Comparison between percutaneous fluoroscopic-guided and conventional open pedicle screw placement techniques for the thoracic spine

A SAFETY EVALUATION IN HUMAN CADAVERS

Percutaneous placement of pedicle screws is a well-established technique, however, no studies have compared percutaneous and open placement of screws in the thoracic spine. The aim of this cadaveric study was to compare the accuracy and safety of these techniques at the thoracic spinal level. A total of 288 screws were inserted in 16 (eight cadavers, 144 screws in percutaneous and eight cadavers, 144 screws in open). Pedicle perforations and fractures were documented subsequent to wide laminectomy followed by skeletalisation of the vertebrae. The perforations were classified as grade 0: no perforation, grade 1: < 2 mm perforation, grade 2: 2 mm to 4 mm perforation and grade 3: > 4 mm perforation. In the percutaneous group, the perforation rate was 11.1% with 15 (10.4%) grade 1 and one (0.7%) grade 2 perforations. In the open group, the perforation rate was 8.3% (12 screws) and all were grade 1. This difference was not significant (p = 0.45). There were 19 (13.2%) pedicle fractures in the percutaneous group and 21 (14.6%) in the open group (p = 0.73). In summary, the safety of percutaneous fluoroscopy-guided pedicle screw placement in the thoracic spine between T4 and T12 is similar to that of the conventional open technique.

Cite this article: Bone Joint J 2015;97-B:1555-61.

Stabilisation of the spine by fixation with pedicle screws was first introduced by Roy-Camille1 and has been shown to have superior biomechanical and clinical results when compared with more established methods of fixation such as wires and hooks.4,14 It has shown efficacy in fixation of fractures, deformity correction, tumour surgery and lumboacetabular fusion.3-10 In the conventional technique of open screw placement, disruption of the muscles is inevitable in order to expose the point of entry of the screw. With a percutaneous fluoroscopy-guided technique, muscle dissection is reduced and no stripping from its bony attachment is required, thereby conserving function, minimizing blood loss, reducing operative time and post-operative pain, and offering a faster recovery.11-14 A minimally invasive technique has also been shown to carry a lower risk of infection than conventional open surgery.15 This has led to better overall clinical results in minimally invasive spinal surgery.16,17

Several studies have reported on the safety of percutaneous pedicle screw placement in the thoracic and lumboacetabular spine.10-27 Only one has compared the accuracy and safety of pedicle screw placement between percutaneous and open techniques in the lumboacetabular spine15 and no such work exists pertaining to the thoracic spine. The purpose of this study using cadavers was to compare the accuracy and safety of pedicle screw placement between percutaneous fluoroscopy-guided and conventional open techniques in the thoracic spine. The outcome measures were pedicle perforation and/or pedicle fracture.

Materials and Methods

Study design. This study was performed in a single institution, using 16 fresh human cadavers. The mean age of the cadavers was 41.7 years (25 to 67; 12 males and four females). Ten cadavers were Chinese and six were Indian in ethnicity. Ethical approval was obtained before the study. These cadavers were divided into two groups, percutaneous and open. The cadaver was inspected before screw placement by any two independent surgeons (MKK, CKC, CKL or CYWC), to exclude anatomical abnormalities. Pedicle screws were inserted in both pedicles from T4 to T12 in every cadaver. Levels T1 to T3 were not included in this study because of the difficulty in obtaining lateral fluoroscopic views at these levels. The pedicle screws were of diameter 5.0 mm from T4 to T6.