

# Compartment Syndrome

The crowd cheered, the football snapped, and helmets clashed as players piled onto the running back. A more ominous snap was heard, and 16-year-old running back, Jason[1], did not get up from the field.

The teenager was admitted to orthopedics via the ED, where studies revealed a comminuted closed fracture of the tibia and fibula with severe swelling. He was started on morphine PCA but complained of numbness in his toes throughout the night and next morning. Dr. Smith performed an open reduction with intramedullary nail fixation later that day, with a total tourniquet time of 80 minutes which is at the upper limit of acceptable tourniquet times. Postoperatively, Jason was given Toradol, Lortab, Morphine PCA, Phenergan, and Motrin. He still had numbness in his toes, but was able to move them on post-op day one. On post-op day two, he had minimal toe movement and nurses documented sensation in the web spaces. Moving the patient's great toe caused excruciating pain up the leg despite the significant doses of narcotics; however, this was not documented by the nurses. When excessive pain prevented his physical therapy participation, nurses notified Dr. Smith, who added IM morphine. Later that evening, nurses called Dr. Hudson to report the patient was having spasms with pain, for which Ativan was ordered.

On post-op day three, Jason had increased numbness, pain, and no toe movement. Dr. Hudson split the dressing to relieve pressure, and rechecked the leg two hours later. At that time, a diagnosis of compartment syndrome was made, and the patient was taken to surgery later that day. Dr. Hudson performed a four-compartment fasciotomy with debridement of necrotic muscle. Cultures were positive for three organisms and the patient was placed on oral antibiotics; Jason endured six more debridements and a split-thickness graft prior to discharge.

Jason's skin graft showed an excellent result when seen in follow-up a week after surgery. However, the graft developed serous drainage three days later, and oral antibiotics were added. At follow-up four days later, the graft had some necrosis with odor from the foreleg. Topical antibiotics were added and debridement performed. Despite use of a wound vacuum, the leg failed to heal and multiple organisms continued to be cultured.

At three and four months post-surgery, necrotic tendons and muscles were documented, with clawing of the patient's toes and impaired motion. After the 16th debridement exposed the fibula, the patient and his family requested referral to a regional children's hospital. Five months after the initial surgery, workup there revealed poor sensation and motion, poor wound healing, and probable chronic osteomyelitis. (He required four more debridements during this process, for a total of 22.) Options were discussed with the

patient and family, including free flaps, exchange nailing to promote bone healing, or below-the-knee amputation (BKA). After contemplation, Jason chose BKA in order to resume some mobility and prevent the need for multiple surgeries.) Eight months after the injury, Jason underwent amputation and was fitted with the initial prosthesis two months later. Twelve months after the accident, the crowd cheered as Jason—wearing a prosthetic leg—ran onto the field with the football team. A lawsuit against the orthopedist and the hospital followed.

What went wrong, and could this tragic outcome have been avoided? Experts agreed that because of Jason's age, long use of tourniquet, and placement of hardware, he was at high risk of developing compartment syndrome (CS). Experts opined that the orthopedist did not write specific orders for vascular checks, movement, sensation, extreme pain, or for notifying him immediately of status changes. He should not have assumed the nurses were familiar with signs of CS. The orthopedist charted that the patient should get out of bed and might go home the day following surgery; thus, the nursing staff was not on high alert for problems - even if they knew the warning signs.

Experts also testified that in a patient with high levels of pain despite narcotics, a surgeon should add CS to the differential diagnoses, if not already under consideration. No investigation was made by the orthopedist when informed of the extreme pain. Once on the radar, the diagnosis of CS should be actively pursued and definitively ruled out rather than taking a wait and see approach. The standard of care required the orthopedist to assume that the intense pain was from muscle ischemia due to CS until proven otherwise. The window of opportunity is as little as three hours to prevent catastrophic damage. Unfortunately, this patient had a 24- to 48-hour delay in diagnosis and suffered a total of 22 debridements prior to amputation.

Compartment syndrome is a challenging diagnosis to make in a timely fashion, and it requires a high index of suspicion. Because the consequences of an untimely diagnosis are often severe, these cases are fraught with sympathy and hindsight bias. In this case, experts were found to support both sides, but the majority of the expert reviews indicated that the diagnosis should have been made sooner. Had the care not been compromised by lack of diligent inquiry and poor communication between staff and surgeons, this young man may have had a very different outcome.

[1] All names have been changed.

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