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A Rare Case of Upper Arm Compartment Syndrome in a Patient on Anticoagulant Therapy

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A Rare Case of Upper Arm Compartment Syndrome in a Patient on Anticoagulant Therapy

Abstract

Background Compartment syndrome is the condition when elevated pressures within an osseofascial compartment cause vascular and neurological compromise, leading to muscle ischemia and possible necrosis if left untreated. It commonly occurs after a traumatic event (e.g., crush injury, fracture, trauma); however, compartment syndrome can still happen spontaneously and in any compartment of the body.

The objective of this case report is to present the signs and symptoms of upper arm compartment syndrome, which is a rare site for compartment syndrome, along with a review of the diagnosis and treatment.

Case Report A 62-year-old man receiving anticoagulant therapy for atrial fibrillation developed compartment syndrome in the flexor compartment of his upper arm, secondary to an axillary hematoma, diagnosed clinically.

Conclusion Upper arm compartment syndrome is uncommon but can happen. Early recognition and intervention are limb-saving.

Keywords

Compartment Syndrome, Anticoagulant

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Introduction

Compartment syndrome is a condition in which elevated pressure within an osseofascial compartment causes vascular and neurological compromise, leading to muscle ischemia and subsequent necrosis if left untreated. While the most common locations for compartment syndrome are the anterior and deep posterior compartments of the leg and the volar compartment of the forearm, it can occur anywhere in the body where there is a compartment, including the upper arm, abdomen, buttock, foot, and thigh.¹⁻⁶ The most common causes include trauma, arterial injury, crush injury, limb compression and burns.^{6,7} Case reports of compartment syndrome after minimal trauma to the upper arm have been noted after instrumentation or procedures such as arterial access devices, venipuncture and prolonged compression from a tourniquet.⁷⁻¹⁶ Spontaneous compartment syndrome (in the absence of any precipitating event), although rare, can occur. These cases have been associated with type 1 diabetes mellitus, ganglion cyst, hypothyroidism, influenza virus-induced myositis, leukemic infiltration, nephrotic syndrome, ruptured aneurysm, and anticoagulation.⁷⁻¹⁶ In these setting, cases are predominantly localized to the compartments of the lower leg and forearm with the upper arm rarely involved.

Case presentation

A 63-year-old male competitive powerlifter with history of atrial fibrillation, hypogonadism, depression, GERD, and non-ischemic cardiomyopathy, treated respectively with carvedilol, warfarin, dofetilide, duloxetine, and pantoprazole, presented to the emergency department with 5 days of worsening intense pain, swelling, and ecchymosis of his left upper arm. One week prior to admission, the patient was doing routine lifting workouts with 30 pound weights and noticed bruises on his left upper arm. Though it was painless initially, his arm gradually became painful and swollen.

One day prior to arrival in the emergency department (ED), he was evaluated at an outside facility for the uncontrolled pain and bruises. He was found to have an INR of 7 and a CT angiogram of his left arm indicated possible biceps tendon injury. Warfarin was held and he received oral 2.5 mg of oral vitamin K. On discharge, he was asked to follow up with orthopedics as an outpatient. When the pain and swelling continued to progress and became associated with pain and numbness in the left hand, he presented for re-evaluation.

Upon arrival to the ED, physical examination revealed the patient to be in pain but hemodynamically stable. The left arm was noted to be ecchymotic with diffuse upper and forearm tenderness. Brachial, radial, and ulnar pulses in the left arm were normal and capillary refill time estimated to be 2 seconds. Sensation, strength, tone in the left arm was also normal and reflexes were symmetric between the two arms.

Laboratory analysis revealed white blood cell count of $10.5 \times 10^3/\mu\text{L}$ (reference range 4–10 $\times 10^3/\mu\text{L}$), hemoglobin of 10.6 g/dL (reference range 13.5–18 g/dL), INR of 5.2 (reference range 0.9–1.1), creatine kinase of 489 U/L (reference range 32–294), creatinine of 1.1 mg/dl (reference range 0.7–1.3 mg/dl). Other bloodwork including electrolytes and liver function were all normal.

Left upper extremity soft tissue ultrasound showed diffuse edema and did not demonstrate a definitive collection or hematoma. He received 10 mg of IV vitamin K and one unit of fresh frozen plasma to reverse the anticoagulation effects of Warfarin. Because of significant pain and swelling of his entire left arm, vascular surgery was emergently consulted.

Vascular surgery initially recommended involving orthopedic surgery, given concern for biceps injury, and the rarity of upper arm compartment syndrome. Orthopedic surgery thought the left upper extremity pain, swelling and tenderness were more consistent with vascular insufficiency than an underlying orthopedic etiology, and recommended MRI of left shoulder to evaluate the biceps tendon.

Given the possibility of developing compartment syndrome, the left upper extremity symptoms (including pain and swelling) and physical examination (including tenderness, pulses, sensation and strength) were being re-evaluated every 2 hours. 10 hours after the initial presentation, his upper arm became tense and the pain worsened significantly. A clinical diagnosis of anterior upper arm compartment syndrome was made. He was taken to the operating room immediately and had a fasciotomy within 1 hour. A posteromedial incision of the left upper arm, which extended to the axilla, was made, including the skin and underlying fascia (Fig. 1). This fully decompressed the upper extremity to the shoulder and an axillary sheath hematoma was evacuated. The biceps compartment of the arm was decompressed through the same incision, and the biceps muscle was found viable. The patient recovered well afterward (Fig. 2) and eventually underwent skin grafting to the left arm two weeks later. After a 3 week hospitalization, he was discharged. At follow up with vascular surgery 10 days later, his left arm showed remarkable return to function.



(Fig. 1): Day 0 of surgical wound after fasciotomy of medial compartment of left upper extremity.



(Fig. 2): Day 14 of surgical wound after fasciotomy of medial compartment of left upper extremity.

Discussion

There are three compartments in the upper arm, two large and one small. The large compartments are the anterior compartment where biceps muscles are located and the

posterior compartment where triceps muscles are located. The deltoid muscle is located in the small lateral compartment. Both the anterior and posterior compartments can tolerate relatively large volumes of fluid without a significant increase in pressure which lowers—but does not eliminate—the risk for compartment syndrome.¹⁷⁻²⁰ The anterior compartment includes the elbow flexor muscles along with the ulnar and median nerves. The posterior compartment contains the extensor muscles of the elbow and the radial nerve. The abductors of the arm and the axillary nerve are located in the lateral compartment. Generally, the clinical signs and symptoms of compartment syndrome include pain out of proportion to clinical exam, a palpably tense compartment and pain with passive muscle stretch with later symptoms of paresthesia and paresis.^{6,7,21} In addition, compartment syndrome of the upper arm has specific clinical findings depending on the compartment involved. For the anterior compartment, paresthesia may present over the entire forearm and hand with pain in passive elbow extension versus flexion, along with global weakness in the hand and wrist as the radial, median, and ulnar nerves all pass through this compartment. If the posterior compartment is affected, paresthesia exists over the dorsum of the hand and forearm in the radial nerve supplied area and passive elbow flexion is more painful than elbow extension. In addition, adduction, abduction, and extension of the fingers, as well as thumb abduction may all be weak. If the deltoid muscle is involved, there will be a limited range of movement with active shoulder abduction, passive shoulder adduction will be extremely painful and sensation will be decreased over the lateral aspect of the arm.^{17,18,20}

Compartment syndrome can result in ischemia and necrosis by impeding venous outflow initially and finally, arterial flow.^{3,6,7} The normal pressure of a tissue compartment is between 0 and 8 mm Hg. Clinical findings associated with acute compartment syndrome generally correlate with increases in pressure measurements, with capillary blood flow compromise at pressures around 20 mm Hg, pain between 20 and 30 mm Hg, and ischemia at pressures more than 30 mm Hg.^{4,7,22} Muscle damage begins within 4 hours of ischemia and becomes irreversible by 6 hours, making early recognition and intervention particularly important. While early recognition is vital, in the case of our patient, the diagnosis of compartment syndrome was complicated by his increased INR and the diagnosis was confirmed intraoperatively

Conclusion

Although uncommon, compartment syndrome of the upper arm can occur but with timely surgical intervention, permanent damage can be avoided.

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