

Acute Compartment Syndrome of the Upper Extremity Due to Staphylococcus aureus Cellulitis: an unusual etiology and dramatic consequence

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CASE STUDY

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Introduction

Richard von Volkmann is credited with making the first known description of compartment syndrome in 1881¹. Subsequently, Petersen reported the first treatment for the condition in 1888, and Jepson was the first author to demonstrate it experimentally in 1926². Compartment syndrome (CS) arises when the pressure within a fascial compartment exceeds the perfusion pressure, resulting in irreversible tissue ischemia and necrosis³. It can be categorized into two types - acute and chronic and between the two, Acute Compartment Syndrome (ACS) is the type that requires more urgent attention and is more concerning⁴.

Compartment syndrome can occur during trauma of the limb, or following surgery. Atraumatic etiology, especially infection, is much rarer. Few studies have reported cases of compartment syndrome secondary to infection, limited to case reports⁵⁻⁷. As it is an emergency situation, the absence of prompt and proper treatment can lead to necrosis or more commonly irreversible ischemic retraction. Therefore, decompression through fasciotomy is necessary in this case, which is considered a significant surgical emergency⁶⁻⁸.

In this report, a case of acute compartment syndrome of the upper extremity without traumatic injury is described in a 26-year-old woman, with the underlying cause identified as cellulitis caused by staphylococcus aureus.

Case presentation

This is a 26-year-old female housekeeper with no notable medical history who presented to the emergency department with a tension-type pain and progressive swelling of her right arm. She reported a superficial wound on her hand that occurred a week ago, which was complicated by neglected swelling of the entire left upper limb. Due to worsening pain and the appearance of blisters and signs of ischemia, the patient presented to the emergency department. She also complained of chills, fever, and general malaise.

On clinical examination, the patient was febrile at 39.5 with a GCS of 13. Inspection revealed a swollen, purple, and shiny limb with blisters. On palpation, the limb was tense and painful, and on vascular-nerve examination, there was hypoesthesia associated with poorly perceived distal pulses (Figure 1). An ultrasound of the soft tissues was performed, showing infiltration of the soft tissues compressing the vascular-nerve pedicles without individualization of abscess collection.

Emergency decompression incisions were made, and bacteriological samples were taken. The results showed the presence of methicillin-resistant Staphylococcus aureus. According to the bacteriological profile, vancomycin was administered. However, despite initial improvement, the patient developed systematic necrosis of her arm, with black discoloration of the skin and signs of gangrene (Figure 2). Finally, a trans humeral amputation was performed. The patient was then treated with intravenous antibiotics, wound care, and rehabilitation to regain functionality of her remaining limb (Figure 3).

Discussion

The compartment syndrome is a rare but potentially serious complication that can occur following a trauma or surgical intervention and in rare cases, it can be caused by an infection, leading to an increase in pressure within a closed muscular compartment. Detecting atraumatic compartment syndrome can be challenging since it is typically linked with

cases of trauma. However, failing to identify such cases can result in severe complications. This case has highlighted the importance of maintaining a high level of clinical suspicion for atraumatic compartment syndrome.

Staphylococcus aureus is a common pathogenic bacterium associated with the development of a compartment syndrome secondary to an infection. Toxins released by this bacterium can cause damage to muscle tissue and fascia, leading to inflammation, necrosis, and infection. The presence of staphylococcus in necrotizing fasciitis can be extremely dangerous as it can spread rapidly and cause serious systemic complications such as sepsis, septic shock, and organ failure⁹⁻¹⁰.

Increase in pressure can cause tissue ischemia and necrosis, posing a life-threatening risk to the patient. There are several risk factors that have been identified, such as muscle injuries, fractures, hematomas, intra-muscular injections, burns, animal bites, orthopedic and vascular surgeries, and others¹¹⁻¹². The diagnosis of compartment syndrome is based on measuring the pressure inside the affected muscle, which must be higher than 30 mmHg to confirm the diagnosis. However, clinical diagnosis can also be established based on signs and symptoms such as pain, tightness, swelling, and abnormal sensations¹³. The fasciotomy is considered the most effective method for treating acute compartment syndrome, with a success rate of 97%. However, muscle decompression can be an effective option in some cases. The choice of treatment will depend on the severity of the condition and the preferences of the treating physician¹⁴⁻¹⁶.

Mantzioros et al. conducted a study to assess whether Minimally Invasive Fasciotomy (MIF) was more effective than Conventional Fasciotomy (CF) in treating acute compartment syndrome. The findings indicated that MIF was equally effective as CF in lowering intracompartmental pressure and reducing postoperative morbidity. Nonetheless, MIF resulted in a considerably shorter hospital stay and faster functional recovery than CF. Based on these results, the authors suggested that MIF may be a reliable and efficient substitute for CF in managing acute compartment syndrome¹⁷. The effectiveness of multidisciplinary management for necrotizing fasciitis caused by infection was studied by A. Alsaawi and M. Saddik. The results of their study demonstrated that this approach, which included aggressive antibiotic therapy, early fasciotomy, surgical debridement, and intensive care, was effective in reducing mortality and improving functional outcomes in patients with this condition¹⁸.

In terms of prevention, early identification of at-risk patients and careful monitoring after trauma or surgery can help prevent compartment syndrome. It is also recommended to avoid unnecessary intramuscular injections and to monitor intramuscular pressure during high-risk surgeries¹⁹.

Conclusion

The occurrence of atraumatic compartment syndrome due to Streptococcal cellulitis is uncommon. However, it should not be overlooked as a possible complication in patients presenting with severe pain, even in the absence of a history of trauma. Rapid detection and multidisciplinary management, including early fasciotomy and aggressive antibiotic therapy, are essential to prevent the serious complications associated with compartment syndrome.

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Figures



Figure 1: : Clinical image showing an upper limb in acute ischemia with blisters on the palm of the hand.



Figure 2: Clinical image showing the incisions of fasciotomy.



Figure 3: Postoperative image of the trans-humeral amputation