The accuracy and safety of fluoroscopically guided percutaneous pedicle screws in the lumbosacral junction and the lumbar spine

A REVIEW OF 880 SCREWS

We undertook a retrospective study investigating the accuracy and safety of percutaneous pedicle screws placed under fluoroscopic guidance in the lumbosacral junction and lumbar spine. The CT scans of patients were chosen from two centres: European patients from University Medical Center Hamburg-Eppendorf, Germany, and Asian patients from the University of Malaya, Malaysia. Screw perforations were classified into grades 0, 1, 2 and 3. A total of 880 percutaneous pedicle screws from 203 patients were analysed: 614 screws from 144 European patients and 266 screws from 59 Asian patients. The mean age of the patients was 58.8 years (16 to 91) and there were 103 men and 100 women. The total rate of perforation was 9.9% (87 screws) with 7.4% grade 1, 2.0% grade 2 and 0.5% grade 3 perforations. The rate of perforation in Europeans was 10.4% and in Asians was 8.6%, with no significant difference between the two (p = 0.42). The rate of perforation was the highest in S1 (19.4%) followed by L5 (14.9%). The accuracy and safety of percutaneous pedicle screw placement are comparable to those cited in the literature for the open method of pedicle screw placement. Greater caution must be taken during the insertion of L5 and S1 percutaneous pedicle screws owing to their more angulated pedicles, the anatomical variations in their vertebral bodies and the morphology of the spinal canal at this location.

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The use of percutaneous pedicle screws is gaining popularity as it leads to less bleeding, better muscular function and less post-operative pain.1–4 Percutaneous screws have also been shown to have a lower risk of transecting the medial branch nerves (of the posterior division of spinal nerves), thereby preserving the innervation of the multifidus muscles.5 However, the safety of this mode of treatment has not been fully elucidated. There have been reports of guide wire-related complications causing retroperitoneal haematoma by breaching the anterior cortex during percutaneous insertion of pedicle screws.6 There are also wide variations in the rate of perforation of misplaced percutaneous screws, from 0.4% to 23.0%,7–14 which has led to a significant number of patients requiring revision surgery.10 Therefore, the safety and accuracy of percutaneous pedicle screw placement needs to be validated to ensure that this technique matches the safety profile of open pedicle screw placement.

Patients and Methods

This was a retrospective evaluation study undertaken in two study populations involving 203 patients (mean age 58.8 years; 16 to 91, 103 male, 100 female) and 880 lumbosacral junction and lumbar percutaneous pedicle screws (Table I). The surgery was performed between January 2008 and December 2012 in consecutive patients. Only those in whom surgery for percutaneous pedicle screw stabilisation was successful, were included. European patients were treated at the University Medical Center Hamburg-Eppendorf, Germany, and Asian patients at the University of Malaya, Malaysia. The percutaneous screws used were the MAN-TIS system (Stryker Spine, Allendale, New Jersey). Only lumbosacral junction and lumbar percutaneous screws were evaluated and assessed. Patients without post-operative CT scans were excluded. The operations were performed by trained orthopaedic spinal surgeons who were proficient in fluoroscopically guided percutaneous screw placement.

Technique of fluoroscopic percutaneous pedicle screw insertion. This can be used only if good visualisation of the pedicle can be obtained with the image intensifier. Relative contraindications for insertion of percutaneous pedicle screws were obese patients, sclerotic pedicles, or poorly visualised pedicles in patients who had metastatic spinal disease. With the patient under general anaesthetic and placed prone on the operating table, a true anteroposterior (AP)