Chronic Exertional Compartment Syndrome of the Leg in the Military

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KEYWORDS

- Chronic exertional compartment syndrome • Intracompartmental pressure
- Paresthesia

KEY POINTS

- Chronic exertional compartment syndrome affects young athletic individuals, especially those in active duty military service.
- Nonoperative treatment may benefit low-demand patients; however, in an athletic cohort surgical decompression must be considered in a patient that fails conservative management.
- Although good surgical outcomes have been reported by tertiary referral centers, return to duty rates in the military are poor, with only 55% of patients experiencing complete resolution of symptoms.
- Patient education, activity modification, and gait retraining may be beneficial to optimize symptomatic relief.

INTRODUCTION

Activity-related lower extremity pain is common among athletes and other active patient populations. Along with other overuse conditions, chronic exertional compartment syndrome (CECS) may contribute significantly to the development of effort-dependent leg symptoms. One of the earliest descriptions of CECS occurred during the British expedition to the South Pole in 1912, in which Edward Wilson described anterior leg swelling and pain during long treks in the Arctic.[1] Subsequent historical records have also emphasized the prevalence of CECS in military cohorts,[2,3] earning the appellation "march gangrene."[4]

Conflict of Interest: None.

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Acute compartment syndrome typically develops after trauma, and secondary tissue ischemia and muscle breakdown warrant emergent fasciotomy to preserve limb viability. By contrast, CECS, otherwise known as exercise-induced compartment syndrome, develops after prolonged exertion in the absence of injury and it is often evaluated in the ambulatory setting. During intensive exercise, intramuscular volume can expand by up to 20% in response to increased metabolic demands, tissue perfusion, and muscle fiber hypertrophy.[5–7] When sustained, compartment syndrome may develop as the interstitial pressure becomes critically elevated above the diastolic pressure of a closed fascial compartment. Consequently, compromised vascular perfusion leads to tissue ischemia, metabolite accumulation, and extremity pain. Alternatively, other investigators have proposed that fluid extravasation and increased intracompartmental pressures (ICPs) contribute to neural compression and potentially irreversible damage with chronic untreated compartment syndrome. Other investigators have also implicated decreased capillary density or hindered venous outflow in the development of CECS.[8,9]

Although the pathophysiology is not fully understood, CECS remains a frequent source of lower extremity disability in contemporary military service members. With heightened occupational demands, daily exercise, and mandated physical fitness performance standards, the military represents a unique, high-demand population at elevated risk for the development of CECS. This article explores the epidemiology, risk factors, diagnosis, and management of CECS within this cohort.

EPIDEMIOLOGY AND RISK FACTORS

The exact prevalence of CECS is currently unclear because of the frequency of self-directed treatment or activity modification, errors in clinical diagnosis, and/or failure to seek medical attention. According to smaller series, CECS may account for 14% to 34% of activity-related leg pain referred for orthopedic treatment.[10–12] Further estimates have indicated that approximately one in every 2000 US military service members is diagnosed with CECS each year,[13] with 4100 individuals identified over a 6-year period.

CECS is most commonly described in the leg, accounting for more than 95% of all cases.[14] However, other investigators have variably reported involvement of the hand,[15,16] forearm,[17–19] thigh,[20,21] and foot[22] in narrow high-risk cohorts. When evaluating the distribution of CECS in the compartments of the leg, the anterior compartment is most frequently affected (42%–60%) followed by the lateral (35%–36%), deep posterior (19%–32%), and the superficial posterior (3%–21%).[10,23] Davis and colleagues[23] found that single compartment involvement was less common (37%). In their series, 40% of cases were symptomatic in two compartments, 18% involved three compartments, and only 5% affected all four compartments. Similarly, bilateral involvement is more common, accounting for up to 95%[23,24] and no differences by laterality have previously been identified.[25]

This condition has usually been described among younger, athletic populations. Patients typically present in the second and early fourth decade of life, often with a long duration of preexisting symptoms.[23,26,27] Earlier studies have described a greater preponderance of affected men,[8,12,28] whereas other investigations have suggested the potential for increased incidence among women.[9,13,23] Meanwhile, selected investigations from the civilian literature have reported that the incidence of CECS between men and women is roughly equal.[10,11,26]

More than 90% of patients presenting with CECS are involved in athletics[23] and there is no reported difference between those involved in elite and recreational levels