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Case Report

Unstable Lumbar Fracture-Dislocation Treated by Long Segment Posterior Pedicle Screw Instrumentation

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ABSTRACT

Background: Among all the thoracolumbar fractures, 50-60% affects the thoracolumbar transitional zone, and 51% AO Type C Fractures has a neurological deficit. We experienced treating a case of unstable lumbar fracture-dislocation treated with long segment pedicle screw instrumentation.
Case: A 26-year-old man came to the ER after his back hit by a canopy while working 2 hours before admission. The motoric function was diminished from the L2-S1 level and hypoesthesia at the T12 level. Plain X-Ray showed Fracture-Dislocation Lumbar Vertebral 1-2 Denis Classification Flexion Rotation (AO Type C) ASIA A. The patient underwent reduction, decompression, and long-segment posterior pedicle screw instrumentation.
Discussion: The surgery's primary purpose is to restore alignment and stability to improve the patient's quality of life by enabling daily activity in a wheelchair without significant pain. Short segment or long segment pedicle screw instrumentation remains a debate. In this case report, we apply long segment pedicle screw instrumentation for lumbar vertebral fracture-dislocation.
Conclusion: Thoracolumbar fracture and dislocation fixation aim to restore alignment and stability, to reduce kyphotic deformity, and to decompress the spinal canal. The long segment pedicle screw instrumentation can resist the deforming force of thoracolumbar fractures and dislocations that will inevitably collapse into further kyphosis, resulting in a better outcome.

Keywords: Fracture-dislocation; Lumbar; Spine; Human and Medicine

INTRODUCTION

Identification of spinal cord injuries on the initial evaluation of trauma is still challenging because it is often in a state of loss of consciousness or under analgesic or sedative. Early detection of spinal cord injury in the emergency department is vital as an initial diagnostic to prevent further damage to the spinal cord.[1,2]

The incidence of thoracal and lumbar fractures is 30% - 50% of all spinal cord injuries. Fractures at the thoracolumbar junction are the most common and occur at T11-L2 levels. The incidence of thoracolumbar fracture in blunt trauma patients is 6.9%. Meanwhile, 26.5% of patients who sustain a thoracolumbar fracture also experience spinal cord injury.[3]

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Neurological deficit is associated with fracture morphology due to high energy trauma that follows in vertebral fracture-dislocation. A study by Knop et al. showed the incidence of neurological deficit ranged from 22% to 51% depending on the fracture type (22% in type A, 28% in type B, and 51% in type C fractures, according to the AO classification).[4]

The lumbar spine fracture and dislocation often occur in thoracolumbar junction due to the transitional zone from a relatively rigid thoracic segment to a more flexible lumbar segment. Fracture and dislocation in the thoracolumbar area involve all vertebral columns and a high rate of neurological deficits and are often indicated for surgery.[5] This case report describes the surgical management in a patient with fracture-dislocation of the lumbar spine using long-segment instrumentation for a trauma case.

CASE REPORT

A 26-year-old man came to the ER after his back hit by a canopy on his back in bending position 2 hours before admission. The primary survey and secondary survey were clear. Physical examination showed deformity in the thoracolumbar region. Swelling, tenderness, step off, and limited range of motion was found (Figure 1). The neurological examination showed that motoric function was diminished from the L2-S1 level and hypoesthesia at the T12 level. The anal sphincter tone decreased, and the bulbocavernosus reflex was absent.

Thoracolumbar X-ray (Figure 2) and CT-scan (Figure 3) showed fracture-dislocation in the first and second lumbar spine. The patient was assessed with Fracture-Dislocation Lumbar Vertebral 1 – 2 Dennis Classification Flexion Rotation (AO Type C) ASIA A.

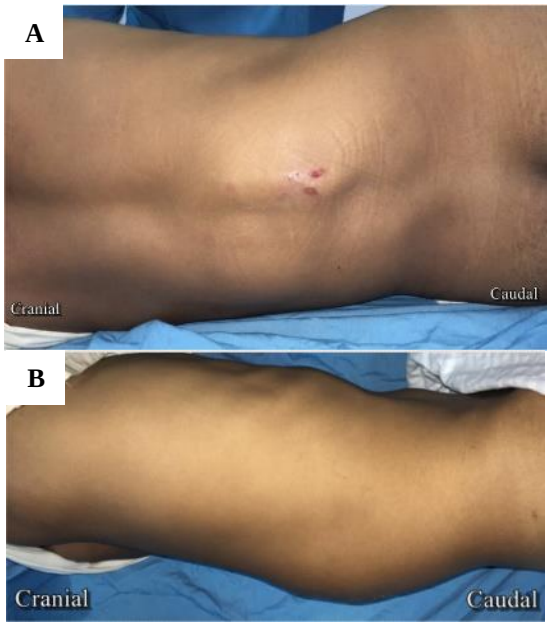

Figure 1. (A) Clinical picture from a posterior view (B) Clinical picture from a lateral view.

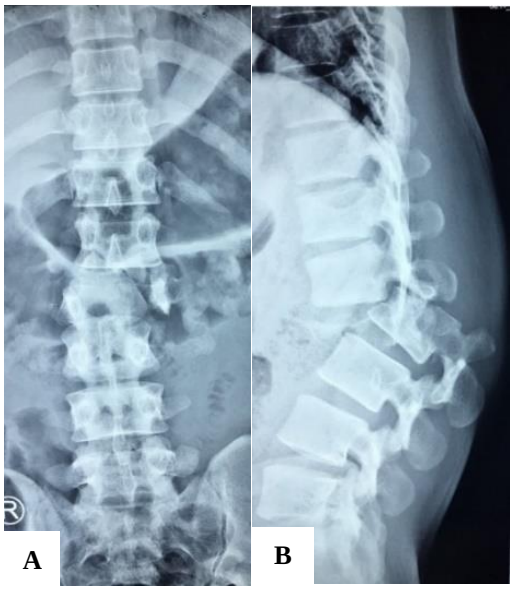

Figure 2. (A) AP View Thoracolumbal Xray (B) Lateral View Thoracolumbal Xray.

Figure 3. CT scan of the thoracolumbar spine (A) Axial Plane; (B) Sagittal Plane; (C) Coronal Plane.

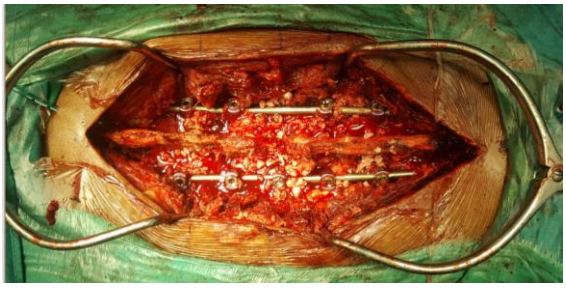

Figure 4. Intraoperative clinical picture.

Figure 5. Post-Operative X-Ray evaluation (A) Antero-Posterior View; (B) Lateral View.

The patient underwent reduction, decompression, and posterior pedicle screw instrumentation (Figure 4). We found fracture and dislocation of the L1 and 2 (flexion rotation) and the spinal cord's total rupture. Pedicle screws and rods were inserted at T12 and L1-L4 levels (Figure 5). The short-term post-operative follow up showed no early complications related to surgery, and the patient could do early mobilization. The patient was discharged from our institution with a TLSO brace and did mobilization in a wheelchair.

DISCUSSION

A 26-year-old male with a mode of injury-hit by a canopy while working. In young patients, thoracolumbar fractures are often caused by high energy trauma. In contrast, at older ages, fractures in this region are usually caused by low energy trauma, for example, falling from standing to sitting position.[3,5]

From the physical examination, we found the lumbar deformity and swelling in the thoracolumbar region. The patient also complained about back pain, and he was unable to feel and move his legs at all. Most thoracolumbar fractures occur at levels of T11-L2. In the adult spine, the thoracolumbar segment represents a transitional zone from a relatively rigid segment on the thoracic segment to a more flexible lumbar segment.[3] Then, the AP and lateral thoracolumbar X-ray examination showed a fracture on the superior endplate of the Lumbar 2 vertebra. Besides, we also found dislocation and rotation of the L2 against the L1 Vertebra.

The patient underwent reduction, decompression, and long-segment posterior pedicle screw instrumentation. The purpose of surgical management is not only limited to restore alignment and decompression of fracture but also to achieve a painless stable spine. Due to the severity of spinal cord injury, there is no guarantee for restoring the neurological function. In this situation, the surgery aimed to improve the patient's quality of life by enabling daily activity in a wheelchair without significant pain.[5–7] The surgical approach and instrumentation selection should be individualized for each patient because many factors influence treatment choice.[8,9]

Among a variety of surgical techniques, the posterior transpedicular screw fixation is the most commonly used.[10] Transpedicular short segment fixation has often been carried out. This modality requires one pedicle screw superior and one inferior to the fracture site. In many studies, short segment instrumentation show to be useful for flexion-distraction injuries and a few other selected fractures. The short segment pedicle screw instrumentation is the most widely used technique for treating thoracolumbar and lumbar fractures worldwide.[11]

Another way that can be used is more extended instrumentation to reduce the burden of each screw. The long segment pedicle screw instrumentation gives fixation with two segments above and two segments below the fracture site. This technique promises lower implant failure rates, but it decreases the vertebrae's mobility and increases back pain risk after surgery.[9]

Extending fusion of the lower lumbar spine changes biomechanics and cause patients to experience back pain and subsequent degeneration. Long segment instrumentation should end at or above the L3 vertebral levels to minimize the risk of early degeneration of the L4-L5 and L5-S1 segments. Fixation construction is often extended by inserting the hook or intermediate screw installed above the fracture and just below the upper fixation point, either distracted cranially to produce ligamentotaxis or compressed caudally to capture and load anterior strut or cage. With the upper and lower fixation points locked in place to neutralize the entire instrumentation length, these intermediate hooks or screws are embedded segmental disorders in fractures to increase vertebral height and indirectly decompress the spinal canal but cannot distract the spine excessively.[11]

Li et al. conducted a meta-analysis to compare the use of long segment versus short-segment instrumentation for treating thoracolumbar burst fracture. The study shows that the long segment pedicle screw instrumentation is superior in implant failure rate, anterior body height loss, cobb's angle, kyphotic angle, and restoration ratio of the compromised canal. Meanwhile, the complication rate, blood loss, and Sagittal Index of the two-groups show no significant difference.[10]

Even though Raheem's study suggested that long segment pedicle screw instrumentation is better than the short segment in treating burst fracture, the short segment showed failure in correcting the kyphotic angle in patients after a long period follows up. The study also demonstrated that short segment pedicle screw instrumentation has the superiority of its duration and the blood loss during the operation. This research also teaches us that the short segment also has a higher risk of implant failure and screw dislodgement.[12]

The decision to choose long or short segment instrumentation depends individually on the surgeon's judgment concerning fracture level, soft tissue integrity, anterior column integrity, and the surgeon's comfort with the instrumentation technique.[11,12]

CONCLUSION

The purpose of thoracolumbar fracture and dislocation fixation is to restore alignment and decompression of fracture and achieve a painless stable spine. The long segment pedicle screw instrumentation can resist the deforming force of thoracolumbar fractures and dislocations that will inevitably collapse into further kyphosis, resulting in a better outcome.

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