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Non-Hodgkin Lymphoma Presenting as Atraumatic Thigh Compartment Syndrome

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Background	Thigh compartment syndrome (TCS) is a rare clinical entity characterized by elevated intracompartmental pressure leading to vascular compromise and tissue ischemia with the affected thigh compartments. Atraumatic TCS is extremely rare.
Summary	This report describes a unique case of atraumatic TCS secondary to occult non-Hodgkin lymphoma (NHL), presenting as an acute-on-chronic process. A comprehensive review of the literature regarding other recognized etiologies of atraumatic TCS is also provided.
Conclusion	In patients presenting with atraumatic TCS, a high index of suspicion for underlying lymphoma is warranted, particularly when accompanied by B symptoms, including fever, night sweats, and unintentional weight loss exceeding 10% of baseline body weight within six months.
Key Words	tension physiology, thigh compartment syndrome; occult lymphoma; intracompartmental pressure

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Case Description

Compartment syndrome, initially described by Richard von Volkman in 1881, is a clinical entity characterized by elevated pressure within a confined osteofascial compartment, leading to compromised vascular perfusion and subsequent tissue ischemia.[1] Left untreated, this condition can result in permanent muscle and/or nerve damage, potentially culminating in amputation, acute kidney injury, and death.[2] Compartment syndrome of the thigh in particular is a rare entity, with atraumatic etiologies being exceedingly uncommon.[3] Such unusual presentations pose a diagnostic challenge and can delay appropriate management of the underlying cause(s). We report the first case of atraumatic thigh compartment syndrome secondary to an aggressive lymphoma in an adult patient.

A 52-year-old male with a medical history of congenital lumbar spinal stenosis complicated by right L4 nerve root compression and an ongoing 7 pack-year smoking history, presented to the emergency department with a six-month history of progressive swelling and pain in the right anterolateral thigh. Initially attributed to radiculopathy by his primary care provider, the pain became too intense for outpatient management, prompting emergency evaluation. The patient was otherwise healthy and denied recent trauma, surgical intervention, prolonged immobilization, or strenuous exercise. Physical exam (PE) was significant for a firm, edematous right anterolateral thigh that was painful to palpation, without erythema, fluctuance, or overt signs of trauma. The medial and posterior thigh compartments as well as the lower leg compartments were soft and nontender. Lower extremity pulses were normal. Laboratory investigations, including complete blood count, basic metabolic panel, lactic acid, creatinine kinase, and coagulation studies, were within normal limits. Lower extremity ultrasonography excluded deep vein thrombosis (DVT). Computed tomography angiography demonstrated asymmetric circumferential prominence and heterogeneity of the right deep thigh musculature, but failed to identify a discrete mass or tumor. Intracompartmental pressure measurements, obtained using a Stryker pressure monitor, revealed 53 mmHg in the anterior compartment, and less than 10 mmHg in the medial and posterior compartments. The patient's diastolic blood pressure was 72 mmHg.

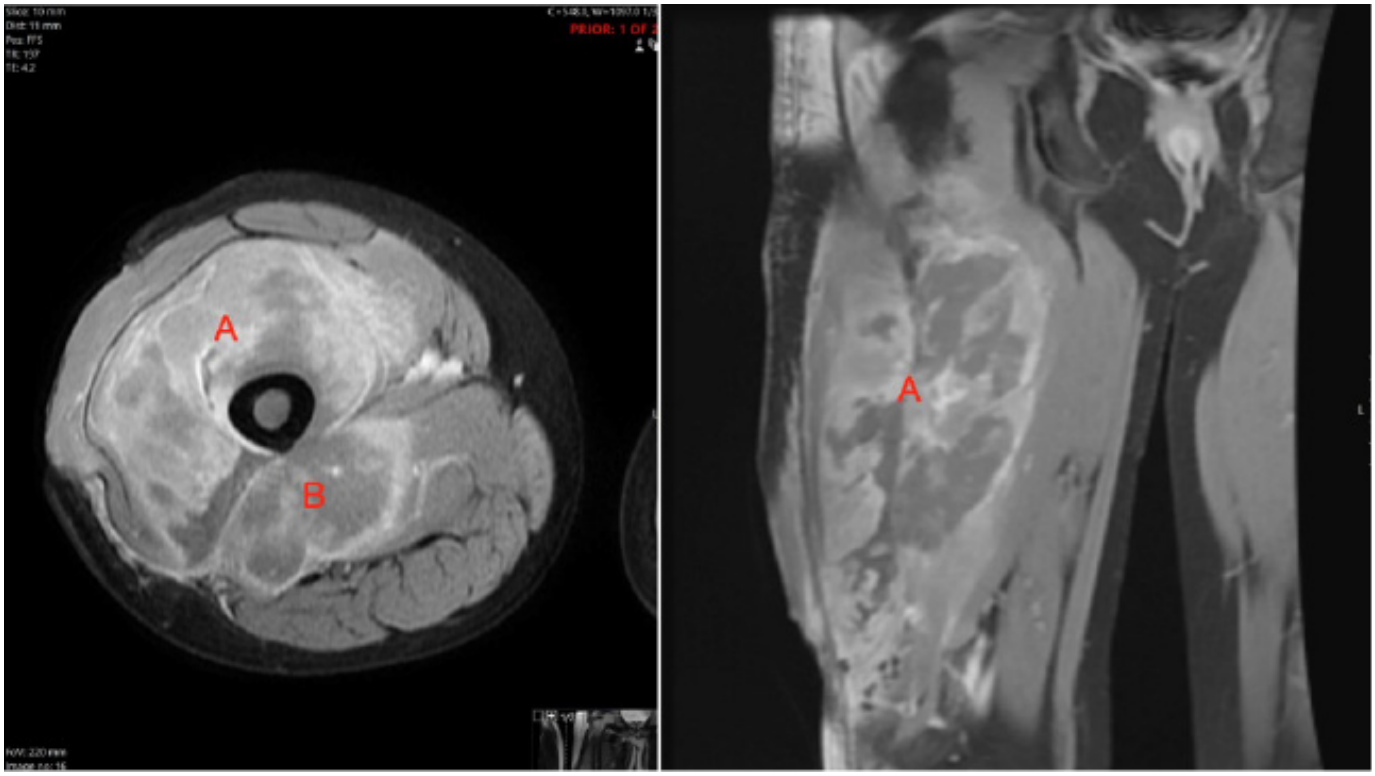
Based on the clinical findings and significantly elevated anterior thigh compartment pressure, the decision was made to proceed with emergent thigh fasciotomy. A longitudinal lateral thigh incision was made, and upon entry into the anterior compartment, immediate bulging of the vastus lateralis muscle was observed (Figure 1). Complete decompression of the anterior compartment was achieved, revealing viable musculature without evidence of fluid collection or mass. The posterior and medial compartments were not explored.

Figure 1. Axial CT Scans. Published with Permission

Intraoperative photograph demonstrating bulging of the vastus lateralis muscle following fasciotomy of the right anterior thigh compartment, indicative of significant compartment pressure

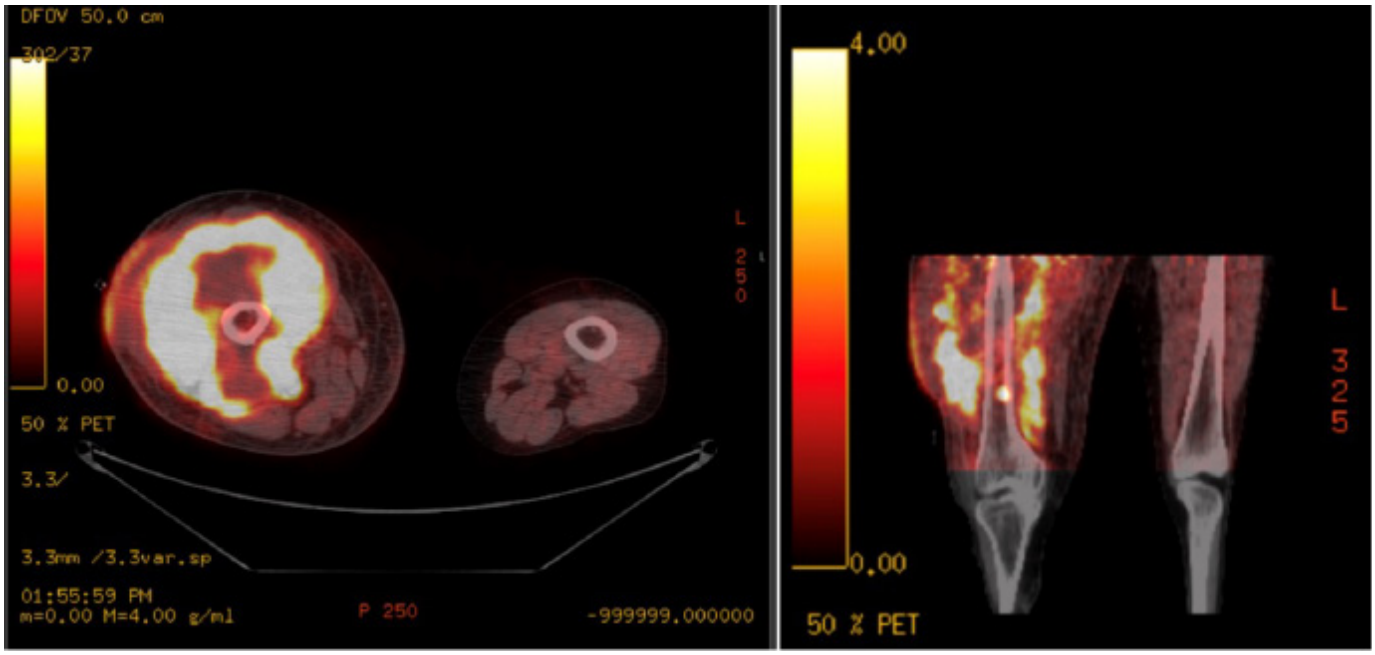
In the postoperative period, a comprehensive review of systems, facilitated by a licensed Spanish interpreter, revealed headaches, weight loss, and night sweats. MRI of the right thigh demonstrated a large, infiltrative mass originating from the right femoral shaft and extending into the anterior and posterior thigh compartments (Figure 2). Right inguinal adenopathy, small bony lesions of the femoral neck and posterior acetabulum, and abnormal marrow signal throughout the right femoral shaft were also noted. Staging CT and PET scans revealed a large heterogeneous mass in the right thigh, extending into the distal femur and knee joint, with bulky lymphadenopathy and heterogeneous mixed lytic and sclerotic changes of the right humerus, exhibiting intense fluorodeoxyglucose (FDG) uptake (Figure 3).

Figure 2. MRI of Right Thigh Demonstrating Infiltrative Mass. Published with Permission



*Axial and coronal T2-weighted magnetic resonance imaging of the right thigh revealing a large, infiltrative mass originating from the right femoral shaft and extending into the **(A)** anterior and **(B)** posterior thigh compartments.*

Figure 3. PET-CT Imaging for Lymphoma Staging. Published with Permission



Axial and coronal PET-CT images of the bilateral thighs demonstrating an intensely fluorodeoxyglucose (FDG)-avid mass in the right thigh, extending into the distal femur and knee joint.

The dominant mass was biopsied, and pathology revealed an aggressive B-cell NHL. Chemotherapy and prophylaxis for tumor lysis syndrome were initiated, and a vacuum-assisted closure (VAC) was applied to the right thigh incision. The patient's hospital course was complicated by bilateral DVT, cellulitis of the right lower extremity and scrotal region, and COVID-19 infection. Approximately three months after diagnosis of lymphoma and three cycles of chemo-therapy, the patient returned to his home country in South America to be with his children, where he subsequently died due to limited access to healthcare.

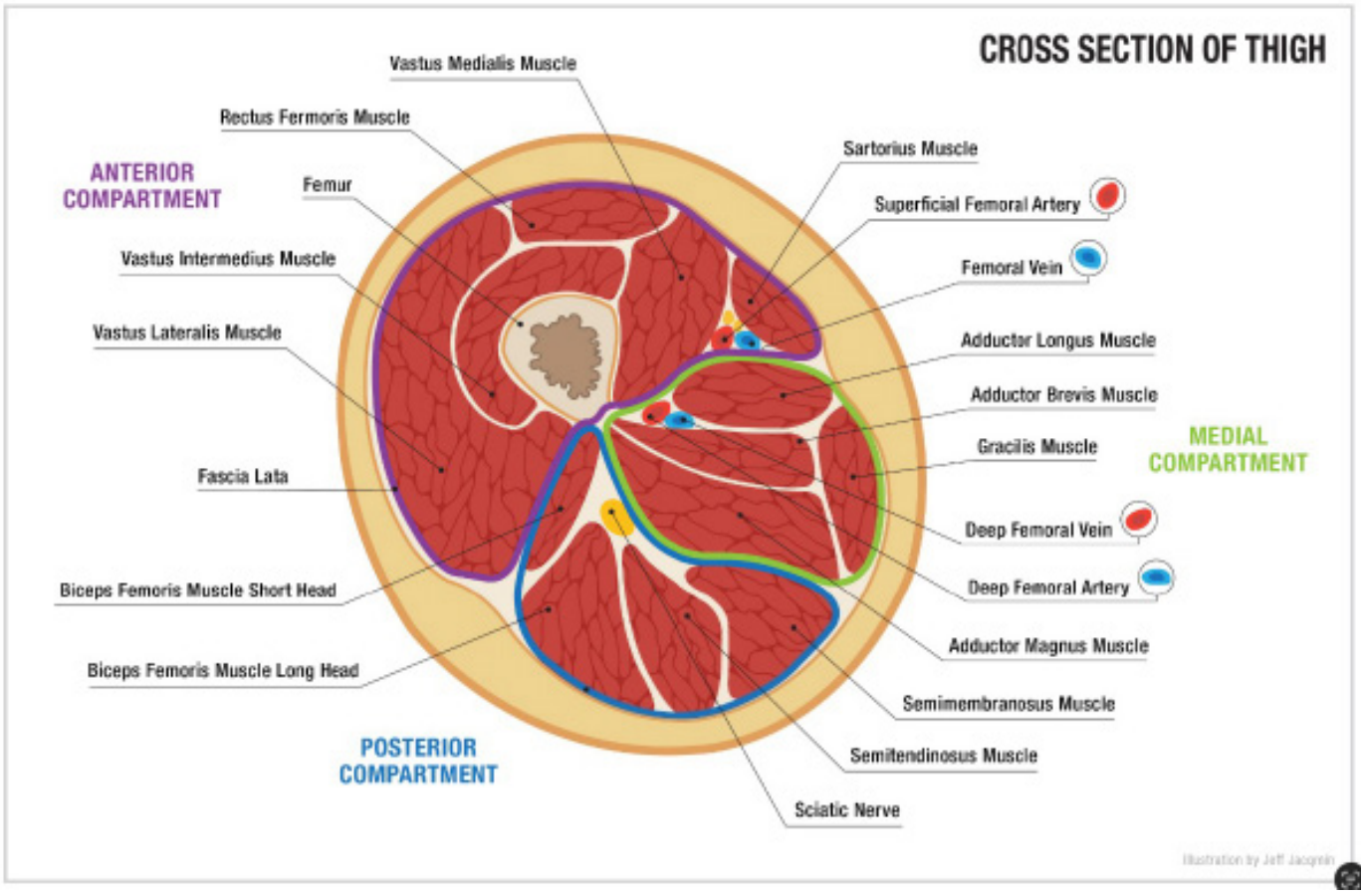
Discussion

The diagnosis of compartment syndrome relies primarily on clinical assessment, characterized by pain, firm edema, and potentially paresthesias, paralysis, and pulselessness. When PE findings are equivocal, intracompartmental pressure measurements are indicated. A pressure exceeding 30 mmHg or a differential pressure within 30 mmHg of the diastolic blood pressure are suggestive of impaired perfusion. While the calf is the most frequently affected anatomical location, compartment syndrome has been described in diverse regions, including the buttocks, thigh, foot, scrotum, abdomen, shoulder, forearm, hand, orbit, and paraspinal compartments.[1,4-7]

Thigh compartment syndrome (TCS) represents a rare entity due to the inherent distensibility of the thigh's fascial compartments and their capacity to accommodate significant increases in intracompartmental volume.[8] The thigh has three muscular compartments: anterior, posterior, and medial (Figure 4).

The anterior compartment is most frequently involved in TCS, whereas the medial compartment is least susceptible. Specific PE findings that may be seen with anterior compartment syndrome include pain exacerbated by passive flexion of the knee (stretching the quadriceps musculature), weakness of knee extension, and numbness along the medial knee and lower leg (saphenous neuropraxia). As

Figure 4. Anatomical Cross-Section of the Thigh Compartments. Published with Permission



Transverse anatomical illustration of the thigh, delineating the anterior, posterior, and medial compartments.

with all compartment syndromes, definitive management entails operative decompression by fasciotomy. Intraoperative confirmation of the diagnosis is achieved by observing muscle bulging upon compartment release. To perform a thigh fasciotomy for anterior compartment decompression, a generous longitudinal lateral incision is made in the mid-axillary line, with subsequent incision of the iliotibial band and the fascia of the vastus lateralis. Posterior compartment decompression is accomplished by medial reflection of the vastus lateralis muscle, exposing and incising the lateral intermuscular septum.[3]

Given the relative infrequency of acute compartment syndrome in the medial thigh, intracompartmental pressure measurements are recommended prior to medial compartment fasciotomy. A second incision overlying the adductor muscle group is used for medial thigh compartment decompression.

Trauma remains the predominant etiology of TCS;[3,9-11] consequently, traumatic injury often serves as a cue to clinicians to consider the possibility of compartment syndrome. However, the absence of trauma may obscure the diagnosis of TCS and delay identification of its underlying cause. Atraumatic etiologies, as described in a recent comprehensive review of TCS cases, include strenuous exercise, suboptimal surgical positioning, anticoagulation, thrombolysis, DVT, and snake envenomation.[11] Furthermore, prolonged immobilization secondary to drug intoxication is increasingly recognized as a significant cause of TCS.[12] There has been no report of TCS due to lymphoma.

Diagnostic challenges include potential provider bias regarding the anatomical distribution of compartment syndrome. Language barriers, as previously reported in a case of alcohol-induced TCS in an Asian patient,[13] necessitate meticulous history acquisition to guide early workup. In cases of occult lymphoma, a comprehensive history should include assessment for B symptoms (fever, night sweats, and unintentional weight loss exceeding 10% of body weight over six months).[6-8] When the etiology remains unclear and B symptoms are present, imaging is valuable not only for diagnostic but for preoperative planning purposes. Iatrogenic tumor lysis syndrome has been reported post debridement and fasciotomy for acute compartment syndrome of the calf secondary to lymphoma, initially misdiagnosed as unspecific fasciitis and myositis.[15]

While this report represents the first case of lymphoma-induced TCS, lymphomas have been implicated in compartment syndrome of the calf, abdomen, forearm, and bilateral orbits.[5,15-21] Furthermore, sarcomas have also been documented as causative agents in acute compartment syndromes of the calf and forearm.[22-25]

Conclusion

This case report presents a unique instance of TCS resulting from an uncommon, atraumatic etiology. In patients presenting with TCS accompanied by B symptoms, occult lymphoma should be included in the differential diagnosis.

Lessons Learned

Barriers to diagnosis of atraumatic TCS secondary to lymphoma include provider bias regarding the presence of TCS, language barriers, and incomplete history acquisition. In this case, the etiology of the patient's TCS remained indeterminate at the time of surgery. Only after retrospective review of systems and re-evaluation of the initial CT scan did we come to suspect malignancy as the most plausible cause of his compartment syndrome. Without this thorough reassessment, the diagnosis would have been missed. Failure to recognize this underlying etiology may lead to surgically-induced tumor lysis syndrome and delays in oncologic intervention.

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