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Transfusiones Pre-Quirúrgicas

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Anemia pre operatoria

Transfusiones Pre-quirúrgicas

- El reconocimiento y tratamiento de la anemia pre operatoria se considera hoy un elemento clave en la adecuada preparación pre operatoria.
- Existe un volumen creciente de literatura que demuestra una asociación independiente de la anemia con peores resultados peri operatorios.
- Incluso la anemia leve se asocia a mayor morbilidad, complicaciones, tiempo de hospitalización y mortalidad.

Objetivos

1. Definición, causas y prevalencia de anemia.
2. Impacto de la anemia en la morbimortalidad peri operatoria.
3. Alternativas para el tratamiento de la anemia perioperatoria.

Definición de anemia (OMS)

Edad o género	Umbral de Hemoglobina (g/dl)
Niños (0.5 a 4.99 años)	11
Niños (5 a 11.99 años)	11,5
Niños (12 a 14.99 años)	12
Mujeres (no embarazadas mayores de 15 años)	12
Mujeres embarazadas	11
Hombres (mayores de 15 años)	13

Adaptado de *Worldwide prevalence of anaemia 1993–2005 : WHO global database on anaemia / Edited by Bruno de Benoist,Erin McLean, Ines Egli and Mary Cogswell.*

Anaesthesia 2017, 72, 811–825

Editorial

Diagnostic criteria for pre-operative anaemia—time to end sex discrimination

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1. Las mujeres tienen mayores probabilidades de sufrir anemia que los hombres y tienen mayor riesgo de ser transfundidas.
2. La anemia pre operatoria se asocia a peores resultados.
3. Proponen una revisión de los criterios diagnósticos de anemia en mujeres (usar 13 gr/dl).

Causas de anemia

Table 1 Main causes of iron deficiency.

A. Increased demand
- Growth during infancy and childhood
- Treatment with erythropoiesis-stimulating agents

B. Limited supply
- Poor intake
- Inappropriate diet with deficit in bioavailable iron and/or ascorbic acid
- Malabsorption
  - Gastric resection
  - *Helicobacter pylori* infection (even without significant bleeding)
  - Malabsorption syndromes (Crohn's disease and celiac disease)
- Drug interference (gastric anti-acid agents and antisecretory drugs)

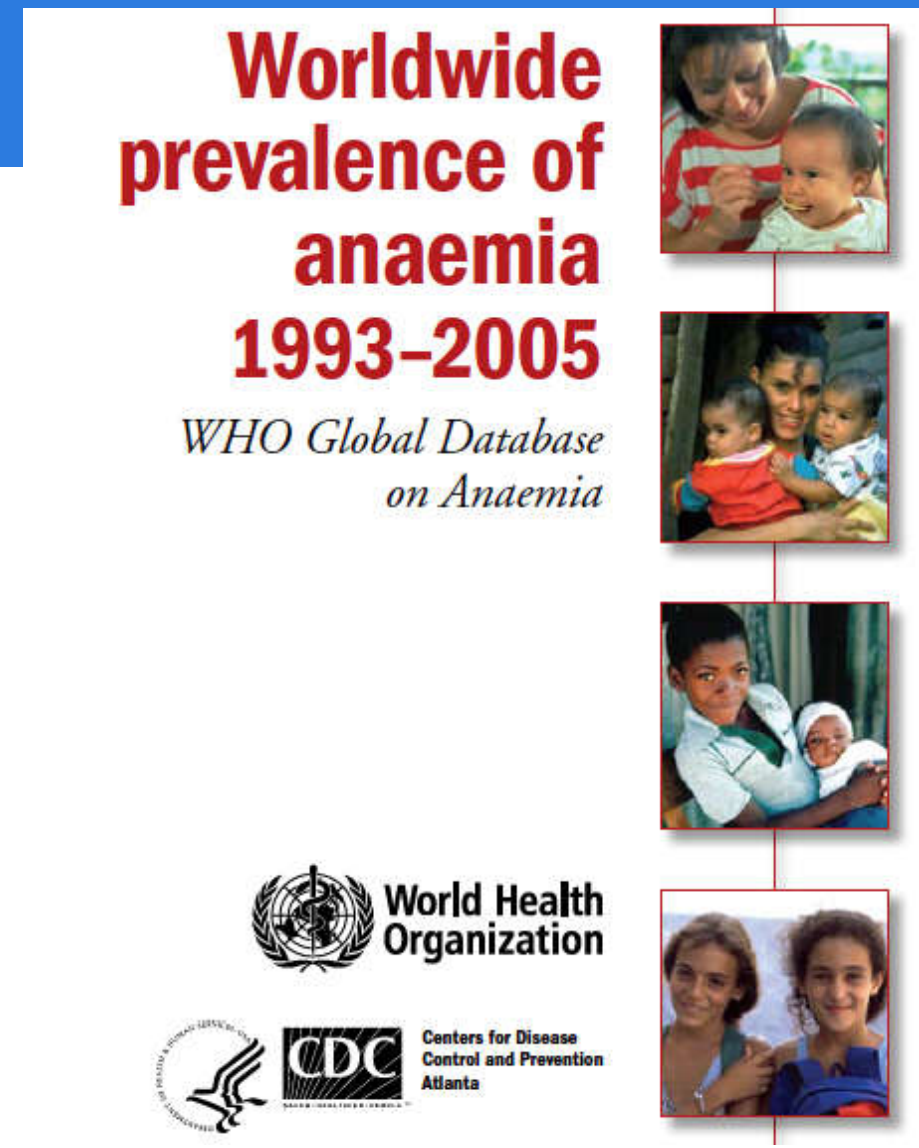
C. Increased losses
- Phlebotomy
  - Blood donation
  - Dialysis (particularly haemodialysis)
- Haemorrhage
  - Surgery
  - Trauma
  - Gastrointestinal bleeding
  - Genitourinary bleeding
  - Respiratory tract bleeding

Muñoz et al. | Peri-operative management of anaemia and iron deficiency

Anaesthesia 2017, 72, 233–247

Prevalencia de anemia

1. La anemia es un problema de salud pública mundial, en países con diferentes niveles de desarrollo.
2. Ocurre en todas las etapas de la vida, pero es más frecuente en extremos de la vida y embarazadas.
3. Su presencia es señal de mala nutrición y/o mala salud.



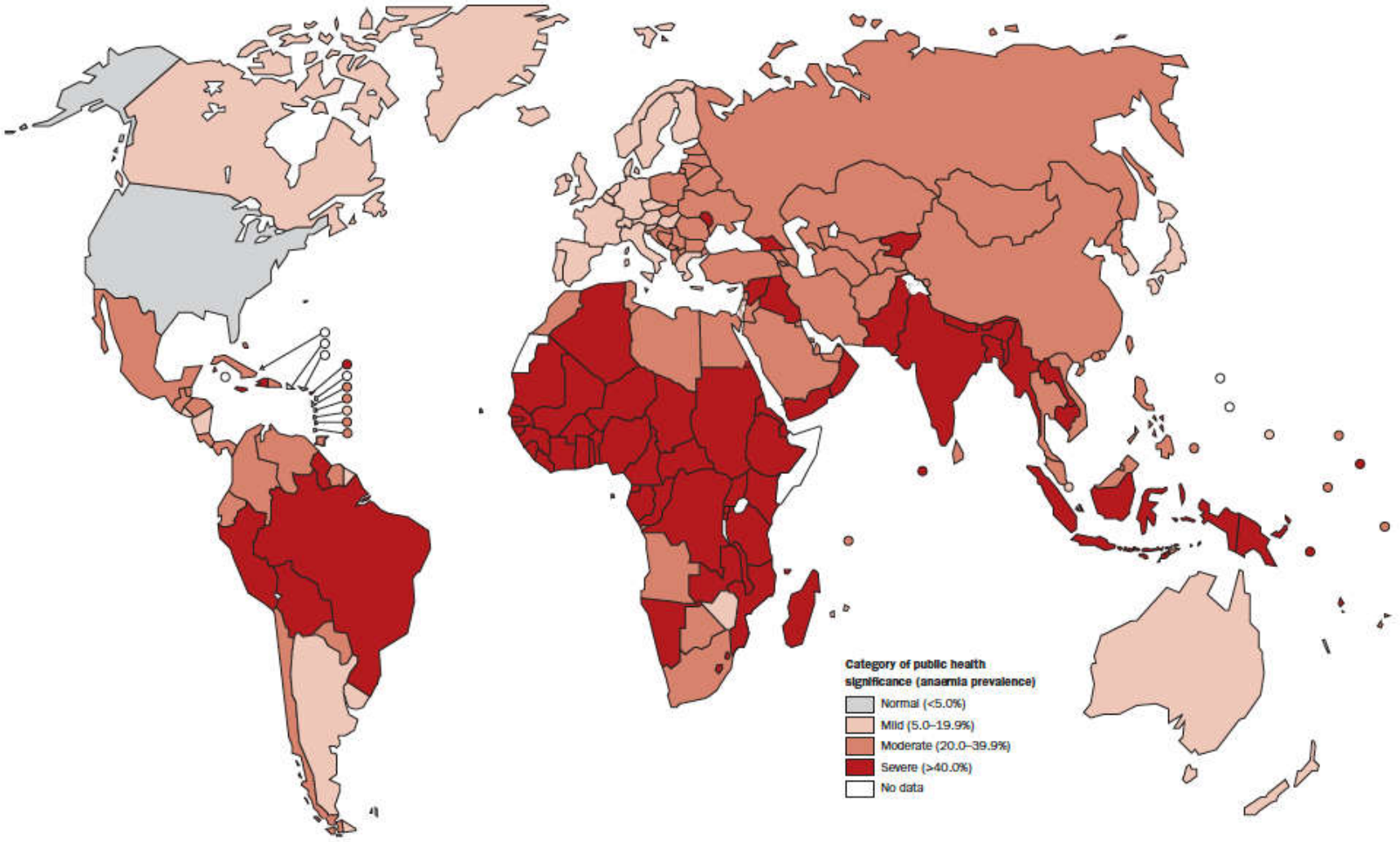
Prevalencia

Table 3.2 ***Global anaemia prevalence and number of individuals affected***

Population group	Prevalence of anaemia		Population affected	
	Percent	95% CI	Number (million)	95% CI
Preschool-age children	47.4	45.7–49.1	293	283–303
School-age children	25.4	19.9–30.9	305	238–371
Pregnant women	41.8	39.9–43.8	56	54–59
Non-pregnant women	30.2	28.7–31.6	468	446–491
Men	12.7	8.6–16.9	260	175–345
Elderly	23.9	18.3–29.4	164	126–202
Total population	**24.8**	**22.9–26.7**	**1620**	**1500–1740**

Worldwide prevalence of anaemia 1993–2005 : WHO global database on anaemia / Edited by Bruno de Benoist,Erin McLean, Ines Egli and Mary Cogswell.

Figure 3.1a Anaemia as a public health problem by country: Preschool-age children



Worldwide prevalence of anaemia 1993–2005 : WHO global database on anaemia / Edited by Bruno de Benoist,Erin McLean, Ines Egli and Mary Cogswell.

Prevalencia en población quirúrgica

Tipo de pacientes y cirugías	Prevalencia
Veteranos sometidos a cirugía no cardiaca	34%
Pacientes sometidos a cirugía colorectal	46%
Pacientes sometidos a cirugía de rodilla o cadera	25 – 45%
Pacientes sometidos a cirugía por fractura de cadera	76%
Pacientes con Ca de colon avanzado sometidos a colectomía	75%

Ankit J. Kansagra, MD[a,*], Mihaela S. Stefan, MD[b]
Anesthesiology Clin 34 (2016) 127–141
http://dx.doi.org/10.1016/j.anclin.2015.10.011

Prevalencia según grupos etarios

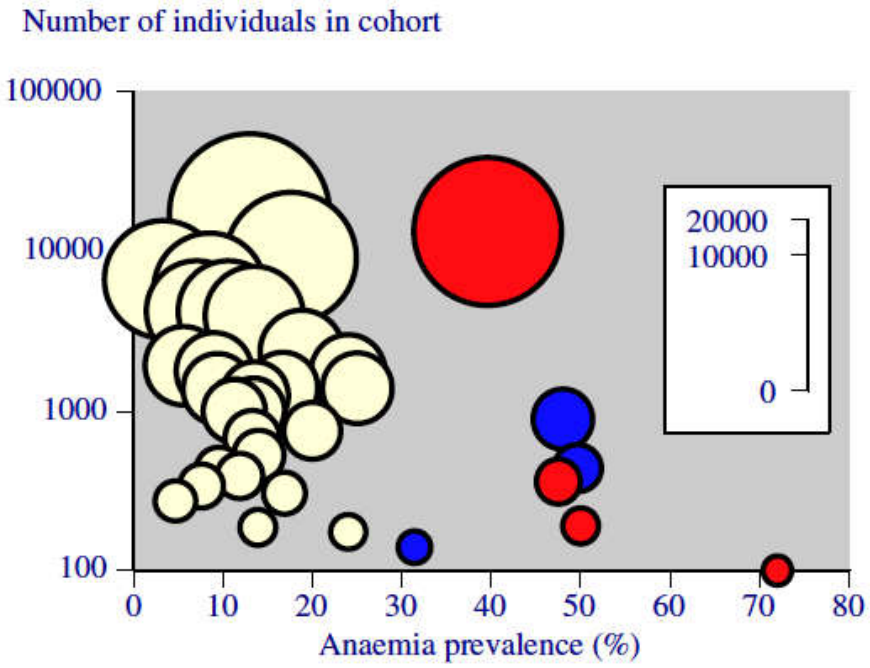


Figure 1
Anaemia prevalence according to the size of cohort (non-linear inset scale). Yellow symbols represent older people living in the community, blue those in nursing homes, and red admission to hospital.

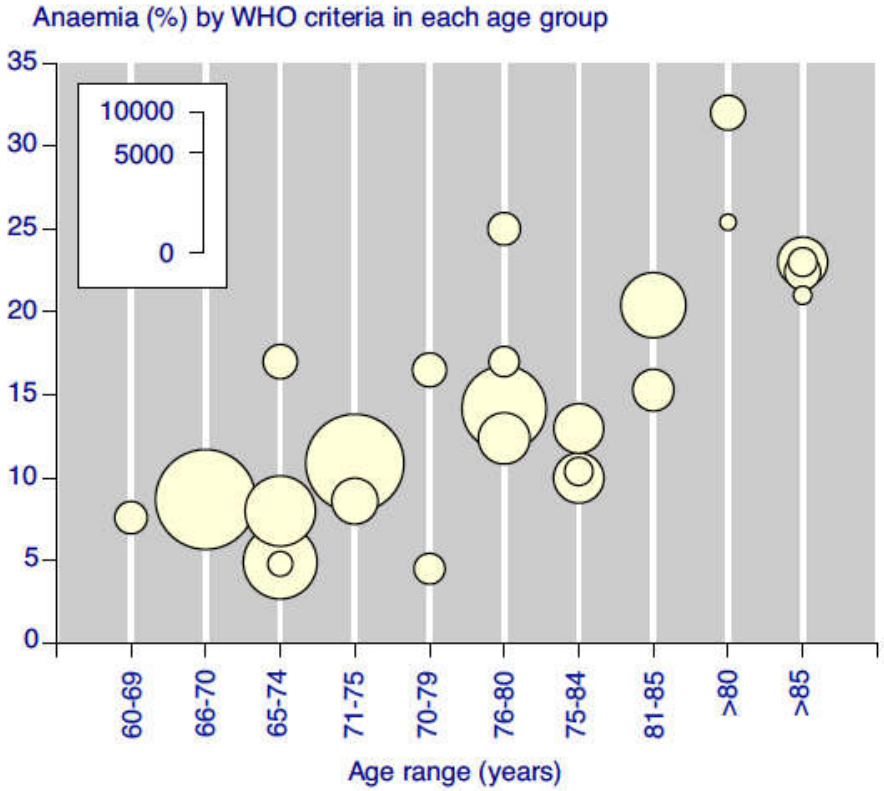


Figure 2
Anaemia prevalence by age range. Size of the symbol is proportional to the size of the cohort (inset scale)

Importancia de la anemia

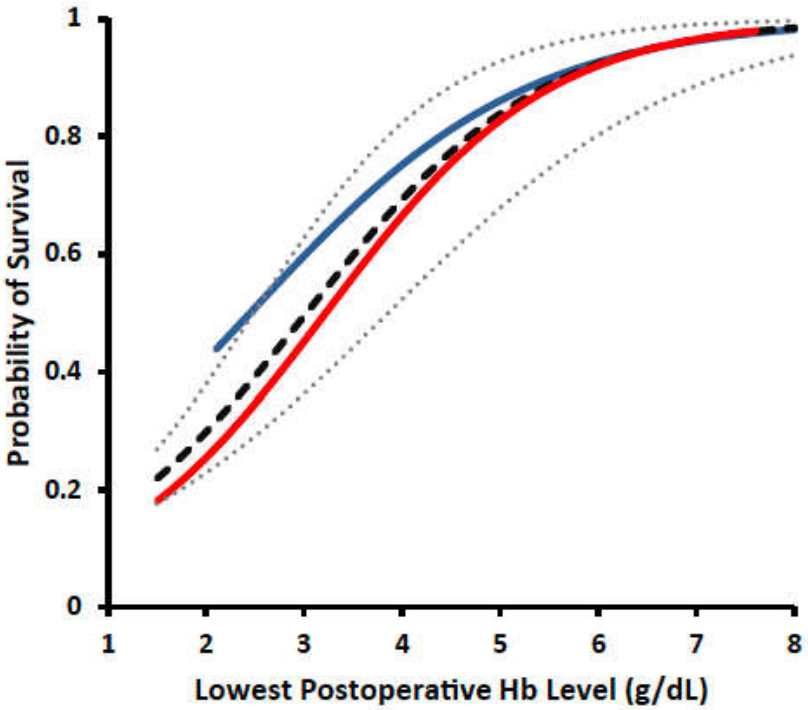


Fig. 1. Probability of survival according to lowest postoperative Hb level predicted by the regression models based on the EHMC data (solid dark line), simulated data mimicking the mortality rates reported by Carson and colleagues[5] (solid light line), and the EHMC and simulated data pooled together (dashed line). Dotted lines represent the upper and lower 95% CI of the pooled data.

TABLE 4. Rates of occurrence of composite morbidity and morbidity/mortality events in the postoperative period in various postoperative nadir Hb levels*

Postoperative Hb (g/dL)	Composite morbidity	Composite morbidity and mortality
2.1-3.0	4 (66.7)	5 (83.3)
3.1-4.0	6 (37.5)	8 (50.0)
4.1-5.0	9 (29.0)	13 (41.9)
5.1-6.0	18 (36.7)	20 (40.8)
6.1-7.0	11 (19.0)	12 (20.7)
7.1-8.0	30 (22.6)	31 (23.3)
All	78 (26.6)	89 (30.4)

* Data are reported as number (%).

Shander et al. *An update on mortality and morbidity in patients with very low postoperative hemoglobin levels who decline blood transfusion*

TRANSFUSION 2014;54:2688-2695.

British Journal of Anaesthesia **113** (3): 416–23 (2014)
Advance Access publication 14 May 2014 · doi:10.1093/bja/aeu098

BJA

Preoperative anaemia is associated with poor clinical outcome in non-cardiac surgery patients

D. M. Baron[1], H. Hochrieser[2], M. Posch[2], B. Metnitz[3], A. Rhodes[4*], R. P. Moreno[5], R. M. Pearse[6] and P. Metnitz[1*], for the European Surgical Outcomes Study (EuSOS) group for the Trials Groups of the European Society of Intensive Care Medicine and the European Society of Anaesthesiology

Table 2 Perioperative outcomes according to preoperative Hb concentrations. ICU, intensive care unit; MV, mechanical ventilation; NIV, non-invasive ventilation

	Severe anaemia		Moderate anaemia		Mild anaemia		Normal haemoglobin		Normal *vs* anaemia
	n	%	*n*	%	*n*	%	*n*	%	*P*-value
Number of patients	637	1.6	3427	8.7	7231	18.4	27 439	69.8	
Age (yr)	60 (18)		65 (17)		63 (19)		56 (18)		
In-hospital mortality		11.3		8.6		4.0		2.2	<0.001
Admitted to ICU		25.6		22.0		11.2		5.4	<0.001
NIV within 24 h		1.1		2.2		1.4		0.7	<0.001
MV within 24 h		17.6		12.1		5.0		1.8	<0.001
Inotrope/vasopressor use		13.0		9.6		4.4		1.4	<0.001
Central venous catheter		22.1		19.7		11.5		4.5	<0.001
Cardiac output monitor		12.9		9.4		7.5		4.3	<0.001

Clasificación de Anemia (Hb en gr/dl)

Severa menor a 8

Moderada 8-11

Leve 11-13

British Journal of Anaesthesia 113 (3): 416–23 (2014)
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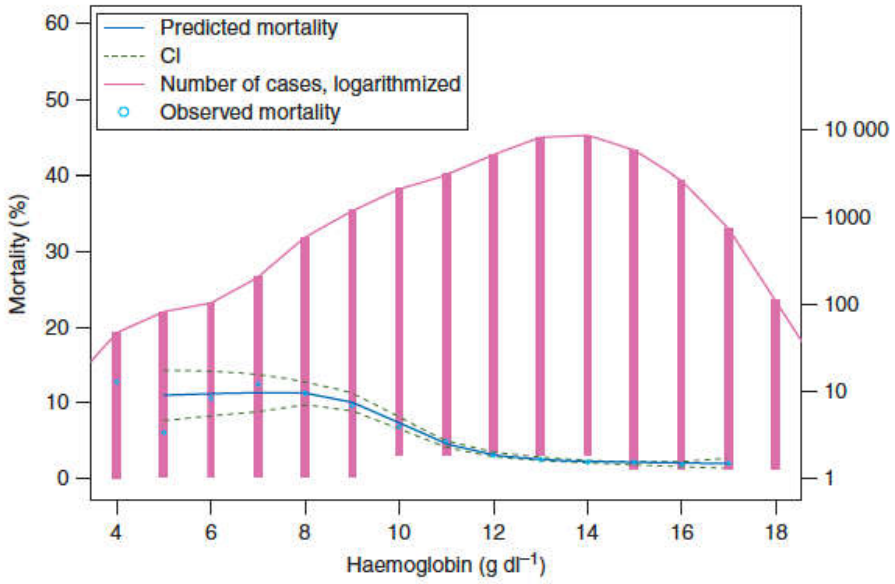


Fig 1 Predicted mortality according to preoperative Hb concentrations.

Conclusions. Anaemia is common among non-cardiac and non-neurological surgical patients, and is associated with poor clinical outcome and increased healthcare resource use.

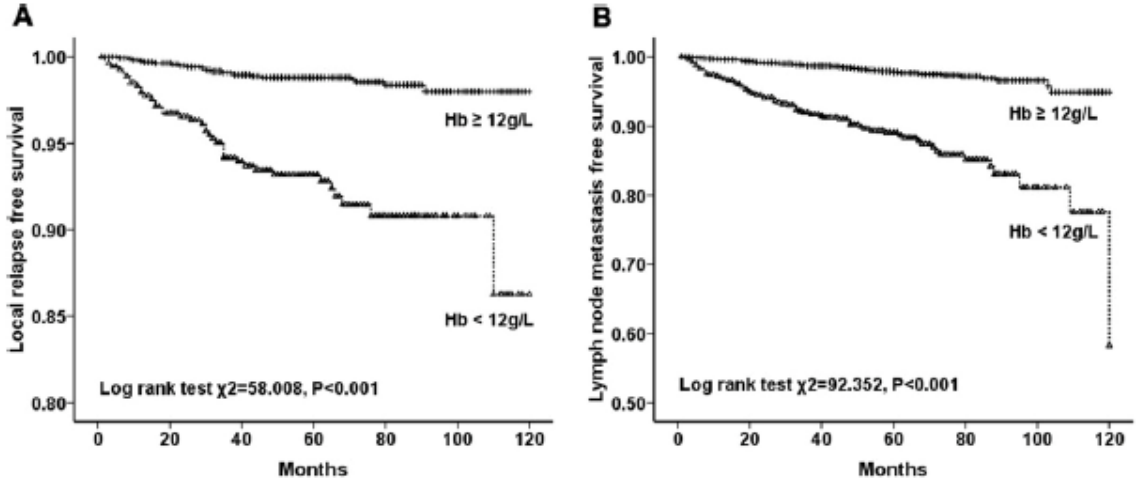
Zhang et al. BMC Cancer 2014, 14:844
http://www.biomedcentral.com/1471-2407/14/844

BMC Cancer

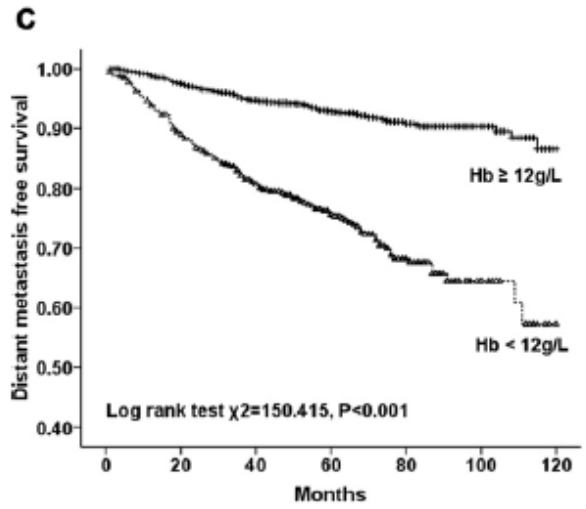
RESEARCH ARTICLE Open Access

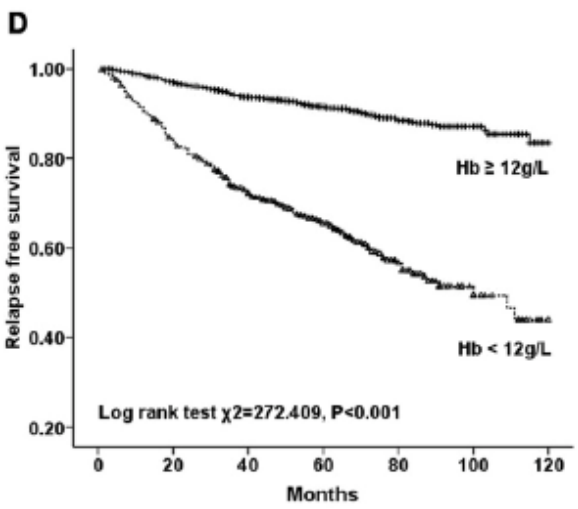
Impact of preoperative anemia on relapse and survival in breast cancer patients

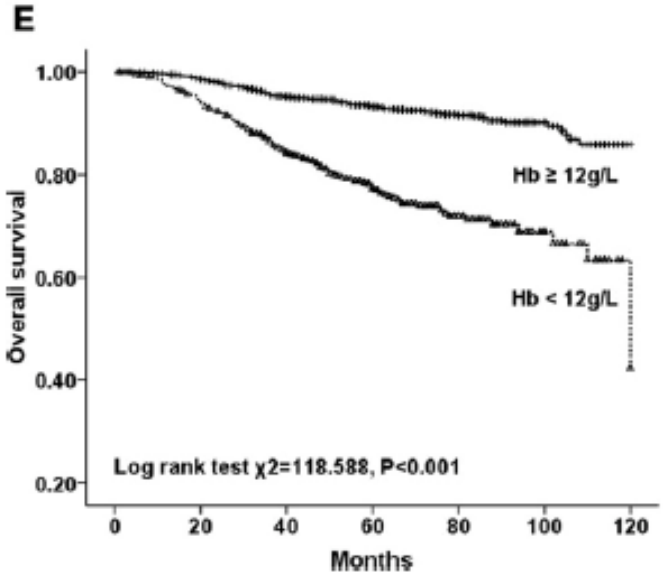
YingJun Zhang[1†], YuYang Chen[2†], DongTai Chen[1†], Yu Jiang[1], Wan Huang[1], HanDong Ouyang[1], Wei Xing[1], MuSheng Zeng[3], XiaoMing Xie[4] and Weian Zeng[1*]



Conclusions: Preoperative anemia was independently associated with poor prognosis of patients with breast cancer.







Zhang *et al. BMC Cancer* 2014, **14**:844

Anaesthesia
Journal of the Association of Anaesthetists of Great Britain and Ireland
Anaesthesia, 2011, **66**, pages 812–818 doi:10.1111/j.1365-2044.2011.06819.x

ORIGINAL ARTICLE

The prevalence and association with transfusion, intensive care unit stay and mortality of pre-operative anaemia in a cohort of cardiac surgery patients*

M. Hung,[1] M. Besser,[2] L. D. Sharples,[3] S. K. Nair[4] and A. A. Klein[5]

Table 2 Outcome data of patients undergoing cardiac surgery. Anaemia defined as haemoglobin concentration < 12 g.dl^{-1} in women or < 13 g.dl^{-1} in men. Values are number (proportion), median (IQR [range]) or mean (SD).

	Non-anaemic (n = 1225)	Anaemic (n = 1463)	p value*
Transfusion	275 (22.4%)	791 (54.1%)	< 0.0001
Total units of RBC transfused	0 (0–1 [0–20])	0 (0–2 [0–34])	< 0.0001
Units of RBC if transfused	2 (1–3 [1–20])	2 (1–3 [1–24])	< 0.0001
Transfusion > 6 units RBC	25 (2%)	102 (7%)	0.098
Postoperative haemoglobin	10.5 (3.1)	9.2 (3.4)	< 0.001
In-hospital deaths	13 (1.1%)	45 (3.1%)	0.0005
ICU stay; days	1 (0–2 [0–81])	1 (0–2) [0–69]	< 0.0001
ICU stay > 2 days	168 (13.7%)	287 (19.6%)	< 0.0001
Transfusion cost per patient; £	133 (0–410 [0–4205]	362 (0–795 [0–4205]	< 0.0001

RBC, red blood cells. *p value refers to the Wilcoxon signed-rank test or Pearson's chi-squared test for contingency tables.

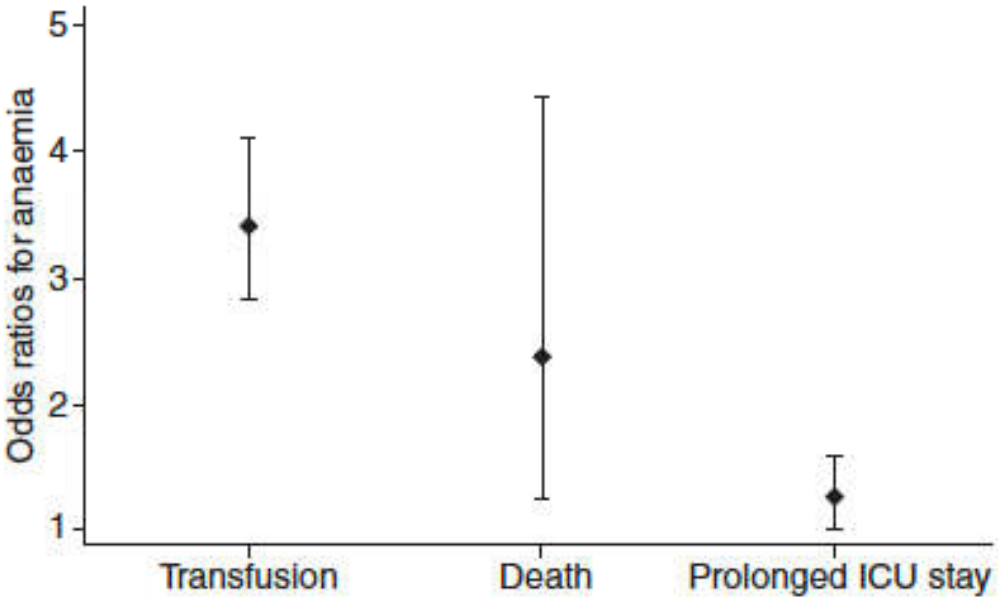
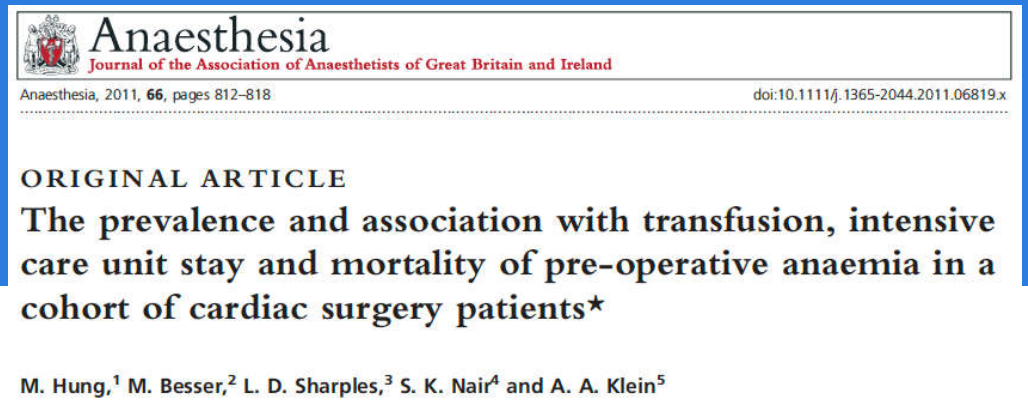


Figure 1 Odds ratio for each outcome for anaemic patients relative to non-anaemic patients. The error bars represent the 95% confidence intervals.

Importancia



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Describen 3 hallazgos:

1. La anemia pre operatoria es un condición prevalente en pacientes adultos que se someten a cirugía cardíaca electiva (más de la mitad de los pacientes de esta cohorte cumplían criterios de anemia según la definición de la OMS).
2. La anemia pre operatoria es un predictor de transfusión peri operatoria de GR. Incluso la anemia leve se traduce en un OR 3,5 veces mayor de recibir GR en el peri operatorio.
3. La anemia pre operatoria se asocia con un aumento en a mortalidad durante la hospitalización y otros resultados adversos, lo cual se refleja en estadías más prolongadas en UCI.

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ORIGINAL ARTICLE

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- Los pacientes con anemia tenían un score de patología concomitante mayor, lo cual refleja un mayor numero de co morbilidades.
- Es difícil discriminar estadísticamente entre el efecto de la anemia y el efecto de la transfusión sobre la morbi mortalidad peri operatoria.
- Dada la evidencia existente hoy, la que demuestra el efecto deletéreo de la transfusión, a estrategia primaria para mantener un hematocrito normal en el perioperatorio en pacientes sometidos a cirugía cardiaca debe ser **corregir la anemia preoperatoria y evitar la transfusión de GR.**

CLINICAL RESEARCH STUDY

THE AMERICAN JOURNAL of MEDICINE®

Association Between Anemia, Bleeding, and Transfusion with Long-term Mortality Following Noncardiac Surgery

Nathaniel R. Smilowitz, MD,[a] Brandon S. Oberweis, MD,[b] Swetha Nukala, MBBS,[c] Andrew Rosenberg, MD,[d] Sibo Zhao, MS,[a] Jinfeng Xu, PhD,[a] Steven Stuchin, MD,[e] Richard Iorio, MD,[e] Thomas Errico, MD,[e] Martha J. Radford, MD,[a,f,g] Jeffrey S. Berger, MD, MS[a,h]

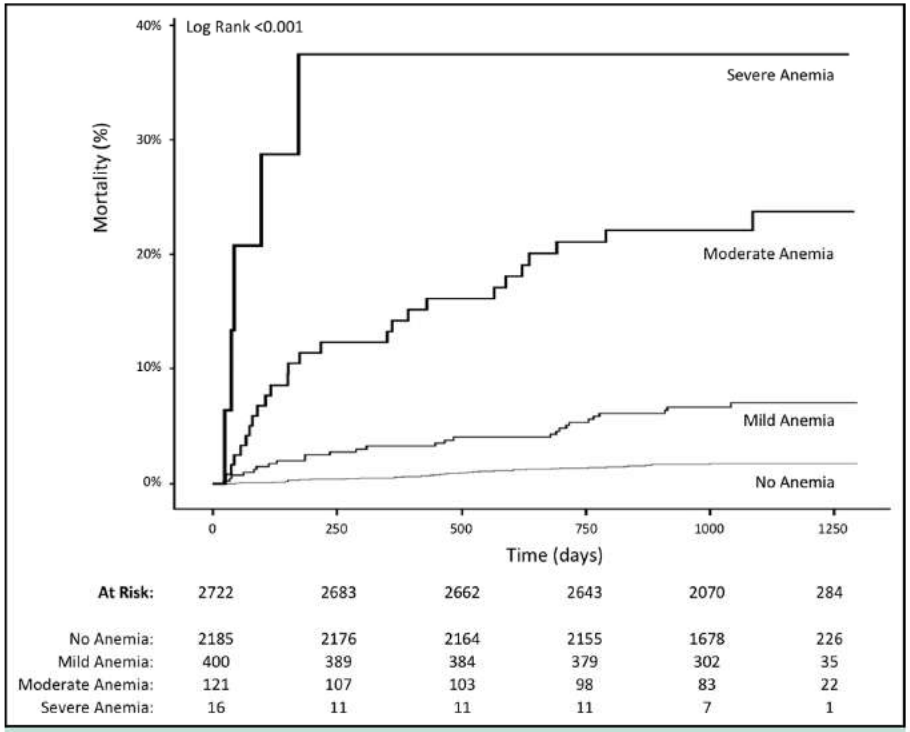

Figure 1 Preoperative anemia and long-term mortality following surgery.

- Estudio de cohortes, retrospectivo
- 3050 pacientes adultos, consecutivos, sometidos a cirugía ortopédica mayor durante 1 año

Am J Med. 2016 March ; 129(3): 315–23.

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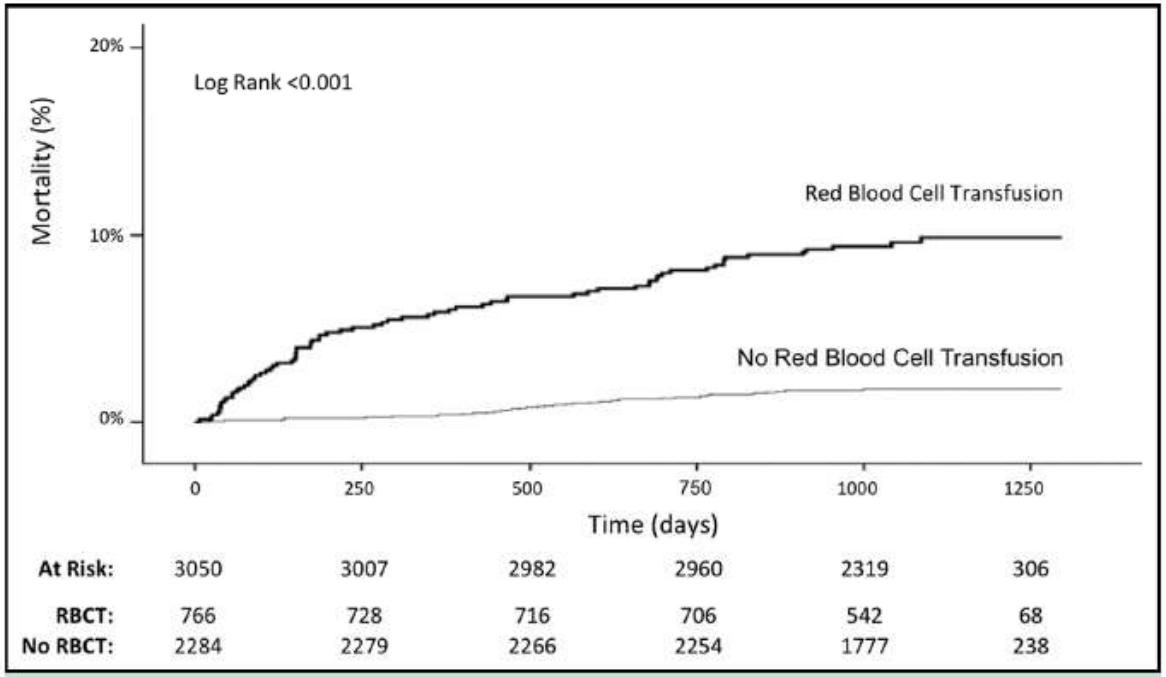


Figure 2 Red blood cell transfusion (RBCT) and long-term mortality following surgery.

CLINICAL SIGNIFICANCE

- Preoperative anemia and perioperative bleeding are associated with increased mortality at long-term follow-up after major noncardiac surgery.
- Red blood cell transfusion during hospitalization for noncardiac surgery was associated with long-term mortality, but the association was attenuated by the severity of preoperative anemia.

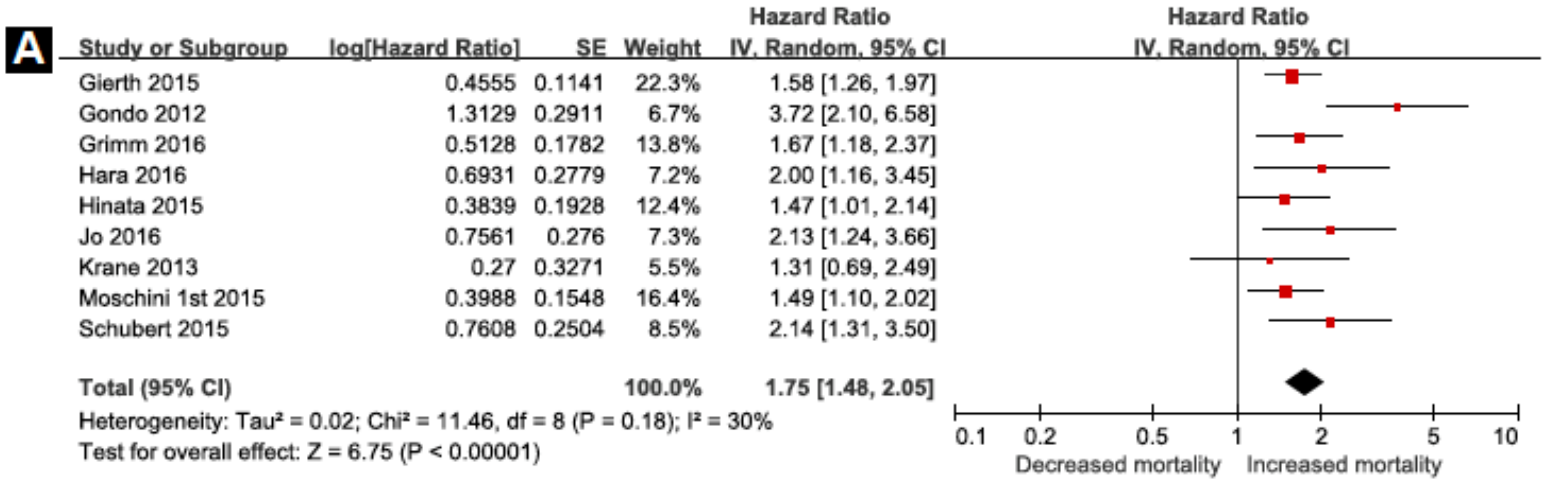
Am J Med. 2016 March ; 129(3): 315–23.

Original Study

Preoperative Anemia and Low Hemoglobin Level Are Associated With Worse Clinical Outcomes in Patients With Bladder Cancer Undergoing Radical Cystectomy: A Meta-Analysis

Leilei Xia, Thomas J. Guzzo

Clinical Genitourinary Cancer, Vol. 15, No. 2, 263-72 © 2016



A

Study or Subgroup	log[Hazard Ratio]	SE	Weight	Hazard Ratio IV, Random, 95% CI
Gierth 2015	0.4555	0.1141	22.3%	1.58 [1.26, 1.97]
Gondo 2012	1.3129	0.2911	6.7%	3.72 [2.10, 6.58]
Grimm 2016	0.5128	0.1782	13.8%	1.67 [1.18, 2.37]
Hara 2016	0.6931	0.2779	7.2%	2.00 [1.16, 3.45]
Hinata 2015	0.3839	0.1928	12.4%	1.47 [1.01, 2.14]
Jo 2016	0.7561	0.276	7.3%	2.13 [1.24, 3.66]
Krane 2013	0.27	0.3271	5.5%	1.31 [0.69, 2.49]
Moschini 1st 2015	0.3988	0.1548	16.4%	1.49 [1.10, 2.02]
Schubert 2015	0.7608	0.2504	8.5%	2.14 [1.31, 3.50]
Total (95% CI)			**100.0%**	**1.75 [1.48, 2.05]**

Heterogeneity: $Tau^2 = 0.02$; $Chi^2 = 11.46$, df = 8 (P = 0.18); $I^2 = 30\%$

Test for overall effect: Z = 6.75 (P < 0.00001)

Anemia y mortalidad global

Original Study

Preoperative Anemia and Low Hemoglobin Level Are Associated With Worse Clinical Outcomes in Patients With Bladder Cancer Undergoing Radical Cystectomy: A Meta-Analysis

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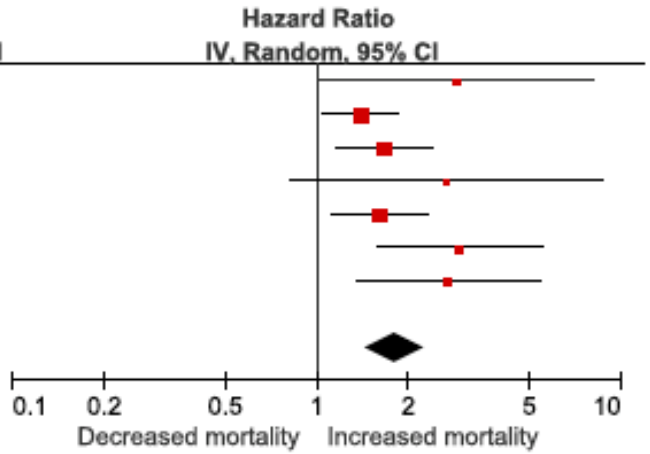
B

Study or Subgroup	log[Hazard Ratio]	SE	Weight	Hazard Ratio IV, Random, 95% CI
Ergani 2015	1.0613	0.5294	4.2%	2.89 [1.02, 8.16]
Gierth 2015	0.3293	0.15	28.6%	1.39 [1.04, 1.87]
Grimm 2016	0.511	0.186	22.5%	1.67 [1.16, 2.40]
Jo 2016	0.9858	0.6042	3.3%	2.68 [0.82, 8.76]
Moschini 1st 2015	0.4762	0.1849	22.6%	1.61 [1.12, 2.31]
Schubert 2015	1.0818	0.3218	10.1%	2.95 [1.57, 5.54]
Sejima 2014	0.9962	0.3533	8.7%	2.71 [1.35, 5.41]
Total (95% CI)			**100.0%**	**1.80 [1.45, 2.25]**

Heterogeneity: $Tau^2 = 0.02$; $Chi^2 = 8.13$, df = 6 (P = 0.23); $I^2 = 26\%$

Test for overall effect: Z = 5.22 (P < 0.00001)



Anemia y mortalidad asociada al cáncer

Original Study

CrossMark

Preoperative Anemia and Low Hemoglobin Level Are Associated With Worse Clinical Outcomes in Patients With Bladder Cancer Undergoing Radical Cystectomy: A Meta-Analysis

Leilei Xia, Thomas J. Guzzo

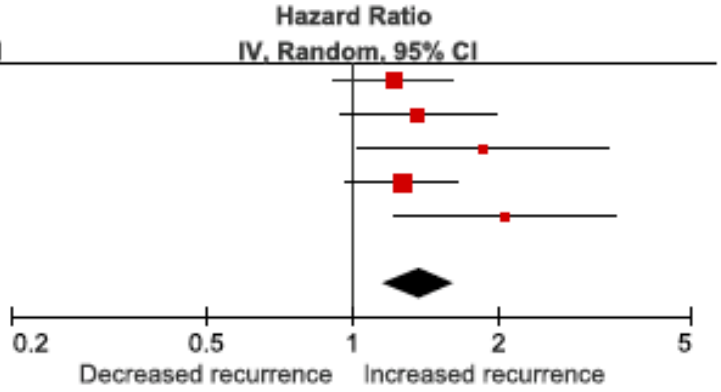
Clinical Genitourinary Cancer, Vol. 15, No. 2, 263-72 © 2016

C

Study or Subgroup	log[Hazard Ratio]	SE	Weight	Hazard Ratio IV, Random, 95% CI
Gierth 2015	0.1939	0.1459	29.7%	1.21 [0.91, 1.62]
Hinata 2015	0.309	0.1881	18.9%	1.36 [0.94, 1.97]
Jo 2016	0.6206	0.3015	7.7%	1.86 [1.03, 3.36]
Moschini 1st 2015	0.2359	0.1347	34.0%	1.27 [0.97, 1.65]
Schubert 2015	0.7227	0.2673	9.8%	2.06 [1.22, 3.48]
Total (95% CI)			**100.0%**	**1.37 [1.16, 1.62]**

Heterogeneity: Tau² = 0.00; Chi² = 4.38, df = 4 (P = 0.36); I² = 9%

Test for overall effect: Z = 3.68 (P = 0.0002)



Anemia y recurrencia de enfermedad

¿Sirve tratar la anemia pre operatoria?

Can J Anesth/J Can Anesth (2013) 60:168–175
DOI 10.1007/s12630-012-9861-y

REVIEW ARTICLE/BRIEF REVIEW

Review article: Risks of anemia and related management strategies: can perioperative blood management improve patient safety?

Gregory M. T. Hare, MD, PhD · John Freedman, MD · C. David Mazer, MD

¿Qué sabemos hasta ahora?

1. La anemia es una condición prevalente, especialmente en los extremos de la vida y en pacientes sometidos a cirugía.
2. La anemia, incluso leve, se asocia a peores resultados, incluyendo falla renal, *stroke* y muerte.
3. El riesgo de daño por anemia se ve acentuado por terapias utilizadas frecuentemente para atenuar respuestas cardiovasculares (beta bloqueadores por ejemplo).
4. Las terapias usadas frecuentemente para el tratamiento de la anemia tienen riesgos propios (transfusión, EPO).

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REVIEW ARTICLE/BRIEF REVIEW

Review article: Risks of anemia and related management strategies: can perioperative blood management improve patient safety?

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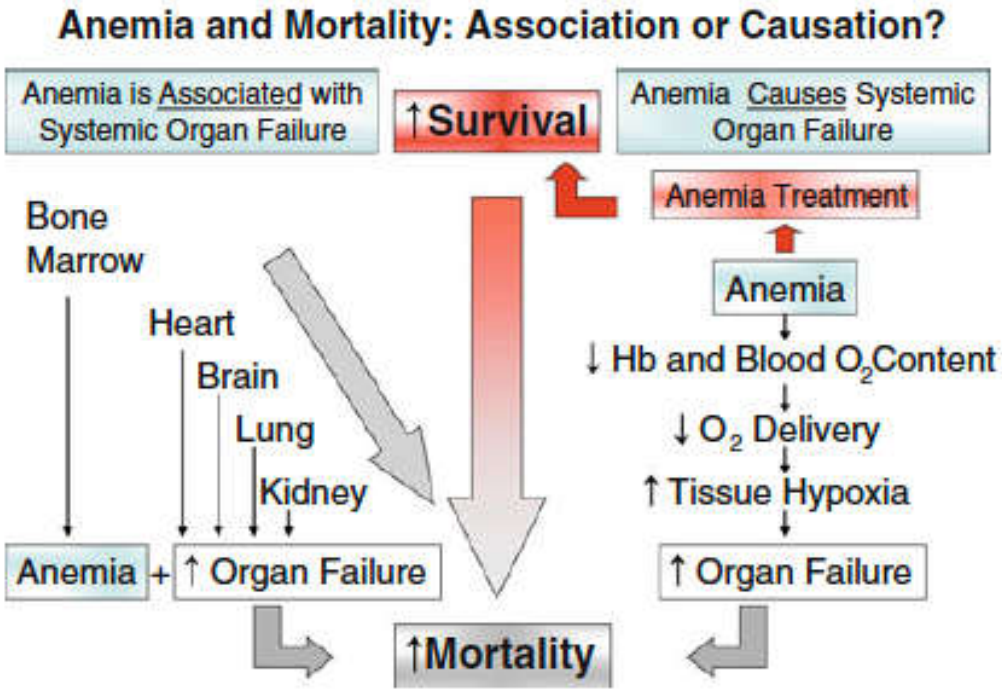


Fig. 1 Potential pathways by which treatment of anemia may affect survival

Suficiente evidencia …

Evaluación preoperatoria y anemia

Los objetivos de la evaluación pre operatoria son dos:

1. Estratificación de riesgo, a modo de informar al paciente y su familia los riesgos de someterse a un procedimiento o cirugía.
2. Identificación de **factores de riesgo modificables** para optimizar las condiciones del paciente para aumentar sus posibilidades de éxito.

Evaluación preoperatoria: ¿Qué pacientes requieren hematocrito o hemoglobina pre operatoria?

Considerar factores de:

- El paciente
  - Edad, ASA
- La cirugía
  - Tipo de cirugía
  - Sagrado estimado

Idealmente 3 a 4 semanas antes de la Qx.

Como regla general:

- Cirugías con sangrado estimado alto (15% de la volemia) o moderado (10% de la volemia)
- Anemia conocida o sospechada
- Alteración conocida de la hemostasia
- Anemia sintomática

Clasificación de la anemia peri operatoria

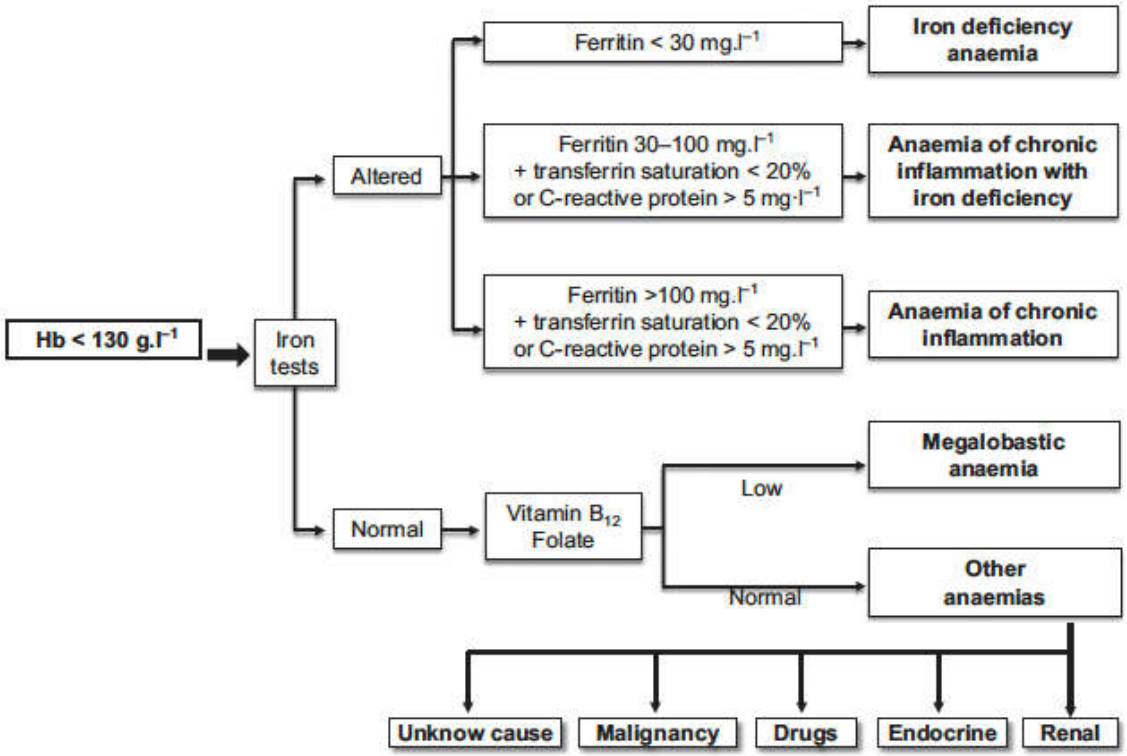


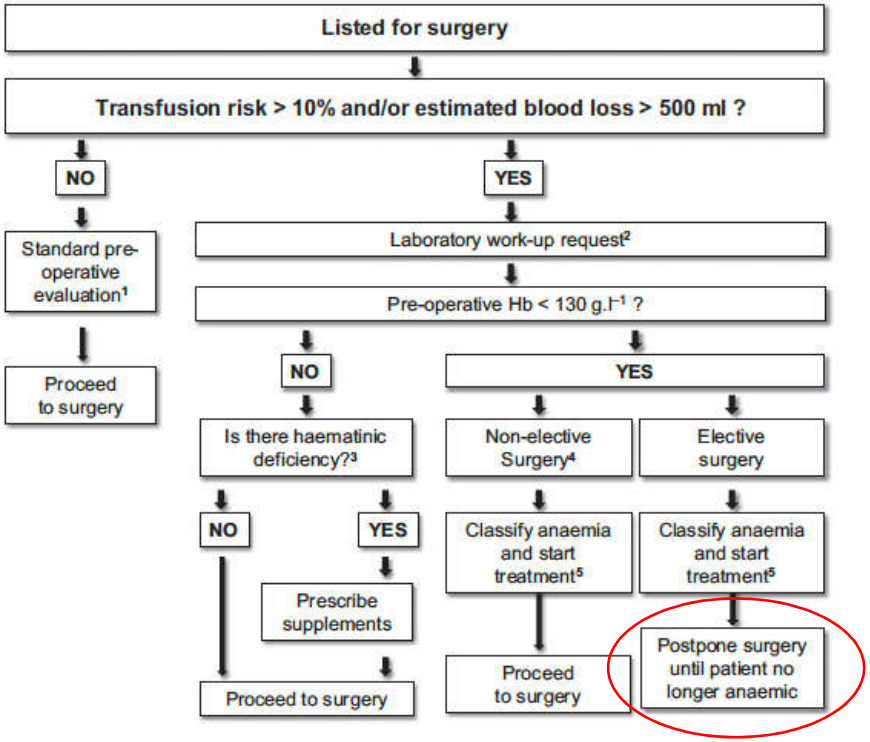
Figure 2 Algorithm for classification of peri-operative anaemia.

Anaesthesia 2017, 72, 233–247 doi:10.1111/anae.13773

Consensus Statement

International consensus statement on the peri-operative management of anaemia and iron deficiency

M. Muñoz,[1] A. G. Acheson,[2] M. Auerbach,[3] M. Besser,[4] O. Habler,[5] H. Kehlet,[6] G. M. Liumbruno,[7] S. Lasocki,[8] P. Meybohm,[9] R. Rao Baikady,[10] T. Richards,[11] A. Shander,[12] C. So-Osman,[13] D. R. Spahn[14] and A. A. Klein[15]



Alternativas de tratamiento

Transfusion Medicine Reviews 27 (2013) 221–234

Contents lists available at ScienceDirect

Transfusion Medicine Reviews

journal homepage: www.tmreviews.com

Efficacy and Safety of Erythropoietin and Intravenous Iron in Perioperative Blood Management: A Systematic Review

David M. Lin [a,*], Estelle S. Lin [b], Minh-Ha Tran [c,d]

Método:

Analizan 24 estudios randomizados y controlados y 15 estudios no randomizados

- Fierro intravenoso
- EPO
- Fiero + EPO

Concluyen:

1. Los pacientes con anemia ferro priva pueden tener una recuperación mas rápida y robusta con Fe IV que PO.
2. Un régimen breve de EPO + Fe preoperatorio, incluso una dosis única, puede disminuir significativamente los requerimientos transfusionales.
3. Riesgo de TVP/TEP con uso de EPO.

Preoperative management of colorectal cancer–induced iron deficiency anemia in clinical practice: data from a large observational cohort

MaríaJesús Laso-Morales,[1] Carlos Jericó,[2] Susana Gómez-Ramírez,[3] Jordi Castellví,[4] Lorenzo Viso,[4] Inmaculada Roig-Martínez,[5] Caridad Pontes,[6] and Manuel Muñoz[7]

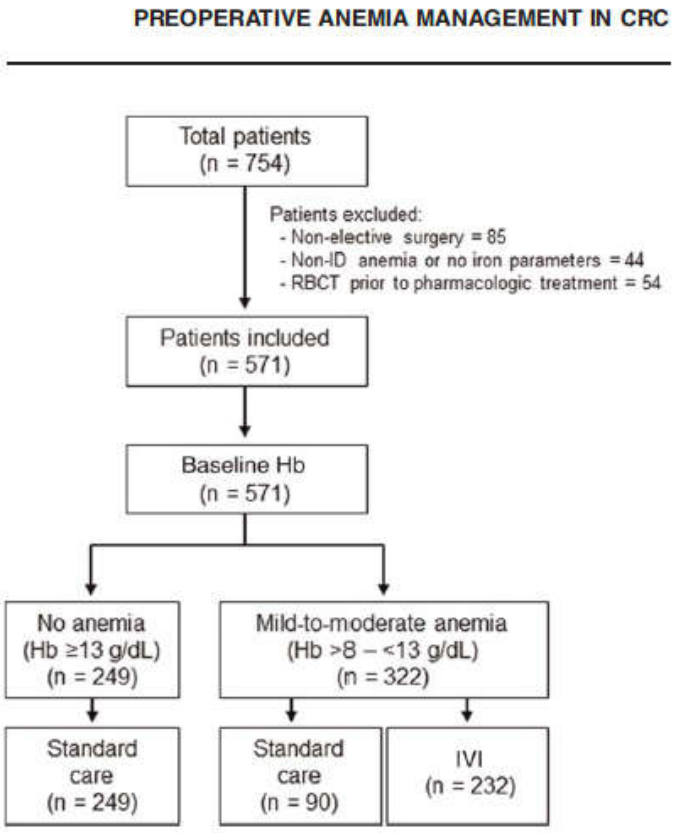


Fig. 1. Flow diagram for patient disposition.

Fierro IV:

- Sacarosa de hierro 200 mg en 100 ml de solución salina hasta 3 veces a la semana
- Carboxi-maltosa férrica 500 a 1000 mg en 200 ml de solución salina, una vez a la semana

Dosis acumulativa de Fe calculada:

$$[(14 - \text{baseline Hb}) \times 2.4 \times \text{body weight (kg)}] + 500$$

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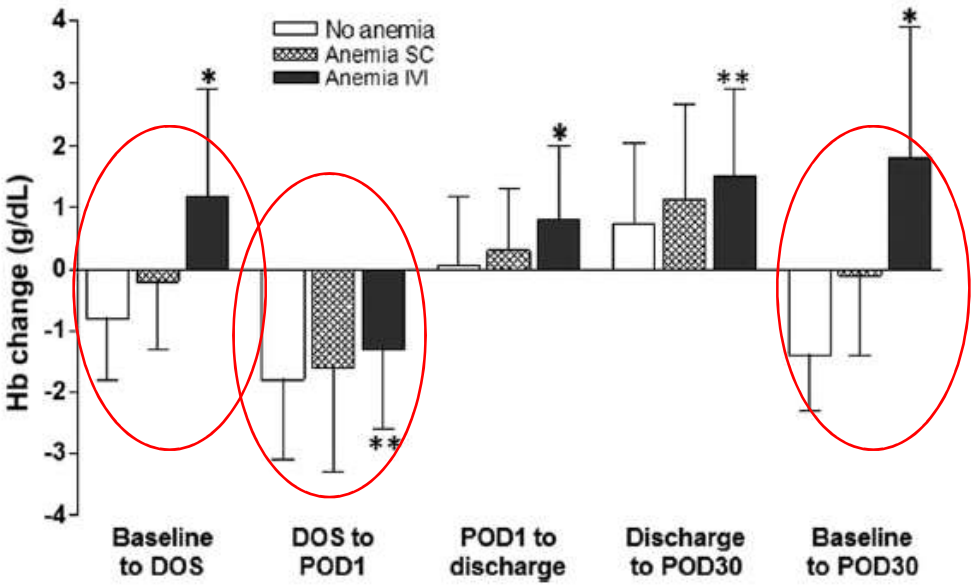

Fig. 3. Perioperative Hb change according to anemia status and treatment. DOS = day of surgery; POD = postoperative day; SC = standard care; *p < 0.01 anemia IVI vs. no anemia or anemia SC; **p < 0.01 anemia IVI vs. no anemia.

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Conclusiones:

1. El fierro IV fue mas efectivo que el tratamiento estándar de la anemia pre operatoria en pacientes portadores de Ca de colon.
2. El uso de Fe IV parece disminuir el riesgo de infecciones.
3. No disminuyó el número de transfusiones postoperatorias de GR.

NARRATIVE REVIEW ARTICLE

Intravenous Iron for Treatment of Anemia in the 3 Perisurgical Phases: A Review and Analysis of the Current Literature

Frank Peters, MD,* Ines Ellermann, PHARM,† and Andrea U. Steinbicker, MD, MPH*

ANESTHESIA & ANALGESIA

Oct 2017

Contributing factors

- Malnutrition
- Reduced iron availability
- Bleeding
- Reduced Epo production and response of the bone marrow
- Increased RBC clearance
- Inflammation
- Acute infection
- Chronic infection
- Decreased immune system
- Cancer
- Hemolysis
- Renal impairment
- Radiation therapy
- Chemotherapy
- Regular medication (i.e. anticoagulants, ACE inhibitors)

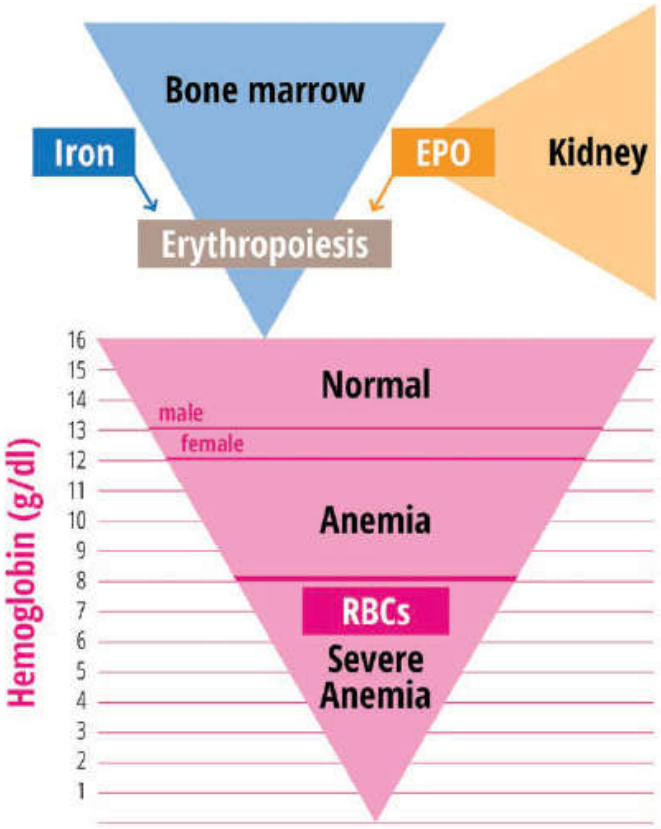

Figure 1. Contributing factors to anemia. A variety of factors contribute to development, progression, or persistence of anemia. These are listed on the left side of the figure. Iron is required as a substrate for the bone marrow to produce erythrocytes. Erythropoietin (EPO) is produced in the kidney and required for erythropoiesis. EPO production may be reduced in renal disease. The amount of erythrocytes determines whether patients are categorized as nonanemic (hemoglobin [Hb] in men ≥13 g/dL, in women ≥12 g/dL), anemic (Hb in men <13 g/dL, in women <12 g/dL), or severely anemic (Hb <8 g/dL) patients. At Hb levels <8 g/dL, transfusions of red blood cells (RBCs) may be considered.

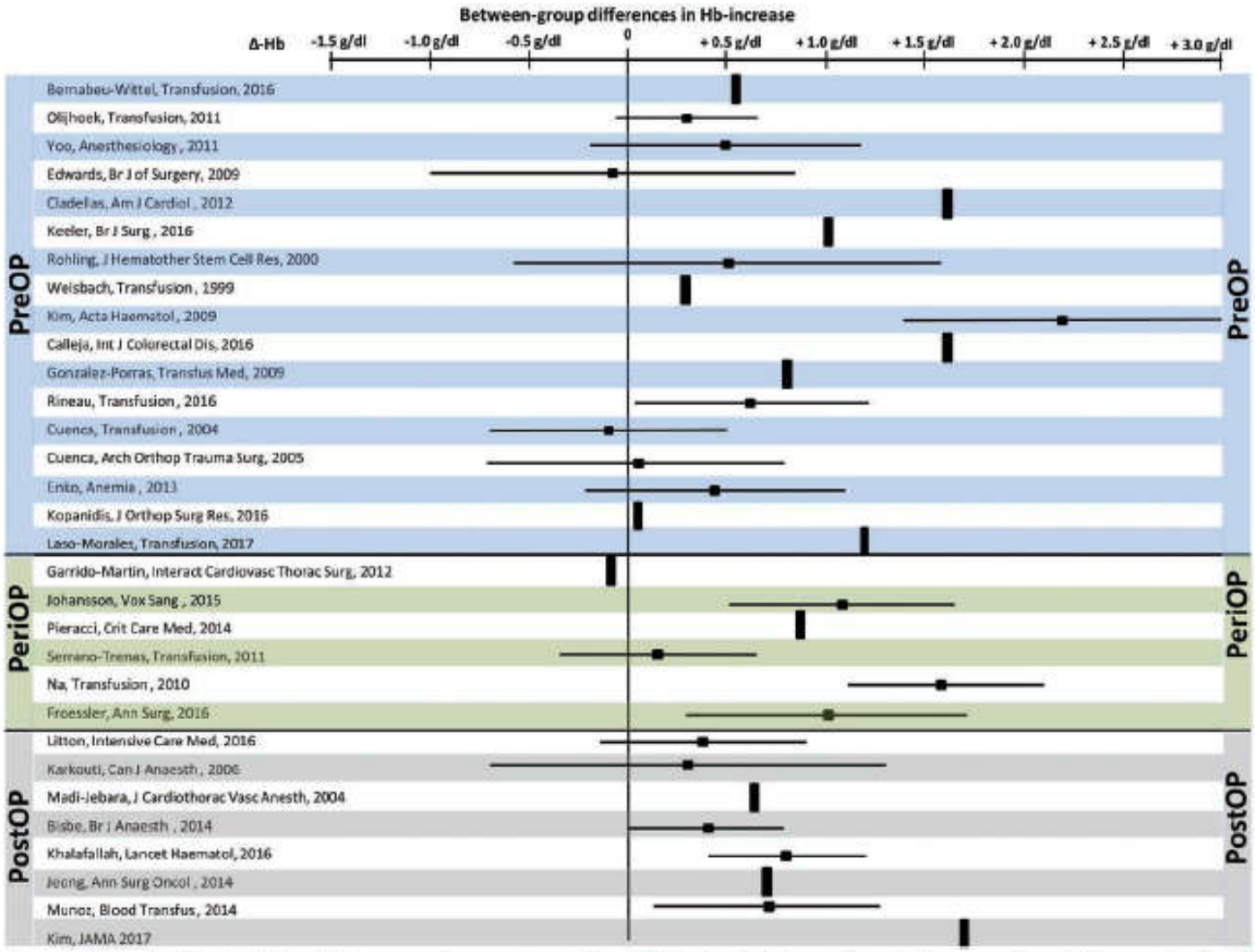

Figure 2. Categorization of effects of intravenous iron on hemoglobin (Hb) levels. Trials from Tables 1–3 were analyzed with regard to the differences (Δ) in Hb increase between the groups (ΔHb with intravenous iron [IVI] compared with controls, g/dL) from baseline Hb to end point.

	Positive effect on RBCs	Positive effect only in subgroups	No effect on RBC tranfsusion	No data on RBCs	
PreOP	Calleja, 2016, Int J Colorectal Dis	Cuenca, 2004, Transfusion	Bernabeu-Wittel, 2016, Transfusion	Enko, 2013, Anemia	PreOP
	Cladellas, 2012, Am J Cardiol	Cuenca, 2005, Arch Orthop Trauma Surg	Edwards, 2009, Br J of Surgery	Kim, 2009, Acta Haematol	
	Gonzalez-Porras, 2009, Transfus Med		Keeler, 2016, Br J Surg	Rohling, 2000, J Hematother Stem Cell Res	
	Kopanidis, 2016, J Orthop Surg Res		Olijhoek, 2011, Transfusion	Weisbach, 1999, Transfusion	
	Rineau, 2016, Transfusion		Laso-Morales, 2017, Transfusion		
	Yoo, 2011, Anesthesiology				
PeriOP	Positive effect on RBCs	Positive effect only in subgroups	No effect on RBC transfusion	No data on RBCs	PeriOP
	Froessler, 2016, Ann Surg	Serrano-Trenas, 2011, Transfusion	Garrido-Martin, 2012, Interact Cardiovasc Thorac Surg	Lasocki, 2016, Eur J Anaesthesiol	
	Na, 2010, Transfusion		Johansson, 2015, Vox Sang		
			Pieracci, 2014, Crit Care Med		
PostOP	Positive effect on RBCs	Positive effect only in subgroups	No effect on RBC transfusion	No data on RBCs	PostOP
	Khalafallah, 2016, Lancet Haematol		Kim, 2017, JAMA Bisbe, 2014, Br J Anaesth	Jeong, 2014, Ann Surg Oncol	
	Munoz, 2014, Blood Transfus		Karkouti, 2006, Can J Anaesth		
			Litton, 2016, Intensive Care Med		
			Madi-Jebara, 2004, J Cardiothorac Vasc Anesth		

Figure 3. Categorization of effects of intravenous iron on red blood cell transfusion. Trials included in the review studied the effect of intravenous iron (IVI) on transfusion of red blood cell (RBC) concentrates. Trials investigating IVI in the preoperative, perioperative, and postoperative setting are listed on the top, middle, and bottom, respectively. Although the trials listed in the column on the outer left state a positive effect on RBC transfusion rate, the studies in the second column find positive effects in subgroup analyses only. The third column lists all the trials that did not show an effect on RBC transfusion rate. The trials listed in the right column did not present data.

NARRATIVE REVIEW ARTICLE

Intravenous Iron for Treatment of Anemia in the 3 Perisurgical Phases: A Review and Analysis of the Current Literature

Frank Peters, MD,* Ines Ellermann, PHARM,† and Andrea U. Steinbicker, MD, MPH*

- La evidencia para el uso de Fierro IV en pre- peri- y postoperatorio es débil.
- La evidencia para el uso de Fierro IV en el preoperatorio es la mas fuerte.
- Se recomienda la corrección de la anemia pre operatoria, con énfasis en la corrección temprana antes de la cirugía.
- A la fecha, la evidencia para el uso de Fierro IV es débil, por lo que solo se puede recomendar para cohortes de pacientes ortopédicos.
- En el postoperatorio, el uso de Fe IV ha mostrado un efecto positivo sobre los niveles de Hb, tiempo de hospitalización y requerimientos transfusionales, pero el número de estudio es aun insuficiente.
- Es importante demostrar el relevancia clínica del aumento de Hb después del uso de Fe IV.

Conclusiones

- La anemia es frecuente en la población general y en los pacientes quirúrgicos.
- Se asocia a mayor morbimortalidad peri operatoria y a mayor riesgo de recibir transfusiones.
- Las alternativas de tratamiento incluyen:
  - Fierro oral (40 -60 mg diarios o 80 – 120 mg día por medio)
  - Fierro Intravenoso
  - EPO (con o sin Fe)
  - GR (*)

(*) solamente en situaciones excepcionales

Conclusiones

- EL uso de fierro oral es posible pero solo razonable si se inicia al menos 4 semanas antes de la cirugía.
- Si el tiempo disponible es menor, usar Fierro intravenoso.
- La evidencia es prometedora, pero estamos a la espera de estudios randomizados y multi-céntricos que confirmen esta tendencia.

Conclusiones

- El tratamiento de la anemia pre operatoria constituye el primer pilar del PBM.
- La cirugía mayor no urgente debe ser postergada para permitir el diagnóstico y tratamiento de la anemia.
- Existe evidencia de que el uso de Fierro intravenoso es más eficaz en el preoperatorio.

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