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16-17
Dicembre
2022

MILANO, PALAZZO STELLINE

ORTHOPEA 2022

RISORSA SANGUE

ELEMENTI DI PBM

Moderatori: Marco Pavesi, Luciana Minieri

11.30 - 12.00 I costi trasfusionali e i dati da monitorare. *Luca Santoleri*

12.00 - 12.30 Appropriatezza trasfusionale e risparmio sangue: il razionale e gli strumenti. *Giovanni Albano*

12.30 - 13.00 Il concetto di prevedibilità trasfusionale. *Marco Pavesi*

13.00 - 13.30 Discussione

Giovanni Albano
Responsabile Dipartimento di Anestesia e Rianimazione
Humanitas Gavazzeni
Bergamo

REVIEW

doi:10.3949/ccjm.84a.15134

CME CREDIT ***EDUCATIONAL OBJECTIVE:*** Readers will consider a conservative strategy for blood transfusion rather than a more liberal one

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Parsimonious blood use and lower transfusion triggers: What is the evidence?

Hemoglobin is essential for tissue oxygenation, but the serum hemoglobin concentration is just one of several factors involved.[1–5] In anemia, the body can adapt not only by increasing production of red blood cells, but also by:

- Increasing cardiac output
- Increasing synthesis of 2,3-diphosphoglycerate (2,3-DPG), with a consequent shift in the oxyhemoglobin dissociation curve to the right, allowing enhanced release of oxygen at the tissue level
- Moving more carbon dioxide into the blood (the Bohr effect), which decreases pH and also shifts the dissociation curve to the right.

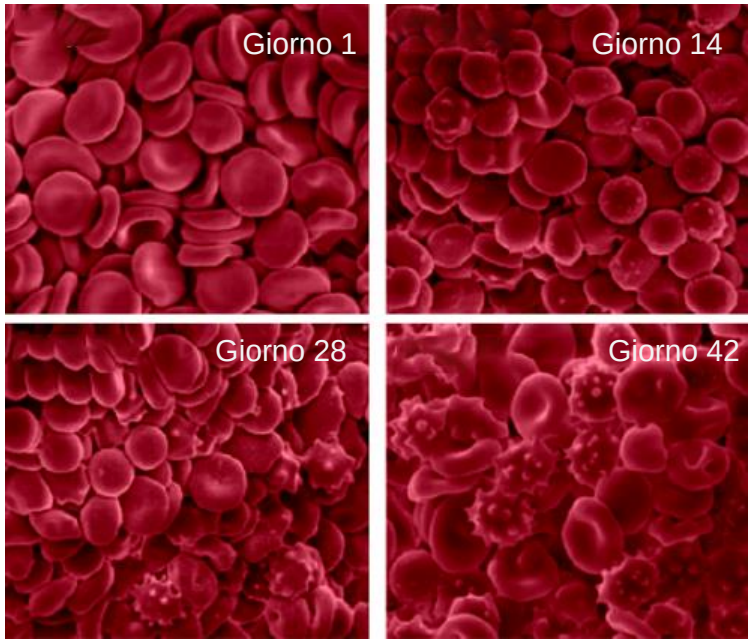
La deformabilità è un parametro critico per il delivery di ossigeno

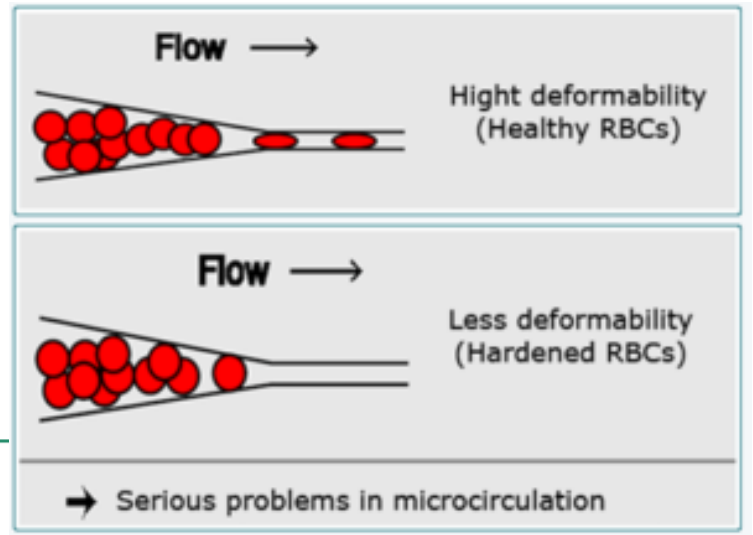
Significato clinico

→I globuli rossi devono essere in grado di deformarsi continuamente mentre attraversano le reti di capillari

→La mancata sostenibilità della deformabilità si traduce in un accorciamento della durata della vita dei globuli rossi, ovvero anemia emolitica

→La conservazione ipotermica dei globuli rossi comporta un progressivo deterioramento delle proprietà reologiche delle cellule, che può ridurre l'efficacia delle trasfusioni di globuli rossi





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doi:10.3949/ccjm.84a.15134

frontiers in Physiology

ORIGINAL RESEARCH
published: 23 December 2020
doi: 10.3389/fphys.2020.616457

Oxygen in Red Blood Cell Concentrates: Influence of Donors' Characteristics and Blood Processing

*Manon Bardyn[1], Agathe Martin[2], Nora Dögnitz[3], Mélanie Abonnenc[1,2], Andrew Dunham[4], Tatsuro Yoshida[4] and Michel Prudent[1,5]**

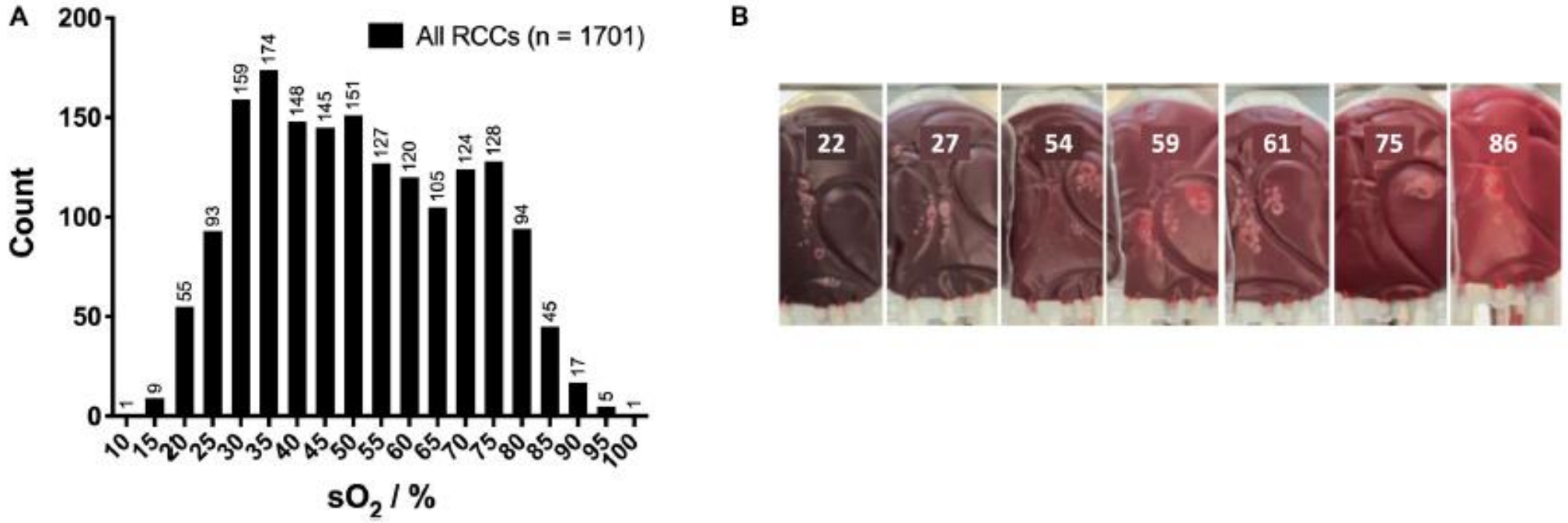
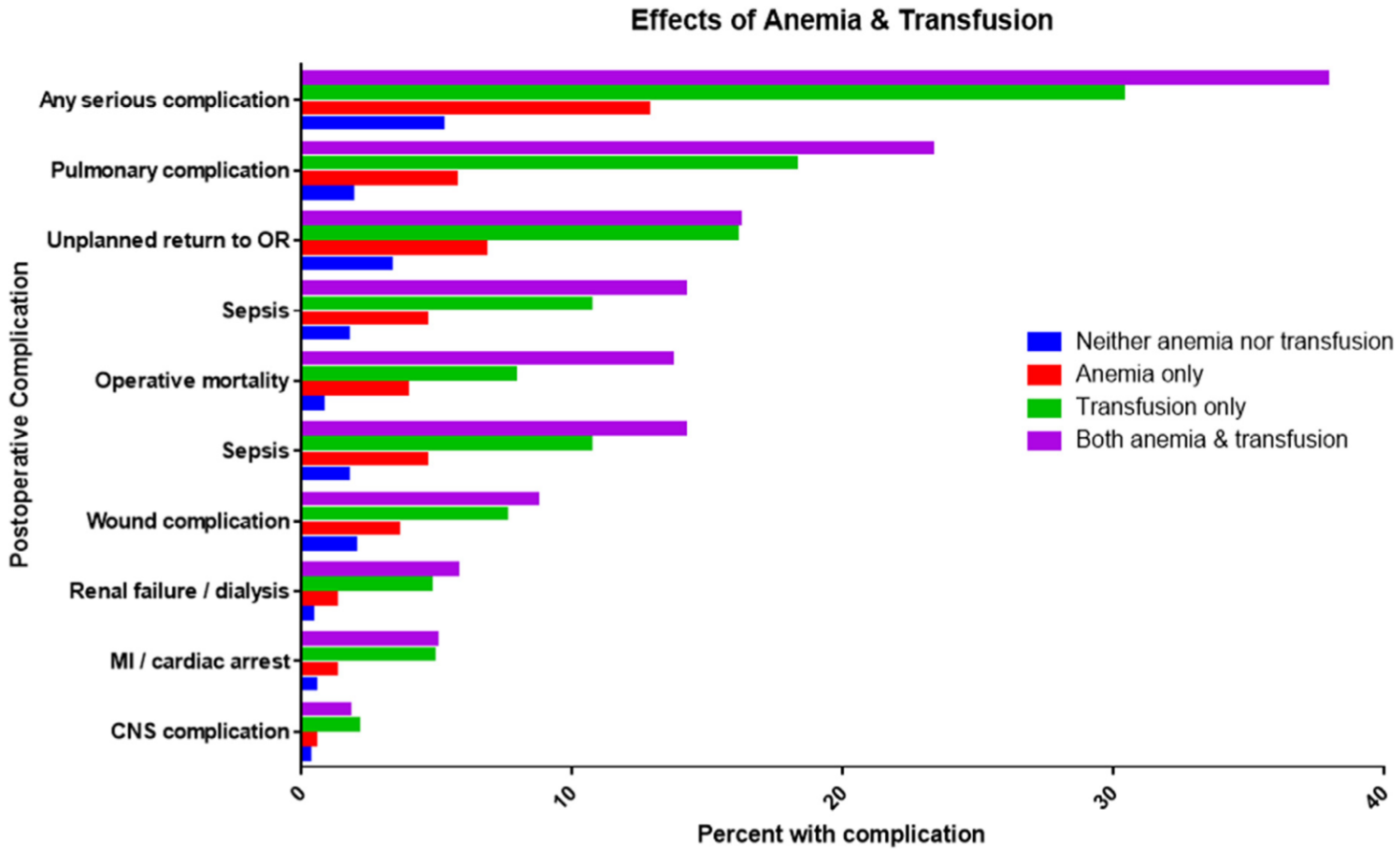


FIGURE 1 | Hemoglobin oxygen saturation (sO_2) within the red cell concentrates (RCCs). **(A)** Overall sO_2 distribution in RCCs. **(B)** Color of RCCs and sO_2 level.

COMPLICANZE NON INFETTIVE DELLA TRASFUSIONE DI GLOBULI ROSSI



P. Tibi et al. / Journal of Cardiothoracic and Vascular Anesthesia 35 (2021) 2569–2591

https://doi.org/10.1016/j.athoracsur.2019.04.108

Mortalità in ospedale e a 30 giorni

Preoperative Anemia and Outcomes in Cardiovascular Surgery: Systematic Review and Meta-Analysis

Hari Padmanabhan, MRCP, Keith Siau, MRCP, Jason Curtis, PGDipIM, MCLIP, Alex Ng, FRCA, Shyam Menon, MD, FRCP, Heyman Luckraz, FRCS, and Matthew J. Brookes, PhD

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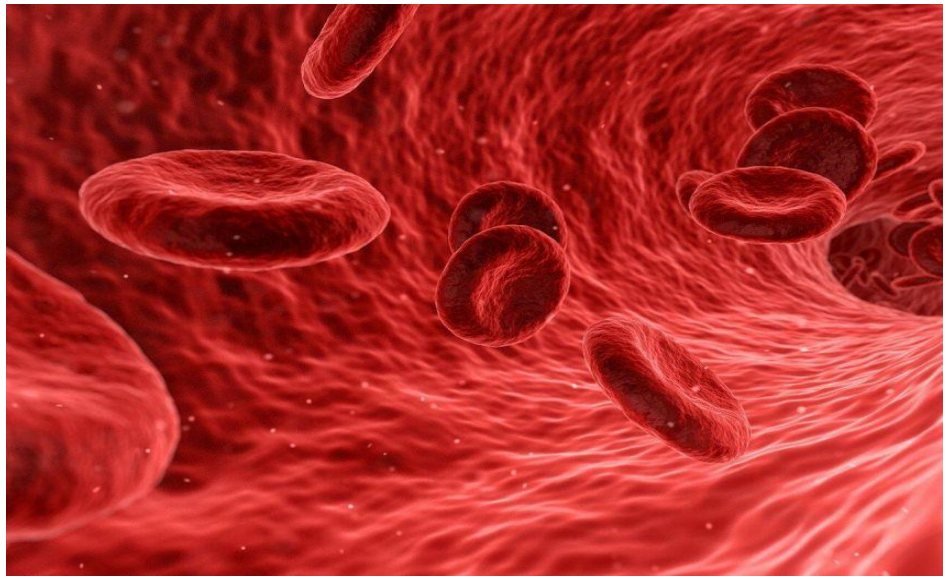

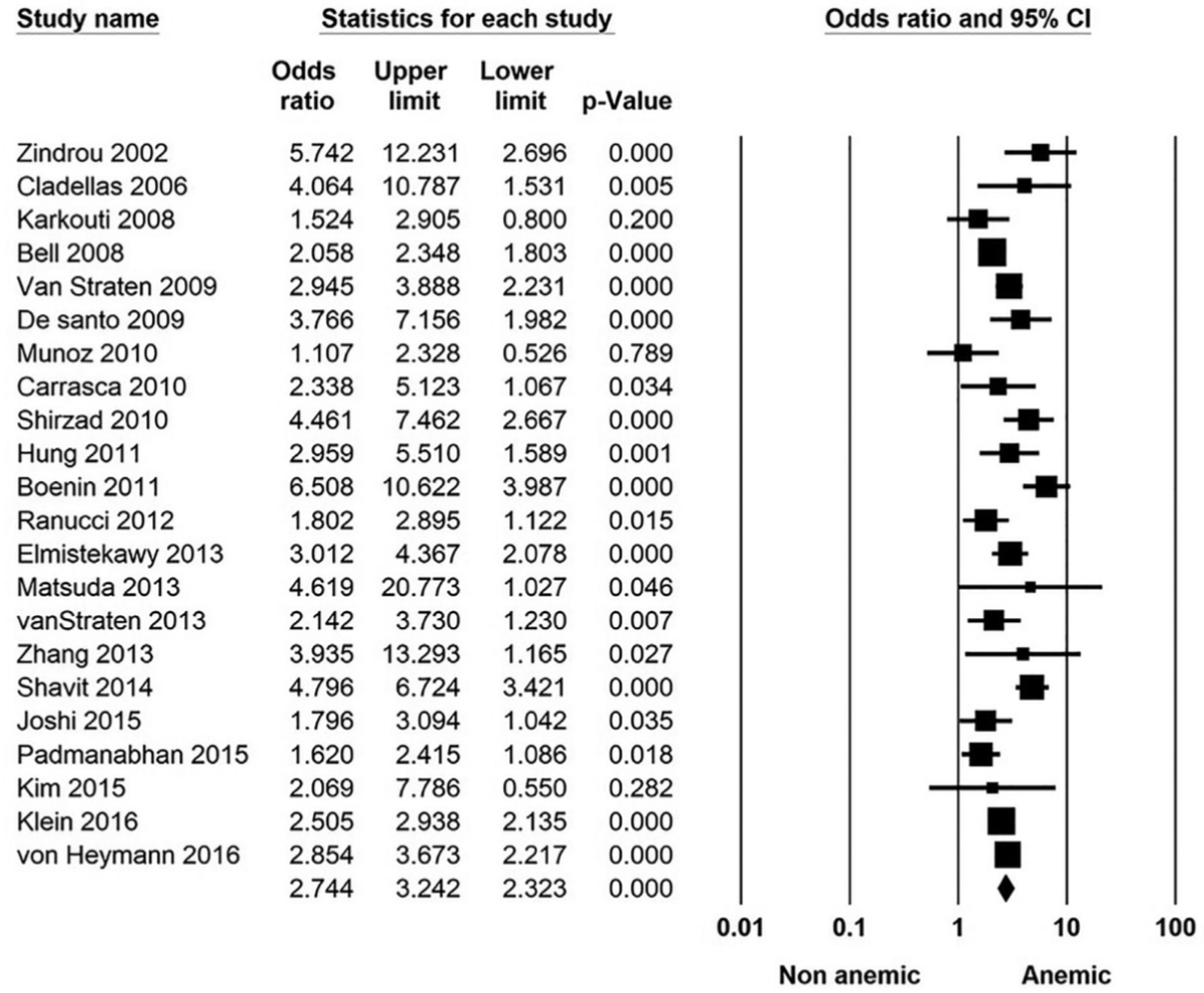

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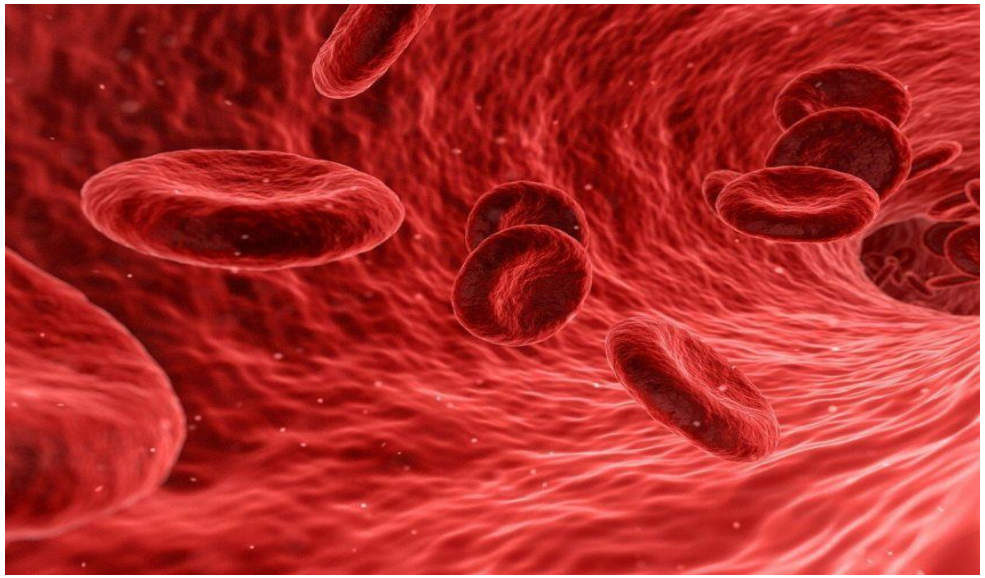

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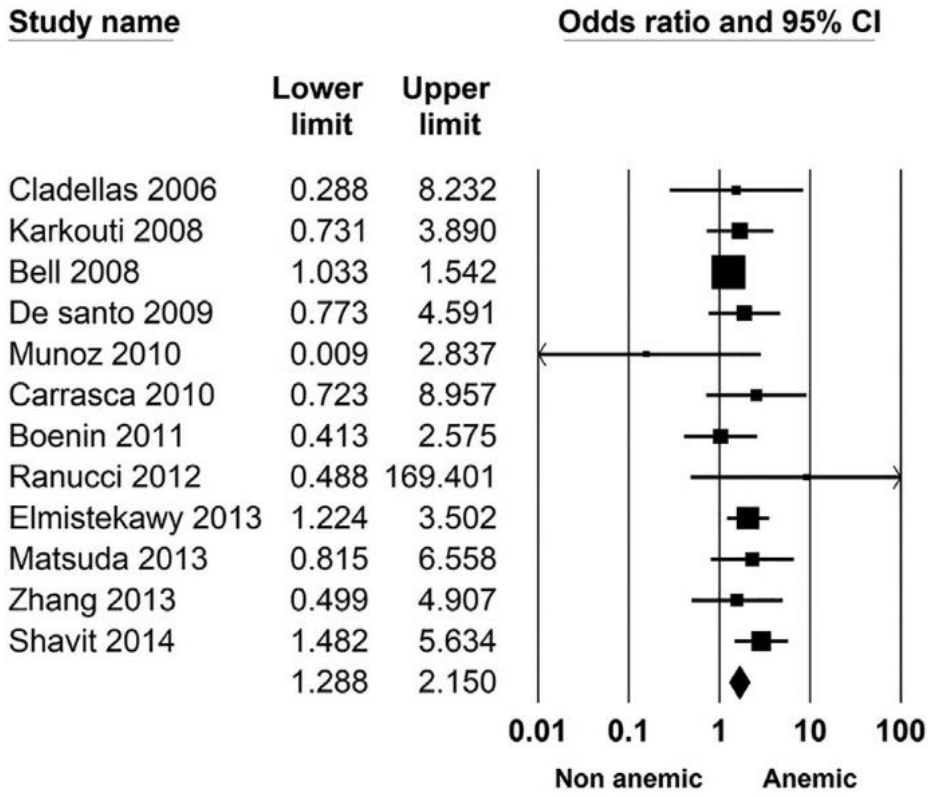

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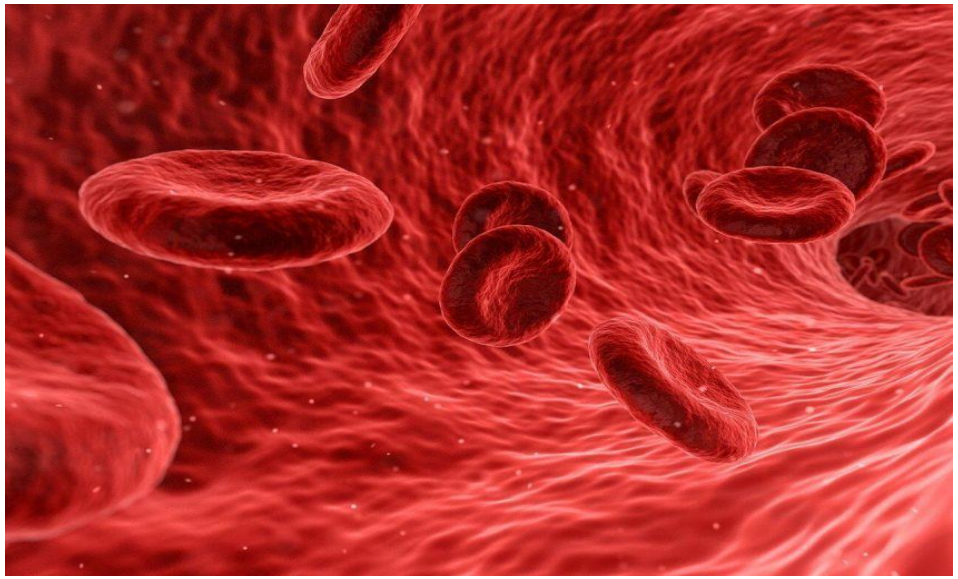

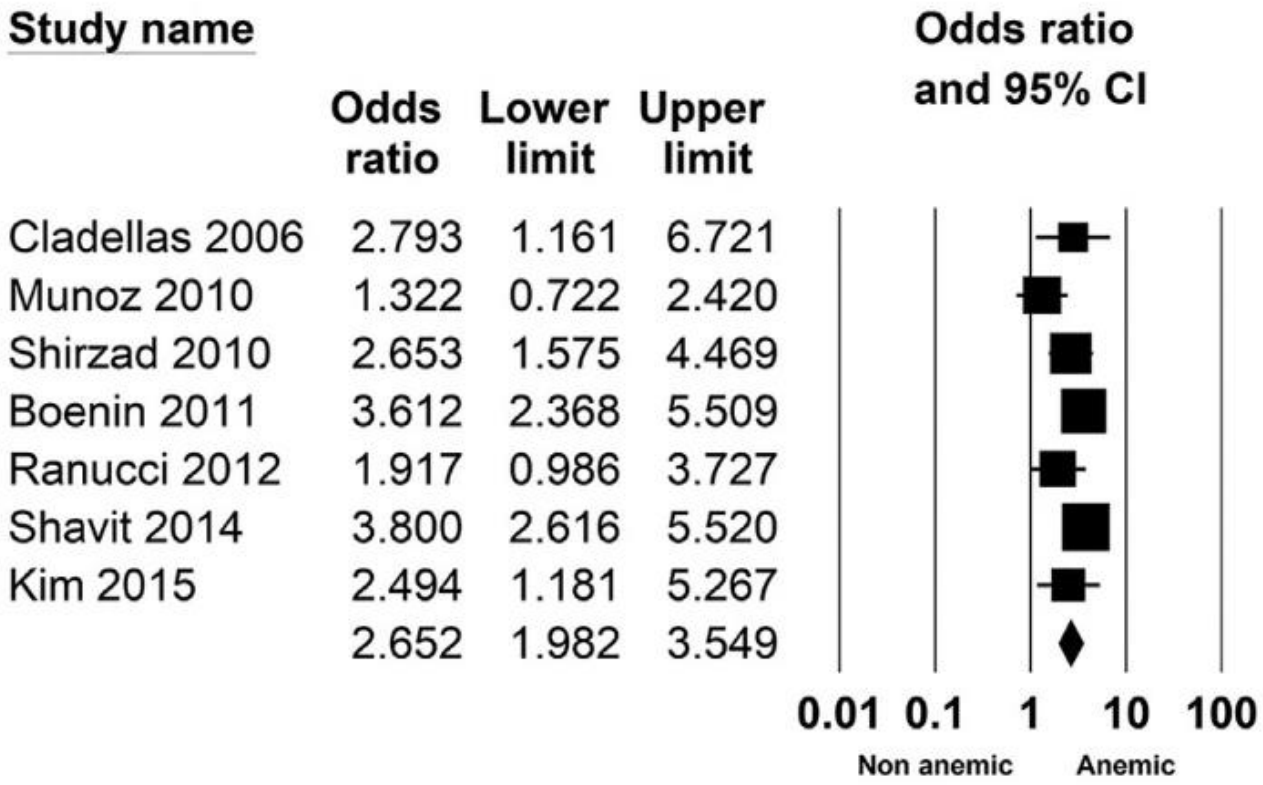

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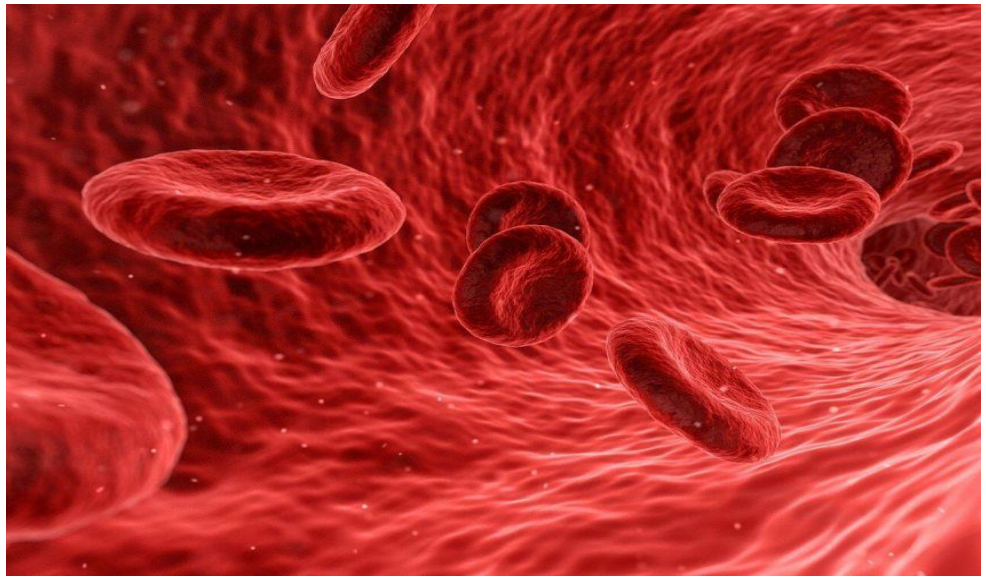
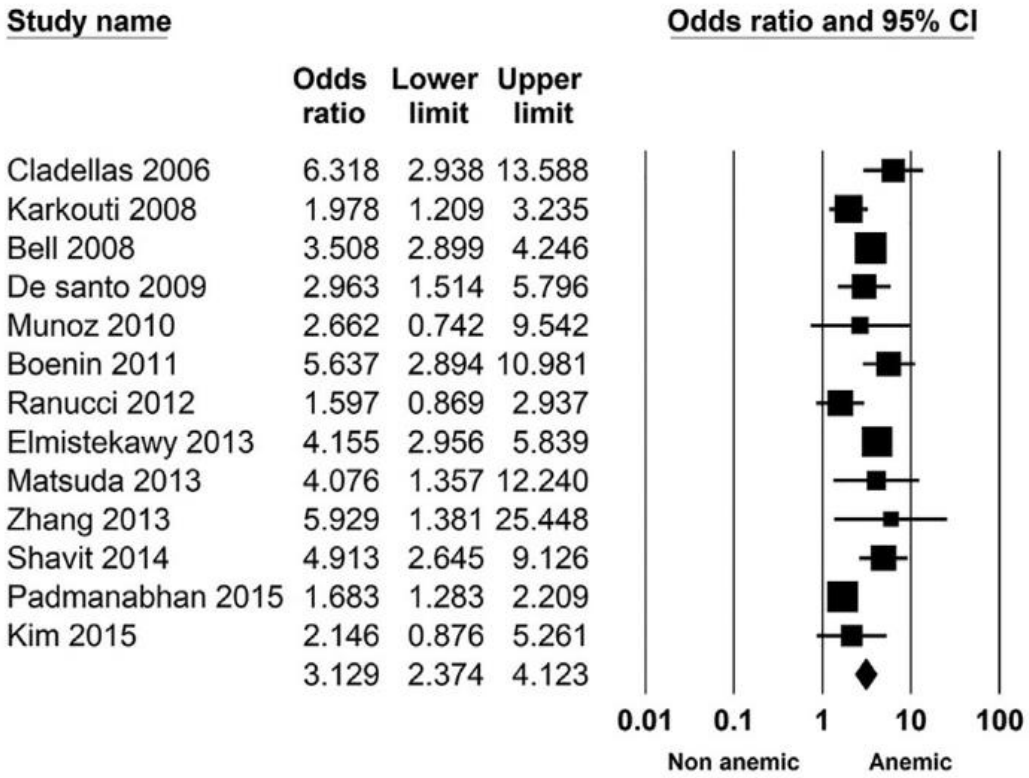




Anesth Analg 2022;135:532–44

NARRATIVE REVIEW ARTICLE

Perioperative Quality Initiative and Enhanced Recovery After Surgery-Cardiac Society Consensus Statement on the Management of Preoperative Anemia and Iron Deficiency in Adult Cardiac Surgery Patients

Nicole R. Guinn, MD,* Jonathon Schwartz, MD,† Rakesh C. Arora, MD, PhD,‡ Vicki Morton-Bailey, DNP, MSN, AGNP-BC,§ Solomon Aronson, MD, MBA, FASA, FACC, FCCP, FAHA, FASE,‖ Charles Scott Brudney, MC, ChB,¶ and Elliott Bennett-Guerrero, MD,† on behalf of the Perioperative Quality Initiative (POQI-8) and the Enhanced Recovery After Surgery-Cardiac Society (ERAS-C) Investigators

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Restrictive or Liberal Red-Cell Transfusion for Cardiac Surgery

C.D. Mazer, R.P. Whitlock, D.A. Fergusson, J. Hall, E. Belley-Cote, K. Connolly, B. Khanykin, A.J. Gregory, É. de Médicis, S. McGuinness, A. Royse, F.M. Carrier, P.J. Young, J.C. Villar, H.P. Grocott, M.D. Seeberger, S. Fremes, F. Lellouche, S. Syed, K. Byrne, S.M. Bagshaw, N.C. Hwang, C. Mehta, T.W. Painter, C. Royse, S. Verma, G.M.T. Hare, A. Cohen, K.E. Thorpe, P. Jüni, and N. Shehata, for the TRICS Investigators and Perioperative Anesthesia Clinical Trials Group*

DOI: 10.1056/NEJMoa1711818

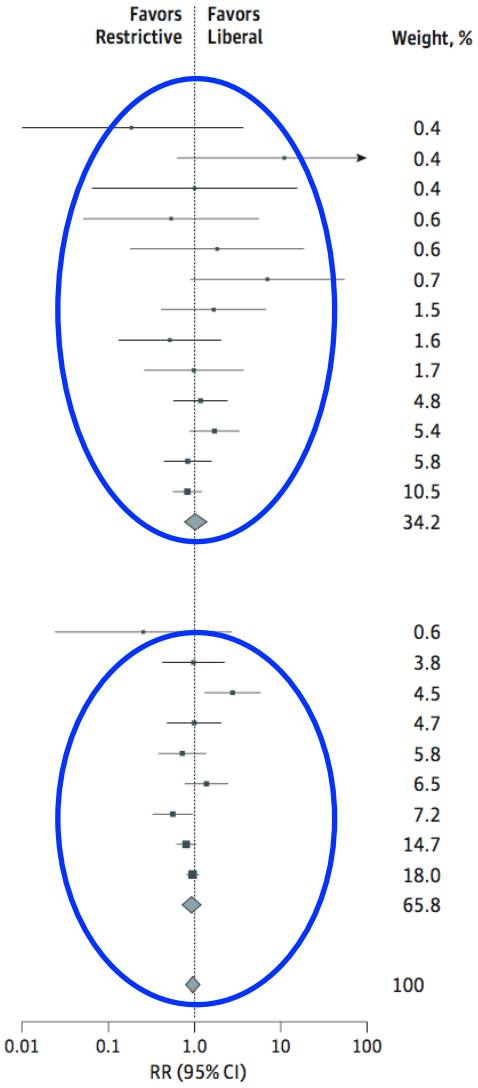
Table 3. Primary and Secondary Outcomes in the Per-Protocol Population.

Characteristic	Restrictive Threshold (N=2430)	Liberal Threshold (N=2430)	Odds Ratio or Hazard Ratio (95% CI)
Primary outcome			
Composite-outcome event — no./total no. (%)	276/2428 (11.4)	303/2429 (12.5)	0.90 (0.76–1.07)
Death — no./total no. (%)	74/2427 (3.0)	87/2429 (3.6)	0.85 (0.62–1.16)
Stroke — no./total no. (%)	45/2428 (1.9)	49/2429 (2.0)	0.92 (0.61–1.38)
Myocardial infarction — no./total no. (%)	144/2428 (5.9)	144/2429 (5.9)	1.00 (0.79–1.27)
New-onset renal failure with dialysis — no./total no. (%)	61/2428 (2.5)	72/2429 (3.0)	0.84 (0.60–1.19)
Secondary outcomes			
Length of stay in ICU			
No. of patients with data	2422	2418	
Median — days	2.1	1.9	0.89 (0.84–0.94)*
Interquartile range — days	1.0–4.0	1.0–3.9	
Length of stay in hospital			
No. of patients with data	2419	2419	
Median — days	8.0	8.0	0.93 (0.88–0.99)*
Interquartile range — days	7.0–13.0	7.0–12.0	
Duration of mechanical ventilation			
No. of patients with data	2416	2421	
Median — days	0.38	0.36	0.94 (0.89–1.00)*
Interquartile range — days	0.22–0.75	0.22–0.71	
Prolonged low-output state — no./total no. (%)†	994/2429 (40.9)	987/2430 (40.6)	1.01 (0.90–1.14)
Infection — no./total no. (%)	121/2428 (5.0)	101/2429 (4.2)	1.21 (0.92–1.58)
Bowel infarction — no./total no. (%)	6/2428 (0.2)	5/2429 (0.2)	1.20 (0.37–3.94)
Acute kidney injury — no./total no. (%)	792/2332 (34.0)	797/2348 (33.9)	1.00 (0.89–1.13)
Seizure — no./total no. (%)	50/2428 (2.1)	42/2429 (1.7)	1.20 (0.79–1.81)
Delirium — no./total no. (%)	306/2428 (12.6)	264/2429 (10.9)	1.18 (0.99–1.41)
Encephalopathy — no./total no. (%)	26/2428 (1.1)	22/2429 (0.9)	1.18 (0.67–2.10)

Clinical Practice Guidelines From the AABB
Red Blood Cell Transfusion Thresholds and Storage

Jeffrey L. Carson, MD; Gordon Guyatt, MD; Nancy M. Heddle, MSc; Brenda J. Grossman, MD, MPH; Claudia S. Cohn, MD, PhD; Mark K. Fung, MD, PhD; Terry Gernsheimer, MD; John B. Holcomb, MD; Lewis J. Kaplan, MD; Louis M. Katz, MD; Nikki Peterson, BA; Glenn Ramsey, MD; Sunil V. Rao, MD; John D. Roback, MD, PhD; Aryeh Shander, MD; Aaron A. R. Tobian, MD, PhD

Source	Restrictive Transfusion Threshold: No. of Deaths	Restrictive Transfusion Threshold: Total No.	Liberal Transfusion Threshold: No. of Deaths	Liberal Transfusion Threshold: Total No.	RR (95% CI)
Restrictive threshold, hemoglobin <8 to 9 g/dL					
Lotke et al,[75] 1999	0	62	0	65	Not estimable
Blair et al,[53] 1986	0	26	2	24	0.19 (0.01-3.67)
Foss et al,[63] 2009	5	60	0	60	11.00 (0.62-194.63)
Carson et al,[58] 1998	1	42	1	42	1.00 (0.06-15.47)
Webert et al,[86] 2008	1	29	2	31	0.53 (0.05-5.58)
Cooper et al,[61] 2011	2	23	1	21	1.83 (0.18-18.70)
Carson et al,[56] 2013	7	55	1	55	7.00 (0.89-55.01)
Parker,[78] 2013	5	100	3	100	1.67 (0.41-6.79)
Bracey et al,[54] 1999	3	215	6	222	0.52 (0.13-2.04)
Bush et al,[55] 1997	4	50	4	49	0.98 (0.26-3.70)
Hajjar et al,[68] 2010	15	249	13	253	1.17 (0.57-2.41)
Gregersen et al,[64] 2015	21	144	12	140	1.70 (0.87-3.32)
Jairath et al,[72] 2015	14	257	25	382	0.83 (0.44-1.57)
Carson et al,[60] 2011	43	1009	52	1007	0.83 (0.56-1.22)
Subtotal	121	2321	122	2451	1.05 (0.78-1.40)
Heterogeneity: $\tau^2 = 0.02$; $\chi^2_{12} = 13.14$; $P = .36$; $I^2 = 9\%$					
Tests for overall effect: z score = 0.31; $P = .76$					
Restrictive threshold, hemoglobin <7 g/dL					
DeZern et al,[87] 2016	1	59	2	30	0.25 (0.02-2.69)
Hébert et al,[70] 1995	8	33	9	36	0.97 (0.42-2.22)
de Almeida et al,[79] 2015	23	101	8	97	2.76 (1.30-5.87)
Lacroix et al,[74] 2007	14	320	14	317	0.99 (0.48-2.04)
Walsh et al,[85] 2013	12	51	16	49	0.72 (0.38-1.36)
Murphy et al,[76] 2015	26	1000	19	1003	1.37 (0.76-2.46)
Villanueva et al,[84] 2013	19	416	34	417	0.56 (0.32-0.97)
Hébert et al,[69] 1999	78	418	98	420	0.80 (0.61-1.04)
Holst et al,[71] 2014	168	502	175	496	0.95 (0.80-1.13)
Subtotal	349	2900	375	2865	0.94 (0.74-1.19)
Heterogeneity: $\tau^2 = 0.05$; $\chi^2_8 = 16.09$; $P = .04$; $I^2 = 50\%$					
Tests for overall effect: z score = 0.53; $P = .59$					
Overall	470	5221	497	5316	0.97 (0.81-1.16)
Heterogeneity: $\tau^2 = 0.04$; $\chi^2_{21} = 29.75$; $P = .10$; $I^2 = 29\%$					
Tests for overall effect: z score = 0.29; $P = .77$					
Tests for subgroup differences: $\chi^2_1 = 0.34$; $P = .56$; $I^2 = 0\%$					



Restrictive compared with liberal red cell transfusion strategies in cardiac surgery: a meta-analysis

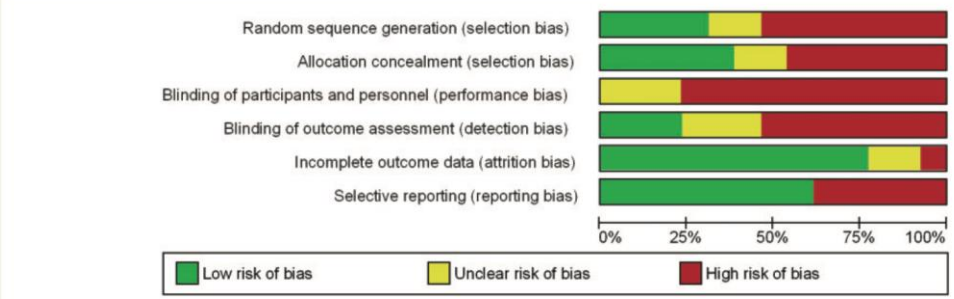
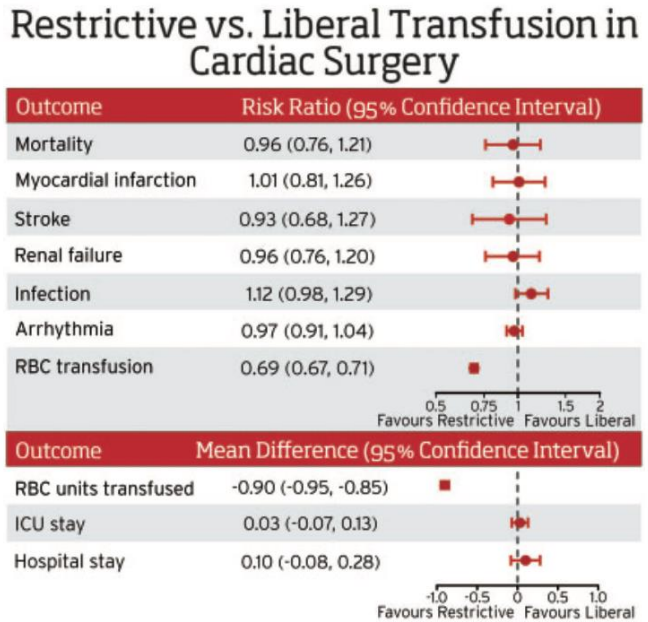


Figure 2 Risk of bias summary.



Take home figure The current evidence suggests restrictive transfusion strategies are not inferior to liberal transfusion strategies in adult and pediatric patients undergoing cardiac surgery. RBC indicates red blood cell; ICU indicates intensive care unit. ICU stay and hospital stay are reported as days.

ESC European Society of Cardiology

European Heart Journal (2019) **40**, 1081–1088
doi:10.1093/eurheartj/ehy435

META-ANALYSIS
Cardiovascular surgery

Restrictive compared with liberal red cell transfusion strategies in cardiac surgery: a meta-analysis

Nadine Shehata[1], Nikhil Mistry[2], Bruno R. da Costa[3,4], Tiago V. Pereira[3], Richard Whitlock[5], Gerard F. Curley[6], David A. Scott[7], Gregory M.T. Hare[8], Peter Jüni[9], and C. David Mazer[8]*

Is it safe to use lower blood counts (haemoglobin levels) as a trigger for blood transfusion in order to give fewer blood transfusions?

- There is no evidence that giving blood transfusions to patients with lower blood counts (haemoglobin levels of 7.0 g/dL to 8.0 g/dL) compared to higher blood counts (9.0 g/dL to 10.0 g/dL) affects risks of death, heart attack, myocardial infarction, stroke, pneumonia, blood clots or infection.

- Giving blood only to patients with lower blood counts (7.0 g/dL to 8.0 g/dL) would reduce the amount of blood transfused substantially. It would also reduce the risk of unnecessary transfusions (transfusions can have harmful effects).

JAMA | Special Communication

Clinical Practice Guidelines From the AABB
Red Blood Cell Transfusion Thresholds and Storage

Jeffrey L. Carson, MD; Gordon Guyatt, MD; Nancy M. Heddle, MSc; Brenda J. Grossman, MD, MPH; Claudia S. Cohn, MD, PhD; Mark K. Fung, MD, PhD; Terry Gernsheimer, MD; John B. Holcomb, MD; Lewis J. Kaplan, MD; Louis M. Katz, MD; Nikki Peterson, BA; Glenn Ramsey, MD; Sunil V. Rao, MD; John D. Roback, MD, PhD; Aryeh Shander, MD; Aaron A. R. Tobian, MD, PhD

Recommendations

First Recommendation

The AABB recommends a restrictive RBC transfusion threshold in which the transfusion is not indicated until the hemoglobin level is 7 g/dL for hospitalized adult patients who are hemodynamically stable, including critically ill patients, rather than a liberal threshold when the hemoglobin level is 10 g/dL (strong recommendation, moderate quality evidence). For patients undergoing orthopedic surgery or cardiac surgery and those with preexisting cardiovascular disease, the AABB recommends a restrictive RBC transfusion threshold (hemoglobin level of 8 g/dL; strong recommendation, moderate quality evidence). The restrictive hemoglobin transfusion threshold of 7 g/dL is likely comparable with 8 g/dL, but RCT evidence is not available for all patient categories. These recommendations apply to all but the following conditions for which the evidence is insufficient for any recommendation: acute coronary syndrome, severe thrombocytopenia (patients treated for hematological or oncological disorders who at risk of bleeding), and chronic transfusion-dependent anemia.

Authors' conclusions—The existing evidence supports the use of restrictive transfusion triggers in most patients, including those with pre-existing cardiovascular disease. As there are no trials, the effects of restrictive transfusion triggers in high-risk groups, such as acute coronary syndrome, need to be tested in further large clinical trials. In countries with inadequate screening of donor blood, the data may constitute a stronger basis for avoiding transfusion with allogeneic red cells.

Transfusion Requirements in Surgical Oncology Patients

A Prospective, Randomized Controlled Trial

Pinheiro de Almeida *et al.*

Anesthesiology 2015; 122:29-38

Another possible explanation for the different finding is that patients with cancer receiving restrictive transfusions may be more susceptible to altered oxygen delivery and impaired tissue oxygenation during the postoperative period, leading to higher rates of complications and death. Jhanji *et al.*[22] reported that patients having major abdominal surgery who had impaired microvascular flow after surgery experienced a higher rate of postoperative complications than did patients with normal microvascular flow (measured with sublingual capillaroscopy).

Transfusion Requirements in Surgical Oncology Patients

A Prospective, Randomized Controlled Trial

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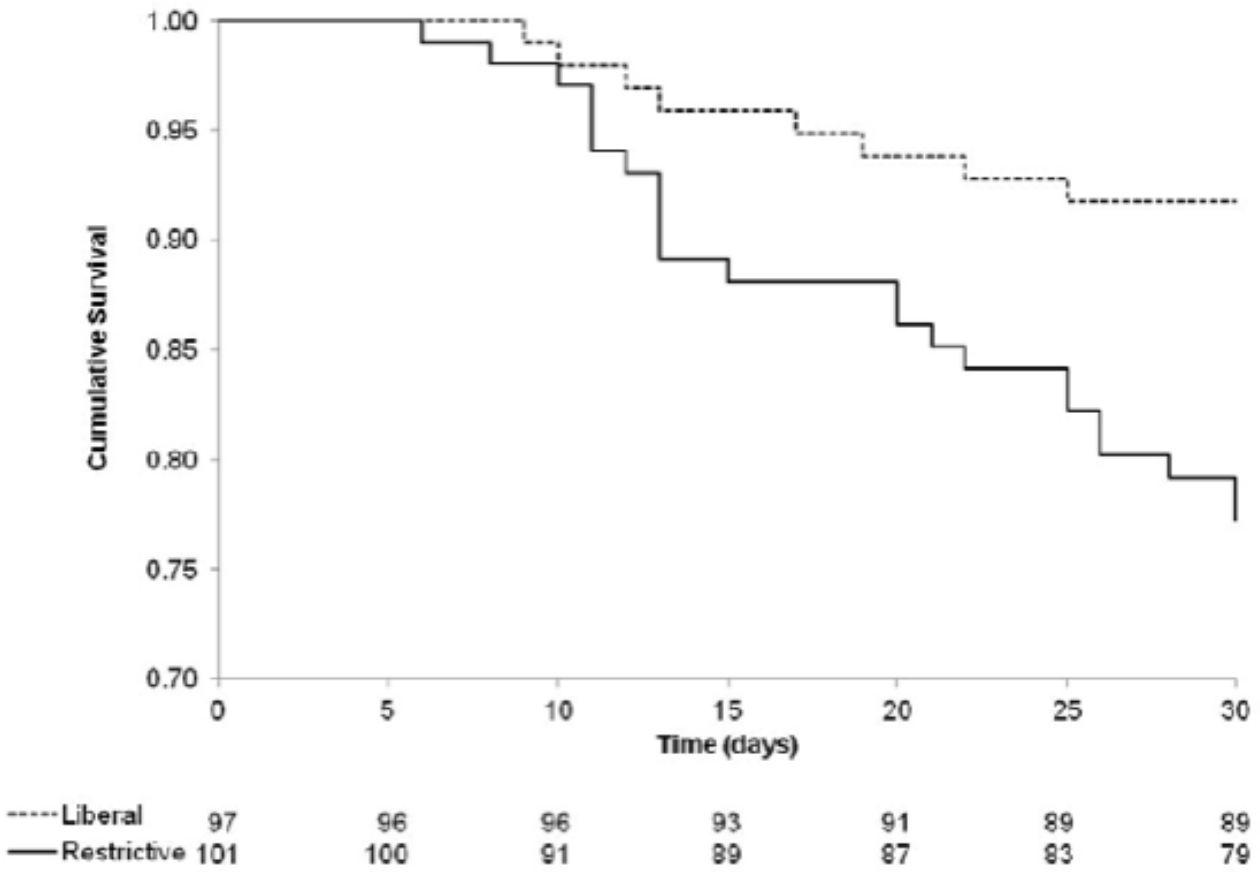


Fig. 2. Kaplan–Meier curves showing the probability of 30-day survival in patients randomized to a restrictive strategy of erythrocyte transfusion (transfusion when hemoglobin concentration <7 g/dl) and those randomized to a liberal strategy (transfusion when hemoglobin concentration <9 g/dl). The *P* value was calculated with the use of the log-rank test.

INAPPROPRIATEZZA

Intraoperative transfusion practices in Europe

J. Meier[1,*], D. Filipescu[2], S. Kozek-Langenecker[3], J. Llau Pitarch[4], S. Mallett[5], P. Martus[6] and I. Matot[7] and the ETPOS collaborators

[1]Clinic of Anesthesiology and Intensive Care Medicine, Faculty of Medicine of the Kepler University Linz, Linz, Austria, [2]Emergency Institute of Cardiovascular Disease, University Bucharest, Bucharest, Romania, [3]Department of Anesthesiology and Intensive Care Medicine, EKH Evangelic Hospital Vienna, Vienna, Austria, [4]Department of Anesthesiology and Intensive Care Medicine, Hospital Clínico Universitario de Valencia, Valencia, Spain, [5]Department of Anesthesiology, Royal Free Hospital Hampstead NHS Trust, London, UK, [6]Clinical Epidemiology, Eberhard Karls University Tübingen, Tübingen, Germany, and [7]Department of Anesthesiology & Intensive Care Medicine & Pain, Tel Aviv Medical Centre, Tel Aviv, Israel

British Journal of Anaesthesia, 116 (2): 255–61 (2016)

doi: 10.1093/bja/aev456
Clinical Practice

Intraoperative transfusion practices in Europe

J. Meier[1,*], D. Filipescu[2], S. Kozek-Langenecker[3], J. Llau Pitarch[4], S. Mallett[5], P. Martus[6] and I. Matot[7] and the ETPOS collaborators

British Journal of Anaesthesia, 116 (2): 255–61 (2016)

Editor's key points

- There is marked variation in blood transfusion practices.
- Most transfusions given intraoperatively are for hypotension or other indicators of tissue hypoperfusion.
- A transfusion threshold or trigger is less relevant in the intraoperative setting.
- Single unit red cell transfusions should be used more often.

Appropriateness of Allogeneic Red Blood Cell Transfusion: The International Consensus Conference on Transfusion Outcomes

Aryeh Shander, Arlene Fink, Mazyar Javidroozi, Jochen Erhard, Shannon L. Farmer, Howard Corwin, Lawrence Tim Goodnough, Axel Hofmann, James Isbister, Sherri Ozawa, and Donat R. Spahn, for the International Consensus Conference on Transfusion Outcomes Group

doi:10.1016/j.tmrv.2011.02.001

TRASFUSIONI DI GRC:

Appropriate 11,8%

Inappropriate 59,3%

Uncertain 28,9%

Perioperative inappropriate red blood cell transfusions significantly increase total costs in elective surgical patients, representing an important economic burden for hospitals

Andrea Saporito[1,2], Davide La Regina[1,3], Axel Hofmann[4,5], Lorenzo Ruinelli[6], Alessandro Merler[6], Francesco Mongelli[1,3]*, Kevin M. Trentino[5] and

TYPE Original Research
PUBLISHED 30 August 2022
DOI 10.3389/fmed.2022.956128

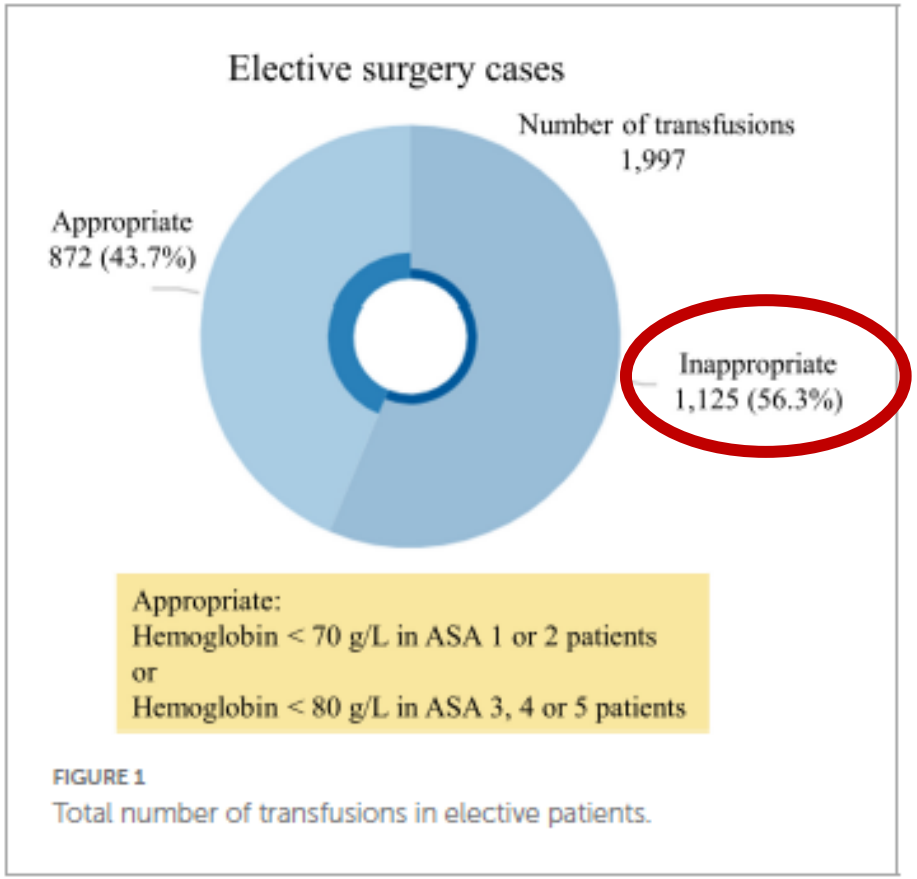
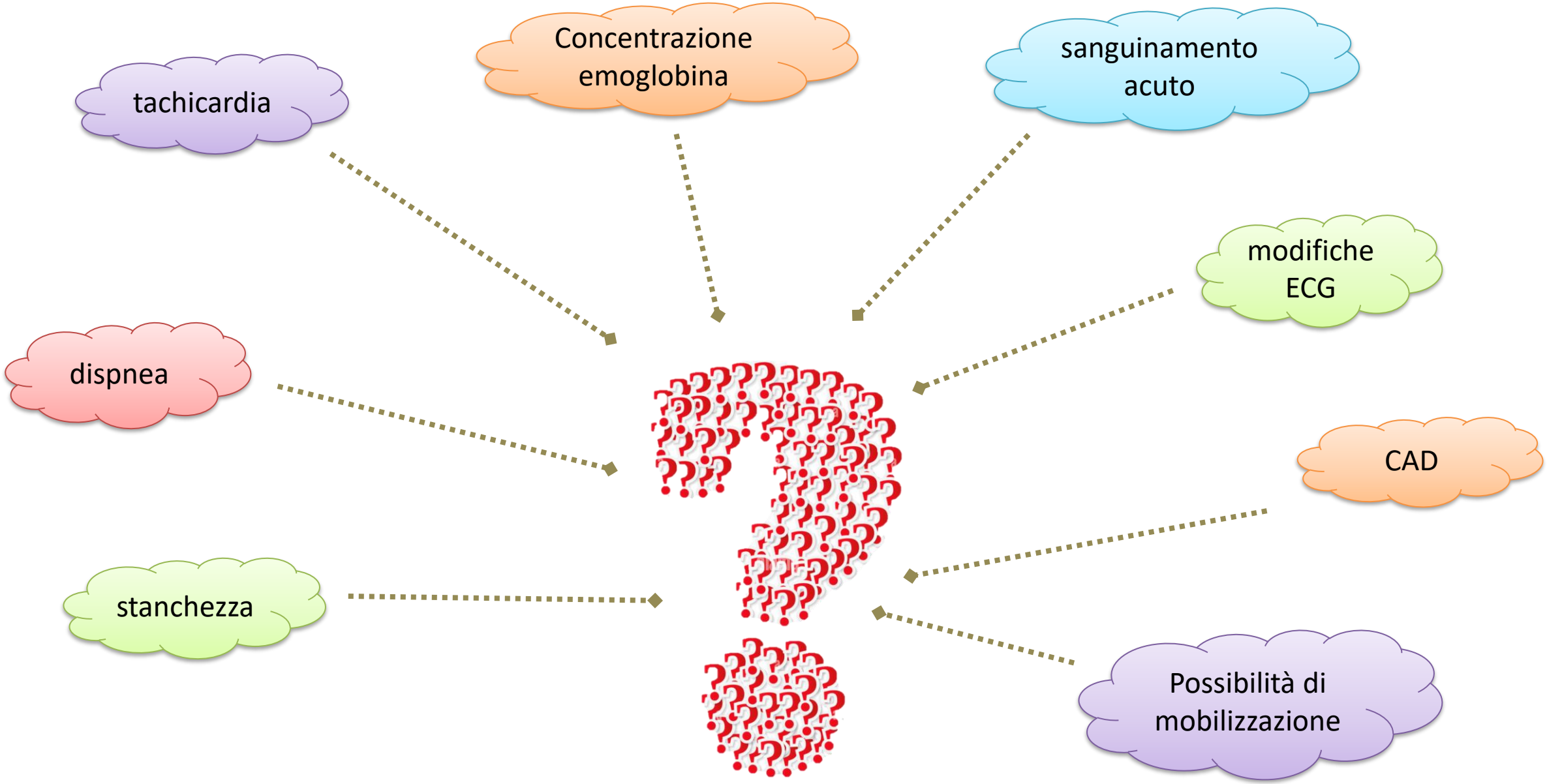


FIGURE 1
Total number of transfusions in elective patients.


tachicardia
Concentrazione emoglobina
sanguinamento acuto
modifiche ECG
dispnea
CAD
stanchezza
Possibilità di mobilizzazione

Bruin et al. Critical Care (2019) 23:309
https://doi.org/10.1186/s13054-019-2591-6

Critical Care

RESEARCH Open Access

Transfusion practice in the non-bleeding critically ill: an international online survey—the TRACE survey

Sanne de Bruin[1,2], Thomas W. L. Scheeren[3], Jan Bakker[4,5,6], Robin van Bruggen[2], Alexander P. J. Vlaar[1*]

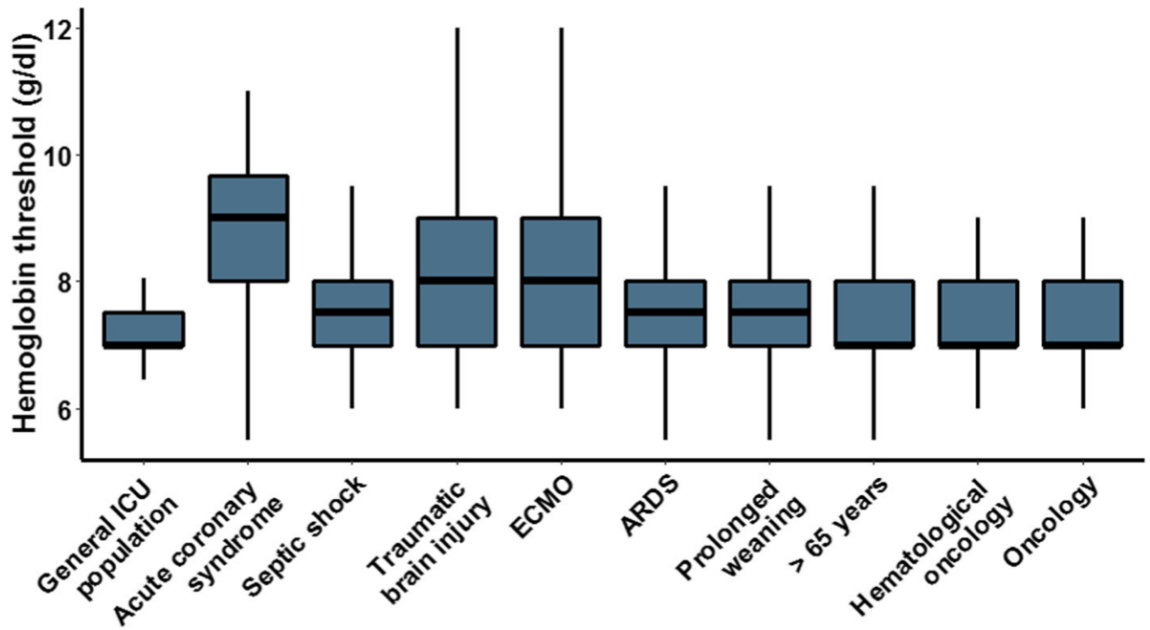


Fig. 1 Respondents were asked which Hb threshold they used for RCC transfusion in the general ICU population and different subpopulations. Respondents used in the general population a Hb threshold of 7.0 g/dL (7.0–7.5). This is significantly lower ($p < 0.001$) compared to patients with acute coronary syndrome (9.0 g/dL (8–9.7)), septic shock (7.5 g/dL (7.0–8.0)), acute brain injury (8.0 g/dL (7.0–9.0)), patients undergoing ECMO (8.0 (7.0–9.0) g/dL), issues of prolonged weaning (7.5 g/dL (7.0–8.0)), or patients with ARDS (7.5 g/dL (7.0–8.0)). No statistical differences were observed between the general ICU population and patients older than 65 years and patients with (haematological) oncology (all three groups were transfused at a Hb threshold of 7.0 g/dL (7.0–7.5))

Bruin et al. Critical Care (2019) 23:309
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Critical Care

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Transfusion practice in the non-bleeding critically ill: an international online survey—the TRACE survey

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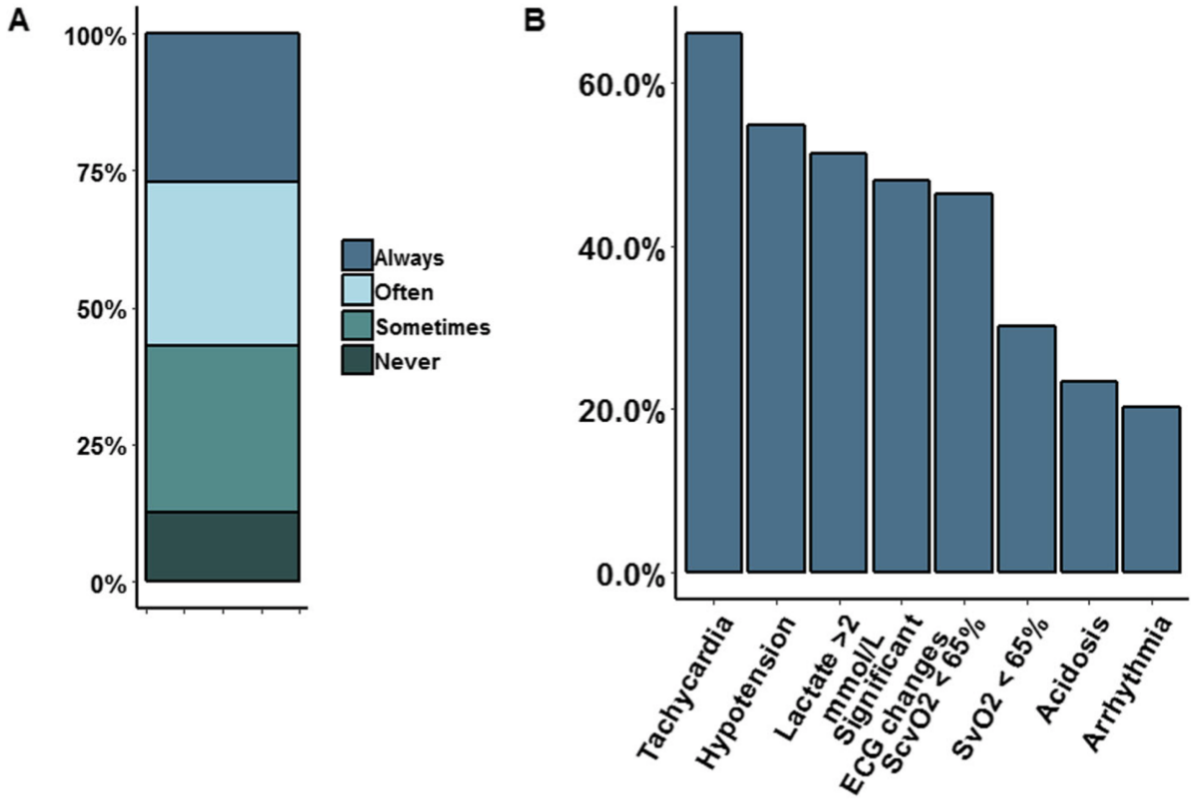

Fig. 2 a, **b** The use of transfusion triggers in addition to a haemoglobin threshold

Ottimizziamo il Delivery

$$DO_2 = CaO_2 \times CO$$

$$DO_2 = [(1.34 \times SaO_2 \times [Hb]) + paO_2 \times 0{,}003] \times FC \times SV$$

Article

Journal of Intensive Care Medicine
1-12

DOI: 10.1177/0885066615571901
jic.sagepub.com
SAGE

Anemia and Transfusion in Critical Care: Physiology and Management

Elena Spinelli, MD[1] and Robert H. Bartlett, MD[1]

Abstract

Objective: The objective of this report is to review the physiology and management of anemia in critical care. Selected publications on physiology and transfusion related to anemia and critical care, including the modern randomized trials of conservative versus liberal transfusion policy, were used. Anemia is compensated and tolerated in most critically ill patients as long as oxygen delivery is at least twice oxygen consumption. There are risks to blood transfusion which can be minimized by blood banking practice. The availability of cultured red cells may allow correction of anemia without significant risk. The benefit of transfusion in anemia must be weighted against the risk in any specific patient. **Conclusion and Recommendation:** In a criticially ill patient, anemia should be managed to avoid oxygen supply dependency (oxygen delivery less than twice comsumption) and to maintain moderate oxygen delivery reserve ($DO_2/VO_2 > 3$).

Keywords

anemia, transfusion, critical care

Quali altri triggers ?

TRANSFUSION MEDICINE
Official Journal of the British Blood Transfusion Society
British Blood Transfusion Society
Transfusion Medicine | REVIEW ARTICLE

Best practice in critical care: anaemia in acute and critical illness

A. B. Docherty,[1] A. F. Turgeon[2] & T. S. Walsh[1]

[1]*Department of Anaesthesia, Critical Care and Pain Medicine, University of Edinburgh, Edinburgh, UK, and* [2]*CHU de Québec-Université Laval, Quebec, Canada*

Received 2 November 2017; accepted for publication 11 December 2017

MEASUREMENT OF OXYGEN DELIVERY

We have no accurate way to measure oxygen delivery. At present, arterial oxygen saturation and PaO_2 remain the principal clinical measures of arterial hypoxaemia. Mixed venous oxygen tension approximates to mean tissue oxygen tension and is useful to detect global decreases in tissue perfusion. However, normal mixed venous oxygen tension does not rule out regional inadequate oxygen delivery, and in fact, both low and elevated measurements are associated with a poor outcome in septic patients (De Backer & Durand, 2014). Blood lactate is frequently used in combination with these measurements as a surrogate measure of tissue hypoxia: inadequate cellular oxygenation results in anaerobic metabolism and production of lactic acid. However, lactate has a poor sensitivity and specificity to detect microcirculatory alterations (De Backer *et al.*, 2013).

Oxygen consumption is a potential surrogate measure, as this falls when delivery can no longer meet meta
This critical value of oxygen delivery was es
8.2 mL^{-1} min^{-1} kg^{-1} (Shibutani *et al.*, 1983),
hypoxia is suggested if oxygen consumption
value. Although potentially possible in a cont
setting, there are too many uncontrolled fac
impact oxygen consumption in the clinical settir
detect the fall due to inadequate delivery. In adc
measurement is difficult.

Gastric tonometry measures the partial pressure of CO_2 in the stomach. When the perfusion of gastric mucosa is reduced, CO_2 accumulates, and this can be used in combination with systemic bicarbonate concentrations to evaluate the adequacy of gastrointestinal mucosal perfusion (Deschamps *et al.*, 2016). Trials have used this to guide inotropic/vasopressor therapy and

In summary, currently available technologies for assessing oxygen delivery and/or tissue oxygenation lack sufficient precision and discriminant value to guide blood transfusions in routine clinical practice.

Near-infrared spectroscopy (NIRS) uses near-infrared light to compare the ratio of oxygenated to deoxygenated Hb, resulting in an indirect measure of tissue oxygenation (StO_2). It has been mainly used in cardiac surgery (Edmonds & Jr., 2006) and neonatal (Plomgaard *et al.*, 2016) and paediatric intensive care, and there is now increased interest in exploring its use in sep-
nd neurocritical care (Messerer *et al.*, 2012). There is
e intra- and inter-patient variability in the estima-
al oxygenation using NIRS. StO_2 values are mostly
by venous HbO_2 saturation, and this proportion
een underlying conditions – in haemorrhage, e.g. the
nponent is significantly reduced. NIRS is unable to
usion heterogeneity, so the interpretation of StO_2 is difficult as it does not represent capillary or mixed venous saturation. There is heterogeneity among studies assessing NIRS in the ICU (Green *et al.*, 2016). At present, NIRS is not used routinely in adult general ICUs.

Transfusion. 2009 Apr;49(4):682-8.

The clinical utility of an index of global oxygenation for guiding red blood cell transfusion in cardiac surgery.

Orlov D[1], O'Farrell R, McCluskey SA, Carroll J, Poonawala H, Hozhabri S, Karkouti K.

TABLE 3. Hb concentrations and O_2ERs

	Transfusion episodes (n = 62)*		
	Baseline O_2ER >30% (n = 27)	Baseline O_2ER ≤ 30% (n = 35)	p Value
Hb concentration (g/L)			
Before transfusion	78.1 ± 7.6 (27)	78.3 ± 16.7 (35)	NS
After transfusion			
15 min	87.0 ± 8.3 (20)	88.5 ± 22.3 (30)	NS
2 hr	86.8 ± 8.94 (19)	87.5 ± 19.6 (32)	NS
Change from baseline			
15 min	+9.24 ± 11.7 (20)	+10.8 ± 9.3 (30)	NS
2 hr	+9.51 ± 12.4 (19)	+9.46 ± 9.4 (32)	NS
O_2ER (%)			
Before transfusion	39.8 ± 9.0 (27)	23.1 ± 4.9 (35)	<0.001
After transfusion			
15 min	33.4 ± 10.2 (20)	23.9 ± 7.8 (26)	<0.001
2 hr	33.3 ± 9.1 (17)	24.7 ± 8.2 (30)	0.001
Change from baseline			
15 min	−5.2 ± 7.8 (20)	+0.7 ± 5.8 (26)	0.004
2 hr	−3.8 ± 8.0 (17)	+1.4 ± 7.0 (30)	0.02

* Data are reported as mean ± SD. Data were not available for all measures; the number of episodes used for each analysis is shown in parentheses. NS = not significant.

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annales françaises d' ANESTHÉSIE ET DE RÉANIMATION

Annales Françaises d'Anesthésie et de Réanimation 28 (2009) 522–530

Article original

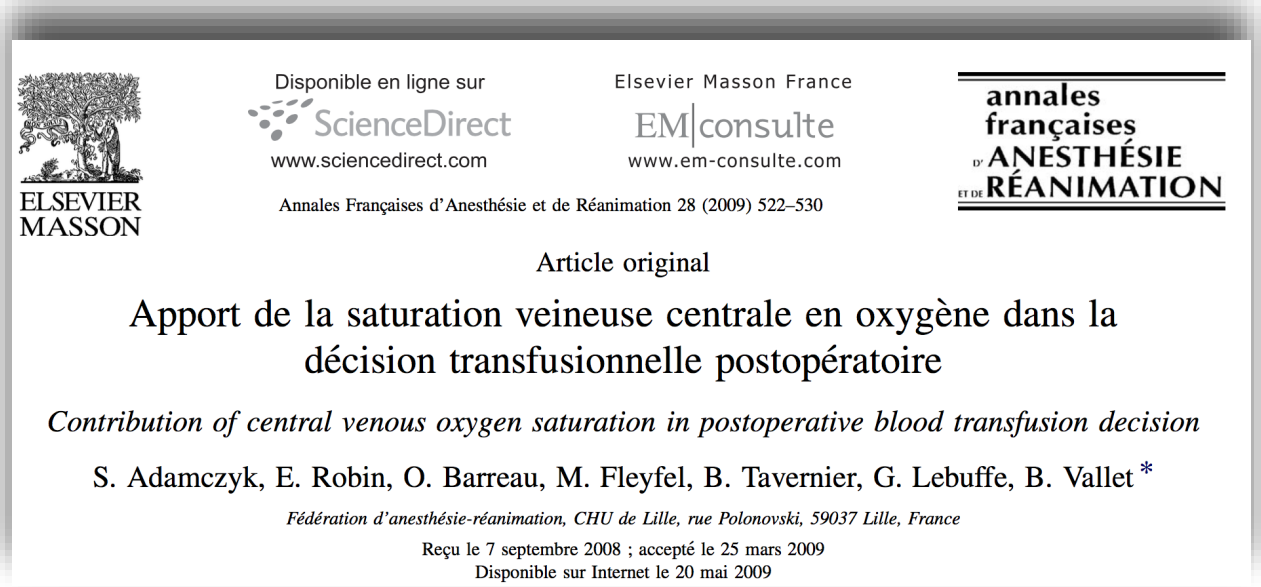
Apport de la saturation veineuse centrale en oxygène dans la décision transfusionnelle postopératoire

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 *

Fédération d'anesthésie-réanimation, CHU de Lille, rue Polonovski, 59037 Lille, France

Reçu le 7 septembre 2008 ; accepté le 25 mars 2009
Disponible sur Internet le 20 mai 2009



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Reçu le 7 septembre 2008 ; accepté le 25 mars 2009
Disponible sur Internet le 20 mai 2009

ScVO2 >70% - 54.4% trasfusioni in guidelines, → trasfusi in eccesso

ScVO2 <70% - 13 pz trasfusioni off guidelines → buon risultato

Transfusion and Apheresis Science 59 (2020) 102770

Contents lists available at ScienceDirect

Transfusion and Apheresis Science

journal homepage: www.elsevier.com/locate/transci

Clinical implications of using non-invasive haemoglobin monitoring for red blood cell transfusion decision in hip arthroplasty

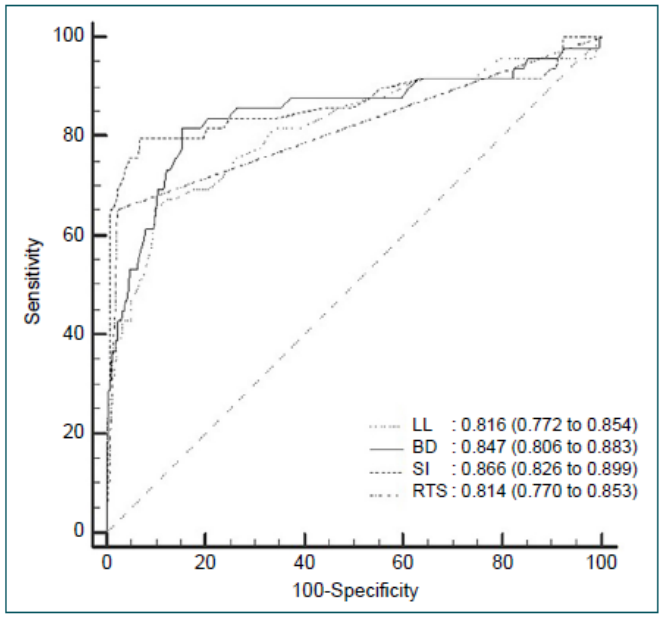
Cristiana Campos[a], José Calheiros[a], Matthias Kreuzer[b], Raquel Fernandes[a], Carla Pinto[a], Manuel Seabra[a], Sérgio Vide[a,*]

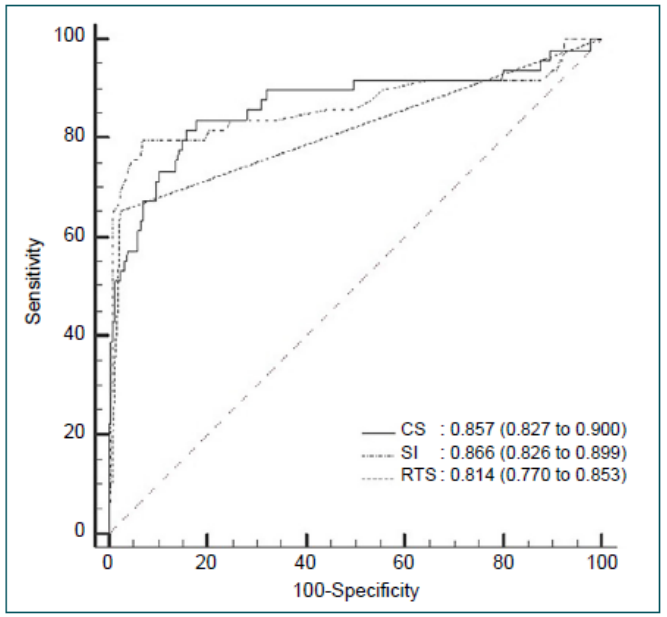
ORIGINAL ARTICLE

Ulus Travma Acil Cerrahi Derg 2022;28(5):599-606 DOI: 10.14744/tjtes.2021.02404

Lactate and base deficit combination score for predicting blood transfusion need in blunt multi-trauma patients

Engin Ozakin, M.D.,[1] Nazli Ozcan Yazlamaz, M.D.,[1] Filiz Baloglu Kaya, M.D.,[1]
Mustafa Emin Canakci, M.D.,[1] Muzaffer Bilgin, M.D.[2]





In our study, lactate and BD measurements were well correlated with physiological, laboratory, SI and RTS. Furthermore, univariate analysis showed that SI, lactate and BD measurements are effective in predicting the need for blood transfusion.

The interesting point of our study is the threshold value determined by CS may be more valuable than the single measurements of SI, RTS, lactate and BD in determining the need for blood transfusion.

Journal of Pediatric Surgery 57 (2022) 202–207

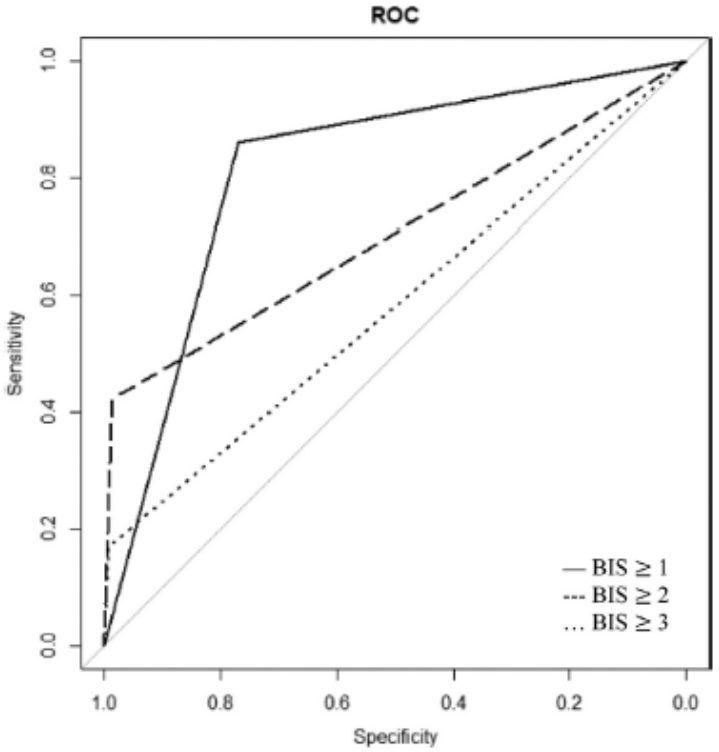
Contents lists available at ScienceDirect

Journal of Pediatric Surgery

journal homepage: www.elsevier.com/locate/jpedsurg.org

Novel tool (BIS) heralds the need for blood transfusion and/or failure of non-operative management in pediatric blunt liver and spleen injuries

Jenny Stevens[a,b,*], Ryan Phillips[a,b], Maxene Meier[c], Marina L Reppucci[a,b], Shannon Acker[a], Niti Shahi[a,b], Gabrielle Shirek[a,b], Denis Bensard[a,1], Steven Moulton[a,1]



Building on these encouraging findings, we developed the BIS score by combining SIPA with two easily measurable indicators of shock: base deficit (BD) and International Normalized Ratio (INR). This score combines measures of acidosis, coagulopathy, and hemodynamic reserve, all of which have independently been shown to predict the need for blood product transfusions in pediatric trauma patients. We initially evaluated the ability of the BIS score to predict massive transfusion (MT) and/or mortality in pediatric trauma patients at our institution. Our data demonstrated that this scoring system was highly sensitive for predicting both outcomes, and a BIS score ≥ 2 was the best predictor of both need for MT and mortality (sensitivity—98% with an area under the curve (AUC) of 0.81). This initial work is in the process of publication. The aim of the current study was to evaluate the ability of the BIS score to predict the need for blood product transfusions and/or failure of NOM in pediatric patients with BLSI. We hypothesize that the BIS score will be a sensitive predictor of both outcomes.

The novel BIS score is a highly sensitive bedside scoring tool that can identify pediatric trauma patients with BLSI at risk for blood product transfusions and/or failure of NOM. A BIS score ≥ 1 was the most sensitive predictor of both need for blood product transfusion and failure of NOM, while a BIS score ≥ 2 was the most specific for predicting both trauma outcomes. These findings demonstrate that children and adolescents with BLSI with concomitant shock, acidosis, and coagulopathy are more likely to require early blood product transfusions and are at risk of requiring surgical intervention.

Received: 22 September 2021 | Revised: 3 March 2022 | Accepted: 9 March 2022
DOI: 10.1111/vox.13274

REVIEW

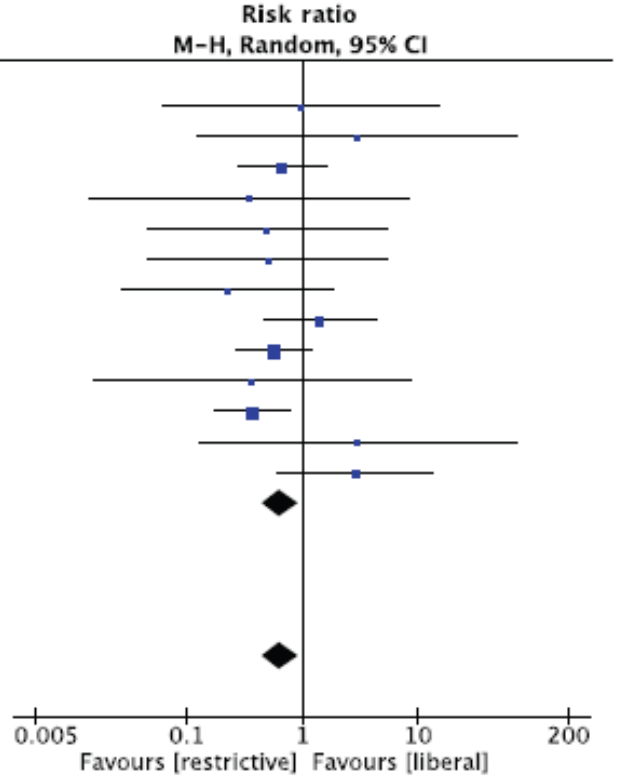
Vox Sanguinis ISBT International Society of Blood Transfusion

Impact of restrictive red blood cell transfusion strategy on thrombosis-related events: A meta-analysis and systematic review

Mairehaba Maimaitiming[1] | Chenxiao Zhang[2] | Jingui Xie[3,4] | Zhichao Zheng[2] | Haidong Luo[5] | Oon Cheong Ooi[5]

Eventi tromboembolici

Study or subgroup	Restrictive Events	Restrictive Total	Liberal Events	Liberal Total	Weight	Risk ratio M-H, Random, 95% CI
1.1.1 all						
Almeida 2015	1	101	1	97	1.9%	0.96 [0.06–15.14]
Carson 1998	1	42	0	42	1.4%	3.00 [0.13–71.61]
Carson 2011	8	1007	12	1005	17.8%	0.67 [0.27–1.62]
Carson 2013	0	54	1	55	1.4%	0.34 [0.01–8.15]
Fan 2014	1	94	2	92	2.5%	0.49 [0.05–5.30]
Foss 2009	1	60	2	60	2.5%	0.50 [0.05–5.37]
Gobatto 2019	1	23	4	21	3.2%	0.23 [0.03–1.88]
Grover 2006	7	109	5	109	11.3%	1.40 [0.46–4.28]
Jairath 2015	9	242	23	350	24.9%	0.57 [0.27–1.20]
Nielsen 2014	0	30	1	33	1.4%	0.37 [0.02–8.65]
Robertson 2014	8	99	22	101	24.4%	0.37 [0.17–0.79]
Shehata 2012	1	25	0	25	1.4%	3.00 [0.13–70.30]
Walsh 2013	6	51	2	49	5.9%	2.88 [0.61–13.60]
Subtotal (95% CI)		**1937**		**2039**	**100.0%**	**0.65 [0.44–0.94]**
Total events	44		75			
Heterogeneity: $\tau^2 = 0.00$; $\chi^2 = 10.79$, df = 12 ($p = 0.55$); $I^2 = 0\%$						
Test for overall effect: $Z = 2.28$ ($p = 0.02$)						
Total (95% CI)		**1937**		**2039**	**100.0%**	**0.65 [0.44, 0.94]**
Total events	44		75			
Heterogeneity: $\tau^2 = 0.00$; $\chi^2 = 10.79$, df = 12 ($p = 0.55$); $I^2 = 0\%$						
Test for overall effect: $Z = 2.28$ ($p = 0.02$)						
Test for subgroup differences: Not applicable						



HUMANITAS GAVAZZENI

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REVIEW

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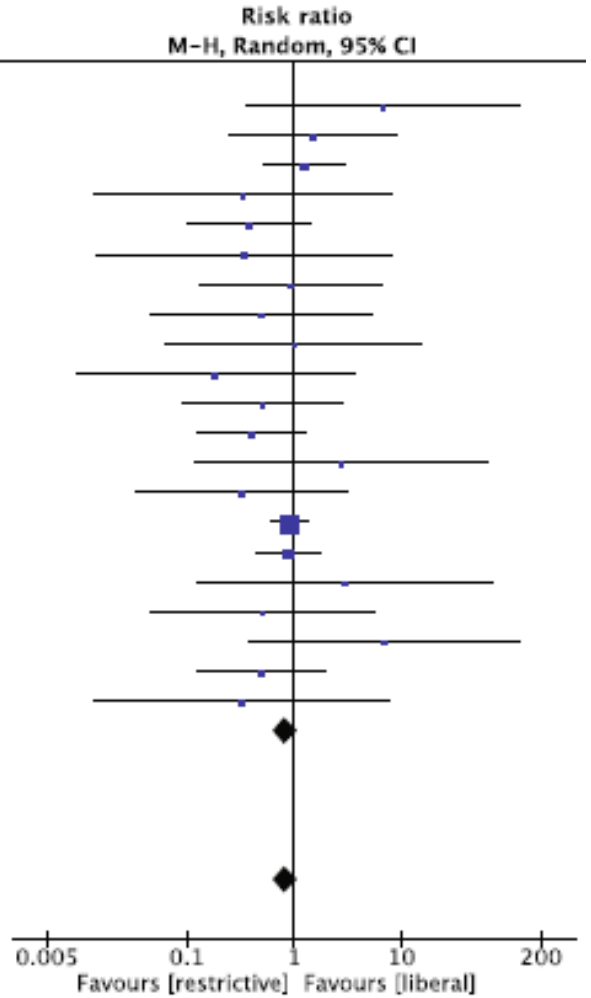
Impact of restrictive red blood cell transfusion strategy on thrombosis-related events: A meta-analysis and systematic review

Mairehaba Maimaitiming[1] | Chenxiao Zhang[2] | Jingui Xie[3,4] | Zhichao Zheng[2] | Haidong Luo[5] | Oon Cheong Ooi[5]

Eventi cerebrovascolari

Study or subgroup	Restrictive Events	Restrictive Total	Liberal Events	Liberal Total	Weight	Risk ratio M-H, Random, 95% CI
1.2.1 all						
Almeida 2015	3	101	0	97	0.8%	6.73 [0.35–128.52]
Bergamin 2017	3	151	2	149	2.3%	1.48 [0.25–8.73]
Bracey 1999	11	212	9	216	9.7%	1.25 [0.53–2.94]
Carson 1998	0	42	1	42	0.7%	0.33 [0.01–7.96]
Carson 2011	3	1007	8	1005	4.1%	0.37 [0.10–1.41]
Carson 2013	0	54	1	55	0.7%	0.34 [0.01–8.15]
Ducrocq 2021	2	342	2	324	1.9%	0.95 [0.13–6.69]
Fan 2014	1	94	2	92	1.3%	0.49 [0.05–5.30]
Foss 2009	1	60	1	60	0.9%	1.00 [0.06–15.62]
Gobatto 2019	0	23	2	21	0.8%	0.18 [0.01–3.61]
Hajjar 2010	2	249	4	253	2.5%	0.51 [0.09–2.75]
Holst 2014	4	488	10	489	5.4%	0.40 [0.13–1.27]
Johnson 1992	1	20	0	18	0.7%	2.71 [0.12–62.70]
Koch 2017	1	363	3	354	1.4%	0.33 [0.03–3.11]
Mazer 2017	45	2428	49	2429	44.5%	0.92 [0.62–1.37]
Murphy 2015	15	989	17	985	15.1%	0.88 [0.44–1.75]
Møller 2019	1	29	0	29	0.7%	3.00 [0.13–70.74]
Robertson 2014	1	99	2	101	1.3%	0.51 [0.05–5.54]
Shehata 2012	3	25	0	25	0.8%	7.00 [0.38–128.87]
Villanueva 2013	3	444	6	445	3.8%	0.50 [0.13–1.99]
Walsh 2013	0	51	1	49	0.7%	0.32 [0.01–7.68]
Subtotal (95% CI)		**7271**		**7238**	**100.0%**	**0.83 [0.64–1.09]**
Total events	100		120			
Heterogeneity: $\tau^2 = 0.00$; $\chi^2 = 13.47$, df = 20 ($p = 0.86$); $I^2 = 0\%$						
Test for overall effect: $Z = 1.35$ ($p = 0.18$)						
Total (95% CI)		**7271**		**7238**	**100.0%**	**0.83 [0.64, 1.09]**
Total events	100		120			
Heterogeneity: $\tau^2 = 0.00$; $\chi^2 = 13.47$, df = 20 ($p = 0.86$); $I^2 = 0\%$						
Test for overall effect: $Z = 1.35$ ($p = 0.18$)						
Test for subgroup differences: Not applicable						



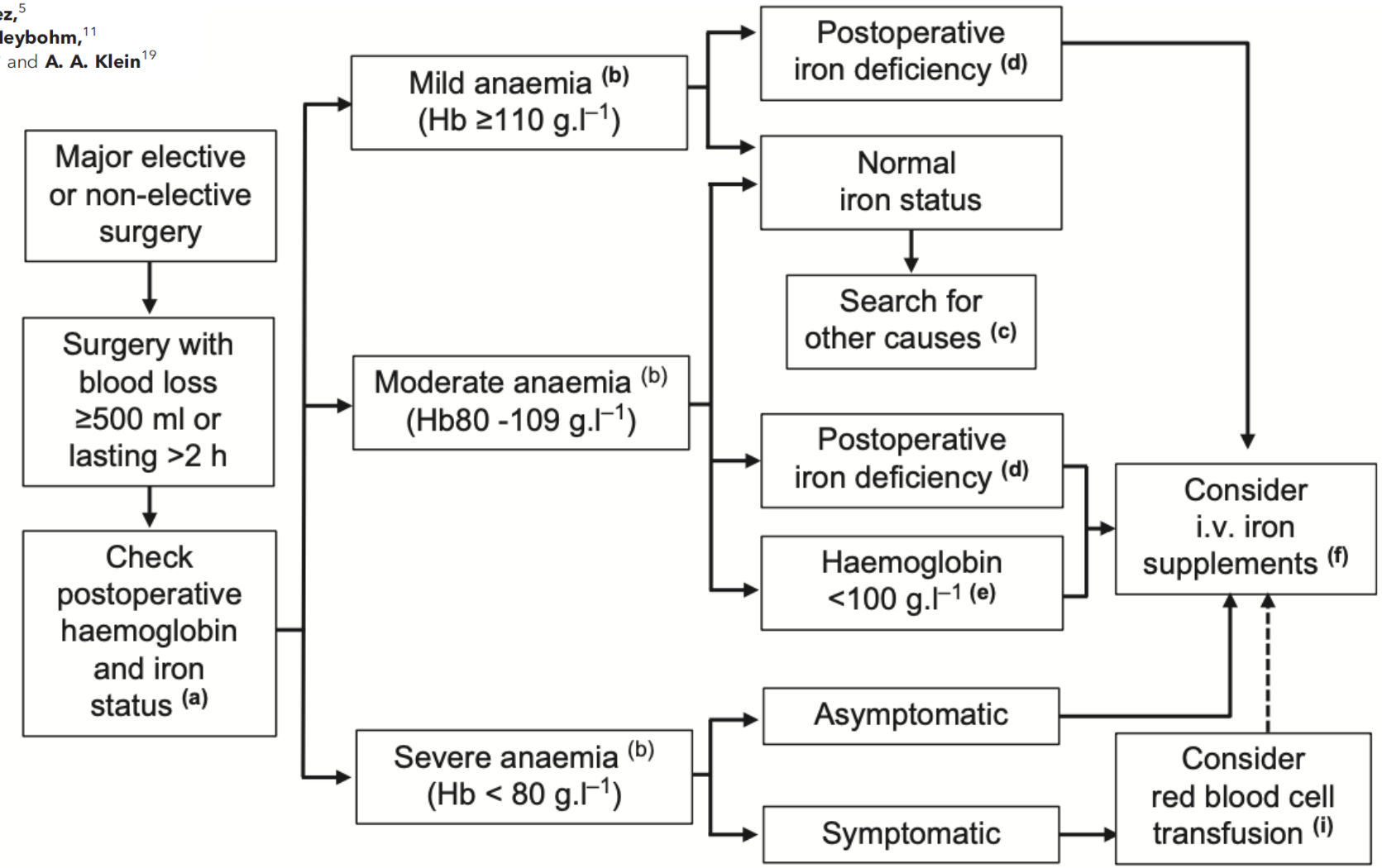
HUMANITAS GAVAZZENI

Anaesthesia 2019, 73, 1418–1431 doi:10.1111/anae.14358

Review Article

An international consensus statement on the management of postoperative anaemia after major surgical procedures

M. Muñoz,[1] A. G. Acheson,[2] E. Bisbe,[3] A. Butcher,[4] S. Gómez-Ramírez,[5] A. A. Khalafallah,[6,7] H. Kehlet,[8] S. Kietaibl,[9] G. M. Liumbruno,[10] P. Meybohm,[11] R. Rao Baikady,[12] A. Shander,[13,14] C. So-Osman,[15,16] D. R. Spahn[17,18] and A. A. Klein[19]



Question 3: Do restrictive or liberal strategies have an impact on the postoperative complication rate or the length of hospital stay?

R5.3 — The experts suggest considering the individual clinical condition, the surgical risk and the balance between oxygen supply and tissue extraction of each patient rather than a theoretical transfusion threshold value.

EXPERT OPINION (STRONG AGREEMENT)

THANK YOU!

HUMANITAS
GAVAZZENI