



Serum Lactate

Applicable for Trauma Triage?



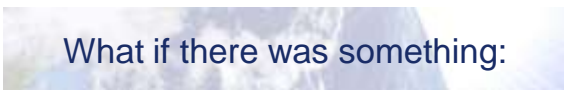


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What if there was something:

Identifies cellular hypoperfusion well before changes in vital signs

Potential to reduce morbidity & mortality

Guides early intervention and destination decision

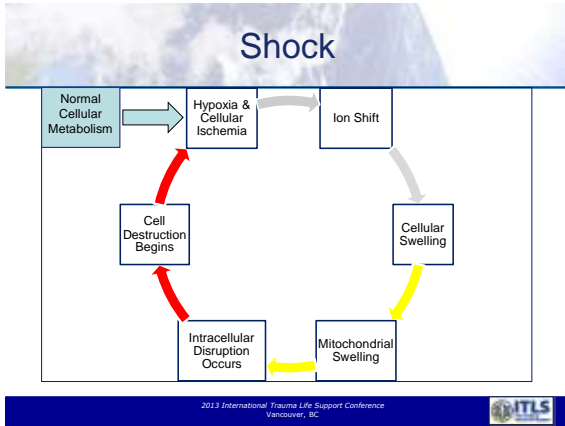
Easily obtained in the field

Does NOT increase scene time

Is inexpensive

Would You Use It?





Classic Shock Pattern

- **Early shock**
 - 15–25% blood volume
 - Tachycardia
 - Pallor
 - Narrowed pulse pressure
 - Thirst
 - Weakness
 - Delayed capillary refill
- **Late shock**
 - 30–45% blood volume
 - Hypotension
 - First sign of “late shock”
 - Weak or no peripheral pulse
 - Prolonged capillary refill

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Serum Lactate Levels

- Normal serum lactate level is between 0.5 – 1.0 mmol/L
- Hyperlactatemia – mild to moderate persistent increase in blood lactate concentration (2.0 – 4.0 mmol/L) without metabolic acidosis
- Lactic acidosis – persistently increased blood lactate levels (usually >4.0 – 5.0 mmol/L) in association with metabolic acidosis.

Cohen, R., & Woods, H. (1976). *Clinical and Biochemical Aspects of Lactic Acidosis*. London, United Kingdom: Blackwell Scientific Publications.

Mizock, B. A., & Falk, J. L. (1992). Lactic acidosis in critical illness. *Crit Care Med.* 20(1), 80-93.

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Pre-hospital Serum Lactate

- Serum lactate (BL, pLA) is a predictive of compromised perfusion and is associated with hypovolemic shock. (Cuyetta, 2008)
- Limited number of studies specific to Out-of-hospital environment utilization
- **Value of BL in out-of-hospital environment?**
 - Sensitivity measures the probability of "something" being tested positive
 - Number of true positives (correctly identified)/ Number of true positives+ Number of false negatives (incorrectly rejected)
 - Specificity measures the probability of something being tested negative
 - Number of true negatives (correctly rejected)/ Number of true negatives+ Number of false positives (incorrectly identified)
- **Questions to Explore:**
 - Potential utility in early identification of patients with significant injury?
 - What value is indicative of an acute or evolving poor physiologic condition?

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Jansen, T. C., van Bommel, J., Mulder, P. G., Rommes, H. J., Schieveld, S. J.M., Bakker, J. (2008). The prognostic value of blood lactate levels relative to that of vital signs in the pre-hospital setting: a pilot study. *Critical Care*. 12(6). Web access <http://ccforum.com/content/12/6/R160>

- **Prospective Observational:** In-hospital mortality; 124/135 patients enrolled; Scene arrival to ED 27 minutes (+/- 10); 92 survivors/ 32 deaths
- **Lactate drawn T1, T2 and ED**
 - Change in lactate level and the GCS were independently associated with in-hospital mortality; prognostic value was independent of vital signs
 - A 3.5 mmol/L or more resulted in mortality rate 41% T1 and 47% T2
 - NPV 88% with low lactate level; more sensitive marker
 - Clinical relevance
 - Triage tool in out-of-hospital (OOH) setting
 - Optimization of oxygen delivery
 - Limitations – data 10 years old; patients utilized presented with abnormal vital signs; unable to generalize across OOH; inclusion criteria utilized hypotension compensatory mechanisms; small sample
- **Outcome**
 - Pre-hospital blood lactate predicts in-hospital mortality
 - Prognostic value over and above common vital signs
 - Lactate more sensitive in identifying at-risk population than BP or HR

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Vandromme, M. J., Griffin, R. L., Weinberg, J. A., Rue, L. W., & Kerby, J. D. (2010). Lactate is a better predictor than systolic blood pressure for determining blood requirements and mortality: Could prehospital measures improve trauma triage? *J Am Coll Surg*. 210, 861-869.

- **Retrospective Observational:** PRBC transfusion or in-hospital mortality; 2,413/787/ 31,032; nine year enrollment period
- **Systolic BP between 90 – 110 mmHg**
 - BL level categorized (≤ 2.5 , > 2.5 to 5.0 , > 5.0 to 7.5 , or > 7.5)
 - Number of PRBC received in first 24 hours
 - Two-fold increase in risk for PRBC and mortality doubled when BL increased into the > 2.5 to 5.0 range ($p < 0.0001$)
- **Clinical Relevance**
 - Superior in mortality prediction than base deficit at initial and 24 hour
 - Not affected by acute drug or alcohol intoxication
- **Limitations** – Retrospective based on SBP from registry; Unable to extrapolate to PH setting; Study looked at SBP range for 90-110 (how about with permissive hypotension?)
- **Outcome**
 - Increase in BL identified significant risk of need for transfusion and mortality
 - No absolute abnormal value of BL was determined

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So What's the Message?

- Serum lactate is a better predictor of injury/ in-hospital mortality than vital signs
- Does **NOT** replace clinical evaluation
- Threshold defining acuity unknown
- Ability to generalize to trauma population unknown

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To Use or Not To Use

- Technology is improving
- Research is ongoing
- Not a standard in industry
- MAY assist with early identification of shock in patients with SBP \geq 90 mmHg and absence of traditional clinical shock patterns

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