

Acute Exertional Compartment Syndrome of the Leg

Consequences of a Delay in Diagnosis: A Report of 2 Cases

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Exercise-induced exertional compartment syndrome (ECS) was first described by Vogt in 1945 as "march gangrene."¹ It is now a well-recognized yet uncommon clinical entity occurring after severe forms of exercise.^{2,3} Patients with ECS present with pain and swelling induced in the affected compartment. This is usually a short-lived, uncomplicated phenomenon that is seldom of any clinical significance, resolving with rest.⁴ Progression to an acute compartment syndrome is a rare but devastating injury to the lower limb. A missed diagnosis and late decompression can have catastrophic consequences.⁵ Not only can it lead to loss of limb, but the systemic manifestations of acidosis, hyperkalemia, myoglobinuria, shock, sepsis, and eventual renal failure may lead to loss of life.⁶ This report describes its onset in 2 young soldiers accustomed to heavy training following strenuous exercise toward the end of 2 separate training weeks.

CASE REPORTS

Case 1

A 19-year-old army private presented with increasing pain and swelling of his right shin. The pain had followed an 8-mile run at the end of an army training week and had gradually intensified over 48 hours. There was no history of trauma. On examination, he was systemically unwell, with a temperature of 39°C and a heart rate of 112 bpm. He was normotensive. The anterior compartment of his right leg was swollen, tense, and acutely tender. Distal limb sensation was intact, and peripheral pulses were present. Full blood count, urea, electrolytes, and creatinine were normal. CRP was elevated to 209,

and the ESR was 58. Right lower limb radiographs revealed no bony injury. A clinical diagnosis of acute compartment syndrome was made, and the patient was taken to surgery, where compartment pressures were measured using a pressure transducer. The anterior compartment pressure was 53 mm Hg, the lateral compartment pressure was 30 mm Hg, and the superficial posterior and deep posterior compartment pressure was 3 mm Hg (normal, 0-8 mm Hg). The diagnosis of acute compartment syndrome was confirmed, and he underwent immediate decompression of his anterior and lateral compartments (Fig. 1). Examination at fasciotomy revealed the muscle in the anterior compartment to be dusky, with poor contractility. The lateral compartment revealed healthy, pink fasciculating muscle. Debridement was not carried out at this stage, and the wound was left open. At the wound check 48 hours postfasciotomy, there was necrosis of the entire anterior compartment, which was debrided. Delayed primary suture was undertaken 48 hours later. The patient was in the hospital for a total of 3 weeks and spent a further 4 months on crutches. His incision healed with no consequences; however, he has been left with a permanent foot drop, for which he requires an ankle foot orthosis (AFO) support. He is unable to run, which has forced him to leave his job in the armed forces, and although he has since found employment, it is not in a field that he would have chosen. He has had to sell his manual car, which he was unable to drive, and buy an automatic car.

Case 2

A 27-year-old soldier presented with increasing pain in his left leg following a 6-mile run again at the end of a physical training week. There was no history of trauma. On examination, his vital signs were normal. There was minimal swelling of his leg, and he was tender over the lateral aspect of his leg. Distal limb sensation was intact, peripheral pulses were present, and a provisional diagnosis of a soft tissue injury was made. Simple analgesia was prescribed, and he was allowed home. He presented again 24 hours later complaining of unrelenting pain and decreased sensation in his left foot. On examination, his leg was now swollen, tense, and tender. Peripheral pulses were present, and fine-touch sensation was reduced on the dorsum of his left foot. Full blood count, urea, electrolytes, and creatinine were normal. Left lower limb radiographs re-

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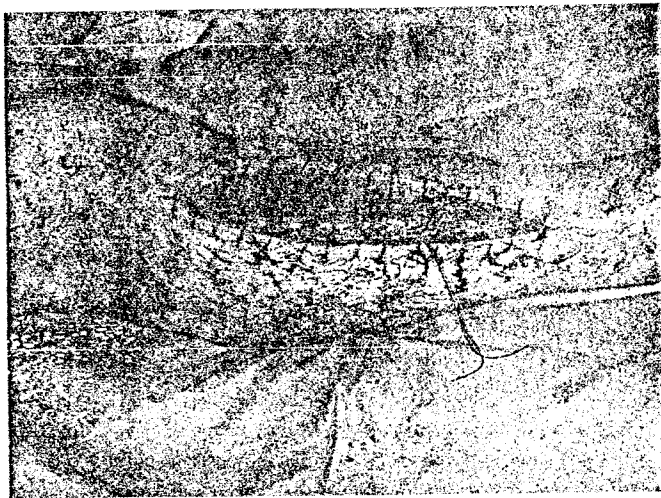


FIGURE 1. Case 1: fasciotomy wound of the right leg following decompression of the lateral and anterior compartments.

vealed no bony injury; however, they revealed gross soft tissue swelling (Fig. 2). A clinical diagnosis of acute compartment syndrome of his left leg was made, and he underwent immediate decompression of all his compartments. Examination at fasciotomy revealed necrosis of the entire lateral compartment, and all devitalized tissue was debrided. Examination of the anterior and posterior compartments revealed healthy, fasciculating muscle. No further debridement was required at a subsequent wound check 48 hours postfasciotomy. Delayed primary suture was undertaken 72 hours later. The patient again required an AFO support prior to discharge from the hospital. In the following year, he made a steady recovery. He has

discontinued his AFO support but has persisting paraesthesia on the dorsum of his foot. His mobility is restricted. Dorsiflexion of his foot is normal, but plantar flexion is associated with inversion. He is unable to run normally, which has forced him to leave the armed forces. He is currently unemployed.

DISCUSSION

Acute limb compartment syndrome is a condition in which raised pressure within a closed fasciculating space reduces capillary perfusion below a level necessary for tissue viability.⁷ It is thought that acute ECS occurs most commonly in relatively sedentary people who undertake strenuous activity.^{4,8} However, we report its occurrence in 2 soldiers who were accustomed to heavy training. A firm grasp of the lower extremity anatomy is central to understanding the pathophysiology of ECS. The leg contains four osseofascial compartments, each surrounded by a relatively inelastic covering (Fig. 3). It is proposed in the mechanical damage theory that eccentric exercise results in myofiber damage and release of protein-bound ions. Repetitive eccentric contraction results in increased release of ions and increased osmotic pressure of the compartment.³ Exertion-related fiber swelling and increased intracompartmental blood volume cause a further rise in intracompartmental pressure. The resultant osmotic pressure gradient causes venous congestion leading to a downward spiral of decreased perfusion and myoneural ischemia. When blood flow is inadequate to meet metabolic demands, tissue loses its function and viability. The most important determinant of poor outcome from acute compartment syndrome is delay in diagnosis.^{9,10} The numerous benign musculoskeletal injuries that present in the same manner as this problem make acute ECS especially difficult to diagnose. This is highlighted by case 2,

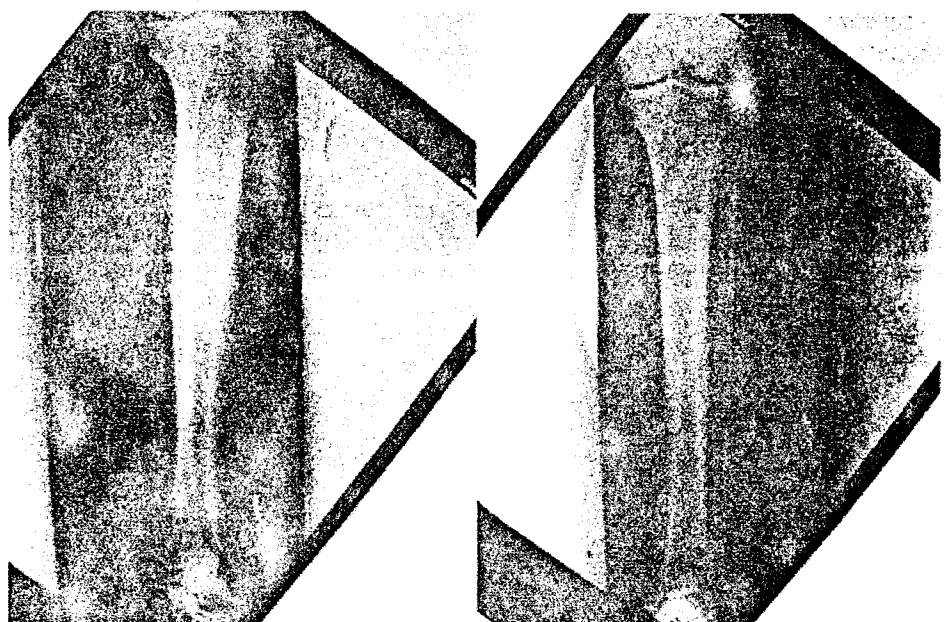


FIGURE 2. Case 2: AP and lateral of left leg showing no bony injury. Note the soft tissue swelling.

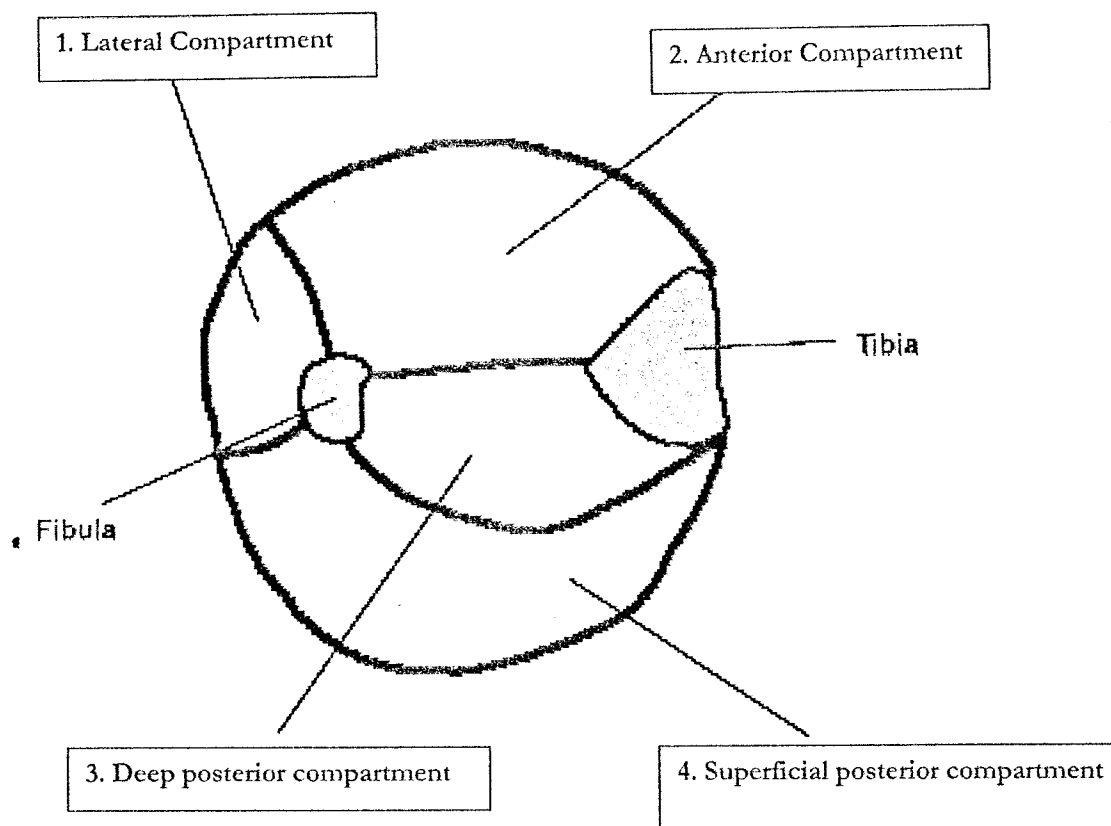


FIGURE 3. Four osseofascial compartments of the leg.

in which a provisional diagnosis of a soft tissue injury was made on initial presentation to A+E. As the clinical diagnosis of acute compartment syndrome is difficult to make in the first instance, methods of monitoring pressure within the muscle compartment have been developed. Monitoring of compartmental pressure in a patient deemed at risk for acute limb compartment syndrome has no significant complications, while not monitoring and relying on a purely clinical diagnosis may lead to a delayed or missed diagnosis.¹¹

These 2 cases highlight the need to maintain a high index of suspicion in those patients at risk for ECS—particularly, it seems, in fit young men who markedly increase their training. This may be due to the fact that their already hypertrophied leg muscles have little room for further expansion secondary to exertion-related muscle fiber swelling. As seen in our 2 cases, it is these same people who rely on perfect limb function to continue working in their profession. They cannot tolerate any loss of limb function, and any delay in diagnosis can have disastrous consequences on their lives, as highlighted in both these cases. Awareness of the possibility of acute ECS among medical staff is an important factor contributing to early diagnosis. Pain out of proportion to the apparent injury and a history of chronic leg pain with exertion may be helpful in identifying these patients prior to development of more obvious

signs and symptoms. The diagnosis of acute compartment syndrome may be confirmed by compartmental pressure measurement so that an urgent fasciotomy may be carried out.

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