Monitorace hemodynamiky v intenzivní péči – PRO

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ARK, FN u svaté Anny v Brně

XVII Colors of Sepsis, Ostrava, 27-30.1.2015

adekvátní monitorace

včas u všech šoků tam

kde neoddálím

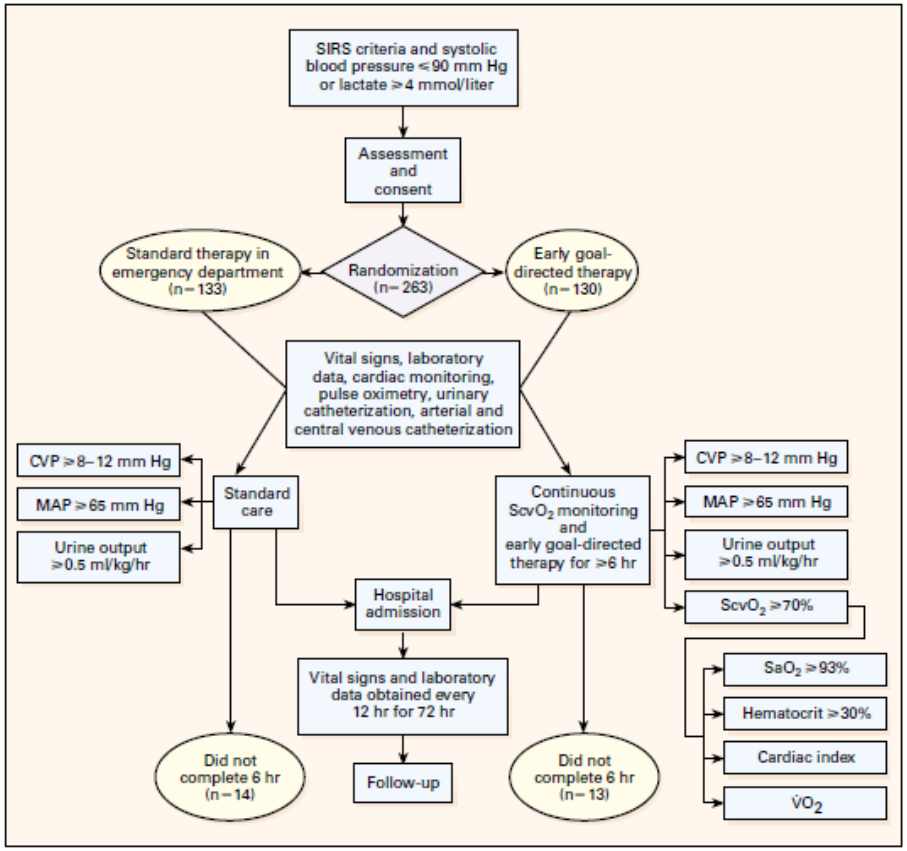
kauzální řešení

3 úrovně monitorace

- neinvazivbní (NIBP, HR, SpO2, CRT, diuréza….)
- **semiinvazivní** (IBP, CVP) + (laktát + ScvO2)
- **invazivní**
  (CI, PAOP,EVLW…. GEDV, RVEDV/REF)

ECHO

RIVERS



TREATMENT	HOURS AFTER THE START OF THERAPY		
	0–6	7–72	0–72
Pulmonary-artery catheterization (%)‡			
Standard therapy	3.4	28.6	31.9
EGDT	0	18.0	18.0
P value	0.12	0.04	0.01

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

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

The ProCESS Investigators*

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Goal-Directed Resuscitation for Patients with Early Septic Shock

The ARISE Investigators and the ANZICS Clinical Trials Group*

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

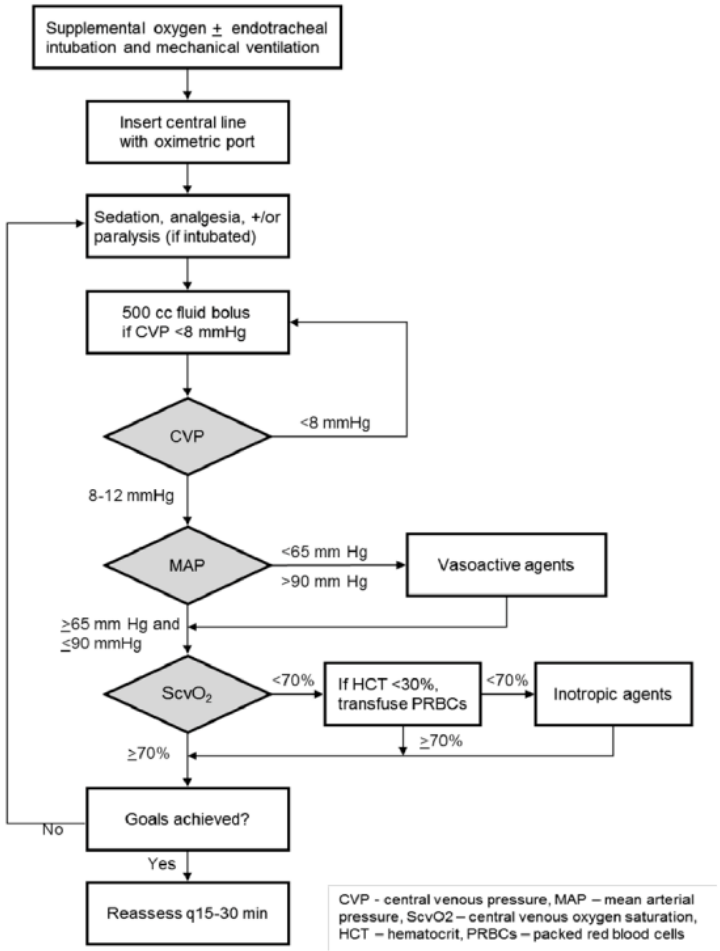
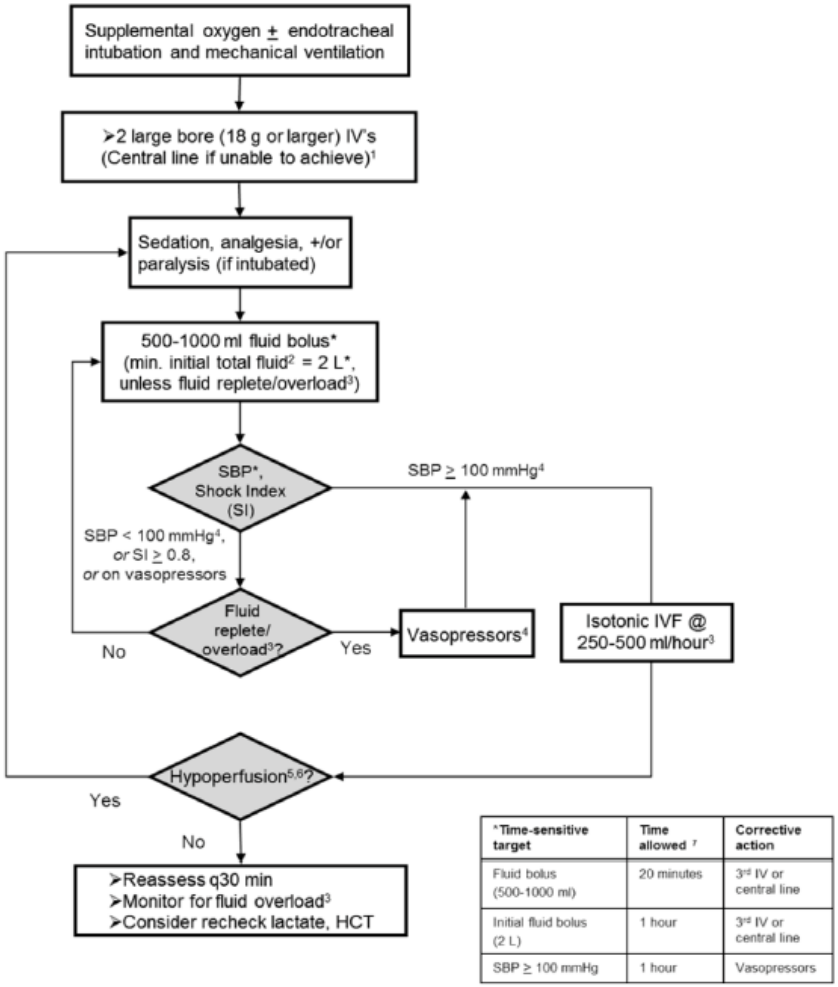


Figure S2. – Protocol for Standard Therapy.



^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

Figure S6. Processes of care during the 6h resuscitation intervention.

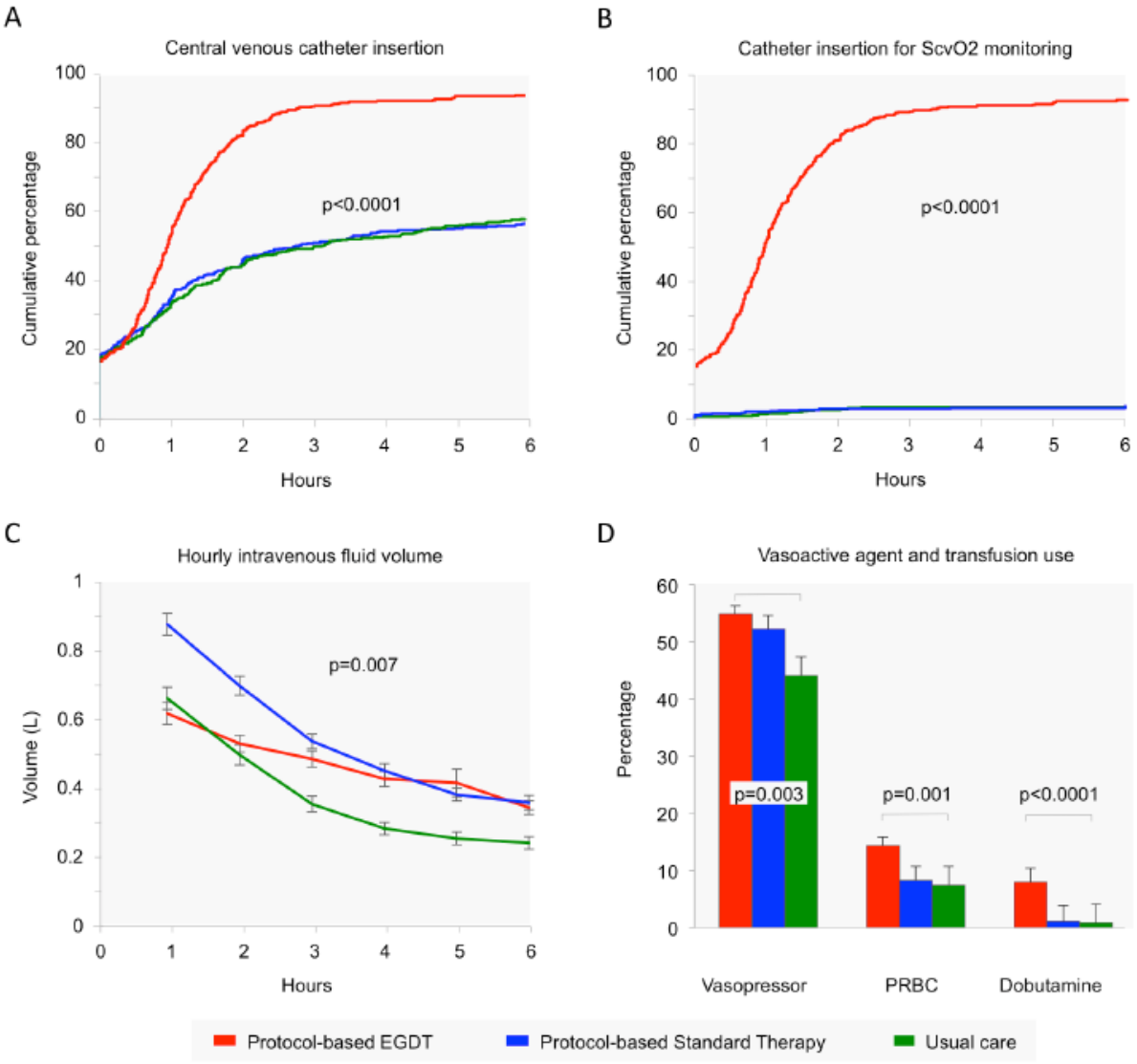
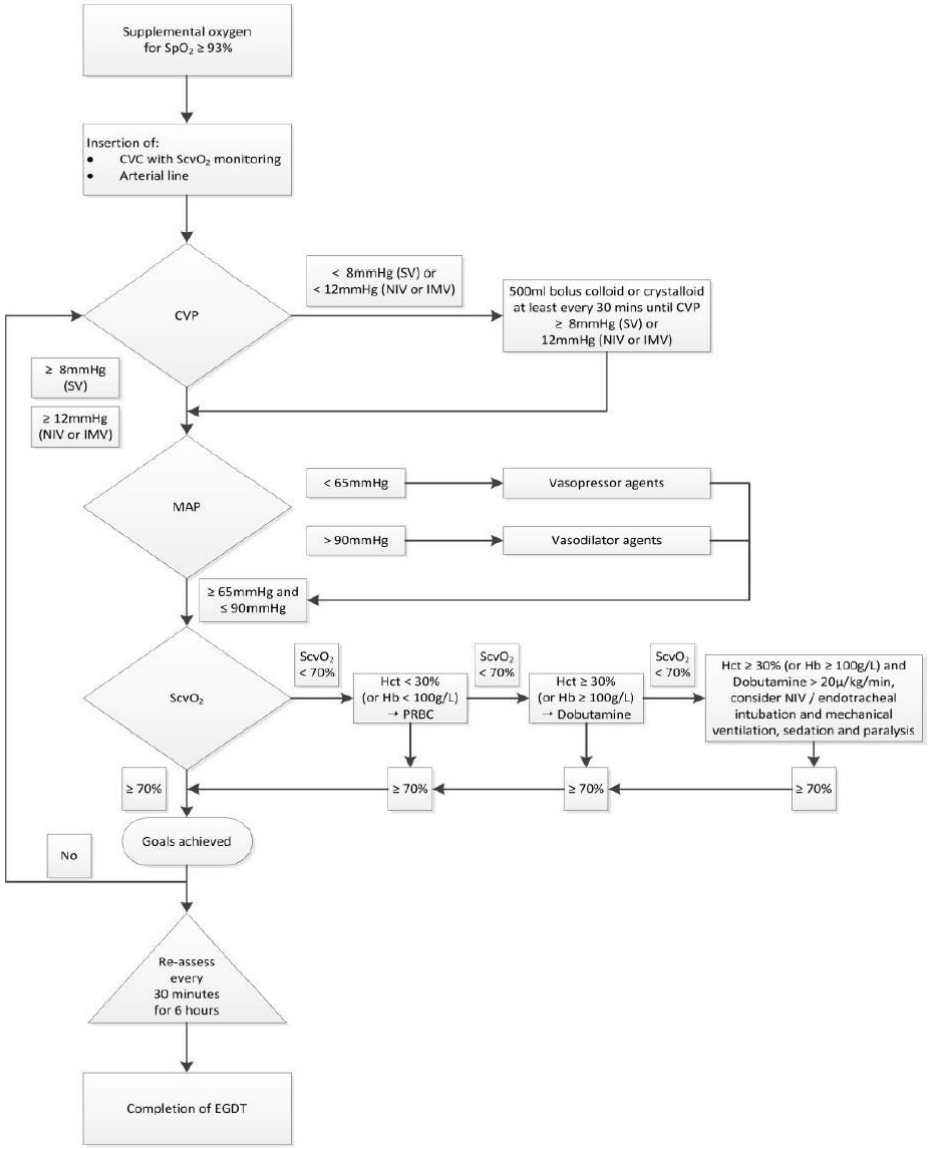
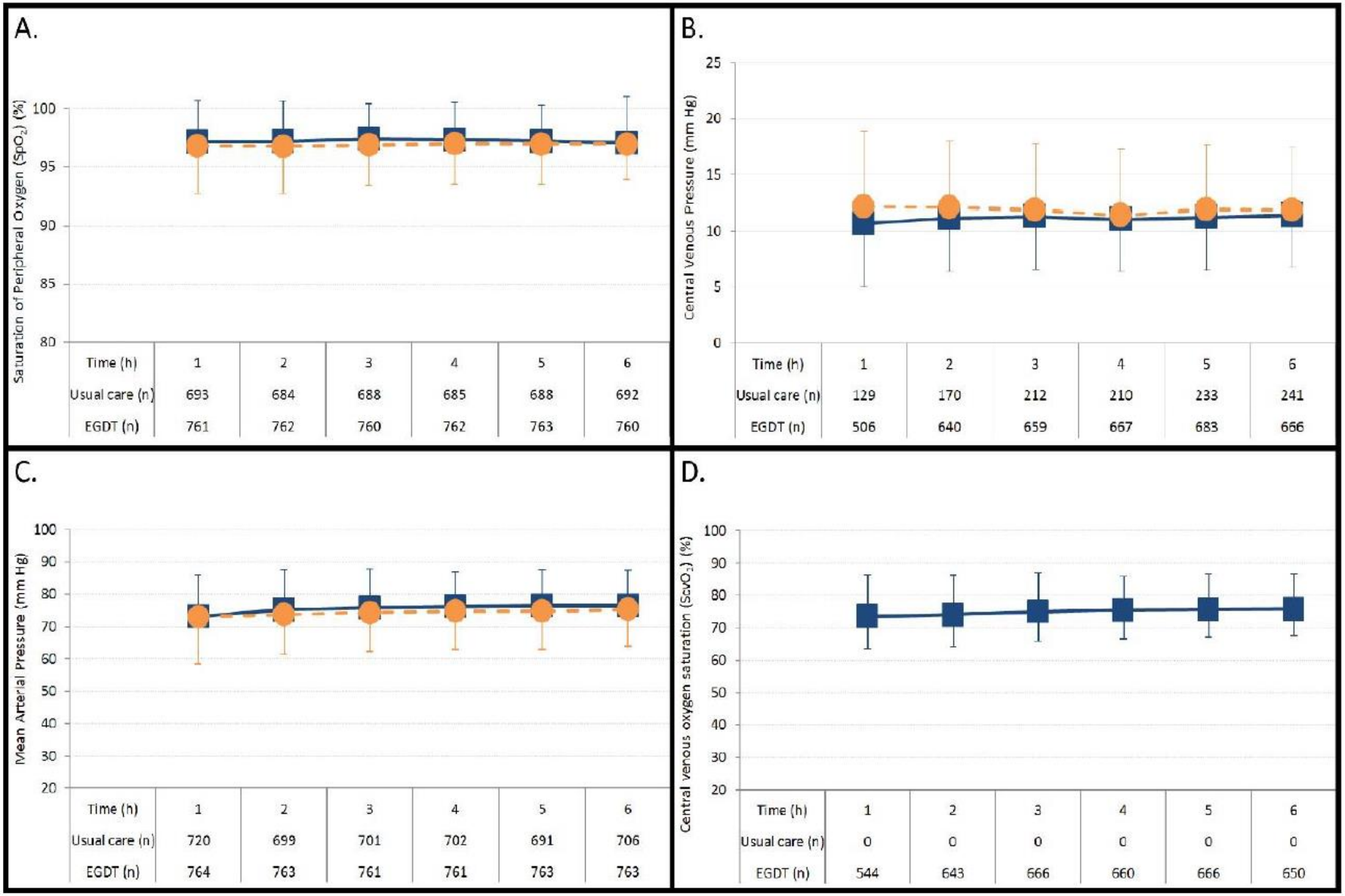


Figure S1. Early goal-directed therapy resuscitation algorithm

ARISE



ARISE


A.
Saturation of Peripheral Oxygen (SpO_2) (%)
100
95
90
85
80
Time (h) 1 2 3 4 5 6
Usual care (n) 693 684 688 685 688 692
EGDT (n) 761 762 760 762 763 760
B.
Central Venous Pressure (mm Hg)
25
20
15
10
5
0
Time (h) 1 2 3 4 5 6
Usual care (n) 129 170 212 210 233 241
EGDT (n) 506 640 659 667 683 666
C.
Mean Arterial Pressure (mm Hg)
100
90
80
70
60
50
40
30
20
Time (h) 1 2 3 4 5 6
Usual care (n) 720 699 701 702 691 706
EGDT (n) 764 763 761 761 763 763
D.
Central venous oxygen saturation ($ScvO_2$) (%)
100
90
80
70
60
50
40
30
20
Time (h) 1 2 3 4 5 6
Usual care (n) 0 0 0 0 0 0
EGDT (n) 544 643 666 660 666 650

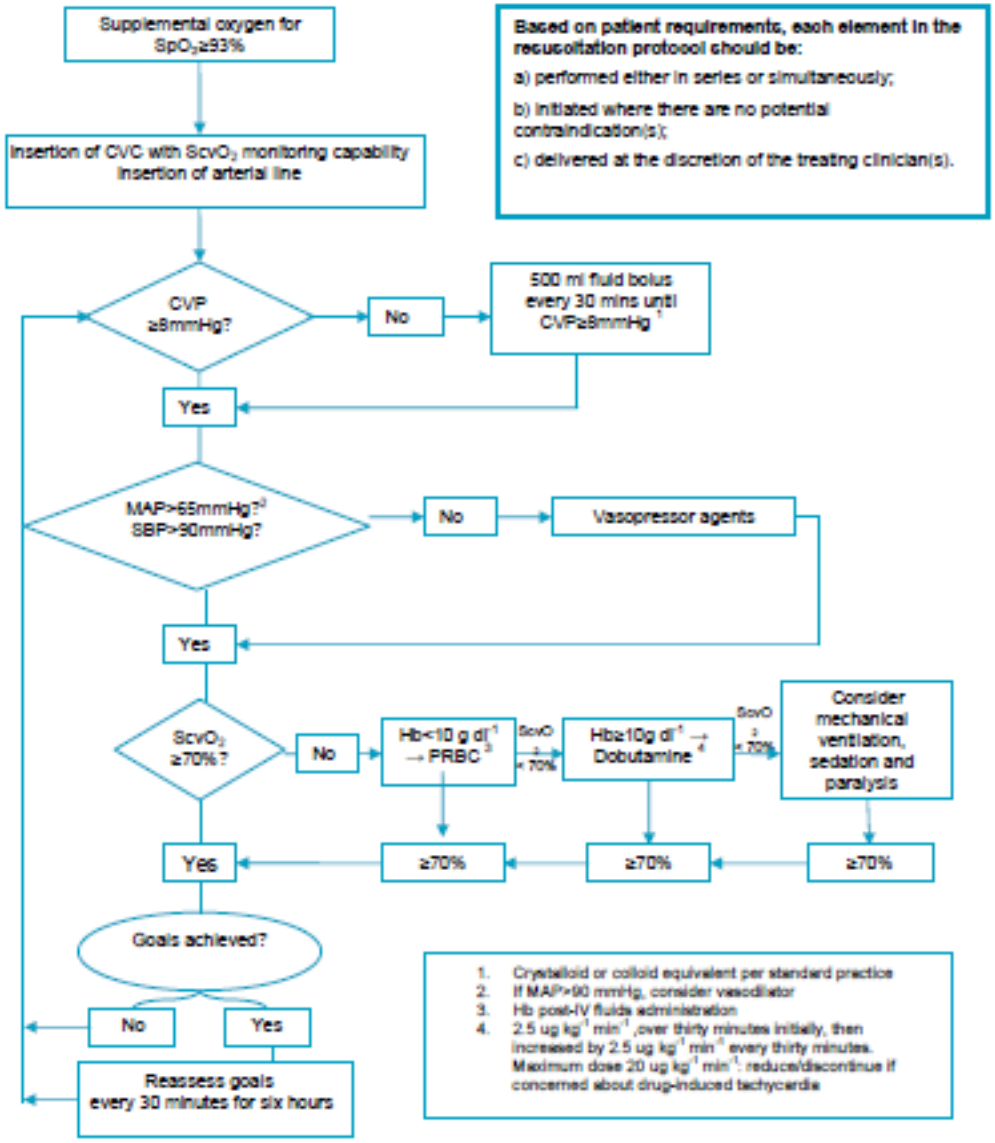
ARISE – hemodynamic monitoring

Table S5. Therapies and haemodynamic monitoring from baseline to 72 hours post-randomization

Intervention	0 to 6 hours			6 to 72 hours[b]		
	EGDT (N = 793)	Usual care (N = 798)	P Value	EGDT (N = 782)	Usual care (N = 778)	P Value
Monitoring inserted - no./total no[e]						
Arterial catheter	725/793 (91.4)	609/798 (76.3)	< 0.001	9/782 (1.2)	32/778 (4.10)	<0.001
Central venous catheter	109/793 (13.7)	494/798 (61.9)	< 0.001	11/782 (1.4)	36/778 (4.6)	< 0.001
$ScvO_2$ central venous catheter[f]	714/793 (90.0)	3/798 (0.4)	< 0.001	0/782 (0)	0/778 (0)	1.00
Pulmonary artery catheter	1/793 (0.1)	9/798 (1.1)	0.01	3/782 (0.4)	7/778 (0.9)	0.20
PiCCO	20/793 (2.5)	22/798 (2.8)	0.77	24/782 (3.1)	27/778 (3.5)	0.66

Figure 2. ProMISe early, goal-directed, resuscitation protocol

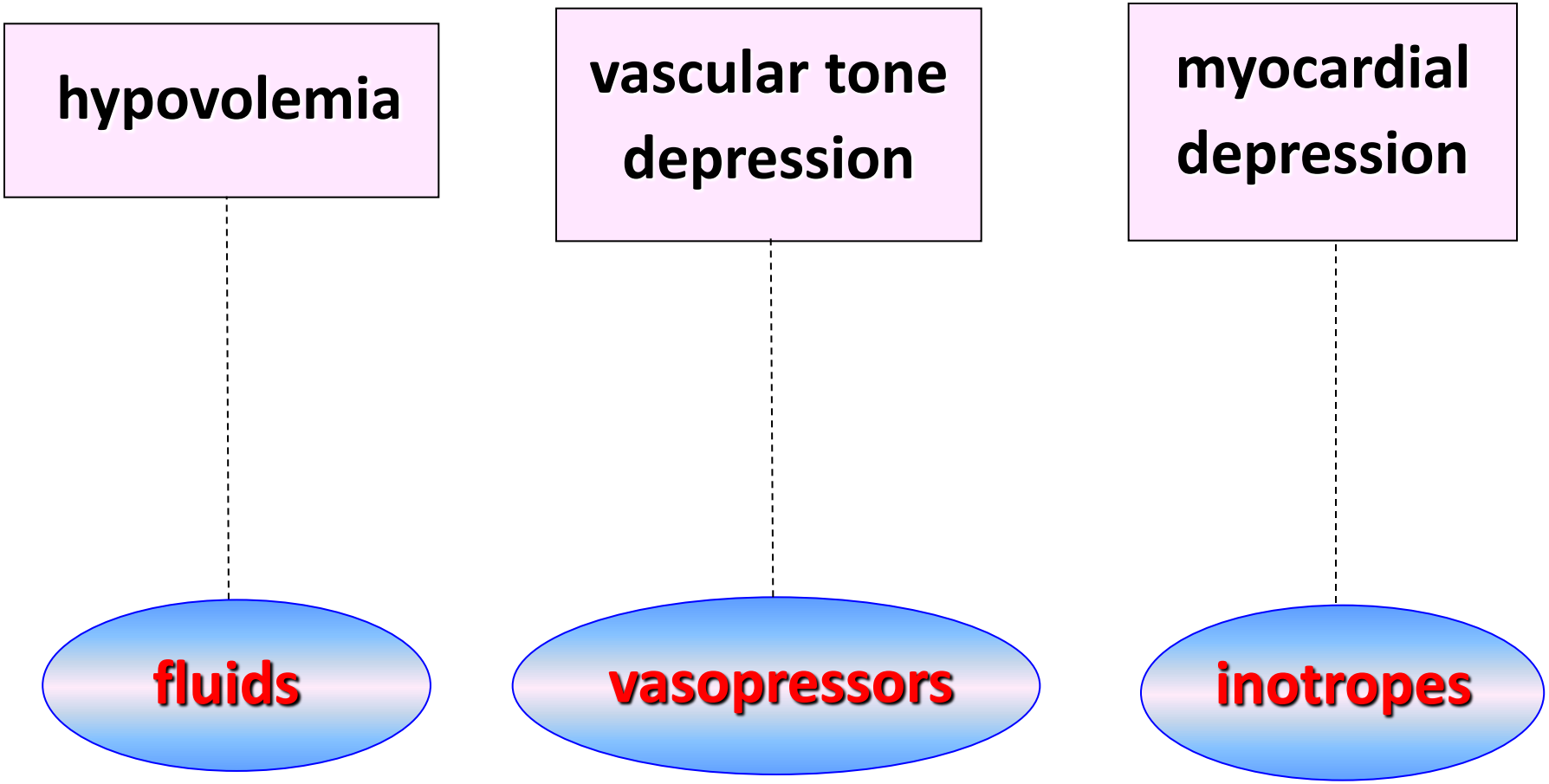
ProMISe



potřebujeme rozšířenou monitoraci hemodynamiky pro řešení šokových stavů?

Hemodynamic failure in critically ill patients: 3 components

JL Teboul



presence of associated **lung injury**

Hemodynamic failure in critically ill patients: 3 components

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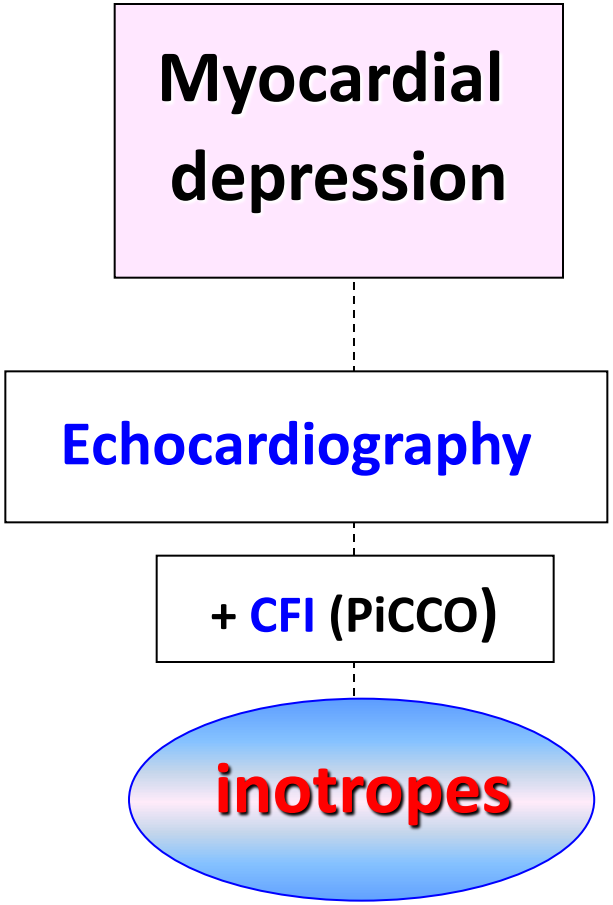

Hemodynamic failure in critically ill patients: 3 components

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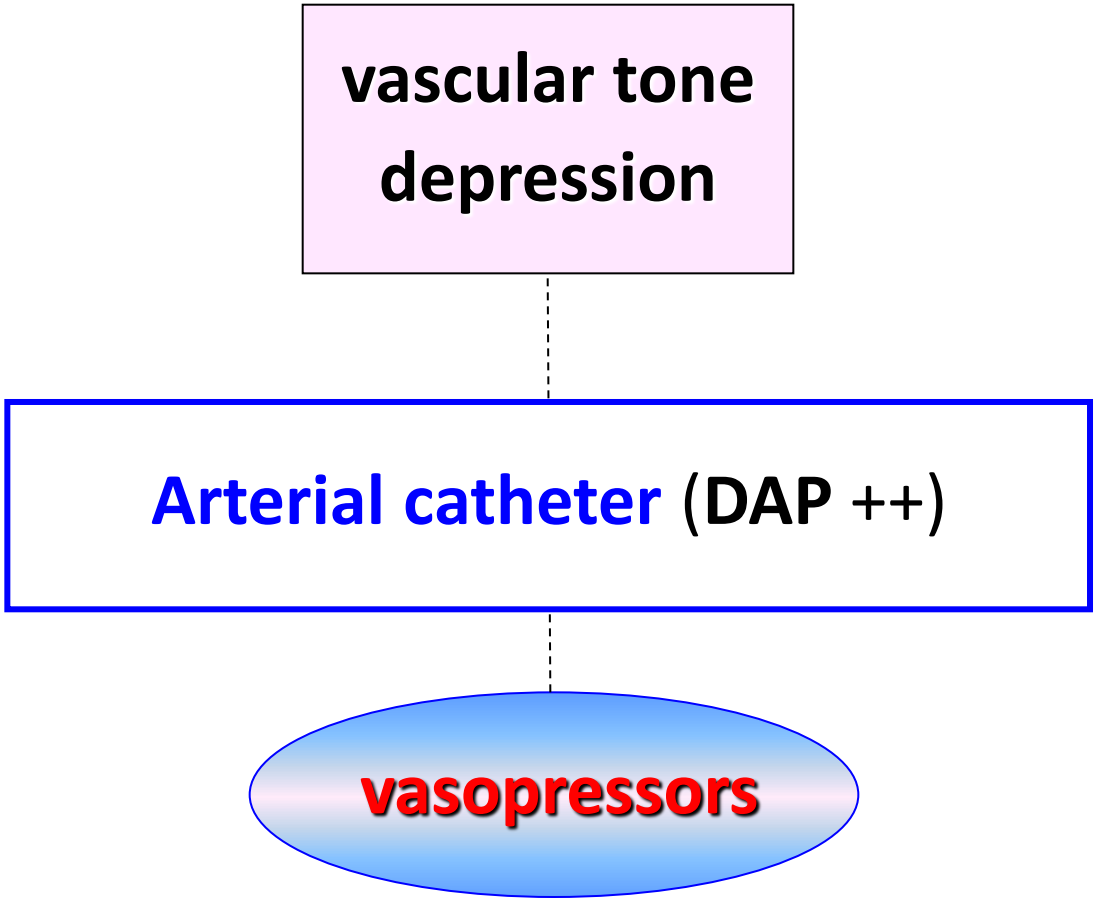

Hemodynamic failure in critically ill patients: 3 components

JL Teboul

hypovolemia

fluids

Prediction of fluid responsiveness

- **PPV, SVV**
- **PLR** or **end-expiratory occlusion test**

if SB, arrhythmias, low TV or low lung compliance

Evaluation: ***real-time CO***

Lung tolerance

PAOP **EVLW**

presence of associated **lung injury**

Patient with circulatory failure

JL Teboul

First, try to perform echocardiography to assess cardiac function

Normal cardiac fonction

Abnormal cardiac function

Lung injury ?
ABG, Chest X-ray

no

yes

Basic monitoring

only

CVC + Art cath

CVP AP

$ScvO_2$ PPV

yes

no

considered valid?

advanced monitoring

PAC

CO

PAOP

RAP, PAP

SvO_2

PiCCO

VolumeView

CO

GEDV, EVLW, CFI

PPV, SVV

$ScvO_2$

Intensive Care Med (2014) 40:1795–1815
DOI 10.1007/s00134-014-3525-z

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Consensus on circulatory shock and hemodynamic monitoring. Task force of the European Society of Intensive Care Medicine

Table 2 Main differences between the 2006 and 2014 consensus papers in terms of hemodynamic monitoring

Topic	ICM Antonelli 2007	ICM Cecconi 2014
Hemodynamic monitoring	–We do not recommend routine measurement of CO for patients with shock. Level 1; QoE moderate (B) –We suggest considering echocardiography or measurement of CO for diagnosis in patients with clinical evidence of ventricular failure and persistent shock with adequate fluid resuscitation. Level 2 (weak); QoE moderate (B) –We do not recommend the routine use of the pulmonary artery catheter for patients in shock. Level 1; QoE high (A)	–We recommend further hemodynamic assessment (such as assessing cardiac function) to determine the type of shock if the clinical examination does not lead to a clear diagnosis. *Ungraded best practice* –We suggest that, when further hemodynamic assessment is needed, echocardiography is the preferred modality to initially evaluate the type of shock as opposed to more invasive technologies. Level 2; QoE moderate (B) –In complex patients we suggest to additionally use pulmonary artery catheterization or transpulmonary thermodilution to determine the type of shock. Level 2; QoE low (C)

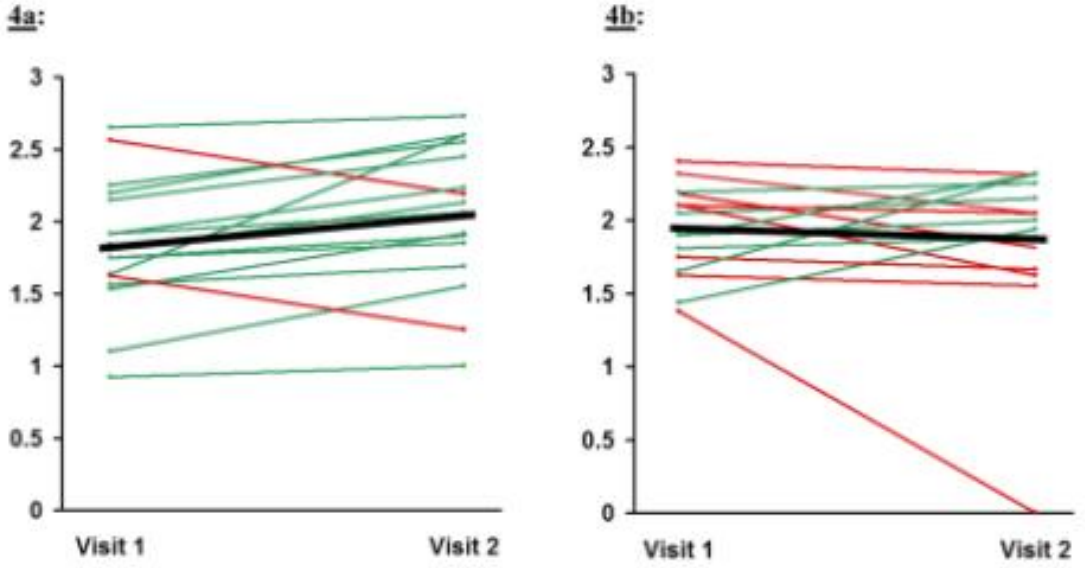
–We do not recommend routine measurement of cardiac output for patients with shock responding to the initial therapy. Level 1; QoE low (C)
–We recommend measurements of cardiac output and stroke volume to evaluate the response to fluids or inotropes in patients that are not responding to initial therapy. Level 1; QoE low (C)
–We suggest sequential evaluation of hemodynamic status during shock. Level 1; QoE low (C)
–Echocardiography can be used for the sequential evaluation of cardiac function in shock. *Statement of fact*
–We do not recommend the routine use of the pulmonary artery catheter for patients in shock. Level 1; QoE high (A)
–We suggest pulmonary artery catheterization in patients with refractory shock and right ventricular dysfunction. Level 2; QoE low (C)
–We suggest the use of transpulmonary thermodilution or pulmonary artery catheterization in patients with severe shock especially in the case of associated acute respiratory distress syndrome. Level 2; QoE low (C)
–We recommend that less invasive devices are used, instead of more invasive devices, only when they have been validated in the context of patients with shock. *Ungraded best practice*

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

algoritmus ARK FNUSA (2007)

2.Výstavbový princip monitorace a resuscitace hemodynamiky na JIP:
(všichni nemocní mají A + CŽK).
Definice nestability = splnění jednoho z velkých kritérií nebo dvou malých kritérií:
Velká kritéria:
1) ScvO2 < 60%
2) BE < - 5 mmol/l (pokud není ve stejné výši přítomna chronicky)
3) laktát > 4 mmol/l
4) známky hypoperfuze kůže na více místech těla
5) MAP < 60 mmHg
Malá kritéria:
1) ScvO2 < 70%
2) BE < - 2.5 mmol/l (pokud není ve stejné výši přítomna chronicky)
3) laktát > 2 mmol/l
4) diference Tc-Tp > 5 st C (?) (při přítomnosti pulsů na ATP nebo ADP)

3.Monitorace:

TTE – hodnocení: stažlivost LKS (dobrá x špatná), další patologie

Pokud dobrá stažlivost LKS:

- bolus tekutin (2 litry krystaloidu nebo 1 litr koloidu během 60 minut).
- **3a) dojde** k normalizaci hodnot (nebo jasný pozitivní trend alespoň o 50%) →nerozšiřuji monitoraci a opakuji bolus tekutiny v poloviční dávce na 60 minut – došlo k normalizaci či dalšímu trendu zlepšení ? ANO → nerozšiřuji monitoraci
-
- **3b) nedojde** → zavedu některou z metodik, které měří CO
- Orientačně:
- myslím na hypovolémii – TE Doppler (sedovaný nemocný) nebo LiDCO
- myslím na levostranné selhávání – PAC
- myslím na plicní příčinu – PiCCO (nebo PAC s kont SvO2)

Pokud špatná stažlivost LKS (nebo nemohu určit z TTE):

- bolus tekutin (1 litru krystaloidu nebo 0.5 litru koloidu během 60 minut) a ev. dobutamin do dávky 5 mcg/kg/min dle zvážení.
- a) dojde k normalizaci hodnot (nebo jasný + trend alespoň o 50%?) – nerozšiřuji monitoraci a opakuji bolus tekutiny v poloviční dávce – došlo k normalizaci či dalšímu trendu zlepšení - ? ANO → nerozšiřuji monitoraci
- b) nedojde → zavedu některou z metodik, které měří CO
- zavedu některou z metodik, které měří CO

Orientačně:

- myslím na levostranné selhávání – PAC
- myslím na plicní příčinu – PiCCO (nebo PAC s kont SvO2)

závěr

U nestabilního nemocného, kde nevím, jak terapeuticky zasáhnout, je třeba (rozšířenou) monitorací hemodynamiky (včas) získat fyziologická data, která mi umožní se zorientovat a adekvátně dál postupovat…