



## IMPROVEMENT OF FRACTURES OF THE LOWER THORACIC AND LUMBAR SPINE USING TRANSPEDICULAR OSTEOSYNTHESIS

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**ABSTRACT.** Fractures of the lower thoracic (T10–T12) and lumbar (L1–L5) spine are common injuries that may result in spinal instability and neurological deficits. Transpedicular osteosynthesis has emerged as an effective surgical technique for stabilizing unstable fractures, restoring spinal alignment, and facilitating early mobilization. This article reviews the principles, indications, surgical technique, and clinical outcomes of transpedicular fixation for lower thoracic and lumbar spine fractures.

### Introduction

The lower thoracic and lumbar spine is particularly vulnerable to traumatic injuries due to its biomechanical characteristics, combining rigidity in the thoracic region with mobility in the lumbar region. Unstable fractures in this area can lead to vertebral body collapse, deformity, and neurological compromise. Conservative treatment is often insufficient for unstable injuries, making surgical stabilization necessary. Transpedicular osteosynthesis, a technique involving pedicle screw and rod fixation, provides rigid stabilization while preserving motion segments.

### Epidemiology

Lower thoracic and lumbar spine fractures represent approximately 50–60% of spinal injuries. High-energy trauma, such as falls from height, motor vehicle accidents, and sports injuries, are the leading causes in young adults. Osteoporotic fractures in elderly populations can also compromise vertebral stability. The male-



to-female ratio is higher among young adults due to occupational and activity-related risk factors.

### **Mechanism of Injury**

Common mechanisms include:

1. **Axial compression** – leading to burst fractures
2. **Flexion-distraction** – associated with seatbelt injuries or sudden bending forces
3. **Rotational or translational forces** – causing fracture-dislocations with significant instability
4. **Low-energy osteoporotic fractures** – common in elderly patients

### **Transpedicular Osteosynthesis: Principles and Indications**

- Pedicle screws are inserted into the vertebral pedicles above and below the fracture site.
  - Rods connect the screws, creating a stable construct that allows for spinal alignment restoration and load sharing.
  - The technique provides immediate stabilization, enabling early mobilization and rehabilitation.
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- Unstable compression or burst fractures
  - Fracture-dislocations with or without neurological deficit
  - Progressive deformity or kyphosis
  - Failure of conservative treatment

### **Surgical Technique**



1. **Preoperative planning** – Imaging with CT and MRI to assess fracture morphology, pedicle integrity, and neural compression.
2. **Patient positioning** – Prone position on a radiolucent table.
3. **Pedicle screw insertion** – Screws are inserted bilaterally above and below the fracture using fluoroscopic guidance.
4. **Rod placement and reduction** – Rods connect screws, restoring vertebral height and sagittal alignment.
5. **Decompression (if necessary)** – Laminectomy or discectomy performed in cases with neural compression.
6. **Closure and postoperative care** – Drain placement if needed; early mobilization encouraged within days post-surgery.

### Clinical Outcomes

Studies indicate that transpedicular osteosynthesis provides:

- Effective stabilization of unstable fractures
- Restoration of sagittal alignment and vertebral height
- Reduced risk of post-traumatic kyphosis
- Favorable neurological recovery in patients with incomplete deficits
- Early ambulation and shorter hospital stay

Complications are relatively low but may include screw malposition, infection, or adjacent segment degeneration.

### Discussion

Transpedicular osteosynthesis has become the gold standard for unstable lower thoracic and lumbar spine fractures due to its biomechanical strength and minimally invasive possibilities. Modern navigation and intraoperative imaging



have further improved screw placement accuracy, reducing complications. Compared with anterior approaches, posterior transpedicular fixation avoids the morbidity associated with thoracoabdominal surgery.

### Conclusion

Transpedicular osteosynthesis is an effective method for improving fractures of the lower thoracic and lumbar spine, offering stability, alignment correction, and neurological protection. Proper patient selection, preoperative planning, and surgical technique are critical for achieving optimal outcomes.

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