spine should be exposed bilaterally to the tip of transverse process and superior articular process.⁹ The facet joint must be exposed with clean, soft tissue dissection.

Three techniques for screw placement in the pedicle are mostly used, these are

1. Free hand technique.^{10,11}
2. Fluoroscopy assisted and
3. CT based or fluoroscopy-based navigation technique.

We use fluoroscopy for most of the screw insertion. Entry point for pedicle screw identified that varies according to spinal level. Entry point for thoracic vertebra- the lower border of superior articular facet, the medial border of transverse process, and the pars interarticularis form a triangle, the center of that triangle is the entry point for pedicle screw.¹² For the lumbar spine- the entry point is located at the transection of pars interarticularis, transverse process, and the mammillary process.

Steps of screw insertion

Step 1. Entry site is decorticated with a rongeur or with aburr.

Step 2. Awl is used to penetrate the dorsal cortex of the pedicle.

Step 3. Curved or straight pedicle probe is used to develop a path for the pedicle screw into the pedicle and vertebral body.

Step 4. Pedicle sound is placed in the pedicle hole to make sure that there is not a medial, lateral, rostral or caudal cortical break.

Step 5. Pedicle screw tied into the hole with or without taping of hole. Placement of screw check with fluoroscopy assistance^{13,14}, then screw connected to each other with the help of rod. Desired level of distraction achieved with a distractor, and finally capscrew tied. All patients were evaluated in follow-up with antero-posterior and lateral X-rays of the spine.^{15,16} Patients followed up for one to two years. Functional outcome was assessed by Oswestry disability index (ODI).

RESULTS

Total thirty-eight patients were included in this study, out of which 25 patients were caused by fall from height or fall from tree, 10 patients caused by roadside accident and remaining 3 patients caused by slip on floor. There were 31 male (81%) and 7 (19%). Age ranges from 23 to 65 years. Mean follow up for 6 months. Out of thirty-eight patients, 17 patients have neurological deficit in the form of paraparesis or paraplegia at the time of admission. Majority of patients operated within 5 days of injury. Average operative time was 60 min. Only pedicle fixation done in 20 cases (without laminectomy). Pedicle fixation with

laminectomy done in 15 cases. Pedicle fixation with laminectomy and transpedicular bone grafting done in two cases. Long segment fixation with osteotomy and bone grafting done in one case. Total 190 pedicle screws applied in thirty-eight cases. Out of 17 patients which suffer from neurological deficit, complete neurological recovery was found in 13 cases without residual neurological deficit. Incomplete recovery in two cases, but they walk with the help of foot drop splint and stick support. No neurological improvement in two cases of complete paraplegia. No case of postoperative neurological deterioration. No cases of dural tear/postoperative CSF leakage, pseudomeningocele formation, CSF fistula formation. No cases of postoperative infection, implant failure (broken implant), bed sore. Implant loosening found in one case. Postoperative back pain occurred in some cases for initial eight to ten weeks which subsided after taking analgesics.

Table 1: Functional evaluation by Oswestry disability index (ODI)

Interpretation of scores	Frequency	Percentage
0% to 20%: minimal disability	34	90
20%-40%: moderate disability	02	05
41%-60%: severe disability	—	—
61%-80%: crippled	02	05
81%-100% bed-bound patients	—	—

DISCUSSION

Relative indications are—Surgery aims to provide a stable vertebral column to allow early mobilization and optimize neurological outcome without any complication. The results of our study are comparable to other studies that support the effectiveness of our fixation method. Pedicle screw fixation provides short, rigid segmental stabilization that allows preservation of motion segments and stabilization of spine in the absence of intact posterior element which is not possible with non-pedicular instrumentation. The average age of patients in our study is 40 yrs (range from 23 to 65 yrs). In our study 81% of patients were male and 19% patients were female. Out of thirty-eight patients, 17 patients have some degree of neurological deficit at the time of admission. Neurological, functional and quality of life were improved after surgery. Conservative treatment may lead to more complication as compared to pedicle screw fixation eg. incomplete neurological recovery, chronic back pain, bed sore etc.

Indication for surgery- Absolute indication are-¹⁸

- Unstable injury- gross instability with disruption of the posterior column.
- Complete spinal cord injury

Relative indication are-

- Incomplete spinal cord injury.
- Unstable spinal cord injuries where risk of progressive kyphosis anticipated.

Early decompression (within 24 hrs of injury) is preferred over late decompression. Even if surgery cannot reverse the damage to the spinal cord, surgery may be needed to stabilize the spine to prevent future pain and deformity. 13 cases (76%) recovered completely after fixation and laminectomy without residual neurological deficit, incomplete recovery in two cases (12%), and no neurological improvement in two cases (12%), this shows effectiveness of pedicle fixation in thoracolumbar injuries with neurological deficit.¹⁹ No cases of postoperative neurological deterioration, CSF leakage, CSF fistula formation, postoperative infection or bed sore found.^{20,21} 90% of patients show excellent results according to the Oswestry disability index (ODI). 5% of patients show moderate results and the remaining 5% show poor results.

CONCLUSION

Pedicle screw fixation for thoraco- lumbar injuries achieved satisfactory results with short rigid segmental stabilization that restore the vertebral height, preservation of motion segment and stabilization of all three column of injured vertebra, decrease the risk of back pain and early restoration of the functional life.

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