Fiziológiás transzfúzió küszöb

Molnár Zsolt

Aneszteziológiai és Intenzív Terápiás Intézet

Szegedi Tudományegyetem

SZINT

SZEGEDI INTENZÍVES TALÁLKOZÓ 2013

2013. november 14-16

Szeged

www.szint-intenziv.hu

„Together we win, divided we're slow!"

Jean-Louis VINCENT	Belgium
Daniel De BACKER	Belgium
Alan SUSTIC	Croatia
Ino HUSEDZINOVIC	Croatia
Jan BENES	Czech Republic
Jean-Louis TEBOUL	France
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Béla FÜLESDI	Hungary
János FAZAKAS	Hungary
Lajos BOGÁR	Hungary
Zsolt MOLNÁR	Hungary
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Mervyn SINGER	United Kingdom
Tamas SZAKMANY	United Kingdom
Yalim DIKMEN	Turkey

SepsEast 2014

2nd Central and Eastern European Sepsis Forum

FREE for junior doctors!

Bevezetés

- Transzfúzió
  - Nem veszélytelen
  - Költséges
  - Hiánycikk
  - Restriktív szemlélet
    - Postreszuszcitációs cél Hb = 7-10 g/dl

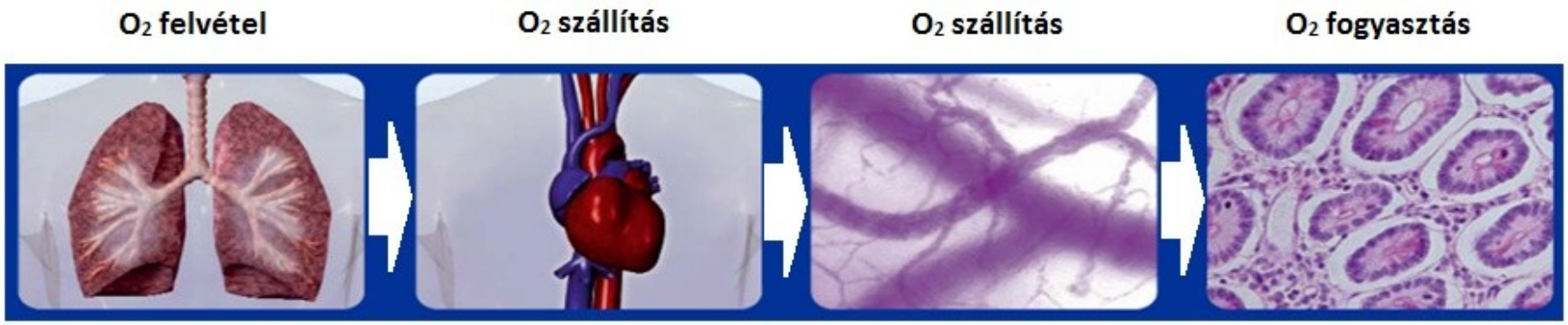
Garder C, et al. *Scand J Surg* 2008; 97: 15-36

Miért adunk vért?

Mik legyenek a transzfúzió indikátorai/végpontjai?

Miért kerülnek bajba a betegek?

Mert eladósodnak…



Folyadék | Vér | Oxigén

$DO_2 = (SV \bullet P) \bullet (Hb \bullet 1.39 \bullet SaO_2 + 0.003 \bullet PaO_2) \sim 1000 ml/min$

$VO_2 = CO \bullet (CaO_2 - CvO_2) \sim 250$ ml/min ($ScvO_2$~70-75%)

Fájdalomcsillapítás, szedáció

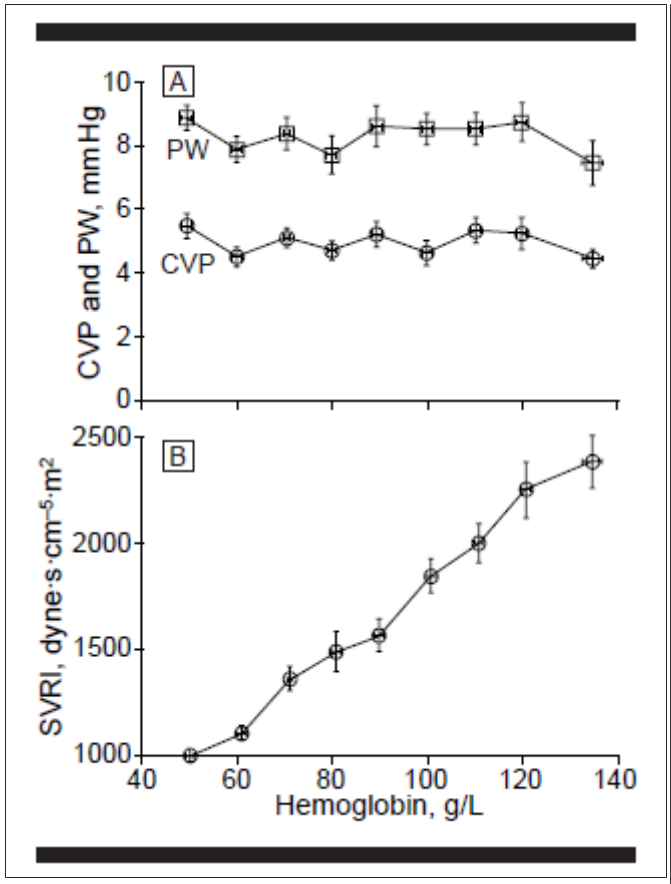
JAMA®

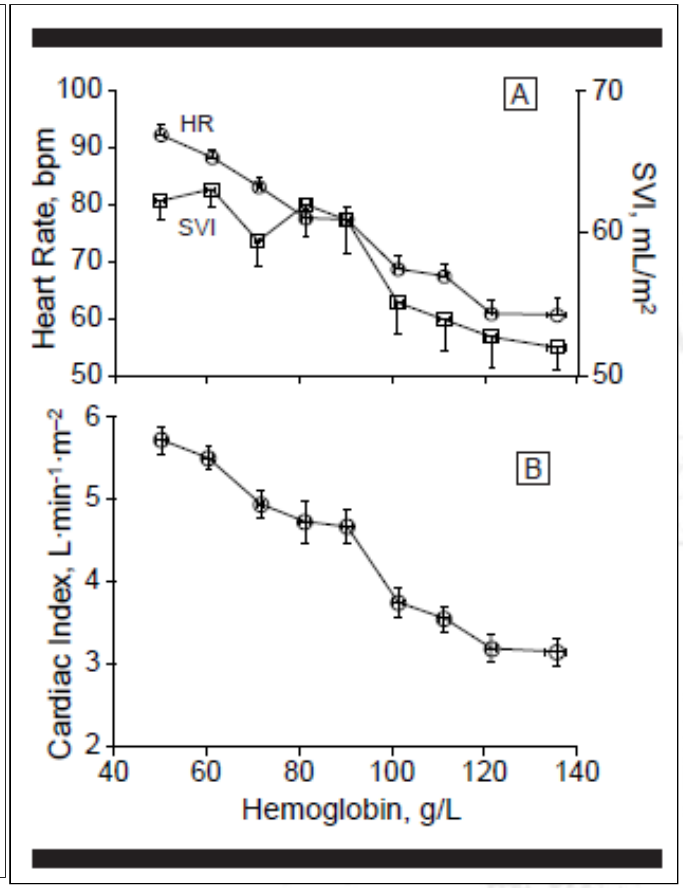
Online article and related content current as of May 10, 2010.

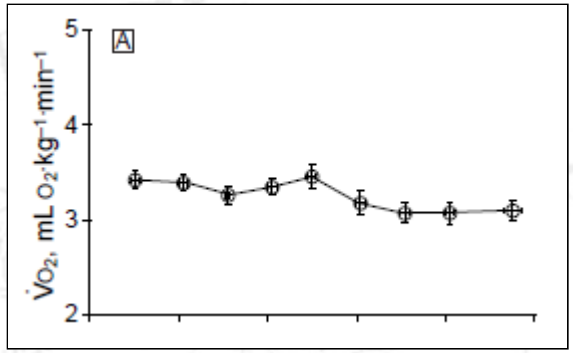
Human Cardiovascular and Metabolic Response to Acute, Severe Isovolemic Anemia

Richard B. Weiskopf; Maurene K. Viele; John Feiner; et al.

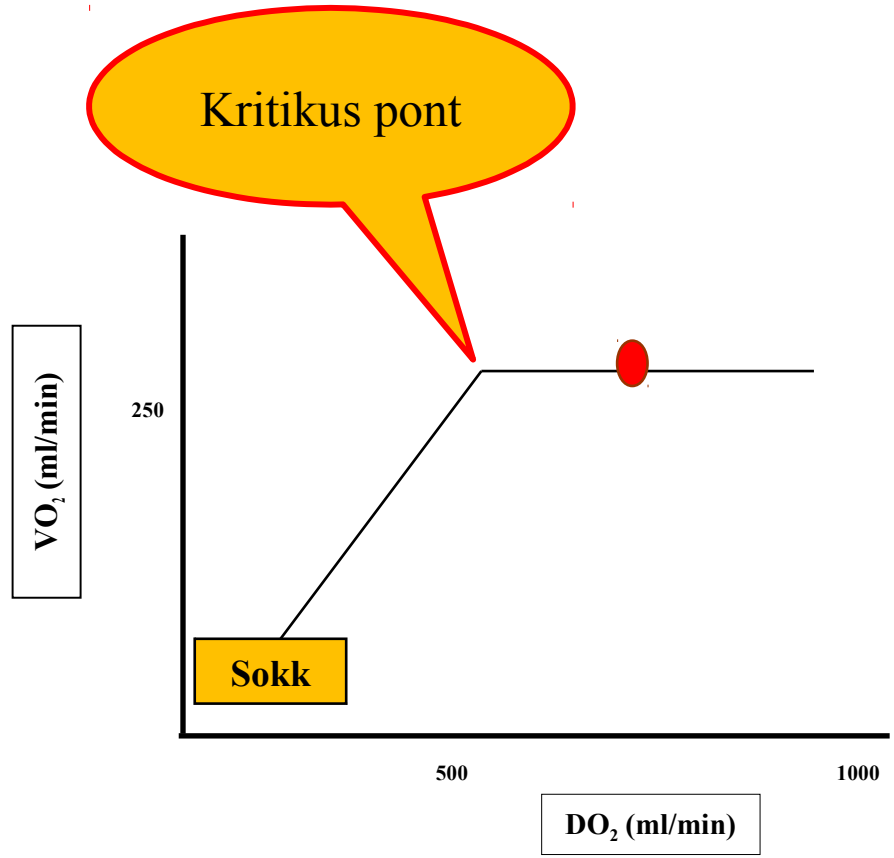
JAMA. 1998;279(3):217-221 (doi:10.1001/jama.279.3.217)





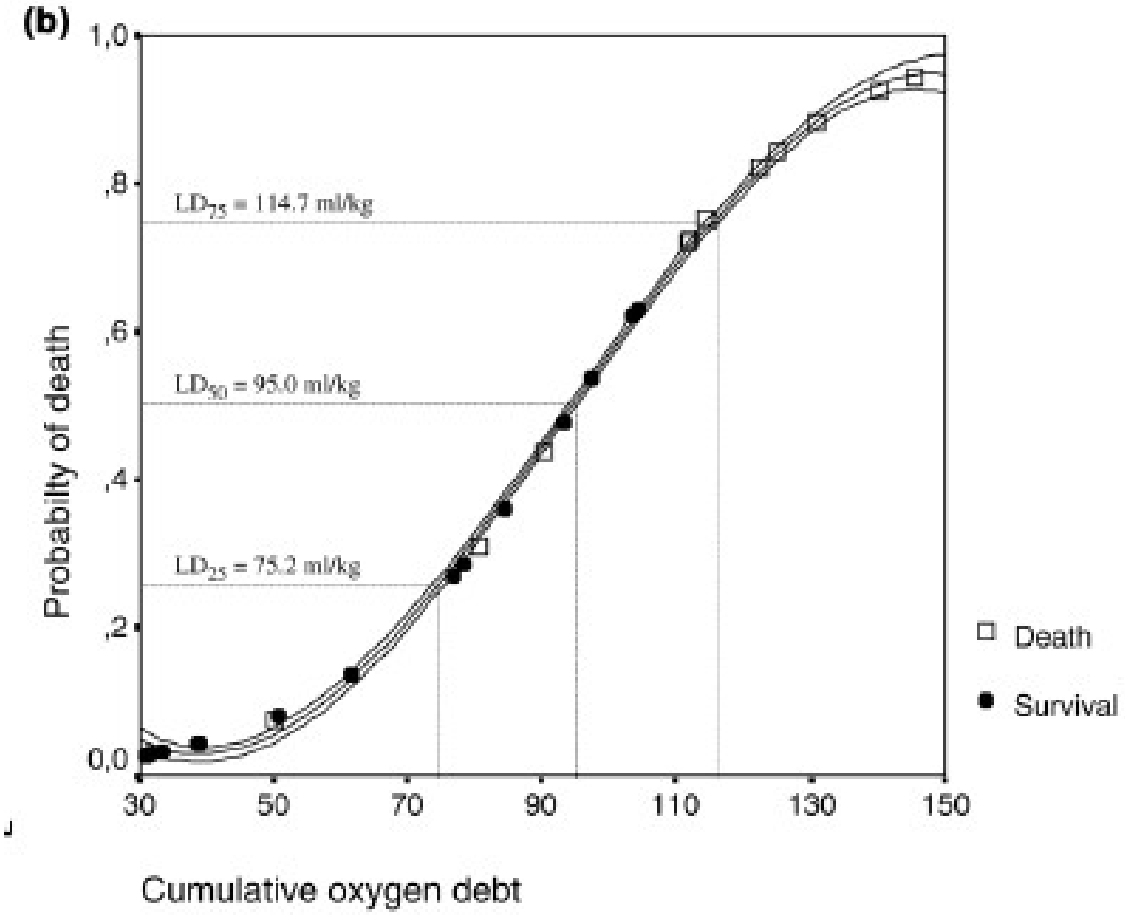


Kompenzáló mechanizmusok



Oxigén adósság és mortalitás

Rixen D, et al. *Shock* 2001, 16:239-244



Válasz

Miért adunk vért?

Hogy fenntartsuk a adekvát DO_2-t

Megfelelő indikátor/végpont a Hb?

$ScvO_2$

SvO_2 és $ScvO_2$ kritikus állapotú betegekben

Van Beest P, et al. *Crit Care* 2011; 15: 232

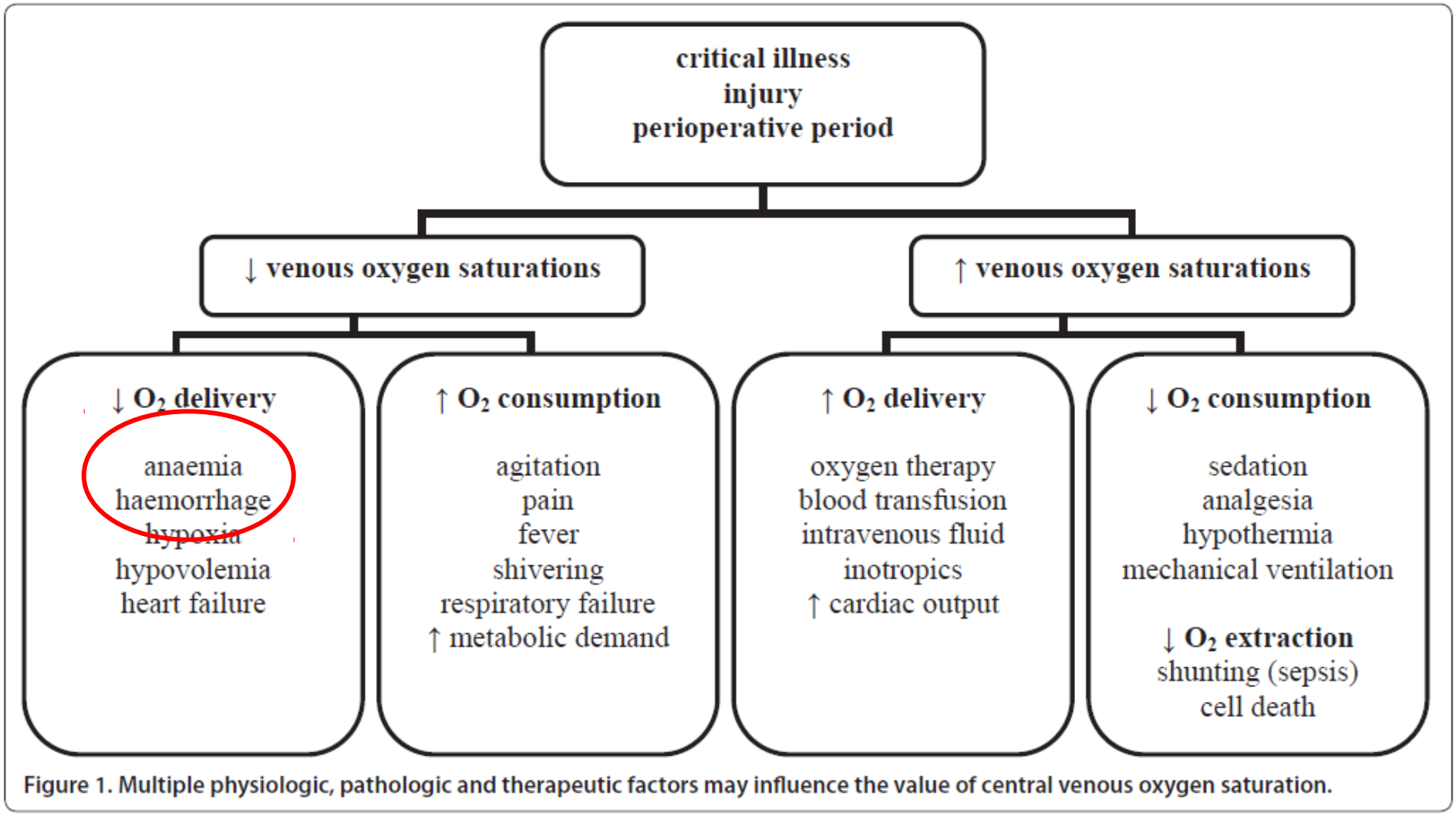


Figure 1. Multiple physiologic, pathologic and therapeutic factors may influence the value of central venous oxygen saturation.

Magas és alacsony$ScvO_2$

Maddirala S, et al. *Crit Care Clin* 2010; 26: 323-333

Table 1
Causes of high and low Svo_2 & $Scvo_2$

High Svo_2 & $Scvo_2$	Low Svo_2 & $Scvo_2$
Late sepsis/post–cardiac arrest/cytopathic hypoxia	Early sepsis
Distributive shock	Cardiogenic shock
High cardiac output	Hypovolemia
Hypothermia	
Arteriovenus fistulae	
Cellular poisons	

REVIEW

Clinical review: use of venous oxygen saturations as a goal – a yet unfinished puzzle

Paul van Beest[1]*, Götz Wietasch[1], Thomas Scheeren[1], Peter Spronk[2,3,4] and Michaël Kuiper[3,4,5]

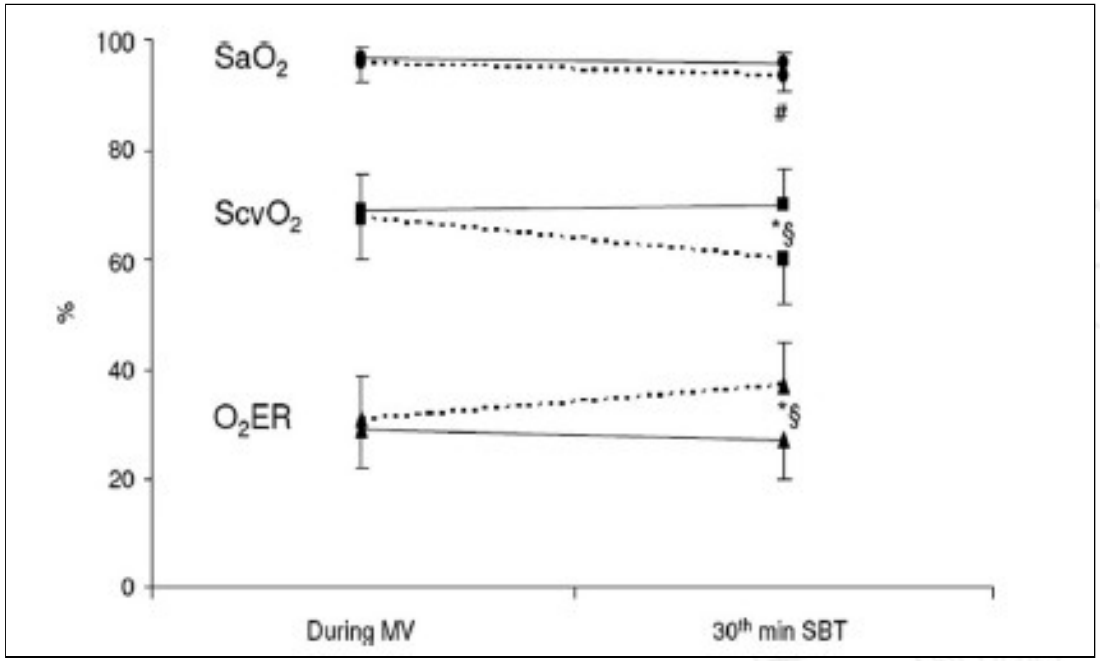
Critical Care 2011, 15:232

caution. Evaluating the available evidence in a clinical setting, we conclude that low venous oxygen saturations are an important warning sign for the inadequacy of DO_2 to meet oxygen demands.

Central venous saturation is a predictor of reintubation in difficult-to-wean patients*

Cassiano Teixeira, MD; Nilton Brandão da Silva, PhD; Augusto Savi, RPT; Silvia Regina Rios Vieira, PhD; Luis Antônio Nasi, MD; Gilberto Friedman, PhD; Roselaine Pinheiro Oliveira, MD; Ricardo Viegas Cremonese, MD; Túlio Frederico Tonietto, MD; Mathias Azevedo Bastian Bressel, MSc; Juçara Gasparetto Maccari, MD; Ricardo Wickert, RPT; Luis Guilherme Borges, RPT

(Crit Care Med 2010; 38:491–496)



Siker

Reintub.

Central venous saturation is a predictor of reintubation in difficult-to-wean patients*

Cassiano Teixeira, MD; Nilton Brandão da Silva, PhD; Augusto Savi, RPT; Silvia Regina Rios Vieira, PhD; Luis Antônio Nasi, MD; Gilberto Friedman, PhD; Roselaine Pinheiro Oliveira, MD; Ricardo Viegas Cremonese, MD; Túlio Frederico Tonietto, MD; Mathias Azevedo Bastian Bressel, MSc; Juçara Gasparetto Maccari, MD; Ricardo Wickert, RPT; Luis Guilherme Borges, RPT

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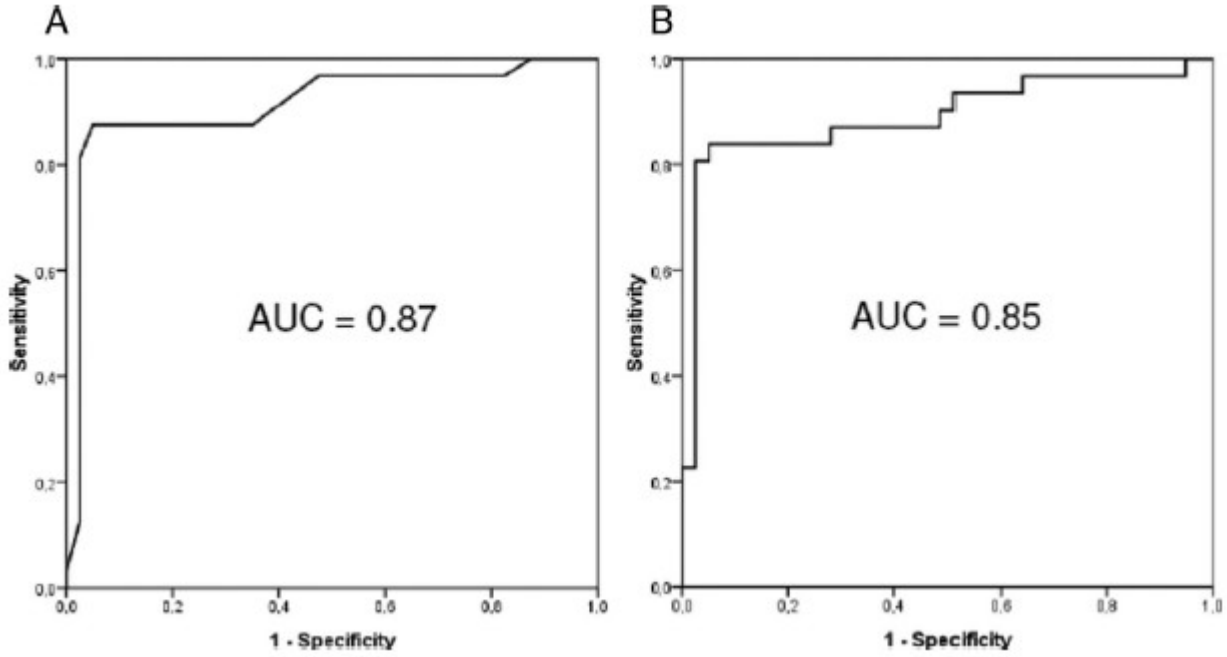


>4.5% decrease in $ScvO_2$	>8% increase in O_2ER
88% sensitivity, 95% specificity	63% sensitivity, 95% specificity

$ScvO_2$ és transzfúzió

Physiologic transfusion triggers

Vallet B, et al. *BP&R Clin Anaesth* 2007; 21: 173-181

Table 2. Demographic characteristics in 53 patients who received blood transfusion (BT).

	$ScvO_2 < 70\%$ ($n = 26$)		$ScvO_2 \geq 70\%$ ($n = 27$)		
Reco	− ($n = 12$)	+ ($n = 14$)	− ($n = 14$)	+ ($n = 13$)	Kruskal-Wallis test ($P = 0.05$)
Age	55.5 [46.4–64.4]	74.5 [62.2–77.2]	46 [30.5–62.9]	69 [59.7–80.3]	NS
Weight	73.5 [62.9–96.9]	74 [67.8–76.8]	70 [58.7–86.7]	70 [57.3–72.5]	NS
Blood units	2 [1.7–2.1]	2 [1.8–2.7]	2 [1.8–2.7]	2 [1.6–2.2]	NS

Patients were divided into two groups according to their central venous oxygen saturation ($ScvO_2$) before BT: $<$ or $\geq$70%, and then into four groups according to the SRLF recommendations (reco) for BT: $reco^+$ for 'recommendation for BT'; $reco^-$ for 'no recommendation for BT'.

Physiologic transfusion triggers

Vallet B, et al. *BP&R Clin Anaesth* 2007; 21: 173-181

Table 3. Central venous oxygen saturation ($ScvO_2$), hemoglobin (Hb), heart rate (HR) and systolic arterial pressure (SAP) values (median [CI 95%]) in patients divided into two groups as in Table 2.

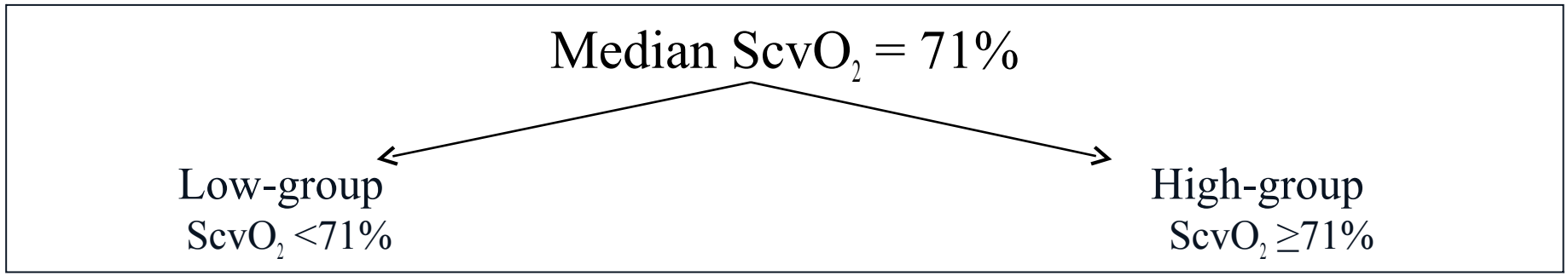
	$ScvO_2 < 70\%$		$ScvO_2 \geq 70\%$		
Reco	+	−	+	−	Kruskal–Wallis test ($P < 0.05$)
$ScvO_2$ pre-BT	58.6 [52.2–62.3]	56.5 [49.0–62.9]	75.3 [68.0–79.9]	75.4 [58.5–86.9]	$P < 0.001$
$ScvO_2$ post-BT	69.3[a] [58.8–74.5]	65.4 [55.5–69.7]	77.4 [71.0–80.8]	75.9 [67.7–80.8]	$P = 0.002$
Hb pre-BT	7.4 [7.2–7.9]	8.0 [7.6–8.5]	[7.2	7.5 [7.3–8.0]	NS
Hb post-BT	9.2[a] [8.7–9.8]	9.9[a] [9.4–10.3]	9.7[a] [9.2–10.6]		
HR pre-BT	89.0 [84.3–106.1]	95.5 [90.1–112.9]	87.5 [75.8–102.		
HR post-BT	92.0 [86.2–98.9]	92.0 [82.9–101.1]	84.0 [78.7–100		
SAP pre-BT	120.5 [105.7–138.4]	130.0 [120.7–149.5]	128.0 [117.1–138.7		
SAP post-BT	122.0 [111.4–138.3]	120.0 [108.6–146.6]	140.0[a] [131.8–159.2]	[11	

[a] $P < 0.05$; Wilcoxon test for values before (pre-BT) versus after BT (post-BT).

Az irányelv tévedett!

CENTRAL VENOUS OXYGEN SATURATION ($ScvO_2$) – THE PHYSIOLOGIC TRANSFUSION TRIGGER?

Kocsi S, et al. *Intensive Care Med* 2010; 36(S2): S351



	Low (n = 27)	**High** (n = 23)	**p**
Heart rate (beats/min)	90 (80-120)	100 (89-110)	0,981
MAP (mmHg)	75 (69-91)	80 (72-90)	0,724
Se lactate (mmol/l)	1,4 (0,9-3,4)	0,9 (0,6-1,3)	0,072
CVP (mmHg)	10 (8-11)	8 (4-10)	0,041

Data are presented as: median (interquartile range).
For statistical analysis Mann-Whitney test was used. *, $p<0.001$

CENTRAL VENOUS OXYGEN SATURATION ($ScvO_2$) – THE PHYSIOLOGIC TRANSFUSION TRIGGER?

Kocsi S, et al. *Intensive Care Med* 2010; 36(S2): S351

	Low $ScvO_2$-group (n=27)		**High $ScvO_2$-group (n=23)**	
	Before	After	Before	After
Hb (g/dl)	7.6(7.0-8.2)	9.2(8.2-9.8)*	7.7(7.1-8.1)	8.6(7.9-9.5)* #
$ScvO_2$ (%)	62(57-64)	70(65-72)*	77(75-81)	80(76-82)
O_2ER (%)	37(33-51)	28(20-35)*	20(15-24)	20(15-22)

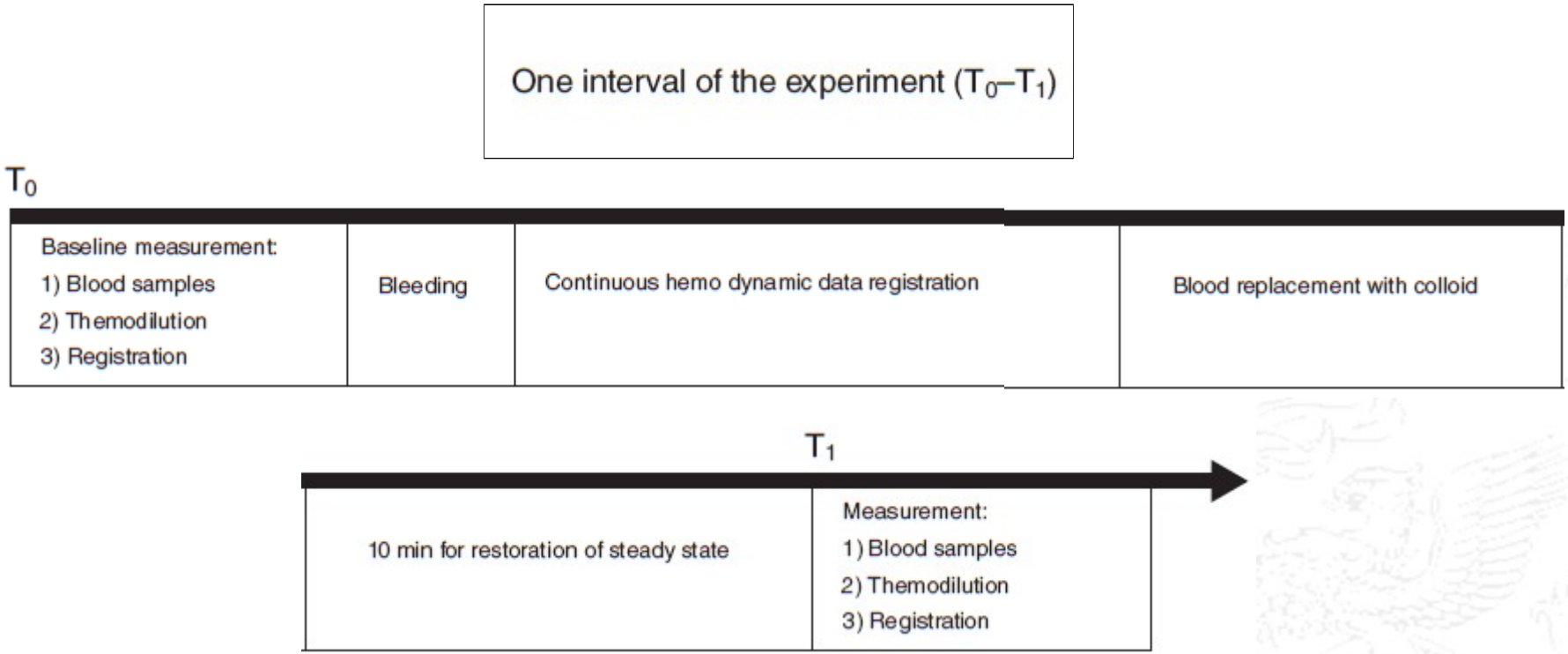
Data are presented as: median (interquartile range).

For statistical analysis: comparing groups before-after Wilcoxon* and comparing Low-High groups Mann-Whitney# tests were used. *, $p<0.001$;#,$p<0.001$

Central venous oxygen saturation is a good indicator of altered oxygen balance in isovolemic anemia

S. Kocsi[1], G. Demeter[1], J. Fogas[1], D. Érces[2], J. Kaszaki[2] and Z. Molnár[1]

Acta Anaesthesiol Scand 2012; ***56: 291–297***



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Hemodynamic effects of isovolemic anemia.

	T_0	T_1	T_2	T_3	T_4	T_5
Hb (g/l)	125 (113–134)	102 (90–109)*†	79 (73–93)*†	68 (60–76)*†	59 (53–67)*†	49 (43–55)*†
(mmol/l)	7.					3.0 (2.6–3.4)
HR (beats/min)	125					47 (131–177)*
MAP (mm Hg)	91 (79–105)	89 (79–101)	83 (75–98)*	82 (68–90)*	72 (59–85)*	72 (63–86)*
CVP (mm Hg)	6 (5–8)	8 (5–9)	7 (4–9)	7 (5–9)	7 (5–9)	7 (3–10)
CI (L/min/m^2)	2.6 (2.3–2.8)	3.3 (2.7–3.6)*†	3.6 (2.9–3.8)*†	3.6 (3.3–4.1)*	3.5 (3.2–4.0)*	3.9 (3.6–4.1)*
GEDI (ml/m^2)	270 (243–284)	271 (245–320)	276 (248–298)	274 (236–305)	268 (227–302)	261 (232–298)
ITBI (ml/m^2)	335 (307–352)	335 (305–400)	343 (303–373)	342 (295–383)	334 (282–375)	333 (285–375)
ELWI (ml/kg)	9 (9–10)	10 (10–10)	9 (9–10)	10 (9–10)	10 (9–10)	10 (9–11)
SVI (ml/m^2)	21 (18–29)	26 (23–31)	27 (24–31)	28 (25–31)	25 (21–33)	28 (22–31)
SVV (%)	17 (14–21)	15 (12–21)	19 (9–21)	15 (11–20)	19 (11–25)	14 (11–27)
dPmx (mm Hg/s)	540 (485–790)	700 (540–985)*	800 (570–1075)*	810 (540–1480)*	880 (560–1360)*	975 (562–1275)*

Decrease by 60%

Central venous oxygen saturation is a good indicator of altered oxygen balance in isovolemic anemia

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Acta Anaesthesiol Scand 2012; ***56: 291–297***

Effects of isovolemic anemia on oxygen balance.

	T_0	T_1	T_2	T_3	T_4	T_5
SaO_2 (%)	95 (92–97)	96 (94–97)	96 (95–97)	96 (95–97)	97 (97–97)	97 (97–97)
DO_2 (ml/min/m2)	431 (362–474)	438 (323–524)	378 (302–412)*†	344 (252–376)*	284 (236–333)*	247 (216–292)*†
VO_2 (ml/min/m2)	119 (82–139)	130 (77–151)	93 (66–136)	113 (67–141)	98 (72–120)	105 (70–120)
VO_2/DO_2 (%)	29 (18–33)	29 (17–33)	29 (18–32)	35 (21–40)*	37 (26–43)*	41 (27–47)*
ERO_2 (%)	19 (13–26)	19 (14–24)	20 (14–22)	21 (16–28)	30 (22–37)*	32 (21–39)*
SvO_2 (%)	68 (64–77)	67 (64–77)	68 (63–79)	64 (58–76)	62 (55–72)*	58 (52–72)*
$ScvO_2$ (%)	76 (69–83)	73 (72 (82)	77 (75–83)	77 (68–81)	68 (61–76)*	66 (60–76)*
Lactate (mmol/l)	4.5 (3.2–5.3)	4.2 (3.0–5.1)	5.0 (3.2–6.0)	4.1 (2.9–6.0)	4.2 (2.9–6.5)	4.0 (3.0–6.4)
pH	7.44 (7.40–7.50)	7.43 (7.40–7.50)	7.43 (7.41–7.50)	7.43 (7.39–[illegible])	7.44 (7.42–7.49)	7.44 (7.40–7.47)
PaO_2 (mm Hg)	76 (66–80)	75 (72–80)	76 (73–80)	77 ([illegible])	79 (75–85)*	81 (77–90)*
(kPa)	10.1 (8.8–10.7)	10.0 (9.6–10.7)	[illegible]	[illegible]–10.9)	10.5 (10.0–11.3)	10.8 (10.3–12.0)
$PaCO_2$ (mm Hg)	39 (35–44)	38 (35–43)	[illegible]	[illegible]–46)	37 (34–42)	38 (35–41)
(kPa)	5.2 (4.7–5.9)	5.1 ([illegible]	[illegible]	[illegible]–6.1)	4.9 (4.5–5.6)	5.1 (4.7–5.5)
$aHCO_3$ (mmol/l)	25 (24–27)	24 ([illegible]	[illegible]	[illegible]	25 (22–27)	25 (21–25)
aBE (mmol/l)	0.90 (–0.05–2.50)	0.4[illegible]	[illegible]	[illegible]5–3.15)	0.90 (–1.45–2.35)	0.70 (0.43–1.08)

$ScvO_2$<70%:
Hb 59 g/l

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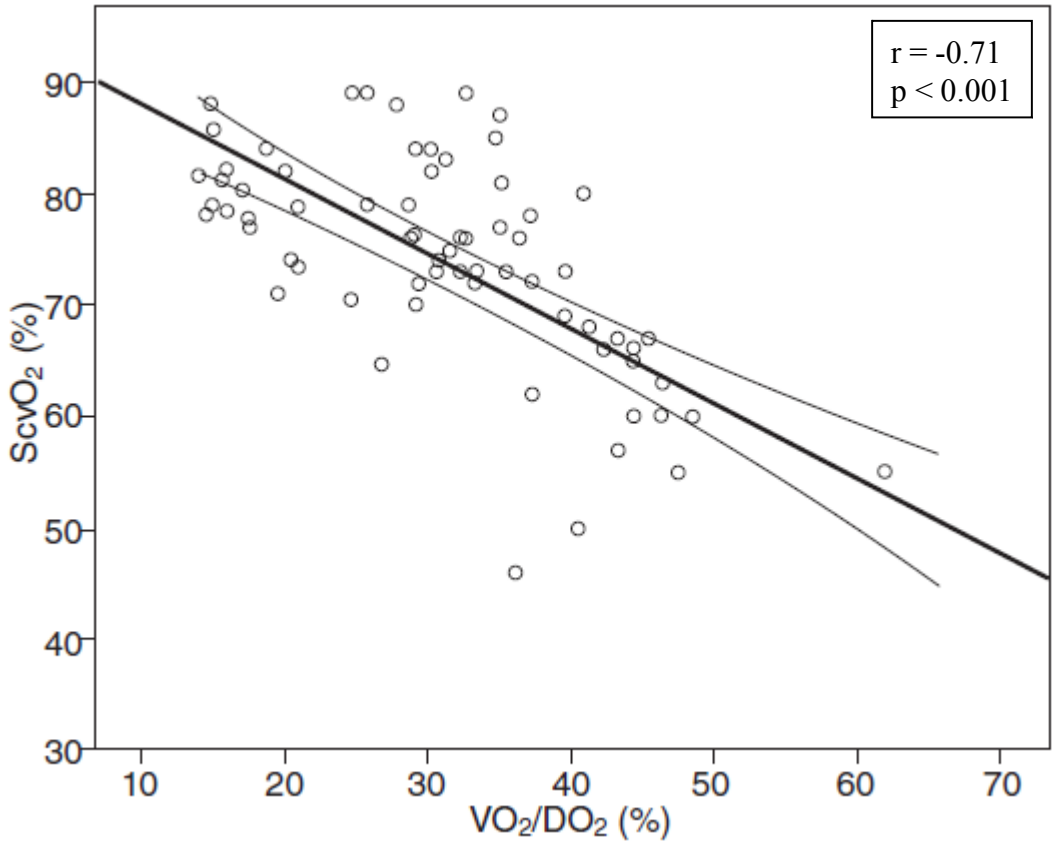


Hogyan alkalmazzuk mindezt
a klinikai gyakorlatban?

Esetismertetés

64 éves ffi

- Autóbaleset
  - Politrauma
  - Medence, borda törések
  - Anamnézis: hypertonia, diabetes

Műtét - ITO

- Gépi lélegeztetés
  - Rutin monitorozás
  -

Posztoperatív 3. nap 9:00

Keringés

Pulzus (min-1)	98
MAP (Hgmm)	70
Hb (g/dl)	7.2
Noradrenaline	-

Légzés

FiO_2	0.5
PEEP (cmH_2O)	8
PaO_2 (Hgmm)	96

Arteriás vérgáz

pH	7.34
pCO_2 (Hgmm)	46
HCO_3 (mmol/l)	26
Lactate (mmol/l)	1.9

Centrális vénás VG

pCO_2 (Hgmm)	50
Cv-aCO_2 (Hgmm)	4
$ScvO_2$ (%)	73

Posztoperatív 3. nap 9:00

Keringés

Pulzus (min-1)	98
MAP (Hgmm)	70
Hb (g/dl)	7.2
Noradrenal	

Légzés

FiO_2	0.5
PEEP (cmH_2O)	8
PaO_2 (Hgmm)	96

Arteriás

vénás VG

Nem - van idő várni

pH	
pCO_2 (Hgmm)	46
HCO_3 (mmol/l)	26
Lactate (mmol/l)	1.9

	50
Cv-aCO_2 (Hgmm)	4
$ScvO_2$ (%)	73

Transzfundálnád?

Posztoperatív 3. nap, 14:00, leszoktatás

Keringés

Heart rate (min-1)	98
MAP (Hgmm)	70
Hb (g/dl)	7.2
Noradrenaline	-

Légzés

FiO_2 (T-szár, SBT)	0.5
PEEP (H_2Ocm)	5
PaO_2 (Hgmm)	88

Arteriás VG

pH	7.34
pCO_2 (Hgmm)	46
HCO_3 (mmol/l)	26
Lactate (mmol/l)	1.9

Centrális vénás VG

pCO_2 (Hgmm)	50
Cv-aCO_2 (Hgmm)	4
$ScvO_2$ (%)	65

Posztoperatív 3. nap, 14:00, leszoktatás

Keringés

Heart rate (min-1)	98
MAP (Hgmm)	70
Hb (g/dl)	7.2
Noradrenaline	-

Légzés

FiO_2 (T-szár, SBT)	0.5
PEEP (H_2Ocm)	5
PaO_2 (Hgmm)	88

Arteriás VG

pH	7.34
pCO_2 (Hgmm)	46
HCO_3 (mmol/l)	26
Lactate (mmol/l)	1.9

Igen!

vénás VG

pCO_2 (Hgmm)	50
Cv-aCO_2 (Hgmm)	4
$ScvO_2$ (%)	65

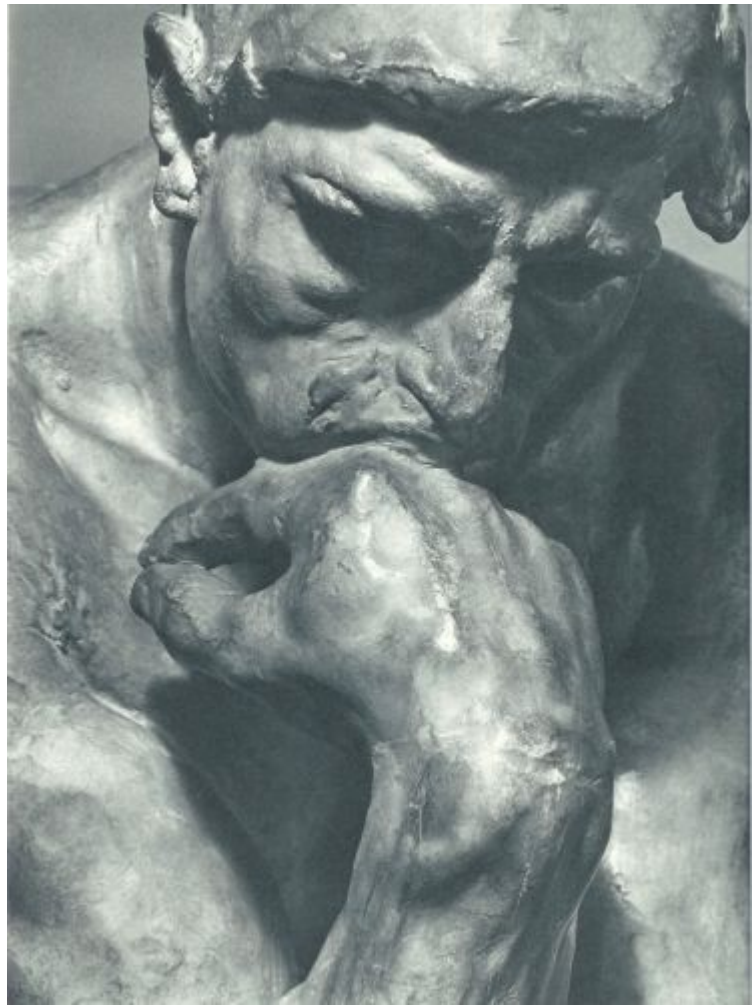
Transzfundálnád?

Összefoglalás

- Minden az O_2 körül forog
  - Mérésére: nincs arany standard
- Transzfúzió nem veszélytelen
  - Gyakran feleslegesen transzfundálunk
- $ScvO_2$
  - Jól korrelál a VO_2/DO_2-vel
  - Használható mint fiziológiás transzfúziós indikátor
  - Dinamikus paraméterként is használható

Treat the triggers, not the figures!®

A legjobb transzfúziós indikátor:



Auguste Rodin: A Gondolkodó

Mottó

Nem az a lényeg, hogy a jó döntést hoztuk-e, hanem, hogy mindent megtettünk-e azért, hogy a jó döntést hozhassuk.