CASE REPORT

Double jeopardy: two episodes of forearm compartment syndrome in the same patient

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SUMMARY

A 55-year-old woman taking warfarin for previous deep venous thrombosis (DVT), presented with an acutely swollen and painful forearm after forcefully contracting her forearm flexor compartment while using a car hand brake and later, an axe. Compartment syndrome was diagnosed and emergency fasciotomy performed, with a haematoma discovered between the flexor compartments of flexor digitorum superficialis (FDS) and flexor digitorum profundus (FDP). After evacuation and resolution of symptoms, the wounds were closed 4 days later. Following discharge on the fifth day, symptoms recurred without warning, prompting re-exploration and discovery of further haematoma. Symptoms again resolved and in due course a skin graft was applied to close the wound without tension.

BACKGROUND

Compartment syndrome is an important clinical diagnosis, as delay in its identification and management can be catastrophic. Raised pressure within an osteofascial compartment can prevent muscle perfusion and lead to muscle necrosis if releasing fasciotomies are not performed urgently. We are usually familiar with compartment syndrome in the context

of significant trauma, with or without bone injury. Unusually, in this case, the trauma involved was seemingly trivial, yet in the context of an anticoagulated patient with convincing symptoms and signs, operative exploration is obligatory and potentially limb saving. Further development of compartment syndrome in the same patient is even more unusual, but underscores the high index of suspicion clinicians must have with anticoagulated patients.

CASE PRESENTATION

A 55-year-old woman presented to the plastic surgery department with a painful left forearm. She had recently tried to release a hand brake in her car and felt excruciating pain in her forearm. As this initially settled she subsequently chopped wood with an axe, the same day. Within 24 h of this event, she developed distal sensory changes in the hand and pain in the forearm, out of proportion to her mechanism of injury (figure 1A, B). She was diagnosed with an acute compartment syndrome and was taken to the theatre immediately following presentation.

Her medical history included a history of multiple deep venous thrombosis (DVT) for which she was on high-dose warfarin use (alternating 8 and 9 mg, with target international normalised ratio

Figure 1 (A and B) Initial presentation. Acute swelling in the distal forearm, with discolouration on the volar aspect of the wrist and forearm.

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Figure 2 (A and B) Fasciotomy incision. The patient was marked for standard fasciotomy incision (A); retraction of the distal flap showed a tense and swollen muscle compartment (B).

(INR) of 3.5) and atrial fibrillation secondary to mitral valve prolapse, for which she was taking propranolol. Allergies included heparin. Her preoperative INR was 3.1.

INVESTIGATIONS

No further investigations were undertaken as the diagnosis was clinically apparent.

TREATMENT

An immediate fasciotomy of the forearm was performed in the operating theatre, with decompression of the carpal tunnel (figure 2A); a tourniquet was applied to a pressure of 280 mm Hg for a period of 10 min to aid visualisation of the compartments in a bloodless field. The flexor digitorum superficialis (FDS) was tense and swollen (figure 2B). On further

Figure 3 (A–D) Initial fasciotomy and haematoma evacuation of distal forearm. The flexor digitorum superficialis (FDS) was tense and swollen (A); further dissection revealed a haematoma between FDS and flexor digitorum profundus (FDP) (B); full decompression of the compartment and carpal tunnel was carried out and all haematoma was evacuated (C); no active bleeding point was found. Proximally, the muscle compartment was explored and showed normal healthy muscle with no evidence of tissue ischaemia (D).

Figure 4 (A–E) Second evacuation of haematoma (5 days after initial fasciotomy and haematoma evacuation). A swollen forearm was noted (A); with a grossly swollen distal volar compartment (B); a large haematoma was present between the muscle bellies of FDS and FDP (C); the haematoma was evacuated and again no bleeding points were found. Incisions were extended further proximally and normal muscle was noted with no evidence of any further ischaemia (D); following evacuation of the haematoma, the gross swelling in the forearm settled (E).

dissection, a large haematoma was found between the FDS and flexor digitorum profundus (FDP) muscle bellies, and evacuated (figure 3A, B). There were no active bleeding points identified but general ooze of blood was noted. The tourniquet was released. Again, no active bleeding points were noted (figure 3C). Proximally, the muscle was normal with no evidence of ischaemia (figure 3D). The dorsal compartment was examined through the volar incision and no abnormalities were detected, therefore formal dorsal fasciotomies were not carried out. The wound was washed out and tisseal solution applied to the profundus muscle belly to aid haemostasis.

The patient was well postoperatively, and was subsequently taken back to theatre for a further washout and closure of the wound at 4 days post initial fasciotomy. At this stage, the arm was under minimal tension and it was possible to close the wound directly. The patient was discharged the following day.

OUTCOME AND FOLLOW-UP

The patient re-presented (day 5 post initial fasciotomy) with extreme pain and a grossly swollen forearm. Her INR had not yet reached a therapeutic level. An immediate return to theatre revealed a large swelling in the distal forearm (figure 4A). Swollen, tense FDS and FDP were noted (figure 4B) and a large haematoma overlying the profundus belly was again evacuated (figure 4C). Again, no active bleeding points were seen. The fasciotomy was extended proximally and no ischaemic tissue was noted (figure 4D). Following evacuation, the swelling settled significantly on table (figure 4E). Dorsal incisions were made over the hand and no abnormalities were detected.

Tisseal was again used and the wound dressed with simple dressings and a splint. The patient was monitored daily and her wound was subsequently closed directly over the carpal tunnel and proximal forearm wound. The central portion of the

Figure 5 Two weeks after closure with split thickness skin graft. The wound was closed primarily over the carpal tunnel and proximally, a split skin graft was placed over the central portion.

wound was closed following application of a split thickness skin graft. At 2 weeks postoperative the wound was healing well with 100% graft and no recurrence of haematoma (figure 5).

DISCUSSION

In acute compartment syndrome, muscle and nerve viability is threatened by increased tissue pressure within an osteofascial compartment, which critically reduces capillary blood perfusion. The diagnosis of compartment syndrome is a clinical one. Awareness and early intervention are the keys to treatment.

The earliest and most important symptom is pain. Increasing, persistent pain, usually out of proportion to the presenting injury, not decreased by immobilisation, and increased despite elevation of the limb, are the most typical findings. The fingers are flexed and pain is worsened on passive extension of the digits. A swollen tense compartment, sensory deficits, and motor weakness and paralysis, a late sign, may ensue.¹ Normally, elevation decreases oedema and pain, owing to a decrease in local hydrostatic pressures.

The diagnosis of compartment syndrome can be difficult. It is important to have a high index of suspicion, particularly when a patient reports severe pain not relieved by analgesia. Compartment pressure monitoring has a role,¹ however, when in doubt the best course of action is decompressing fasciotomies as the diagnosis is ultimately clinical.

The patient's initial presentation was unusual, as compartment syndrome usually follows severe trauma or surgery. However, compartment syndrome has been reported in long-term anticoagulated patients after minor trauma such as pulling

a muscle, or light impacts,² or even spontaneously, with no clear precipitant.^{3 4} It has also been reported in newly anticoagulated patients following iatrogenic interventions such as arterial puncture.^{5 6}

In this case, the mechanism of injury seemed innocuous, yet the history of anticoagulation use was an important clue to the diagnosis. The further development of compartment syndrome again shortly after an initial episode is unusual, and underscores again the importance of a thorough history and clinical examination.

This case should remind us to widen our suspicion for compartment syndrome beyond those sustaining serious trauma, to any patient who is significantly anticoagulated or coagulopathic, with convincing signs. A thorough history may reveal the precipitating trauma, which may seem surprisingly trivial. Emergency referral to a specialist, usually a plastic or orthopaedic surgeon capable of performing fasciotomies, is paramount, with minimal delay before reaching the operating table.

Learning points

- ▶ Therapeutic anticoagulation greatly increases the chance of bleeding-related events, which can occur after minimal trauma or even apparently spontaneously.
- ▶ After closing fasciotomy wounds be vigilant for recurrent signs of compartment syndrome. When discharging the patient home, ensure that they are fully informed, and know how to quickly access the surgical team if concerned.
- ▶ Trust your clinical judgement. If the clinical examination is convincing for compartment syndrome, yet the history seems atypical, it is safest to perform potentially limb-saving fasciotomies, or seek someone who can.
- ▶ Be open to the possibility that a problem may recur even after it has seemingly definitively been treated. If unsure, go back to first principles and consider what the safest course of action is; in this case, to re-explore the wounds.

Competing interests None.

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