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Bilateral Compartment Syndrome of Hand: A Rare Case Report and it's Unique Management

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Abstract

Bilateral compartment syndrome of the hand, though infrequent, presents considerable clinical complexities requiring a comprehensive grasp and innovative therapeutic approaches. This syndrome, characterized by heightened pressure in multiple compartments of both hands, is uncommon due to the intricate anatomy and vital functionality of the hand. While compartment syndrome primarily affects the arms and lower legs, bilateral involvement of the hands is exceedingly rare. Therefore, diagnosing and managing bilateral hand compartment syndrome necessitates meticulous attention to anatomical nuances, pathogenic mechanisms clinical presentations. Magnetic resonance imaging (MRI) emerges as a pivotal tool in diagnosis, facilitating precise evaluation of tissue damage and customized treatment planning. The cornerstone of treatment remains prompt identification and emergent fasciotomy to alleviate compartmental pressure, crucial for minimizing irreversible tissue damage and optimizing patient outcomes. This case report outlines a unique manifestation of bilateral hand compartment syndrome, delineating clinical symptomatology, diagnostic methodologies therapeutic interventions employed.

INTRODUCTION

Bilateral compartment syndrome of the hand, while relatively rare, presents a substantial clinical difficulty that requires a thorough comprehension and inventive therapy approaches^[1]. This syndrome is characterized by increased pressure in several compartments of both hands, which is seldom seen due to the complex structure of the hand and its vital role in functioning^[2].

Although compartment syndrome mainly affects the arms and lower legs, it is extremely uncommon for it to occur in the hands, especially on both sides^[3]. Therefore, the diagnosis and treatment of bilateral hand compartment syndrome needs a careful and detailed approach that takes into consideration the intricate relationship between anatomical factors, pathogenic mechanisms clinical symptoms^[4].

MRI, or magnetic resonance imaging, is crucial in the field of diagnostics, notably for assessing and tracking compartment syndrome^[5]. These technologies assist in assessing the level of tissue damage, assisting in the development of customized treatment strategies^[6].

The basic approach to treating compartment syndrome continues to be the prompt identification and immediate performance of fasciotomy to relieve pressure inside the affected compartment^[7]. Prompt action is essential in minimizing permanent tissue damage and maximizing patient outcomes^[8]. This case report aims to describe a unique occurrence of bilateral compartment syndrome of the hand, including the course of clinical symptoms, methods of diagnosis treatments used. By presenting the complex scientific details underlying this uncommon event and describing the unique methods used to handle it.

Case Study: A 25-year-old guy presented to the emergency room with severe pain and edema in both hands, exhibiting symptoms of impaired blood flow such as paleness, coldness reduced feeling. His medical history revealed a long-standing problem with alcohol addiction and a recent incident of self-inflicted wrist confinement using a ligature for around 12 hours. The physical examination showed tight compartments, significant edema and discolouration from the forearm to the fingers. There was also a loss of feeling and motor function, suggesting a neurological problem (Fig 1). The presence of weak distal pulses indicated that there was reduced blood flow in the arteries, likely caused by elevated pressure inside the compartment. The diagnosis of bilateral compartment syndrome of the forearm was established by clinical examination and patient history. Emergency bedside pressure readings revealed high pressures, requiring emergent surgical surgery. A bilateral fasciotomy was conducted,

which revealed significant muscular necrosis and ischemia alterations. After the surgery, the patient's wound was taken care of, antibiotics were given rehabilitation was started. Despite the implementation of intensive medical intervention, the patient required an extended period of hospitalization because of the severity of the injury and the accompanying sequelae. Although there was some incremental recovery in hand function and feeling over the course of many weeks, there were still remaining deficiencies. A long-term follow-up showed that there were persistent functional restrictions and psychological consequences resulting from the traumatic experience.

RESULTS AND DISCUSSION

Bilateral Compartment syndrome occurs when there is an increase in pressure inside tightly enclosed myofascial compartments that are surrounded by dense connective tissue or bone^[9]. The primary characteristics of compartment syndrome include vascular collapse and hypoxia caused by increased pressure^[10]. An elevation in pressure may occur due to either an increase in volume inside a closed space or external compression^[11]. Intercompartmental causes of pressure elevation include conditions such as edema, hemorrhage fracture^[12]. On the contrary, external compression factors involve burns, extended immobility tight wrapping. An increase in pressure causes the veins to get blocked and the arteries to collapse, resulting in restricted blood flow to the capillaries, lack of oxygen supply injury to the nerves^[13]. When the energy-dependent pumps in the cells stop working due to reduced blood flow, the muscle cells start to expand. This swelling boosts to the already high pressure in the compartment, which continues the cycle of oxygen deprivation and muscle injury^[14].

This instance of a 25-year-old boy highlights the critical need for timely identification and treatment of compartment syndrome, especially in unusual cases like bilateral involvement of the hands. The patient appeared with acute discomfort and swelling in both hands, with symptoms of impaired circulation, such as pallor, coldness and reduced feeling. The individual's prolonged history of chronic drinking, together with



Fig 1: Patient with Bilateral Compartment Syndrome

the recent use of wrist restraints for 12 hours, increased the likelihood of experiencing ischemic damage. The individual's chronic drinking made them more likely to have defective tissue repair, which further complicated their clinical course. Timely surgical intervention, such as bilateral fasciotomy, was crucial in avoiding permanent tissue damage and maintaining limb function.

This case study primarily emphasizes the crucial importance of promptly identifying and handling compartment syndrome, particularly in unusual scenarios such as bilateral involvement of the hands. Similarly, O'Leary *et al.* (2006) reported a case of a 31-year-old person with a medical background of depression and hypothyroidism, who had sudden bilateral upper limb compartment syndrome. The patient was receiving thyroxine and sertraline as part of their therapy^[16]. It is worth mentioning that while there were no documented cases of sertraline-induced myositis at that time, later studies have confirmed a link between selective serotonin reuptake inhibitors (SSRIs) such as sertraline and rhabdomyolysis. Rhabdomyolysis is defined as the disintegration of muscle tissue and the subsequent release of its constituents into the circulatory system.

In the same way, Dalton *et al.* documented an additional instance of unexplained bilateral compartment syndrome in a 31-year-old woman with hypertension who was being treated with telmisartan, an angiotensinogen II receptor antagonist^[17]. Although the patient did not initially show typical signs of compartment syndrome, their creatine kinase (CK) levels were greatly increased, which is symptomatic of rhabdomyolysis. This instance indicates that rhabdomyolysis could occur before compartment syndrome and might be the cause of its initiation.

This discussion also delves into the relationship between rhabdomyolysis and certain prescription medications, notably statins and angiotensinogen II receptor antagonists like telmisartan. Statins, commonly prescribed for managing cholesterol, have been linked to rhabdomyolysis—a condition characterized by the breakdown of muscle fibers. The risk of developing this condition is directly proportional to the dosage of statins. As illustrated in the case outlined by Stewart and Singleton, a patient taking simvastatin experienced isolated extensor carpi ulnaris compartment syndrome. This underscores the importance of exercising caution when administering these medications^[18].

CONCLUSION

In conclusion, the case highlights the importance of promptly identifying and treating compartment syndrome, particularly when it manifests in atypical

ways like affecting both hands. The concurrent presence of persistent drinking and ligature-induced wrist restraint increases the likelihood of ischemia damage, which further complicates the clinical progression. Performing bilateral fasciotomy in a timely manner was essential to avoid permanent tissue damage and maintain the function of the limb. Nevertheless, despite the implementation of intensive medical intervention, the patient endured an extended period of hospitalization and continued to suffer from ongoing impairments in functionality. This underscores the need of providing comprehensive and sustained long-term care and rehabilitation. This example serves as a reminder of the intricacies required in treating such injuries and emphasizes the need of using multi disciplinary techniques to maximize results and address both the immediate and long-term elements of the disease.

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