

Clinical and Radiologic Outcomes of Thoracolumbar Fusions Using Intraoperative CT Guidance (O-Arm) and Stereotactic Navigation (SteathStation): Analysis in Spinal Trauma Populations

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Introduction

Placement of pedicle screws has become commonplace for thoracolumbar fusions. Suboptimal placement may lead to neurovascular complications and postoperative pain. In the advent of outcomes-based payment, precision and accuracy of pedicle screws is important. Image-guided spinal surgery is commonly used to improve accuracy, particularly for complex anatomy such as ankylosing conditions. We sought to analyze the clinical and radiographic outcomes of posterior thoracolumbar fusions using intraoperative CT-guidance (O-Arm, Medtronic) and stereotactic navigation (SteathStation, Medtronic), specifically in thoracolumbar spinal trauma.

Methods

We retrospectively identified 59 patients undergoing posterior thoracolumbar fusions using intraoperative CT and stereotactic navigation for trauma from 2010 to 2017 at a single institution. Specifically, analysis of pedicle screw accuracy, realignment in setting of trauma, and clinical outcomes were queried. Accuracy was judged in comparison to expected placement. Breach grades included: Grade 1 (<2mm), Grade 2 (2-4mm), Grade 3 (>4mm).

Results

59 patients were identified having undergone 59 operations (595 pedicle screws). Various degree of injury included chance fracture, burst fracture, and fracture-dislocation. Levels of injury varied throughout the thoracic and lumbar spine. Accurate pedicle screw placement, without cortical breach or anterior breach, was found in 97.6% (581/595). Breach included: Grade 1 in 10 screws (1.7%); Grade 2 in 4 screws (0.7%). No neurovascular complications were noted. Alignment was restored in all patients (n=59; 100%). No revision surgery was performed for misplacement. Overall, patient outcomes were significantly improved at follow-up.

Conclusions

Intraoperative CT-guidance and stereotactic navigation can overcome the difficulty associated with complex anatomy, such as thoracolumbar trauma with malalignment and unpredictable trajectories, and can improve the accuracy of instrumentation. Intraoperative CT can be used with stereotactic guidance or for intraoperative verification of free-hand screw placement with repositioning as needed. CT-guidance maintains the benefit of reduced fluoroscopic exposure and reduced reoperation for screw

Learning Objectives

By conclusion of this session, participants should be able to: 1) describe utility of 3-dimensional imaging for spinal fusions in setting of complex anatomy; 2) identify one technique for improving pedicle screw accuracy.

References