Practical Guidance for Treating Anemia in Cardiac Surgical Patients Including Next Generation Iron Therapies

A surgeon's perspective

Pierre R Tibi MD

Chief of Cardiac Surgery

Yavapai Regional Medical Center

Prescott Arizona USA

October 24th 2025

The Korean Society of Patient Blood Management

Disclosures

Baxter – Medical Consultant

hc1 – Medical Advisory Board

Pharmacosmos – Medical Advisor

Objectives

Recognition of anemia in preoperative cardiac patients

Understand the various types of anemia

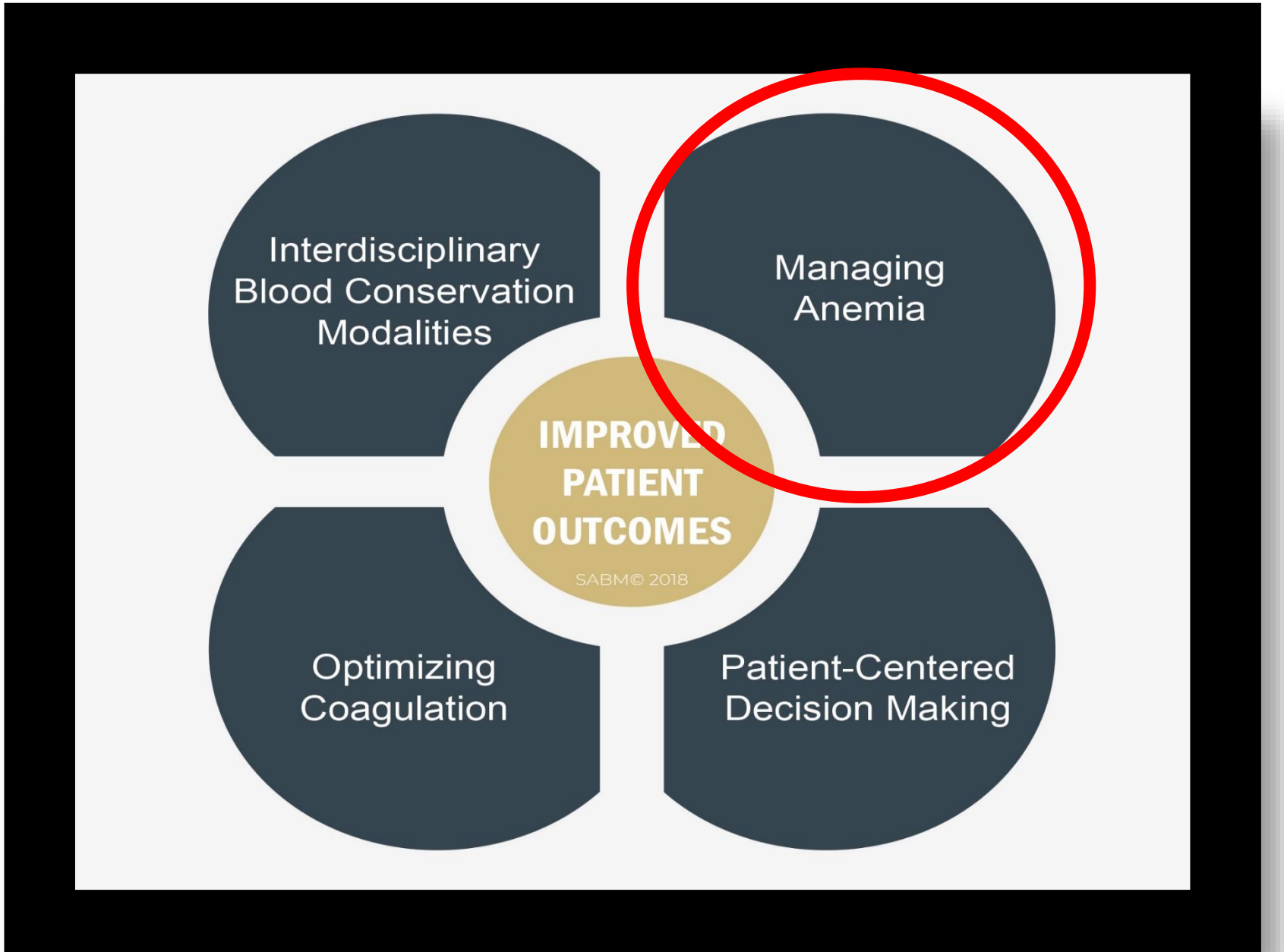
Discuss treatment for patients who are anemic or iron deficient undergoing heart surgery including Next-Gen Options

QUESTIONS TO BE ANSWERED

Cardiac surgery accounts for 15-20% of all perioperative blood transfusions

- Why is iron deficiency with or without anemia important in cardiac surgery?
- What is the current therapy for iron deficiency and ID anemia in cardiac surgery??
- How can successful treatment be promoted?
- What is on the horizon in the treatment of ID and ID anemia in cardiac surgery?

SABM/STS FOUR PILLARS OF PBM



So….whose role is it to manage anemia in a heart patient in the US?

Primary Care?	Only pre-op
Admitting Physician?	Only pre-op
Anesthesiologist?	Only intra-op
Intensivist/Hospitalist?	Only post-op

It has to be the surgeon's role!!!!

Pre-op

Intra-op

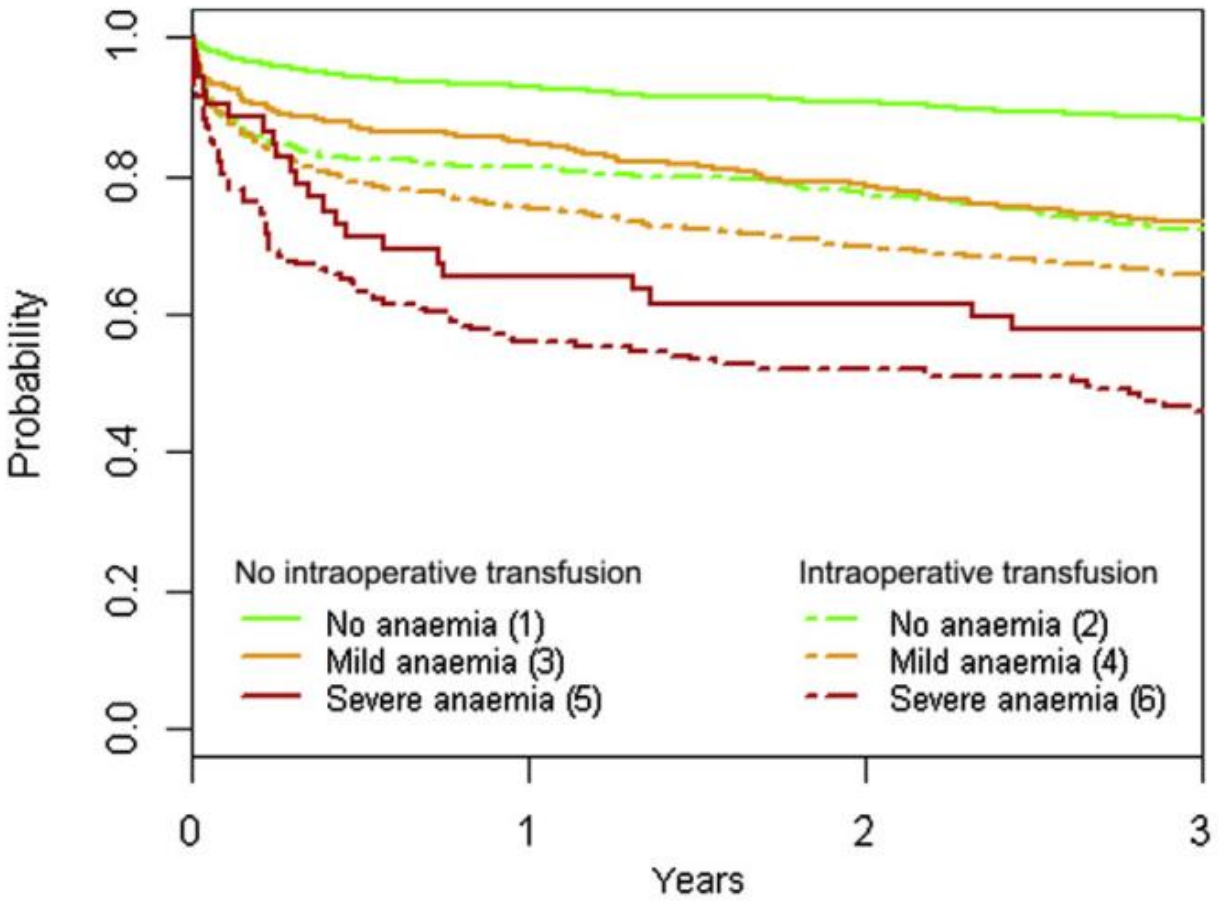
Post-op

PBM spans the full spectrum of care and is to be practiced long before admission, surgery or any need for transfusion other than immediate and overwhelming blood loss. The surgeon is in the best position to do so.

Does the severity of preoperative anemia or blood transfusion have a stronger impact on long-term survival after cardiac surgery?

von Heymann *et al*.
J Thorac Cardiovasc Surg
2016;152(5):1412–20

Kaplan-Meier curves depicting long-term survival of patients depending on anemia and/or transfusion.



Preoperative anemia has been shown to impact long-term survival in CTS patients

CTS, cardio-thoracic surgery.

Updated Guidelines Inform Surgical Practice

In patients undergoing cardiac surgery, a restrictive perioperative allogeneic red blood cell (RBC) transfusion strategy is recommended in preference to a liberal transfusion strategy for perioperative blood conservation, as it reduces both transfusion rate and units of allogeneic RBCs without increased risk for mortality or morbidity. Class I, Level A

Tibi *et al*. *J Cardiothorac Vasc Anesth* 2021;35(9):2569–91.

0003-4975/$36.00 981
https://doi.org/10.1016/j.athoracsur.2021.03.033

PATIENT BLOOD MANAGEMENT GUIDELINES

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

Check for updates

Pierre Tibi, MD, R. Scott McClure, MD, FRCSC, Jiapeng Huang, MD, Robert A. Baker, PhD, CCP, David Fitzgerald, DHA, CCP, C. David Mazer, MD, Marc Stone, MD, Danny Chu, MD, Alfred H. Stammers, MSA, CCP Emeritus, Tim Dickinson, CCP, Linda Shore-Lesserson, MD, Victor Ferraris, MD, Scott Firestone, MS, Kalie Kissoon, and Susan Moffatt-Bruce, MD, FRCSC

Department of Cardiovascular Surgery, Yavapai Regional Medical Center, Prescott, Arizona; Division of Cardiac Surgery, Libin Cardiovascular Institute, Foothills Medical Center, University of Calgary, Calgary, Alberta, Canada; Department of Anesthesiology & Perioperative Medicine, University of Louisville, Louisville, Kentucky; Cardiac Surgery Research and Perfusion, Flinders University and Flinders Medical Centre, Adelaide, South Australia, Australia; Division of Cardiovascular Perfusion, Medical University of South Carolina, Charleston, South Carolina; Department of Anesthesia, St. Michael's Hospital, University of Toronto, Toronto, Ontario, Canada; Department of Anesthesia, Mount Sinai Medical Center, New York, New York; Department of Cardiothoracic Surgery, University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania; Specialty Care, Nashville, Tennessee; Department of Cardiovascular Surgery, Mayo Clinic, Rochester, Minnesota; Department of Anesthesiology, Zucker School of Medicine at Hofstra/Northwell Northshore University Hospital, Manhasset, New York; Division of Cardiovascular and Thoracic Surgery, University of Kentucky, Lexington, Kentucky; The Society of Thoracic Surgeons, Chicago, Illinois; and Division of Thoracic Surgery, Department of Surgery, University of Ottawa, Ottawa, Ontario, Canada

EXECUTIVE SUMMARY

Owing to the constantly evolving nature of the medical literature, The Society of Thoracic Surgeons (STS) clinical practice guidelines periodically undergo evaluation and updating. A multidisciplinary panel of experts was convened by STS, which includes members of the Society of Cardiovascular Anesthesiologists (SCA), the American Society of ExtraCorporeal Technology (AmSECT), and the Society for the Advancement of Blood Management (SABM), to review the latest data on patient blood management and to update the 2011 *Update to The Society of Thoracic Surgeons and the Society of Cardiovascular Anesthesiologists Blood Conservation Clinical Practice Guidelines*.

The concept of patient blood management informs the recommendations in this document and stresses the importance of an evidence-based, multimodal, and multidisciplinary approach to not just conserving blood resources but also optimizing outcomes in patients at high risk for transfusion. The individual recommendations are meant to be conceived of as part of an all-inclusive protocol-based and shared decision-making approach rather than isolated interventions to reduce blood loss and transfusion.

Because standards for clinical practice guidelines have evolved since 2011, the authors were tasked with prioritizing topics for systematic review, while still aiming for the comprehensive approach of previous versions of this article. These high-priority topics make up the bulk of this article and resulted in 23 new or updated recommendations. Additionally, all previous recommendations not directly addressed were voted on by consensus and can be found in Table 1. Together, these recommendations address the full spectrum of care for patients undergoing cardiac surgery, as seen in Table 2.

Blood transfusion is a critical and life-saving facet of the care for cardiothoracic surgery patients. Inherent to the transfusing of blood is the understanding of the preservation of blood as well as the appropriateness of techniques to prevent hemorrhage through the clinical

Dr Stammers discloses a financial relationship with SpecialtyCare.

The Appendices can be viewed in the online version of this article [https://doi.org/10.1016/j.athoracsur.2021.03.033] on https://www.annalsthoracicsurgery.org.

This article has been copublished in *The Annals of Thoracic Surgery*, the *Journal of ExtraCorporeal Technology*, and the *Journal of Cardiothoracic and Vascular Anesthesia*.

The Society of Thoracic Surgeons requests that this article be cited as: Tibi P, McClure RS, Huang J, et al. STS/SCA/AmSECT/SABM Update to the Clinical Practice Guidelines on Patient Blood Management. *Ann Thorac Surg*. 2021;112:1825–1864.

Address correspondence to Dr Moffatt-Bruce, Royal College of Physicians and Surgeons of Canada, Surgery-Cardiothoracic, 774 Echo Dr, Ottawa, ON K1S5N8, Canada; email: smoffatt@royalcollege.ca.

REPORT

Society of Thoracic Surgeons Guidelines

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, Robert A. Baker, PhD, CCP, David Fitzgerald, DHA, CCP, C. David Mazer, MD, Marc Stone, MD, Danny Chu, MD, Alfred H. Stammers, MSA, CCP Emeritus, Tim Dickinson, CCP, Linda Shore-Lesserson, MD, Victor Ferraris, MD, Scott Firestone, MS, Kalie Kissoon, and Susan Moffatt-Bruce, MD, FRCSC

EXECUTIVE SUMMARY

REPORT

Preoperative identification of high-risk patients should be performed, and all available preoperative and perioperative measures of blood conservation should be undertaken in this group as they account for the majority of blood products transfused. Class I, Level A

"Patients with preoperative anemia are more likely to require transfusions, and it is obvious that if the ability to treat iron-deficiency anemia is available without any untoward effects, ***it should be instituted before surgery.*** *Differentiation must be made between anemias caused by iron deficiency as opposed to other causes of anemia. Iron-deficiency anemia is usually microcytic, whereas normocytic or macrocytic anemia stem from a variety of causes.* ***Routine iron studies*** *are of importance in the determination of the type of anemia present and* ***should be done routinely in the careful preoperative assessment of patients*** *so that treatment can be instituted if warranted."*

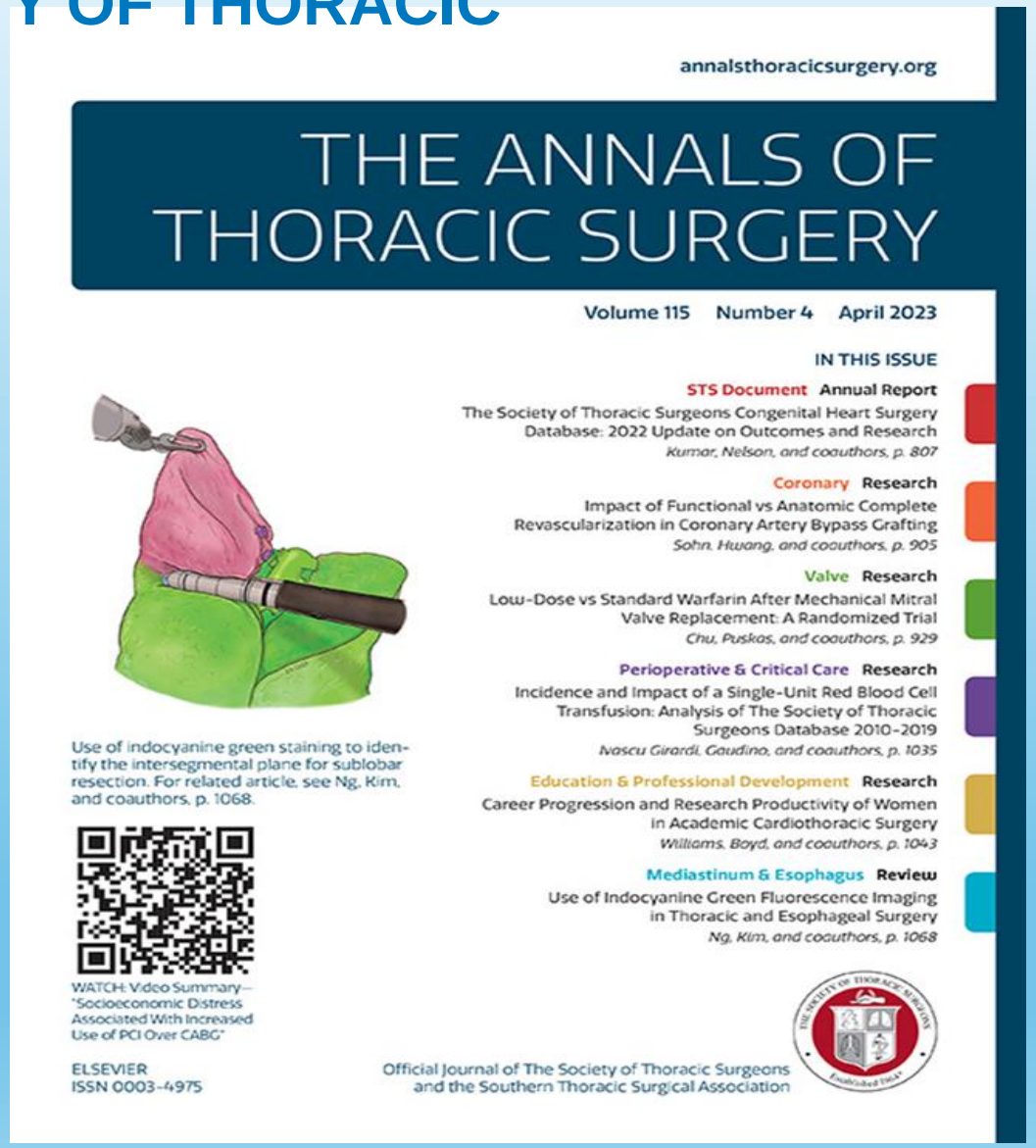
Tibi *et al*. *J Cardiothorac Vasc Anesth* 2021;35(9):2569–91.

INCIDENCE AND IMPACT OF A SINGLE-UNIT RED BLOOD CELL TRANSFUSION: ANALYSIS OF THE SOCIETY OF THORACIC SURGEONS DATABASE 2010–2019

- Girardi *et al. Ann Thorac Surg* 2023;115:1035–42
  - 10 years
  - Isolated CABG and AVR
  - 2,151,430 encounters
  - 847,442 received transfusions
    - 1,303,988 received 0 units
    - 206,555 received 1 unit
  - Propensity matching of 206,555 pairs for comparison

TABLE 4 Outcomes of Propensity-Matched Cohort

Variable	No RBCs (n ¼ 206,555)	1 Unit of RBCs (n ¼ 206,555)	P Value
Operative mortality	2058 (1.0)	2990 (1.4)	<.001
Stroke	2492 (1.2)	3458 (1.7)	<.001
Sternal wound infection	1070 (0.5)	1343 (0.7)	<.001
Prolonged ventilation	6990 (3.4)	13,305 (6.4)	<.001
New hemodialysis	1816 (0.9)	3703 (1.8)	<.001
Reoperation for bleeding	1064 (0.5)	2685 (1.3)	<.001



AVR, aortic valve replacement CABG, coronary artery bypass grafting; RBCs, red blood cells.

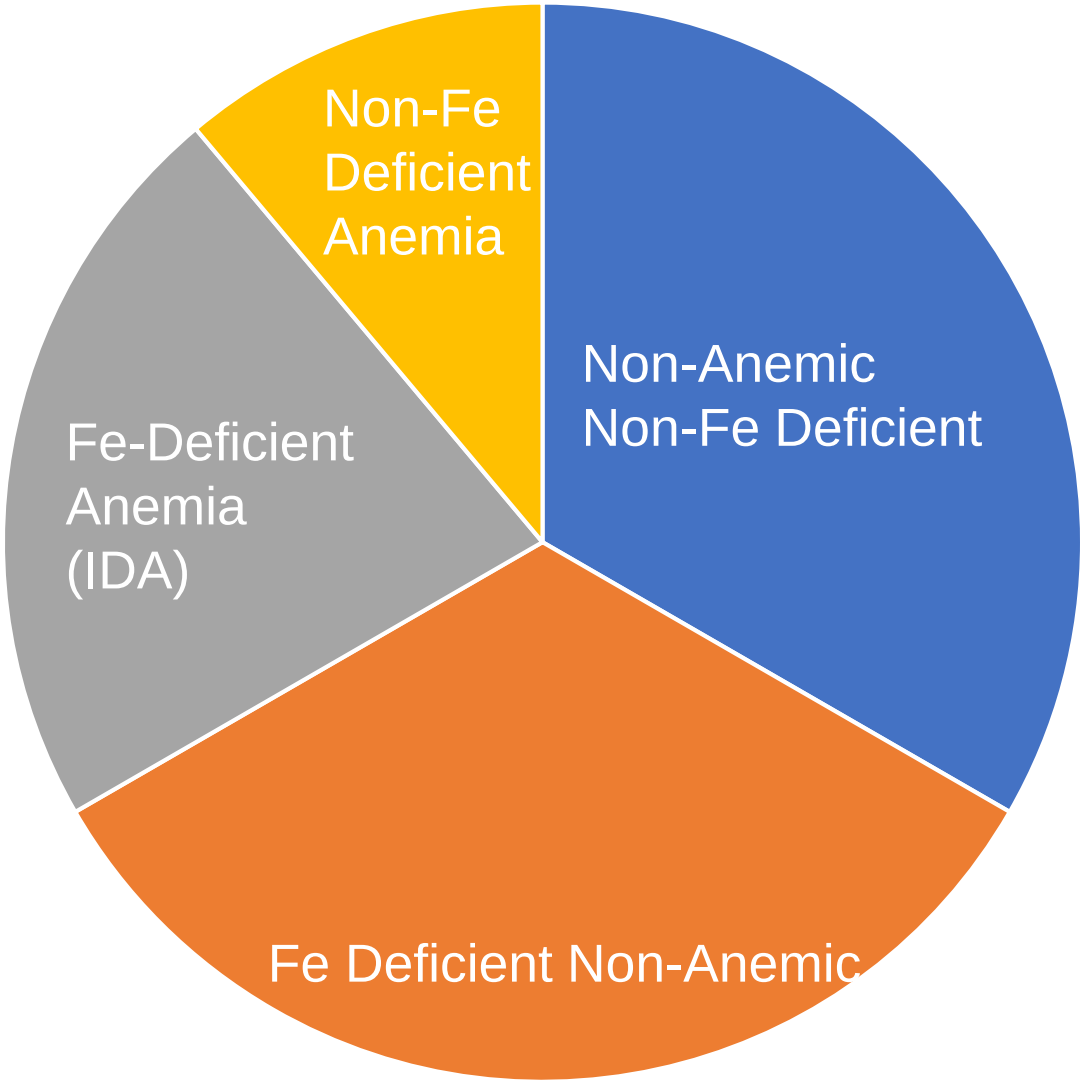
All Cardiac Surgical Patients

Management of Preoperative Iron Deficiency in Cardiac Surgery

Corwin HL, Shander A, Spiess B, Munoz M , Faroni D, Calcaterra D, Welsby I, Ozawa S, Arnofsky, A Goldweit RS, Tibi P, Ann Thor Surg 2022;113:316-323

In the US, high-risk groups for anemia include:[2]

- The elderly
- Reproductive-age & pregnant women
- Hispanic and non-Hispanic black Americans



All Cardiac Surgical Patients

Management of Perioperative Iron Deficiency in Cardiac Surgery

Corwin HL, Shander A, Spiess B, Munoz M, Faroni D, Calcaterra D, Welsby I, Ozawa S, Arnofsky, A Goldweit RS, Tibi P
Ann Thor Surg
2022;113:316–23

Recommendation 1: All patients undergoing cardiac surgery be evaluated for ID, whether or not anemia is present

Recommendation 2: The evaluation for ID includes iron studies (serum iron, TIBC, transferrin saturation, serum ferritin) and reticulocyte hemoglobin content

Recommendation 3: Patients found to be non-ID anemic be referred for further evaluation

Recommendation 4: All cardiac surgical patients identified with preoperative ID (with or without anemia) should be treated with parenteral iron

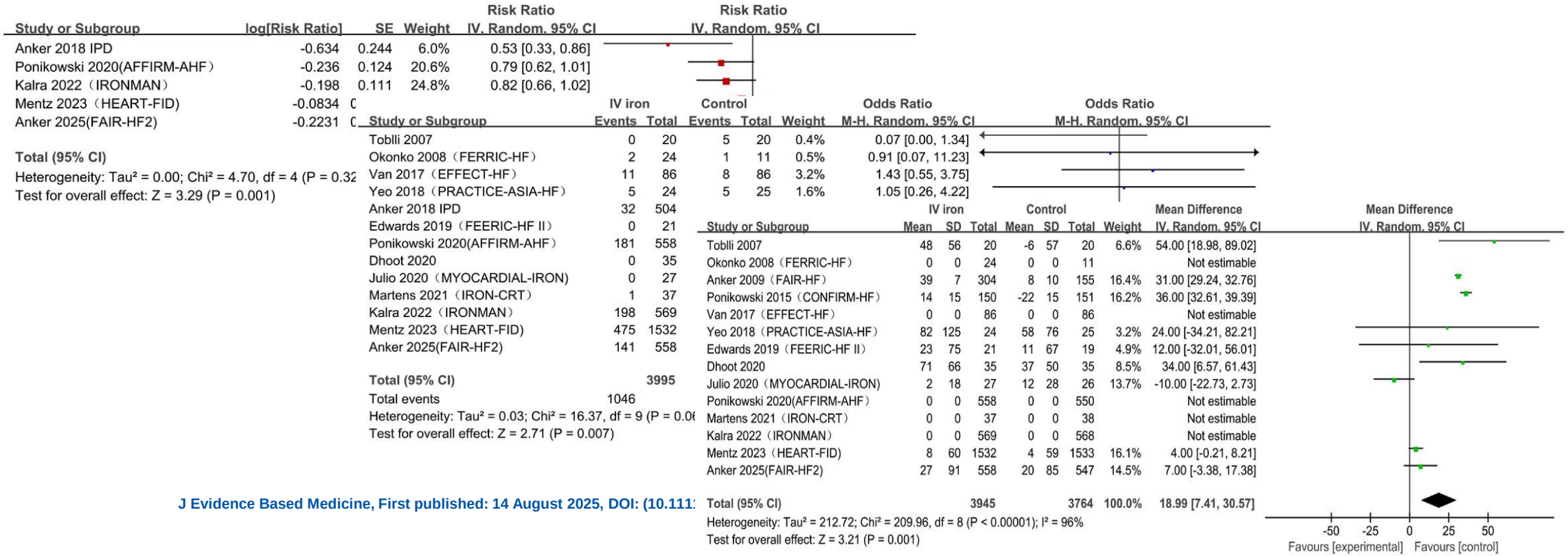
Recommendation 5: ESAs should be considered for treating patients with preoperative anemia on a case-by-case basis

ESA, erythropoietin stimulating agent; ID, iron deficiency; TIBC, total iron-binding capacity.

Intravenous Iron in Heart Failure Patients With Iron Deficiency: A Meta-Analysis of Randomized Controlled Trials

https://doi.org/10.1111/jebm.70057

For HF patients with ID, intravenous iron therapy can decrease the risk of hospitalization for HF, CV death and improve their exercise capacity. Patients with ischemic cardiomyopathy or with TSAT <20% may derive greater benefit from intravenous iron therapy



J Evidence Based Medicine, First published: 14 August 2025, DOI: (10.111

STS Recommendations

1. Evaluate all cardiac surgical patients for iron deficiencies
2. Full iron studies including Serum Fe, TIBC, Transferrin Saturation, Serum Ferritin,& Retic Count
3. Hematology consult in patients with anemia without iron deficiency
4. Treat all patients with iron deficiency ***regardless of anemia status***
5. Use ESAs in select patients

Guidelines for Assessment and Treatment of Anemia and Iron Deficiency in Cardiac Patients

1.Universal assessment of anemia and Iron Deficiency in ALL cardiac patients if possible.

2. Determination of cause of iron deficiency or anemia

3.Development of treatment plan for patients taking into account timing/urgency of planned procedure

4. Discussion with patient regarding importance of treatment to ensure compliance

5. Careful coordination with PBM team or anemia clinic

Oral Iron Supplements

- Ferrous Sulfate, Ferrous Gluconate, Ferrous Fumarate
- Maltofer, Accrufer (bound to carbohydrate)
- Ferrous Bisglycinate (bound to glycine molecules)
- *Sucrosomial iron (Sideral) (iron pyrophosphate encapsulated in a phospholipid + sucrester matrix)

SABM
SOCIETY FOR THE ADVANCEMENT OF PATIENT BLOOD MANAGEMENT

IV Iron Products

Agent	Test Dose	Dosing	Infusion Time
Sodium ferric gluconate (Ferrlecit)	N*	125–250 mg/dose	125 mg: 1 hr 250 mg: 2–4 hrs Min: 2.1 mg/min
Iron sucrose (Venofer)	N*	100–500 mg/dose	IV push: 2–5 mins (into HD line) 100–200 mg: 15 mins 300 mg: 1.5 hrs 500 mg: 3.5–4 hrs
Iron dextran, LMW (INFeD)	Y (25 mg prior to 1st dose)	Multiple doses of 100 mg or single dose of 1000 mg/250 mL NS	100 mg: 50 mg/min 1000 mg: infusion over 1 or more hours
Ferric carboxymaltose (Injectafer)	N	750 mg/dose; max 20 mg/kg per dose	750 mg: 15 mins
Ferumoxytol (Feraheme)	N	510–1020 mg/dose	510 mg: 15 mins 1020 mg: 30 mins
Iron isomaltoside (Monoferric)	N	1000 mg; max 20 mg/kg per dose	1000 mg: 15 mins

*Not required but recommended if patient has history of multiple drug allergies

HD, hemodialysis; IV, intravenous; LMW, low molecular weight; N, no; NS, normal saline; Y, yes.

The Safety of Intravenous Iron Preparations

Tomer Avni MD, Amir Bieber MD, Alon Grossman MD, MHA, Hefziba Green MD, Leonard Leibovici MD and Anat Gafter-Gvili MD

Mayo Clinic Proceedings 2015;90(1):12–23

103 trials published between 1965–2013 were included

10,390 patients were treated with IV iron compared with 4,044 patients treated with oral iron, 1,329 with no iron, 3,335 with placebo, and 155 with intramuscular iron

No increased risk of SAEs with IV iron (RR, 1.04; 95% CI, 0.93–1.17; I^2 = 9%)

Decreased rate of SAEs when IV iron was used to treat heart failure (RR, 0.45; 95% CI, 0.29–0.70; I^2 =0%)

No increased risk of infections and reduced GI AEs with IV iron

AE, adverse event; CI, confidence interval; GI, gastrointestinal; IV, intravenous; RR, risk ratio; SAE, serious adverse event.

Studies on Preoperative Anemia Treatment

Iron Only	
• Garrido-Martin 2012 (RCT), Padmanabhan 2019 (RCT)	***No change in Hb***
• Johansson 2015 (RCT), Peters 2018 (PO), Xu 2019 (RCT)	***Increased Hb***
EPO Only	
• Sowade 1997 (RCT), D'Ambra 1997 (RCT), Song 2009 (RCT), Weltert 2010 (RCT), Oh 2012 (RCT), Tasanorong 2013 (RCT), Weltert 2015 (RCT)	***Increased Hb, decreased transfusion and/or improved renal AKI***
• Deseigneux 2012 (RCT), Kim 2013 (RCT), Duce 2018 (RO)	***No difference***
EPO + Iron	
• Yoo 2011 (RCT), Spahn 2019 (RCT)	***Increase Hb and/or decreased transfusions***

AKI, acute kidney injury; EPO, erythropoietin; Hb, hemoglobin; PO, prospective observational study; RCT, randomized clinical trial; RO, retrospective observational study.

Clinical Studies using EPO +/- Iron

	Weltert *et al*. 2010[1]	Yoo *et al.* 2011[2]	Weltert *et al*. 2015[3]	Spahn *et al*. 2019[4]
Design	Prospective, randomized study	Prospective, single-site, single-blind	Prospective single-blind randomized study	Single center, randomized, double-blind, parallel group, controlled
N	320	74	600	484
Population	Isolated coronary vessel disease with Hgb <14.5 g/dL undergoing off-pump CABG	Pre-op Hgb <12 g/dL (women) and <13 g/dL (men) undergoing valvular surgery	Pre-op Hgb ≤14.5 g/dL undergoing cardiac surgery	Elective cardiac surgery (valve, CABG, or combined) Anemia or iron deficiency (ferritin <100 mcg/L)
Pre-op Baseline Hgb	13 g/dL	9.3 g/dL	12.1 g/dL	12.8 g/dL
Intervention	EPO 14,000 U x 2 days pre-op EPO 8,000 U day of surgery EPO 8,000 U x 2 days post-op	Given day before surgery: EPO 500 U/kg + iron sucrose 200 mg IV	Two days before surgery: EPO 80,000 U + oral iron 40 mg/day (also given in the placebo arm)	Given day before surgery: Ferric carboxymaltose 20 mg/kg IV EPO 40,000 U SC Vitamin B12 1 mg SC Folic acid 5 mg PO
Efficacy Endpoints	On POD4, Hgb was 15.5% higher in EPO group which required 0.33 units/blood per patient vs 0.76 units/blood per patient (p=0.008)	Total of 86% vs 59% required transfusions of RBCs (p=0.009)	Total of 17% vs 39% required transfusions of RBCs (p<0.01); no difference in patients with baseline Hgb ≥13 g/dL	Tx reduced RBC transfusions from median of 1 in the placebo group to 0 in the tx group (p=0.036); no differences in clinical end points
Safety Endpoints	No adverse events were recorded related to EPO	No difference in adverse events or mortality	No difference in adverse event rates or mortality	No difference in thromboembolic events including stroke, MI

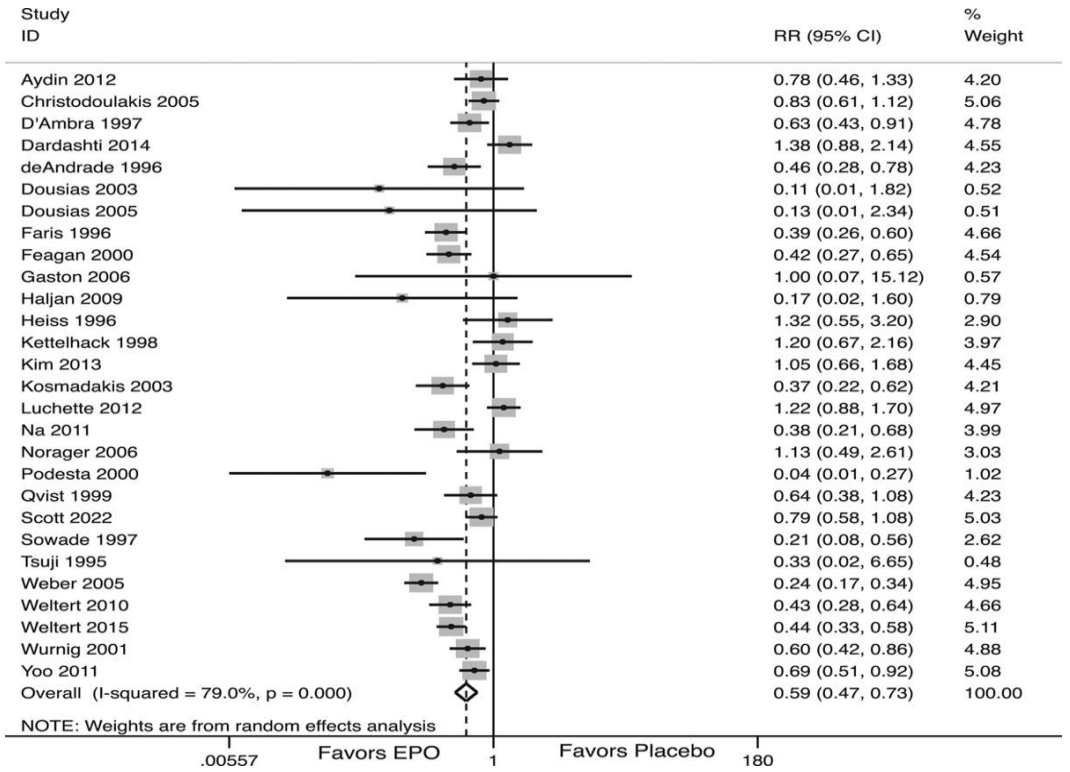
CABG, coronary artery bypass grafting; EPO, erythropoietin; Hgb, hemoglobin; IV, intravenous; MI, myocardial infarction; PO, per os, orally; POD4, postoperative day 4; RBC, red blood cell; SC, subcutaneous; tx, treatment; U, unit.

1. Weltert L, et al. *J Thorac Cardiovasc Surg* 2010;139(3):621–627; 2. Yoo YC, et al. *Anesthesiology* 2011;115(5):929–937; 3. Weltert L, et al. *Transfusion* 2015; 55(7):1644–1654; 4. Spahn DR, et al. *Lancet* 2019; 393(10187):2201–2212.

Impact of Preoperative Erythropoietin on Allogeneic Blood Transfusions in Surgical Patients: Results From a Systematic Review and Meta-analysis

Cho *et al*.
Anesth Analg
2019;128(5):981–92

The weighted (pooled) estimate for the effect of preoperative EPO administration on incidence of whole hospitalization allogeneic transfusions (RR, 0.59; 95% CI, 0.47–0.73; p<0.001) compared with placebo administration



"***preoperative erythropoietin*** is not only a viable agent for ***reducing perioperative transfusion*** requirements, but it may also be time to reconsider its ***routine use as a tool for preoperative optimization***, particularly for procedures associated with high incidence of blood product administration such as cardiac and orthopedic surgeries."

EPO, erythropoietin; CI, confidence interval.

REVIEW ARTICLE

OPEN

Recommendations From the International Consensus Conference on Anemia Management in Surgical Patients (ICCAMS)

Aryeh Shander, MD,†✉ Howard L. Corwin, MD,‡ Jens Meier, MD,§‖ Michael Auerbach, MD,¶# Elvira Bisbe, MD,‖** Jeanna Blitz, MD,†† Jochen Erhard, MD,‡‡ David Faraoni, MD,§§ Shannon L. Farmer, DHSc,‖‖¶¶ Steven M. Frank, MD,## Domenico Girelli, MD,*** Tiffany Hall, RN,††† Jean-François Hardy, MD,‖‡‡‡ Axel Hofmann, Dr rer medic,§§§ Cheuk-Kwong Lee, MD,‖‖‖ Tsin W. Leung, MD,¶¶¶ Sherri Ozawa, RN,### Jameela Sathar, MD,**** Donat R. Spahn, MD,†††† Rosalio Torres, MD,‡‡‡‡ Matthew A. Warner, MD,§§§§ and Manuel Muñoz, MD‖‖‖‖‖‖‖‖*

Journal of *Cardiovascular Development and Disease*

MDPI

Article

Prognostic Implication of Preoperative Anemia in Redo Cardiac Surgery: A Single-Center Propensity-Matched Analysis

Antonino Salvatore Rubino [1,*,†], Luca Salvatore De Santo [2,†], Antonio Pio Montella [2], Caterina Golini Petrarcone [2], Lucrezia Palmieri [2], Denise Galbiati [3], Nicola Galdieri [4] and Marisa De Feo [2]

1 Cardio-Thoraco-Vascular Department, Division of Cardiac Surgery, Papardo Hospital, 98158 Messina, Italy
2 Department of Translational Medical Sciences, University of Campania "Luigi Vanvitelli", Monaldi Hospital, Via Leonardo Bianchi, 80131 Neaples, Italy
3 Cardiovascular Department, Cardiac Surgery Unit of the IRCCS Humanitas Research Hospital, 20089 Rozzano, Italy
4 Cardiac Intensive Care Unit, Monaldi Hospital, Via Leonardo Bianchi, 80131 Neaples, Italy
* Correspondence: antonio.rubino@hotmail.com
† These authors contributed equally to this work.

ELSEVIER

Contents lists available at ScienceDirect

Journal of Cardiothoracic and Vascular Anesthesia

journal homepage: www.jcvaonline.com

Review Article

Treatment Strategies in Anemic Patients Before Cardiac Surgery

Raphael Kloeser, MD[*], Andreas Buser, MD[†], Daniel Bolliger, MD[*,†]

[*]*Clinic for Anesthesia, Intermediate Care, Prehospital Emergency Medicine and Pain Therapy, University Hospital Basel, Basel, Switzerland*
[†]*Regional Blood Transfusion Service, Swiss Red Cross, Basel, and Department of Hematology, University Hospital Basel, Basel, Switzerland*

Patient Blood Management

ORIGINAL CLINICAL RESEARCH REPORT

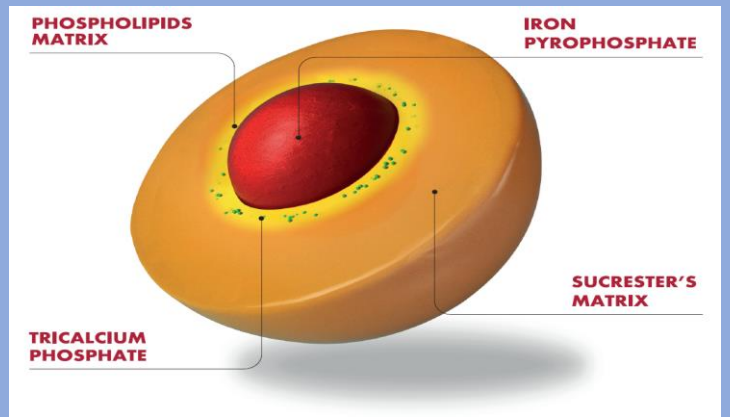
Preoperative Anemia and Postoperative Outcomes in Cardiac Surgery: A Mediation Analysis Evaluating Intraoperative Transfusion Exposures

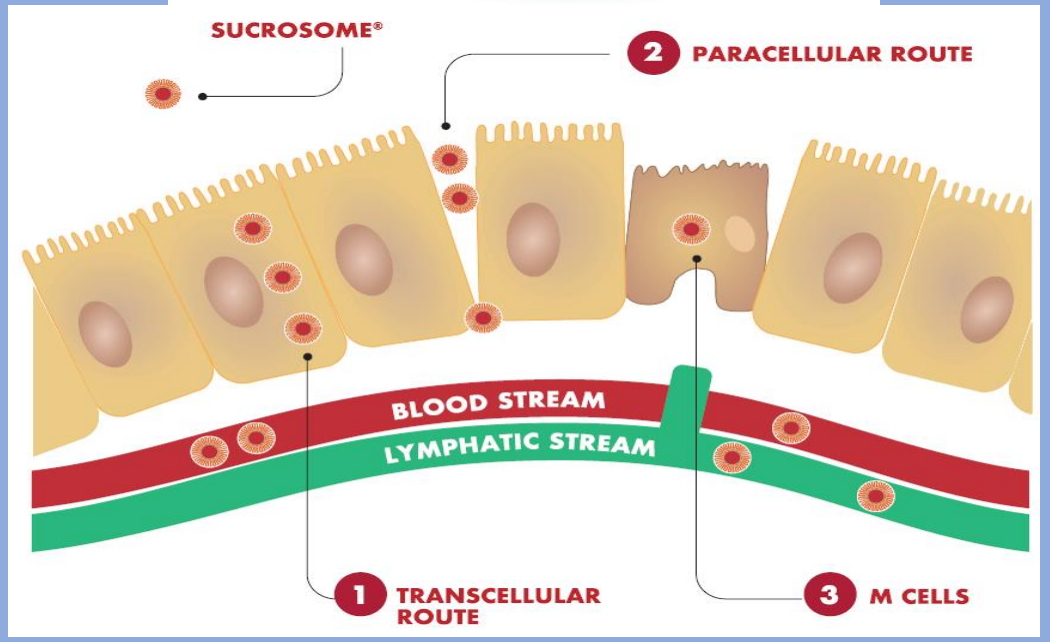
Matthew A. Warner, MD,* Andrew C. Hanson, MS,† Phillip J. Schulte, PhD,† Juan Ripoll Sanz, MD,* Mark M. Smith, MD,* Marissa L. Kauss, MD,* Juan A. Crestanello, MD,‡ and Daryl J. Kor, MD*

Sucrosomial® Components + MOA

INTRAVENOUS IRON

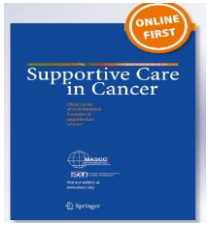
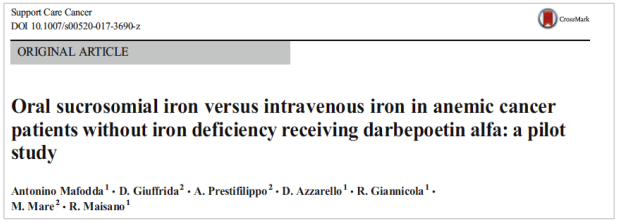
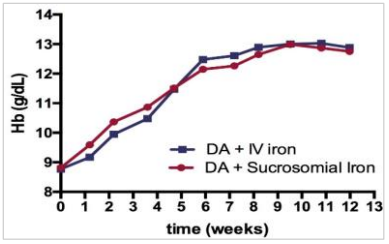
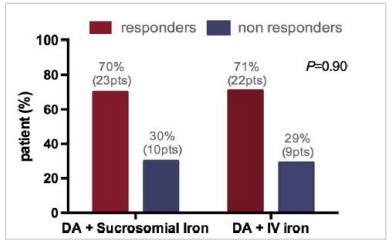
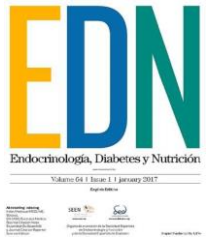
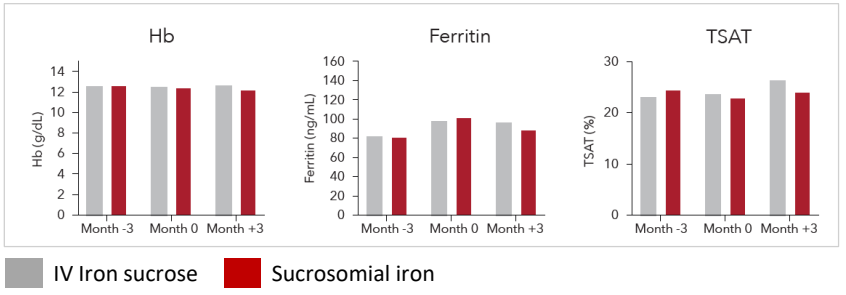
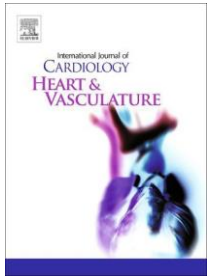
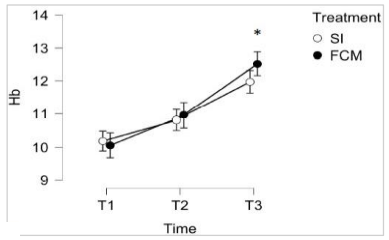
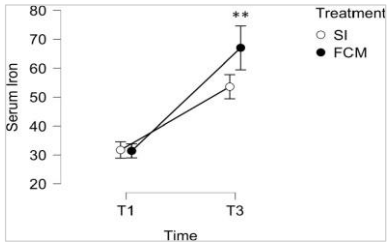
- Expensive
- Insurance issues
- Infusion center
- Possible need for multiple treatments
- Discomfort
- Adverse reactions





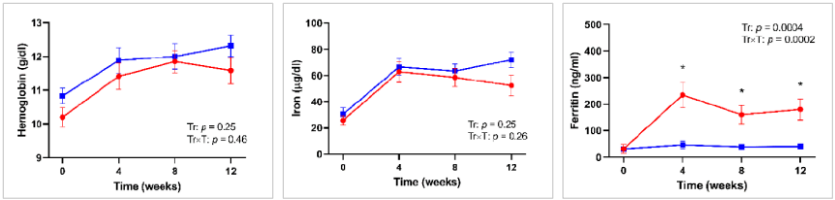
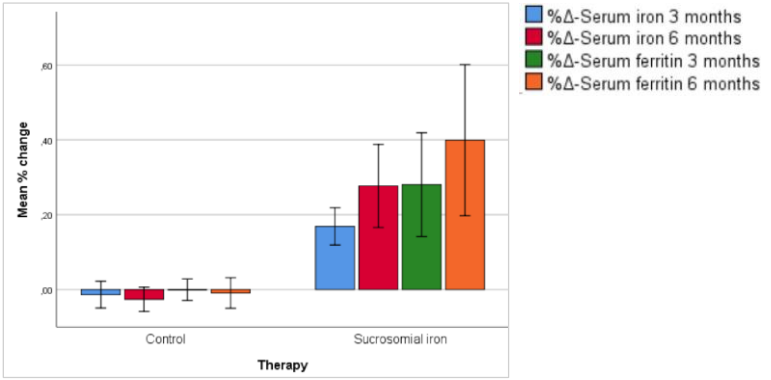
Studies on Sucrosomial® Iron

Selected studies on the effectiveness of Sucrosomial iron compared to iron IV

Journal	Article	Results	
		 	70% of SI population achieved erythropoietic response vs 71% of IV gluconate group (Increase 2 g/dL or target of 12 g/dL)
			Sucrosomial iron proved to deliver equivalent results to IV sucrose in maintaining hemoglobin, ferritin and TSAT in bariatric patients after 3 months of use
		 	Sucrosomial Iron proven to be non-inferior to FCM in recovering HB/serum iron levels and functional capacity post cardiac surgery

Studies on Sucrosomial® Iron

- **Selected studies on the effectiveness of Sucrosomial iron compared to iron IV**

Journal	Article	Results	
MDPI	*nutrients* MDPI *Article* **Oral Sucrosomial Iron Is as Effective as Intravenous Ferric Carboxy-Maltose in Treating Anemia in Patients with Ulcerative Colitis** Lorenzo Bertani [1,*], Domenico Tricò [2], Federico Zanzi [1], Giovanni Baiano Svizzero [1], Francesca Coppini [1], Nicola de Bortoli [1], Massimo Bellini [1], Luca Antonioli [3], Corrado Blandizzi [3] and Santino Marchi [1]		SI demonstrated to increase HB and serum iron levels comparably to FCM in patients with UC while avoiding iron overload
European Journal of Heart Failure	**Oral sucrosomial iron improves exercise capacity and quality of life in heart failure with reduced ejection fraction and iron deficiency: a non-randomized, open-label, proof-of-concept study** Apostolos Karavidas[1], Efstratios Troganis[1], George Lazaros[2], Despina Balta[1], Ioannis-Nektarios Karavidas[3], Eftihia Polyzogopoulou[4], John Parissis[4], and Dimitrios Farmakis[5]*		SI shown to improve ferritin, exercise capacity and QOL in heart failure with reduced ejection fraction and iron deficiency

Sucrosomial® Iron by the European Association for Cardio-Thoracic Surgery as a pre-op solution for anemic patients to avoid RBCT
IIa(B) level)

EACTS
European Association For Cardio-Thoracic Surgery

2024 EACTS/EACTAIC Guidelines on patient blood management in adult cardiac surgery in collaboration with EBCP

Filip P A Casselman ✉ , Marcus D Lance ✉ , Aamer Ahmed , Alice Ascari , Juan Blanco-Morillo , Daniel Bolliger , Maroua Eid , Gabor Erdoes , Renard Gerhardus Haumann , Anders Jeppsson ... Show more
Author Notes

European Journal of Cardio-Thoracic Surgery, ezae352,
https://doi.org/10.1093/ejcts/ezae352
Published: 10 October 2024 **Article history** ▾

Recommendation Table 3. Recommendations for preoperative management of patients with anaemia

Recommendations	Class[a]	Level[b]	Ref[c]
It is recommended to investigate newly diagnosed patients with anaemia to determine the aetiology and initiate causal treatment.	I	B	(156, 157, 166)
Oral iron supplementation with a Sucrosomial formulation prior to cardiac surgery should be considered in iron-depleted anaemic patients (females: Hb less than 120 g/L; males: Hb less than 130 g/L) to improve erythropoiesis and reduce postoperative transfusions if the time frame allows it.	IIa	B	(168-170)
Intravenous iron supplementation prior to cardiac surgery should be considered in iron-depleted patients with anaemia (females: Hb less than 120 g/L; males: Hb less than 130 g/L) to improve erythropoiesis and reduce postoperative transfusions when the time frame of the operation does not allow the use of oral iron supplementation.	IIa	A	(171-175)
Erythropoietin supplementation in addition to iron should be considered to improve erythropoiesis and reduce postoperative transfusions in anaemic patients when rapid Hb increase is required.	IIa	A	(173, 175-183)
Preoperative erythrocyte transfusion is not routinely recommended to treat anaemic patients.	III	B	(184)

EPO: erythropoietin; Hb: haemoglobin.
[a] Class of recommendation.
[b] Level of evidence.
[c] References.

Sucrosomial® Iron PBM Guidance of the World Health Organization as for CHF & Diabetes

Anaemia	Global prevalence estimates	Potential and expected benefits for blood health
• Chronic kidney disease (CKD)[a]	Of 700 million **patients** with **CKD, 100 million or more are likely to have anaemia** (prevalence estimates for anaemia range between 14% and 64%) *(315-319)*.	Anaemia in people with non-dialysis-dependent CKD remains vastly underrecognized. Less than 20% receive anaemia treatment even though anaemia of CKD is highly responsive to iron, ESAs or both, as well as recently introduced hypoxia-inducible factor prolyl hydroxylase (HIF-PH) inhibitors. PBM would significantly improve blood health, productivity and quality of life in this population as well as reducing transfusion dependency *(320)*.
• Cardiovascular disease (CVD) and diabetes	Among the 420 million patients with CVD *(321)* and the 476 million patients with diabetes *(322)*, anaemia is common. Its prevalence in the subset of CVD patients with chronic heart failure (CHF) is approximately **26 million worldwide** *(323)*. It occurs in approximately 30% of stable and 50% of hospitalized CHF patients *(324)*. In addition, **50% of CHF patients with or without anaemia have ID** *(325)*. The overall prevalence of anaemia in people with type 2 diabetes is estimated at 30% *(326)*. **Anaemia as a comorbidity of CHF and diabetes affects at least 170 million people**.	Anaemia in these populations remains underrecognized and undertreated *(317, 327-329)*. Data from randomized controlled trials show that treatment of ID in CHF patients improves quality of life and exercise capacity, and decreases cardiovascular morbidity and hospitalization *(330)*. Oral sucrosomial iron may provide a less expensive alternative to intravenous (IV) iron therapy *(331)*. However, more studies are needed to demonstrate that oral sucrosomial iron is an effective alternative to IV iron in patients with non-anaemic ID and CHF.
• Upper digestive system diseases[a]	Anaemia and ID in upper gastrointestinal disease is common but prevalence varies widely depending on the population and the specific condition. Thus, regional epidemiological data are needed to obtain accurate estimates. Anaemia and ID results from bleeding, malabsorption and inflammation. Studies suggest that anaemia in people with upper digestive system disease may be more prevalent than in those with lower digestive disease, suggesting it is a significant contributor to overall prevalence of anaemia *(332)*. Bariatric surgery for obesity and major oncological surgery on the upper gastrointestinal tract interferes with iron absorption and is a frequent iatrogenic cause of ID involving the upper digestive system.	Gastrointestinal causes should be considered a possibility in any patient with anaemia. The most common cause is ID. Recognition and treatment will decrease the risk that a transfusion will be administered and mitigate the consequences of ID. A structured approach to diagnosis and management often identifies comorbidities such as peptic ulcer disease (particularly detection and eradication of *Helicobacter pylori* infection), coeliac disease, erosive gastritis, oesophagitis, liver disease, etc., which when identified and treated improve health status beyond blood health alone *(333)*. A structured approach to managing iron absorption after surgery to the upper gastrointestinal system will reduce the incidence of postoperative anaemia in these patients.
• Inflammatory bowel disease (IBD)[a]	**Anaemia and ID is highly prevalent in people with IBD**, but the precise figure remains unknown. Estimates vary widely **from 36–90%** *(334)*.	Iron therapy has been associated with significant benefits in patients with IBD and IDA, in terms of both disease progression and health care resource utilization (335).

Other Next Generation Therapies

- Hepcidin Modulators-Lexaptepid-hepcidin antagonists to lower hepcidin levels and improve iron availability
- Anti-hepcidin Monoclonal Antibodies
- Gene Therapy- Zinteglo-modifies a patient's own blood stem cells to treat thalassemias
- Erythrocyte maturation agents- Reblozyl

PATIENT BLOOD MANAGEMENT

Preoperative anemia management and hemoglobin (Hgb) optimization.

AT-RISK PATIENT POPULATIONS:

Hgb<13 g/dL (male or female), weight <65kg, female gender, complex or revision surgery, renal disease, ani-platelet and/or anti-coagulant therapy, hematologic conditions (e.g. Thalassemia), "No Blood"/transfusion refusal.

IDEAL TIMELINE FOR ASSESSMENT:

Ideally at surgical INTAKE, at time of acceptance for surgery; at least 30 days pre-op.

POINTS OF EMPHASIS:

Patient Blood Management strategies (including Anemia Management and Hgb Optimization) should be individualized to patient condition and risks of surgical procedure. Ideal pre-op Hgb targets may need to be adjusted for:

- Renal disease (e.g.: max Hgb 12g/L)
- Patients declining transfusion "No Blood"
- Patients with preexisting arterial-venous thrombotic events should be monitored closely

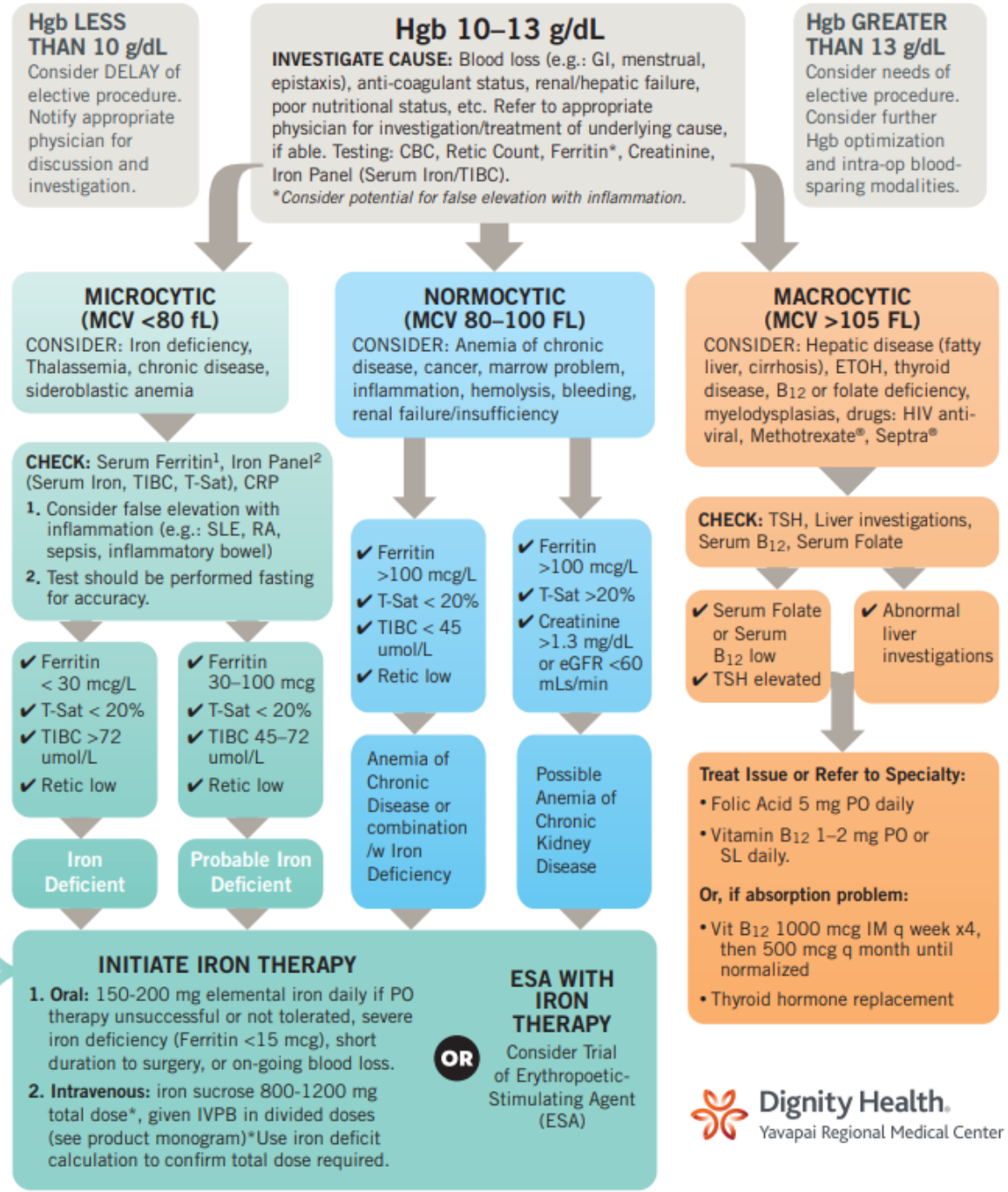
Oral Therapy:
Choice of oral iron agent should consider degree of iron deficiency, drug interactions, likelihood of compliance with therapy, likelihood of iron/Hgb correction by surgery date

ESA (erythropoietin-alpha)Therapy:

- Requires iron repletion or concurrent iron therapy
- Requires consideration of risk/benefit balance

Standard ESA Dosing:

- 600IU/Kg given SC weekly to target Hgb
  Ex: 20,000-40,000IU SC given on day 21, 14, and day 7 pre-op, and then day of surgery.
- Urgent case: 300 IU/kg pre-op daily x10, day of surgery, then daily x4 post-op
- **CHECK Hgb after every 2 doses** to monitor effect and avoid exceeding safe Hgb targets



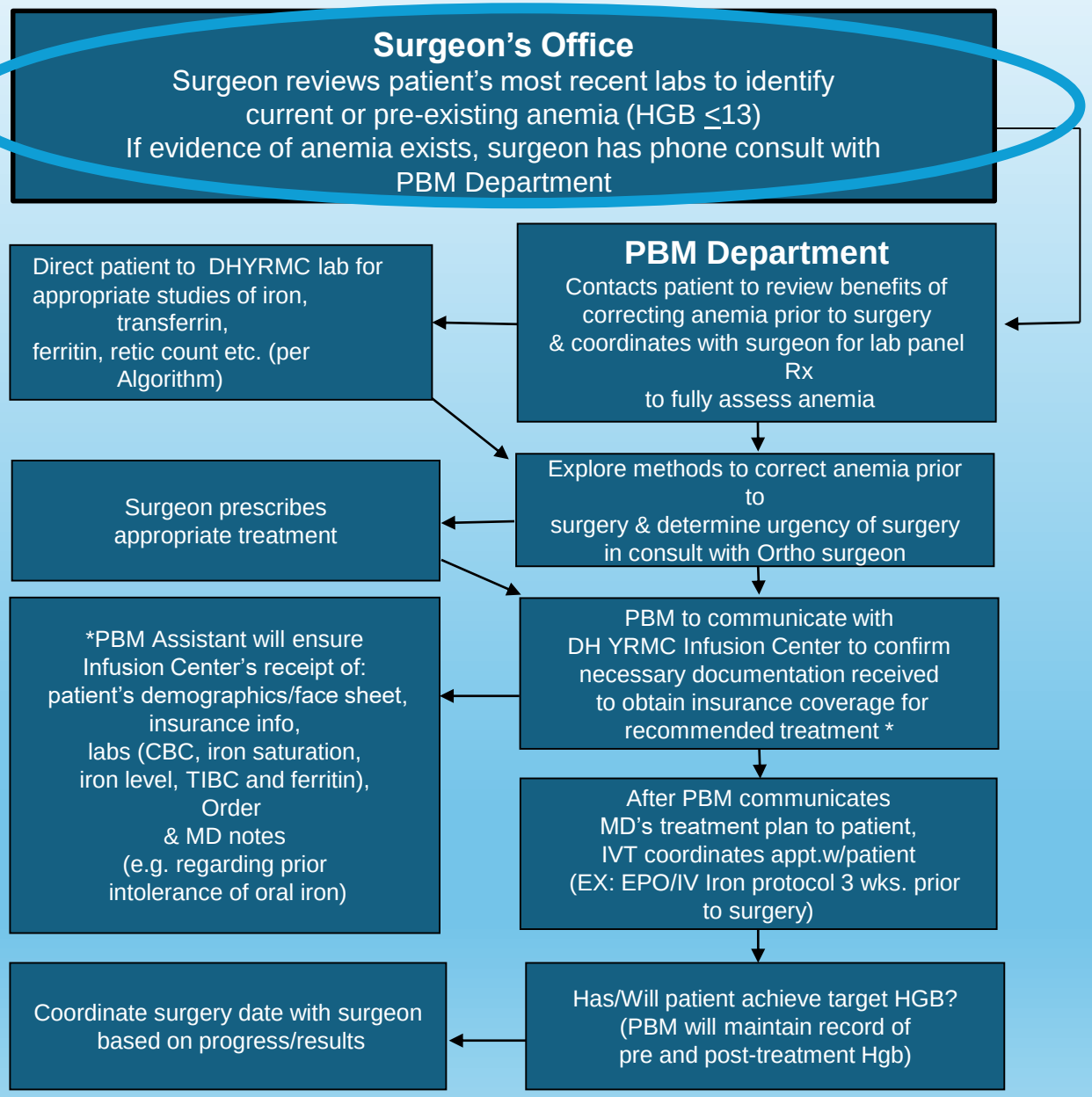
Dignity Health.
Yavapai Regional Medical Center

“Virtual” Center with Real Results!

Evaluation for Readiness Begins with Initial Consult

Preoperative Virtual Anemia Center

Elective patients scheduled for Orthopedic Surgery



Multiple Education Strategies Developed

- Presentations targeting high opportunity areas to physician and nursing groups
- Presentations to the community at public libraries, assisted living and retirement facilities explaining patient's role in and benefits of PBM e.g. "Doctors & Donuts"

A Yavapai Regional Medical Center Presentation

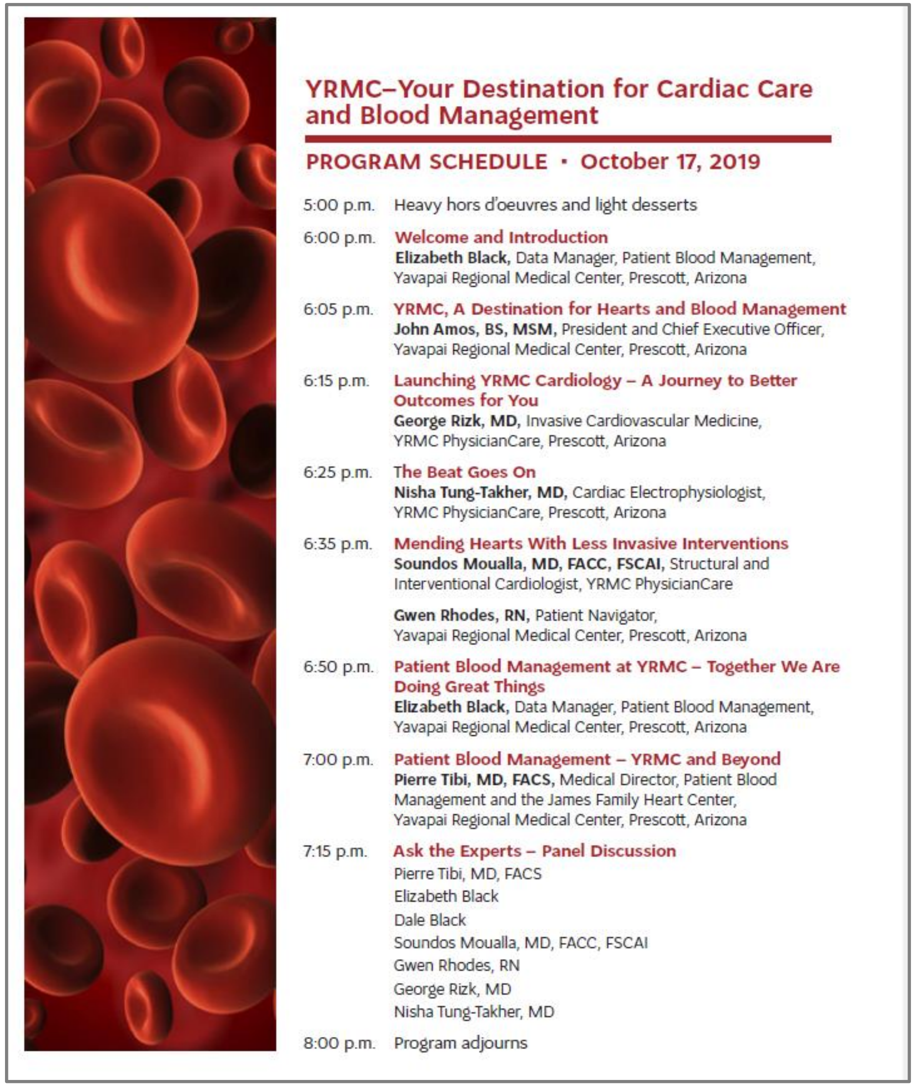
You Are Cordially Invited

Patient Blood Management: Yesterday, Today and Tomorrow

Thursday, October 25th, 2018

Patient Blood Management: Yesterday, Today and Tomorrow • Thursday, October 25, 2018

YAVAPAI REGIONAL MEDICAL CENTER



YRMC–Your Destination for Cardiac Care and Blood Management

PROGRAM SCHEDULE • October 17, 2019

5:00 p.m. Heavy hors d'oeuvres and light desserts

6:00 p.m. **Welcome and Introduction**
Elizabeth Black, Data Manager, Patient Blood Management, Yavapai Regional Medical Center, Prescott, Arizona

6:05 p.m. **YRMC, A Destination for Hearts and Blood Management**
John Amos, BS, MSM, President and Chief Executive Officer, Yavapai Regional Medical Center, Prescott, Arizona

6:15 p.m. **Launching YRMC Cardiology – A Journey to Better Outcomes for You**
George Rizk, MD, Invasive Cardiovascular Medicine, YRMC PhysicianCare, Prescott, Arizona

6:25 p.m. **The Beat Goes On**
Nisha Tung-Takher, MD, Cardiac Electrophysiologist, YRMC PhysicianCare, Prescott, Arizona

6:35 p.m. **Mending Hearts With Less Invasive Interventions**
Soundos Moualla, MD, FACC, FSCAI, Structural and Interventional Cardiologist, YRMC PhysicianCare

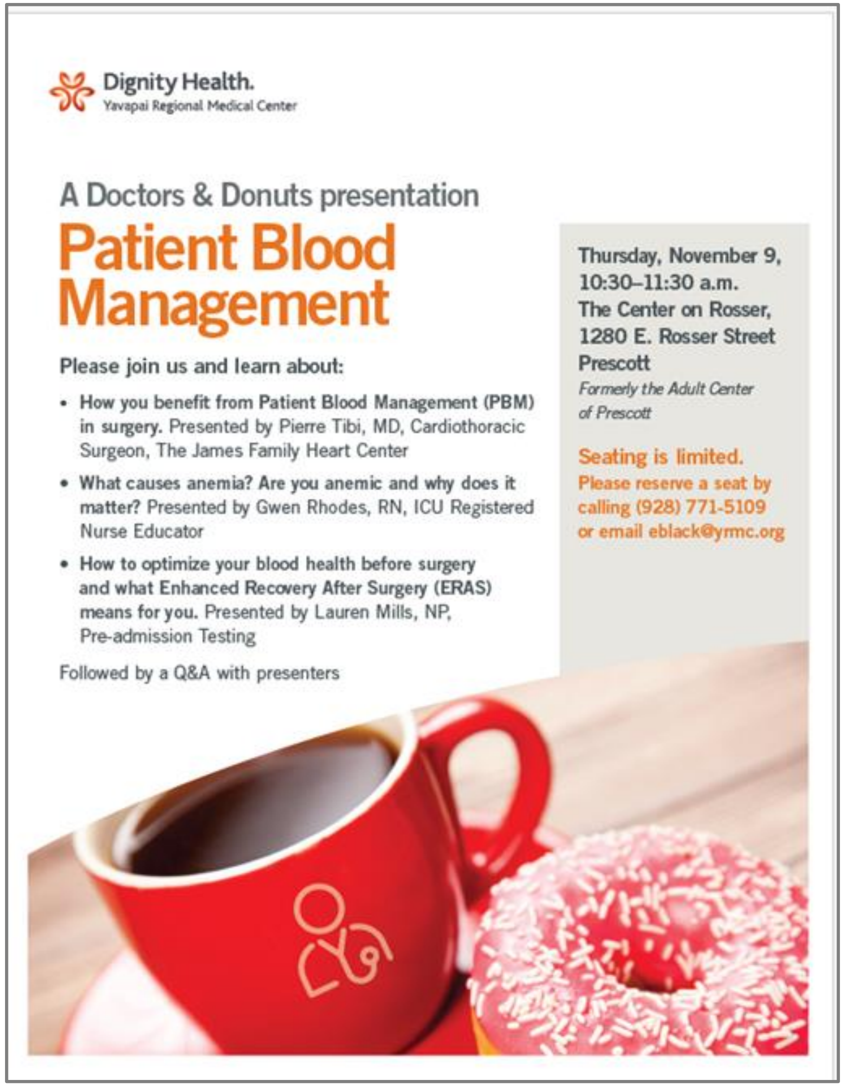
Gwen Rhodes, RN, Patient Navigator, Yavapai Regional Medical Center, Prescott, Arizona

6:50 p.m. **Patient Blood Management at YRMC – Together We Are Doing Great Things**
Elizabeth Black, Data Manager, Patient Blood Management, Yavapai Regional Medical Center, Prescott, Arizona

7:00 p.m. **Patient Blood Management – YRMC and Beyond**
Pierre Tibi, MD, FACS, Medical Director, Patient Blood Management and the James Family Heart Center, Yavapai Regional Medical Center, Prescott, Arizona

7:15 p.m. **Ask the Experts – Panel Discussion**
Pierre Tibi, MD, FACS
Elizabeth Black
Dale Black
Soundos Moualla, MD, FACC, FSCAI
Gwen Rhodes, RN
George Rizk, MD
Nisha Tung-Takher, MD

8:00 p.m. Program adjourns



Dignity Health. Yavapai Regional Medical Center

A Doctors & Donuts presentation

Patient Blood Management

Please join us and learn about:

- How you benefit from Patient Blood Management (PBM) in surgery. Presented by Pierre Tibi, MD, Cardiothoracic Surgeon, The James Family Heart Center
- What causes anemia? Are you anemic and why does it matter? Presented by Gwen Rhodes, RN, ICU Registered Nurse Educator
- How to optimize your blood health before surgery and what Enhanced Recovery After Surgery (ERAS) means for you. Presented by Lauren Mills, NP, Pre-admission Testing

Followed by a Q&A with presenters

Thursday, November 9,
10:30–11:30 a.m.
The Center on Rosser,
1280 E. Rosser Street
Prescott
Formerly the Adult Center of Prescott

Seating is limited.
Please reserve a seat by calling (928) 771-5109 or email eblack@yrmc.org

SUMMARY

- Anemia is a modifiable risk factor
- All efforts to address pre-operative anemia and iron deficiency should be made to avoid transfusions (preferably several weeks before surgery, nevertheless, can be instituted 1-2 days prior to surgery)
- Even one transfusion may be detrimental in cardiac surgery
- Pre-operative anemia can be safely treated with iron +/- ESAs
- Algorithms and Virtual Anemia Clinics facilitate treatment of anemia in surgical patients

EPO, erythropoietin; ESA, erythropoietin stimulating agent; IV, intravenous; PO, per os, orally.


Thank you.