Malpractice litigation following spine surgery

Alan H. Daniels, MD,^{1–4} Roy Ruttiman, MS,^{1,2} Adam E. M. Eltorai, MS,^{1,2} J. Mason DePasse, MD,^{1–3} Bielinsky A. Brea, MS,¹ and Mark A. Palumbo, MD^{1–4}

⁴Division of Spine Surgery, ³Department of Orthopaedic Surgery, and ²Alpert Medical School of ¹Brown University, Providence, Rhode Island

OBJECTIVE Adverse events related to spine surgery sometimes lead to litigation. Few studies have evaluated the association between spine surgical complications and medical malpractice proceedings, outcomes, and awards. The aim of this study was to identify the most frequent causes of alleged malpractice in spine surgery and to gain insight into patient demographic and clinical characteristics associated with medical negligence litigation.

METHODS A search for “spine surgery” spanning February 1988 to May 2015 was conducted utilizing the medicolegal research service VerdictSearch (ALM Media Properties, LLC). Demographic data for the plaintiff and defendant in addition to clinical data for the procedure and legal outcomes were examined. Spinal cord injury, anoxic/hypoxic brain injury, and death were classified as catastrophic complications; all other complications were classified as noncatastrophic. Both chi-square and t-tests were used to evaluate the effect of these variables on case outcomes and awards granted.

RESULTS A total of 569 legal cases were examined; 335 cases were excluded due to irrelevance or insufficient information. Of the 234 cases included in this investigation, 54.2% (127 cases) resulted in a defendant ruling, 26.1% (61) in a plaintiff ruling, and 19.6% (46) in a settlement. The awards granted for plaintiff rulings ranged from \$134,000 to \$38,323,196 (mean \$4,045,205 ± \$6,804,647). Awards for settlements ranged from \$125,000 to \$9,000,000 (mean \$1,930,278 ± \$2,113,593), which was significantly less than plaintiff rulings ($p = 0.022$). Compared with cases without a delay in diagnosis of the complication, the cases with a diagnostic delay were more likely to result in a plaintiff verdict or settlement (42.9% vs 72.7%, $p = 0.007$) than a defense verdict, and were more likely to settle out of court (17.5% vs 40.9%, $p = 0.008$). Similarly, compared with cases without a delay in treatment of the complication, those with a therapeutic delay were more likely to result in a plaintiff verdict or settlement (43.7% vs 68.4%, $p = 0.03$) than a defense verdict, and were more likely to settle out of court (18.1% vs 36.8%, $p = 0.04$). Overall, 28% of cases (66/234) involved catastrophic complications. Physicians were more likely to lose cases (plaintiff verdict or settlement) with catastrophic complications (66.7% vs 37.5%, $p < 0.001$). In cases with a plaintiff ruling, catastrophic complications resulted in significantly larger mean awards than noncatastrophic complications (\$6.1M vs \$2.9M, $p = 0.04$). The medical specialty of the provider and the age or sex of the patient were not associated with the case outcome or award granted ($p > 0.05$). The average time to a decision for defendant verdicts was 5.1 years; for plaintiff rulings, 5.0 years; and for settlements, 3.4 years.

CONCLUSIONS Delays in the diagnosis and the treatment of a surgical complication predict legal case outcomes favoring the plaintiff. Catastrophic complications are linked to large sums awarded to the plaintiff and are predictive of rulings against the physician. For physician defendants, the costs of settlements are significantly less than those of losing in court. Although this study provides potentially valuable data from a large series of postoperative litigation cases, it may not provide a true representation of all jurisdictions, each of which has variable malpractice laws and medicolegal environments.

<https://thejns.org/doi/abs/10.3171/2016.11.SPINE16646>

KEY WORDS complications; spine surgery; malpractice; predictors

MEDICAL malpractice litigation increasingly affects the delivery and cost of health care. In 2014, malpractice payments totaled \$3.9 billion in the United States.^{18,20} The risk of malpractice encourages the defensive medicine practices of increased diagnostic testing, unnecessary referrals, and patient avoidance.^{4,5}

Neurosurgeons have the highest annual rate of malpractice claims of any medical specialty, with 19.1% of neurosurgeons facing a claim annually.^{11,14} Spine surgery represents the majority of malpractice claims for neurosurgeons⁹ and leads to similarly high rates of malpractice cases for orthopedic spine surgeons. The considerable risk

ACCOMPANYING EDITORIAL See pp 468–469. DOI: 10.3171/2017.1.SPINE161371.

SUBMITTED June 6, 2016. **ACCEPTED** November 23, 2016.

INCLUDE WHEN CITING Published online July 21, 2017; DOI: 10.3171/2016.11.SPINE16646.

TABLE 1. Case characteristics for 234 spine surgery malpractice suits

Variable	No.
Mean age in yrs (SD)	48.1 (15.8)
Age not provided (no. of cases)	10
Sex (no. of cases)	
Male	99 (42.3%)
Female	135 (57.7%)
State (no. of cases)	
California	49
Massachusetts	13
New York	57
Ohio	13
Texas	26
Other states*	76
Procedure (no. of cases)†	
Decompression	33
Discectomy	44
Foraminotomy	6
Fusion	90
Laminectomy	53
Other surgical procedure	60
Procedure not listed	11
Spine region (no. of cases)	
Cervical	61
Thoracic	41
Lumbar	73
Multiple	59
Complication (no. of cases)‡	
Death	8
Spinal cord injury	60
Anoxic/hypoxic brain injury	2
Nerve root injury	37
Malpositioned instrumentation	6
Incorrect surgical site	11
Other medical or anesthetic complications	192
Delay in Dx (no. of cases)	
Yes	22
No	212
Delay in Tx (no. of cases)	
Yes	19
No	215
Profession sued (no. of cases)	
Orthopedic surgery	136
Neurosurgery	79
Nonsurgical	19

Dx = diagnosis; Tx = treatment.

* AR = 1 case; CO = 1; CT = 4; FL = 8; GA = 11; IL = 4; MD = 11; MI = 8; MO = 1; NJ = 4; NC = 1; OK = 1; OR = 1; PA = 10; SC = 3; VA = 4; WV = 1; Washington, DC = 2.

† 30.8% of patients underwent multiple procedures.

‡ 54.3% of cases listed more than 1 complication.

of morbidity and mortality associated with operative spine procedures combined with the growing use of spine surgery¹⁸ may continue to increase the potential for litigation.

It is important for spine surgeons to understand the risk factors for malpractice litigation. Few studies have evaluated the association between spine surgical complications and medical malpractice proceedings, outcomes, and awards. The aim of this study was to identify the most frequent causes of alleged malpractice in spine surgery and to gain insight into patient demographic and clinical characteristics associated with medical negligence litigation.

Methods

The “malpractice” subcategory of the legal research service VerdictSearch (ALM Media Properties, LLC), which includes cases from February 1988 to May 2015, was queried utilizing the term “spine surgery.” The demographic data collected for each plaintiff included age, sex, and state in which the lawsuit was filed. The type of surgical complication (death, anoxic/hypoxic brain injury, spinal cord injury, nerve root damage, malposition of instrumentation, wrong surgical site, and other intraoperative medical complications), operative site (cervical, thoracic, lumbar, multiple regions), surgical procedure performed, the presence of delayed diagnosis and/or treatment, and the medical specialty of the provider were also recorded. Spinal cord injury, anoxic/hypoxic brain injury, and death were classified as catastrophic complications. All other complications were classified as noncatastrophic. The litigation outcome of each case was categorized as a defense verdict (physician or hospital victory), plaintiff verdict (physician or hospital loss), or settlement; associated indemnity payments were documented, as was the time to case settlement or court ruling. The effects of the age of the plaintiff, sex of the plaintiff, surgical complications, operative site, specialty of the surgeon, hospital defendant named in the suit, delay in diagnosis, and delay in treatment were evaluated using chi-square testing (Microsoft Excel). Effect on the amount of indemnity payment was evaluated for all variables using Student’s t-tests and 1-way ANOVAs. Statistical significance was set at $p < 0.05$.

Results

Case Characteristics

A total of 569 legal cases were examined; 335 cases were excluded due to irrelevance or insufficient information, leaving 234 cases available for review (Table 1). There were 99 male (42.3% of all cases) and 135 female (57.7%) patients included in this study. The average patient age was 48.1 ± 15.8 years (mean $\pm$ SD; 224 patients; age was not available for 10 cases). In total, 158 cases (67.5% all cases) were filed in 5 states: New York (57), California (49), Texas (26), Massachusetts (13), and Ohio (13). The remaining 76 cases were filed in 17 other states and Washington, DC.

Ninety cases (38.5% of all cases) listed spinal fusion as a performed surgical procedure. Spinal decompression (33 cases), discectomy (44), foraminotomy (6), laminectomy (53), and other surgical procedures (60) were reported

TABLE 2. Amounts awarded in catastrophic versus noncatastrophic complications cases

Outcome	Mean Award (SEM)		Range of Awards	
	Catastrophic	Noncatastrophic	Catastrophic	Noncatastrophic
Defense verdict	\$0	\$0	\$0	\$0
Plaintiff verdict	\$6.07M (1.57)	\$2.90M (1.01)	\$400,000–\$26.8M	\$134,000–\$38.3M
Settlement	\$2.35M (0.55)	\$1.54M (0.31)	\$125,000–\$9.0M	\$225,000–\$6.60M

Total of 234 cases: 66 (28.2%) catastrophic cases, 168 (71.8%) noncatastrophic cases. More than 1 complication was listed in 54.3% of cases.

as well. Overall, 30.8% of patients underwent combined procedures (for example, fusion and decompression). Procedure type was not provided in 11 cases. Seventy-three cases (31.2% of all cases) included a surgical procedure in the lumbar spine region. Operations performed in the cervical, thoracic, or multiple spine regions were cited in 61 (26.1%), 41 (17.5%), and 59 (25.2%) cases, respectively.

Sixty-six patients (28.2% all cases) experienced catastrophic complications: death (8 cases), anoxic/hypoxic brain injury (2), and spinal cord injury (60). Noncatastrophic cases included nerve root damage (37 cases), malpositioned instrumentation (6), incorrect surgical site (11), and other perioperative medical or anesthetic complications (192). More than 1 complication was listed in 54.3% of cases.

A delay in diagnosis of the complication occurred in 10.4% of cases (22 cases) and a delay in its treatment in 8.1% of cases (19). Orthopedic surgeons were sued in 136 cases (58% of all cases), while neurosurgeons and nonsurgical specialties were sued in 79 (34%) and 19 (8%) cases, respectively.

Litigation Outcomes

Overall, 54.2% of cases (127 cases) resulted in a defendant ruling, 26.1% (61) in a plaintiff ruling, and 19.6% (46) in a settlement. The average time to a decision for defendant verdicts was 5.1 years; for plaintiff rulings, 5.0 years; and for settlements, 3.4 years. Total liabilities of the 234 cases were \$335,550,287, with awards ranging from \$125,000 to \$38,323,196. The average award granted for plaintiff rulings (\$4,045,205 ± \$6,804,647 [mean ± SEM], range \$134,000–\$38,323,196) was significantly greater than the amount awarded in settlement cases (\$1,930,278 ± \$2,113,593, range \$125,000–\$9,000,000; $p = 0.022$; Table 2).

The medical specialty of the provider and the age and sex of the patient were not statistically associated with case outcome or award granted ($p > 0.05$).

Hospital Defendant Analysis

Hospitals were named as a defendant in 40.6% (95/234) of suits. Cases filed against hospitals were more likely to result in a plaintiff verdict or settlement compared with cases in which a hospital was not named (53.7% vs 40.3%, $p = 0.04$). There was no statistical difference in the monetary award granted for plaintiff verdicts (\$4,298,211 vs \$3,766,025, respectively; $p = 0.38$) or settlement cases (\$2,191,945 vs \$1,690,417, respectively; $p = 0.21$) between cases filed against hospitals and those filed against individual physicians.

Delay in Diagnosis

A delay in diagnosis of the complication occurred in 4.7% of defendant rulings (6 cases), 11.5% of plaintiff rulings (7), and 19.6% of settlement cases (9). Compared with cases without a delay in diagnosis, those that did cite a delay were more likely to result in a plaintiff verdict or settlement (42.9% vs 72.7%, $p = 0.007$) than a defense verdict, and were more likely to settle out of court (17.5% vs 40.9%, $p = 0.008$; Table 3).

There was no statistical difference between the monetary awards granted to cases with or without a delay in diagnosis for both plaintiff verdicts (\$3,878,090 vs \$4,066,868, respectively; $p = 0.94$) and settlement cases (\$2,184,799 vs \$1,868,508, respectively; $p = 0.69$).

Delay in Treatment

A delay in treatment of the complication was present in 4.7% of defendant rulings (6 cases), 9.8% of plaintiff rulings (6), and 15.2% ending in settlements (7). Compared with cases without a delay in treatment, those with a delay were more likely to result in a plaintiff verdict or settlement (43.7% vs 68.4%, $p = 0.03$) than a defense verdict, and were more likely to settle out of court (18.2% vs 36.8%, $p = 0.04$; Table 3).

There was no statistical difference between the monetary awards granted to cases with or without a delay in treatment for both plaintiff verdicts (\$4,758,367 vs \$3,967,405, respectively; $p = 0.78$) and settlement cases (\$2,356,857 vs \$1,853,713, respectively; $p = 0.56$).

Surgical Complications

In cases in which patients experienced catastrophic complications compared with those in which patients ex-

TABLE 3. Case outcomes for a delay versus no delay in diagnosis and treatment of a complication

Parameter	Defense Verdict	Plaintiff		Court Case	Settlement
		Verdict & Settlement	Settlement		
Delay in Dx	6 (27.3%)	16 (72.7%)*	13 (59.1%)	9 (40.9%)†	
No delay in Dx	121 (57.1%)	91 (42.9%)	175 (82.5%)	37 (17.4%)	
Delay in Tx	6 (31.6%)	13 (68.4%)‡	12 (63.2%)	7 (36.8%)§	
No delay in Tx	121 (56.3%)	94 (43.7%)	176 (81.9%)	39 (18.1%)	

* $p = 0.007$, compared with cases without a delay in diagnosis.

† $p = 0.008$, compared with cases without a delay in diagnosis.

‡ $p = 0.03$, compared with cases without a delay in treatment.

§ $p = 0.04$, compared with cases without a delay in treatment.

TABLE 4. Outcomes in catastrophic versus noncatastrophic complications cases

Complications	Defense Verdict	Plaintiff Verdict & Settlement	Court Case	Settlement
Catastrophic (66)	22 (33.3%)	44 (66.7%)*	44 (66.7%)	22 (33.3%)†
Noncatastrophic (168)	105 (62.5%)	63 (37.5%)	144 (85.7%)	24 (14.3%)
Total	127 (54.3%)	107 (45.7%)	188 (80.3%)	46 (19.6%)

* $p < 0.001$.† $p < 0.001$.

perienced noncatastrophic complications, physicians were more likely to lose (66.7% [44/66] vs 37.5% [63/168], $p < 0.001$) and to settle out of court (33.3% [22/44] vs 14.3% [24/168], $p < 0.001$; Table 4).

Catastrophic complications in cases with a plaintiff ruling resulted in awards significantly larger than those in noncatastrophic complications cases (\$6,077,060 vs \$2,899,030; $p = 0.04$). In cases resulting in a settlement, there was no statistical difference between awards granted for catastrophic complications and noncatastrophic complications (\$2,351,491 vs \$1,544,167, respectively; $p = 0.09$; Table 2).

Effects of Age

The average age of patients in defendant-verdict cases was 49.3 ± 14.5 years. Patients involved in plaintiff rulings and settlement cases averaged 49.1 ± 15.9 and 42.9 ± 18.2 years of age, respectively. Cases involving patients younger than 18 years of age were statistically more likely to end in settlement ($p = 0.015$; Table 5).

There was no statistical difference between awards granted to patients with an age of < 18, 19–30, 31–45, 46–60, or > 61 years in either plaintiff rulings or settlements ($p = 0.27$ and $p = 0.66$, respectively; Fig. 1).

Effects of Sex

Male patients received a defendant ruling in 60.6% (77/127) of their cases, compared with female patients who received a defendant ruling in 39.4% (50/127) of their cases. Plaintiff verdicts involved 50.8% males (31/61) and 49.2% females (30/61), whereas settlements involved 58.7% males (27/46) and 41.3% females (19/46). The sex of the plaintiff did not have a significant effect on the legal outcome of the cases studied ($p = 0.32$). In addition, sex did not influence whether the involved parties went through with court pro-

ceedings or settled out of court ($p = 0.87$). There was no statistical difference between the monetary award granted to men and women in both plaintiff verdicts (\$3,996,743 vs \$4,095,282, respectively; $p = 0.95$) and settlement cases (\$2,279,252 vs \$1,434,368, respectively; $p = 0.18$).

Provider Specialty

The medical specialty of the provider was not associated with the legal outcome of the case ($p = 0.41$). Moreover, the provider's specialty did not affect whether his or her case was handled in court or via settlement ($p = 0.68$). There was no statistical difference between awards granted to patients who sued orthopedic surgeons, neurosurgeons, or nonsurgical specialties in either plaintiff rulings or settlements ($p = 0.56$ and $p = 0.09$, respectively; Fig. 2).

Discussion

In this study, we evaluated the association between spine surgery complications and malpractice proceedings, outcomes, and awards. In the cases examined, catastrophic complications (death, anoxic/hypoxic brain injury, and spinal cord injury) were predictors of a medicolegal case outcome in favor of the plaintiff and were linked to large sums awarded to the plaintiff. Delays in the diagnosis and treatment of a postoperative complication were also significantly related to plaintiff rulings and settlements.

Previous studies have evaluated neurosurgical and orthopedic malpractice claims data;^{1,3–7,9–14,17,19,20} however, none has focused specifically on spine surgery. Past studies have been limited to physician surveys^{12,13,15,20} and single-institution experiences,^{5,14} have solely focused on the size of malpractice claims,^{5,7,12,14,17} or have been multicenter studies of specific US regions or data subgroups.^{3,12,17,19} In contrast, the present investigation specifically evaluated spine surgery data by including the specialties of neurosurgery and orthopedic surgery and by using claims data from litigation cases from around the country.

The current investigation revealed that 54.2% of spine malpractice cases concluded in a defense (physician) verdict. This percentage of cases with a ruling in favor of the physician is lower than the 75% reported national average,^{2,21} which may be attributable to the catastrophic nature of many spine complications.

An additional consideration is that awards were generally higher for younger plaintiffs, although not statistically significantly higher given the relatively small number of young patients in this sample. The reason for the larger settlements in young patients is probably related to actuarial methodology, which factors in the number of years remaining in a patient's working life to calculate damage

TABLE 5. Case outcomes among age groups

Age Group (no.)	Defense Verdict	Plaintiff Verdict & Settlement	Court Case	Settlement
<18 yrs (10)	2 (20.0%)	8 (80.0%)	4 (40.0%)	6 (60.0%)*
19–30 yrs (20)	11 (55.0%)	9 (45.0%)	17 (85.0%)	3 (15.0%)
31–45 yrs (66)	37 (56.1%)	29 (43.9%)	51 (77.3%)	15 (22.7%)
46–60 yrs (79)	45 (57.0%)	34 (43.0%)	66 (83.5%)	13 (16.4%)
>60 yrs (49)	28 (57.1%)	21 (42.9%)	42 (85.7%)	7 (14.3%)
Total (224)	123 (54.9%)	101 (45.1%)	180 (80.4%)	44 (19.6%)

* $p = 0.015$.

FIG. 1. Awards granted in plaintiff rulings and settlement cases among different age groups. There was no statistical difference between awards granted to patients with an age of < 18, 19–30, 31–45, 46–60, or > 61 years in either plaintiff rulings or settlements. Figure is available in color online only.

amounts. Our data also revealed that cases in which a hospital was named as a defendant were more likely to result in a plaintiff verdict or settlement. This outcome may be due to lawyers’ propensity to add the hospital as a defendant in more serious cases of malpractice and in cases in which awards are likely to be larger.

Although this study does provide potentially valuable data from a large series of postoperative litigation cases, it may not provide a true representation of all spine surgery lawsuits, as many cases are settled or rejected by the courts

before court proceedings take place. Furthermore, jurisdictions may have varying lawsuit outcome profiles and may differ from those reported in this study because of variable local malpractice laws and medicolegal environments.

There are several potential limitations to this study. VerdictSearch cases are electively submitted by case attorneys, reviewed by the VerdictSearch editorial staff, published in their weekly newsletter, and ultimately incorporated into their database. VerdictSearch is not a comprehensive malpractice database and cannot be used to

FIG. 2. Awards granted in plaintiff rulings and settlement cases among provider specialties. There was no statistical difference between awards granted to patients who sued orthopedic surgeons, neurosurgeons, or nonsurgical specialties in either plaintiff rulings or settlement cases. Figure is available in color online only.

assess the prevalence of all spine procedure litigation. Furthermore, settlements that do not progress to court records are not included in this database, limiting the out-of-court data available for analysis. In addition, cases resulting in a plaintiff verdict, especially those ending in large awards, may be overrepresented in the database, while defendant verdicts could be underreported. Additionally, the level of medical detail for each case is variable based on court reports. Despite these limitations, VerdictSearch has been used in numerous studies^{7,8,16,17} and provides a unique and meaningful approach to analyzing the impact of malpractice in spine surgery.

Conclusions

As a high-risk malpractice specialty, spine surgery is particularly influenced by the current litigation climate. The well-recognized practice of defensive medicine substantially impacts the delivery and cost of health care. This study serves as a preliminary report regarding the factors that affect spine surgery litigation outcomes. Our results indicate that catastrophic complications and a delay in the diagnosis or treatment of a spine surgery complication are predictive of a plaintiff victory. Understanding what leads to litigation in spine surgery should help remind surgeons to work diligently to prevent avoidable complications, especially those caused by delayed diagnosis and delayed treatment.

Further research on legal outcomes in spine surgery is needed, including analyses of other similar legal databases. An enhanced understanding of the reasons for and outcomes of medical malpractice litigation may allow for the implementation of protocols to improve patient safety and reduce the risk of litigation.

References

- Daniels EW, Gordon Z, French K, Ahn UM, Ahn NU: Review of medicolegal cases for cauda equina syndrome: what factors lead to an adverse outcome for the provider? *Orthopedics* **35**:e414–e419, 2012
- Danzon PM: *Medical Malpractice: Theory, Evidence, and Public Policy*. Cambridge, MA: Harvard University Press, 1985
- Dranove D, Gron A: Effects of the malpractice crisis on access to and incidence of high-risk procedures: evidence from Florida. *Health Aff (Millwood)* **24**:802–810, 2005
- Eloy JA, Svider PF, Folbe AJ, Couldwell WT, Liu JK: Comparison of plaintiff and defendant expert witness qualification in malpractice litigation in neurological surgery. *J Neurosurg* **120**:185–190, 2014
- Emery E, Balossier A, Mertens P: Is the medicolegal issue avoidable in neurosurgery? A retrospective survey of a series of 115 medicolegal cases from public hospitals. *World Neurosurg* **81**:218–222, 2014
- Epstein NE: It is easier to confuse a jury than convince a judge: the crisis in medical malpractice. *Spine (Phila Pa 1976)* **27**:2425–2430, 2002
- Epstein NE: A medico-legal review of cases involving quadriplegia following cervical spine surgery: Is there an argument for a no-fault compensation system? *Surg Neurol Int* **1**:3, 2010
- Epstein NE: A review of medicolegal malpractice suits involving cervical spine: what can we learn or change? *J Spinal Disord Tech* **24**:15–19, 2011
- Fager CA: Malpractice issues in neurological surgery. *Surg Neurol* **65**:416–421, 2006
- Groff MW, Heller JE, Potts EA, Mummaneni PV, Shaffrey CI, Smith JS: A survey-based study of wrong-level lumbar spine surgery: the scope of the problem and current practices in place to help avoid these errors. *World Neurosurg* **79**:585–592, 2013
- Jena AB, Seabury S, Lakdawalla D, Chandra A: Malpractice risk according to physician specialty. *N Engl J Med* **365**:629–636, 2011
- Matsen FA III, Stephens L, Jette JL, Warme WJ, Posner KL: Lessons regarding the safety of orthopaedic patient care: an analysis of four hundred and sixty-four closed malpractice claims. *J Bone Joint Surg Am* **95**:e201–e208, 2013
- Mello MM, Studdert DM, DesRoches CM, Peugh J, Zapert K, Brennan TA, et al: Effects of a malpractice crisis on specialist supply and patient access to care. *Ann Surg* **242**:621–628, 2005
- Mukherjee S, Pringle C, Crocker M: A nine-year review of medicolegal claims in neurosurgery. *Ann R Coll Surg Engl* **96**:266–270, 2014
- Nahed BV, Babu MA, Smith TR, Heary RF: Malpractice liability and defensive medicine: a national survey of neurosurgeons. *PLoS One* **7**:e39237, 2012
- Quigley RS, Akpolat YT, Forrest BD, Wongworawat MD, Cheng WK: Reason for lawsuit in spinal cord injury affects final outcome. *Spine (Phila Pa 1976)* **40**:851–855, 2015
- Quraishi NA, Hammett TC, Todd DB, Bhutta MA, Kapoor V: Malpractice litigation and the spine: the NHS perspective on 235 successful claims in England. *Eur Spine J* **21** (Suppl 2):S196–S199, 2012
- Rajae SS, Bae HW, Kanim LE, Delamarter RB: Spinal fusion in the United States: analysis of trends from 1998 to 2008. *Spine (Phila Pa 1976)* **37**:67–76, 2012
- Rovit RL, Simon AS, Drew J, Murali R, Robb J: Neurosurgical experience with malpractice litigation: an analysis of closed claims against neurosurgeons in New York State, 1999 through 2003. *J Neurosurg* **106**:1108–1114, 2007
- Studdert DM, Mello MM, Sage WM, DesRoches CM, Peugh J, Zapert K, et al: Defensive medicine among high-risk specialist physicians in a volatile malpractice environment. *JAMA* **293**:2609–2617, 2005
- Vidmar N: Juries and medical malpractice claims: empirical facts versus myths. *Clin Orthop Relat Res* **467**:367–375, 2009

Disclosures

Dr. Daniels is a consultant for Stryker and Orthofix and has received clinical or research support from Orthofix for the study described. Dr. Palumbo is a consultant for Stryker.

Author Contributions

Conception and design: all authors. Acquisition of data: all authors. Analysis and interpretation of data: all authors. Drafting the article: all authors. Critically revising the article: all authors. Reviewed submitted version of manuscript: all authors. Approved the final version of the manuscript on behalf of all authors: Daniels. Statistical analysis: all authors. Administrative/technical/material support: Daniels, Palumbo. Study supervision: Daniels, Palumbo.

Correspondence

Alan H. Daniels, Department of Orthopaedics, Alpert Medical School of Brown University, 100 Butler Dr., Providence, RI 02906. email: alan_daniels@brown.edu.