

**SURGICAL STABILIZATION OF FRACTURES OF THE LOWER
THORACIC AND LUMBAR SPINE**

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Abstract. Fractures of the lower thoracic (T10–T12) and lumbar (L1–L5) spine are frequently encountered in high-energy trauma and can lead to spinal instability and neurological deficits. Surgical stabilization is often necessary for unstable fractures, fracture-dislocations, or injuries with neurological compromise. Techniques such as posterior pedicle screw fixation, transpedicular osteosynthesis, and combined anterior-posterior approaches provide rigid spinal stabilization, restore alignment, and facilitate early mobilization. This article reviews the indications, surgical techniques, and outcomes of surgical stabilization for lower thoracic and lumbar spine fractures.

Introduction. The lower thoracic and lumbar spine is structurally complex, bearing substantial axial load while allowing mobility. Fractures in this region may result in vertebral body collapse, kyphotic deformity, and spinal cord or nerve root injury. While conservative treatment may suffice for stable compression fractures without neurological deficits, unstable fractures require surgical stabilization to prevent progressive deformity, reduce pain, and restore function. Surgical stabilization aims to provide rigid fixation, maintain spinal alignment, and promote early rehabilitation.

Epidemiology. Lower thoracic and lumbar spine fractures account for more than half of all spinal injuries. Young adults are commonly affected due to motor vehicle accidents, falls from height, and sports injuries, whereas elderly individuals may sustain osteoporotic fractures with minimal trauma. Males are more frequently affected in high-energy trauma scenarios, while osteoporosis-related fractures are more prevalent in elderly females.



Mechanism of Injury

The mechanisms of injury include:

1. **Axial compression** – resulting in burst fractures
2. **Flexion-distraction** – common in seatbelt injuries
3. **Rotational or translational forces** – causing fracture-dislocations
4. **Osteoporotic low-energy trauma** – typically in elderly patients

Fractures involving two or more columns according to Denis' three-column theory are usually considered unstable and require surgical fixation.

Indications for Surgical Stabilization

Surgical stabilization is indicated in the following situations:

- Unstable fractures of the lower thoracic and lumbar spine
- Fracture-dislocations with or without neurological deficit
- Progressive kyphotic deformity
- Failure of conservative treatment
- Multiple trauma patients requiring early mobilization

Surgical Techniques

1. Posterior Pedicle Screw Fixation

- Most commonly used technique for stabilization of unstable fractures.
- Screws are inserted into the pedicles above and below the fracture site and connected with rods.
- Provides immediate stability and allows for correction of sagittal and coronal deformities.

2. Transpedicular Osteosynthesis

- Pedicle screws placed across the fractured vertebra or adjacent vertebrae.
- Effective for burst fractures and allows reduction of vertebral body height.
- Can be performed with minimally invasive approaches.



3. Anterior or Combined Anterior-Posterior Approaches

- Used for fractures with severe vertebral body comminution or significant canal compromise.
- Anterior approach allows for direct decompression of neural elements and reconstruction of vertebral body.
- Combined approach may be indicated in highly unstable fracture-dislocations.

Outcomes and Prognosis

- Surgical stabilization provides rigid fixation, restores spinal alignment, and facilitates early mobilization.
- Neurological recovery is most favorable in patients with incomplete deficits treated early.
- Complications may include screw malposition, infection, adjacent segment degeneration, and implant failure, though these are relatively uncommon with modern techniques.
- Long-term outcomes generally show improved functional recovery, reduced pain, and decreased deformity compared to conservative management in unstable fractures.

Discussion

Surgical stabilization has become the standard of care for unstable lower thoracic and lumbar fractures. Modern imaging, intraoperative navigation, and minimally invasive techniques have improved accuracy, safety, and patient outcomes. Posterior pedicle screw fixation and transpedicular osteosynthesis offer biomechanical stability while minimizing tissue disruption. Early stabilization is crucial in polytrauma patients to enable mobilization and reduce systemic complications.

Conclusion

Surgical stabilization of fractures of the lower thoracic and lumbar spine is essential for unstable injuries or those with neurological compromise. Posterior pedicle screw fixation, transpedicular osteosynthesis, and combined approaches



provide effective stabilization, restore spinal alignment, and facilitate early rehabilitation, improving functional outcomes and reducing long-term morbidity.

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