



## Atraumatic acute compartment syndrome secondary to group C Streptococcus infection

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A 74 year-old female presented to the emergency department with sudden onset severe foot pain and was diagnosed with an acute, atraumatic compartment syndrome. The patient had urgent surgical decompression and washouts in theatre. Microbiological samples grew group C hemolytic Streptococcus; she was treated with high dose intravenous antibiotics and made a good recovery.

**Keywords:** atraumatic compartment syndrome; foot; group C hemolytic Streptococcus

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This case is important for two reasons; Firstly, because regardless of cause, compartment syndrome is a surgical emergency and is a diagnosis which requires early recognition and appropriate treatment. Secondly and most important, because it is an unusual presentation and pathophysiology of compartment syndrome. Cases of atraumatic compartment syndrome have been reported previously [1], with causes including reperfusion injuries, bleeding, animal toxins, and intravenous drug use [2], and have been reported in the literature [1], but the majority of acute cases are due to trauma. When searching the literature for infectious causes, there are even fewer cases [3,4], and no cases have been previously described due a group C Streptococcus infection.

### Case Presentation

A 74 year-old female presented to A&E with a five-hour history of acute left foot pain, which had increased in severity to a subjective 10/10 and required intravenous morphine and nitrous oxide. The patient described pain all over her left foot, especially the big toe and dorsum of the foot. There was no history of trauma, the patient was systemically well, and had no other notable symptoms.

Past medical history included hypertension, atrial fibrillation, and a previous laparoscopic cholecystectomy. The patient had no known drug allergies, and her only medication was 5 mg Ramipril QD. The only relevant family history was gout.

On examination the patient's foot was swollen throughout the dorsal and plantar aspect, slightly warm to touch, and extremely tender to palpation. There was acute pain with all passive movements of the foot and toes, and ankle movements were restricted due to pain. The foot exhibited no neurovascular compromise and had no lacerations or wounds. She was afebrile, and observations were all normal.

### Investigations

On admission white cell count was 13.5/mL and C-reactive protein 10 mg/L. Other blood values (including uric acid and creatine phosphokinase) were normal.

Left foot radiographs revealed no acute abnormalities, and an MRI showed a large amount of high signal over the dorsum of the foot. However, only one long axis STIR sagittal acquisition was obtained due to patient discomfort and difficulty remaining still.

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The patient was referred to the trauma and orthopedics team due to severe pain out of proportion to the history, where the differential diagnosis included infection and compartment syndrome.

### *Treatment*

Despite an inconclusive MRI, due to a high clinical suspicion of compartment syndrome the patient went to surgery the same day for a fasciotomy of her left foot. Due to dorsal swelling and the MRI result, the four interosseous compartments were decompressed through two dorsal incisions. The compartments deep to these were decompressed through the same incisions. The muscles appeared viable, there was no collection, and a small amount of fluid was found in the lateral deep compartment. This fluid was sent for microbiological analysis, and the wound was left open with a vacuum dressing and the leg kept elevated post-operatively.

### *Outcome and Follow-Up*

The patient's pain was much improved postoperatively; nerve blocks were not performed. Two days later the patient's pain increased, this time more focussed on the medial foot. She was taken back to surgery for a medial fasciotomy to release the medial compartment. The muscles were viable, with no suggestion of infection.

Despite this, the patient began to spike temperatures and had high inflammatory markers. CRP peaked on day 5 at 474 mg/L, although white cell count did not rise higher than the admission level. Cultures of fluid from both fasciotomies grew group C hemolytic *Streptococcus*. It was therefore thought that this patient's compartment syndrome was secondary to infection – although there was no history of any wound or animal bite, and on examination no entry site for infection had been found. She was treated with intravenous amoxicillin, initially 1g TID, which was later increased to 2g QID on day ten of admission. Three days later she had a planned third surgery. The medial wound was clean and therefore closed, but the two dorsal wounds were irrigated with saline and left open.

Four days after this the patient had a planned fourth surgery with the medial wound healing, and the dorsal wounds had no pus although the dorsum was still very swollen. The wounds were washed out and left to heal by secondary intention.

A repeat MRI was performed on day twelve because of persistently high inflammatory markers, which showed no evidence of soft tissue or intraosseous collection. She continued high dose intravenous antibiotics, and started to recover. CRP tailed off following this, and her pain settled. The patient was discharged after a twenty-five day admission with outpatient follow up.

## **Discussion**

Compartment syndrome is caused by an increase of pressure in a closed compartment bounded by fascia and bone compromising vascular supply to that compartment. It is usually due to bleeding or edema secondary to trauma or reperfusion injury [5,6] and can be acute or chronic. The majority of acute cases are secondary to trauma [7] including fractures, crush injuries and surgery [8]. A study looking at causation showed that the most common cause in over two-thirds of patients was fracture, followed by soft tissue injury and then bleeding disorder or use of oral anticoagulants [9]. Other causes include tight casts, burn injuries, and vascular injuries. The treatment of choice for acute compartment syndrome is immediate decompression by fasciotomy [5].

A diagnosis of compartment syndrome is suggested by history and examination; pain is thought to be the first and most sensitive sign [10], although other symptoms include paraesthesia, limb paresis, lack of pulses, and pallor [11]. However, when the diagnosis is in doubt other investigations include measuring tissue pressure and nerve stimulation [12]. Compartment pressures within 30-mmHg of diastolic pressure would suggest compartment syndrome [11]. There should be a low threshold for surgical intervention and clinical symptoms alone are usually enough to justify surgery.

Acute compartment syndrome most commonly involves the lower limb and cases involving the foot have been reported previously [13].

There is no consensus on the number of compartments in the foot, but it is most commonly argued that there are nine compartments in the foot – four interosseous compartments, three central (superficial, central and deep), the medial compartment and the lateral compartment [8, 14, 15]. Effective decompression can be achieved from dorsal incisions, as was done in this case because of the dorsal swelling and MRI findings; however a single medial incision can be used to decompress all nine foot compartments [15].

There has been debate amongst foot and ankle orthopaedic surgeons as well as military surgeons about surgical decompression versus conservative treatment for compartment syndrome of the foot. A recent survey of military surgeons concluded that if compartment syndrome is suspected, it should be decompressed with the aim of preventing chronic pain and deformity [16].

Atraumatic compartment syndrome of the foot is a rare condition; case reports of compartment syndrome secondary to infection have been described, but no cases due to group C hemolytic *Streptococcus*. One paper describes three case reports of acute, atraumatic compartment syndrome in the lower limb, one seemingly spontaneous, and two secondary to gastrocnemius hematomas and subsequent edema [1]. A small number of case reports have described similar cases of compartment syndrome of the upper limb secondary to infection (group A hemolytic *Streptococcus*) requiring decompression and antibiotics and, in one case, amputation [3,4].

Group C *Streptococcus* (and group G *Streptococcus*) of human origin are thought to be a single subspecies, *Streptococcus dysgalactiae* subspecies *equisimilis*. They are a normal commensal flora of the upper respiratory tract, skin, gastrointestinal tract, and female genital tract, and have been identified in pharyngitis, septic arthritis and osteomyelitis, soft tissue infections and meningitis [17].

Atraumatic cases can be easily missed, risking complications such as contractures or deformities of the foot, weakness, paralysis, sensory neuropathies and rarely amputation [8].

There is high morbidity and mortality [2], and it is now thought that serious complications such as muscle necrosis can occur as early as within three hours [18]. The risk of long-term complications is reduced the earlier a compartment syndrome is decompressed, although as acute compartment syndrome is relatively uncommon, there are no large studies describing chronic sequelae and overall patient outcomes [11].

There are several learning points from this case report, primarily that acute foot compartment syndrome is a limb threatening emergency which needs rapid recognition and often surgical decompression. Although the majority of acute cases are secondary to trauma, it is important to remember that there can be atraumatic causes as these are more likely to be missed. If a diagnosis is in doubt from the clinical history and examination, there are other investigations – such as measurement of compartmental pressures, but it is important not to delay fasciotomy due to associated morbidity and mortality of untreated acute compartment syndrome.

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