

CHRONIC EXERTIONAL COMPARTMENT SYNDROME RELEASE CLINICAL CARE GUIDELINE

Background

Chronic exertional compartment syndrome (CECS) is a condition caused by repetitive physical activity, commonly seen in athletic and military populations. It causes an increase in intramuscular pressure within fascial compartments of the body, leading to reduced local blood flow and resulting in pain, tightness, paresthesia, and possible muscle weakness.

Symptoms are increased with exertion, and relieved with rest. CECS can occur in any fascial compartment of the body, most commonly in the anterior and lateral compartments of the lower leg. Intracompartmental pressure tests are the gold standard for diagnosing CECS, however diagnosis is not dependent on a positive test result, as false negatives are possible. A positive test is often defined as pressure ≥ 15 mm Hg at rest, pressure ≥ 30 mm Hg 1 minute after exercise, or pressure ≥ 20 mm Hg 5 minutes after exercise.

CECS can be treated non-operatively, however it is often treated with a surgical fasciotomy if conservative treatment is not successful. This procedure releases the pressure on the compartment and is considered the most successful and definitive treatment for CECS. This protocol will focus on the open fasciotomy for the lower leg, which involves 1-2 approximately 6-10mm incisions on the skin. Despite the small skin incisions the fascia can be completely released from just below the knee to just above the ankle.

Weightbearing Guidelines	<ul style="list-style-type: none"> • WBAT immediately following surgery • Crutches during the first few postoperative days if needed (usually 3-5 days)
ROM Guidelines	<ul style="list-style-type: none"> • Progress ROM as tolerated starting within the first few postoperative days
Criteria to Discharge Assistive Device	<ul style="list-style-type: none"> • Pain-free ambulation with normalized gait pattern
Criteria to Initiate Running/Jumping	<ul style="list-style-type: none"> • Ability to tolerate 15-30 minutes of continuous aerobic activity without onset of symptoms/pain • 5/5 pain-free ankle strength of involved compartment • Ability to complete single leg functional movements (i.e. squats and lunges) with proper mechanics and no pain • No increase in swelling 12-24 hours following physical activity • No pain 1-2 hours following physical activity
Criteria to Return to Sport	<ul style="list-style-type: none"> • Meet criteria to initiate running/jumping • Proper neuromuscular control of eccentric and concentric multi-planar activities with absence of pain, instability and swelling • At least 90% plantarflexion strength of uninvolved side assessed with unilateral heel raises on leg press or maximum heel raise repetitions with equal heel height
Outcome Tools	<ul style="list-style-type: none"> • FAAM (ADL and Sports subscales) • LEFS



Weeks 0-3: Protection and Mobility

Weightbearing	<ul style="list-style-type: none"> • WBAT with progression to full, pain-free weight bearing with ambulation • Axillary crutches (or other AD) if needed in the first few postoperative days <ul style="list-style-type: none"> ◦ Discontinue crutches when gait is normalized
Precautions	<ul style="list-style-type: none"> • Avoid activities that increase swelling (i.e. extended sitting, tight clothing proximal to site of surgery, and excessive heat such as a hot pack or bath) • Avoid friction over new scar formation at incision site • Avoid high impact activity such as running, jumping, and hopping
Edema Control	<ul style="list-style-type: none"> • Gentle distal to proximal massage of lower leg to assist with venous return and reduce swelling • Ankle pumps (can perform with lower extremity elevated to assist with swelling reduction)
ROM	<ul style="list-style-type: none"> • NWB ankle PROM and AROM <ul style="list-style-type: none"> ◦ PF, DF, inversion, eversion ◦ Alphabet exercise ◦ Seated BAPS • Knee PROM and AROM as needed
Strengthening	<ul style="list-style-type: none"> • Sub-maximal isometric strengthening <ul style="list-style-type: none"> ◦ Ankle PF, DF, inversion, eversion • Quad sets <ul style="list-style-type: none"> ◦ Progress to SAQ, LAQ and SLR • 4-way hip <ul style="list-style-type: none"> ◦ Progress from non-weight bearing to standing
Goals to Progress to Next Phase	<ul style="list-style-type: none"> • Lower leg circumference within 2 cm of uninvolved side • Knee and ankle AROM equal to uninvolved side • Normalized gait mechanics including full pain-free weight bearing on level surface, and equal step length bilaterally



Weeks 4-6: Light Strengthening

Precautions	<ul style="list-style-type: none"> • Limit swelling by minimizing prolonged weight bearing activity • Continue to avoid friction over new scar formation at site of incision • Avoid excessive weight bearing eccentric loading • Avoid high impact activity such as running, jumping and hopping
ROM	<ul style="list-style-type: none"> • Initiate scar massage/mobility and desensitization when incision is fully healed • Gentle ankle stretching <ul style="list-style-type: none"> ○ 30-60 second holds • Nerve mobilizations in supine <ul style="list-style-type: none"> ○ Focus on involved compartment (i.e. ankle PF and inversion to focus on common peroneal nerve) ○ Progress repetitions and range of motion as tolerated • BAPS progression (seated →standing)
Strengthening	<ul style="list-style-type: none"> • Start open kinetic chain ankle strengthening <ul style="list-style-type: none"> ○ 4 way ankle with theraband resistance • Balance and proprioception exercises <ul style="list-style-type: none"> ○ Bilateral → unilateral ○ Level, firm surface → soft/unstable surface (foam or BOSU) → balance board ○ Eyes open → head turns → eyes closed • Double leg squats: mini-squats →full squats • Gait drills <ul style="list-style-type: none"> ○ Sagittal plane → frontal and transverse planes ○ Forward and retro marching (sagittal plane), side-stepping (frontal plane), and carioca/grapevine walking (transverse plane)
Cardiovascular	<p>Only initiate the following when incision is fully healed:</p> <ul style="list-style-type: none"> • Stationary bicycle starting with 5-10 minutes at a low resistance and speed • Treadmill walking starting with 5-10 minutes at 2-3 mph and progress time and speed as able • If desired, may begin aquatic activities/swimming starting with 10-15 minutes and progressing time/amount as able
Goals to Progress to Next Phase	<ul style="list-style-type: none"> • Lower extremity circumference within 1 cm of uninvolved side • Ability to maintain single leg stance with eyes open on unstable surface for 30-60 seconds • Ankle DF ROM equivalent to uninvolved side measured in weight bearing lunge position • Proper lower extremity mechanics with no pain during functional double leg squats



Weeks 6-8: Progression of Strengthening/Return to Jogging

Precautions	<ul style="list-style-type: none"> • Continue to limit activities which increase swelling • Limit friction over scar tissue • No strenuous or painful activities
ROM	<ul style="list-style-type: none"> • Continue stretching and nerve mobilizations as needed • Lower extremity soft tissue mobilization to improve flexibility and soft tissue mobility of the lower leg <ul style="list-style-type: none"> ○ Instrument assisted, foam roller, massage stick roller
Strengthening	<ul style="list-style-type: none"> • Progression of closed chain functional strengthening <ul style="list-style-type: none"> ○ Lunges, step-ups, single leg squats ○ Double leg heel raise → single leg heel raise <ul style="list-style-type: none"> • Can combine with gait drills such as marching, or heel/toe walking • Initiate plyometric exercises at 6 weeks <ul style="list-style-type: none"> ○ Plyometric shuttle (DL→SL jumping) ○ DL jumping → SL jump to contralateral foot (leaping) → SL jump to same foot (hopping) <ul style="list-style-type: none"> • Progress repetitions, and height/distance as able
Cardiovascular	<ul style="list-style-type: none"> • Initiate or progress aquatic activities/swimming if wounds are fully healed • Progressive treadmill walking time and speed • Light jogging can be initiated on level surface <ul style="list-style-type: none"> ○ 6-8 weeks for 1-2 compartment release ○ 8-10 weeks for 4 compartment release ○ Progressive walk-jog interval training
Goals to Progress to Next Phase	<ul style="list-style-type: none"> • Complete 15-30 minutes of continuous aerobic activity without symptoms or pain • 5/5 pain-free ankle strength of muscles in involved compartment • Ability to complete SL functional movements (such as SL squats and lunges) without pain, and with proper mechanics • No residual swelling 12-24 hours following physical activity • No pain 1-2 hours after physical activity



Weeks 8-12+: Return to Sport/Impact Training

Precautions	<ul style="list-style-type: none"> • Continue to avoid pain and increased swelling during and following activity
ROM	<ul style="list-style-type: none"> • Continue knee and ankle stretching and ROM exercises as appropriate
Strengthening	<ul style="list-style-type: none"> • Progress strengthening exercises to promote stability and neuromuscular control with increased loads and speeds <ul style="list-style-type: none"> ◦ Low velocity, single plane activities → higher velocity, multi-plane activities ◦ Forward and backward → side-to-side and transverse plane movements • Sport-specific training beginning at a low-intensity <ul style="list-style-type: none"> ◦ Instruct patient on gradual return to sport/activity progression • Biomechanical assessment of specific sport activity with video analysis as needed <ul style="list-style-type: none"> ◦ Running gait: <ul style="list-style-type: none"> ◦ Forefoot strike running pattern reduces anterior and lateral intracompartmental pressure ◦ Increase cadence 5-10% to reduce impact loading
Goals to Progress to Return to Sport/Work	<ul style="list-style-type: none"> • Meet criteria to initiate running/jumping • Proper neuromuscular control of eccentric and concentric multi-planar activities with absence of pain, instability, and swelling • At least 90% plantarflexion strength of uninvolved side assessed with unilateral heel raises on leg press or maximum heel raise repetitions with equal heel height



Author: Kat Rethman, PT, DPT

Reviewers: Bryant Walrod, MD; Timothy Miller, MD

Revised: June 2021

References

1. Blackman PG. A review of chronic exertional compartment syndrome in the lower leg. *Med Sci Sports Exerc.* 2000;32(3 Suppl):S4-10.
2. Bong MR, Polatsch DB, Jazrawi LM, Rokito AS. Chronic exertional compartment syndrome: diagnosis and management. *Bull Hosp Jt Dis.* 2005;62(3-4):77-84.
3. Brennan FH, Kane SF. Diagnosis, treatment options, and rehabilitation of chronic lower leg exertional compartment syndrome. *Curr Sports Med Rep.* 2003;2(5):247-50.
4. Bresnahan JJ, Hennrikus WL. Chronic Exertional Compartment Syndrome in a High School Soccer Player. *Case Rep Orthop.* 2015;2015:965257.
5. Buerba, RA, Fretes, NF, Devana, SK, Beck, JJ. Chronic exertional compartment syndrome: current management strategies. *Journal of Sports Medicine.* 2019; 23(10):71-79.
6. Campano D, Robaina JA, Kusnezov N, Dunn JC, Waterman BR. Surgical Management for Chronic Exertional Compartment Syndrome of the Leg: A Systematic Review of the Literature. *Arthroscopy.* 2016;32(7):1478-86.
7. Dai AZ, Zacchilli M, Jejurikar N, Pham H, Jazrawi L. Open 4-Compartment Fasciotomy for Chronic Exertional Compartment Syndrome of the Leg. *Arthrosc Tech.* 2017;6(6):e2191-e2201.
8. Flautt W, Miller J. Post-surgical rehabilitation following fasciotomies for bilateral chronic exertional compartment syndrome in a special forces soldier: a case report. *Int J Sports Phys Ther.* 2013;8(5):701-15.
9. Fraipont MJ, Adamson GJ. Chronic exertional compartment syndrome. *J Am Acad Orthop Surg.* 2003;11(4):268-76.
10. George CA, Hutchinson MR. Chronic exertional compartment syndrome. *Clin Sports Med.* 2012;31(2):307-19.
11. Helmhout PH, Diebal AR, Van der kaaden L, Harts CC, Beutler A, Zimmermann WO. The Effectiveness of a 6-Week Intervention Program Aimed at Modifying Running Style in Patients With Chronic Exertional Compartment Syndrome: Results From a Series of Case Studies. *Orthop J Sports Med.* 2015;3(3):2325967115575691.
12. Irion V, Magnussen RA, Miller TL, Kaeding CC. Return to activity following fasciotomy for chronic exertional compartment syndrome. *Eur J Orthop Surg Traumatol.* 2014;24(7):1223-8.
13. Konor MM, Morton S, Eckerson JM, Grindstaff TL. Reliability of three measures of ankle dorsiflexion range of motion. *Int J Sports Phys Ther.* 2012;7(3):279-87.
14. Möller M, Lind K, Styf J, Karlsson J. The reliability of isokinetic testing of the ankle joint and a heel-raise test for endurance. *Knee Surg Sports Traumatol Arthrosc.* 2005;13(1):60-71.
15. Pedowitz RA, Hargens AR, Mubarak SJ, Gershuni DH. Modified criteria for the objective diagnosis of chronic compartment syndrome of the leg. *Am J Sports Med.* 1990;18(1):35-40.
16. Roberts A, Franklyn-miller A. The validity of the diagnostic criteria used in chronic exertional compartment syndrome: a systematic review. *Scand J Med Sci Sports.* 2012;22(5):585-95.
17. Schubert AG. Exertional compartment syndrome: review of the literature and proposed rehabilitation guidelines following surgical release. *Int J Sports Phys Ther.* 2011;6(2):126-41.
18. Snowden J, Becker JA, Brosky JA, Hazle C. Chronic leg pain in a division ii field hockey player: a case report. *Int J Sports Phys Ther.* 2014;9(1):125-34.
19. Tjeerdsma J. 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. *J Foot Ankle Surg.* 2016;55(5):1027-34.
20. Vajapey S, Miller TL. Evaluation, diagnosis, and treatment of chronic exertional compartment syndrome: a review of current literature. *The Physician and Sportsmedicine.* 2017;45(4):391-398.
21. Zimmerman, WO, Hutchinson, MR, Van den Berg, R, Hoencamp, R, Backx, FJG, Bakker, EWP. Conservative treatment of anterior chronic exertional compartment syndrome in the military with a mid-term follow-up. *BMJ Open Sport & Exercise Medicine.* 2019; 5:e000532.



THE OHIO STATE UNIVERSITY

WEXNER MEDICAL CENTER

For OSUWMC USE ONLY. To license, please contact the OSU Technology Commercialization Office at <https://tco.osu.edu>.