



Spring 2023

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Chronic Exertional Compartment Syndrome: Surgical Treatment vs Conservative Care

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Abstract

- Summary of Problem:** Chronic exertional compartment syndrome (CECS) is a relatively rare pathology characterized by pain, tightness, and/or numbness in the affected calf upon performance of repetitive physical activity, most commonly with running or serving in the military. CECS usually has a delay in diagnosis due to low levels of awareness among clinicians and a wide range of differential diagnoses for chronic exertional leg pain. The natural course of CECS is often not self-limiting and therefore requires intervention, as symptoms can be severely debilitating and eventually force patients to avoid any provoking activity. The purpose of this literature review is to take a closer look at both conservative and surgical management of CECS and compare which has greater effectiveness in treating and relieving the symptoms associated with this chronic condition.
- Research Methods:** Search databases were used including PubMed, ClinicalKey, and SportDiscuss. Literature was deemed inclusive if the study focused on and evaluated treatment options of CECS, specifically fasciotomy or conservative care measures. Reference articles were thoroughly examined and chosen based on the ability to fit beneath one of three themes: decreased pain, patient satisfaction, and/or return to activity. All searches were narrowed to the past 25 years.
- Findings:** Overall, this literature review revealed the success of fasciotomy as a treatment option in patients with CECS. It showed that surgical intervention made a significant difference in pain level, patient satisfaction, and return to activity in patients as opposed to conservative care. It would be beneficial to utilize prospective randomized controlled trials in future studies to help with some of the noted study limitations, including overall small sample size, disproportionate sample size between surgical and conservative groups, and higher initial ICP values in surgically treated patients versus conservatively treated.

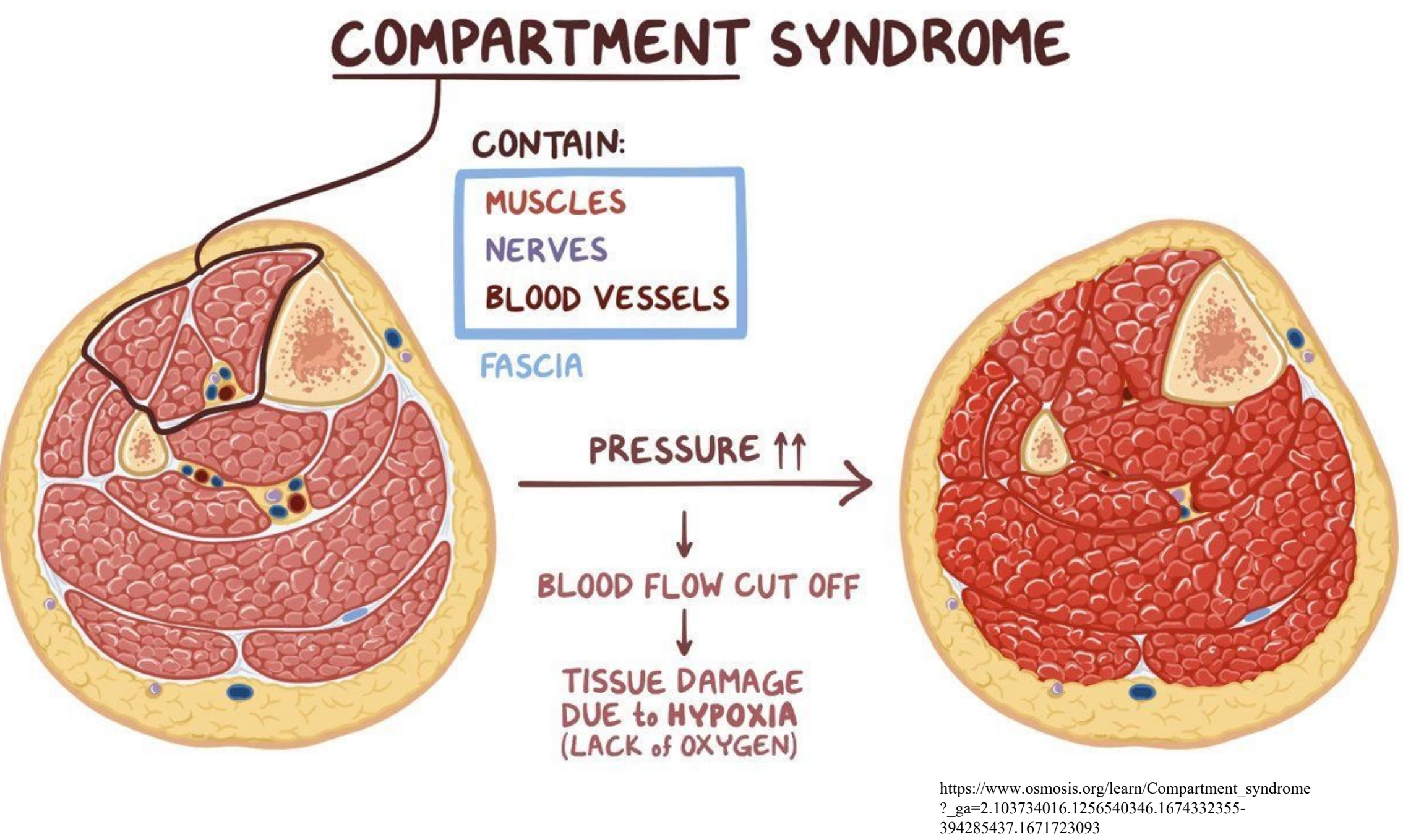
Keywords: *chronic exertional compartment syndrome (CECS), conservative care, conservative treatment, fasciotomy, surgical treatment*

Introduction

- Although not well understood, it is thought that symptoms related to CECS are caused by an elevation of intracompartmental pressures (ICP) following muscular expansion during exercise (Zimmermann et al., 2019) which impedes neuromuscular blood flow in the affected compartment (Vajapey et al., 2017).
- Diagnosis of CECS is based on a positive history of exercise-induced leg pain, tightness, and/or paresthesia, which is relieved with rest. It is confirmed by compartment pressure measurements before and after exercise. Diagnosis is made if the patient has a resting pressure of ≥ 15 mmHg and/or a pressure of ≥ 30 mmHg at 1 min post-exercise in any compartment (Drexler et al., 2017).
- Surgery for CECS is often considered once conservative treatments have failed or the patient's symptoms are severely disabling. (Vogels et al., 2020)
- Although conservative management is the initial recommended treatment, the gold standard is decompressive fasciotomy by open, partial, minimally invasive, or endoscopic techniques, resulting in documented high rates of pain relief (Vajapey et al., 2017).
- The purpose of this literature review is to take a closer look at both conservative and surgical management of CECS and compare which has greater effectiveness in treating and relieving the symptoms associated with this chronic condition.

Statement of the Problem

- Chronic exertional compartment syndrome (CECS), though well established, usually has a delay in diagnosis due to low levels of awareness among clinicians and a wide range of differential diagnoses for chronic exertional leg pain (Drexler et al., 2017).
- The natural course of CECS is often not-self limiting and therefore requires intervention, as symptoms can be severely debilitating and eventually force patients to avoid any provoking activity (Vogels et al., 2020).
- For army recruits and infantry soldiers, there is a high prevalence of lower extremity overuse injuries like CECS. Without prompt and proper treatment, these types of injuries may result in significant lost duty and training time and greatly increased costs of medical care (Helmhout et al., 2015).



Research Question

In patients with chronic exertional compartment syndrome, does treatment with surgical intervention as compared to conservative care result in improved outcomes?

Literature Review

Decreased Pain

- Fasciotomy has shown a larger drop in pain levels (1.6 ± 0.1) vs conservative treatment (0.9 ± 0.2 ; $p = 0.01$) and tightness (surgery 1.4 ± 0.1 vs conservative 0.4 ± 0.3 ; $p = 0.001$) during exercise. This concluded that fasciotomy was more effective in reducing the intensity and frequency of cardinal symptoms compared to a conservatively treated CECS patient (Vogels et al., 2021)
- Initiating a more specific conservative treatment protocol can decrease pain during activity and significantly reduce the need for surgical fasciotomy (Zimmermann et al., 2019).
- Overall improvement in symptoms following fasciotomy were higher in those with anterior/lateral compartment release (26/32; 81%) vs deep posterior compartment release (3/6; 50%) (Howard et al., 2000).
- Reported long-term results showed significant improvement in SF-12 scores (both physical and mental summary scores) after surgery, as well as in pain reduction (as expressed by NAS) ($p < 0.05$) (Drexler et al., 2016).

Patient Satisfaction

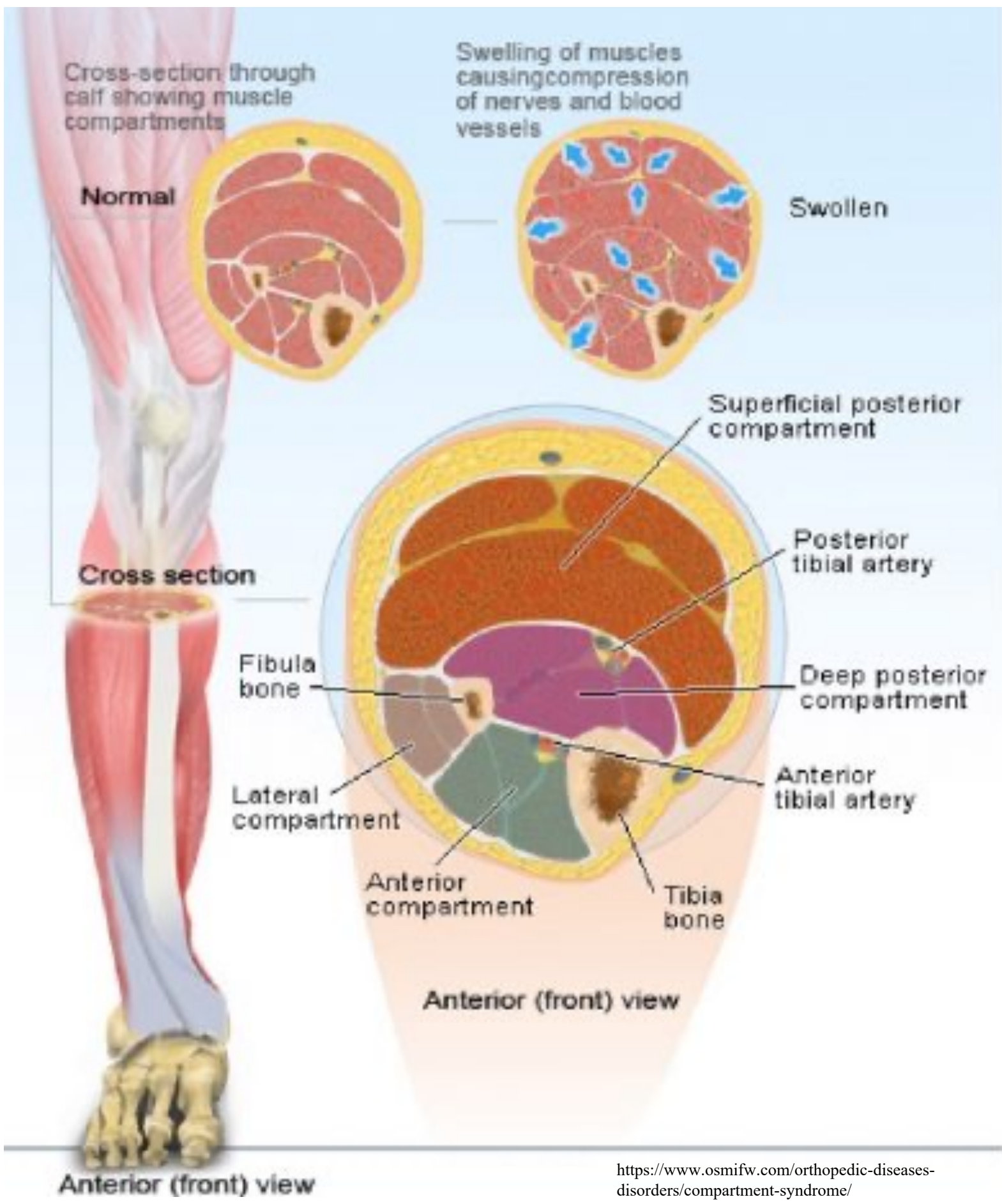
- Functional outcome and self-perceived best outcomes measured via LEFS showed significant patient satisfaction. At time of follow-up, 76% of patients reported that their expectations were met after surgery, 87% of patients indicated that knowing what they know now, they would have chosen to undergo the fasciotomy, 91% of patients said they would recommend fasciotomy for someone else, and 78% reported being either satisfied ($n = 14$) or very satisfied ($n = 22$) (Pasic et al., 2015).
- Younger patients (< 23 years of age) who had isolated anterior compartment release (as compared to both anterior and lateral release) had more successful results in terms of improved subjective function and satisfaction (Packet et al., 2013).
- Patient recovery and satisfaction self-scored on a 7-point Likert scale showed more satisfaction with fasciotomy in the CECS diagnosed group vs the conservatively treated ERLP group (2.5 ± 1.8 vs 3.8 ± 1.6 ; $p = 0.003$ on a 7-point Likert scale) and reported higher levels of recovery (2.3 ± 1.5 vs 3.2 ± 1.4 ; $p = 0.009$ on a 7-point Likert scale) (Maksymiak et al., (2021).

Return to Activity

- Tegner sports activity score comparing pre and post-treatment showed significant difference between surgical (77.4%) vs conservative group (25%) in full return to their previous activity level ($p = 0.001$) (Thein et al., 2019).
- Running athletes showed high rates of "return to activity" after fasciotomy (27/32; 84%) and promising rates of "return to presurgical level" up to 4 years postoperative (40%) (Salzler et al., 2020).
- The effectiveness of intervention programs that involved modifying running style and collaborating with a group of specialists, overall showed a mean increase of 43% in running distance and a mean decrease of 36% for post-exercise ICP (both $p < .05$) (Helmhout et al., 2015).

Discussion

- Overall, this literature review revealed the success of fasciotomy as a treatment option in patients with CECS. It showed that surgical intervention made a significant difference in pain level, patient satisfaction, and return to activity in patients as opposed to conservative care.
- Studies in this literature review that centered solely on fasciotomy for relief of CECS symptoms and limitations all concluded that it was a reasonable, effective, and safe option for those willing to undergo surgery.
- In the study done by Salzler et al. (2020), which focused more specifically on the running population, a high percentage (84%) of return to activity postoperative was noted along with a modest return to presurgical level of activity (40%) at 4 years postoperative.
- Another study done by Packer et al. (2013) also took age into account when analyzing their data, which showed significant difference in postoperative subjective function and satisfaction rates ($p = .017$) between those < 23 years of age (89%) and those > 23 years of age (66%). This suggested that the best outcomes post-fasciotomy would be for the younger population: high school and college-aged patients.
- Studies done by Packer et al. (2013) and Schepesis et al. (1999) compared both anterior and lateral compartment release, and concluded that release of the lateral compartment in addition to the anterior compartment was not necessary, and may even extend return to activity time.
- The studies done by Zimmermann et al. (2019) and Helmhout et al. (2015), which focused specifically on conservative treatment, showed great promise in decreased pain and return to activity for patients without undergoing invasive surgery. Both involved conservative measures and intervention programs that slowly but progressively reintroduced patients to their activity.
- It would be beneficial for prospective randomized controlled trials to be utilized in future studies. This would help eliminate some of those barriers, such as unequal numbers and large differences in ICP values in the two study groups. It would also be beneficial to have a standardized postoperative regimen for those who undergo surgery and a more standardized and thorough treatment regimen for those undergoing the conservative measures. Success would likely be increased in both groups if more focus was put on strengthening, recovery, and careful progression of rehabilitation back into activity.



Applicability to Clinical Practice

Although chronic exertional compartment syndrome (CECS) is not as common as other musculoskeletal conditions seen in primary care, it is still of great importance to be able to identify these individuals and get them the treatment that best fits their needs. Being able to clinically diagnose CECS in patients and having the knowledge about conservative treatments is an excellent tool and skill to have as a primary care provider, as the earlier the conservative measures are started the more likely they are to be effective. Knowing when to refer to a surgeon and understanding which patients will see benefit from fasciotomy is also a crucial part of their care, and is why continued studies are very much needed.

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Acknowledgements

I would like to thank my advisor and instructor Julie Solberg, PA-C for her positivity and encouragement while developing this scholarly project; her guidance and reassurance helped the process unfold almost effortlessly. I would like to thank Russ Kauffman, MPAS, PA-C for his instruction and flexibility with this paper and the research that went into it to help make it my own. I would like to thank Dr. Marilyn Klug for taking time out of her busy schedule to explain her expertise in statistics to help improve upon my research. I would like to thank Heather Brekke, PA-C for her athletic training expertise and insight in regard to my topic. I am so grateful to all my classmates and professors at the University of North Dakota for their inspiration and motivation. Lastly, I wish to thank my friends and family for their incredible support and encouragement throughout my time in the Physician Assistant Program; I could not have done it without them.