

Navigation Trends in the Top Ten Lumbar Spine Procedures

Hannah Shelby BS¹, Tara Shelby BS¹, Emily S. Mills MD¹, Matthew Chen BS¹, Hyunwoo P. Kang MD¹, Andy Ton BS¹, Jeffrey C. Wang MD¹, Raymond J. Hah MD¹, Ram K. Alluri MD¹

¹Department of Orthopaedic Surgery, Keck School of Medicine at The University of Southern California, Los Angeles, CA
Presenting Author: Hannah Shelby, hshelby@usc.edu

Disclosures: Hannah Shelby BS, Tara Shelby BS, Emily Mills MD, H Paco Kang MD have no conflicts to declare. Raymond J. Hah is a paid consultant for Nuvasive. He is on the editorial boards for Global Spine Journal, Clinical Spine Surgery, and The Spine Journal. Ram K. Alluri is a paid consultant and receives royalties from HIA Technologies Incorporate. Jeffrey C. Wang receives royalties from Biomet, Seaspine, and Synthes. He owns investments or options in Bone Biologics, Pearldiver, Electrocore, and Surgitech. He is on the Board of Directors for AO Foundation, Society for Brain Mapping and Therapeutics, and the American Orthopaedic Association. He is on the editorial board for Spine, The Spine Journal, Clinical Spine Surgery, and Global Spine Journal. His institution receives fellowship funding from AO Foundation.

INTRODUCTION: Intraoperative computer-assisted navigation (CAN) has fostered the growth of minimally invasive techniques and improved anatomical characterization. Using CAN minimizes intraoperative risks, as it allows for greater surgical precision. As such, CAN utilization has seen a steady increase over the past decade within cervical and thoracic spine procedures. Given the high prevalence of degenerative lumbar pathologies, studies investigating CAN specifically in the context of the lumbar spine are warranted, as existing literature is sparse and mainly focused on lumbar fusion. This is the first study of its kind to track CAN utilization trends in the top ten lumbar spine procedures for degenerative conditions over the course of 12 years and characterize its results as compared to the conventional spinal procedure counterpart.

METHODS: Patient data from 2010 to 2021 was accessed through the querying of the national insurance database PearlDiver using ICD-9, ICD-10 and CPT codes. After first identifying the top five lumbar degeneration codes, the top ten lumbar spine CPT procedure codes associated with these diagnoses were isolated to create a cohort of patients. This cohort was then split into the patients who had the procedure along with one of the top five computer navigation procedure codes and those that didn't. Temporal analysis was then conducted to identify trend of navigation incidence over time (Figure 1). Univariate and multivariate analysis adjusting for patient age, ECI score, and gender was subsequently performed over primary outcomes of wound complication, surgical site infection, cardiac, respiratory, pulmonary embolism, deep vein thrombosis and acute renal failure.

RESULTS SECTION: Querying PearlDiver found a total of 1234493 patients underwent one of the top ten lumbar spine procedure for lumbar degeneration pathology from 2010 to 2021, with 10760 (0.87%) and 1223733 (99.13%) patients undergoing procedures performed with and without CAN. The top ten lumbar spinal codes broadly included, from greatest population to least, laminectomy, fusion, and laminotomy. Comparing 2010 to 2021 demonstrated a significant increase in the use of CAN with lumbar spine procedures ($p < 0.001$), increasing from 0.553% (556 patients) to 2.187% (769 patients) (Table 2). Trends in CAN utilization was relatively steady from 2010 to 2015, with a decrease from 2015 (0.763%, 933 patients) to 2016 (0.483%, 541 patients), before linearly increasing from 2016 to 2021 (2.187%, 769 patients) (Figure 1). Both univariate and multivariate analysis demonstrated similar postoperative outcomes.

DISCUSSION: The current analysis has demonstrated in lumbar spine procedures what has been shown previously in cervical and thoracic procedures: the use of computer assisted navigation has been increasing in use over time. Additionally, outcomes are similar to conventional surgery. We intend to further compare demographic variables between the two subgroups and extend statistical analysis to include mortality, length of surgery, cost, readmission, and discharge to SNF. Subgroup analysis based on type of lumbar spinal procedure will also be performed.

SIGNIFICANCE/CLINICAL RELEVANCE: Given the complexity of lumbar procedures, CAN provides the surgeon with improved orientation to lumbar spinal anatomy with the added benefit of reduced radiation. As this study has demonstrated, CAN for lumbar pathology has undergone a significant uptrend, most significantly over the past five years. With this growing popularity, further large-scale studies into outcomes of CAN are warranted.

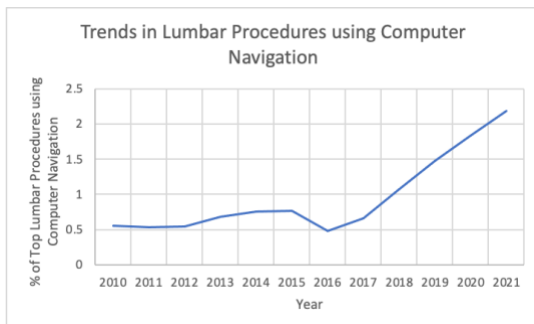


Figure 1. Computer Assisted Navigation Trends in Lumbar Procedures from 2010 to 2021.

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
WithNav Procedures	556	529	589	796	933	900	541	669	1082	1606	1790	769
% of Top Lumbar Procedures using CompNav	0.553	0.529	0.546	0.676	0.755	0.763	0.483	0.655	1.071	1.478	1.839	2.187

Table 1. Computer Assisted Navigation Trends in Lumbar Procedures from 2010 to 2021.

