Lactate Clearance Rates: A New Predictor of Mortality in Severe Sepsis and Septic Shock

Jon Kerr, MD • Paul Murphy, BA • Otar Taktakishvili, MD • Gregory Garra, DO

Henry C. Thode, Jr, PhD • Peter Viccellio, MD • Adam J. Singer, MD

Department of Emergency Medicine, Stony Brook University Medical Center

STONY BROOK UNIVERSITY MEDICAL CENTER

Background:

● Recent studies indicate that serum lactate and lactate clearance predict mortality in sepsis.

● The sensitivity and specificity of single lactate concentrations as markers of tissue hypoperfusion have been debated, however, serial measurements of lactate clearance over time may be better prognosticators of organ failure and mortality.

● A recent study demonstrated a relationship between lactate clearance and mortality but the time interval between the two lactates was not standardized or reported.

Objective:

Validate whether lactate clearance can be used to predict mortality in patients with sepsis and to determine the utility of lactate clearance rates in predicting mortality.

Methods:

Study Design

Systematic electronic medical database review.

Setting

Suburban academic medical center with annual ED census of 80,000 that participates in the Surviving Sepsis Campaign.

Subjects

Patients with severe sepsis and septic shock identified using the Severe Sepsis Screening Tool.

Measures and Outcomes

● Lactate clearance rate was calculated by dividing the lactate clearance by the elapsed time between lactate measurements.

● The primary outcome was in-hospital mortality. Secondary outcomes were need for pressors and hospital length of stay (LOS) for survivors.

● Analysis was via descriptive statistics and multivariate logistic regression.

Results:

● There were 960 patients in the database of which 611 had repeat lactates. Overall mortality was 17.5% among patients with repeat lactate measurements.

● Initial lactate was significantly higher in patients who died compared to those who survived (5.61 vs. 4.39; P=0.03).

● For all patients, mortality was lower in patients with a decrease in lactate level compared to those whose lactate increased or remained the same (14.8% [77/522] vs. 33.7% [30/89]).

● Mean (sd) initial lactate level was 4.61 (2.82) for all patients. The mean 2nd lactate level was 2.95 (2.43).

● 303 patients (49.6%) had the second measurement in less than 6 hours. Lactate levels decreased from the first to the second measurement in 522 patients (85.4%) and increased or remained the same in the remaining 89 patients.

● After adjusting for age and gender, every 1% decrease in lactate was associated with a 1% decrease in the odds of mortality (OR 1.01, 95% CI 1.002-1.01; P=0.006).

● The rate of lactate clearance was also significantly associated with a decrease in mortality (OR 2.57, 95%CI 1.42-4.65; P=0.002).

● Age, gender, lactate clearance and lactate clearance rate were not predictive of need for pressors or hospital LOS.

Table 1 **Multivariate Odds Ratios for Predicting Mortality**

Factor	Odds Ratio	95% CI	P
Age (years)	1.02	1.01 - 1.03	.002
Gender (male)	0.63	0.40 - 1.01	.06
Initial Lactate Level	1.27	1.16 - 1.38	<.001
% Change in Lactate*	1.01	1.002 - 1.01	.006
Clearance Rate*	2.57	1.42 - 4.65	.002

* from 1st to 2nd measurement; positive values indicate increase in lactate

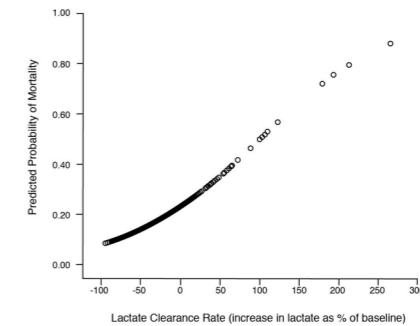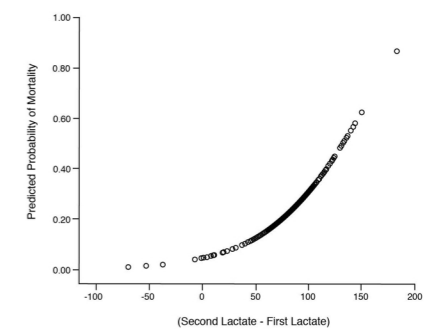Table 2 **Predicted Mortality as a Function of Lactate Clearance Rate**

Table 3 **Predicted Mortality as a Function of Lactate Clearance**

Limitations:

● Retrospective study

● Single center study

● Possible errors in lactate measurement (venous vs. arterial, whole blood vs. grey top)

● Sepsis treatment was individualized

● Not designed to assess validation

Conclusions:

● After adjusting for age and gender, every 1% decrease in lactate was associated with a 1% decrease in the odds of mortality.

● The lactate clearance rate has an additional effect to mortality over and above initial lactate and percentage of overall change in patients with severe sepsis and septic shock and therefore appears to be a promising predictor of mortality.