Chronic Exertional Compartment Syndrome of the Hand: Case Report and Literature Review

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Abstract

Background: Chronic exertional compartment syndrome (CECS) is characterized by activity-induced pain, swelling, and decreased muscle function due to increased pressure and decreased circulation within a confined muscle compartment. Although well-known to occur in the leg, involvement of the hand has rarely been reported in the literature. **Methods:** We present a 44 year old male with CECS involving bilateral thenar and hypothenar compartments. Symptoms were reproduced on exam by driving screws into wood with a screwdriver. Elevated compartment pressures were confirmed with a hand-held digital device which employs a rigid needle that is readily directed to specific compartments. **Results:** Selective releases of the thenar and hypothenar compartments were performed under local anesthesia and forearm tourniquet in the ambulatory surgery center. At 3-month follow-up, the patient reported full use of his right hand, including woodworking, with excellent relief of symptoms. At 5 months postoperatively, he underwent identical surgical releases on the contralateral left side, with similar relief. **Conclusions:** CECS of the hand is a rare condition. Our case is unique among prior reports with regard to pattern of compartment involvement, as well as provocative maneuvers and compartment testing methods employed. This report should help foster clinical suspicion, facilitate diagnosis, and demonstrate success of targeted surgical treatment.

Keywords: hand, thenar, hypothenar, compartment syndrome, chronic exertional

Introduction

Chronic exertional compartment syndrome (CECS) of the hand has rarely been reported in the literature.¹⁻⁶ We present a unique case of this rare condition, involving bilateral thenar and hypothenar compartments, treated successfully with bilateral selective fasciotomies.

Case Report

A 44-year-old right-hand-dominant male law enforcement officer presented with activity-induced bilateral hand pain, worse on the right. He described sharp pain, cramping, and firm swelling associated with repetitive grasping and twisting of the hand, requiring rest periods for relief. He denied any antecedent trauma. Symptoms had worsened over the past year and were noted specifically when using a screwdriver while woodworking at home. On examination, the patient had large muscular hands with well-developed bilateral thenar and hypothenar eminences (Figure 1). Muscle strength measured 5/5 throughout the hand. Sensation was intact to light touch in all nerve distributions. Tinel's and Phalen's tests at the wrists were negative. Symptoms were not reproduced by repetitive grip strength

Figure 1. The right hand demonstrates well-developed thenar and hypothenar musculature.

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Figure 2. Swollen hypothenar muscle is revealed during release of tight and thickened fascia.

testing with a dynamometer. The remainder of the examination was unremarkable. Radiographs of the hand were normal and nerve conduction studies were negative for compression or other nerve pathology.

After a 10-week period of rest with activity modifications, the patient returned with continued symptoms. In our clinic, he demonstrated the provocation of his symptoms by using a screwdriver to insert 10 screws into a wooden board with his right hand. Symptoms remained specific to the thenar and hypothenar eminences, with no appreciable pain or swelling in the first dorsal interosseous or adductor pollicis compartments. Immediately after symptoms developed, thenar compartment pressure measured 56 mm Hg using a hand-held digital device with needle (Intra-Compartmental Pressure Monitor; Stryker, Kalamazoo, Michigan). After 5 minutes of rest, as symptoms resolved, thenar compartment pressure measured 26 mm Hg.

Based on history, physical exam, and compartment pressure measurements, the diagnosis of CECS was made. Selective releases of the thenar and hypothenar compartments were then performed under local anesthesia and forearm tourniquet in the ambulatory surgery center. Longitudinal incisions were made along the border of the glabrous skin at the thenar and hypothenar eminences. Careful dissection was performed and the muscle fascia was released. Prominent swollen muscle belly was visualized beneath the tight and thickened fascia (Figure 2). Care was taken to ensure complete release and decompression. The fascia was left open and the skin was closed. A soft bulky dressing was placed without splinting.

Sutures were removed at 2 weeks, and the patient was allowed to advance activities gradually as tolerated. At 3-month follow-up, he reported full use of his right hand

including woodworking with excellent relief of symptoms. The patient declined further compartment pressure measurements on either side due to discomfort with the measurement procedure. At 5 months postoperatively, he underwent identical surgical releases on the contralateral left side, with similar relief.

Discussion

CECS is characterized by activity-induced pain, swelling, and decreased muscle function due to increased pressure and decreased circulation within a confined muscle compartment.¹ Although well-known to occur in the anterior compartment of the leg, it has rarely been reported in the hand, which consists of 10 compartments: 4 dorsal interossei, 3 volar interossei, the thenar, hypothenar, and the adductor pollicis. Reports of CECS in the hand comprise a total of 10 cases.¹⁻⁶ In 9 of the 10 cases, the first dorsal interosseous compartment was involved, and 7 of these 9 were isolated to this compartment.^{1,2,4,6} Other cases have involved only the adductor pollicis³; first dorsal interosseous and thenar⁵; first dorsal interosseous, thenar, and hypothenar.⁵ Four cases had bilateral involvement.^{2,3,5} Our case is the first involving only the thenar and hypothenar compartments, and only the second to exclude the first dorsal interosseous compartment. Surgeons should be aware of this possible variation as well as others that have been or have yet to be reported.

Diagnosis begins with a thorough history and includes chronic activity-induced pain of the hand, most often in manual laborers. The differential may also include arthritis, nerve compression, and focal dystonia (ie, “writer’s cramp”).¹ Physical exam usually reveals well-developed musculature, although it is otherwise benign. Provocative maneuvers have most often included repetitive key pinch.²⁻⁶ Our patient reproduced his symptoms by driving screws into wood with a screwdriver, which is a convenient and practical maneuver that can be performed in clinic. Compartment pressures have previously been measured with a slit catheter^{1,2,4-6} or the Whitesides infusion technique.³ We used a hand-held digital device, which employs a rigid needle that is readily directed to specific compartments. When the diagnosis is still in question, or if direct invasive measurement is not tolerated due to pain, magnetic resonance imaging after provocation has also been utilized and may demonstrate increased T2-weighted signal in the involved compartments.³ Surgical treatment is reliable and should include release of the affected compartments, of which the first dorsal interosseous is typically involved, although not always, and asymptomatic compartments may be left intact.

Ethical Approval

This study was approved by our institutional review board.

Statement of Human and Animal Rights

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.

Statement of Informed Consent

Informed consent was obtained from all individual participants included in the study.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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