The Safety and Strength of a Novel Medial, Partial Non-Threaded Pedicle Screw: A Cadaveric and Biomechanical Investigation
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Study Design: Cadaveric and biomechanical study.
Objective: Assess the safety and pullout strength of medial, partial non-threaded thoracic pedicle screws compared to conventional screws.

Summary of Background Data: The perforation rate of pedicle screws has been reported as high as 41%. Nerve injury and irritation can result from compression of malpositioned screw on neural structures.

Methods: Ten fresh cadavers were studied. 5.0 mm and 6.0 mm screws were inserted from T1-T6 and T7-T12 respectively. Pedicle perforations and fractures were recorded upon screw insertion and final positioning (non-threaded portion facing medially) following a wide laminectomy. Pullout strength of novel and conventional screws were then tested using an Instron machine in an artificial bone substitute.

Results: 240 thoracic pedicle screws were inserted. 88.0% (213 screws) were fully contained during screw insertion. There were 5.0% (12 screws) Grade 1 medial perforations and 6.2% (15 screws) Grade 1 lateral perforations during screw insertion. Upon final positioning, 3.3% (225 screws) were fully contained. All Grade 1 medial perforations, which occurred during insertion, were converted to Grade 0. No dural or nerve root injuries occurred. Pedicle split fractures were noted in 6.7% (16 screws). The use of medial, partial non-threaded screws reduced the overall perforation rate from 11.2% to 6.2%. The mean pullout load for the 5 mm fully threaded screw vs. medial, partial non-threaded was 1419.3 N±406.1 (1275.8-1538.8 N) and 1336.6 N±44.2 (1293.0-1405.1 N) respectively, whereas 6 mm pullout load averaged 2126.0 N±134.8 (1985.3-2338.3 N) and 2036.5 N±210.0 (1910.4-2356.9 N). The difference was not statistically significant.

Conclusion: The use of medial, partial non-threaded pedicle screws reduced the medial perforation rate from 5.0% to 0%; however, pullout strength was not significantly reduced. The use of this novel screw can potentially reduce the incidence of nerve injury or irritation following medial pedicle perforations.

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