

A Cadaver Feasibility Study Comparing Freehand and Navigated Pedicle Screw Placement in the Subaxial Cervical Spine

Samuel Harrison Farber MD; Jakub Godzik MD MSc; Randall Hlubek MD; Jay D. Turner MD, PhD

[Institution]

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Introduction

Pedicle screw placement in the subaxial cervical spine provides superior biomechanical stability compared to lateral mass fixation. However, accurate placement is imperative given diminutive anatomy and the proximity of critical neurovascular structures. A wide range of accuracy (20-97%) has been reported in the literature. The purpose of this study was to compare the accuracy of a specific freehand technique with CT-based neuronavigation for the placement of subaxial cervical pedicle screws.

Methods

Six fresh frozen cadaveric cervical spine segments were used. The StealthStation surgical guidance system (Medtronic) was used for the navigated technique. With the freehand technique, preoperative CT was used to study bony anatomy and a laminotomy was performed for direct visualization of the pedicle borders. Screws were placed from C3-C7. Screw placement was not attempted for pedicles <3.5mm or for sclerotic pedicles without a cancellous channel. Screw position was evaluated by post-operative CT scan with the O-arm (Medtronic). Breaches were classified using the previously published Neo classification by three independent physicians. Categorical data were

Results

A total of 50 pedicle screws were placed at 25 levels across six cadavers. 25 screws were placed using the freehand and the navigated technique, respectively. The starting side and technique were alternated for each cadaver. There were a total of 3 (12%) and 9 (36%) breaches using the freehand and navigated techniques, respectively ($p = 0.10$). Breaches were evenly distributed across all levels. There were no (0%) high grade breaches for the freehand technique and one (3.2%) high grade breach for the navigated technique ($p = 1.0$).

Conclusions

This cadaveric study demonstrates similar accuracy of freehand technique and CT-based navigation for placement of subaxial cervical pedicle screws. Freehand technique can be performed with similar accuracy as neuronavigation and may be utilized with acceptable risk when maximum biomechanical stability is desired.

Learning Objectives

By the conclusion of this session, participants should be able to 1) describe the indications for instrumentation and fixation of the cervical spine 2) understand the different methods of cervical fixation 3) understand the risks and benefits of placing subaxial pedicle screws 4) understand the similar results between the freehand and navigated technique for cervical pedicle screw placement.

References

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