



CONSORCI  
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VALÈNCIA



# Actitud transfusional individualizada en el postoperatorio del paciente crítico.

¿Cual es la hemoglobina con la que hemos de transfundir?  
¿Otros parámetros?

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Valencia 28 de Febrero de 2017

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2. EPIDEMIOLOGIA
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5. EFECTOS ADVERSOS
6. SITUACIONES CLÍNICAS
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# INTRODUCCIÓN

## Guidelines on the management of anaemia and red cell transfusion in adult critically ill patients

Andrew Retter, Duncan Wyncoll, Rupert Pearse, Damien Carson, Stuart McKechnie, Simon Stanworth, Shubha Allard, Dafydd Thomas, Tim Walsh, British Committee for Standards in Haematology

- Resumen de la literatura actual sobre las transfusión en pacientes críticos
- Pacientes criticos: diferente edad, diagnostico, comorbilidades, severidad....
- Manejo de la anemia en pacientes críticos de causa no hemorrágica



# EPIDEMIOLOGIA

## UNIDAD DE CRITICOS

- 60% Anemia
- 20-30% < 9g/dl
- A los 7 días  
↳ 80% < 9 g/dl



**FUERTE ASOCIACIÓN  
ENTRE ANEMIA Y PEORES  
RESULTADOS**

## Definición anemia ( OMS )

- Mujeres < 12 g/dl
- Hombres < 13 g/dl
- Grave < 8 g/dl



# EPIDEMIOLOGIA

## UNIDAD DE CUIDADOS CRÍTICOS

SE LLEVA EL 10% DE LAS TRANSFUSIONES



Pacientes en UCI transfundidos  
( 30 – 50 % )



10% POR SANGRADO



90% POR ANEMIA



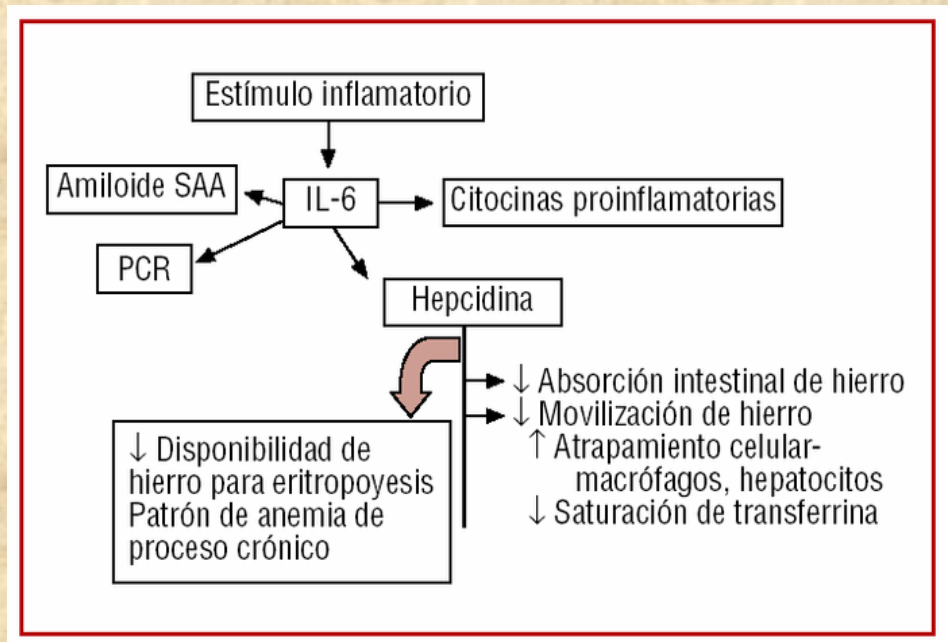
# CAUSAS DE ANEMIA EN CRITICOS

## CAUSAS PRINCIPALES

- HEMODILUCIÓN
- PÉRDIDAS DE SANGRE
- MUESTRAS DE SANGRE

EN LOS PRIMEROS DIAS

## ANEMIA DE PROCESOS CRÓNICOS



# OBJETIVOS EN EL PACIENTE CRÍTICO

CORRECTA OXIGENACIÓN TISULAR



DEPENDE DEL APORTE DE O<sub>2</sub> ( DO<sub>2</sub> )



- HEMOGLOBINA

- OTROS FACTORES

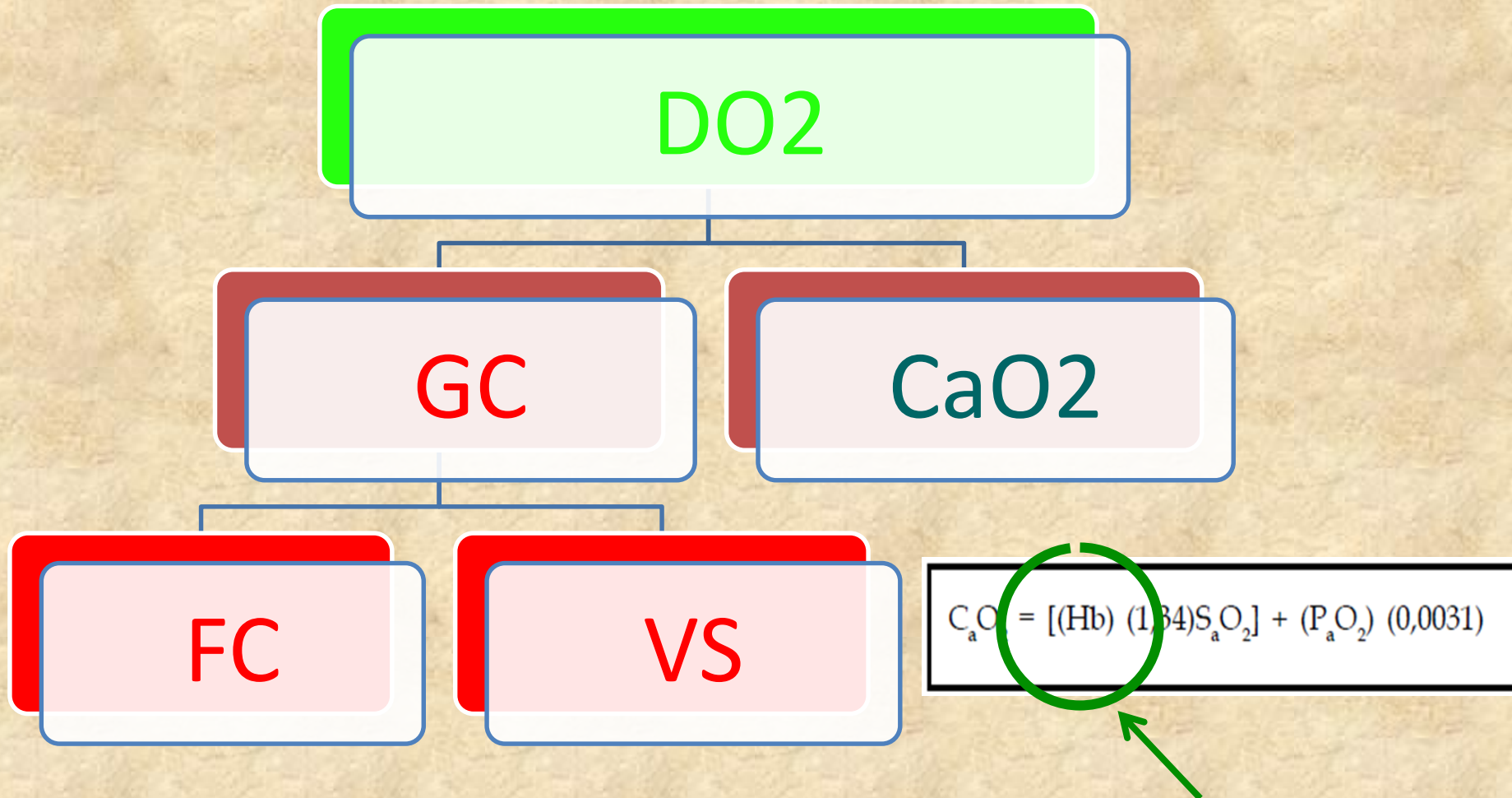
CAPACIDAD PULMONAR

FUNCIÓN CARDIACA

FLUJO MICROVASCULAR



# APORTE DE OXÍGENO





# APORTE DE OXÍGENO



EL CONTENIDO ARTERIAL DE OXÍGENO  
Depende de la Hemoglobina



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# APORTE DE OXÍGENO

## NO SÓLO DEPENDE DE LA Hb

**Gasto cardíaco = Volumen sistólico x Frecuencia cardíaca**



$$C_aO_2 = [(Hb) (1,34)S_aO_2] + (P_aO_2) (0,0031)$$



# FISIOPATOLOGIA EN EL PACIENTE CRITICO

## PACIENTE SANO

↓ Hb

### MECANISMO COMPENSATORIOS

↑ GASTO CARDIACO

CAMBIOS  
EN LA VENTILACIÓN PULMONAR

CAMBIOS EN LAS RESISTENCIAS ARTERIALES



↑ **EXTRACCIÓN DE O<sub>2</sub>**



**CORRECTA OXIGENACIÓN TISULAR**

## PACIENTE CRITICO

↓ Hb

**AUMENTO DE DEMANDAS**



**HIPOXIA TISULAR**

PEOR TOLERANCIA  
A LA ANEMIA



# TRANSFUSIONES EN PACIENTE CRITICO

PACIENTES CON Hb < 9 g/dl

## GRUPO " LIBERAL "

( OBJETIVO: Hb 10-12 g/dl )



- 54% recibió menos transfusiones
- 33% Ninguna

## GRUPO " RESTRICTIVO "

( OBJETIVO: Hb 7-9 g/dl )



Todos fueron transfundidos

ESTUDIO TRICC ( Hebert, et al 1999 )

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# TRANSFUSIONES EN PACIENTE CRITICO

PACIENTES CON Hb < 9 g/dl

## GRUPO " LIBERAL "

( OBJETIVO: Hb 10-12 g/dl )



Mortalidad: 23.3%

## GRUPO " RESTRICTIVO "

( OBJETIVO: Hb 7-9 g/dl )



Mortalidad: 18.7%

**NO DIFERENCIAS ESTADISTICAMENTE SIGNIFICATIVAS**



# TRANSFUSIONES EN PACIENTE CRITICO

PACIENTES CON Hb < 9 g/dl

**GRUPO " LIBERAL "**

( OBJETIVO: Hb 10-12 g/dl )

**GRUPO " RESTRICTIVO "**

( OBJETIVO: Hb 7-9 g/dl )

**SUBGRUPO DE PACIENTES  
< 55 AÑOS  
APACHE SCORE < 20**

MORTALIDAD A LOS 30 DÍAS

**13.0%**

**5.7 %**

**SIGNIFICATIVAMENTE MENOR**



# OTRAS OPCIONES

## HIERRO/ERITROPOYETINA

- Disminuye los requerimientos de transfusiones de forma muy modesta
- Incrementa riesgo de TVP



**Uso no indicado críticos**

## TECNICAS DE AHORRO DE SANGRE

- Uso de botes pediátricos
- Sistemas de ahorro de extracción de sangre



# TRANSFUSIONES EN CRITICOS

## PLASMA FRESCO

13% >> FFP  40 % No sangrantes con coagulación normal o ligeramente alterada

Tratamiento: Sangrado en pacientes con alteración de la coagulación

---

**NO**

Profilaxis en pacientes no-sangrantes + coagulación anormal  
Reversión inmediata de la warfarina  
Hepatopatías con INR < 1,7

**DOSIS : 12-15 mL /Kg**

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# TRANSFUSIONES EN CRITICOS

## PLAQUETAS

### Indication

### Transfusion threshold or target

**Nonbleeding patients without severe sepsis  
or haemostatic abnormalities**

**Not indicated**

**Prophylaxis in nonbleeding patients with severe sepsis  
or haemostatic abnormalities**

**Threshold  $20 \times 10^9 / L$**

**DIC with bleeding**

**Maintain  $>50 \times 10^9 / L$**

**Platelet dysfunction with nonsurgically correctable  
bleeding (e.g. postcardiopulmonary bypass  
or potent antiplatelet drugs)**

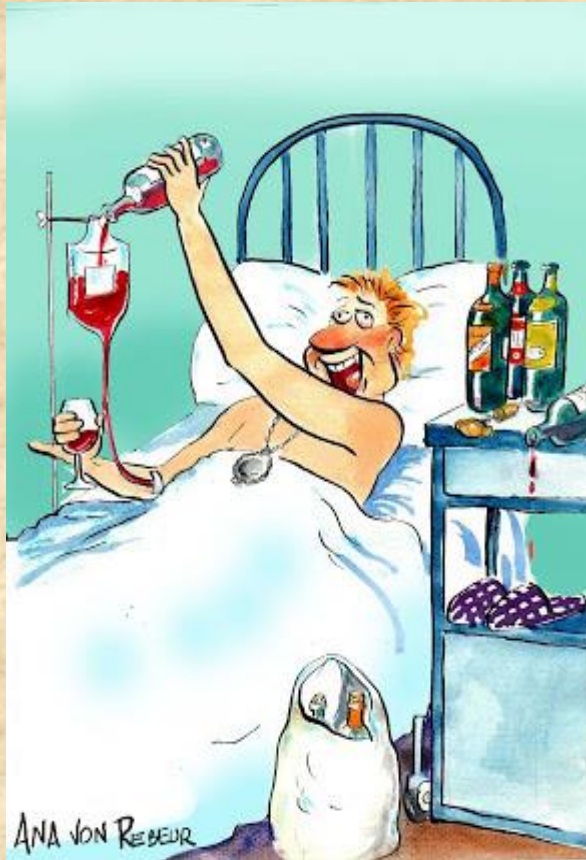
**May bleed despite a normal platelet count.  
Transfusion of one adult therapeutic dose  
and repeat according to clinical response**

**Major haemorrhage and massive transfusion**

**Maintain  $>75 \times 10^9 / L$  ( $>100 \times 10^9 / L$  if multiple  
trauma or trauma to the central nervous  
system or inner eye)**



# EFECTOS ADVERSOS TRANSFUSIONALES



## EFECTOS ADVERSOS DE LA TRANSFUSIÓN

### ➤ Complicaciones agudas: ❖ Complicaciones retardadas:

#### ➤ Inmunológicas:

- Rc hemolítica aguda.
- Rc febril no hemolítica.
- Rc alérgica.
- TRALI.
- Aloinmunización con destrucción plaquetaria.

#### ➤ No Inmunológicas:

- Contaminación bacteriana.
- Sobrecarga circulatoria.
- Hemólisis no inmune.
- Rc hipotensivas.

#### ❖ Inmunológicas:

- ❖ Rc hemolítica retardada.
- ❖ Aloinmunización frente Ag.
- ❖ Enfermedad injerto contra huésped postransfusional.
- ❖ Púrpura postransfusional.
- ❖ Inmunomodulación.

#### ❖ No Inmunológicas:

- ❖ Transmisión de agentes infecciosos.
- ❖ Hemosiderosis postransfusional.



Original Investigation

# Health Care–Associated Infection After Red Blood Cell Transfusion A Systematic Review and Meta-analysis

Jeffrey M. Rohde, MD; Derek E. Dimcheff, MD, PhD; Neil Blumberg, MD; Sanjay Saint, MD, MPH;  
Kenneth M. Langa, MD, PhD; Latoya Kuhn, MPH; Andrew Hickner, MSI; Mary A. M. Rogers, PhD

JAMA. 2014;311(13):1317-1326.

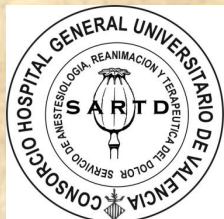
**CONCLUSIONS AND RELEVANCE** Among hospitalized patients, a restrictive RBC transfusion strategy was associated with a reduced risk of health care–associated infection compared with a liberal transfusion strategy. Implementing restrictive strategies may have the potential to lower the incidence of health care–associated infection.

Selección de 18 artículos

Mayor número de infecciones en el grupo liberal

└───┬───> Excepto en

**Cardiopatas  
Críticos  
Sangrantes ( GI )**



**Tabla 2** Criterios para la definición de la lesión pulmonar aguda producida por transfusión (Canadian Blood Service and Hema-Quebec)

**Criterios de TRALI**

**LPA:**

- a. Comienzo agudo
- b. Hipoxemia:  $PO_2/FiO_2 < 300$  mmHg o  $SaO_2 < 90\%$  respirando aire ambiente
- c. Rx de tórax: infiltrados bilaterales
- d. No hay evidencia de aumento de presión en la aurícula izquierda.

No existencia de LPA previa a la transfusión

Aparición durante las primeras 6 h de la transfusión

*Sin relación temporal con otros factores de riesgo para la LPA*

**Posible TRALI**

**LPA**

No existencia de LPA previa a la transfusión

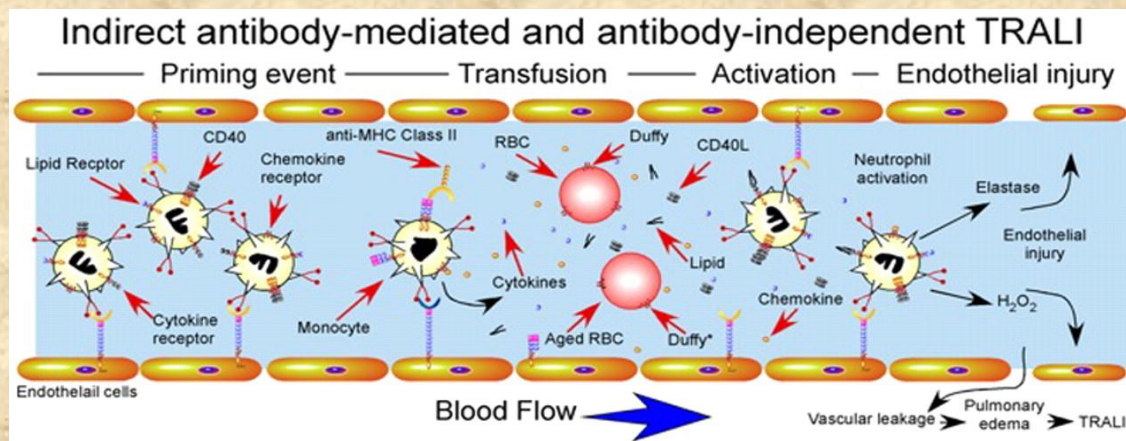
Aparición durante las 6 primeras horas de la transfusión

*Relación temporal clara con otras causas de LPA*

Adaptado de Kleinman et al<sup>4</sup>.

LPA: lesión pulmonar aguda; Rx: radiografía; TRALI: *transfusion related acute lung injury* 'lesión pulmonar aguda producida por transfusión'.

# TRALI





# INSUFICIENCIA RESPIRATORIA Y TRANSFUSIÓN

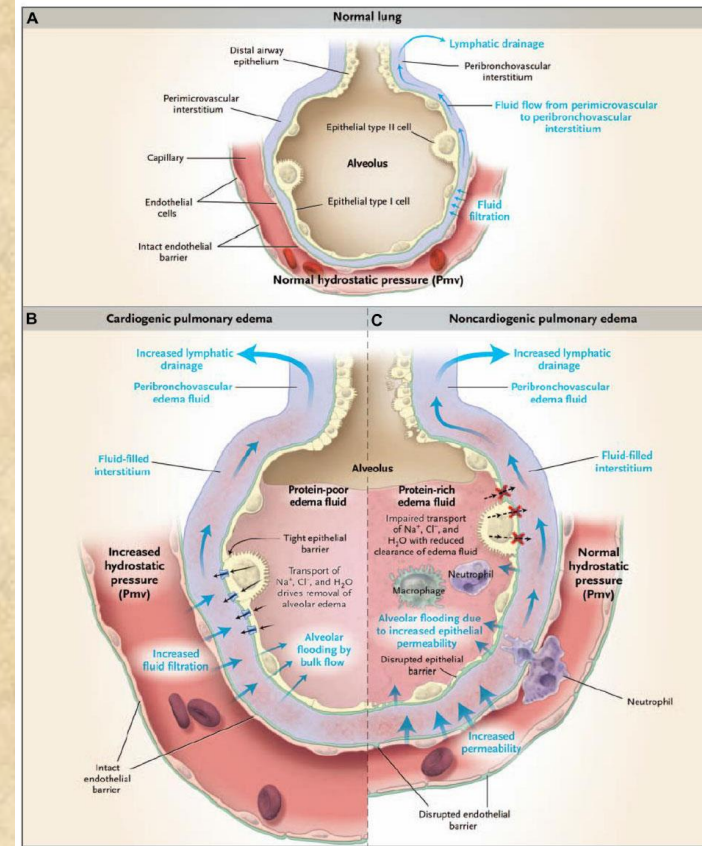
**TRALI:** "Lesión pulmonar aguda asociada a transfusión"

## DIAGNÓSTICO DIFERENCIAL: "TACO"

*"EDEMA PULMONAR SECUNDARIO A SOBRECARGA DURANTE LA TRANSFUSION ó TRANSFUSION ACUTE CIRCULATORY OVERLOAD"*



MANAGEMENT



# | TACO |

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# “ STRANGER DANGER- MORTALITY AFTER TRANSFUSIONS ”

*British Journal of Anaesthesia 118 (3 ): 20-2 ( 2017 )*

- 1. Transfusiones más restrictivas en críticos no se asocian con peores resultados*
- 2. TRICC: No diferencias de resultados en transfundir con Hb < 7 g/dl o < 10 g/dl*
- 3. Efecto inmunosupresor de las transfusiones*
  - Mejorar la supervivencia después del trasplante renal*
  - Reducción enfermedades inflamatorias crónicas*
  - Incremento recidiva resecciones malignas*
  - Incremento infección bacterianas durante el postoperatorio*



# CONOCIENDO ESTO .....

¿¿¿¿ CUAL ES EL MEJOR MOMENTO ????



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# ¿ CUANDO TRANSFUNDIMOS ?



## ***INDIVIDUALIZAR***

- Estabilidad hemodinámica
- Antecedentes médicos del paciente
- Situación por la que ingresa
- Causa anemización





# Pulmonary Artery Catheter Use During Cardiac Surgery in the United States, 2010 to 2014



Ethan Y. Brovman, MD,\* Rodney A. Gabriel, MD,\* Richard P. Dutton, MD, MBA,† and  
Richard D. Urman, MD, MBA\*

*Journal of Cardiothoracic and Vascular Anesthesia*, Vol 30, No 3 (June), 2016: pp 579–584

**Conclusions: Pulmonary artery catheter use remains a mainstay of cardiac anesthesia practice. No significant change in the incidence of intraoperative death was noted, but patients with a PAC were less likely to have blood transfused.**

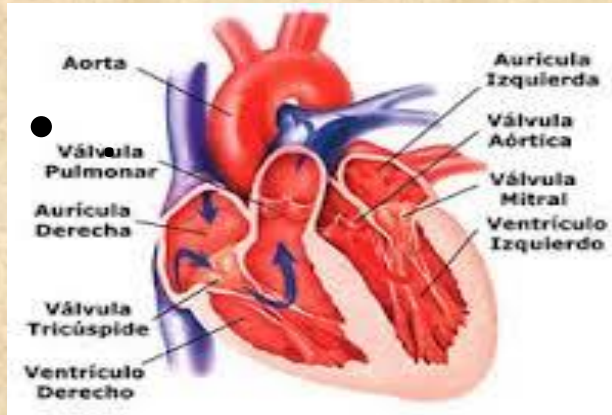
- Pacientes sometidos a cirugía cardíaca
- No diferencia de mortalidad entre grupos
- Transfusión: 75% menor en el grupo de cohorte



# ¿ QUE CIFRA ?



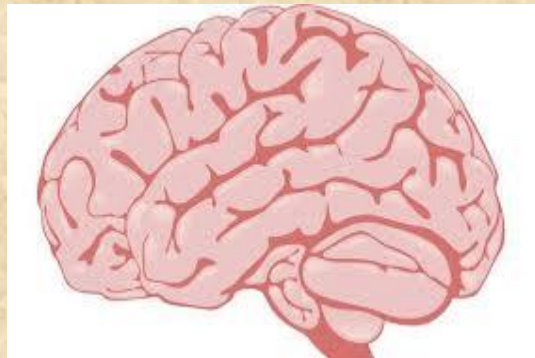
# SITUACIONES CLÍNICAS



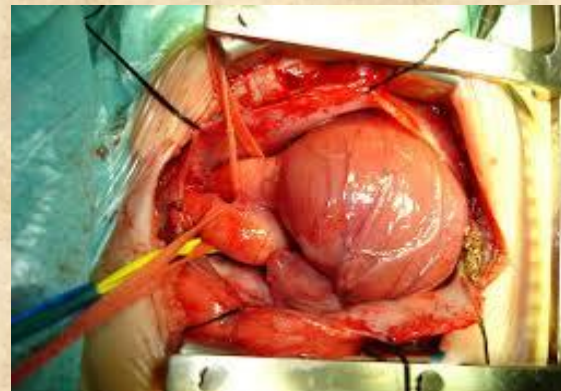
**CARDIOPATIA ISQUÉMICA**



**SEPSIS**



**DAÑO CEREBRAL**



**CIRUGIA CARDIACA**



# SEPSIS

- Primera causa de admisión en UCI
- Daño en la oxigenación tisular

Fallo respiratorio  
Alteración función cardíaca  
Alteraciones microcirculación



FINALIDAD



MEJORAR EL APORTE DE O<sub>2</sub> A LOS TEJIDOS

# SEPSIS

## FASE AGUDA

( Hipoxia tisular )

Objetivo: Mejorar el aporte de O<sub>2</sub>

Monitorización: ScvO<sub>2</sub>, SvO<sub>2</sub>, lacticos



< 70% ( CH, Dobutamina .. ) << Hb > 10 g/dl

Resultados: Disminución mortalidad

## FASE ESTABLECIDA



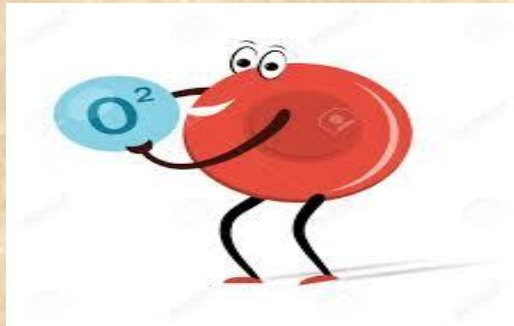
NO BENEFICIO

CLINICO UNA VEZ  
ESTABLECIDO EL FALLO  
ORGÁNICO

Hb > 7-9 g/dl



# PACIENTE NEUROCRÍTICO



Flujo cerebral sangre

Contenido arterial de O<sub>2</sub>

## APORTE DE O<sub>2</sub> CEREBRAL

**Objetivo:** Mantener un adecuado D<sub>O<sub>2</sub></sub> <<< Prevenir la isquemia cerebral

↑ Hc << ↑ Viscosidad << ↓ FCS <<< ISQUEMIA

**No está claro que la terapia restrictiva sea segura en pacientes neurocríticos**

Corwin, et al 2004



# PACIENTE NEUROCRITICO

## TCE

### Isquemia cerebral

Mantener adecuado DO<sub>2</sub> cerebral



Anemia se asocia con peores resultados

**No diferencia de mortalidad en pacientes del grupo restrictivo frente al liberal**

Trauma cerebral <<<< Hb > 7-9 g/ dl

Trauma cerebral + Isquemia <<<< Hb > 9 g/dl

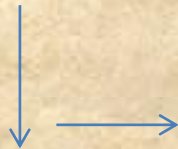


# PACIENTE NEUROCRITICO

HSA

## Isquemia cerebral

Mantener adecuado DO<sub>2</sub> cerebral



Anemia se asocia con peores resultados

Transfusión se asocia con reducción de la mortalidad

Hb > 8- 10 g/dl

Dhar, et al 2009, Sheth, et al 2011



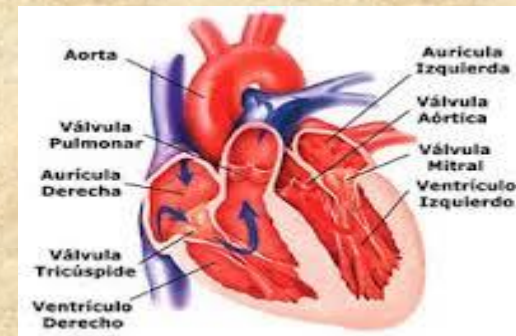


# PACIENTE CARDIOPATA

## ISQUEMIA CRONICA

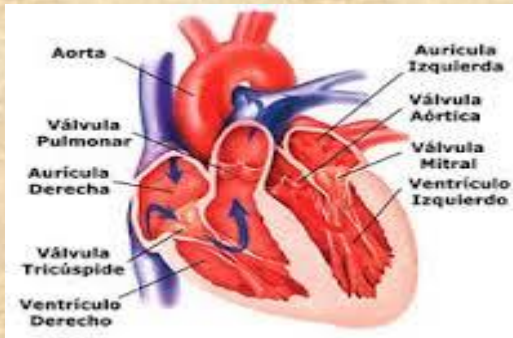
Hb > 7 g/dl

- Asociación entre anemia y mortalidad
- Hb < 10 g/dl se asocia con exceso de mortalidad
- Estudio TRICC no más efectos adversos en terapias más restrictivas
- Carson, et al 2011: No diferencias de mortalidad o efectos CV entre ambas estrategias



# PACIENTE CARDIOPATA

## SINDROME CORONARIO AGUDO



Hb > 8 -9 g/dl

Coronary Artery Disease

**Liberal versus restrictive transfusion thresholds for patients with symptomatic coronary artery disease**



## **Liberal versus restrictive transfusion thresholds for patients with symptomatic coronary artery disease**

**Background** Prior trials suggest it is safe to defer transfusion at hemoglobin levels above 7 to 8 g/dL in most patients. Patients with acute coronary syndrome may benefit from higher hemoglobin levels.

**Methods** We performed a pilot trial in 110 patients with acute coronary syndrome or stable angina undergoing cardiac catheterization and a hemoglobin <10 g/dL. Patients in the liberal transfusion strategy received one or more units of blood to raise the hemoglobin level  $\geq 10$  g/dL. Patients in the restrictive transfusion strategy were permitted to receive blood for symptoms from anemia or for a hemoglobin <8 g/dL. The predefined primary outcome was the composite of death, myocardial infarction, or unscheduled revascularization 30 days post randomization.

**Results** Baseline characteristics were similar between groups except age (liberal, 67.3; restrictive, 74.3). The mean number of units transfused was 1.6 in the liberal group and 0.6 in the restrictive group. The primary outcome occurred in 6 patients (10.9%) in the liberal group and 14 (25.5%) in the restrictive group (risk difference = 15.0%; 95% confidence interval of difference 0.7% to 29.3%;  $P = .054$  and adjusted for age  $P = .076$ ). Death at 30 days was less frequent in liberal group ( $n = 1$ , 1.8%) compared to restrictive group ( $n = 7$ , 13.0%;  $P = .032$ ).

**Conclusions** The liberal transfusion strategy was associated with a trend for fewer major cardiac events and deaths than a more restrictive strategy. These results support the feasibility of and the need for a definitive trial. (Am Heart J 2013;165:964-971.e1.)

# Effect of restrictive versus liberal transfusion strategies on outcomes in patients with cardiovascular disease in a non-cardiac surgery setting: systematic review and meta-analysis

Annemarie B Docherty,<sup>1,2</sup> Rob O'Donnell,<sup>2</sup> Susan Brunskill,<sup>3</sup> Marialena Trivella,<sup>3</sup> Carolyn Doree,<sup>4</sup> Lars Holst,<sup>5</sup> Martyn Parker,<sup>6</sup> Merete Gregersen,<sup>7</sup> Juliano Pinheiro de Almeida,<sup>8</sup> Timothy S Walsh,<sup>1,2</sup> Simon J Stanworth<sup>3,9</sup>

**BMJ 2016;352:i1351**

## CONCLUSIONS

The results show that it may not be safe to use a restrictive transfusion threshold of less than 80 g/L in patients with ongoing acute coronary syndrome or chronic cardiovascular disease. Effects on mortality and other outcomes are uncertain. These data support the use of a more liberal transfusion threshold (>80 g/L) for patients with both acute and chronic cardiovascular disease until adequately powered high quality randomised trials have been undertaken in patients with cardiovascular disease.

- **Cardiopatas sometidos a cirugía no cardíaca**
- **Las terapias restrictivas pueden ser no seguras**



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For numbered affiliations see end of article.

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Additional material is published online only. To view please visit the journal online.

Cite this as: *BMJ* 2016;352:i1351 <http://dx.doi.org/10.1136/bmj.i1351>

## ABSTRACT OBJECTIVE

To compare patient outcomes of restrictive versus liberal blood transfusion strategies in patients with cardiovascular disease not undergoing cardiac surgery.

## DESIGN

Systematic review and meta-analysis.

## DATA SOURCES

Randomised controlled trials involving a threshold for red blood cell transfusion in hospital. We searched (to 2 November 2015) CENTRAL, Medline, Embase, CINAHL, PubMed, LILACS, NHSBT Transfusion Evidence Library, ClinicalTrials.gov, WHO International Clinical Trials Registry Platform, ISRCTN Register, and EU Clinical Trials Register. Authors were contacted for data whenever possible.

## TRIAL SELECTION

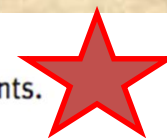
Published and unpublished randomised controlled trials comparing a restrictive with liberal transfusion threshold and that included patients with cardiovascular disease.

## DATA EXTRACTION AND SYNTHESIS

Data extraction was completed in duplicate. Risk of bias was assessed using Cochrane methods. Relative risk ratios with 95% confidence intervals were presented in all meta-analyses. Mantel-Haenszel random effects models were used to pool risk ratios.

## MAIN OUTCOME MEASURES

30 day mortality, and cardiovascular events.



## RESULTS

41 trials were identified: of these, seven included data on patients with cardiovascular disease. Data from a further four trials enrolling patients with cardiovascular disease were obtained from the authors. In total, 11 trials enrolling patients with cardiovascular disease (n=3033) were included for meta-analysis (restrictive transfusion, n=1514 patients; liberal transfusion, n=1519). The pooled risk ratio for the association between transfusion thresholds and 30 day mortality was 1.15 (95% confidence interval 0.88 to 1.50, P=0.50), with little heterogeneity (I<sup>2</sup>=14%). The risk of acute coronary syndrome in patients managed with restrictive compared with liberal transfusion was increased (nine trials; risk ratio 1.78, 95% confidence interval 1.18 to 2.70, P=0.01, I<sup>2</sup>=0%).

## CONCLUSIONS

The results show that it may not be safe to use a restrictive transfusion threshold of less than 80 g/L in patients with ongoing acute coronary syndrome or chronic cardiovascular disease. Effects on mortality and other outcomes are uncertain. These data support the use of a more liberal transfusion threshold (>80 g/L) for patients with both acute and chronic cardiovascular disease until adequately powered high quality randomised trials have been undertaken in patients with cardiovascular disease.

**- Ser menos restrictivos en cardiopatas ( Hb > 8 g/dl )**

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# Restrictive versus liberal transfusion strategy for red blood cell transfusion: systematic review of randomised trials with meta-analysis and trial sequential analysis

Lars B Holst,<sup>1</sup> Marie W Petersen,<sup>1</sup> Nicolai Haase,<sup>1</sup> Anders Perner,<sup>1</sup> Jørn Wetterslev<sup>2</sup>

**BMJ 2015;350:h1354**

## CONCLUSIONS

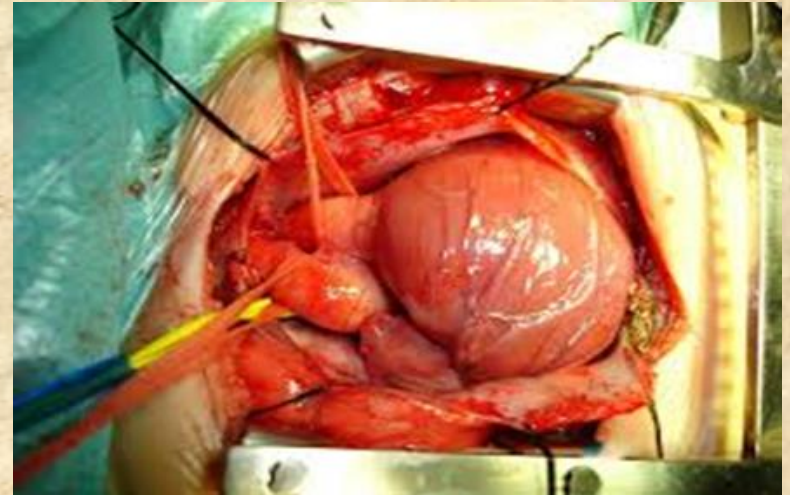
Compared with liberal strategies, restrictive transfusion strategies were associated with a reduction in the number of red blood cell units transfused and number of patients being transfused, but mortality, overall morbidity, and myocardial infarction seemed to be unaltered. Restrictive transfusion strategies are safe in most clinical settings. Liberal transfusion strategies have not been shown to convey any benefit to patients.

- Diferentes tipos de cirugías
- 9813 pacientes ( 31 estudios )
- No diferencias

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# CIRUGIA CARDIACA



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## Liberal or Restrictive Transfusion after Cardiac Surgery

Gavin J. Murphy, F.R.C.S., Katie Pike, M.Sc., Chris A. Rogers, Ph.D., Sarah Wordsworth, Ph.D., Elizabeth A. Stokes, M.Sc., Gianni D. Angelini, F.R.C.S., and Barnaby C. Reeves, D.Phil., for the TITRe2 Investigators\*

### BACKGROUND

Whether a restrictive threshold for hemoglobin level in red-cell transfusions, as compared with a liberal threshold, reduces postoperative morbidity and health care costs after cardiac surgery is uncertain.

### METHODS

We conducted a multicenter, parallel-group trial in which patients older than 16 years of age who were undergoing nonemergency cardiac surgery were recruited from 17 centers in the United Kingdom. Patients with a postoperative hemoglobin level of less than 9 g per deciliter were randomly assigned to a restrictive transfusion threshold (hemoglobin level <7.5 g per deciliter) or a liberal transfusion threshold (hemoglobin level <9 g per deciliter). The primary outcome was a serious infection (sepsis or wound infection) or an ischemic event (permanent stroke [confirmation on brain imaging and deficit in motor, sensory, or coordination functions], myocardial infarction, infarction of the gut, or acute kidney injury) within 3 months after randomization. Health care costs, excluding the index surgery, were estimated from the day of surgery to 3 months after surgery.

### RESULTS

A total of 2007 patients underwent randomization; 4 participants withdrew, leaving 1000 in the restrictive-threshold group and 1003 in the liberal-threshold group. Transfusion rates after randomization were 53.4% and 92.2% in the two groups, respectively. The primary outcome occurred in 35.1% of the patients in the restrictive-threshold group and 33.0% of the patients in the liberal-threshold group (odds ratio, 1.11; 95% confidence interval [CI], 0.91 to 1.34;  $P=0.30$ ); there was no indication of heterogeneity according to subgroup. There were more deaths in the restrictive-threshold group than in the liberal-threshold group (4.2% vs. 2.6%; hazard ratio, 1.64; 95% CI, 1.00 to 2.67;  $P=0.045$ ). Serious postoperative complications, excluding primary-outcome events, occurred in 35.7% of participants in the restrictive-threshold group and 34.2% of participants in the liberal-threshold group. Total costs did not differ significantly between the groups.

- Cirugía cardíaca no emergente

- No superioridad del “restrictivo”

### CONCLUSIONS

A restrictive transfusion threshold after cardiac surgery was not superior to a liberal threshold with respect to morbidity or health care costs. (Funded by the National Institute for Health Research Health Technology Assessment program; Current Controlled Trials number, ISRCTN70923932.)



**A multicentre randomised controlled trial of Transfusion Indication Threshold Reduction on transfusion rates, morbidity and health-care resource use following cardiac surgery (TITRe2)**

HEALTH TECHNOLOGY ASSESSMENT 2016 VOL. 20 NO. 60

**Conclusion**

A restrictive threshold is not superior to a liberal threshold after cardiac surgery.

- **Publicado en Agosto ( revisión del anterior estudio )**
- **Mayor mortalidad en pacientes del grupo restrictivo**



# Transfusion Requirements After Cardiac Surgery

## The TRACS Randomized Controlled Trial

*JAMA. 2010;304(14):1559-1567*

- Estudio aleatorizado, controlado, prospectivo
- 502 pacientes sometidos a By-pass cardiopulmonar

- Hc  $\geq$  30

- Hc  $\geq$  24

**Conclusion** Among patients undergoing cardiac surgery, the use of a restrictive perioperative transfusion strategy compared with a more liberal strategy resulted in noninferior rates of the combined outcome of 30-day all-cause mortality and severe morbidity.



# TRICS-III: Transfusion Requirements in Cardiac Surgery

An international, multi-centre, randomized controlled trial to assess transfusion thresholds in patients undergoing cardiac surgery

## Hypothesis

A lower hemoglobin concentration for red cell transfusion (restrictive transfusion strategy) will be non-inferior to a liberal strategy in terms of vital organ function (heart, brain and kidney) and mortality.

Restrictive transfusion group: patients will receive a red cell transfusion if their hemoglobin is  $<75$  g/L intraoperatively and/or postoperatively

Liberal transfusion strategy: patients will receive a red cell transfusion if their hemoglobin concentration is  $<95$  g/L intraoperatively, or postoperatively in the intensive care unit; or  $<85$  g/L on the ward.



# Comparison of Two Different Red Blood Cell Transfusion Thresholds on Short-Term Clinical Outcomes of Patients Undergoing Aortic Surgery With Deep Hypothermic Circulatory Arrest

Yongyuan Wang, BA, and Hongwen Ji, MD

**Objective:** Patients undergoing aortic surgery with deep hypothermic circulatory arrest (DHCA) usually are associated with a high rate of allogeneic blood transfusion, and their red blood cell (RBC) transfusion threshold is unclear and controversial. The purpose of this study was to explore whether a restrictive transfusion threshold was as effective as a liberal transfusion threshold for patients undergoing aortic surgery with DHCA.

**Design:** Retrospective, controlled study.

**Setting:** National Center for Cardiovascular Diseases and a university hospital, Beijing, China.

**Participants:** The study comprised 74 patients undergoing aortic surgery with DHCA from January 1 to December 31, 2014.

**Interventions:** Patients were divided retrospectively into the following 2 groups according to the RBC transfusion thresholds—the restrictive group received allogeneic RBC transfusion if the hemoglobin (Hb) level of the patient fell below 8 g/dL during the surgery, and in the liberal group the hemoglobin threshold for allogeneic transfusion was 10 g/dL.

**Measurements and Main Results:** Data on patient demographics, procedure characteristics, allogeneic blood use, and postoperative morbidity and mortality were collected and analyzed. In total, the restrictive group required fewer perioperative transfusions of RBCs ( $3.9 \pm 4.8$  v  $8.5 \pm 6.9$  units,  $p = 0.001$ ) and platelets ( $1.9 \pm 0.8$  v  $2.6 \pm 1.0$  units,  $p = 0.003$ ) compared with the liberal group. Postoperative mortality and complications, including 30-day mortality and bleeding requiring re-exploration, did not differ significantly between the 2 groups.

**Conclusions:** For patients undergoing aortic surgery with DHCA, a restrictive RBC transfusion threshold (Hb <8 g per deciliter) may be as effective as a liberal RBC transfusion threshold (Hb <10 g per deciliter) during the surgery, with similar short-term clinical outcomes and less allogeneic transfusion.

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**KEY WORDS:** red blood cell transfusion, circulatory arrest, deep hypothermia induced, aortic surgery

# CONCLUSIONES

- Cuadro isquémico
- Daño cerebral isquémico
- Síndrome coronario agudo
- Estados tempranos de la sepsis

LA TRANSFUSIÓN  
PODRÍA SER  
BENEFICIOSA



Is the patient anaemic and haemodynamically stable?

YES

Is the Hb >90 g/l?

YES

DO NOT  
TRANSFUSE

NO

Does the patient have acute  
coronary syndrome, severe sepsis  
or a neurological injury?

NO

GENERAL CRITICAL CARE

Use a default Hb trigger of <70 g/l with a target range 70–90 g/l

SEVERE SEPSIS

Early (< 6 h from onset) and  
evidence of tissue hypoxia  
- Target Hb 90–100 g/l  
Late (> 6 h from onset)  
- Target Hb >70 g/l

NEURO CRITICAL CARE

Traumatic brain injury  
and/or cerebral ischaemia  
- Target Hb 90 g/l  
Subarachnoid haemorrhage  
- Target Hb >80–100 g/l

ISCHAEMIC HEART DISEASE

Acute coronary syndrome  
- Target Hb >80–90 g/l  
Patient with stable angina  
- Target Hb >70 g/l

YES

Be **LESS** confident using an Hb trigger of 70 g/l (but  
target Hb should be between 70–90 g/l) **IF:**

- The patient is elderly with significant cardiorespiratory co-morbidities.
- The patient has evidence of inadequate oxygen supply to the tissues (high lactate or low ScvO<sub>2</sub>)

Be confident using an Hb trigger of 70 g/l **IF:**

- The patient is younger than 55 years.
- The patient's severity of illness is relatively low

# Clinical Practice Guidelines From the AABB 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

*JAMA*. 2016;316(19):2025-2035.

an individual patient. Recommendation 1: a restrictive RBC transfusion threshold in which the transfusion is not indicated until the hemoglobin level is 7 g/dL is recommended for hospitalized adult patients who are hemodynamically stable, including critically ill patients, rather than when the hemoglobin level is 10 g/dL (strong recommendation, moderate quality evidence). A restrictive RBC transfusion threshold of 8 g/dL is recommended for patients undergoing orthopedic surgery, cardiac surgery, and those with preexisting cardiovascular disease (strong recommendation, moderate quality evidence). The restrictive 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 do not apply to patients with acute coronary syndrome, severe thrombocytopenia (patients treated for hematological or oncological reasons who are at risk of bleeding), and chronic transfusion-dependent anemia (not recommended due to insufficient evidence). Recommendation 2: patients, including

**CONCLUSIONS AND RELEVANCE** Research in RBC transfusion medicine has significantly advanced the science in recent years and provides high-quality evidence to inform guidelines. A restrictive transfusion threshold is safe in most clinical settings and the current blood banking practices of using standard-issue blood should be continued.

# DIRECTRICES DE PRÁCTICA CLÍNICA DE LA AABB

ADULTOS  
HEMODINÁMICAMENTE  
ESTABLES



7 g/dl

TENIENDO EN CUENTA

NO SÓLO LA Hb  
DÉFICIT DE BASES  
LACTATO  
OTROS BIMARCADORES

CARDIOPATAS  
Y  
SOMETIDOS A CIRUGÍA  
CARDÍACA Y ORTOPÉDICA



8 g/dl





# GRACIAS



**SARTD-CHGUV Sesión de Formación Continuada**  
**Valencia 28 de Febrero de 2017**