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Delayed presentation of compartment syndrome of the thigh secondary to quadriceps trauma and vascular injury in a soccer athlete



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ABSTRACT

INTRODUCTION: Compartment syndrome isolated to the anterior thigh is a rare complication of soccer injury. Previous reports in the English literature on sports trauma-related compartment syndrome of the thigh are vague in their description of the response of thigh musculature to blunt trauma, magnetic resonance imaging (MRI) findings of high-risk features of compartment syndrome, vascular injury in quadriceps trauma, and the role of vascular study in blunt thigh injury.

CASE REPORT: We present herein the rare case of a 30-year-old man who developed thigh compartment syndrome 8 days after soccer injury due to severe edema of vastus intermedius and large thigh hematoma secondary to rupture of the profunda femoris vein. MRI revealed “blow-out” rupture of the vastus lateralis. Decompressive fasciotomy and vein repair performed with subsequent split-skin grafting of the wound defect resulted in a good functional outcome at 2-years follow-up.

CONCLUSION: A high index of suspicion for compartment syndrome is needed in all severe quadriceps contusion. Vascular injury can cause thigh compartment syndrome in sports trauma. MRI findings of deep thigh muscle swelling and “blow-out” tear of the vastus lateralis are strongly suggestive of severe quadriceps injury, and may be a harbinger of delayed thigh compartment syndrome.

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1. Introduction

Compartment syndrome of the thigh is an orthopedic emergency whereby increased pressure within a closed osseofascial compartment compromises the circulation, leading to cellular anoxia, muscle ischemia, and death. If compartment syndrome is not recognized or decompressive fasciotomy is delayed, complications such as ischemic contracture, neurologic deficit, infection, and crush syndrome can occur [1]. Hence thigh compartment syndrome can be both limb threatening and life threatening, and necessitates prompt management.

Thigh compartment syndrome is an underrecognized condition, especially in the absence of fracture. Furthermore, because of the large and compliant thigh compartment, presentation of compartment syndrome of the thigh can potentially be delayed. We present the rare case of an athlete who sustained delayed compartment syndrome of the thigh following a soccer injury.

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2. Case report

A 30-year-old man presented with a severe right distal thigh pain and knee swelling of 4 days' duration. He had sustained a direct blow to the right thigh during a soccer game, after which he was able to stand and ambulate. He received no medical attention, and continued playing for 1 h. He had no significant medical history and was not taking any anticoagulant medication. On examination there was mild knee effusion, tenderness was elicited over the superolateral aspect of the patella, and active knee range of motion measured 0–140°. The thigh compartment was soft. Plain radiographs of the right femur and knee were normal. Magnetic resonance imaging (MRI) of the right knee identified only a partial musculotendinous junction tear of the distal fibers of the vastus lateralis muscle. The patient was given analgesia and discharged.

However, 4 days later and without further trauma, the patient experienced severe constant pain in his right thigh. He recalled that the pain had acutely worsened and was not relieved by analgesia on the day prior to admission. He was unable to ambulate on the affected leg, and denied any paresthesia. At presentation the right thigh was tense, swollen, and tender (Fig. 1). The circumference of the right thigh was 8 cm larger than that of the left. Passive knee movement exacerbated the pain in the right thigh. The peripheral pulses were normal and remained symmetric. Neurologic examination of the lower limb was unremarkable. An urgent MRI of the right thigh was performed, which showed a large 11.7 × 7.6 × 6.9-cm hematoma within the swollen vastus intermedius muscle with



Fig. 1. Picture demonstrating a swollen and tense right thigh. It was 8 cm bigger than the left side.

significant surrounding mass effect, and a high-grade tear of the distal half of the posterior fibers of the vastus lateralis muscle (Fig. 2). Computed tomographic (CT) angiography of the lower extremity did not demonstrate active contrast extravasation in the arterial and venous phases.

The patient was taken to the operating room for an emergency fasciotomy using a single lateral thigh incision. The vastus lateralis bulge through the wound and the muscle appeared swollen and contused distally (Fig. 3). Otherwise, the vastus lateralis was viable and reactive. Through the same incision the medial and posterior compartments were evaluated, and were soft and compliant



Fig. 2. MRI of the right thigh (sagittal view) showing grossly swollen vastus intermedeus muscle (small arrows) and a large hematoma displacing surrounding structures (large arrow).

on palpation. Six hundred milliliters of blood was evacuated from the hematoma in the anterior compartment. Continuous venous exudation was evident deep toward the vastus intermedeus. The profunda femoris vein was found to be partially ruptured, and was repaired with Prolene interrupted suture. After irrigation, a vacuum-assisted closure dressing was applied. Fourteen days later, once the swelling in the thigh had reduced, the wound was covered by a split-skin graft. At 2-years follow-up the patient had recovered fully, with no limitation of joint movements or quadriceps weakness.

3. Discussion

Richard von Volkmann first described compartment syndrome in 1881 [2], reporting clinical findings of muscle contracture caused by prolonged muscle ischemia after forearm and supracondylar humeral fractures in children. In general, compartment syndrome is uncommon in the absence of fracture. In the thigh, compartment syndrome is often observed in nonfracture conditions such as gunshot wounds, multiple-trauma accidents, prolonged external compression, lower limb revascularization syndrome, and intramedullary nailing of a closed femur fracture [3]. It is noteworthy that the leading cause of thigh compartment syndrome is sporting injury, which represents the most severe spectrum of quadriceps injury [4]. Unfortunately, thigh pain in athletes is often attributed to quadriceps muscle strain. The diagnosis of thigh compartment syndrome in the absence of fracture is often not considered because of a lack of awareness and inexperience [5]. As a result, the time interval for delayed fasciotomy has been reported to be up to 34 h [4].

To the best of our knowledge, this is the only reported case of delayed presentation of thigh compartment syndrome following quadriceps muscle contusion and hematoma formation secondary to rupture of the profunda femoris vein. Our case also highlights additional issues not covered in previous studies: (1) the response of thigh musculature to blunt trauma; and (2) vascular injury and the role of vascular study in evaluating thigh hematoma.

The quadriceps muscle is commonly injured in sports because of its vulnerable location anterior to the femur. In 1983, Walton et al. first described the effect of external compressive forces to thigh tissues in sheep [6]. The vastus intermedeus, which is attached to the bone, compressed firmly against the femur and sustained the most tissue damage. The lateral forces generated lead to “blow-out” tear in the posterior aspect of the vastus lateralis, and the superficial muscle layer is spared from injury. Our patient sustained blunt trauma to the thigh that resulted in vastus lateralis tear and severe contusion of the vastus intermedeus, which progressively swell up over time and lead to thigh compartment syndrome. This is the first case reported to reproduce the findings of cadaveric animal studies. Such an injury pattern observed on MRI



Fig. 3. An intraoperative photo showing the vastus lateralis bulge through the lateral thigh fasciotomy incision, and the muscle appeared swollen and contused distally.

suggests severe quadriceps damage and edema. Clinicians should monitor patients for impending compartment syndrome in such cases.

To our knowledge, only a few cases of thigh compartment syndrome was related to vascular injury, which include common femoral artery dissection, perforating arterial vessels rupture and pseudoaneurysm involving the descending branch of the lateral circumflex femoral artery [3,7–9]. Our case described rupture of the profunda femoris vein after blunt trauma to the quadriceps muscle. Unfortunately vascular examination might not be reliable to identify either the major artery or vein injury. Vascular imaging is necessary if there is high index of suspicion for vessel injury. Leg venogram or arteriogram remains the gold-standard imaging modality. Alternatively, CT angiography of the lower extremity has high diagnostic accuracy in arterial injury after trauma [10], although it can miss a venous injury, as demonstrated in our case. We emphasize the importance of evaluating for venous injury at the time of surgical exploration when there is high index of suspicion for vascular injury and the CT angiogram is normal.

We agree with the recommendation by Rooser et al. that athletes who sustain blunt thigh trauma should stop ongoing activity for at least 1 week even if the primary injury is of moderate degree [11]. Persistent muscle activity increases blood flow, further raising the compartmental volume and aggravating intramuscular bleeding. The fibrinolytic activity in the hematoma could also promote persistent bleeding and hematoma expansion, and may explain the delayed presentation observed in our patient [8]. We suggest serial examination of thigh circumference to monitor progression as hematoma may enlarge and compartment syndrome may present after some delay.

4. Conclusion

Most athletes will suffer thigh contusion of varying degrees from sporting trauma, and conservative management is often adequate. Our case highlights the difficulty of differentiating severe quadriceps contusion from thigh compartment syndrome. The absence of a fracture should not mislead the diagnosis. It is important to consider compartment syndrome in severe quadriceps contusion. Vascular examination and continual surveillance should be conducted for patients at high risk of delayed compartment syndrome. MRI findings of deep thigh muscle swelling and “blow-out” tear of the vastus lateralis are strongly suggestive of severe quadriceps injury, and may be a harbinger of delayed thigh compartment syndrome.

Conflict of interest

No conflicts of interest.

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Ethical approval

Ethical committee has approved the case report study.

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Consent

Identifying details are omitted in the manuscript for publication. Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

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Group 1 - Conception and design, acquisition of data, analysis and interpretation of data.

Group 2 - Drafting the article, critical revision of the article.

Group 3 - Final approval of the version to be published.

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Guarantor

The Corresponding author is the guarantor of submission.

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