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Case Presentation

Ultrasound-Guided, Percutaneous Needle Fascial Fenestration for the Treatment of Chronic Exertional Compartment Syndrome: A Case Report

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Abstract

Chronic exertional compartment syndrome (CECS) involves a painful increase in compartment pressure caused by exercise and relieved by rest. The most common site for CECS in the lower extremity is the anterior leg compartment. We report a case of a collegiate athlete with bilateral anterior and lateral leg compartment CECS who was successfully treated with an ultrasound-guided, percutaneous needle fascial fenestration of the affected compartments in both legs and was able to return to full, unrestricted activity within 1 week of the procedure. This case highlights the potential application of this procedure for the treatment of anterior and lateral leg CECS.

Introduction

Chronic exertional compartment syndrome (CECS) is a condition characterized by a painful elevation of compartment pressures that occurs after a specific type (eg, running) and volume (eg, time, distance, or intensity) of exercise [1]. Approximately 95% of CECS cases occur in the leg [2]. The most commonly affected leg compartment is the anterior compartment, followed by the deep posterior, lateral, and superficial posterior leg compartments [1]. The surgical treatment for CECS involves releasing the compartment through a fasciotomy, a fasciectomy, or a combination of both using an open or endoscopic technique. The success rate for anterior compartment CECS fasciotomies ranges between 81%-100%, with concomitant lateral compartment release associated with the lower end of the reported range [3]. Complication rates as high as 16% after fasciotomy have been reported, and 6-12 weeks is commonly required to return to unrestricted sports participation [1,4]. Therefore, the development of safe and effective alternative treatment methods for CECS that enable rapid return to sports is imperative. The following case report introduces a new, minimally invasive ultrasound-guided technique for treating anterior and lateral leg CECS that may meet these criteria.

Case Presentation

The patient was an 18-year-old female college lacrosse player with a 2-year history of bilateral exertional anterolateral leg pain. The symptoms began insidiously with no history of trauma or illness and progressively worsened to the point where she was unable to continue to participate in lacrosse. She described an aching, burning, pressure type of pain in the anterolateral legs that was aggravated by fast walking or running (9/10 severity). When her pain was severe, she also experienced swelling of the lower legs, numbness and paresthesias in the anterolateral legs and dorsum of her feet, and leg weakness. Her signs and symptoms resolved within 10 to 30 minutes of discontinuation of the aggravating activity. Despite several months of conservative measures, including rest, modalities (eg, heat, ice), compression, myofascial release, dry needling, and stretching and strengthening, her symptoms persisted.

She was eventually diagnosed with CECS based on positive pre- and postexertional bilateral anterior and lateral leg compartment pressure testing (Table 1). After discussing surgical options with her local orthopedist, she scheduled an appointment with the lead author (JTF) to discuss minimally invasive alternative treatments.

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Table 1
Pre- and postexercise compartment pressures

Compartment	Before Exercise	1 Minute After Exercise	5 Minutes After Exercise
Left anterior	8 mm Hg	68 mm Hg	30 mm Hg
Left lateral	10 mm Hg	54 mm Hg	22 mm Hg
Right anterior	9 mm Hg	82 mm Hg	43 mm Hg
Right lateral	10 mm Hg	73 mm Hg	35 mm Hg

Her examination at rest was normal. She had no erythema, ecchymosis, or edema in her lower extremities. She had no asymmetries in muscle bulk. Her gait pattern was normal. She had normal strength, sensation, and reflexes in the bilateral lower extremities. She did not demonstrate sensitivity or a positive Tinel's sign with percussion over the common peroneal, superficial peroneal, deep peroneal, or saphenous nerves. She had no tenderness to palpation in either lower extremity. Her dorsalis pedis and posterior tibial artery pulses were normal, with no decrement in pulse strength during popliteal artery entrapment maneuvers (ie, passive ankle dorsiflexion with the knee in extension or active ankle plantar flexion with the knee in extension). After exacerbating exercise, her bilateral anterior and lateral leg compartments were visibly swollen and tender to palpation, but findings of her neurovascular examination remained normal.

Several nonoperative treatment options were discussed with the patient, including discontinuation of aggravating activities, altering her running pattern to ensure she uses a mid to forefoot initial contact pattern rather than a heel strike pattern, or a botulinum toxin injection into the musculature of her affected compartments. After presenting various minimally invasive treatment options, the patient opted to undergo an ultrasound-guided, percutaneous needle fenestration of the bilateral anterior and lateral leg compartment fascias. A limited diagnostic ultrasound examination was performed to identify the muscles, nerves, arteries, and the bony and fascial borders of the bilateral anterior and lateral leg compartments using a CX50 portable ultrasound machine with a 12-3 MHz standard footprint linear array transducer (Philips Medical Systems Inc, Bothell, WA; Figure 1). An indelible marker was used to demarcate the compartment borders, identify superficial neurovascular structures, and determine needle entry points (every 3 inches from the bottom to the top of each compartment; Figure 2).

The patient's skin was cleansed with antiseptic soap and covered with sterile drapes. The patient's right leg was rescanned using a sterile transducer cover and gel. Her skin and subcutaneous tissues were anesthetized beginning at the distal aspect of the anterior right leg compartment using 0.5 mL of 0.5% lidocaine delivered through a 25-gauge, 2-inch needle. The needle was

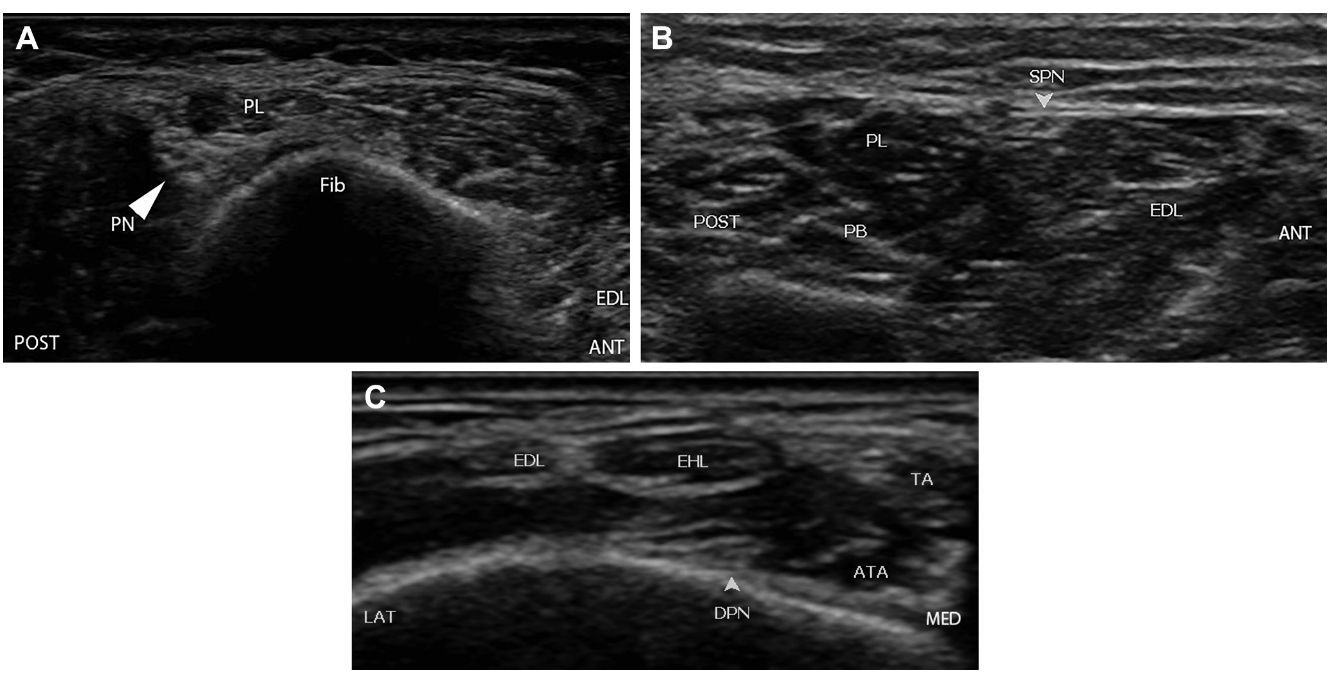

Figure 1. (A) Short-axis ultrasound image of the peroneal nerve as it passes under the peroneus longus tendon at the fibular head. (B) Short-axis ultrasound image of the superficial peroneal nerve as it pierces the crural fascia at the junction of the anterior and lateral compartment in the distal third of the lower leg. (C) Short-axis ultrasound image of the deep peroneal nerve as it courses superficial in the distal lower leg. Arrowhead = nerve; PN = peroneal nerve; PL= peroneus longus tendon/muscle; EDL = extensor digitorum longus tendon/muscle; SPN = superficial peroneal nerve; PB = peroneus brevis muscle; DPN = deep peroneal nerve; EHL = extensor hallucis longus tendon; TA = tibialis anterior tendon; ATA = anterior tibial artery; POST = posterior; ANT = anterior; MED = medial; LAT = lateral.