Accuracy and Safety of Fluoroscopic Guided Percutaneous Pedicle Screws in Thoracic and Lumbosacral Spine

A Review of 2000 Screws

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Study Design. Retrospective study.
Objective. To investigate the accuracy and safety of percutaneous pedicle screws placed using fluoroscopic guidance in the thoracic and lumbosacral spine.
Summary of Background Data. Several studies had examined the accuracy and safety of percutaneous pedicle screws but provided large variations in their results with small number of patients or few number of pedicle screws evaluated.
Methods. Computerized tomography of patients who had surgery with fluoroscopic guided percutaneous pedicle screws were chosen from 2 centers: (1) European patients from University Medical Center Hamburg-Eppendorf, Germany and (2) Asian patients from University Malaya Medical Centre, Malaysia. Screw perforations were classified into Grade 0, Grade 1 (<2 mm), Grade 2 (2–4 mm), and Grade 3 (>4 mm).
Results. In total, 2000 percutaneous pedicle screws from 273 patients were analyzed: 1290 screws from 183 European patients and 710 screws from 90 Asian patients. The mean age was 59.1 ± 15.6. There were 140 male patients and 133 female patients. The total perforation rate was 9.4% with 151 (7.5%) Grade 1, 31 (1.6%) Grade 2, and 5 (0.3%) Grade 3 perforations. The total perforation rates among Europeans were 9.4% and among Asians were 9.3%.

There was no difference between the 2 groups (P > 0.05). There were 3 distinct peaks in perforation rates (trimodal distribution) at T1, midthoracic region (T4–T7), and lumbosacral junction (L5 and S1). The highest perforation rates were at T1 (33.3%), S1 (19.4%), and T4 (18.6%).

Conclusion. Implantation of percutaneous pedicle screws insertion using fluoroscopic guidance is safe and has the accuracy comparable to open techniques of pedicle screws insertion.

Key words: pedicle screw, percutaneous, minimal invasive, spine, thoracic, lumbosacral, accuracy, safety, perforation, breach, complication.

Level of Evidence: 4

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Fluoroscopic-guided percutaneous pedicle screws insertion is a minimal invasive spine surgical technique used in many spinal conditions. It is preferred because it can reduce intraoperative bleeding, preserve muscular function, and lessen postoperative pain resulting in earlier recovery compared with the conventional open method of pedicle screw fixation. The percutaneous pedicle screws technique had also been reported to cause less risk of transaction of the medial branch nerve thus preserving the innervation of the multifidus muscle. However, there are concerns about its safety and accuracy when compared with the conventional open method of pedicle screw placements. Literature had reported a wide variation in pedicle perforation rates in this new technique ranging from 0.4% to 23.0% with a significant number of revision surgeries due to misplaced percutaneous screws. Guide wire related complication had been reported causing retroperitoneal hematoma due to anterior breach during the procedure. Therefore, this study was conducted with the aim to improve the current knowledge on the safety and accuracy of fluoroscopic guided percutaneous pedicle screw placement and to identify the differences and the precautions when compared with the open pedicle screw technique.