SPINAL INTRAOPERATIVE 3D NAVIGATION: CORRELATION BETWEEN CLINICAL AND ABSOLUTE ENGINEERING ACCURACY

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ABSTRACT

Background: Spinalcomputer-assistednavigation(CAN)mayguideinstrumentationplacement, reliably reducing screw breach rates. Definitions of screw breach, if reported, vary widely across studies. Absolute quantitative error is theoretically a more precise and generalizable metric of navigation accuracy. It has also been computed variably and reported in less than one-quarter of clinical studies of CAN-guided pedicle screw accuracy. Here, we characterize the correlation between clinical pedicle screw accuracy based on postoperative imaging and absolute quantitative navigation accuracy.

Methods: We reviewed a prospectively collected series of 209 pedicle screws placed with CAN guidance in 30 patients undergoing open posterior thoracolumbar instrumentation. All patients underwent postoperative computed tomography (CT). Screws were graded clinically by multiple independent raters using the Heary and 2 mm classifications. Absolute screw accuracies were quantified by the translational and angular error in each of the axial and sagittal planes.

Results: Acceptable screw accuracy was achieved for significantly fewer screws based on 2 mm grade versus Heary grade (92.6%v. 95.1%, p = 0.036), particularly in the lumbar spine. Interrater agreement was good for the Heary classification and moderate for the 2 mm grade, significantly greater among radiologists than surgeon raters. Mean absolute translational/angular accuracies were 1.75 mm/3.13° and 1.20 mm/3.64° in the axial and sagittal planes, respectively. There was no correlation between clinical and absolute navigation accuracy. Surgeons appear to compensate for perceived translational navigation error by adjusting screw medialization angle.

Conclusion: Radiographic classifications of pedicle screw accuracy vary in sensitivity across spinal levels as well as in interrater reliability. Correlation between clinical screw grade and absolute navigation accuracy is poor, as surgeons appear to compensate for perceived navigation registration error. Future studies of navigation accuracy should report absolute translational and angular errors. Clinical screw grades based on postoperative imaging may be more reliable if performed in multiple by radiologist raters.

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