XIVe CONGRÈS NATIONAL
DE LA SOCIÉTÉ FRANÇAISE
DE VIGILANCE ET DE THÉRAPEUTIQUE TRANSFUSIONNELLE

Du 23 au 25 novembre 2022
Le Corum - Palais des Congrès

PBM EN REA

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DPC

CFAR COLLÈGE FRANÇAIS DES ANESTHÉSISTES RÉANIMATEURS

UNIVERSITÉ DE STRASBOURG

Conflits d'Intérêt

- PM Mertes:
  - Membre du Groupe Hemovigilance Donneur ANSM
  - Président de l'OA-CFAR
  - Membre du CS ART
  - Campus -EFS

Emergence d’un Questionnement

The New England Journal of Medicine

VOLUME 340 FEBRUARY 11, 1999 NUMBER 6

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*

Restrictive versus Liberal Strategy

N Engl J Med 1999;340:409-17

- 838 critically ill patients with **euvolemia** and hemoglobin **< 9.0 g/dL** within **72 hours** after admission to the intensive care unit
- **Restrictive strategy** of transfusion: **hb< 7.0 g/dL**, concentrations maintained at 7.0 to 9.0 g d/L
- **Liberal strategy** of transfusion : **hb< 10.0 g /dL**, concentrations maintained at 10.0 to 12.0 g d/L

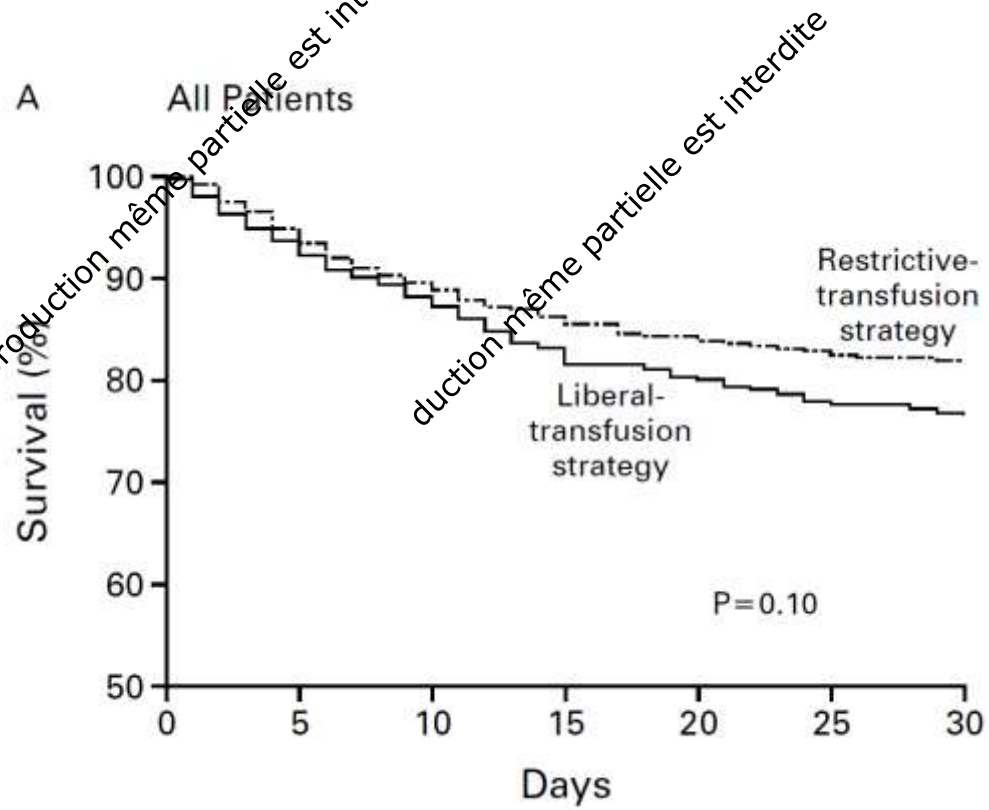


Figure 2. Kaplan–Meier Estimates of Survival in the 30 Days after Admission to the Intensive Care Unit

A **restrictive strategy** of transfusion is at least as effective as and possibly superior to a liberal transfusion strategy in critically ill patients, with the **possible exception of patients with acute myocardial infarction and unstable angina.**

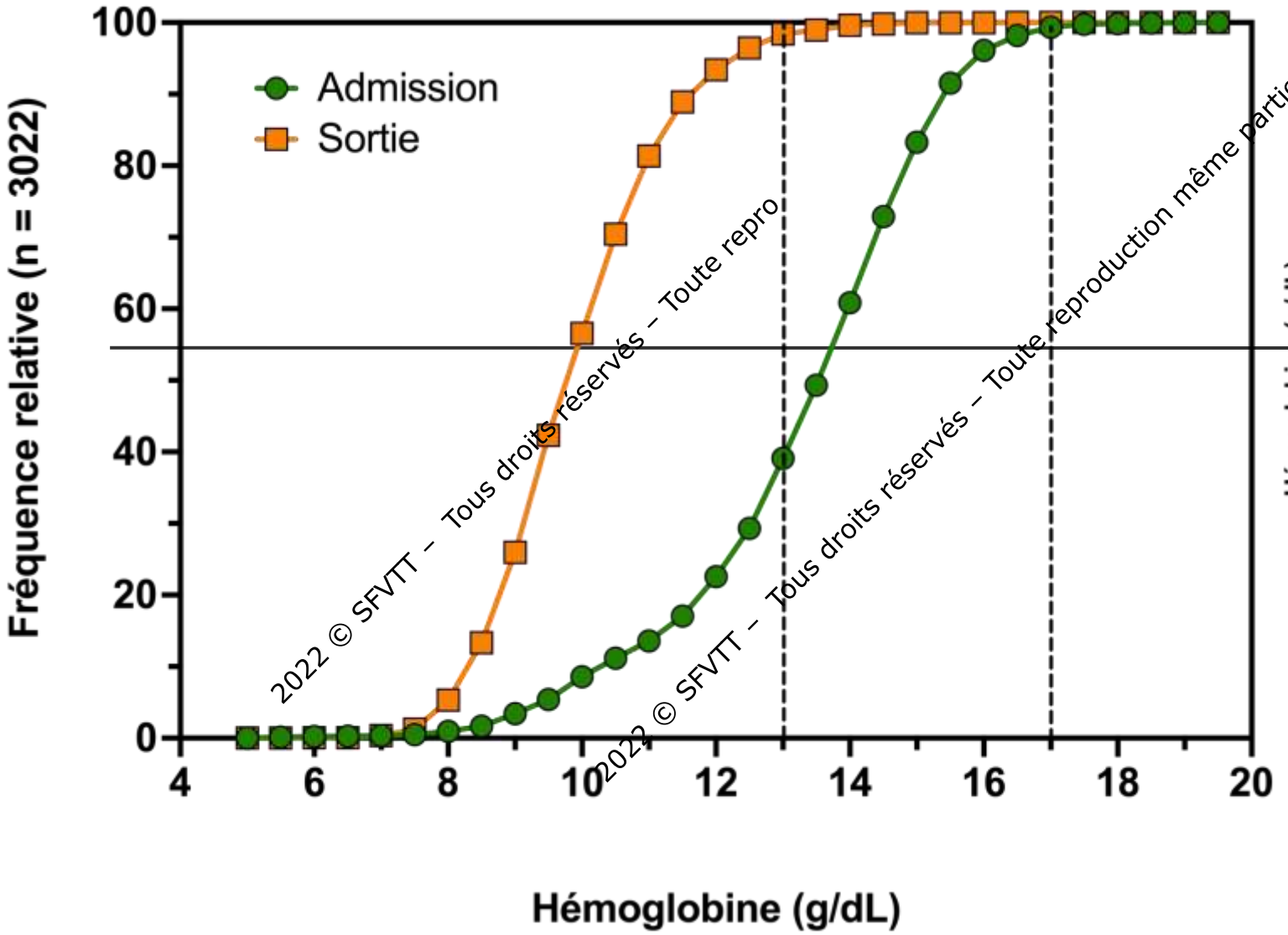
L'Anémie est elle Fréquente en Soins Critiques ?

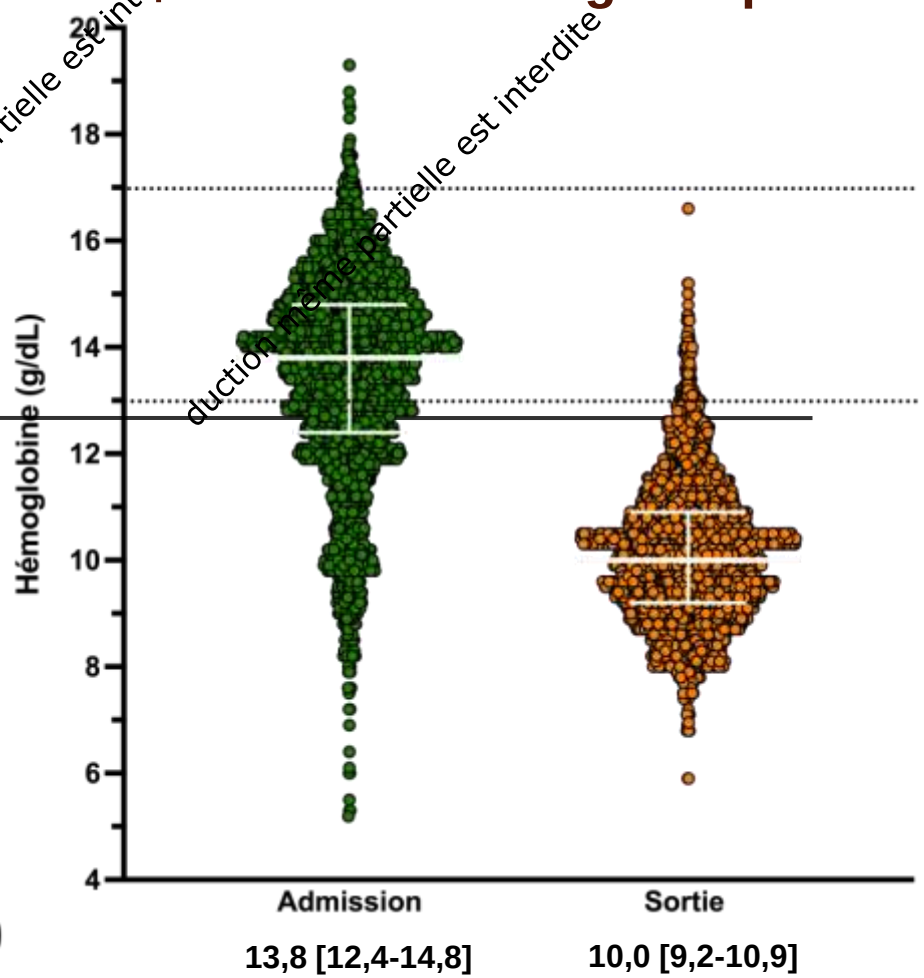
- Anemie : **2/3 des patients Hb <11.0 g/dL** à l'admission *Vincent et al, JAMA. 2002;288:1499–507; Corwin HL et al, Crit Care Med. 2004;32:39–52.*

- **Baisse continue** Hb au cours du séjour *: von Ahsen N et al, Crit Care Med. 1999;27:2630–9; Weiss G et al, . N Engl J Med. 2005;352:1011–23.*
  - pertes sanguines : biologie, chirurgie, procedures invasives
  - Hemodilution
  - inflammation

Chirurgie Cardiaque Hôpitaux Universitaires de Strasbourg

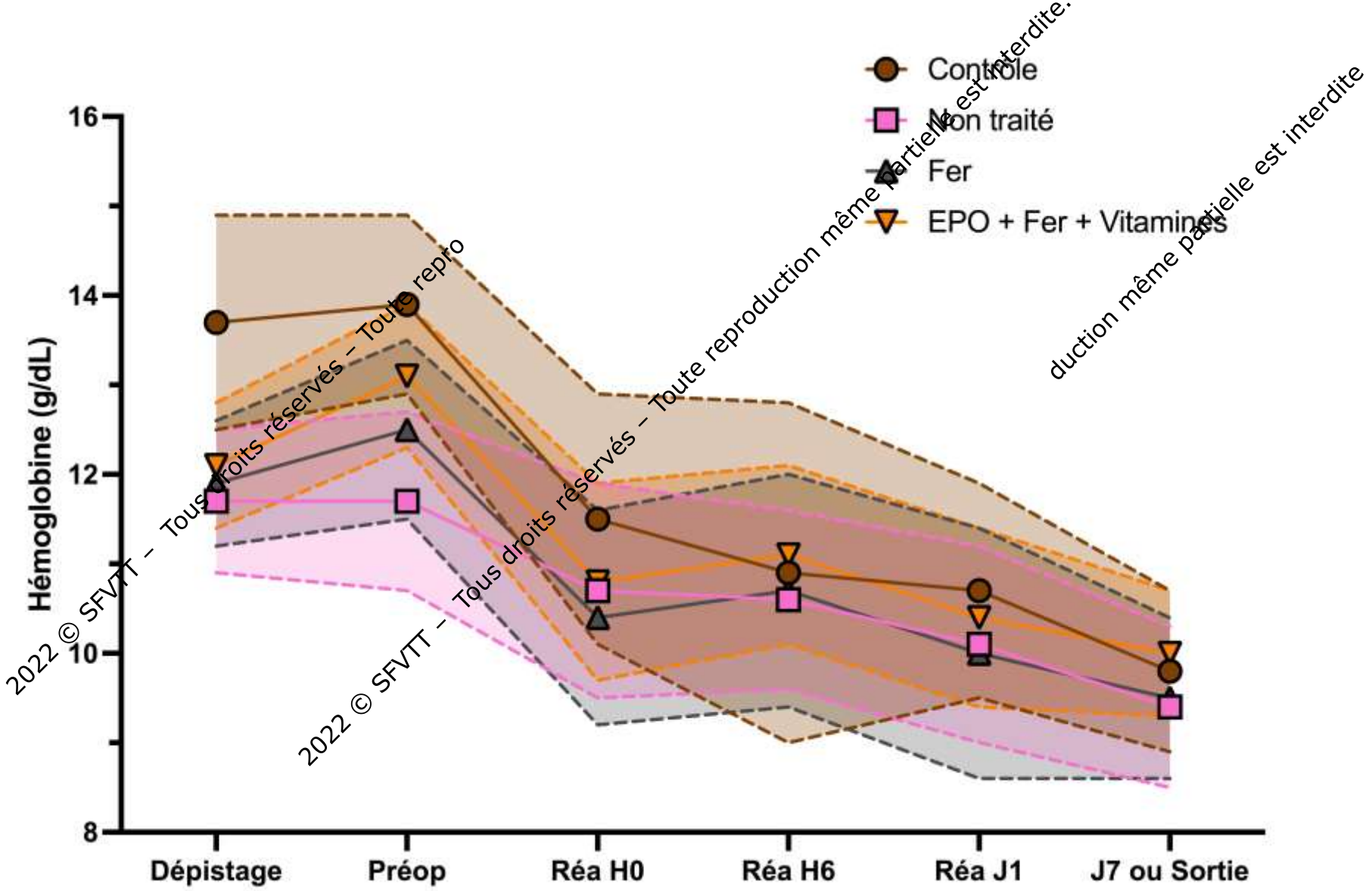
¼ de la masse sanguine perdue !





Données personnelles base ASTRE, Chirurgie cardiaque, HUS

Chirurgie Cardiaque Hôpitaux Universitaires de Strasbourg



Quelle Correction de l'Anémie au Sortir d'un Séjour en Soins Critiques ?

Quelles Conséquences à l'Ere de la RAC?

Time course of anemia during six months follow up following intensive care discharge and factors associated with impaired recovery of erythropoiesis

- **47%** (9 of 19) of patients recovered from their anemia
- Median time to **recovery : 11 wks**
- **53% (10 of 19) still anemic after 6 months**

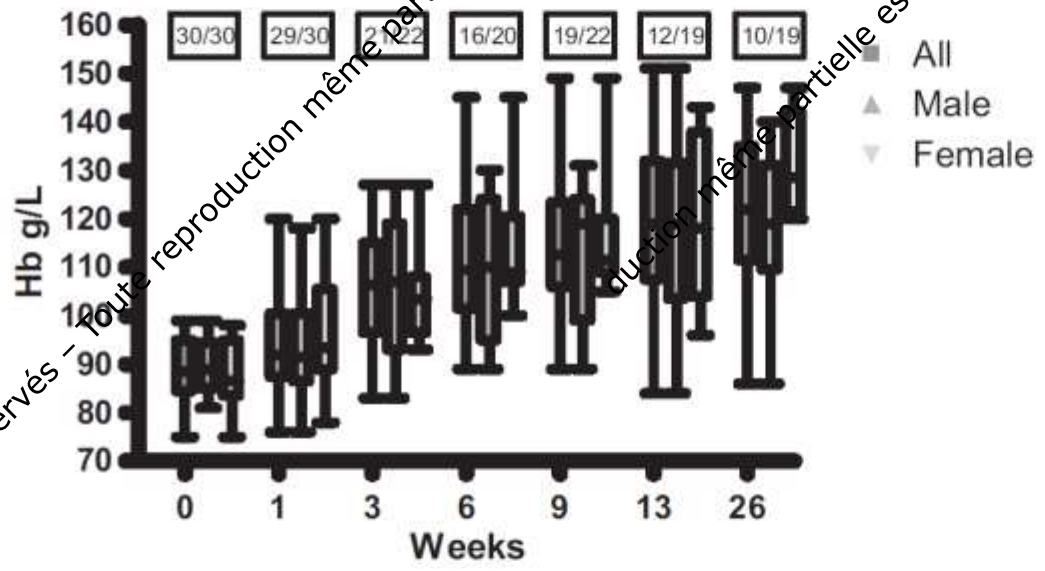


Figure 2. Distribution of hemoglobin concentrations for all patients (*dark gray*) and male and female subset (*mid and light gray, respectively*). Box and whisker plots illustrating median, inter-quartile range and range. The boxes including numbers at each time point represent the number of patients remaining anemic (*numerator*) and the number of samples obtained at each point (*denominator*).

(Crit Care Med 2009; 37:1906 –1912)

Time course of anemia during six months follow up following intensive care discharge and factors associated with impaired recovery of erythropoiesis

- Inappropriately **low erythropoietin** response to anemia observed in **all patients**

- Patients with **delayed recovery**:
  - higher IL-6 and **C-reactive protein**
  - reduced reticulocytosis
  - **Lowest SF36** values at 3 and **6** months

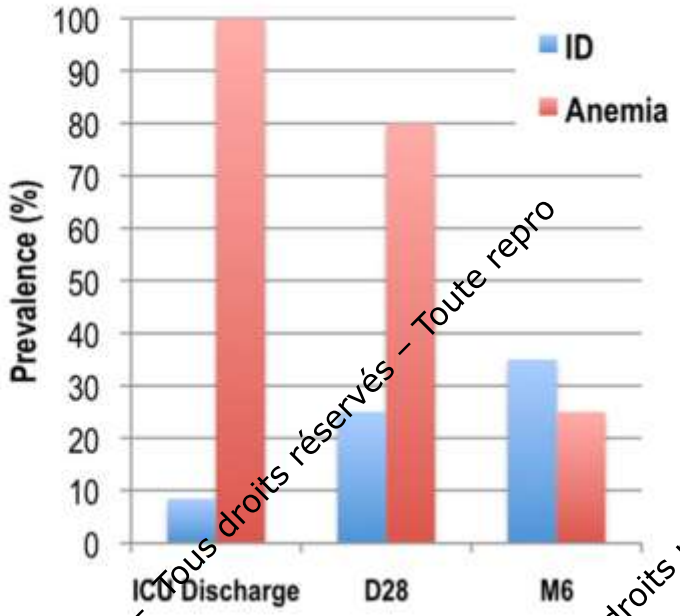
(Crit Care Med 2009; 37:1906 –1912)

Table 3. Week 3 parameters of inflammation, erythropoietin, and marrow response for "responder" (anemia recovered by week 13) vs. "nonresponder" (failure to recover by week 13) groups

Parameter	Responder Group (N = 7)	Nonresponder Group (N = 12)	p
Baseline characteristics			
Age (yrs)	57.2 (54.0–63.0)	69.9 (64.5–75.5)	0.075
ICU stay (days)	11.0 (4.0–12.0)	14.5 (9.0–17.0)	0.150
APACHE II (admission)	23.0 (16.0–28.0)	20.5 (14.5–25.0)	0.554
SOFA max (not neuro)	8.0 (6.0–12.0)	10.5 (7.5–14.5)	0.472
ICU Transfusions (units)	2.0 (0.0–8.0)	7.0 (4.0–16.0)	0.188
Proportion of patients with abnormal GFR (<60 mL/min/1.73 m^2)	2/7 (28.5%)	5/12 (41.6%)	0.654
Parameters			
Hemoglobin (g/L)	115 (110.0–120.5)	105 (100.5–115.0)	0.208
Erythropoietin concentration (mIU/mL)	14 (10.2–19.25)	13.2 (10.7–14.2)	0.690
Number (proportion) with inappropriately low erythropoietin levels	5/7 (71%)	8/11 (72%)	1.000
CRP (mg/dL)	5 (5–11)	60 (27.8–124.5)	0.013[a]
Number (proportion) with elevated CRP	2/7 (28%)	8/8 (100%)	0.007
IL-6 (pg/mL)	11.99 (8.01–14.44)	32.48 (18.03–49.62)	0.197
Number (proportion) with elevated IL-6	1/7 (14%)	6/9 (66%)	0.060
Reticulocytes ($\times 10^9$)	62.1 (53.2–98.0)	43.6 (33.8–54.8)	0.014[a]
Number (proportion) with reticulocytes $<55 \times 10^9$	2/7 (29%)	9/11 (81%)	0.049[a]
Ferritin 3 months (μg/L)	90.0 (15.0–130.0)	365.5 (45.5–512.5)	0.0312[a]
Vitamin B_{12} 3 months (ng/L)	348 (297–541)	359 (285–589)	0.7577
Folate 3 months (μg/L)	9.4 (6.2–17.1)	5.8 (2.6–8.1)	0.0549

Prevalence of iron deficiency on ICU discharge and its relation with fatigue: a multicenter prospective study

Critical Care 2014, 18:542



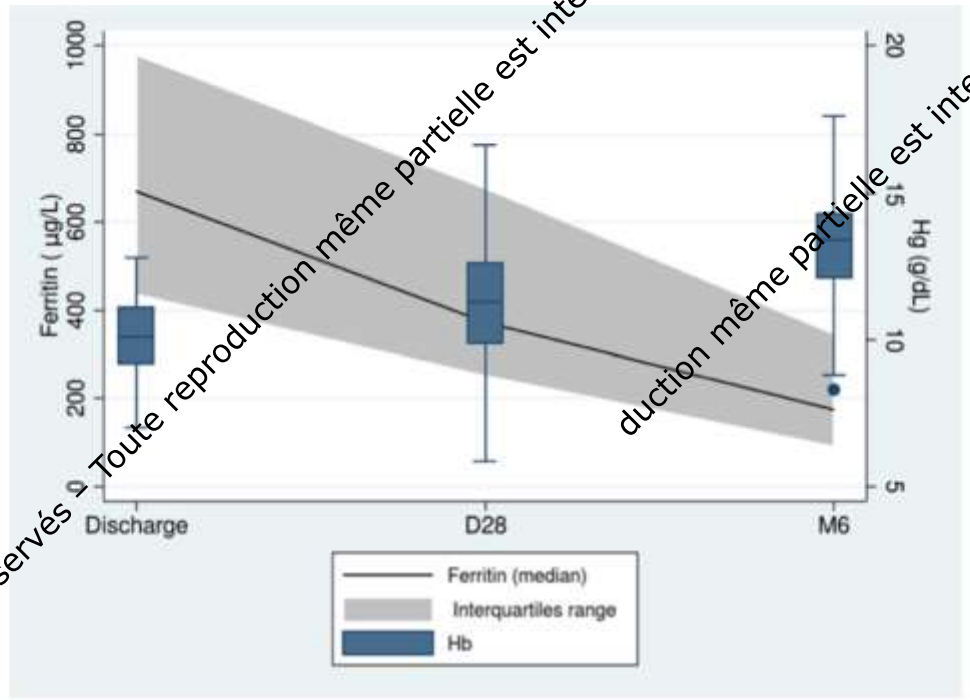


Figure 2 Evolution of anemia and iron stores after ICU discharge. The left panel represents the prevalence of anemia and iron deficiency after ICU discharge, showing an increasing ID prevalence together with a decreasing anemia prevalence. The right panel shows the evolution of ferritin and hemoglobin levels after ICU discharge. Ferritin levels (expressed as median and inter-quartile ranges) decreased from ICU discharge until M6, whereas Hb levels (medians (Q1 to Q3)) increased. D28, 28 days after discharge; ID: iron deficiency; M6, 6 months after discharge.

The prevalence of **ID increases** from 8% at discharge to **35% six months** after prolonged ICU stay.
ID was associated with **increased fatigue**, independently of anemia, at D28.

Que Savons –nous des Pratiques Transfusionnelles en Soins Critiques?

The CRIT Study: Anemia and blood transfusion in the critically ill—Current clinical practice in the United States

Table 3. Admitting Diagnostic Categories

Admitting Diagnostic Category	% of Patients
Respiratory failure	32
Postoperative	20
Pneumonia	15
Cardiovascular	12
Trauma	12
Sepsis/SIRS	11
Hemodynamic instability	10
Neurologic	8
Gastrointestinal bleed	8
ARDS	3
Primary hematologic disease	1
Other	23

Table 5. Transfusion Results

	Mean ± SD
ICU	
Total no. of RBC units transfused	9990
Percentage of patients with transfusions	44.1
No. of units transfused (for patients with transfusions)	4.6 ± 4.9
Pretransfusion hemoglobin, g/dL	8.6 ± 1.7
Days to first transfusion	2.3 ± 3.7
Age of blood, days	21.3 ± 11.4
Post-ICU	
Total no. of RBC units transfused	1401
Percentage of patients with transfusions	13.4
No. of units transfused (for patients with transfusions)	2.7 ± 2.8
Pretransfusion hemoglobin, g/dL	8.5 ± 1.5
Age of blood, days	21.0 ± 11.4
ICU and Post-ICU	
Total no. of RBC units transfused	11391
Percentage of patients with transfusions	48.2
No. of units transfused (for patients with transfusions)	4.8 ± 5.1
Pretransfusion hemoglobin, g/dL	8.6 ± 1.7
Days to first transfusion	2.8 ± 4.3
Age of blood, days	21.2 ± 11.4

Crit Care Med 2004 Vol. 32, No. 1

The CRIT Study: Anemia and blood transfusion in the critically ill—Current clinical practice in the United States

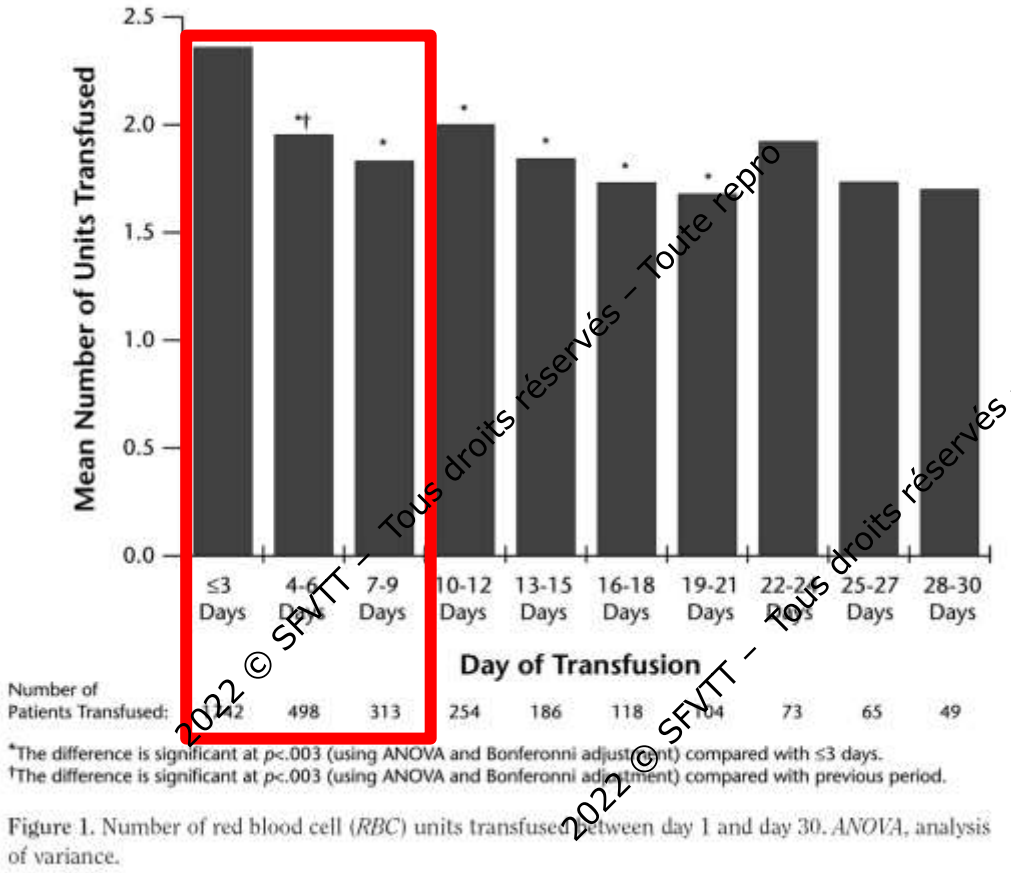


Figure 1. Number of red blood cell (*RBC*) units transfused between day 1 and day 30. *ANOVA*, analysis of variance.

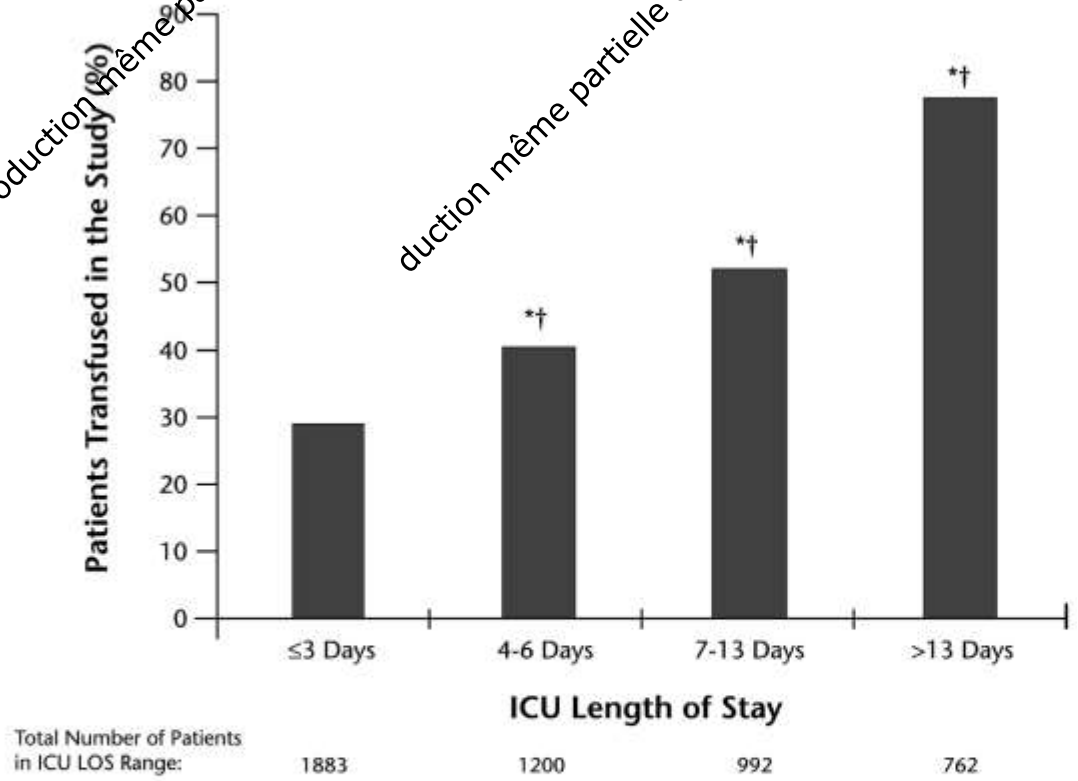


Figure 2. Percentage of patients receiving transfusions by intensive care unit (*ICU*) length of stay (*LOS*).

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The CRIT Study: Anemia and blood transfusion in the critically ill—Current clinical practice in the United States

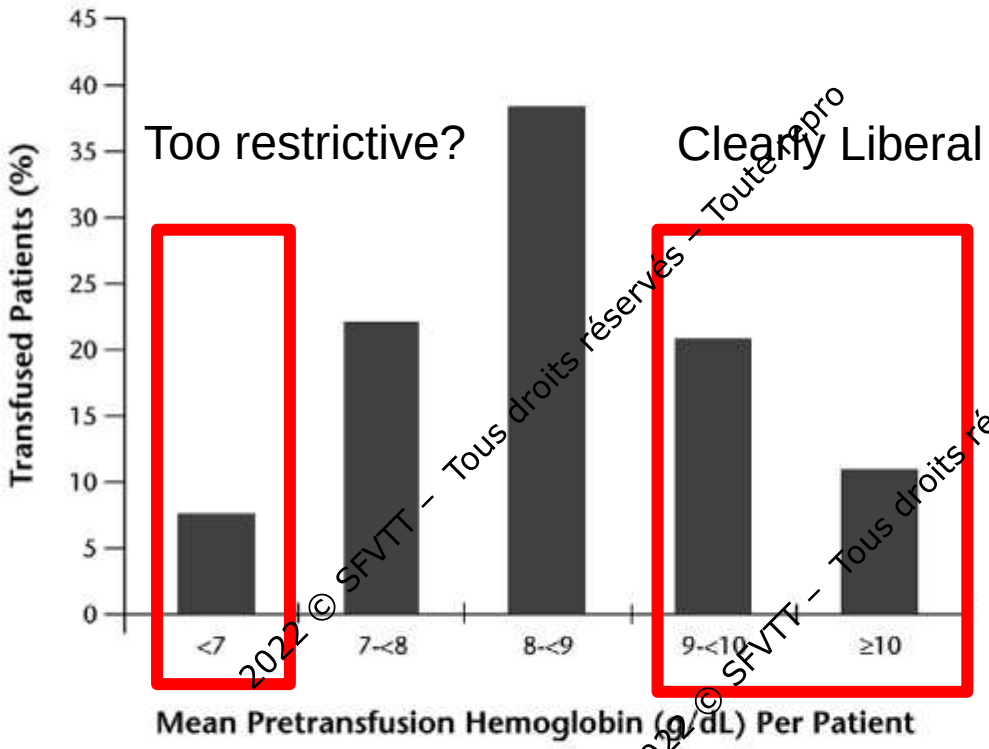
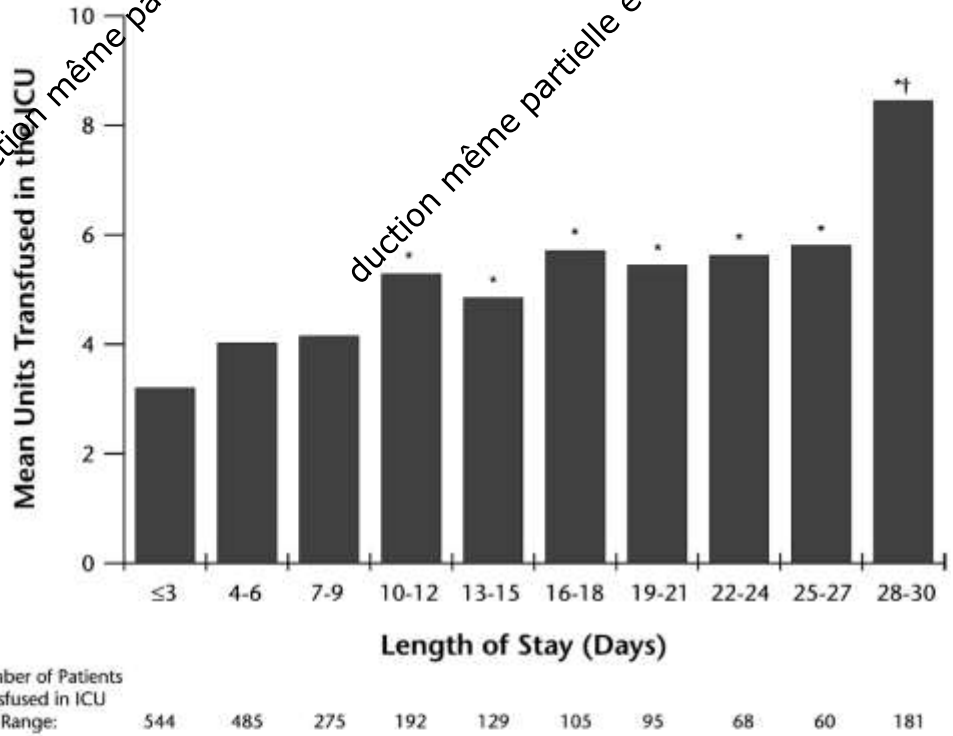


Figure 4. Pretransfusion hemoglobin.

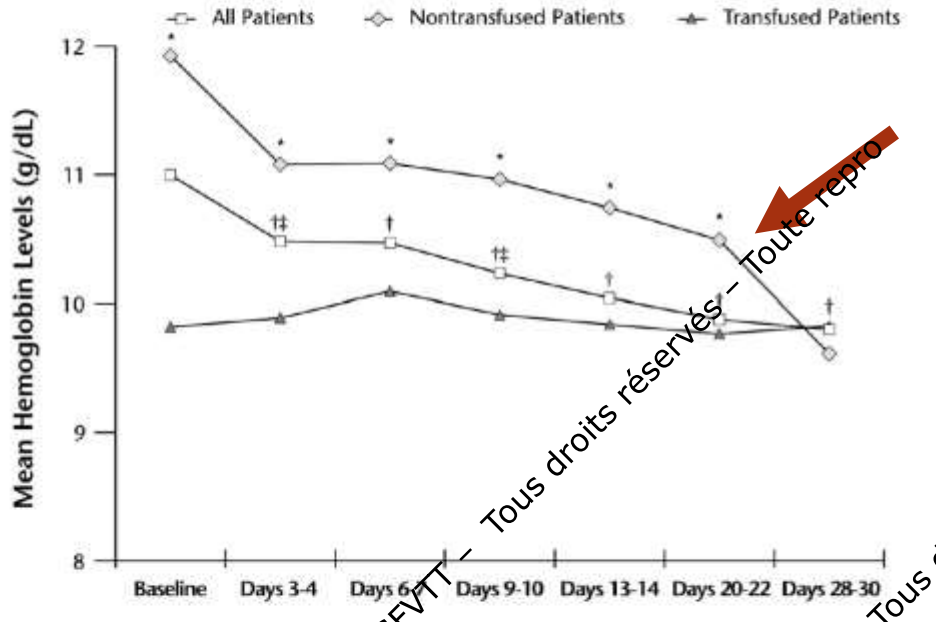


*The difference is significant at $p<.003$ (Bonferonni adjustment) compared with the first ICU stay group.
†The difference is significant at $p<.003$ (Bonferonni adjustment) compared with previous ICU stay group.
23 transfused patients do not have an Intensive Care Unit length of stay.

Figure 3. Mean number of red blood cell (*RBC*) units transfused by length of stay (*LOS*). *ICU*, intensive care unit.

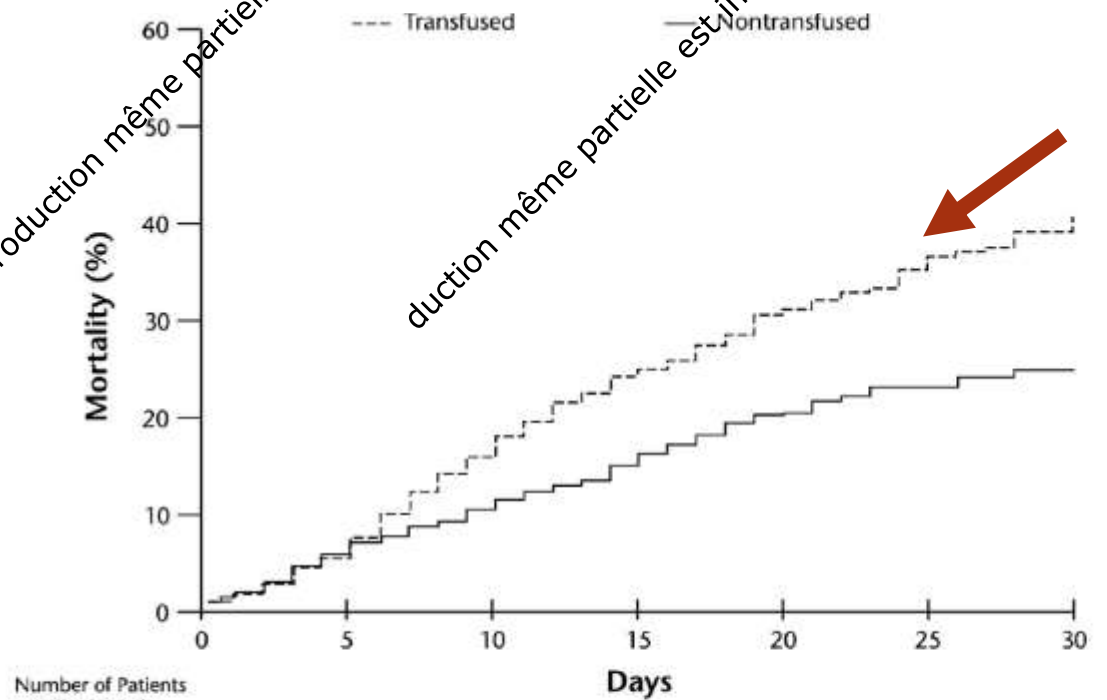
Crit Care Med 2004 Vol. 32, No. 1

The CRIT Study: Anemia and blood transfusion in the critically ill—Current clinical practice in the United States



*The difference across groups (transfused vs. nontransfused) is significant at $p<0.007$ (using Bonferroni adjustment).
†The difference is significant at $p<.0045$ (using ANOVA and Bonferonni adjustment) compared with baseline (all patients sample).
‡The difference is significant at $p<.0045$ (using ANOVA and Bonferonni adjustment) compared with previous period (all patients sample).

Figure 5. Hemoglobin (*Hb*) levels day 1 through day 30. *Trans/No Trans*, ratio of patients who received transfusions to those who did not; *ANOVA*, analysis of variance.



Log-Rank=24.02; $p<.0001$.

Figure 7. Mortality by transfusion status for propensity-matched patients.

Crit Care Med 2004 Vol. 32, No. 1

Worldwide audit of blood transfusion practice in critically ill patients

- 730 ICUs in 84 countries
- **> 1/4 patients transfused**
- Considerable **variations** in transfusion practice among geographic regions.
- Transfusion **trigger** was **higher** in **surgical patients**
- Middle East 7.7 ± 2.3 g/dL
- Africa 9.0 ± 2.4 g/dL
- Western Europe 8.1 ± 1.8

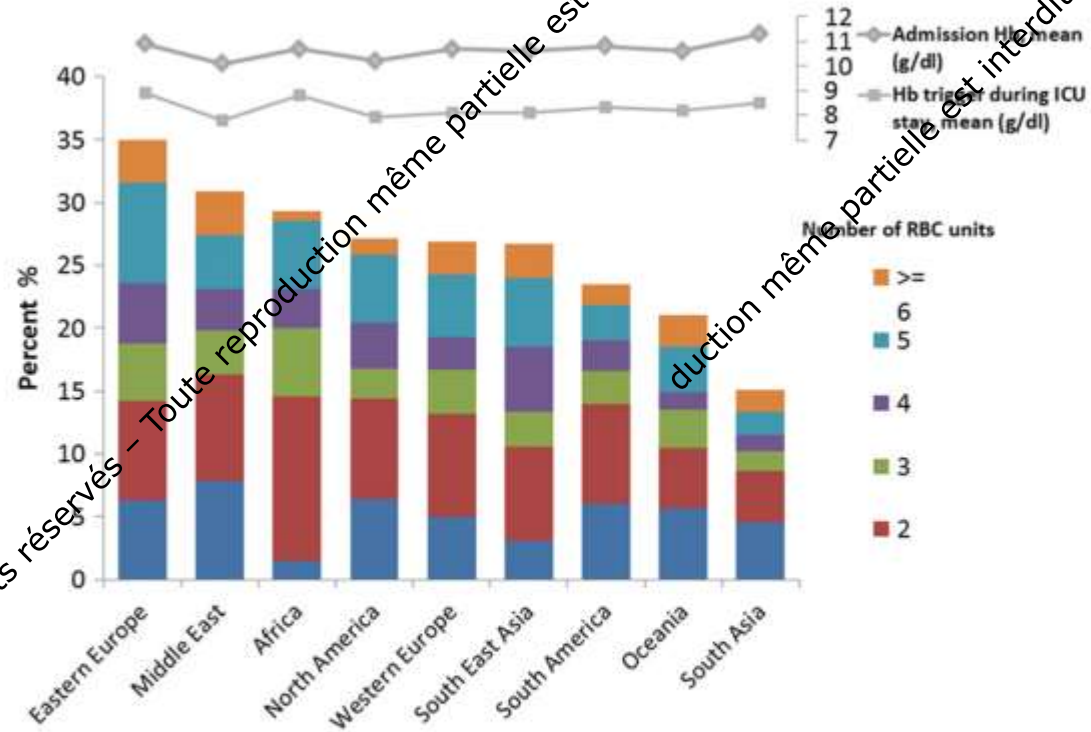


Fig. 2 Proportion of patients who received a red blood cell (RBC) transfusion during the ICU stay in the different geographic regions. Hb, hemoglobin

Vincent et al. Critical Care (2018) 22:102

Worldwide audit of blood transfusion practice in critically ill patients

- After adjustment for confounders, RBC transfusions were associated with a slightly **lower relative risk of in-hospital death**, especially in the most severely ill patients
- Importance of **taking the severity of illness** into account when making transfusion decisions.

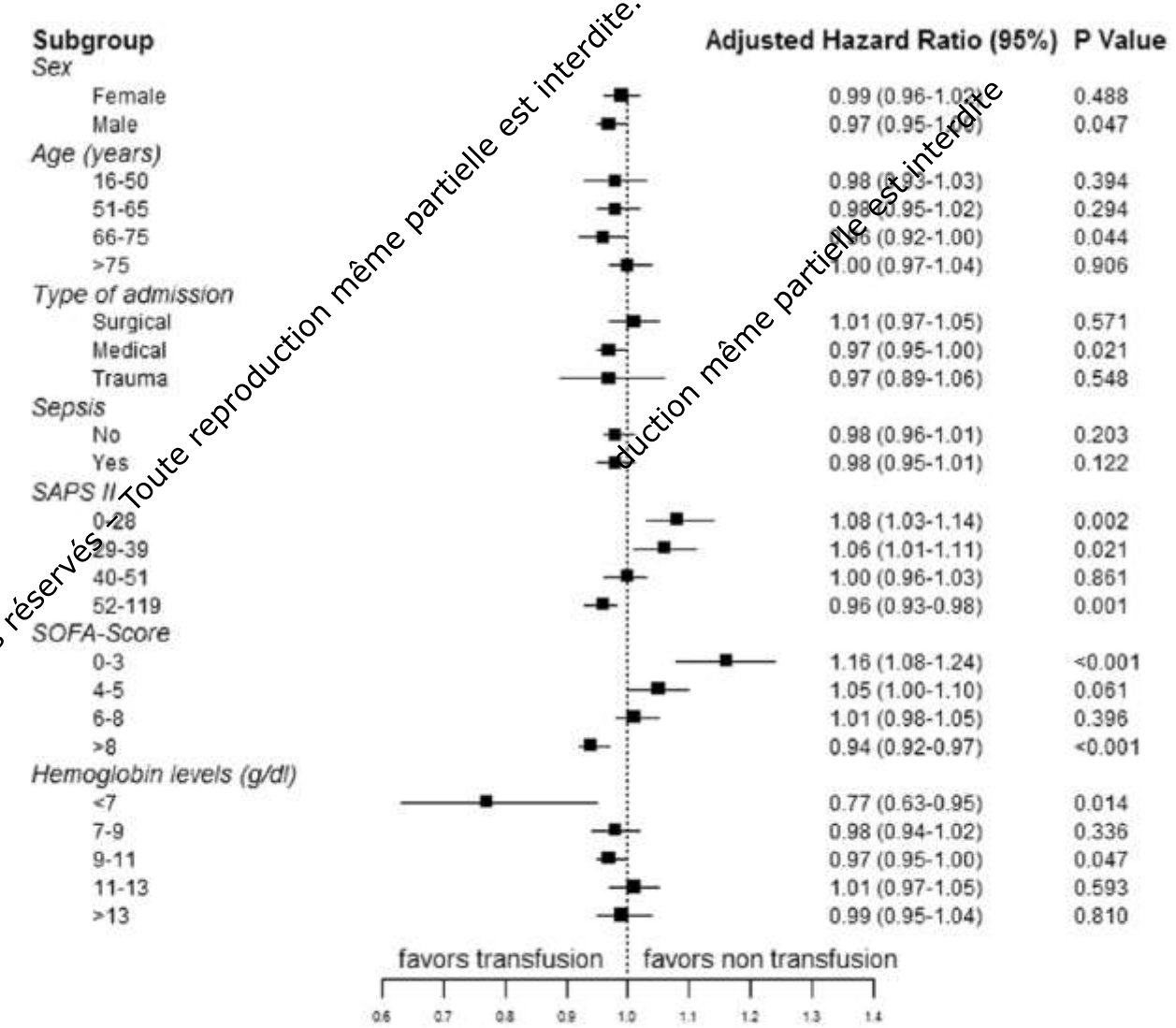
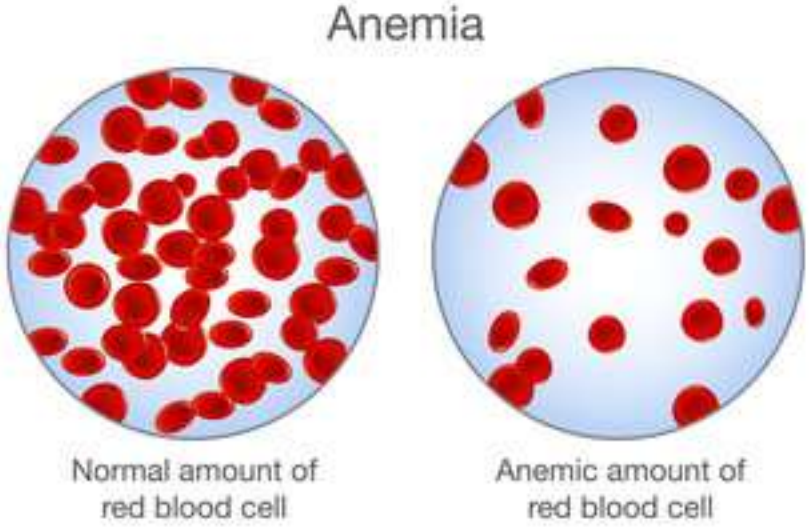


Fig. 3 Forest plot was created from modelling of our observational data showing the risk of in-hospital death after transfusion in the various subgroups of patients. SAPS, Simplified Acute Physiology Score; SOFA, Sequential Organ Failure Assessment (on admission)

Vincent et al. Critical Care (2018) 22:102

Mécanismes de l'Anémie en Soins Critiques



Diagnosis and management of iron-related anemias in critical illness

- **Fe deficiency** anemia and the anemia of **inflammation may co-exist .**
- Diagnosis of and **differentiation between these two anemias** involves careful interpretation of **multiple markers of total body Fe stores.**
- **Treatment** with both Fe and recombinant human erythropoietin **?**

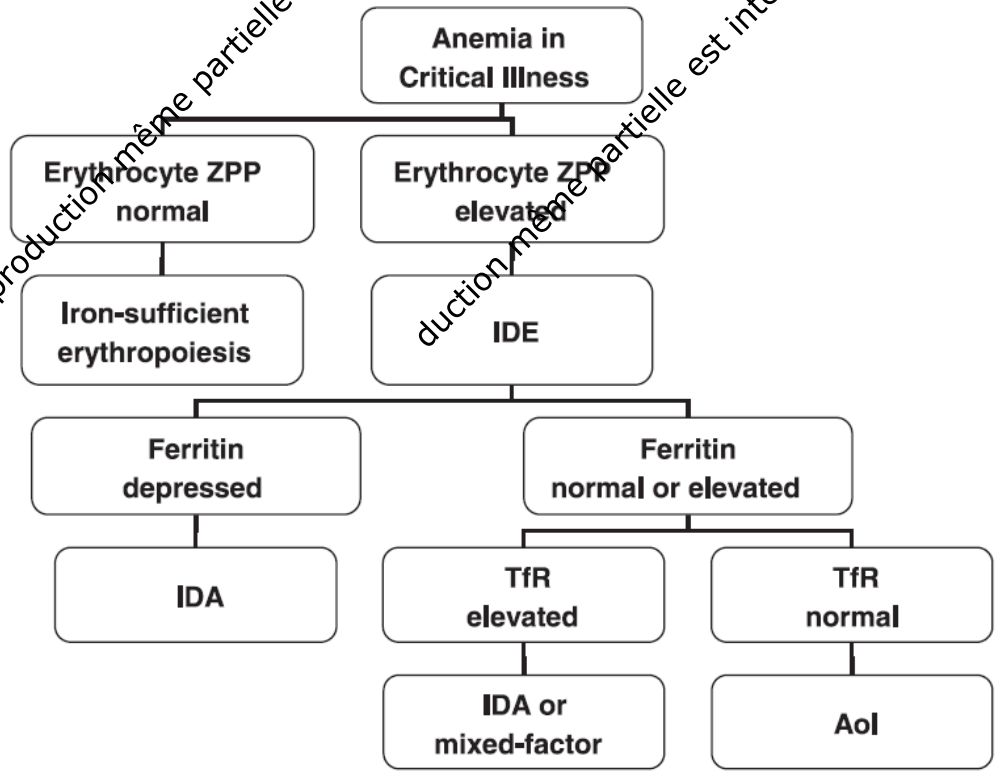
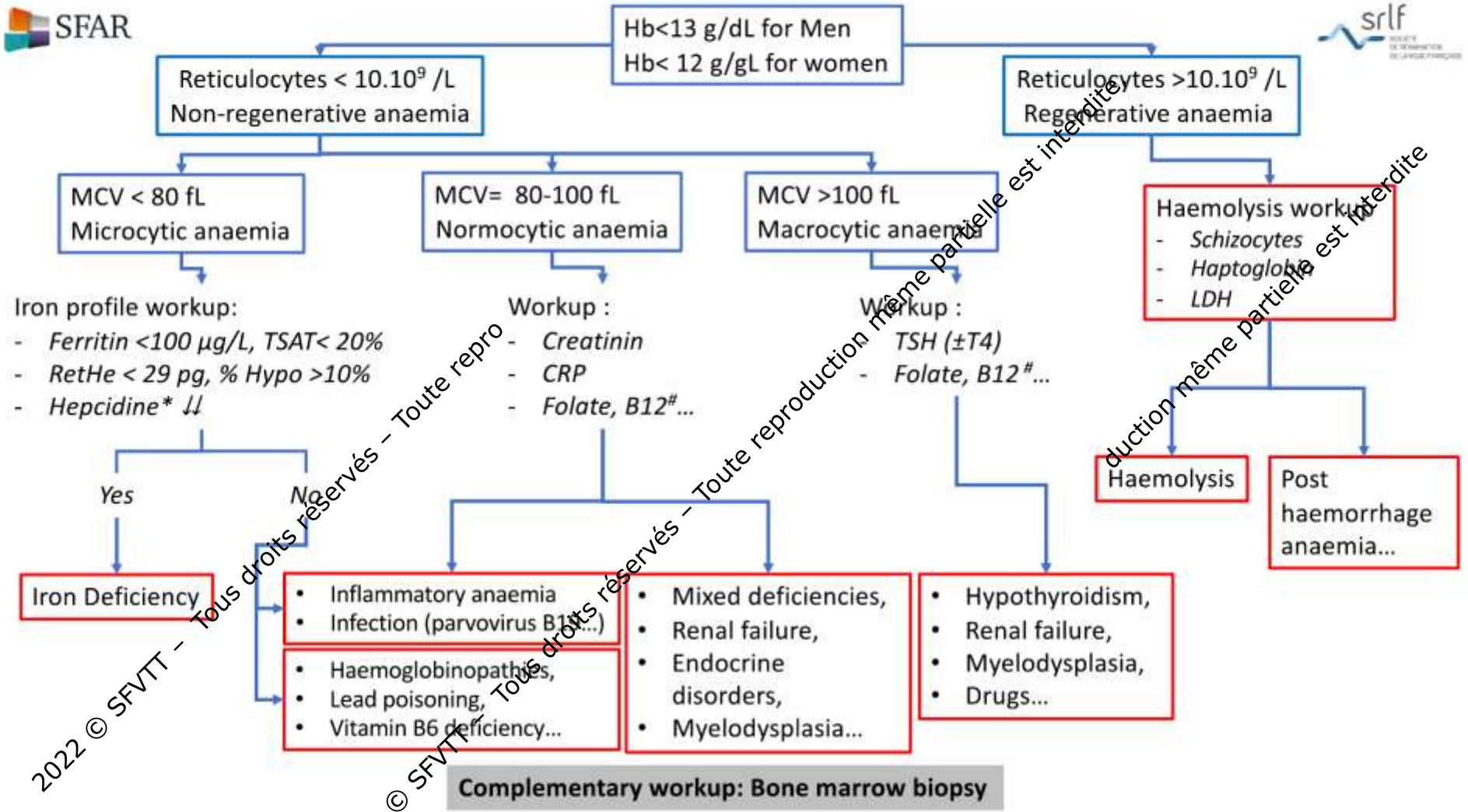


Figure 3. Algorithm for the diagnosis of and differentiation between iron deficiency anemia (*IDA*) and the anemia of inflammation (*AoI*) in critical illness. *ZPP*, zinc protoporphyrin; *IDE*, iron-deficient erythropoieses; *TfR*, transferrin receptor.

Pieracci et al, Crit Care Med 2006; 34:1898–1905



ig. 1 Anemia diagnostic flow-chart. This anemia diagnostic flow-chart is presented as a guide. Asterisk: Hepcidin is not yet available in routine linical practice. Hash: WHO defines folate deficiency as serum folate < 10 nmol/L (4.4 g/L) or red blood cell folate, reflecting long-term status and issue reserves, < 305 nmol/L (< 140 µg/L). Serum vitamin B12 < 150 pmol/L (< 203 ng/L) indicates vitamin B12 deficiency and a higher level does ot exclude vitamin B12 deficiency, in which case blood methylmalonic acid must be assayed (a level > 271 nmol/L is in favour of vitamin B12 leficiency)

Lasocki *et al. Ann. Intensive Care (2020) 10:97*

Que « **Fer** » en Pratique ?

Management and prevention of anemia (acute bleeding excluded) in adult critical care patients (SFAR – SRLF)

- **Field 1. Which non-pharmacological interventions can reduce red blood cell transfusion and/ or morbidity and mortality related to anemia or transfusion in critical care patients?**

R1.1—The experts propose a diagnostic **phlebotomy reduction strategy** (volume and number) to decrease the incidence of anemia and transfusion in critical care patients. EXPERT OPINION, STRONG AGREEMENT

Ann. Intensive Care (2020) 10:97

Devices to Reduce the Volume of Blood Taken for Laboratory Testing in ICU Patients: A Systematic Review

- **paediatric tubes** : 29 to 74% reduction of the blood volume drawn
- devices designed to **conserve blood flushed** from arterial catheters allow a 19 to 80% reduction of the blood volume drawn

Table 3. Effect of Interventions on Blood Sampling Volumes.[a]

Author (year)	Type of Average and Timeframe	Average Volume of Blood, mL		Percent Change in Volume of Blood Collected, %
		Intervention	Comparator	
Blood collection tube interventions				
Dolman (2015)	Mean (SD) per ICU stay	174.0 (182.0)	299.0 (355.0)	41.8
	Mean (SD) per day	22.5 (17.3)	31.7 (15.5)	29.0
Sanchez-Giron (2008)	Median (IQR) per ICU stay	5.1 (2.3-10.8)	19.9 (12.0-35.8)	74.4
Smoker (1989)[b]	Mean per ICU stay	120.2	226.1	46.8[c]
	Mean per day	32.2	55.6	42.1[c]
Arterial Line Interventions				
Gleason (1992)	Mean per day	35.0	69.0	49.3
Harber (2006)	Median (range) per day	8.0 (7.0-10.0)	40.0 (28.0-43.0)	80.0
MacIsaac (2003)	Median (range) per ICU stay	63.0 (0-787.0)	133.0 (7.0-1227.0)	52.6
Peruzzi (1993)[b]	Mean per ICU stay	260.3	320.8	18.9[c]
Low (1995)	Mean (SD) per ICU stay	63.6 (28.4)	114.7 (53.9)	44.5

Abbreviation: ICU, intensive care unit.
[a]Comparisons were statistically significant unless otherwise specified.
[b]Standard deviation not provided.
[c]*P* value not provided

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Management and prevention of anemia (acute bleeding excluded) in adult critical care patients (SFAR – SRLF)

- **Field 2: Which transfusion strategies can reduce red blood cell transfusion and/or morbidity and mortality related to anemia in critical care patients?**
- R2.1—It is recommended to adopt a **restrictive transfusion strategy** (Hb threshold: 7.0 g/dL) in critical care patients in general, including septic patients, in order to reduce the use of red blood cell transfusion without increasing morbidity and mortality. (GRADE 1+), (STRONG AGREEMENT)
- R2.2—It is recommended to adopt a **restrictive transfusion strategy** (Hb threshold between 7.5 and 8.0 g/dL) in **postoperative cardiac surgery** critical care patients in order to reduce the red blood cell transfusion rate without increasing morbidity and mortality. (GRADE 1+), STRONG AGREEMENT

Ann. Intensive Care (2020) 10:97

Réhabilitation Améliorée Après Chirurgie Cardiaque adulte sous CEC ou à cœur battant SFAR-SFTCV 2021

- **Question 3. La stratégie transfusionnelle (restrictive ou libérale) a-t-elle un impact sur la survenue de complications postopératoires ou sur la durée d'hospitalisation ?**
- **ABSENCE DE RECOMMANDATION –** Les données actuelles de la littérature **ne permettent pas de recommander une stratégie transfusionnelle** (restrictive ou libérale) en chirurgie cardiaque pour diminuer la survenue de complications postopératoires et la durée d'hospitalisation.
- R5.3 - Les experts suggèrent de considérer **individuellement** l'état clinique du patient, le risque chirurgical et la balance entre les apports en oxygène et l'extraction tissulaire, plutôt qu'une valeur systématique de seuil transfusionnel.

Management and prevention of anemia (acute bleeding excluded) in adult critical care patients (SFAR – SRLF)

- **Field 2: Which transfusion strategies can reduce red blood cell transfusion and/or morbidity and mortality related to anemia in critical care patients?**
- R2.3—It is probably not recommended to adopt a liberal transfusion strategy targeting Hb > 10.0 g/dL in order to decrease the morbidity and mortality in patients with **revascularized or non-revascularized acute coronary syndrome**. (GRADE 2−), STRONG AGREEMENT
- R2.4—It is probably not recommended to adopt a liberal transfusion strategy targeting Hb > 10.0 g/dL to decrease morbidity and mortality in **brain injured** patients. (GRADE 2−), STRONG AGREEMENT
- R2.6—The experts suggest adoption of a restrictive transfusion strategy based on transfusion of a **single unit** of red blood cells followed by review of the indication for subsequent transfusion in order to reduce red blood cell utilisation without increasing morbidity and mortality. EXPERT OPINION, STRONG AGREEMENT

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Management and prevention of anemia (acute bleeding excluded) in adult critical care patients (SFAR – SRLF)

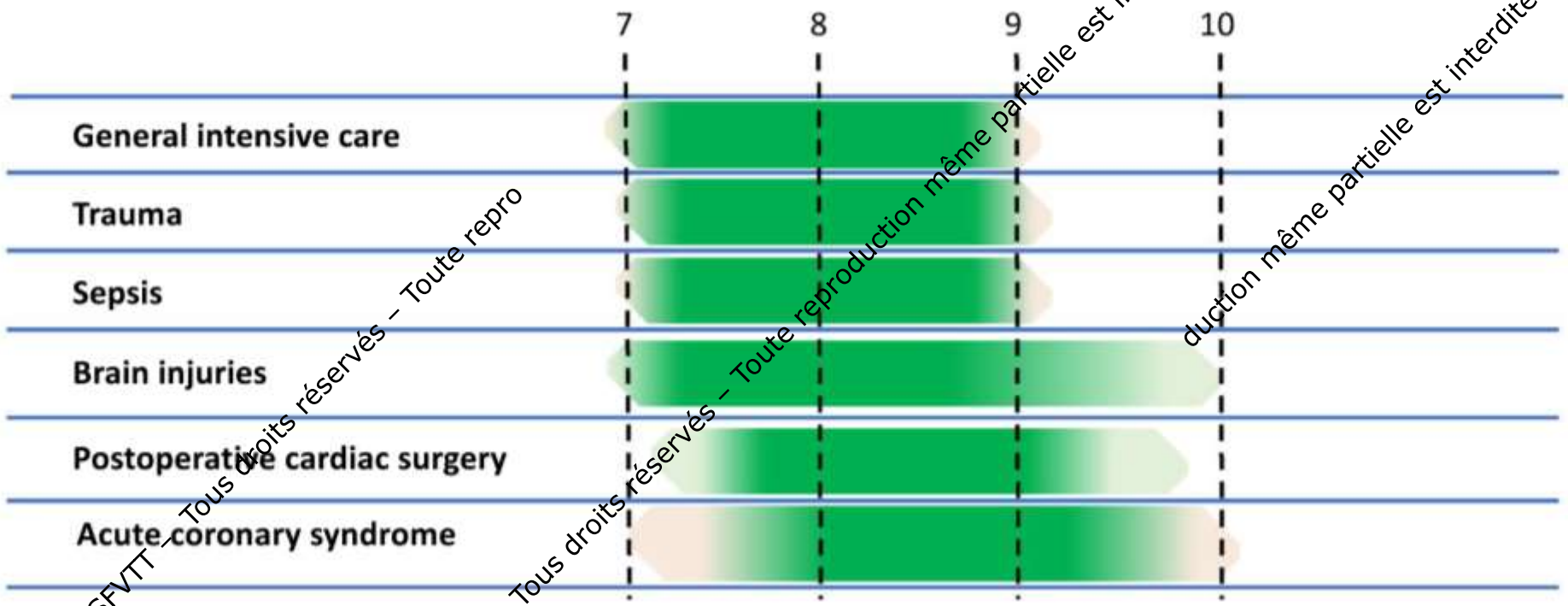

Fig. 2 Target haemoglobin in the case of transfusion (Expert opinion). The following figure proposes target Hb levels for transfusion in critical care patients, as a function of various clinical settings (i.e. the haemoglobin level below which (lower bound) single-unit transfusion is probably recommended to achieve Hb not exceeding the upper bound). The shaded zones on the figure represent the degree of uncertainty according to the experts, which is why this figure is proposed on the basis of expert opinion. The GRADE level of recommendation is indicated for each setting, in accordance with the above recommendations (R2.1 to R2.4). Note that these targets apply in the absence of active bleeding or poorly tolerated anemia, especially with cardiovascular symptoms

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Management and prevention of anemia (acute bleeding excluded) in adult critical care patients (SFAR – SRLF)

- **Field 3: In critical care patients, which non-transfusional treatments are able to reduce red blood cell transfusion and/or morbidity and mortality related to anemia or transfusion?**
- R3.1—It is probably recommended to use **erythropoiesis-stimulating agents** in critically ill anaemic (**Hb ≤ 10.0–12.0 g/dL**) and/or trauma patients in the absence of contraindication, especially with a history of ischaemic cardiovascular disease and/or venous thromboembolism, in order to reduce red blood cell utilisation and decrease mortality. (GRADE 2+), STRONG AGREEMENT
- R3.2—The experts suggest **stopping erythropoiesis-stimulating agents** when haemoglobin stabilises **between 10.0 and 12.0 g/dL** in order to decrease morbidity and mortality. EXPERT OPINION, STRONG AGREEMENT
- R3.3—It is probably **not recommended to administer iron** to reduce red blood cell utilisation or morbidity and mortality in critical care patients, **except in combination with erythropoiesis-stimulating agents**. (GRADE 2−), STRONG AGREEMENT

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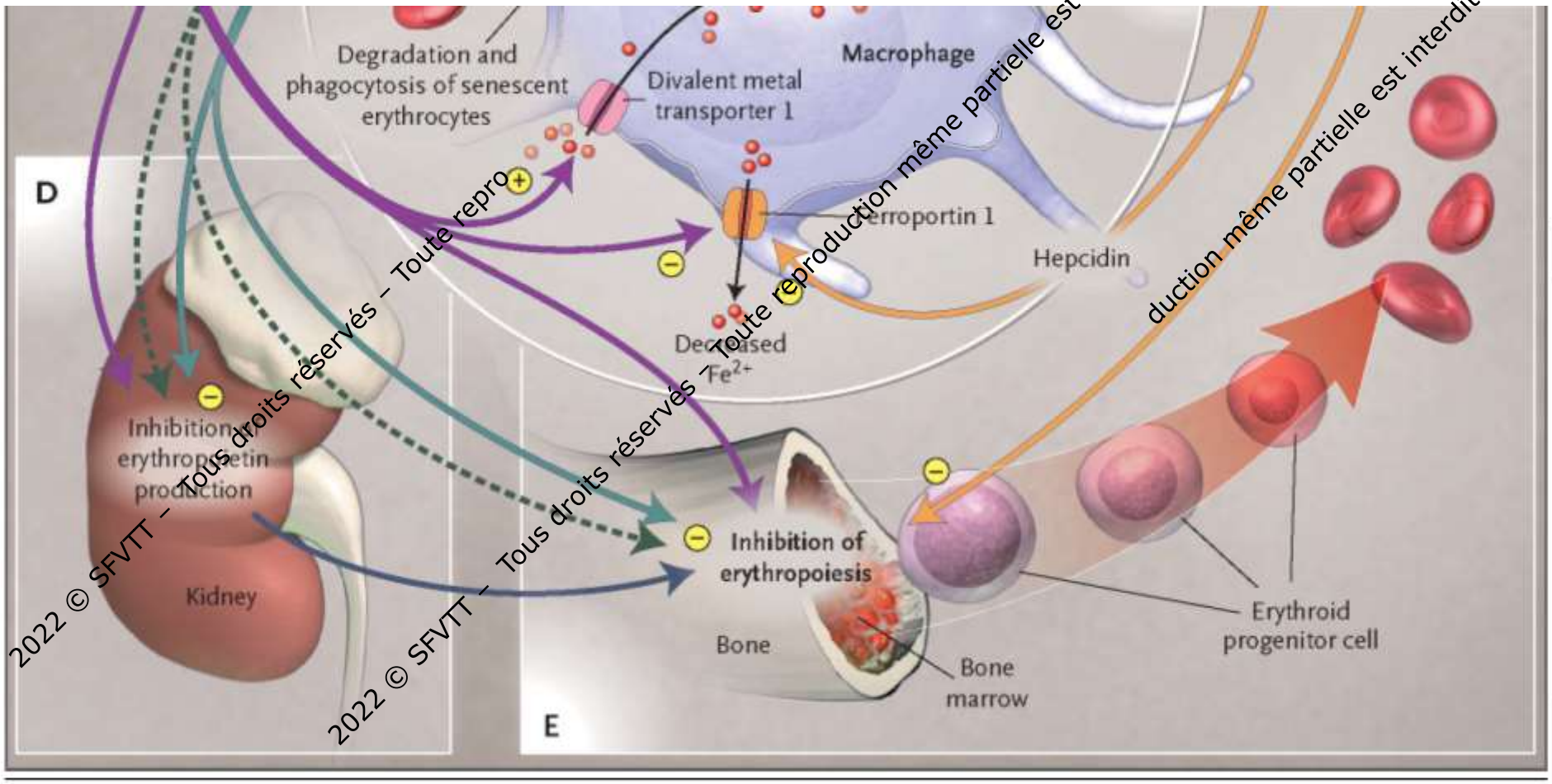
EPO et ICU : Quand administrer chez le Patient « Inflammatoire »?

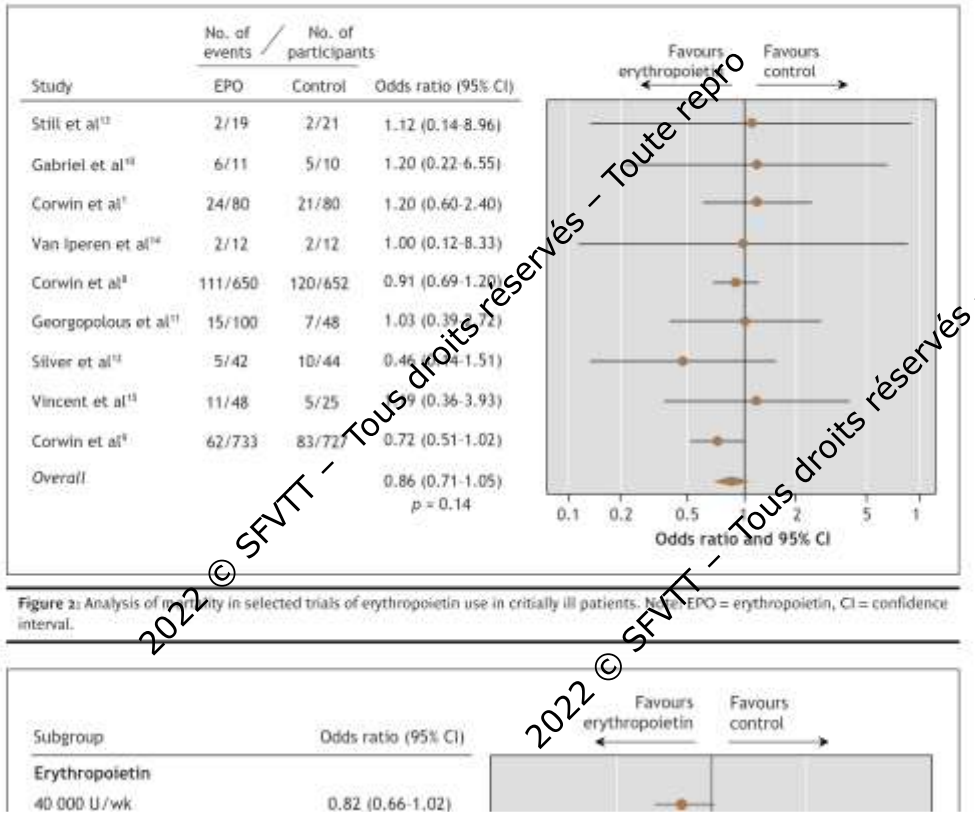


Inflammation et Inhibition EPO/Erythropoièse

N Engl J Med 2005;352:1011-23.

Erythropoietin-receptor agonists in critically ill patients: a meta-analysis of randomized controlled trials

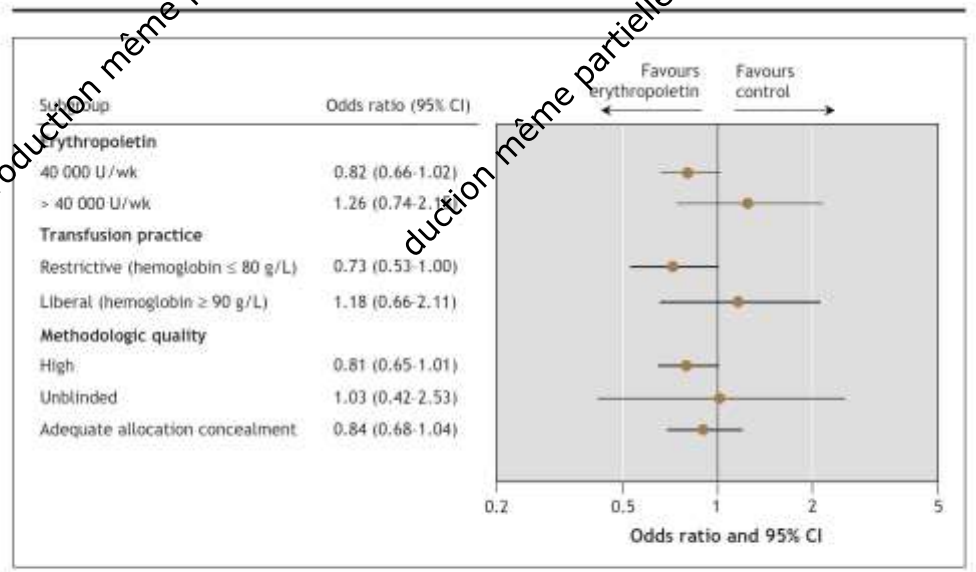
RESEARCH



Study	No. of events EPO	No. of participants Control	Odds ratio (95% CI)
Still et al[12]	2/19	2/21	1.12 (0.14-8.96)
Gabriel et al[10]	6/11	5/10	1.20 (0.22-6.55)
Corwin et al[7]	24/80	21/80	1.20 (0.60-2.40)
Van Iperen et al[14]	2/12	2/12	1.00 (0.12-8.33)
Corwin et al[8]	111/650	120/652	0.91 (0.69-1.20)
Georgopolous et al[11]	15/100	7/48	1.03 (0.39-2.72)
Silver et al[13]	5/42	10/44	0.46 (0.14-1.51)
Vincent et al[15]	11/48	5/25	0.77 (0.36-3.93)
Corwin et al[9]	62/733	83/727	0.72 (0.51-1.02)
Overall			0.86 (0.71-1.05) $p = 0.14$

Figure 2: Analysis of mortality in selected trials of erythropoietin use in critically ill patients. Note: EPO = erythropoietin, CI = confidence interval.

Subgroup	Odds ratio (95% CI)
Erythropoietin	
40 000 U/wk	0.82 (0.66-1.02)



Subgroup	Odds ratio (95% CI)
Erythropoietin	
40 000 U/wk	0.82 (0.66-1.02)
> 40 000 U/wk	1.26 (0.74-2.1[illegible])
Transfusion practice	
Restrictive (hemoglobin ≤ 80 g/L)	0.73 (0.53-1.00)
Liberal (hemoglobin ≥ 90 g/L)	1.18 (0.66-2.11)
Methodologic quality	
High	0.81 (0.65-1.01)
Unblinded	1.03 (0.42-2.53)
Adequate allocation concealment	0.84 (0.68-1.04)

Figure 3: Mortality sensitivity analysis of studies included in the meta-analysis of erythropoietin use in critically ill patients. Note: CI = confidence interval.

Économie de transfusion < 0.5 unité:patient

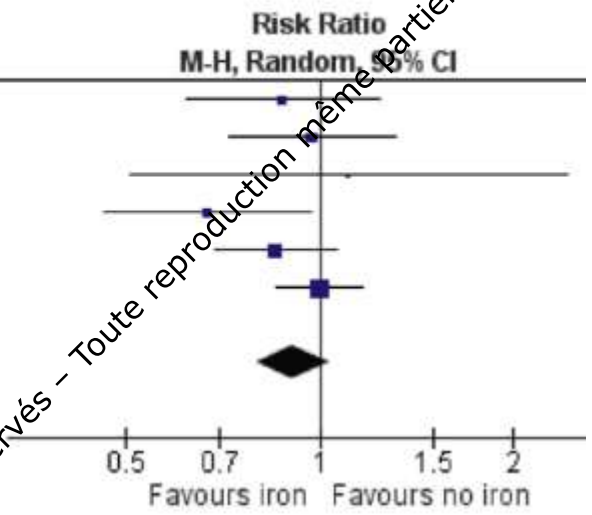
CMAJ 2007;177(7):725-34

Safety and efficacy of iron therapy on reducing red blood cell transfusion requirements and treating anaemia in critically ill adults: A systematic review with meta-analysis and trial sequential analysis Journal of Critical Care 49 (2019) 162–171

(a) Requirement for RBC transfusion

Study or Subgroup	Iron Events	Iron Total	No iron Events	No iron Total	Weight	Risk Ratio M-H, Random, 95% CI
Garrido-Martin 2012	47	107	26	52	11.8%	0.88 [0.62, 1.24]
Litton 2016	38	70	39	70	15.0%	0.97 [0.72, 1.31]
Madi-Jebara 2004	10	40	9	40	2.6%	1.11 [0.51, 2.44]
Pieracci 2009	29	97	46	103	10.4%	0.67 [0.46, 0.97]
Pieracci 2014	47	75	55	75	23.5%	0.85 [0.68, 1.07]
van Iperen 2000	12	12	12	12	36.6%	1.00 [0.86, 1.17]
Total (95% CI)		**401**		**352**	**100.0%**	**0.91 [0.80, 1.04]**
Total events	183		187			

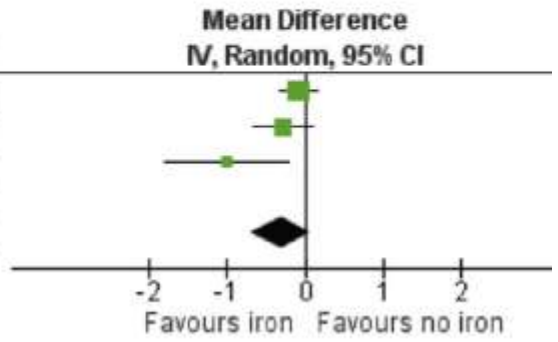
Heterogeneity: Tau² = 0.01; Chi² = 6.43, df = 5 (P = 0.27); I² = 22%
Test for overall effect: Z = 1.44 (P = 0.15)



(b) Mean number of RBCs transfused

Study or Subgroup	Iron Mean	Iron SD	Iron Total	No iron Mean	No iron SD	No iron Total	Weight	Mean Difference IV, Random, 95% CI
Garrido-Martin 2012	-0.085	0.74	107	-0.01	0.73	52	46.6%	-0.08 [-0.32, 0.17]
Litton 2016	-0.27	1.1	70	0.016	1.15	70	37.0%	-0.29 [-0.66, 0.09]
van Iperen 2000	1.07	1.04	12	2.06	0.93	12	16.4%	-0.99 [-1.78, -0.20]
Total (95% CI)			**189**			**134**	**100.0%**	**-0.30 [-0.68, 0.07]**

Heterogeneity: Tau² = 0.06; Chi² = 5.06, df = 2 (P = 0.08); I² = 60%
Test for overall effect: Z = 1.57 (P = 0.12)



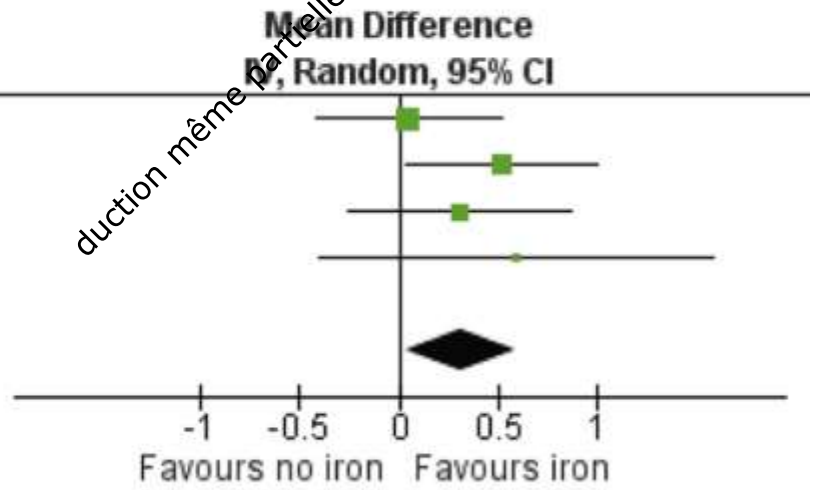
- Iron therapy **did not decrease**
  - the risk of requirement for a red blood cell (RBC) **transfusion** (Risk ratio (RR) 0.91, 95% CI 0.80 to 1.04, p = 0.15)
  - the mean **number of RBCs** transfused per participant (mean difference (MD) -0.30, 95% CI -0.68 to 0.07, p = 0.15).

Safety and efficacy of iron therapy on reducing red blood cell transfusion requirements and treating anaemia in critically ill adults: A systematic review with meta-analysis and trial sequential analysis Journal of Critical Care 49 (2019) 162–171

(d) Mean Hb concentration (g/dL) (>10 days)

Study or Subgroup	Iron Mean	Iron SD	Iron Total	No iron Mean	No iron SD	No iron Total	Weight	Mean Difference IV, Random, 95% CI
Garrido-Martin 2012	11.05	1.4	107	11	1.44	52	34.4%	-0.05 [-0.42, 0.52]
Litton 2016	10.67	1.38	70	10.15	1.5	70	33.8%	0.52 [0.04, 1.00]
Madi-Jebara 2004	12.18	1.04	30	11.87	1.21	31	24.1%	0.31 [-0.26, 0.88]
van Iperen 2000	11.4	1.3	9	10.8	0.8	9	7.7%	0.60 [-0.40, 1.60]
Total (95% CI)			**216**			**162**	**100.0%**	**0.31 [0.04, 0.59]**

Heterogeneity: Tau² = 0.00; Chi² = 2.23, df = 3 (P = 0.53); I² = 0%
Test for overall effect: Z = 2.22 (P = 0.03)



- Iron therapy increase mean Hb concentration (MD **0.31 g/d**L, 95% CI 0.04 to 0.59, p=0.03).

Réhabilitation Cardio-Musculaire et Respiratoire Précoces

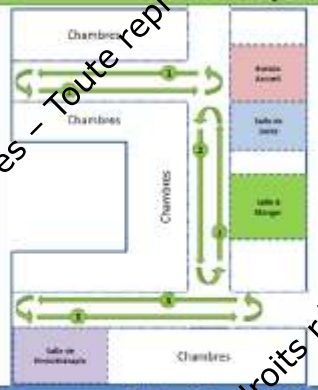
Comment réussir sa récupération après la chirurgie cardiaque

	Signalez toutes douleurs ou essoufflements
	Faites vos exercices respiratoires toutes les 2 heures minimum
	Ne restez pas au lit la journée
	Sortez de votre chambre Marchez régulièrement dans le couloir (au minimum 4 fois par jour)
	Prenez les médicaments qui vous sont prescrits
	Portez votre ceinture de maintien sternal

Réentrainement à l'effort après chirurgie cardiaque

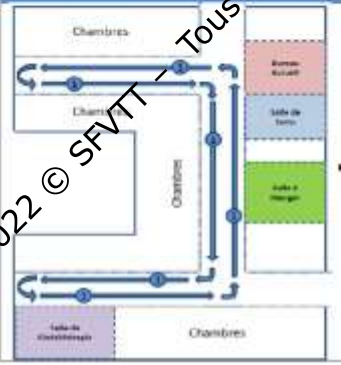
- ✓ Réentrainez vous à l'effort en suivant le programme de marche ci-dessous.
- ✓ Le réentrainement à l'effort améliore votre récupération et facilite votre retour à domicile.

Piste Verte (50m) – 1er jour postopératoire



- Faire 2 fois minimum dans la journée l'une des Pistes Vertes en fonction de la localisation de votre chambre

Piste Bleue (150 m) – 2ème jour postopératoire



- Faire 2 fois minimum dans la journée la Piste Bleue

Réhabilitation Cardio-Musculaire et Respiratoire Précoces

PHASE DE CONVALESCENCE ACTIVE

- **Poursuite de la kinésithérapie respiratoire**
- **Débuter précocement** (2 semaines postOP)
- **<u>SSR spécialisée en CV:</u>**
  - **Ambulatoire ou Hospitalisation**
  - **Programme adapté à la symptomatologie et aux risques CV <u>: Cardiopathie non corrigée</u>**
  - **Epreuve d'effort à l'admission**
  - **Entrainement en endurance (exercice avec intervalles à haute intensité)**
  - **Entrainement en résistance**
  - **Marche+++**
  - **Epreuve d'effort à la fin du programme:**
    - Directives de poursuite de réentrainement (prescription Activité Physique Adaptée)
    - Informations et recommandations sur les activités sportives

HAS 2022 Gestion du capital sanguin en pré, per et postopératoire et en obstétrique

- **3.1. Surveillance du saignement et diagnostic de l'anémie postopératoire**
- Il est recommandé de refaire un bilan (hémogramme et bilan martial) **4 semaines** environ après une **chirurgie hémorragique** et/ou en cas **d'anémie postopératoire**, en impliquant le médecin traitant (AE).
- **3.2. Supplémentation en fer**
- En cas d'anémie postopératoire avec un taux d'hémoglobine inférieur à 12 g/dL lié à des pertes sanguines importantes et/ou à une carence martiale préopératoire non traitée, une **administration précoce de fer** est recommandée, de préférence par voie intraveineuse (Grade B) .
- La dose d'un gramme de carboxymaltose ferrique est à privilégier (en cas de poids supérieur à 35 kg) puisqu'elle peut être réalisée en une seule injection de 15 min (AE) .

ICU and Post-ICU : Quelle dose de Fer ?

iron deficit = body weight (kg)× (target hb - actual hb) × 2.4.

fractionated injections : avoid exceeding the iron-binding capacity of transferrin and limit induction of hepcidin synthesis.

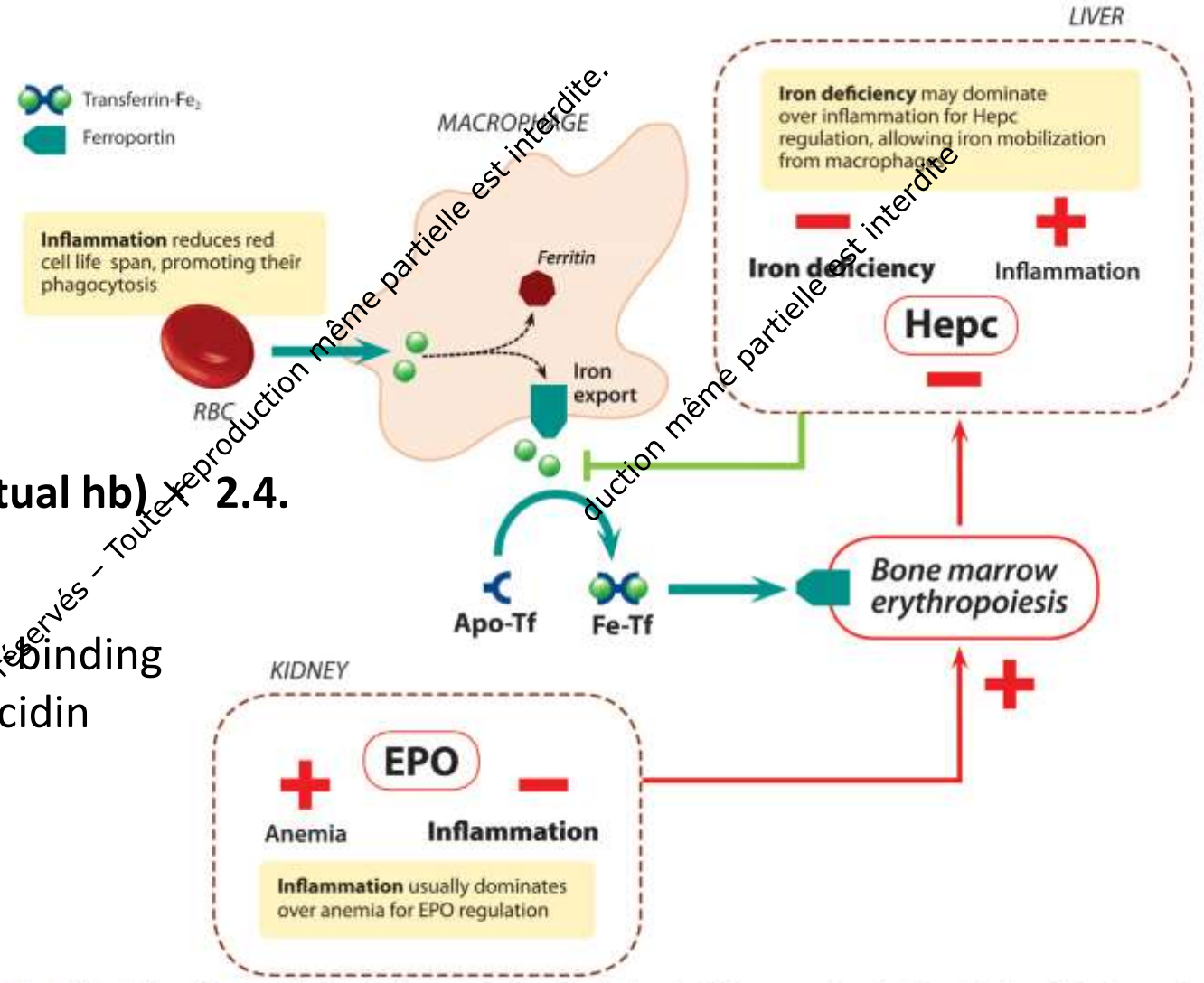


Fig. 2. Regulation of iron metabolism in the anemia of a critically ill patient. Two opposite stimuli regulate hepcidin, the master regulator of iron metabolism. Inflammation induces hepcidin synthesis, whereas iron deficiency, blood loss, and erythropoiesis stimulation (modulated by erythropoietin synthesis) repress it. A low hepcidin concentration is required to allow iron export and its utilization for erythropoiesis. Apo-Tf = apo-transferrin (*i.e.*, transferrin free of iron); EPO = erythropoietin; Fe-Tf = transferrin binding iron; Hepc = hepcidin; RBC = erythrocytes.

Inflammation et Métabolisme du Fer

Anesthesiology, V 114 • No 3 688 March 2011

Management and prevention of anemia (acute bleeding excluded) in adult critical care patients (SFAR – SRLF)

- **Should vitamin B12 or folic acid be administered to critical care patients to decrease red blood cell utilisation, morbidity and mortality?**
- R3.4—No recommendation could be formulated concerning administration of vitamins to critical care patients in order to reduce red blood cell transfusion and/or morbidity and mortality related to anemia or transfusion. NO RECOMMENDATION

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1.2.3. Traitements vitaminiques

- Les traitements vitaminiques (vitamine B9, vitamine B12) peuvent s'envisager en cas de déficit biologique, c'est-à-dire acide folique plasmatique < 3 ng/mL et/ou cobalamine plasmatique < 200 pg/mL (Grade C)

- Quel Cout ? B12 30 à 40 Euros

- **B9 et B12 : B245**

Conclusion

Trois Objectifs Majeurs

- Réduire les pertes sanguines
- Adapter la Politique Transfusionnelle au Patient
- Favoriser la Correction de l’Anémie et de la Carence Martiale

Merci pour votre attention