



Intraoperative O-arm® Imaging Versus Stimulus-evoked Electromyography (EMG) for Evaluation of Pedicle Screw Breaches: A Prospective Study of 1006 Screws in 164 Cases

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Introduction

Historically, intraoperative EMG has been utilized to detect pedicle screw breaches. The use of intraoperative O-arm imaging to assess pedicle fixation has replaced EMG assessment for screw breaches at our institution. There have been no reports on the reliability of EMG when compared with intraoperative imaging.

Methods

A total of 1006 lumbar screws were placed in 164 consecutive cases. Prospective data was obtained by stimulating all screws and then evaluating them with intraoperative O-arm imaging. EMG data was compared with O-arm images to assess pedicle breaches, and all breaches were corrected at the time of initial surgery by palpating the entire trajectory and directly visualizing the pedicle in cases of medial breach.

Results

There were 35 breaches (20 lateral, 15 medial) visualized during surgery with O-arm imaging; 3.5% of all lumbar screws placed. Of the breaches, 14 screws stimulated below the 12-mA threshold; 9 screws stimulated between 12-20 mA; and 12 breached screws did not generate an EMG response. 40 screws stimulated below a 12-mA threshold but showed no breach on imaging. Using the 12-mA threshold for our analysis, the sensitivity of EMG was 40%, specificity 96%, and a PPV of 26% (95% CI: 15 - 40%). All 35 breached screws were corrected during surgery. There were no false-positives in the O-arm group as assessed by direct visualization and palpation of the trajectory. There were no postoperative symptoms caused by breached screws and no patients required re-operation.

Conclusions

Our data confirm that the EMG modality for testing screw breaches is unreliable. In the modern era of intraoperative imaging, lumbar screws should be evaluated for breaches with O-arm rather than relying on EMG stimulation if there are doubts about the position. Direct visualization of the pedicle and palpation of the entire trajectory confirm that O-arm is highly accurate in assessing pedicle breaches.

Learning Objectives

Pedicle Fixation

Intra-operative imaging

EMG Testing

References

Wang, et al. Stimulus-evoked electromyography testing of percutaneous pedicle screws for the detection of pedicle breaches: a clinical study of 409 screws in 93 patients. JNS Spine 2010.

Glassman, et al. A prospective analysis of intraoperative electromyographic monitoring of pedicle screw placement with computed tomographic scan confirmation. Spine. 1995

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