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Exertional Induced Rhabdomyolysis: A Case Study Report

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Abstract: ***22 years healthy male presented with myalgia. History revealed muscle spasm post exercise. Investigations shows elevated liver enzymes, Lactate dehydrogenase (LDH) and Creatine kinase (CK). Diagnosis confirmed for mild rhabdomyolysis. Case managed conservatively with rest; refrain from exercise and good hydration. Further follow up showed improvement of symptoms and normalization of laboratory results.***

Learning points

- ***Proper hydration before, during and after exercise***
- ***Graduating Exercise intensity and duration depending on individual endurance***
- ***Encouraging patients to enroll in structured exercise programs or enlisting a trainer to construct one for them***
- ***Prioritize patient safety among patients engaged in wellness service.***

Keywords: rhabdomyolysis, exercise, Creatine kinase

1. Introduction

Exertional rhabdomyolysis (ERM)is a condition resulting from muscular injury and leakage of its content into the bloodstream [1]. Mostly,the breakdown of muscle isa result from strenuous exercise and is well described among athletes and military personnel[11]. ERM may presentwith mild symptoms, requires outpatient follow up and hydration [12]. On the other hand, circulation of muscle contents in the bloodstream may harm the kidneys and lead to acute kidney injury (AKI). Therefore, sever symptoms of ERM needurgent secondary care referral and hospital admission [12,13]. The annual rhabdomyolysis prevalence has been reported as 26 000 cases in the USA, with 47% meeting the diagnostic criteria of ERM. [9] A lower percentage of ERM has been suggested [2]in other studies. The discrepancy mainly reflects the differences in the cohorts studies carried out. In addition, ERM may become complicated by electrolyte disturbances and theensuing sequel of AKI or renal failure [13].

According to Kim et al., exercising inhot and humid conditions may increase the risk of rhabdomyolysis. That may occur either directly, by rising the body temperature, or as a result of excessive sweating that leads to hypokalaemia or hyponatremia which then inducesrhabdomyolysis. Supplements, such as Creatine and Steroids are widely used by athletes who tendto gain a bigger muscle mass. In order to shorten the period of muscle mass enlargement, athletes may take Creatine and Steroids in concentrations higher than a recommended doses leading to dehydration, muscle ischemia and eventually rhabdomyolysis[5]. Alcohol consumption, especially after exercise, is another risk factor forrhabdomyolysis. Illicit drugs like heroin, cocaine and amphetamines as well as cyclosporine may cause rhabdomyolysis[5]. Therefore, a detailed medication history is essential to determine cases, and risk factors of rhabdomyolysis.

As we do have a wellness program as part of our health center, we would like to highlight the precaution before and during exercise based on the exercise intensity and duration. Although, in this case report, we will focus on how to differentiate between mild ERM which can be managed as an outpatient, and severe ERM which requiresurgent referral and hospital admission.

2. Case Presentation

A healthy 22 years male presented with myalgia as his main complaint.A detailed history was taken. It revealed that a few days before, the patient engaged in a strenuous exercise routine for 2 hours, followed by swimming for 45 minutes. Afterwards, he suffered from a muscle spasm in his right thigh. His physical examination was unremarkable. He was scheduled to do some investigations as part of his screening, which were done before his initial consultation with his family physician about his complaint.The preliminary investigationsshowed an aspartate aminotransferase (AST)level of 565 U/L, alanine aminotransferase (ALT) 117 U/L , lactate dehydrogenase (LDH) 1265U/L. At the time Creatinine Kinase (CK) level was not measured since there was no indication for it when conducting the general screening.

A repeat of his investigations on the day of consultation showed a fall in the AST level to 401 U/L and LDH to 357 U/L, a rise in ALT to 160 U/L , and a CK level of 8450 U/L. In addition, Hepatitis C Antibody was non-reactive, and Hepatitis B surface antigen was also non-reactive. There

was no history of regular use of any medication, Alcohol use or heat exposure.

A diagnosis of mild Rhabdomyolysis (Physiological ERM) was made. The patient was advised to rest, refrain from exercise, and hydrate properly. In the follow up visit a month later, he reported an improvement in symptoms. Further laboratory investigations showed AST to be 16 U/L, alanine ALT 13 U/L, LDH 181 U/L and CK 78 U/L.

3. Discussion

Scalco et al. (2016) described criteria of rhabdomyolysis diagnosis as:

- A CK elevation 12–36 hours after exercise, with a maximum at 3–4 days, followed by normalization within several weeks of rest.
- The CK increase is usually preceded by exercise, beyond the limits of fatigue, also referred to as 'unaccustomed physical exertion' or 'involuntary exertion'.
- The CK increase is deemed symptomatic if it occurs with any of the following features: myalgia [muscle soreness or tenderness; in general, rhabdomyolysis is very painful], swelling and/or weakness of the muscles.
- The presence of myoglobinaemia and/or myoglobinuria: either by inspection (pigmenturia) or by laboratory testing. Since myoglobin testing in blood or urine is not widely available, many experts consider the combination of the first three features diagnostic for ERM. [1]

ERM results in the entry of muscle contents, in particular CK and myoglobin, into the circulation. In most cases, the condition has a mild course which is reflected by myalgia with mild-to-moderate CK increases, mild myoglobinuria, and will often not even come to medical attention. However, in a minority of patients, the clinical course can be severe, resulting in a marked increase in CK levels, compartment syndrome, acute renal injury, disseminated intravascular coagulation, cardiac arrhythmias secondary to electrolyte imbalances, and even cardiac arrest if left untreated.

In this case report we will focus on how to differentiate between mild ERM which can be managed as an outpatient case, and severe ERM which requires hospital admission.

There are no randomized controlled trials offering concrete management guidelines for this question or other aspects of rhabdomyolysis treatment. However, the study of Kenney et al reporting many cases of physiological ERM offers a practical guideline for this first step (which includes laboratory investigations for renal function and electrolytes).By demonstrating that patients with a CK>50 times the upper limits of normal (ULN), with no associated muscle weakness or swelling, no myoglobinuria, and normal renal function and electrolytes, it is very likely the condition is that of a physiological ERM episode [4]

Table 1: Selection of patients who require hospital admission and intravenous fluid administration[1,4,5]

	Physiological ERM	Clinically significant ERM
Clinical features	Only myalgia	Also, muscle weakness and/or swelling and/or altered consciousness
Vital signs	Normal	Abnormal and/or body temperature >40°C [heat stroke]
Exercise	Clearly unaccustomed	Accustomed/unaccustomed
CK [U/L]	<50 times	≥50 times
Myoglobinuria/myoglobinaemia	Absent	Present
Acute renal failure	Absent	Absent or present
Electrolyte abnormalities	Absent	Absent or present
Acid base status	Normal	Abnormal
Other factors possibly provoking rhabdomyolysis	Absent	Absent or present
History	No prior episodes of ERM No other indicators of NMD No renal, cardiac or pulmonary medical comorbidity	Prior episodes of ERM Other indicators of NMD Renal, cardiac or comorbidity
	Outpatient follow-up if all normal	Referral to the ER in case of any of these factors

The goals of inpatient or outpatient treatment are to avoid renal injury, prevent further muscle injury and avoid complications resulting from electrolyte disturbances.

Management of ERM

Outpatient follow-up of patients with physiological ERM [6]

- Advising rest for 72 hours and encouraging oral hydration.
- Sleeping 8 hours consecutively, throughout the night.
- Remaining in a thermally controlled environment, if ERM occurred in association with heat injury.
- Emergency referral of the ERM case to the hospital, if the temperature exceeds 40°C.
- Follow-up in 72 hours for repeat CK and blood urea if:
  - CK falls to below five times the upper limit of normal ULN and the blood urea also normalizes, then no further studies are required.
  - Repeating the above investigations every 72 hours until the levels are stable.
  - CK≥5×ULN or abnormal blood urea for >2 weeks warrants referral to a specialist.
  - CK≥50×ULN:referring the patient to the accident and emergency department again.
- Refraining from sports until the blood results normalize.
- Elimination of medications, drugs and toxins that may contribute to causing rhabdomyolysis.

Management of patients with clinically significant rhabdomyolysis: [7, 8]

- Hyperhydration: Intravenous fluids should be initiated as soon as possible, preferably within the first 6 hours after muscle injury, at a rate that maintains a urine output in adults of ≥300 mL/hours for at least the first 24 hours.
- Admitting the patientto an ICU and considering peritoneal dialysis or hemodialysis in patients with little or no urine output despite hyperhydration, profound acidosis or severe hyperkaliemia.
- Mannitol should be administered only to maintain a urine output of 300 mL/h or more, on top of adequate fluid administration.
- Sodium bicarbonate should be administered only if necessary, to correct systemic acidosis.
- Elimination of medications, drugs and toxins that are considered to cause rhabdomyolysis.

4. Conclusion

Rhabdomyolysis can be a serious condition that may affect any patients engaged in strenuous exercise programs. Health education, hydration andbuilding up the intensity of exercise at a level that would accommodate the individual's stamina are key points to preventing Rhabdomyolysis.

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