Medical malpractice in spine surgery: a review

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Medical malpractice is an important but often underappreciated topic within neurosurgery, particularly for surgeons in the early phases of practice. The practice of spinal neurosurgery involves substantial risk for litigation, as both the natural history of the conditions being treated and the operations being performed almost always carry the risk of permanent damage to the spinal cord or nerve roots, a cardiopulmonary event, death, or other dire outcomes. In this review, the authors discuss important topics related to medical malpractice in spine surgery, including tort reform, trends and frequency of litigation claims in spine surgery, wrong-level and wrong-site surgery, catastrophic outcomes including spinal cord injury and death, and ethical considerations.

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The late 1970s, however, saw major shifts in the legal handling of malpractice cases, as tort reform efforts began to emerge in individual states. In one of the earliest and most aggressive state-led initiatives, California ratified the Medical Injury Compensation Reform Act in 1975, which enacted a maximum flat cap of $250,000 on noneconomic damages while comprehensively reworking the longitudinal handling of malpractice cases. Shortly thereafter, 16 other states enacted malpractice litigation reforms, and by 1986 every state had ratified new legislation governing the handling of medical malpractice lawsuits. Reform extent ranged broadly but, generally, the most frequently addressed issues involved malpractice claim limits and payment scheduling, attorney fees, collateral source rules, and pretrial screening panels.

The marginal impact of this legislation on the handling of medical malpractice complaints is difficult to directly quantify, as the myriad factors contributing to trends in medicolegal claims span often-intangible aspects of medicine, law, and economics. However, continued efforts to improve and modernize tort laws pertaining to malpractice litigation have certainly contributed to the ever-dynamic landscape of malpractice lawsuits and their resolution. As documented by the National Practitioner Data Bank, more than 350,000 lawsuits costing over $132 billion (US, adjusted to 2019 dollar values) have been filed between the start of 1991 and the end of 2019. Since 2000, nationwide case volume and litigation reparation costs (inflation-adjusted) have decreased significantly (Fig. 1A). The past 2 decades have seen annual physician malpractice case volume decrease by approximately 450 cases per year and annual malpractice costs decrease by approximately $150 million per year. Despite this, it remains noteworthy that the average inflation-adjusted value per case has increased during this time period by approximately $1500 per year, from approximately $376,000 in 2000 to nearly $430,000 in 2019 (Fig. 1B). Similar trends may be observed in the 12 states with the highest malpractice litigation cost totals since 1991, where the majority of states have experienced decreases in case volume (Fig. 1C) and total malpractice payment costs (Fig. 1D). However, reinforcing the assertion that per-lawsuit payments have increased, the number of cases in excess of $500,000 has increased significantly between 1991 and 2019, while those less than $250,000 have decreased during that period (Fig. 1E). These high-value litigation cases constitute a significant portion of total malpractice payouts (Fig. 1F) and reiterate the importance of defensive medicine across physician specialties.
Trends and Frequency of Medicolegal Malpractice Claims in Spine Surgery

Historically, neurosurgeons have faced high rates of malpractice lawsuits; Jena et al. noted that not only did nearly 20% of neurosurgeons face at least one malpractice claim annually between 1991 and 2005, but also median annual payments to plaintiffs were the highest in neurosurgery at more than $200,000 per year.1 Malpractice claims were particularly common following spine surgery compared to other neurosurgical subspecialties, with estimates suggesting that nearly 60% of cases involve spine surgeons while the next most common subspecialty, general neurosurgery, only constituted 15% of cases.9,10 This skew is further exemplified by surveying the most frequent medical conditions among plaintiffs. Of the malpractice claims served to neurosurgeons between 2003 and 2012, the three most common conditions (intervertebral disc disease, back disorders/pain, and spinal stenosis) together comprised over 40% of all cases and payments totaled nearly $105 million.11 In a query of the Thomson Reuters Westlaw online legal database, Agarwal et al. identified 98 malpractice cases filed between 2010 and 2015 involving spine operations.12 The vast majority (79%) were elective procedures, in which the predominantly cited reasons included “lack of informed consent” (29.9%), “failure to treat” (20.8%), and “failure to diagnose” (19.5). Procedural error was more frequently cited as a reason for litigation of elective procedures (71.4%) than for emergent procedures (14.3%).

Elsamadicy et al.11 and Agarwal et al.12 offer two independent analyses of neurosurgery- and spine-specific malpractice, respectively, from two data sets: the Physician Insurers Association of America Data Sharing Project, and the Thomson Reuters Westlaw legal database. Although neither study represents a wholly comprehensive collection of malpractice litigation attributable to neurosurgeons or spine surgeons, internal comparisons of temporal case distribution may help identify recent trends in litigation volume. A nonsignificant downward-sloping trend was present in the neurosurgical data set;11 by comparison, spine-specific litigation case volume12 more closely mirrors the previously mentioned trends among all physician providers, suggesting a more consistent decrease in annual malpractice lawsuits after 2010 (Fig. 2A). Though systematic studies evaluating the robustness and etiology of these declines are warranted, it may be speculated that increasing education on malpractice litigation and expanded adoption of defensive medicine may have contributed to the observed trends. A keyword-based query of neurosurgery and spine surgery articles related to medical malpractice indexed on PubMed between the years 2000 and 2020 reveals that in that time span, 204 and 57 peer-reviewed papers, respectively, were published (Fig. 2B). This ever-expanding wealth of knowledge and literature helps to cultivate an understanding of malpractice litigation, in turn enabling neurosurgeons to provide quality care in accordance with patient expectations.

Spinal Cord Injury

Nearly 5% of spinal cord injuries result from medical or surgical procedures.13 In a systematic query of the Verdict-Search database by Daniels et al., spinal cord injury comprised 60 (25.6%) of 234 qualifying malpractice litigation cases between 1988 and 2015.14 Catastrophic complications, including not only spinal cord injury but also brain injury and death, significantly increased the likelihood of a plaintiff-favoring verdict or settlement (66.7%). A sepa-
Wrong-Level Surgery

Wrong-site surgeries are surgical procedures performed on the wrong patient or side. Designated as sentinel events by the Joint Commission on Accreditation of Healthcare Organizations (JC), they have been the second most commonly reported event from 1995 to 2005, involving 455 (12.8%) of 3548 events. With regard to spine surgery, wrong-level surgery is a particular subcategory of wrong-site surgery, defined as the correct procedure and site but incorrect level or portion of the operative field. A query from the American Board or Orthopedic Surgery’s database of spinal procedures between 1999 and 2010 calculated a rate of 0.041% for wrong-level surgery. This estimate falls into the range of wrong-level surgery rates, 0.09–4.5 per 10,000 surgeries (0.0009%–0.045%), determined by a systematic review. Additionally, most incorrect-level procedures are performed in the lumbar spine. While seemingly rare, the occurrence of wrong-level surgery in one’s career cannot be underestimated. In a survey of AANS members, Mody et al. found that 50% of responders performed at least one wrong-level surgery. In the medicolegal context, wrong-level surgery frequently results in litigation, with prior indemnities as high as $1.5 million.

In 2004, the JC developed the Universal Protocol (UP) that highlighted preoperative verification, site marking, and surgical “time-out”; all accredited hospitals have since been required to implement the UP. For spine procedures, this includes stating and verifying the level, and side if applicable, intended to be operated upon. Vachhani and Klopfenstein found a statistically significant reduction of wrong-site surgery incidence after UP implementation; 93.3% of wrong-site cases were wrong-level spine surgeries. However, further analysis by Algie et al. determined that annual incidence of wrong-site surgery was already trending downward prior to UP implementation. Given confounding factors such as increased adoption of intraoperative imaging, the impact of UP is unclear. In a survey of neurological surgeons, Groff et al. found that only 40% of respondents believed that the UP had reduced wrong-level errors. Certain challenges of wrong-level surgeries cannot be overcome by the standardized, systems-based approach of the UP. Integration of both pre- and intraoperative imaging with the knowledge of the patient’s pathology while navigating spinal anatomy is a complex task that can only be accomplished by the spine surgeon. Patient-level characteristics from congenital variants to deformities of anatomy need to be appreciated and integrated into a patient-specific intraoperative plan.

In some cases, an operative level may be mislabeled in the preoperative radiological examination, an error that may be carried forward to the time of the operation.

Intraoperative imaging is a major key to determining the correct spinal level. Marking alone has proven to be insufficient. Nassr et al. determined needle localization during anterior cervical surgery incorrectly marked the spinal level at a 17% rate. With new techniques and technologies, various localization modalities have been developed that utilize fluoroscopy or plain radiography in conjunction with fiducial marking of an anatomical landmark. Still, the continued prevalence of wrong-level surgery underscores its limitations. While intraoperative imaging has mostly become common practice, its use is not universal among providers. Only 80% of respondents strictly follow guidelines for intraoperative radiography. Furthermore, intraoperative imaging is no panacea to wrong-level prevention. Miscounting or misinterpretation of spinal anatomy and patient obesity or operating room limitations leading to poor radiograph quality are all potential factors that negate the usefulness of imaging. In addition, there is also notable heterogeneity in the specific imaging methods and other preventative measures adopted. From the perspective of litigation, utilization of intraoperative imaging does not prevent liability.
Many more, most cases (83.3%) ruled in favor of the plaintiff bladder dysfunction presumed for CES diagnosis; further cases (73.3%) did not present with the defining bowel or CES malpractice cases, Daniels et al. reported that most with delayed surgery. Likewise, time to surgery was incontinence, motor deficit, pain, and sexual dysfunction correctly found statistically higher risks for persistent bladder incontinence, motor deficit, pain, and sexual dysfunction with delayed surgery. Likewise, time to surgery was significantly associated with plaintiff verdict in the study by Daniels et al.

Cauda Equina Syndrome

Cauda equina syndrome (CES) is a neurosurgical emergency characterized by severe compression of the cauda equina nerve roots in the central canal by a herniated disc, tumor, hematoma, abscess, or fractured bone fragments leading to paraparesis, saddle anesthesia, and bowel and bladder incontinence. There is strong evidence supporting the need for prompt diagnosis and surgical intervention in cases of CES, with delayed treatment associated with permanent motor deficits and loss of bowel and bladder function. With failures to diagnose and treat among the most commonly cited reasons for malpractice cases, particularly in spine surgery, CES is an important condition to consider due to significant medicolegal consequences. CES is an absolute indication for surgical emergency of the lumbar spine given the potential for permanent neurological damage affecting normal bladder, normal bowel, and sexual function. Reflecting the serious impact on patient well-being and quality of life, malpractice for CES can be very costly. Studies from the United Kingdom (UK) report average payments of £177,331–£336,000 ($292,596–$554,400 US) per case at 2003 prices. A review of CES cases in the US between 1983 and 2010 revealed a mean award of $1.57 million. Thus, from the perspectives of patient care and litigation, recognition and appreciation of CES are necessary for appropriate management.

Variability in clinical presentation may prolong diagnosis and surgical intervention for CES, which has important medicolegal ramifications. In a review of US CES malpractice cases, Daniels et al. reported that most cases (73.3%) did not present with the defining bowel or bladder dysfunction presumed for CES diagnosis; furthermore, most cases (83.3%) ruled in favor of the plaintiff also did not have the classic CES presentation. Many patients (43%) lacked urinary dysfunction in a report of CES cases in the UK by Todd. Following diagnosis of CES, early decompressive surgery within 48 hours is crucial for improving prognosis. Nielsen et al. reported return of normal detrusor contraction in 72.7% versus 30% of patients who received surgery < 48 hours and > 48 hours, respectively, after CES symptom onset. Similarly, Shapiro found 100% versus 33% resolution of urinary and stool incontinence with surgeries performed < 48 hours and > 48 hours, respectively. Both Shapiro and Ahn et al. separately found statistically higher risks for persistent bladder incontinence, motor deficit, pain, and sexual dysfunction with delayed surgery. Likewise, time to surgery was significantly associated with plaintiff verdict in the study by Daniels et al.

Death

In the context of spine surgery, intraoperative or perioperative death may occur from acute blood loss, cardiac arrest, anaphylaxis, massive pulmonary embolism, septic shock, pneumonia, acute respiratory distress disorder, or massive stroke. These outcomes may be a direct cause of the disease or injury being treated, due to technical aspects of the operation being performed, administration of anesthesia, preexisting medical conditions, incidents occurring in the postoperative period, or some combination of the above. Administration of a general anesthetic, required to perform most spine surgeries, carries a small risk of death itself. The risk of death from anesthesia was estimated to be 1 in 5500 cases in 1960 to 1 in 26,000 in 1984. Reaction to drugs used for general anesthesia may cause anaphylaxis, cardiac arrhythmias, liver necrosis, or malignant hyperthermia. A study of National Health Service hospitals in the UK found that anesthesia played a role in 14.1% of deaths reported in the intraoperative and perioperative period. Almost all inhalational anesthetic agents cause some degree of peripheral vasodilation and cardiac depression, which may cause myocardial ischemia.

Unsurprisingly, patient death is a major aspect of litigation brought against neurosurgeons. In a recent analysis by Elsamadicy et al., 17.4% of claims brought against neurosurgeons involved patient death. Of all claims against neurosurgeons involving patient death, displacement of intervertebral disc was the most common associated medical condition, with an average payment of $457,222. In these cases, improper performance of the procedure resulted in the highest total payments ($330,500 average payout per claim) in cases involving patient death.

Ethical Considerations

The successful practice of spinal neurosurgery is founded not only on technical excellence, knowledge, and clinical acumen, but also on an unwavering commitment to high ethical standards. Ethics is a foundational principle in medicine, highlighted by the recitation of the Hippocratic Oath by medical students to “First do no harm.” In the context of spine surgery, ethical behavior involves avoiding any intentional wrongdoing or harm to patients, respecting the wishes and dignity of patients, surgeons setting appropriate limitations on their scope of practice, and prompt disclosure of errors or complications to patients and their families.

The prompt disclosure of errors or complications to patients and their families is now universally advocated by patient safety organizations, experts, and physician groups. Since the publication of To Err Is Human by the Institute of Medicine in 1999, there has been increased attention on the need for transparency between providers and patients regarding medical errors. Although the risk of malpractice may be invoked as an obstacle of physician disclosure of errors, there is evidence that lack of transparency about errors and complications increases the risk of litigation. In a review of malpractice claims, 10% of claims cited failure to provide an explanation as motivation for pursuing litigation. Conversely, there is evidence that clear communication of errors to patients does not increase the risk of litigation. In 2002, an act was passed in Pennsylvania mandating the written and verbal disclosure of serious events to patients. The implementation of this act...
medical errors and complications to patients has been as - also at increased risk for litigation. Prompt disclosure of such as CES or incomplete spinal cord injury, which are neurosurgical intervention to mitigate long-term disability, of the spinal cord and nerve roots to traumatic or iatro - genic injury. Tort reform is an important geographic de - terminant on the rate of malpractice claims levied against neurosurgeons and the average amount awarded per claim. Overall, the rate of malpractice claims appears to be trending downward, but the amount awarded per claim has increased. Like other surgical subspecialties, wrong-sided surgery is considered a sentinel event with high risk for litigation, but the complex segmental anatomy of the human spinal column creates the possibility of wrong-level surgery, which is also highly litigated. In addition, spine surgeons treat conditions requiring prompt diagnosis and neurosurgical intervention to mitigate long-term disability, such as CES or incomplete spinal cord injury, which are also at increased risk for litigation. Prompt disclosure of medical errors and complications to patients has been associated with reduced rates of litigation. Above all, maintaining high ethical standards in the face of complications is critical in spine surgery.

Conclusions

Spinal neurosurgery is among the highest litigated specialties due to the possibility of permanent disability from the natural history of the conditions being treated, the need for instrumentation placed in close proximity to vital neurovascular structures, and the unforgiving nature of the spinal cord and nerve roots to traumatic or iatrogenic injury. Tort reform is an important geographic determinant on the rate of malpractice claims levied against neurosurgeons and the average amount awarded per claim. Overall, the rate of malpractice claims appears to be trending downward, but the amount awarded per claim has increased. Like other surgical subspecialties, wrong-sided surgery is considered a sentinel event with high risk for litigation, but the complex segmental anatomy of the human spinal column creates the possibility of wrong-level surgery, which is also highly litigated. In addition, spine surgeons treat conditions requiring prompt diagnosis and neurosurgical intervention to mitigate long-term disability, such as CES or incomplete spinal cord injury, which are also at increased risk for litigation. Prompt disclosure of medical errors and complications to patients has been associated with reduced rates of litigation. Above all, maintaining high ethical standards in the face of complications is critical in spine surgery.

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