



## CASE REPORT

# Rhabdomyolysis and conservatively managed bilateral compartment syndrome of the thighs following strenuous exercise

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## Introduction

Rhabdomyolysis as a result of episodes of physical exertion, while remaining a relatively rare presentation to the accident and emergency department, has been well established in the literature.<sup>2,6,7,11,12,18,19,22,25</sup> Compartment syndrome of the thigh is also an unusual presentation due to the relative size and room for expansion within the three fascial compartments of the thigh. It normally occurs as a result of femoral fracture and other trauma, particularly involving crush injuries.<sup>23</sup> The occurrence of compartment syndrome secondary to contusion and strain of the quadriceps muscles<sup>3,15</sup> has previously been reported along with bilateral compartment syndrome of the thighs following strenuous squatting exercises.<sup>6</sup> Here a case will be presented of a 40-year-old male who presented 1 day post strenuous exercise with bilateral pain and swelling of the thighs.

## Case

A 40-year-old male presented to the accident and emergency department of his local hospital complaining of pain in both legs following a bout of intense physical activity. He was an active gentleman, still participating in gaelic football for which he trained two to three times per week, besides matches, for the best part of 20 years and remained competitive to second XV standard. Two days prior to presentation he attended a 'spin' class for 1 h for the first time. This involves high intensity static cycling with interspersed periods of maximal anaerobic effort. The gentleman, who was not used to cycling commented that he could not complete the entire class but felt that it was not unduly taxing. The atmosphere was reported as being warm and humid but he felt that an adequate level of hydration was achieved throughout. He reported some leg stiffness at the time but no pain. The next day he complained of mild pain and stiffness but felt able to attend his regular club training. This involved some light running and match play for approximately 1 h 30 min and was similar in intensity to normal sessions. During the night and increasingly through the next day the gentleman had increasing pain and swelling in both thighs, particularly the right, to

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an extent where weight bearing was difficult. On further questioning he had also noted a dark discoloration to his urine for approximately 12 h. This prompted him to attend his club physiotherapist who promptly referred him for medical assessment. He had taken no alcohol or drugs, was a non-smoker, had no significant past medical history and was not on any regular medications or nutritional supplements.

On examination his initial pulse rate was  $84 \text{ min}^{-1}$ , blood pressure was 140/89 mmHg with oxygen saturations of 97% and a temperature of  $37.3^\circ\text{C}$ . Examination of the legs revealed marked tenderness and tense swelling over the anterior thighs, particularly the right side, with pain exacerbated by both active and passive movements of the hip and knee although a normal range of movement was possible. Full power was present in all lower limb muscle groups along with full sensation and normal reflexes. All peripheral pulses were preserved although the right dorsalis pedis was felt to be weaker.

Biochemical analysis was performed revealing a haemoglobin concentration of 15 g/dL and a white cell count within the normal range. Analysis of urea and electrolytes revealed a potassium level of 3.6 mmol/L (3.5–5.3 mmol/L), urea of 4.7 mmol/L (2.5–10 mmol/L) and creatinine of  $96 \mu\text{mol/L}$  ( $<106 \mu\text{mol/L}$ ) with sodium, magnesium, calcium and phosphate all within normal ranges. Liver function tests revealed an AST of 898 U/L ( $<42 \text{ U/L}$ ) and ALT of 213 U/L ( $<48 \text{ U/L}$ ). Total creatine kinase (CK) was grossly elevated at  $68314 \mu\text{U/L}$  ( $<235 \mu\text{U/L}$ ) with CKMB at  $527 \mu\text{U/L}$  (cardiac isoenzyme; normal if less than 3% total CK). Urinalysis demonstrated +++ blood (equivalent to  $>200$  erythrocytes/ $\mu\text{L}$ ) with no red cells visible on direct microscopy (diagnostic for myoglobin). Lactate dehydrogenase levels were elevated at  $1829 \mu\text{U/L}$  (240–400  $\mu\text{U/L}$ ). Electrocardiogram analysis revealed a sinus bradycardia of  $51 \text{ min}^{-1}$ .

The gentleman was admitted with aggressive intravenous fluid therapy commenced. Compartment pressures were analysed and pressures of between 40 and 50 mmHg were found in all three compartments of the right thigh. Doppler analysis revealed normal arterial blood flow in the right lower limb with no neurological deficit. A decision was made to monitor the neurovascular status of the limbs overnight with no fasciotomy undertaken. Urine output was closely monitored and appropriate analgesia given.

On examination the following day, the pain and swelling of the limbs had decreased significantly, with repeat CK down to  $39,019 \mu\text{U/L}$ . The gentleman continued to be closely observed over the next

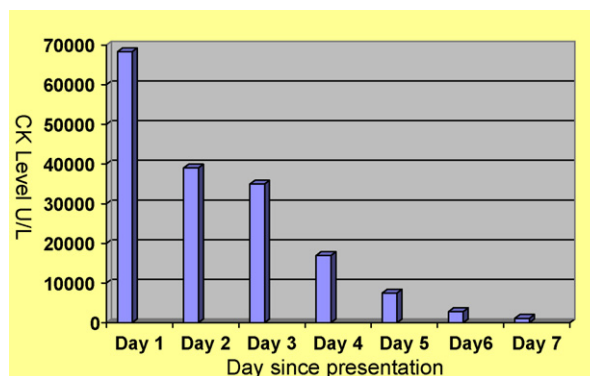


Figure 1 Creatinine kinase levels throughout admission.

week. His urinalysis returned to normal on day 2 post admission and he was able to mobilise at this time. Renal function remained normal throughout and he was eventually discharged on day 7 when his CK had reached  $1123 \mu\text{U/L}$  (Fig. 1). Further blood analysis carried out during admission; anti double-stranded DNA, auto-antibody screen, IgG/IgM anti-cardiolipin antibody, complement C3/C4, thyroid function tests, troponin-T and plasma protein electrophoresis were all within normal limits.

The gentleman reported experiencing frequent anterior thigh pain for approximately 2 years previous to the incident, associated with activity, for which he was undergoing tests organised through his general practitioner. He has resumed a light to moderate level of physical activity some 3–4 months since discharge and is now pain free with normal range of motion. Muscle biopsy is to be performed to rule out an underlying pathology.

## Discussion

Acute compartment syndrome of the thigh is an uncommon presentation<sup>5</sup> owing to the relatively large potential intracompartmental space that exists within the three fascial compartments. It most commonly occurs secondary to fractures and crushing trauma to the limb.<sup>2,3</sup> Compartment syndrome secondary to exercise has been noted to occur following muscular strain,<sup>3</sup> contusion<sup>15</sup> and rupture of the quadriceps, hamstrings<sup>9</sup> and supporting structures<sup>8</sup> owing to haematoma formation. Several cases of exertional rhabdomyolysis and ensuing thigh compartment syndrome have also appeared in the literature following weight training, performance of squats, following a marathon and following a 2 mile run.<sup>2,6,7,11,12,18,19,22,25</sup> To the authors' knowledge only one previous report exists following so-called 'spinning' training for which the gentleman in question had to undergo bilateral

fasciotomies.<sup>1</sup> All these cases share a common trend of a single episode of abnormal training behaviour associated with ensuing hypertrophy and oedema of the quadriceps and adductors in one case.<sup>11</sup> Two of these cases resulted in fatalities<sup>7,12</sup> while the remainder all had to undergo surgical compartmental pressure release.

The literature has long stated immediate fasciotomy to be the treatment of choice in acute compartment syndrome.<sup>10</sup> Owing to its relatively rare occurrence no definitive guidelines exist for the management of this condition.<sup>18</sup> A compartmental pressure of greater than 8 mmHg is considered abnormal,<sup>10</sup> with values of greater than 30 mmHg posing a threat to neurovascular compartmental structures.<sup>4</sup> Some authors state a compartmental pressure of over 40 mmHg to be the cut-off point for delay of surgical intervention.<sup>14</sup> Others state a pressure of within 20 mmHg of the diastolic as the point of intervention.<sup>24</sup> In this case it is conceivable that bilateral fasciotomies would have been an appropriate intervention. Obviously, if the neurovascular status of the limb is deemed to be compromised immediate surgery needs to be undertaken, however the decision was taken to monitor compartmental pressure and the neurovascular status of the limb overnight with favourable results. Acute compartment syndrome of the thigh is associated with considerable long-term morbidity<sup>17</sup> which is often compounded by associated injuries in trauma.<sup>16</sup> The complications of fasciotomy such as poor knee flexion and wound infection mean that the long-term results of such a procedure are not without risk especially in an active population in whom this condition occurs.<sup>21</sup> Robinson et al.<sup>21</sup> presented a case series of conservatively managed compartment syndromes of the thigh occurring in an athletic population as a result of blunt trauma. The outcomes stated compared more favourably to those of fasciotomy with no residual muscle weakness. There is one case report<sup>13</sup> in the literature of a high-class athlete returning to sport after fasciotomy of the thigh but in general this is unlikely owing to residual muscular deficits. Reide et al.<sup>20</sup> presented a case of conservatively managed blunt trauma to the thigh where, despite an elevated intracompartmental pressure fasciotomy was delayed and resolution occurred. As in this case, they found that a return to activity was possible but with a long healing time. In conclusion, a case is developing for the conservative management of compartment syndrome of the thigh as a result of blunt trauma or exercise induced raised intracompartmental pressure. A conservative approach is only advisable if no fracture, penetrating trauma

or neurovascular deficit exist.<sup>20</sup> A return to activity is achievable using this approach.

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