

Chapter 2

Legal Aspects of Compartment Syndrome



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Objectives

- Understand the relationship between malpractice and orthopedic surgery
- Recognize the medicolegal implications of missed compartment syndrome
- Understand factors which contribute to indemnity payments with acute compartment syndrome
- Discuss methods of avoiding compartment syndrome-related litigation

Introduction

Acute compartment syndrome is one of the few orthopedic emergencies requiring urgent evaluation and intervention. The sequelae of missed compartment syndrome include loss of limb, kidney failure, sepsis, and death [1–3]. As such, early evaluation of patients is essential for adequate care and treatment. This chapter will discuss the medicolegal aspects of the treatment of compartment syndrome and its associated complications. There is a paucity of orthopedic research evaluating the factors that lead to malpractice claims and indemnity payments in acute compartment syndrome cases. Despite this, it is essential to thoroughly examine the available data and provide guidelines for the care of these complex patients.

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The objectives of this chapter are as follows:

1. To understand the relationship between malpractice claims and orthopedic surgery
2. To recognize the medicolegal implications of a missed compartment syndrome
3. To understand the factors that contribute to malpractice claims and indemnity payments
4. To develop a method of patient evaluation to limit the risks of missed compartment syndrome and avoid compartment syndrome-related litigation

Malpractice and Orthopedics

7.6% of all physicians have been named in a malpractice claim in their careers, while 1.6% of physicians have been named in a claim leading to an indemnity payment. Orthopedic surgery is one of top five specialties facing malpractice claims each year [4]. In an analysis of malpractice claims between 1991 and 2005, orthopedic surgeons faced 14% of all malpractice claims during that time period. Neurosurgery was the specialty with the highest number of claims (i.e., 19.1%). The mean indemnity payment for the orthopedic surgery claims has been anywhere from \$136,000 to \$460,000 [5–7]. For those specialties in the top five, it is estimated that 99% of all physicians will face a malpractice claim by the time they reach the age of 65. Those numbers can lead to significant physician anxiety regarding the risks associated with patient care. Despite the large number of claims, surgeries, and possible outcomes, nearly 75% of the orthopedic malpractice claims rule in favor of the physician [4].

These are a few specific terms to keep in mind when discussing malpractice [8]:

- *Medical negligence*: The breach of duty of care owed by a doctor to a patient that results in damage
- *Standard of care*: The level of care and skill in treatment that, under the circumstances, is recognized as acceptable and appropriate by reasonably prudent similar healthcare providers.
- *Breach of duty*: The doctor fails to work up to the standard of skill required by the law.

Five factors must be present for a malpractice claim to be ruled in favor of the plaintiff:

1. One must prove that a physician-patient relationship existed.
2. There must have been a deviation from the standard of care during the treatment of the patient.
3. The patient must sustain an injury or poor outcome as a result of a deviation from that standard of care.
4. The actions of the physician must be proven to be the cause of the injury [7].

The number of malpractice claims filed per year has continued to rise steadily in Canada, United States, and England [9, 10]. Additionally, significant increases in the sizes of indemnity payments have led to an increased need for malpractice insurance for physicians. One UK hospital found an approximately £40 million increase in payments for negligence between 2006 and 2007 [9].

The increasing number and size of claims has led to increased cost for malpractice insurance which, in turn, has created cyclic crises in the medical field. The United States has faced three serious malpractice crises in the last 50 years [11]. In the 1970s, a crisis availability occurred as an exodus of malpractice insurers became rampant due to the growing numbers of payments. In the 1980s, there was a crisis of affordability as the malpractice insurers increased premiums making them too expensive for some physicians. In the early 2000s, there was a crisis of affordability and availability caused by the departure of several major insurers, leading physicians to turn to prohibitively expensive state-sponsored Joint Underwriting Associations as a last resort. It has been hypothesized that this most recent crisis was caused in part by increased payments, increased frequency of claims, aggressive trial lawyers, and changing public perceptions of medicine in which patients expect perfection [11].

All of these factors have altered the way physicians are treating patients. A survey assessment of orthopedic surgeons showed that 96% of orthopedic surgeons practice defensive medicine by ordering imaging, lab test, and referrals or even admitting patients to the hospital to avoid the risk of a malpractice. Additionally, they reported that approximately 24% of all their tests were ordered as defensive measures and resulted in nearly \$2 billion annually [12].

A comparison of the cost between orthopedic trauma surgeons and other subspecialties showed that orthopedic trauma surgeons utilize resources for defensive purposes slightly less than their counterparts (20.3% vs 23%). This comparison still resulted in nearly \$7800 per month and \$256.3 million per year. Additionally, it was noted that nearly 70% of physicians actually reduced the number of high-risk patients that they accepted into their practice over the last 5 years [13]. It is in this complex climate that we must assess the medicolegal implications compartment syndrome.

Acute Compartment Syndrome and Malpractice

Most analyses of malpractice are performed on closed claims from the state, high volume malpractice insurances, or large-scale databases (national and international). These studies allow one to assess the number of malpractice claims filed for acute compartment syndrome as well as analyze the indemnity payments and the factors leading to the specific ruling in many of the cases. Unfortunately, these closed claim analyses do not provide us with the total number of cases of acute compartment syndrome per year. Therefore, it is difficult to truly assess the risk of facing a malpractice claim in all cases of compartment syndrome. A

closed claim analysis performed by Bhattacharyya demonstrated an annual 0.002% claims of practice per orthopedic surgeon [7].

Examination of the defendants in the acute compartment syndrome claims provides some insight into the causes of these claims. When evaluating acute traumatic compartment syndrome, traumatologists were the most commonly named defendants, but when evaluating elective surgery, vascular surgeons (18.2%) were the most commonly sued specialty followed by orthopedists (9.2%) [5]. In one study, orthopedic surgeons were the most common defendants (40.1%) in all claims, followed by nonsurgical providers (38.1%), general surgeons (10.8%), vascular surgeons (6.5%), and plastic surgeons (4.3%) [14]. Understanding the defendants allows us to understand the impact of compartment syndrome on the medical field and how easily one could miss the diagnosis. One must be acutely aware of the signs and symptoms of compartment syndrome in all cases, not just tibia fractures or trauma cases.

Understanding the plaintiffs in these cases is just as critical as understanding the defendants. New York (24.5%) and California (18%) were the locations with the majority of the compartment syndrome claims with Michigan (9.4%) a distant third [5]. Between 20% and 27% of compartment syndrome claims were in pediatric patients, and 27–38% of the claims were in female patients [5, 7, 14]. Men aged 11–30 years old were the highest group of patients presenting with acute compartment syndrome [15]. For patients undergoing elective surgeries, they included total hip/knee arthroplasty, osteotomies, bypass grafts, fistula, abdominal aortic aneurysm repair, skin traction, plastic surgeries, and even “transsexual surgeries.” Due to small sample sizes, the frequencies of each were not assessed.

These studies have the unique ability to show us many of the details surrounding acute compartment syndrome claims including the mechanism of injury. DePasse et al. showed that 42.4% of the compartment syndrome cases resulted from acute trauma situations, and surprisingly, 36.75% resulted from elective or cardiac procedures [5]. Marchesi et al. reported an even higher percentage of claims related to acute trauma (63%), with 36% related to elective surgery. More than 70% of acute trauma cases are due to tibia fractures, which is not surprising as it is the most common injury associated with compartment syndrome [5, 7]. Bhattacharya and Vrahas found that 12 of 16 compartment syndrome cases in their report were traumatic tibia fractures, most of which were treated with closed reduction and casting. On the contrary, the majority of thigh compartment syndromes resulted from elective surgery, while the majority of forearm compartment resulted from traumatic injuries (i.e., supracondylar humerus fractures) [5]. Intravenous infiltration (10.1%) is the 3rd most common cause of compartment syndrome claims, and these claims included many nonsurgical hospital staff as defendants.

The signs and symptoms present in the plaintiffs were examined in many of these studies. Between 55% and 68% patients in the cases presented with severe pain as the primary symptom of compartment syndrome [7, 14]. Paresthesias, numbness, or increased compartment tension to palpation were the second common presenting symptoms. Surprisingly, only one study noted the frequency with which compartment pressures were measured, and the frequency was only 25% in their study [7,

14]. Other presenting symptoms included the other cardinal signs of compartment syndrome (e.g., pallor, poikilothermia, paralysis, pulselessness, and pain with passive stretch), but these were less frequently noted [7, 14].

Timing to fasciotomy and sequela of missed compartment were also examined in these closed claims studies. Sixty-eight percent of patients underwent fasciotomies following diagnosis of the symptoms with an average of 3.5 subsequent surgeries [7, 14]. Moreover, 32% of patients underwent delayed fasciotomy (> 8 hours post first sign/symptom) [14], and 18–24% of patients underwent amputations post fasciotomy [5, 7]. Finally, 77% of patients reported permanent physical disability as a result of a missed compartment syndrome [15]. The most common complications were weakness/numbness and contracture in 58% followed by persistent pain, subsequent operations, difficulty walking, and scarring [5].

Delays in diagnosis (87%) and in treatment (36.7%) were the most common causes of acute compartment syndrome claims [5, 7, 14, 15]. This is understandable considering the difficulty in establishing a diagnosis of compartment syndrome. Often, physicians are reluctant to perform compartment pressure measurements due to the level of discomfort they cause to patients. Additionally, the patient's pain may be attributed to postsurgical or post-injury-related pain rather than compartment syndrome. Medications may be utilized to control the pain, leading to masking of the symptoms. Patients who had documented signs such as paresthesias or pain with passive stretch without further investigation were more likely to win the trial or participate in a settled case. Failure to investigate phone calls from patients or disregarding patient complaints without further investigation (poor physician-patient communication) more likely results in ruling for the plaintiff [7]. The studies demonstrated mixed results regarding the impact of patient sex, age, and level of disability with the ruling of the claims and that will be discussed below with the indemnity payments. Based on their report, Bhattacharyya et al. concluded that a fasciotomy within 8 hours of presentation and early action once physical findings are documented could prevent a malpractice claim [7].

The plaintiffs were successful in 56–77% of the claims in the studies examined [5, 7, 14, 15] with 27–56% of the claims resulting in a settlement rather than trial [5, 7]. Depasse et al. reported that 68% of trials were won by the defendant, and the Bhattacharyya study reported that the defendant was successful in all three cases that went to trial [5, 7]. Marchesi found that 72% of the damages were due to the physician's actions or inaction [14]. Interestingly, the post procedure compartment syndrome was more commonly ruled in favor of the plaintiffs compared to traumatic compartment syndrome where the sequelae were thought to be due to the injuries themselves rather than the physicians. Depasse et al. reported that cases with pediatric plaintiffs were more likely to be settled out of court and that judges were more likely to rule in favor of pediatric plaintiffs than adult plaintiffs. Additionally, they also demonstrated that judges were more likely to rule in favor of female plaintiffs than male plaintiffs. There was no sex or age-related differences in indemnity payments in the studies [5].

The indemnity payments in the acute compartment syndrome cases far exceed the average indemnity payment (\$136,000) for orthopedic surgeons' malpractice

claims. Cases that were settled reported indemnity payments from \$52,500 to \$3,500,000, whereas cases that went to court reported indemnity payments from \$106,970 to \$22,565,000 [5]. Indemnity payments were noted to correlate linearly with the number of presenting cardinal signs of compartment syndrome as well as with the time to fasciotomy [7]. The indemnity payments were significantly higher in the post procedure acute compartment syndrome (mean \$3,399,035) compared to the traumatic compartment syndrome (\$986,716) [5]. There was no significant difference in the indemnity payments for juvenile or female patients when compared to their adult or male counterparts. And there was no association between amputation or level of dysfunction and indemnity payment.

Patient Assessment and Future Directions

The sequela and medicolegal ramifications of missed compartment syndrome are severe. Training institutions in particular face unique difficulties with the implementation of the 80-hour work week. Limitations in staffing necessitate an increased number of patient handoffs which can lead to poor physician communication, lack of care coordination and continuity, and an increased likelihood of missed diagnoses [2]. As noted above, delay in diagnosis and delay in intervention are the most common causes of malpractice claims in acute compartment syndrome cases. Developing a systematic approach to patient care is critical to avoiding malpractice claims, indemnity payments, and poor patient outcomes. Garner et al. described an algorithm for care of patients at risk for compartment syndrome which we review below [2].

The first step in the care of these patients is recognizing who are at high risk for development of compartment syndrome, most commonly victims of trauma (tibia fractures, supracondylar humerus fractures, and crush injuries). It is also essential to recognize that patients outside of these categories may also develop compartment syndrome (vascular bypass, IV infiltration, elective procedures and plastic surgery). These high-risk patients should be assessed by the oncoming team and the outgoing team together to compare the examination findings and medication administration record. Careful communication pre- and postoperatively should be performed with the patients regarding the signs and risks of compartment syndrome. Patients or their families should be informed of the sequelae of a missed compartment syndrome as well as the clinical course of those patients diagnosed and treated for compartment syndrome. In particular, the limb-saving nature of fasciotomies for this condition should be emphasized. This communication is critical for the patient to have appropriate expectations regarding the condition, the necessity of treatment, and the possible need for additional interventions.

Patients should be assessed closely for increasing analgesic requirements and any of the cardinal signs or symptoms of compartment syndrome with worsening pain aggravated by passive muscle stretch being the essential sign [16]. Increasing medication requirements may be the only sign of a nascent compartment syndrome in young children or patients who have difficulties in communicating. Paresthesias and

severe pain should be investigated fully by opening splints/dressings and close monitoring for any improvement or changes. After discussing with senior staffing, there should be a low threshold for compartment pressure measurements in any patient displaying any of the cardinal signs. While palpation of compartments is the most commonly reported aspect of the exam, it has been shown to have a very poor correlation with a true diagnosis of compartment syndrome with reported sensitivities as low as 24% [17].

Patients should be examined by the same medical professional every 2–4 hours until the combined pass-on examination between staff members. Care must be taken in obtunded patients or patients who have undergone regional analgesia or neuraxial block pre or post procedure as the symptoms may be masked. The threshold for compartment measurements should be even lower in these patients. However, while intra-compartmental pressures have a high estimated sensitivity and specificity, it is still possible to have both false-positive and false-negative results, and so the patient's clinical presentation should be heavily considered. Though fasciotomies can be morbid procedures, many consider the significant sequelae of untreated compartment syndrome to be worse. As such, surgeons can expect that up to 3–4% of clinically concerning patients undergoing fasciotomies may not ultimately have a true compartment syndrome so as to be certain that no cases are ever missed [18].

Take-Home Messages

- Compartment syndrome accounts for 0.03–0.05% of all malpractice claims per year.
- Misdiagnosed compartment syndrome and delayed compartment releases result in some of the highest indemnity payments in orthopedic litigation.
- Compartment syndrome following elective surgery, female sex, young plaintiffs, and the presence of cardinal symptoms (pain out of proportion, paresthesias, pallor, poikilothermia, pulselessness) is associated with a high rate of plaintiff victory in litigation.
- Thorough documentation, early compartment releases (<8 hours), and clear physician-patient communication decrease the risk of plaintiff victory in compartment syndrome litigation.
- Consistent examination and early action when symptoms develop are critical to properly diagnose compartment syndrome.

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