

Acute compartment syndrome of the thigh complicated with a pseudoaneurysm of the arteria profunda femoris

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Compartment syndrome of the thigh and a pseudoaneurysm of the arteria profunda femoris are rare entities that usually occur independently. Untreated, both can lead to life-threatening complications making prompt diagnosis and management mandatory.

The diagnosis of an acute compartment syndrome can be suspected clinically, and subsequently needs to be confirmed by intra-compartmental pressure measurement. Treatment should be done by urgent fasciotomy within 6 hours.

A pseudoaneurysm can also be suspected clinically. Various imaging modalities exist to confirm the diagnosis, with duplex ultrasound being the diagnostic test of choice. Treatment is depending on the importance of clinical symptoms and on the size of the pseudoaneurysm.

We present the first case in which an acute compartment syndrome of the thigh was complicated by a pseudoaneurysm of the arteria profunda femoris. The pseudoaneurysm was subsequently complicated by hemorrhage and infection.

Keywords: case report, acute compartment syndrome, arteria profunda femoris, thigh, trauma.

INTRODUCTION

Acute compartment syndrome and pseudoaneurysms are both medical entities that can be life threatening and need adequate treatment. Although trauma is the most common cause for both entities, they often occur independently from each other. However, in rare cases, acute compartment syndrome can arise as a complication of a pseudoaneurysm and vice versa¹⁻³.

We will describe the first case of an acute compartment syndrome, occurring after blunt trauma, being complicated with a pseudoaneurysm of the arteria profunda femoris which itself was complicated with hemorrhage and infection.

CASE REPORT

A 27-year-old man came in with acute pain and swelling in the right upper leg, following a blunt trauma while playing soccer. Clinically, there was substantial swelling of the anterior compartment, very painful passive mobilization, and an inability to actively flex the knee. The neurovascular examination was normal. Past medical history was, apart from an

anterior cruciate ligament repair on the same side two years before the trauma, blank.

The X-ray showed no signs of fracture, and blood sampling showed a creatinine kinase value of 288 U/L (normal range 46 to 171 U/L). Pressure measurement at rest of the anterior compartment was 85mmHg. The diagnosis of an acute compartment syndrome was made, and an urgent fasciotomy of the anterior and posterior compartments was performed. The wound was left open with a viscous pattern of vessel loops and staples.

Two days after the procedure, the swelling was clearly reduced so that the tightening of the vessel loops could be started.

However, the following day, severe arterial bleeding occurred from the wound. An ultrasound of the right upper leg did not reveal an organized hematoma. Computed tomography angiography of the abdomen and lower extremities was performed to detect any bleeding site. No occlusion was found in the abdominal aorta, iliac, femoral, and popliteal vessels. Posterolateral in the proximal right thigh, a polylobular contrast staining was seen between the vastus lateralis and hamstrings (figure 1). This had a length of 2.8cm with no increase in volume in the late phase, but a decrease

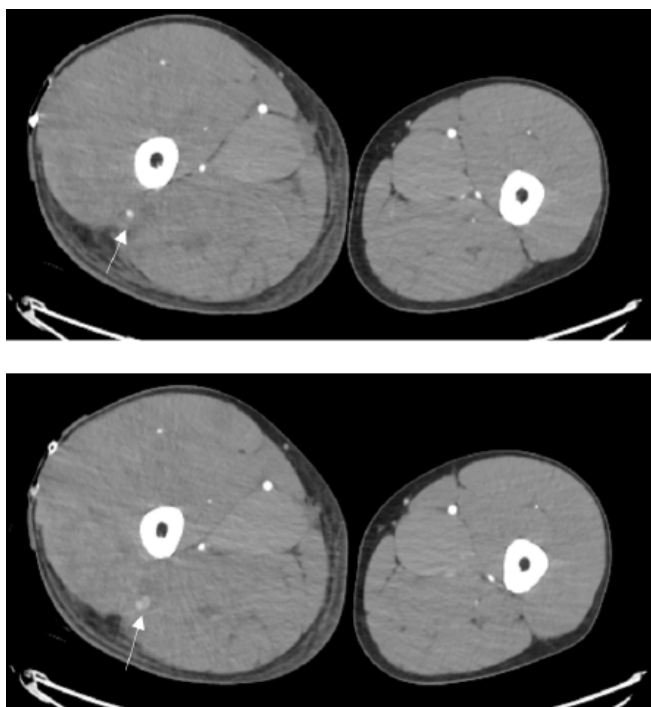


Figure 1. — Computed tomography angiography of the abdomen and lower extremities showing a polylobular contrast staining (arrow) in the posterolateral right thigh, suggestive for a pseudoaneurysm of the arteria profunda femoris.

in density, which was suggestive for a pseudoaneurysm of the arteria profunda femoris. Furthermore, no active arterial bleeding was detectable.

The pseudoaneurysm was treated the next day by embolization using 2x2 hilal coils and gel foam.

Since the patient had a normal postoperative recovery, the vessel loops could be tightened progressively.

Six days after embolization, the remaining hematoma could be drained, and the fasciotomy closed. However, the patient developed a wound infection postoperatively. To treat this, the wound was irrigated in the operating room and cultures were taken, showing a rich growth of *Staphylococcus aureus* and *Serratia marcescens*. After taking hemocultures and an antibiogram, Piperacillin/Tazobactam 4g IV four times a day was started immediately. The hemoculture results were negative.

Since there was no improvement, a second wound debridement with a new culture collection was done in the operating room five days after the first debridement. A PICO dressing was applied. The culture again revealed a rich growth of the same bacteria, so the Piperacillin/Tazobactam IV was continued.

Postoperatively, there was no more leakage from the wound and after five days the antibiotics could be stopped. Two days later, the patient could be discharged from the hospital after one month of hospitalization.

Multiple ambulatory controls afterwards showed a favorable course.

DISCUSSION

Compartment syndrome of the thigh is a rare entity and is caused by an increased pressure within an osteofascial compartment which exceeds the capillary perfusion pressure gradient²⁻⁵. This results in less supply of oxygen and nutrients to the soft tissue leading to cellular anoxia and death^{2-4,6}.

The estimated incidence of this urgent condition is 3.1 per 100 000 people per year^{2,5}.

It usually occurs after blunt trauma^{2,3}. Other frequent causes are fractures, external compression, the use of anticoagulants, burns, prolonged immobilization, ischemic reperfusion, venous obstruction, surgery, or vascular injury^{1,3-5,7-9}.

The clinical presentation consists of severe pain that is disproportionate to the injury and increases with passive motion^{1,2,4-6,8-10}. During the clinical examination, the affected limb often feels hard and tense^{4,10}. Usually there is no response to opiate pain medications^{1,4}. Neurological and vascular signs like paresthesia, paralyzes, pulselessness, a cold limb and pallor are late signs and need to be avoided^{4,9,10}.

Clinical suspicion is not enough to confirm the diagnosis of an acute compartment syndrome^{2,5,9}. Intracompartmental pressure measurement is therefore recommended to objectify the diagnosis^{2,8}. However, there is still much debate about the threshold where the diagnosis can be made and fasciotomy should be performed^{1,5,11}. In general, it is assumed a pressure measurement of >30 mmHg is diagnostic and requires urgent surgical fasciotomy to prevent tissue necrosis^{1-3,11,12}. Another threshold commonly used is a perfusion pressure (diastolic pressure - intracompartmental pressure) of <20-30 mmHg⁵.

The extent of the injury depends on the duration of ischemia and thus a late diagnosis can lead to necrosis of muscles and nerves with sensory and motor deficits, contracture, infection, and in severe cases amputation or systemic dysregulation with acidosis, rhabdomyolysis, acute kidney failure and death^{5,8}. Therefore, fasciotomy should be performed within 6 hours after diagnosis. However, according to one systematic review on the timing of fasciotomy, there is no exact time period in which fasciotomy should be performed, but generally it should be done within 8 hours except in patients with an intracompartmental pressure measurement of >40mmHg where it should be done within the hour⁹.

In this case, an acute compartment syndrome was diagnosed by an intracompartmental pressure measurement of 85mmHg. A double fasciotomy was therefore urgently performed within 3 hours. The day after surgery, the patient had bleeding from a pseudoaneurysm.

In this type of vascular injury, there is a collection of blood between the tunica media and tunica adventitia of the blood vessel. It most commonly occurs after trauma or endovascular procedures. Other causes are surgeries, infection, arteritis, IV drug abuse, and congenital defects of arteries^{1,12-14}.

The cause of the pseudoaneurysm in this case is subject to debate. It is unlikely that the anterior cruciate ligament repair in the patient's history led to this since surgery on the knee usually results in a pseudoaneurysm of the arteria poplitea and not the arteria profunda femoris as this artery is located more proximally. Surgical fasciotomy as treatment of the compartment syndrome is also an unlikely cause since the arteria profunda femoris is localized deep in the upper leg.

We believe trauma was the single cause for the development of an acute compartment syndrome and the pseudoaneurysm in this case.

Symptoms of pseudoaneurysms are pain, swelling and bruising of the affected region¹⁴⁻¹⁶. When the pseudoaneurysm interferes with a neighboring nerve, it can also lead to paresthesia. Superficially located pseudoaneurysms can be detected on clinical examination by a pulsatile mass and audible souffle^{1,12,14,17}.

If suspected, the diagnosis can be confirmed by a duplex ultrasound, CT angiography, an MRI or angiography^{12,16,18-20}. However, duplex ultrasound is the diagnostic test of choice^{12,14,15} and will show a high velocity jet through a defect in the arterial wall¹⁴. In this case we did an ultrasound, which didn't show an organized hematoma, followed by a CT angiography that detected the pseudoaneurysm.

Although rare, an untreated pseudoaneurysm can lead to life-threatening conditions such as acute compartment syndrome, thromboembolism, and infections^{12,15,17,18,21}. In addition, the chance of rupture and bleeding is higher compared to a true aneurysm^{12,15-18,21}. Other complications are nerve compression, soft tissue damage and arteriovenous malformations^{12,15,17,18,21}. Therefore, it is important to recognize and treat a pseudoaneurysm when needed. In our case, the pseudoaneurysm of the patient was complicated with both hemorrhage and infection, which is very uncommon.

Treatment of symptomatic femoral pseudoaneurysms can be surgical or nonsurgical. Surgical treatment is believed to give better results. Despite of this, there is a growing interest in non-surgical treatments, like ultrasound-guided or blind compression of the pseudoaneurysm, which has a reported success rate of 63% to 88%^{14,22}, and the percutaneous injection of thrombin, with a success rate ranging from 91% to 100%²².

Novel non-surgical treatment options are the injection of para-aneurysmal saline, endovascular coil embolization and endovascular stent-grafts.

A 2013 review aimed to identify the most efficient treatment for femoral pseudoaneurysms, comparing ultrasound-guided and blind compression with thrombin injection. This review concluded that thrombin injection appeared to be the most effective non-surgical treatment option but can lead to serious complications¹⁴.

Another systematic review and meta-analyses (2016) compared ultrasound guided compression with ultrasound guided thrombin injection and concluded that ultrasound guided thrombin injection should be used as the primary modality for treatment of femoral pseudoaneurysms²².

However, the scientific support for the use of para-aneurysmal saline injections and of coil embolization is sparse and further investigation is needed.

In our patient, we did an embolization using 2x2 hial coils and gel foam, which had a good result on the treatment of the pseudoaneurysm.

CONCLUSION

Compartment syndrome of the thigh, a pseudoaneurysm of the arteria profunda femoris and complication of this pseudoaneurysm with hemorrhage and infection are all very rare, making the combination of these entities have not been described before.

This case illustrates that, when swelling and pain keeps persisting after treatment of an acute compartment syndrome of the thigh, an underlying vascular cause such as a pseudoaneurysm should be considered. In this way, diagnosis can be made promptly, and serious complications and inappropriate intervention can be avoided.

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