The Effectiveness of Surgical and Non-Surgical Management Strategies in Patients with Chronic Exertional Compartment Syndrome of the Anterior Compartment of the Leg: A Systematic Review and Meta-Analysis

Sean Kaplan

A dissertation submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in fulfilment of the requirements for the degree of MSc (Physiotherapy).

Johannesburg, 2021

Declaration

I, Sean Kaplan, declare that this Dissertation is my own, unaided work. It is being submitted for the MSc (Physiotherapy) degree at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

Sean Kaplan

Signed in Johannesburg on this 21st day of June 2021

Abstract

Objective: The objective of this review was to evaluate the effectiveness of surgical management versus non-surgical management on pain, range of motion, intracompartmental pressure (ICP) values, patient satisfaction, recurrence of symptoms, return to activity, function, strength, and sensation in patients diagnosed with Chronic Exertional Compartment Syndrome (CECS) of the anterior compartment of the leg.

Introduction: CECS is the most prevalent cause of exercise-induced leg pain in athletes. Current evidence suggests that the best methods for management of the condition include activity modification or cessation, injection of botulinum toxin into the affected compartment, or surgical intervention. However, no systematic review has been done to provide level one evidence of the effectiveness of surgical versus non-surgical management of CECS of the anterior compartment of the leg. Findings from this study will inform clinical practice and identify gaps for further research into this condition.

Study Design: Systematic review and meta-analysis of case reports, case series, cohort studies, case-control studies, quasi-experimental studies, and randomised controlled trials. Level of evidence: 1

Inclusion criteria: Studies were included if they assessed human participants that were diagnosed with CECS of the anterior compartment of the leg through a combination of elevated ICP values and patient history. Studies reporting patients with CECS in addition to diagnoses of another lower limb pathology were included. Studies that included patient reported outcome measures such as return to activity, pain, and those that use specific outcome measures related to function were included. Studies published in all languages were considered for inclusion. Studies were excluded if they included management of acute compartment syndrome or if they did not mention and specify the method of ICP measurement and/or other diagnostic parameters. Studies assessing multiple compartments of the leg were excluded if they do not separately report results for the anterior compartment.

Methods: MEDLINE via PubMed, SPORTDiscus, Physiotherapy Evidence Database (PEDro), EBSCOhost MasterFILE Premier, EBSCOhost CINAHL Complete, ProQuest Health and Medical Complete, SCOPUS and Science Direct were systematically searched from 1956 to December 2020. Grey literature databases were also searched. Included full-text studies were critically appraised using JBI SUMARI. Where statistical pooling was possible, results from the articles were synthesised for statistical analysis using JBI SUMARI and R. The findings of all included studies were presented in a narrative review, including results from studies that underwent meta-analysis.

Results: A total of 52 studies were included in the review, with a collective sample size of 1458 participants. The designs of the included studies were case reports (n=15), case series (n=24), cohort studies (n=8), quasi-experimental studies (n=3), case-control studies (n=1), and randomised controlled trials (n=1). Regardless of the type of management intervention, pain scores improved significantly across all studies (95% CI[1.73-4.11], $p<0.01$, $I^2=94\%$). ICP values improved following intervention in patients undergoing surgical fasciotomy, gait re-training, and botulinum toxin injection into the affected compartment (at rest 95% CI [9.74-17.83], $p<0.01$, $I^2=98\%$; at P_0 95% CI [12.08-49.79], $p<0.01$, $I^2=99\%$; at P_1 95% CI [13.95-40.63], $p<0.01$, $I^2=99\%$; at P_5 95% CI [11.43-30.15], $p<0.01$, $I^2=99\%$). Satisfaction rates for surgical fasciotomy were greater than both surgical fasciectomy and combination surgery, but comparable to those reported for non-surgical management (95% CI [2.20-10.70], $p<0.51$, $I^2=0\%$). Symptom recurrence was reported as 36% for fasciectomy and ranged from 0% to 23% for fasciotomy. Symptom recurrence was not expressly presented for non-surgical management. Range of motion for ankle dorsiflexion improved significantly for patients managed with botulinum toxin and manual therapy. Muscle strength initially decreased following intervention with botulinum toxin but did not affect function and returned to normal at follow-up. Sensory deficits were reported following fasciotomy and were either due to peroneal nerve entrapment, sural nerve damage, or pre-existing CECS. Rates of return to activity were 25-95% in patients that underwent fasciotomy and 57-100% for patients receiving gait-retraining (95% CI [0.40-0.79], $p<0.01$, $I^2=95\%$).

Conclusions: Non-surgical management strategies are a safe and effective intervention for CECS of the anterior compartment of the leg with low risk and should be exhausted prior to referral for surgical management, preferably in the form of surgical fasciotomy. If surgical management is unsuccessful, repeat fasciotomies including additional compartments may be necessary. A consensus needs to be reached regarding diagnostic parameters for CECS. Further research into non-surgical interventions and novel surgical interventions such as fascial fenestration is necessary.