DOI: https://doi.org/10.30795/jfootankle.2024.v18.1799

Case Report

Acute compartment syndrome with dorsalis pedis artery rupture after an acute ankle inversion trauma

Gregorio Alejandro Villarreal-Villarreal[1], Omar Ituriel Vela Goñi[1], Gerardo Lozano Balderas[2], José Fernando de la Garza Salazar[1], Adriana Hernandez Lopez[1]

1. Instituto de Ortopedia. Hospital Zambrano Hellion TecSalud. Nuevo León, México.
2. Instituto de Cirugia Vascular. Hospital Zambrano Hellion TecSalud. Nuevo León, México.

Abstract

Acute compartment syndrome in lower limbs is commonly seen in fractures, crash injuries, vascular impairment, and rarely due to ankle sprain. We report a case of a 16-year-old male who was admitted to the emergency room after a traumatic lateral ankle inversion. Significant swelling and moderate pain were present at admission. Plain radiographs showed no bone abnormality. After 60 minutes, the classic signs and symptoms of acute compartment syndrome began, with no response to painkillers. Doppler ultrasound revealed arteries occlusion distal to the superior portion of the extensors retinaculum of the ankle. Anterior foot and ankle fasciotomy were performed, with an angiography revealing a dorsalis pedis artery rupture; both ends were ligated intraoperatively. Postoperative flow was observed through the local collateral system.

Level of Evidence IV; Therapeutic Studies; Case Report.

Keywords: Compartment syndrome; Pediatric; Ankle injuries; Supination.

Introduction

Ankle sprain resulting from an inversion mechanism is a common injury in daily practice[1]. These injuries rarely lead to acute compartment syndrome (ACS)[1,2,3]. ACS is an increase in interstitial pressures within a closed compartment resulting from high-energy mechanisms like fractures and crash injuries, leading to alterations in local circulation that can cause necrosis of the affected tissues[4]. Clinically, pain is non-proportional with the observed injury, does not respond to analgesics, and occurs with passive and active muscle stretching. Other clinical signs include paresis, paresthesia, diminished pulses, and changes in skin color[4]. Timely interventions are key to avoiding irreversible damage. This case report describes an ACS of the foot and ankle due to a dorsalis pedis artery rupture after an ankle inversion.

Case description

A 16-year-old male was admitted to the emergency room after suffering an ankle inversion of the left ankle while playing basketball. This case report was approved by the Institutional Review Board.

He was treated promptly, a routine protocol of oral painkillers was administered, and radiographs were performed. Thirty minutes after admission, the patient reported increasing pain in the anterior and lateral part of the left ankle, rated 10/10 on the visual analog pain scores (VAS). Passive flexion of the toes increased pain, paresis, and "cramps" in the leg were reported by the patient. Intravenous opioids were administered, and after 15 minutes, pain decreased from 10/10 to 6/10 on VAS; however, at a passive extension of the toes maneuver, the pain increased to 10/10 on VAS. Plain radiographs demonstrated no signs of fracture; however, a considerable amount of swelling in the lateral aspect of the ankle was observed (Figure 1).

A physical exam revealed significant swelling of the lateral aspect of the ankle and "ring-like" structures, corresponding to the anatomic borders of the superior extensors retinaculum (Figure 2). No pulses were palpable distal to the dorsal retinaculum, except for a diminished posterior tibialis artery

Study performed at the Hospital Zambrano Hellion TecSalud, San Pedro Garza Garcia, Nuevo León, Mexico.

Correspondence: Gregorio Alejandro Villarreal Villarreal. Avinda Batallon de San Patricio 112, Real de San Agustin; zip code 66260; San Pedro Garza Garcia, Nuevo León, México. **Email:** villarrealga@gmail.com **Conflicts of interest**: none. **Source of funding:** none. **Date received:** June 10, 2024. **Date accepted:** Setembro 22, 2024. **Online:** December 20, 2024.

How to cite this article: Villarreal-Villarreal GA; Vela Goñi OI; Balderas GL; Salazar JFG; Lopez AH. Acute compartment syndrome with dorsalis pedis artery rupture after an acute ankle inversion trauma. J Foot Ankle. 2024;18(3):398-401.

pulse. A Doppler ultrasound was performed, and no pulses distal to the superior extensor retinaculum were observed, except for biphasic posterior tibialis (Figure 3).

The patient was taken emergently to the operating room 90 minutes after the onset of these symptoms. Epidural anesthesia was administered. The superior extensor retinaculum was liberated using a dorsal fasciotomy, and a 50cc hematoma under the retinaculum was found and drained (Figure 4). The skin discoloration partially improved; however, the dorsalis pedis artery rupture was found. The rupture was confirmed by angiography (Figure 5), but due to the avulsed and damaged vessel, repair was not possible, and ligation was performed instead. Intraoperatively, collateral connections of the dorsalis pedis artery were confirmed by angiography. Other intraoperative findings included completely ruptured anterior and posterior tibiofibular ligaments and the calcaneofibular ligament.

Postoperatively, pain improved. The patient reported no pain from passive toe stretching, and a 6-hour postoperative Doppler ultrasound confirmed triphasic flows on the posterior tibialis. The patient was discharged three days after the surgery.

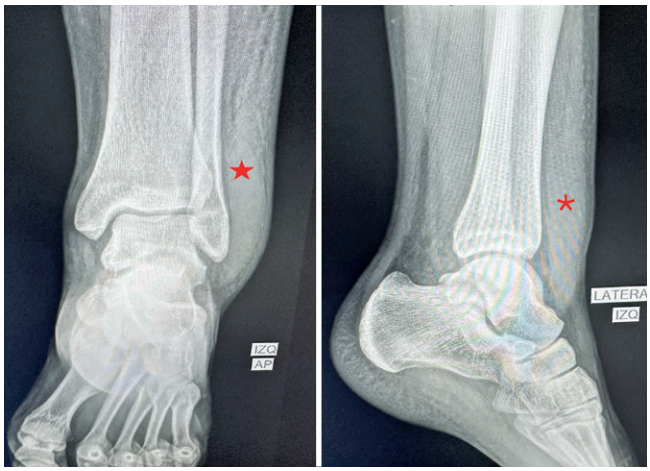

Figure 1. Anterolateral and lateral views of non-weight-bearing ankle radiographs.
There are no signs of fracture but a significant increase in soft tissue volume in the anterolateral region of the ankle, marked by a star in the anterolateral view and an asterisk on the lateral view.

Discussion

The most important finding of this report is that an ankle inversion may rarely produce a traumatic dorsalis pedis artery rupture, even in pediatric patients. This injury causes an expanding hematoma that may induce an ACS. The ACS requires prompt diagnosis and treatment with fasciotomy, hematoma evacuation, and artery repair or ligation.

ACS after traumatic injuries in the lower extremity, particularly ankle sprains, have been described due to vascular disruptions, aneurysms, or muscle belly disruption of the peroneus longus[3,5,6]. When the perforating branch of the peroneal artery is affected, it causes an ACS of the lower leg and ankle[3,5]. When the patient presents with a muscle disruption of the peroneus longus, the ACS most commonly occurs in the lateral compartment of the leg[6]. Our patient presented with ACS of the anterior compartment of the foot and ankle due to a dorsalis pedis artery rupture.

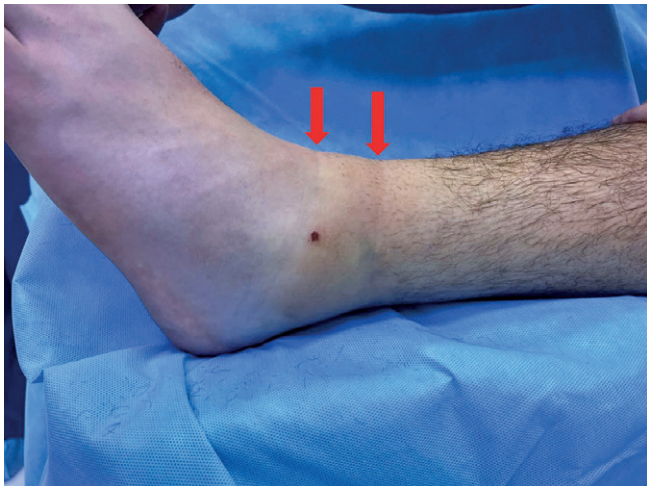

Figure 2. Clinical image of the ankle.
Image showing the "ring-like" structures marked with arrows corresponding to the anatomic borders of the superior extensor retinaculum.

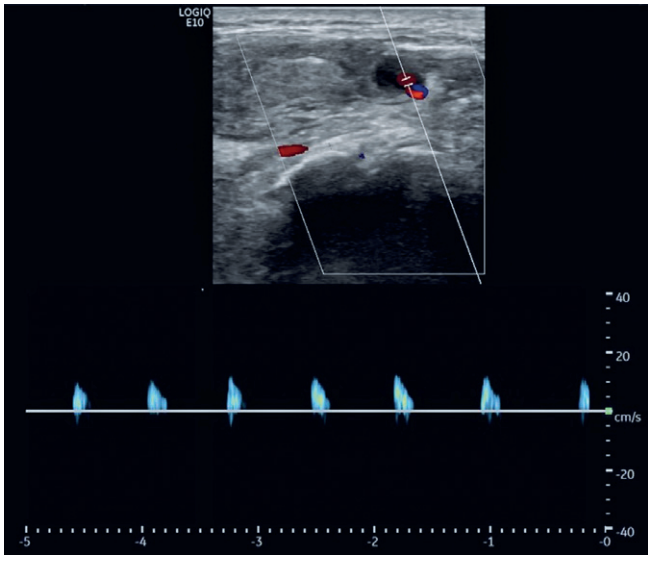

Figure 3. Doppler ultrasound showing the obliteration of the blood flow at the level of the superior extensor retinaculum.

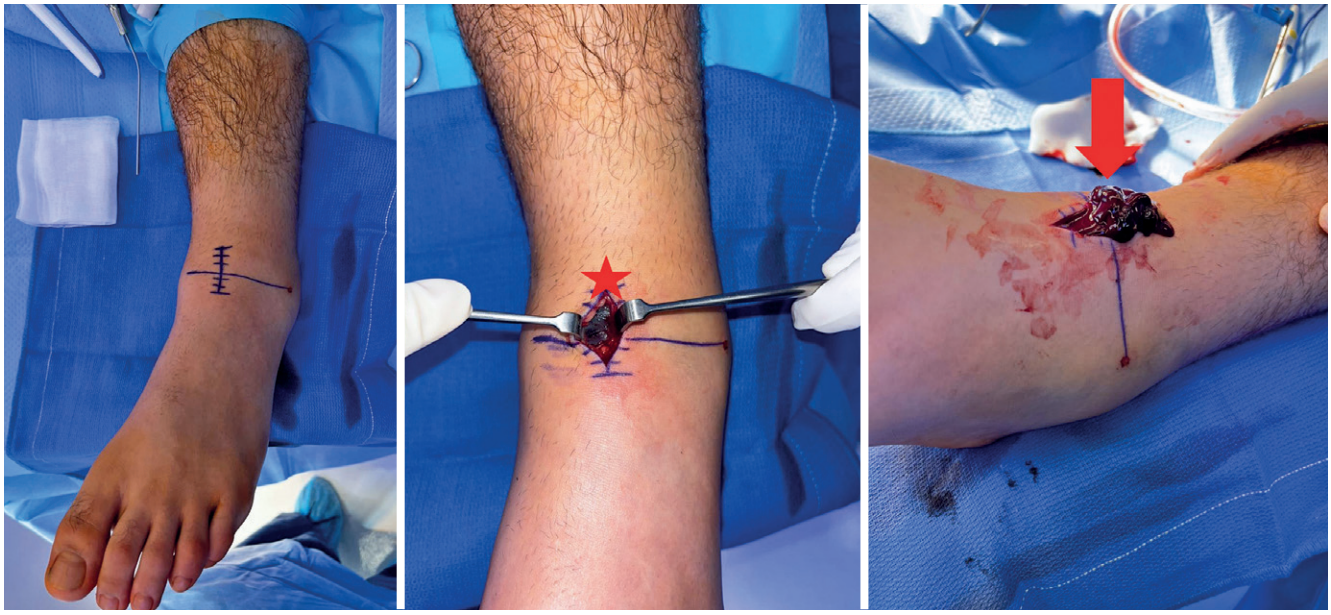

Figure 4. Surgery landmark, incision, and exposure. The first image on the left shows the surgery landmarks in the superior extensor retinaculum. The central image marked with a star shows the superior extensor retinaculum. The image on the right with the arrowhead shows the hematoma drained after the liberation of the superior extensor retinaculum.

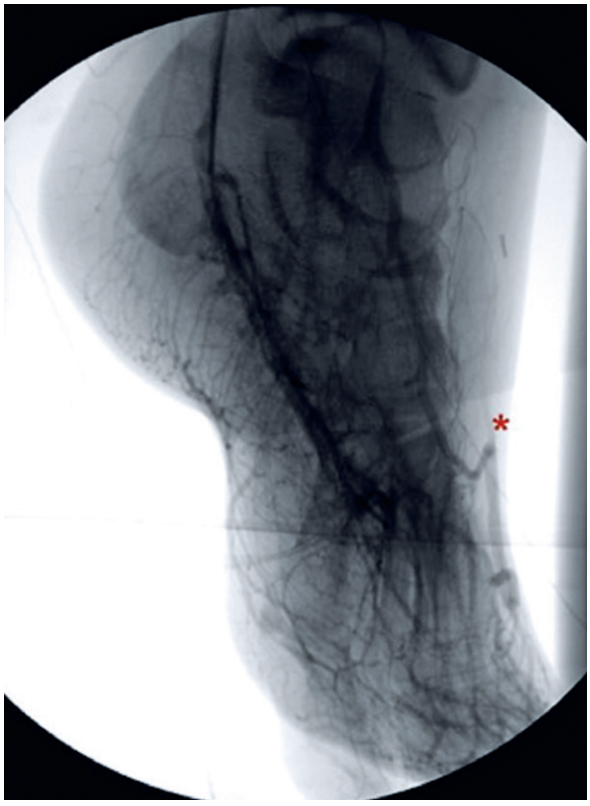

Figure 5. Angiography of the foot. Intraoperative angiography, where the asterisk marks the dorsalis pedis artery rupture.

Maguire et al.[5] in 1972 reported the first case of an ACS after an ankle inversion on a 19-year-old basketball player. The patient suffered a traumatic aneurysm in the perforating branch of the peroneal artery[5]. Later, Ward et al.[3] described a rupture of the perforating branch of the peroneal artery after an ankle inversion for the first time. They presented a case of a 23-year-old soldier injured while playing basketball[3]. Similarly, Kemp et al.[7] described a 24-year-old adult male with a similar injury after an ankle inversion[7]. The most common artery that causes ACS after ankle inversions is the perforating branch of the peroneal artery. Maguire et al.[5] theorized about this, describing the artery's trajectory through the interosseous membrane as the cause of its susceptibility to stress in ankle flexion and inversion. These injuries may cause either a partial or complete disruption or a false aneurysm of the artery. Also, 3.5% of the population has a vascular anomaly of this artery, resulting in the alteration course of the artery being more likely to be injured[5].

According to the literature, ACS after ankle inversion in the pediatric population is even more uncommon than in adults. Hull et al.[6] reported a case series of three pediatric patients who suffered an ACS after ankle inversion. The diagnosis was an avulsion of the muscle belly of the peroneus longus, and surgical treatment included fasciotomy and debridement or tenodesis of the peroneus longus to the brevis. All return to sports between 3–4 months[6]. Another report by Livingston et al.[8] described 39 cases, including six females with ACS; however, the report is brief, and they seem to include adults in their study[8]. On the other hand, Raad et al.[2] reported an ACS on a 10-year-old female patient who suffered an

ankle inversion after jumping out of a trampoline and was diagnosed with a rupture of the perforating branch of the peroneal artery and treated surgically[2]. To our knowledge, this is the fourth case reported of ACS after ankle inversion while playing basketball[3,5,9].

Foot and ankle ACS are rare, often undiagnosed, and represent less than 5% of the ACS in the body[10]. However, to our knowledge, this is the first case that combines inversion in basketball and a dorsalis pedis artery rupture in a pediatric patient.

Authors' contribution: Each author contributed individually and significantly to the development of this article: GAVV *(https://orcid.org/0000-0001-9712-8227) Wrote the paper and participated in the reviewing process; OIVG *(https://orcid.org/0000-0002-7958-9676), and GLB *(https://orcid.org/0000-0002-9074-8973) Performed the surgery and data gathering; JFGS *(https://orcid.org/000-0001-6465-2372) Conceived and planned the activities of each author that led to the writing of the study; AHL *(https://orcid.org/0000-0001-5409-176X) Wrote the paper and participated in the reviewing process. All authors read and approved the final manuscript.*ORCID (Open Researcher and Contributor ID).

References

1. Chen YP, Ho WP, Wong PK. Acute compartment syndrome secondary to disruption of the perforating branch of the peroneal artery following an acute inversion injury to the ankle. Int J Surg Case Rep. 2014;5(12):1275-7.
2. Raad M, Anugraha A. Acute Compartment Syndrome of the Leg Following Injury to Perforating Branch of Peroneal Artery After a Severe Ankle Sprain in a Pediatric Patient - A Case and a Review of Literature. J Orthop Case Rep. 2020;10(8):68-71.
3. Ward NJ, Wilde GP, Jackson WF, Walker N. Compartment syndrome following ankle sprain. J Bone Joint Surg Br. 2007;89(7):953-5.
4. Creighton RA, Kinder J, Bach BR Jr. Compartment syndrome following recurrent ankle inversion injury. Orthopedics. 2005; 28(7):703-5.
5. Maguire DW, Huffer JM, Ahlstrand RA, Crummy AB Jr. Traumatic aneurysm of perforating peroneal artery. Arterial bleeding-cause of severe pain following inversion, plantar flexion, ankle sprains. J Bone Joint Surg Am. 1972;54(2):409-12.
6. Hull BR, Wingfield JJ, Stall A, Birch CM, Ho CA. Pediatric acute leg compartment syndrome after peroneus longus rupture: a case series. J Pediatr Orthop B. 2020;29(4):355-8.
7. Kemp MA, Barnes JR, Thorpe PL, Williams JL. Avulsion of the perforating branch of the peroneal artery secondary to an ankle sprain: a cause of acute compartment syndrome in the leg. J Foot Ankle Surg. 2011;50(1):102-3.
8. Livingston K, Glotzbecker M, Miller PE, Hresko MT, Hedequist D, Shore BJ. Pediatric Nonfracture Acute Compartment Syndrome: A Review of 39 Cases. J Pediatr Orthop. 2016;36(7):685-90.
9. Dhawan A, Doukas WC. Acute compartment syndrome of the foot following an inversion injury of the ankle with disruption of the anterior tibial artery. A case report. J Bone Joint Surg Am. 2003; 85(3):528-32.
10. Wagner HE, Wagner HP. Foot and Ankle Disorders. Springer International Publishing; 2022.