resuscitace oběhu u SŠ
SSC guidelines a fyziologie

Vladimír Šrámek

ARK, FN u svaté Anny v Brně

Sepse Ostrava 21.-24.ledna 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
   (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.

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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).

H. Vasopressors
1. Vasopressor therapy initially to target a mean arterial pressure (MAP) of 65 mm Hg (grade 1C).
2. Norepinephrine as the first choice vasopressor (grade 1B).
3. Epinephrine (added to and potentially substituted for norepinephrine) when an additional agent is needed to maintain adequate blood pressure (grade 2B).
4. Vasopressin 0.03 units/minute can be added to norepinephrine (NE) with intent of either raising MAP or decreasing NE 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 units/minute should be reserved for salvage therapy (failure to achieve adequate MAP with other vasopressor agents) (UG).
6. Dopamine as an alternative vasopressor agent to norepinephrine only in highly selected patients (eg, patients with low risk of tachyarrhythmias and absolute or relative bradycardia) (grade 2C).
7. Phenylephrine is not recommended in the treatment of septic shock except in circumstances where (a) norepinephrine is associated with serious arrhythmias, (b) cardiac output is known to be high and blood pressure persistently low or (c) as salvage therapy when combined inotrope/vasopressor drugs and low dose vasopressin have failed to achieve MAP target (grade 1C).
8. Low-dose dopamine should not be used for renal protection (grade 1A).
9. All patients requiring vasopressors have an arterial catheter placed as soon as practical if resources are available (UG).

I. Inotropic therapy
1. A trial of dobutamine infusion up to 20 micrograms/kg/min be administered or added to vasopressor (if in use) in the presence of (a) myocardial dysfunction as suggested by elevated cardiac filling pressures and low cardiac output, or (b) ongoing signs of hypoperfusion, despite achieving adequate intravascular volume and adequate MAP (grade 1C).
2. Not using a strategy to increase cardiac index to predetermined supranormal levels (grade 1B).

J. Corticosteroids
1. Not using intravenous hydrocortisone to treat adult septic shock patients if adequate fluid resuscitation and vasopressor therapy are able to restore hemodynamic stability (see goals for Initial Resuscitation). In case this is not achievable, we suggest intravenous hydrocortisone alone at a dose of 200 mg per day (grade 2C).
2. Not using the ACTH stimulation test to identify adults with septic shock who should receive hydrocortisone (grade 2B).
3. In treated patients hydrocortisone tapered when vasopressors are no longer required (grade 2D).
4. Corticosteroids not be administered for the treatment of sepsis in the absence of shock (grade 1D).
5. When hydrocortisone is given, use continuous flow (grade 2D).

struktura přednášky

- **bundles**
- MAP
- laktát; $ScvO_2$

SSC bundles

protokol (EBM) – ANO, ale automatická aplikace má svá úskalí (fyziologie!)

Evidence-Based Medicine

A New Approach to Teaching the Practice of Medicine

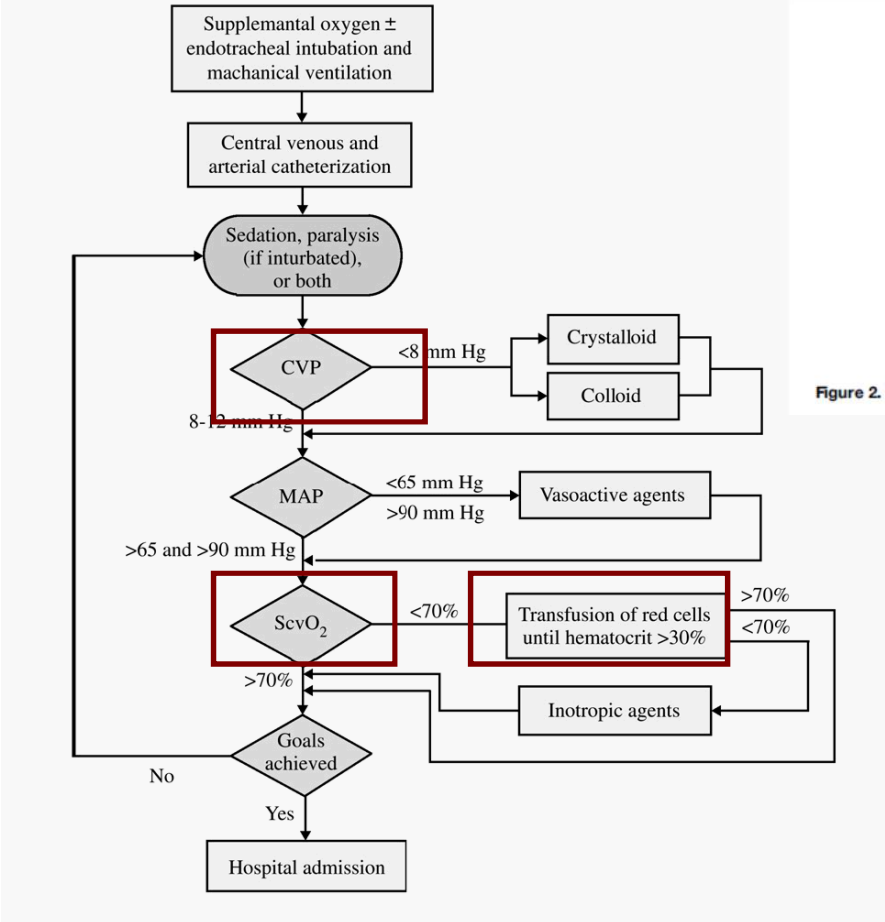
Evidence-Based Medicine Working Group

JAMA, November 4, 1992—Vol 268, No. 17

A NEW paradigm for medical practice is emerging. Evidence-based medicine de-emphasizes intuition, unsystematic clinical experience, and pathophysiologic rationale as sufficient grounds for clinical decision making and stresses the examination of evidence from clinical research. Evidence-based medicine requires new skills of the physician, including efficient literature searching and the application of formal rules of evidence evaluating the clinical literature.

Levy MM, Dellinger RP, Townsend SR, Surviving Sepsis Campaign et al (2010) The Surviving Sepsis Campaign: results of an international guideline-based performance improvement program targeting severe sepsis. Crit Care Med 38:367–374

které části EGDT?



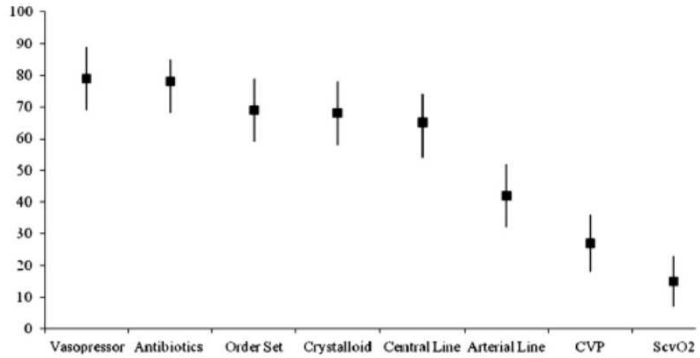


Figure 2. Compliance with components of EGDT. CVP = central venous pressure; $ScvO_2$ = central venous oxygen saturation.

EARLY GOAL-DIRECTED THERAPY (EGDT) FOR SEVERE SEPSIS/SEPTIC SHOCK: WHICH COMPONENTS OF TREATMENT ARE MORE DIFFICULT TO IMPLEMENT IN A COMMUNITY-BASED EMERGENCY DEPARTMENT?

Rory O'Neill, DO, Javier Morales, DO, and Michael Jule, DO

The Journal of Emergency Medicine, Vol. 42, No. 5, pp. 503–510, 2012

sporný efekt RBC na oxygenaci tkání
ale jsou data na recruitment mikrocirkulace (ne SS)

EGDT?

- **EBM** (CAVE single RCT)

Early Goal-Directed Therapy Collaborative Group of Zhejiang Province (2010) The effect of early goal-directed therapy on treatment of critical patients with severe sepsis/ septic shock: a multi-center, prospective, randomized, controlled study (in Chinese). Zhongguo Wei Zhong Bing Ji Jiu Yi Xue 6:331–334

The New England Journal of Medicine

EARLY GOAL-DIRECTED THERAPY IN THE TREATMENT OF SEVERE SEPSIS AND SEPTIC SHOCK

EMANUEL RIVERS, M.D., M.P.H., BRYANT NGUYEN, M.D., SUZANNE HAVSTAD, M.A., JULIE RESSLER, B.S., ALEXANDRIA MUZZIN, B.S., BERNHARD KNOBLICH, M.D., EDWARD PETERSON, PH.D., AND MICHAEL TOMLANOVICH, M.D., FOR THE EARLY GOAL-DIRECTED THERAPY COLLABORATIVE GROUP*

N Engl J Med, 2001;345:1368-77.

Očekávané studie:

ARISE (AUS) – 2013

ProCESS (USA) – 2013

ProMISe (UK) – 2013

Intensive Care Med (2013) 39:1760–1775
DOI 10.1007/s00134-013-3024-7

ORIGINAL

The ProCESS/ARISE/ ProMISe Methodology Writing Committee

Harmonizing international trials of early goal-directed resuscitation for severe sepsis and septic shock: methodology of ProCESS, ARISE, and ProMISe

- **(pato)fyziologie?** (molekulární biologie?- not yet)

The influence of early hemodynamic optimization on biomarker patterns of severe sepsis and septic shock*

Emanuel P. Rivers, MD, MPH; James A. Kruse, MD; Gordon Jacobsen, MS; Kant Shah, MD; Manisha Loomba, MD; Ronny Otero, MD; Ed W. Childs, MD

Crit Care Med 2007 Vol. 35, No. 9 2016-2024.

Intensive Care Med (2005) 31:1161–1167
DOI 10.1007/s00134-005-2729-7

CLINICAL COMMENTARY

Brian P. Kavanagh
L. Joanne Meyer

Normalizing physiological variables in acute illness: five reasons for caution

- **vlastní zkušenosti** (skills/knowledge)

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struktura přednášky

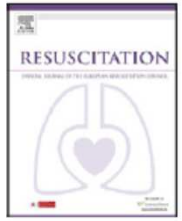
bundles

MAP

- **jaký potřebuju?**
- **jak ho dosáhnout? (tekutiny, vasopresory)**

laktát; $ScvO_2$

Problémy s normálním MAP (SV x SVR)



Outcomes of patients undergoing early sepsis resuscitation for cryptic shock compared with overt shock☆

Michael A. Puskarich[a], Stephen Trzeciak[c], Nathan I. Shapiro[d], Alan C. Heffner[a], Jeffrey A. Kline[a], Alan E. Jones[a,b,*], On behalf of the Emergency Medicine Shock Research Network (EMSHOCKNET)

Conclusion: Severe sepsis with cryptic shock carries a mortality rate not significantly different from that of overt septic shock. These data suggest the need for early aggressive screening for and treatment of patients with an elevated serum lactate in the absence of hypotension.

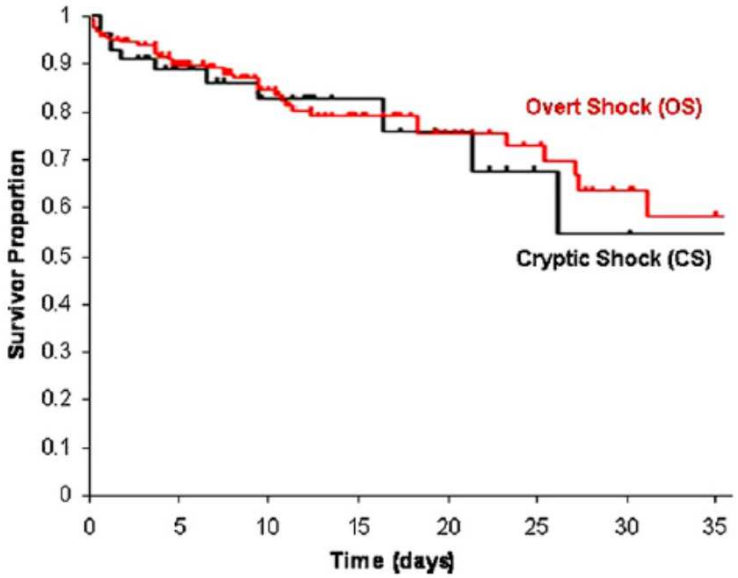


Fig. 2. Kaplan–Meier survival curves for overt shock and cryptic shock groups.

cílový MAP – kolik?

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

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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

MAP < 65 mmHg škodí
je málo důkazů že vyšší MAP je prospěšný

Research

Open Access

Association of arterial blood pressure and vasopressor load with septic shock mortality: a post hoc analysis of a multicenter trial

Martin W Dünser[1], Esko Ruokonen[2], Ville Pettilä[3], Hanno Ulmer[4], Christian Torgersen[5], Christian A Schmittinger[5], Stephan Jakob[1] and Jukka Takala[1]

Critical Care 2009, 13:R181 (doi:10.1186/cc8167)

Table 1 Summary of relevant prospective studies

Study patients (*n*)	Incremental increases in the MBP (mmHg) (time for each step of MBP)	Measures	Results
Bourgoin et al. [30] (2 × 14)	MBP 65 versus 85 (4 h)	Hemodynamics, renal function	↑CI
Ledoux et al. [31] (10)	65, 75, 85 (105′)	Hemodynamics, tonometry, laser Doppler, renal function	↑CI
Deruddre et al. [32] (11)	65, 75, 85 (120′)	Hemodynamics, renal function, renal resistance index	For 65–75 mmHg step, ↑urine output, ↓renal resistance index
Jhanji et al. [33] (16) CCM 2009	60, 70, 80, 90 (45′)	Hemodynamics, PtO_2, LD, SDI	↑DO_2, ↑PtO_2↑LD. SDI ns
Dubin et el. [34] (20)	65, 75, 85 (30′)	Hemodynamics, tonometry, SDI	↑CI, DO_2 ns, tonometry ns, SDI ns

MBP mean blood pressure, *CI* cardiac index, *PtO_2* cutaneous tissue PtO_2, *LD* laser Doppler. *SDI* sidestream darkfield imaging, *DO_2* oxygen delivery, *ns* result not significant

další úvahy:
kvalita křivky
DAP > 40 mmHg
je oligurie/anurie problém?
rozdíl a.f./a.rad./NIBP
anamnéza HT/věk

SEPSISPAM (Francie 2009), 800 pts, 65-70 vs. 80-85 mmHg (completed 9/2012)
nepublikováno, předběžně bez větších rozdílů – ledviny? (Asfar P, ISICEM 2013)

Research

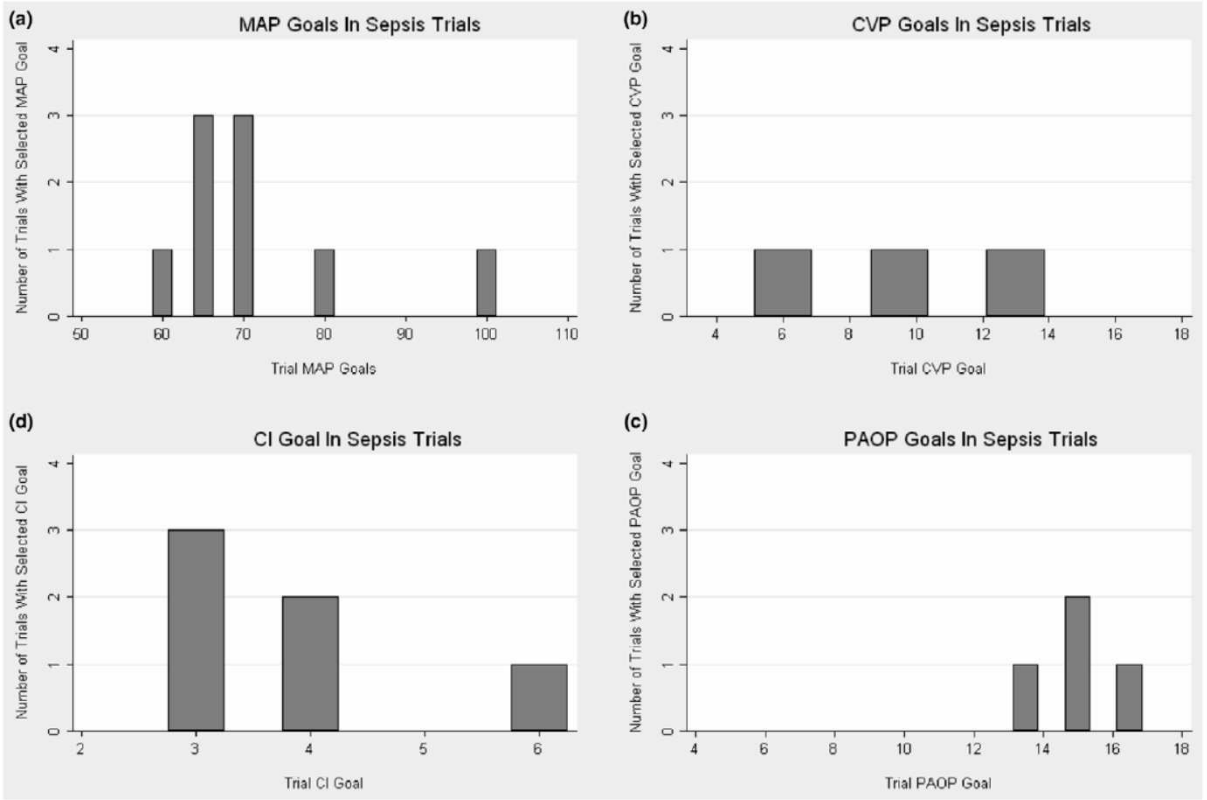
Open Access

Hemodynamic goals in randomized clinical trials in patients with sepsis: a systematic review of the literature

Jonathan E Sevransky[1], Seema Nour[2], Gregory M Susla[3], Dale M Needham[1], Steven Hollenberg[4] and Peter Pronovost[5]

Critical Care 2007, 11:R67 (doi:10.1186/cc5948)

Figure 2



Hemodynamic goals in sepsis trials. (a) Mean arterial pressure (MAP) goals in sepsis trials. (b) Central venous pressure (CVP) goals in sepsis trials

permissive hypotension (MAP 45 – 50 mmHg)

Dünser *et al. Critical Care* 2013, **17**:326
http://ccforum.com/content/17/5/326

CRITICAL CARE

VIEWPOINT

Re-thinking resuscitation: leaving blood pressure cosmetics behind and moving forward to permissive hypotension and a tissue perfusion-based approach

Martin W Dünser*[1], Jukka Takala[2], Andreas Brunauer[1] and Jan Bakker[3]

It was fatal for the development of our understanding of circulation that blood flow is relatively difficult while blood pressure so easy to measure: This is the reason why the sphygmomanometer has gained such a fascinating influence, although most organs do not need blood pressure but flow.

Jarisch A: **Kreislauffragen.**
Dtsch Med Wochenschr 1928, **29:**1211-1213

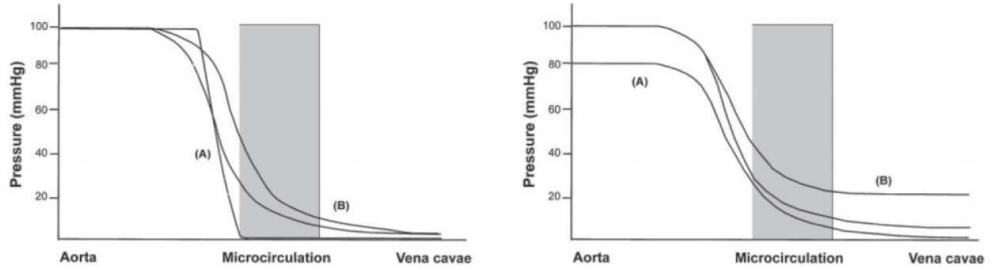


Figure 1. Hydrostatic pressures in circulation. Microcirculation pressure is indicated by shaded area. Values shown to the left and right indicate arterial and venous portions of circulation, respectively. Unlabeled solid curve in both frames represents a normal pressure profile. Left panel: curve A represents maximal arteriolar constriction, and curve B represents arteriolar dilation. Right panel: curves A and B represent decreasing arterial and increasing venous pressures, respectively. Reprinted with permission from the American Physiological Society [21].

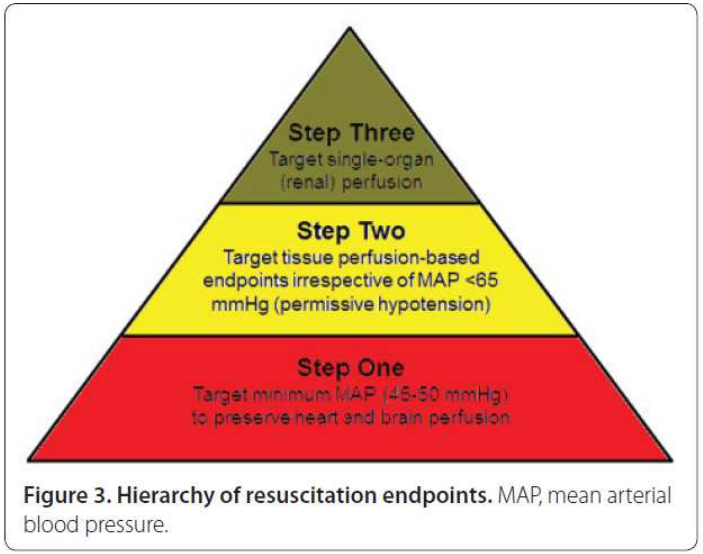


Figure 3. Hierarchy of resuscitation endpoints. MAP, mean arterial blood pressure.

jaké tekutiny a kolik? - 2013

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Table 6 Recommendations: hemodynamic support and adjunctive therapy

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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).

	Mortalita	AKI
CRYSTMAS	0	0
6S	**+**	**+**
CHEST	**0**	**+**
CRISTAL	**(-)**	**0**

krystaloidy **20ml – 40ml/kg** úvodní bolus
jak rychle? (stress response když rychle vs příliš pomalu)
kolik? (mini-fluid challenge – Muller L, Anaesthesiology 2011; vs FENICE 999ml/hod)

tekutiny po úvodním bolusu - monitorace

Optimalizace preloadu

- dle predikce fluid responsiveness (PPV/SVV, dIVC, dVTI….
- Napodobení bolusu tekutiny (End Expiratory 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?

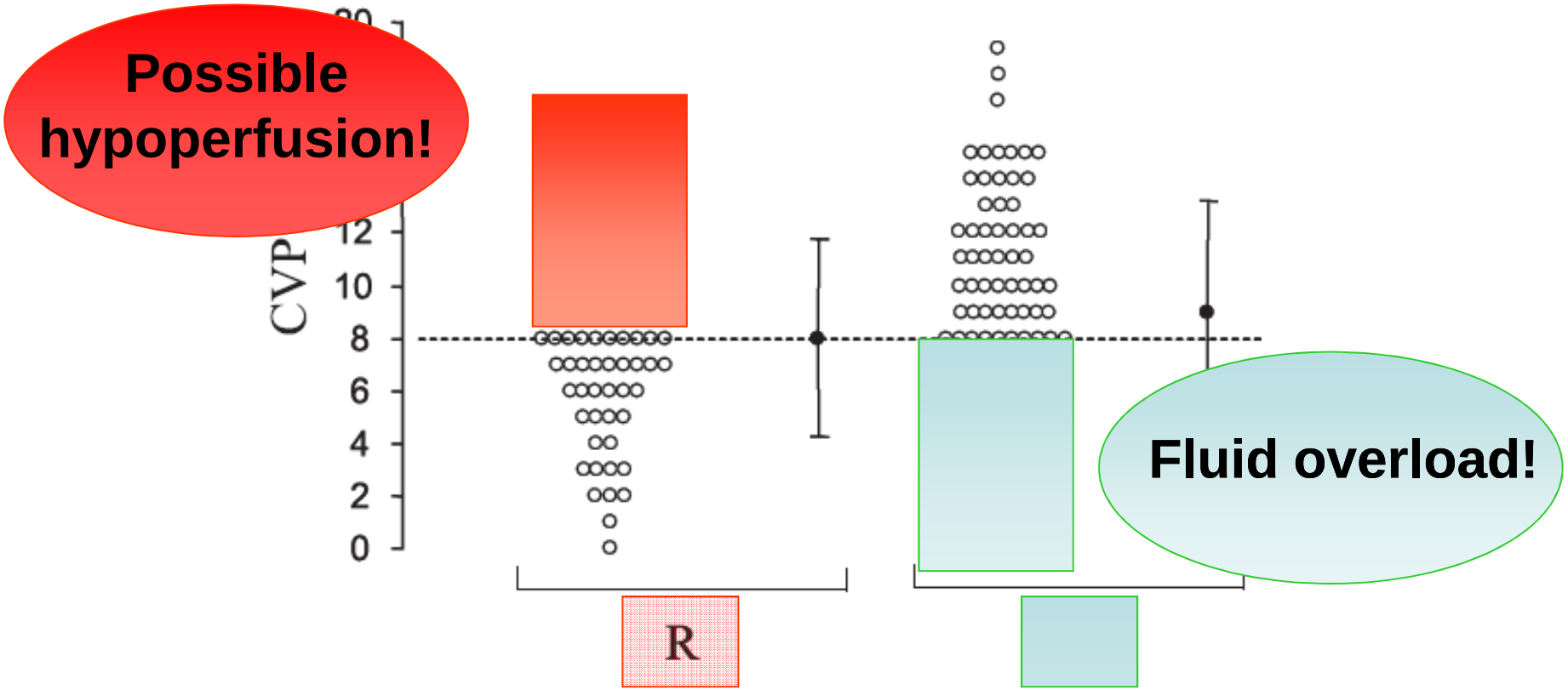
NE

Cardiac filling pressures are not appropriate to predict hemodynamic response to volume challenge*

CCM 2007 35:64-8

David Osman, MD; Christophe Ridel, MD; Patrick Ray, MD; Xavier Monnet, MD, PhD; Nadia Anguel, MD; Christian Richard, MD; Jean-Louis Teboul, MD, PhD

Central venous pressure (CVP): 8–12 mm Hg

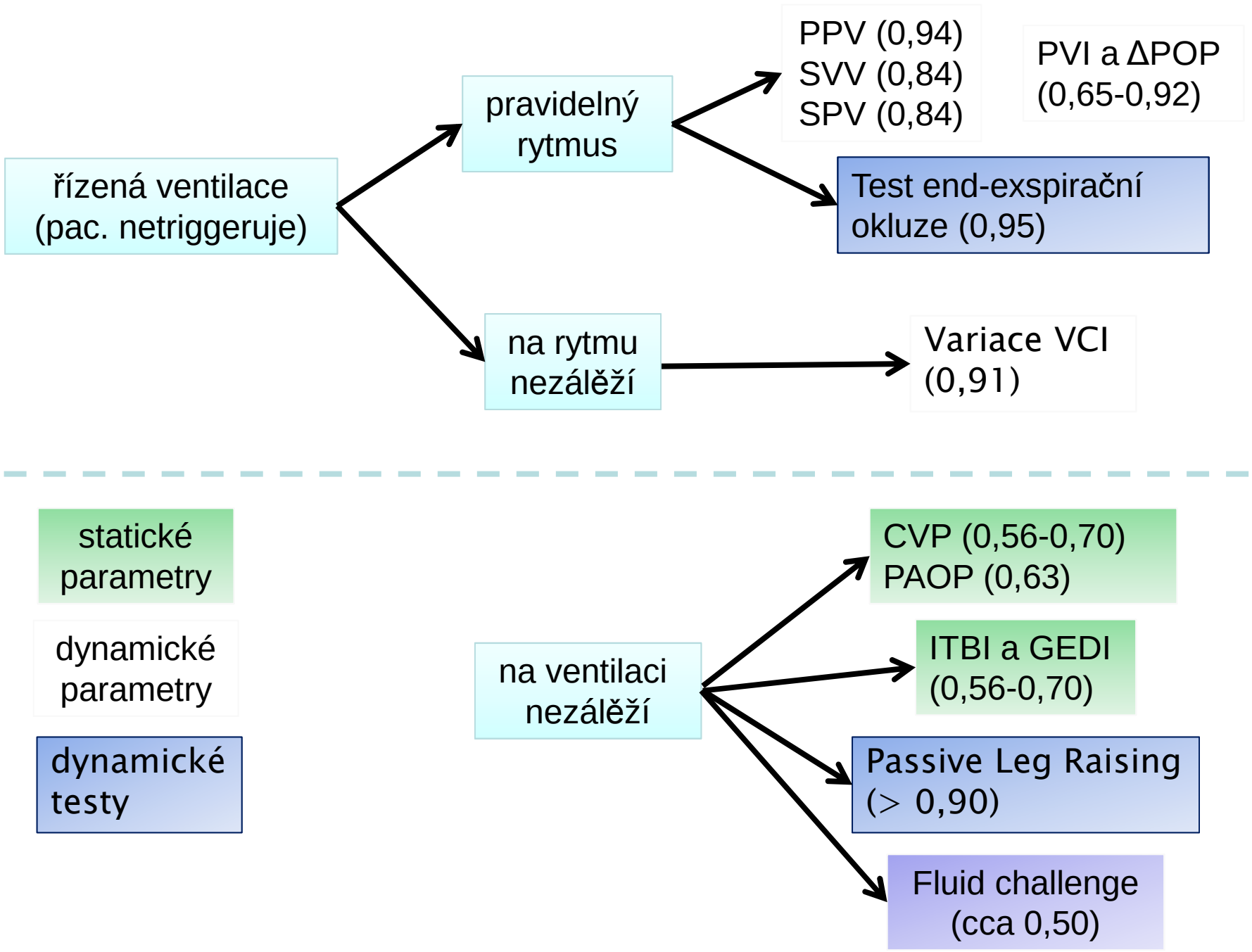


Optimum left heart filling pressure during fluid resuscitation of patients with hypovolemic and septic shock

MICHAEL I. PACKMAN, MD; ERIC C. RACKOW, MD

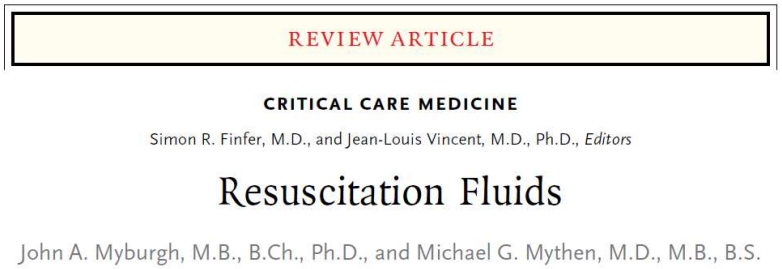
166 CRITICAL CARE MEDICINE MARCH, 1983

The data were analyzed for the 15 patients in whom at least 3 WP determinations were obtained and the final WP was ≥15 mm Hg. Four patients had only 2 data points (WP ≥15 mm Hg after 250 ml of fluid administration) and in 2 the protocol was terminated because of inability to increase the WP of 10 mm Hg, despite administration of 5 and 8 L, respectively, of normal saline solution.


řízená ventilace
(pac. netriggeruje)
pravidelný
rytmus
na rytmu
nezáléží
PPV (0,94)
SVV (0,84)
SPV (0,84)
PVI a ΔPOP
(0,65-0,92)
Test end-exspirační
okluze (0,95)
Variace VCI
(0,91)
statické
parametry
dynamické
parametry
dynamické
testy
na ventilaci
nezáléží
CVP (0,56-0,70)
PAOP (0,63)
ITBI a GEDI
(0,56-0,70)
Passive Leg Raising
(> 0,90)
Fluid challenge
(cca 0,50)

2013 cont'd

roztoky s fyziologickým chloridem



The NEW ENGLAND JOURNAL of MEDICINE

REVIEW ARTICLE

CRITICAL CARE MEDICINE

Simon R. Finfer, M.D., and Jean-Louis Vincent, M.D., Ph.D., *Editors*

Resuscitation Fluids

John A. Myburgh, M.B., B.Ch., Ph.D., and Michael G. Mythen, M.D., M.B., B.S.

44. Shaw AD, Bagshaw SM, Goldstein SL, et al. Major complications, mortality, and resource utilization after open abdominal surgery: 0.9% saline compared to Plasma-Lyte. Ann Surg 2012;255:821-9.

45. Yunos NM, Bellomo R, Hegarty C, Story D, Ho L, Bailey M. Association between a chloride-liberal vs chloride-restrictive intravenous fluid administration strategy and kidney injury in critically ill adults. JAMA 2012;308:1566-72.

…. a co albumin?
rozdílné meta-analýzy; pozitivní výsledky 4% v sepsi (SAFE);
negativní signál 20% (CRYCO); pozitivní signál 20% v SŠ (ALBIOS).
CENA!!! - 20% 100ml 1050 Kč bez DPH (Baxter, vak), 5% 250ml (700-900 Kč)
… nejasné, snad 4%, když úvodní bolus krystaloidu nestačí

resuscitace hemodynamiky – jen tekutiny?

Mortality after Fluid Bolus in African Children with Severe Infection

Kathryn Maitland, M.B., B.S., Ph.D., Sarah Kiguli, M.B., Ch.B., M.Med., Robert O. Opoka, M.B., Ch.B., M.Med., Charles Engoru, M.B., Ch.B., M.Med., Peter Olupot-Olupot, M.B., Ch.B., Samuel O. Akech, M.B., Ch.B., Richard Nyeko, M.B., Ch.B., M.Med., George Mtove, M.D., Hugh Reyburn, M.B., B.S., Trudie Lang, Ph.D., Bernadette Brent, M.B., B.S., Jennifer A. Evans, M.B., B.S., James K. Tibenderana, M.B., Ch.B., Ph.D., Jane Crawley, M.B., B.S., M.D., Elizabeth C. Russell, M.Sc., Michael Levin, F.Med.Sci., Ph.D., Abdel G. Babiker, Ph.D., and Diana M. Gibb, M.B., Ch.B., M.D., for the FEAST Trial Group*

The NEW ENGLAND JOURNAL of MEDICINE

CONCLUSIONS

Fluid boluses significantly increased 48-hour mortality in critically ill children with impaired perfusion in these resource-limited settings in Africa. (Funded by the Medical Research Council, United Kingdom; FEAST Current Controlled Trials number, ISRCTN69856593.)

N ENGL J MED 364;26 NEJM.ORG JUNE 30, 2011

Maitland *et al. BMC Medicine* 2013, **11**:68
http://www.biomedcentral.com/1741-7015/11/68

BMC Medicine

RESEARCH Open Access

Exploring mechanisms of excess mortality with early fluid resuscitation: insights from the FEAST trial

Kathryn Maitland[1,2*], Elizabeth C George[3], Jennifer A Evans[4], Sarah Kiguli[5], Peter Olupot-Olupot[6], Samuel O Akech[2],

Katecholaminy – NA brzo

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

Jaké a kolik katecholaminů - 2013

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

GUIDELINES

R. P. Dellinger
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Surviving Sepsis Campaign: International Guidelines for Management of Severe Sepsis and Septic Shock, 2012

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).

tíže šoku dle dávky NA (mcg/kg/min)
<0.1….0.3……**0.6**…..>1,0

VASST trial

The NEW ENGLAND JOURNAL of MEDICINE
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Comparison of Dopamine and Norepinephrine in the Treatment of Shock

Daniel De Backer, M.D., Ph.D., Patrick Biston, M.D., Jacques Devriendt, M.D., Christian Madl, M.D., Didier Chochrad, M.D., Cesar Aldecoa, M.D., Alexandre Brasseur, M.D., Pierre Defrance, M.D., Philippe Gottignies, M.D., and Jean-Louis Vincent, M.D., Ph.D., for the SOAP II Investigators*

CONCLUSIONS
Although there was no significant difference in the rate of death between patients with shock who were treated with dopamine as the first-line vasopressor agent and those who were treated with norepinephrine, the use of dopamine was associated with a greater number of adverse events. (ClinicalTrials.gov number, NCT00314704.)

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.

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

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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®

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
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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

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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.

reevaluace v průběhu EGDT

průběžná, po každém terapeutickém zásahu

schematicky:

1 hodina (2) hodiny

- MAP, efekt úvodního bolusu tekutin, NA

3 hodiny

- pokles laktátu o 20-30% (zlepšení -BE, ScvO2, mottled skin, diu…). Provedený RACE
- rozšíření monitorace (CO... event. další)

6 hodin

- viz 3 hod