Case Report

Chronic exertional compartment syndrome of the superficial posterior compartment: Soleus syndrome

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Abstract

Chronic exertional compartment syndrome (CECS) represents the second most-common cause of exertional leg pain with incidence of 27-33%. CECS of the superficial posterior compartment, or soleus syndrome, is rare and has only been discussed briefly in the literature. We discuss the management of two patients with bilateral soleus syndrome or CECS of the superficial posterior compartment.

Key words: Chronic exertional compartment syndrome, shin splints, soleus syndrome
MeSH terms: Compartment syndromes, soleus muscle, surgical technique

Introduction

Chronic exertional compartment syndrome (CECS) is an overuse injury of the lower extremity frustrating for both patient and the orthopedic surgeon. CECS represents the second most common cause of exertional leg pain with incidence of 27-33% respectively.[1] The differential diagnosis for activity induced lower extremity pain includes medial tibial stress syndrome, tibial stress fracture, muscle strain and popliteal artery entrapment syndrome.

Often, the diagnosis of CECS may take months to years to identify the chronic nature of symptoms. At rest, patients are typically asymptomatic and have few physical examination findings. CECS presents as a dull aching pain made worse with exertion, most often running. It is important for the patient to note the location of the pain while exercising as this will help direct more focused questioning/examining as well as point to which muscle groups are possibly affected. Patients with medial tibial stress syndrome (pain related to traction on the periosteum by the posterior tibialis or flexor digitorum longus)[2] will have posteromedial tibial pain. Tibial stress fractures will have pain with palpation of the tibia.

Patients with anterolateral CECS may present with tightened anterior and lateral compartments along with dorsal foot paresthesias with weak ankle dorsiflexion (anterior compartment) or weak eversion (lateral compartment). The deep posterior compartment contains the peroneal artery, tibial nerve, posterior tibialis muscle and long toe flexors. Symptoms of compression are plantar numbness and weakness with toe-off, plantar flexion, and flexion of the great goe. The superficial posterior compartment contains the distal portion of the sural nerve with the gastrocnemius and soleus muscles. Increased pressure in this compartment, or soleus syndrome, manifests itself as plantar flexion weakness and paresthesias of the lateral foot and distal calf.

The incidence of CECS is equal in men and women with an average age of 20-year-old.[3] The most commonly-affected compartments are the anterior and lateral compartments (or a combination thereof) with an incidence of up to 95% of all CECS.[4] The posterior compartment can also be affected in runners as well,[5] however this study failed to discern between superficial and deep compartments. CECS of the superficial posterior compartment is rare and has only been discussed briefly in the literature.[6,7]

We discuss the management of two patients with bilateral soleus syndrome or CECS of the superficial posterior compartment.

Case Reports

Case 1

An 18-year old female patient presented to our office for an

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evaluation of bilateral Achilles and posterior compartment pain ongoing for approximately 2 years. The pain was dull aching and made worse with exercising- mainly running. She was evaluated by another physician who recommended physical therapy, NSAIDS and night splints. While she responded modestly to physical therapy, she did not experience any relief from the splints or medication.

On physical examination, the patient had bilateral tenderness to the superficial posterior compartment roughly at the musculotendinous junction and muscle belly. She also had some swelling noted. On strength testing, the patient had 4/5 muscle strength with dorsiflexion. She had no loss of motion. Radiographs were obtained which showed a mild Haglund's deformity of the bilateral ankles. The patient's magnetic resonance imaging (MRI) revealed some subtalar synovitis and an os trigonum. These later pathologies were only mildly painful and did not contribute or replicate her main posterior leg pain. After reviewing the MRI, we offered the patient a pre and post exertional compartment pressure check, however she refused. Due to her lack of responsiveness to conservative therapy, we elected to perform a superficial and a deep compartment fasciotomy of her right leg and a right subtalar joint arthroscopy with extensive debridement, os trigonum resection, Haglund calcaneal exostectomy, as well as a left posterior superficial and a deep compartment release staged 6 months apart. Since, the right leg was more symptomatic, surgical treatment was first directed to this extremity. Intraoperatively, neither the gastrocnemius nor the soleus muscle showed any signs of ischemia or necrosis.

Immediately postoperatively, a Bulky Jones dressing was applied. She was allowed to weight bear in a Controlled Ankle Motion (CAM) walker 2 weeks postoperatively. Six months postoperatively, the patient had a full resolution of her symptoms on the right. She was continued to have symptoms on the left and underwent a similar compartment release of the superficial and deep compartments. She was allowed to weight bear immediately in a CAM boot. At 4 weeks after the surgery, she discontinued the boot and was progressed in her activity level. At 6 months after the second surgery, she had 5/5 plantar flexion strength bilaterally. She is currently running with minimal pain and is able to play soccer for her collegiate intramural team.

Case 2

A 38 year-old male military officer presented with a history of left calf pain for the past 6 months. There was no history of trauma. The patient stated that he had surgical intervention on the right calf twice in form of fascial release and was now having similar symptoms on the left. He reported that his compartment pressure testing had been normal as per his military surgeon. The patient reported pain while running and could not run more than one mile without pain. The pain was sharp with some residual achiness and throbbing. Anti-inflammatories failed to relieve his pain.

On examination, the patient had pain with deep palpation of the gastrocsoleus complex [Figure 1]. He had normal strength testing, sensation and range of motion. The patient was offered a diagnostic compartment pressure check with a needle device; he refused since his symptoms were so similar to the other leg and his prior studies were negative. Due to his lack of responsiveness to conservative therapy, we elected to perform a superficial and a deep compartment fasciotomy of his left leg. Intraoperatively, the muscle showed no signs of ischemia or necrosis.

Immediately postoperatively, the patient was placed in a Bulky Jones dressing. He was allowed to weight bear 2 weeks postoperatively in a CAM boot. At 6 months postoperatively, the patient reported significant symptom improvement. He rated his pain as 0/10. He returned to aggressive physical activity, his normal military duties and running as desired without difficulty.

Operative procedure

Both patients underwent similar procedures in terms of compartment release. An incision was made over the musculotendinous junction on the medial side of the gastrocsoleus complex with a 15 blade [Figure 2]. All subcutaneous vessels were cauterized. The incision was taken to the fascia and retractors were placed [Figure 3]. The deep fascia was identified and opened with a 15 blade [Figure 4]. Metzenbaum scissors were then used to extend the fasciotomy proximally and distally. The superficial compartment was released in a similar fashion [Figure 5]. All wounds were irrigated and closed with Vicryl sutures

Figure 1: Superficial posterior compartment is noted to be hypertrophied and swollen. The dotted line marks the posterior medial margin of the tibia. The "x" marks denote the areas of most pain

Figure 2: An incision is made over the musculotendinous junction on the medial side of the gastrocsoleus complex

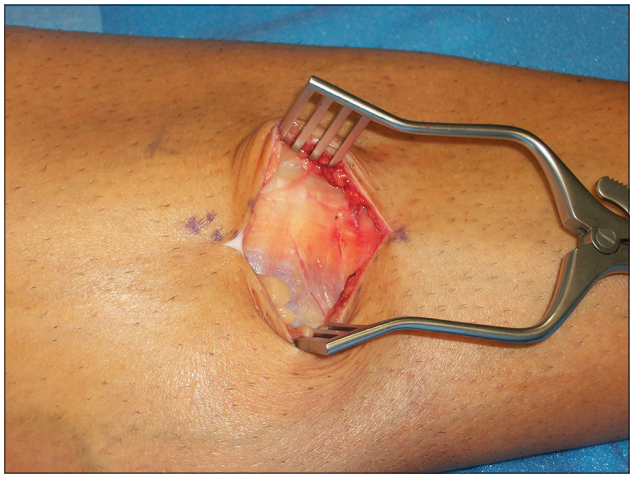

Figure 3: All subcutaneous vessels are cauterized. The incision is taken to the fascia and the deep fascia is identified

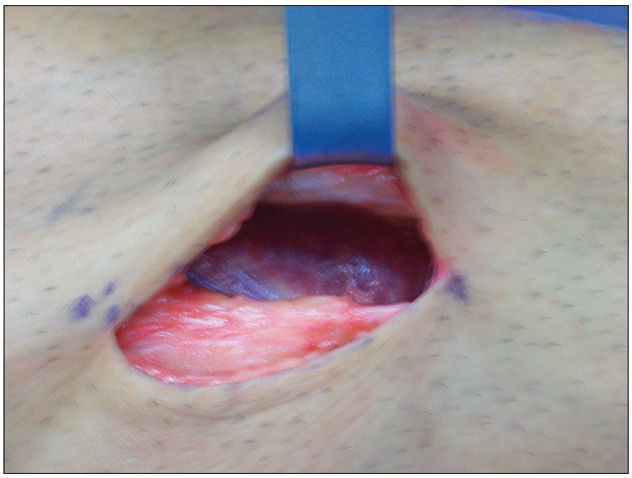

Figure 4: The deep fascia is identified and opened with a scalpel

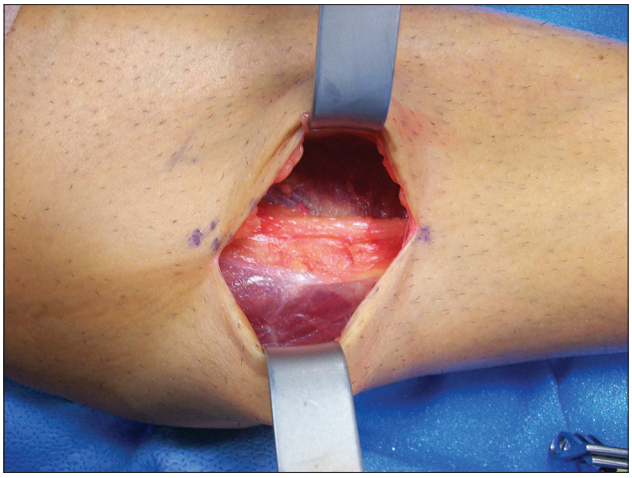

Figure 5: The superficial fascia is similarly released

followed by staples. The patient was placed in Bulky Jones splint in neutral dorsiflexion and plantar flexion, neutral inversion and eversion.

Discussion

Conservative management of CECS has not been extensively studied. The first step in treating someone with a suspicion of CECS is to reduce the intensity and frequency of activity or discontinue the exacerbating exercise.[8] Athletes who suspend their activities may then slowly train back up to their original level of activity. However, it is important for these athletes to ice their leg and take NSAIDs. Other treatment techniques include altering footwear, orthotics, or the way one runs (forefoot strike versus heel strike).[9]

Historically, soleus syndrome has been used to describe medial tibial stress syndrome.[2] However, soleus syndrome is a rare overuse injury and may help people identify their symptoms sooner. Though there is no way to quantify the occurrence of these syndromes, many runners may have soleus syndrome without a proper diagnosis or treatment plan.

The diagnosis of CECS generally involves invasive pressure monitoring pre and postexertion since the underlying pathophysiology of muscle hypertrophy, reduced compartment volume due to decreased fascial compliance and shorter periods of muscle relaxation contribute to the pathology. During exertion, compartment pressures increase 3 or 4 times from baseline and return to basal levels within a few minutes in normal patients, whereas in patients with CECS, pressures increased more strikingly and take longer to return to their baseline (over 10 min).[10,11] At present, the most widely-accepted diagnostic criteria for CECS is established as a basal pressure of >15 mm Hg, >30 mm Hg 1 min after stopping exercise and >20 mm Hg at 5 min[12] for the anterior compartment. Currently, there is little data to base a diagnosis of superficial posterior compartment syndrome.[12]

In a recent systematic review of studies investigating intracompartment pressures for CECS,[13] the researchers called the reliability of current pressure criteria for diagnosis into question. They recommended that a thorough patient history should be the main diagnostic criteria. Another systematic review of similar pressure monitoring of the anterior compartment showed that with the exception of relaxation pressure (pressure taken immediately postexertion), the current criteria for diagnosing CECS as stated by Pedowitz, overlapped the range found in normal healthy subjects.[14] In our first patient, we offered to perform pre and postexertion intracompartmental pressure monitoring; the patient refused. We felt that given her history, lack of response to conservative care and description of the location of her pain, we were confident that the patient had CECS of the superficial compartment. In our second patient, he had pressure monitoring of bilateral four compartments of the lower legs in the past which were reportedly normal. He stated his pain was directly posterior and had similar episodes of pain in his contralateral leg which was fasciotomized. Again, the patient refused pressure monitoring and wanted to proceed directly to surgery. We agreed that his history was compelling enough to proceed confidently to release the superficial posterior compartment. Ultimately, the treatment of CECS is fasciotomy.[5,8] Release of the anterior and lateral compartments have predicable success rates of roughly 80% while deep posterior releases may reach success rates of 50%.[15] In a review of 100 fasciotomies for CECS, Detmer reported a recurrence rate of 3.4%.[5] In general, only the involved compartments are released. In our series, we elected to release the deep posterior compartment as well as the superficial compartment given the minimal morbidity of releasing the compartment and its ease of accessibility. We also felt that it helped mobilize our superficial compartment more readily.

There are few reports of superficial posterior compartment syndrome in the literature, whether it is acute or chronic.[6,7,16,17] In Mubarak *et al*. (1978)[16] described an 18-year-old runner who had experienced symptoms consistent with CECS for 3 weeks while running. Passive extension of the toes caused pain as well. The patient was treated with a fasciotomy. His sensory and motor functions returned to normal within 1 week. In another case series, Srikanth, *et al*.[17] discussed three patients with acute compartment syndrome who were initially diagnosed with a deep vein thrombosis on initial diagnosis. There are only three patients described in the literature regarding chronic exertional superficial posterior compartment syndrome.[6,7]

Although the incidence of CECS of the lower leg is relatively common in patients with exertional leg pain, soleus syndrome is a rare occurrence. A greater index of suspicion may be warranted in patients describing long term crampy pain in the calf during exertion. In this case report, we describe two patients in which the history and not intracompartmental pressure measuring, led to a diagnosis and successful treatment with a fasciotomy.

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