

COMPUTER-ASSISTED INTRAOPERATIVE 3D NAVIGATION: TRENDS AND OUTCOMES AMONG ONTARIO SPINAL SURGEONS

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ABSTRACT

Background: Computer-assisted navigation (CAN) has become the standard of care in cranial neurosurgery for the localization of subsurface structures. In spinal procedures, CAN guidance has been proven to increase the accuracy of instrumentation. However, adoption remains limited owing to workflow restrictions, steep learning curves and high costs. Here, we aim to assess the usage of spinal CAN among Ontario surgeons to identify potential gaps in application and impact on patient outcomes.

Methods: A prospectively collected database of billed provincial health insurance fee codes and corresponding diagnostic codes was reviewed retrospectively from 2002 to 2014. Patients undergoing instrumented spinal fusions or percutaneous vertebroplasty/kyphoplasty were identified. A combination of fee codes and ICD-9 codes were applied to distinguish the surgical approach, spinal level and indication for surgery (i.e., trauma, degenerative, deformity, infection, tumour). The use of intraoperative navigation was determined for each identified case.

Results: A total of 4607 cases of instrumented spinal fusion were identified, with more than half performed between 2010 and 2014. A total of 35.3% of patients were older than 65 years, with no sex predilection. Most (63.2%) procedures were performed by orthopedic surgeons, with the remainder by neurosurgeons. Most (86.0%) identified cases occurred in an academic institution. Of 2239 cases with identifiable etiology, CAN was used in 8.8%. In univariate analyses, CAN was used more often by neurosurgeons than orthopedic surgeons (20.9% v. 12.4%, $p = 0.002$) and in academic institutions than in community hospitals (15.9% v. 12.3%, $p = 0.008$), and it was performed more often in/after 2010 than earlier (18.9% v. 8.9%, $p < 0.001$). Differences in CAN usage by specialty and year remained significant in multiple logistic regression modelling.

Conclusion: Intraoperative navigation for spinal procedures has proven benefit for instrumentation accuracy, but is used preferentially by neurosurgeons at large academic institutions. The substantial increase in CAN usage after 2010 may reflect improvements in available technologies; however, significant gains must be made in cost and usability to improve access among all surgical disciplines and in smaller institutions. This is a preliminary analysis, with results forthcoming on the impact of CAN usage on surgical revision rates.

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