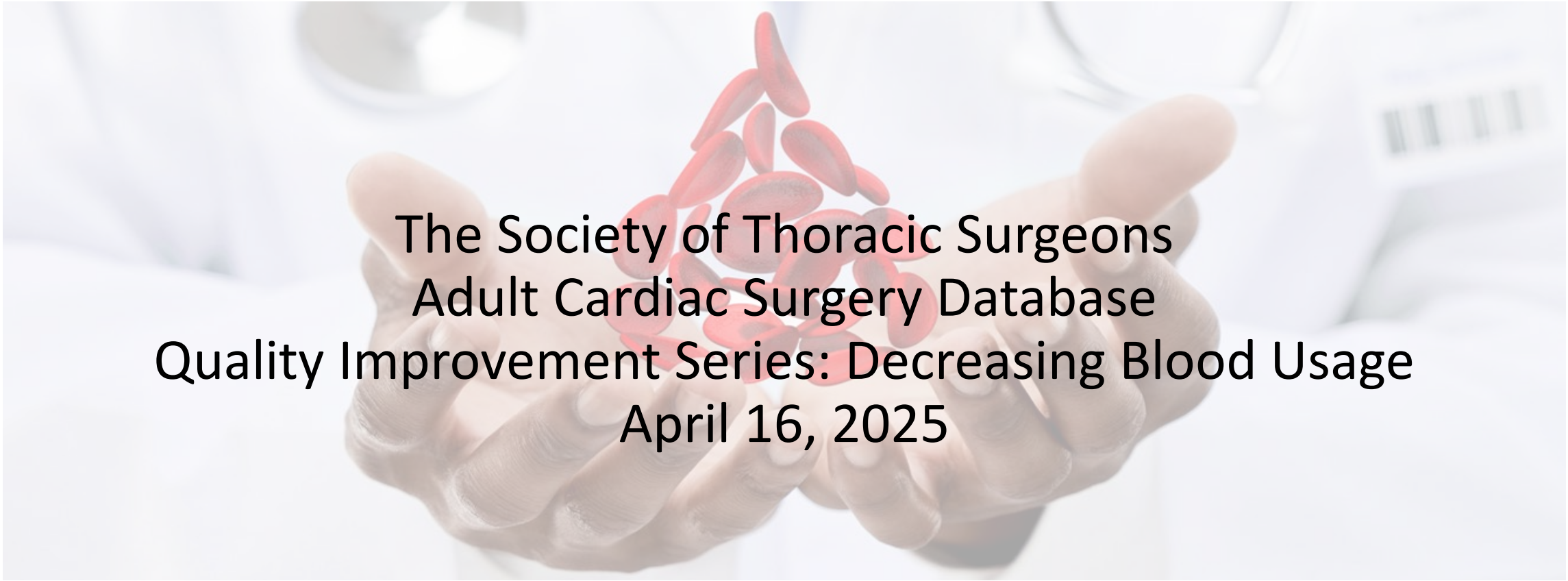


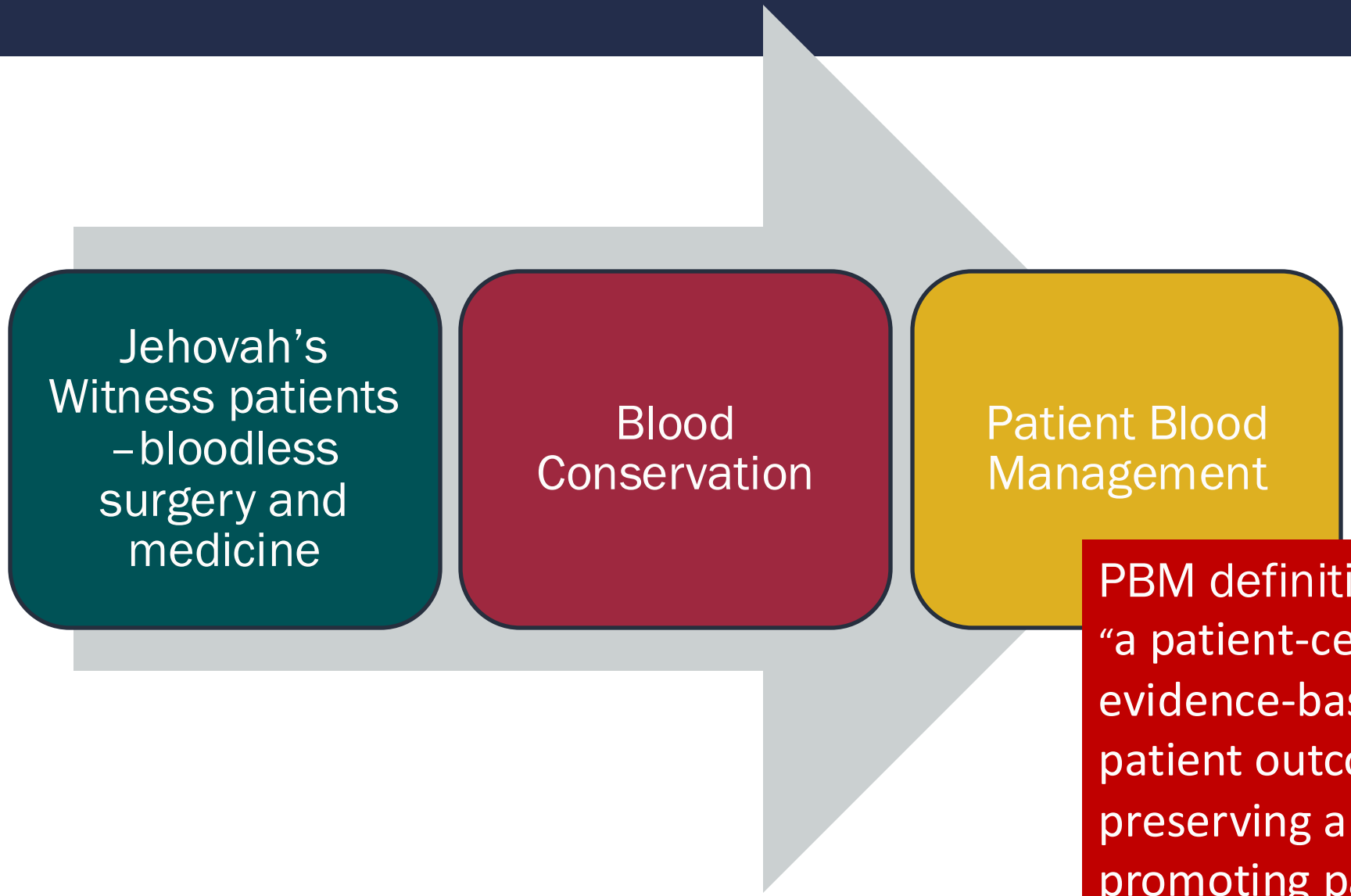
The Society of Thoracic Surgeons
Adult Cardiac Surgery Database
Quality Improvement Series: Decreasing Blood Usage
April 16, 2025

Translating cardiac surgery PBM guidelines into clinical practice: UVA experience

Karen Singh, MD, FASE

Associate Professor, Anesthesiology

April 16th, 2025



PBM definition:
"a patient-centered, systematic, evidence-based approach to improve patient outcomes by managing and preserving a patient's own blood, while promoting patient safety and empowerment."

Shander A, Hardy JF, Ozawa S, et al. A Global Definition of Patient Blood Management. *Anesth Analg*. Sep 1 2022; 135(3):476-488

2021: Were we following the latest guidelines?

UVA Health

0003-4975/$36.00 981
Published by Elsevier Inc.
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

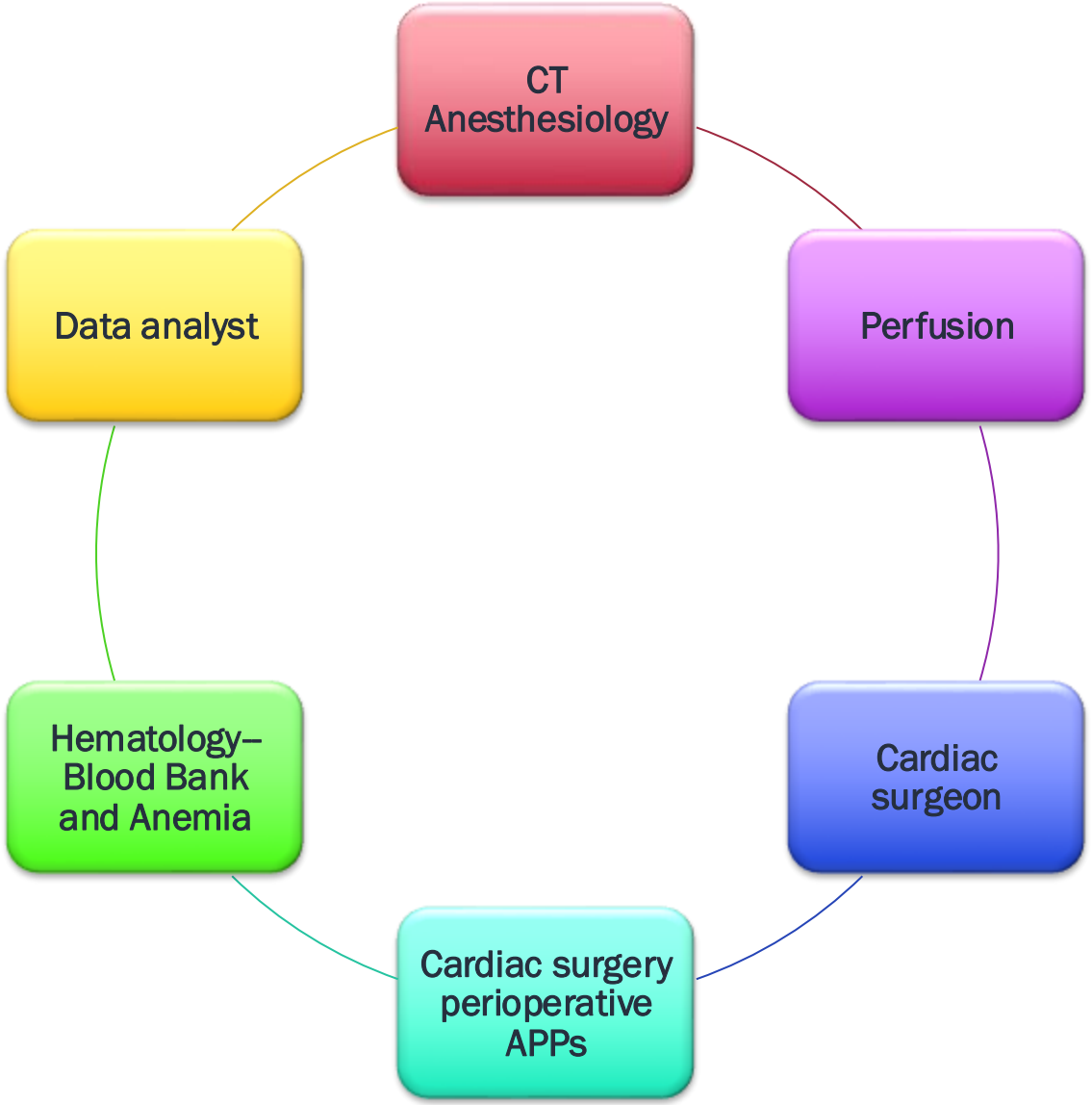
2021: Recommendations we were following:

- Cell saver
- Utilizing ATIII in cases of heparin resistance
- Standardized transfusion protocol with restrictive RBC transfusion
- Appropriate management of preoperative antiplatelets and anticoagulants, platelet function assays for P2Y inhibitors
- Antifibrinolytic agents
- 4-factor PCC in cases of extreme bleeding
- Utilizing targeted transfusion based on point of care coagulation testing in the OR

2021: Recommendations we were not following:

- Use retrograde autologous priming whenever possible (Class I)
- Use POC viscoelastic testing perioperatively to reduce bleeding and transfusion (Class I) NOT using in ICU
- ANH (reasonable method to reduce bleeding and transfusion (Class II)
- Preoperative identification of high-risk patients and performing all available measures of blood conservation for these (Class I)
- Assessment of anemia, determination of etiology, IV iron if indicated (Class II)
- Have a multimodality PBM program led by multidisciplinary team (Class I)

Step #1: Form a multidisciplinary team to build our PBM program



Our goals for cardiac surgery patients:

- Increase % of patients undergoing RAP
- Identify and treat preoperative anemia
- Increase POC coagulation testing in ICU
- Possibly start an ANH program

RAP = retrograde autologous priming (of CPB circuit)
ANH = acute normovolemic hemodilution

Retrograde autologous priming

UVAHealth

Why RAP?

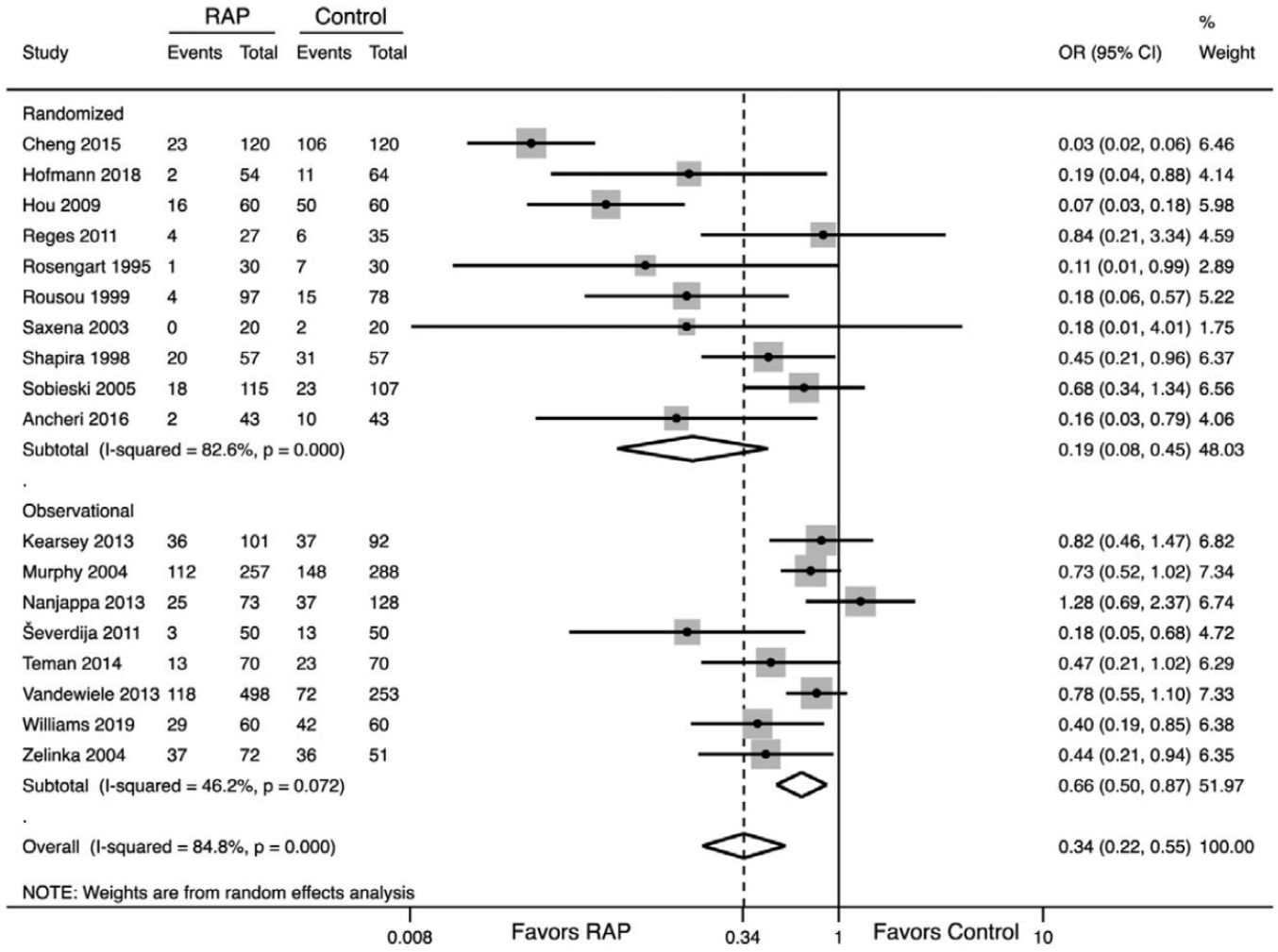
- Drain patient's blood (about 300-400 ml) into the bypass circuit just prior to initiation of bypass, limiting crystalloid priming volume
- Class I recommendation
- Safe and effective
- Minimize hemodilution on CPB
- Decrease risk of blood transfusion

Retrograde Autologous Priming in Cardiac Surgery: Results From a Systematic Review and Meta-analysis

UVA Health

Nadia B. Hensley, MD,* Richard Gyi, MD,† Andres Zorrilla-Vaca, BS,‡ Chun W. Choi, MD,§
Jennifer S. Lawton, MD,§ Charles H. Brown IV, MD,† Steve M. Frank, MD,*
Michael C. Grant, MD,* and Brian C. Cho, MD†

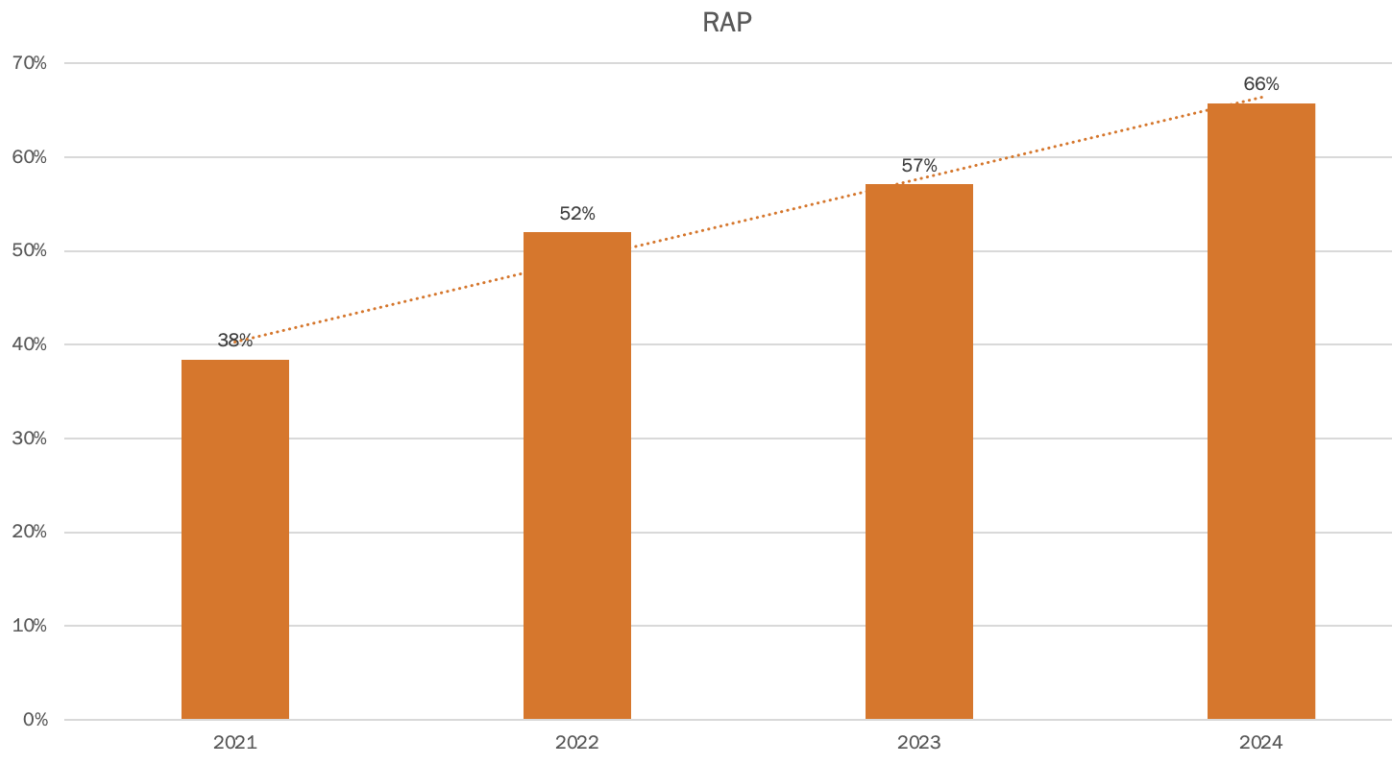
- RAP associated with significantly decreased intraoperative and hospital RBC transfusion
- No increased risk of AKI or stroke identified



January 2021 • Volume 132 • Number 1

- Emails with latest recommendations sent to surgeons
- Increased communication during Time-Out for surgery

RAP: January 2021 to December 2024

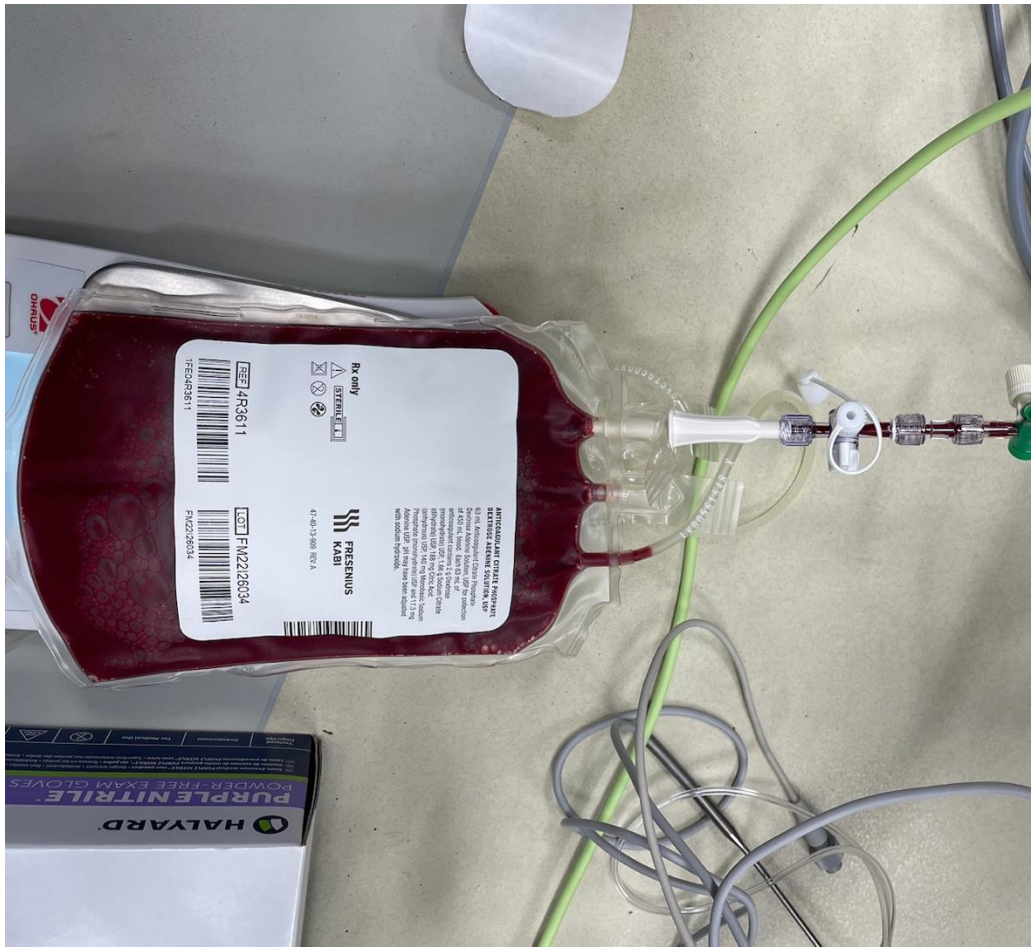


Time Out:

- Starting Hct
- Discuss RAP

Acute Normovolemic Hemodilution

- Removing 1-2 units of patient's blood in the OR, prior to heparinization
- Replacing volume, if needed, with crystalloid
- Return blood to patient after cardiopulmonary bypass/heparin reversal
- Class IIa recommendation: reasonable method to reduce bleeding and transfusion
- Earlier studies, larger volume of ANH seem to show most benefit



Why NOT perform ANH?

- Program set-up and education
- Requires significant time and resources
- Risk of hemodynamic instability
- Risk of blood clotting in bag
- Anemia on CPB, hemodilution of clotting factors

"Oh, me? I make e-mails."

Cartoon by Tommy Siegel and Dan Kirkwood

Acute Normovolemic Hemodilution

Materials

- Blood scale
- Blood collection bag with citrate
- Peds connector, one way stopcock
- Patient/Blood label

Exclusion Criteria

- Emergency surgery
- Significant hemodynamic instability
- Starting Hgb < 11 g/dl
- Severe aortic stenosis or mitral stenosis
- HCM/LVOT obstruction
- Severe left main disease or equivalent
- Ejection fraction < 30%
- CKD
- Endocarditis/concern for sepsis
- BMI < 18 kg/m^2

Methods

- Obtain ABG with Hgb prior to ANH collection
- Standard ANH collection is 400-500 mL (grams) per blood pack (unit).
- Collect 1 unit or 2 units prior to sternotomy via CVL.
- Replace collected blood volume with crystalloid (1:1.5 ratio) or albumin (1:1 ratio), as needed to maintain euvolemia, using a separate line for fluid replacement or avoiding simultaneous replacement through CVL.
- Agitate blood after collection to mix blood and anticoagulant.
- Each unit of ANH blood should be immediately labeled with a patient label that includes:
  - the date and time of collection
  - date and time of expiration (eight hours)
  - sequential unit number (if two units are collected).
- Blood units collected by ANH are to be stored in the OR at RT (~22°C [72°F]).
  - Storage duration of up to eight hours is acceptable.
  - If storage exceeds eight hours, the ANH unit must be discarded.
- Reinfusion of the ANH unit(s) must take place in the OR, prior to the patient's leaving the OR.
  - ANH units should be reinfused **after** protamine administration in opposite order of collection, in the case of multiple units
  - Give ANH blood **prior to** cell saver blood and/or allogeneic (Blood Bank) RBC administration
  - If the ANH unit(s) is/ are not reinfused in the OR, it/ they must be discarded.

ANH at UVA

- Started performing ANH in November 2022
- Over 144 patients so far
- Slow blood collection seemed to be associated with increased risk of ANH clotting in bag
- Site for international randomized controlled trial of ANH in cardiac surgery --results should be published soon!

Viscoelastic testing

UVA Health

Point of Care Coagulation Testing –Rotational Thromboelastometry (ROTEM)

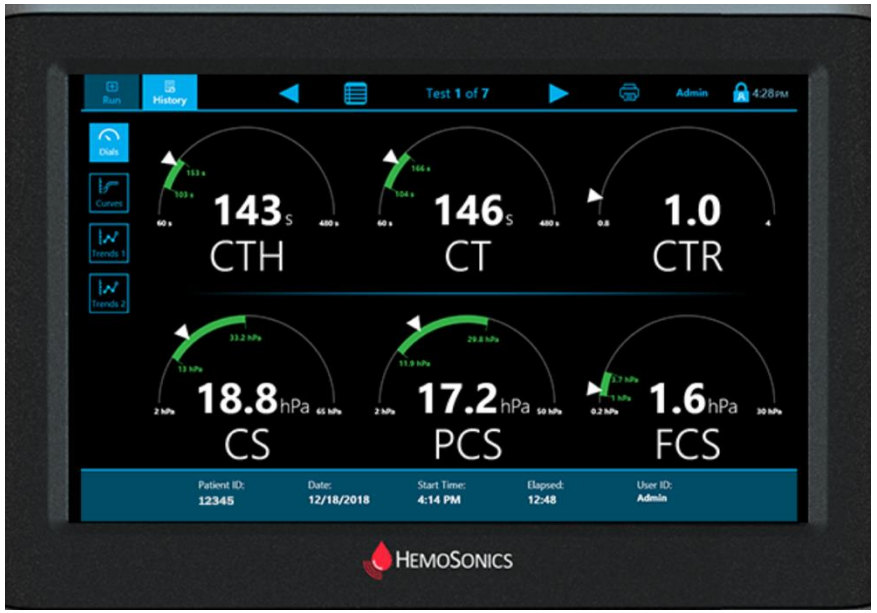
ROTEM® delta

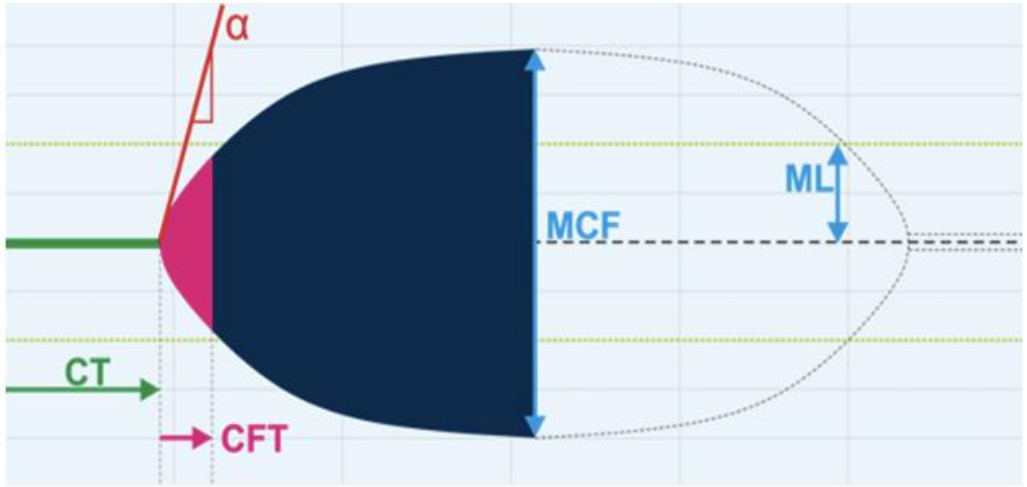
- Timely targeted transfusion--indicate need for plt, FFP, cryo
- NOT working for bleeding patients in ICU (logistics)
- Needed to upgrade current system to ROTEM sigma or obtain Hemosonics Quantra

Hemosonics Quantra trial in TCV ICU… Comparing with ROTEM delta results

Quantra –uses ultrasound to measure clot stiffness –Sonic Estimation of Elasticity versus Resonance (SEER) Sonorheometry

ROTEM—uses a rotating pin in a cup with blood to assess the viscoelastic properties of clot formation and dissolution—creating a temogram





Internal trial results:

- 33 samples underwent Quantra and ROTEM test
- Overall, good correlation between Quantra and ROTEM
- Quantra more frequently indicated platelet deficiency
- Quantra impressed with ease of use, no cartridge failure, result display capabilities
- ROTEM sigma would have required creation of a new algorithm anyway –different cutoffs than delta

WINNER for us. . . . .HEMOSONICS QUANTRA!!

UVA Cardiac Surgery Quantra QPlus Guideline

UVA Health

1) Consider baseline Quantra QPlus immediately prior to start of surgery in high-risk patients or at the discretion of the anesthesiologist

2) Obtain **Quantra QPlus and OR platelet count** values upon rewarming when patient ≥ 35 degrees and treat per algorithm below after cardiopulmonary bypass *if bleeding:*

A) FCS < 1.9 hPa ———> administer cryoprecipitate

B) CTH > 175 s———> administer FFP or PCC*

C) PCS < 14 hPa and platelet count < 100 K———> administer platelets

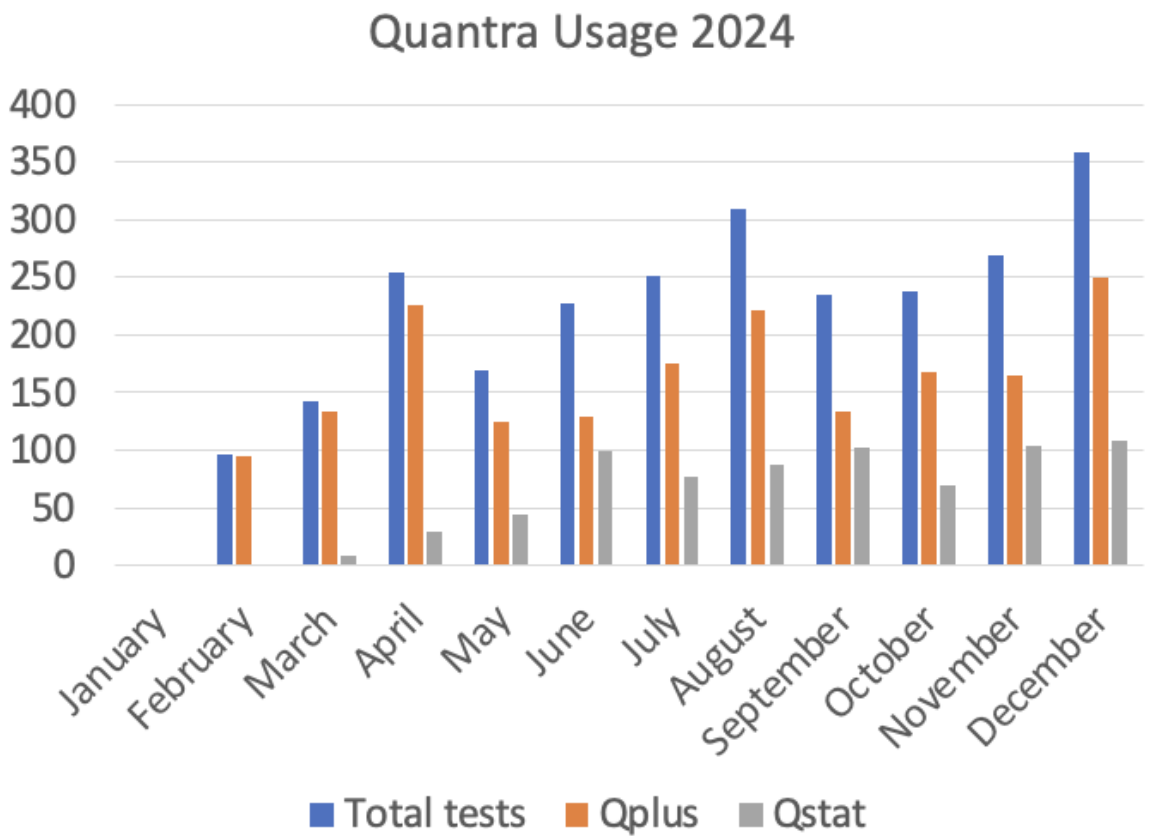
**PCC should be reserved for warfarin reversal after Vit K administration, or extreme coagulopathic bleeding cases in which large volume of FFP would be poorly tolerated.*

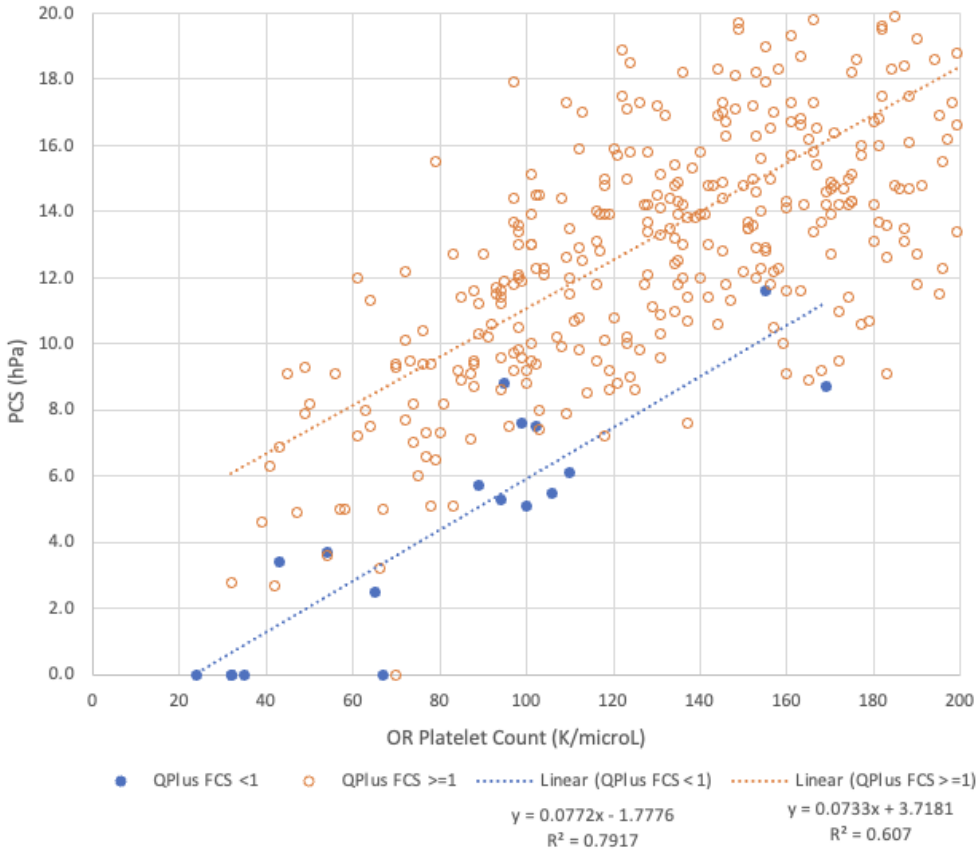
3) If there is no bleeding after protamine administration, no further testing is necessary

4) If there is significant bleeding after heparin reversal with protamine, obtain Quantra QPlus and treat as **ABOVE**; in addition:

If CTR > 1.4, administer additional protamine 50 mg IV

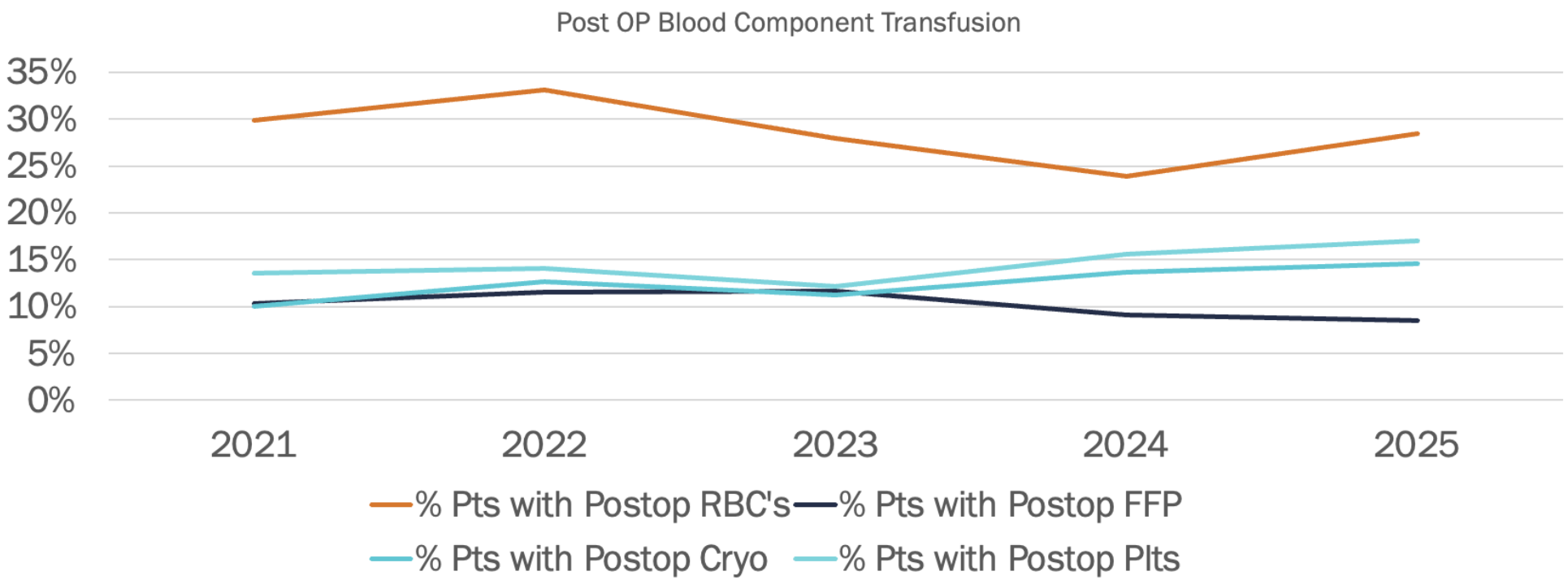
If CT > 190 s and CTR < 1.4 ———> administer FFP or PCC*

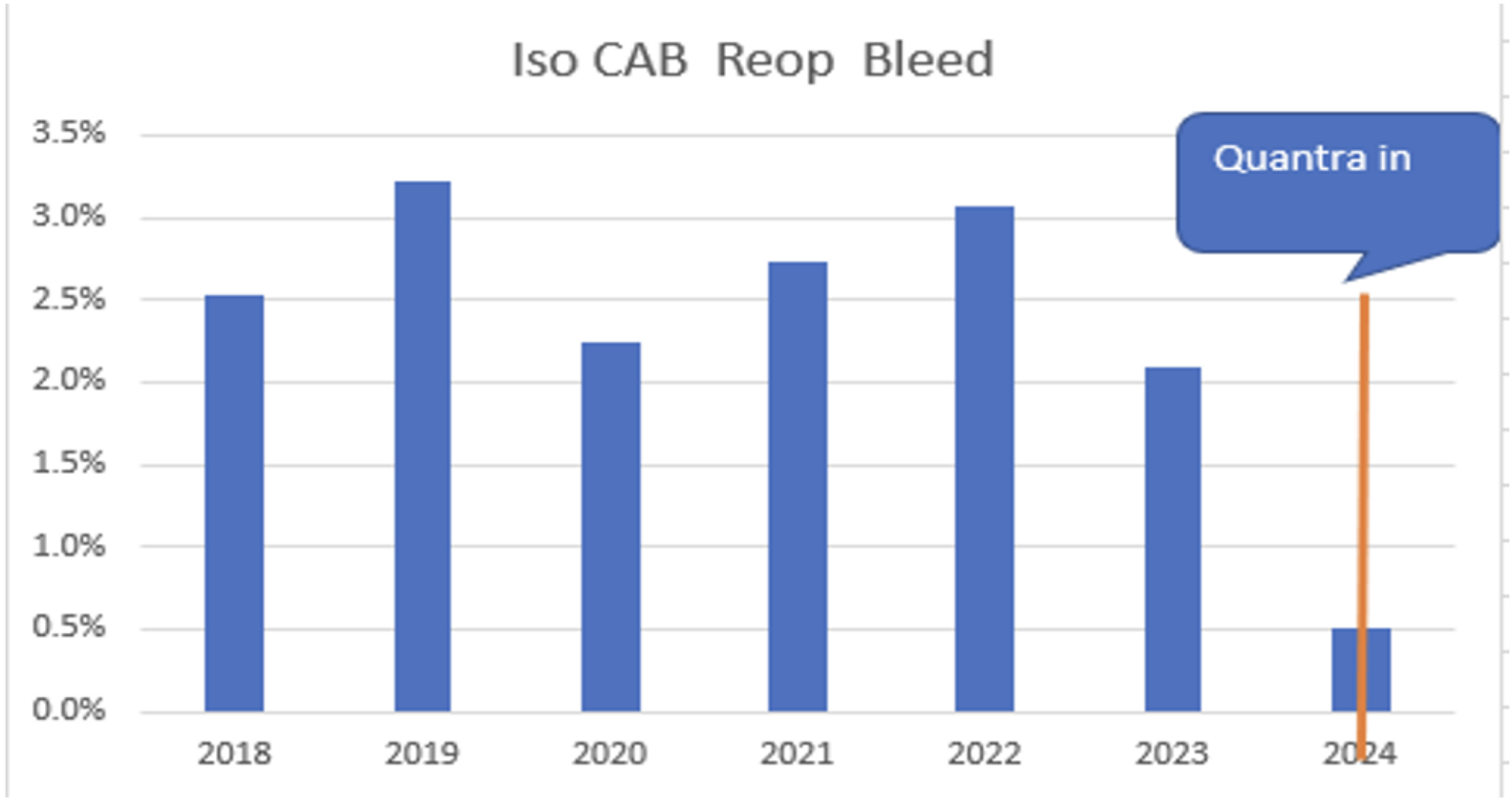




*Adjusted PCS cutoff to < 12 based on data

Post op Individual Blood Component Transfusion for All Patients




Iso CAB Reop Bleed
3.5%
3.0%
2.5%
2.0%
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1.0%
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2018
2019
2020
2021
2022
2023
2024
Quantra in

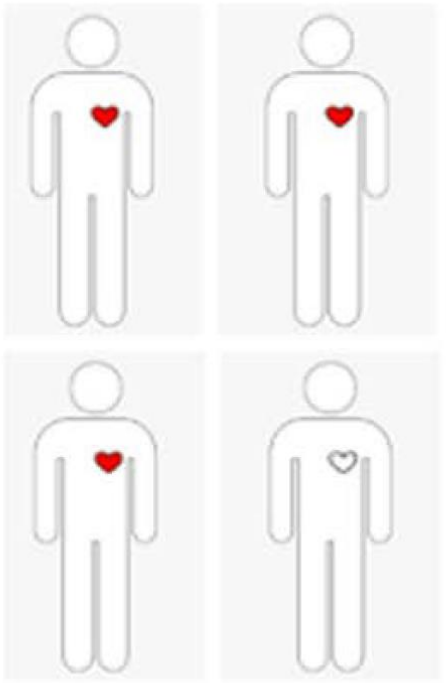
September 2022 • Volume 135 • Number 3

Perioperative Quality Initiative and Enhanced Recovery After Surgery-Cardiac Society Consensus Statement on the Management of Preoperative Anemia and Iron Deficiency in Adult Cardiac Surgery Patients

Nicole R. Guinn, MD,* Jonathon Schwartz, MD,† Rakesh C. Arora, MD, PhD,‡
Vicki Morton-Bailey, DNP, MSN, AGNP-BC,§ Solomon Aronson, MD, MBA, FASA, FACC, FCCP, FAHA, FASE,‖
Charles Scott Brudney, MC, ChB,¶ and Elliott Bennett-Guerrero, MD,† on behalf of the Perioperative

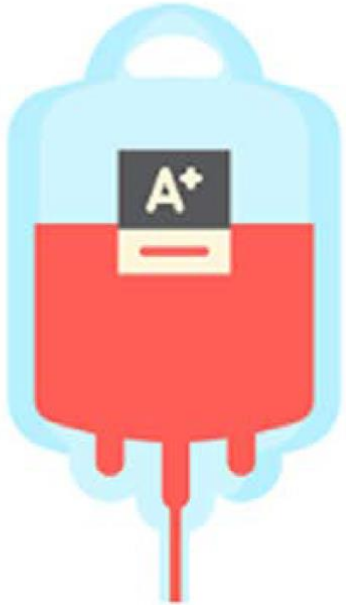
Table 1. POQI 8 Consensus Statements and Recommendations

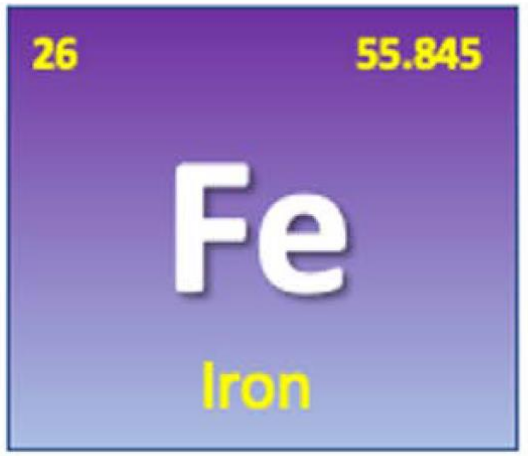
		Strength[a]	LOE[b]
Statement 1.1	We recommend screening all patients for anemia and iron deficiency as soon as surgery is contemplated.	Strong	B
Statement 1.2	We recommend measurement of hemoglobin concentration as a screening tool for anemia.	Strong	A
Statement 1.3	We recommend measurement of ferritin and transferrin saturation as a screening tool for iron deficiency.	Strong	B
Statement 1.4	We recommend further work-up for patients identified as being anemic to determine etiology and appropriate treatment (laboratory work-up including CBC, if anemia identified by POC testing, creatinine, vitamin B12, folate, reticulocyte count, H&P).	Strong	B
Statement 2.1	We recommend preoperative treatment for anemia.	Strong	B
Statement 2.2	We recommend preoperative treatment of iron deficiency with or without anemia.	Strong	C
Statement 2.3	We recommend treatment of iron-deficiency anemia with intravenous iron preferred over oral iron when there is limited time before surgery.	Strong	B
Statement 2.4	We recommend referral for consideration of erythropoietin stimulating agents treatment for the following patient populations: patients who decline red cell transfusion, have moderate to severe anemia, or have anemia secondary to chronic kidney disease and/or anemia of chronic inflammation.	Strong	B
Statement 3.1	We recommend the use of a structured clinical pathway to evaluate and treat preoperative anemia in cardiac surgery.	Strong	B
Statement 3.2	We recommend leveraging the EMR to provide alerts to clinicians to identify patients who are anemic before surgery and prompt further evaluation.	Weak	C
Statement 4.1	We recommend the use of a preoperative anemia care coordination program as a cost-effective method to improve outcomes.	Weak	C



1 in 4 patients presenting for cardiac surgery are anemic

Anemic patients are 4X more likely to be transfused

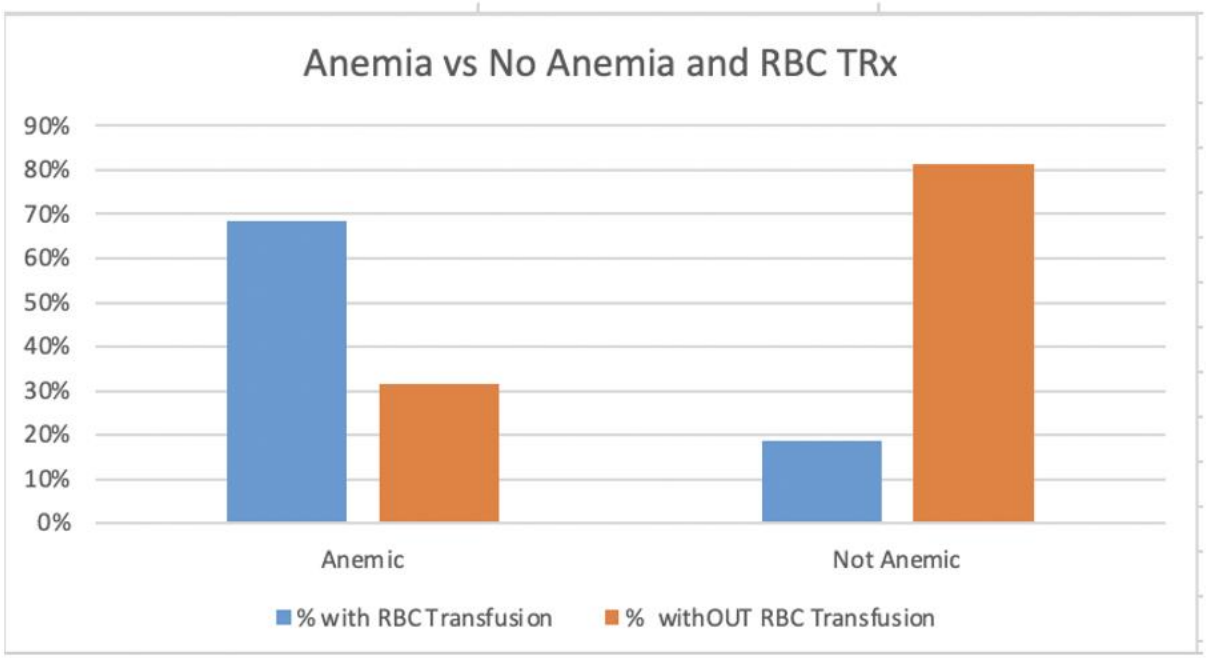




Treating anemia before surgery reduces the risk of transfusion

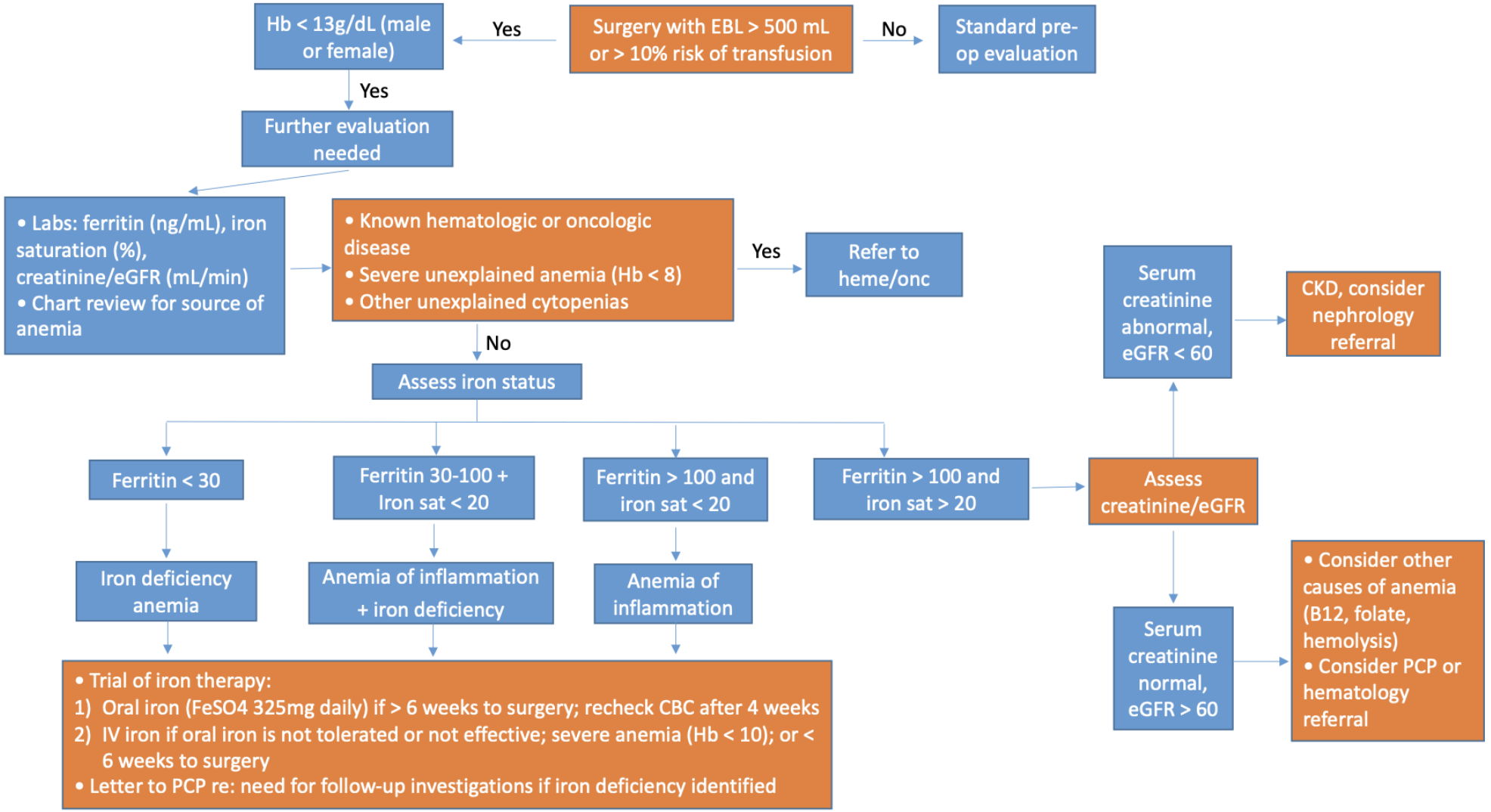
Figure 1. Summary of anemia prevalence and association with transfusion in cardiac surgery patients. Figure reused with permission from the Perioperative Quality Initiative.

- Review of 612 UVA patients in CY 21 from STS database
- Overall, 33% of cardiac surgery patients anemic (Hgb < 13)
- Anemic patients over 3x as likely to have RBC transfusion



Anemia treatment algorithm for UVA cardiac surgery patients

UVA Health



Outpatient anemic workflow

UVA Health

Outpatient assessment and treatment begun Nov 2022

Pre-clinic visit chart review

- If Hgb < 13 on recent labs:
  - ❑ Order "ferritin" and "iron and tibc"- *linked to future encounter*
  - ❑ Enter patient's data into Anemia Optimization Database
- If no CBC is available, order CBC with reflex iron studies- *linked to future encounter*

Review iron studies – Iron deficiency anemia present

- ❑Follow iron repletion protocol- ordered through Beacon
- ❑Letter to PCP
- ❑Update patient database
- ❑Enter FYI flag- "TCV anemia protocol"

Review iron studies – no iron deficiency anemia present

- Consider other causes
- Consider referral to PCP or hematology

Elective anemic patients over time

	2022-Pre-Intervention Elective Patients	2023-Elective	2024-Elective
# of patients with Preop HGB <13	64	67	63
# of patients with iron studies for HGB<13	7	38	45
% of Elective Anemic Patients with Iron Studies	11%	57%	71%

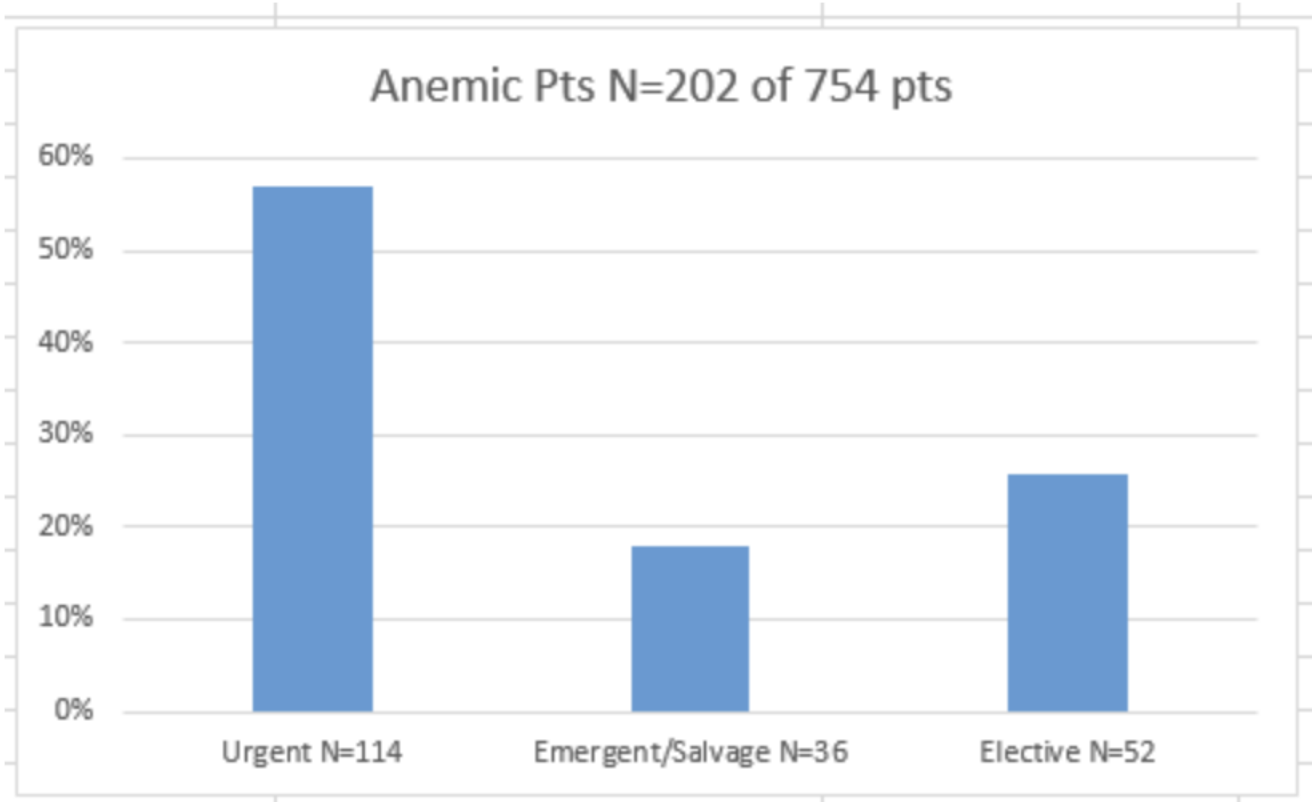
CHALLENGES:

- Staffing challenges
- Time constraints
- Checking labs/follow-up
- Scheduling iron infusion preoperatively

Inpatients with preoperative anemia

UVAHealth

Jan 2021-March 2022



- Mean preop LOS 6 days

Patients with **iron deficiency anemia** may benefit from **IV iron infusion** in the preoperative setting. Treating iron deficiency anemia may lead to improved patient outcomes by reducing rates of blood transfusions, AKI, and operative mortality and may reduce length of stay and cost. Optimal timing is 2-4 weeks prior to surgery, but IV iron can be beneficial even in the **hours and days leading up to surgery**. At UVA we have implemented an initiative to give IV iron to **ALL patients with iron deficiency anemia** planned for cardiac surgery.

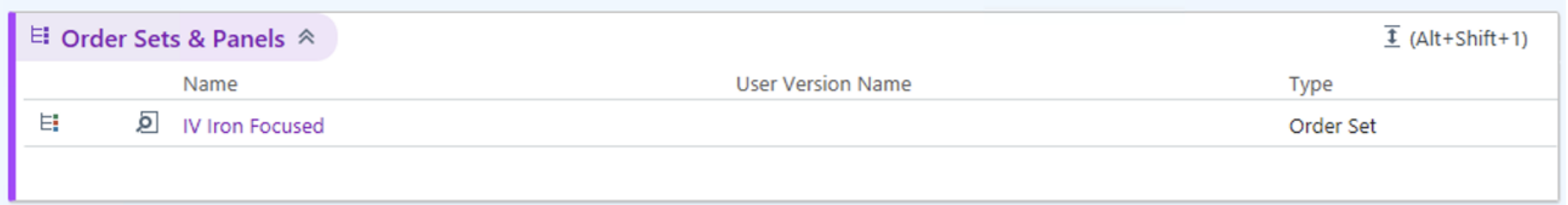
For **male and female patients** with **Hemoglobin < 13**, please order

- Ferritin
- Iron and Transferrin

For **Hemoglobin < 8 without explanation** OR significant **concurrent leukopenia or thrombocytopenia**, consult classical hematology (PIC 1641).

If **Ferritin is < 30 and/or Iron Saturation is < 20%**, please order the **"IV Iron Focused"** order set

- Use the **"Preferred Iron Panel"** option to place an order for **both** the **Iron Dextran (INFED) 25 mg test dose** AND the **975 mg treatment dose** if available
- Provide patient education, including explanation of risk of self-limiting urticaria, palpitations, dizziness, and neck and back spasm as well as more significant anaphylactic-type reaction. Generally, these occur in < 1% of individuals.



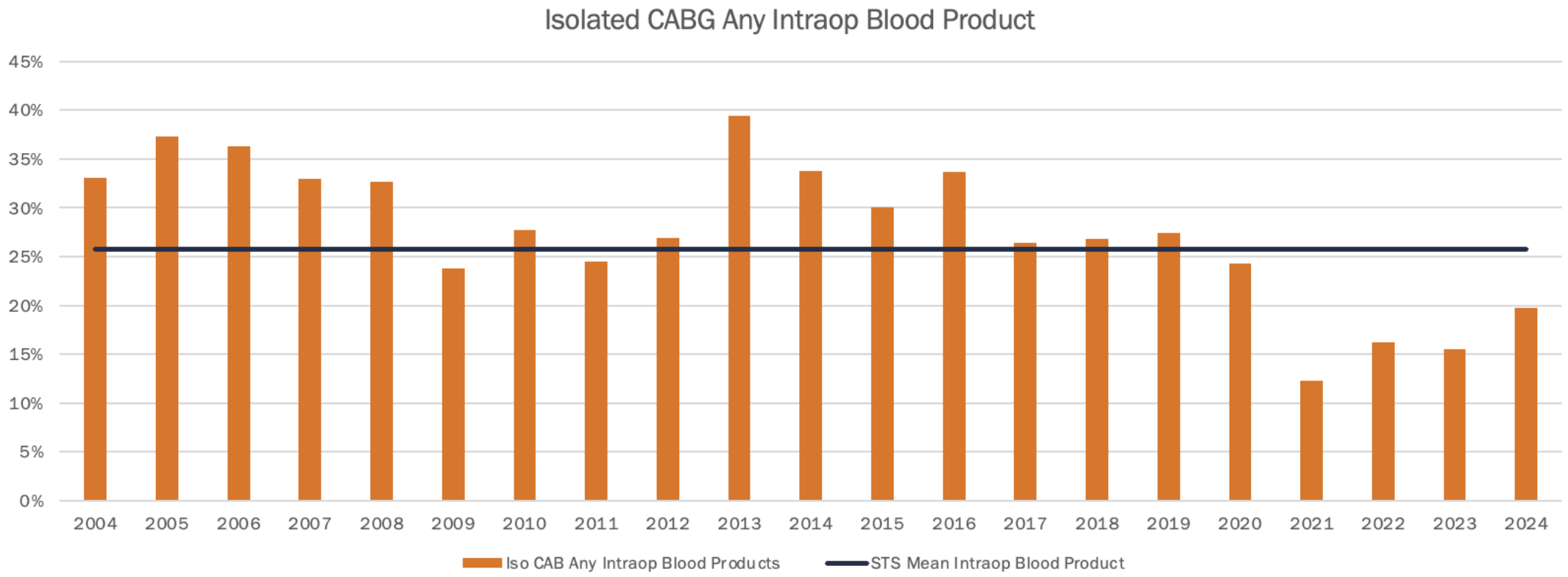
UVA Health

- Involved cardiac surgery APPs in creating smartphrase for cardiac surgery H&P
- Relies on cardiology team to follow consult recommendations!

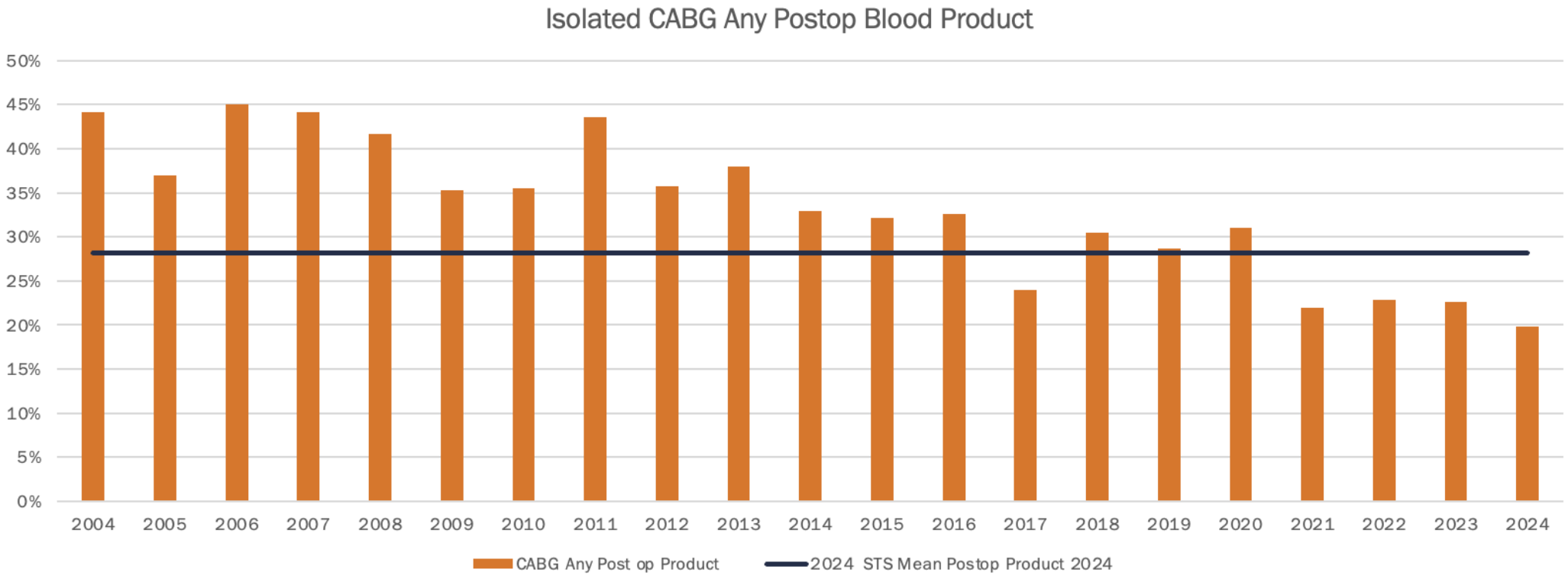
How are we doing now?

UVAHealth

Isolated CABG Any Intraop Blood Product with 2024 STS Average



Isolated CABG Any Post op Product with 2024 STS Mean



- Successes:
  - Increased % of patients undergoing RAP
  - Started an ANH program for cardiac surgery
  - Trying to identifying and treat outpatient and inpatient anemia preoperatively
  - Established POC coagulation testing in TCV ICU
- Challenges:
  - Staffing and bandwidth
    - ANH challenges
    - Lack of anemia coordinator/anemia clinic
      - Still missing anemic patients
      - Coordination of preop iron time-consuming

Team effort is

KEY!

What's next?

UVAHealth

EXPERT CONSENSUS DOCUMENT

Cardiac Surgical Bleeding, Trans Quality Metrics: Joint Consensus by the Enhanced Recovery Afte Cardiac Society and Society for Advancement of Patient Blood Management

Rawn Salenger, MD,[1] Rakesh C. Arora, MD, PhD,[2] A Daniel T. Engelman, MD,[5] Caroline Evans, MD,[6] Mic Serdar Gunaydin, MD, PhD,[8] Vicki Morton, DNP,[9] S Prakash A. Patel, MD,[12] Jacob Raphael, MD,[13] Todd Linda Shore-Lesserson, MD,[15] Pierre Tibi, MD,[16] and

8. Treatments for Cardiac Surgical Bleeding

- *Prophylactic antifibrinolytic therapy reduces blood loss and transfusions in cardiac surgery and should be administered to cardiac surgical patients undergoing CPB unless contraindicated.*
- *Owing to its thrombotic risk, recombinant factor VIIa (rFVIIa) should be used cautiously, and its use should be restricted to extreme circumstances of intractable bleeding.*
- *PCCs are effective at reducing transfusions in patients with documented coagulopathies as part of a comprehensive PBM program.*
- *Where possible, a 4-factor PCC should be used rather than rFVIIa alone.*
- *Fibrinogen supplementation can effectively decrease blood loss and blood component utilization in patients with acquired hypofibrinogenemia.*

Huge Thanks to:

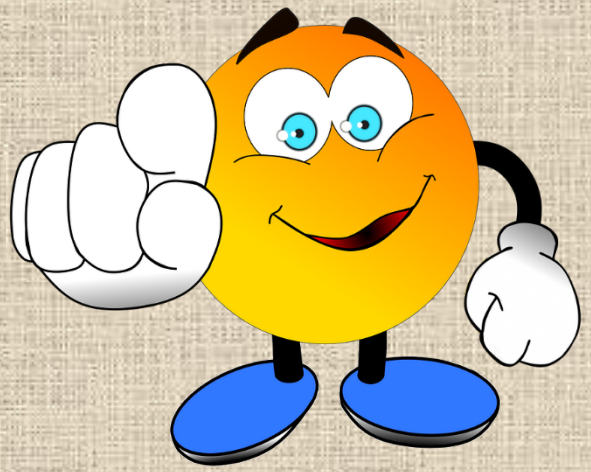
Judy Smith, RN
Mike Gelvin, perfusionist
Kelly Davidson, MD
Jenna Khan, MD
Catherine Hite, RN
And many others!

QUESTIONS?

ACSD Quality Improvement Series

Our next quality webinar is May 21, 2025 3 pm ET/2 pm CT

We need presenters and we want to hear from YOU!

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Open Discussion

Please use the raise-hand function.

Please use the Q&A Function.

We will answer as many questions as possible.

We encourage your feedback and want to hear from you!

Contact Information

- STSDB@sts.org
  - Database Operational Questions (Billing, Contracts, Contacts)
- STSDB_Helpdesk@sts.org
  - IQVIA/Database Platform Questions (Uploader, DQR, Missing Variable, Dashboard, Password and Login)
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  - Clinical Questions
- Carole Krohn, Director, STS National Database
  - ckrohn@sts.org
- Nancy Honeycutt, STS National Database Manager, ACSD, Intermacs/Pedimacs
  - nhoneycutt@sts.org

Thank You For Joining!

May 7, 2025, 3 ET/2 CT ACSD Monthly Webinar
May 21, 2025, 3 ET/2 CT ACSD QI Series Webinar

If your site has had success implementing a blood conservation project and decreasing blood usage, we invite you to share your story with us on an upcoming ACSD QI Series Webinar!