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Compartment syndrome following isolated ankle fracture

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Abstract We report two cases of compartment syndrome following isolated ankle fractures. Both required decompression of all the compartments following early clinical diagnosis and measurements of the intra-compartmental pressures.

Résumé Nous rapportons deux cas de syndrome de loge qui suit des fractures de la cheville isolées. Les 2 cas ont nécessité une décompression de tous les compartiments après un diagnostic précoce et la prise des pressions intra-compartmentales.

Introduction

Acute compartment syndrome of the lower extremity is a condition that requires immediate surgical treatment. Failure or delay in reaching the diagnosis may lead to irreparable damage to muscle or nerve and, hence, poor long-term function [3,7].

In the international literature there are only very few reported cases of compartment syndrome following ankle fractures. Of the cases described, the diagnosis of compartment syndrome was either made retrospectively or late. In the one case where the diagnosis was made early, compartment pressures were not recorded [1]. Furthermore, in all the cases only the posterior compartment was affected. We describe two cases of compartment syndrome following ankle fractures where the diagnosis was made clinically and confirmed with measurements of compartment pressures.

Case 1

A 19-year-old male presented following a twisting injury to his ankle while playing football. Examination revealed tenderness over the malleoli and considerable swelling with no neurovascular deficit. X-rays revealed a fracture of the lateral malleolus (Fig. 1). The patient was placed in a bivalved cast and his leg elevated. Due to the presence of the swelling operative fixation was delayed.

While waiting for the operative procedure, the patient developed acute severe pain with increased analgesia requirement. Compartment pressures were measured: posterior (superficial): 35 mmHg; posterior (deep): 29 mmHg; anterior: 27 mmHg and lateral: 44 mmHg.

The diastolic arterial blood pressure was 70 mmHg. He underwent medial and lateral fasciotomies. The compartments were noted to be bulging and tight just above the ankle; however, more proximally the muscles were healthy and soft. He also underwent fracture fixation of the lateral malleolus with a lag screw and semi-tubular plate. Split skin grafts were applied to close the fasciotomies 11 days postoperatively. Closure was delayed due to *Acinetobacter* infection in the wounds, which was treated with daily dressings and antibiotic medication. The patient progressed uneventfully to union with no neuromuscular deficit.

Case 2

A 29-year-old male presented after having slipped on ice and sustaining a fracture-dislocation of his ankle. The skin was noted to be tight. The fracture was reduced in the Accident and Emergency department under intravenous sedation. X-rays revealed a Weber type C fracture with an associated fracture of the medial malleolus (Fig. 2). Following reduction no neurovascular deficit was noted. The patient was placed in a back-slab and his leg elevated. The patient was booked for fixation of his fracture the next day. On review, he described increasing pain. He was taken promptly to the operating room where lower leg compartments were noted to be swollen and tense. The pressures were measured, as follows: posterior (superficial): 35 mmHg; posterior (deep): 47 mmHg; anterior: 60 mmHg; lateral: 66 mmHg.

The diastolic arterial blood pressure was 75 mmHg. Lateral and medial incisions were made to release all the compartments. The underlying muscles were noted to be bulging and the muscle color was also noted to have improved 2 min after decompression. The lateral side was fixed with a 3.5 dynamic compression plate in bridging mode. The medial side was comminuted and therefore fixed by using tension band wiring technique. There was a diastasis, which was reduced and fixed by means of a syndesmosis screw. Both wounds were closed with split skin grafts 5 days post-

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Fig. 1 Case 1: A-P radiograph of lateral malleolar ankle fracture

operatively. The syndesmosis screw was removed 8 weeks following surgery. Following a period of rehabilitation the patient regained full functional capacity without neuromuscular deficit.

Discussion

Compartment syndrome is a serious potential complication of trauma to the extremities. Fractures, crush injuries, burns and arterial injuries can result in increased tissue pressure within closed compartmental spaces that may cause irreparable damage to muscle or nerve, leading to a poor functional result. This is characterized by pain, hypoesthesia, weakness of toe flexion/extension,

Fig. 2 Case 2: A-P and lateral radiographs of trimalleolar ankle fracture

painful passive toe movement and tension in the fascial boundaries of the affected compartment.

While compartment syndrome has been well described in the literature following long bone fractures, particularly of the tibia and the femur [2,8], it is rarely seen following ankle fractures. Only 4 cases of compartment syndrome have been previously reported in the literature (Table 1). Ashworth and Patel [1] reported a case of a 22-year-old male with an unstable bimalleolar fracture-dislocation of the ankle, which was initially reduced under intravenous sedation. This patient developed signs of compartment syndrome within 20 h with decreased sensation and loss of power of flexor hallucis longus. This patient underwent medial longitudinal fasciotomy to decompress the deep and superficial posterior compartments with exploration of the tarsal tunnel and also fracture fixation. There was no neuromuscular deficit postoperatively.

Hawkins and Bays [4] described a case of a 36-year-old male with a minimally displaced fracture of the medial malleolus who was treated in a short leg cast. The patient returned to hospital after 24 h complaining of increasing pain below his cast, which was changed to a long leg cast. At 48 h post-injury the pain continued to increase and became very severe; the cast was then removed, revealing severe blistering of the lower leg. At this time the patient had developed a “crush syndrome”. The patient underwent an emergency above-knee amputation, despite which he died of a cardiorespiratory arrest.

Horne [5] reported a case of a patient who developed a deep posterior compartment syndrome following open reduction internal fixation of the medial malleolar component of a trimalleolar fracture. This patient did not undergo fasciotomy and developed a pes cavo-varus deformity.

Matsen and Clawson [6] reported retrospectively 1 case of compartment syndrome in association with an-

Table 1 Reported cases of compartment syndrome following isolated ankle fractures

Author (date)	Cause/mechanism	Fracture type	Compartments decompressed/affected	Follow-up time and findings
Matsen and Clawson (1975) [6]	Not known	Trimalleolar fracture (ORIF)	Posterior	6 months; calf spasms, cramping toe flexors
Horne (1984) [5]	Eversion external rotation injury ankle	Trimalleolar fracture (ORIF)	Posterior	6 months; pes cavovarus
Hawkins and Bays (1993) [4]	Fall 10 feet from ladder	Minimally displaced fracture medial malleolus	Not applicable. Above-knee amputation	Death – multiple organ failure secondary to ischaemic lower limb
Ashworth and Patel (1998) [1]	Not known	Unstable bimalleolar fracture ankle	Posterior	Bulging flexor muscles at operation; at 3 months no neuromuscular deficit
Joseph et al., (2000)	Inversion injury	Lateral malleolar fracture	All	Bulging muscle bodies; no neuromuscular deficit at 3 months
Joseph et al., (2000)	Slipped on ice	Unstable Weber C fracture with associated	All	Dark, swollen muscle at operation; no neuromuscular defect at 3 months medial malleolar fracture

kle fracture. The patient did not undergo decompression with a fasciotomy. At follow-up the patient was noted to have developed claw toes and plantar hypoesthesia.

In all these cases reported in the literature only the posterior compartments were implicated. In both of our cases all the compartments were involved. Early clinical diagnosis, confirmed by pressure measurements, prevented the sequelae previously reported. We conclude that all compartments are at risk from this type of fracture. Clinical awareness, early fasciotomy and fracture fixation will prevent the potentially disastrous sequelae of compartment syndrome.

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