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Clinical Study

Malpractice claims in spine surgery in Germany: a 5-year analysis

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Abstract

STUDY DESIGN: Retrospective analysis of anonymized malpractice claims.
SUMMARY OF BACKGROUND DATA: Spine surgery is considered a high-risk specialty with regards to malpractice claims. However, limited data is available for Germany. We analyzed the rate, subject, and legal outcome of malpractice claims faced by spine surgeons in one of the largest Medical Council coverage areas in Germany, representing 60,000 physicians and a population of 10 million.
METHODS: Analysis of all malpractice claims regarding spinal surgeries completed by the Review Board of the North Rhine Medical Council (NRMC) from 2012 to 2016. Claim merit, content, and actual treatment errors were reviewed. Severity of damage was graded from negligible (1) to death (6).
RESULTS: A total of 8,381 malpractice cases were reviewed by the NRMC from 2012 to 2016. Four percent (340 cases: 181 females, 159 males) pertained to patients undergoing spinal surgery with 94.7% of patients undergoing inhospital treatment and 5.3% as outpatients. Malpractice claims most frequently involved neurosurgery (48.5%) and orthopedic surgery (37.6%). Trauma surgery was involved in 9.1% and other specialties in 4.8%. Actual treatment errors were found in 89 of 340 cases (26.2%).Of those, 81 resulted in treatment-associated health impairment. Negligible and/or temporary impairment was found in 49.3%. Negligible to moderate but permanent damage was observed in 39.5%. Nine patients suffered severe permanent damage or death (11.1%). The treated diagnosis was degenerative disc disease in 34 patients (41.9%), spinal canal stenosis in 13 (16%), vertebral body fractures in 10 (12.3%), spondylolisthesis in 6 (7.4%), and other diagnoses accounting for the remaining 18 (22.2%). Errors involved actual surgical treatment in 40.7%, surgical indication and preoperative workup in 28.4%, postoperative treatment in 25.9%, and patient consent in 4.9%.
CONCLUSIONS: Spinal surgery claims account for 4% of all claims reviewed by the NRMC in the 5-year period from 2012 to 2016. Eighty-nine (26.2%) were deemed justified. The majority of treatment errors (59.3%) occurred during workup, indication and consent, or during postoperative care. Errors during actual surgery were responsible for 40.7% of all treatment-associated damages. Understanding the distribution and content of claims is key to improving patient satisfaction not only by honing surgical skills, but also by improving pre- and postoperative communication and care. © 2019 Elsevier Inc. All rights reserved.

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Introduction

Actual medical malpractice litigation as well as its perceived threat continue to strongly influence healthcare providers worldwide. A representative survey among US primary care physicians identified malpractice concerns as the most important factor leading to overly aggressive patient care [1]. More recently, a study by Lyu et al. [2] found 20.6% of all medical care to be deemed unnecessary in a survey of 2,106 physicians, 84.7% of whom cited concerns regarding malpractice litigation as the principal reason for overtreatment.

This sentiment continues to influence diagnostic and treatment decisions despite recent data published by Schaffer et al. analyzing over 280,000 compensated malpractice claims [3]. While 20.1 paid claims per 1,000 physician-years were registered between 1992 and 1996, just 8.9 paid claims per 1,000 physician-years were registered in the 2009–2014 period [3]. However, the actual amount awarded to plaintiffs increased by 23.3% (from USD 286,751 to USD 353,473) over the same periods. Another factor likely contributing to the prevailing sentiment regarding malpractice is the fact that over two-thirds of all subspecialty surgeons above 55 years of age have been sued at least once in their careers, many of them repeatedly [4].

Among subspecialties, spine surgery is considered a high-risk discipline with regard to frequency of litigation and magnitude of financial compensation. Daniels et al. reported an average compensation in excess of USD 4 million in their analysis of 234 legal cases following spine surgery [5]. Most malpractice claims in Germany are filed out of court through review board of the federal medical councils. In 2017, 7,307 filings were reviewed, with plaintiff rulings in 2,157 cases (29.5%) [6]. However, limited data is available regarding malpractice claims related to spine surgery in Germany. In this study, we analyzed the rate, subject, and outcome of malpractice claims after spinal surgery in one of the largest medical council coverage areas in Germany, representing 60,000 physicians and 10 million inhabitants.

Methods

Data on malpractice claims

In Germany, patients may file malpractice claims with the state's medical council free of charge. Once filed, a review process by the board's advisory committee is triggered, gathering pertaining data from both patient and physicians involved, ultimately ruling the claim to be of merit or not. In more than 90% of cases deemed to be justified, out-of-court settlements are arranged (Fig. 1). In 2016 the German Medical Council advisory committees completed a total of 7,639 malpractice claims, of which 1,839 (24%) were filed with the North Rhine Medical Council (NRMC), a division covering the most densely populated area of Germany and thus deemed representative of the country as a whole [6,7]. We performed a retrospective analysis of the prospective database containing all cases completed by the advisory committee of the NRMC. Malpractice claims concerning spine surgery between 2012 and 2016 in patients aged 18 and older were extracted from the database. Claim objectives, legal implications, and actual treatment errors were reviewed. Advisory committee decisions were categorized as 1) treatment-associated damage resulting from medical error, 2) medical or treatment error without associated damage, or 3) adverse event/disease-related damage. The severity of impairment resulting from surgical treatment was graded on a 6-item scale as negligible (grade 1), transient minor (grade 2), transient major (grade 3), permanent minor (grade 4), permanent major (grade 5), and death (grade 6).

Data on overall number of spine surgeries in Germany

No precise data is available regarding the total number of spine surgeries performed in the area serviced by the NRMC between 2012 and 2016. Since the German Federal Bureau of Statistics only tracks disease (ICD) and procedural (OPS) codes, consideration of these metrics without proper context will likely lead to a significant overestimation of the total number of cases, as multiple procedural codes (ie, surgical steps) are assigned to a single patient's diagnosis. Although this shortcoming has been recognized by the German Spine Society, more precise data will likely not be available until a nationwide registry is established [8]. Instead, recent investigations have resorted to insurance data to assess surgical treatment. However, these metrics suffer from significant limitations related to the mixture of public and private insurance coverage. The authors thus refrained from using these rather crude insurance-based estimates for statistical analysis. Statistical data from the German Federal Bureau of Statistics is employed in the discussion section only.

Results

General characteristics and frequencies

From 2012 to 2016, a total of 8,381 malpractice claims were reviewed by the NRMC. Of these, 340 cases (4%) were related to spinal surgery. As patients were allowed to file individual claims for distinct treatment components (eg, diagnostic workup as well as surgical treatment), these 340 patients filed a total of 523 claims. Treatments occurred inhospital in 95.6% of cases and in outpatient settings in 4.4%. Neurosurgery was the most frequently involved subspecialty (48.5% of all cases), followed by orthopedic surgery (37.6%) and trauma surgery (9.1%). The time elapsed from the filing of a claim to the final decision by the NRMC was 12.14±6.3 months (Table 1).

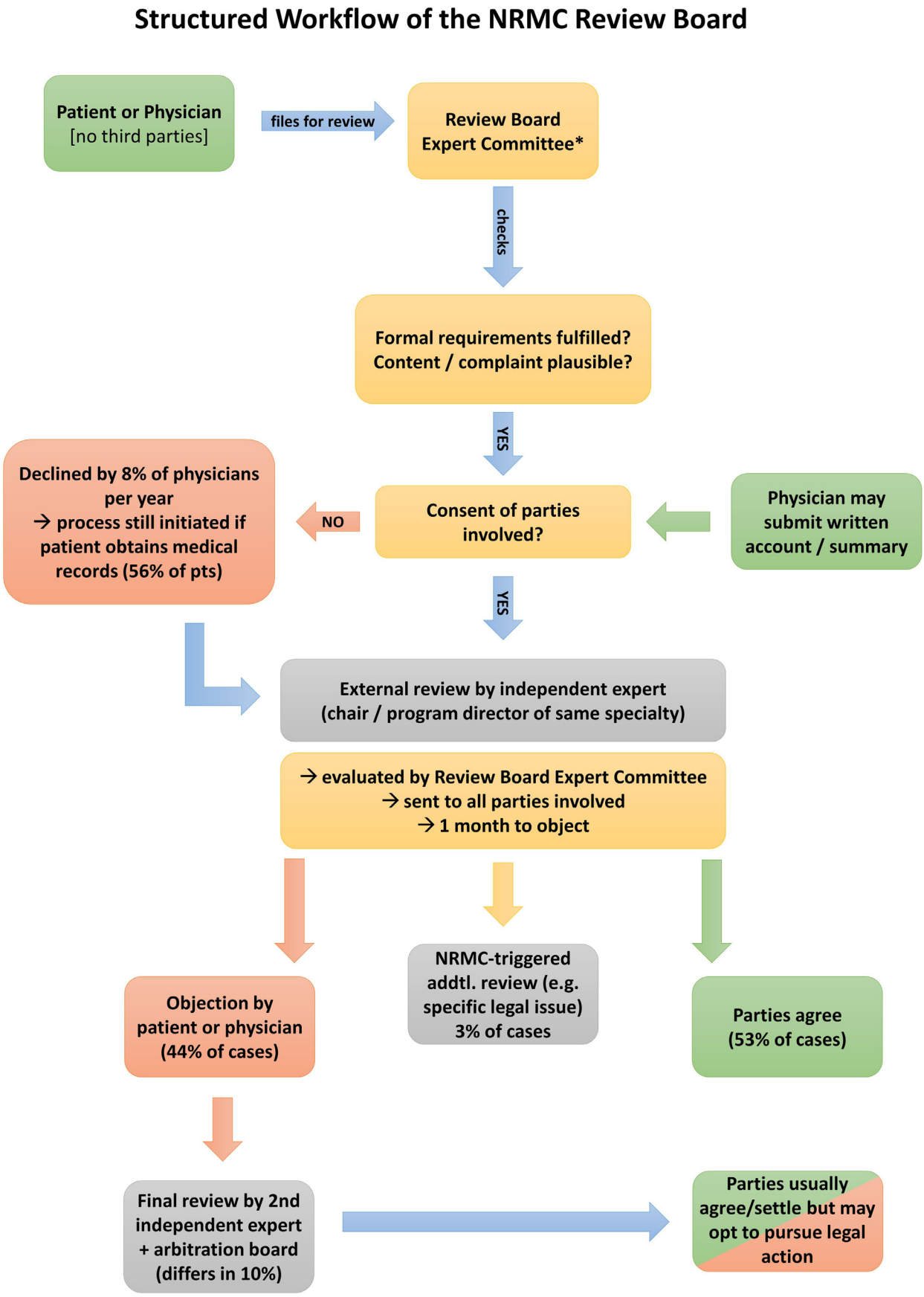

Fig. 1. Structured workflow of the NRMC Review Board. *NRMC Expert Committee consists of physicians and lawyers. Note that even in instances where physicians decline to participate patients can still initiate the review process by obtaining their medical records from the hospital.

Table 1
Patient characteristics, subspecialties involved and main diagnoses treated

Total cases reviewed by NRMC (2012–2016)	8,381
Treatment errors found	2,452 (29.3%)
Spinal surgery cases reviewed	340 (4%)
	181 female
	159 male
Case duration	12.14±6.3 mo
	(range: 3–50 mo)
Age (at time of treatment)	56.16±15.2 y
Inhospital vs outpatient	95.6% vs 4.4%
Subspecialty involved	
Neurosurgery	165 pts (48.5%)
Orthopedic surgery	128 pts (37.6%)
Trauma surgery	31 pts (9.1%)
Other	16 pts (4.8%)
Main diagnoses leading to treatment	
Disc herniation	150 pts (44.1%)
Spinal canal stenosis	68 pts (20.0%)
Vertebral body fracture	37 pts (10.9%)
Back pain (any type)	22 pts (6.5%)
Spondylolisthesis	16 pts (4.7%)
Others	47 pts (13.8%)

See text for details.

Perceived errors and damages from claimant's perspective

Of the 340 patients filing claims, the majority considered more than one component of their treatment as erroneous or damaging, accruing a total of 523 perceived errors. Most patients (65.4%) perceived their surgical treatment in general as improper or erroneous. Several claims were more specific, listing infections (28 patients), timing of surgery (nine patients), and issues related to surgical positioning (five patients). Postoperative care was considered erroneous by only 4.8% of claimants, whereas allegations of deficient informed consent and/or perioperative documentation were the reason to file a claim in 14.1% (Table 2).

To glean a better understanding of the motivating force behind each claim, an attempt was made to isolate the main issue from the patient's perspective. The majority were filed due to new postoperative neurological deficits, accounting for 37.6% of all claims. Chronic pain and insufficient relief of preoperative symptoms were cause for concern in 22.1% and 15%, respectively. In 10 cases (2.9%), a claim was filed after treatment-related death (Table 3).

Table 2
Perceived errors as per patient claims filed from 2012–2016. Several claims cited multiple perceived errors

Perceived errors 2012–2016	N=523
Error category	
Diagnostics	47 pts (9.0%)
Pre-op	26 pts (5.0%)
Post-op	21 pts (4.0%)
Indication	35 pts (6.7%)
Surgery	342 pts (65.4%)
Procedural	300 pts (57.4%)
Infection	28 pts (5.3%)
Timing	9 pts (1.7%)
Positioning	5 pts (1.0%)
Postoperative care	25 pts (4.8%)
Documentation/informed consent	74 pts (14.1 %)

Table 3
"Motivating Force" to file a claim

"Motivating Force" to file a claim	N=340
New neurological deficit	128 pts (37.6%)
Chronic pain	75 pts (22.1%)
Insufficient symptom relief	51 pts (15.0%)
Infection	24 pts (7.1%)
Additional surgery	23 pts (6.8%)
Intraoperative complications	18 pts (5.3%)
Death	10 pts (2.9%)
Other	11 (3.2%)

See text for details.

Error rates and associated damages

Of the 340 spinal surgery cases reviewed, actual treatment errors were found in 89 cases (26.2%). This figure is slightly lower than the overall treatment error rate of 29.3% from all 8,381 cases reviewed by the NRMC within the same time-frame. Treatment errors that caused physical harm (treatment-associated damages) were arbitrated in 81 patients (91%). Negligible and/or temporary damage was noted in 49.4% (40 patients). Negligible to moderate but permanent damage was observed in 39.5% (32 patients). Nine (11.1%) patients suffered severe permanent damage or death (Table 4).

Distribution of treatment errors

The above figures remain vague and rather useless to spine surgeons without more detailed knowledge of when and how these errors actually occurred. We therefore examined all 81 cases with treatment-associated damage in more

Table 4
Treatment errors, associated damages and pathologies treated

Spinal surgery claims reviewed (2012–2016)	340
Treatment errors	89 (26.2%)
Treatment-associated damages	81 (91% of total errors)
	female: 45 (54.9%)
	male: 36 (45.1%)
Damage severity	
1. Negligible	1 pt (1 m), 1.2%
2. Transient minor	38 pts (20 f; 18 m), 46.9%
3. Transient major	1 pt (1 m), 1.2%
4. Permanent minor	32 pts (21 f; 11 m), 39.5%
5. Permanent major	8 pts (3 f; 5 m), 9.9%
6. Death	1 pt (1 f), 1.2%%
Type of treatment	
Disc herniation	37 pts (45.7%)
Spinal canal stenosis	13 pts (16.0%)
Vertebral body fracture	10 pts (12.3%)
Back pain (any type)	9 pts (11.1%)
Spondylolisthesis	4 pts (4.9%)
Others	8 pts (9.9%)

Table 5
Treatment-associated damages stratified by error category

Treatment-associated damages 2012–2016	81
Error category	
Diagnostics	11 pts (13.6%)
History/examination	3 pts (3.7%)
Imaging	7 pts (8.6%)
Other	1 pt (1.2%)
Indication	12 pts (14.8%)
Surgery	33 pts (40.7%)
Procedural	25 pts (30.9%)
Strategy	6 pts (7.4%)
Positioning	2 pts (2.5%)
Postoperative care	21 pts (25.9%)
Documentation/informed consent	4 pts (4.9 %)

detail. Errors involved actual surgical treatment in 41.5%, indications, preoperative workup in 28%, postoperative treatment in 25.6%, and informed consent in 4.9% (Table 5).We further analyzed all errors made during surgery. In two cases, patients were allegedly improperly positioned on the operating room (OR) table and subsequently suffered pressure-related damages. Six damages were strategy-related and purportedly due to either employing improper approaches or by overtreating patients when more simple procedures would have sufficed. Twenty-five patients suffered treatment-associated damages due to procedural errors. These included wrong-level or wrong-side surgeries, misplaced pedicle screws with associated neural damage, or improper surgical technique (Table 6).

Discussion

General

This study presents a detailed analysis of malpractice claims related to spinal surgery in Germany from 2012 to 2016 using a representative sample covering 10 million inhabitants. In the entire sample, 4% of all malpractice claims were filed after spinal procedures. Nearly 75% of claims were filed due to either new postoperative neurological deficits (37.6%), chronic pain (22.1%), or insufficient postoperative symptom relief (15%).While the occurrence of new neurological deficits can be considered a plausible reason to file a malpractice claim, chronic pain and insufficient symptom relief in particular, stand out as common motivations for malpractice claims in this representative patient cohort. Claims encompassed 523 perceived errors, with surgical treatment in general considered erroneous by 65.4% of patients. Informed consent and written documentation were considered inadequate by 14.1%, and postoperative care by 4.8% of patients filing claims. In total, 89 of 340 cases (26.2%) were ruled as treatment errors by the advisory committee. Eighty-one of those patients (91%) suffered treatment-associated damages (Tables 5 and 6). Contrary to patient perception, actual surgical errors accounted for only 40.7% of all damages while 59.3% (48 cases) were deemed erroneous regarding preoperative workup, indication, informed consent, or postoperative care. Hence, in spinal surgery, even with impeccable operative skills, and even if utmost care is taken during surgery, the majority of treatment-related damages occur *prior to* or *after* completion of the actual surgical procedure.

Malpractice claims in Germany and the United States

Scientific data for Germany regarding malpractice claims and treatment-associated damages is limited. Advisory committees of all German medical boards publish yearly reports on malpractice claim rates. Although these reports rarely discuss particular subspecialties in detail, they are very useful to assess trends and overall risks of treatment-associated damages within the German healthcare system [6,9]. Assessment of those reports from 2012 to 2017 revealed an overall decline in malpractice claim filings, reviews, and actual treatment errors of 9.25, 3.58, and 3.32% respectively over this 6-year period (Fig. 2). The authors cannot rule out a shift towards other routes for litigation (eg, legal action, immediate settlements with providers or hospitals). However, these figures resemble the overall decline seen in the United States reported by Guardado on behalf of the American Medical Association, as well as the reduction in total claims seen in the UK's National Health Service (NHS) by 8.2% from 2013–2014 to 2015–2016 [4,10]. This overall decline is in stark contrast to the increase in spinal procedures conducted worldwide, and in Germany in particular [11]. The increase in procedures from 2012 to 2016 underscores the overall decline in malpractice claims within this time period (Fig. 3).

Significant differences between the legal systems in general, and the way malpractice claims are submitted in particular, render a meaningful comparison of claim rates impractical. Researchers frequently reviewed law databases to identify court rulings and settlements or analyzed federal records such as the National Practitioner Data Bank to identify malpractice payments made on behalf of US physicians [3,12–14]. Because US patients have very few options regarding a review of their surgical treatment by an independent party outside a lawsuit, even the definition of medical malpractice likely varies between American and German spine surgeons.

Unlike the situation in the United States medical system, concerns about litigation appear less prominent among German healthcare providers in the authors' experience. However, solid data on physician sentiments regarding this issue is not available. While certain subspecialties within German medical care, such as pediatrics and obstetrics/gynecology have previously been scrutinized regarding malpractice and associated damages, reliable data for spinal procedures is basically nonexistent [15,16].

Malpractice claims after spinal surgery

To better gauge the scope of malpractice litigation in Germany, we conducted a thorough search of court

Table 6
Surgical errors in detail, stratified by error sub-category (positioning, procedural and strategy)

Case	Error	Result
#208	Positioning	Eye-brow pressure ulcer
#304	Positioning	Pressure ulcer on forearm of patient
#012	Procedural	Improper (wet) skin preparation, pt suffering penile burn injury
#030	Procedural	Nerve root damage during anterior cervical TDR procedure
#036	Procedural	Surgery performed on the wrong side, herniated disc not treated
#052	Procedural	Extraforaminal disc herniation, approach not suitable, unsuccessful surgery, revision with same approach, again unsuccessful
#055	Procedural	Anterior intervertebral space exceeded during dorsal procedure, surgeon unable to prove usage of x-ray or other safety checks to reduce this risk
#057	Procedural	Improper/insufficient decompression of nerve root in spinal stenosis
#077	Procedural	Prolapsed disc was not removed as discussed with patient before procedure and despite being clearly indicated
#086	Procedural	Herniated lumbar disc not properly addressed, fragments not removed properly
#089	Procedural	Nerve root injury, reviewer deemed use of kerrison punch improperly prepared, actual disc prolapse not addressed by surgeon
#102	Procedural	Injury to nerve root during drilling, reviewers found lack of procedural safety measures
#138	Procedural	Pedicle screws misplaced during percutaneous procedure, spinal cord injury, lack of x-ray usage during k-wire positioning
#147	Procedural	Insufficient decompression during anterior cervical procedure during initial and revision surgery, corpectomy deemed indicated by reviewer
#149	Procedural	Improper pedicle screw length with large-vessel contact
#170	Procedural	Pedicle screws misplaced, not detected by surgeon on intraoperative x-ray despite obvious misplacement
#183	Procedural	Wrong-level surgery, fractured T11 not treated but T10, not detected during procedure
#201	Procedural	Insufficient intervertebral preparation before cage insertion, thereby causing spinal canal compression upon insertion
#221	Procedural	Vertebroplasty performed on old fracture without obtaining consent
#233	Procedural	Misplaced pedicle screw, not detected by surgeon on intraoperative x-ray
#269	Procedural	Pedicle screw misplaced, causing dural tear, misplacement not corrected in revision surgery
#273	Procedural	Pedicle screw misplaced
#296	Procedural	Nerve root damage by misplaced pedicle screw, overtreatment (fusion performed despite root decompression deemed sufficient)
#302	Procedural	Pedicle screw misplacement with damage, no post-op CT scan
#325	Procedural	Injury to L4-nerve root with high-speed drill, unnoticed, and without further correcting measures during surgery
#333	Procedural	Bony spur during anterior cervical procedure not removed although deemed detectable by reviewer, post-op CT not properly read
#337	Procedural	Surgery for herniated disc begun on the wrong side, dural tear untreated
#226	Strategy	Improper procedure after questionable indication, not employing proper fusion, implant insufficiency requiring revision
#253	Strategy	Staged dorsal and ventral revision of case intended for dorsal-only procedure
#268	Strategy	Simple procedure indicated for disc herniation, fusion performed
#281	Strategy	Simple procedure indicated for disc herniation, fusion performed despite known coagulopathy
#306	Strategy	Percutaneous procedure for herniated disc performed, unsuccessful, deemed improper to reach location of herniated nucleus
#313	Strategy	Improper procedure for herniated disc performed, unsuccessful, revision surgery necessary, dural tear

decisions regarding medical malpractice from 2012 to 2016 period. Employing Germany's largest law database, we identified 1,185 cases related to medical liability and indemnity payments [17]. Refining the search to include only cases related to spine surgery, the database yielded just 141 court decisions for all of Germany. Additional searches in state court's databases returned comparably low case numbers. Because lower courts in particular rarely publish their decisions online, these databases are not comprehensive and thus not useful to properly assess the overall frequency of malpractice lawsuits. Considering the 341 cases reported in this study, cover a population of nearly 10 million, these figures would extrapolate from 2,500–3,000 cases reviewed by all medical councils in Germany, underlining the relevance of these advisory committees and their decisions. Fig. 4 shows the distribution of claims and advisory committee decisions for Germany and for our cohort. No firm data regarding the total number of spinal surgeries performed in Germany per year is available. Petzold et al. [18] recently published data extracted from one of the largest health insurance providers in Germany. Accordingly, there were 378 spine surgeries conducted per 100,000 insured patients in 2014, which corresponds to an annual total of 36,288 spine surgeries for the patient population covered herein. Using this figure as a comparative average for the 2012–2016 period investigated in our study, it would yield an annual claim rate of 0.19%, with actual treatment-associated damages found in 0.045%, or 1 per 2,240 surgeries.

Data extracted from US and UK judicial and malpractice databases are likely more comprehensive, and have thus been employed in similar analyses before [12,19,20]. An investigation of 235 cases of successful litigation after spinal surgery in England between 2002 and 2010 revealed a steady decline of litigation rates over the 9-year period [20]. Successful claims dropped from 51 in 2002–2003 to

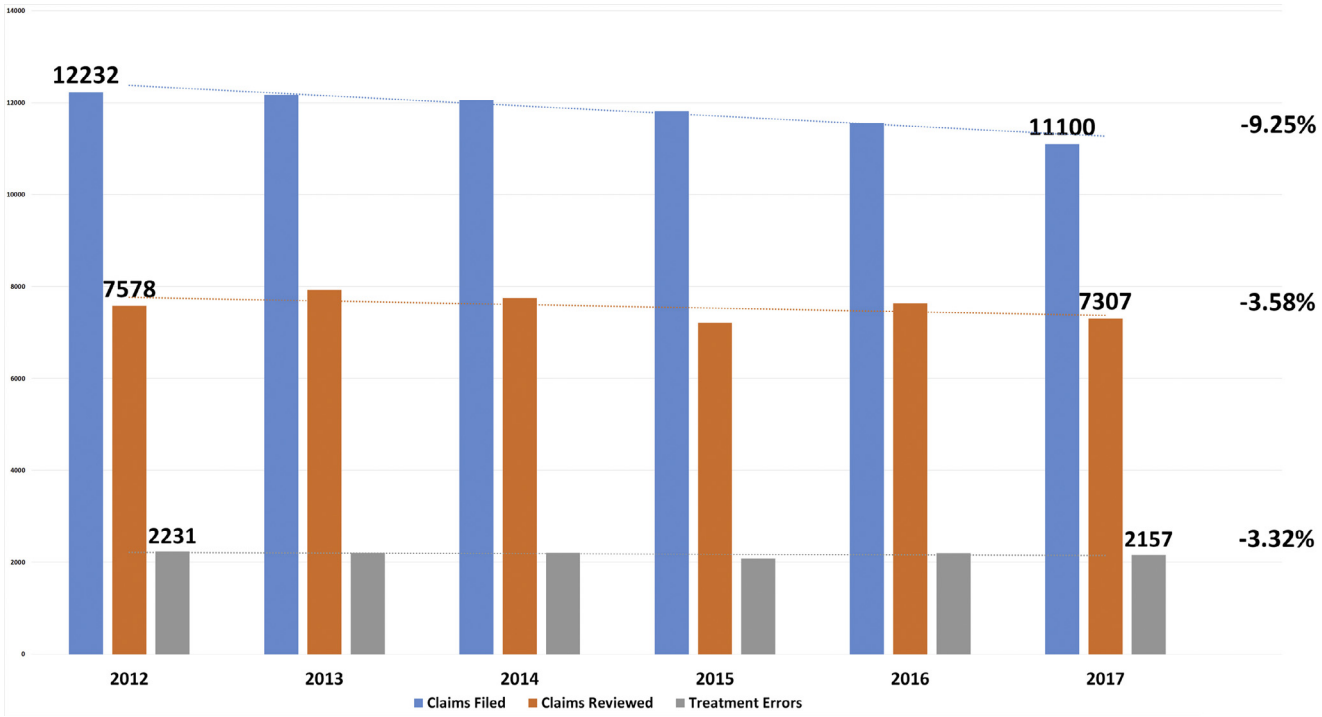

Fig. 2. Malpractice claim trends in Germany 2012–2017. Claims filed (blue bars), claims accepted for review (orange bars), and treatment errors found (gray bars), all declined over the period. See text for details.

5 in 2009–2010, while the total number of procedures within the same time frame increased by 30%.The authors cautioned that the decline in malpractice claims could be partially attributed to lengthy court proceedings warranting verification. While claim duration figures were not provided in this particular report, the NHS Litigation Authority (NHSLA) handling all claims against its providers, reported an average duration of litigation of 15.7 months [21].

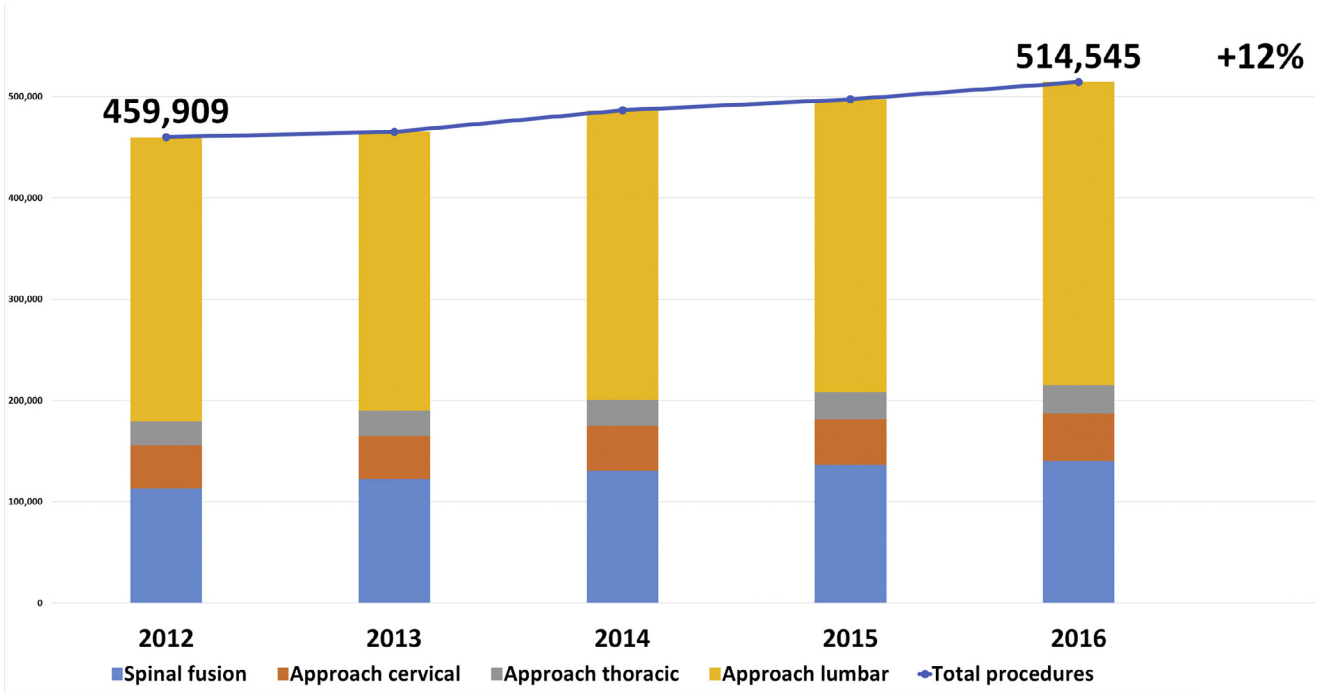

Fig. 3. Spinal procedures in Germany 2012–2016. Total procedures (blue line) rose by 12% over the period. Spinal fusions (blue), cervical (orange), thoracic (gray), and lumbar approaches (yellow bars) were analyzed. See text for details.

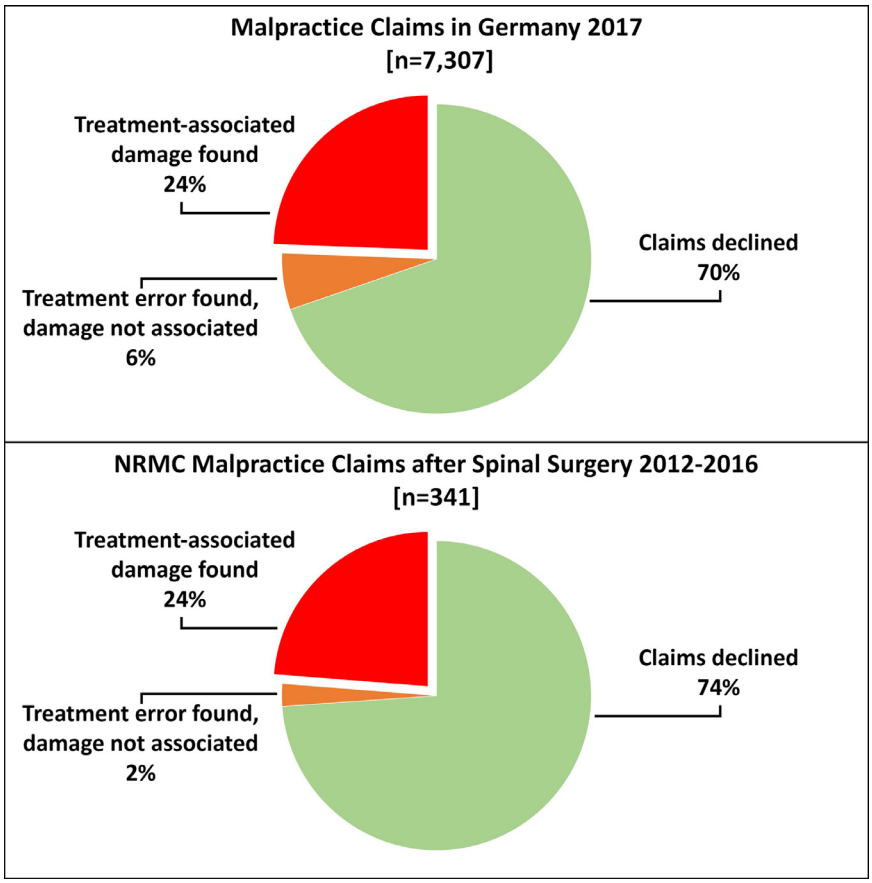

Fig. 4. Malpractice claims and advisory board decisions for Germany and for the NRMC catchment area. Upper graph depicts all claims filed in 2017 irrespective of subspecialty. Lower graph shows NRMC data for the 2012–2016 period. Note the similar distribution of claims declined and treatment-associated damages found.

According to the NHSLA, only 96 out of 16,459 claims brought up against the NHS in 2015–2016 went to court, and 60% of those were ruled in favor of the defendant [10]. Quraishi et al. [20] reported an average malpractice claim success rate of 0.13% in the United Kingdom (1 per 788 surgeries). This number further decreases considering only the time frame between 2008 and 2010 with 0.057% successful claims, or 1 per 1,743 cases.

For the United States, Epstein [22] conducted a legal review of 78 cases of cervical spine litigation, 68 of which had undergone surgical treatment. Patients were suing for negligence during surgery, lack of informed consent as well as errors in diagnostics, and failure to brace. Thirty cases (38.5%) returned defense verdicts, while indemnity payments were necessary for 22 cases (28.2%) ruled in favor of the plaintiff, and 26 cases (33.3%) in which settlements were agreed upon. On average, 2.5–5.7 years were required to obtain a verdict or reach a settlement. This is considerably longer than the average time to completion in the United Kingdom and in Germany, but also in comparison to all malpractice cases independent of provider specialty. Seabury et al. [23] analyzed 26,853 claims and found an average time to resolution of 20.3 months. Makhni et al. [19] examined American legal proceedings covering the years 2010–2014. The authors identified 103 spine surgery malpractice cases, of which 75% were ruled in favor of the defendant surgeon, 26 cases were ruled in favor of the plaintiff. Claim types were primarily categorized as "technical/judgment" (45%), followed by "nerve injuries" and "consent". The authors identified three cases of wrong level surgery, and one case with foreign body retention. While settlements were reached after 3.78 years on average, cases ruled in favor of the defendant took the longest to complete, 5.51 years on average.

The high price of liability

Malpractice litigation is costly from a financial perspective, and its monetary burden on healthcare systems worldwide keeps rising: the NHSLA reported a GBP 319 million increase in payments for a total of GBP 1,488.5 million for the year 2015/16 [10]. For a total of 11,524 cases resolved by disbursement, these figures translate to an average claim value of GBP 129,165. Schaffer et al. conducted a meticulous analysis of compensation payments for malpractice litigation in the United States. Payouts for the 2009–2014

period averaged USD 353,473 [3]. The National Practitioner Data Bank does not provide data regarding surgeon specialties or specific procedures but is useful in gauging the general frequency of malpractice payments in population-wise comparable states: US Census Bureau population estimates for Georgia, North Carolina, and Michigan are within five percent of the 10 million catchment area of the NRMC, allowing for at least some comparability [24]. In the 2012–2016 period, the NRMC reviewed 8,381 claims, of which 29.3% (2,452 cases) were ruled as treatment errors. Data from one of the largest malpractice insurers in Germany showed significantly lower monetary awards for out-of-court settlements in Germany, averaging EUR 36,000 (approximately USD 41,000) compared with plaintiff rulings averaging EUR 93,000 (approx. USD 105,000) [25]. North Carolina had the lowest number of malpractice cases (550) and average payments of USD 323,000. Georgia reported 971 payments with an average of USD 440,000. Physicians in Michigan were significantly more frequently involved in malpractice cases resulting in payments (1,518) but averaged significantly lower monetary awards (USD 183,000). When focusing only on spine surgery litigation, average values go up significantly in all jurisdictions, reflecting the frequently disabling nature of malpractice in high-risk specialties. Quaraishi et al. reported data for the United Kingdom, with an average payout of nearly GBP 260,000. These payouts are certainly dwarfed by those handed to successful spine surgery claimants in the United States—Epstein's analysis of cervical spine malpractice cases reported an average compensation of USD 4.0 million in cases of plaintiffs' verdicts, and USD 2.4 million in cases settled out of court [22]. The recent publication by Makhni et al. [19] reported nearly identical compensations: USD 3.945 million in cases with jury verdicts, and USD 2.384 million for cases settled out of court. Using the same database for a different cohort, Agarwal et al. [26] found plaintiff rulings to average USD 2.525 million, and settlements of USD 1.3 million. Daniels et al. [5] used a different legal search engine, identifying 234 cases of litigation following spine surgery. The authors confirmed the more significant financial burden of plaintiff rulings (USD 4.045 million) compared with settlements (USD 1.930 million). While these averages are astounding, it is the range of disbursement figures that is disturbing: settlements of up to USD 9 million, and plaintiff rulings of more than USD 38 million illustrate the at times ludicrous financial consequences of malpractice claims that leave health care providers scrambling for ways to reduce vulnerability to these types of indemnity payments. While caps on plaintiff compensations make sense and are implemented in many state legislatures, the authors disagree with the American Medical Association's notion that medical practitioners are still in a state of crisis, or ever were for that matter, when it comes to malpractice litigation [27]. We are, however, in a bind when it comes to treating patients, particularly in acute care regarding doing what is necessary and doing what most likely prevents us from facing litigation. Ideally, these two should be identical, with medical necessities dictating diagnostics and treatment algorithms. However, knowing patients are filing claims for reasons such as alleged incomplete imaging before surgery, surgical site infections or simply a lack of improvement of neurological deficits (Table 2), the urge to "cover all bases" by overtreating patients and by overutilizing diagnostic modalities is understandable. At the peak of the last "malpractice crisis" of the early 2000s, Baicker et al. [28] published compelling data on the relationship between litigation costs and increased healthcare spending. The authors demonstrated the concomitant rise of indemnity payments and increased usage of imaging modalities and its associated costs. Spine surgery procedures were identified as the only procedure significantly decreasing in frequency as liability spending increased—likely due to the high risk of litigation. Missios and Bekelis [12] were more recently able to show similar correlations of aggressive malpractice environments and increased hospitalization charges in their big data analysis of patients undergoing spine surgery. It is this increased overutilization of imaging modalities that many authors attribute to defensive medicine, and malpractice litigation is most likely a relevant contributor to this practice. Nahed et al. [29] surveyed 1,028 neurosurgeons regarding their views on defensive medicine: the authors identified 72% of neurosurgeons ordering additional imaging studies for their patients and 67% ordering additional laboratory tests, solely due to concerns of malpractice litigation. In total, 45% of those surveyed actually eliminated high-risk procedures from their portfolio to minimize liabilities. More recently, Din et al. [30] found spine surgeons three times more likely to practice defensive medicine when compared with nonspine surgeons in a survey of 1,024 neurosurgeons, 499 of which were spine specialists. Spine surgeons in this analysis were also significantly more frequently sued in their lifetimes and were significantly more concerned about the location they practiced in, due to the risk of litigation compared with nonspine surgeons. A total of 77.4% stated that they viewed every patient as "a potential lawsuit," and nearly 90% stated that a liability crisis existed in their location. However, this sentiment of a malpractice crisis should be questioned when considering the actual decrease in total litigation cases. Additionally, malpractice insurance premiums in the United States are actually decreasing, as outlined in a recent article on the 'perpetual crisis' by Rodwin et al. [31] While 43.7% of the surgeons surveyed in the publication by Din et al. [30] had been sued before, the average number of lifetime settlements was just 1.1, underlining the notion that it is the perception of a crisis that needs to be addressed as much as the issues that clearly exist in malpractice litigation. Health care providers have felt this way for several centuries: Spiegel and Kavaler [32] published an excellent review of what they called "America's First Medical Malpractice Crisis" of 1835–1865. Interestingly, even then those treating the

most complex cases were most at risk of litigation: doctors trying to save limbs instead of amputating them in cases of compound fractures were an easy target when cosmetic or functional results were lacking. The solution should in our view not be sought in offering care only to the less-complex or less complication-prone patients, nor should it be common thinking to regard every patient as a potential lawsuit—the data presented clearly shows that only a tiny minority of those treated actually file malpractice complaints, and even then, only a fraction will be considered medical errors. Instead of practicing defensively in avoidance of a small and manageable risk, we should emphasize the high-risk nature of our specialty to each patient, and to acknowledge that undesired outcomes are part of our practice. With the rise in revision surgeries, complications are rising significantly as well, emphasizing the need to address and prepare these patients, in particular for possibly prolonged hospitalization and increased morbidity [33]. Explaining this to patients before surgery, and confronting less satisfying results openly, will likely reduce the number of meritless complaints much more effectively than caps and fearful overtreatment ever can. Those that suffer actual damages that negatively and continuously affect their lives should not be regarded as adversaries. Rather, their motivation to obtain adequate financial compensation should be accepted and understood. Enabling them to seek independent arbitration would not only expedite the process of malpractice litigation, as shown for the United Kingdom and Germany, but would also reduce costs and premiums for all involved.

Limitations

Our study provides data regarding the quality and quantity of malpractice litigation after spinal surgery in Germany. Our data is based on a representative region of Germany. However, despite being the most densely populated area covering nearly 10 million inhabitants, it is not an exact representation of Germany as a whole, with a total population of 82 million. In addition, our data only represents cases processed by the advisory committee of the NRMC. Cases in which patients sought other avenues of litigation, such as lawsuits without prior arbitration, or arbitration sought via health insurance providers, were not included in our analysis. Finally, the lack of reliable data regarding the total number of spine surgeries in the patient population covered herein remains unsatisfactory. However, we have provided estimates based on the best data available. Considering these shortcomings, the authors are still convinced that the data provided is solid, reliable, and of significant relevance to spine surgeons worldwide.

Conclusions

Among all physicians, neurosurgeons and orthopedic surgeons are faced with the highest and fourth highest rates of malpractice claims, respectively [34]. With indemnity payments rising, and the lasting and widespread effects of litigation both on the surgeon as well as hospitalization costs, it would appear wise to not seek solution in capping patient rights, but to seek ways of complication avoidance, and to avoid court verdicts by offering patients simple routes to file their claims to independent expert panels. Compared to lengthy court battles, the management of malpractice claims by the German arbitration boards is to be commended for its swiftness and economic efficiency. Our results underline the need to optimize pre- and postoperative care: intraoperative errors comprised only 40.7% of all treatment-associated damages. Thus, intraoperative complication avoidance only addresses part of the problem. The fact that more than one-third of filings was due to either chronic pain or insufficient symptom relief underlines the need for improved communication regarding realistic expectations from spine surgery. Patients left to their own devices without proper guidance and care will seek other avenues to obtain what they consider fair treatment. Therefore, it should be our focus to improve not only our surgical training and vigilance, but also to emphasize meticulous care both pre- and postoperatively in us and our residents. This will not eradicate tedious litigation claims entirely, but it will help to alter the perceived hostile landscape we have come to accept as normal in our specialty.

Supplementary materials

Supplementary material associated with this article can be found in the online version at https://doi.org/10.1016/j.spinee.2019.02.001.

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