Case Report

A potentially life-threatening complication of university orientation activities

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BACKGROUND: This case report describes a university student who participated in an orientation activity and developed exertional rhabdomyolysis.

METHODS: With prompt intravenous volume expansion started in the accident and emergency department, he made an uneventful recovery despite a marked elevation of creatine kinase. The risk factors of developing exertional rhabdomyolysis were reviewed. Suggestions based on these risk factors were made to the organizers of such orientation programmes.

RESULTS: He was discharged on day 6. On follow-up on day 8 after presentation at the accident and emergency department, the CK level was 46 000 U/L and it fell to 2600 U/L in another 2 weeks. On follow-up 3 weeks after the incident, he remained well without symptoms.

CONCLUSION: For the clinicians, once rhabdomyolysis is suspected or diagnosed, intravenous fluid therapy with a crystalloid should be initiated as soon as possible to prevent the occurrence of acute renal failure.

KEY WORDS: Rhabdomyolysis; Acute renal failure

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INTRODUCTION

Intense exercise is a known cause of rhabdomyolysis. According to studies on law enforcement or military personnel in the United States, the incidence of exertional rhabdomyolysis ranged from 0.3% to 3%.^[1] The immediate life-threatening consequence of rhabdomyolysis is hyperkalemia. It results from muscle cell damage and may lead to arrhythmia and even cardiac arrest. Acute renal failure (ARF) may occur 12-72 hours after the insult and is thought to be induced by myoglobin. The reported incidence is about 10%-50% after rhabdomyolysis.^[2] Mortality depends on the cause and severity of rhabdomyolysis. The patient described ran an uneventful clinical course despite a markedly raised CK. The threshold value of CK that ARF may develop is unknown. In a study including 26 patients of rhabdomyolysis treated in an intensive care unit, the onset of ARF was more likely in those with

higher admission and peak CK level.^[3] That ARF did not develop in this patient may be attributed to prompt treatment with volume expansion and urine alkalization as well as the absence of serious co-morbidities. As this kind of orientation activity in universities is expected to occur every year, the best treatment is prevention.

This case report describes a university student who participated in an orientation activity and developed exertional rhabdomyolysis.

Case report

A 19-year-old man with dizziness and near-syncope presented at the Accident & Emergency (AE) Department of our hospital. He was a university student. On the day of presentation, he was participating in an orientation activity in which he was required to run outdoors in the early morning. According to the Hong Kong Observatory

record, the mean atmospheric temperature was 28 °C and the mean relative humidity was 85% that day.^[4] After running on the road for about 90 minutes with several short breaks in between, he became dizzy, felt exhausted and nearly lost his consciousness. He reported no trauma or use of illicit drugs. His past medical record was insignificant. At the AE department, his body temperature was 38 °C and there was profuse perspiration. He was alert and oriented. Besides bilateral lower limb weakness with power of grade 3/5, there were no other neurological deficits. Both of his lower limbs were neither swollen nor tender. He was tachypnoeic but chest auscultation was clear. His blood pressure was 107/38 mmHg and pulse was 160 per minute. ECG showed sinus rhythm. His urine was dark brown and dipstick was 4+ for red blood cell. Bedside blood test showed normal levels of sodium and potassium at 142 mmol/L and 4.7 mmol/L respectively. He was given intravenous 0.9% sodium chloride (normal saline) at full rate with external cooling by removal of clothing and fanning. After receiving 1 L normal saline, his blood pressure was 120/36 mmHg and the pulse was 130 per minute. His body temperature dropped to 37 °C. He was then admitted to the emergency medicine (EM) ward to continue treatment.

In the EM ward, blood taken at the AE department showed urea 7.6 mmol/L, creatinine 197 µmol/L, creatine kinase (CK) 895 U/L, and aspartate aminotransferase 40 U/L. The levels of sodium and potassium were normal. A diagnosis of rhabdomyolysis was made. His vital signs, fluid balance and blood biochemistry were closely monitored. He was treated with intravenous infusion of approximately 3 to 4 L normal saline per day to ensure adequate urine output as well as urine alkalinization by intravenous boluses of 8.5% sodium bicarbonate as needed. At 7 hours after presentation, his CK rose to 82 669 U/L while urine myoglobin was detectable. The CK level peaked at about 234 000 U/L 40 hours after presentation. Despite a much elevated CK level, his creatinine normalized within 24 hours of presentation and remained throughout his hospitalization. Clinically, he became ambulatory with normal lower limb power 24 hours after EM ward admission. Thereafter he remained asymptomatic and the CK level dropped gradually. The intravenous therapy was discontinued on day 5 as the downward trend of CK was evident, his urine output was adequate and he was symptom free. He was discharged on day 6. On follow-up on day 8 after AE presentation, the CK level was 46 000 U/L and it fell to 2600 U/L in another 2 weeks. On follow-up 3 weeks after the incident, he remained well without symptoms.

DISCUSSION

Exercise and non-exercise factors play a role in the development of exertional rhabdomyolysis. An individual's fitness level is an important consideration. Prior physical conditioning was shown to be associated with lower risk of exertional rhabdomyolysis. In a study of fire department recruits, the relative risk of rhabdomyolysis was 0.2 for those candidates who exercised regularly.^[5] The other exercise related factors include the intensity and type of exercise. Exercise of high physical demand e.g. running a marathon, and the eccentric type e.g. repeated elbow flexor contraction bear a higher risk of rhabdomyolysis.^[6] On the other hand, exercises with lesser eccentric activity, e.g. swimming and cycling are less prone to rhabdomyolysis. As for the non-exercise factors, individuals with inherited muscle enzyme defect in the metabolism of glycogen and lipids are at risk of developing exertional rhabdomyolysis. It is related to reduced muscle cell integrity.^[7] Concurrent viral infection with, for instance, influenza virus, coxsackie virus or adenovirus, is also a risk factor.^[8] However, the mechanism of muscle damage caused by the viral infections is unclear. Strenuous exercise performed under conditions of high humidity and environmental temperature is also associated with a higher risk.^[9] Dehydration, electrolyte imbalance and reduced heat dissipation all contribute to the development of rhabdomyolysis.

Once rhabdomyolysis set in, prevention of ARF is of paramount importance. Fluid replacement is the mainstay of treatment. The earlier the initiation of fluid therapy the better chance of preventing ARF is.^[10] Although urine alkalinization and use of diuretics like mannitol are often included in most treatment algorithms of rhabdomyolysis, their clinical efficacy is not supported by well conducted randomized trials.^[11] Some found that crystalloid infusion alone could induce a solute diuresis enough to alkalinize the urine, and also prevent ARF.^[12]

This report described a patient with exertional rhabdomyolysis secondary to university orientation activities. For the organizers of such activities, the fitness level of the students, the intensity and type of physical activities should be taken into account when they plan the activities. Vigorous exertion should be avoided when the weather is hot and humid. Students with active viral illness, even if it is mild clinically, should refrain from strenuous exercise. For the clinicians, once rhabdomyolysis is suspected or diagnosed, intravenous fluid therapy with a crystalloid should be initiated as soon as possible to prevent the occurrence of ARF.

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Contributors: Leung LP proposed the study and wrote the paper.

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