

A Comparison of Intraoperative CT Guided Power Drill Neuronavigation to Traditional Fluoroscopic Guidance in Pedicle Screw Placement Accuracy for Spinal Fusion Surgery Firas Sbeih MS3; John Stelzer MS3; Melvin Field MD, FAANS

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Introduction

Posterolateral pedicle screw fixation for spinal stabilization surgery is perhaps the most common approach for stabilizing the spine. The proper placement of such screws plays a large role in patient outcome. Accuracy in screw placement is crucial because a bony breach could lead to neurovascular injury, pain, or failed stabilization and fusion. This retrospective study analyzed the accuracy of a novel technique for pedicle screw placement in which a navigated high speed drill was used for pedicle screw placement in combination with intraoperative CT neuronavigated imaging. The accuracy of screw placement was compared to historical data using traditional fluoroscopic based pedicle screw placement.

Learning Objectives

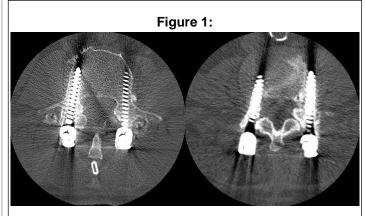
1. Introduce a novel approach for pedicle screw placement in spinal fusion surgery.

2. Compare the accuracy of CT guided power drill neuronavigation to fluoroscopic guidance in spinal fusion surgery.

3. Demonstrate an improvement in patient safety outcomes through CT guided power drill neuronavigation.

Methods

100 consecutive patients who underwent this technique at Florida Hospital Orlando between 2011 and 2014 were evaluated. Of these, 89 patients had postoperative CT scans for analysis of screw placement. The data analyzed includes: total number of screws placed, total number of screw bony breaches based on post-op CT, and type of screw perforation (Table1). The results of this study were compared to published historical outcomes utilizing fluoroscopic guidance for pedicle screw placement. In this study, 728 screws were analyzed with only 9 perforating screw which led to an accuracy of 98.8% (Table 2).



Normal screw placement vs left sided perforation.

Table 1				
Patient Number	Type of Screw Perforation			
1	Right L5 anterior breach			
2	Right L4 superior lateral breach			
3	Right L1 outside and lateral to the pedicle			
4	Right L5 lateral vertebral body breach			
5	Right T5 anterolateral breach			
6	Left L5 anterior breach			
7	Left L5 anterolateral breach			
8	Right L2 superior breach & left L3 lateral breach			

Area of screw perforation

Table 2				
Study	Number of Perforations	Accurate Screws	p-value	
Our Study	9 (1.2)	719 (98.8)	comparison study	
Laine et al. Free hand insertion	37 (13.4)	240 (86.6)	<0.001	
Han et al. Fluoroscopy	14 (6.7)	70 (83.3)	<0.001	

Screw placement accuracy across different studies

Results

A total of 728 screws were inserted for the 89 patients. The accuracy rate for screw placement was 98.8% with only 9 screws (1.2%) showing a breach on post-op CT. None of the screw breaches were medial and there were no patient complications caused by the breaches seen on post-operative CT imaging. Other studies in the literature utilizing fluoroscopy demonstrated lower accuracy by up to 15% as well as medial breaches.

Conclusions

The results of this study demonstrate that utilizing CT guided neuronavigation and a navigated high speed power drill during pedicle screw placement for thoracolumbar stabilization improves the accuracy rate significantly compared to fluoroscopic modalities. It also reduces the incidence of medial breaches and improves patient safety outcomes.

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