



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: <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> Risk, Injury, Failure, Loss of kidney function, End-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 μ mol/l), a percentage increase in serum creatinine of $\geq 50\%$ (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)	<ul style="list-style-type: none"> 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

Related Presentations:

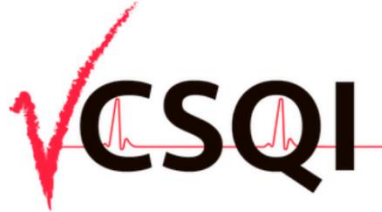
[AKI: A Case Presentation - Nick Teman, MD \(UVA\)](#)

[AKI: A Cardiologist's Perspective - Kerry Prewitt, MD \(Sentara\)](#)

[AKI: A Cardiac Surgeon's Perspective - Kevin Lobdell, MD, LTC, MC, USAR \(Perfect Care\)](#)

[AKI: A Perfusionist's Perspective - Bridgett Keeley, CCP \(Winchester\)](#)

[AKI Recommendations: Summary and Implementation Steps - Mike Brown, CCP \(Mary Washington\) Chris Sytsma, RN, MSN \(Winchester\)](#)



AKI WORKGROUP

AKI Reduction Recommendations and Suggestions for Care

The following recommendations were prepared for our cardiology partners to utilize when performing heart cath procedures. These recommendations may be used to serve as a bridge for patients undergoing a cath followed by an invasive procedure.

PRE-CATHETERIZATION RECOMMENDATIONS

Obtain baseline Serum Creatinine level: <ul style="list-style-type: none">A. No known kidney disease: within 30 daysB. Known kidney disease or risk factors for disease: within 7 days of known contrast exposureC. Unstable renal function: within 24-48 hours of known contrast exposure
Hold Nephrotoxic Medications 24 hours prior to procedure per physician discretion <ul style="list-style-type: none">A. NSAIDSB. MetforminC. AminoglycosidesD. Anti-Virals (Acyclovir, Foscarnet)E. Amphotericin BF. ACE-I/ARB/ARNIs
Hold diuretics day of procedure
Calculate Risk Assessment using Mehran Score or SCAI (optional)
1. Avoid contrast loads within 72 hours of procedure 2. Prior to angiography, identify ideal, acceptable, and maximum contrast volume and included in the pre-procedure time out: <ul style="list-style-type: none">A. Ideal: 2x eGFRB. Acceptable: 3x eGFRC. Maximal: 5x eGFR
Hydration (If BMI > 35, use ideal weight) <ul style="list-style-type: none">A. For all patients <u>except</u> patients with ESRD and/or active or decompensated HF:<ul style="list-style-type: none">- Oral: 16 oz water night before procedure and 16 oz water morning of procedure- Standard Rate of 1.5 mL/kg/hr for fluid maximum of 500 mL and then 30 ml/hrA. Standard Hydration Therapy<ul style="list-style-type: none">1) NS 1.5mL/kg/hr IV plus 32 ounces of water for a maximum of 500 mL



OR

2) NS 1.5mL/kg/hr IV x 4 hours for a maximum of 500 mL

B. Followed by:

1) NS 30mL/hr

INTRA-PROCEDURE RECOMMENDATIONS

1. Communication During Time Out

- A. Serum Creatinine level
- B. Fluid
 - a. Volume received pre-procedure
 - b. Current IV fluid rate
- C. Contrast
 - a. Volume received in the past 72 hours
 - b. Contrast limit for procedure
 - c. For GFR < 30, consider contrast-sparing device

2. Communicate During Procedure

The primary operator should be notified when:

- A. Approaching the ideal contrast volume limit
- B. Approaching the acceptable contrast volume limit
- C. Approaching the maximal contrast volume
- D. IV fluid rate and total volume given

3. End of Procedure Hydration (If BMI > 35, use ideal weight)

- A. Standard Hydration Therapy
 - 3) NS 1.5mL/kg/hr IV plus 32 ounces of water
 - OR**
 - 4) NS 1.5mL/kg/hr IV x 4 hours
- B. LVEDP Guided Hydration Therapy:
 - 2) LVEDP \leq 18 mmHg 3 mL/kg/hr for maximum volume to be determined by provider

POST-PROCEDURE RECOMMENDATIONS

RISK REDUCTION: POST-PROCEDURE

1. Communication

The primary operator **and** receiving RN should be informed of:

- A. Serum Creatinine level
- B. Total contrast volume given
- C. Total fluid volume given

2. Hydration (If BMI > 35, use ideal weight)

- A. Continue **Standard Hydration Therapy** post-procedure
 - 1) NS 1.5 mL/kg/hr IV plus 32 ounces of water

OR

 - 2) NS 1.5mL/kg/hr IV x 4 hours

3. Serum Creatinine

- A. Patients at high risk for Contrast-Induced Nephropathy¹ should have a serum creatinine obtained 48-72 hours post procedure
- B. The Interventional Cardiologist who performed the procedure should then be notified in order to provide further management

4. Medications

- A. Re-assess for resumption of diuretics the day after procedure
- B. The following medications should be 48 hours post-procedure per physician discretion:
 - 1) NSAIDS
 - 2) Metformin
 - 3) Aminoglycosides
 - 4) Anti-virals (Acyclovir, Foscarnet)
 - 5) Amphotericin B
 - 6) ACE/ARB/ARNI

¹**Characteristics of High Risk for Contrast-Induced Nephropathy:** Age ≥ 75 years, Diabetes Mellitus, Pre-existing CKD (eGFR < 60ml/min per m² or serum creatinine), History of CHF, Cardiogenic shock, Repeated exposure to iodinated contrast over a period of a few days, Previous episodes of CI-AKI

SURGICAL
RECOMMENDATIONS



The following recommendations were prepared for our cardiac surgery partners to utilize when performing invasive surgical procedures. These recommendations may be used with our cath recommendations to serve as a bridge in reducing the rate of AKI.

PRE-OPERATIVE CARDIAC SURGERY RECOMMENDATIONS

- A. Obtain Serum Creatinine level prior to procedure.
- B. Perform a complete urinalysis. Consult nephrology for proteinuria.

- A. For patients with a high risk for AKI or pre-existing AKI AND contrast exposure prior to surgery consider IV hydration.
- B. Consider clear liquids until 2 hours before general anesthesia.

Avoidance of nephrotoxic medications

- A. Discontinue ACE/ARB/ARNI 48 hours prior to procedure.
- B. Consider DC Metformin 24 hours prior to surgery.
- C. Avoidance of NSAIDS.
- D. Limit aminoglycoside antibiotics. Use vancomycin judiciously.

Renal consult for post-cath AKI/pre-op AKI for GFR <45.

- A. Consider delaying surgery 48-72 hours.
- B. Consider surgery once GFR returns to nadir or improves.

Optimize glycemic control by maintaining blood glucose 80-180 mg/dL.



INTRA-OPERATIVE CARDIAC SURGERY RECOMMENDATIONS

Optimize glycemic control by maintaining blood glucose 80-180 mg/dL with an insulin infusion
Avoid Mannitol in CPB prime
Avoid Hyperthermia on CPB <ul style="list-style-type: none">- Maintain arterial line perfusion temperature > 37° C on rewarming
Goal-Directed Oxygen Delivery on CPB <ul style="list-style-type: none">- Avoid DO₂i below 270 ml/min/m²
Consider minimally invasive extracorporeal circulation techniques (reducing prime volume of bypass circuit)
<u>DO NOT USE</u> dopamine infusion for renal protection during CPB
Consider limiting ultrafiltration with following exceptions: <ul style="list-style-type: none">A. Processing residual pump blood after termination of CPBB. Excessive hemodilution/hypervolemia
Cerebral Oximetry

POST-OPERATIVE RECOMMENDATIONS

- A. Avoid of hyperglycemia.
- B. Avoid nephrotoxic medications (Metformin, NSAIDs, aminoglycosides).
- C. Hold ACE/ARB/ARNI x 48 hours.
- D. Avoid intravenous radiocontrast agents.
- E. Strict urine output and daily BUN/creatinine monitoring.
- F. Close hemodynamic monitoring (consider minimally invasive monitoring strategies).
- G. For goal-directed volume therapy maintain parameters:
 - a. Systolic blood pressure 100-130 mm Hg or mean arterial pressure 65-90 mm Hgb
 - b. Cardiac index > 2.2 L/min/m²
 - c. UO >0.5 mL/kg/h (using lean body mass)
 - d. SvO₂ >55%.
- H. Consider fluid challenges with lactated Ringers if oliguric, cardiac index <2.0 L/min/m² and CVP <5 mm Hg, PAD <14 mm Hg, or SVV>13% in a ventilated patient in normal sinus rhythm.
- I. Consider limiting transfusion of PRBC to a hemoglobin <7.0 g/dL or <8.0 g/dL in the presence of oliguria, lactic acidosis, low cardiac output, or positive urinary biomarkers.
- J. Consider diuretics if CVP >15 mm Hg or PAD >20 mm Hg. Consider ultrafiltration if diuretic unresponsive
- K. Adjust medication dosing/interval for persistent oliguria (UO < 03.ml/dl) per institution policy or discontinue nephrotoxic medications.
- L. If GFR < 45 and/or oliguria, consult nephrology for pre-existing AKI or new post-op AKI

Revisions:

1/20/2023	<p>Modifications conducted after review of D Engelman, A Shaw. A Turnkey Order Set for Prevention of Cardiac Surgery–Associated Acute Kidney Injury. Ann Thorac Surg 2023;115:11-5 0003-4975 and Brown ET AL. AKI Guidelines. Ann Thorac Surg 023;115:34-42.</p> <p>Section: Post-op Removed: dopamine, IABP, ANP, fenoldopam consideration. Additions: obtaining urinalysis, modification of hydration protocol. Aminoglycoside limits, glycemic control.</p> <p>Section: Intraop Removed: Classes Additions: glycemic control optimization</p> <p>Section: Postop Removed: scheduling of post-op BUN/creatinine, Systolic BP range, fluid changes, classes Moved: nephrology consult, GFR, Changes: anuria changed to ologuria</p>
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