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Modification of Measures of Acute Kidney Injury to Risk Stratify Combat Casualties

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Introduction

- With the need to prepare for potential extended evacuation times from theater of operation due to both changing mission profiles and potential future conflicts, identifying acute kidney injury (AKI) early can help us determine the need for rapidity of evacuation.
- Early identification of AKI can also assist in aeroevacuation priorities for Role III to Role IV facility transfers.
- Creatinine is easily available as point of care testing and as part of serum chemistries in Role I to III, depending on deployment equipment.
- But, creatinine has both false positives and negatives due to being a muscle breakdown product that takes time to reach steady state.
- The Nephrocheck® Test System is an FDA approved device for identifying early AKI within 12 hours of acute cardiovascular or respiratory compromise in an ICU setting.
- We hypothesize that Nephrocheck® can also be used to identify AKI in injured patients in combat casualty, using burn patients as a

NephroCheck® Test System

Insulin-like Growth Factor-Binding Protein 7
Tissue-Inhibitor of Metalloproteinases 2

Methods

Patients:
130 consecutive burn patients admitted to the ICU at the United States Army Institute of Surgical Research, Burn Unit.
Inclusion Criteria: Age 18-65; Foley catheter placed for clinical purposes; Able to provide a fresh urine sample collected within 72 hours of injury
Exclusion Criteria: End-Stage Renal Disease; Anuria; Pregnant

Admission creatinine compared to the admission Nephrocheck® risk score for the combined outcome of death or need for renal replacement therapy.
Creatinine followed for 2 additional days.
Urine collected at admission measured using the Nephrocheck® twice (once on a centrifuged sample and once on an un-centrifuged sample) to look at need for centrifuge downrange
Combined Outcomes (death or need for dialysis by 30 days) determined on chart review
Interim Analysis of first 50 patients displayed on poster

Table 1. Descriptive Statistics N=50

Variable	Number (%)	Variable	Mean (STD)
Sex		Age	36.7 (12.3)
Female	9 (18.0)	ISS*	4.5 (3-13)
Male	41 (82.0)	TBSA*	15 (6-25)
MOI		Creatinine	1.0 (0.3)
Burn	42 (84.0)	SBP	123.3 (25.5)
Chemical	1 (2.0)	DBP	68.6 (16.3)
Electrical	7 (14.0)	MAP	88.0 (18.6)
Inhalation Injury		Heart Rate	96.7 (19.6)
No	36 (72.0)	Resp Rate	18.3 (8.1)
Yes	14 (28.0)	Temp	99.1 (1.7)
RRT		Weight (kg)	87.8 (18.2)
No	44 (88.0)	Height (cm)	173.7 (9.9)
Yes	6 (12.0)	BMI	28.8 (5.4)
Death			
No	48 (96.0)		
Yes	2 (4.0)		
Combined			
No	42 (84.0)		
Yes	8 (16.0)		

*Median (IQR)

Table 2. Logistic Regression Results

Variable	OR (95% CI); p value
Age	0.97 (0.90,1.05); p=0.49
Sex	
Female	0.12 (0.01,2.88); p=0.19
Male (ref)	
Creatinine	0.02 (0.01,0.87); p=0.04
Centrifuged	0.81 (0.41,1.59); p=0.53
TBSA	0.95 (0.88,1.03); p=0.25

Figure 1. Scatterplot Comparing Centrifuge Samples

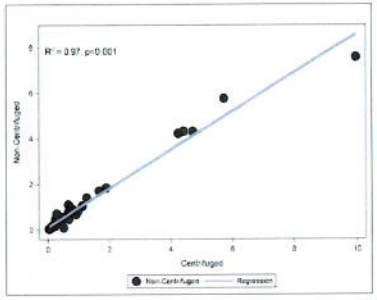
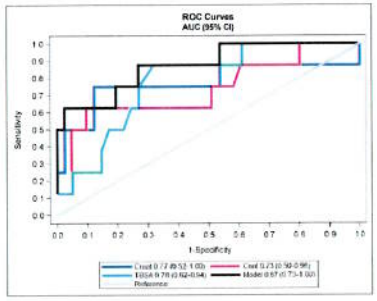


Figure 2. ROC Curve Comparisons



Results

- Centrifuged results are similar to non-centrifuged
- Creatinine is primary predictor of outcomes
- Including TBSA and Centrifuged NephroCheck® results only has a mild increase in predictive capabilities
- Only one patient had an increase of creatinine greater than 0.3

Conclusions

- Centrifuging samples does not significantly change results suggesting that NephroCheck® could be fielded without a centrifuge
- Even with lack of AKI in time period tested, both creatinine and NephroCheck® predicted 30 day outcomes
- Future studies might need to check repeated measures in order to capture an early AKI in burn patients to test operating characteristics of NephroCheck® vs Creatinine
- Creatinine remains as a key factor in prognosis for triage decisions. A better understanding of its dynamics is clearly warranted.

Statements

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