

The Use of Dynamic Surgical Guidance (DSG) Shortens the Learning Curve for Accurate Placement of Pedicle Screws: A Cadaveric Study

Abstract

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Introduction: Pedicle screw fixation commonly uses a manual probe technique for preparation and insertion of the screw. However, the accuracy of obtaining a centrally located path using the probe is often dependent on the experience of the surgeon and may lead to increased complications. Fluoroscopy and navigation assistance improves accuracy but may expose the patient and surgeon to excessive radiation. Dynamic Surgical Guidance, measures electrical conductivity at the tip and provides the surgeon with real-time audio and visual feedback based on differences in tissue density between cortical and cancellous bone and soft tissue. The authors investigated the effectiveness of DSG for training residents on safe placement of pedicle screws.

Methods: 15 male cadaveric thoracolumbar spine specimens were fresh-frozen at the time of expiration. Residents were assigned 3 specimens each and randomized by pedicle side and order of technique for pedicle screw placement (free-hand versus DSG). Fluoroscopy and other navigation assistance were not used for pedicle preparation. All specimens were imaged using CT following insertion of all pedicle screws. The accuracy was assessed by a senior radiologist and graded as within ($\leq 2\text{mm}$ breach) or outside ($> 2\text{mm}$ breach) the pedicle.

Results: 15 specimens were dissected in standard fashion to expose the thoracolumbar spine (T7-L5). 5 residents were randomized and assigned 3 specimens each to prepare bilateral pedicles from T8 to L5 (60 pedicles per resident) using either with DSG or free-hand technique. A total of 249 pedicle screws were placed. Post-procedure CT scans demonstrated 214 (85.9%) screws within the pedicle. Breach rate for the PediGuard group was 8.2% and 19.7% for the non-PediGuard group, with an overall reduction of 58% ($p=0.025$) (**Figure 1**).

Conclusion: The use of Dynamic Surgical Guidance decreased the pedicle screw placement learning curve in residents, while improving breach rate by 58%. This study demonstrates that DSG has the potential for resident education and refinement in operative technique.

Learning Objectives: By the conclusion of this session, participants should be able to: 1) Describe the importance of minimizing operative complications related to pedicle screw placement, 2) Discuss, in small groups, the possible advantages of DSG on resident education, and 3) Identify an effective treatment plan for spinal fusion using this system.

Key Words: Dynamic Surgical Guidance (DSG) Pedicle screw, accuracy, complication, operative technique, learning curve

How will your research improve patient care? This study will improve patient care by highlighting the benefits of DSG in training residents to accurately and safely place pedicle screws.

Figure 1. Pedicle Breach Rates Using DSG versus Free-Hand Technique

