

Review Article

A scoping review of spine surgeries between specialties: comparing neurosurgeons versus orthopedic surgeons

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ABSTRACT

Spine surgeries are both performed by neurosurgeons and orthopedic surgeons. However, there remains controversy whether surgeon specialty affects spine surgery outcomes and complications. The objective of this scoping review was to map the existing knowledge comparing the outcomes and complications of spine surgeries between neurosurgeons and orthopedic surgeons. Eligible studies are any English-written or -translated published journals written from year 2000 onwards that compared outcomes and/or complications of spine surgeries between neurosurgeons and orthopedic surgeons. Excluded papers are those which do not dichotomize or specify the surgeon specialty to either neurosurgeon or orthopedic surgeon. Medline database was used to systematically search for papers that compare the two specialties. Ten studies were selected which directly compared spine surgery outcomes of the two specialties, all of which are retrospective studies and most of it relied on the national database. Specific spine surgeries were varied between all studies. Overwhelmingly, these studies showed no significant differences between neurosurgeons and orthopedic surgeons in short term outcomes while there were some significant differences in complications. Based on this scoping study, surgeon specialty, whether neurosurgery or orthopedics, has no significant association in spine surgery outcomes. This may imply that despite the differences in training, patients may have good outcomes if treated by either specialty. However, questions remain whether the effect of further training after residency or fellowship, length of experience and number of cases of both surgeon specialties have a causal effect in outcomes of spine surgeries.

Keywords: Spine surgery, Spine surgeon specialty, Neurosurgeon, Orthopedic surgeon

INTRODUCTION

In general, spine surgeries are performed by either of the two specialties: neurosurgery and orthopedics.¹⁻¹⁰ Despite the inherent differences in training pathway, there exists a significant overlap in the patient population and management by both specialties.¹ To date, several studies have attempted to compare spine surgeries between the two specialties. However, a lack of high-quality evidence such as randomized controlled trials has hindered definite conclusions and recommendations for the standard of care for spine surgeries. Moreover, there remains confusion even with patients and healthcare workers on

when to refer to either specialty since there is no clear guidelines or consensus.¹¹

This scoping review was conducted to examine the existing publications and investigate if there are any differences in spine surgeries of different surgeon specialties. This review will look at outcomes and complications of studies comparing the spine surgery of the two specialties. Moreover, this study aimed to map existing information with regard to this topic. Findings of this study may contribute to the advancement, improvement and even collaboration between the two specialties by identifying the gaps of knowledge in the topic.

Methods

The inclusion criteria were as follows: any English-written or -translated published journals written from year 2000 onwards, comparing outcomes and/or complications of spine surgeries between neurosurgeons and orthopedic surgeons. Excluded papers were those which do not dichotomize or specify the surgeon specialty to either neurosurgeon or orthopedic surgeon. Emergency spine surgeries were also excluded.

Medline (Pubmed) was used to search for journals using MeSH terms and keywords. For the term “Spine Surgery”, no specific MeSH term was identified. Therefore, more specific MeSH terms were used to

identify studies that pertain to spine surgery which are as follows: MeSH: "Laminectomy" with keywords as follows: “spinal surger*” OR “laminectom*” OR “laminoplast*” OR “laminotomy*” OR “dissectom*” OR “spinal fusion*” OR “spine fusion*” OR “instrumentation*” OR “vertebroplast*” OR “foraminotom*”.

For the Neurosurgeon, the MeSH term used was MeSH: "Neurosurgeons" with key words “neurological surgeon*” OR “neuro surgeon*”. While for the orthopedic surgeon, the MeSH term used was “orthopaedic surgeon” OR “orthopedic spine surgeon” OR “orthopedist*”. Upon screening of journals, the keywords “spine surgeon specialty” was also included since it encompasses the two specialties.

Table 1: Studies comparing spine surgeries between neurosurgeons vs orthopedic surgeons.

Author, year (Country)	Author specialty	Title	Study type	Total no. of patients	Significant findings/ outcomes/complications		Conclusions
					Neurosurgeon	Orthopedic	
Kim, 2014 (USA)	2 orthopedic	Spine surgeon specialty is not a risk factor for 30-day complication rates in single-level lumbar fusion: a propensity score-matched study of 2528 patients.	Retrospective cohort, multicenter	2970 patients: 1,565 Neurosurgeon 1405 Orthopedic	No statistically significant differences in medical or surgical complications or reoperation	Surgeon specialty NOT a risk factor for 30-day complications	
Minhas, 2014 (USA)	2 orthopedic	Surgeon specialty differences in single-level anterior cervical discectomy and fusion	Retrospective cohort	1944 patients: 1557 (80.1%) Neurosurgeon 387 (19.9 %) Orthopedic	More procedures for NS (~4x); After propensity matching, no demographic variables or comorbidity differences	No statistical differences in any postoperative complications	
Seicean, 2014 (USA)	2 Neurosurgeons	Surgeon specialty and outcomes after elective spine surgery	Retrospective	50,361 patients: 33,235 (66%) Neurosurgeon 17,126 (33%) Ortho	Slightly higher odds of Prolonged length of stay, 2x odds of perioperative	30 day postop outcomes no difference Not account for fellowship	

Continued.

Author, year	Author specialty	Title	Study type	Total no. of patients	Significant findings/ outcomes/complications	Conclusions	
McCutcheon, 2015 (USA)	neurosurgeons	Thirty-Day Perioperative Outcomes in Spinal Fusion by Specialty Within the NSQIP Database	Retrospective	9719 patients 5247 (54%) Neurosurgeon 4350 (46%) Orthopedic	Decreased incidence of operations requiring blood transfusions	Regardless of specialty, equivalent outcomes: mortality, 30-day readmission and SSI	
Mabud, 2017 (USA)	Neurosurgeons	Complications, Readmissions, and Revisions for Spine Procedures Performed by Orthopedic Surgeons Versus Neurosurgeon	Retrospective, longitudinal	197,682 patients Neurosurgeons 44.7% laminectomy, 57.6% fusion, 61.7% laminectomy w fusion 41.3% ACDF	Neurosurgeons : marginally higher odds of any complication for lumbar fusions [odds ratio (OR) 1.14; 95% (CI), 1.09–1.20] and ACDFs (OR, 1.09; 95% CI, 1.04–1.15); slightly higher rates of revision surgery for concurrent lumbar laminectomy with fusion (OR, 1.14; 95% CI, 1.08–1.22), and ACDFs (OR, 1.20; 95% CI, 1.14–1.28).	No significant associations between surgeon type and 30-day readmission	
Bronheim, 2018 (USA)	5 orthopedic 1 neurosurgeon	Anterior Lumbar Fusion: Differences in Patient Selection and Surgical Outcomes Between Neurosurgeons and Orthopedic Surgeons.	Retrospective cohort	3,182 patients: 1,629 (51.2%) Neurosurgeon 1,553 (48.8%) Orthopedic	Greater proportion >65y/o Preop steroids, higher comorbids (cardiac pulmo) Higher ASA (III and higher)	Higher risk Reoperation (OR 1.61) UTI (OR 1.94)	
Baek, 2019 (USA)	5 Orthopedic 1 neurosurgery	Orthopedic versus Neurosurgeon-Understanding 90-Day Complications and Costs in Patients Undergoing Elective 1-Level to 2-Level Posterior Lumbar Fusions by Different Specialties	Retrospective	10,509 px 4,986 (47.4%) Neurosurgeon 5,523 (52.6%) Ortho	(higher odds of wound complications- hematomas and infections Less dural tears)	Lower odds of wound complications Higher odds of dural tear	provider's specialty does not largely influence 90-day surgical outcomes and costs after elective PLFs
Hu, 2019	3	Spine	Retrospective	2248 patients	No significant differences	Short- term	

Continued.

Author, year	Author specialty	Title	Study type	Total no. of patients	Significant findings/ outcomes/ complications	Conclusions
(China)	neurosurgeons 2 ortho	surgeon specialty differences in single-level percutaneous kyphoplasty	Retrospective NSQIP database	1129 (54.7%)	in postoperative complications and unplanned readmission *Ortho higher postoperative transfusion rate	adverse events is not affected by spine surgeon specialty
Malik, 2020 (USA)	Ortho only	Orthopaedic vs. Neurosurgery – Does a surgeon’s specialty have an influence on 90-day complications following surgical intervention of spinal metastases?	Retrospective cohort	887 patients 683 (77%) neurosurgeon 204 (23%) Ortho	no statistically significant differences in complications: wound (p = 0.992), pulmonary (p = 0.461), cardiac (p = 0.631), thrombotic (p = 0.177), sepsis (p = 0.463), pneumonia (p = 0.767), urinary tract infection (p = 0.916), acute renal failure (p = 0.934), hardware complications (p = 0.892), emergency department visits (p = 0.934), 90-day readmissions (p = 0.277) and 90-day mortality (p = 0.786)	Specialty has no influence on immediate-term complications
Alomari, 2022 (USA)	7 Neurosurgeons	Surgeon specialty effect on early outcomes of elective posterior spinal fusion for adolescent idiopathic scoliosis: a propensity-matched analysis of 965 patients	Retrospective Propensity-matched (Pediatric population)	5520 patients 213 (3.9%) Neuro 5307 (96.1%) Ortho	Lower perioperative blood transfusion shorter OR, hospital stay, lower OR return	Mortality not different

This search was supplemented by identifying and selecting other similar journals within the references of the screened articles.

Selection of articles was done by screening all abstracts that have a clear dichotomy of any spinal surgery between neurosurgeons and orthopedic surgeons. Moreover, articles selected are those which have data showing differences between neurosurgeons and orthopedic surgeons regarding outcomes and/or complications. Fully accessible articles were included while abstract only are excluded in this review.

A total of 10 articles were selected to be part of this scoping review after the inclusion and exclusion criteria

were applied (Table 1). Information gathered in these articles are the following: journal title, author/s, author/s’ specialty, year published, country of origin, study type, total number of patients, proportion and total patients of neurosurgeons and orthopedic surgeons and the outcomes and complications of the studies.

Of the ten studies fully accessed, nine of them have origins from the United States while only one study is from another country, China. All of the studies were relatively recent studies with the oldest published in 2014 while the most recent is in 2022. Four papers were done by neurosurgeons, while three papers were done by Orthopedic surgeons. The three other studies are authored by a combination of the two specialties, but two out of the three are dominantly authored by orthopedic

surgeons. All studies were retrospective, with majority of data retrieved from Databases of the American College of Surgeons National Quality Improvement Program (NSQIP).

Six studies compared purely fusion surgeries, two studies compared a wide variety of elective spine surgeries (fusion alone, laminectomy with or without fusions) while the other 2 studies are management of kyphoplasty and spine metastasis.

A total of 285,022 spine surgeries were done in all ten studies combined. In three studies Neurosurgeons are the predominant surgeon ranging from 66% to as high as 80.1%. Six studies have almost equal numbers of surgeries between two specialties. Only one study was predominantly done by orthopedic surgeons (96.1%) which involved posterior spinal fusion for adolescent idiopathic scoliosis.

In general, all ten studies showed very little difference between the two specialties that are of significance. However, there were some notable differences in complications between the two specialties. Three studies showed that neurosurgeons had less preoperative transfusions. One study mentioned that orthopedics had higher odds of dural tear. Overall, regardless of specialty, the complications, both medical and surgically-related were the statistically insignificant.

DISCUSSION

This study had revealed that there was indeed scarce literature that investigated if specialty affected spine surgery outcome. The heterogeneity of the topics of spine surgeries as well as the scarcity of randomized controlled trials had also shown that there was much to investigate about this topic. Moreover, interest in knowing if there were differences between the two specialties seemed to be only a recent interest among researchers as the studies can only be seen as early as year 2014. This may also coincide with the advent of combined spine training/fellowship of orthopedic spine surgery and neurosurgery. Most studies arise from the USA, indicating that spine surgeries in other countries are likely not represented here.

The results that there was no difference in outcomes and complications between the two specialties were confounded by the fact that in all studies included, we could not identify which orthopedic surgeons did further fellowship training. If the neurosurgery training provided much more exposure and cases in spine in comparison with orthopedics, further spine fellowship for orthopedics could account for their improved outcomes and decreased complications. Likewise, neurosurgeons in the studies were also not specified if further training was done. This conclusion in the study by Pham.¹³ Other factors which may affect these outcomes but were unable to be elicited

in the studies would be the surgeon's length of practice, cases done in training as well as in practice.

The scoping review had shown that complications for the two specialties are not statistically different.¹⁻¹⁰ However, there is still some variations in the complications between specialties (e.g., blood transfusions and dural tear).³ These complications may reflect the differences in technique and case exposure. However, these may be areas where one specialty may improve the other specialty by sharing their expertise to avoid such complications. Still, similar complication rates in most studies may suggest that the same core fundamentals are taught in both specialty trainings.²

This study was limited by the fact that all studies were retrospective which can only provide associations and not causality. Moreover, since scoping reviews answer broad questions, specific management questions and guidelines cannot be derived. Also, it would have been a better comparison if the spine surgeons were classified more specifically as: spine trained-neurosurgeon, general neurosurgeon, spine trained-orthopedic surgeon, or general orthopedic surgeon.

Recommendations for future study include a local study comparing the surgical outcomes of Neurosurgeons vs Orthopedic spine surgeons to better understand the differences in these specialties in our setting. Furthermore, a spine database for the country would provide valuable information for training and improvement in patient management. Finally, as concluded by Baek et al dual training pathway to spine surgery is necessary to provide top-quality care.²

CONCLUSION

In conclusion, the studies gathered comparing outcomes of spine surgeries between Neurosurgeons and Orthopedic surgeons to date, has shown no significant differences in the short-term outcomes despite the disparity in the training pathways of both specialties. However, questions remain whether the effect of further training after residency or fellowship, length of experience and number of cases of both surgeon specialties have a causal effect in outcomes of spine surgeries.

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