



## **Second Impact Syndrome: Diagnosis versus Myth**

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On November 5, 2005, La Salle University's Preston Plevretes took a massive blow to the head during a college football game against La Salle's rival, Duquesne University.<sup>[1]</sup> The play occurred in the fourth quarter, when an opposing player collided head-first with the nineteen-year-old Plevretes on a punt return. He lapsed into a coma almost immediately, and eventually underwent lifesaving brain surgery at a nearby hospital. Plevretes survived, but suffered life-long catastrophic injuries as a result of the hit.

A few years after Plevretes' injury, twenty-two-year-old fullback Derek Sheely lost consciousness and collapsed on the football field during a preseason practice at Frostburg State University.<sup>[2]</sup> Sheely was rushed to a nearby hospital and, on August 28, 2011, passed away due to traumatic brain injury (TBI), by some accounts from a helmet-to-helmet hit.

Ever since sport-related concussions in football became a hot-button topic in 2007 when Alan Schwartz published his first CTE article in the *New York Times*, followed soon after by the 2009 and 2010 Congressional hearings on legal issues relating to football head injuries, stories such as Plevretes' and Sheely's started becoming more commonly reported (and litigated).

Ryne Dougherty and Kenney Bui also were young football players who endured fatal hits to the head.<sup>[3]</sup> Nicholas Zemke, a high school football star from California, likewise suffered a debilitating head injury on the field,<sup>[4]</sup> as did Cody Lehe, Aaron Singleton, and Andrew Swank.<sup>[5]</sup> And the list goes on. While in recent years, there has been a greater focus on the health and safety of the athlete, one point remains clear: TBI in the contact sports world isn't going away.

What is *less* clear is the condition that purportedly claimed the deaths of all eight of these athletes:



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Second Impact Syndrome (SIS). SIS is a controversial phenomenon that allegedly occurs when the brain sustains a second, subsequent impact before a previous injury has had adequate time to heal and recover.<sup>[6]</sup> The initial injury is said to make the brain more vulnerable, and the "second impact" purportedly sets in motion catastrophic cerebral swelling. Death can occur within two to five minutes after the second impact.<sup>[7]</sup>

Given TBI's tragic consequences, brain injury lawsuits are on the rise all across the country. In 2017 alone, at least three athletes commenced legal action seeking damages relating to traumatic injuries sustained on the field.<sup>[8]</sup> And who are the defendants in these lawsuits? Coaches, school officials, team doctors, athletic trainers, and other healthcare professionals of record – all alleged to have been negligent (e.g., for prematurely returning a player to play following a prior concussion).

Negligence is a traditional legal claim that has four main elements—duty, breach, causation, and harm. A plaintiff alleging negligence must prove each of these

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elements by a preponderance of the evidence; first, the plaintiff must show that the defendant owed the plaintiff a duty, and failed to use reasonable care in executing that duty. Then, the plaintiff must establish a causal link between the defendant's behavior and the resulting damages. In other words, even if a plaintiff successfully satisfies the first two elements, the plaintiff will not prevail unless it is shown that the defendant's conduct actually *caused* the resulting injuries.

This is where SIS comes into play. Since at least 2007, plaintiffs have been relying on SIS as the theory of causation in their negligence lawsuits. They claim SIS triggers rapid and severe cerebral swelling, and they say this swelling leads to death or permanent disability. In 2014, for example, Derek Sheely's parents alleged that Derek died "due to complications from massive swelling *caused* by second-impact syndrome;" just last month, parents of another athlete who died following a TBI made similar allegations in a wrongful death suit against the athlete's school and coach.<sup>191</sup> At first blush, this seems unproblematic. But, here is the catch: SIS may not actually exist.<sup>191</sup>

#### The Science—or lack thereof—Behind Second Impact Syndrome

The Preston Plevretes matter was a landmark TBI case involving a plaintiff's reliance on SIS as a theory of causation. In 2007, two years after Plevretes sustained a catastrophic blow to the head on the football field, he filed an action against La Salle University claiming, among other things, that the school's head athletic trainer and a nurse practitioner negligently cleared him to play despite ongoing concussion symptoms from a prior concussion he sustained several weeks earlier. He alleged that SIS caused his injuries, and retained as an expert Robert Cantu, MD—a neurosurgeon with experience in sport-related TBI—to opine on the condition.<sup>111</sup> In preparation for trial, Cantu penned an extensive report detailing the pathophysiology of SIS and concluded that SIS caused Plevretes' death. The case settled in 2009.

Years later, Cantu's name popped up in another catastrophic injury lawsuit. This time, he was called by lawyers for Nicholas Zemke, a high school football player who sued his coaches and school district after sustaining a debilitating head injury during a game.<sup>121</sup> At trial, Zemke presented Cantu's opinion regarding the cause of death, namely, that Zemke's brain trauma was the result of SIS, and SIS would not have occurred had Zemke's coaches kept him on the sidelines. However, this opinion never made it into evidence. Ultimately, the court sustained the defendants' objections to Cantu's declaration on relevance grounds.

Cantu also was retained by Ryne Dougherty of Montclair, New Jersey—a young athlete who endured a fatal hit to the head less than a month after returning to football following a concussion.<sup>131</sup> Dougherty's parents sued Montclair High and the township's board of education, alleging that school officials prematurely cleared Dougherty to play. SIS emerged as the theory of causation, and Cantu was prepared to testify about the condition had the case gone to trial. That never happened because, in 2013, the parties settled for \$2.8 million.

These three stories, tragic as they are, illustrate that SIS surfaces in TBI lawsuits, but it has yet to be proven. Plaintiffs' lawyers advance SIS as the theory of causation, and retain medical experts to testify about the science and pathophysiology behind this so-called syndrome. These experts are finding SIS, however, even when the "second" impact occurs weeks – and multiple games – after the first impact, as in Plevretes, or where the first and second impacts are not easily identifiable, if identifiable at all, as was the case in Sheely.

Cantu has emerged as one of the go-to experts on the plaintiff's side. His name continues to appear in medical literature, news reports, and legal proceedings, and his opinion generally remains the same: that SIS is a valid diagnosis that can lead to death or permanent disability.

Cantu, however, represents just one side of the SIS debate. SIS has garnered much controversy in the sports-medicine community, and some experts question the existence of the condition altogether. For example, Dr. Paul McCrory, a leading neurologist and sports physician from Melbourne, Australia, has been studying SIS for almost two decades, but has yet to find verifiable scientific evidence to suggest that a repeated concussive injury is a risk factor for rapid and severe cerebral swelling.

Dr. McCrory's research is compelling. In 1998, he undertook an empirical study of SIS, seeking to gain a better understanding of the elusive condition. He and his colleague Samuel F. Berkovic analyzed seventeen fatal-cases of so-called SIS, evaluating them under four diagnostic criteria. Under this study, a case that satisfied all four categories would be classified as "Definite SIS."

Notably, *not one* case fulfilled the criteria for this classification. Of the seventeen cases, only five actually involved a repeated blow to the head, and it was unclear whether the initial injuries played any contributory role in the ensuing deaths.<sup>141</sup> Twelve of the cases displayed SIS-like cerebral swelling, but one thing was missing: a second impact. The athletes in these cases simply collapsed and died without any

further injury occurring. Given these results, McCrory found that SIS as a risk factor for the described cerebral swelling is not established.<sup>[15]</sup>

Almost twenty years later, McCrory appears to stand by his initial conclusion.<sup>[16]</sup> To him, SIS is still an anecdotal myth based on the interpretation of unreliable reports and eyewitness accounts.<sup>[17]</sup> As he explained in the *Clinical Journal of Sports Medicine*:

Most cases of traumatic cerebral swelling, whether associated with a structural brain injury or not, have no prior evidence of head injury with ongoing symptoms that would support the concept of second impact syndrome as defined in the literature. In those cases that are presumed to represent SIS, the evidence that a prior head injury is a risk factor for this pathophysiology entity is not compelling.<sup>[18]</sup>

Experts like Cantu undoubtedly disagree with this outlook. McCrory, however, makes a good point. Researchers have been studying SIS for decades, but there is still a complete “lack of systemic evidence for its existence.”<sup>[19]</sup> Belief in SIS remains largely opinion-based, and, while new studies emerge each year, none has provided concrete answers about this condition. It may take many years before a universal conclusion is reached.

The problem, of course, is that plaintiffs – and their lawyers – are not going to sit back and wait for the scientific community to reach a resolution on SIS to start using the condition in their lawsuits. So long as experts like Dr. Cantu view SIS as a valid diagnosis and are willing to liberally reach an opinion that a plaintiff sustained SIS, plaintiffs will continue to use the syndrome in attempting to establish the requisite causal link between breach and damages in negligence cases. Indeed, the SIS theory is becoming so flexible that lawyers through their experts are taking any given fact pattern and just slapping the label SIS on it, whether it’s the second, 50<sup>th</sup>, or 250<sup>th</sup> impact that causes the ultimate injury and regardless of the timing between the first and “second” impact or whether the injury-causing impact is a forceful one or one that is relatively minor. In short, lawyers and their experts are making SIS whatever they want it to be to establish their case.

How courts will grapple with SIS as a theory of causation is another issue and remains to be seen. What is certain, however, is that coaches, athletic trainers, and school officials alike need to know how to best defend against these claims.

Injury Prevention and Management in the SIS World

By now, it is clear that sport-related concussion is a common injury among athletes and associated with a host of potential legal issues. TBI lawsuits are

popping up all over the country, and coaches, athletic trainers, and school officials are often named as defendants in these litigious situations. The risk of liability is especially high for athletic trainers. When an athlete is injured during a sporting event, athletic trainers are often the first to identify the injury, develop a treatment plan, and clear the athlete to return to play. Every action athletic trainers make in this regard carries with it significant responsibility. In a world where SIS remains a debate, these decisions become even more critical.

Fortunately, there are steps athletic trainers can take to ensure they are keeping with best practices. The key is education. Athletic trainers should be intimately familiar with the most recent National Athletic Trainers’ Association (NATA) Position Statement on the management of sport concussion.<sup>[20]</sup> Irrespective of the validity of the existence of SIS, the Position Statement purports to describe the syndrome as malignant cerebral edema that occurs after an athlete sustains an impact while still symptomatic from a previous injury to the head or body, and recommends that athletic trainers be aware of the potential for this condition, especially in young athletes. What athletic trainers should take from the NATA Position Statement is that while NATA has yet to take a firm stance on the existence (or non-existence) of SIS, it nonetheless regards diffuse cerebral swelling as a potential danger for young athletes and cautions athletic trainers to understand the threat of this condition.

Next, athletic trainers must know their institution’s concussion management plans and make certain that post-concussive student-athletes are prohibited from returning to play until they are asymptomatic and have been evaluated and cleared by a medical doctor or doctor’s designee. Whether SIS exists or not, these protocols, at the very least, are designed to protect student-athletes from sustaining further injury on the field. As McCrory explains:

The danger of prematurely returning to sports relates to the risk of sustaining further injury. Neuropsychologic measures of speed of information processing and reaction times are slowed in the early stages post injury. In this setting, an athlete participating in a collision sport (such as football) or high-risk sport (such as motor car racing) may not be able to respond appropriately to dangers in the sporting situation and hence sustain further injury.<sup>[21]</sup>

Finally, athletic trainers should keep informed of the latest changes and developments in traumatic brain injury research. If the debate over SIS tells us anything, it is that the science behind sport-related concussion is ever-evolving. Athletic trainers in particular not only need to stay abreast of advances in

the field, but also need to proactively modify their concussion management protocols according to changes in local and state laws, professional organization standards, and international consensus statements. Hopefully, there will be more clarity over the existence of SIS in the near future. Until then, athletic trainers and other health care professionals should err on the side of caution and continue to treat brain injuries with a combination of good sense and clinical judgment.<sup>[22]</sup>

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[2] Matt Grossman, Sharing Derek Sheely, *SB Nation* (Dec. 17, 2013), <https://www.sbnation.com/longform/2013/12/17/5217634/sharing-derek-sheely-a-helmet-to-helmet-hit-took-the-life-of-a-22>.

[3] Thomas Zambito, Family of Montclair High School football player Ryne Dougherty who died in 2008 settles lawsuit for \$2.8 million, *NJ.com* (Sept. 9, 2013, 7:00 PM), [http://www.nj.com/essex/index.ssf/2013/09/family\\_of\\_montclair\\_high\\_school\\_football\\_player\\_ryne\\_dougherty\\_who\\_died\\_in\\_2008\\_settles\\_lawsuit\\_for.html](http://www.nj.com/essex/index.ssf/2013/09/family_of_montclair_high_school_football_player_ryne_dougherty_who_died_in_2008_settles_lawsuit_for.html); see also Megan Molteni, How a Mere Prick of the Finger Can Diagnose a Concussion, *Wired* (Jan. 1, 2017, 7:00 AM), <https://www.wired.com/2017/01/mere-prick-finger-can-diagnose-concussion/>.

[4] *Zemke v. Arreola*, No. B182891, 2006 WL 1587101, at \*1 (Cal. Ct. Ap. June 12, 2006).

[5] Sydney Lupkin, High School Football Player Victim of ‘Second Impact Syndrome,’ *ABC News* (Jan. 1, 2013), <http://abcnews.go.com/Health/impact-syndrome-high-school-football-player-normal-ct/story?id=18102534>; see also *Swank v. Valley Christian Sch.*, No. 93282-4, 2017 WL 2876139 (Wash. July 6, 2017); Bianca Castro, North Texas Teen’s Death Could Provide Answers About Head Injury, *NBC* (Nov. 11, 2016, 5:54 PM), <http://www.nbcdfw.com/news/health/North-Texas-Teens-Death-Could-Provide-Answers-About-Head-Injury-400887991.html>.

[6] Paul R. McCrory & Samuel F. Berkovic, Second impact syndrome, *50 Neurology* 677, 677 (March 1, 1998).

[7] Tareg Bey & Brian Ostick, Second Impact Syndrome, *X W.J. of Emergency Med.: Integrating Emergency Care with Population*

*Health* 6, 7 (Feb. 2009).

[8] See *Bradley v. Nat’l Collegiate Athletic Ass’n*, No. 16-346, 2017 WL 1364853, at \*11 (D.D.C. Apr. 12, 2017); see also *Swank*, 2017 WL 2876139, at \*1; *Williams v. Athletico, Ltd.*, 74 N.E.3d 1047, 1050 (Ill. App. Ct. 2017).

[9] *Swank v. Valley Christian Sch.*, No. 93282-4, 2017 WL 2876139 (Wash. July 6, 2017).

[10] See Paul McCrory, Does Second Impact Syndrome Exist?, 11 *Clinical J. of Sport Med.*, 144, 144 (2001).

[11] Steven Pachman & Adria Lamba, Legal Aspects of Concussion: The Ever-Evolving Standard of Care, 52 *J. of Athletic Training*, 186, 187 (March 2017).

[12] *Zemke v. Arreola*, No. B182891, 2006 WL 1587101, at \*1 (Cal. Ct. Ap. June 12, 2006).

[13] Thomas Zambito, Montclair High School trainer faced tough questions in football player’s 2008 death, *NJ.com* (Sept. 22, 2013, 6:32 AM), [http://www.nj.com/essex/index.ssf/2013/09/ryne\\_dougherty\\_lawsuit\\_montclair\\_high\\_school\\_trainer\\_faced\\_tough\\_questions\\_in\\_football\\_players\\_2008.html](http://www.nj.com/essex/index.ssf/2013/09/ryne_dougherty_lawsuit_montclair_high_school_trainer_faced_tough_questions_in_football_players_2008.html).

[14] Paul McCrory, Gavin A. Davis, & Michael Makkdissi, Second Impact Syndrome or Cerebral Swelling after Sporting Head Injury, *Current Sports Med. Reports*, 21, 21 (Jan. 2012).

[15] McCrory & Berkovic, *supra*, at 681.

[16] Alan Neuhauser, Sudden Death, *U.S. News* (Aug. 11, 2016, 7:30 PM), <https://www.usnews.com/news/articles/2016-08-11/sudden-death-the-mysterious-brain-injury-killing-young-football-players>.

[17] Paul McCrory, The eighth wonder of the world: the mythology of concussion management, 33 *British J. of Sports Medicine*, 136, 137 (Jan. 1999).

[18] McCrory, *supra*, at 147.

[19] McCrory, Davis, & Makkdissi, *supra*, at 21.

[20] Steven P. Broglio, et al., National Athletic Trainers’ Association Position Statement: Management of Sport Concussion, *J. of Athletic Training* 245, 245-248 (2014).

[21] McCrory & Berkovic, *supra*, at 682.

[22] McCrory, *supra*, at 148.