

Research Paper

Litigation involving patients with slipped capital femoral epiphysis

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ABSTRACT

Background: Slipped capital femoral epiphysis (SCFE) is a hip disorder of late childhood and adolescence. Litigation involving SCFE may occur, as it is frequently diagnosed late, and/or may be temporally related to an injury. The purpose of this study was to review litigation cases involving SCFE in the US, focusing on the type of litigation (professional, premise, or product liability), the outcome of the litigation and indemnity payouts.

Methods: Cases of litigation involving SCFE were identified using 5 legal databases and Google Scholar searching for the term "slipped capital femoral epiphysis". These databases originated as early as 1973. The data collected was the alleged complaint, type of defendant, outcome, state where filed, and amount of indemnity payout. Payout amounts were converted to 2020 US\$. Statistical analyses were performed with SYSTAT® 10 software.

Results: There were 135 unique cases identified which involved professional liability (103), premise liability (30), both premise and professional liability (1), and product liability (1). Complaints for professional liability cases were alleged failure in diagnosis (71), inappropriate treatment (14), both diagnosis and treatment (12), and others (7). The delay in those with an alleged late diagnosis (37 cases) was 5.8 months. The three most common specialties named as defendant(s) were primary care (31%), orthopaedic surgeons (29%), and radiologists (16%). The primary allegations against non-orthopaedic surgeons were failure in diagnosis (89%) as opposed to orthopaedic surgeons where the complaints of alleged failures in diagnosis and inappropriate treatment were equal (50%). The geographic region of the filed cases was the Northeast (44%), South (24%), Midwest (16%), and West (16%). There were no differences between premise and professional liability cases by geographic region. The overall outcome was favorable for the defendant(s) in 53% and the plaintiff in 47%; the defense prevailed in 60% of the professional liability but only 33% of the premise liability cases. The indemnity payout amount (for the 52 cases where known) averaged \$1.28 million. Payout was higher in the complaints for professional compared to premise liability (\$1.5 vs. \$0.9 million). The average payout for those with and without avascular necrosis was \$2.97 million vs. \$1.02 million. For the professional liability claims, indemnity payout was most frequent in the Western US. It must be remembered that this study only represents law suits filed in the US court system. It does not include cases that might have been resolved prior to any legal action as those cases are not publicly available.

Conclusions: Reported litigation involving SCFE patients involved claims of professional liability in 77% and premise liability in 22% of located cases. Due to significant exposure, this study should serve as a reminder to all health care providers to include SCFE in the differential diagnosis of knee/thigh pain in adolescents.

1. Background and rationale for the study

Slipped capital femoral epiphysis (SCFE) is a hip disorder well known to pediatric orthopaedic surgeons, but often less so to other specialists. The symptoms are often ambiguous.^{1,2} The diagnosis can be missed early in the course of the disease due to a nebulous history,¹ symptoms of knee pain,²⁻⁷ lack of confidence by initial providers in their evaluation,⁸ and Medicaid insurance.² Medicaid insurance in the US is for

low-income adults, children, pregnant women, elderly adults and people with disabilities. Medicaid Payments for physician services are well below commercial rates, such as the well known US carrier Blue Cross/Blue Shield. This lower payment schedule can result in reduced access to medical care for those with Medicaid insurance as some health care providers do not accept Medicaid patients. SCFE is also often temporally correlated with an event, such as a fall resulting in litigation against the sponsor/owner (e.g., football injury at school). Most children

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with SCFE are obese/overweight⁹ and the surgical implants used in the treatment of SCFE can occasionally fail. Due to these various factors, patients/parents of children with SCFE may pursue litigation depending upon the circumstances of causation, initial presentation, diagnosis, and perceived substandard treatment.

There are several types of legal liability: professional liability, premise liability, and product liability and differ in whom is the alleged tortfeasor. Professional liability claims are made against healthcare providers for alleged negligence in treating a patient. This differs from premise liability, which claims an alleged failure of a property owner to maintain a safe environment, and product liability which claims a manufacturer or supplier of goods produced or sold a faulty product. In all three claims, the injured party must allege that the failure(s) directly caused or contributed to their alleged injuries and services resulting in property damage or personal injury.

Healthcare providers can be involved in legal complaints in several ways. First, they may be the subject of legal complaints regarding the diagnosis and treatment of SCFE. When health care providers think of litigation, it is often in the context of professional liability, also known as medical malpractice. Orthopaedic surgeons are acutely aware of malpractice litigation,^{10–21} experiencing a 14% annual rate of litigation compared to the overall US national physician rate of 7%.²² Other specialties involved in the care of children with SCFE include emergency medicine, diagnostic radiology, family practice, and pediatrics. The annual rate of litigation for these specialties is 7%, 6%, 5%, and 3% respectively.²² When looking at paid malpractice claims (2017 data) per 1000 physician years,²³ orthopedics was at 40.9, radiology 18.9, emergency medicine 18.8, family medicine 14.3, and pediatrics 4.9. In premise liability cases, orthopaedic surgeons are often called upon by attorneys to render an expert opinion regarding the prognosis of the disease, especially when the SCFE is diagnosed late rather than early, or when treatment outcomes do not meet the patient's expectations.

An understanding of the types of litigation surrounding SCFE is important information, not only for orthopaedic surgeons, but for all health care providers. The only study involving alleged malpractice in the field of pediatric orthopaedics²⁴ was an overview of all pediatric orthopaedic surgery claims but did not specifically study the subgroup of SCFE cases. The purpose of this study was to review all forms of reported litigation cases involving SCFE in the USA and provide a better understanding of the same. This will give health care providers insight and knowledge of potential claims and an understanding as to the different issues that lead to such claims. Recognizing such pitfalls educates health care providers regarding potential mishaps and reminds them to include SCFE in the differential diagnosis of a child with hip/thigh/knee pain or a limp. This is especially important for primary care, emergency medicine, and sports medicine health care providers, as a recent study demonstrated that 1/3 of patients with SCFE have a history of athletic activity associated with their symptoms.²⁵

2. Materials and methods

2.1. Data source

Reported cases of litigation involving SCFE were identified using multiple legal databases searching for the term "slipped capital femoral epiphysis". The data bases were Westlaw, Nexis Uni®, Lexis Jury Verdict, VerdictSearch®, MoreLaw, and Google Scholar (scholar.google.com). These databases are well known in the legal profession regarding jury verdict research. The searches were performed March through June 2021. The year these databases were created was 1973 for Nexis Uni® and Lexis Jury Verdict, 1975 for Westlaw, 1996 for MoreLaw, and 2004 for Google Scholar. The earliest date of a SCFE case for each of these databases was 1942 for Nexis Uni®, 1957 for Google Scholar, 1989 for Westlaw, 1991 for Lexis Jury Verdict, 1996 for VerdictSearch®, and 2003 for MoreLaw. (Note that the filing date of a case may predate the creation date for the database, as the database often retroactively adds

cases as they become known). Duplicate cases were removed. Cases with a prior history of SCFE and where the patient or patient's guardian filed for social security disability, government disability, or other disability issues were excluded.

The data collected was: 1) alleged complaint (i.e., failure to diagnose, improper treatment, slip and fall, etc.) 2) nature of the defendant(s) – (health care provider and specialty [e.g., family practice, pediatrics, radiology, orthopedic surgery]), medical center, property owner, etc. 3) year and final outcome of the claim (dismissed, settled, verdict for the defense or plaintiff) 4) amount of indemnity payout and 5) the state in which the litigation occurred. Payout amounts were converted to 2020 US\$ equivalents using the "Inflation Adjustment Calculator 1635 → 2021, Department of Labor data" <https://www.officialdata.org>. The states in which the cases occurred were grouped into four regions (Northeast, South, Midwest, and West) as defined by the US Census Bureau (<https://www.census.gov/geo/reference/webatlas/regions.html>). The occurrence of avascular necrosis (AVN) was specifically noted in the legal descriptions, as AVN portends a poorer outcome^{26,27} which could potentially impact the outcome of litigation. Our local Institutional Review Board, upon review, deemed that the study was not human subject's research and thus did not require IRB review/approval.

2.2. Statistical analysis

Continuous data are expressed as the mean \pm 1 standard deviation, as well as the median and range, due to the data not always being normal. Categorical data are expressed as frequencies and percentages. Differences between groups of continuous data were analyzed with non-parametric methods (Mann-Whitney U – 2 groups; Kruskal Wallis – 3 or more groups). Differences between categorical data were analyzed with the Fisher exact test (2×2 groups) or Pearson χ^2 square test (greater than 2×2 groups). All statistical analyses were performed with SYSTAT® 10 software (SPSS, Chicago, IL 2000). A $p < 0.05$ was considered statistically significant.

3. Results

3.1. Types of litigation

There were 135 unique cases; these involved professional liability (103), premise liability (30), both premise and professional liability (1), and product liability (1). The cases originated in the Northeast (59 cases-44%), South (33 cases – 24%), Midwest (21 cases – 16%), and West (22 cases – 16%). Four states (New York, California, Pennsylvania, and Florida) accounted for 51% of all the cases (22%, 10%, 10% and 9% respectively).

The alleged complaint(s) in the 104 cases of professional liability cases was failure in diagnosis (71), treatment (14), both diagnosis and treatment (12), and others (7) (such as nursing care and police action). Of the 83 cases involving diagnosis, 32 alleged a late diagnosis alone, 18 a missed diagnosis alone, mixed in 7, and unknown in 26. The health care provider's specialty was known in 86 of the 103 cases (excluding the one case involving a police officer). There was a total of 113 health care providers named in these 103 lawsuits. The three most common specialties cited (Fig. 1) were primary care (family practitioners, pediatricians, and primary care providers not specified) (31%), orthopaedic surgery (29%), and radiologists (16%). Non-orthopaedic surgeons were alleged to have mostly failures in diagnosis (89% for both radiologists and primary care physicians). Alleged failure to recognize the SCFE by the radiologist occurred in 16 cases. For orthopaedic surgeons, the alleged complaints of failures in diagnosis and improper treatment were equal (50% each). The "lag time" in those with an alleged late diagnosis was given in 37 cases and was 5.8 ± 7.1 months (median 4 months, range 0.1–26 months).

The complaints filed in the 30 premise liability cases were for a fall

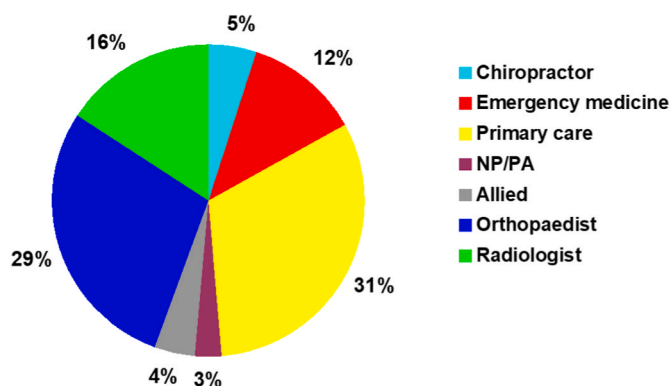


Fig. 1. Distribution of SCFE professional liability claims by type of health care provider. NP/PA = nurse practitioner, physician assistant; allied = nurses, physical therapists, and athletic trainers.

(22 cases), motor vehicle crash (3 cases), being hit/struck by an object/person (2 cases), work related injury (2 cases), and other negligence (1 case). The location of the events for these 30 cases was at school (14), business locations (8), homes/apartments (5), and public property such as streets and highways (3).

3.2. Litigation outcome

The defendant(s) prevailed in 71 (53%) and the plaintiff in 64 (47%) (Table 1). The indemnity payout amount was known in 52 cases and averaged \$1.28 ± 1.78 million (range \$8,491 to \$7,050,000 [median \$626,222]) in 2020 US\$. The outcome was more favorable for the defense in professional liability cases (60% vs. 30%). However, when the plaintiff prevailed, the payout was higher in the professional liability group (Table 1). The average and median payout for those was statistically greater in those cases with AVN (with - \$2,971,150 ±

Table 1 Differences in litigation in SCFE patients between professional and premise liability.

	Premise Liability	Professional Liability	p value
US Region			
Midwest	6	15	0.35
Northeast	13	45	
South	9	23	
West	2	20	
Overall Case Outcome ^a			
Defense	9	62	0.006
Plaintiff	21	41	
Detailed Case Outcome ^b			
Defense	9	30	0.12
Dismissed	0	11	
Mixed	0	3	
Settled	11	29	
Plaintiff	10	16	
Indemnity payout			
No	9	62	0.006
Yes	21	41	
Payout Amount (mean ± 1 sd [median]) in 2020 US \$	898,249 ± 1,707,470 [297,677]	1,497,190 ± 1,857,010 [714,536]	0.025
Avascular necrosis			
No	28	95	1.0
Yes	2	8	

^a Excludes the 1 case involving product liability and the 1 case involving both professional and premise liability.

^b Excludes the 14 cases favorable for the defense but where the exact outcome (ie verdict for defense vs. dismissed) was not given; these 14 excluded cases plus the 89 cases with detailed outcomes results in the total 103 cases in the overall case outcome lines.

\$2,571,110, without \$1,021,070 ± \$1,500,720; p = 0.038). There were no differences between the premise and professional liability cases by geographic region or development of AVN. Within the professional liability group, indemnity payouts were most frequent in the Western region (78% - p = 0.006) (Table 2). While the amount of payout was highest in the Northeast, it was not statistically significant between the other regions (p = 0.09).

When studying the 41 professional liability claims where there was an award or settlement, there was no difference by type of health care provider for those where an indemnity payout occurred compared to the entire group (p = 0.95) (Fig. 2). All the complaints were for a missed or late diagnosis except for orthopaedic surgeons, where the alleged complaint was a missed diagnosis in two cases, surgical care in two cases, and inappropriate patient triage/surgical urgency in one case.

3.3. Illustrative cases

3.3.1. Professional liability

Case 1. – Medical Malpractice (2013 WL 7871091) An 11-year-old female felt a sharp pain in her hip following a flip turn in a pool. Approximately a week later, she saw Dr. A who diagnosed her with a groin strain. A few days later, with progressive pain and difficulty ambulating, she saw Dr. B who again diagnosed an adductor strain and referred her to physical therapy. She was unable to perform physical therapy and one month later felt a “pop” in her hip while climbing stairs at home, fell to the ground and was transported by ambulance to the emergency department. She was seen there by Dr. C who diagnosed a SCFE. As she was unable to ambulate, the SCFE was likely an unstable type.²⁸ Dr. C alleged that he contacted the orthopedic surgeon on call, and following the telephonic consultation, agreed to discharge the patient to follow up with the orthopedic surgeon in two to three days. Dr. C claimed that the orthopedic surgeon with whom he spoke was Dr. D, who was on vacation at the time and was in reality not contacted. Subsequently, Dr. C claimed that he contacted Dr. E and phone records did show two calls to Dr. E on that date. Dr. E denied any recollection of a telephone conference and claimed that, had he been contacted, the patient would have been immediately admitted, and surgery performed, if possible, within 24 h. The patient, ultimately, had surgery 4 days after the first ED visit. AVN subsequently occurred which resulted in a total hip arthroplasty 7 months later. The first total hip arthroplasty failed requiring a revision 3 years later. Unfortunately, the first revision failed as well, resulting in the child’s second revision 14 months after the first revision. All physicians were named in the lawsuit as well as the emergency department medical center. The total plaintiff demand was for \$3,000,000; the case settled for \$2,383,285 2020 US\$.

Case 2. – Law Enforcement Liability (2006 WL 6366758) A 14-year-old boy (plaintiff) along with his father were requested to leave an intersection where they were selling fruit. The police officer requested them to leave, and the plaintiff became combative and resisted arrest. The plaintiff alleged that the police officer used excessive force during the arrest, yelled racial slurs, kneed, and punched him several times, with the physical injuries causing a SCFE. The defendant noted that no medical attention had been sought for several months after the incident and the plaintiff later supplied information on a medical report that his hip was injured during a skating accident. The defendants further

Table 2 SCFE professional liability outcomes by region and indemnity payout.

Region	Payout/No Payout	Payout %	p value	Payout Amount in 2020 US\$ (median)	p value
Midwest	5/10	33	0.006	269,152	0.089
Northeast	23/22	51		1,241,260	
South	18/5	78		699,811	
West	16/4	80		1,033,150	

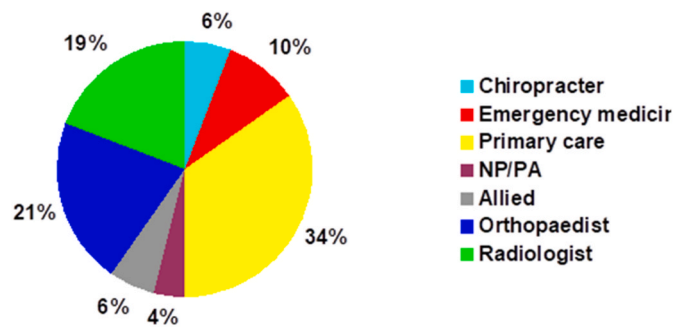


Fig. 2. Distribution of SCFE professional liability claims by type of health care provider where an indemnity payout occurred. There was no difference by type of health care provider for those where an indemnity payout occurred compared to the entire group ($p = 0.95$).

contended that the plaintiff and his father were previously ordered by a nonparty officer to leave the location, that the officers never used racial epithets, and that only the degree of force necessary was used to effect his arrest. Jury trial resulted in a verdict for the defendant.

3.3.2. Premise liability

Case 3. A 10-year-old boy fell on a broken step in the stairwell between the fourth and fifth floors of property A. Discovery established that 2 years before the accident, the owner of property A had received a violation and directive from the Housing department of the city to replace the treads on the stairs. Such repairs were not performed, and photographs showed the steps to be broken, not level, and in poor condition. The defendant denied that the stairway was defective and contended that the child was at fault for failing to watch where he walked. The child had a Grade I slipped capital femoral epiphysis of the right hip requiring internal fixation and resulted in a ½-inch leg length difference. This action settled for a structured settlement of \$870,000 with a future payout of \$4,374,171 (equivalent to \$7,053,498 2020 US \$). (Extracted from VerdictSearch®, A Division of ALM Media, LLC, with permission).

3.3.3. Product liability (29 A.3d 9 (2011))

Case 4. A 15-year-old boy had a 4-week history of right thigh pain and was diagnosed with a SCFE. He underwent surgery with 2 screw fixation. Radiographs performed 2 weeks and 6 weeks post-operatively demonstrated the screws to be intact. He again developed symptoms 7 months later, and radiographs demonstrated a reslip with broken screws. Repeat surgery was performed 15 months after the first surgery at which time the broken screws were removed and discarded by the hospital. A total hip arthroplasty was performed 25 months after the first surgery. Suit was filed against the screw manufacturer for defective implants, asserting a claim of strict liability under the malfunction theory, resulting in a jury trial verdict of \$2,000,000 (equivalent to \$2,412,746 2020 US\$). The verdict was upheld upon appeal. The appellate court noted that under the malfunction theory of product liability, the jury can infer the existence of a defect through circumstantial evidence of a malfunction in the absence of abnormal uses or reasonable secondary causes. Abnormal use was eliminated in the jury's view as at the initial trial it was stated that the patient followed the physician's instructions regarding limitations on walking and moving his hip as well as not to play basketball or football. His mother testified that he did not engage in any strenuous activity or exercise. In a malfunction theory case, there is no requirement that evidence regarding the absence of abnormal use be presented by expert testimony. Accordingly, the testimony of the patient and his mother was sufficient to allow the jury to conclude that abnormal use did not cause the surgical screws to malfunction.

3.3.4. Multiple liabilities

Case 5. A 15-year-old girl was a guest at a party given by her brother, who was a tenant of a 20-unit apartment building in City A owned by Property Owner B. At night, while walking in the driveway, she stepped in a four-inch-deep hole and fell. Approximately one month after the accident, she went to Medical Center C with pain in her left hip. Radiographs were obtained, but the radiologist failed to detect a grade I SCFE. The SCFE was diagnosed two months post-accident and had progressed to a grade III SCFE. Property Owner B was sued; B filed a cross complaint against C alleging causes of action for implied indemnity and contribution. (The radiologist was not named and reportedly could not be located). The plaintiff contended that the four-inch-deep hole constituted a dangerous condition of public property and that B had notice of this condition. The plaintiff claimed in depositions that the managers of B admitted that during the year before the accident they had parked their truck within four feet of the four-inch-deep hole. The girl also maintained that the lights in the driveway were not on at the time of the accident. B disputed liability and causation and contended that the child's injuries were due to the radiologist's failure to initially diagnose the SCFE. C disputed liability and causation, contending that the radiologist in question was an independent contractor and not an employee. The claim was settled for \$700,000 (equivalent to \$984,609 in 2020 US\$) which was paid into a trust that will eventually pay out \$1.5 million over a 25-year period. Party B paid \$650,000 into the trust and C contributed \$50,000. (Extracted from VerdictSearch®, A Division of ALM Media, LLC, with permission).

4. Discussion

This study was designed to locate and analyze cases involving litigation and SCFE in the US. Most studies of malpractice litigation in orthopedic surgery have used only one database: Westlaw,^{12-15,18-20,24,29} VerdictSearch,^{11,21} or the Medical Liability Association Data Sharing Project.¹⁶ In this study we used several legal case databases, including the Westlaw, VerdictSearch®, MoreLaw, Lexis Jury Verdict, Nexis Uni®, and Google Scholar, allowing us to find as many reported cases as possible.

4.1. Malpractice litigation

The authors located three studies of alleged malpractice and SCFE; one from Germany and,³⁰ one from Denmark³¹ and one case report.³² When comparing the result of this study to these studies, both differences and similarities were seen. In the study of 39 alleged malpractice SCFE cases from Germany,³⁰ 28 (72%) were adjudicated to be malpractice. These included 26 alleged errors in diagnosis and 17 alleged errors in treatment, with alleged errors in both diagnosis and treatment in several cases. There were 14 cases of AVN (36%). In this study 10 cases of AVN (7.4%) were identified. In the study of 40 SCFE malpractice cases in Denmark, an alleged delay in diagnosis occurred in 27, with an average delay of 181 days (5.0 months). Surgical complications were noted in 16 (40%). We found issues with diagnosis were present in 68% of the professional liability cases, with an alleged delay in diagnosis of 5.8 months, which is very similar to the Danish study.

For family practitioners/pediatricians, the typical reason for loss is late diagnosis, and for emergency physicians and diagnostic radiologists, the typical allegation is failure to diagnose in the ED or on radiographs. For orthopaedic surgeons, we found that 50% of adverse outcomes were in cases alleging failure or delayed diagnosis and 50% due to surgical/technical errors, which was surprising to us. In the single study of 84 cases specifically involving pediatric orthopaedics,²⁴ orthopaedic surgeons were named as a defendant in 38%, the pediatrician in 26%, multiple physicians in 27%, and other specialties in 8%. In our study, primary care physicians were named in 31%, orthopaedic surgeons in 29%, radiologists in 16%, emergency room physicians in 12%,

chiropractors in 5%, and nursing personnel in 4%.

4.2. Litigation outcome and indemnity payments in orthopaedics

In this study, the overall outcome for the 103 professional liability claims was a decision for the defendant(s) in 60% and the plaintiff in 40%. Regarding other orthopaedic studies of medical malpractice litigation (Table 3), the percentage of complaints resolved in favor of the defense ranged from 20% (fracture litigation) to 80% (shoulder/elbow surgery). The 60% in this study of SCFE is clearly within these percentages. Regarding monetary payouts, the average payout ranged, in million US\$ from 0.204 for upper extremity nerve complaints¹⁶ to 3.778 for traumatic fracture complaints.¹¹ The average SCFE payout of \$1.497 million in this study falls within these ranges. Thus, the results of SCFE malpractice litigation in the US are similar to the results from other studies of orthopaedic malpractice claims for both defense/plaintiff outcomes as well as monetary payouts.

4.3. Issues regarding litigation

Many of the premise liability cases alleged that a fall/event caused the SCFE. However, the etiology of SCFE is very complex. Association of an event/injury with causation of the SCFE can be difficult, as noted in *Hamad vs. Busch Entertainment Corporation (Hamad v Busch Entm't Corp., 2006 U.S. Dist. LEXIS 66028 (M.D.FL 2006))*.

A 6-year-old girl was riding the log flume at Busch Gardens (Florida). When attempting to exit her log at the end of the ride, another log bumped hers from behind. She lost her balance, striking her right knee. Five days later she visited her pediatrician. However, the pain increased, and 7 days after the accident she visited a medical center where a SCFE was diagnosed; surgical fixation was performed but avascular necrosis later developed. Two years later she developed a left SCFE. During evidentiary hearings, the Magistrate Judge noted that whether the bumping of the logs caused the right SCFE was vigorously disputed, and that the plaintiff's proof that it did was particularly problematic. The Magistrate Judge determined that there were three reasons which made proving this link difficult: (1) the current scientific uncertainties about the causes of SCFE; (2) the known risk factors for the condition (obesity); and (3) the physics of the condition. The Magistrate Judge found that the Defendant's liability was not only debatable but questionable, noting that all three experts involved in the case agreed that certain risk factors, like obesity, predispose a child for SCFE. The child weighed 108 pounds (at or above the 95th percentile for her age group) which placed her at high risk for SCFE. Furthermore, the Magistrate Judge noted that all the experts uniformly acknowledged that much about the causes of SCFE is unknown or theoretical and that they recognized the child sustained a low impact collision. In this particular case it was settled for \$165,000 2020US\$ and upheld upon appeal.

Table 3

Compilation of studies regarding malpractice complaints in orthopaedic surgery.

Study	n	Topic	Litigation Outcome (%) ^a		Mean Indemnity Payout (US\$ millions) ^a	Year Published
			Defense	Plaintiff		
Present study	103	SCFE	60	40	1.497	–
Galey ²⁴	84	Pediatric orthopaedics	49	51	2.448	2019
Krauss ¹⁶	614	Upper extremity nerve injuries	67	30	0.204	2020
Samuel ¹³	148	Total joint arthroplasty	74	26	1.433	2019
Rynecki ¹⁵	81	Orthopaedic surgery	62	38	3.015/1.571 ^b	2018
Cichos ¹²	1562	Orthopaedic surgery	70	30	1.35	2019
Ahmed ¹¹	201	Traumatic fracture	20	80	3.778/1.097 ^b	2019
Phair ¹⁴	124	Compartment syndrome	68	32	1.544	2020
Fano ¹⁹	82	Hip surgery	59	41	1.648/0.657 ^b	2022
Sharma ²⁹	25	Shoulder/elbow surgery	80	20	4.06	2021
Gatto ¹⁸	328	Sports medicine	70	30	1.29/0.72	2022

^a Settlements are considered as an outcome for the plaintiff.

^b Trial verdict/settlement amounts.

Most pediatric orthopaedic surgeons would have difficulty understanding why a child with a grade I SCFE and ½ leg length inch discrepancy without AVN as noted in Case 3 above would be awarded \$7.05 million, when the natural history of a mild SCFE is excellent and will likely not be until midlife when a total hip arthroplasty may be needed.^{33–35} In neurosurgery it has been noted that some cases with injuries sustained by the patient resulted in no award, while other cases without extensive injuries resulted in an award.³⁶ Further, while some of the premise liability cases have resulted in much larger payouts (as noted), others have resulted in defense verdicts. This variance demonstrates the difficulty for the plaintiff to medically/scientifically prove that an event proximately caused the SCFE and the difficulty facing a jury as to what is reasonable, in spite of the known complex etiologies regarding SCFE.³⁷

While premise liability claims do not directly impact a clinician as a party, the facts of the injury or event leading to the diagnosis of SCFE are important. The clinician should be aware that they may be called upon as a witness regarding a premise claim in the future. As time passes, memories fade and clinicians rely solely upon the medical record. Such a complete record may also provide the patient assistance in disproving the likely claim by defense counsel that the injury did not cause the SCFE but that it was a result of the SCFE.

4.4. Other legal strategies/issues

A hurdle in the analysis of such cases is that many if not all pre-trial settlement agreements deny liability and contain strict confidentiality clauses. Therefore, if a case is resolved through a settlement process or mediation, the settlement amount is usually not made public,³⁸ which has been controversial.³⁹

It should be noted that in the US the thought processes behind parties in medical litigation, including settlement, are privileged, and almost never divulged. Also, every case involves distinct juries and jurisdictions, which certainly can influence outcomes. However, in most cases, in evaluating whether or not to proceed to trial, the defense counsel, provider, and liability carrier will evaluate not only the medical facts, the alleged damages, and witnesses but also the possibility of pre-trial publicity, the impact of the provider being forced to be in court for the entirety of the trial and not seeing patients as well as the various possible trial outcomes: The plaintiff and their counsel will also evaluate the amount of any settlement or award which will actually be paid to the Plaintiff since many attorneys take such matters on contingency for a percentage of any settlement or award.^{11,40}

Kiser et al.⁴¹ studied 2,054 contested litigation cases in settlement negotiations were unsuccessful and the parties proceeded to trial. Kiser found plaintiffs erroneously concluded that rejecting settlement and proceeding to trial was a superior option in 61.2% of the cases, while defendants made an erroneous assessment in 24.3%. However, the

magnitude of defendants' miscalculation vastly exceeded that of plaintiffs' miscalculation with the plaintiff's average error being \$43,100 below the pre-trial settlement offer and the defendants' average error \$1.14 million over the pre-trial demand.⁴¹ As Gross and Syverud⁴² asserted, the "real question for any party is whether it would have been better off if it had not gone to trial," the answer for a majority of plaintiffs and one-quarter of defendants is "Yes." This conclusion is supported by the study of Fano et al.¹⁹ in which 82 litigation cases involving orthopaedic surgery of the hip had a pre-trial settlement of \$657,823 while the average jury verdict was \$1,642,981. The percentage of US civil cases settled before trial is difficult to determine, but best estimates are between 60% and 90%⁴³; the percentage for medical liability cases specifically is unknown.

This study only addresses claims that are actually formally filed in a court of law. A question that arises is what is the impact of pre-suit resolution? It is not uncommon for providers to receive complaints from patients prior to the filing of a law suit. If an investigation reveals possible exposure, a pre-suit resolution may occur. In some jurisdictions, an injured party is required by law to present their claim to a panel of independent physicians for review. If the panel issues an opinion adverse to the healthcare provider, it is not uncommon for the provider (through their professional liability insurer) to resolve the claim prior to a suit being filed in court. Unfortunately, these pre-suit resolutions are not public record and are not reported in legal databases. In addition, most pre-suit resolutions contain confidentiality agreements. Therefore, the impact of pre-suit resolution in SCFE cases could not be evaluated.

Pre-suit resolution may also impact premise liability claims, as many rental agreements contain clauses requiring mediation prior to filing of any complaints. However, those claims resulting from injuries at school or non-domicile premises would not be at all impacted. Of the 30 premise liability cases reviewed, only one was where the plaintiff actually resided at the property in question. Therefore, with only one case of a resident filing a lawsuit against a premise owner, no real conclusions can be drawn regarding domicile property owners.

4.5. Limitations

There are several limitations to this study. First, the legal databases used were not created for or by physicians, but rather for the legal profession; varying amounts of medical information are given. Reporters from various jurisdictions submit data on jury verdicts and settlements; however, the coverage and information gathering details are spotty and vary between jurisdictions. There is no national clearinghouse or registry of litigated cases, making it difficult to ensure that this is truly representative of cases for such a study, as not all cases are reported. Second, the authors were unable to access the Medical Professional Liability Data Sharing Project, as there were less than 15 closed claims for SCFE and due to the small number of records, access was denied. Another source would be the National Practitioner Data Bank; however, the National Practitioner Data Bank does not classify their data by a particular diagnosis for public use. Third, the reported cases involving disability issues (social security benefits, disability insurance policy issues, etc.) in adults with a prior SCFE were not included in this study. Fourth, our study did not take into account jurisdictions where a cap on damages was/is in effect, nor did it evaluate cases in which "nominal" settlements were made by indemnity carriers in order to avoid increased costs of trying a case. The cases reported to these databases are restricted to parties that actually report settlements and courts that report verdicts. Finally, the cases reported only represent those matters which proceeded to resolution, as statistics for the cases that were filed but either dismissed by the plaintiff or by the court were not available.

Many of the clinical details of interest to health care providers are not available in these legal databases. In these legal databases, information beyond the vague allegations contained within the public complaint is usually not (if ever) provided. The inclusion of medical information is made by the counsel reporting such cases to the database(s). Plaintiff

counsel usually does not reveal detailed information about a case to protect the privacy of their client and/or so they can maintain control and discourage competition from other plaintiff's counsel, as many tend to specialize in certain types of claims, while defense counsel limits information in an effort to protect the healthcare provider.

5. Conclusion

Not all SCFE-related litigation cases in the US sample studied are for professional liability. We found that 77% of the reported SCFE litigation cases involved professional liability, 22% premise liability, and 1% product liability. This study is a poignant reminder to all health care providers to consider SCFE in a differential diagnosis for a child with thigh/knee/hip pain and limp, with or without associated athletic activity. Similarly, it is a reminder to radiologists to especially look for SCFE on the radiographs of children with any of the above complaints. Also, it is a reminder to mid-level health care providers (NPs, PAs) that clearly keep this diagnosis in a differential, as successful claims against health care providers, compared to the filed claims, only increased for that group. Knowledge and awareness are the best step for a health care provider to avoid negligence claims. Such claims are not only costly monetarily, but also in the time spent to defend such claims, which would be better used to provide care for other patients.

Additionally, in all cases alleging physical injury, the plaintiff must prove that the alleged substandard action or treatment proximately caused the injury. This requires the testimony of a healthcare provider. Therefore, even if not a party to the complaint, healthcare providers may be often called upon to provide expert opinions as to the treatment and cause of the alleged injuries. Most jurisdictions require the expert witness to be familiar with the care/treatment of the alleged injury in order to be qualified as an expert. However, this familiarity is often tenuous and dependent upon the witness's testimony of their education, training, and experience. This study provides background data as to the types of litigation that SCFE patients may pursue and areas in which an expert witness may be questioned.

In conclusion, this study provides the reader with insight and knowledge of potential claims surrounding SCFE and an understanding as to the different issues that lead to such claims. Recognizing such pitfalls will remind the reader to include SCFE in the differential diagnosis of a child with hip/thigh/knee pain or a limp and not ignore its impact on the patient and possibly the clinician.

Data availability

The data is proprietary and can be purchased by accessing each of the legal databases, with the exception of Google Scholar which is free and accessible to everyone at their website.

Author contributions

RTL, LL, and KEC conceived and designed the study; LL and RTL collected the data; RTL performed statistical analyses; RTL, LL and KEC prepared the original manuscript; RTL, LL, and KEC participated in manuscript reviews and approved the final manuscript.

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Declaration of competing interest

RTL has and may receive royalties for book chapters and compensation for expert opinions from law firms regarding this topic. LL and KEC certify that they have no conflicts of interest.

References

1. Uvodich M, Schwend R, Stevanovic O, Wurster W, Leamon J, Hermanson A. Patterns of pain in adolescents with slipped capital femoral epiphysis. *J Pediatr*. 2019;206:184–189.
2. Kocher MS, Bishop JA, Weed B, et al. Delay in diagnosis of slipped capital femoral epiphysis. *Pediatrics*. 2004;113:e322–e325.
3. Matava MJ, Patton CM, Luhmann S, Gordon JE, Schoenecker PL. Knee pain as the initial symptom of slipped capital femoral epiphysis: an analysis of initial presentation and treatment. *J Pediatr Orthop*. 1999;19:455–460.
4. Hatfield SJ, Baxter RE. Slipped capital femoral epiphysis in a patient with knee pain. *J Orthop Sports Phys Ther*. 2012;42:482.
5. Greene KA, Ross MD. Slipped capital femoral epiphysis in a patient referred to physical therapy for knee pain. *J Orthop Sports Phys Ther*. 2008;38:26.
6. Ballas MT, Tytko J, Mannario F. Commonly missed orthopedic problems. *Am Fam Physician*. 1998;57:267–274.
7. Skaggs DL, Roy AK, Vitale MG, et al. Quality of evaluation and management of children requiring timely orthopaedic surgery before admission to a tertiary pediatric facility. *J Pediatr Orthop*. 2002;22:265–267.
8. Mofidi J, Sarkisova N, Andras LM, et al. A pilot study on resident and pediatrician knowledge and confidence in the diagnosis of slipped capital femoral epiphysis. *Glob Pediatr Health*. 2019;6:1–6.
9. Loder RT, Skopelja EN. The epidemiology and demographics of slipped capital femoral epiphysis. *ISRN Orthopaedics*. 2011;486512(19):486512.
10. Casali MB, Blandino A, Sordo SD, et al. Alleged malpractice in orthopaedics. Analysis of a series of medial insurance claims. *J Orthop Traumatol*. 2019;20(1-7):7.
11. Ahmed SA, DeFroda SF, Naqvi SJ, et al. Malpractice litigation following traumatic fracture. *J Bone Joint Surg [Am]*. 2019;101. Am]:e27(108).
12. Cichos KH, Ewing MA, Sheppard ED, et al. Trends and risk factors in orthopedic lawsuits: analysis of a national legal database. *Orthopedics*. 2019;42:e260–e267.
13. Samuel LT, Sultan AA, Rabin JM, et al. Medical malpractice litigation following primary total joint arthroplasty: a comprehensive, nationwide analysis of the past. *J Arthroplasty*. 2019;34:S102–S107.
14. Phair J, Carnevale M, Scher LA, Garg K. Malpractice litigation for compartment syndrome. *Ann Vasc Surg*. 2020;67:143–147.
15. Rynecki ND, Cobanbanban D, Ganantz O, et al. Medical malpractice in orthopedic surgery: a Westlaw-based demographic analysis. *Orthopedics*. 2018;41:e615–e620.
16. Krauss E, Shankar V, Patterson JMM, Mackinnon SE. Medical malpractice in nerve injury of the upper extremity. *Hand*. 2020.
17. Bernstein J. Malpractice: problems and solutions. *Clin Orthop*. 2013;471:715–720.
18. Gatto JD, Park HY, Hwang R, et al. Analysis of medical malpractice outcomes for sports orthopedic procedures. *Orthopedics*. 2022;45:e47–e52.
19. Fano AN, Fields MW, Levidy MF, et al. Malpractice litigation following orthopaedic surgery of the hip: frequency, reasons for lawsuit, and outcomes. *Med Leg J*. 2022;90:70–75.
20. Kadakia RJ, Orland KJ, Sharma A, Akoh CC, Chen J, Parekh SG. Medical malpractice trends in foot and ankle surgery. *J Foot Ankle Surg*. 2022;61:104–108.
21. Lynch JC, Radack TM, Stenson JF, Riebesell SA, Austin LS. Malpractice against shoulder surgeons: what the data says. *J Shoulder Elbow Surg*. 2022 (epub ahead of print).
22. Jena AB, Seabury S, Lakdawalla D, Chandra A. Malpractice risk according to physician specialty. *N Engl J Med*. 2011;365:629–636.
23. Schaffer AC, Jena AB, Seabury SA, Singh H, Chalasani V, Kachalia A. Rates and characteristics of paid malpractice claims among US physicians by specialty, 1992–2014. *JAMA Intern Med*. 2017;177:710–718.
24. Galey SA, Margalit A, Ain MC, Brooks JT. Medical malpractice in pediatric orthopaedics: a systematic review of US case law. *J Pediatr Orthop*. 2019;39:e482–e486.
25. Loder RT, Gunderson ZJ, Sun S, Liu RW, Novais EV. Slipped capital femoral epiphysis associated with athletic activity. *Sport Health*. 2022 (online ahead of print).
26. Larson AN, McIntosh AL, Trousdale RT, Lewallen DG. Avascular necrosis most common indication for hip arthroplasty in patients with slipped capital femoral epiphysis. *J Pediatr Orthop*. 2010;30:767–773.
27. Krahn TH, Canale ST, Beaty JH, Warner WC, Lourenco P. Long-term follow-up of patients with avascular necrosis after treatment of slipped capital femoral epiphysis. *J Pediatr Orthop*. 1993;13:154–158.
28. Loder RT, Richards BS, Shapiro PS, Reznick LR, Aronson DD. Acute slipped capital femoral epiphysis: the importance of physeal stability. *J Bone Joint Surg [Am]*. 1993;75–:1134–1140.
29. Sharma AN, Whitlock KG, Gage MJ, Lassiter TE, Anakwenze OA, Klifto CS. Malpractice trends in shoulder and elbow surgery. *J Shoulder Elbow Surg*. 2021;30:2007–2013.
30. Püschmann H, Vinz H, Neu J. Fehler bei der Diagnostik und Behandlung der Epiphyseolysis capitis femoris. Erfahrungen der schlichtungsstelle der norddeutschen Ärztekammern [Malpractice in the diagnosis and treatment of the slipped capital femoral epiphysis. Experience of arbitration offices (Schlichtungsstelle) of the Northern German Medical Boards (Ärztekammern)]. *Z für Orthop Unfallchirurgie*. 2008;146:710–714.
31. Pihl M, Sonne-Holm S, Christoffersen eK, Wong C. Doctor's delay in diagnosis of slipped capital femoral epiphysis. *Dan Med J*. 2014;61(1-4):A4905.
32. Barchilon J. Clinical report - slipped capital femoral epiphysis. *Med Trial Tech Q*. 1978;25:23–62.
33. Carney BT, Weinstein SW, Noble J. Long-term follow-up of slipped capital femoral epiphysis. *J Bone Joint Surg [Am]*. 1991;73-A:667–674.
34. Mathew SE, Larson AN. Natural history of slipped capital femoral epiphysis. *J Pediatr Orthop*. 2019;39:S23–S37.
35. Larson AN, Sierra RJ, Yu EM, Trousdale RT, Stans AA. Outcomes of slipped capital femoral epiphysis treated with in situ pinning. *J Pediatr Orthop*. 2012;32:125–130.
36. Epstein NE. It is easier to confuse a jury than convince a judge. The crisis in medical malpractice. *Spine*. 2002;27:2425–2430.
37. Weiner D. Pathogenesis of slipped capital femoral epiphysis: current concepts. *J Pediatr Orthop B*. 1996;5-B:67–73.
38. Sage WM, Jablonski JS, Thomas EJ. Use of nondisclosure agreements in medical malpractice settlements by a large academic health care system. *JAMA Intern Med*. 2015;175:1130–1135.
39. Mello MM, Catalano JN. Should malpractice settlements be secret? *JAMA Intern Med*. 2015;175:1135–1137.
40. Chodos JE. Should there be specialty courts for medical malpractice litigation? *Columbia Medical Review*. 2015;1:10–22.
41. Kiser RL, Asher MA, McShane BB. Let's not make a deal: an empirical study of decision making in unsuccessful settlement negotiations. *J Empir Leg Stud*. 2008;5:551–591.
42. Gross SR, Syverud KD. Don't try: civil jury verdicts in a system geared to settlement. *UCLA Law Rev*. 1996;44:1–64.
43. Moffitt M. Settlement malpractice. *Univ Chicago Law Rev*. 2019;86:1825–1900.