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Adult Patient with Diabetic Ketoacidosis and Rhabdomyolysis

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Abstract

Rhabdomyolysis, acute kidney injury and diabetic ketoacidosis all are life-threatening conditions. Coincidence of them can be missed because the patient is usually asymptomatic or has mild symptoms related to rhabdomyolysis. The development of rhabdomyolysis as a complication of diabetic ketoacidosis is not well understood and only a few clinical studies address the phenomenon. We are reporting, along with a literature review, a 39-year-old male, who presented with diabetic ketoacidosis complicated with rhabdomyolysis and acute kidney injury. To the best of our knowledge, this is the first case reported in the United Arab Emirates. We highlight the syndrome because it is curable with early detection and proper treatment.

Keywords

Rhabdomyolysis, Diabetic Ketoacidosis, Acute Kidney Injury, Electrolytes Disturbance

1. Introduction

The world diabetes prevalence in adults in 2021 was estimated to be 10.5% [1]. Diabetic nephropathy is the leading cause of mortality in type 1 diabetes, which develops at a rate of around 2% - 3% annually [2]. Diabetes ketoacidosis is one of the common acute complications in patients with type 1 diabetes. Rhabdomyolysis is a leading cause of acute kidney injury. Emphasizing the occurrence of rhabdomyolysis in patients with diabetic ketoacidosis is vital since it will add a cumulative risk of developing renal impairment. Rhabdomyolysis is a life-threatening syndrome; the main attribute of rhabdomyolysis is the disruption of the sarcolemma and the release of creatinine kinase at a high level from the myocytes results in acute kidney injury. Electrolyte disturbance and metabolic

acidosis are common features of diabetic ketoacidosis (DKA); on the other hand, they are known to trigger rhabdomyolysis. There are a few reported cases in literature that address the existence of rhabdomyolysis and acute kidney injury in a patient with diabetic ketoacidosis. Most of the reported cases are in pediatrics. We would like to bring the physician's attention to the occurrence of rhabdomyolysis in the context of diabetes ketoacidosis, which can help in early diagnosis.

2. The Case

2.1. Case Presentation

A 39-year-old male was recently diagnosed with hypertension, for which he took an over-the-counter antihypertension medication; the patient was unsure about the name of the drug. However, he did not use it for one week prior to admission. He presented to our emergency department with generalized fatigability, nausea, and abdominal discomfort. On the clinical examination, he was conscious, slightly confused and dehydrated. His chest was clear on auscultation and his abdomen was soft and lax. In the emergency department, the patient's Venous blood gas (VBG) confirmed the diagnosis of diabetic ketoacidosis (anion gap 35 mEq/L, pH < 7.08, serum bicarbonate 6.5 mEq/L, serum ketones more than 7 mmol/L, blood Glucose 33.3 mmol/L). This is the first presentation for his diabetes. The Lab results revealed acute kidney injury and elevated creatinine kinase. Upon further history taking, he mentioned mild diffuse lower limb pain bilaterally. He denied fever, strenuous exercise or prolonged exposure to the sun. No recent use of herbal, alcohol, or recreational drugs was recorded. No history of recent trauma or abnormal movements. The Imaging studies reported a normal ultrasound scan study of the abdomen and pelvis and in the chest x-ray, there was no detectable pulmonary consolidation. The laboratory investigation on admission showed in **Table 1** and **Figure 1**.

The patient was treated according to the diabetic ketoacidosis protocol as well as alkalization of urine and his condition showed significant improvement.

2.2. Similar Case

A few cases reports in the literature have mentioned the association of hypophosphatemia, severe acidosis, and high osmolality as contributors to rhabdomyolysis in a patient with DKA.

I. A 31-year-old male presented with two weeks history of polyuria, polydipsia, and nocturia and showed up at ED with epigastric abdominal pain, nausea, and non-bloody vomiting. The patient was in a diabetic ketoacidosis episode in which rhabdomyolysis developed and complicated into acute renal failure. [3]

II. A 12-year-old female was admitted to the hospital with severe DKA, severe metabolic acidosis, hypophosphatemia, rhabdomyolysis, and oliguria ARF. [4]

III. Two type 2 diabetes mellitus (T2DM) adolescent patients who had diabetic ketoacidosis (DKA) and hyperglycemic hyperosmolar state (HHS) predisposing

Table 1. Show the lab result upon admission and the following days.

Test	Result	Normal reference range
Hgb	12.40 gm/dL	13 - 17 gm/dL
Platelet	152.00 k	150 - 450 k
Sodium	123.00 mmol/L	136 - 145 mmol/L
Potassium	5.29 mmol/L (high)	3.5 - 5.1 mmol/L
Magnesium	1.1 mmol/L	0.66 - 1.07 mmol/L
Creatinine	173 decreased to 81 umol/L (high)	59 - 104 umol/L
Urea	23.10 mmol/L	2.76 - 8.07mmol/L
Calcium	2.02 mmol/L	2.15 - 2.5 mmol/L
Phosphorus	0.14 mmol/L (low)	0.37 - 1.47 nmol/L
Total CK	2356.00 increased to 14816.00 U/L ((high)	20 - 200 U/L
C-Peptide	0.289 nmol/L	0.37 - 1.47 nmol/L
HbA1C%	13.70 % (high)	4.8% - 6%
CRP	14.46 mg/L	0 - 5 mg/L
Myoglobin	705.90 ng/mL (high)	28 - 72 ng/mL

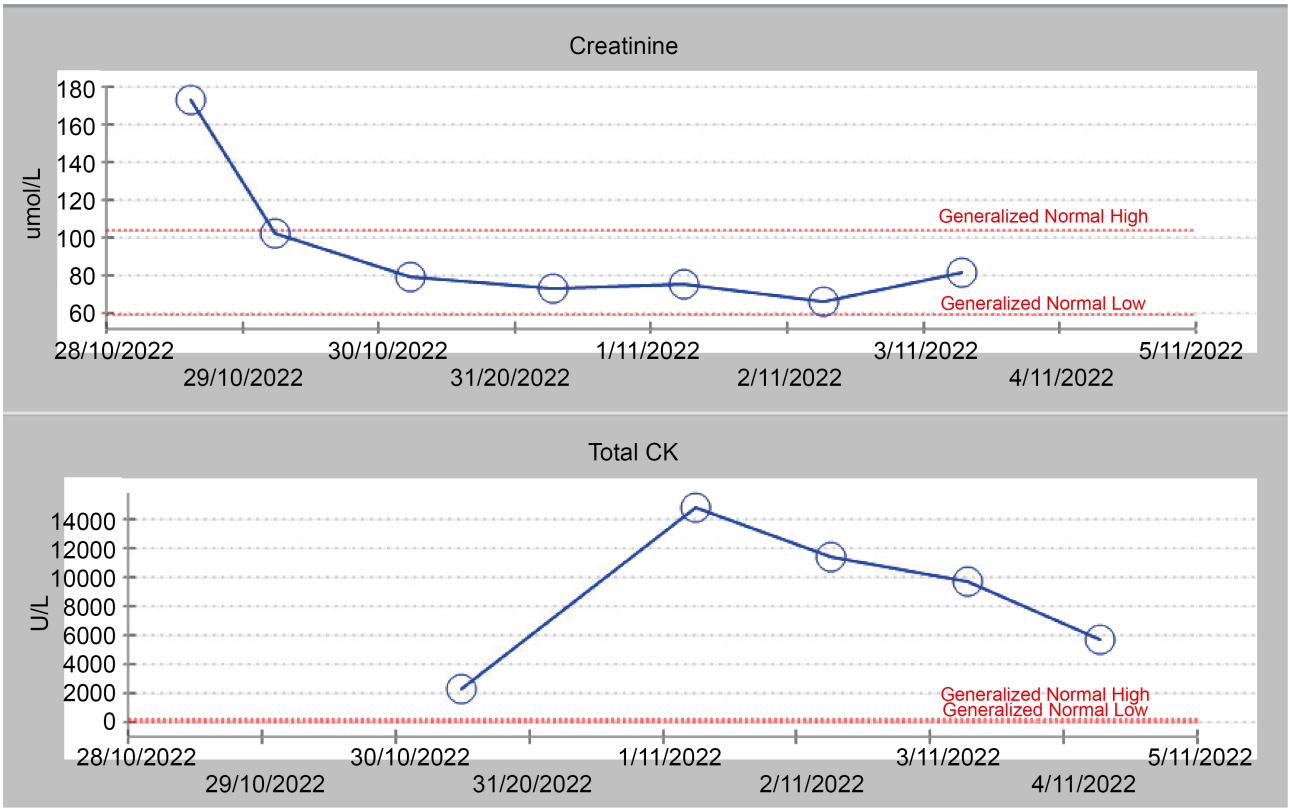

Figure 1. Show the trend of creatinine and creatinine kinase from day 29-10-2022 till 5-11-2022.

rhabdomyolysis (RM) [5].

2.3. Discussion

The Na/K-ATPase pump actively controls the transport across the cell membrane and maintained the charges gradient. These processes depend on ATP as a source of energy. ATP (adenosine triphosphate) depletion appears to be the end result of most causes of rhabdomyolysis. The depletion disrupts cellular transport mechanisms. [6] Subsequently, an increase in intracellular calcium levels will lead to the hyperactivity of proteases and proteolytic enzymes. [7] These enzymes degrade myofilaments and injure cell membrane phospholipids resulting in the leakage of intracellular contents into the plasma. However, the pathophysiology of diabetic ketoacidosis consists of marked metabolic acidosis and electrolyte disorder which theoretically can precipitate rhabdomyolysis. In a cross-sectional study carried out in the emergency department of Baghdad teaching hospital/Iraq; where 43 patients with type1 diabetes presenting with diabetic ketoacidosis were included. Rhabdomyolysis incidence in this study was 6.98%, statistically, a significant finding was observed with the duration of diabetes, higher serum creatinine, higher serum potassium, higher serum chloride, and severe acidosis. [8] The risk of renal injury is low when initial CK levels are lower than 15,000 - 20,000 U/L. However, lower CK levels may lead to renal injury in patients with sepsis, dehydration, or acidosis. [9] Based on the trend of CK and creatinine levels, we think the cause of acute kidney injury in our case is due to hypovolemia rather than rhabdomyolysis

3. Conclusion

Rhabdomyolysis in the context of diabetic ketoacidosis is usually overlooked because the patient is asymptomatic or has mild symptoms related to rhabdomyolysis. However, it may lead to permanent kidney damage and progress to chronic kidney disease. We advise focusing on the possible coincidence of Rhabdomyolysis while treating patients with diabetic ketoacidosis. Further studies to understand the underlying pathophysiology and prevalence are recommended.

Abbreviations and Acronyms

DKA: diabetic ketoacidosis; CK: creatinine kinase; ED: emergency department; ARF: acute renal failure; ATP: adenosine triphosphate.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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