

# Reliability of Pedicle Screw EMG Monitoring in Predicting Pedicle Breach When Utilizing Intraoperative CT Guided Neuronavigation in Conjunction With a Navigated High Speed Drill in Instrumented Posterolateral Spinal Fusion Surgery

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## Introduction

Pedicle screw stabilization is perhaps the most common way surgeons fixate the unstable spine. Accuracy of screw placement is crucial to prevent neurovascular injury, pain, or biomechanical failure. Electromyography (EMG) is commonly used to analyze the accuracy of screw placement, but recent literature has questioned the value of EMG in detecting bony breaches caused by screw placement. CT is an accepted method to evaluate a bony breach from a malpositioned screw. In this study, the authors evaluated the accuracy of EMG monitoring in predicting bony breaches when utilizing intraoperative CT guided neuronavigation in conjunction with a navigated high speed drill for screw placement.

## Learning Objectives

1. Assess the correlation between EMG and post-operative CT in detecting pedicle screw perforation.
2. Suggest alternatives for assessing screw accuracy in surgical management.
3. Introduce a novel approach for pedicle screw placement in spinal fusion surgery.

## Methods

100 consecutive patients who underwent this procedure at Florida Hospital Orlando between 2011 and 2014 were evaluated. Of these, 89 patients had postoperative CT imaging available for analysis. The data analyzed includes the total number of screws placed, the total number of screw breaches based on post-op CT, and the EMG results of each screw placed. The number of screw breaches based on post-op CT was compared to EMG results to determine whether a correlation exists.

## Results

A total of 728 screws were inserted for the 89 patients considered for analysis. The accuracy of screw placement was 98.8% with only 9 screws (1.2%) showing a bony breach based on CT scan review. Meanwhile out of the 728 screws inserted only 5 screws (0.69%) demonstrated an EMG positive result, but these 5 screws were determined to be accurately placed based on follow-up CT scan review (Table 1). Surprisingly, the 9 screws that showed pedicle screw breach showed normal EMG values. In table 2 and figure 1, we demonstrate the lack of correlation between the EMG results and the imaging by demonstrating the EMG results with CT images from the different corresponding levels.

**Table 1**

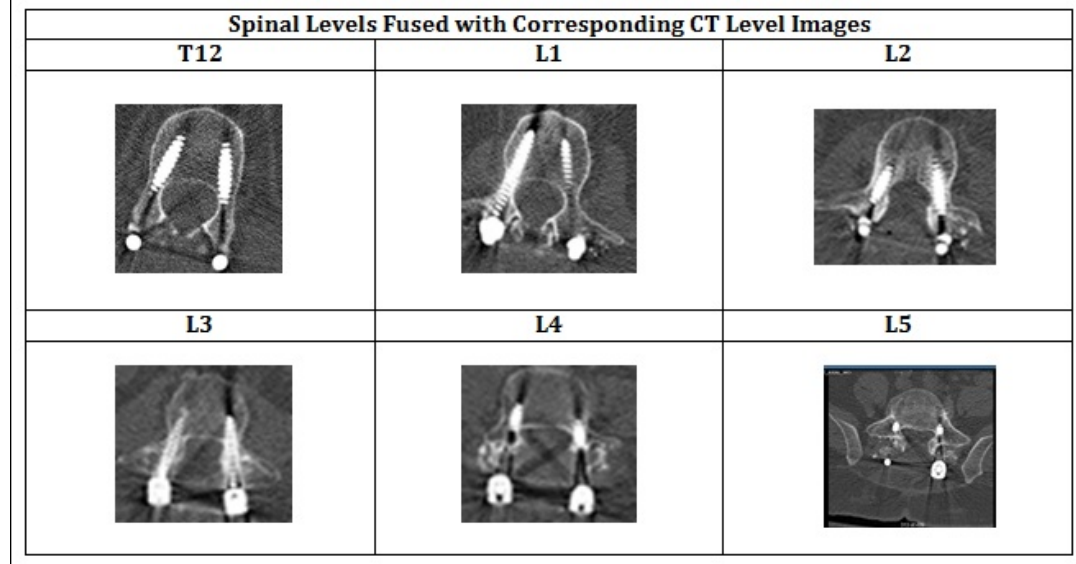
Pedicle Screw Perforation Status	Electromyography (EMG) Outcome Based on Number of Screws	
	EMG Positive (Value of 8 or less)	EMG negative (Value greater than 8)
Perforation Present	0	9
Perforation Absent	5	714

**Table 2**

Side	EMG Values at each Spinal Level for T12-L5 Spinal Fusion					
	T12	L1	L2	L3	L4	L5
Right	8	12	46	29	34	30
Left	31	50+	37	50+	33	38

EMG Values for T12-L5 Spinal Fusion

**Figure 1**



## Conclusions

Intraoperative CT guided power drill neuronavigation demonstrates an accuracy of 98.8% and a lack of correlation between post-op CT and EMG results. In this study, EMG monitoring was unable to detect any of the true perforations and made five false-positive errors. Post-op CT is a more accurate measure for the accuracy of pedicle screw placement, and an alternative for EMG monitoring needs to be established as a standard of care for spinal fusion surgery.

## References

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