The Society of Thoracic Surgeons

Adult Cardiac Surgery Database

Quality Improvement Series

Decreasing Postoperative Renal Failure

September 17, 2025

STS National Database™
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Agenda

- Welcome and Introductions
- Brief STS Updates
- Guest Speaker-Mike Brown, CCP
- Q&A

AQO 2025

sts.org

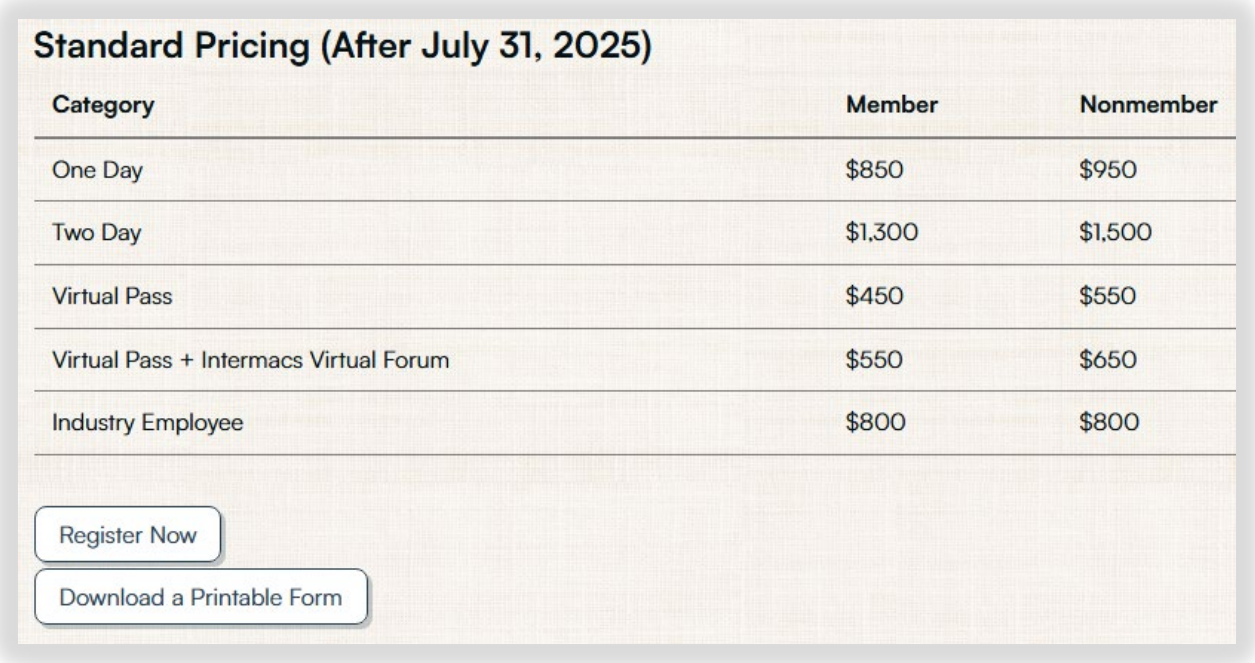
- Intermacs and Pedimacs Session: Tuesday, September 23rd VIRTUAL Forum
- CHSD and GTSD Sessions: Thursday, September 25th
- Networking Reception: Thursday, September 25th @ 5 PM
- ACSD Session: Friday, September 26th
- Grand Hyatt San Antonio Riverwalk
- Virtual options also available

AQO Reminders

- Registration is still open!

[2025 Advances in Quality & Outcomes: A Data Managers Meeting | STS]

- If you have not already done so, please sign up for the breakout sessions.
- We will do our best to place you in your top 3 choices.



Standard Pricing (After July 31, 2025)

Category	Member	Nonmember
One Day	$850	$950
Two Day	$1,300	$1,500
Virtual Pass	$450	$550
Virtual Pass + Intermacs Virtual Forum	$550	$650
Industry Employee	$800	$800

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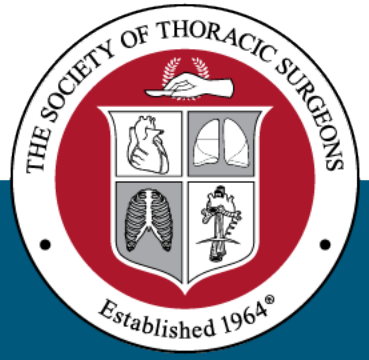
Successful Integration of AKI Strategies Focusing on VCSQI AKI Recommendation Guidelines to Improve Outcomes

Mike Brown, CCP

Mary Washington Healthcare

Program Director, Cardiac Surgery/Structural Heart

Chief, Perfusion Services



Successful Integration of AKI Strategies Focusing on VCSQI AKI Recommendation Guidelines to Improve Outcomes

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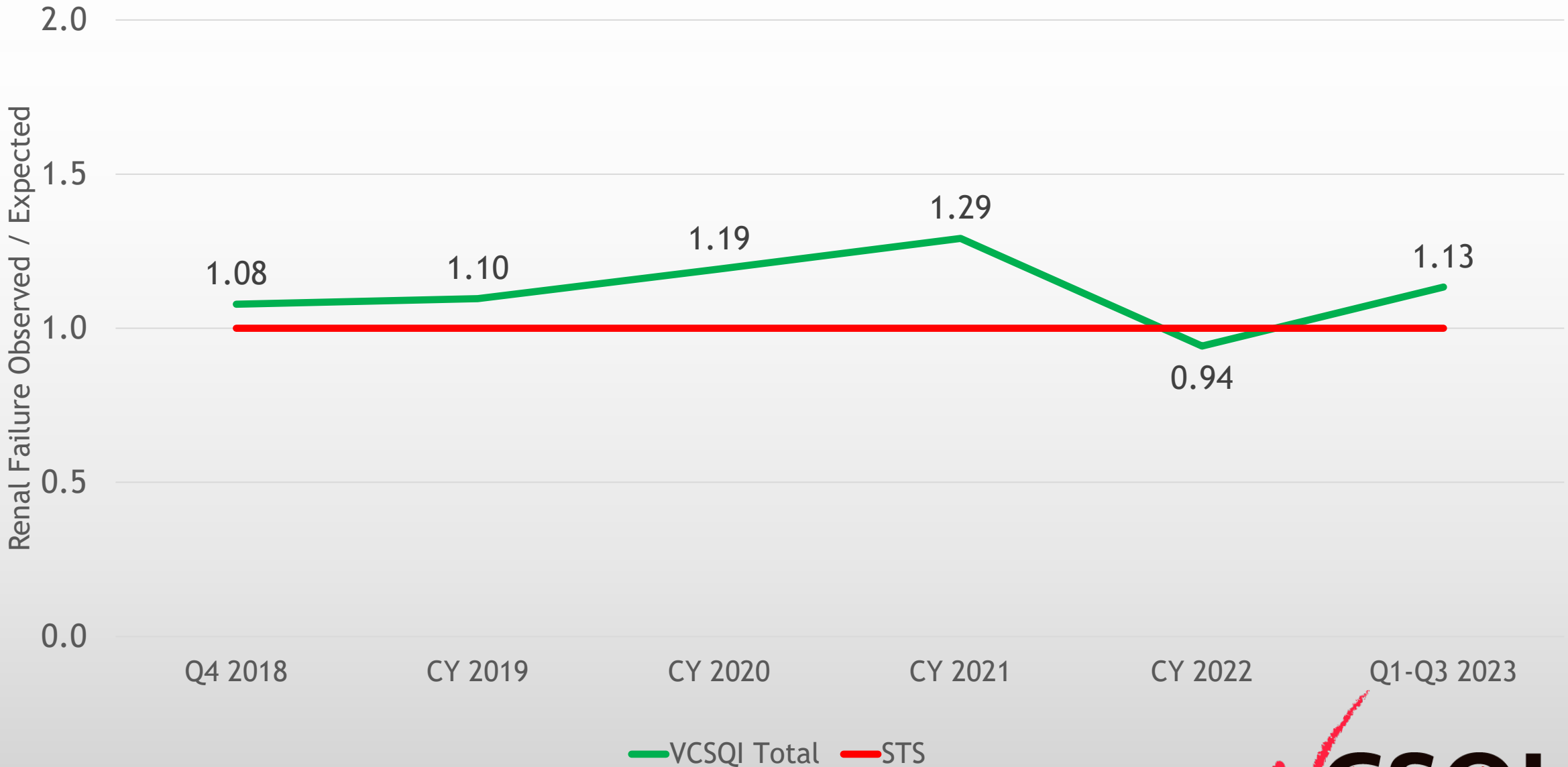
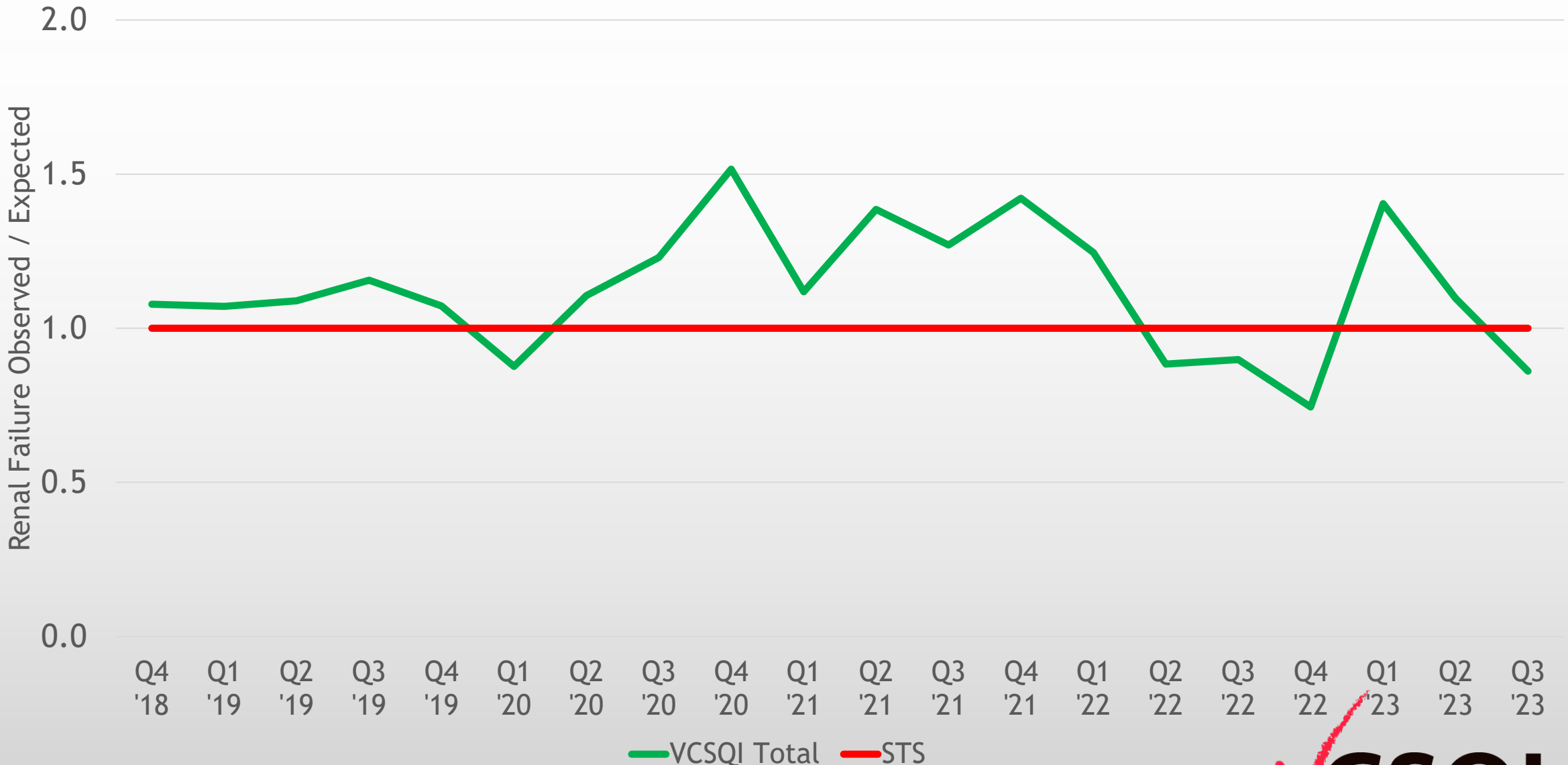
Renal Failure O/E (Recalibrated) by Year: Isolated CAB, Q4 2018—Q3 2023 (N=15,852)



Renal Failure O/E (Recalibrated) by Quarter: Isolated CAB, Q4 2018—Q3 2023 (N=15,852)



AKI WORKGROUP

AKI Reduction Recommendations and Suggestions for Care

OVERVIEW

The following recommendations were developed within the VCSQI AKI Workgroup.
Champion(s): Michael Brown, CCP (Mary Washington), Chris Sytsma, RN, MSN (Winchester), Nicholas Teman, MD (UVA), Kerry Prewitt, MD (Sentara).

Project Members: Denise Cox (Sentara), Bridget Keeley, CCP (Winchester), Jeff Rich, MD (VCSQI), Judy Smith (UVA), Kevin Lobdell, MD (Perfect Care), Shelley Cahalan (Sentara), LouAnn Janney (Carilion), Emaad Abdel-Rahman, MD (UVA), Christine Kim, MD (VCU), Evelyn Dallas, CCP (UVA)

Recognition and a special thanks to Dr. Matthew Cauchi and members of the Carilion Clinic for laying the foundation in developing AKI recommendations for Cardiology. Additional recognition is due to the members of the Sentara Health System for carrying the torch to enhance Cardiology recommendations.

We are also honored to recognize the input of the VCSQI Perfusion Group for providing guidance in this regard.

The following are the definitions of AKI as presented during the 2021 Winter Quarterly Meeting by Dr. Gregory Dehmer (Carilion) Click here to watch the full presentation.

	NCDR	STS
Source	Derives from the consensus statements formulated by the: • Acute Dialysis Quality Initiative (ADQI) group • American Society of Nephrology (ASN) • ARF Advisory group • International Society of Nephrology (ISN), • National Kidney Foundation (NKF) • Kidney Disease: Improving Global Outcomes group (KDIGO)	Derived from the RIFLE criteria **R**isk, **I**njury, **F**ailure, **L**oss of kidney function, **E**nd-stage renal disease
Definition	An abrupt (within 48 hours) reduction in kidney function currently defined as an absolute increase in serum creatinine of ≥ 0.3 mg/dl (≥ 26.4 µmol/l), a percentage increase in serum creatinine of ≥ 50% (1.5-fold from baseline), or a reduction in urine output (documented oliguria of less than 0.5 ml/kg per hour for > six hours).	Renal failure is defined as sCr levels 4 mg/dL or greater (176.8 mmol/L), a 3x or greater increase in sCr levels over the baseline preoperative value, or a new requirement for dialysis
Reference(s)	• Mehta RL, Kellum JA, Shah SV, et al. Crit Care 2007;11:R31 • Kellum JA, Mehta RL, Angus DC, et al. Kidney Int 2002;62:1855-63	Bellomo R, Ronco C, Kellum JA, Mehta RL, Palevsky P and the Acute Dialysis Quality Initiative (ADQI) workgroup. Crit Care. 2004 Aug; 8(4):R204-12

Where do we start? Ask the difficult questions…

- **What are we currently doing right and wrong?**
  - What does our performance in key contributing indicators look like?
- **Are we doing the small things?**
  - First focus → low hanging fruit
- **Blood conservation: Did we go too far?**
  - Perfusion strategies
  - Intra-Op Fluid Resuscitation Strategy/Guidelines
  - Transfusion Trigger: do we reconsider the high-risk patient population?
- **How do we integrate new strategies post Covid-19?**
  - Changes in staff/travelers → time for restructuring orientation and re-education process

How does hyperglycemia (and hypoglycemia) impact kidney function?

Hyperglycemia and Acute Kidney Injury During the Perioperative Period

Carlos E. Mendez[1] · Paul J. Der Mesropian[1] · Roy O. Mathew[1] · Barbara Slawski[2]

Abstract Hyperglycemia and acute kidney injury (AKI) are frequently observed during the perioperative period. Substantial evidence indicates that hyperglycemia increases the prevalence of AKI as a surgical complication. Patients who develop hyperglycemia and AKI during the perioperative period are at significantly elevated risk for poor outcomes such as major adverse cardiac events and all-cause mortality. Early observational and interventional trials demonstrated that the use of intensive insulin therapy to achieve strict glycemic control resulted in remarkable reductions of AKI in surgical populations. However, more recent interventional trials and meta-analyses have produced contradictory evidence questioning the renal benefits of strict glycemic control. Although the exact mechanisms through which hyperglycemia increases the risk of AKI have not been elucidated, multiple pathophysiologic pathways have been proposed. Hypoglycemia and glycemic variability may also play a significant role in the development of AKI. In this literature review, the complex relationship between hyperglycemia and AKI as well as its impact on clinical outcomes during the perioperative period is explored.

Keywords Hyperglycemia · Perioperative · Postoperative · Acute kidney injury · Inpatient glycemic control · Hypoglycemia · Glycemic variability

This article is part of the Topical Collection on *Hospital Management of Diabetes*

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Published online: 20 January 2016

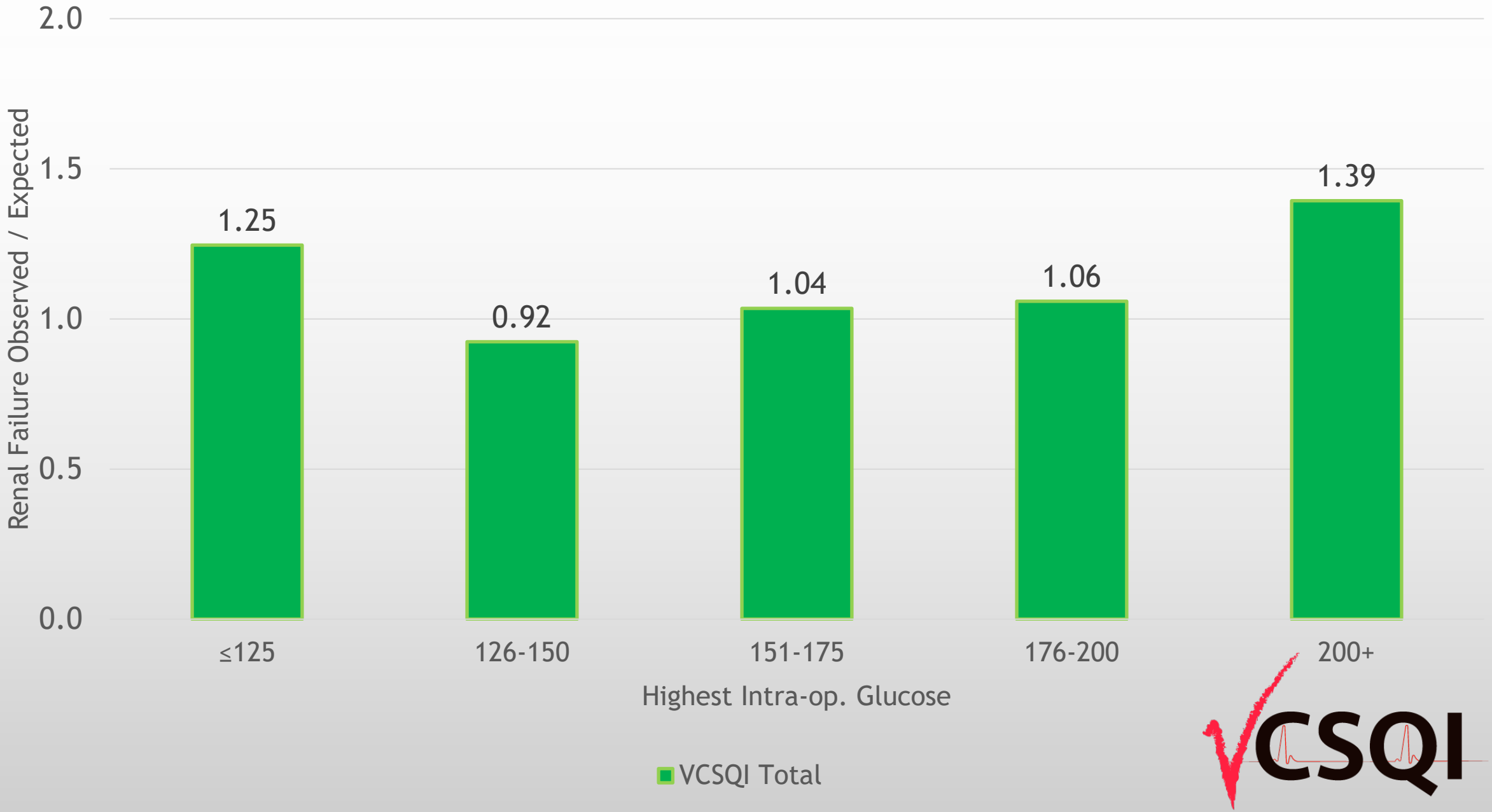
Introduction

Hyperglycemia is frequently seen in the perioperative setting. Whereas it is estimated to be present in 32 to 38 % of overall hospitalized patients [1, 2], in surgical patients, it is found in as many as 40 % of non-cardiac surgeries and 80 % of cardiac surgeries [3, 4••]. Hyperglycemia is directly associated with overall increased morbidity and mortality in hospitalized patients [5], and it has been especially recognized as an important risk factor for postoperative complications in patients with and without a previous history of diabetes [6–9].

The majority of the clinical evidence on the negative effects of perioperative hyperglycemia comes from studies on cardiac surgical patients. In this setting, perioperative hyperglycemia has been primarily associated with an increased rate of deep sternal wound infections and mortality [10–12]. In addition, perioperative hyperglycemia has also been shown to increase the risks of stroke and systemic blood infections [13], lengths of ventilation and intensive care unit (ICU) stay [14], and acute kidney injury (AKI) during the postoperative period [15]. In non-cardiac surgery patients, studies suggest similar negative effects. Postoperative hyperglycemia has been proposed as the single most important factor associated with increased rate of surgical site infections in general surgical patients [16•]. Additionally, perioperative hyperglycemia has

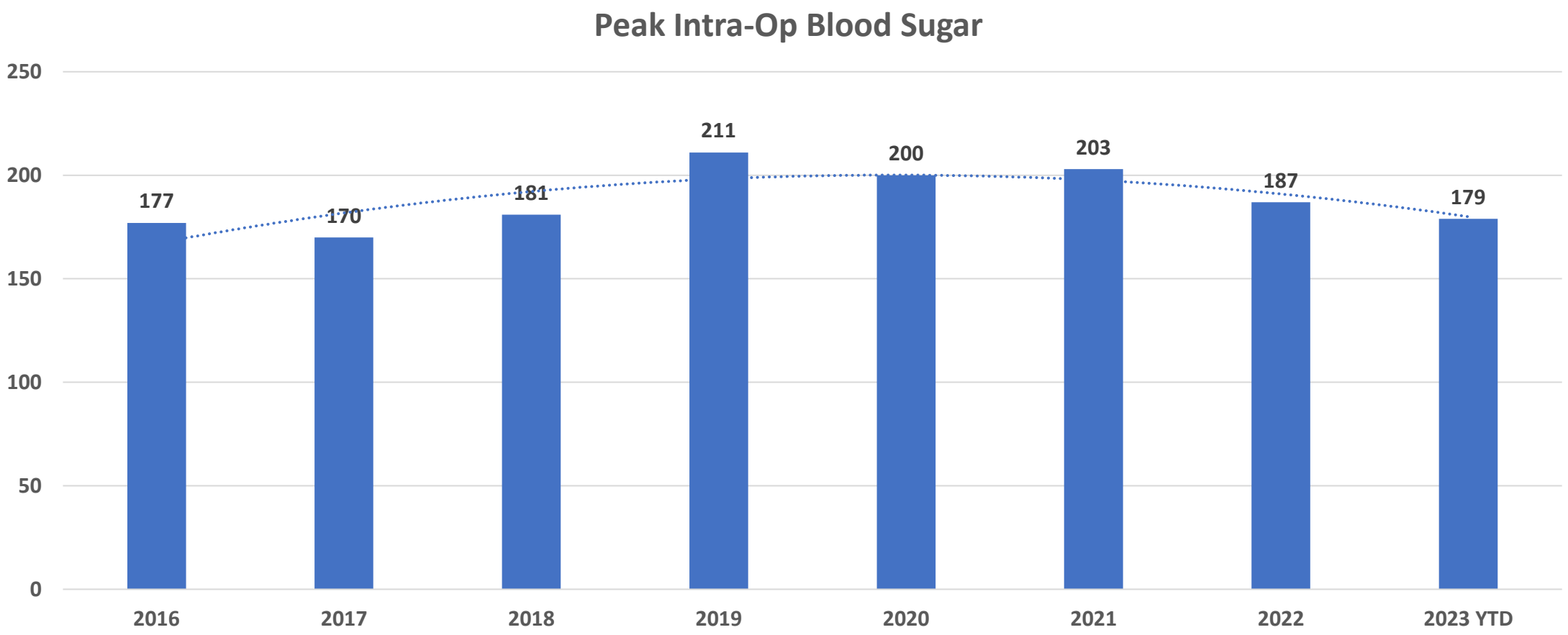
- Increases activation and production of inflammatory cytokines causing vascular permeability
- Increases production of reactive oxygen species in the mitochondria
- Increases oxidative stress
- Anesthesia → stimulates hyperglycemia, RAS activation, and intrarenal inflammation

Renal Failure O/E vs. Highest Intra-op. Glucose: Isolated CAB, Q4 2018—Q3 2023



Low hanging fruit…

2024-Present Mean Peak BS: 165



What were the barriers, and did we need to fix?
Keep it simple

Cardiac Surgery Intraop Blood Sugar Algorithm

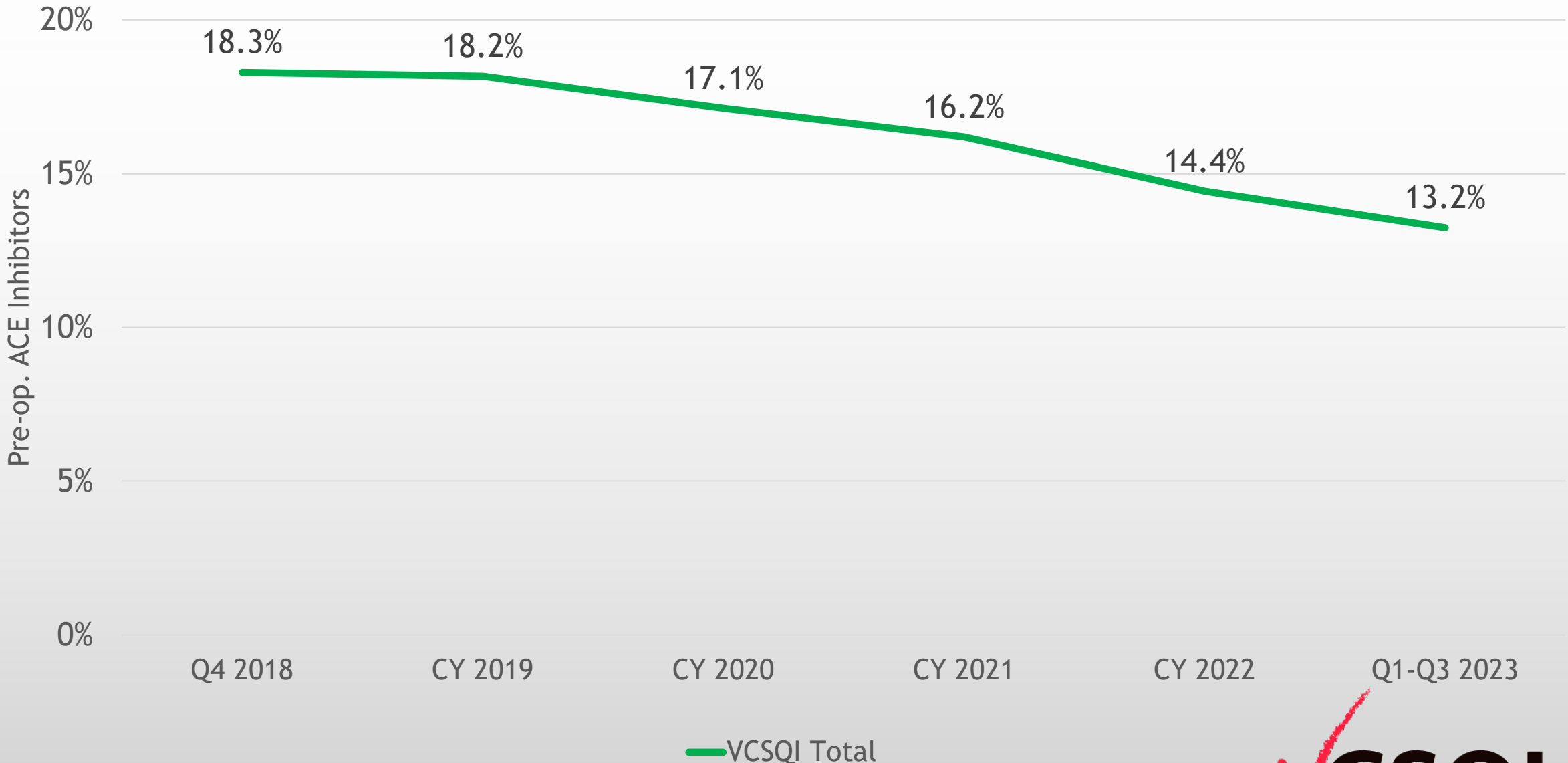
Trigger: Start Insulin infusion when blood glucose ≥ 110mg/dl

BG mg/dl	Bolus	Infusion
110-130	_____	2 unit/hr.
131-150	1 unit	2 unit/hr.
151-180	2 units	3 unit/hr.
181-200	3 units	4 unit/hr.
200-250	4 units	5 units/hr.

- ✓ Protocol changes
  - ✓ Start insulin sooner
  - ✓ Recheck more often
- ✓ New CRNAs/re-education

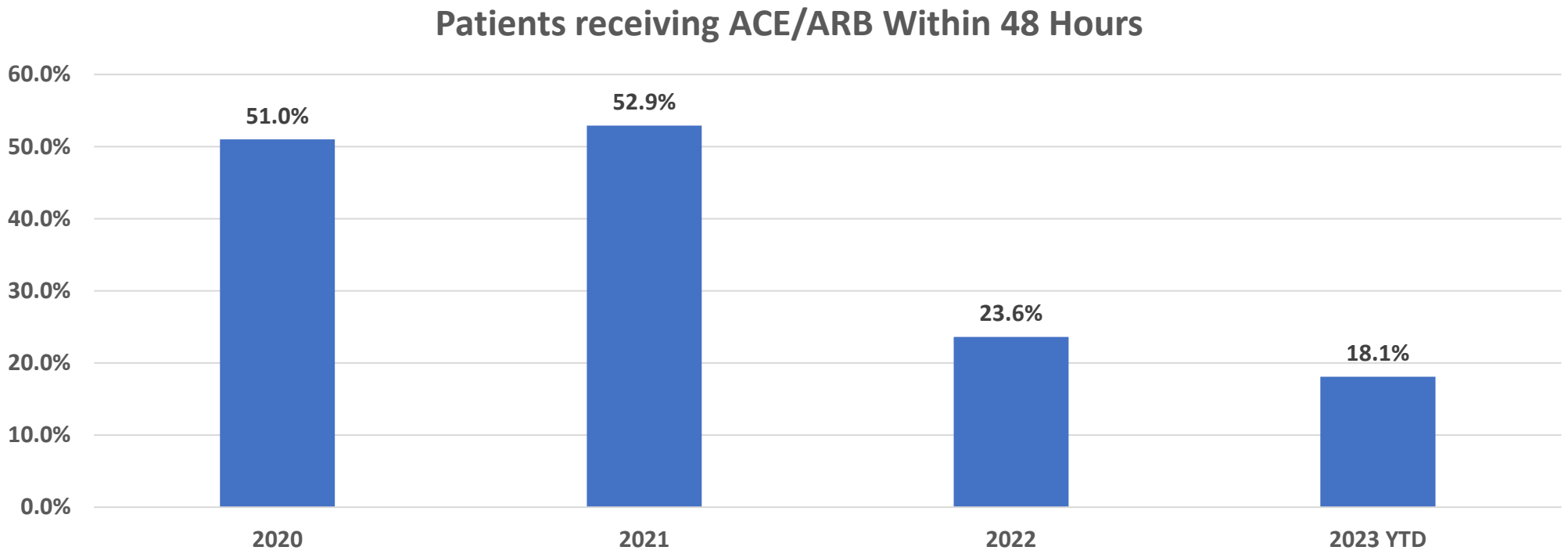
✓ **Q30 minute blood glucose or < when indicated**

Pre-op. ACE Inhibitors by Year: Isolated CAB, Q4 2018—Q3 2023



More low hanging fruit…

2024-Present: 8.7%



What were the barriers?

- Covid-19- transient staff
- Hospitalists and cardiology restarting DC'd meds
- Poor partnership and compliance with collaborating physicians

Intraoperative fluid balance and cardiac surgery-associated acute kidney injury: a multicenter prospective study

Henrique Palomba [a], Ricardo E. Treml [b], Tulio Caldonazo [c], Henrique T. Katayama [d], Brenno C. Gomes [e], Luiz M.S. Malbouisson [d], João Manoel Silva Junior [d,*]

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KEYWORDS
Acute kidney injury;
Coronary artery bypass;
Cardiac surgery;
Fluid therapy;
Cardiovascular disease;
Cardiopulmonary bypass

Abstract
Background: Recent data suggest the regime of fluid therapy intraoperatively in patients undergoing major surgeries may interfere in patient outcomes. The development of postoperative Acute Kidney Injury (AKI) has been associated with both Restrictive Fluid Balance (RFB) and Liberal Fluid Balance (LFB) during non-cardiac surgery. In patients undergoing cardiac surgery, this influence remains unclear. The study objective was to evaluate the relationship between intraoperative RFB vs. LFB and the incidence of Cardiac-Surgery-Associated AKI (CSA-AKI) and major postoperative outcomes in patients undergoing on-pump Coronary Artery Bypass Grafting (CABG).
Methods: This prospective, multicenter, observational cohort study was set at two high-complexity university hospitals in Brazil. Adult patients who required postoperative intensive care after undergoing elective on-pump CABG were allocated to two groups according to their intraoperative fluid strategy (RFB or LFB) with no intervention.
Results: The primary endpoint was CSA-AKI. The secondary outcomes were in-hospital mortality, cardiovascular complications, ICU Length of Stay (ICU-LOS), and Hospital LOS (H-LOS). After propensity score matching, 180 patients remained in each group. There was no difference in risk of CSA-AKI between the two groups (RR = 1.15; 95% CI, 0.85-1.56,

Brazilian Journal of Anesthesiology Volume 72, Issue 6, Nove-Dec 2022, Pages 688-694

Compared Restrictive Versus Liberal Fluid Balance (≤ 2000 ml versus ≥ 2000 ml)

Excluded insensible fluid loss

Primary Endpoint: CSA-AKI

Defined as increase in Creatinine ≥ 0.3 within 48 hrs or ≥ 1.5-1.9 x baseline OR urine output < 0.5ml.kg.h in 6-12 hours.

Secondary Endpoints:

In-Hospital Mortality

Cardiovascular complications

ICU-LOS

Findings:

No difference in risk of CSA-AKI between groups

Liberal Fluid Balance showed:

Greater in-hospital mortality

Greater cardiovascular complications

Did we go too far with blood conservation?

✓Retrograde Autologous Prime

✓Single Pass Ultrafiltration

✓Intra-Op Transfusion Trigger: Historical intra-op RBC transfusion for Iso Cabg→ **5.2%** ***Is this a good thing?***

PLUS

✓1,500ml Anesthesia intra-op crystalloid fluid resuscitation guide

What did we observe?

Intra-Op fluid management: ***Significant*** Variation among clinicians…

Rising lactate… Are we too dry?

- ***Opportunity:*** *Re-educate staff*

Transfusion triggers: Is there a best time to transfuse?

RESEARCH ARTICLE

Perioperative hemoglobin area under the curve is an independent predictor of renal failure after cardiac surgery. Results from a Spanish multicenter retrospective cohort study

Paula Duque-Sosa[1]*, Diego Martínez-Urbistondo[2☯], Gemma Echarri[1☯], Raquel Callejas[1☯], María Josefa Iribarren[1‡], Gregorio Rábago[3‡], Pablo Monedero[1☯], Spanish group of renal dysfunction in cardiac surgery (GEDRCC-2)[¶]

1 Department of Anesthesia and Critical Care, Clínica Universidad de Navarra, Pamplona, Navarra, Spain, **2** Department of Internal Medicine, Division of Intermediate Care and Hospitalists Unit, Clínica Universidad de Navarra, Pamplona, Navarra Spain, **3** Department of Cardiovascular Surgery, Clínica Universidad de Navarra, Pamplona, Navarra, Spain

☯ These authors contributed equally to this work.
‡These authors also contributed equally to this work.
¶Membership of the Spanish group of renal dysfunction in cardiac surgery (GEDRCC-2) is provided in the Acknowledgments.
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Preoperative anemia in patients undergoing coronary artery bypass grafting predicts acute kidney injury

Luca De Santo, MD,[a] Gianpaolo Romano, MD,[b] Alessandro Della Corte, MD, PhD,[c] Vincenzo de Simone, MD,[c] Francesco Grimaldi, MD,[c] Maurizio Cotrufo, MD,[c] and Marisa de Feo, PhD[c]

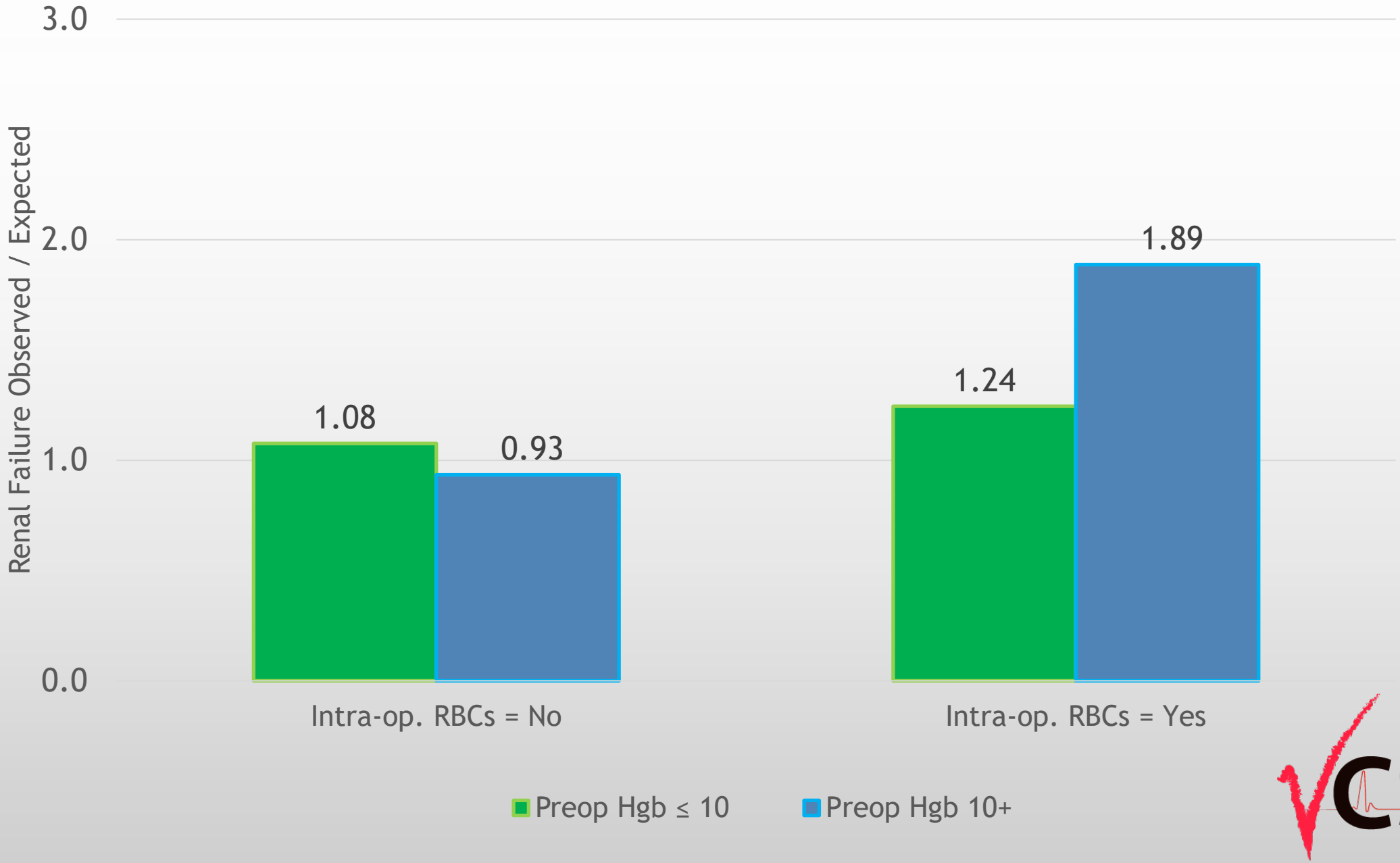
Objectives: Recent authoritative studies suggested that low preoperative hemoglobin concentration may affect cardiac surgery outcomes. This study aimed, primarily, to investigate whether preoperative anemia is an independent determinant of adverse events after coronary artery bypass grafting and, secondarily, to evaluate the potential dose responsiveness between anemia severity and primary end points.

Methods: This single-center prospective study investigated 1214 consecutive patients undergoing coronary artery bypass grafting between January 2004 and June 2007, collecting 100 variables per patient. In 1047 patients (median age 64 years, 18.8% female, 38.9% diabetic, 31.9% urgent/emergency, 15.3% with low preoperative left ventricular ejection fraction) who underwent on-pump procedures and received no preoperative transfusion, the prevalence of preoperative anemia (according to World Health Organization definition) and its unadjusted and adjusted relationships with in-hospital death, cardiac morbidity, and acute kidney injury (AKI–RIFLE [Risk, Injury, Failure, Loss, End-stage kidney disease] criteria) were obtained.

Results: The prevalence of preoperative anemia was 28%. In-hospital death averaged 3.9%, cardiac morbidity 7.3%, and acute kidney injury 4%. Unadjusted odds ratios (Ors) for in-hospital death, cardiac morbidity, and acute kidney injury were 3.8 (95% confidence interval [CI] 2.0–7.3), 1.7 (95% CI 1.1–2.8), and 4.0 (95% CI 2.1–7.6), respectively. Adjusting for anemia in confounders proved an independent predictor of acute kidney injury (OR 2.06; 95% CI 1.14–3.70), whereas the cardiac morbidity and in-hospital mortality were independently predicted by kidney function. No dose–response relationship emerged between anemia severity and acute kidney injury.

Conclusions: Preoperative anemia is independently associated with acute kidney injury after coronary artery bypass grafting. Further studies are warranted to determine whether preoperative low hemoglobin concentration is a marker of severity of illness or a modifiable risk factor.

Renal Failure O/E vs. Preop Hgb and Intra-op. RBCs: Isolated CAB, Q4 2018—Q3 2023



What is DO2i Perfusion?

DO2i = “Indexed” oxygen delivery

Calculated as:

10 * Blood Flow/Cardiac Output * (Hgb x 1.34 x O2 Saturation)/BSA

Goal-Directed Oxygen Delivery

Hemoglobin 7.0-8.0 gm
@ 2.4 L/min Cardiac Index
DO2i= 222-252 ml O^2/min/m^2

Hemoglobin 10.0 gm
@ 2.4 L/min Cardiac Index
DO2i= 314.4 ml O^2/min/m^2

J Extra Corpor Technol. 2021;53:97–124
The Journal of ExtraCorporeal Technology

Original Articles

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

Pierre Tibi, MD;[a] R. Scott McClure, MD, FRCSC;[b] Jiapeng Huang, MD;[c] Robert A. Baker, PhD, CCP;[d] David Fitzgerald, DHA, CCP;[e] C. David Mazer, MD;[f] Marc Stone, MD;[g] Danny Chu, MD;[h] Alfred H. Stammers, MSA, CCP Emeritus;[i] Tim Dickinson, CCP;[j] Linda Shore-Lesserson, MD;[k] Victor Ferraris, MD;[l] Scott Firestone, MS;[m] Kalie Kissoon;[m] Susan Moffatt-Bruce, MD, FRCSC[n]

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POSTOPERATIVE MANAGEMENT

Transfusion Triggers

- In patients undergoing cardiac surgery, a restrictive perioperative allogeneic 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 of mortality or morbidity (Class I, Level A).
- Allogeneic RBC transfusion is unlikely to improve oxygen transport when the hemoglobin concentration is greater than 10 g/dL and is not recommended (Class III: No benefit; Level B–R).

Transfusion and anemia trends among our ARF patients

Q4 2018-Q1 2022 Iso Cabg with Post Op ARF

- 33% Pre-op Hgb ≤ 10gm
- 60% Normal pre-op creatinine
- 7.1 gm Average low intra-op Hgb
- **Only** 30% Transfused RBCs Intra-Op

Changes in practice/trends:

Intra-op RBC transfusion rate ↑ from 5.2% historical to 8.5%

50% of patients with intra-op Hgb < 8gm transfused based on DO2i ≤ 270 ml O2/min/m2

New observations: **0 ARF in the anemia transfused population**

Perfusion Management: Past and present

Historical: Conventional perfusion management

- Cardiac Index 2.4 L/minute
- SVO^2- based cardiopulmonary bypass
- MAP $\geq$ 60 mmHg

Current Strategy: Goal-Directed Perfusion Management

✓ Goal-Directed Oxygen Delivery

✓ Arterial Perfusion Blood Temp $\leq$ 36.9^{o}C

✓ Mean Arterial Pressure $\geq$ 65 mmHg (MWH)

J Extra Corpor Technol. 2022;54:128–34
The Journal of ExtraCorporeal Technology

Goal Directed Perfusion Is Not Associated with a Decrease in Acute Kidney Injury in Patients Predicted to Be at High Risk for Acute Renal Failure after Cardiac Surgery

Mark Broadwin, MD;* Monica Palmeri, MS;† Tyler Kelting, MS, CCP;† Robert Groom, MS, CCP;‡ Michael Robich, MD;§ F. Lee Lucas, RN, PhD;‖ Robert Kramer, MD†

**Lehigh Valley Health Network, Department of Surgery, Allentown, Pennsylvania; †Maine Medical Center, Division of Cardiovascular Surgery, Portland, Maine; ‡Tenwek Hospital, Bomet, Kenya; §Tufts University Medical Center, Department of Cardiac Surgery, Boston, Massachusetts; and ‖Center for OUtcomes Research and Evaluation, Maine Medical Center, Portland, Maine*

Abstract: Small increases in serum creatinine postoperatively reflect an acute kidney injury (AKI) that likely occurred during cardiopulmonary bypass (CPB). Maintaining adequate oxygen delivery (DO_2) during CPB, known as GDP (goal-directed perfusion), improves outcomes. Whether GDP improves outcomes of patients at high risk for acute renal failure (ARF) is unknown. Forty-seven adult patients undergoing cardiac surgery with CPB utilizing GDP with Cleveland Clinic Acute Renal Failure Score of 3 or greater were compared with a matched cohort of patients operated upon using a flow-directed strategy. CPB flow in the GDP cohort was based on a DO_2 goal of 260 mL/min/m^2. Serum creatinine values were used to determine whether postoperative AKI occurred according to AKIN (Acute Kidney Injury Network) guidelines. We examined the distribution of all variables using proportions for categorical variables and means (standard deviations) for continuous variables and compared treatment groups using *t* tests for categorical variables and tests for differences in distributions for continuous and count variables. We used inverse probability of treatment weighting to adjust for treatment selection bias. In adjusted models, GDP was not associated with a decrease in AKI (odds ratio [OR]: .97; confidence interval [CI]: .62, 1.52), but was associated with higher odds of ARF (OR: 3.13; CI: 1.26, 7.79), mortality (OR: 3.35; CI: 1.14, 9.89), intensive care unit readmission (OR: 2.59; CI: 1.31, 5.15), need for intraoperative red blood cell transfusion (OR: 2.02; CI: 1.26, 3.25), and postoperative platelet transfusion (OR: 1.78; CI: 1.05, 3.01) when compared with the historic cohort. In patients who are at high risk for postoperative renal failure, GDP was not associated with a decrease in AKI when compared to the historical cohort managed traditionally by determining CPB flows based on body surface area. Surprisingly, the GDP cohort performed significantly worse than the retrospective control group in terms of ARF, mortality, intensive care unit readmission, and RBC and platelet transfusions. **Keywords:** CPB, physiology, pathophysiology, kidney, perioperative care. *J Extra Corpor Technol. 2022;54:128–34*

Acute kidney injury (AKI) after cardiac surgery is associated with poor short- and long-term outcomes and is a signal for adverse outcomes (1–6). Small increases (.3 mg/dL) in serum creatinine (SCr) postoperatively reflect a kidney injury that most likely occurred in the operating room during cardiopulmonary bypass (CPB). This delayed signal provides an opportunity to scrutinize intraoperative processes of care and determine strategies to decrease its incidence. One of the possible sources of the renal injury is poor oxygen delivery during CPB. The renal medulla is a reliable hypoxemic signal for this research purpose and is vulnerable to small shifts of oxygen delivery (DO_2) that can result in organ dysfunction and cell death. Small changes in SCr can provide a surrogate marker for hypoxemia and inadequate organ perfusion.

Maintaining DO_2 levels above a recommended level during CPB improves physiological and clinical outcomes (7–9). This strategy is described as goal-directed perfusion (GDP) (10). DO_2 is measured in real time

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The senior author has stated that the authors have reported no material, financial, or other relationship with any healthcare-related business or other entity whose products or services are discussed in this paper.

Summary:

- Patients with high-risk for AKI treated with a goal-directed oxygen delivery strategy did **not** reduce incidence of post-op AKI when compared to conventional perfusion.

- GDP performed worse than conventional perfusion in mortality, ARF, ICU readmission and RBC transfusion

Goal-directed perfusion to reduce acute kidney injury: A randomized trial

Marco Ranucci, MD, FESC,[a] Ian Johnson, CCP,[b,c] Timothy Willcox, CCP,[d,e] Robert A. Baker, PhD, CCP,[f] Christa Boer, MD, PhD,[g,h] Andreas Baumann, MD,[i,j] George A. Justison, CCP,[k,l] Filip de Somer, CCP,[m] Paul Exton, BSc (Hon) ACP,[n] Seema Agarwal, FRCA,[b,c] Rachael Parke, PhD,[d,e] Richard F. Newland, CCP,[f] Renard G. Haumann, CCP,[g,h] Dirk Buchwald, PhD, CCP,[i,j] Nathaen Weitzel, MD,[k,l] Rajamiyer Venkateswaran, MD FRCS(Cth),[n] Federico Ambrogi, PhD,[o] and Valeria Pistuddi[a]

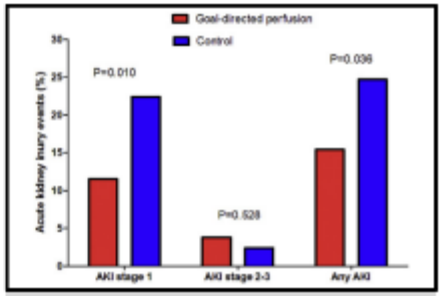
ABSTRACT

Objective: To determine whether a goal-directed perfusion (GDP) strategy aimed at maintaining oxygen delivery (DO_2) at $\geq$280 mL·min^{-1}·m^{-2} reduces the incidence of acute kidney injury (AKI).

Methods: This multicenter randomized trial enrolled a total of 350 patients undergoing cardiac surgery in 9 institutions. Patients were randomized to receive either GDP or conventional perfusion. A total of 326 patients completed the study and were analyzed. Patients in the treatment arm were treated with a GDP strategy during cardiopulmonary bypass (CPB) aimed to maintain DO_2 at $\geq$280 mL·min^{-1}·m^{-2}. The perfusion strategy for patients in the control arm was factored on body surface area and temperature. The primary endpoint was the rate of AKI. Secondary endpoints were intensive care unit length of stay, major morbidity, red blood cell transfusions, and operative mortality.

Results: Acute Kidney Injury Network (AKIN) stage 1 was reduced in patients treated with GDP (relative risk [RR], 0.45; 95% confidence interval [CI], 0.25-0.83; $P = .01$). AKIN stage 2-3 did not differ between the 2 study arms (RR, 1.66; 95% CI, 0.46-6.0; $P = .528$). There were no significant differences in secondary outcomes. In a prespecified analysis of patients with a CPB time between 1 and 3 hours, the differences in favor of the treatment arm were more pronounced, with an RR for AKI of 0.49 (95% CI, 0.27-0.89; $P = .017$).

Conclusions: A GDP strategy is effective in reducing AKIN stage 1 AKI. Further studies are needed to define perfusion interventions that may reduce more severe levels of renal injury (AKIN stage 2 or 3). (J Thorac Cardiovasc Surg 2018;156:1918-27)



Acute kidney injury in the goal-directed perfusion and control groups.

Central Message

A goal-directed perfusion strategy aimed at preserving oxygen delivery during cardiopulmonary bypass is effective in reducing AKIN class 1 postoperative acute kidney injury.

Perspective

Acute kidney injury (AKI) is a major complication of cardiac surgery. This study demonstrates that minor patterns of AKI in medium- to low-risk patients may be limited by a strategy of cardiopulmonary bypass based on a target oxygen delivery. Further studies are needed to define perfusion interventions that may reduce more severe levels of renal injury (AKIN stage 2 or 3).

See Editorial Commentary page 1928.

Goal-Directed Oxygen Delivery versus Conventional Perfusion:

- Reduced Stage 1 AKI
- No difference in Stage 2 or 3 AKI

Acute Renal Failure in High-Risk Patients: Conventional versus GDP

2020-2021 Iso Cabg Patients

422 patient assessed for AKI risk using the Cleveland Clinic ARF Score

- Excluding re-operation and patients with pre-op creatinine ≥4.0 +/- HD
- 122 Patients with risk score of 3-10
  - 10 patients with ARF

2022 – Q3 2023 Iso Cabg Patients

247 patients assessed for AKI risk using the Cleveland Clinic ARF Score

- Excluding re-operations and patients with pre-op creatinine ≥4.0 +/- HD
- 48 Patients with risk score of 3-9 (Mean 4.1)
  - 0 patients with ARF

How much value can your perfusion team bring to your program: GDP

Goal-Directed Perfusion: July 2022

✓Goal-Directed Oxygen Delivery

✓Arterial Perfusion Blood Temp ≤ 36.9°C

✓Mean Arterial Pressure ≥ 65 mmHg

Barriers:

- Venous drainage/High CPB arterial line pressure
- Appropriate arterial and venous cannulation size
- Volume management on CPB

✓DO2i % >270 ml O2/min/m^2→*98.9%*

✓Arterial perfusion blood temperature management 4.3% ↓ *0.54%*

✓*53.5%* improvement in blood pressure management

What did we change?

- Consult nephrology for **GFR<45** or new post-cath AKI.
- Revised and expanded protocol for discontinuation of nephrotoxic meds.
- Clear liquids until 2 hours before general anesthesia.
- Adopted Goal-Directed Perfusion Initiative.
- Revised intra-op glucose management protocol.
- Moved “towards the middle” for intra-op fluid management.
- Less conservative transfusion trigger for “high risk” patients or DO2i < 270 ml O2/min/m2.
- Revised post-op fluid resuscitation and vaso-active medication orders.
- **Goal-directed post-op fluid and hemodynamic management (Hemosphere)**

Dramatic improvement and some compromise

- Improvement in intra-op hyperglycemia management
- Improvement in discontinuation of nephrotoxic meds
- Increase in intra-op RBC transfusion (5.2% to 11.7%)
- 100% Compliance with GDP (Epic reports)
- Reduction in post-op RBC transfusion (24.6% to 21.9%)
- **72.6% reduction in Isolated CABG AKI**
- **Bonus: 1 Isolated CABG Stroke since 2023**

Thanks for your time☺

- Questions?


WHEN?
WHO?
WHAT?
WHEN?
WHERE?
ANY
WHERE?
When?
What?
QUESTIONS?
WHEN?
WHAT?
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HOW?
Where?
When?
WHERE?
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HOW?

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

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  - Clinical Questions

We Need You!

If you or someone at your site have been successful in implementing a QI project to decrease postoperative renal failure, please reach out to Nancy Honeycutt @ nhoneycutt@sts.org.

Thank You for Joining!

Reminder: Our next ACSD QI Webinar will be held on Wednesday, October 15, 2025 at 3pm ET/2pm CT.

Reminder: Our next ACSD Monthly Webinar will be held on Wednesday, November 5, 2025 at 3pm ET/2pm CT.