# PBM en chirurgie orthopédique: effet de mode ou véritable nécessité?

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Anesthésie réanimation

CHU Douera- Université de Blida

# Aucun conflit d'intérêts

« Je n’ai aucun conflit d’intérêts relativement à cette présentation. »

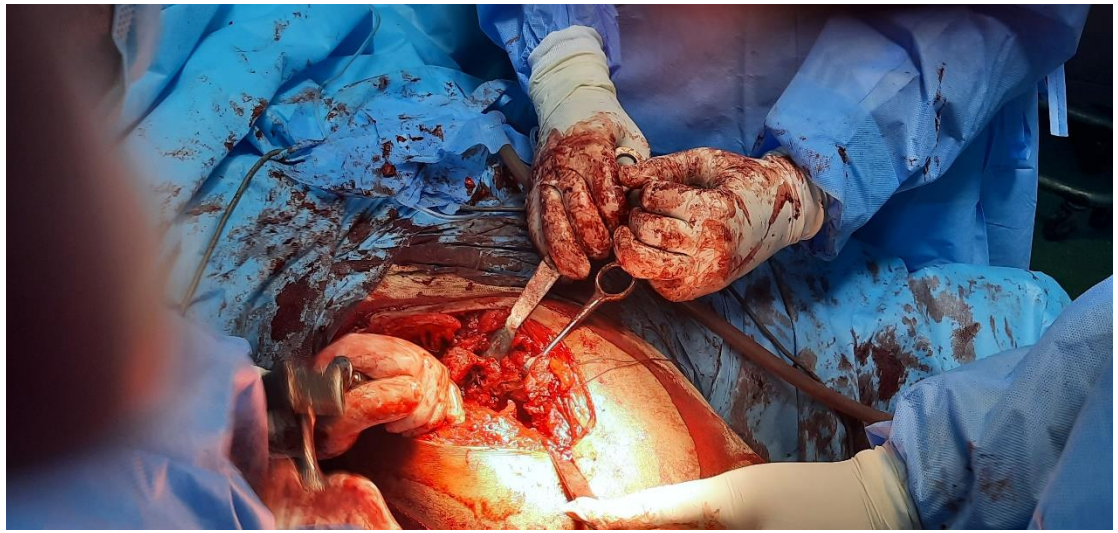
Patient Blood Management = épargne sanguine périopératoire

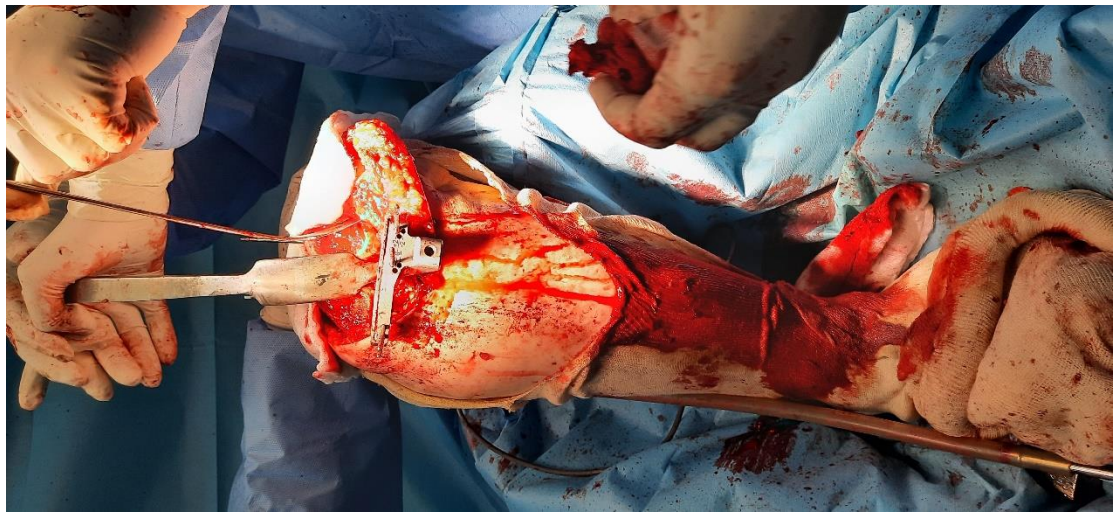
Gestion personnalisée du capital sanguin périopératoire

Concept basé sur des **preuves** scientifiques multidisciplinaires, multimodales et visent à maintenir la **masse sanguine** et **améliorer** la qualité des soins du
patient.

# Chirurgie orthopédique: hémorragie?

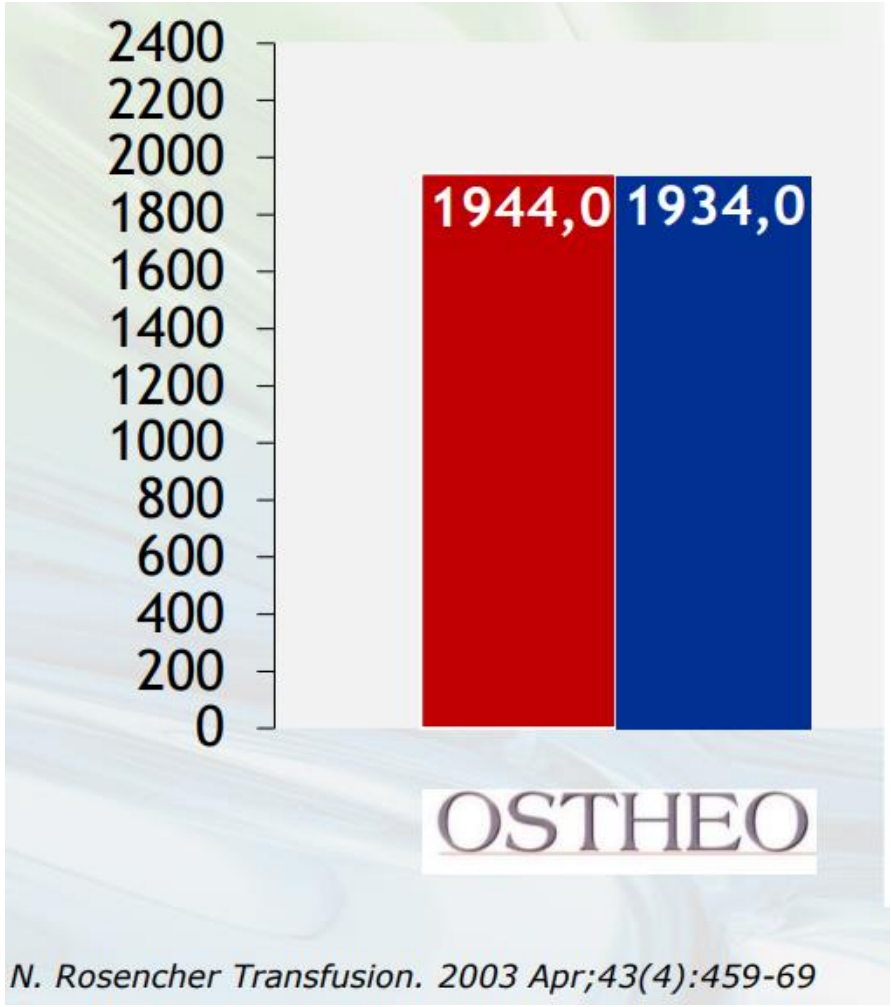
Ames sensibles, s’abstenir!





# Chirurgie prothétique

**Median Blood Loss (ml at Ht=35%)**




La Chirurgie Orthopédique prothétique réglée, même primaire, reste une chirurgie à risque hémorragique modéré voire élevé **(>500ml)** avec un risque de transfusion **>10%**

# Chirurgie du rachis

## Blood loss in adult spinal surgery

**Serena S. Hu** Eur Spine J (2004) 13 (Suppl. 1) : S3–S5

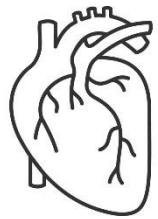

**Spine 2013;38:1331–1341**

Anemia is associated with increased need for blood transfusion and has been suggested as an independent risk factor for postoperative complications in patients undergoing various noncardiac surgical procedures.[1–6] Spine surgery is not infrequently associated with blood loss, which may range from 100 to 4700 mL, depending on the procedure.[7] A single institutional study that assessed factors associated with spine fusion failure found anemia to be a risk.[8] The effect of anemia on global short-term outcomes of spine surgery, including mortality, has not been defined. With more than 3 million elective spine surgery procedures performed in the United States between 2006 and 2010[9] (see Supplemental Digital Content available at http://links.lww.com/BRS/A759), it is important to assess the effect of anemia on postoperative complications and 30-day mortality.

We investigated the association between preoperative anemia, alone and in combination with several pre- and intraoperative factors, on 30-day outcomes in patients undergoing elective spine surgery.

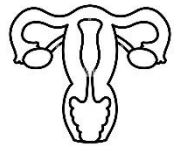
# Anémie: prévalence?

**Up to 40% of patient have preoperative anaemia**



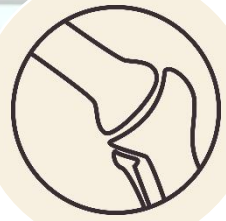
Chirurgie cardiaque

26%*



Chirurgie gynécologique

24%**



Chirurgie orthopédique

?

Karkouti K et al. Circulation. 2008;117:478–84*
Richards T et al. PLoS One. 2015;10(7):e0130861**

# Anémie préopératoire: prévalence

| Type de chirurgie | Prévalence de l'anémie |
|---|---|
| Chirurgie orthopédique majeure | 20%- 40% |
| Chirurgie cardiaque | 22%-31% |
| Chirurgie gynécologique | 24%-30% |
| Chirurgie colo-réctale | 30%-40% |

# Anémie préopératoire: prévalence

- Revue systématique : 19 études
  - → 13 études (n = 29.068) **PTH/PTG**
  - → 6 études (n = 6.366) **Fractures hanches**

- Anémie préopératoire : **24** ± 9 et **44** ± 9 %
- Anémie postopératoire : **51** et **87** ± 10 %
- Taux de Transfusion : **45** ± 25 et **44** ± 15 %

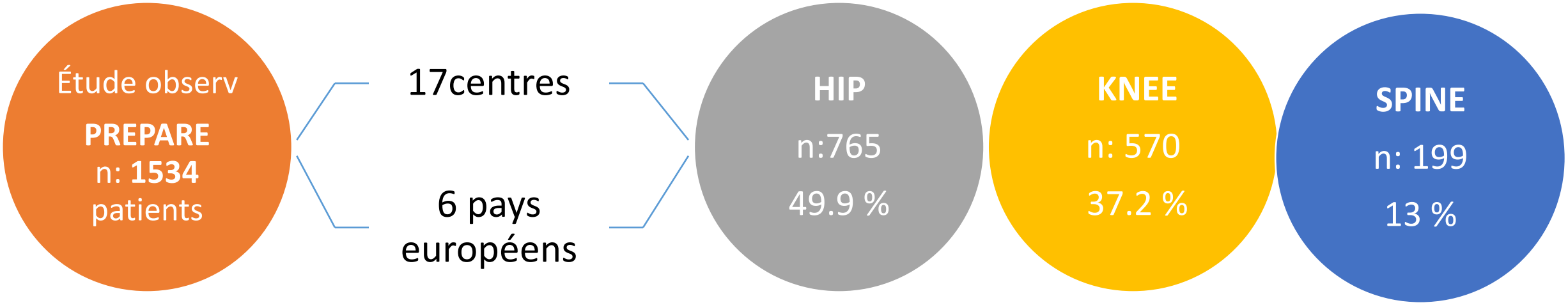
**Spahn DR. Anesthesiology 2010;113:482-95**

# PREPARE: the prevalence of perioperative anaemia and need for patient blood management in elective orthopaedic surgery

*A multicentre, observational study*

Sigismond Lasocki, Rüdiger Krauspe, Christian von Heymann, Anna Mezzacasa, Suki Chainey and Donat R. Spahn

*Eur J Anaesthesiol* 2015; **32:**160–167



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**RESULTS** Anaemia prevalence increased from 14.1% preoperatively to 85.8% postoperatively. Mean Hb decrease was 1.9 (1.5) and 3.0 (1.3) g $dl^{-1}$ in preoperatively anaemic and nonanaemic patients, respectively ($P < 0.001$). In PBM ($n = 7$) vs. non-PBM centres, preoperative anaemia was less frequent (8.0 vs. 18.5%; $P < 0.001$) and iron status assessed more frequently (ferritin 11.0 vs. 2.6%, transferrin saturation 11.0 vs. 0.1%; $P < 0.001$). Perioperative anaemia correction (mainly transfusion) was given to 34.3%. Intraoperatively, 14.8% of preoperatively anaemic and 2.8% nonanaemic patients received transfusions [units per patient: 2.4 (1.5) and 2.2 (1.4), median time to first intraoperative transfusion: 130 (88, 158) vs. 179 (135, 256), $P < 0.001$]. Postoperative complications were more frequent in preoperatively anaemic vs. nonanaemic patients (36.9 vs. 22.2%; $P = 0.009$).

**CONCLUSION** Most patients who underwent elective orthopaedic surgery had normal preoperative Hb levels but became anaemic after the procedure. Those who were anaemic prior to surgery had an increased intraoperative transfusion risk and postoperative complication rate. PBM measures such as iron status assessment and strategies to avoid transfusion are still underused in Europe.

# Pre-operative haemoglobin levels and iron status in a large multicentre cohort of patients undergoing major elective surgery*

M. Muñoz,[1] M. J. Laso-Morales,[2] S. Gómez-Ramírez,[3] M. Cadellas,[4] M. J. Núñez-Matas[5] and J. A. García-Erce[6]

Anaesthesia 2017, 72, 826–834

**3342 patients**
1286 chirurgie orthopédique élective

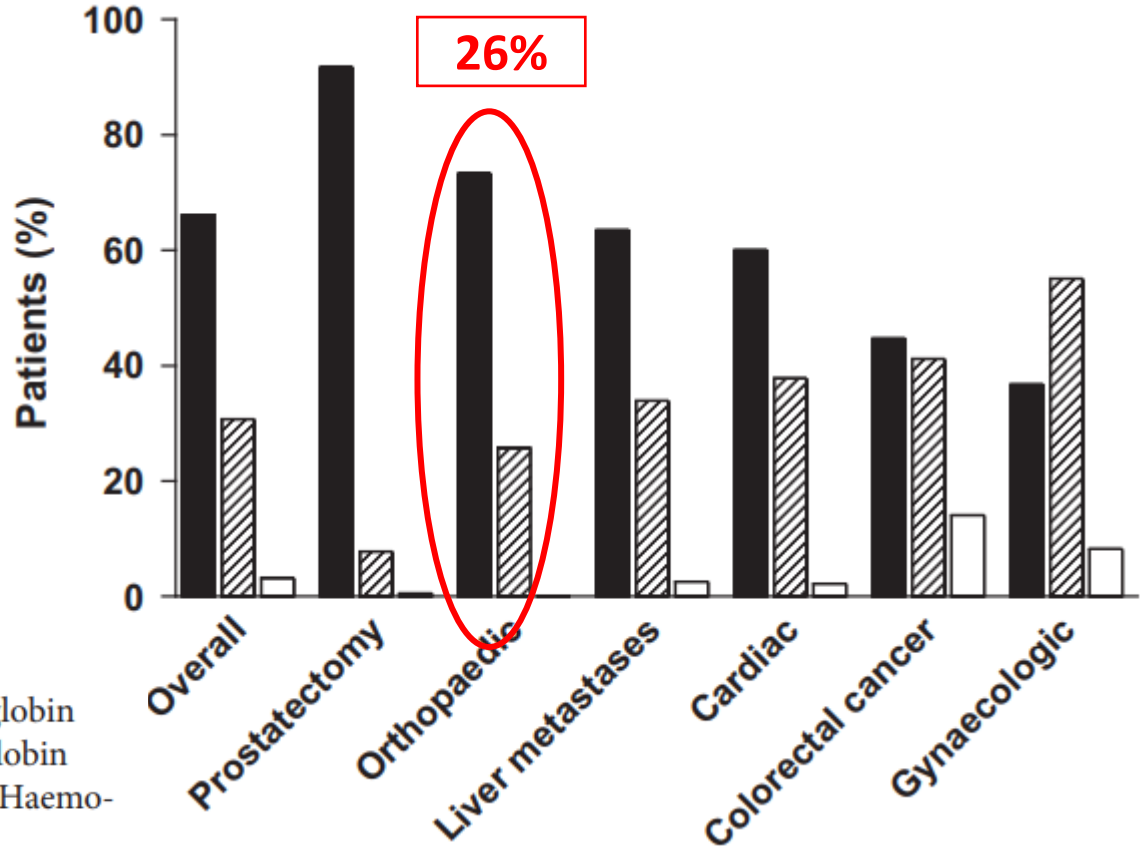


**Figure 1** Distribution of pre-operative haemoglobin levels according to type of surgery. ■ Haemoglobin ≥ 130 g.l$^{-1}$; ▨ Haemoglobin 100–129 g.l$^{-1}$; □ Haemoglobin < 100 g.l$^{-1}$; p = 0.001 between groups.

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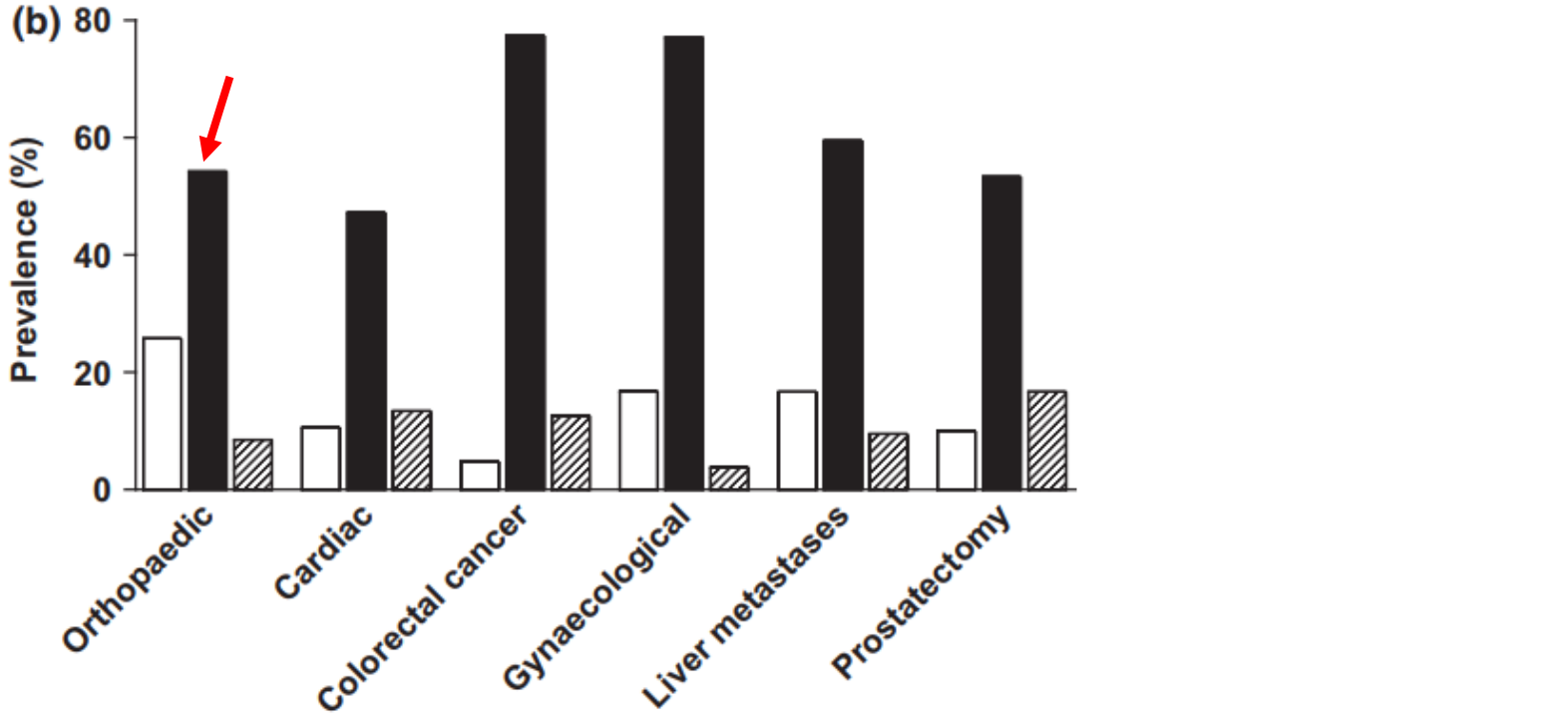
- Carence Martiale Absolue
  F<30, ou F<100 + CST<20% et/ou CRP>5
- Séquestration de Fer
  F>100 et CST<20%
- Faible réserve en Fer
  F entre 30 et 100 et CST>20%



# Anémie préopératoire: impact?


Anémie

Transfusion

Complications

# Harms associated with single unit perioperative transfusion: retrospective population based analysis

*BMJ* 2015;350:h3037

Elizabeth L Whitlock,[1] Helen Kim,[1] Andrew D Auerbach[2]

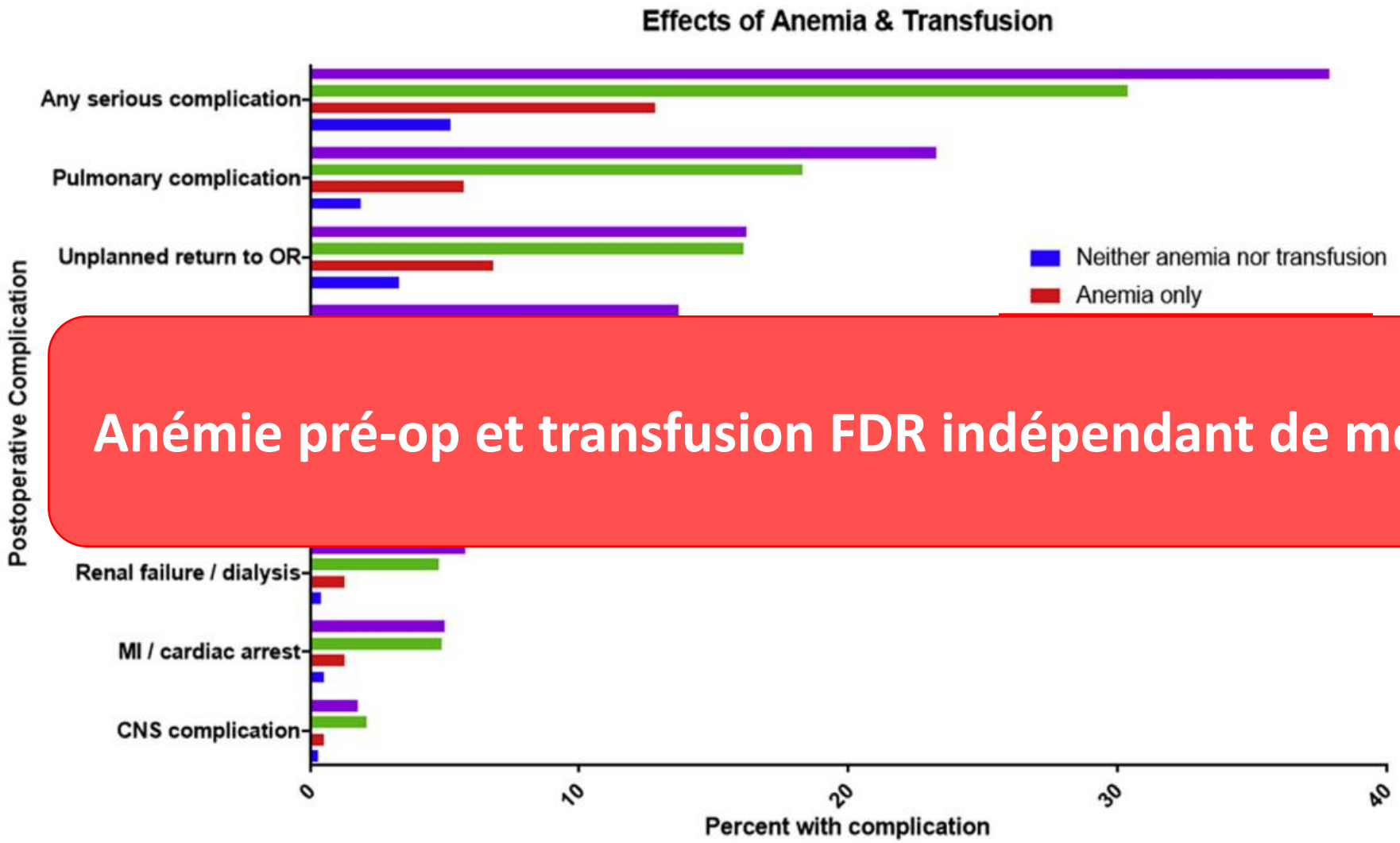
1 583 819 adults

**Table 4 | Surgical subgroup analyses with primary hierarchical logistic regression model for stroke/myocardial infarction. Odds ratios are adjusted for age, sex, race, insurance payor, cardiovascular risk factors,* cerebrovascular disease, coronary artery disease, obesity, smoking status, anemia, and interactions between transfusion and cardiovascular risk factors or cerebrovascular disease, as well as random effects by hospital**

| Subgroup variable | Colectomy (partial and total) | Small bowel resection | Hip/knee replacement or revision | Spine, including fusion and laminectomy | Hysterectomy |
|---|---|---|---|---|---|
| No of patients | 37 989 | 16 179 | 432 419 | 196 802 | 112 960† |
| No (%) transfused | 1748 (4.6) | 647 (4.0) | 15 516 (3.6) | 3903 (2.0) | 1747 (1.6) |
| No (%) with stroke/MI (%) | 689 (1.8) | 309 (1.9) | 1447 (0.33) | 670 (0.34) | 115 (0.10) |
| **Odds ratio for stroke/myocardial infarction (95% CI)** | | | | | |
| pRBC use (units) (reference: 0 units): | | | | | |
| 1 | 2.36 (1.33 to 4.19) | 2.05 (0.66 to 6.30) | 1.26 (0.78 to 2.03) | 1.43 (0.65 to 3.14) | 5.21 (1.15 to 23.7) |
| 2 | 2.21 (1.38 to 3.54) | 2.84 (1.32 to 6.11) | 1.77 (1.22 to 2.56) | 1.73 (0.90 to 3.33) | 7.57 (3.33 to 17.2) |
| 3 | 2.56 (1.06 to 6.17) | 1.80 (0.23 to 13.9) | 3.29 (1.61 to 6.74) | 3.87 (1.46 to 10.3) | 4.79 (1.45 to 15.8) |
| ≥4 | 1.96 (0.84 to 4.54) | 4.37 (1.45 to 13.1) | 3.05 (1.29 to 7.21) | 4.27 (1.73 to 10.5) | 9.46 (2.29 to 39.0) |

**WHAT THIS STUDY ADDS**

There is an association between perioperative transfusion of as little as one unit of blood and ischemic stroke or myocardial infarction




**Anémie pré-op et transfusion FDR indépendant de mortalité**

Ferraris VA,. 2015;158:608-617

W Scott Beattie. Anesthesiology 2010; 11O: 574-81*

# Anémie préopératoire: impact?


■ TRAUMA

## Low haemoglobin at admission is associated with mortality after hip fractures in elderly patients

J. C. Yombi, *Bone Joint J* 2019;101-B:1122–1128.

### Results

We included 829 patients; the mean age was 81 years (SD 11). Mortality at 30 days, 90 days, 180 days, and one year was mortality was observed in p (85/267, 32%). Survival at 9( lower in patients with a Hb level below 120 g/l at admis mortality (adjusted hazard r p = 0.001), along with age (a (95% CI 1.61 to 2.96); p < 0.001), and need for RBC transfusions (aHR 1.10 (95% CI 1.02 to 1.19); p = 0.01).

### Conclusion

Our results suggest that low Hb at admission along with age and RBC transfusions is significantly associated with short- and long-term mortality after hip fracture surgery, independently of comorbidity confounders. Further studies should be performed to understand how preoperative Hb could be taken into account in perioperative management.

# Evidence

**Anemia and Patient Blood Management in Hip and Knee Surgery**

*A Systematic Review of the Literature*

Donat R. Spahn, M.D., F.R.C.A.*

Anesthesiology 2010; 113:482-95

49 publications
Plus de 38000 patients

Anémie préopératoire

Functionnal recovery
OR 0.41

Lengh of stay
+22%
(11 vs 9 jours, P=0,0001)

Cost

Mortality
OR 2,9

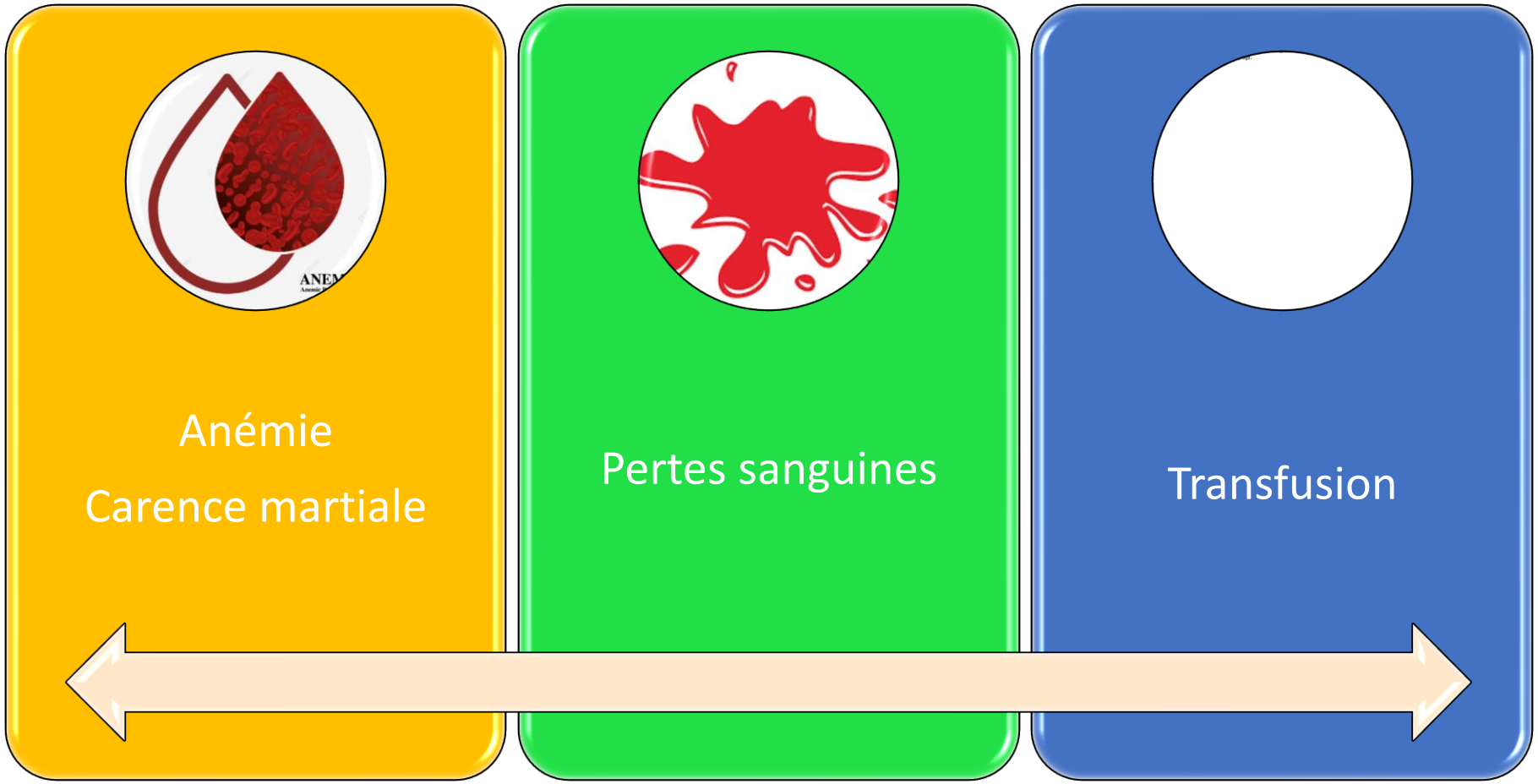
Infection
1,93 , P 0.039


- Chirurgie orthopédique: hémorragique
- Anémie préopératoire: fréquente
- Carence martiale: origine
- Transfusion et anémie: morbi-mortalité

**→ PBM**

# PBM en chirurgie orthopédique

# Modifier les facteurs de risque



**Préopératoire**

**Peropératoire**

**Postopératoire**

## PALIER 1

Optimiser la masse érythrocytaire

## PALIER 2

Réduire les pertes sanguines

## PALIER 3

Restreindre la transfusion

Améliorer la tolérance

Approche multidisciplinaire

PATIENT BLOOD MANAGEMENT GUIDELINES

## STS/SCA/AmSECT/SABM Update to the Clinical Practice Guidelines on Patient Blood Management

Pierre Tibi, MD, R. Scott McClure, MD, FRCSC, Jiapeng Huang, MD,



Ann Thorac Surg
2021;112:981-1004

## Patient blood management in India - Review of current practices and feasibility of applying appropriate standard of care guidelines. A position paper by an interdisciplinary expert group

Ajay Gandhi, Klaus Görlinger[1], Sukesh C. Nair[2], Poonam M. Kapoor[3], Anjan Trikha[4], Yatin Mehta[5],

Journal of Anaesthesiology Clinical Pharmacology | Volume 37 | Issue 1 | January-March 2021

JAMA | Special Communication

## Patient Blood Management Recommendations From the 2018 Frankfurt Consensus Conference

Markus M. Mueller, MD; Hans Van Remoortel, PhD; Patrick Meybohm, MD, PhD; Kari Aranko, MD, PhD;

RECOMMENDATION

## Recommendations for the implementation of a Patient Blood Management programme. Application to elective major orthopaedic surgery in adults

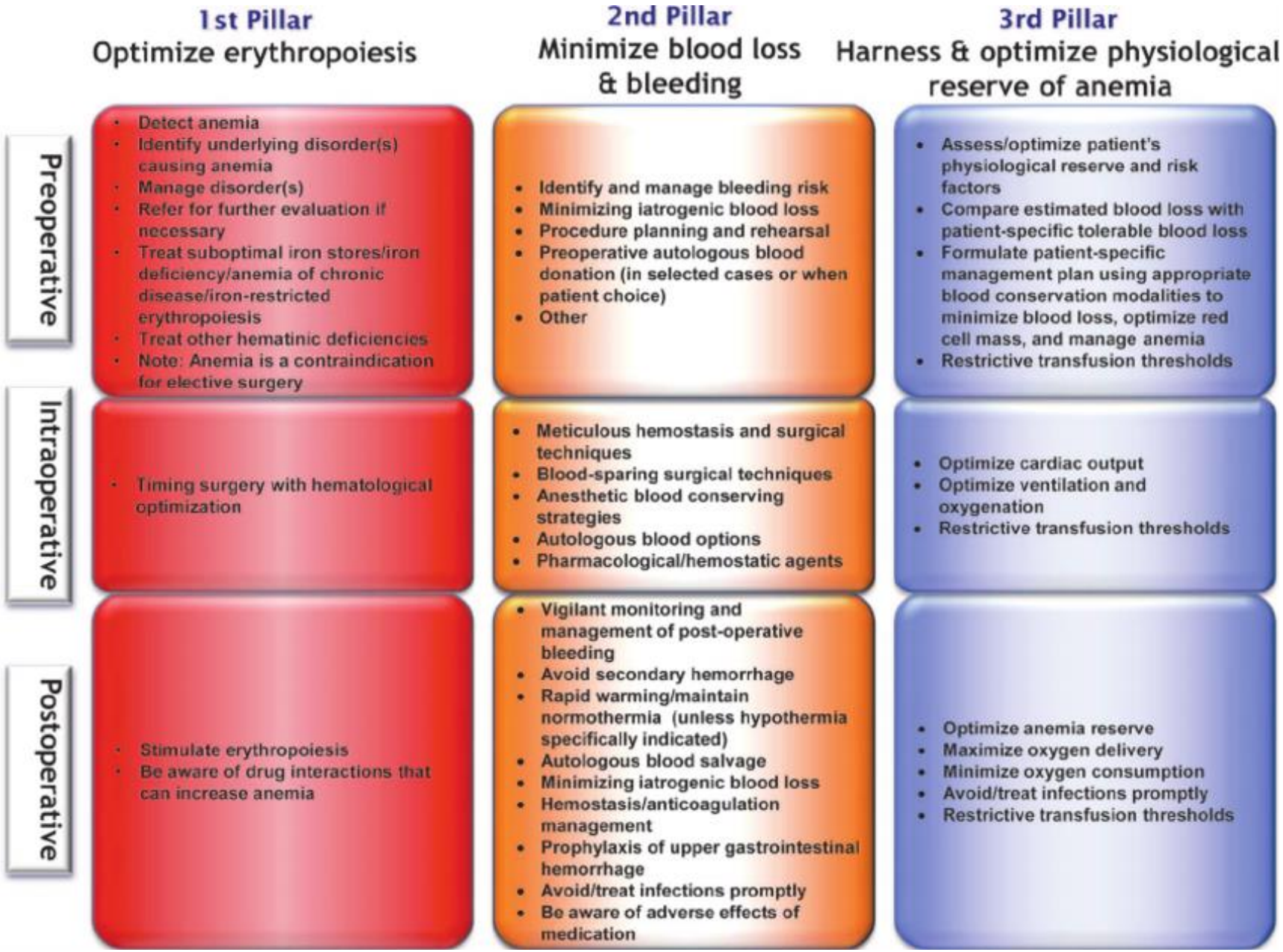
Stefania Vaglio[1,2], Domenico Prisco[3], Gianni Biancofiore[4], Daniela Rafanelli[5], Paola Antonioli[6], Michele Lisanti[7],

*Blood Transfus 2016; 14: 23-65*

## Practical recommendations for patient blood management and the reduction of perioperative transfusion in joint replacement surgery

Warwick Bruce,* David Campbell,† David Daly‡ and James Isbister§

ANZ J Surg 83 (2013) 222–229


1st Pillar
Optimize erythropoiesis
2nd Pillar
Minimize blood loss & bleeding
3rd Pillar
Harness & optimize physiological reserve of anemia
Preoperative
Detect anemia
Identify underlying disorder(s) causing anemia
Manage disorder(s)
Refer for further evaluation if necessary
Treat suboptimal iron stores/iron deficiency/anemia of chronic disease/iron-restricted erythropoiesis
Treat other hematinic deficiencies
Note: Anemia is a contraindication for elective surgery
Identify and manage bleeding risk
Minimizing iatrogenic blood loss
Procedure planning and rehearsal
Preoperative autologous blood donation (in selected cases or when patient choice)
Other
Assess/optimize patient's physiological reserve and risk factors
Compare estimated blood loss with patient-specific tolerable blood loss
Formulate patient-specific management plan using appropriate blood conservation modalities to minimize blood loss, optimize red cell mass, and manage anemia
Restrictive transfusion thresholds
Intraoperative
Timing surgery with hematological optimization
Meticulous hemostasis and surgical techniques
Blood-sparing surgical techniques
Anesthetic blood conserving strategies
Autologous blood options
Pharmacological/hemostatic agents
Optimize cardiac output
Optimize ventilation and oxygenation
Restrictive transfusion thresholds
Postoperative
Stimulate erythropoiesis
Be aware of drug interactions that can increase anemia
Vigilant monitoring and management of post-operative bleeding
Avoid secondary hemorrhage
Rapid warming/maintain normothermia (unless hypothermia specifically indicated)
Autologous blood salvage
Minimizing iatrogenic blood loss
Hemostasis/anticoagulation management
Prophylaxis of upper gastrointestinal hemorrhage
Avoid/treat infections promptly
Be aware of adverse effects of medication
Optimize anemia reserve
Maximize oxygen delivery
Minimize oxygen consumption
Avoid/treat infections promptly
Restrictive transfusion thresholds

# Recommandations palier 1

**Dépister**

- Hb< 13g
- Carence martiale (Ferritine + CST)

**Bilan étiologique**

- Bilan spécialisé
- Vit B9, B12, acide folique, CRP

**Traitement**

- Fer
- EPO
- Vit B9, B12, acide folique

# Dépister

Lors d'ur mmandé
de l le à

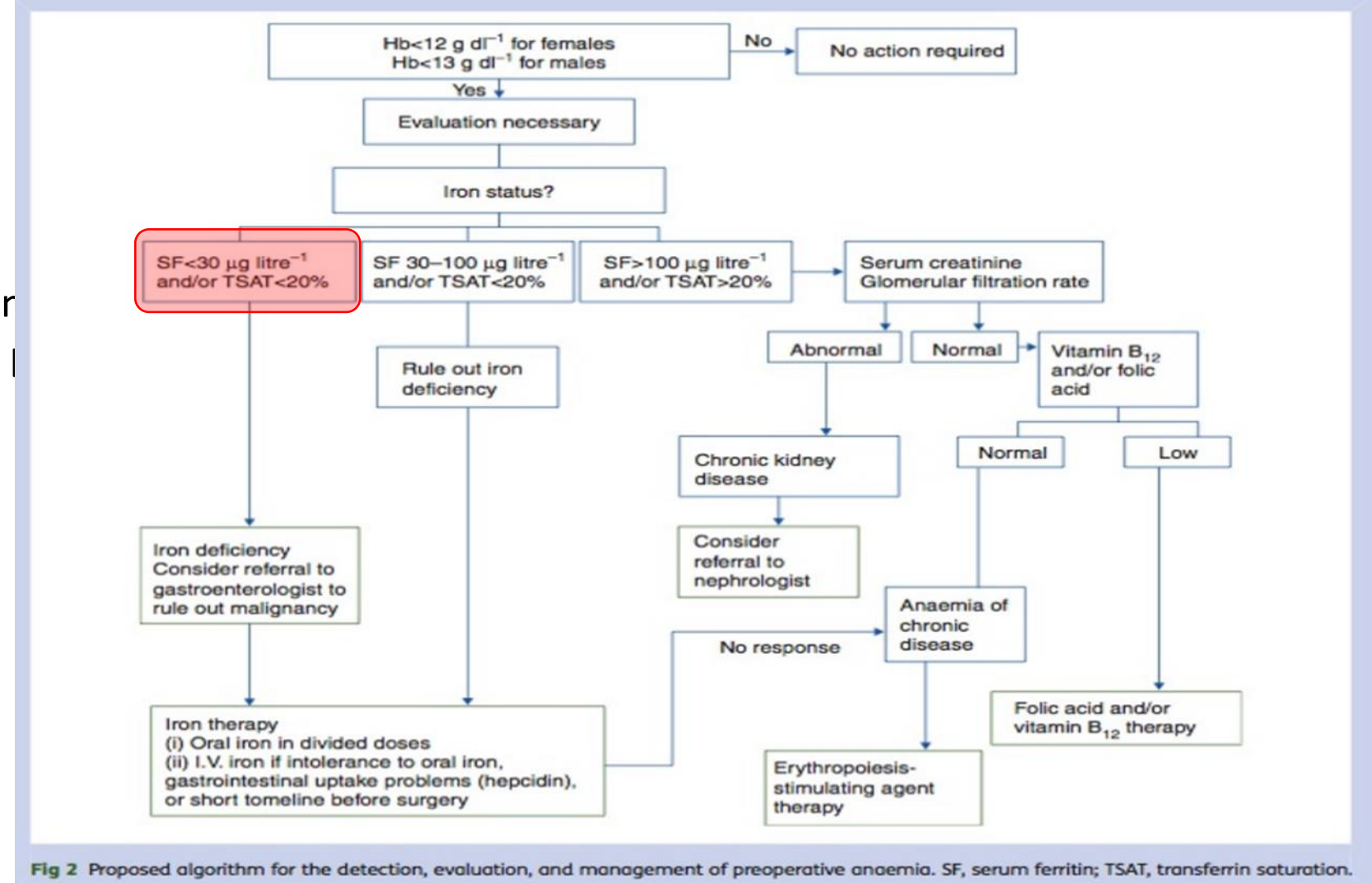



Fig 2 Proposed algorithm for the detection, evaluation, and management of preoperative anaemia. SF, serum ferritin; TSAT, transferrin saturation.

d'experts – 2012

A 2011;106:13-22

# Traiter

| | |
|---|---|
| A | L'utilisation de l'EPO est recommandée en préopératoire de la chirurgie orthopédique hémorragique chez les patients modérément anémiques. L'utilisation devra être réservée aux patients ayant une anémie modérée (par exemple Hb : 10 à 13 g/dl), et chez lesquels on s'attend à des pertes de sang modérées (900 à 1 800 ml). |

**Fer Oral**

- Beaucoup moins cher
- Tolérance limitée
  30-60% effets IIaires
- Observance ?
- Doses effectivement ingérées très faibles, compensation lente
- Interactions médicamenteuses
- Non réabsorbé si S inflammatoire.

**Fer IV**

- Coût
- Effets secondaires sévères mais rares
- Anaphylaxie (dextran)
- Nécessite une voie veineuse / HdJ / Doses répétées
- Efficace, Compensation rapide
- Pas d'interactions médicamenteuses
- A utiliser en priorité en cas de S inflammatoire.
- Améliore la réponse à l'EPO

# Traiter

## Preoperative Epoetin-α with Intravenous or Oral Iron for Major Orthopedic Surgery

*A Randomized Controlled Trial*

Philippe Biboulet, M.D., Sophie Bringuier, Pharm.D., Ph.D., Pierre Smilevitch, M.D.,

*Ann Intern Med.* 2000;133:845-854.

(ANESTHESIOLOGY 2018; 129:710-20)

PATIENT BLOOD MANAGEMENT

*Editorial*

## Iron, iron everywhere and not a transfusion should be had

Richard R. Gammon

*Blood Transfus 2023; 21: 189-192*

Cochrane Library

Cochrane Database of Systematic Reviews

## Iron in Perioperative Blood

*Transfusion Medicine Reviews 27 (2013) 221–234*

## Erythropoietin plus iron versus control treatment including placebo or iron for preoperative anaemic adults undergoing non-cardiac surgery (Review)

Kaufner L, von Heymann C, Henkelmann A, Pace NL, Weibel S, Kranke P, Meerpohl JJ, Gill R

*Cochrane Database of Systematic Reviews* 2020, Issue 8. Art. No.: CD012451.

- Patients with preoperative iron deficiency anemia may have an earlier and more robust hemoglobin recovery with preoperative IV iron therapy than with oral iron supplementation.
- A short preoperative regimen of EPO, or a single dose of EPO plus IV iron in the preoperative or intraoperative period, may significantly reduce transfusion requirements (NNT to completely avoid RBC transfusions ranged from 3 to 6).
- Intravenous iron appears to be as well tolerated as oral iron; however, the incidence of severe anaphylactic-type reactions attributable to IV iron is difficult to estimate in prospective trials because of its relatively infrequent occurrence.
- Erythropoietin may increase the risk of thromboembolism in spinal surgery patients who receive mechanical antithrombotic prophylaxis in the perioperative period so pharmacological thromboprophylaxis is advised.

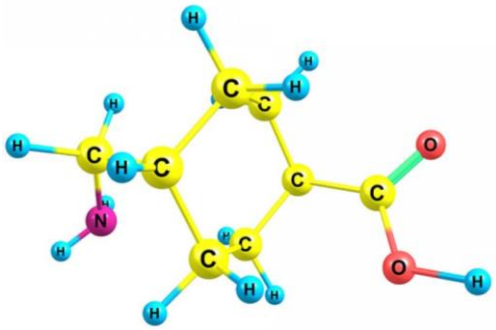
**CONCLUSIONS:** Algorithm-led preoperative anemia screening and management in elective arthroplasty was associated with reduced RBC transfusion, readmission, critical care admission, LOS, and costs.

# Recommandations palier 2

- ✓ Hémostase
- ✓ Chirurgie mini-invasive
- ✓ Récupération peropératoire de sang
- ✓ Cell-saver
- ✓ Limiter drains
- ✓ Limiter garrot

- ✓ Acide tranéxamique
- ✓ Monitorage des pertes sanguines
- ✓ Optimiser la condition du patient
- ✓ Normothermie

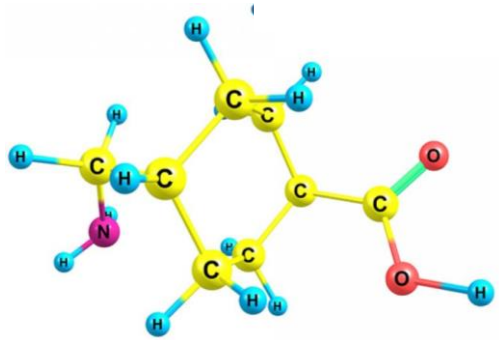
# Acide tranéxamique



- Antifibrinolytique
- Réduit le saignement
- Réduit la transfusion
- Plusieurs protocoles:
  - IV: 1g
  - IA: 3g ± entretien
  - PO: 2g
- Efficacité, sécurité, coût

- Mais risque thrombo-embolique??

# Acide tranéxamique



JOURNAL OF SURGICAL RESEARCH 186 (2014) 318–327

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.JournalofSurgicalResearch.com

## The use of tranexamic acid to reduce blood loss and transfusion in major orthopedic surgery: a meta-analysis

*Fei Huang, MD,*[a,1] *Dan Wu, PhD,*[b,1] *Guangwen Ma,*

*Results:* A total of 46 randomized controlled trials involving 2925 patients were included. The use of TXA reduced total blood loss by a mean of 408.33 mL (95% confidence interval [CI], −505.69 to −310.77), intraoperative blood loss by a mean of 125.65 mL (95% CI, −182.58 to −68.72), postoperative blood loss by a mean of 214.58 mL (95% CI, −274.63 to −154.52), the number of blood transfusions per patient by 0.78 U (95% CI, −0.19 to −0.37), and the volumes of blood transfusions per patient by 205.33 mL (95% CI, −301.37 to −109.28). TXA led to a significant reduction in transfusion requirements (relative risk, 0.51; 95% CI, 0.46 −0.56), and no increase in the risk of DVT (relative risk, 1.11; 95% CI, 0.69–1.79).

*Conclusions:* TXA significantly reduced blood loss and blood transfusion requirements in patients undergoing orthopedic surgery, and did not appear to increase the risk of DVT.

# Ac TRX et risque thromboembolique?

*Review Article*

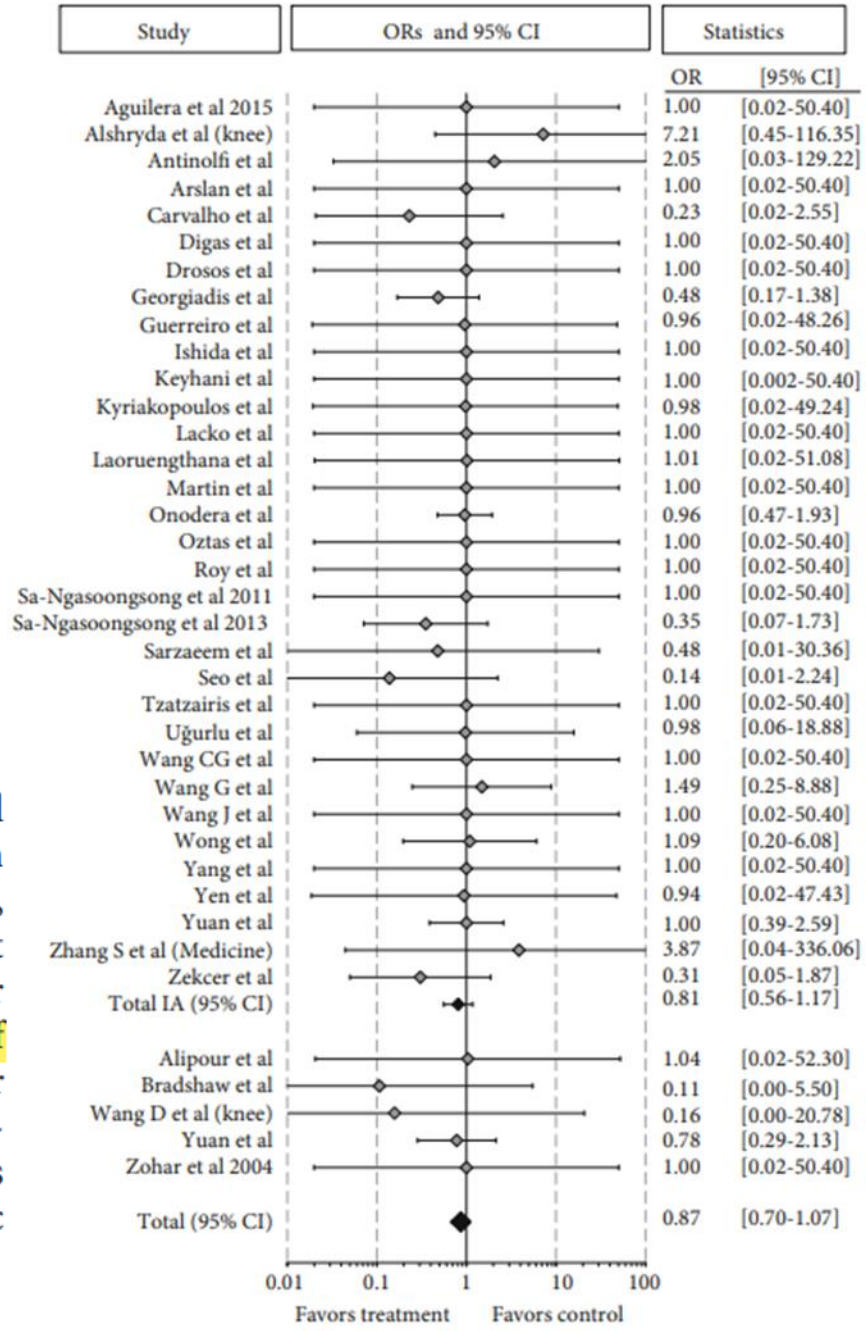
**Complications of Tranexamic Acid in Orthopedic Lower Limb Surgery: A Meta-Analysis of Randomized Controlled Trials**

Volume 2021, Article ID 6961540

- 140 études (1995-2020)
- 9,067 patients
- Chirurgie orthopédique du membre inférieur
- Différents protocoles Ac TRX (IV, IA, Oral)

## 5. Conclusions

This meta-analysis of TXA for lower limb orthopedic surgical procedures showed an increasing interest over time, with most of the articles published in the last 5 years. Moreover, besides the most common applications for joint replacement procedures, TXA use has been recently broadened to other types of surgery. Overall, TXA did not increase the risk of VTE complications. This finding remained consistent for patients undergoing THA, TKA, and other lower limb surgical procedures, regardless of the administration route, thus supporting the safety of using TXA for lower limb orthopedic surgical procedures.



# Recommandations palier 3

- Améliorer la tolérance à l'anémie
- Surveillance cinétique du saignement
- Rechercher une anémie post-opératoire (51%- 87%)
- Limiter les prélèvements systématiques (Hemocue)
- Refaire le point à 4 semaines si pertes sanguines et anémie post-opératoire

- Fer en postopératoire?
  - Si anémie par pertes hémorragiques
  - Si carence préopératoire ± EPO
- Transfusion?
  - Seuil 7g/dl
  - Tolérance clinique
  - 1 culot à la fois

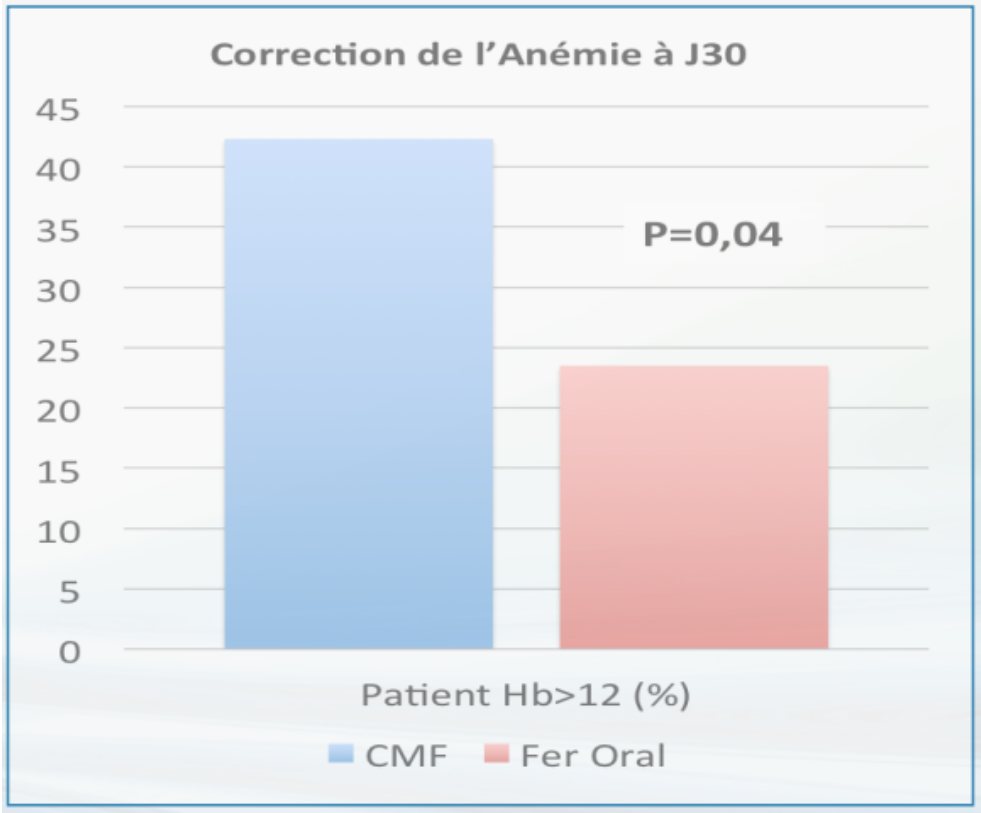
Transfusion restrictive!!

# Fer en postopératoire?

- 122 patients (PTG)
- Anémie post-op (J2) Hb [8.5-12]
- Fe IV (700-1000 mg) vs Fer Oral (100 mg/j)
- Augmentation d'Hb

  +1.7 vs +1.3 (p=0.075)

  Si Hb<10 : +2.4 vs +1.1 (p=0.018)
- Diminution de la Fatigue si Hb <10




Bisbe E et al., BJA 2014; 113(3):402-9

# Protocole PBM en chirurgie orthopédique prothétique et chirurgie du rachis

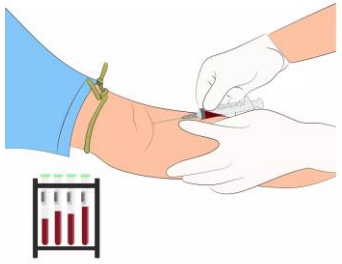
**Bloc**

CS > 3 sem
avant chirurgie

Fe IV

J-21 J-14 J-7 J0 J+1

Si Hb < 13 g/dl
Ferritinémie
CST



EPO
40000 UI
+ Fe IV

EPO
40000 UI

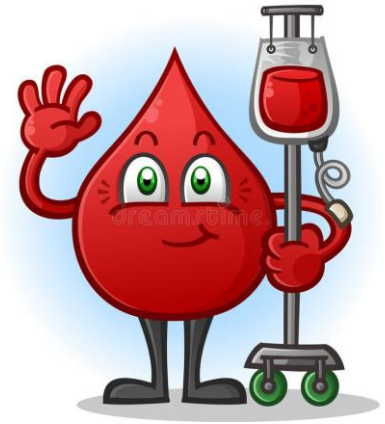
EPO
40000 UI

Si Hb
<15g/dl

Ac TRX
1g IV 15mn

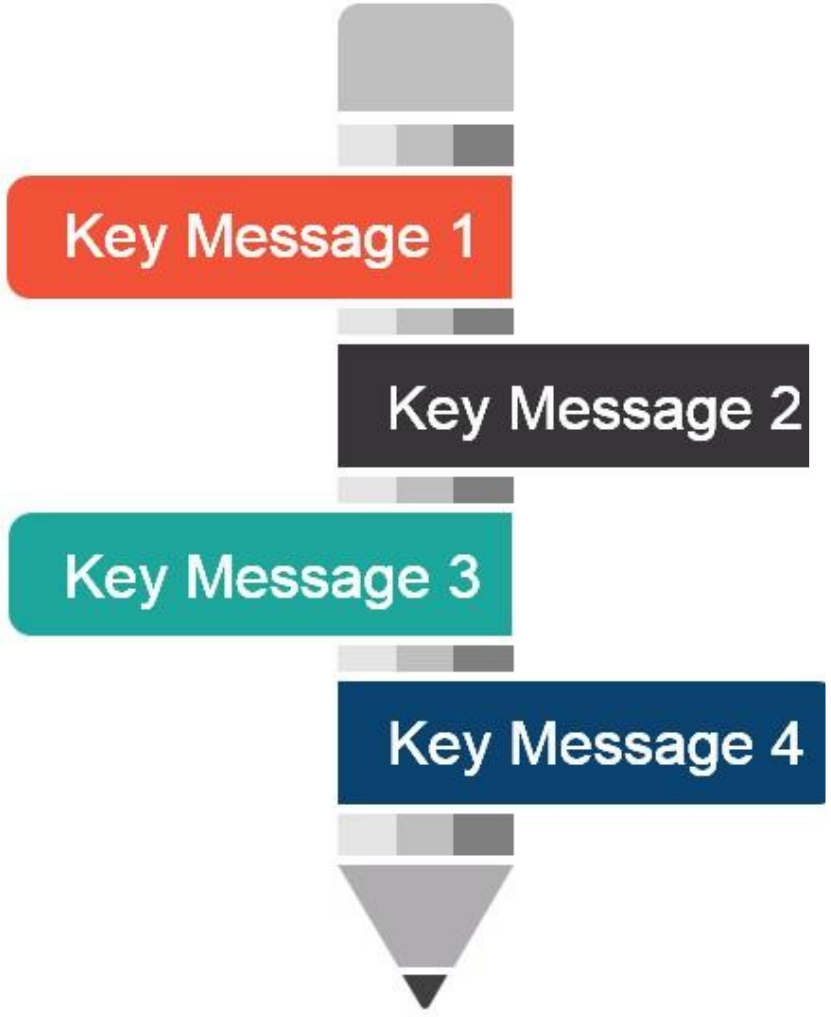
EPO
40000 UI

Transfusion si
Hb < 7g/dl



# Take home message

- ✓ Simple et efficace

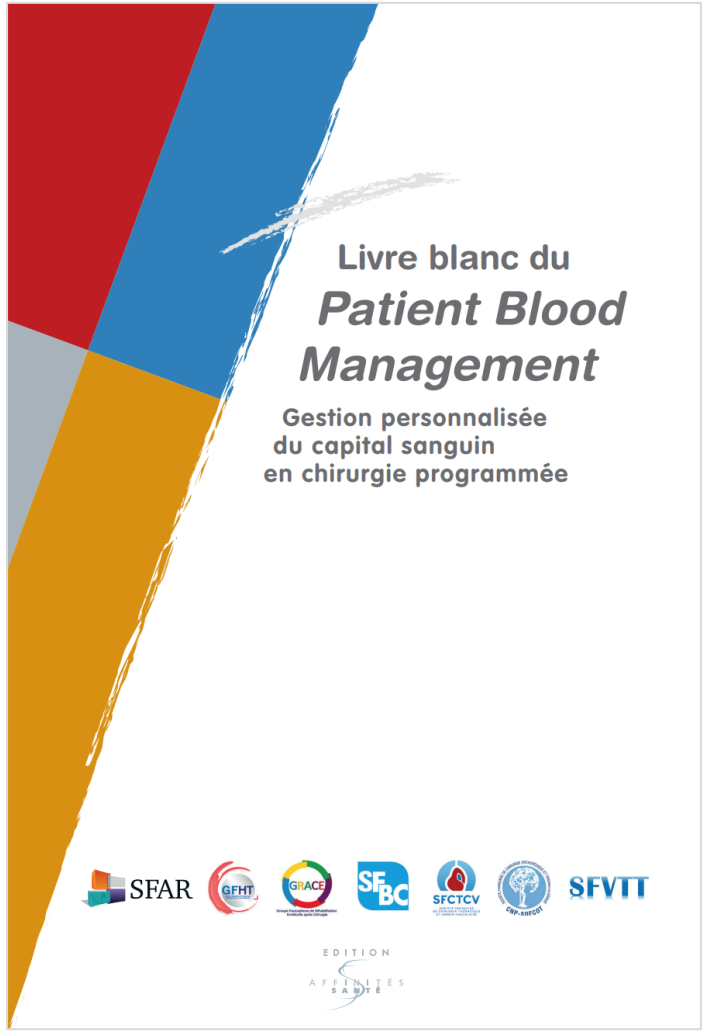



- ✓ Approche intégrée: RAAC/PBM
- ✓ La triade des principaux FDR de complications périopératoires
- ✓ Trois facteurs interdépendants : Anémie/pertes sanguine/transfusion
- ✓ Couple: anesthésiste/chirurgien
- ✓ Aspect organisationnel
- ✓ Protocoles



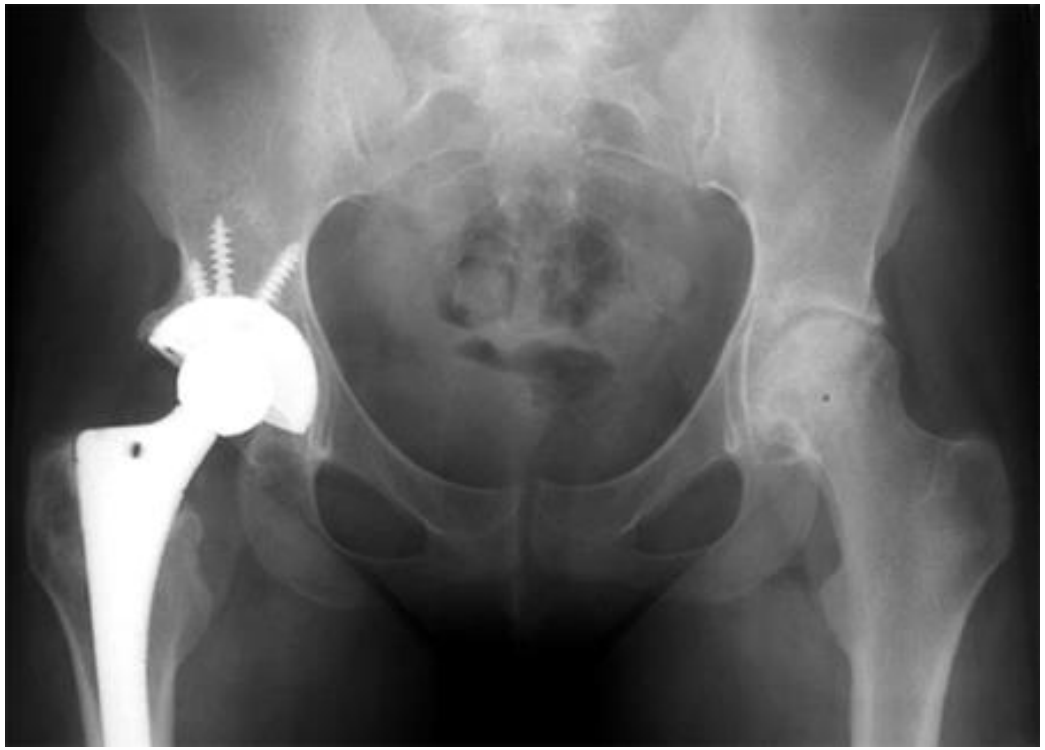
**WHY GIVE TWO WHEN ONE WILL DO?**

« In most hospitals, patient blood management programs, however started small and developed consecutively over years »


« The leader of the patient blood management programs […] is a particularly enthusiastic anesthesiologist »

# PBM ça marche!




MERCI !