

Percutaneous Pedicle Screw Fixation for Thoracolumbar Fractures

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KEYWORDS

- Thoracolumbar fractures • Thoracic fractures • Lumbar fractures • Minimally invasive spine surgery
- Percutaneous pedicle screws

KEY POINTS

- A thorough knowledge of the current classification system is key to successful management of various thoracolumbar fractures.
- Percutaneous pedicle screw fixation is an option for a wide variety of thoracolumbar fractures in patients who are neurologically normal and do not require decompression of neural elements.

INTRODUCTION

Percutaneous spinal techniques have gained wide popularity in the degenerative spinal arena over the past 2 decades. Supported by an immense and still growing amount of evidence, the main principle of avoiding unnecessary muscle dissection and tissue disruption¹ translates into faster recovery, decreased blood loss, decreased complications, shorter hospitalization, and improved cost-effectiveness when compared with traditional open surgical techniques,^{2–7} obviously without compromising efficacy and long-term outcome.

In parallel, percutaneous pedicle screw fixation has been gaining popularity in the management of a variety of thoracic, thoracolumbar junction, and lumbar fractures.^{8–12} With goals beyond sparing muscle and tissue disruption, percutaneous surgery for spinal fractures offers the option of internal fixation, stabilization, and fracture healing while sparing fusion and maintaining motion at

the segments above and below the fracture. To date, clinical studies have shown that instrumentation without fusion in the treatment of thoracolumbar burst fractures is viable.¹³ Thoracolumbar burst fractures with fusion in 37 fractures and without fusion in 36 fractures did equally well at 5 years' follow-up. Operative time and blood loss were less in the nonfusion group, and the operative time was shorter. There was no hardware failure in the nonfusion group. Both groups showed improvement in kyphosis and neurologic performance.

In general, the immediate goals of treating any spinal fracture include the achievement of spinal stability with anatomic or near anatomic alignment, and the ability to expedite patient mobilization. Long-term goals include healing of the fracture with maintenance of alignment, avoidance of posttraumatic kyphosis, and, if possible, sparing motion at the segments above and below the fracture.¹⁴

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CLASSIFICATION OF THORACOLUMBAR SPINE FRACTURES

An in-depth knowledge of the current and popular systems that classify spinal fractures is of utmost importance. The first step in the management of thoracolumbar fractures requires the ability to differentiate between stable fractures that can be treated safely with or without bracing, and unstable fractures that require operative intervention. The second step in the decision making requires the selection of the appropriate surgical technique and approach (or approaches) in fractures that require operative intervention.

One classification that has stood the test of time because of its ease of use and applicability is the one devised by Denis¹⁵ that divides the spine into 3 columns: anterior, middle, and posterior. Based on this and other classification systems that take into account the integrity of the posterior ligaments, neurologic state, and persistent pain, the Iowa algorithm has been successfully used at the authors' institution (Fig. 1).¹⁶ This classification simply identifies 4 types of fractures based on the Denis columns involved. Compression fractures, also known as flexion compression fractures, involve the fracture of the anterior column. These injuries are usually treated conservatively with or without bracing. Two-column injuries, also known as burst fractures, occur because of axial loading and involve fractures of the anterior and middle Denis columns. Identification of instability in this category is more challenging and is based on the neurologic state, degree of kyphosis, and disruption of the posterior ligamentous complex. When operative treatment is required it might require anterior column reconstruction, as explained later. Three-column injuries include fracture dislocations and flexion (or extension) distraction injuries. These fractures are inherently clinically and

biomechanically unstable, and always require operative internal fixation.

FRACTURES TREATABLE BY PERCUTANEOUS PEDICLE SCREW FIXATION

Percutaneous pedicle screw fixation provides an appropriate option to internally fix a spinal fracture until the healing of the fracture takes place. Fractures most suited for minimally invasive surgery (MIS) instrumentation are intact with or without pain. Obviously a fracture that lends itself as treatable by MIS is one that does not require reduction or decompression (Magerl type A1, A2, and some A3 fractures, and Thoracolumbar Injury Classification and Severity [TLICS] score <5). Fractures with disruption of the posterior ligamentous complex without subluxation or dislocation (some Magerl type B fractures) are also suited for percutaneous screw fixation (Fig. 2). Fracture dislocations that are irreducible percutaneously because of locked facets require open reduction. Fractures such as bursts with bone in the canal and neurologic deficit (TLICS score >5) also require open decompression.

After fracture healing or union takes place, the surgeon has the option to remove the screws without compromising alignment, and hence maintain the mobility of segments cranial and caudal to the fracture. Most investigators agree that the appropriate time for hardware removal is after 9 months to 1 year following the injury and operative fixation.

TECHNIQUE FOR PERCUTANEOUS PEDICLE SCREW PLACEMENT

The fractured level is identified using C-arm fluoroscopy. The anteroposterior (AP) view is then used. A good AP image would show the spinous

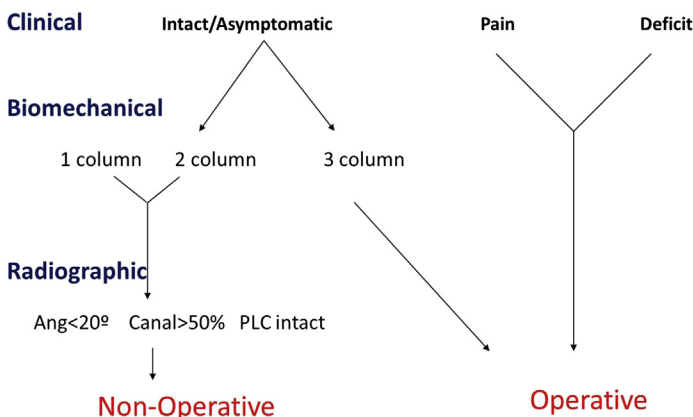


Fig. 1. Iowa algorithm for the management of thoracolumbar fractures. PLC, posterior ligament complex.

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