

Minimally Invasive Surgery for Traumatic High-Grade Lateral Spondylolisthesis of L1 with Multiple Spinal Fractures: Closed Reduction and Internal Fixation Using Percutaneous Pedicle Screws

Abstract

Background: Traumatic high grade lateral spondylolisthesis at the thoracolumbar junction is an extremely severe injury caused by high-energy trauma, commonly resulting in polytrauma. The treatment of this pathology is challenging, and even death following surgery has been reported. Therefore, it is necessary to focus on making surgical invasion minimal. **Methods:** A 53-year-old female fell from a height and presented with severe back pain and complete paralysis below L1. Computed tomography (CT) showed a Grade 4 traumatic lateral spondylolisthesis and severe comminution of L1, and mild compression fractures at T9 and L3. **Results:** First, we performed posterior surgery on the day of the injury to reduce the fracture and stabilize the spinal column using percutaneous pedicle screws (PPS). Twelve days later we resected the L1 vertebral body and inserted a cage with an iliac bone graft using an anterior approach. The estimated blood loss from posterior and anterior surgeries was 320ml and 200ml, respectively. Bony fusion was achieved as seen on CT at the 1-year follow-up. **Conclusion:** A 2-stage combined posterior-anterior approach using PPS can be performed less invasively, enabling adequate reduction, internal fixation, and anterior reconstruction for patients with high grade traumatic lateral spondylolisthesis without spinal shortening or facet interlocking.

Keywords: Combined posterior–anterior approach, lateral spondylolisthesis, minimally invasive surgery, percutaneous pedicle screws, thoracolumbar fracture

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Introduction

Traumatic high-grade lateral spondylolisthesis at the thoracolumbar junction is an extremely severe injury caused by high-energy trauma, commonly resulting in polytrauma.^[1,2] The treatment of this pathology is challenging, and even death following surgery has been reported.^[1] Therefore, it is necessary to focus on making surgical invasion minimal. Here, we report treatment of a case of traumatic high-grade lateral spondylolisthesis with multiple spinal fractures using percutaneous pedicle screws (PPS).

Technical Note

A 53-year-old female fell from a height and presented with severe back pain and complete paralysis (Frankel A) below L1. Computed tomography (CT) showed a Grade 4 traumatic lateral spondylolisthesis and severe comminution of L1 and

mild compression fractures at T9 and L3 [Figure 1a-c]. Other than the spinal injury, the patient had bilateral rib fractures and a pneumothorax [Figure 1a and b], and a thoracostomy tube was inserted. We planned a 2-stage posterior–anterior surgery. First, we performed posterior surgery on the day of the injury to reduce the fracture and stabilize the spinal column. Displacement of the fracture was reduced to Grade 3 spondylolisthesis by pushing the left thoracic cage to the right with the patient in the prone position. After placing PPS at T8 to L5, except for the fractured vertebrae (T9, L1, and L3), we reduced displacement of the fracture by assembling a 5.5 mm titanium rod from T8 to L5 bilaterally. Postoperative images demonstrated appropriate vertebral alignment [Figure 2]. Twelve days later, we resected the L1 vertebral body and inserted a cage with an iliac bone graft

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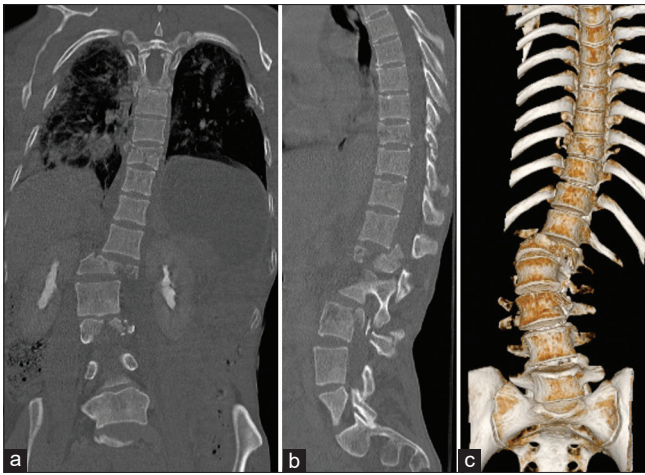


Figure 1: Computed tomography at the initial visit to our hospital. (a) Coronal image. (b) Sagittal image. (c) 3D image

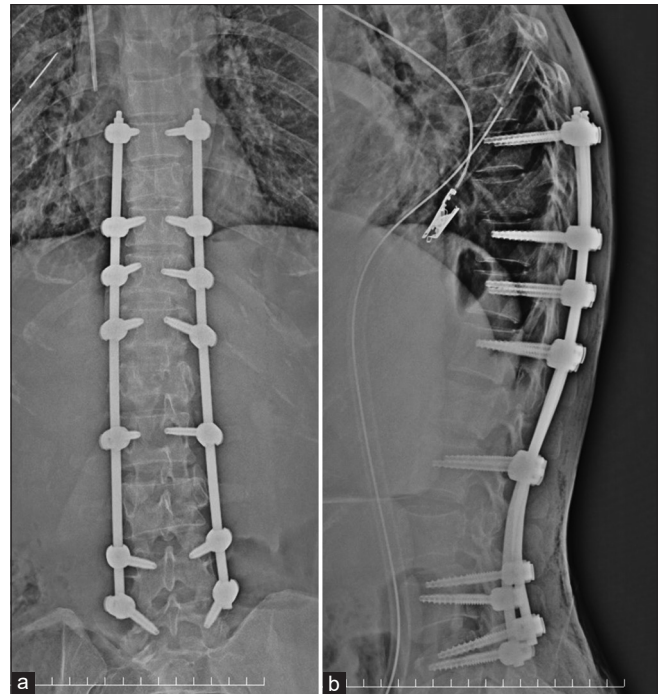


Figure 2: Postoperative X-ray images after posterior surgery. (a) Frontal view. (b) Lateral view

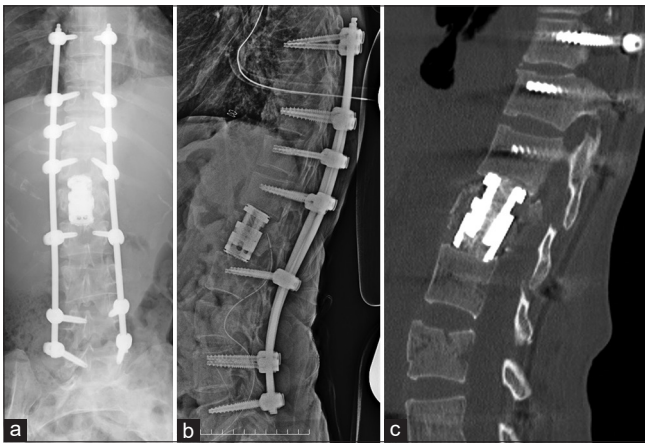


Figure 3: Postoperative images after anterior surgery. (a) Frontal view. (b) Lateral view. (c) Sagittal computed tomography image

using an anterior approach [Figure 3]. The estimated blood loss from posterior and anterior surgeries was 320ml and 200ml, respectively. Bony fusion was achieved as seen on CT at the 1-year follow-up, and we removed the posterior instrumentation. Neurological improvement to Frankel C was evident.

Discussion

Intraoperative blood loss during surgery for traumatic thoracolumbar fracture cannot be ignored, especially in the early acute phase of surgery.^[3] Excessive intraoperative blood loss can worsen the general condition.^[4] The use of PPS for fixation of traumatic thoracolumbar fracture has been found to result in less visible intraoperative blood loss than conventional open surgery.^[5] However, to the best of our knowledge, all reported cases with traumatic high-grade lateral spondylolisthesis have been treated using open surgery.^[1,6,7] Open reduction and internal fixation using spinal instrumentation are needed for traumatic high-grade lateral spondylolisthesis with spinal shortening or facet interlocking.^[8,9] Because

the present case involved severe comminution of the vertebral body without spinal shortening, the fracture was easily reduced and stabilized by adapting the use of PPS to the rods. PPS, having extended threads on polyaxial screws, can function as reduction screws. Therefore, as with open surgery, we were able to reduce the dislocation successfully using PPS and a rod system. The present case involved polytrauma with thoracic injury. Early spine damage necessitated surgery to control further damage.^[10] Using PPS, blood loss was small, even though long posterior stabilization from T8 to L5 was performed on the day of the injury. There were no complications or worsening of the patient's general condition postoperatively. Thus, ideal spine damage control was achieved using PPS.

There are some disadvantages to posterior surgery using PPS, such as difficulty in bone grafting. Anterior spinal reconstruction is needed for cases with severe comminution of the vertebral body.^[11] Therefore, we grafted bone by inserting an expandable cage for anterior reconstruction. Because damage control was achieved by prior posterior stabilization, the amount of blood loss from the anterior approach was small. A 2-stage combined posterior–anterior approach using PPS can be performed less invasively, enabling adequate reduction, internal fixation, anterior cage and bone insertion, and fusion for patients with high-grade traumatic lateral spondylolisthesis without spinal shortening or facet interlocking.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given her consent for her images and other clinical information to be reported in the journal. The patient understands that her name and initials will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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