

# Assessing resuscitation – lactate or physical exam?



Laura Evans MD, MSc  
Medical Director of Critical Care, UWMC

UNIVERSITY *of* WASHINGTON



# Disclosures

---

- > No financial conflicts to disclose
- > SSC Adult Guidelines co-chair and Steering Committee member



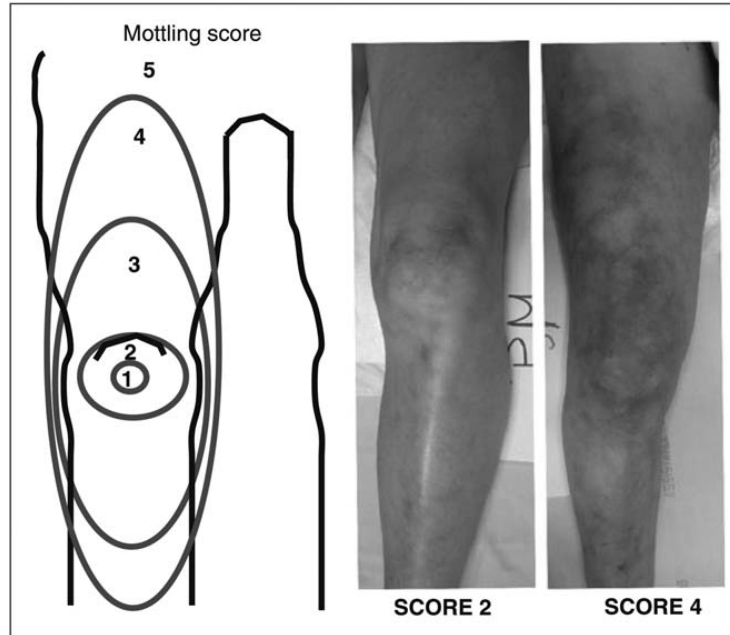
# Physical exam to assess resuscitation

---

- > Mental status
- > Capillary refill time
- > Skin mottling
- > Temperature gradients
  - Toe - ambient
  - Central - peripheral



# Physical exam to assess resuscitation



Current Opinion in Critical Care: June 2017 - Volume 23 - Issue 3 - p 232-236  
doi: 10.1097/MCC.0000000000000403



# Lactate measurement to assess resuscitation

---

- > Not a direct measure of tissue perfusion
- > But can represent
  - tissue hypoxia
  - accelerated aerobic glycolysis (i.e. beta-adrenergic stimulation)
  - liver failure
- > Increased lactate levels are associated with worse outcomes
- > Meta-analysis suggests reduced mortality with lactate-guided resuscitation compared to resuscitation without lactate monitoring



# Lactate clearance to assess resuscitation

---

## > Limitations

- Not all patients with septic shock have an elevated lactate (up to 40% in some cohorts)
- Clearance rate not well established
- Not universally available, especially in lower resource settings



# Lactate compared to physical exam?



**QUESTION** Does a resuscitation strategy targeting normalization of capillary refill time, compared with targeting serum lactate levels, reduce mortality in patients with septic shock?

**CONCLUSION** This randomized clinical trial of adults with septic shock found that use of a peripheral perfusion-targeted resuscitation strategy, compared with targeting serum lactate, did not significantly reduce mortality.

### POPULATION



198 Men 226 Women

Adults in the ICU with septic shock

Mean age: 63 years

### LOCATIONS

28 ICUs in 5 countries in South America



### INTERVENTION

424 Patients randomized

212

#### Peripheral perfusion group

Resuscitation protocol of normalizing capillary refill time (measured in seconds)

212

#### Lactate group

Resuscitation protocol of normalizing or decreasing lactate levels (>20% per 2 hours)

### PRIMARY OUTCOME

All-cause mortality at 28 days

### FINDINGS

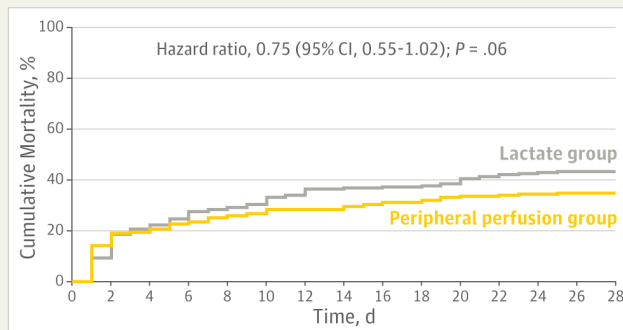
All-cause mortality at 28 days

Peripheral perfusion group

34.9% (74 patients died)

Lactate group

43.4% (92 patients died)



No significant risk difference between groups:

**-8.5%** (95% CI, -18.2% to 1.2%),



**Table 1. Patient Characteristics at Baseline<sup>a</sup>**

Characteristic	Peripheral Perfusion-Targeted Resuscitation (n = 212)	Lactate Level-Targeted Resuscitation (n = 212)
Age, mean (SD), y	62 (17)	64 (17)
Sex, No. (%)		
Men	108 (50.9)	90 (42.5)
Women	104 (49.1)	122 (57.5)
Charlson Comorbidity Index, median (IQR) <sup>b</sup>	3 (1-5)	3 (1-5)
APACHE II, mean (SD) <sup>c</sup>	21.9 (8.0)	22.0 (7.6)
SOFA, mean (SD) <sup>d</sup>	9.7 (3.4)	9.6 (3.5)
Chronic hypertension, No. (%)	83 (39.2)	93 (43.9)
Confirmed microbiology, No. (%)	151 (71.2)	153 (72.2)
Septic shock source, No. (%)		
Intra-abdominal infection	72 (34.0)	77 (36.3)
Pneumonia	70 (33.0)	58 (27.4)
Urinary tract infection	42 (19.8)	45 (21.2)
Other sources <sup>e</sup>	18 (8.5)	19 (9.0)
Unknown origin	10 (4.7)	13 (6.1)
Hemodynamic and perfusion-related variables		
Heart rate, mean (SD), /min	103 (24)	104 (23)
Arterial blood pressure, mean (SD), mm Hg	69 (14)	68 (13)
Norepinephrine dose, median (IQR), µg/kg/min	0.24 (0.11-0.40)	0.20 (0.10-0.35)
Central venous pressure, No.	199	194
Median (IQR), mm Hg	9 (6-13)	9 (6-12)
Serum lactate, mean (SD), mmol/L	4.6 (4.3)	4.5 (2.5)
Central venous oxygen saturation, No.	204	197
Mean (SD)	71 (13)	71 (12)
Venous-arterial Pco <sub>2</sub> gradient, No.	203	195
Median (IQR), mm Hg	7 (5-10)	7 (5-10)
Capillary refill time		
Median (IQR), s	5 (4-6)	4 (3-6)
≤3 s, No. (%)	48 (22.6)	60 (28.3)
Initial management data, median (IQR)		
Time from matching entry criteria to randomization, h	1.5 (0.0-3.0)	1.3 (0.0-2.6)
Intravenous fluid loading per weight, mL/kg <sup>f</sup>	25 (16-40)	30 (20-43)
Time from diagnosis of septic shock to antibiotics, h	2.0 (1.0-2.0)	1.5 (1.0-2.0)

Abbreviations: APACHE, Acute Physiology and Chronic Health Evaluation; IQR, interquartile range; SOFA, Sequential Organ Failure Assessment.

<sup>a</sup> For variables with missing data, summary data are based on available cases.

<sup>b</sup> Range, 0 to 33; higher scores indicate a greater burden of disease.

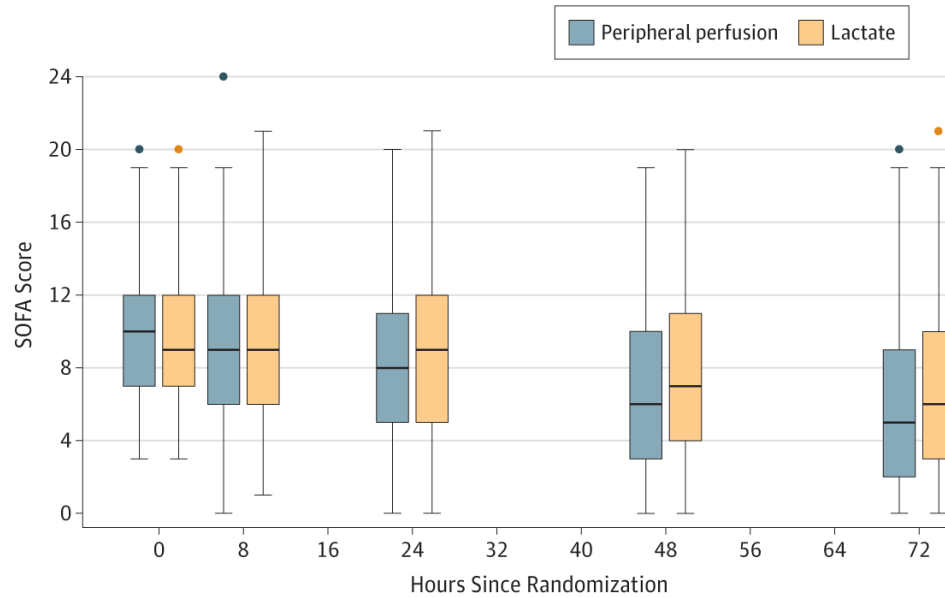
<sup>c</sup> Range, 0 to 71; higher scores indicate greater severity of illness and risk of in-hospital death (eg, a score of 22 in a medical patient with sepsis predicts an in-hospital mortality of 45%).<sup>22</sup>

<sup>d</sup> Range, 0 to 24; higher scores indicate a greater severity of organ dysfunction in critically ill patients and risk of in-hospital death (eg, a score of 10 predicts an in-hospital mortality of 50%).<sup>22</sup>

<sup>e</sup> Other sources of infection were soft-tissue infection (n = 18), meningitis (n = 6), central line-associated bloodstream infection (n = 4), endocarditis (n = 2), mediastinitis (n = 2), herpes encephalitis (n = 1), subdural empyema (n = 1), pleural empyema (n = 1), septic arthritis (n = 1), and septic abortion (n = 1).

<sup>f</sup> Total intravenous fluids include fluids administered during the interval between presentation to the emergency department and randomization.



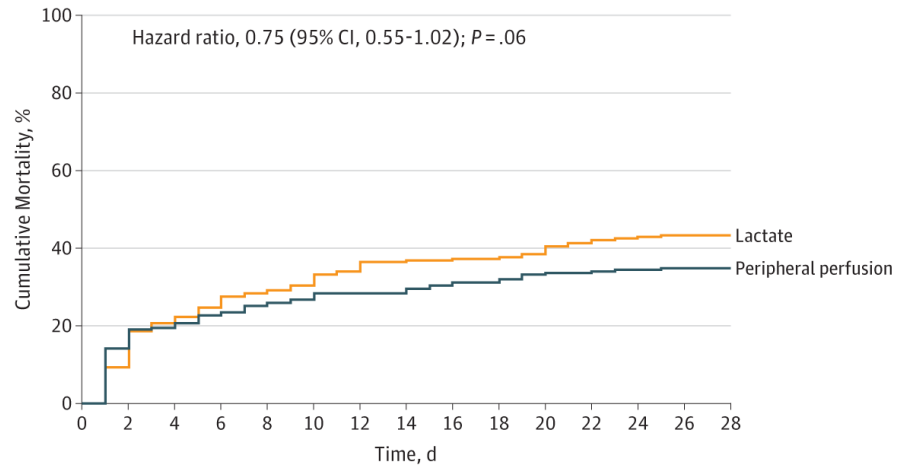


No. of patients	0	8	24	48	72
Peripheral perfusion	212	197	181	172	165
Lactate	212	203	189	173	166



	Peripheral perfusion targeted resuscitation	Lactate targeted resuscitation		
<b>Exploratory Outcomes</b>				
Amount of resuscitation fluids within the first 8 h, No.	206	209		
Mean (SD), mL	2359 (1344)	2767 (1749)	-408 (-705 to -110)	.01
Total fluid balance, mL <sup>g</sup>				
Within 8 h, No.	198	205		
Mean (SD)	1587 (1388)	1874 (1756)	-288 (-598 to 22.0)	.07
Within 24 h, No.	176	185		
Mean (SD)	2025 (2181)	2343 (2336)	-318 (-785 to 149)	.18
Within 48 h, No.	153	160		
Mean (SD)	992 (1810)	1224 (3336)	-233 (-831 to 366)	.45
Within 72 h, No.	157	162		
Mean (SD)	1389 (2809)	1601 (3069)	-212 (-858 to 434)	.52
Intra-abdominal hypertension, No. of events/total (%) <sup>h</sup>	75/119 (63.0)	68/120 (56.7)	6.4 (-6.9 to 19.6)	RR, 1.11 (0.90 to 1.37) .36 <sup>i</sup>
Use of renal replacement therapy, No. (%)	30 (14.2)	42 (19.8)	-5.7 (-13.3 to 1.9)	RR, 0.71 (0.47 to 1.10) .15 <sup>i</sup>
In-hospital mortality, No. (%)	84 (39.6)	97 (45.8)	-6.1 (-16.0 to 3.7)	RR, 0.87 (0.69 to 1.08) .20 <sup>i</sup>





No. at risk	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28
Lactate	212	192	168	160	152	148	140	135	134	133	130	124	122	120	120
Peripheral perfusion	212	182	171	164	159	155	152	152	148	146	142	141	139	138	138



# Assessing resuscitation – lactate or physical exam?

---

- > My take:
  - Both have utility
  - Use all the information that you have in assessing resuscitation
  - The key is to assess resuscitation
    - > No "set it and forget it"

