Case Report

Acute compartment syndrome of the foot after an ankle sprain: a case report

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Abstract

The aim of this study is to report the case of a patient with an acute foot compartment syndrome after an ankle sprain, discussing the diagnostic challenges and rarity of such an uncommon complication of a very common and low-trauma event. A 19-year old young man presented at the emergency department for a twisting injury of his left ankle. Physical and radiological evaluation revealed a 2nd degree lateral ankle sprain and the patient was treated conservatively. Two days later, the patient returned to the emergency department, late at night, with worsening and excruciating pain of his left foot and inability to walk. Physical evaluation showed severe swelling of the left foot and decreased range of active and passive motion. X-rays and CT scan were negative for fractures. An emergency fasciotomy of the lateral and medial compartment of the foot was performed and necrotic muscle parts were removed. Postoperatively, patient's symptoms were controlled and a week later he was discharged from the hospital. Twelve months later, the patient is pain-free with full range of motion of his left ankle and foot.

Keywords: Acute compartment syndrome, Ankle sprain, Fasciotomy, Muscle necrosis, Intracompartmental pressure

Introduction

Compartment syndrome occurs whenever the pressure within a closed osseofascial anatomic space is greater than its perfusion pressure leading to muscle and nerve ischemia. If left untreated, it may lead to tissue necrosis and functional impairment, an acute limb-threatening condition which may cause acute renal failure¹. Ankle sprains are very common musculoskeletal injuries usually treated successfully with a low cast for a short period of time. Acute compartment syndrome of the foot after an ankle sprain is extremely rare in literature and its diagnosis is challenging. This study presents a case of acute foot compartment syndrome following a grade two lateral ankle sprain in a 19-year-old previously healthy male.

Case report

A 19-year old, previously healthy, non-smoker, young man presented at the emergency department reporting a twisting injury of his left ankle, during sports activities. Physical examination revealed tenderness and swelling upon the left anterior talofibular ligament, decreased range of motion of the ankle joint and moderate instability determined by the anterior drawer test. Neurovascular status was

normal. Anteroposterior and lateral X-rays of the ankle joint were negative for fracture. A diagnosis of a 2nd degree lateral ankle sprain was made, and the patient was treated with RICE (Rest, Ice, Compression, Elevation) protocol. A below-the-knee posterior splint was applied, along with an antithrombotic prophylaxis (Enoxaparin 4000 I.U. once per day) in order to reduce the risk of venous thromboembolism². The patient was advised not to weight-bear and the follow-up examination was set in a week.

Two days later, the patient returned to the emergency department, late at night, with excruciating pain of his left foot and inability to walk and weight-bear. The pain initiated a day after the injury and was worsening, forcing

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Figure 1. Lateral ankle X-ray showing no clear evidence of fracture.

Figure 2. Anteroposterior ankle X-ray showing no clear evidence of fracture.

Figure 3. Anteroposterior foot X-ray showing no clear evidence of fracture.

Figure 4. Lateral foot X-ray showing no clear evidence of fracture.

the patient to remove the splint by himself. Physical evaluation showed severe swelling of the left foot and decreased range of active and passive motion. Vital signs revealed a temperature of 36.7°C, pulse rate 115 bpm and blood pressure was 130/80. Blood test results

were normal. The patient complained of worsening pain which dramatically increased within the last 24 hours. Furthermore, there was severe edema with ecchymosis on the dorsum of the left foot the toes. The skin was tense and pale. The dorsalis pedis and posterior tibial

pulses were palpable. Bilateral capillary refill time was less than 3 seconds. X-rays and CT scan were negative for fractures (Figures 1-5). Doppler ultrasound showed intact dorsalis pedis and posterior tibial pulses of the left foot. Emergency MRI was not available at that time. No sign of deep vein thrombosis in the left leg was noticed.

Under the potential diagnosis of foot compartment syndrome, an emergency fasciotomy of the lateral and medial compartment of the foot was performed, with dual dorsal incision, overlying the second and fourth metatarsals (Figure 6). All the foot web spaces under the incisions were carefully opened and necrotic muscle parts were excised. Within minutes, skin colour turned from pale to pink.

After the operation, patient's symptoms diminished and a week later he was discharged from the hospital, with a below knee plaster splint and instructions for non-weight-bearing for 20 days. Rehabilitation exercises followed at home for 2 months.

At 12 months follow-up, the patient was pain-free, full range of motion of his left ankle and foot. There were no contractures of the toes or deformities of the affected leg or foot.

Discussion

This study reports a case of an acute foot compartment syndrome as a complication of a second grade degree ankle sprain. The rarity of the case is justified by the absence of any fracture, determined both by X-ray and CT. The possibility that the splint applied might have been too tight or not properly handled by the patient, so as to actually caused the compartment syndrome is not considered in our case report. Acute compartment syndrome usually occurs after fracture, major soft tissue injury, or vascular trauma³. The foot is a rare site for compartment syndrome, with a prevalence of 5%⁴. The result may be devastating without surgical management including severe nerve injuries, ischemic contractures, gangrene, and tissue necrosis that may eventually lead to amputation⁵. Therefore, early diagnosis is of paramount importance requiring high level of suspicion during patient evaluation⁶.

Even though, there are various theories for the development of compartment syndrome, the precise mechanism remains unclear. The most accepted explanation is that the tissue hypoperfusion evolves in response to the increased intracompartmental pressure, leading to ischemia and necrosis of muscles and nerves^{7,8}. Nerves are very sensitive to ischemia and after 12-24 hours of hypoperfusion, nerve damage becomes irreversible. Muscular damage takes place after 2-4 hours and becomes irreversible after 4-12 hours of ischemia⁹. For this reason emergency fasciotomy has to be performed within 12 hours to avoid complications such as muscular necrosis resulting in permanent contractures and chronic pain⁸.

A foot compartment syndrome usually is triggered by a

Figure 5. 3D-CT of the ankle showing no clear evidence of fracture.

Figures 6. Surgical decompression of the foot compartments.

high energy bone or soft-tissue injury, as an ankle, calcaneal or Lisfranc joint fracture^{6,10}. Acute foot compartment syndrome has been attributed also to closed muscle injury¹¹, use of anabolic steroids¹², local medication injection¹³, cellulitis¹⁴, bleeding disorders¹⁵, thrombosis of the popliteal vein¹⁶, patient positioning in the operating room¹⁸ and after thrombolytic therapy for acute myocardial infarction¹⁷. Open injuries can also cause compartment syndrome as some compartments may not be released after an open injury. In our case, no major trauma was noticed, leaving the pathogenesis of compartment syndrome, seemingly unexplained.

To the best of our knowledge, in current literature only 5 cases of acute foot compartment syndrome after ankle sprains were identified. Kym et al have been reported a case of a foot compartment syndrome after a severe ankle sprain, where authors concluded that the most likely cause was a pseudoaneurysm of the dorsalis pedis artery¹⁹. Dhawan et al described a foot compartment syndrome after a severe ankle sprain with disruption of the anterior tibial artery²⁰. A study by Creighton et al reported a foot compartment syndrome after a recurrent ankle inversion injury²¹. Cortina et al reported a case of a medial foot compartment syndrome after a deltoid ligament rupture with no vascular association²². Finally, a study by Maurel et al is the only study that reported a foot compartment syndrome after a minor ankle sprain without vascular injury, but in contrast to our case, the patient was treated with a 3-incision decompression of the foot²³.

Acute compartment syndrome may present as increased pain out of proportion of the original injury, which is especially worsened by active and passive movement of the ankle joint, forefoot or toes. Other symptoms include sensory deficits in the affected compartment, pallor, paresthesia and paralysis. Excruciating and spontaneous pain has been identified as the earliest and most sensitive clinical sign of an acute compartment syndrome of the foot⁵. The observed ecchymosis of the dorsum of the foot, in our case, may be attributed to the expansion of the initial hematoma of the injured anterior talofibular ligament.

Frequently, the clinical diagnosis of acute compartment syndrome is confirmed by measurement of the intracompartmental pressure (ICP). In patients presenting with acute compartment syndrome, pain and paresthesia appear when ICP levels are between 15-30 mmHg. Measured ICP of 30 mmHg is an absolute indication for immediate fasciotomy⁹. In our case, we did not measure ICP because of convincing signs and symptoms of acute compartment syndrome. Usually, imaging studies do not contribute to the diagnosis of foot compartment syndrome but they are helpful for the differential diagnosis. Doppler ultrasound can assess arterial flow and rule out deep venous thrombosis. Angiography may be used to exclude vascular injuries, but in our case, it was not performed due to the emergency of the situation. The absence of ICP measurement and angiography for the exclusion of

vascular injuries are considerable limitations of our study.

The definitive treatment of compartment syndrome is emergent fasciotomy²⁴. The goal of surgical treatment is the dissection of the fascia that surrounds the swollen muscle allowing venous circulation to recover⁴. Proposed surgical approaches for an acute foot compartment syndrome include the double dorsal incision and/or an additional medial incision⁴. In our case a double- dorsal incision technique was performed to reduce intracompartment pressure and prevent muscular necrosis and other complications.

Foot compartment syndrome is a rare but existent complication of ankle injuries which should be taken into consideration early in the assessment of any foot injury associated with soft tissue swelling. Every patient with ankle sprain should be informed about potential complications and advised to be immediately examined in case of suspicious symptoms.

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