Place des déterminants physiologiques dans la décision de transfuser des CGR

Cécile Aubron

Journée de Printemps de la SFTS - 14 mai 2024

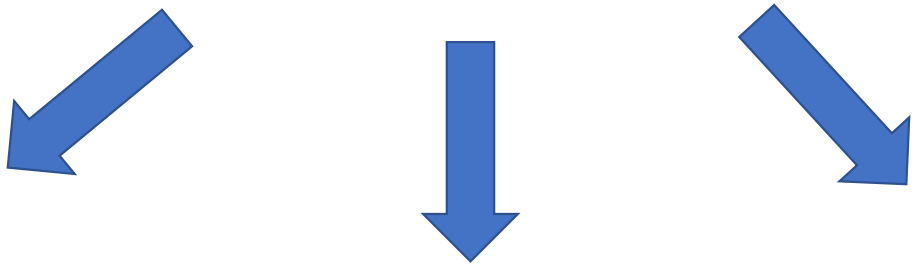
UBO Université de Bretagne Occidentale | Faculté de Médecine & Sciences de la Santé

CHRU BREST

Conflits d'intérêts

- MSD : Oratrice d'un symposium

Objectifs



Pourquoi utiliser des déterminants physiologiques *?

Quels déterminants physiologiques utiliser *?

Les déterminants physiologiques en pratique*?

**Chez le patient anémique sans saignement*

CONFERENCE REPORTS AND EXPERT PANEL

Transfusion strategies in non-bleeding critically ill adults: a clinical practice guideline from the European Society of Intensive Care Medicine

Alexander P. Vlaar[1,18*], Simon Oczkowski[2,3,4], Sanne de Bruin[1], Marije Wijnberge[1,5], Massimo Antonelli[6,7], Cecile Aubron[8], Philippe Aries[8], Jacques Duranteau[9], Nicole P. Juffermans[1], Jens Meier[10], Gavin J. Murphy[11], Riccardo Abbasciano[11], Marcella Muller[1], Akshay Shah[12,13], Anders Perner[14], Sofie Rygaard[14], Timothy S. Walsh[15], Gordon Guyatt[2,3,4], J. C. Dionne[2,3,4] and Maurizio Cecconi[16,17]

Intensive Care Medicine 2020; 46:673–696

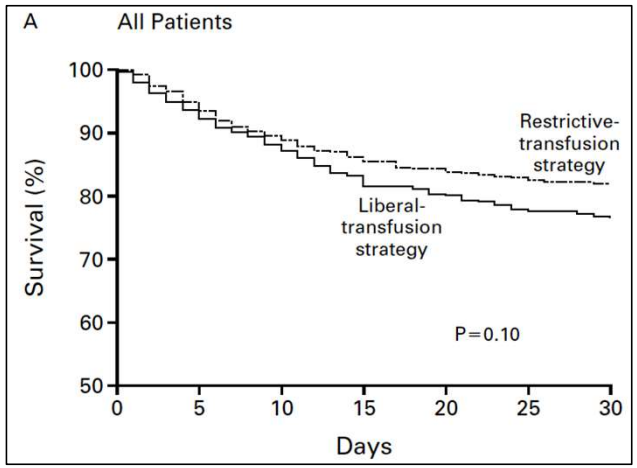
Décision de transfuser basée sur l'Hb et la tolérance clinique

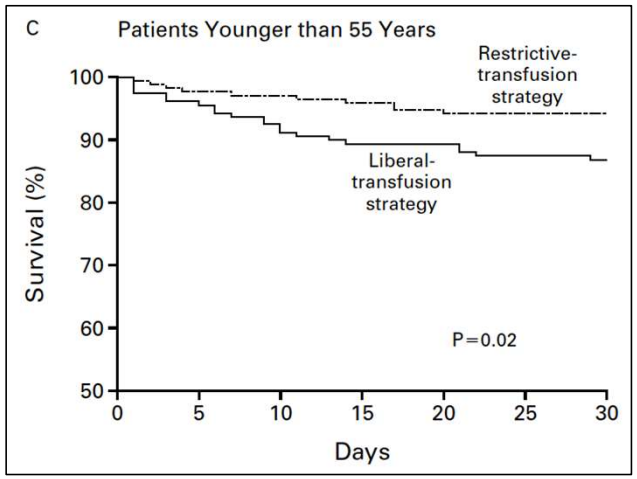
1. Hb ne reflète pas la tolérance systémique ou tissulaire de l'anémie

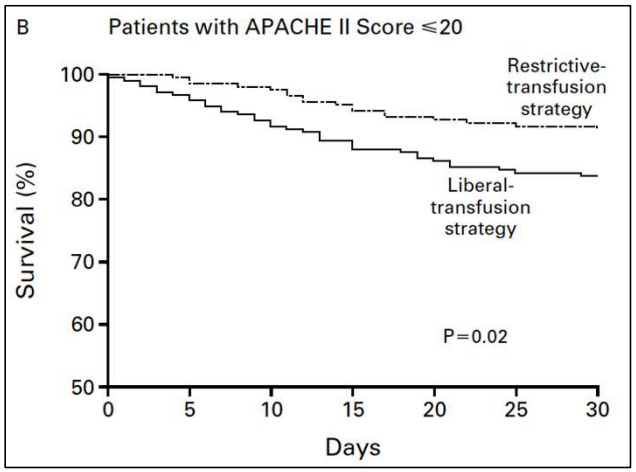
2. Les critères de tolérance cliniques/ECG de l'anémie peu spécifiques en réanimation

A MULTICENTER, RANDOMIZED, CONTROLLED CLINICAL TRIAL OF TRANSFUSION REQUIREMENTS IN CRITICAL CARE

PAUL C. HÉBERT, M.D., GEORGE WELLS, PH.D., MORRIS A. BLAJCHMAN, M.D., JOHN MARSHALL, M.D., CLAUDIO MARTIN, M.D., GIUSEPPE PAGLIARELLO, M.D., MARTIN TWEEDDALE, M.D., PH.D., IRWIN SCHWEITZER, M.SC., ELIZABETH YETISIR, M.SC., AND THE TRANSFUSION REQUIREMENTS IN CRITICAL CARE INVESTIGATORS FOR THE CANADIAN CRITICAL CARE TRIALS GROUP*







Tous les patients

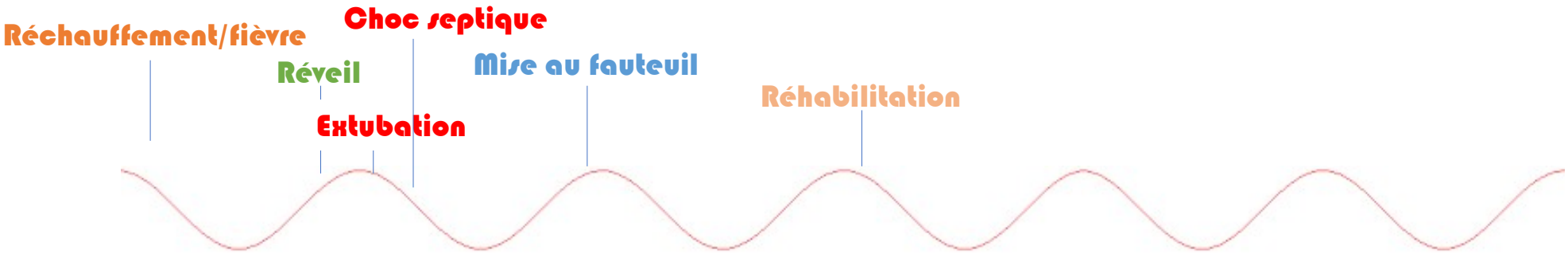
< 55 ans

Patients les moins sévères

3. Un même taux d'Hb ne permet pas d'éviter des transfusions potentiellement délétères

Hebert P et al., New England Journal Medicine 1999;340:409-17

4. Le taux d'Hb ne prend pas en compte les changements des besoins en O_2



5. Anomalies physiopathologiques et le ratio DO_2/VO_2

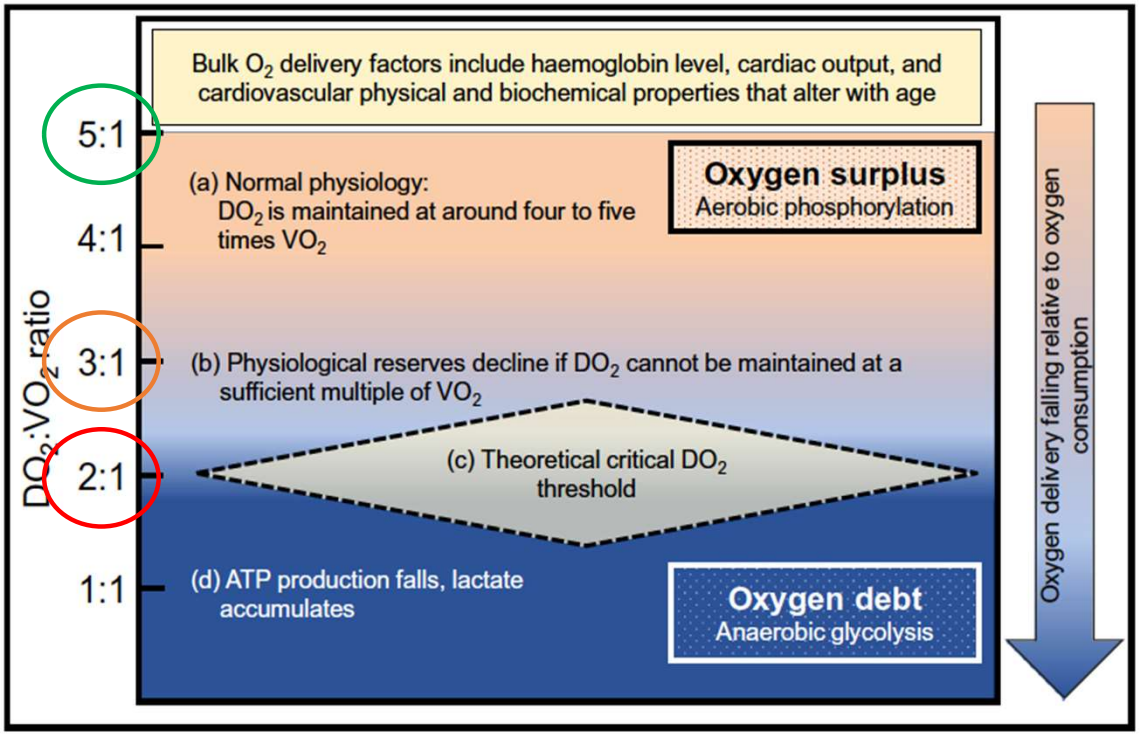
Hypoxie

Choc septique

Anémie, saignement

Coronaropathie

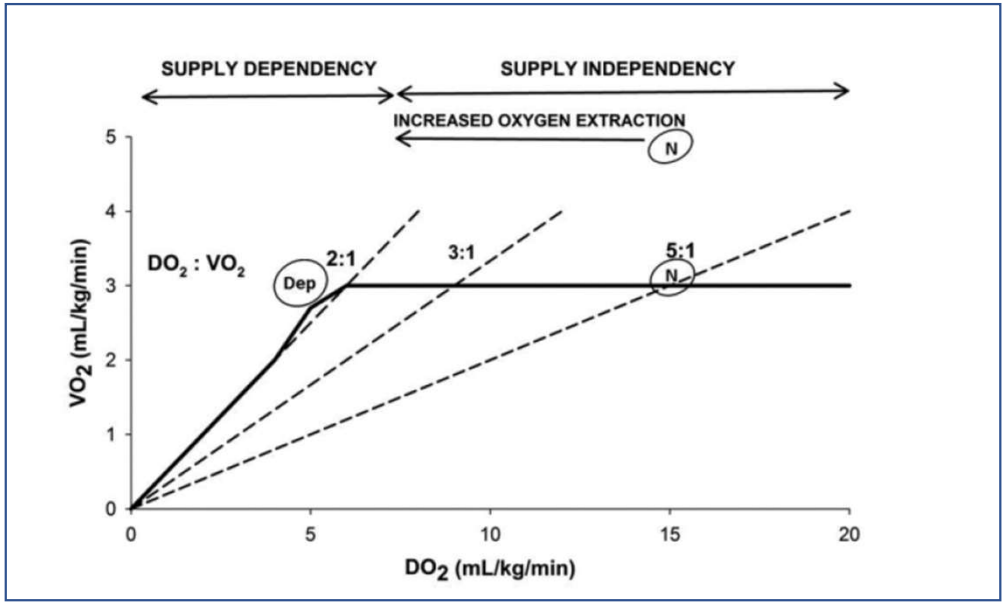
Age avancé

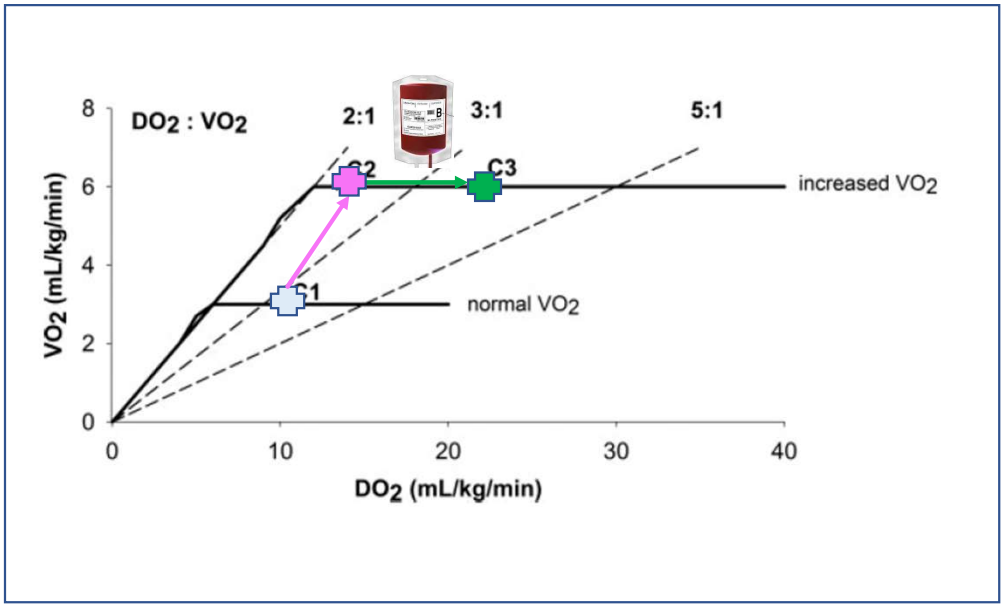


Simon GI et al., Transfusion Medicine Reviews 33:2019; 154-61

6. L'Hb ne reflète pas les « réserves » en O_2 chez le patient de réanimation

Relation entre consommation en O_2 (VO_2) et apports en O_2 (DO_2)



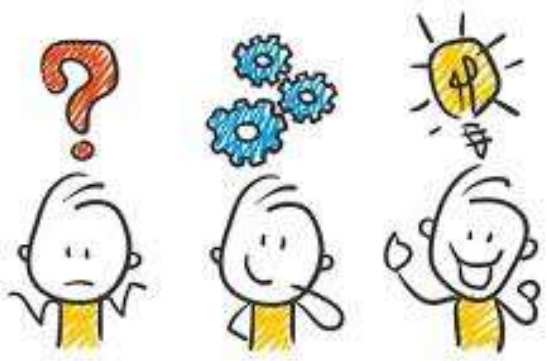


DO_2 = Débit Cardiaque x CaO_2
$CaO_2 = SaO_2 \times Hb \times 1.34 + 0.0031 \times PaO_2$
VO_2 = Débit Cardiaque x (CaO_2-CvO_2)
$ERO_2 = VO_2/DO_2$ => Normal ERO_2= 20 à 30%

Spinelli E., Journal of Intensive Care Medicine 2016, Vol. 31(5) 295-306

Quels paramètres d'oxygénation systémique?

- Évite les transfusions prématurées/inutiles
- Évite les transfusions retardées
- Tient compte de la tolérance à l'anémie des différents organes
- Peut être déterminé en continu
- A une grande sensibilité et spécificité



Extraction en O_2

$ERO_2 = VO_2/DO_2$

$ERO_2 = (SaO_2 x Hb x 1.34) \times DC / (SaO_2 - SvO_2) x 1.34 \times Hb \times DC$

$ERO_2 = SaO_2 - SvO_2 / SaO_2 = 1 - SvO_2$

$SvO_2 = SaO_2 - VO_2 / (DC x 1.34 x Hb) = 68\text{-}77\%$
-> $ScvO_2$

Différence artério-veineuse en O_2
Diff A-V O_2 = CaO_2 - Cv O_2

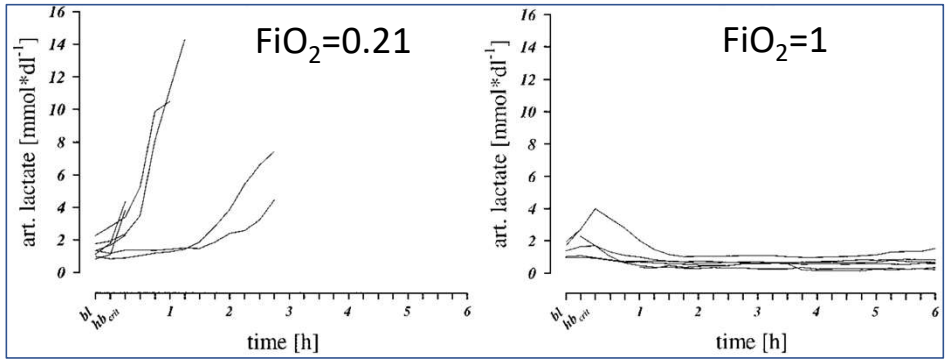
Lactatémie

ECG

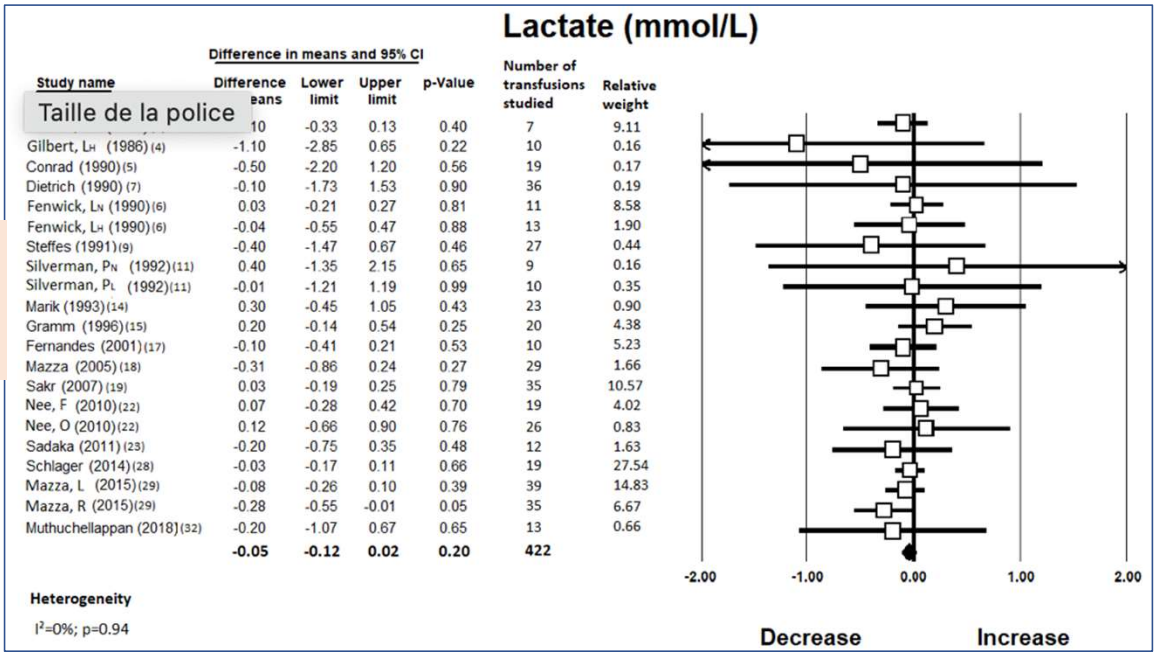
Arynov A BMC Anesthesiology 2024;24:71

Hyperlactatémie

- “Tardive” = que pour des taux d’Hb bas
- Non spécifique
- Non sensible



Taux de lactate et transfusion de CGR



Meier J et al., Anesthesiology 2004; 100:70 – 6

Cavalcante dos Santos E et al., Critical Care Medicine 2020; 48:2

Effects of red blood cell transfusion on global oxygenation in anemic critically ill patients

Nicolas Themelin[1] | Patrick Biston[1] | Jacqueline Massart[1] | Christophe Lelubre[2] | Michaël Piagnerelli[1,3]

- 62 patients anémiques sans saignement actif
- 105 transfusion de CGR

Characteristics	Before	After	*P* value
Hb, g/dL	7.4 (7.0-7.8)	8.4 (7.7-8.9)	<.001
Temperature, °C	36.9 (36.2-37.2)	36.9 (36.3-37.2)	.56
HR, bpm	86 (75-102)	87 (75-99)	.88
MAP, mm Hg	77 (69-88)	81 (73-91)	<.001
PaO_2/FiO_2, n = 90	274 (180-346)	273 (160-354)	.63
$S(c)vO_2$, %	65.5 (59.1-72.9)	68.6 (61.9-74.8)	<.001
Lactate, mmol/L	1.1 (0.8-1.5)	1.1 (0.8-1.6)	.51
$Pv\text{-}aCO_2$, mm Hg	6.5 (3.0-9.0)	6.0 (3.0-9.0)	.32
CI/EO_2, n = 29	7.0 (4.4-10.7)	7.0 (5.5-12.9)	.31

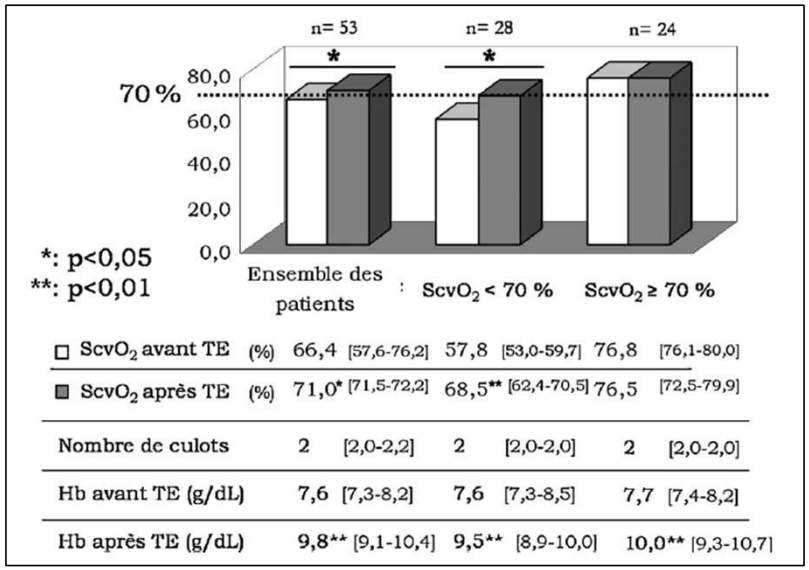
➔ **Augmentation de la ScvO2, uniquement si ScvO2 < 70% avant transfusion**

Themelin N et al., Transfusion 2021;61:1071–1079

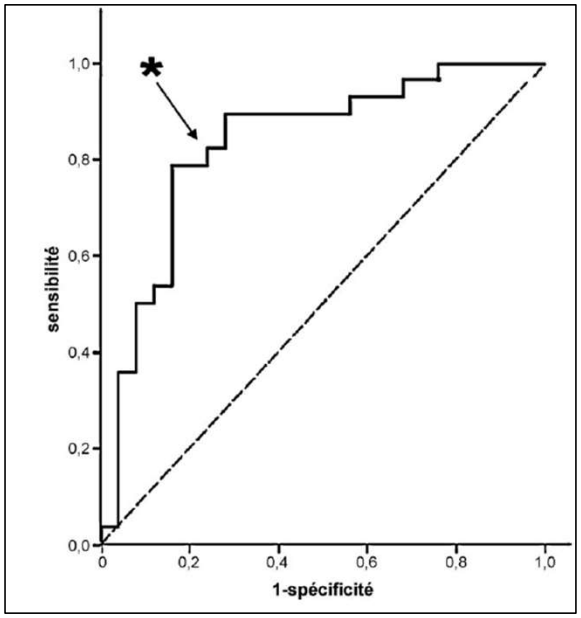
Apport de la saturation veineuse centrale en oxygène dans la décision transfusionnelle postopératoire

Contribution of central venous oxygen saturation in postoperative blood transfusion decision

S. Adamczyk, E. Robin, O. Barreau, M. Fleyfel, B. Tavernier, G. Lebuffe, B. Vallet *



		Ensemble des patients		ScvO2 < 70 %		ScvO2 ≥ 70 %	
ScvO2 avant TE	(%)	66,4	[57,6-76,2]	57,8	[53,0-59,7]	76,8	[76,1-80,0]
ScvO2 après TE	(%)	71,0*	[71,5-72,2]	68,5**	[62,4-70,5]	76,5	[72,5-79,9]
Nombre de culots		2	[2,0-2,2]	2	[2,0-2,0]	2	[2,0-2,0]
Hb avant TE (g/dL)		7,6	[7,3-8,2]	7,6	[7,3-8,5]	7,7	[7,4-8,2]
Hb après TE (g/dL)		9,8**	[9,1-10,4]	9,5**	[8,9-10,0]	10,0**	[9,3-10,7]



La valeur de $ScVO_2$ 69.5% , prédit une augmentation de 5% avec une Se 82% et une Sp 76%

=> Une $ScvO_2$< 70% permet de discriminer de manière objective les répondeurs et non répondeurs à la transfusion en post opératoire

Adamczyk S et al., Annales Françaises d'Anesthésie et de Réanimation 2009 ; 28:522–530

$ScvO_2$ changes after red-blood-cell transfusion for anaemia in cardiothoracic and vascular ICU patients: an observational study

N. Zeroual,[1] G. Samarani,[1] J. Gallais,[1] G. Culas,[1] M. Saour,[1] M. Mourad,[1] P. Gaudard[1,2] & P. H. Colson[1,3]

- 53 patients post chirurgie cardiaque, Hb=7.2 g/dl, 100 transfusions

	All (n = 100)	$ScvO_2 \leq 65\%$ (n = 42)	$ScvO_2 > 65\%$ (n = 58)	P^a
Delay form ICU admission, days, median [IQ]	4 [1–11]	3 [1–11]	4 [1–11]	0·66
AoTVI*, cm, median [IQ]	17 [14–20]	17 [13–21]	18 [15–20]	0·97
Norepinephrine, n (%)	64 (64)	31 (73·8)	33 (56·9)	0·12
Inotrope, n (%)	6 (6)	1 (2·3)	5 (8·6)	0·34
Lactate, mmol/l, median [IQ]	1·6 [1·1-2·2]	1·6 [1·1-2·3]	1·7 [1·1-2]	0·52
SOFA score, median [IQ]	7 [4–14]	6 [4–14]	7 [4–14]	0·47
Mechanical ventilation, n (%)	50 (50)	17 (40·5)	33 (56·9)	0·11
SaO_2, %, median [IQ]	100 [98-100]	100 [98-100]	100 [98-100]	0·47

Table 4 $ScvO_2$ cutoff value to predict an increase after transfusion

$ScvO_2$ increase	$ScvO_2$ cutoff value%	Sensitivity% (IQ95%)	Specificity% (IQ95%)	PPV%	NPV%	AUC (IQ95%)
+5%	65	68 (54·1–79·2)	88 (75·7–94·7)	85	73·3	0·82 (0·74–0·90)
+10%	61·9	82·6 (62·1–93·5)	84·4 (74·5–91)	61·3	94·2	0·88 (0·79–0·94)
+15%	60	82·2 (53·8–96·2)	84·1 (74·9–90·4)	41·7	97·4	0·87 (0·76–0·97)
+20%	59	100 (45–100)	82·3 (73·3–88·7)	19	100	0·92 (0·86–0·97)

Zeroual N et al., Vox Sanguinis 2018 ; 113, 136–142

The effect of blood transfusion on central venous oxygen saturation in critically ill patients admitted to a neurointensive care unit

R. M. Surve,[1] R. Muthuchellappan,[1] G.S.U. Rao[1] & M. Philip[2]

- 70 patients neuro-lésés

	Pre-transfusion[1]	End of transfusion	6 h post-transfusion	12 h post-transfusion	18 h post-transfusion	24 h post-transfusion	*P* value
HR (beats/min)	100·2 ± 18	92·2 ± 17·8	85·6 ± 18·6	86·4 ± 16·9	87·6 ± 16	84·6 ± 15·3	0·000
SBP (mmHg)	123·7 ± 16·7[2]	131·4 ± 21	130 ± 17·9	132·9 ± 19·1	131·2 ± 16·8	131·5 ± 17·1	0·001
MBP (mm Hg)	93·2 ± 13·2	98·3 ± 13·5	96·6 ± 12·5	97·1 ± 12·8	97·8 ± 10·9	96·6 ± 11·2	0·025
CVP (mm Hg)	12·2 ± 2·4 [3]	13·6 ± 2·6	12·7 ± 3·1	13·2 ± 2·9	13 ± 2·1	13 ± 2·3	0·012
Hb (gm dL^{-1})	8 ± 1[2]	10·9 ± 2·3	10·7 ± 2·3	10·2 ± 2·1	10·3 ± 1·9	10·6 ± 2·2	0·001
$ScvO_2$ (%)	69·6 ± 11·5 [4]	74·4 ± 8·9	74·9 ± 8·3	73·6 ± 8·6	73·9 ± 8·6	74·6 ± 9·4	0·000
$PcvO_2$ (mm Hg)	38·4 ± 6·5	40·3 ± 6·2	39·6 ± 6·6	39·3 ± 6·2	40·3 ± 5·8	41·7 ± 7·4	0·056

Si $ScvO_2$ avant transfusion <70% , Se 80% et Sp97%; AUC 0.891
Facteurs associés à l'augmentation $ScvO_2$: $ScvO_2$ pré-transfusion, Hb pré-transfusion, nbre de CGR transfusé

Surve RM et al.,Transfusion Medicine 2016 ; 26, 343–348

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*

263 patients en choc septique < sixième heure de prise en charge

EGDT to maintain $ScVO_2$>70%	**Standard of care**
Fluid = 4,9 (±2,9) L	Fluid = 3.5 (±2,4) L
Inotrope agent : 13,7%	Inotrope agent : 0.8%
RBC : 64,1%	**RBC : 18.5%**
Mean $ScVO_2$ = 77%	Mean $ScVO_2$ = 66%
28-day mortality 33.3%	**28-day mortality 49.2%**

Rivers E et al., New England Journal of Medicine 2001;345:1368-77

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 MAY 1, 2014 VOL. 370 NO. 18

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

The ProCESS Investigators*

	EGDT N=439	Standard of care N=456	P
Transfusion CGR	14.4%	8.5%	P<0.01
Mortalité J60	21%	18.9%	NS

ORIGINAL ARTICLE

Trial of Early, Goal-Directed Resuscitation for Septic Shock

Paul R. Mouncey, M.Sc., Tiffany M. Osborn, M.D., G. Sarah Power, M.Sc., David A. Harrison, Ph.D., M. Zia Sadique, Ph.D., Richard D. Grieve, Ph.D., Rahi Jahan, B.A., Sheila E. Harvey, Ph.D., Derek Bell, M.D., Julian F. Bion, M.D., Timothy J. Coats, M.D., Mervyn Singer, M.D., J. Duncan Young, D.M., and Kathryn M. Rowan, Ph.D., for the ProMISe Trial Investigat

(NEJM 2015;372:1301-11)

	EGDT N=625	Standard of care N=626	
Transfusion CGR	8.8%	3.8%	P<0.05
Mortalité J90	29.5	29.2	NS

ORIGINAL ARTICLE

Goal-Directed Resuscitation for Patients with Early Septic Shock

The ARISE Investigators and the ANZICS Clinical Trials Group*

(NEJM 2014;371:1496-506)

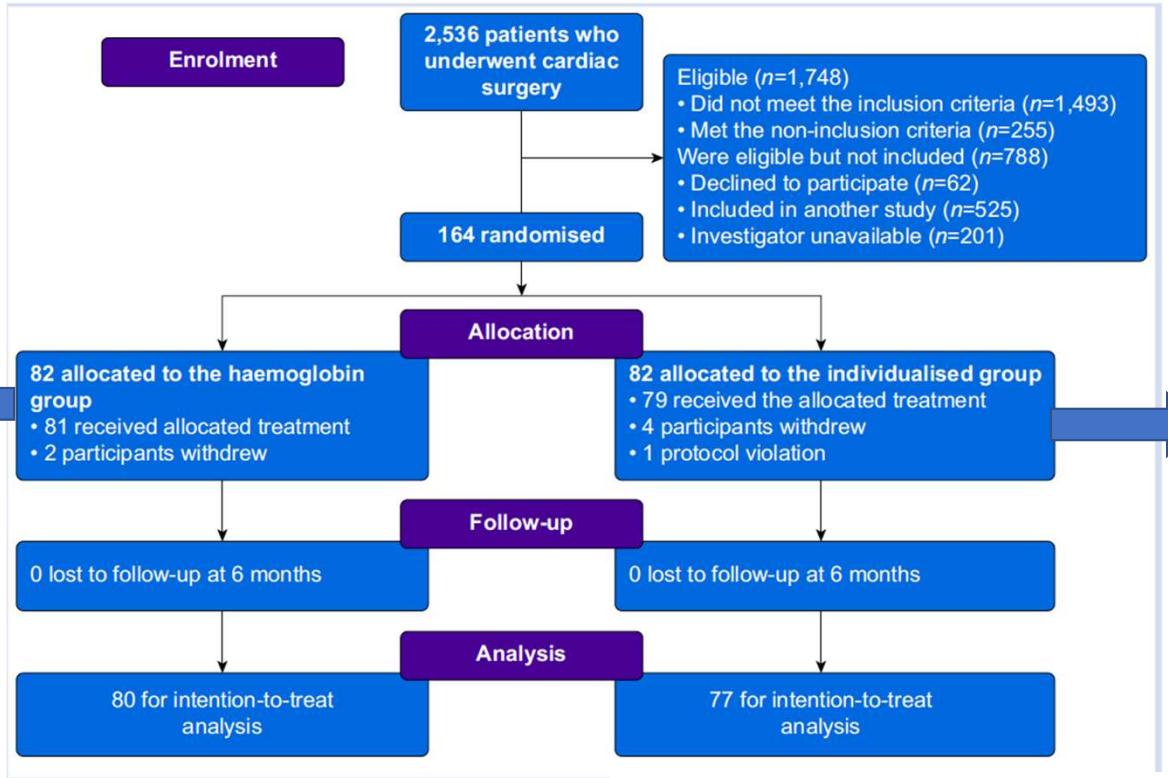
	EGDT N=793	Standard of care N=798	P
Transfusion CGR	13.6%	7%	<0.0001
Mortalité J90	18.6%	18.8%	NS

Individualised or liberal red blood cell transfusion after cardiac surgery: a randomised controlled trial

Marc-Olivier Fischer[1,*], Pierre-Grégoire Guinot[2], Stéphane Debroczi[1], Pierre Huette[3], Christophe Beyls[3], Gérard Babatasi[4], Kevin Bafi[1], Mathieu Guilbart[3], Thierry Caus[5], Emmanuel Lorne[6], Hervé Dupont[3], Jean-Luc Hanouz[1], Momar Diouf[7] and Osama Abou-Arab[3]

- Adultes après chirurgie cardiaque, Hb < 9g/dl, pas de saignement

CGR si Hb<9g/dl



CGR si $ScvO_2$< 70%

Fisher MO et al., British Journal of Anaesthesia 2022; 128 (1): 37e44

Individualised or liberal red blood cell transfusion after cardiac surgery: a randomised controlled trial

Marc-Olivier Fischer[1,*], Pierre-Grégoire Guinot[2], Stéphane Debroczi[1], Pierre Huette[3], Christophe Beyls[3], Gérard Babatasi[4], Kevin Bafi[1], Mathieu Guilbart[3], Thierry Caus[5], Emmanuel Lorne[6], Hervé Dupont[3], Jean-Luc Hanouz[1], Momar Diouf[7] and Osama Abou-Arab[3]

Characteristics	Haemoglobin group (*n*=80)	Individualised group (*n*=77)	P-value
At inclusion time			
Haemodynamic data			
HR (beats min^{-1})	86 [17]	85 [15]	0.625
SAP (mm Hg)	120 [14]	121 [14]	0.715
DAP (mm Hg)	58 [9]	58 [10]	0.813
Cardiac output (L min^{-1})	4.8 [1.6]	5.2 [1.8]	0.276
Catecholamine use, *n* (%)			
Dobutamine	3 (4)	4 (5)	0.661
Norepinephrine	24 (30)	15 (20)	0.127
SOFA	2 [1–4]	2 [1–4]	0.856
$ScvO_2$ (%)	63 [11]	62 [11]	0.895
$ScvO_2$ <70%, *n* (%)	64 (80)	59 (77)	0.635
Arterial lactate (mM)	1.3 [0.8]	1.2 [0.7]	0.521
Creatinine (μmol L^{-1})	80 [39]	104 [72]	0.011
Cardiac troponin (ng ml^{-1})	1.20 [0.63–3.15]	1.72 [0.80–3.15]	0.250
Pa_{o2} (mm Hg)	103 [36]	101 [33]	0.677
Haemoglobin (g dl^{-1})	8.2 [0.4]	8.2 [0.5]	
Haemoglobin between 8 and 9 g dl^{-1} and $ScvO_2$ <70%	51 of 61 (84)	45 of 57 (79)	
Platelet count (10^3 mm^{-3})	155 [63]	158 [58]	
aPTT (%)	70 [13]	73 [15]	
Day of RBC transfusion from surgery	2 [1–3]	2 [2–3]	
After RBC transfusion			
$ScvO_2$ after RBC transfusion (%)	60 [11]	63 [9]	
Haemoglobin after inclusion			
Day 1	9.0 [1.3]	9.0 [0.7]	
Day 2	9.2 [0.7]	9.0 [0.8]	
Day 7	9.6 [1.0]	9.2 [0.8]	

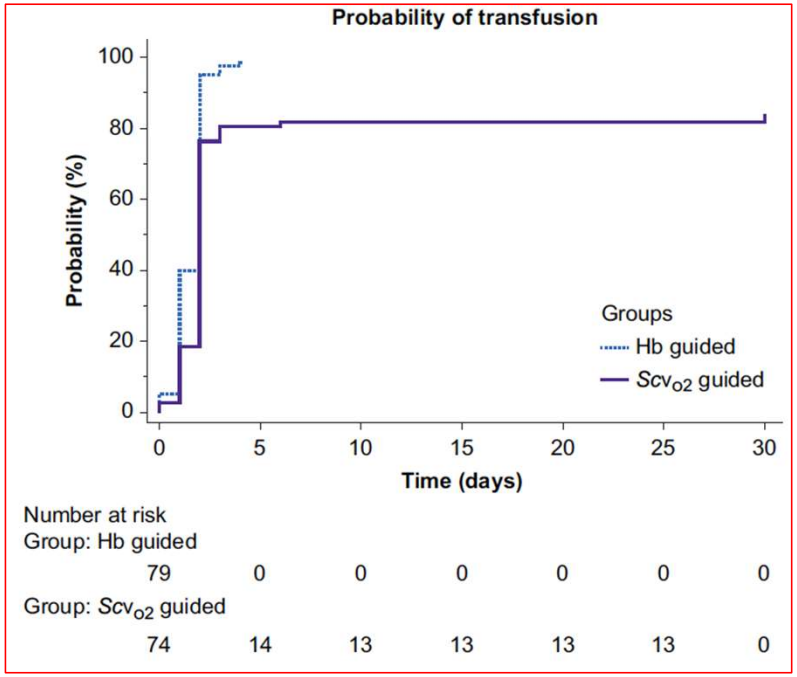


Table 3 Primary and secondary endpoints. AKI, acute kidney injury, NA, non-applicable; RBC, red blood cell.

Variables	Haemoglobin group (*n*=80)	Individualised group (*n*=77)	Absolute risk difference (individualised haemoglobin) (%)	P-value
Primary endpoint				
RBC units, *n* (%)	80 (100)	61 (79)	−21 [−32.0; −14.0]	<0.001
Secondary endpoint, *n* (%)	2 (2.7)	2 (2.8)	0.11 [−5.15 to 5.37]	0.967
AKI	0 (0.0)	2 (3.3)	3.28 [−1.19 to 7.75]	0.141
Stroke	0 (0)	1 (1.4)	1.43 [−1.35 to 4.21]	0.312
Myocardial infarction	1 (1.4)	2 (2.9)	1.45 [−3.32 to 6.22]	0.551
Acute heart failure	1 (1.3)	0 (0)	−1.33 [−3.93 to 1.26]	0.326
Mesenteric ischaemia	2 (2.7)	1 (1.4)	−1.28 [−5.82 to 3.26]	0.584
In-hospital mortality	2 (2.7)	1 (1.4)	−1.28 [−5.82 to 3.26]	0.584
1 month mortality	2 (2.7)	1 (1.4)	−1.28 [−5.82 to 3.26]	0.584
6 month mortality	2 (2.7)	1 (1.4)	−1.28 [−5.82 to 3.26]	0.584
ICU stay (days)	4 [3–6]	5 [3–6]	NA	0.526
Hospital stay (days)	12 [10–17]	11 [10–17]	NA	0.671

Fisher MO et al., British Journal of Anaesthesia 2022; 128 (1): 37e44

ANESTHESIOLOGY

Restrictive Transfusion Strategy after Cardiac Surgery

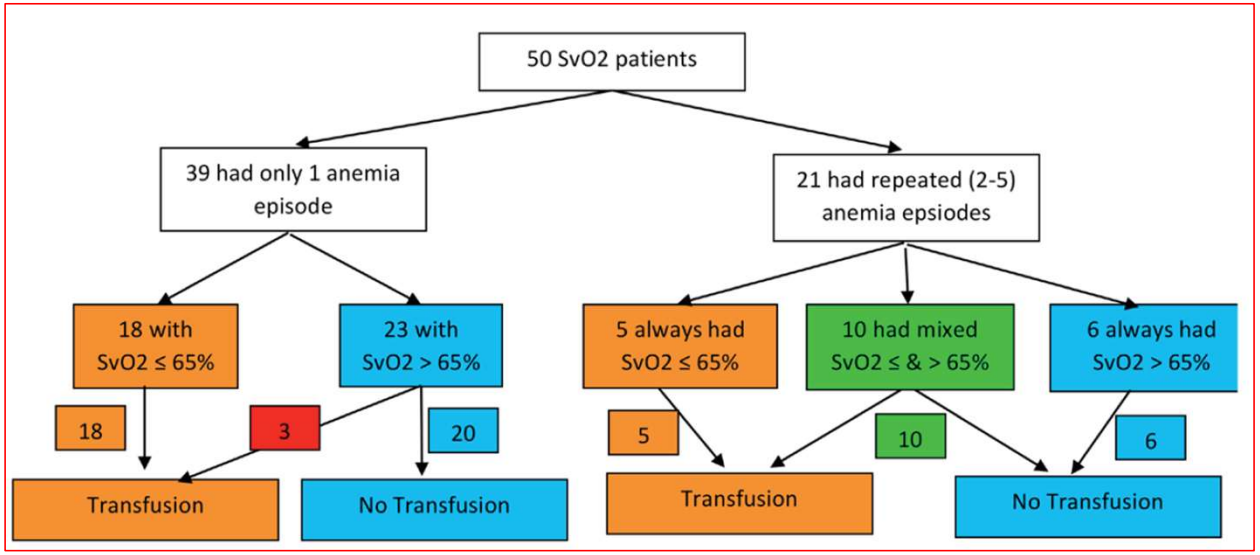
Role of Central Venous Oxygen Saturation Trigger: A Randomized Controlled Trial

Norddine Zeroual, M.D., Cinderella Blin, M.D., Marine Saour, M.D., Hélène David, M.D., Safa Aouinti, Ph.D., Marie-Christine Picot, M.D., Pascal H. Colson, M.D., Ph.D., Philippe Gaudard, M.D., Ph.D.

ANESTHESIOLOGY 2021; 134:370–80

	Central Svo_2 (n = 50)	Control (n = 50)	*P* Value
Hemoglobin course (g/dl)*			
Preoperative	12.2 ± 2.0	12.6 ± 1.8	0.407
ICU admission	10.1 ± 1.3	10.2 ± 1.4	0.708
Before transfusion in ICU	8.0 ± 0.7	8.0 ± 0.7	0.865
After transfusion in ICU	8.9 ± 0.1†	9.0 ± 0.1‡	0.409
ICU discharge	8.6 ± 1.0	8.9 ± 0.8	0.254
Hospital discharge or postoperative day 28	9.8 ± 0.9	10.0 ± 1.0	0.512
Erythrocyte transfusion			
In ICU			
Patients transfused§	34 (68)	50 (100)	< 0.001
Units total	65	94	
Median‖	1 [1–2]	1 [1–2]	0.887
Distribution§			
0	16 (32)	0 (0)	
1	21 (42)	31 (62)	
2	8 (16)	14 (28)	
3	2 (4)	1 (2)	
4	2 (4)	1 (2)	
≥ 5	1 (2)	3 (6)	

- 100 patients post chirurgie-cardiaque
- Transfusion si Hb < 9g/dl versus $ScvO_2$< 65%
  =>réduction de 30% le nombre de patients transfusés



Zeroual N et al., Anesthesiology 2021; 134:370-80

RESEARCH Open Access

Using arterial-venous oxygen difference to guide red blood cell transfusion strategy

Alberto Fogagnolo[1†], Fabio Silvio Taccone[2†], Jean Louis Vincent[2], Giulia Benetto[1], Elaine Cavalcante[2], Elisabetta Marangoni[1], Riccardo Ragazzi[1], Jacques Creteur[2], Carlo Alberto Volta[1] and Savino Spadaro[1*]

- Différence artério-veineuse du contenu en O_2: A-V_{O2diff} = CaO_2- $CcvO_2$ = (SaO2-ScvO2) x Hb x 1.39
- VO_2= Débit Cardiaque x A-V_{O2diff}
- « Oxygen extraction ratio » ERO_2= (CaO_2- $CcvO_2$) / CaO_2

177 patients réanimation, euvolémiques, CVC
7g/dl <Hb < 10 g/dl

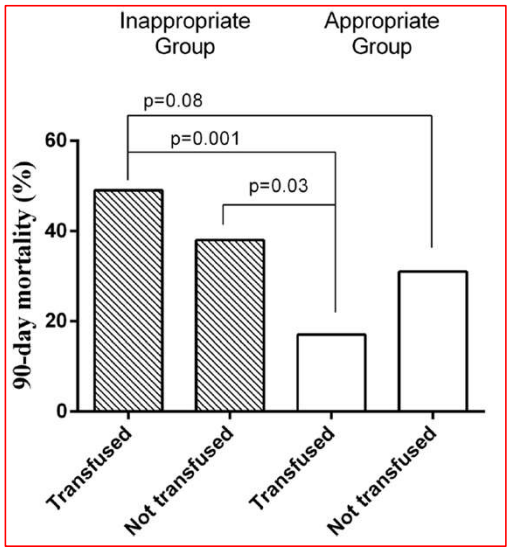
stratégie transfusionnelle appropriée si
- A-V_{O2diff}> médiane et transfusé
- A-V_{O2diff}< médiane et non transfusé

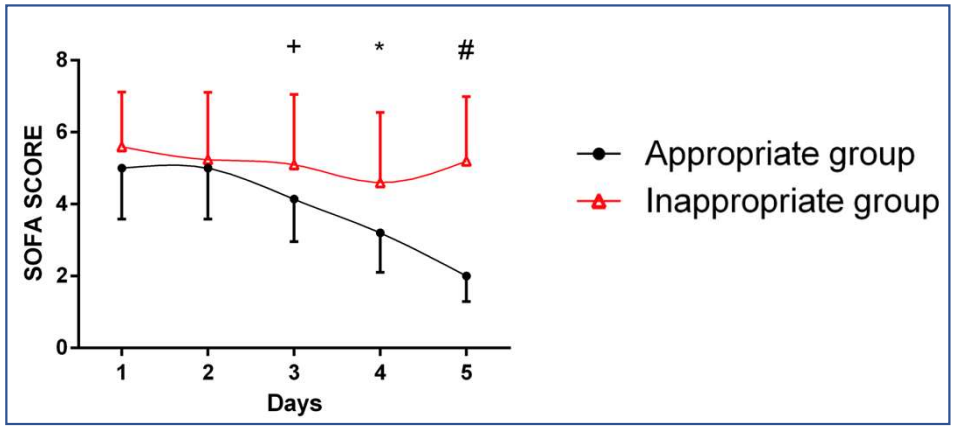
stratégie transfusionnelle inappropriée si
- A-V_{O2diff}> médiane et non-transfusé
- A-V_{O2diff}< médiane et transfusé

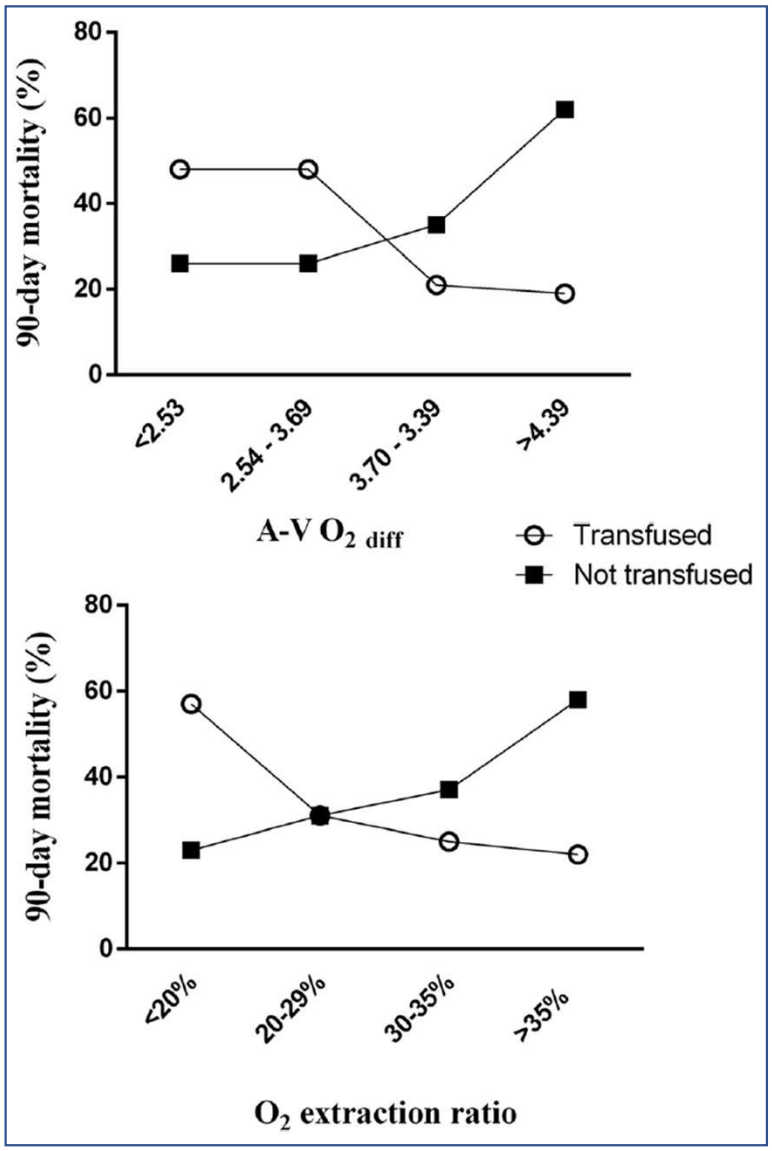
Fogagnolo A et al., Critical Care 2020;24:160

Characteristic	All patients ($n = 177$)	"Appropriate" strategy ($n = 96$)	"Inappropriate" strategy ($n = 81$)	p value
Age, years	72 ± 12	71 ± 14	72 ± 10	0.73
BMI, kg/m^2	28 ± 5	27 ± 4	29 ± 6	0.08
SAPS II score at admission	42 [29–50]	42 [30–48]	45 [33–55]	0.06
SOFA score at admission	5 [2–6]	5 [3–6]	5 [2–6]	0.81
Interventions on admission				
Mechanical ventilation, n (%)	157 (88)	88 (93)	69 (85)	0.18
Vasopressors, n (%)	81 (46)	47 (49)	34 (42)	0.40
Laboratory values on inclusion				
Hemoglobin, g/dL	8.7 ± 0.7	8.8 ± 0.6	8.6 ± 0.8	0.06
MCV, fL	88 ± 9	90 ± 6	87 ± 11	0.07
RDW, %	15.9 ± 3.0	15.4 ± 2.5	16.4 ± 3.3	0.02
Platelets, 10^3/μL	179 [129–266]	178 [132–282]	189 [126–244]	0.72
INR	1.27 ± 0.3	1.26 ± 0.3	1.32 ± 0.3	0.12
Creatinine, mg/dL	1.09 [0.89–2.01]	1.08 [0.77–1.96]	1.10 [0.98–2.40]	0.15
Bilirubin, mg/dL	0.72 [0.41–1.10]	0.85 [0.45–1.00]	0.63 [0.41–1.00]	0.26
Lactate, mmol/L	1.6 [1.1–2.0]	1.4 [1.0–2.0]	2.0 [1.2–2.0]	0.04
CaO_2, mL	12.4 ± 1.6	12.5 ± 1.1	12.2 ± 2.1	0.26
$ScvO_2$, %	71 ± 9	71 ± 10	73 ± 9	0.16

Fogagnolo A et al., Critical Care 2020;24:160



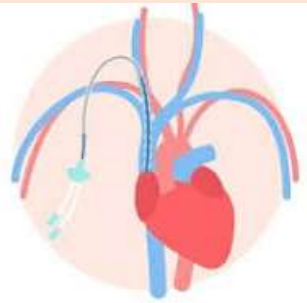




Fogagnolo A et al., Critical Care 2020;24:160

Limites des déterminants physiologiques
$ScvO_2$ / Diff A-V O_2

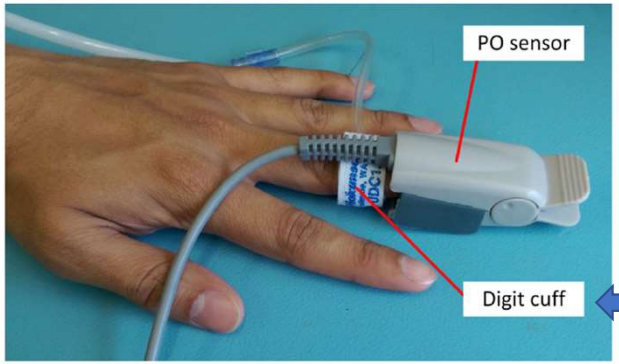
- Évaluation apports-besoins en oxygène du système cave supérieur
- Dépendent d'autres paramètres (débit cardiaque, SaO_2)
- Ne tiennent pas compte de la possibilité de l'inadéquation DO_2-VO_2 au niveau régional
- Tolérance de l'anémie varie selon les organes
- Effets délétères de l'anémie pour des taux d'Hb plus élevés que les seuils transfusionnels
- Nécessité d'un cathéter veineux central



Proof of concept non-invasive estimation of peripheral venous oxygen saturation

Musabbir Khan[1*], Chris G. Pretty[1], Alexander C. Amies[1], Joel Balmer[1], Houda E. Banna[2], Geoffrey M. Shaw[2] and J. Geoffrey Chase[1]

- Détermination de la saturation de l'Hb en oxygène par photo pléthysmographie / oxymètres pulsée => SpO2 par distinction oxy- et désoxy-hémoglobine
- Génération artificielle de pulsatilité veineuse associée à oxymètre modifié → $SpvO_2$



Ondes
basse fréquence 0.2 Hz
basse pression 40-50 mmgH

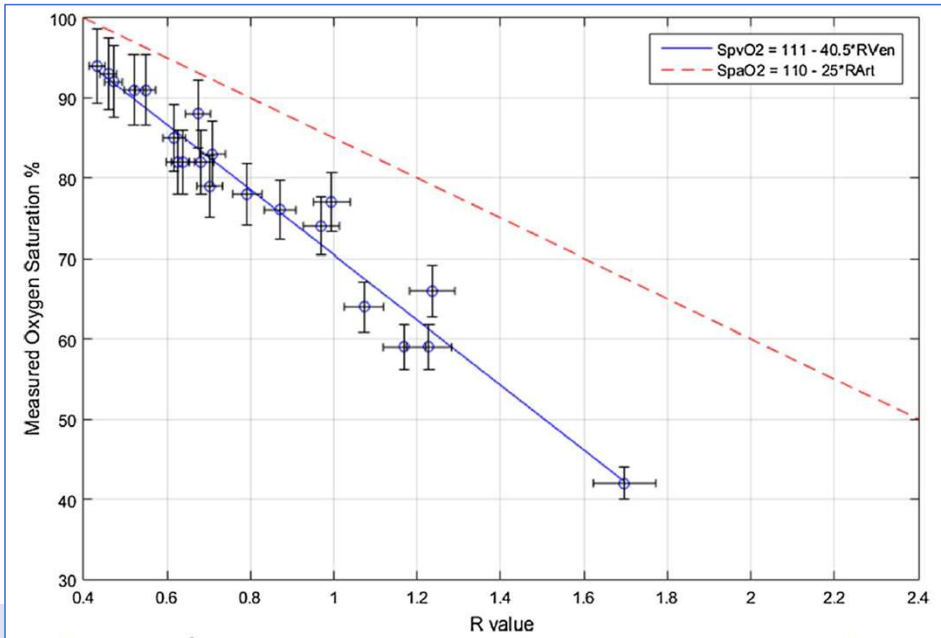
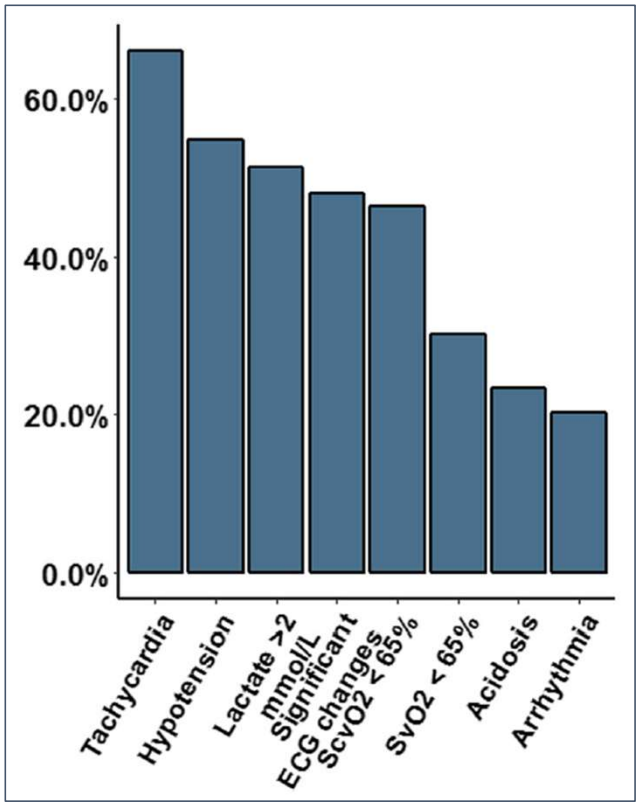


Fig. 7 Correlation ($r^2 = 0.95$) between all estimated R_{Ven} and measured SvO_2 samples across the whole cohort from the 3 tests. The *solid blue line* is the proposed $SpvO_2$ calibration model and the *dashed red line* is the empirical $SpaO_2$ calibration model related to R_{Art} [25]

Khan M et al., BioMed Eng OnLine 2017 ; 16:60

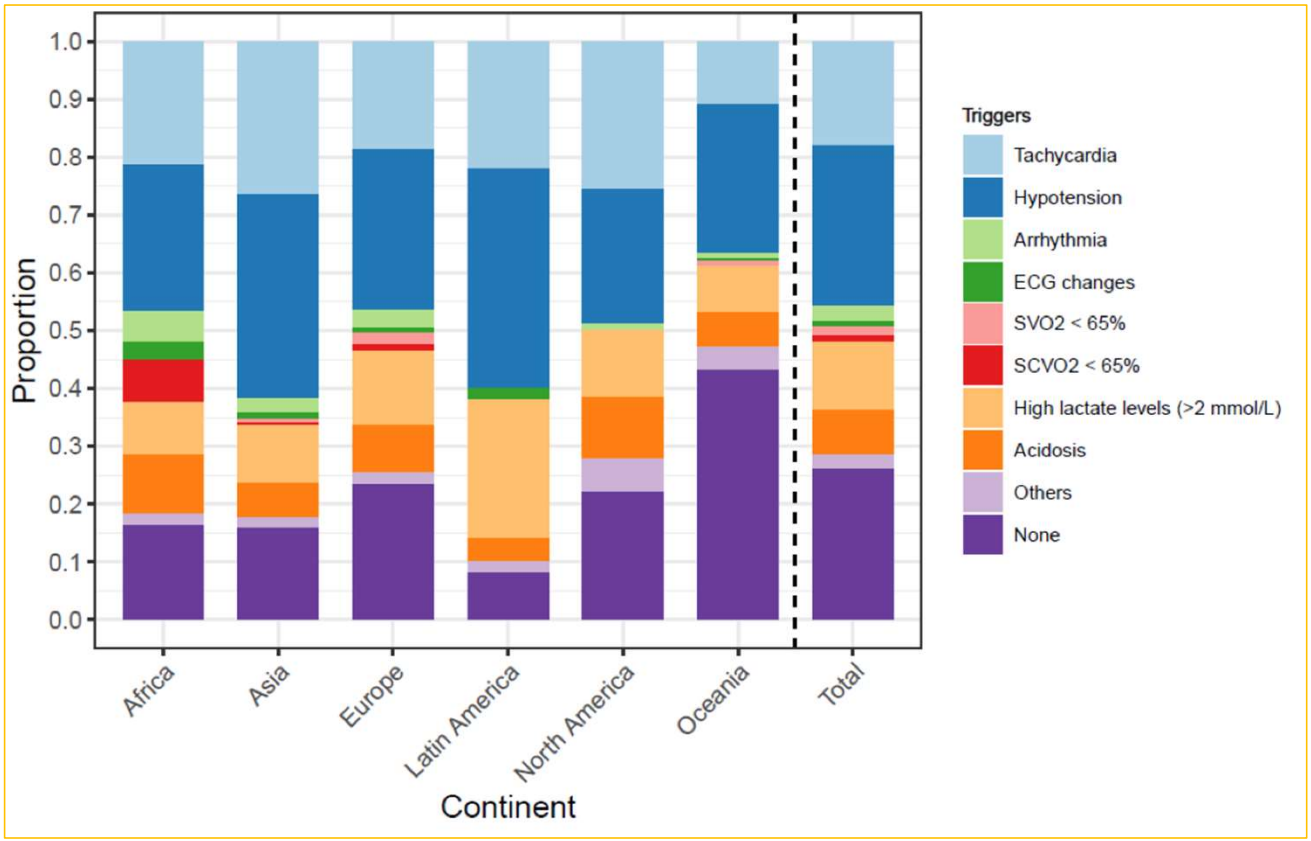
En pratique, déterminants transfusionnels physiologiques

Pratiques déclaratives



De Bruin S et al. Critical Care 2019 ; 23:309

Pratiques effectives



Raasveld JS et al, JAMA 2023, 330(19):1852-1861

Conclusions

- Le taux d'hémoglobine est un déterminant transfusionnel imparfait

- L'utilisation de paramètres physiologiques reflétant les réserves systémiques en O_2 pourrait permettre une prise en charge plus individualisée
  - **$ScvO_2$<65%-70%** peut refléter une dette en O_2 corrigeable par la transfusion de CGR
  - **Diff A-VO_2** augmentée peut refléter des besoins accrus en O_2 et dans le contexte d'anémie un bénéfice de la transfusion

- Problème des facteurs confondants
- Interprétation complexe

=> La décision de transfuser pourrait être l'intégration de plusieurs déterminants selon la population