The Safety and Accuracy of Freehand Pedicle Screw Placement in the Subaxial Cervical Spine: A Series of 60 Consecutive Patients

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Introduction: Although the efficacy and safety of freehand screw fixation in thoracic and lumbar vertebrae is proven, reports on this technique of screw insertion in the subaxial cervical spine are lacking. So, this study aimed to assess the safety and accuracy of subaxial cervical pedicle screw (CPS) placement with freehand technique and to report the technical nuances.

Methods: From March 2012 to April 2014, 60 consecutive patients underwent posterior cervical fusion. The diagnoses were trauma (31 patients), degenerative disease (23 patients), discitis/osteomyelitis (two patients), pathologic fracture (three patients), and post-laminoplasty kyphosis (one patient). Preoperative computed tomography (CT) was performed in all patients. We included patients whose outer diameter of the pedicle was greater than 3.0 mm. The standard entry points were modified according to the CT anatomy of each patient. A small pilot hole was fashioned at a predetermined entry point. Then, a 2.5 mm diameter curved pedicle probe was slowly inserted with a medial trajectory into the pedicle. After ball tip probing and tapping, the screw was inserted. If ball tip probing was suggestive of risk to neurovascular structures, conversion to a lateral mass screw was performed. Postoperatively, a CT scan was performed in all patients and the conversion rate from pedicle to lateral mass screw was recorded. The breech rate of pedicle screws was also analyzed.

Results: There were 339 planned pedicle screws. There were 25 incidences (7.4%) of conversion to lateral mass screws. Lateral wall violation was observed in 15 pedicle screws (accuracy rate: 95.2%) on the postoperative CT scan. No medial, superior, and inferior pedicle wall violations were observed. There was no patient who developed symptoms related to vertebral artery.

Conclusions: The most important factors for safe and accurate freehand placement were the planning of the screw entry point using information from the preoperative CT scan, the achievement of an adequate medial angle for screw insertion through the use of a curved and small sized pedicle probe, the ability to detect pedicle breech with a ball tip probe, the proper conversion to a lateral mass screw when a breech is detected, and the ability to properly interpret the intraoperative X-ray image after screw insertion. By following these technical steps and with proper training, this freehand technique for insertion of CPSs may be safe and effective for posterior cervical fusion surgery.