Patient Blood Management in der Orthopädie: Warum ist das notwendig ?

Donat R. Spahn

Conflict-of-Interest

- **Consulting for B. Braun**
- **ABC / ABC trauma faculty, managed by Thomson Physicians World GmbH (unrestricted educational grant - Novo Nordisk)**
- **In the past 5 years I received honoraria / travel support for occasional consulting / lecturing:**

Abbott
Astra-Zeneca
Bayer
Boehringer Ingelheim
CSL Behring
Essex
Galenica (incl. Vifor)
Janssen-Cilag
Octapharma
Oxygen Biotherapeutics
Roche
Alliance Pharmaceutical
Baxter
B. Braun
Bristol-Myers Squibb/Pfizer
Ethicon Biosurgery
Fresenius Kabi
GlaxoSmithKline
Merck Sharp & Dohme
Organon
Pentapharm

Patient Blood Management

- **Correct preoperative anemia**
  - → Iron (iv) + EPO, (autologous predonation)
- **Reduce perioperative RBC loss**
  - → Surgical technique ⬆
  - → Cell salvage and re-transfusion
  - → Acute normovolemic hemodilution
  - → Coagulopathy ⬇ (anti-fibrinolyt., fibrinogen, F XIII, PCC)
  - → Low CVP, no hypertension, normothermia,
- **Optimize anemia management**
  - → Tolerate low hemoglobin values
  - → FiO2 ⬆
  - → Iron (iv) + EPO postoperatively

Spahn D. R. et al. Anesthesiology (2008) 109: 951
Farrugia A. Transfusion (2011) 51: 216

Falsification or paradigm shift? Toward a revision of the common sense of transfusion

Albert Farrugia

THE PATIENT AS THE PARADIGM

The new paradigm to succeed the product paradigm should be based on patient blood management as described by Thomson and colleagues.[20] Blood management programs "falsify" (are demarcated from) the product paradigm by a potential to decrease blood usage while improving outcomes (Fig. 4). In contrast with the

Farrugia A. Transfusion (2011) 51: 216

Patient Blood Management: WHY ?

- **RBC transfusion do compromise the outcome of your patient**
- **Patient Blood Management measures can be implemented and render most RBC transfusions unnecessary**
- **Treating your patient without RBC transfusions is attractive – ask your patients**

Concerns vis-à-vis RBCs

- **RBC transfusions are associated with major adverse outcome also in OS**
  - ➔ **Mortality ⬆**
  - ➔ **Major morbidity (ischemia) ⬆**
  - ➔ **Infection ⬆**
  - ➔ **TRALI, TACO ⬆**
  - ➔ **Transfusion reaction**
  - ➔ **Tumor growth promotion ⬆**
  - ➔ **Costs ⬆**
  - ➔ **Non-Hodgkin lymphoma ⬆**

Spahn D. R. et al. Anesthesiology (2008) 109: 951
Farrugia A. Transfusion (2011) 51: 216

BMC Musculoskeletal Disorders

BioMed Central

Research article

Open Access

Allogeneic blood transfusion and prognosis following total hip replacement: a population-based follow up study

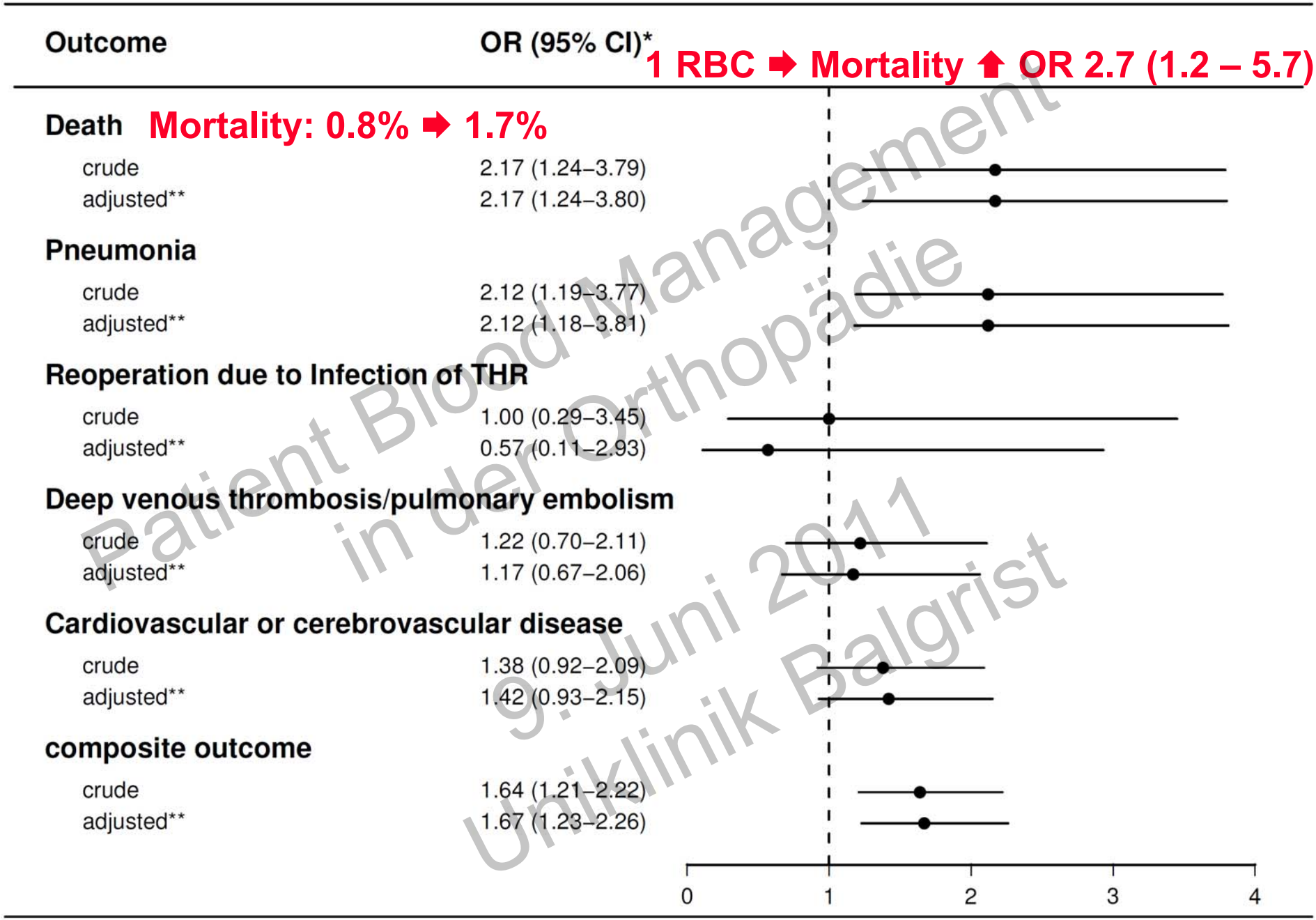
Alma B Pedersen*†1, Frank Mehnert†1, Soren Overgaard†2 and Soren P Johnsen†1

Multicenter (n=15) observational study (Danish Hip Arthroplasty Registry)
Patients (n=28'087) primary THR
Groups (propensity score): Transfused vs. non-transfused (n=2254 each)
Outcomes within 90 days:

- **Death**
- **Pneumonia**
- **DVT/PE**
- **Cardiovascular complications with hospitalization**

Results:
Transfusion rate = 32%

Pedersen A. B. et al. BMC Musculockeletal Disord (2009) 10: 167



Pedersen A. B. et al. BMC Musculockeletal Disord (2009) 10: 167

Anemia and PBM in orthopedic surgery

- **Preoperative anemia:**
  - ➔ **THA / TKA (29‘068 patients): 24±9%**
  - ➔ **Hip fracture (6‘366 patients): 44±9%**
- **Transfusion rate**
  - ➔ **THA / TKA (29‘068 patients): 45±25%**
  - ➔ **Hip fracture (6‘366 patients): 44±15%**
- **Preoperative anemia (and ABT)**
  - ➔ **Infection rate ⬆**
  - ➔ **Length of hospital stay ⬆**
  - ➔ **Mortality ⬆ (hip fracture)**

Spahn D. R. Anesthesiology (2010) 113: 482

Timing and Incidence of Postoperative Infections Associated with Blood Transfusion: Analysis of 1,489 Orthopedic and Cardiac Surgery Patients*

- **1034 orthopedic and 455 cardiac surgery patients**
- **Postoperative infections + / - RBC transfusion (including timing)**
- **Cost outcomes**

Shander A. et al. Surg Inf (2009) 10: 277

Infection and cost outcome

- Infections: Cardiac > orthopedic
- RBC transfusion independently ➡ Postoperative infections ⬆ (OR 1.7)
- Postoperative infections
  - ➔86 during hospitalization
  - ➔81 in the follwoing 4 weeks
- Costs in orthopedic surgery: Postoperative infection ➡ cost ⬆ by 7'000 – 10'000$ at total costs of 14'000$

Shander A. et al. Surg Inf (2009) 10: 277

Cost of a RBC transfusion

Acquisition cost

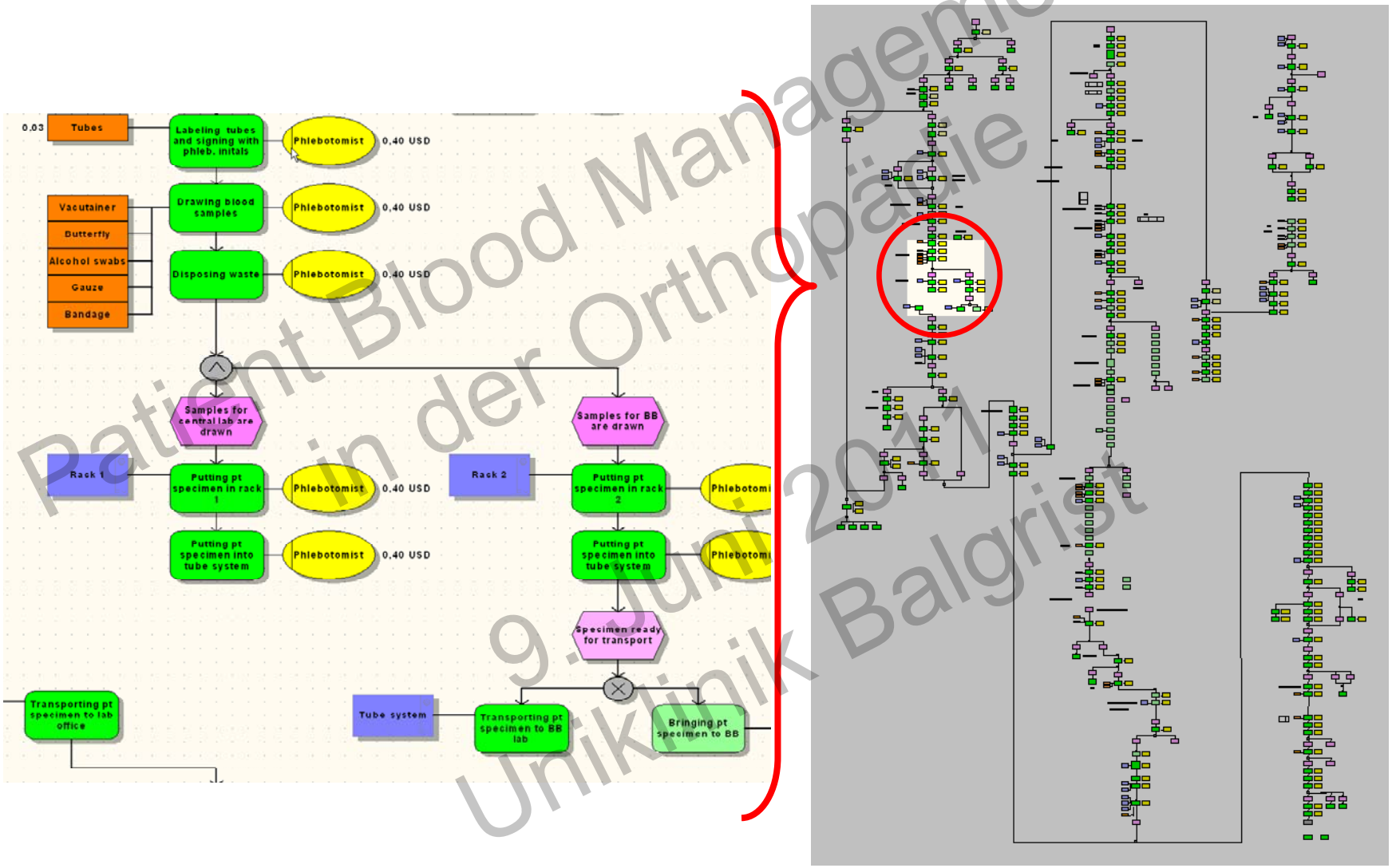
1unit of RBC = 212 CHF

Process cost analysis

Shander A. et al. COBCON I Transfus Med Rev (2005) 19: 66

Shander A. et al. Best Pract Res Clin Anaesthesiol (2007) 21:271

Process cost analysis (PCA)



Shander A. et al. Transfusion (2010) 50:753

True costs of 1 u of RBC in surgery

684 CHF
450 €

+

"unknown" costs for donation and RBC production, and the treatment of adverse effects such as postoperative infections, TRALI, tumor growth promotion, hemovigilance programs, litigation and (mortality)

Shander A. et al. Transfusion (2010) 50:753

Association between red blood cell transfusions and development of non-Hodgkin lymphoma: a meta-analysis of observational studies

Jorge J. Castillo,[1] Samir Dalia,[2] and Sheila K. Pascual[3]

- **Meta-analysis on the association with previous RBC transfusion and development of NHL**
- **RR: 1.2 (1.07 – 1.35, p < 0.01)**

Castillo J. J. et al. Blood (2010) 116: 2897
Cerhan J. R. Blood (2010) 116: 2863

Patient Blood Management

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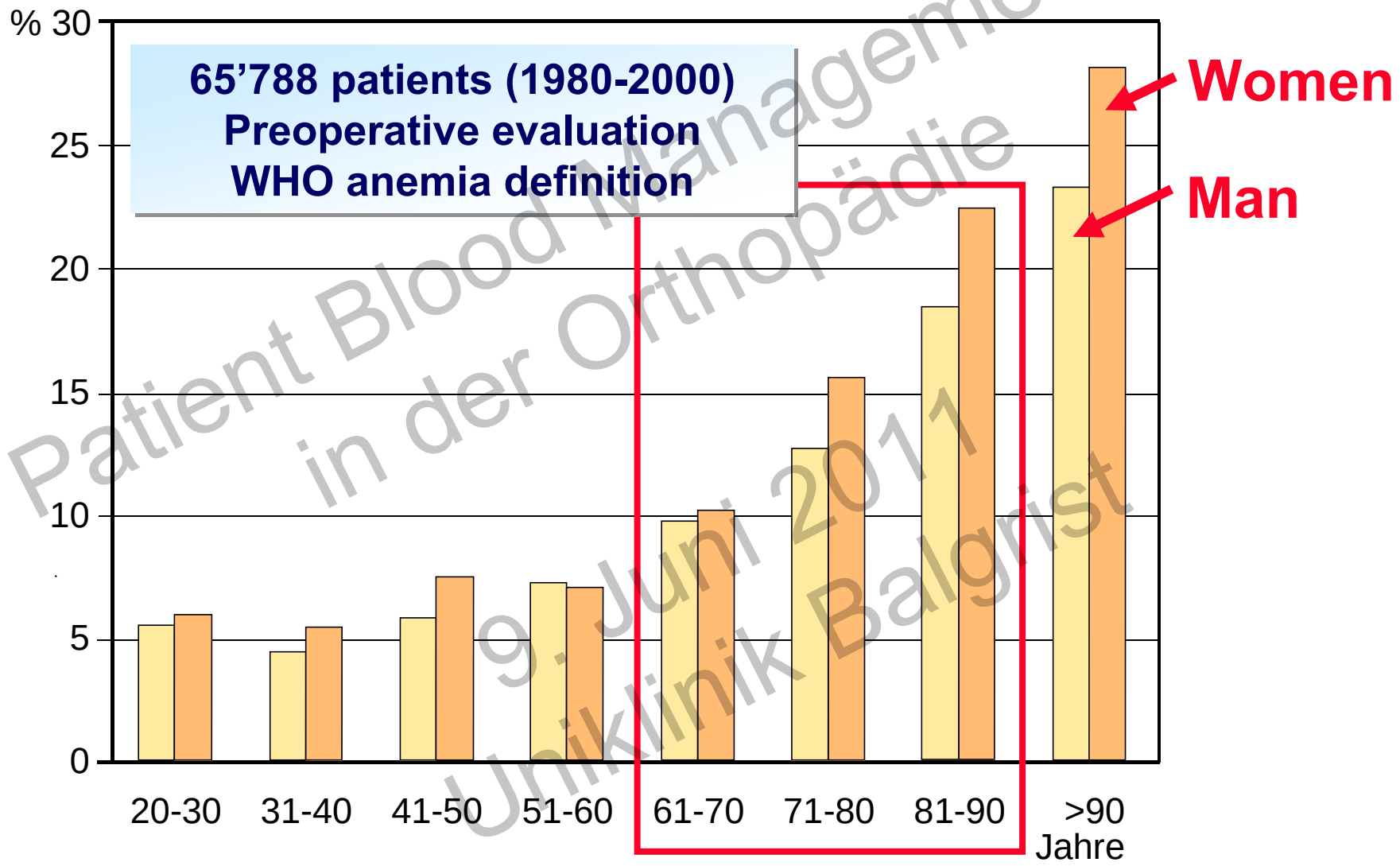
Spahn D. R. et al. Anesthesiology (2008) 109: 951

Farrugia A. Transfusion (2011) 51: 216

Incidence of preoperative anemia



Kulier A. et al. Anaesthesist (2001) 50: 73

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Spahn D. R. Anesthesiology (2010) 113: 482

Anemia and PBM in orthopedic surgery

- **Preoperative iron treatment:**
  - ➔**Allogeneic blood transfusion rate ⬇**
  - ➔**Infection rate ⬇**
- **Preoperative rHuEPO (ESA)**
  - ➔**Allogeneic blood transfusion rate ⬇**
- **Cell salvage**
  - ➔**Allogeneic blood transfusion rate ⬇**
  - ➔**Length of hospital stay ⬇**

Spahn D. R. Anesthesiology (2010) 113: 482

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]

Goodnough L. T. et al. Br J Anaesth (2011) 106: 13

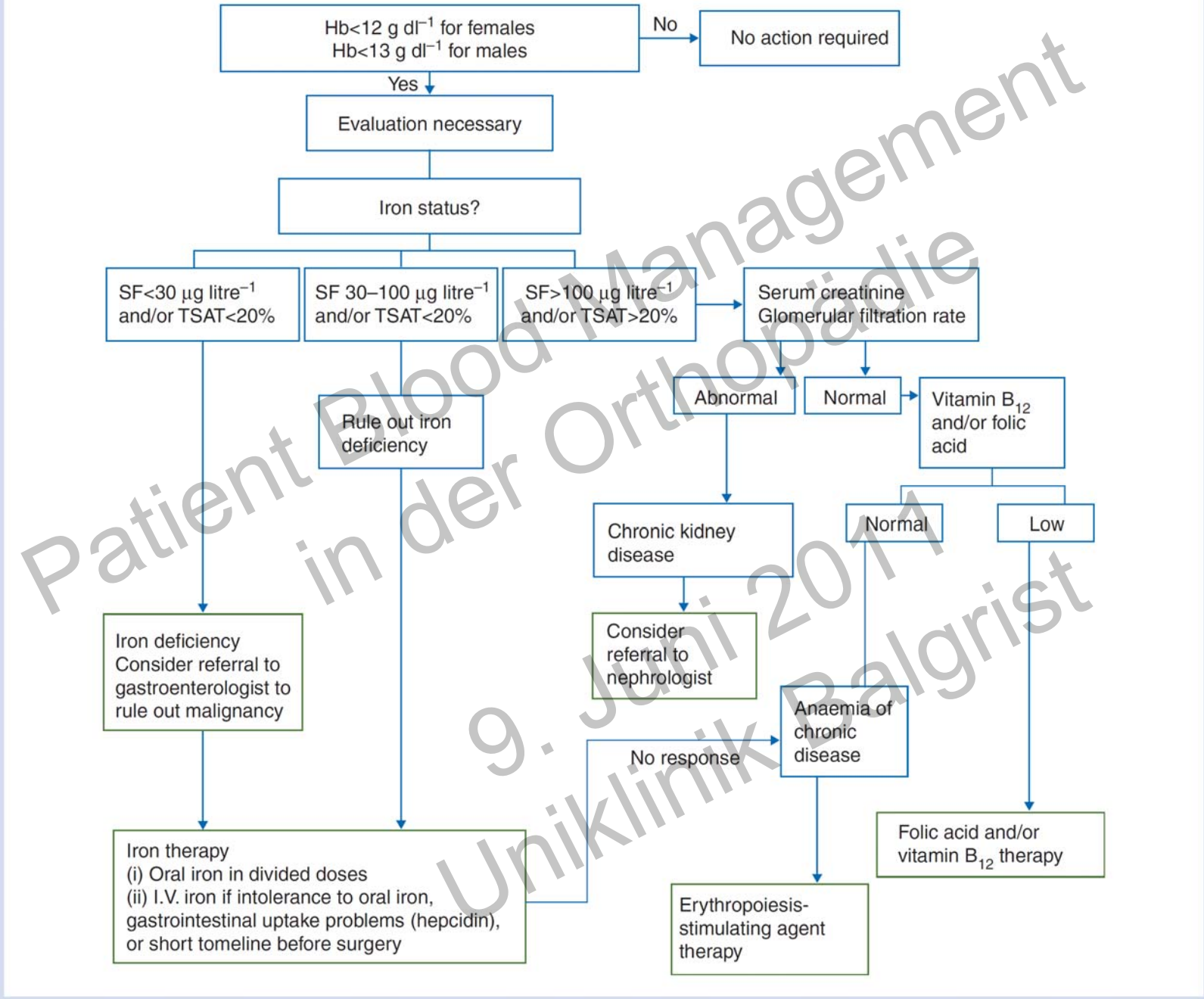

Fig 2 Proposed algorithm for the detection, evaluation, and management of preoperative anaemia. SF, serum ferritin; TSAT, transferrin saturation.

Goodnough L. T. et al. Br J Anaesth (2011) 106: 13

Treatment of Iron Deficiency Anemia in Orthopedic Surgery with Intravenous Iron: Efficacy and Limits

A Prospective Study

Oliver M. Theusinger, M.D., Pierre-François Leyvraz, M.D.,† Urs Schanz, M.D.,‡ Burkhardt Seifert, Ph.D.,§ Donat R. Spahn, M.D., F.R.C.A.‖*

- **20 patients**
- **Major orthopedic surgery**
- **Iron deficiency anemia (WHO)**
  - ➔**Hb men < 13.0 g/dL**
  - ➔**Hb women < 12.0 g/dL**
  - ➔**Ferritin < 100 μg/l or**
  - ➔**Ferritin < 300 μg/l and TSat < 20%**

Theusinger O.M. et al. Anesthesiology (2007) 107: 923

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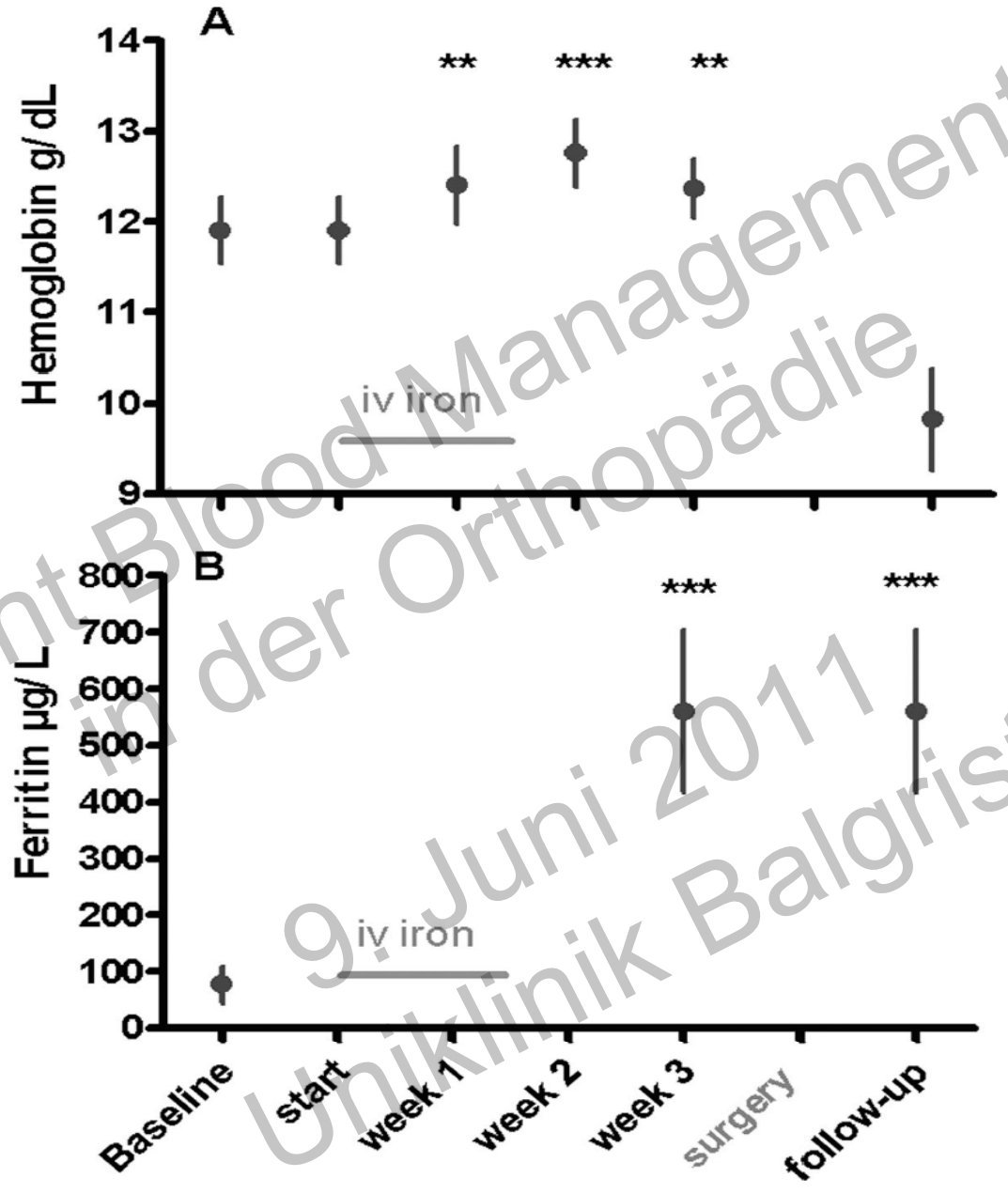
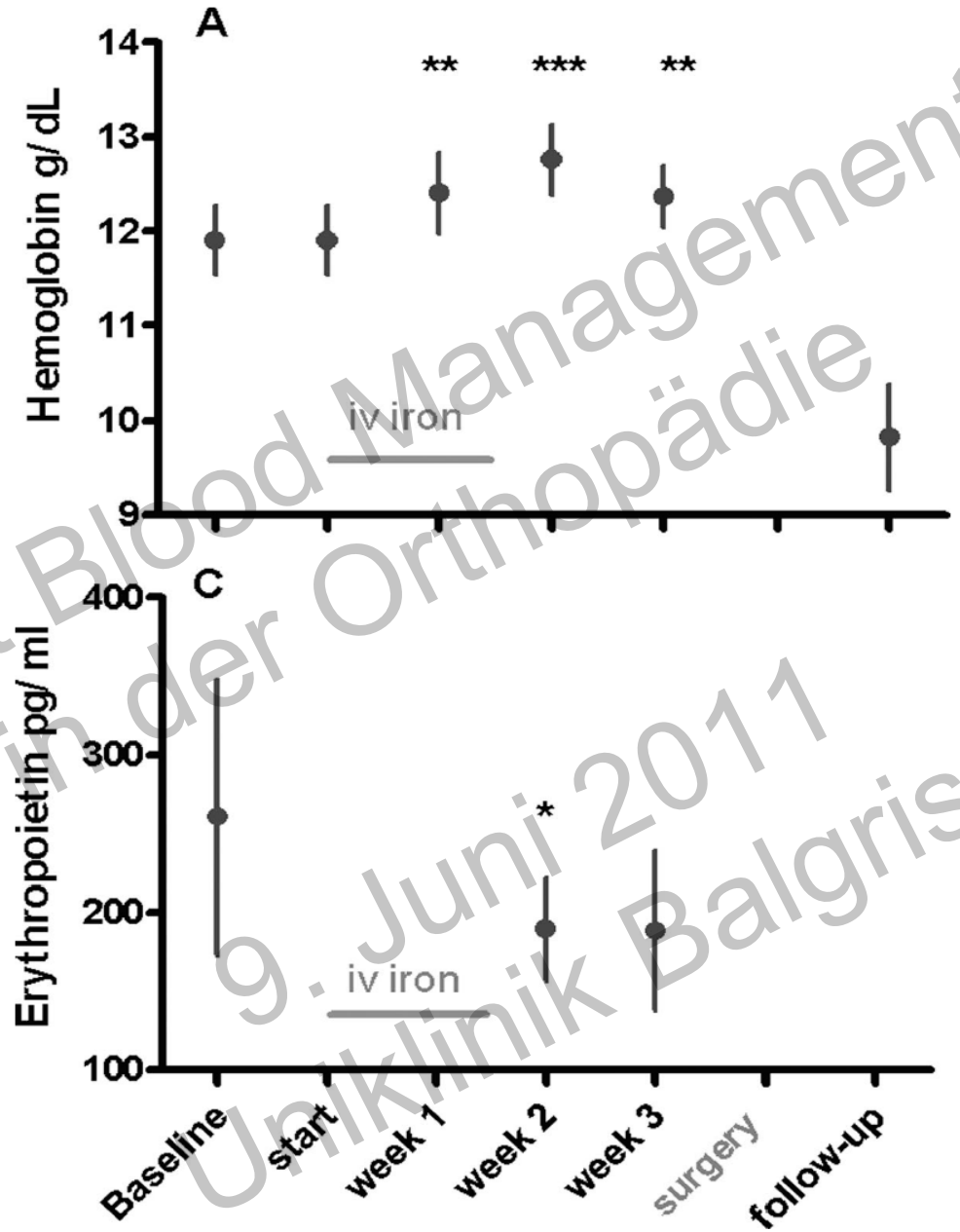
- **21% patients were anemic**
- **100% iron deficiency anemia**
- **3 x 300 mg iv iron sucrose over 10 days**

Theusinger O.M. et al. Anesthesiology (2007) 107: 923



Theusinger O. M. et al. Anesthesiology (2007) 107: 923



Theusinger O. M. et al. Anesthesiology (2007) 107: 923

Two injections of erythropoietin correct moderate anemia in most patients awaiting orthopedic surgery

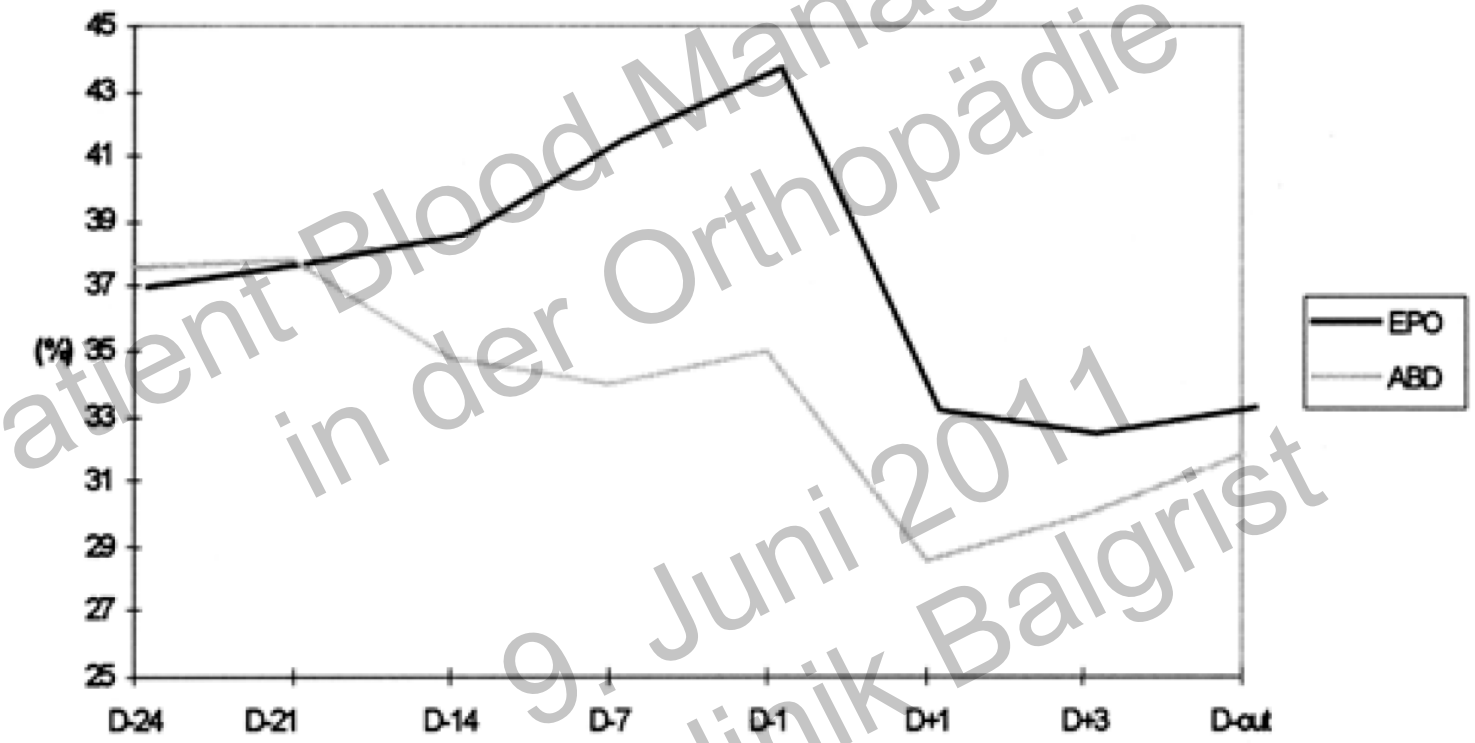
[Deux injections d'érythropoïétine corrigent une anémie modérée chez la plupart des patients en attente d'une opération orthopédique]

Nadia Rosencher MD,* Dominique Poisson MD,† Aline Albi MD,* Martine Aperce MD,‡ Jeanne Barré MD,§ Charles Marc Samama MD PhD¶

- **100 patients - orthopedic surgery**
  - **HCT 30-39%**
  - **Prospective randomized trial**
  - **EPO 40'000 U / week + oral iron**
  - **ABD + oral iron**

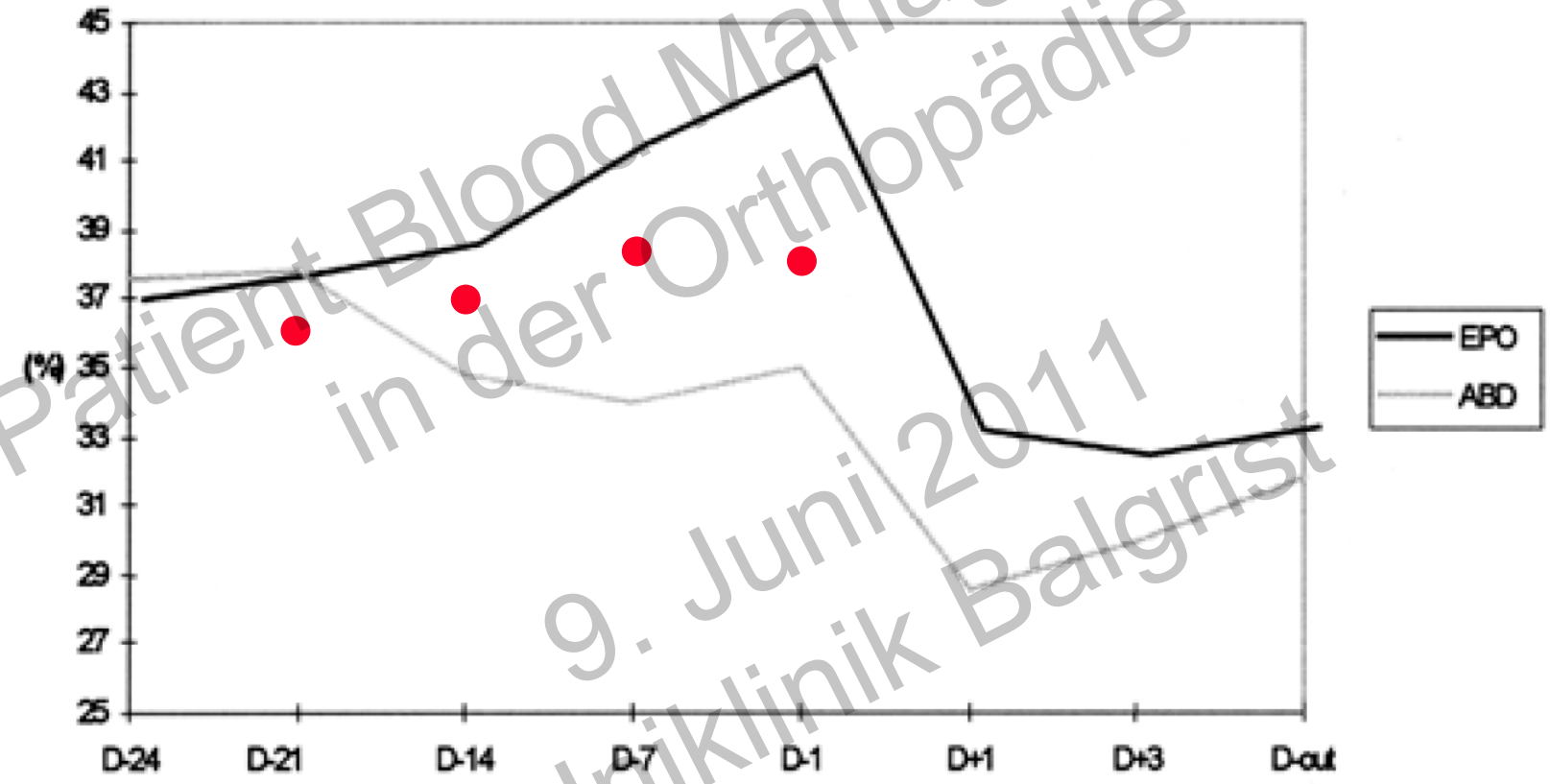
Rosencher N. et al. Can J Anesth (2005) 52: 160

Increase in HCT due to EPO treatment



Rosencher N. et al. Can J Anesth (2005) 52: 160

Increase in HCT due to EPO vs. iv iron



Rosencher N. et al. Can J Anesth (2005) 52: 160

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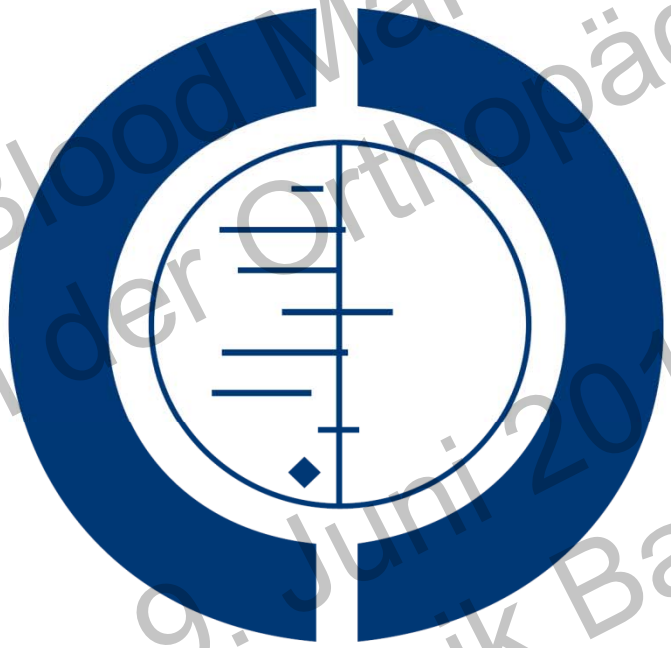
Spahn D. R. et al. Anesthesiology (2008) 109: 951
Farrugia A. Transfusion (2011) 51: 216

In your personal practice
key questions

- How many of your patients (elective orthopedic surgery) are anemic preoperatively ?
- What is your blood loss in standard orthopedic operations ?
- What is the transfusion rate of your patients undergoing elective standard orthopedic operations ?

Anti-fibrinolytic use for minimising perioperative allogeneic blood transfusion (Review)

Henry DA, Carless PA, Moxey AJ, O'Connell D, Stokes BJ, Fergusson DA, Ker K



THE COCHRANE COLLABORATION®

Henry D.A. et al. Cochrane Database of Systematic Reviews (2011) No. CD001886 doi:10.1002/14651858.CD001886.pub4.

Efficacy and Safety of TA

- 252 trial with > 25’000 patients
- RBC transfusion ⬇ by 39%
- Safety: OK, *“… appears to be free of serious adverse effects”*

Henry D.A. et al. Cochrane Database of Systematic Reviews (2011) No. CD001886 doi:10.1002/14651858.CD001886.pub4.
Elwatidy, S. et al. Spine (2008) 33: 2577
Alvarez, J. C. et al. Transfusion (2008) 48: 519

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UMDNJ ROBERT WOOD JOHNSON MEDICAL SCHOOL
University of Medicine & Dentistry of New Jersey

Principal Investigators

Jeffrey L Carson, MD
Principal Investigator and Study Chairm
Clinical Coordinating Center

Richard C Reynolds Professor of Medicin
Chief, Division of General Internal Medic

Dr. Jeffrey Carson is Richard C. Reynold
General Internal Medicine at the UMDN
principal investigator and study chairma
internist and his practice includes the ca

Dr. Carson received his initial research t
Fellowship at the University of Pennsylv
and Disease Control - 1 Study Section a
reviewer for AHCPR and NIH. He receive
area of clinical trials as a Fogarty Senior
Oxford, England from September 1995-

Carson's research in blood transfusion b
cohort study of 125 Jehovah Witness pa
investigator on the NHLBI supported stu
Witness patients and the Agency for He
Surgical Blood Transfusion. Dr. Carson a
center study involving 20 hospitals. He
industry sponsored trials.

Dr. Carson has published over 125 peer
He has been awarded 5 teaching award
Faculty Recognition Award. He has been on the Best Doctors list for many years.

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University of Medicine & Dentistry of New Jersey

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- ⊞ Investigators
- ⊞ Major Institutions
- Privacy Policy

FOCUS
TRANSFUSION TRIGGER TRIAL

Funded by:
National Heart, Lung, and Blood Institute
National Institutes of Health
Bethesda, Maryland

NHLBI PEOPLE SCIENCE HEALTH
United States Department of Health & Human Services
NATIONAL INSTITUTES OF HEALTH
UMDNJ ROBERT WOOD JOHNSON MEDICAL SCHOOL
University of Medicine & Dentistry of New Jersey

FOCUS trial

- Prospective randomized trial
- Elderly patients with hip fracture and CAD / risk factors
- N = 2016, 47 centers in US + Canada
- Transfusion triggers (POD 0-3)
  - ➔ Hb < 10 g/dL
  - ➔ Symptoms of anemia or Hb < 8 g/dL
- Outcome: MI, stroke, infections, function, mortality, fatigue, CHF, composite outcomes
- Results: No difference

Carson J. et al., ??? (2011, in press)

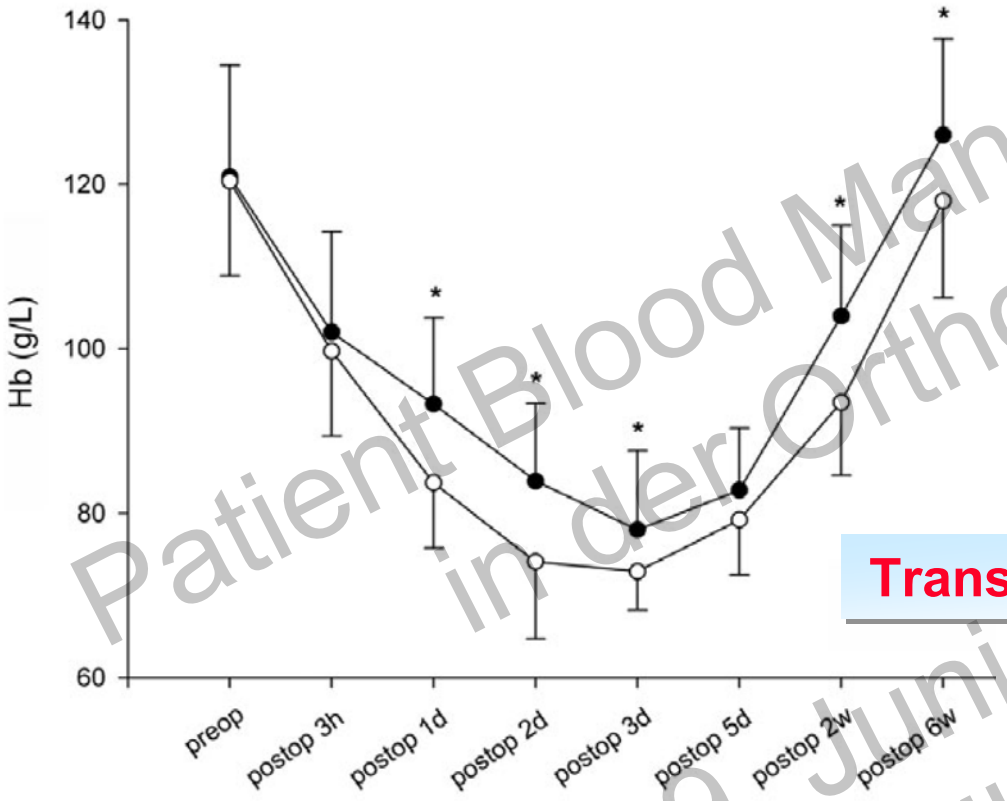
Q1: Is transfusion *life saving*?

FOCUS Transfusion Trigger Trial - Clinical implications:

”These results suggest that **it is reasonable** to **withhold transfusion** in post surgical patients in the **absence of symptoms of anemia** or a **hemoglobin concentration > 8 g/dL, even in elderly patients with underlying cardiovascular disease or risk factors**“

Jeff Carson, NATA Conference, Dublin, April 08, 2011

Intra- and postop. iv Iron + EPO



Transfusion rate: 20 vs. 54%, p< 0.01

PRS in patients with iron deficiency undergoing bilateral TKA
Iv iron (200 mg) and sc rHU-EPO-β (3000u) intraoperatively and up to 2 times postop if Hb = 7 - 8 g/dL
RBC transfusions at Hb < 7 g/dL

Na H. S. et al. Transfusion (2011) 51: 118

CARDIOTHORACIC ANESTHESIOLOGY:

The Annals of Thoracic Surgery CME Program is located online at http://cme.ctsnetjournals.org. To take the CME activity related to this article, you must have either an STS member or an individual non-member subscription to the journal.

The Impact of Blood Conservation on Outcomes in Cardiac Surgery: Is It Safe and Effective?

David M. Moskowitz, MD, Jock N. McCullough, MD, Aryeh Shander, MD, James J. Klein, MD, Carol A. Bodian, DrPH, Richard S. Goldweit, MD, and M. Arisan Ergin, MD

Moskowitz D. M. et al. Ann Thorac Surg (2010) 90: 451

Patient Blood Management at EH

- **Correct preoperative anemia**
  - → Iron (iv) + EPO, (autologous predonation)
- **Reduce perioperative RBC loss**
  - → Surgical technique ⬆
  - → Topical hemostatic agents
  - → Cell salvage and re-transfusion
  - → Acute normovolemic hemodilution
  - → Coagulation monitoring (anti-fibrinolytics, desmopres.)
  - → Low CVP, no hypertension, normothermia
- **Optimize anemia management**
  - → Tolerate low hemoglobin values (Hb 6-7 g/dL = OK)
  - → FiO2 ⬆
  - → Iron (iv) + EPO postoperatively

Moskowitz D. M. et al. Ann Thorac Surg (2010) 90: 451

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	Engelwood - PBM	NJ – no PMB
Transfusion rate	10.6%★	42.5%
Mortality	0.8%★	2.5%
Major complications	11.1%★	26%

Moskowitz D. M. et al. Ann Thorac Surg (2010) 90: 451

Conclusion 1

- Transfusions of blood products are associated with serious adverse outcome
- Every transfusion should and most can be avoided
- Patient Blood Management is the way
- Cost saving potential is tremendous (1 RBC = 684 CHF, 450 €)
- Preoperative optimization starts 4 weeks prior to the operation

Conclusion - 2

- **RBC transfusion are associated / cause serious adverse outcome**
- **Patient Blood Management is the way**
- **Change is urgent**
- ***"Maintaining the clinical status quo under such circumstances would not be accepted in any other field of medicine in the context of current safety and quality standards."***

Spahn D.R. et al. Anesthesiology (2011) 114: 283