



## Acute Compartment Syndrome of the Thigh Following Traumatic Quad Tendon Rupture

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### Abstract

Acute compartment syndrome can be a devastating complication associated with significant morbidity in the orthopedic patient. Typically, compartment syndrome is associated with high energy injuries which impart significant damage on the surrounding tissues, but it is important to recognize that compartment syndrome can develop after low energy injuries as well. It is the job of the orthopedic surgeon to maintain a high level of suspicion in order to diagnose and appropriately treat these patients. Our case highlights an atypical presentation of anterior thigh compartment syndrome following an acute quadriceps tendon rupture and addresses the management from diagnosis through treatment.

### Introduction

Acute Compartment Syndrome (ACS) can be a devastating complication associated with significant morbidity in the orthopedic patient. Compartment syndrome occurs when the pressure in a confined space rises, resulting in a reduction of blood flow to the tissues within the space, leading to ischemia, necrosis and functional impairment [1]. ACS is typically associated with high energy injuries, but recent literature has demonstrated a significant proportion of ACS associated with lower energy injuries. Classically the signs of ACS include pain out of proportion to exam and pain with passive stretch, with late findings including pulselessness and paresthesias. Risk factors associated with the development of ACS include anticoagulant use, younger age, polytrauma, altered level of conscious and associated nerve injury. Prompt diagnosis and treatment are paramount as a delay in diagnosis is the main factor associated with significant sequela and treatment failure [1,2].

This article describes the case of a 67 year old man who developed anterior thigh compartment syndrome following an acute quadriceps tendon rupture sustained after a ground level fall [3]. To our knowledge there is only a single case report documenting ACS following a quadriceps tendon rupture, and it is our goal to raise awareness regarding this clinical entity.

### Case Presentation

An obese male with a history of atrial fibrillation on Xarelto 20 mg QD presented to our ED after a ground level fall onto a hyper flexed right knee with thigh pain and inability to ambulate. He was initially evaluated by a non-orthopedic physician and diagnosed with a quadriceps strain, placed in a knee immobilizer and discharged home. He was not evaluated by an orthopedic surgeon on his initial emergency room visit.

The patient returned to the ED the next day with significantly worsening pain, paresthesias, and noted his thigh had become "hard like a rock". On examination the patient appeared uncomfortable and was diaphoretic. Upon evaluation by an orthopedic surgeon he was found to be unable to perform a straight leg raise and had a palpable defect at the superior pole of the patella, and was diagnosed with a quadriceps tendon rupture with suspected complete medial and lateral retinacular tears. Even though we were unable to assess pain with passive stretch due to the disruption of his extensor mechanism there was great concern for acute compartment syndrome of the anterior thigh based on his clinical picture [4]. His anterior thigh was swollen compared to the left, measuring 58 cm compared to 55 cm (both measured 10 cm proximal to the superior pole of the patella). He had developed diffuse bruising over the anterior and anterolateral aspect of his thigh with a firm anterior compartment and little swelling of the medial and posterior compartments. Paresthesias were present over the anterolateral thigh but were neurovascularly intact distally. The decision was made to take the patient to the operative room emergently fasciotomy and possible quadriceps repair.

Prior to the procedure the anterior compartment pressure was measured with the use of a

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Stryker Intra-Compartmental Pressure Monitor System (Stryker, Kalamazoo, Michigan), and found to be 85 mmHg. The diagnosis of compartment syndrome was confirmed and we proceeded with the surgery.

In reference to Kuri et al. [5] we proceeded with a longitudinal midline incision made over the anterior aspect of the knee. Upon incision of the fascia there was a gross extrusion of approximately 500 cc of clot as well as an additional 500 cc of hematoma, significantly decreasing the pressure in the anterior compartment. This fascial incision was then extended proximally to the level of the proximal thigh and distally past the inferior pole of the patella and all remaining hematoma and clot was removed. Further inspection of the anterior compartment revealed an avulsion of the quadriceps tendon off the superior pole of the patella, and no continued source of bleeding was identified. Throughout the case the color, consistency, contraction, and circulation of the quadriceps muscle was continually evaluated. A small portion of the medial VMO was found to be dusky in appearance and was debrided, while the rest of the musculature was deemed viable. We then performed a repair of the quadriceps tendon with #2 fiber wire and bone tunnel construct, followed by repair of the medial and lateral retinacula. Superficial and deep Hemovac drains were placed and the wound was primarily closed and dressed with a negative pressure dressing and placed into a Knee immobilizer.

After the procedure the patient's symptoms of intractable thigh pain had resolved. His post-operative course was uneventful. At 8 month follow up the patient has full active and passive ROM of the right knee 0 to 120 degrees of flexion without extensor lag. There is minimal strength asymmetry between the operative and non-operative knee with mild palpable decrease in muscle bulk most notable over the VMO. The patient was able to ambulate independently without the use of an assistive device.

## Discussion

Acute compartment syndrome of the thigh is a rare clinical entity that is typically seen in high energy injuries with associated femoral shaft fractures [2], but none the less, ACS of the thigh has been shown to occur in lower energy injuries as well. Rupture of the quadriceps tendon is a relatively common injury, but is rarely associated with the development of ACS [3]. To our knowledge there is only a single case report documenting the development of acute anterior thigh compartment syndrome following an acute quadriceps tendon rupture [5]. It is our goal to bring light to this distinct clinical entity as well as highlight patients at risk for developing this complication.

Certain risk factors predispose patients to developing ACS, and in our situation anticoagulant use was a contributing factor. Previously reported risk factors for the development of ACS include direct thigh trauma, anticoagulant use, coagulopathy, older age, neurologic deficit, and crush or vascular injuries [2]. On initial presentation our patient did not demonstrate evidence of compartment syndrome. Over the next 24 h he continued to bleed into his thigh, likely influenced by his anticoagulation use, and presented back to the hospital with an evolving compartment syndrome of the anterior thigh. The posterior and medial compartments remained soft and were seemingly uninvolved which was similar to the previously reported case.

The vascular supply to the anterior knee is derived from the rich anastomotic network formed by the geniculate arteries which are branches off the popliteal artery. No identifiable source of bleeding was found intraoperatively, which supports the idea that a network of smaller vessels were disrupted, and an effective clot was only formed once a significant tamponade was achieved. After decompression and hematoma removal the thigh was soft and the decision was made to perform a tension free closure at the time of surgery. This goes against the traditional thinking that fasciotomies should not be closed acutely, but based on our intraoperative findings and after removal of a large space occupying lesion we felt this to be appropriate. Both the medial and posterior compartments remained soft and were found to have minimal swelling so no intervention was deemed necessary.

Preoperatively, the decision to hold the patient's anticoagulation was clear, but when it is safe to restart is not as clear cut. Based on our experience the patient's chemical anticoagulant was held after his injury and for two weeks following surgery. There is no evidence defining a timeline for restarting anticoagulation following ACS, but our decision was made once the patient's wound showed no drainage and demonstrated minimal and improving clinical swelling of the thigh.

The clinical impact of ACS cannot be understated as compartment syndrome is routinely associated with worse outcomes compared to similar fractures without ACS. Due to this there are also significant medicolegal ramifications for all parties involved. Prompt diagnosis and treatment are paramount, as a delay in diagnosis is linearly related to the value of the indemnity payment and any decompression performed within 8 h was uniformly associated with a successful defense [6]. ACS most commonly is seen in high energy injuries, but this case demonstrates the possibility of ACS developing following lower energy soft tissue injuries in at risk patients.

In conclusion, all consultations for compartment syndrome should be taken seriously. Frequently it is the responsibility of the orthopedic surgeon to appropriately diagnose these injuries, and timely management is essential to improve outcomes and prevent further complications.

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