


Acute Compartment Syndrome After Isolated Soleus Tear in an Elderly Recreational Athlete

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Abstract

Case: A 62-year-old man without significant medical history (no anticoagulation) presented to the emergency department with intense leg pain following a short track race, during which he felt a pop in his calf. His physical exam was highly concerning for acute compartment syndrome (ACS) despite the lack of a typical mechanism or fracture. Compartment pressures were measured and found to be significantly elevated. He underwent compartment releases revealing a medial soleus tear with 400–500 cc hematoma. **Conclusion:** The case presents a patient with ACS after a soleus muscle tear. Prompt recognition and fasciotomy led to a good clinical outcome. Physicians should recognize that not only gastrocnemius tears can lead to compartment syndrome.

Keywords

Sports medicine, compartment syndrome, fasciotomy, geriatric trauma, soleus muscle

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Introduction

Acute compartment syndrome (ACS) is a severe condition for which a delay in diagnosis can result in significant limb morbidity, including irreversible nerve and muscle damage and rhabdomyolysis.^{1,2} Prompt diagnosis of ACS typically relies on a suggestive history and the presence of typical physical exam findings, as well as the measurement of compartment pressures.²⁻⁵

While ACS of the lower extremity is most commonly encountered following a fracture,⁶ there have also been a number of case reports describing ACS in association with calf strain and muscle rupture.⁷⁻¹⁴ These cases most typically involve tears of the medial gastrocnemius, so called “tennis leg,” and have been described in both athletes and nonathletes.¹⁵ Here, we report a case of a 62-year-old man with atraumatic ACS associated with a medial soleus tear.

To our knowledge, this is the only reported case of ACS after an isolated tear of the soleus.

Case Report

A 62-year-old man was beginning to run a short distance race when he felt a pop in his calf while coming off the starting block. He felt a short intense pain and did not finish

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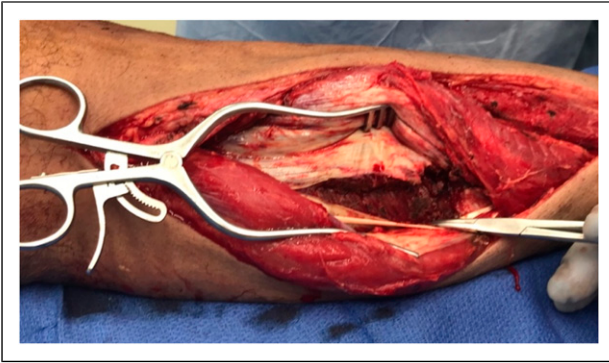


Figure 1. Intra-operative photo of ruptured soleus.

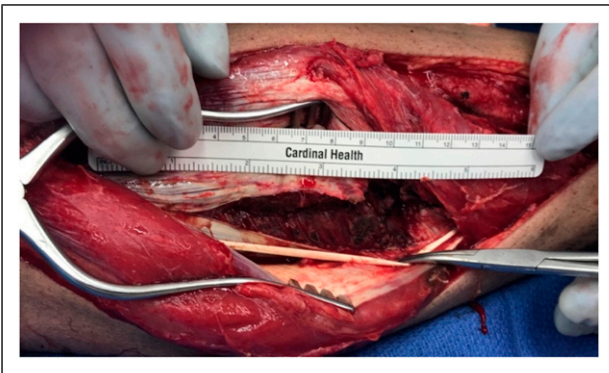


Figure 2. Intra-operative photo of ruptured soleus.

the race. He went home to ice and rest his leg, but his pain and swelling continued to increase. He presented to the emergency department but left due to long wait. He returned 2–3 hours later when the pain became “unbearable.” His physical exam revealed firm swelling of the posterior leg, with taut skin and significant pain with palpation. His foot was held in resting plantarflexion and he demonstrated pain with passive movement of the ankle but no significant increase in pain with flexion or extension of the toes. He had no neurological deficits and distal pulses were intact. He had no history of injury to that leg previously, no history of coagulopathy, and was not taking any anticoagulants.

Clinical suspicion for ACS was high despite the lack of high energy mechanism or fracture. Compartment pressures were measured and found to be significantly elevated in all four compartments of the leg, with a diastolic BP 95 mmHg, anterior compartment 58 mmHg ($\Delta p = 37$ mmHg), lateral compartment 63 mmHg ($\Delta p = 32$ mmHg), superficial posterior compartment 70 mmHg ($\Delta p = 25$ mmHg), and deep posterior compartment 86 mmHg ($\Delta p = 9$ mmHg). He was promptly brought to the operating room for exploration and four-compartment fasciotomies.

Based on clinical presentation, the superficial posterior compartment released first. After incising the superficial fascia and releasing the compartment, there was evacuation of approximately 400–500 cc of hematoma proximally between the gastrocnemius and the soleus (Figures 1 and 2). After decompression of the hematoma, the tension in the leg compartments was significantly improved to palpation. The deep posterior, anterior, and lateral compartments were then released. All muscles were noted to be contractile and viable; however, there was contusion noted of the soleus and gastrocnemius. The medial and lateral wounds were left open with vacuum-assisted closure (VAC) device. He returned to the operating room 2 days later for irrigation and debridement, at which time there was a visible medial soleus tear noted. Both medial and lateral wounds were closed primarily, and incisional wound VACs were placed. On post-operative day four from fasciotomies, the incisional VACs were taken down and the patient was discharged home. At his 8-week post-op appointment, he was doing well with no functional deficit when compared to contralateral side. At his 1-year follow-up, he continued to do well. He reported little to no pain and was only bothered by a mild persistent swelling of the leg and ankle that would occur after a full day of being on his feet. He is back to all of his previous activities, although he now mountain bikes instead of running as his main exercise as it is easier on his joints. He reported no functional limitations and is overall very pleased with the outcome of his operation.

Discussion

ACS commonly occurs as a result of soft tissue injury following a fracture. McQueen et al performed a review of 164 cases of ACS in which 69% of cases were associated with a fracture.⁶ Other risk factors include male gender, young age, and protracted hypotension. McQueen estimates the incidence of ACS to be 0.7 per 100 000 for women and 7.3 per 100 000 for men. It has been suggested that the greater incidence in men may be related to the greater muscle mass within a fixed compartment size in men.³

In addition to fractures, ACS has also been reported following severe exercise,⁶ or less frequently following moderate or minimal exercise,^{7,9,16} and even rarer reports of ACS in nonathletes.¹⁰⁻¹² This wide variety of injury patterns raises a diagnostic dilemma, as the clinician must maintain a high degree of suspicion even in those without fracture or high energy mechanism.

Calf strains are relatively common injuries, particularly in athletes.¹⁷ They are most commonly found in the medial head of the gastrocnemius, so called “tennis leg¹⁵,” which is at an increased risk for strains as it is biarthrodial and has a high density of type two fast twitch muscle fibers.¹⁸

Strains of the soleus are less frequently reported, although it has been suggested that they are underreported due to misdiagnosis as thrombophlebitis or gastrocnemius strains.^{7,18} Unlike the gastrocnemius, the soleus crosses only the ankle and contains primarily type one slow twitch muscle fibers.¹⁸ Treatment for calf strains can typically be conservative; however, there have been a number of case reports of calf strains resulting in ACS, which requires prompt diagnosis and typically necessitates surgical treatment.

Straehly et al reported a case of ACS in a 51-year-old man playing softball found to have a large tear in the gastrocnemius.¹⁶ Double incision four-compartment fasciotomies were performed and 300 cc of blood clot was removed. Complete resolution of sensory and motor function was obtained after delayed closure and skin grafting.

Anouchi et al⁷ reported a similar case in a 47-year-old man with calf pain and swelling after a night of dancing. After initial misdiagnosis as a deep vein thrombosis and initiation of heparin, compartment pressures were found to be elevated. Fasciotomy was performed where a medial gastrocnemius tear was found.

ACS following calf strain has also been reported in nonathletes. Thennavan et al¹¹ reported a case of progressive calf swelling and pain in a 47-year-old man after stepping down off of a tractor. Compartment pressures were elevated, and fasciotomy was performed, where a medial gastrocnemius tear was identified. Tao et al¹⁰ reported a similar occurrence, when a 47-year-old man felt a sudden pop in his left calf after stepping off a truck. At fasciotomy, he was found to have a complete rupture of the musculotendinous junction of the medial gastrocnemius.

Atraumatic cases of ACS associated with anticoagulant use have also been reported. Phillips et al¹² reported on a case of atraumatic gastrocnemius rupture in a 56-year-old man on rivaroxaban, a novel oral anticoagulant that works by directly inhibiting factor Xa. The authors suggest that the anticoagulant caused significant intracompartmental bleeding and edema, contributing to his development of ACS. While our patient was not on anticoagulants, this highlights the importance of maintaining a high degree of clinical suspicion for ACS even in patients without significant mechanism.

While a majority of lower extremity compartment syndromes following muscle strains are associated with the gastrocnemius,^{7-14,16} ACS is not limited to tears of the gastroc. Slabaugh et al¹⁹ report on a 33-year-old man with a noncontact ankle injury causing a peroneus longus tear at the musculotendinous junction, resulting in acute lateral compartment syndrome which was successfully treated with emergent lateral compartment fasciotomy.

The diagnosis of ACS is often described as a clinical diagnosis; however, the reliability of the classic "6 Ps," including pain, pallor, paresthesia, paralysis, pulselessness, and poikilothermia, has proven unreliable.^{2,3,5} In a review

of prospective studies on compartment syndrome, Ulmer⁵ looked at pain, pain with passive stretch, paresthesias, and paresis and determined that these clinical findings have very low sensitivity (13–19%) and positive predictive value (11–19%) but have very high specificity and negative predictive values (97–98%).⁵ The authors conclude that these clinical findings may be more valuable in excluding the diagnosis of ACS in their absence than in making the diagnosis in their presence. The diagnosis of ACS is not always straightforward, and the true rate of ACS is difficult to ascertain. One retrospective study at a single institution demonstrated wide variation among surgeons in the rate of diagnosis and treatment of compartment syndrome, ranging from 2 to 24% of tibial fractures.¹

Confirmation of the diagnosis can be made by measuring compartment pressures, where a pressure within 30 mmHg of the diastolic pressure is suggestive of ACS.⁴ However, even this tool has recently been called into question as O'Toole et al¹ noted that any patient in their study who had their compartments checked had a 73% chance of being diagnosed with compartment syndrome, raising a concern for a high rate of false positives resulting in a higher rate of ACS diagnosis and fasciotomies.

Our case highlights the importance of maintaining a high degree of suspicion for ACS even in the absence of direct trauma or fracture. All previously reported cases of ACS from calf muscle rupture were due to an injury of the gastrocnemius. Prompt recognition and treatment with fasciotomy resulted in excellent clinical outcome.

Declaration of Conflicting Interests

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Informed Consent

The patient was informed that data concerning the case would be submitted for publication, and they provided consent.

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