když nemohu dosáhnout cíle pro úvodní resuscitaci

Vladimír Šrámek

ARK, FN u svaté Anny v Brně

VIII. kongres ČSIM, Ostrava 11.-13.června 2014

Intensive Care Med (2013) 39:165–228
DOI 10.1007/s00134-012-2769-8

GUIDELINES

R. P. Dellinger
Mitchell M. Levy
Andrew Rhodes
Djillali Annane
Herwig Gerlach
Steven M. Opal

Surviving Sepsis Campaign: International Guidelines for Management of Severe Sepsis and Septic Shock, 2012

A. Initial resuscitation

1. Protocolized, quantitative resuscitation of patients with sepsis-induced tissue hypoperfusion (defined in this document as hypotension persisting after initial fluid challenge or blood lactate concentration ≥4 mmol/L). Goals during the first 6 h of resuscitation:
   (a) Central venous pressure 8–12 mmHg
   (b) Mean arterial pressure (MAP) ≥ 65 mmHg
   (c) Urine output ≥ 0.5 mL kg^{-1} h^{-1}
   (d) Central venous (superior vena cava) or mixed venous oxygen saturation 70 or 65 %, respectively (grade 1C)
2. In patients with elevated lactate levels targeting resuscitation to normalize lactate as rapidly as possible (grade 2C)

SURVIVING SEPSIS CAMPAIGN CARE BUNDLES

TO BE COMPLETED WITHIN 3 HOURS:
1) Measure lactate level
2) Obtain blood cultures prior to administration of antibiotics
3) Administer broad spectrum antibiotics
4) Administer 30 mL/kg crystalloid for hypotension or lactate ≥ 4 mmol/L

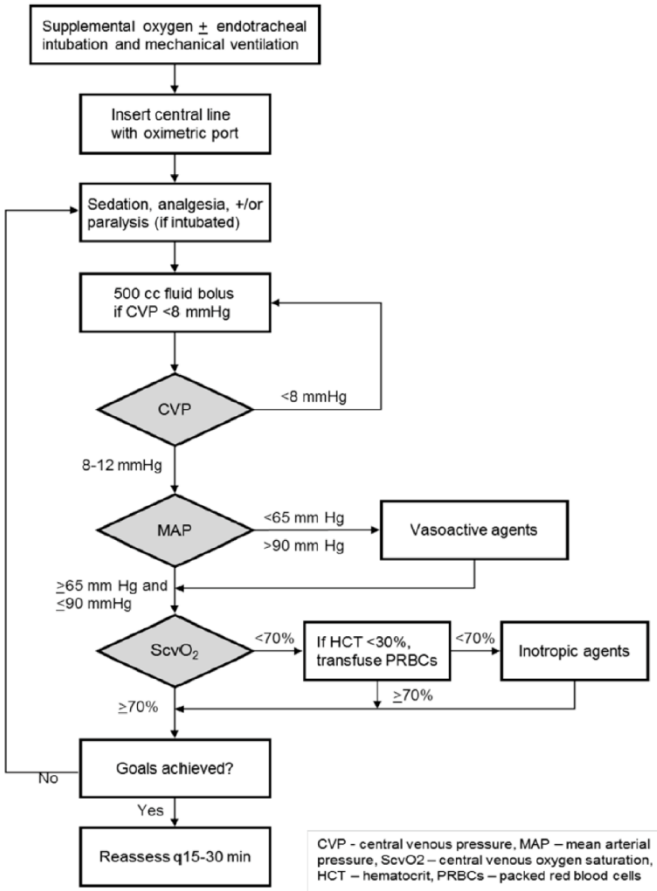
TO BE COMPLETED WITHIN 6 HOURS:
5) Apply vasopressors (for hypotension that does not respond to initial fluid resuscitation) to maintain a mean arterial pressure (MAP) ≥ 65 mm Hg
6) In the event of persistent arterial hypotension despite volume resuscitation (septic shock) or initial lactate ≥ 4 mmol/L (36 mg/dL):
   - Measure central venous pressure (CVP)*
   - Measure central venous oxygen saturation ($ScvO_2$)*
7) Remeasure lactate if initial lactate was elevated*

*Targets for quantitative resuscitation included in the guidelines are CVP of ≥8 mm Hg, $ScvO_2$ of ≥ 70%, and normalization of lactate.

protokoly?

Supplementary Figures

Figure S1. – Protocol for early goal-directed therapy (EGDT).



CVP - central venous pressure, MAP – mean arterial pressure, ScvO2 – central venous oxygen saturation, HCT – hematocrit, PRBCs – packed red blood cells

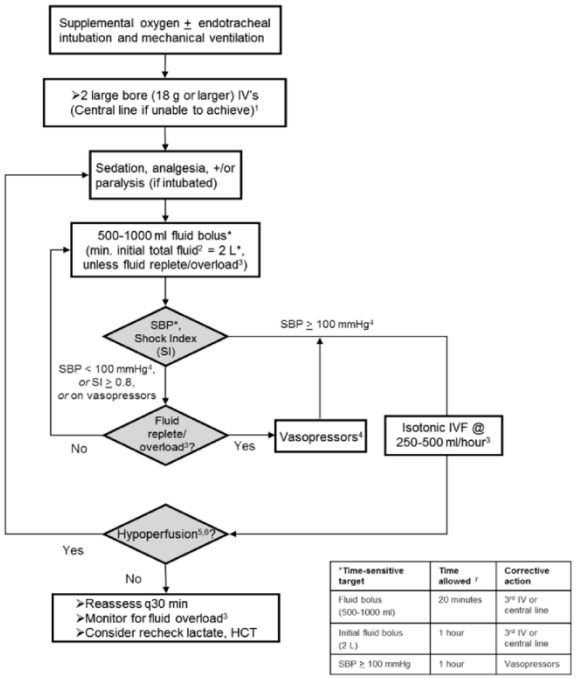
The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

A Randomized Trial of Protocol-Based Care for Early Septic Shock

The ProCESS Investigators*

Figure S2. – Protocol for Standard Therapy.



*Time-sensitive target	Time allowed [7]	Corrective action
Fluid bolus (500-1000 ml)	20 minutes	3rd IV or central line
Initial fluid bolus (2 L)	1 hour	3rd IV or central line
SBP ≥ 100 mmHg	1 hour	Vasopressors

IVF – intravenous fluids; HCT – hematocrit; SBP – systolic blood pressure; SI – shock index; CVP – central venous pressure; $ScvO_2$ – central venous oxygen saturation; MAP – mean arterial pressure; PRBC – packed red blood cells.

1. Central line should only be placed and used for venous access. During the 6h intervention, CVP and ScvO2 measurements are discouraged. If time-sensitive fluid targets can be achieved with smaller IVs (e.g., one 18g and one 20g), that is acceptable.
2. Only isotonic fluid should be used (e.g., saline, lactated Ringer's). Colloids are neither encouraged nor excluded.
3. Fluid replete/overload is defined here as a clinical diagnosis by the treating ProCESS Investigator. Signs and symptoms of overload include jugular venous distention, rales, and decreased pulse oximetry readings. Discontinue all IVF (boluses, background rate) once this occurs, until no longer deemed fluid replete/overload.
4. If patient's SBP is within 10% of known baseline SBP, AND patient is not deemed to be clinically hypoperfused, the SBP>100 mmHg target can be deemed fulfilled. Arterial lines allowed if deemed necessary, but not mandatory. Shock index = heart rate / systolic blood pressure.
5. Hypoperfusion is defined here as a clinical diagnosis by the treating ProCESS Investigator. Signs and symptoms include, but are not limited to, MAP < 65 despite SBP > 100, arterial lactate > 4, mottled skin, oliguria, and altered sensorium.
6. Transfuse PRBCs for Hgb < 7.5 g/dL.
7. From time of prompt by protocol (i.e., not from time of physician order, or from when intravenous fluid bag hung).

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*Targets for quantitative resuscitation included in the guidelines are CVP of ≥8 mm Hg, $ScvO_2$ of ≥ 70%, and normalization of lactate.

hypotenze

1. We **recommend** mean arterial pressure (MAP) be maintained ≥ 65 mm Hg (Grade 1C).

MAP < 65 mmHg škodí →

Intensive Care Med (2005) 31:1066–1071
DOI 10.1007/s00134-005-2688-z

ORIGINAL

Marjut Varpula
Minna Tallgren
Katri Saukkonen
Liisa-Maria Voipio-Pulkki
Ville Pettilä

Hemodynamic variables related to outcome in septic shock

EPOSS

75 pacientů z 897 tj. 8.4% Hg (p<0.001); MAP > 65mmHg 0.36 (0.20-0.64)

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

High versus Low Blood-Pressure Target in Patients with Septic Shock

CONCLUSIONS

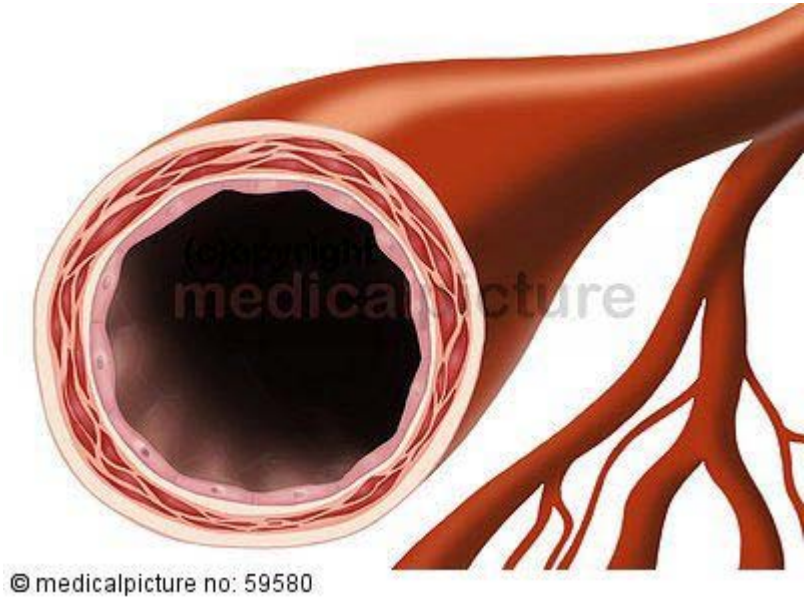
Targeting a mean arterial pressure of 80 to 85 mm Hg, as compared with 65 to 70 mm Hg, in patients with septic shock undergoing resuscitation did not result in significant differences in mortality at either 28 or 90 days. (Funded by the French Ministry of Health; SEPSISPAM ClinicalTrials.gov number, NCT01149278.)

hypotenze

MAP = SV x SVR

Problém?
ECHO

MAP



Problém?
CRT

problém je

ECHO

Chlopeň? Perikard? P/L srdce? D dysfunkce? LVOT? Kontraktilita?

- dobutamine
- inhibitory PDE3
- levosimendan – Hysebye T, Eur J Heart Fail 2013
- (esmolol) - Morelli A, JAMA 2013
- mechanická podpora (IABC…. LVAD)

problém je

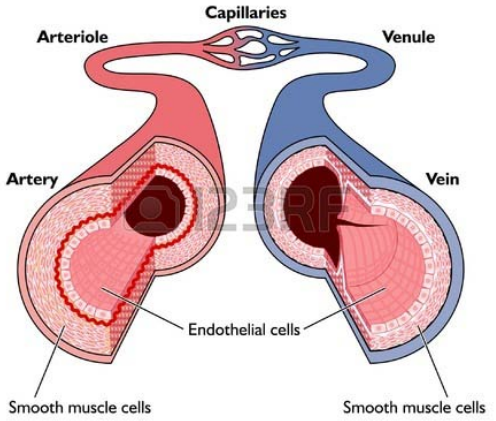


Table 6 Recommendations: hemodynamic support and adjunctive therapy

G. Fluid therapy of severe sepsis

1. Crystalloids as the initial fluid of choice in the resuscitation of severe sepsis and septic shock (grade 1B).
2. Against the use of hydroxyethyl starches for fluid resuscitation of severe sepsis and septic shock (grade 1B).
3. Albumin in the fluid resuscitation of severe sepsis and septic shock when patients require substantial amounts of crystalloids (grade 2C).
4. Initial fluid challenge in patients with sepsis-induced tissue hypoperfusion with suspicion of hypovolemia to achieve a minimum of 30 mL/kg of crystalloids (a portion of this may be albumin equivalent). More rapid administration and greater amounts of fluid may be needed in some patients (grade 1C).
5. Fluid challenge technique be applied wherein fluid administration is continued as long as there is hemodynamic improvement either based on dynamic (e.g., change in pulse pressure, stroke volume variation) or static (eg, arterial pressure, heart rate) variables (UG).

Hamzaoui *et al. Critical Care* 2010, **14**:R142
http://ccforum.com/content/14/4/R142

CRITICAL CARE

RESEARCH Open Access

Early administration of norepinephrine increases cardiac preload and cardiac output in septic patients with life-threatening hypotension

Olfa Hamzaoui, Jean-François Georger, Xavier Monnet, Hatem Ksouri, Julien Maizel, Christian Richard, Jean-Louis Teboul*

Effects of norepinephrine on mean systemic pressure and venous return in human septic shock

Romain Persichini, MD; Serena Silva, MD; Jean-Louis Teboul, MD, PhD; Mathieu Jozwiak, MD; Denis Chemla, MD, PhD; Christian Richard, MD; Xavier Monnet, MD, PhD

tekutiny po úvodním bolusu - monitorace

Optimalizace preloadu

- dle predikce fluid responsiveness (PPV/SVV, dIVC, dVTI….
- Napodobení bolusu tekutiny (End Expiratoiry Hold, PLR)

critical care review

Predicting Fluid Responsiveness in ICU Patients*

A Critical Analysis of the Evidence

Frédéric Michard, MD, PhD; and Jean-Louis Teboul, MD, PhD

CHEST 2012

Intensive Care Med (2012) 38:422–428
DOI 10.1007/s00134-011-2457-0

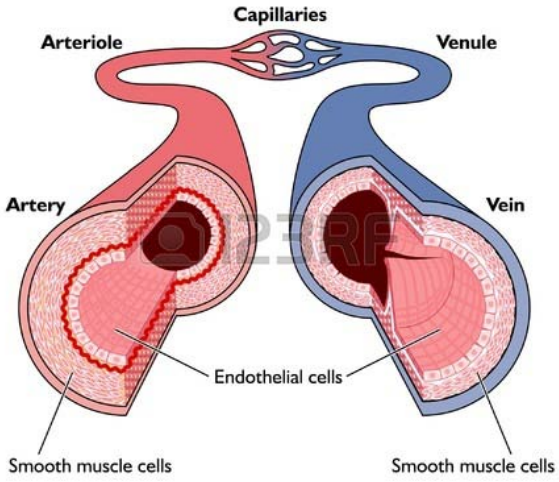
ORIGINAL

Charalampos Pierrakos
Dimitrios Velissaris
Sabino Scolletta
Sarah Heenen
Daniel De Backer
Jean-Louis Vincent

Can changes in arterial pressure be used to detect changes in cardiac index during fluid challenge in patients with septic shock?

NE

problém je



2. We recommend norepinephrine as the first-choice vasopressor (grade 1B).
3. We suggest epinephrine (added to and potentially substituted for norepinephrine) when an additional agent is needed to maintain adequate blood pressure (grade 2B).
4. Vasopressin (up to 0.03 U/min) can be added to norepinephrine with the intent of raising MAP to target or decreasing norepinephrine dosage (UG).
5. Low-dose vasopressin is not recommended as the single initial vasopressor for treatment of sepsis-induced hypotension, and vasopressin doses higher than 0.03–0.04 U/min should be reserved for salvage therapy (failure to achieve an adequate MAP with other vasopressor agents) (UG).
6. We suggest dopamine as an alternative vasopressor agent to norepinephrine only in highly selected patients (e.g., patients with low risk of tachyarrhythmias and absolute or relative bradycardia) (grade 2C).

Adrenalin?
Terlipresin 0,05-0,1 mg/hod kont.
HCT
NE: blok NOx, CRRT

adrenalin

Norepinephrine plus dobutamine versus epinephrine alone for management of septic shock: a randomised trial

Djillali Annane, Philippe Vignon, Alain Renault, Pierre-Edouard Bollaert, Claire Charpentier, Claude Martin, Gilles Troché, Jean-Damien Ricard, Gérard Nitenberg, Laurent Papazian, Elie Azoulay, Eric Bellissant, for the CATS Study Group*

Lancet 2007; 370: 676–84

Summary

Background International guidelines for management of septic shock recommend that dopamine or norepinephrine

Interpretation There is no evidence for a difference in efficacy and safety between epinephrine alone and norepinephrine plus dobutamine for the management of septic shock.

Review

Bench-to-bedside review: Is there a place for epinephrine in septic shock?

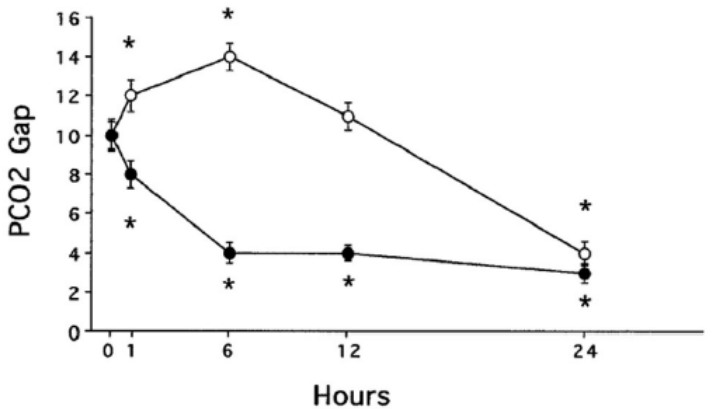
Bruno Levy

Service de Réanimation Médicale, Hôpital Central, 54000 Nancy, France

Corresponding author: Bruno Levy, b.levy@chu-nancy.fr

Published online: 4 November 2005
This article is online at http://ccforum.com/content/9/6/561

Critical Care 2005, 9:561-565 (DOI 10.1186/cc3901)



individuální přístup resuscitace hemodynamiky

každý nemocný

každá diagnóza

každý time-point

Pinsky MR, Payen D. Functional hemodynamic monitoring.
Crit Care 2005; 9:566-572

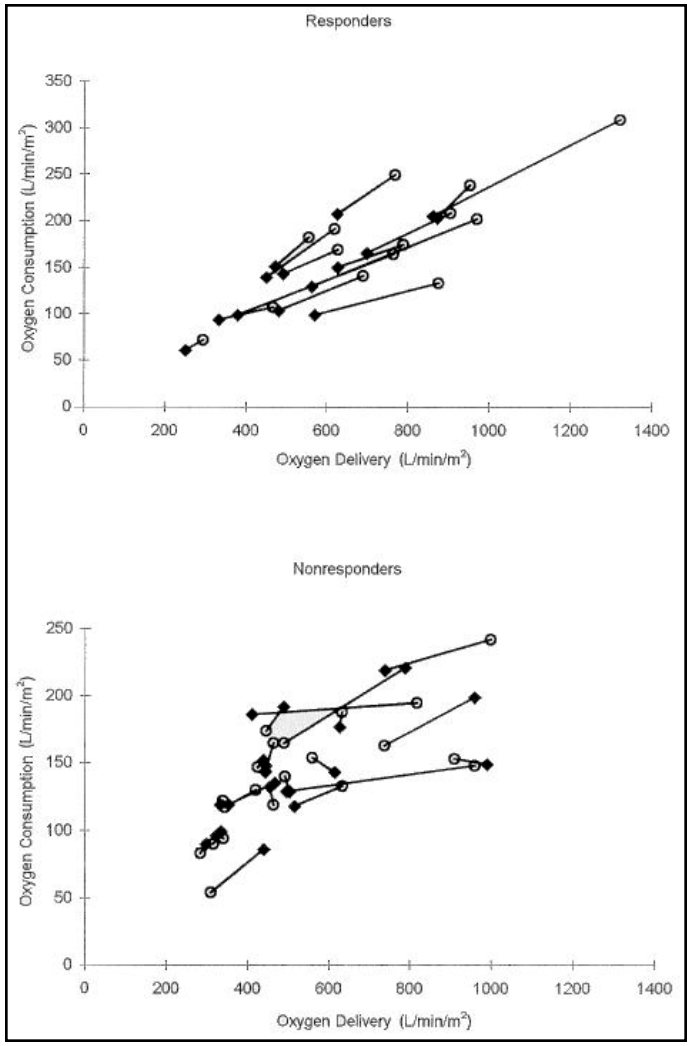
odmítnutí předdefinovaných hodnot DO2I

beyond CI (DO2I) ⌦ VO2

- pCO2gap
- ShO2/SvO2
- mikrocirkulace
- VO2

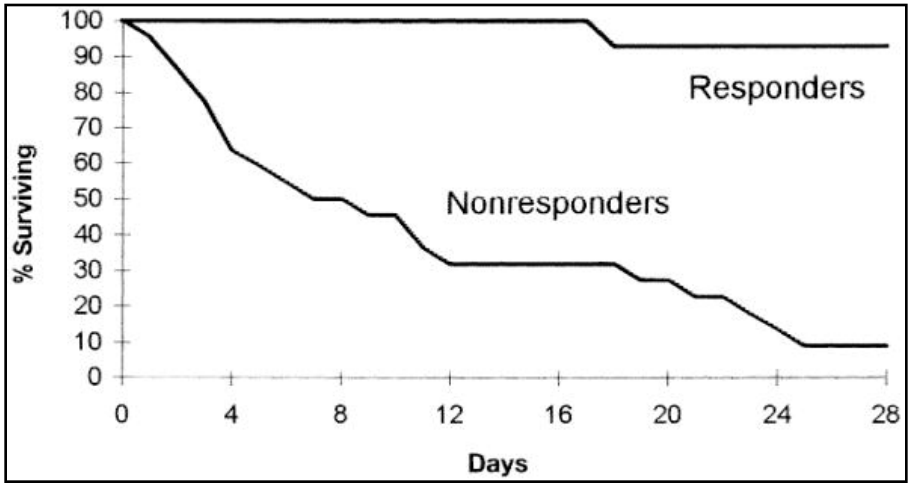
ShO2:
ShO2/SvO2 < 0.9
De Backer D, Vincent JL (1999) Why, when, and how to insert a hepatic vein catheter in critically ill patients. Crit Care Med 27:1680-1

Dobutaminový test a DO2/VO2



A prospective study of the use of a dobutamine stress test to identify outcome in patients with sepsis, severe sepsis, or septic shock.
Rhodes, Andrew; MRCP, FRCA; Lamb, Fiona; Malagon, Ignazio; Newman, Philip; Grounds, R; Michael MD, FRCA; Bennett, E

Critical Care Medicine. 27(11):2361-2366, November 1999.

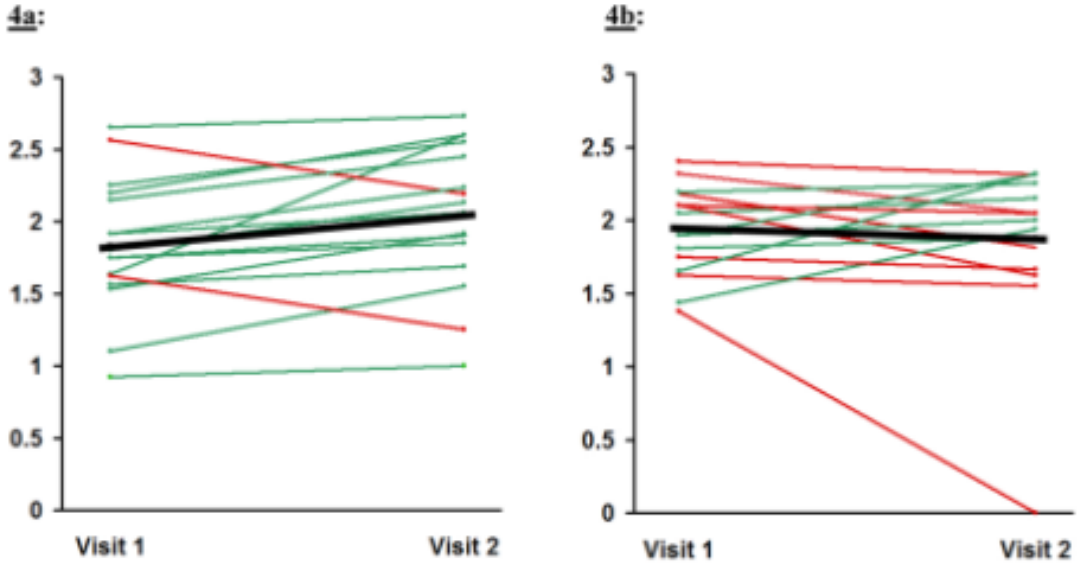


mikrocirkulace

Intensive Care Med. 2008 December ; 34(12): 2210–2217. doi:10.1007/s00134-008-1193-6.

Early Increases in Microcirculatory Perfusion During Protocol-Directed Resuscitation are Associated with Reduced Multi-Organ Failure at 24 hours in Patients with Sepsis

Stephen Trzeciak, MD, MPH[1,2], Jonathan V. McCoy, MD[2], R. Phillip Dellinger, MD[1], Ryan



Ospina-Tascon G et al. **Effects of fluids on microvascular perfusion in patients with severe sepsis.** Intensive Care Med. 2010 Jun;36(6):949-55.

mikrocirlulace = CI nebo MAP

laktát > 4 mmol/L (stratifikace 1/2/3/4) clearance >10-20% za 2 hod (6-8 hod)

1. Shapiro NI, Howell MD, Talmor D, Nathanson LA, Lisbon A, Wolfe RE, Weiss JW: **Serum lactate as a predictor of mortality in emergency department patients with infection.** *Ann Emerg Med* 2005, **45**:524–528.
2. Arnold RC, Shapiro NI, Jones AE, Schorr C, Pope J, Casner E, Parrillo JE, Dellinger RP, Trzeciak S: **Multi-center study of early lactate clearance as a determinant of survival in patients with presumed sepsis.** *Shock* 2009, **32**:35–39.
3. Nichol AD, Egi M, Pettila V, Bellomo R, French C, Hart G, Davies A, Stachowski E, Reade MC, Bailey M, Cooper DJ: **Relative hyperlactatemia and hospital mortality in critically ill patients: a retrospective multi-centre study.** *Crit Care* 2010, **14**:R25.
4. Nguyen HB, Rivers EP, Knoblich BP, Jacobsen G, Muzzin A, Ressler JA, Tomlanovich MC: **Early lactate clearance is associated with improved outcome in severe sepsis and septic shock.** *Crit Care Med* 2004, **32**:1637–1642.
5. Jones AE, Shapiro NI, Trzeciak S, Arnold RC, Claremont HA, Kline JA: **Lactate clearance vs central venous oxygen saturation as goals of early sepsis therapy: a randomized clinical trial.** *JAMA* 2010, **303**:739–746.
6. Jansen TC, van Bommel J, Schoonderbeek FJ, Sleeswijk Visser SJ, van der Klooster JM, Lima AP, Willemsen SP, Bakker J: **Early lactate-guided therapy in intensive care unit patients: a multicenter, open-label, randomized controlled trial.** *Am J Respir Crit Care Med* 2010, **182**:752–761.

JAMA®
The Journal of the American Medical Association
Weekly Audio Commentary

20. Mikkelsen ME, Miltiades AN, Gaieski DF, Goyal M, Fuchs BD, Shah CV, Bellamy SL, Christie JD (2009) Serum lactate is associated with mortality in severe sepsis independent of organ failure and shock. Crit Care Med 37:1670–1677. doi:10.1097/CCM.0b013e31819fcf68
21. Jansen TC, van Bommel J, Woodward R, Mulder PG, Bakker J (2009) Association between blood lactate levels, sequential organ failure assessment subscores, and 28-day mortality during early and late intensive care unit stay: a retrospective observational study. Crit Care Med 37:2369–2374. doi:10.1097/CCM.0b013e3181a0f919

TABLE 2. BLOOD LACTATE LEVELS

Hours after Start of Therapy	Lactate Level (mEq/L)		*P* Value
	Control Group	Lactate Group	
Baseline (0 h)	4.7 (3.9–5.5)	4.6 (3.9–5.4)	0.75
8	2.7 (2.3–3.2)	2.6 (2.2–3.1)	0.59
0–8	3.3 (2.8–3.9)	3.2 (2.7–3.8)	0.80
9–72	1.7 (1.4–2.0)	1.6 (1.3–1.9)	0.17

AMERICAN JOURNAL OF
Respiratory and Critical Care Medicine®

laktát

Early Lactate-Guided Therapy in ICU Patients: A Multicenter, Open-Label, Randomized, Controlled Trial. Am J Resp Crit Care Med 2010 May 12. [Epub ahead of print]

Jansen TC, et al Bakker J. for the LACTATE Study Group.

OBJECTIVE: To assess the effect of lactate monitoring and resuscitation directed at decreasing lactate levels in ICU patients admitted with a lactate level of >/= 3.0 mEq/l.

- **METHODS:** to decrease lactate by >/= 20% per two hours for the initial 8 hours of ICU stay….
- **MEASUREMENTS AND MAIN RESULTS:** The lactate group received more fluids and vasodilators. However, there were no significant differences in lactate levels between the groups. In the intention-to-treat population (348 patients), hospital mortality in the control group was 43.5% (77/177) compared with 33.9% (58/171) in the lactate group (p=0.067). When adjusted for predefined risk factors, **hospital mortality was lower in the lactate group (hazard ratio 0.61, 95%CI 0.43-0.87, p=0.006).**
- **CONCLUSIONS:** In patients with hyperlactatemia on ICU admission, lactate-guided therapy significantly reduced hospital mortality when adjusting for predefined risk factors.

Intensive Care Med (2007) 33:1863–1865
DOI 10.1007/s00134-007-0679-y

EDITORIAL

Jan Bakker
Tim C. Jansen

Don’t take vitals, take a lactate

laktát 2- 4 mmol/L

Journal of Critical Care 29 (2014) 334–339

Contents lists available at ScienceDirect

Journal of Critical Care

journal homepage: www.jccjournal.org

Prognosis of emergency department patients with suspected infection and intermediate lactate levels: A systematic review

Michael A. Puskarich, MD, Benjamin M. Illich, Alan E. Jones, MD *

Department of Emergency Medicine, University of Mississippi Medical Center, Jackson, MS

A B S T R A C T

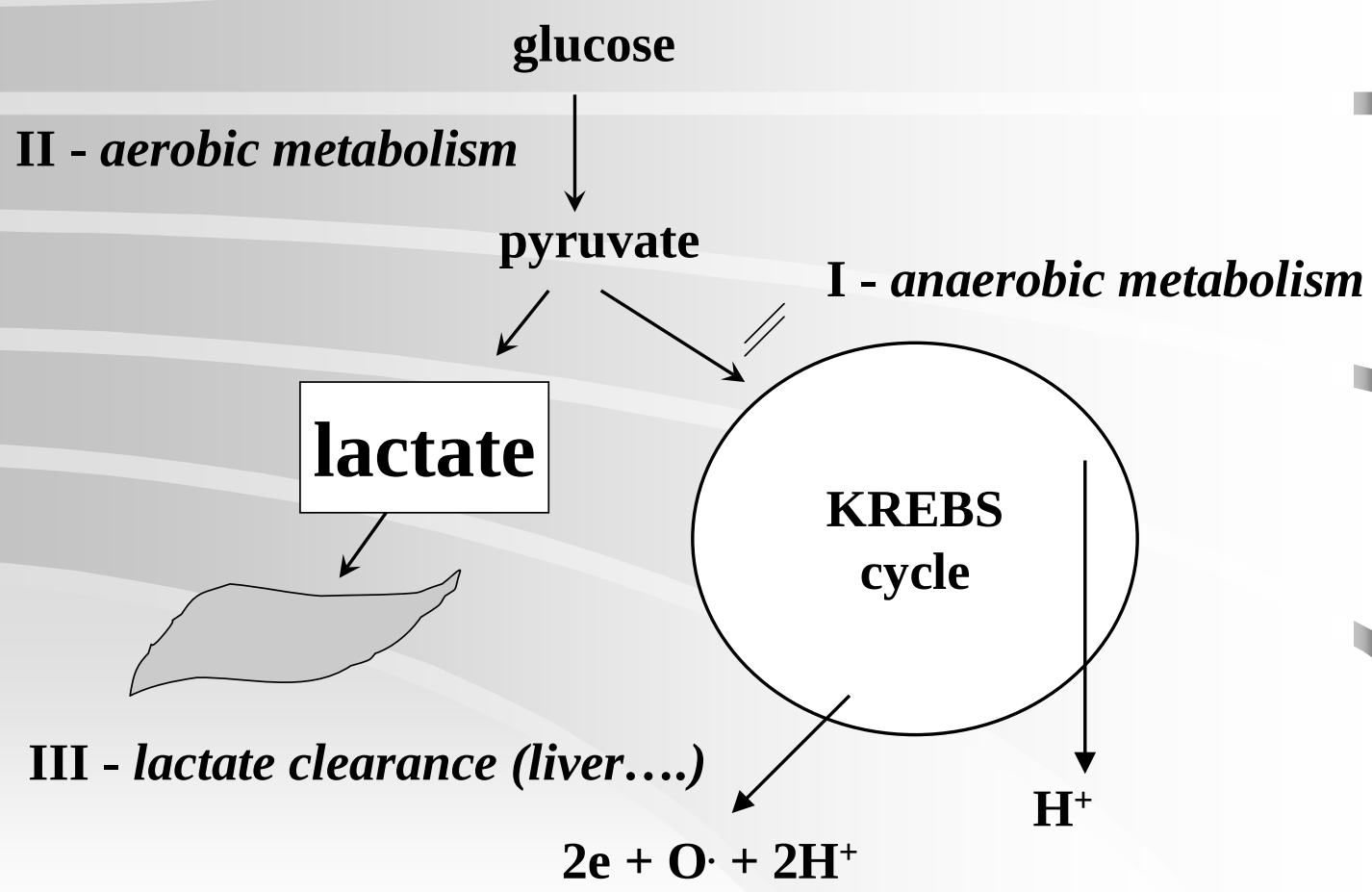
Purpose: Previous studies have shown a correlation between blood lactate greater than 4.0 mmol/L and mortality in patients with suspected infection in the emergency department (ED), but data are more limited regarding the prognosis of intermediate blood lactate (2.0-3.9 mmol/L), particularly in the absence of hemodynamic instability. We sought to quantify the prognostic significance of intermediate blood lactate levels in ED patients with suspected infection, emphasizing patients without hypotension.

Methods: A systematic review of 4 databases was conducted to identify studies using a comprehensive search strategy. All studies performed on adult ED patients with suspected infection and available data on hemodynamics, intermediate lactate levels, and mortality rates were included.

Results: We identified 20 potential publications, 8 of which were included. Intermediate lactate elevation was found in 11062 patients with suspected or confirmed infection, 1672 (15.1%) of whom died. Subgroup analysis of normotensive patients demonstrated a mortality of 1561 (14.9%) of 10 442, with rates from individual studies between 3.2% and 16.4%.

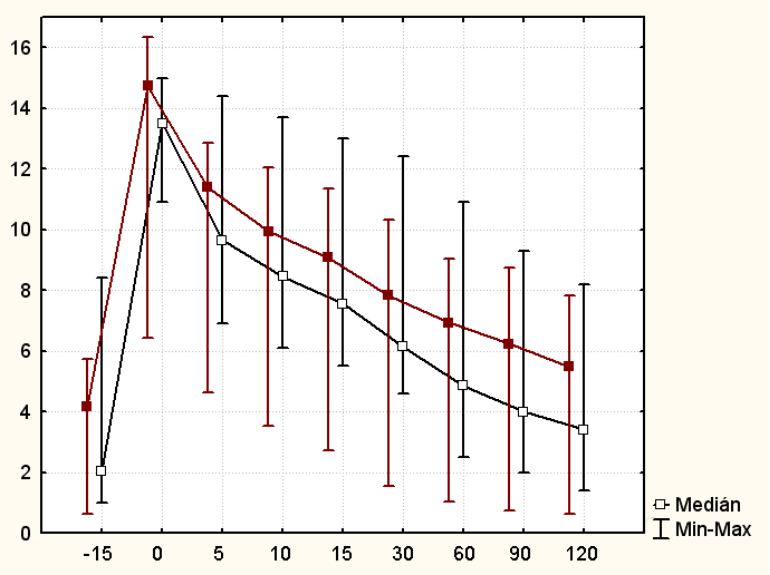
Conclusion: This systematic review found that among ED patients with suspected infection, intermediate lactate elevation is associated with a moderate to high risk of mortality, even among patients without hypotension. Physicians should consider close monitoring and aggressive treatment for such patients.

BLOOD LACTATE LEVEL



časná resuscitace SŠ

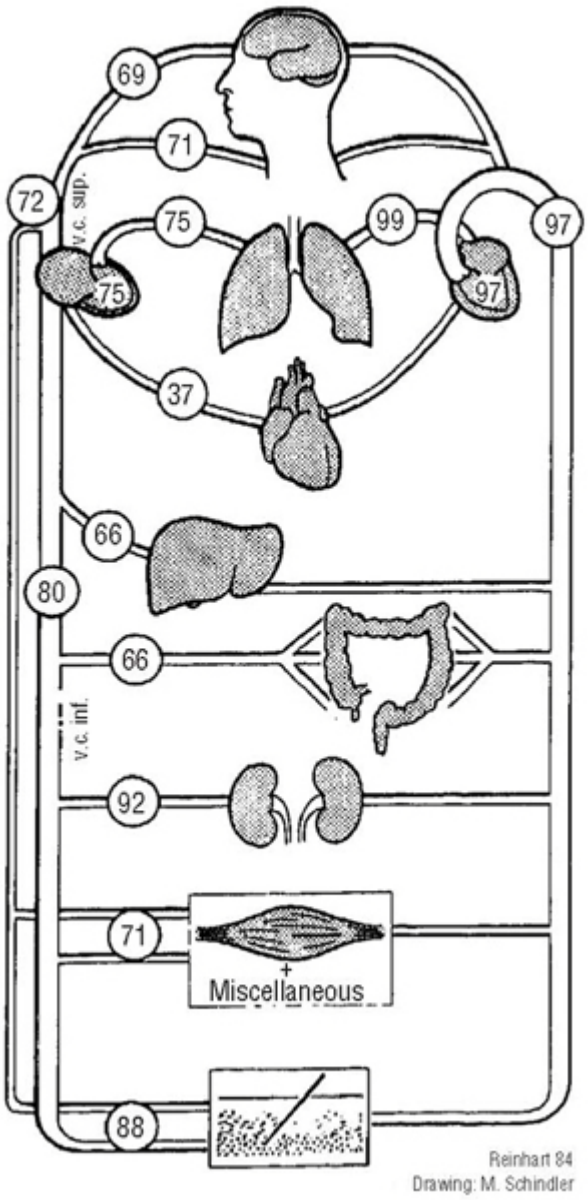
Suk P a kol. AIM 2007



	clearance (ml/kg/hod)		endogenní produkce (µmol/kg/hod)	
	T1	T2	T1	T2
G65	283 (224-920)*	345 (213-917)*	1039 (293-1924)#	1398 (320-2637)#
G85	331 (135-384)	323 (154-521)	702 (242-3223)	761 (423-2708)
p	0,46	0,60	0,29	0,34

Saturace Hb ve venózní krvi

S(c)vO2



SvO2 = saturace z plicnice
> 60%

S(c)vO2 = saturace z HDŽ
> 70%

SvO2 = S(c)vO2
≠

ScvO2

Velissaris et al. Critical Care 2011, 15:R177
http://ccforum.com/content/15/4/R177

CRITICAL CARE

RESEARCH Open Access

High mixed venous oxygen saturation levels do not exclude fluid responsiveness in critically ill septic patients

Dimitrios Velissaris, Charalampos Pierrakos, Sabino Scolletta, Daniel De Backer and Jean Louis Vincent*

Důležité:

- ScVO2 nemusí odpovídat SvO2 (ani v trendu) (zdroj patologie v SVC nebo ICV?)
- SŠ lepší přežíval když ScvO2 > 70%

> 70%

Intensive Care Med (2005) 31:1066–1071
DOI 10.1007/s00134-005-2688-z

ORIGINAL

Marjut Varpula
Minna Tallgren
Katri Saukkonen
Liisa-Maria Voipio-Pulkki
Ville Pettilä

Hemodynamic variables related to outcome in septic shock

- nízké hodnoty jsou špatné (ale znamenají, že není přítomna porucha mikrocirkulace/cytotox. hypoxie) ⌦ manipulace s DO2
- problém s vysokými hodnotami ScvO2 (>80%) – hodnotit s laktátem

co mě dále zajímá?

- klinika
- CRT, Tc-Tp, mottling score…
- pCO2gap (celotělový)
- BE
- diuréza

závěr

Co dělat, když nemohu dosáhnout cíle pro úvodní resuscitaci:

- **TIMING je důležitý**
- **být u lůžka**
- **poradit se**
- **vážit cost/benefit léčebných intervencí**

M: „Co dělat když laktát neklesá?

Š: „Nebesa!“

„Nesmí opustit nás noblesa!“