The accuracy and safety of fluoroscopic-guided percutaneous pedicle screws in the thoracic and lumbosacral spine in the Asian population: A CT scan analysis of 1002 screws

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Abstract
Purpose: This study investigates the safety and accuracy of percutaneous pedicle screws placed using fluoroscopic guidance in the thoracolumbosacral spine among Asian patients. Methods: Computerized tomography scans of 128 patients who had surgery using fluoroscopic-guided percutaneous pedicle screws were selected. Medial, lateral, superior, and inferior screw perforations were classified into grade 0 (no violation), grade 1 (<2 mm perforation), grade 2 (2–4 mm perforation), and grade 3 (>4 mm perforation). Anterior perforations were classified into grade 0 (no violation), grade 1 (<4 mm perforation), grade 2 (4–6 mm perforation), and grade 3 (>6 mm perforation). Grade 2 and grade 3 perforation were considered as “critical” perforation. Results: In total, 1002 percutaneous pedicle screws from 128 patients were analyzed. The mean age was 52.7 ± 16.6. There were 70 male patients and 58 female patients. The total perforation rate was 11.3% (113) with 8.4% (84) grade 1, 2.6% (26) grade 2, and 0.3% (3) grade 3 perforations. The overall “critical” perforation rate was 2.9% (29 screws) and no complications were noted. The highest perforation rates were at T4 (21.6%), T2 (19.4%), and T6 (19.2%). Conclusion: The total perforation rate of 11.3% with the total “critical” perforation rate of 2.9% (2.6% grade 2 and 0.3% grade 3 perforations). The highest perforation rates were found over the upper to mid-thoracic region. Fluoroscopic-guided percutaneous pedicle screws insertion among Asians has the safety and accuracy comparable to the current reported percutaneous pedicle screws and open pedicle screws techniques.

Keywords
complication, minimal invasive, pedicle screw, percutaneous, perforation

Introduction
Minimal invasive techniques in spine surgery are expanding recently and indications for the usage of fluoroscopically-guided percutaneous pedicle screws had widened. The preference for percutaneous screws compared with the conventional open method of pedicle screw fixation was due to its advantages in reducing intraoperative bleeding, preserving muscular function, and lessening postoperative pain resulting in earlier recovery.1–4 Since its introduction, several studies had reported its perforation rates that vary from 0.4% to 23.0%.5–15 Majority of these studies were done on Caucasians. Only one publication reported

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