

Serum Myoglobin Predictive of Acute Kidney Injury (AKI) After High Voltage Electrical Contact Injuries

**Saturday, November 10, 2018
8:00 – 8:15 am**

Author and Co-authors:

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Objective:

Upon completion of the lecture, attendees should be better prepared to:

- Define rhabdomyolysis and the role of myoglobin in acute kidney injury
- Define serum myoglobin threshold levels that can be used to initiate renal protective therapies in electrical injuries

Abstract:

Introduction: Electrical high-voltage contact injuries are the second leading cause of occupational death in the U.S. and its survivors may suffer profound sequelae, including severe renal damage. When the electrical surge encounters the muscle cells, it causes a sudden and intense myocyte contraction, which induces the release of intracellular contents such as myoglobin and creatine kinase (CK). The most devastating sequelae include pigment induced renal damage that causes obstruction of the renal tubules leading to acute renal failure. Currently, the trauma literature supports the use of elevated serum CK as an indicator of muscle damage and rhabdomyolysis as well as an indicator of the risk of renal damage due to the filtration of pigment released from the damage. Despite the unique mechanisms surrounding a high voltage electrical injury, CK is currently used as an indicator of risk for renal damage in electrical burn patients similar to how it is used in trauma patients. While CK can be a reliable screening method for muscle injury, we believe that myoglobin is a more sensitive and specific indicator of risk and severity of renal damage. Therefore, our study aims to determine whether elevated CK or elevated myoglobin is more sensitive in predicting the risk of renal injury for electrical burn patients and to possibly define parameters for serum myoglobin when implementing renal protective therapies.

Methods: A retrospective, single institution review was conducted on all patients over the age of 18 years who suffered a high voltage electrical injury (>1,000 volts) admitted to the Timothy J. Harnar Regional Burn Center from 2006 to 2017. Patients were excluded from this study if they had preexisting end stage renal disease, were on dialysis, or died within 48 hours of admission. The data was analyzed by Chi-Square Testing to compare means in serum myoglobin and serum creatine kinase levels collected daily and acute kidney injury (AKI) as defined by the RIFLE criteria. Urine output and fluid resuscitation therapies were collected daily to track the progression of AKI. A Pearson product-moment correlation coefficient was computed to assess the relationship between AKI and serum myoglobin and serum CK. An independent

sample mean's test was performed on patients who developed AKI to determine a serum myoglobin threshold for initiation of treatment.

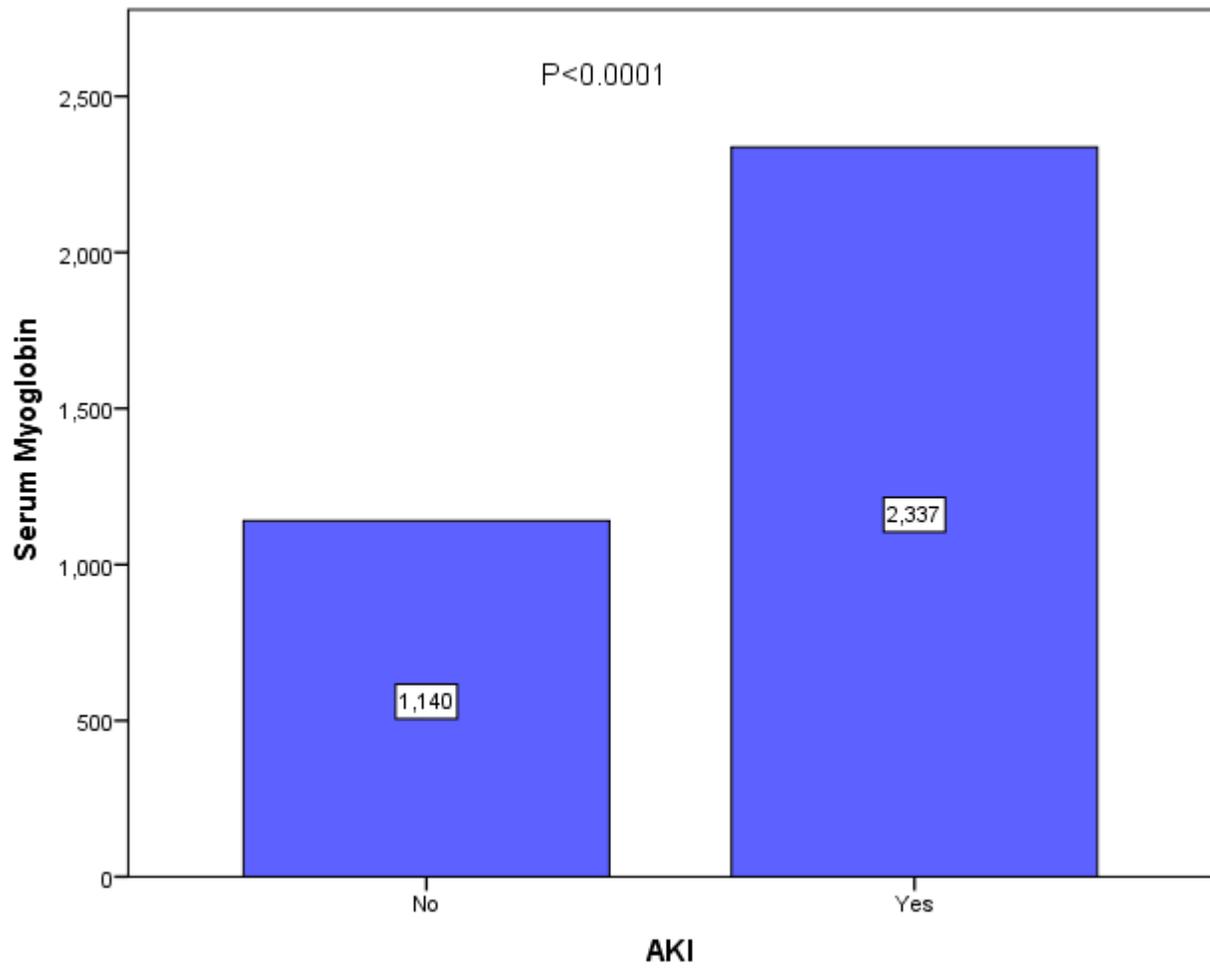
Results: A total of 207 patients were analyzed 2006-2017. Of those, 27.1% of patients developed AKI as determined by the RIFLE criteria, which breaks AKI into three categories Risk, Injury, and Failure. The criteria for Risk, the lowest level of AKI is as follows: increased serum creatinine x 1.5, GFR decrease >25% or urine output <0.5 ml kg⁻¹ h⁻¹ for 6 hours. The mean serum myoglobin in patients with AKI was found to be 2,336.9 versus no AKI 1,140.14 (P=0.0001). The mean serum CK level in patients with AKI was found to be 10,926 versus no AKI 8,174 (P=0.132). There was a positive correlation between serum myoglobin levels and developing AKI (r = 0.212, n = 120, p = 0.02), whereas there was no statistically significant correlation between serum CK levels and developing AKI. Patients with a myoglobin level of 1,449.52 or above are at significant risk of developing AKI (P=0.053) and need aggressive renal protective measures.

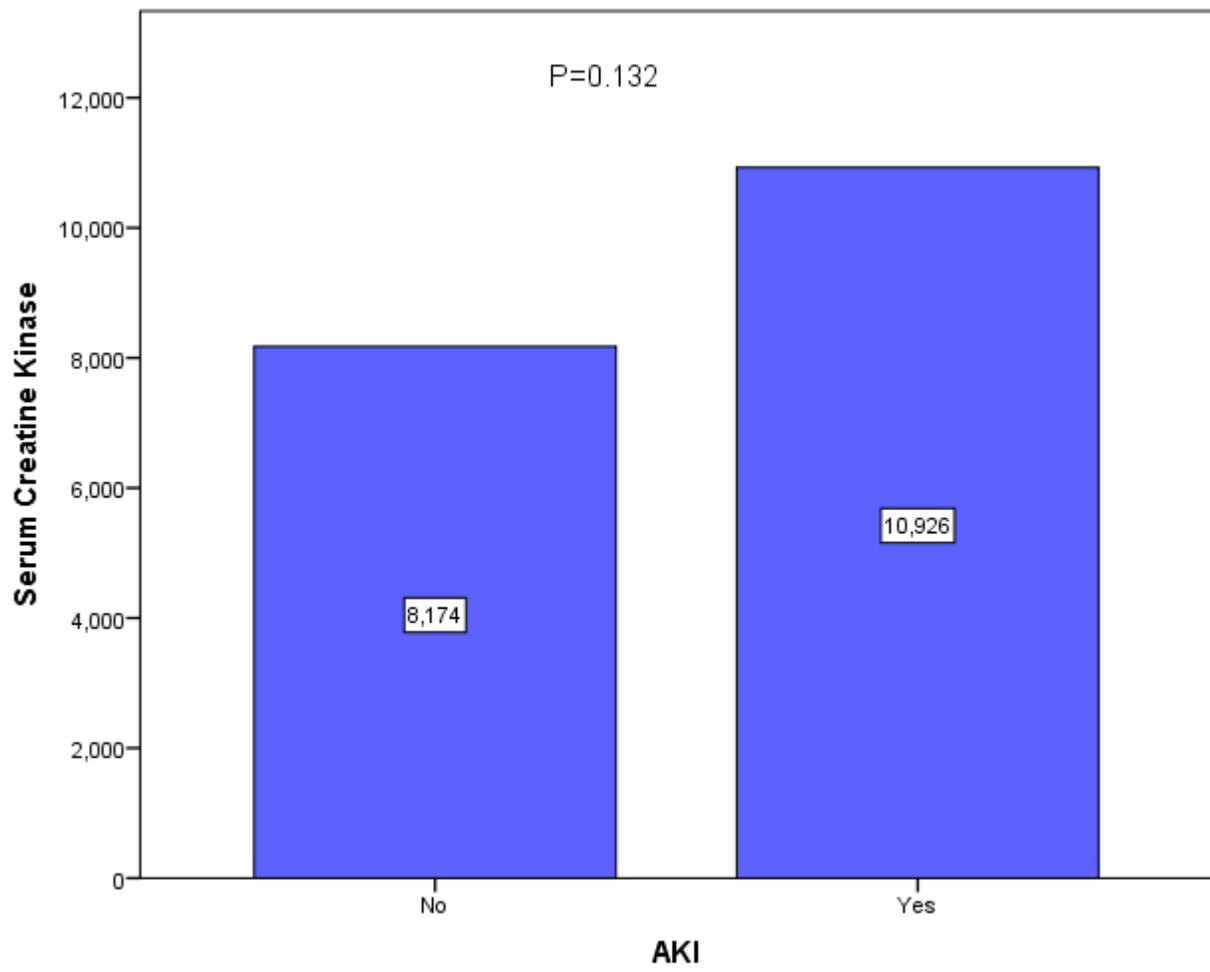
Conclusions: Serum myoglobin is a more sensitive marker for predicting AKI when compared to serum CK in patients who suffered high-voltage electrical burns. A serum myoglobin threshold level of >1500 was associated with increased risk of developing AKI and therefore, can indicate the need to initiate renal protective therapies. Although in trauma and rhabdomyolysis patients CK may be useful both for indication of muscle damage and indicating risk of renal damage, in electrical contact injuries myoglobin must be used to determine risk of renal damage and to direct renal protective measures.

Disclosure:

Pradeep Attaluri – No Relevant Financial Relationships to Disclose
Jon Henderson – No Relevant Financial Relationships to Disclose
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Ellie He, BS – No Relevant Financial Relationships to Disclose
Yana Puckett – No Relevant Financial Relationships to Disclose
John Griswold – No Relevant Financial Relationships to Disclose

Results





RIFLE Criteria

	GFR Criteria	Urine Output Criteria
<u>R</u>isk	<ul style="list-style-type: none">• Increased serum creatinine x 1.5 or• GFR decrease >25%	<ul style="list-style-type: none">• Urine output <0.5 ml kg⁻¹ h⁻¹ for 6 hours
<u>I</u>njury	<ul style="list-style-type: none">• Increased serum creatinine x 2 or• GFR decrease >50%	<ul style="list-style-type: none">• Urine output <0.5 ml kg⁻¹ h⁻¹ for 12 hours
<u>F</u>ailure	<ul style="list-style-type: none">• Increased serum creatinine x 3 or• GFR decrease >75% or• Serum creatinine >4 mg per 100 ml	<ul style="list-style-type: none">• Urine output <0.3 ml kg⁻¹ h⁻¹ for 12 hours or• Anuria for 12 hours
<u>L</u>oss	Persistent AKI (complete loss of kidney function for more than 4 weeks)	
<u>E</u>SRD	End Stage Renal Disease	