World Journal of Orthopedics

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World J Orthop 2023 July 18; 14(7): 582-588

DOI: 10.5312/wjo.v14.i7.582

ISSN 2218-5836 (online)

CASE REPORT

Isolated lateral leg compartment syndrome: A case report

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Specialty type: Orthopedics

Provenance and peer review: Unsolicited article; Externally peer reviewed.

Peer-review model: Single blind

Peer-review report's scientific quality classification

Grade A (Excellent): 0
Grade B (Very good): 0
Grade C (Good): C, C
Grade D (Fair): 0
Grade E (Poor): 0

P-Reviewer: Lee YK, South Korea; Murdoch MM, United Kingdom

Received: February 10, 2023
Peer-review started: February 10, 2023
First decision: April 13, 2023
Revised: April 25, 2023
Accepted: April 27, 2023
Article in press: April 27, 2023
Published online: July 18, 2023

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Abstract

BACKGROUND

Acute leg compartment syndrome is a well-known orthopedic emergency associated with potentially devastating consequences if not treated immediately. Multiple compartments are usually involved with a clear history of trauma and classic symptoms and signs. However, isolated lateral leg compartment syndrome is relatively rare and is often misdiagnosed due to the atypical presentation of no trauma and the lack of pathognomonic signs.

CASE SUMMARY

A 31-year-old male patient presented to our emergency room with excruciating left calf pain and inability to mobilize one-day after participating in a football match despite no clear history of preceding trauma. The patient went to another hospital before presenting to us where he was diagnosed to have a soft tissue injury and was discharged home on simple analgesics. On clinical examination, the left leg showed a tense lateral compartment with severe tenderness. The pain was aggravated by dorsiflexion and ankle inversion. Neurovascular examination of the limb was normal. We suspected a compartment syndrome but as the presentation was atypical and an magnetic resonance imaging (MRI) was readily available in our institution, we immediately performed an MRI and this confirmed a large hematoma in the lateral compartment with a possible partial proximal peroneus longus muscle tear. The patient was taken immediately for an emergency open fasciotomy. The patient is now 18 mo postoperatively having recovered completely and engages fully in sports with no restrictions.

CONCLUSION

Atypical presentation due to the lack of pathognomonic signs makes the diagnosis of isolated lateral leg compartment syndrome difficult. Pain on passive inversion

and dorsiflexion and weak active eversion may be suggested as sensitive signs.

Key Words: Isolated; Lateral compartment; Peroneal compartment; Atraumatic compartment syndrome; Case report

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Core Tip: Atraumatic isolated lateral leg compartment syndrome is rare and constitutes a diagnostic challenge due to the atypical presentation and lack of pathognomonic signs. It should be considered even in the context of atraumatic events. Pain on passive inversion and dorsiflexion and weak active eversion may be suggested as sensitive signs. Drop foot is a delayed presentation as a result of deep peroneal nerve involvement. A high index of clinical suspicion is the key to early diagnosis and timely surgical intervention.

Citation: Alrayes MM, Alqudah M, Bani Hamad W, Sukeik M. Isolated lateral leg compartment syndrome: A case report. *World J Orthop* 2023; 14(7): 582-588
URL: https://www.wjgnet.com/2218-5836/full/v14/i7/582.htm
DOI: https://dx.doi.org/10.5312/wjo.v14.i7.582

INTRODUCTION

Compartment syndrome of the leg is a well-known orthopedic emergency. It usually involves the anterior compartment of the leg or multiple compartments. However, isolated lateral (also known as peroneal) leg compartment syndrome is rare and may be caused by a traumatic or atraumatic (exertional) event[1,2]. In these cases, the peroneus longus muscle is typically affected and the accompanying hematoma is presumed to be the reason for the intracompartmental pressure rise[3]. Early diagnosis can be challenging especially in atraumatic events due to the atypical presentation. Hereby, we present a case of an isolated lateral leg compartment syndrome in the context of an atraumatic event. Additionally, we performed a comprehensive review of all reported cases of acute atraumatic isolated lateral leg compartment syndrome.

CASE PRESENTATION

Chief complaints

A 31-year-old male patient with no past medical history presented to our emergency room (ER) with severe left calf pain and inability to walk after participating in a football game the preceding day despite no clear history of trauma.

History of present illness

The patient went to another hospital on the same day of the injury and was diagnosed to have a soft tissue injury and got reassured and discharged home on simple analgesics. The following day, the patient presented to our hospital as the pain was worsening and became intolerable.

Physical examination

On examination, the patient was in excruciating pain, his vitals were normal, and his left leg showed a tense lateral compartment with severe tenderness. The overlying skin was normal, and no bullae were seen. The pain was aggravated by dorsiflexion and ankle inversion. Distal pulses were intact, and the neurological status was normal.

Laboratory examinations

Laboratory tests were normal.

Imaging examinations

X-rays were normal. As magnetic resonance imaging (MRI) is readily available at our institution, it was performed immediately without any delay and showed diffuse abnormal signals over the lateral compartment indicating a large hematoma in the lateral compartment with a possible partial proximal peroneus longus muscle tear (Figure 1).

FINAL DIAGNOSIS

Acute isolated lateral leg compartment syndrome was diagnosed based on the clinical picture and the MRI findings which was further confirmed intraoperatively.

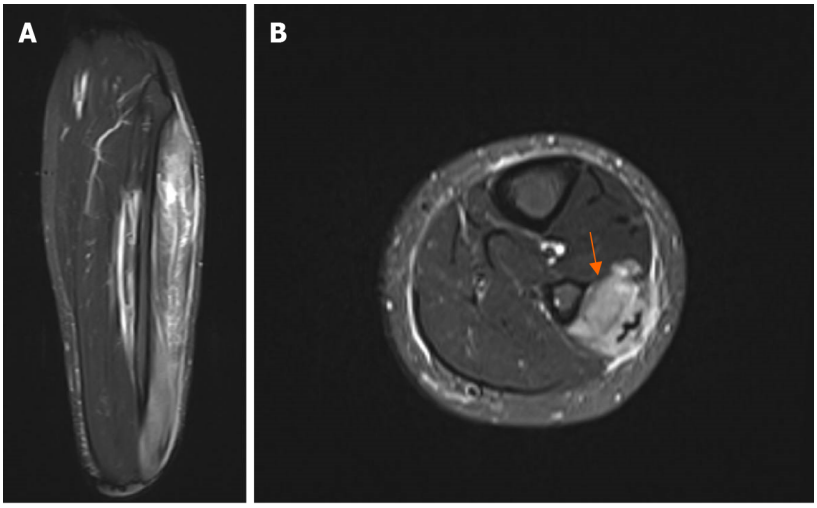

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Figure 1 Magnetic resonance imaging of the left leg. A: Coronal view demonstrating diffuse abnormal signals over the left lateral compartment; B: Axial view, showing possible proximal partial tear of the peroneal muscle as indicated by the orange arrow.

TREATMENT

The patient was taken directly to the operating room (OR) for an emergency open fasciotomy. In the OR, a longitudinal incision over the lateral compartment was made extending from the fibula down to the lateral malleolus. Immediate relief and bulging of the underlying muscles which were under significant pressure was noted. Most of the hematoma was seen at the proximal and distal thirds of the compartment and surrounding the peroneus longus muscle but there was no active bleeding seen. The entire compartment was successfully decompressed. The muscles appeared dusky in color and edematous and were slow to respond to stimulation with diathermy initially but towards the end of the operation, they recovered fully with no evidence of muscle damage or necrosis. A washout of the entire area was performed. As the skin was healthy and other compartments were not affected, the skin edges were approximated and the wound closed primarily but avoiding any tight closure. The patient recovered well and was discharged home the following day after the operation.

OUTCOME AND FOLLOW-UP

The patient is now 18 mo postoperatively having recovered completely and engages fully in sports with no restrictions.

DISCUSSION

Anterior or multiple compartments syndrome of the leg is common and well documented in the literature. However, acute isolated lateral leg compartment syndrome is rare with a variety of etiologies, presentations, symptoms, and signs reported in the literature. Hence, we performed a comprehensive literature review using PubMed to summarise all reported cases. The following keywords were searched: [(lateral compartment) OR (peroneal compartment)] AND (isolated compartment syndrome). The relevant literature was carefully studied and the results were summarized in Table 1. Forty-seven papers were identified but only 12 were relevant and thus included.

Acute compartment syndrome commonly occurs shortly after substantial trauma in long bone fractures[4,5]. However, it could also arise as a result of minimal trauma or atraumatic events[2]. Isolated lateral leg compartment syndrome has been linked to atraumatic events and atypical presentations in 12 papers reporting 14 cases. Two interesting cases have linked atypical events to the development of isolated lateral compartment syndrome of the leg; wearing high heels without any obvious history of trauma[6] and using excessively tight compression stockings for DVT prophylaxis during surgery[7]. Additionally, other preceding events reported include playing football[2,8-12], basketball[9], running[13], dancing[14], and forced marching[15]. Hypothetically, any reduction of the compartment volume or increase in the amount of fluid present inside the compartment will lead to an elevation of the osseofascial compartment pressure which may result in reduction of the perfusion gradient across tissue capillaries. This leads to cellular anoxia and muscle ischemia resulting in the development of compartment syndrome[4,16]. The incidence is believed to be greatest in young men who have a larger muscle mass at this age contained within the restricted fascia[5,17]. This goes along with what we found in our review in which the mean age of the cases at presentation was 27 years and most cases occurred in males, with a male to female ratio of 7:1.

Table 1 A summary of the 12 included papers reporting on 14 cases of atraumatic isolated lateral leg compartment syndrome

Ref.	Age	Gender	Site	Presentation	Preceding event	Comorbidities	Intercompartmental pressure	Management	Other
[6]	Mid 30s	F	R	Atraumatic, painless ankle swelling and footdrop 1 d prior to presentation	Wearing high heels, no history of trauma	Obese, bipolar on lithium	Lateral compartment pressure 92 mmHg	Anterior and lateral compartment fasciotomy; significant muscle necrosis lateral compartment	-
[7]	44	M	R	Severe pain lateral aspect of the lower extremity and loss of protective sensation over the dorsolateral aspect of the foot	Excessively tight compression stockings used for DVT prophylaxis post surgery	Obesity, atrial fibrillation, congestive heart failure, obstructive sleep apnea, and obesity	Lateral compartment pressure 122 mmHg	Lateral compartment fasciotomy and delayed closure with a split-thickness skin graft	-
[9]	21	M	R	Mild pain in the lower leg and drop foot	Basketball, no history of trauma	Medically free	Anterior compartment pressure 42; lateral compartment pressure 120 mmHg	Lateral compartment fasciotomy closed primarily then reopened next day due to recurrent pain and raised intercompartmental pressure underwent delayed closure after 14 d	Peroneus longus found completely detached from its proximal origin
	16	M	R	Swelling, pain and numbness in the leg	Football, no history of trauma	Medically free	Lateral compartment pressure 100 mmHg, anterior compartment pressure 42 mmHg	Lateral compartment fasciotomy, with delayed closure	Peroneus longus found completely detached from its proximal origin
[2]	34	M	R	Dorsal foot numbness and burning pain, excruciating lateral leg pain and persistent but not severe swelling of the leg	Football, no history of trauma	Medically free	Lateral compartment pressure 130 mmHg	Lateral compartment fasciotomy	Peroneus longus partially exhibited a burgundy discoloration
[13]	33	M	R	Excruciating lateral leg pain, numbness and tingling dorsum of the foot	Noncontact injury with forceful inversion of the ankle while running on uneven ground	Not reported	Lateral compartment pressure 120 mmHg	Lateral compartment fasciotomy with delayed closure	Hematoma at the musculotendinous junction of the peroneus longus
[1]	27	M	L	Pain and tightness along the lateral aspect of the leg and swelling; passive foot inversion produced significant pain in the ankle and lateral leg	Noncontact inversion ankle injury during practice	Not reported	Lateral compartment pressure 115 mmHg anterior compartment pressure 5 mmHg	Lateral compartment fasciotomy	Peroneus longus belly initially dusky in color and edematous but no evidence of muscle rupture or hematoma
[12]	25	M	L	Lateral ankle pain rapidly increasing in intensity and spreading to the leg, lateral malleolus edema and severe pain with foot inversion and weakness on foot eversion	Football, inversion ankle injury	Not reported	Lateral compartment pressure > 130 mmHg	Lateral compartment fasciotomy	Partial muscle necrosis with proximal rupture of the peroneus longus muscle
[15]	21	M	R	Severe lateral leg pain, decreased	Two- mile mark of a 12-	Not reported	Lateral compartment pressure > 130 mmHg	Lateral compartment fasciotomy with	-

				range of motion of the foot and paresthesias over the dorsum of the foot, peroneal pain on passive inversion of the subtalar joint	mile forced-march			delayed closure	
	24	M	L	Pain and tenderness over the lateral aspect of the leg, tense peroneal compartment and pain on passive stretch of the peroneal muscles with inversion of the foot. Reduced sensation to pin-prick in the first web space	18-km cross-country march	Not reported	Lateral compartment pressure 130-140 mmHg	Lateral compartment fasciotomy with delayed closure	-
[10]	17	M	R	Anterolateral leg pain, swelling and numbness in the lateral leg and dorsal foot	Football practice, no history of trauma	Medically free	Lateral compartment pressure 44 mmHg anterior compartment pressure 26 mmHg	Anterolateral fasciotomy; lateral compartment was under severe pressure, vac pump applied, returned to OR after 2 d	At 2 d, peroneus longus necrotic and noncontractile with tendon detachment proximally
[11]	29	M	R	Extreme pain, paresthesia and decreased sensation in the second web space with extreme tenderness over the proximal lateral compartment	Touch football, insignificant twisting of the knee while warming up	Not reported	Lateral compartment pressure 55 mmHg Anterior compartment pressure 20 mmHg	Lateral compartment fasciotomy with delayed closure	Ischemic muscles in the lateral compartment and small bleeding vessel in the mid portion of the muscle
[14]	25	F	R	Pain distal to the fibular head, difficulty to walk, calf swelling and spasms	Inversion ankle injury while dancing	Medically free	Lateral compartment pressure 70 mmHg	Lateral compartment fasciotomy with delayed closure	50% of the lateral compartment muscles necrotic
[8]	28	M	R	Pain and paresthesia, tense swelling in the lateral compartment with extreme pain to passive stretching of the compartment	Football, no history of injury	Medically free	Lateral compartment pressure 122 mmHg	Lateral compartment fasciotomy	-

DVP: Dose-volume parameter; OR: Operating room.

Acute compartment syndrome is usually diagnosed clinically with pain, pallor, paresthesia, paralysis, and pulselessness as classic symptoms and signs[4,18]. However, the diagnosis of acute isolated lateral leg compartment syndrome in specific is quite challenging due to the lack of characteristic clinical symptoms and signs. Thus, it is often missed or delayed[9]. Persistent or worsening pain following a minor injury or exertion is often described and the initial physical findings are usually nonspecific. A marked increase in pain with passive inversion, dorsiflexion, and weak active eversion of the ankle have been commonly reported among most cases and may be suggested as sensitive signs for the diagnosis of the lateral compartment syndrome of the leg. In cases that present late or where the diagnosis is initially missed, there is often common and/or deep peroneal nerve palsy which causes paresthesia or if severe enough leads to foot drop as reported by Hiramatsu *et al*[9].

The use of other diagnostic methods besides good history and physical examination such as intracompartmental pressure measurement may be beneficial when the physical exam is equivocal or in unconscious patients[4,18]. In our review, all authors have measured the compartmental pressures of the different compartments to confirm the diagnosis, and the lateral compartment pressure was particularly elevated with a mean pressure of 106 mmHg among the 14 cases. In our case, we did not measure the intracompartmental pressures as the clinical picture of the patient alongside the MRI report were sufficient to decide that surgery is warranted. However, we agree that measuring the pressures would have confirmed the diagnosis and this could be considered as a potential limitation in our workup despite no delays to surgery

or resultant adverse outcomes.

Prompt diagnosis and immediate surgical decompression of compartment syndrome are necessary to prevent permanent impairment[19]. As seen in the majority of cases reviewed in the literature, partial or complete injury to the peroneus longus muscle and the subsequent hematoma were the culprit for the isolated elevation of the lateral compartment pressure of the leg[3]. Interestingly, none of the cases included in the literature review reported any history of trauma or direct injury[1,2,14,15,6-13]. Hence, we presume that the pathophysiological process causing the detachment of the proximal origin of the peroneus longus muscle is an overuse or repetitive extensive eccentric muscular contraction against the floor during inversion of the subtalar joint. Interestingly, despite the late presentation of our patient at 24 h after playing football, he recovered well with no residual deficit. This may be attributed to him developing gradual increased pressures at the time when he presented to the other hospital and over the following hours prior to attending our hospital but reaching the threshold to having significant compartment syndrome only recently prior to his presentation to our ER.

Other principles of acute compartment syndrome management can be applied in isolated lateral compartment syndrome as well such as debridement of all nonviable tissues, delayed surgical site closure if needed, close postoperative monitoring, and pain control.

CONCLUSION

Acute isolated lateral leg compartment syndrome is rare and constitutes a diagnostic challenge. It can be missed easily due to the atypical presentation and the lack of diagnostic symptoms and signs. It should be considered even in the context of atraumatic events. Pain on passive inversion and dorsiflexion and weak active eversion may be suggested as sensitive signs. Drop foot is a delayed presentation as a result of deep peroneal nerve involvement. A high index of clinical suspicion is the key to early diagnosis and timely surgical intervention.

FOOTNOTES

Author contributions: Alrayes MM and Alqudah M contributed to manuscript writing, and literature search; Bani Hamad W contributed by providing and reviewing the radiological content; Sukeik M was the primary surgeon of the case and contributed to scientific content, paper revision, editing, and overall supervision.

Informed consent statement: Informed consent was obtained from the patient for the publication of this report and any accompanying images.

Conflict-of-interest statement: The authors declare that they have no conflict of interest.

CARE Checklist (2016) statement: The authors have read the CARE Checklist (2016), and the manuscript was prepared and revised according to the CARE Checklist (2016).

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S-Editor: Chen YL
L-Editor: A
P-Editor: Yuan YY

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