

Increased Creatinine Clearance in Acute Kidney Injury due to Heat Stroke

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Abstract

Acute kidney injury (AKI) is associated with increased mortality and risk of chronic kidney disease (CKD). Whereas AKI is well known to occur frequently in patients with heat stroke, creatinine clearance levels of these patients have not been evaluated in literature. In this report, we present the case of a patient with increased creatinine clearance who developed AKI due to heat stroke. A 40-year-old male with no past medical history was admitted to the intensive care unit of our hospital due to AKI from heat stroke. Although he was diagnosed with stage 3 AKI at admission, his creatinine clearance, measured by a 12-h urine collection, was highly elevated to 230 mL/min/1.73 m². His serum creatinine was decreased to the baseline level 12 h after admission, with fluid resuscitation. This case can suggest that creatinine clearance might be underestimated, although serum creatinine levels are elevated in AKI due to heat stroke.

Keywords: Acute kidney injury; Heat stroke; Creatinine clearance

Introduction

Acute kidney Injury (AKI) is associated with increased mortality and risk of chronic kidney disease (CKD). Whereas AKI is well known to occur frequently in patients with heat stroke, no studies have examined potential changes in creatinine clearance in this patient population. We herein present the case of a patient with AKI due to heat stroke whose creatinine clearance was elevated.

Case Report

A 40-year-old male without past medical or family history pre-

sented to our hospital with nausea and generalized muscle pain after working outdoors on a hot summer day. On arrival, his rectal temperature was 37.6 °C, and his serum creatinine, aspartate aminotransferase and alanine aminotransferase levels were 2.58 mg/dL, 68 IU/L and 82 IU/L, respectively. His serum creatinine kinase (CK) was 237 IU/L. On physical examination, his tongue was dry; however, no other abnormal findings were observed. He was diagnosed with heat stroke and renal dysfunction and admitted to the intensive care unit. According to the Kidney Disease: Improving Global Outcomes (KDIGO) criteria, his renal dysfunction was classified as stage 3 AKI based on the Modification of Diet in Renal Disease equation. Fluid resuscitation successfully decreased serum creatinine level to 0.84 mg/dL by 12 h after admission. However, his creatinine clearance, measured by a 12-h urine collection, was elevated to 230 mL/min/1.73 m². He was discharged home from hospital on day three.

Discussion

The presented case can suggest that in patients with elevated serum creatinine due to heat stroke, creatinine clearance calculated by a 12-h urine collection might also be elevated. The KDIGO criteria and severity classification for AKI have an important role in predicting mortality and CKD risk. Previous studies found that AKI was associated with increased short and long-term risk of death and increased risk of CKD and end-stage renal disease (ESRD) [1, 2]. Conversely, one study reported that while AKI occurred in about 90% of heat stroke patients, more than 95% of the AKI patients were alive with serum creatinine levels that were recovered to baseline at the time of discharge [3]. Thus, renal function may not be impaired in heat stroke patients diagnosed with AKI.

Rhabdomyolysis is known to be associated with heat stroke, and cause AKI. CK level in this case was under 250 IU/L throughout the hospital stay. It was much lower than the reported cases of rhabdomyolysis [4, 5]. Thus, we consider that the AKI was not caused by rhabdomyolysis, but by hypovolemia from heat stroke. The elevation of serum creatinine is potentially caused by muscle injury by heat stroke, thereby meeting the AKI criteria [3, 6-9].

As shown in this patient, creatinine clearance is also known to be probably elevated in septic AKI, ultimately affecting dosing of drugs such as antibiotics. In septic AKI patients, renal function was reported not to decline as low as expected, which could lead to underestimation of glomerular filtration rate and insufficient drug dosing [10]. This phenomenon is termed aug-

Manuscript submitted January 23, 2018, accepted January 29, 2018

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doi: <https://doi.org/10.14740/jmc3007w>

mented renal clearance in which renal function for solution clearance is elevated more than expected by visible laboratory data in critically ill patients [11, 12]. Therefore, more sensitive biomarkers such as the measured creatinine clearance are needed.

Conclusions

The measured creatinine clearance might be elevated in AKI due to heat stroke, and renal function for solution clearance might be underestimated with estimated glomerular filtration rate.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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