BBTS Annual Conference
24th - 26th September 2014 | Harrogate
British Blood Transfusion Society

Title of Session: **Iron supplementation in clinical practice**

Iron therapy in Surgery Practice - when and where?.

Experience from the European leaders

Dr. José A García-Erce

Servicio de Hematología-Hemoterapia
Hospital San Jorge. Huesca
GIEMSA-AWGE. SEHH. IdiPaz 49

British Blood Transfusion Society

BBTS Annual Conference 2014

Acknowledgement

www.awge.org

Prof. Manolo Muñoz Gómez

Medicina Transfusional. *GIEMSA. Universidad de Málaga*

Dr. Jorge Cuenca Espiérrez

Department of Orthopaedic Surgery. Hospital Miguel Servet, Zaragoza

Prof. Antonio Herrera Rodríguez

Cátedra Department of Orthopaedic Surgery. University of Zaragoza

Dr Santiago Ramón Lea-Noval

Coordinador General Documento «Sevilla» de Consenso sobre Alternativas a la Transfusión de Sangre Alogénica

Dra. Elvira Bisbe

Department of Anaesthesiology. University Hospital Mar-Esperança, Barcelona

GIEMSA

IACS (Institudo Aragonés de Ciencias de la Salud)

Conflict of interests

External Assesor

- AMGEN Oncología 2010 y 2012
- Roche Anemia 2009
- Ditassa-Ferrer 2004

Talks, Conference, grants,

-Vifor-Uriach/Ferralinze
-Janssen-Cilag/GSK/Novartis
-Astra-Tech de Aztra Zeneca
-Sanofi Aventis/Esteve
-Cobe-Caridian/Roche Oncología

Member of Trasfusion Acreditation Committee 2002-2005
Member of Documento de Sevilla "Alternativas a la Transfusión"
Member GIEMSA/AWGE/SETS, SEHH, SEFRAOS
NATA Scientific Committee
SEHH representant at ONT

When?
and Where?

But, first of all,
WHY?

When?
and Where?

British Blood Transfusion Society

BBTS Annual Conference 2014

World Health Organization

Blood transfusion is an essential part of modern health care. Used correctly, it can save life and improve health. However, as with any therapeutic intervention, it **may result in acute or delayed complications** and carries the risk of transmission of infectious agents.

*It is necessary to **reduce the unnecessary transfusions**. This can be achieved through the appropriate clinical use of blood, avoiding the needs for transfusion and **use of alternatives to transfusion**.*

*The commitment of the health authorities, health care providers and clinicians are important in **prevention**, **early diagnosis and treatment** of diseases/ conditions that could lead to the need for blood transfusion.*

http://www.who.int/bloodsafety/clinical_use/en/

Manual of Optimal Blood Use

2010

Optimal Blood Use Project

Support for safe, clinically effective and efficient use of blood in Europe

2010 www.optimalblooduse.eu

The outcome, **optimal use** of blood is defined as:
The safe, clinically effective and efficient use of donated human blood

Safe: No adverse reactions or infections
Clinically effective: Benefits the patient
Efficient: ***No unnecessary transfusions.***
Transfusion at the time the patient needs it

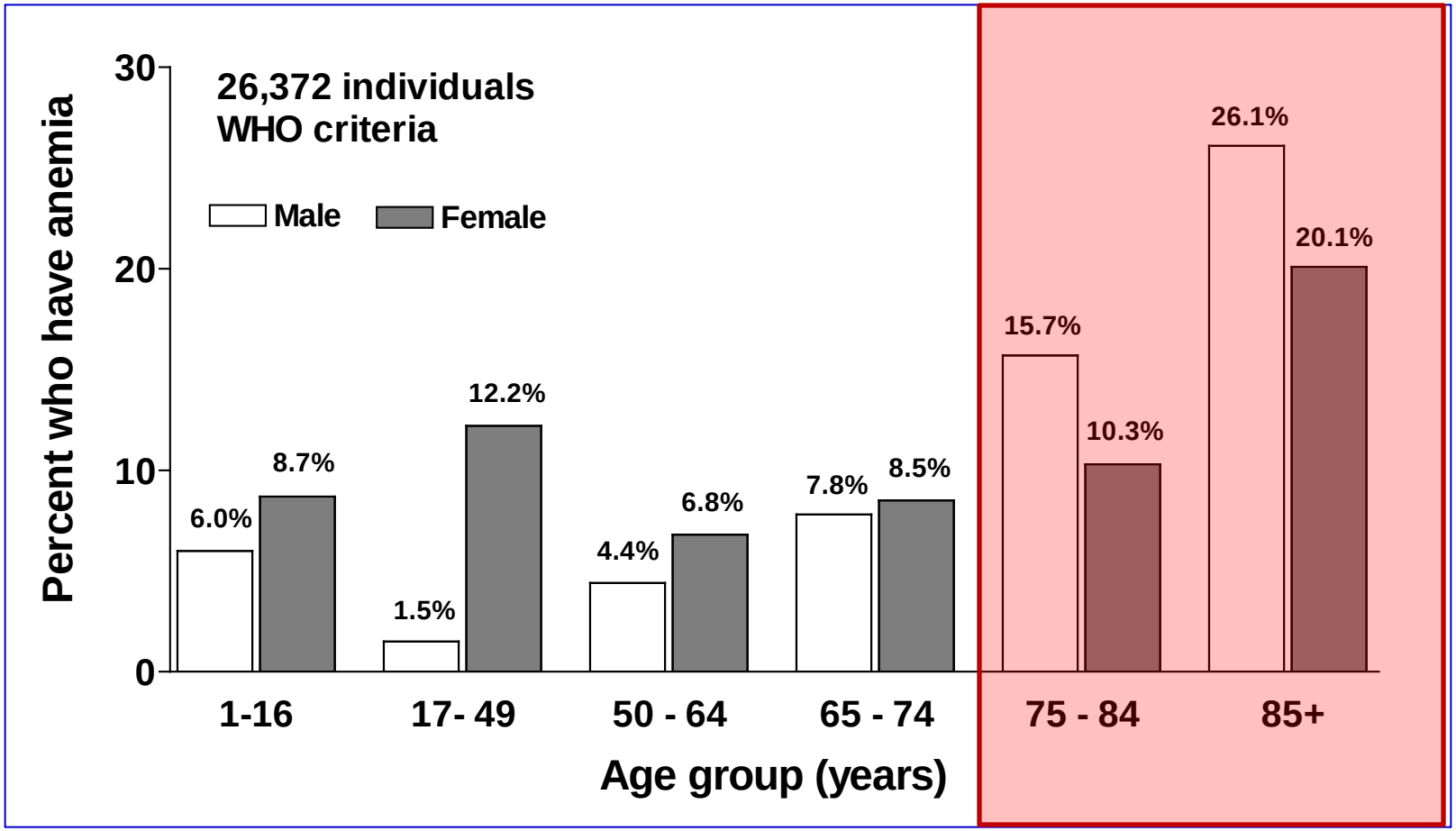
WHY must treat anaemia with Iron therapy in Surgery ?

British Blood Transfusion Society

BBTS Annual Conference 2014

Preoperative Anaemia Incidence

Figure 1. Percentage of persons considered anemic according to age and sex.
NHANES III, phases 1 and 2, 1988 to 1994.



Jack M. Guralnik, Richard S. Eisenstaedt, Luigi Ferrucci, Harvey G. Klein, and Richard C. Woodman

Blood. 2004;104:2263-2268

British Blood Transfusion Society

Preoperative Anaemia Incidence

BBTS Annual Conference 2014

Preoperative Hematocrit Levels and Postoperative Outcomes in Older Patients Undergoing Noncardiac Surgery

Wen-Chih WU et al. **JAMA 2007; 297: 2481 – 2488**

Setting and Patients A total of 310 311 veterans aged 65 years or older who underwent major noncardiac surgery between 1997 and 2004 in 132 Veterans' Affairs medical centers across the United States.

		Haematocrit < 39%	
Procedure	Patients (n)	n	%
General surgery	106 340	45 478	42.8
Urology	59 157	21 408	36.2
Orthopaedics	57 636	25 131	43.6
Periferic vascular	47 734	24 865	52.1
Thoracic	14 051	6 780	48.3
Others	25 393	9 308	36.7
Overall	310 311	132 970	42.8

GIEMSA

British Blood Transfusion Society

BBTS Annual Conference 2014

Preoperative Anaemia Incidence

Preoperative anaemia and postoperative outcomes in non-cardiac surgery: a retrospective cohort study

Khaled M Musallam, Hani M Tamim, Toby Richards, Donat R Spahn, Frits R Rosendaal, Aida Habbal, Mohammad Khreiss, Fadi S Dahdaleh, Kaivan Khavandi , Pierre M Sfeir, Assaad Soweid, Jamal J Hoballah, Ali T Taher, Faek R Jamali

Lancet 2011; 378: 1396–407

Anaemia*	Patients N (%)	Mortality OR (IC 95%)	Morbidity** OR (IC 95%)
Non-anaemic	158196 (69.4)	1	1
Anaemic	69229 (**30.4**)	**1.42** (1.31 – 1.54)	**1.35** (1.30 – 1.40)
• Mild	57870 (25.4)	1.41 (1.30 – 1.53)	1.31 (1.26 – 1.36)
• Moderate - severe	11359 (5.0)	1.44 (1.29 – 1.60)	1.56 (1.47 – 1.66)

Total: **227425** patients

*Mild anaemia: Hto >29% – <36/39%; Moderate-severe anaemia: Hto ≤29%.

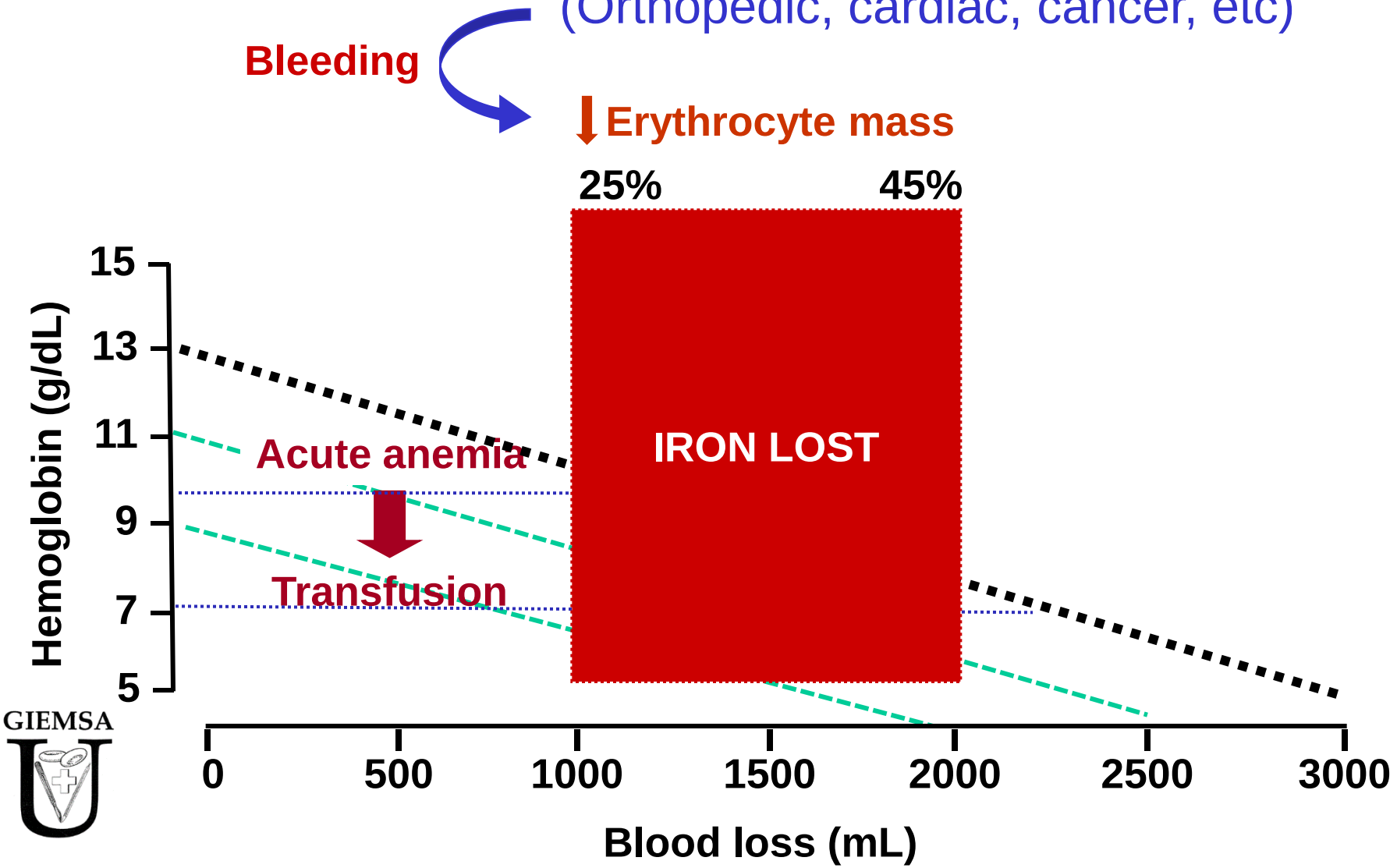
** One o more cardiac, respiratory, renal, neurologic or surgical wound complications, sepsis or deep venous thrombosis (30d postOP).

British Blood Transfusion Society

BBTS Annual Conference 2014

Peri-operative Anemia Etiology

Major surgical procedures
(Orthopedic, cardiac, cancer, etc)



GIEMSA

British Blood Transfusion Society

BBTS Annual Conference 2014

Preoperative Anaemia Etiology

Table 2. Distribution of types of anemia in persons 65 years and older, United States: NHANES III, phase 2, 1991 to 1994

Anemia	No. in the United States	Type, %	All anemia, %
With nutrient deficiency			
Iron only	467 000	48.3	16.6
Folate only	181 000	18.8	6.4
B_{12} only	166 000	17.2	5.9
Folate and B_{12}	56 000	5.8	2.0
Iron with folate or B_{12} or both	95 000	9.9	3.4
Total	965 000	100.0	34.3
Without nutrient deficiencies			
Renal insufficiency only	230 000	12.4	8.2
ACI, no renal insufficiency	554 000	30.0	19.7
Renal insufficiency and ACI	120 000	6.5	4.3
UA	945 000	51.1	33.6
Total	1 849 000	100.0	65.7
Total, all anemia	2 814 000	NA	100.0

GIEMSA

Jack M. Guralnik, Richard S. Eisenstaedt, Luigi Ferrucci, Harvey G. Klein, and Richard C. Woodman

Blood. 2004;104:2263-2268

British Blood Transfusion Society

BBTS Annual Conference 2014

Preoperative Anemia Etiology

Pharmacological management of perioperative anaemia: our experience with intravenous iron in orthopaedic surgery

Manuel Muñoz,[1] José Antonio García-Erce,[2] Jorge Cuenca[3] & Elvira Bisbe[4]

ISBT Science Series (2007) **2**, 257–263

Anaemia: 18 %

	Anaemic *n* = 62	Non-anaemic *n* = 282
Haemoglobin(g/dl)	11,5	14,0*
Ferritin < 30 ng/ml (%)	35,5	17,7*
Vitamin B12 < 270 pg/ml (%)	24,2	21,2
Folate < 3 ng/ml (%)	14,5	7,1
CRP > 1 g/dl (%)	40,7	18,5
Reticulocyte count < 25 × 10^3/µl (%)	25,8	15,2*
MCH < 27 pg (%)	16,9	5*

GIEMSA

British Blood Transfusion Society

BBTS Annual Conference 2014

Preoperative Anemia Etiology

358 patients with colorectal cancer

- 23% anaemia (82/358) (Hb <10 g/dL)
- **40% iron deficient** (70/173) (Fe <40 mg/dL)

Sadahiro et al. J Gastroenterol 1998; 33: 488-94

130 patients with colorectal cancer (12-month period)

- 41% iron deficient with anaemia (53/130) (Hb <11.5 – 12.5 g/dL)
- **60% iron deficient** (77/130) (Ferritin <15 ng/L ± TSI <14%)

Beale et al. Colorectal Disease 2005; 7: 398-402

63 patients with colorectal cancer

- 70% anaemia (Hb <12 – 14 g/dL)
- **80% low serum iron** (Fe <12.5 – 14.3 μmol/L)
- **40% low ferritin** (<20 ng/L) or low MCH (< 27 pg)

Prutki et al. Cancer Lett. 2006;238:188-96.

GIEMSA

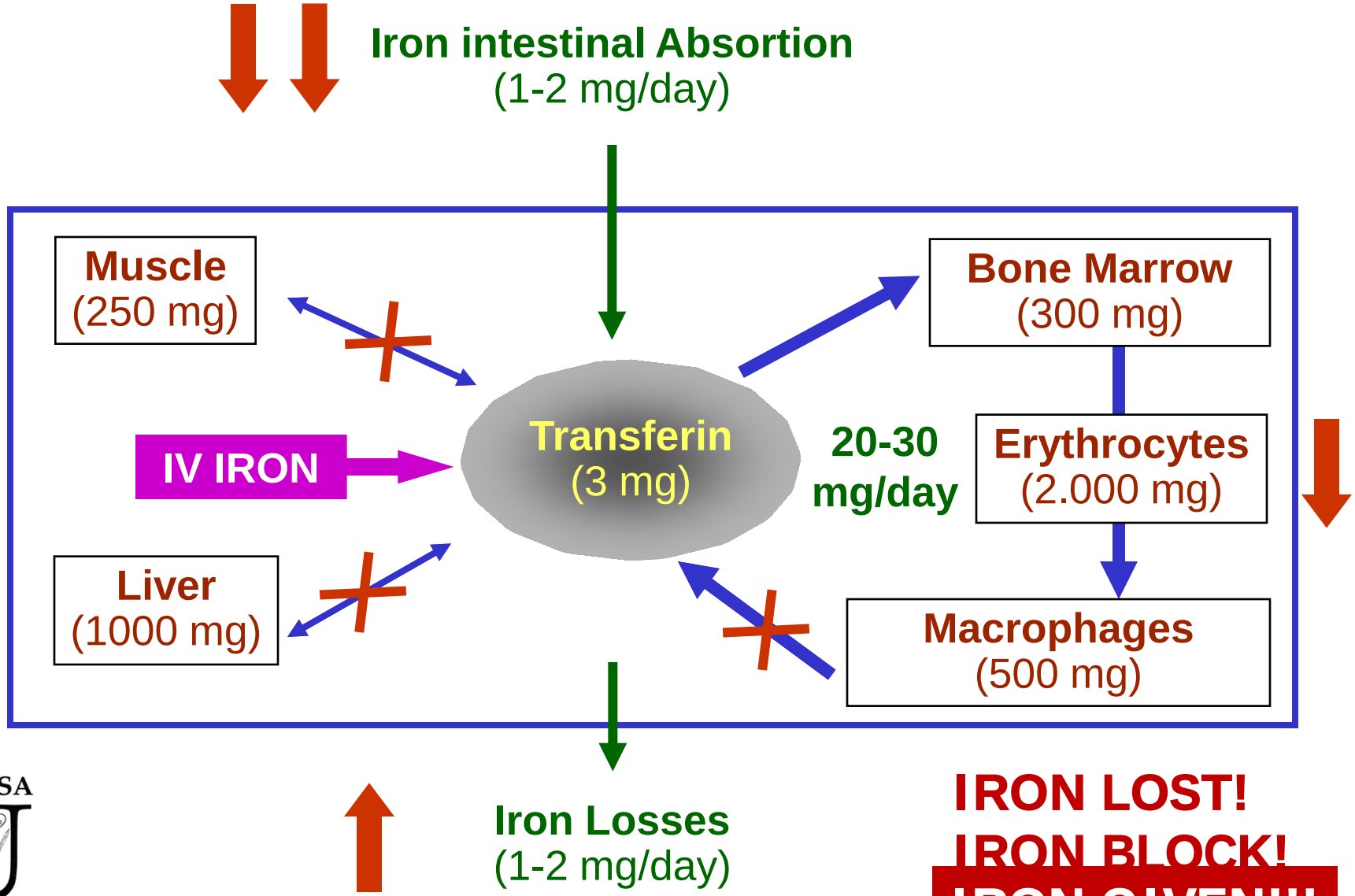
WHY must treat anaemia with Iron therapy in Surgery ?

- *High Preoperative Anemia Incidence*
- *High Iron Deficiency (Anemia) Incidence*
- *Preoperative Haemoglobin and transfusion risk*
- *Transfusion and postoperative complications*
- *Anemia +/- Transfusion and mortality*

British Blood Transfusion Society

BBTS Annual Conference 2014

Preoperative Anemia Etiology



GIEMSA

IRON LOST!

IRON BLOCK!

IRON GIVEN!!!

Patient Blood Management

GIEMSA

Iron therapy in Surgery Practice –
when and where?.

Second,
HOW must we give **Iron therapy in Surgery ?**

When?
and Where?

GIEMSA

Patient Blood Management

Health-care services of member states should establish multidisciplinary, multimodal perioperative Patient Blood Management programs, based on:

- **Perioperative optimization of haematopoiesis**
- **Minimization of blood loss and perioperative coagulopathy ***
- **Optimize tolerance to postoperative anaemia**

* including meticulous surgical hemostasis

World Health Organization

WHA 63.12 (resolution). Availability, safety and quality of blood products, 2010. Available at: http://apps.who.int/gb/ebwha/pdf_files/WHA63/A63_R12-en.pdf.

GIEMSA

Patient Blood Management

	1st Pillar Optimize hematopoiesis	2nd Pillar Minimize blood loss & bleeding	3rd Pillar Harness & optimize tolerance of anemia
Preoperative	• Screen for & manage anemia • Manage underlying disorder(s) • Refer for further evaluation if necessary • Consider anemia as a contraindication for elective surgery	• Identify & manage bleeding risk • Minimize iatrogenic blood loss • Procedure planning & rehearsal • Consider preoperative autologous blood donation	• Assess/optimize physiological reserve & risk factors • Consider patient's estimated blood loss versus tolerable blood loss • Restrictive, evidence-based transfusion strategies
Intraoperative	• Time surgery with hematological optimization	• Meticulous hemostasis & blood-sparing surgical techniques • Autologous blood options • Pharmacological/haemostatic agents	• Optimize cardiac output • Optimize ventilation & oxygenation • Restrictive, evidence-based transfusion strategies
Postoperative	• Screen for & Treat anemia • Be aware of drug interactions that can cause/worsen anemia	• Monitor & manage post-operative bleeding/secondary hemorrhage/infections • Maintain normothermia • Autologous blood salvage • Minimize iatrogenic blood loss • Manage anticoagulation • Prophylaxis of upper GI hemorrhage • Be aware of adverse effects of medications	• Optimise tolerance of anemia • Maximize oxygen delivery • Minimize oxygen consumption • Avoid/treat infections promptly • Restrictive, evidence-based transfusion strategies

British Blood Transfusion Society

BBTS Annual Conference 2014

Spaniard Patient Blood Management

Hb <70-80 g/L

Transfusional "*restrictive*" ciriteria

Erythropoiesis Stimulation

- Vitamina B_{12}
- Acido Fólico
- *rHuEpo*
- *Hierro*

Bleeding reduction

- Aprotinina
- Antifibrinoliticos
- Desmopresina
- rFVIIa

Autologous Blood

- Donacion preoperatoria
- Hemodilución
- Recuperación perioperatoria

GIEMSA

Spanish Consensus Statement on alternatives to allogeneic blood transfusion: the 2013 update of the "Seville Document". Blood Transfus. 2013 Jun 17:1-25.

So,

WHEN

Iron therapy in Surgery ?

- PREOPERATIVE

Patient Blood Management

1st Pillar

Optimise haemopoiesis

Preoperative

- Screen for anaemia
- Identify underlying disorder(s) causing anaemia
- Manage underlying disorder(s)
- Refer for further evaluation if necessary
- Treat iron deficiency, anaemia of chronic disease, iron-restricted erythropoiesis
- Note: anaemia is a contraindication for elective surgery

GIEMSA

A multimodal approach to PBM (or blood conservation). Adapted from Hofmann and colleagues

British Journal of Anaesthesia **106** (1): 13–22 (2011)
doi:10.1093/bja/aeq361

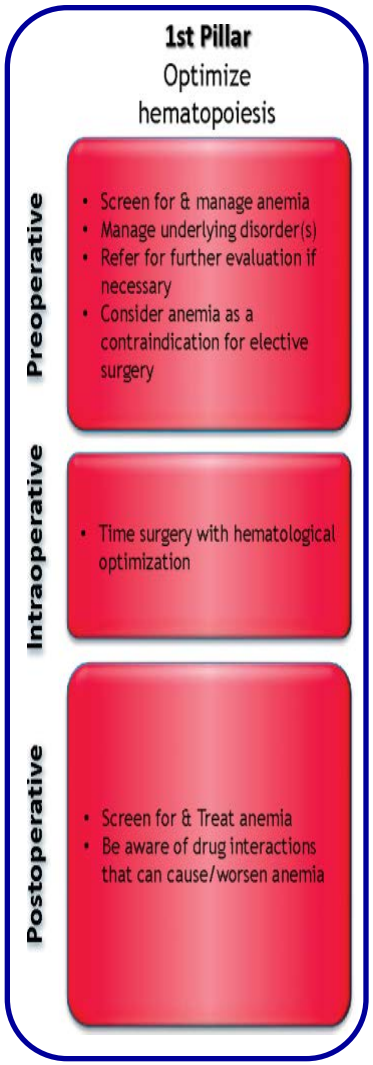
BJA

Detection, evaluation, and management of preoperative anaemia in the elective orthopaedic surgical patient: NATA guidelines

L. T. Goodnough[1*], A. Maniatis[2], P. Earnshaw[3], G. Benoni[4], P. Beris[5], E. Bisbe[6], D. A. Fergusson[7], H. Gombotz[8], O. Habler[9], T. G. Monk[10], Y. Ozier[11], R. Slappendel[12] and M. Szpalski[13]

"Whenever clinically feasible, patients undergoing elective surgery with a high risk of severe postoperative anaemia should have their **haemoglobin level and iron status tested, preferably at least 28 days before the surgical procedure**. For patients >60 yr old, **vitamin B_{12} and folic acid** should also be measured".

How can we manage preoperative anaemia?

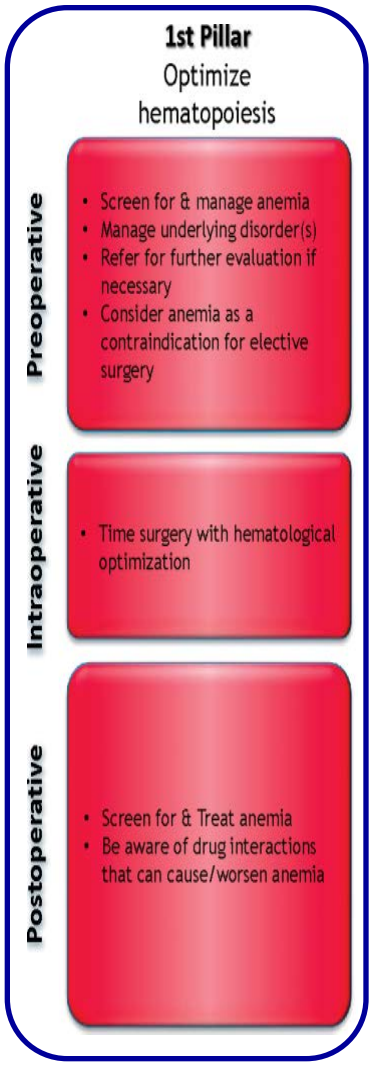


The "*ORTHODOX* " approach

- ✓ **Detection of anaemia**, preferably at least 28 days before the surgical procedure.
- ✓ **Classification of anaemia** to implement appropriate treatment, if possible.
- ✓ **Unexplained anaemia** should be further investigated and surgical procedure postponed, if possible.
- ✓ **Haematinic defficiencies** without anaemia should be supplemented to allow:
  - Preoperative Hb optimization.
  - Hastening the recovery from postoperative anaemia.

Goodnough et al. NATA guidelines. BJA 2011;106:13-22.
Seville Document Update. Blood Transfusion 2013.

Treatment options



"*ORTHODOX*" Iron supplementation

- ✓ **Preoperative oral iron (Grade 2B)**
  - ID or low iron stores (ferritin <100 ng/mL), if there is enough time.

- ✓ **Postoperative oral iron (Grade – 1B)**
  - No recommended.

- ✓ **Preoperative IV iron (Grade 2B)**
  - Orthopaedic, gynaecologic, colo-rectal.
- ✓ **Perioperative IV iron (Grade 2B)**
  - Orthopaedic, gynaecologic, cardiac (± rHuEPO).

Seville Document Update. Blood Transfusion 2013.

British Blood Transfusion Society

BBTS Annual Conference 2014

PBM *PREOPERATIVE IV IRON*

"*ORTHODOX* " IRON TREATMENT

TID (mg) = (Hb_{target} - $Hb_{baseline}$) x Weight x 2.4 + 500

Low preOP Hb levels	≈ 150 mg of iron to increase Hb 1 g/dL
Oral iron	Maximal daily absorption 10 mg: for a patient with Hb 10 g/dL, treatment for 3-4 months
Surgical blood loss	500 mL of blood contain ≈ 200-250 mg of iron
Low/empty iron stores	20-25 ng/mL of ferritin to increase Hb 1 g/dL: 100 ng/mL to recover from 3-4 g/dL Hb loss
Inflammation	*Hepcidin impairs/blocks iron absorption from intestine and iron mobilisation from macrophages*
Intravenous iron	*Overcomes hepcidin blockage* *High single doses at once*

GIEMSA

PBM *PRE-OPERATIVE IV IRON*

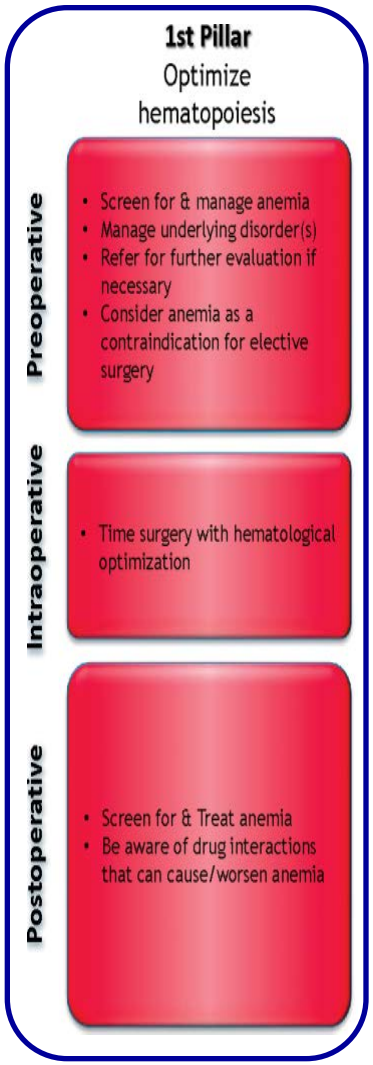
A multicentre comparative study on the efficacy of intravenous ferric carboxymaltose and iron sucrose for correcting preoperative anaemia in patients undergoing major elective surgery

E. Bisbe
J. A. García-Erce
A. I. Díez-Lobo
M. Muñoz*
Anaemia Working Group España (AWGE), Barcelona, Huesca, Segovia and Málaga, Spain

	Iron sucrose				Ferric carboxymaltose			
	All	Colon cancer resection	Abdominal hysterectomy	Lower limb arthroplasty	All	Colon cancer resection	Abdominal hysterectomy	Lower limb arthroplasty
Patients (*n*)†	84	30	33	21	76	15	19	42
Gender (female/male)	59/25	8/22	33/0	17/4	66/10	5/10	19/0	37/5
Age (yr)	60 (32–88)	67 (36–83)	45 (32–55)	72 (53–88)	62 (36–87)	65 (36–87)	48 (36–75)	68 (46–82)
Sessions (n)	5 (2)	6 (3)	5 (2)	4 (4)	2 (1)**	3 (1)**	2 (1)**	2 (1)**
Baseline Hb (g dl^{-1})	10.1 (1.3)	10.1 (1.2)	9.7 (1.2)	10.7 (1.1)	10.4 (1.6)	9.2 (1.0)*	10.6 (1.3)	10.9 (1.7)
Final Hb (g dl^{-1})‡	12.1 (1.4)	11.0 (1.4)	12.7 (0.8)	12.6 (1.0)	12.5 (1.0)*	11.7 (0.8)**	12.4 (1.2)	12.8 (0.9)
Hb increment (g dl^{-1})¶	2.0 (1.6)	0.9 (1.5)	3.0 (1.2)	1.8 (1.1)	2.1 (1.4)	2.5 (1.3)*	2.3 (1.1)	1.8 (1.4)
Response rate [*n* (%)]§	56 (67)	10 (33)	32 (97)	14 (67)	53 (70)	11 (73)*	13 (68)*	29 (69)
Anaemia correction [*n* (%)]‖	50 (59)	6 (20)	29 (88)	15 (71)	55 (72)	5 (33)	13 (68)	37 (88)
Allogeneic transfusion	20 (24)	12 (40)	2 (6)	6 (29)	7 (9)*	1 (7)*	0 (0)	6 (14)

Br J Anaesth 2011; 107: 477-478

How can we manage preoperative anaemia?



- The "ORTHODOX" approach

- **The "PRAGMATIC" approach**

EDITORIAL

Implementing Patient Blood Management in major orthopaedic procedures: orthodoxy or pragmatism?

Manuel Muñoz[1], Susana Gómez-Ramírez[2], José A. García-Erce[3]

Blood Transfus 2014; 12: 146-9 DOI 10.2450/2014.0050-14

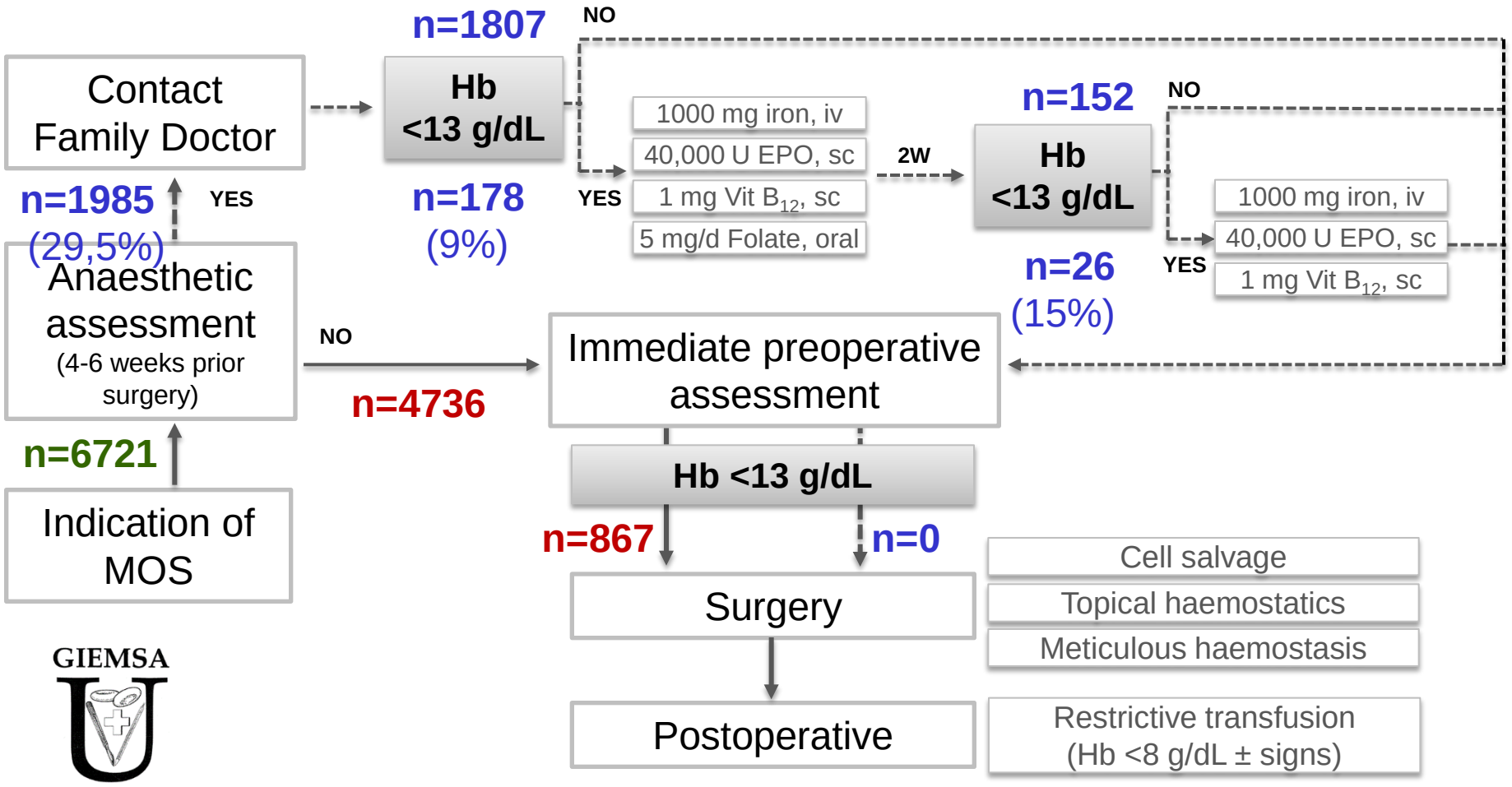
British Blood Transfusion Society

BBTS Annual Conference 2014

PBM *PREOPERATIVE IV IRON*

A PRAGMATIC APPROACH

Balgrist University Hospital, Zurich (2009 - 2011)



GIEMSA

Modified © Prof. M. Muñoz

Theusinger, et al. Blood Transfusion 2014; 195-203

British Blood Transfusion Society

BBTS Annual Conference 2014

PBM *PREOPERATIVE IV IRON*

A PRAGMATIC APPROACH

Balgrist University Hospital, Zurich. A 4-years audit (2008-2011)

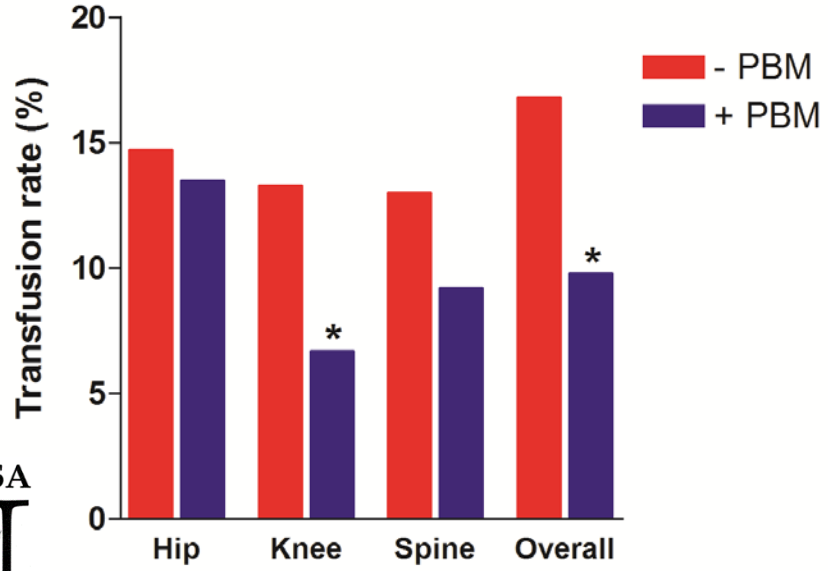
Transfusion rates according to period, anaemia status and type of surgery

- PBM, control (2008, n:2150); + PBM, study period (2009-2011, n:6721)

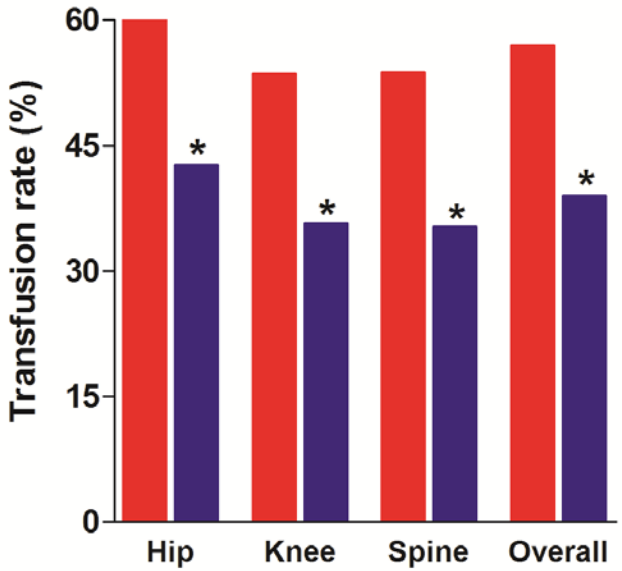
Anaemia on day of surgery decreased from **15.4**% vs **9**% (*); 17.6% to 12.9 % (*) in THR and 15.5% to 7.8% (*) in TKR. **Transfusion** rates decreased from **20.7**% vs **12.8**%(*);, 21.8% to 15.7% (*) in THR, from 19.3% to 4.9% (*) in TKR.

(*) p<0.001)

Non-anaemic patients on DS



Anaemic patients on DS



GIEMSA

Modified: © Prof. M. Muñoz

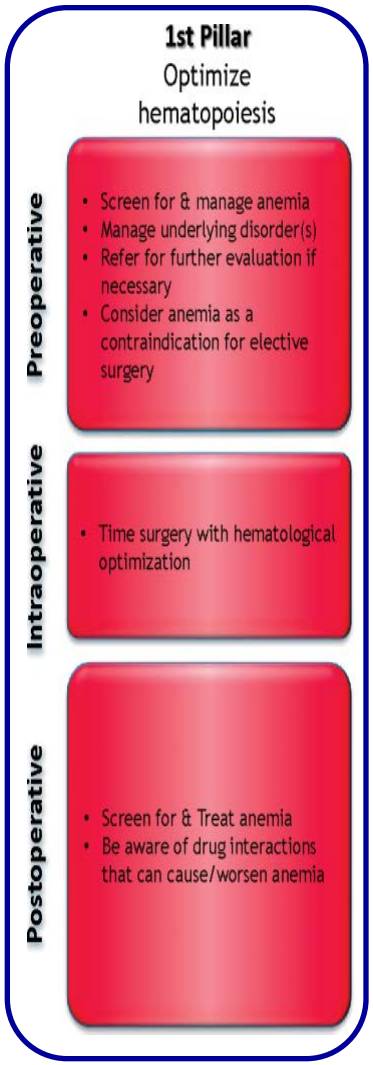
Theusinger, et al. Blood Transfusion 2014; 195-203

So,

WHEN
Iron therapy in Surgery ?

- PREOPERATIVE
- **PERI-OPERATIVE**

How can we manage preoperative anaemia?



- The "ORTHODOX" approach
- The "PRAGMATIC" approach

What can we do if this time-frame in not available?

- **The "OPPORTUNITY" approach**

✓ **Very short-term perioperative IV iron ± ESA**

Beris et al. NATA Consensus IV iron. BJA 2009;100: 599-604.
Seville Document Update. Blood Transfus 2013; 11:585-610.

British Journal of Anaesthesia **100 (5):** 599–604 (2008)
doi:10.1093/bja/aen054 Advance Access publication March 27, 2008

BJA

REVIEW ARTICLE

CME

Perioperative anaemia management: consensus statement on the role of intravenous iron

P. Beris[1]*†, M. Muñoz[2], J. A. García-Erce[3], D. Thomas[4], A. Maniatis[5]† and P. Van der Linden[6]

- *Grade of recommendation:* .

"For patients undergoing orthopaedic surgery expected to develop severe postoperative anaemia we currently suggest IV iron administration during the perioperative period".

For all other surgeries no evidence-based recommendation can be made. We strongly recommend that large prospective randomised controlled trials are undertaken in patients undergoing surgery expected to develop severe post operative anaemia.

Muñoz et al. Transfusion 2014; 54: 289 – 299.

ORIGINAL ARTICLE

Very-short-term perioperative intravenous iron administration and postoperative outcome in major orthopedic surgery: a pooled analysis of observational data from 2547 patients

Manuel Muñoz, Susana Gómez-Ramírez, Jorge Cuenca, José Antonio García-Erce, Daniel Iglesias-Aparicio, Sami Haman-Alcober, Daniel Ariza, and Enrique Naveira

Transfusion. 2013 Apr 15. doi: 10.1111/trf.12195. [Epub ahead of print]

GIEMSA

4 Spanish hospitals (October 2002 – December 2011)

Muñoz et al. Transfusion 2014; 54: 289 – 299.

Objective

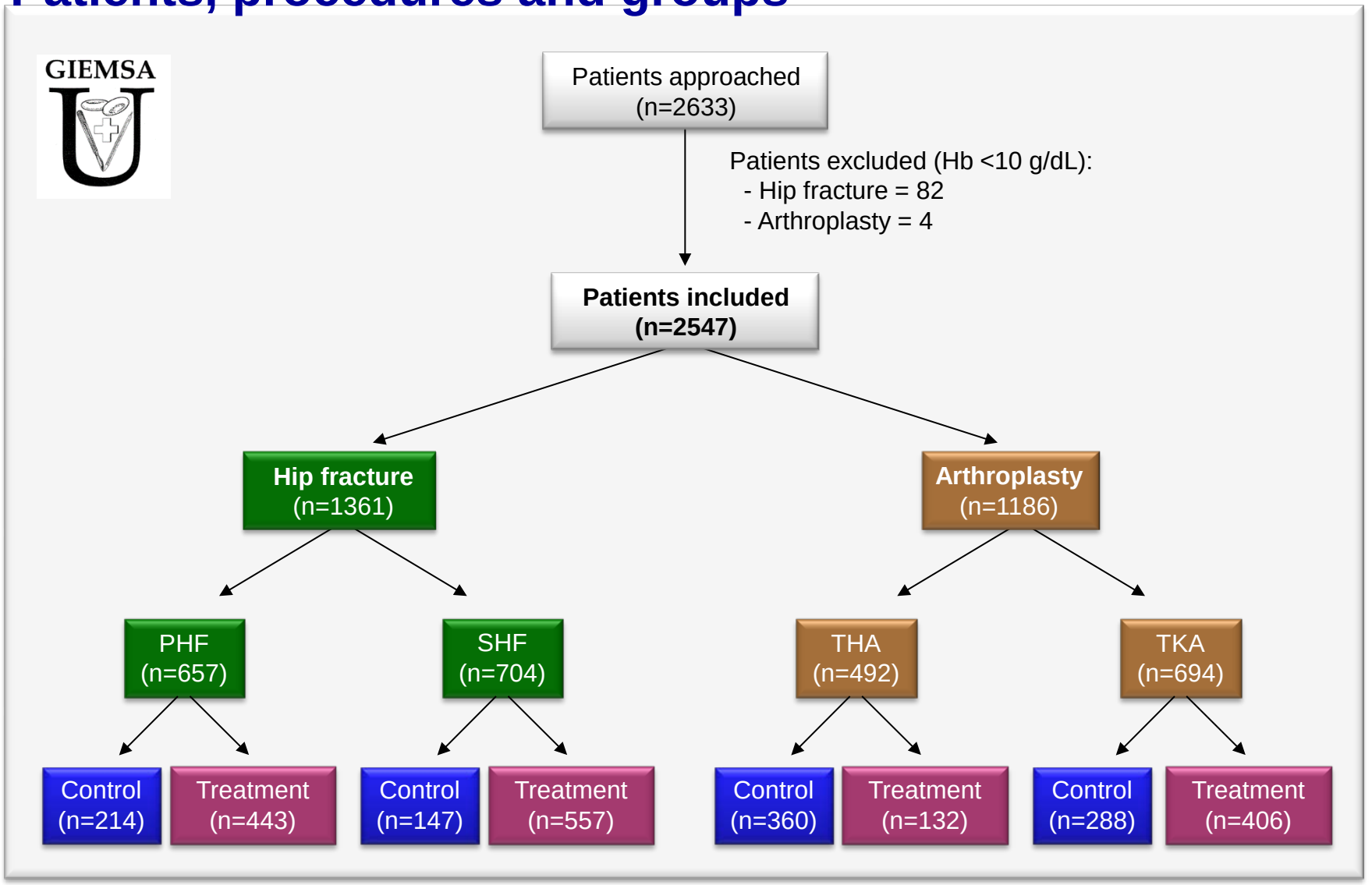
We pooled all our observational data to ascertain the benefits of this treatment on:

- **Transfusion reduction** (primary outcome variable)
- **Postoperative nosocomial infection** (primary outcome variable)
- **Length of hospital stay** (secondary outcome variable)
- **Postoperative 30-day mortality** (secondary outcome variable)

Note: Postoperative nosocomial infection was clinically diagnosed by a senior member of the surgical or medical team, and was always confirmed by laboratory, microbiological or radiological evidence.

Patients, procedures and groups

Muñoz et al. Transfusion 2014; 54: 289 – 299.



Muñoz et al. Transfusion 2014; 54: 289 – 299.

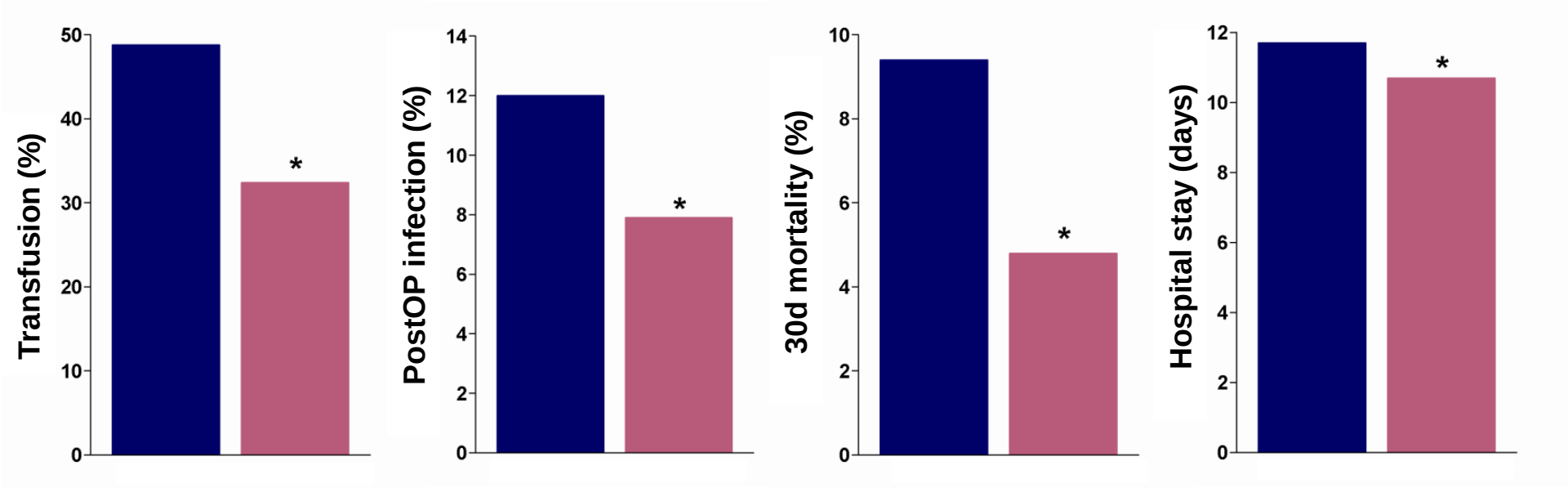
Treatment

- **Intravenous iron:** either 2-5 days preoperatively and/or 2-3 days postoperatively, with a maximum 600 mg.
- **rHuEPO:** single preoperative dose (40,000 IU, sc) was administered at the orthopedic ward to some patients presenting with preoperative Hb level of less than 13 g/dL.
- Control group: oral iron or no treatment
- No other blood conservation measure was used.
- Patients were managed with a ***restrictive transfusion trigger***.

Muñoz et al. Transfusion 2014; 54: 289 – 299.

Transfusion and postoperative outcomes

- Respect to **control**, very short-term **perioperative IV iron** administration, with or without rHuEPO, significantly reduced (*p<0.01):



- **No clinically relevant AEs** were observed.
- The **scheduled IV iron dose** (200-600 mg) may not cover total iron loss, especially in patients with preoperative iron deficiency.
- **Preoperative rHuEPO** was only administered in 351 out of 1059 patients presenting with Hb level <13 g/dL and no contraindication.

GIEMSA

Muñoz et al. Transfusion 2014; 54: 289 – 299.

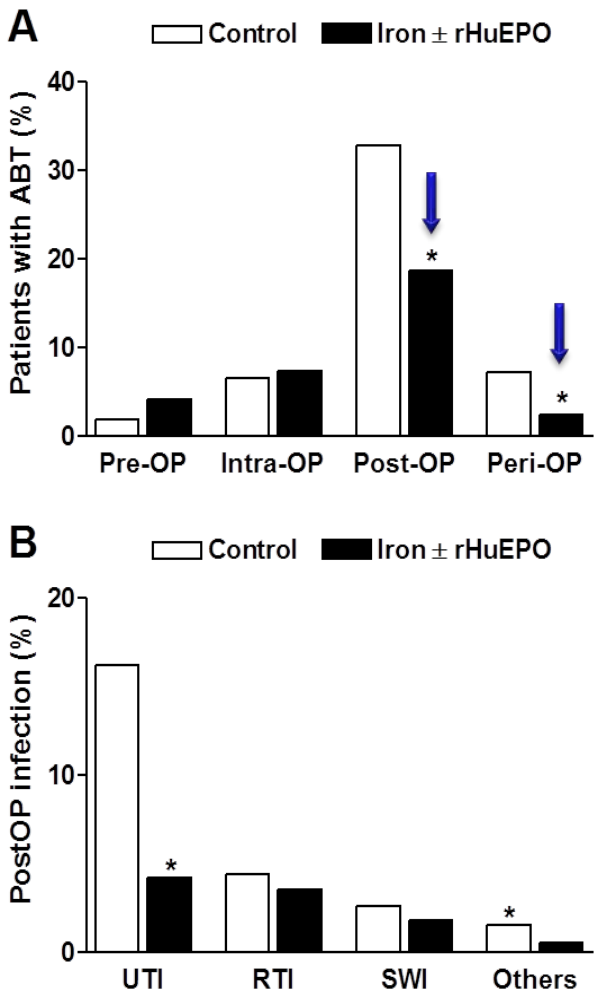
GIEMSA

Hip fracture repair

Transfusion

	All HF patients	
	Control	Iron ± rHuEPO
Patients	361	1000
Age (years)	83 ± 7	83 ± 8
Gender (M/F)	63/298	161/839
ASA III/IV (n, %)	214 (59.3)	611 (61.1)
Time to surgery (days)	4.5 ± 3.3	4.1 ± 2.4*
PHF/SHF	214/147	443/557
Treatment, n (%)		
200-600 mg IV iron	0	710
IV iron + rHuEPO	0	290
Admission Hb (g/dL)	13.0 ± 1.3	13.1 ± 1.4
Patients transfused, n (%)	176 (48.8)	324 (32.4)**
Transfusion index (U/patient)	1.2 ± 1.5	0.7 ± 1.3**
Postoperative infection, n (%)	97 (26.9)	107 (10.7)**
30d mortality, n (%)	34 (9.4)	48 (4.8)**
Length of hospital stay (days)	13.4 ± 6.3	11.9 ± 6.1**

Iron ± rHuEPO, 400-600 mg iron sucrose IV ± 40,000 IU recombinant human erythropoietin;
*p<0.05, control vs. treatment;
**p<0.01, control vs. treatment



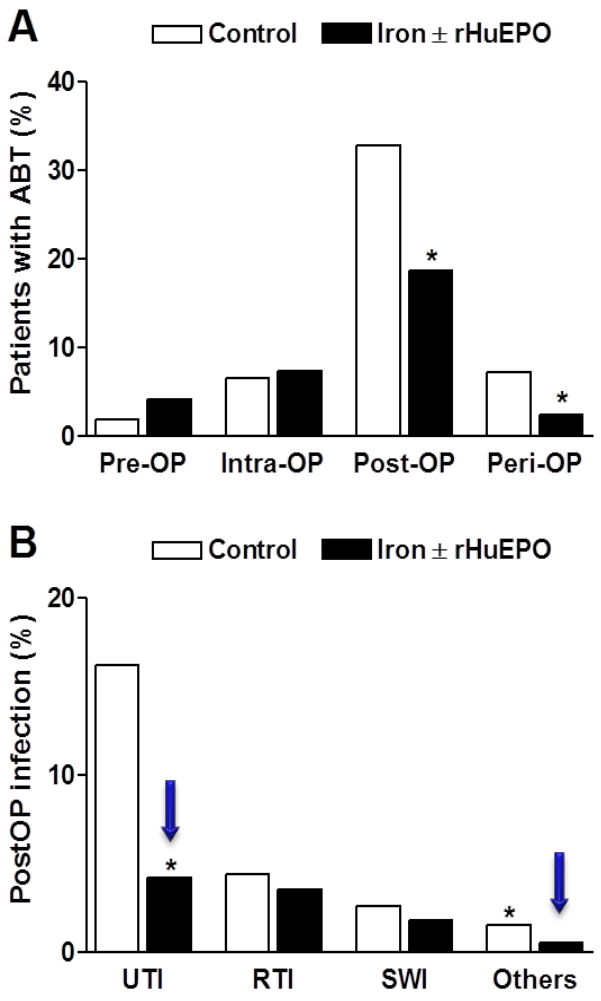
GIEMSA

Hip fracture repair

Infection

	All HF patients	
	Control	Iron ± rHuEPO
Patients	361	1000
Age (years)	83 ± 7	83 ± 8
Gender (M/F)	63/298	161/839
ASA III/IV (n, %)	214 (59.3)	611 (61.1)
Time to surgery (days)	4.5 ± 3.3	4.1 ± 2.4*
PHF/SHF	214/147	443/557
Treatment, n (%)		
200-600 mg IV iron	0	710
IV iron + rHuEPO	0	290
Admission Hb (g/dL)	13.0 ± 1.3	13.1 ± 1.4
Patients transfused, n (%)	176 (48.8)	324 (32.4)**
Transfusion index (U/patient)	1.2 ± 1.5	0.7 ± 1.3**
Postoperative infection, n (%)	97 (26.9)	107 (10.7)**
30d mortality, n (%)	34 (9.4)	48 (4.8)**
Length of hospital stay (days)	13.4 ± 6.3	11.9 ± 6.1**

Iron ± rHuEPO, 400-600 mg iron sucrose IV ± 40,000 IU recombinant human erythropoietin;
*p<0.05, control vs. treatment;
**p<0.01, control vs. treatment



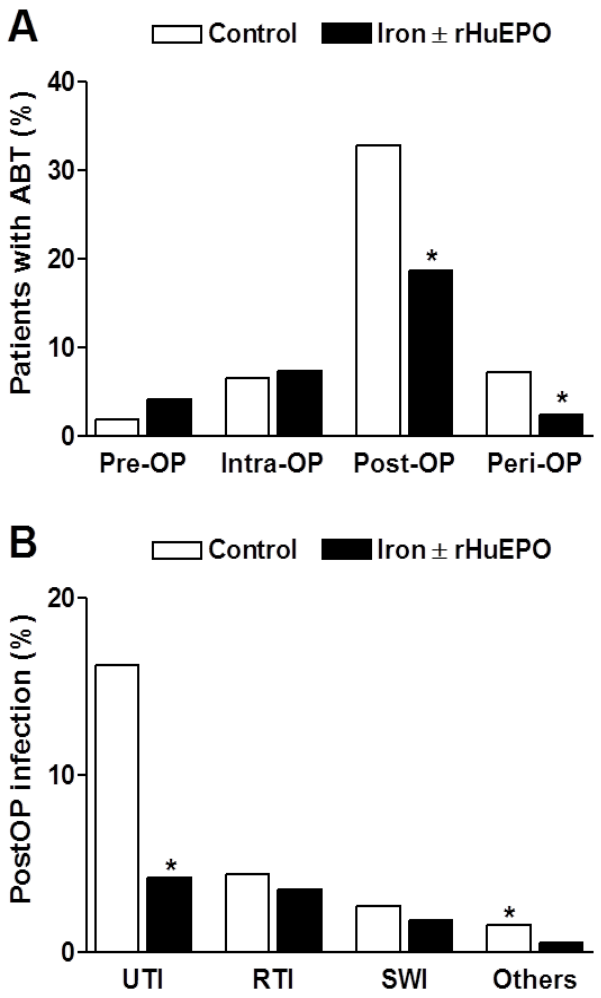
GIEMSA

Hip fracture repair

Hospital stay & mortality

	All HF patients	
	Control	Iron ± rHuEPO
Patients	361	1000
Age (years)	83 ± 7	83 ± 8
Gender (M/F)	63/298	161/839
ASA III/IV (n, %)	214 (59.3)	611 (61.1)
Time to surgery (days)	4.5 ± 3.3	4.1 ± 2.4*
PHF/SHF	214/147	443/557
Treatment, n (%)		
200-600 mg IV iron	0	710
IV iron + rHuEPO	0	290
Admission Hb (g/dL)	13.0 ± 1.3	13.1 ± 1.4
Patients transfused, n (%)	176 (48.8)	324 (32.4)**
Transfusion index (U/patient)	1.2 ± 1.5	0.7 ± 1.3**
Postoperative infection, n (%)	97 (26.9)	107 (10.7)**
30d mortality, n (%)	34 (9.4)	48 (4.8)**
Length of hospital stay (days)	13.4 ± 6.3	11.9 ± 6.1**

Iron ± rHuEPO, 400-600 mg iron sucrose IV ± 40,000 IU recombinant human erythropoietin;
*p<0.05, control vs. treatment;
**p<0.01, control vs. treatment



GIEMSA

Hip fracture repair

Effects of IVI & transfusion

TABLE 3. Demographic and clinical data of patients undergoing surgery for hip fracture repair according to ABT status and treatment with IV iron with or without rHuEPO

	Patients without ABT		Patients with ABT	
Parameter	Control	Iron ± rHuEPO	Control	Iron ± rHuEPO
Patients, n	185	676	176	324
Age (years)	82 ± 7	83 ± 8	84 ± 7	84 ± 9
Sex (M/F)	37/148	118/558	26/150	43/281
ASA III/IV, n (%)	124 (67.0)	396 (58.6)*	90 (51.1)	215 (66.4)†
PHF/SHF (n/n)	86/99	273/403	128/48	170/154†
Admission Hb (g/dL)	13.6 ± 1.2	13.4 ± 1.3	12.5 ± 1.1	12.3 ± 1.4
Time to surgery (days)	4.3 ± 3.0	4.0 ± 2.3	4.7 ± 3.6	4.2 ± 2.6
Infection, n (%)	36 (19.5)	49 (7.2)†	61 (34.7)	58 (17.9)†
30-day mortality, n (%)	13 (7.0)	19 (2.8)†	21 (11.9)	29 (8.9)
LHS (days)	12.1 ± 5.7	11.1 ± 5.2*	14.7 ± 6.6	13.6 ± 7.4

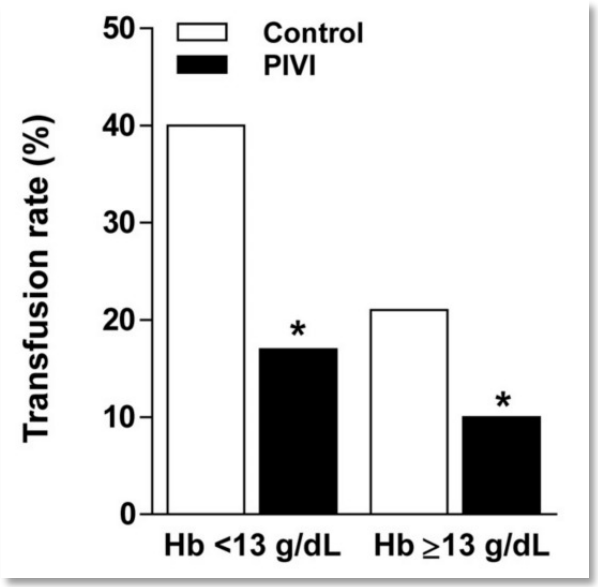
* $p < 0.05$, control versus treatment.

† $p < 0.01$, control versus treatment.

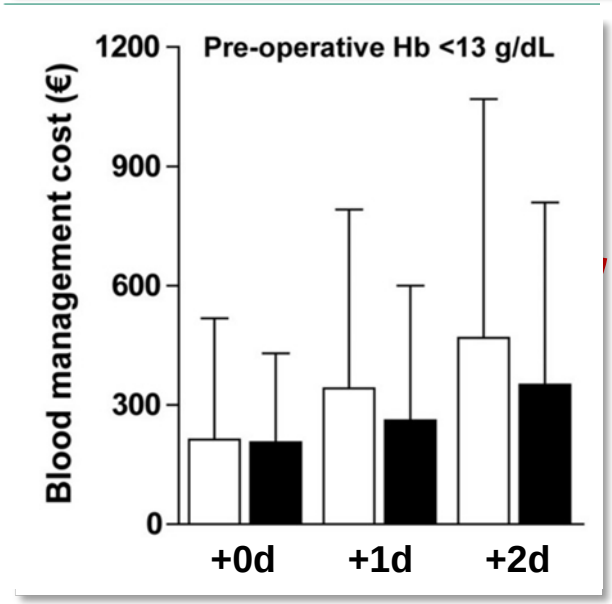
The "opportunity" approach: cost-efficacy

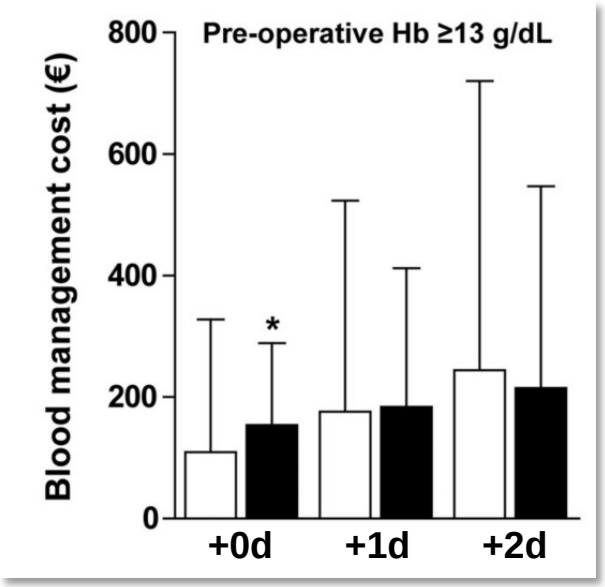
- Data from **182 matched-pairs** of total lower limb arthroplasty patients.
- Managed with a restrictive transfusion protocol without (control group) or with **post-operative intravenous iron** (iron group; 600 mg IVI).
- **Cost analysis model** included: acquisition and administration costs of IV iron and allogeneic red cell concentrates, haemoglobin measurements, and prolonged stay in hospital (+0, +1 or +2 days).

Transfusion analysis



Cost-efficacy analysis





Muñoz et al. Blood Transfusion 2014; 12(1):40-9

The "*opportunity*" approach: long term benefits

Transfusion Medicine, 2006, **16**, 335–341 doi: 10.1111/j.1365-3148.2006.00682.x

ORIGINAL ARTICLE

Perioperative intravenous iron preserves iron stores and may hasten the recovery from post-operative anaemia after knee replacement surgery

J. A. García-Erce,* J. Cuenca,† F. Martínez,† R. Cardona,† L. Pérez-Serrano† & M. Muñoz‡

**Departments of Haematology and †Orthopaedic and Trauma Surgery, University Hospital "Miguel Servet", Zaragoza, Spain, and ‡GIEMSA, School of Medicine, University of Málaga, Málaga, Spain*


MegaPortadas.com

So,

WHEN

Iron therapy in Surgery ?

- PREOPERATIVE
- PERI-OPERATIVE
- **POST-OPERATIVE**

Patient Blood Management

1st Pillar

Optimise haemopoiesis

Postoperative

- Treat anaemia/iron deficiency
- Stimulate erythropoiesis
- Be aware of drug interactions that can cause/increase anaemia

GIEMSA

A multimodal approach to PBM (or blood conservation). Adapted from Hofmann and colleagues

GIEMSA

Muñoz M et al. **Effects of postoperative IV iron on transfusion requirements after lower limbarthroplasty.** Br J Anaesth. 2012 Mar;108(3):532

Table 1 Patients' characteristics and postoperative i.v. iron supplementation. Values are expressed as mean (SD) or incidence (%). #*P*-value (two-way ANOVA or Pearson χ^2). **P*<0.05, 600 *vs* control; ***P*<0.05, 600 *vs* 300 (Student's *t*-test *post-hoc*). M, male; F, female; THA, total hip arthroplasty; TKA, total knee arthroplasty; THA-HF, total hip arthroplasty for hip fracture; preOP, preoperative; POD, postoperative day; ABT, allogeneic blood transfusion; LOS, length of hospital stay

	Postoperative i.v. iron dose (mg)			#*P*-value
	0 (control)	300	600	
Patients (*n*)	19	32	63	
Gender (M/F)	3/15	11/20	15/44	0.308
Age (yr)	75 (10)	74 (10)	73 (13)	0.205
Surgery (*n*)				0.208
TKA	13	16	25	
THA	1	7	15	
THA-HF	5	9	23	
Hb preOP (g dl^{-1})	12.5 (1.5)	11.8 (1.2)	12.4 (1.3)**	0.031
Hb POD1 (g dl^{-1})	8.7 (1.0)	8.7 (0.8)	9.1 (0.6)*,**	0.012
Hb POD7 (g dl^{-1})	10.1 (0.7)	9.6 (0.7)*	9.8 (0.9)	0.009
ABT rate [*n* (%)]	16 (84)	20 (62)	29 (46)	0.010
ABT index (U pte^{-1})	2.0 (0.9)	1.4 (1.3)	0.9 (1.2)*	0.007
Hb pre-ABT (g dl^{-1})	7.6 (0.8)	7.7 (0.8)	7.7 (0.9)	0.566
Infection [*n* (%)]	5 (26.3)	5 (15.6)	2 (3.2)	0.009
In-hospital death [*n* (%)]	1 (5.3)	0 (0)	1 (1.6)	0.379
LOS (days)	11.8 (3.6)	11.3 (4.2)	9.2 (3.0)*,**	0.013

PBM *POSTOPERATIVE IV IRON*

BJA

BBTS Annual Conference 2014

Randomized trial comparing ferric carboxymaltose *vs* oral ferrous glycine sulphate for postoperative anaemia after total knee arthroplasty

Br J Anaesth. 2014 Sep;113(3):402-9

E. Bisbe[1,3*], L. Moltó[1], R. Arroyo[1], J. M. Muniesa[2] and M. Tejero[2]

Results. Of 161 preoperatively non-anaemic patients, 122 (75.8%) developed anaemia after operation (within 24 h) and were enrolled in this study (60 FCM, 62 FS). Hb substantially decreased until day 4 in both groups, and partly recovered by day 30. FCM-treated patients achieved Hb >12.0 g dl^{-1} more frequently (42.3% *vs* 23.5%; *P*=0.04) and showed a trend towards higher Hb increase from day 4 to day 30 [+1.7 (1.2) *vs* +1.3 (1.0); *P*=0.075] compared with FS-treated patients. Patients with postoperative Hb <10 g dl^{-1} experienced better Hb increase with FCM [+2.4 (0.3) g dl^{-1}] than FS [+1.1 (0.4) g dl^{-1}; *P*=0.018]. Patients being iron-deficient at enrolment (56.7%) had a higher Hb increase with FCM [+1.9 (0.3) g dl^{-1}] than FS [+1.2 (0.2) g dl^{-1}; *P*=0.03]. Total EQ-5D and performance outcomes were comparable between the groups, but FCM was associated with better scores for 'usual activities'. No i.v. iron-related adverse events were reported.

Conclusions. Preoperatively non-anaemic TKA patients are at high risk of postoperative anaemia. Postoperative i.v. FCM provided significant benefit over oral FS, particularly in patients with preoperative iron deficiency, severe postoperative anaemia, or both.

Clinical trial registration. EudraCT 2010-023038-22; ClinicalTrials.gov NCT01913808.

So,

WHEN

Iron therapy in Surgery ?

Any time is a good time
for treating perioperative anaemia!

Please,
AS SOON AS POSSIBLE!!

So,

WHERE
Iron therapy in Surgery ?

New recommendations to manage risk of allergic reactions with intravenous iron-containing medicines

Intravenous iron medicines should only be administered when staff trained to evaluate and manage anaphylactic and anaphylactoid reactions are immediately available as well as resuscitation facilities.

Patients should be closely observed for signs and symptoms of hypersensitivity reactions during and for at least 30 minutes following each injection of an intravenous iron medicine.


forging the Ring
THE IRON REVENGE
ENJOY SPINACHS

HOW
Iron therapy in Surgery ?

NICELY,
But sometimes with EPO

The International Journal of Transfusion Medicine
Vox Sanguinis

PBM PERIOPERATIVE IV IRON

+ EPO

Vox Sanguinis (2009) 97, 260–267

ORIGINAL PAPER

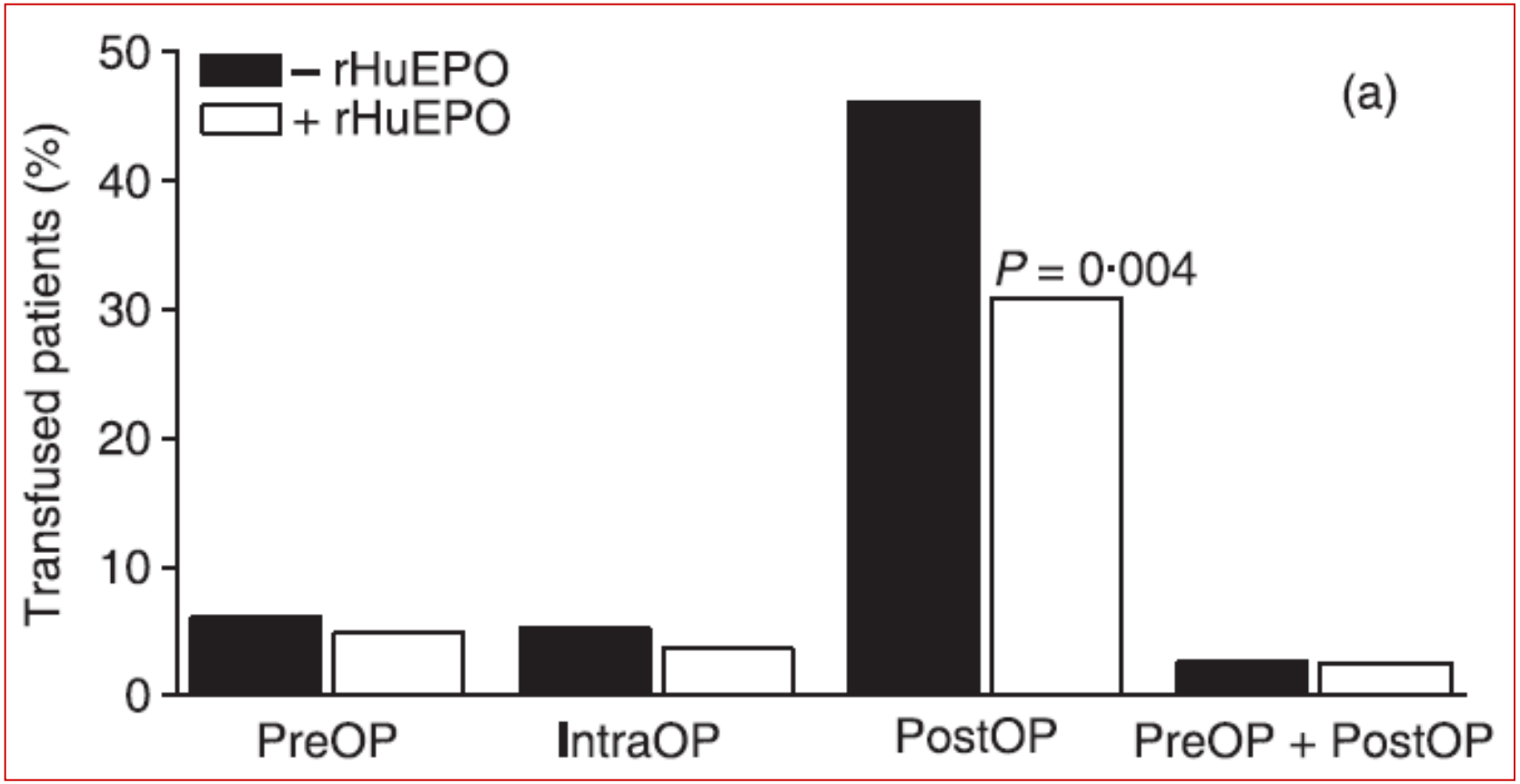
DOI: 10.1111/j.1423-0410.2009.01200.x

Efficacy of preoperative recombinant human erythropoietin administration for reducing transfusion requirements in patients undergoing surgery for hip fracture repair. An observational cohort study

J. A. García-Erce,[1] J. Cuenca,[2] S. Haman-Alcober,[2] A. A. Martínez,[2] A. Herrera[2] & M. Muñoz[3]
[1]Departments of Haematology and [2]Orthopaedic and Trauma Surgery, University Hospital Miguel Servet, Zaragoza, Spain
[3]Transfusion Medicine, School of Medicine, University of Málaga, Málaga, Spain

Fe sucrosa 200 mg iv / 48 h (3 d)

EPO 40.000 UI sc ifHb < 13 g/dL



The International Journal of Transfusion Medicine
Vox Sanguinis

PBM PERIOPERATIVE IV IRON

+ EPO

Vox Sanguinis (2009) 97, 260–267

ORIGINAL PAPER

DOI: 10.1111/j.1423-0410.2009.01200.x

Efficacy of preoperative re
administration for reducir
in patients undergoing sur
An observational cohort st

J. A. García-Erce,[1] J. Cuenca,[2] S. Haman-Alcober,[2] A
[1]Departments of Haematology and [2]Orthopaedic and Trauma Su
[3]Transfusion Medicine, School of Medicine, University of Málaga

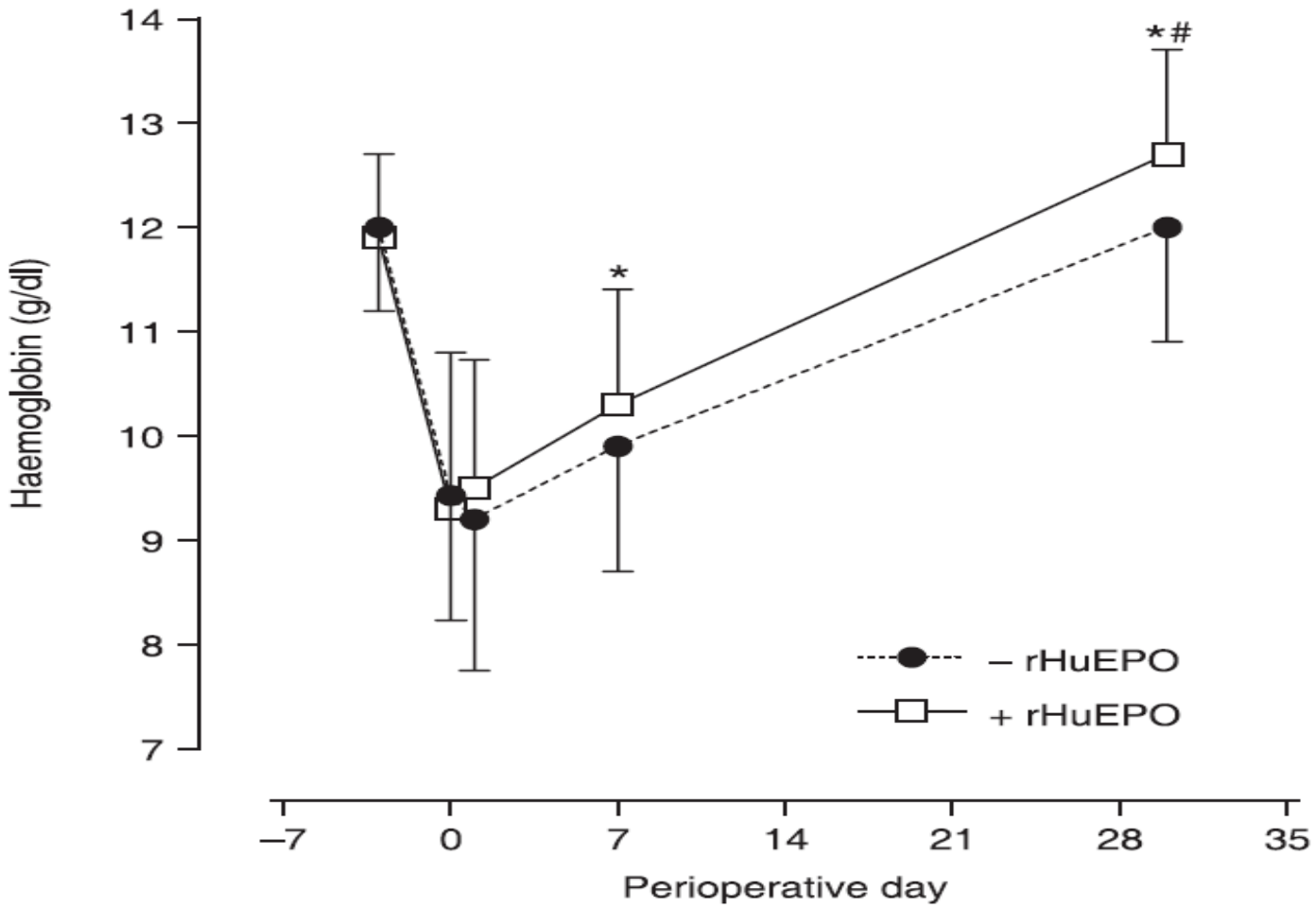


Fig. 2 Perioperative haemoglobin levels in patients undergoing surgery for hip fracture repair according to the preoperative administration [+] or not [–] of recombinant human erythropoietin (rHuEPO). $^{*}P < 0{\cdot}05$, –rHuEPO vs. +rHuEPO; $^{\#}P < 0{\cdot}05$, preoperative vs. postoperative day 30.

British Blood Transfusion Society

BBTS Annual Conference 2014

PBM *PERIOPERATIVE IV IRON* + EPO

- 412 patients with Hb preOP <13 g/dL and iron deficit.
- Iron Sucrose 200 mg/sewsion (max 600 mg/wk).
- rHuEPO 40,000 U/wk, if Hb <13 g/dL after FeIV or inflammation

	I.V. iron	I.V. iron + rHuEPO
n	279	133
Female (%)	87.1	91.5
Age (yr)	69.7 (26–88)	65.3 (23–84)
Weight (kg)	73.7 (12.6)	71.8 (14.6)
ASA I, II/III, IV (%)	81/19	73/27
Hb, baseline (g dl^{-1})	11.9 (1.1)	11.8 (1.0)
Iron dose (mg)	752.8 (271.4)	736.8 (343.5)
rHuEPO, 40 000 U	—	2.5 (0.8)
Final Hb (g dl^{-1})	12.7 (1.1)	13.2 (1.2)
% Patients final Hb > 13 g dl^{-1}	39.3	56.8
Hb increase (dl^{-1})	0.80 (1.1)	1.50 (1.3)

Basora M, et al. Br J Anaesth 2013; 110: 488-490

Ferric carboxymaltose increases epoetin-α response and prevents iron deficiency before elective orthopaedic surgery

E. Rineau, A. Chaudet, L. Carlier, P. Bizot, S. Lasocki. BJA 2014

doi:10.1093/bja/aeu245

In conclusion, the use of FCM, compared with oral iron, increases EPO response, with increased discharge haemoglobin levels, and prevents the depletion of iron stores induced by EPO.

This could be another benefit of i.v. iron, as depleted iron stores may impair the correction of postoperative anaemia. In addition, there is accumulating evidence that iron deficiency per se, independently of anaemia, is associated with fatigue and muscle weakness. Thus, the correction of iron deficiency, with or without anaemia, could be effective in improving fatigue and physical performance.

Finally

HOW

Iron therapy in Surgery ?

WISELY

British Blood Transfusion Society

BBTS Annual Conference 2014

Choosing Wisely®

An initiative of the ABIM Foundation

Five Things Physicians and Patients Should Question

1 Don't transfuse more units of blood than absolutely necessary.

Each unit of blood carries risks. A restrictive threshold (7.0-8.0g/dL) should be used for the vast majority of hospitalized, stable patients without evidence of inadequate tissue oxygenation (evidence supports a threshold of 8.0g/dL in patients with pre-existing cardiovascular disease). Transfusion decisions should be influenced by symptoms and hemoglobin concentration. Single unit red cell transfusions should be the standard for non-bleeding, hospitalized patients. Additional units should only be prescribed after re-assessment of the patient and their hemoglobin value.

2 Don't transfuse red blood cells for iron deficiency without hemodynamic instability.

Blood transfusion has become a routine medical response despite cheaper and safer alternatives in some settings. Pre-operative patients with iron deficiency and patients with chronic iron deficiency without hemodynamic instability (even with low hemoglobin levels) should be given oral and/or intravenous iron.


THAT´S ALL FOLKS! THANK YOU
ADIÓS
MUCHAS GRACIAS