

Letter to the Editor on “Transpedicular Screw Placement Accuracy Using the O-Arm Versus Freehand Technique at a Single Institution. Global Spine Journal” by Crawford et al

Global Spine Journal
2021, Vol. 11(3) 416-417
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DOI: 10.1177/2192568220979660
journals.sagepub.com/home/gsj



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We read with great interest the recent study by Crawford et al. assessing the effectiveness of the O-arm as an intraoperative imaging tool—the authors compared the accuracy for pedicle screw placement between O-arm guided navigation and freehand technique, and found no significant difference between the 2.¹ We appreciate the authors’ efforts to shed light on this important topic—however, we wish to register some of our observations in the belief that it will send out the message expounded in this study with greater clarity.

The authors have used the existence of a pedicle breach in itself—defined using the “in-versus-out” grading scale—to estimate the accuracy of pedicle screw placement in this study. In their landmark study, Gertzbein & Robbins observed a low incidence of neurological complications when the screw perforated the pedicle by < 4 mm—describing this as a “safe zone” for screw placement.² Considering the rarity of clinical complications that occur with pedicle wall perforations < 2 mm, there is a growing tendency on the part of surgeons to accept these perforations. In fact, volumetric studies have shown that a medial pedicle screw perforation upto 2 mm would be equivalent to the intrusion volume of a standard pedicle hook.³ Apart from the threat of neurological complications looming large with medial perforations that exceed 4 mm, perforations > 2 mm in any direction also compromise the pull-out strength of the pedicle screw. Thus, the mere existence of a pedicle breach is an inappropriate measure to compare the accuracy of 2 techniques—unless the degree of perforation is also compared. The Gertzbein grading system—which is widely used in many studies—employs these relevant cut-offs of 2 mm and 4 mm to classify pedicle screw placement into 4 grades.² An outcome-based classification for assessment of pedicle screw placement has also been proposed which correlates better with the clinically observed results—this classification grades the

pedicle screw placement into “acceptable,” “unacceptable” or “grievous” placements.^{4,5} Unlike the Gertzbein grading system, this also takes into account the direction of the breach—a lateral perforation in thoracolumbar spine may be more acceptable compared to a medial perforation, but the opposite would be true for the cervical spine. Furthermore, real-time visual feedback provided by navigation allows the surgeon to place the screw in a trajectory that matches the longitudinal midline axis of the pedicle—typically, this would have a more lateral starting point and a more medial insertion angle than that seen with the freehand technique. Adherence to this “ideal” trajectory increases the pull-out strength and allows for placement of a longer screw. Navigated screw placement also allows the surgeon to occasionally place the pedicle screw with an “intended” lateral perforation to avoid cranial facet violation. When using the freehand technique, sometimes a misplaced screw is recognized intraoperatively during the final fluoroscopy check image—although, this screw is eventually repositioned, it may still be a reason for compromised purchase in the pedicle or iatrogenic nerve root injury. Since the authors have only compared the “final” screw placements, such intraoperatively recognized screw misplacements have not been compared between the 2 groups. We feel that these are some

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important aspects of screw placement “accuracy” that should also be given due consideration.

There was a significant difference in the proportion of patients with degenerative pathology between the O-arm navigation and freehand groups in the study—which merits focus on how degenerative conditions of lumbar spine can influence accuracy of pedicle screw placement. Accurate pedicle screw placement using the freehand technique requires the correct identification of a suitable entry point based on anatomical landmarks intricately related to the superior articular process. Degeneration of the facet joints is associated with sagittal orientation of the facets and presence of osteophytes growing posterolaterally over the superior articular process—this distorts the anatomical landmarks and causes difficulty in judging the insertion point and the trajectory for the screw being planned for insertion. O-arm navigation proves to be useful in such situations. Patients with degenerative lumbar canal stenosis very often have a “trefoil” shaped spinal canal—typically at L5 and S1 levels. Previous studies have noted that such “trefoil” shaped spinal canals portend a higher risk of medial pedicle wall perforations during screw placement following the conventional insertion landmarks and trajectory—this can also be avoided by the use of navigation.^{6,7} We compliment the authors for choosing to study an important topic in modern-day spine surgery, and hope that our observations provide the readers with an additional perspective with which they may interpret this study’s findings.

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