EM CASE OF THE WEEK.
BROWARD HEALTH MEDICAL CENTER
DEPARTMENT OF EMERGENCY MEDICINE

BROWARD HEALTH
Care Warriors

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Rhabdomyolysis

A 24 year-old male arrives to emergency room by EMS after being found down by a friend. The patient has no past medical history and had been drinking alcohol and consumed an unknown amount of Ativan the night prior and was last seen 14 hours prior to arrival. On arrival, patient is awake and arousable, with labored breathing. Vitals reveal a blood pressure of 60/48 mmHg and a heart rate of 110bm. Initial labs reveal a potassium of 5.5, CO2 of 16, BUN/Cr of 61/3.0. CK is elevated at 30,000 and a UA is done which shows a large of amount of blood with <5 RBCs/hpf. Which of the following is the most specific indicator that this patient's electrolyte and acid base derangement is due to rhabdomyolysis?

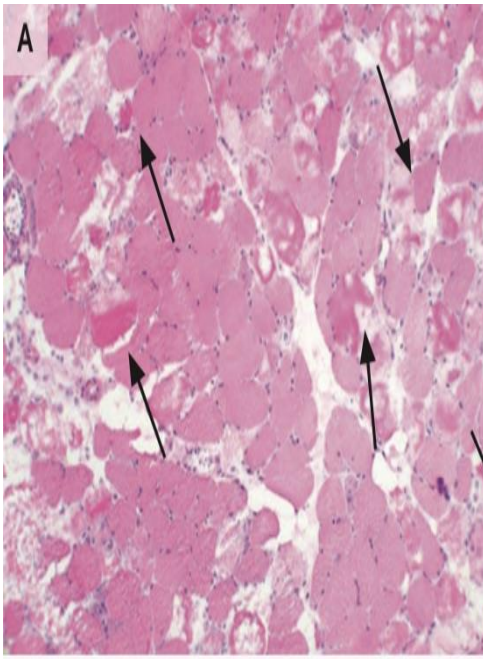
A. Elevated CK

B. Metabolic acidosis with respiratory compensation

C. Hyperkalemia

D. UA with large of amount of blood but no RBCs

E. Hypotension and tachycardia



Massive muscle necrosis on specimen stained with hematoxylin and eosin

Rhabdomyloysis and Acute Kidney Injury – NEJM 2009

EM Case of the Week is a weekly "pop quiz" for ED staff.

The goal is to educate all ED personnel by sharing common pearls and pitfalls involving the care of ED patients. We intend on providing better patient care through better education for our nurses and staff.

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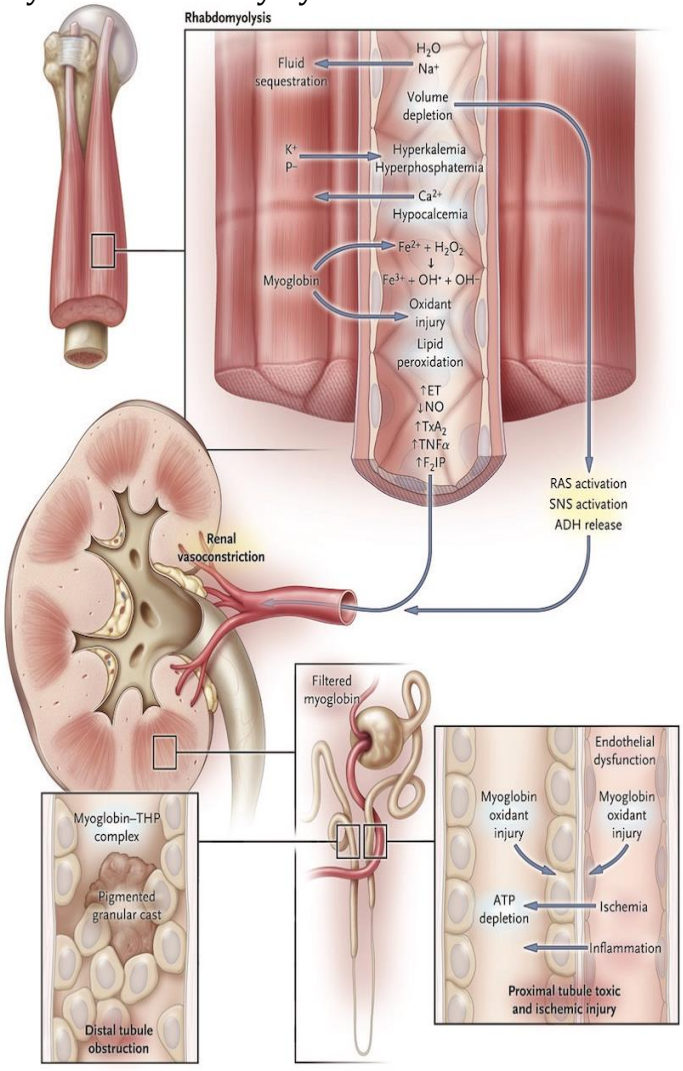
The correct answer is D: UA with large amount of blood but no RBCs.

Clinically significant rhabdomyolysis is due to massive muscular necrosis that leads to pimgenturia without hematuria or myoglobin induced acute kidney injury. Hyperkalemia, metabolic acidosis, elevated CK, and hypotension/tachycardia are other common symptoms, but may also occur with a number of other disease processes. As such, an elevated CK does not necessarily mean rhabdomyolysis and can be termed "HyperCKemia".

Discussion

Rhabdomyolysis occurs when muscle damage leads to leakage of intracellular electrolytes and sarcoplasmic proteins into the circulation causing muscle weakness, myalgias, swelling, and in severe cases metabolic derangements and acute kidney injury. The sarcoplasmic proteins that leak into the serum include myoglobin, creatine kinase, lactate dehydrogenase, alanine aminotransferase, and aspartate aminotransferase. Causes of rhabdomyolysis includes trauma, exertion, muscle hypoxia, genetic defects such as glycogen storage diseases or mitochondrial disorders, infection, body temperature changes, electrolyte disorders such as hypokalemia, and drugs or toxins.

Metabolic derangement's that can occur with rhabdomyolysis includes; hyperkalemia, hyperuricemia, hypermagnesemia, and hyperphosphatemia from leakage; hypocalcemia as a result of calcium entering damaged cells and precipitation of calcium phosphate; and high anion gap metabolic acidosis with onset of renal failure. The mechanism behind renal failure in rhabdomyolysis falls in free radical generation by the circulating myoglobin which causes oxidant injury and lipid peroxidation leading to renal vasoconstriction in addition to tubular obstruction by granular pigmented casts.



Rhabdomyolysis and Acute Kidney Injury – NEJM 2009

For a list of educational lectures, grand rounds, workshops, and didactics please visit ***BrowardER.com*** and **click** on the ***"Conference"*** **link**.

All are welcome to attend!

Warriors

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Discussion on Treatment

Volume Resuscitation: The primary treatment is aggressive volume resuscitation. Choice of fluid for resuscitation is as controversial as is the rate. Depending on severity, the rate of fluid administration should be between 400-1000mL/hour until euvolemia is achieved and/or urine output reaches 3cc/kg/hr. In terms of fluid choice most established guidelines call for isotonic saline or even 0.45% normal saline solutions. However, it can be argued that resuscitation with such high volumes of NS (in any scenario) can do more harm than good. Large volume NS resuscitation has been known to cause worsening renal function due to high chloride content and a hyperchloremic metabolic acidosis. Lactated ringers has been shown to be more in line with the physiological composition of serum and can help treat the metabolic acidosis that comes with rhabdomyolysis rather than contributing negatively to the acid-base disturbances. Volume repletion can be considered complete once myoglobinuria has cleared as observed on urine dipstick that tests negative for blood.

Renal Replacement Therapy: This is indicated if the patient has severe/symptomatic hyperkalemia, is oliguric/anuric, hypervolemia, or has a metabolic acidosis that is not responsive to treatment.

Take Home Points

- Rhabdomyolysis of clinical significance is characterized by massive muscle necrosis that leads to acute kidney injury with metabolic derangement as evidenced by urine dipstick positive for blood without a significant amount of RBCs.
- Elevated CK is not necessarily indicative of rhabdomyolysis that poses risk of renal injury to the patient. Often, patients with chronic or intermittent muscle destruction can have hyperCKemia.
- Mainstay of treatment is volume resuscitation and correction of electrolyte derangements.
- Trending CK to guide treatment goal is not supported by data and does not necessarily mean that a patient is still going through significant rhabdomyolysis.
- Use lactated ringers as opposed to normal saline for volume resuscitation.

ABOUT THE AUTHOR

This month's case was written by Christopher Naranjo. Chris is a 4th year medical student from NSU-COM. He did his emergency medicine rotation at BHMC in April 2019. Chris plans on pursuing a fellowship in nephrology or critical care after residency

REFERENCES

Bosch X, et.al. Rhabdomyolysis and Acute Kidney Injury. The New England Journal of Medicine. July 2, 2009. 361;1.