Non-traumatic rhabdomyolysis and diabetes

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Abstract

The present clinical report describes the case of a spontaneously resolving rhabdomyolysis episode in a type 1 diabetic patient, who presented with multiple risk factors of this muscle complication, including uncontrolled brittle diabetes with sequences of hyper- and hypoglycaemic episodes in the same day, caloric restriction and intensive exercise. It should be borne in mind that rhabdomyolysis is not particularly rare in diabetes and can be severe. To raise clinicians’ awareness of a possible rhabdomyolysis diagnosis, the various clinical conditions that are likely to lead to this complication in diabetic patients are also reviewed here.

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1. Introduction

Rhabdomyolysis is a potentially severe clinical syndrome that results from acute muscle fibre necrosis [1]. The muscle damage leads to the release of myoglobin, enzymes and electrolytes from muscle into the circulation. The most serious complication is represented by acute kidney failure, which is mainly due to the obstruction of renal tubules by myoglobin and uric acid deposits. Disseminated intravascular coagulation, hyper- and hypokalaemia, and cardiac arrest and arrhythmias can also occur.

Various clinical conditions have been associated with rhabdomyolysis, such as muscle compression or ischaemia, seizures, trauma, drugs and toxins, muscle overexertion, inherited disorders of muscle metabolism, hypo- and hyperthermia, hypothyroidism and infections [1]. Diabetes mellitus [2] can also be a cause of rhabdomyolysis, especially during ketotic and non-ketotic diabetic coma. However, in the literature, other conditions, such as hypoglycaemia and excessive exercise, have been associated with this manifestation in patients with diabetes [3].

The present clinical report describes the case of a spontaneously resolving rhabdomyolysis episode in a type 1 diabetic patient, who presented with multiple risk factors of rhabdomyolysis. The present report took advantage of this observation to also review the possible causes of rhabdomyolysis in diabetes to increase the awareness of clinicians to this rare, but potentially severe, complication.

2. Case report

A 22-year-old medical student with type 1 diabetes [body mass index (BMI): 21.5 kg/m²] was admitted to our emergency
Fig. 1. The patient’s record of erratic plasma glucose excursions, as revealed by the memory of his discontinuous glucose-monitoring system (Accu-Chek® report), from 25 May to 17 August 2010. The patient was admitted with overt rhabdomyolysis to the emergency ward on 8 August 2010. x: individual glucose values; gray circles: mean glucose values.

unit for severe bilateral muscle pain predominantly in the thighs, muscle weakness in the lower limbs and profound asthenia. These signs had progressively increased in intensity over the past 5 days. The patient reported no severe hypoglycaemic episode with coma or convulsions during the previous weeks.

The patient’s diabetes had been diagnosed 12 years earlier, and was treated by intensified insulin therapy (basal insulin: insulin analogue glargine, 30 units/day; prandial bolus: rapid insulin analogue lispro, 7–13 units administered before meals, depending on carbohydrate count and plasma glucose). Glycaemic control was apparently good (HbA1c: 7%) although, during the previous 8 weeks, the diabetes had been particularly ‘brittle’ due to a self-determined intensive weight-loss programme combining calorie restriction and intensive exercise. Indeed, overt hyperglycaemia and hypoglycaemia frequently occurred on the same day (Fig. 1). Urinary ketone bodies were not checked by the patient (although it may be speculated that ketone production occurred frequently, as the patient reported difficulties in suppressing hyperglycaemia with the extra doses of rapid analogue he used to compensate for the glucose excursions). His body weight decreased by 14 kg over the past 2 months, and his calorie intake was evaluated as less than 1200 calories/day. No familial history of diabetes, deafness or muscle disease was reported. Type 1 diabetes was confirmed by the presence of positive autoantibodies against both glutamic acid decarboxylase (GAD) and IA2 antigens at the time of the disease diagnosis.

On admission to emergency, quadriiceps tenderness was noted. Neurological examination was normal, there was no myotonia, and body temperature was normal. Laboratory investigations revealed the following values: plasma glucose, 11.66 mmol/L; plasma sodium, 135.5 mmol/L; potassium, 4.6 mmol/L; and plasma creatinine, 98 µmol/L. An increase of plasma creatine kinase (CK) was observed (16,951 IU/L at D0, 13,000 IU/L at D + 1 and 7000 IU/L at D + 2). Plasma calcium and phosphorus levels were in the normal range. Lactate was not measured. Thyroid-stimulating hormone (TSH) was slightly increased (4.75 mU/L), but FT3 and FT4 were normal, and antithyroperoxidase antibodies were undetectable. Myocardial infarction was excluded. Electromyography examination performed 2 days after admission was normal.

The patient’s condition rapidly improved after per oral hydration and urine alkalinization, using sodium bicarbonate-enriched mineral water (Vichy), and cessation of physical activity. CK levels were normalized within 1 week.

3. Discussion and review

This case report combines several factors predisposing to rhabdomyolysis in a patient with type 1 diabetes – specifically, uncontrolled brittle diabetes with sequences of hyper- and hypoglycaemic episodes in the same day, caloric restriction and intensive exercise.

The main mechanism of rhabdomyolysis is disruption of calcium flux in muscle cells, leading to activation of calcium-dependent neutral proteases and phospholipases, and resulting in muscle cell destruction [1]. Inadequate energy supply, which leads to these calcium flux anomalies, is the main mechanism involved in diabetes-induced rhabdomyolysis. In diabetic
patients, the most frequent condition of rhabdomyolysis is represented by hyperglycaemic ketotic [2] and non-ketotic diabetic emergencies. In ketoadiposis, overt elevation of CK occurs in 40.6% of cases [4]. Hyperglycaemic hyperosmolar states are also at risk of rhabdomyolysis [2,5], independently of renal insufficiency. Wang et al. [6] analyzed a series of 265 diabetic emergencies due to ketoacidosis, hyperosmolar coma or both, and observed 44 cases of rhabdomyolysis defined by an increase of CK to greater than 1000 IU/L. The presence of this complication significantly increased the mortality risk at 1 week in this population. In addition, in two retrospective studies, CK increments were positively correlated with serum sodium levels, osmolarity and plasma glucose at the time of admission [6,7]. Hypophosphataemia may also be involved in rhabdomyolysis development in these severe metabolic disorders [2]. Of the various types of diabetes, fulminant type 1 diabetes may be complicated by rhabdomyolysis, as suggested by previous case reports [8]. It is also worth noting that new-onset rhabdomyolysis in a diabetic patient could represent a clinical condition suggestive of possible mitochondrial diabetes (MIDD) [9].

However, other conditions characterized by a decrease in energy supply to the muscles can cause rhabdomyolysis in diabetic patients with brittle diabetes, hypoglycaemia, caloric restriction and strenuous exercise. Virally et al. [10] reported a related observation characterized by muscle infarction in a patient with brittle diabetes. Graveling and Frier [3] made the observation of a rhabdomyolysis episode in a diabetic patient who ran a marathon the day after having a severe nocturnal hypoglycaemic attack that led to tonic–clonic seizure and an intramuscular injection of glucagon. However, it should be borne in mind that even in the absence of diabetes, intensive physical exercise [11] and caloric restriction [12] can bring about such muscle complications. Furthermore, other medical conditions may also precipitate a diabetic patient into rhabdomyolysis, including hyperthermia [13], hypothyroidism [14] and drugs prone to muscle toxicity (see a review by Cervellin et al. [1]). Diabetes is also a risk factor for rhabdomyolysis after bariatric surgery, especially in patients with a BMI greater than 40 kg/m² [15].

In conclusion, rhabdomyolysis is a rare, but severe, complication of diabetes. Being aware of its precipitating clinical conditions, mainly represented by the causes of a decreased energy supply to the muscles, can help to diagnose such a muscle insult and prevent its life-threatening consequences.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

References