

MADE FOR NEW YORK.



**Dr. Laith M. Jazrawi**

Chief, Division of Sports Medicine  
Associate Professor Department of Orthopaedic Surgery

## Rehabilitation Guidelines Following Compartment Syndrome Release With Open Fasciotomy

Chronic Exertional Compartment Syndrome (CECS) is a painful condition of the lower leg that affects many runners and other athletes involved in repetitive impact activities. The pain associated with this condition is thought to be abnormal pressure in the compartments of the lower leg. The lower leg is comprised of four universally described compartments— anterior, lateral, superficial posterior, and deep posterior (Figure 1). Bone and connective tissue structures define the various compartments in the lower leg. The compartments have relatively fixed volumes and surround muscles, arteries, veins and nerves. Compartment syndrome occurs when increased pressure impedes blood flow thereby impairing function of tissues within the lower leg.<sup>1</sup> Unlike acute compartment syndrome, CECS is non-emergent. CECS is a reversible form of abnormally increased pressure in the compartment that occurs during exercise/exertion of tissues that are noncompliant with increased muscle volume during exercise.<sup>1,2</sup> The exact physiological cause of CECS remains unclear but it is thought to be multi-factorial. Contributors to CECS may include: increased muscle size, connective tissue thickness or stiffness, decreased blood flow, and microtraumatic injuries.<sup>3</sup> Factors inherent to the individual may include leg length differences and malalignment of the lower leg. Other factors may include: muscle imbalances or weakness, lack of endurance, decreased flexibility, incorrect movement control patterns, and training intensity or frequency.<sup>4</sup> The incidence of CECS in those with chronic exercise-induced leg pain ranges from 14-27%.<sup>5</sup> Seventy percent of patients with CECS in the anterior compartment are runners.<sup>1,6,7</sup> The condition is nearly evenly split between males and females.<sup>7</sup> CECS has been reported in the forearm, thigh, hand and foot however 95% of cases occur in the lower leg.<sup>7</sup> Symptoms in both of the legs occur in 85-95% of those affected.<sup>8</sup> Those affected with CECS often complain of dull, aching, or cramping pain localized to the compartment affected in the lower extremity at the same duration of time (minutes) following the initiation of each episode of exercise.<sup>9</sup> Confirmation of the diagnosis is made with needle compartmental pressure testing at rest and following exercise.<sup>5,7,8,9</sup> If rehabilitation is unsuccessful, surgical management may be the treatment choice for CECS in the active population. Specifics of surgical decompression vary, but many include: open fasciotomies or fasciotomies with partial fasciectomy.<sup>9</sup> An open fasciotomy typically involves 1-2 large incisions where connective/fascial tissue is cut. A partial fasciectomy describes a procedure in which a portion of the connective tissue/fascia is removed. Surgical treatment can be performed as an outpatient procedure under local anesthesia.<sup>10</sup> A carefully planned and implemented rehabilitation program is important for a patient to achieve optimal functional outcomes postoperatively.<sup>11</sup>

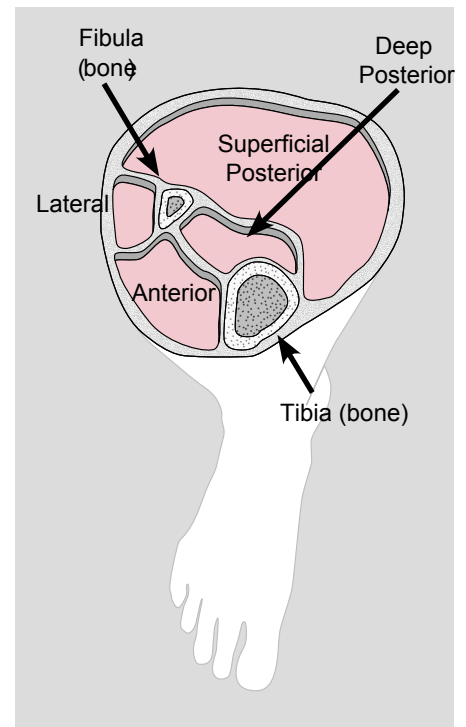


Figure 1. Lower leg compartments

## Rehabilitation Guidelines Following Compartment Syndrome Release With Open Fasciotomy

### Phase I (Day 1 to Day 14 after surgery)

Goals	<ul style="list-style-type: none"> <li>○ Pain Management</li> <li>○ Prevent Swelling</li> </ul>
Precautions	<ul style="list-style-type: none"> <li>○ Crutches and PWB x 2 weeks</li> </ul>
Range of Motion Exercises	<ul style="list-style-type: none"> <li>○ AROM hip and knee</li> <li>○ Wiggle toes, gentle ankle AROM DF/PF as tolerated</li> </ul>
Therapeutic Exercises	<ul style="list-style-type: none"> <li>○ Straight leg raises (SLR) x 4</li> <li>○ Upper body exercises (seated or bench only – no pushups)</li> <li>○ LE stretches – hamstring, quads, ITB, hip flexors</li> </ul>
Other Suggestions	<ul style="list-style-type: none"> <li>○ Ice and elevation</li> </ul>

### Phase II (2 weeks to 4 weeks following surgery)

Goals	<ul style="list-style-type: none"> <li>○ DF/PF</li> <li>○ AROM WNL</li> </ul>
Precautions	<ul style="list-style-type: none"> <li>○ Progress to WBAT (d/c crutches)</li> </ul>
Range of Motion Exercises	<ul style="list-style-type: none"> <li>○ Continue appropriate previous exercises</li> </ul>
Therapeutic Exercises	<ul style="list-style-type: none"> <li>○ Calf pumping, alphabet, rotations</li> <li>○ Gentle DF stretch w/ towel</li> <li>○ Light Theraband exercises x 4</li> <li>○ Towel crunches and side-to-side</li> <li>○ Seated BAPS • Stationary bike (no resistance)</li> <li>○ Leg press &lt; 25% body weight and pain-free</li> <li>○ Calf press &lt; 25% body weight and pain-free</li> </ul>
Other Suggestions	<ul style="list-style-type: none"> <li>○ Compression stocking if persistent swelling</li> <li>○ Ice as needed</li> </ul>

## Rehabilitation Guidelines Following Compartment Syndrome Release With Open Fasciotomy

### Phase III (4 weeks to 6 weeks following surgery)

Goals	<ul style="list-style-type: none"> <li>○ 10 single leg heel raises</li> <li>○ Normal walking gait x 1 mile</li> </ul>
Precautions	<ul style="list-style-type: none"> <li>○ WBAT</li> </ul>
Range of Motion Exercises	<ul style="list-style-type: none"> <li>○ Scar massage (if incision well healed)</li> <li>○ Continue appropriate previous exercises</li> </ul>
Therapeutic Exercises	<ul style="list-style-type: none"> <li>○ Steamboats (Theraband x 4 while standing on involved LE)</li> <li>○ Mini-squats, wall squats, total gym</li> <li>○ Double leg heel raises – progress to single leg heel raises</li> <li>○ Double to single leg BAPS , ball toss, and body blade</li> <li>○ Treadmill – walking forwards and backwards</li> <li>○ Elliptical trainer</li> <li>○ Pool therapy – chest or shoulder deep water running (optional)</li> </ul>

### Phase IV (6 weeks to 12 weeks following surgery)

Goals	<ul style="list-style-type: none"> <li>○ Strength via weight machines 90% of non-involved</li> <li>○ 45 minutes low impact cardio 5/week</li> <li>○ Walk 2 miles at 15min/mile pace with minimum symptoms</li> </ul>
Range of Motion Exercises	<ul style="list-style-type: none"> <li>○ Continue appropriate previous exercises</li> </ul>
Therapeutic Exercises	<ul style="list-style-type: none"> <li>○ Progressive strengthening program             <ul style="list-style-type: none"> <li>○ Leg press and hip weight</li> <li>○ Knee extension and HS curl weight machine</li> <li>○ Fitter, slide board</li> <li>○ Push-up progression</li> <li>○ Sit-up progression</li> </ul> </li> <li>○ Progressive low-impact cardio program             <ul style="list-style-type: none"> <li>○ Stairmaster</li> <li>○ Pool therapy- unrestricted</li> </ul> </li> </ul>

## Rehabilitation Guidelines Following Compartment Syndrome Release With Open Fasciotomy

### Phase V (12 weeks to 16 weeks following surgery)

Goals	<ul style="list-style-type: none"><li>○ Pass APFT at 4 months post-op</li><li>○ Run 1 mile at 12 min/mile pace with min symptoms at 3 months</li></ul>
Range of Motion Exercises	<ul style="list-style-type: none"><li>○ Continue appropriate previous exercises</li></ul>
Therapeutic Exercises	<ul style="list-style-type: none"><li>○ Running progression program when following criteria met:<ul style="list-style-type: none"><li>○ Pain-free 2 mile walk at 15min/mile pace</li><li>○ No post-exercise swelling</li></ul></li><li>○ Transition to home/gym program 2x per week</li><li>○ Agility Drills/ Plyometrics</li></ul>

# Rehabilitation Guidelines Following Compartment Syndrome Release With Open Fasciotomy

## References

1. Styf, J. Definitions and terminology. Etiology and pathogenesis of chronic compartment syndrome. In: *Compartment syndromes: diagnosis, treatment, and complications*. 2004. Boca Raton, FL. CRC Press LLC.
2. Wilder, RP. Exertional compartment syndrome. *Clin Sports Med*. 2010;29:429-435.
3. Lecocq J, Isner-Horobeti ME, Dupeyron A, et al. Exertional compartment syndrome. *Ann Readapt Med Phys*. 2004;47:334-345.
4. Anuar K, Gurumoorthy P. Systematic review of the management of chronic compartment syndrome in the lower leg. *Physiotherapy Singapore*. 2006; 9:2-15.
5. Turnipseed WD, Hurschler C, Vanderby R Jr. The effects of elevated compartment pressure on tibial arteriovenous flow and relationship of mechanical and biochemical characteristics of fascia to genesis of chronic anterior compartment syndrome. *J Vasc Surg*. 1995;21:810-816. Anuar K, Gurumoorthy P. Systematic review of the management of chronic compartment syndrome in the lower leg. *Physiotherapy Singapore*. 2006; 9:2-15.
6. Bong MR, Polatsch DB, et al. Chronic exertional compartment syndrome: diagnosis and management. *Bulletin of NYU Hosp for Jt Diseases*. Winter-Spring 2005.
7. Shah SN, Miller BS, Kuhn JE. Chronic exertional compartment syndrome. *Am Jour Ortho*. 2004;335-341.
8. Gill CS, Halstead ME, Matava MJ. Chronic exertional compartment syndrome of the leg in athletes: evaluation and management. *Physician and Sportsmed*. 2010;38:1-7.
9. Wittstein J, Moorman CT III, Levin LS. Endoscopic compartment release for chronic exertional compartment syndrome. *Am Jour Sports Med*. 2010;20:1-6.
10. Hutchinson MR, Lloyd Ireland M. Common compartment syndromes in athletes: treatment and rehabilitation. *Sports Med*. 1994;17:200-208.
11. Kisner, C, Colby LA. Surgical interventions and postoperative management, the ankle and foot. In: *Therapeutic Exercise: Foundations and Techniques*. 5th Edition. 2007. Philadelphia, PA. F. A. Davis Company.
12. Schubert, AG. Exertional Compartment Syndrome: Review of the Literature and Proposed Rehabilitation Guidelines Following Surgical Release. *Intern Jour Sports Phys Ther*. 2011; 6: 126-141.