The Journal of Foot & Ankle Surgery 55 (2016) 1027–1034

Contents lists available at ScienceDirect

The Journal of Foot & Ankle Surgery

journal homepage: www.jfas.org

Outcome of a Specific Compartment Fasciotomy Versus a Complete Compartment Fasciotomy of the Leg in One Patient With Bilateral Anterior Chronic Exertional Compartment Syndrome: A Case Report

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A R T I C L E I N F O

Level of Clinical Evidence: 4

Keywords:
compartment pressure
fascia
ischemia
lower extremity
physical rehabilitation

A B S T R A C T

Chronic exertional compartment syndrome of the leg is a debilitating lower extremity condition in which increased intracompartmental pressure impedes blood flow to the involved compartments of the distal lower extremity, resulting in ischemia and pain. Owing to the lack of success with conservative management, most surgeons perform complete release fasciotomy as the preferred method of fasciotomy to avoid an unsuccessful release or outcome. Studies have been performed regarding the outcomes of complete compartmental release versus specific compartmental release, but no study has been performed comparing complete fasciotomy and compartment-specific fasciotomy in a single patient. The purpose of the present case report was to compare the efficacy of a complete fasciotomy versus a specific fasciotomy in 1 patient with properly diagnosed bilateral anterior compartment chronic exertional compartment syndrome with an 18-month follow-up period. The Lower Extremity Functional Scale and both subscales of the Foot and Ankle Ability Measure were administered to assess the functional outcomes. Circumferential measurements and range of motion photographs were taken to compare the objective data throughout the recovery process. In general, the range of motion, circumferential measurements, and functional outcome measure scores were better for the specific compartmental fasciotomy leg than for the complete fasciotomy leg during the recovery period. The overall functional outcomes were the same for both surgical approaches, with the specific fasciotomy leg returning to baseline function 13 to 23 days before the complete fasciotomy leg. The outcomes remained unchanged 18 months after surgery.

Chronic exertional compartment syndrome (CECS) of the leg is a debilitating lower extremity condition in which increased intracompartmental pressure impedes blood flow to the involved compartments of the distal lower extremity, resulting in ischemia and pain (1–7). It most commonly presents in young adult recreational runners, elite athletes, and military recruits (2,3,6,8,9). CECS has been reported to occur bilaterally in 50% to 95% of patients (3,5,6,8). CECS is characterized by pain presenting at a reproducible time, distance, or intensity of exercise and resolves with relative rest (2,6–8). There has long been uncertainty regarding the etiology and cause of CECS; however, a study by Edmundsson et al (1) supported the generally accepted pathophysiology that high intramuscular pressure during activity impairs local perfusion, resulting in ischemia and pain.

An increasing amount of research is available regarding the treatment of CECS both preoperatively and postoperatively. Growing awareness of this condition has led to it being diagnosed more often, and it has been reported that, typically, a 22-month delay occurs in arriving at the correct diagnosis (6). Other common diagnoses that can delay the proper diagnosis of CECS include, but are not limited to, shin splints, medial tibial stress syndrome, stress fracture, muscle strain, tendinopathy, fascial hernia, and nerve entrapment or pain referred from the knee (2,5–9).

Different tests are available for diagnosing CECS, such as magnetic resonance imaging, near-infrared spectroscopy, methoxy isobutyl isonitrile perfusion imaging, thallous chloride scintigraphy, triple-phase bone scan, and thallium-201 single photon emission tomography scanning. However, intracompartmental pressure testing is the reference standard, because it is more specific and easier to administer (3,5–8). The currently accepted threshold values for elevated compartment pressures as reported by Pedowitz et al (10) are $\geq$15 mmHg before exercise, $\geq$30 mm Hg at 1 minute after exercise, and $\geq$20 mm Hg after a 5-minute rest period after exercise. Once conservative measures have failed and CECS has been confirmed by

Financial Disclosure: None reported.
Conflict of Interest: None reported.
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http://dx.doi.org/10.1053/j.jfas.2015.06.017

compartment pressure testing, the operative treatment of choice is compartmental decompression by fasciotomy (2–9).

Most surgeons perform compartment-specific fasciotomy, although some prefer complete fasciotomy to avoid an unsuccessful release or poor outcomes (2,3). The success rates for specific anterior and/or lateral compartment fasciotomy have been reported to be 80% to 100% (2,3,5,6); however, releases involving the posterior compartment can range from 50% to 70% (2,5–7). George and Hutchinson (2) reported that all compartments were released in their early surgical experience; however, they found an increased risk of postoperative hematoma or cellulitis compared with specific releases. George and Hutchinson (2) now perform complete compartmental pressure testing and specific fasciotomies according to those measurements, with a significantly reduced risk of complications. Data regarding the outcome success of complete versus specific fasciotomy in their experience were not provided; however, it can be assumed to be high or they would likely have reverted to complete fasciotomy as their standard of care (2). Poor outcomes after fasciotomy can result from improper diagnosis, wound hematoma, infection, delayed healing, inadequate decompression, postoperative muscle or fascial adhesions, or damage to cutaneous nerves (2,9).

Studies have identified the efficacy of compartmental release for CECS; however, no research has compared the surgical approaches (8). The objective of the present case report was to compare the efficacy of complete fasciotomy versus specific fasciotomy in 1 patient with properly diagnosed bilateral anterior compartment CECS.

Case Report

The present patient was a 27-year-old male, measuring 6-ft, 3.5-in. tall and weighing approximately 185 lb. Symptom onset began in 1999 with prolonged running. An improper diagnosis delayed proper treatment for nearly 11 years. He had been improperly diagnosed multiple times with shin splints in his adolescence. Previous treatment had included ice, nonsteroidal anti-inflammatory drugs, rest, stretching, strengthening, orthotics, myofascial release, and, ultimately, ended with activity modification or avoidance. This patient could run approximately 3 city blocks before symptom onset and reported being able to run as long as desired on a treadmill no faster than 5.0 miles per hour without an incline.

Testing

The anterior and deep posterior compartments were tested bilaterally using a Stryker® needle (Stryker®, Portage, MI) and force transducer after anesthesia with 4 mL of 1% xylocaine was injected into the respective compartments. The Table shows the pre- and postexercise measurements for each leg and the respective compartments. The postexercise measurements in the anterior compartment were high; thus, the deep posterior compartments pressures were not tested, because the results were already positive and additional invasiveness was not necessary.

Table
Compartment pressures

Compartment	Compartment Pressure (mm Hg)			
	Before Exercise		After Exercise	
	Left	Right	Left	Right
Anterior	52	45	72	97
Deep posterior	22	27	Not tested	Not tested

The compartment pressures tested before and after exercise before the surgery. Both anterior and deep posterior compartments tested positive prior to exercise.

Surgery

The surgeon had been certified through the American Board of Orthopaedic Surgery and completed residency training in general orthopedic surgery and fellowship training in general orthopedics with an emphasis on sports medicine. The surgery was completed on February 18, 2012. A complete 4-compartment fasciotomy was performed on the right leg, but only the anterior and lateral compartments were released on the left leg. In performing surgery on the right leg, a 4-cm-long incision was made on the anterolateral aspect of the leg, and the dissection was carried down through the subcutaneous fat and fascia. The anterior and lateral compartments were identified and completely released by slitting the fascia proximally and distally allowing the underlying musculature to expand from the compartment. The posterior compartment on the right leg was then released using a 4-cm longitudinal incision dissection on the medial aspect of the leg and slitting the fascial compartment. The deep posterior compartment was also released through this same incision by dissecting along the medial border of the tibia. For the left leg, an identical 4-cm-long incision was made on the anterolateral aspect of the leg, and dissection was carried down through the subcutaneous fat and fascia. This was followed by release of the anterior and lateral compartments by slitting the fascia proximally and distally. After each aspect of the respective fasciotomy, hemostasis was meticulously achieved using cautery. A standard layered closure was then performed with antibiotic-impregnated sutures.

Rehabilitation

The patient used crutches for 2 days after surgery, with weight-bearing as tolerated or a 2-point gait. Rehabilitation followed the proposed guidelines as outlined by Schubert (5) for 4 weeks after surgery. Celecoxib 200 mg was taken orally twice daily for 1 week, followed by ibuprofen as needed. No running or jogging was attempted until exactly 4 weeks after surgery.

Outcomes

The Lower Extremity Functional Scale (LEFS) and Foot and Ankle Ability Measure (FAAM) were completed on a daily basis for each individual leg before surgery, after surgery, each day after surgery for 10 days, every other day for another 10 days, and on days 27 and 37 after surgery until subjective full functional recovery had been achieved for each leg. The LEFS has been shown to be both sensitive and reliable with a minimally clinical important difference (MCID) of 9 scale points (11). The FAAM, consisting of activities of daily living and sports subscales, has also been shown to be reliable and responsive and a valid measure of physical function for leg, foot, and ankle musculoskeletal disorders (12). The MCID for the activities of daily living subscale is 8 points, and the MCID for the sports subscale is 9 points (12).

Measures

Photographs of knee flexion, ankle dorsiflexion in knee extension, ankle dorsiflexion in knee flexion, and the plantar flexion range of motion were taken before surgery and on each day the outcome measures were administered. The photographs were taken with the skin exposed and finger placement at the fibular head for ease of measurement. The range of motion was measured using an on-screen protractor placed at the appropriate anatomic landmarks for measurement and cross-referenced with a standard goniometer for accuracy. The values were averaged if in disagreement.