

The Problem:

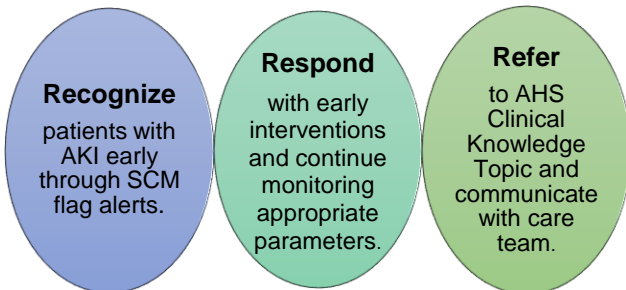
Acute kidney injury (AKI) is common complication after surgery, as evidence suggests:

- 10% - 30% incidence in Alberta
- More than 3-fold increase in dialysis for AKI after major surgery in the last 20 years
- Increased length of hospital stay and costs of care

Perioperative AKI is often reversible with early recognition and management.

What is SUPPORT AKI?

- A clinical decision support initiative
- A process that will be implemented to:



As a member of the care team, what is my role?



Recognize and respond to SCM flag alerts for early identification of patients who develop AKI.



Review guidance provided to help reverse AKI using fluid therapies and medication adjustment.



Ensure patients are monitored appropriately for complications and refer to specialists if required.



Provide feedback on the tools and processes for AKI.

Who is the target population?

Hospitalized patients:

- 18 years or older
- Develop AKI on general/vascular surgery units
- Identified by an SCM alert

Excluded patients:

- Hospitalized on non-surgical units
- Already receiving dialysis

Who is involved?

Calgary Steering Committee: Dr. Elijah Dixon, Dr. Anthony MacLean, Dr. Indraneel Datta, Dr. Gregory Samis, Dr. Jennifer Landry, Dr. Rohan Lall, Sonia Ficaccio-Scarcelli, Sharon Falk

Calgary Sites: Foothills Medical Centre Unit 102 and Unit 44; Peter Lougheed Centre Unit 29/44 and Unit 58/59

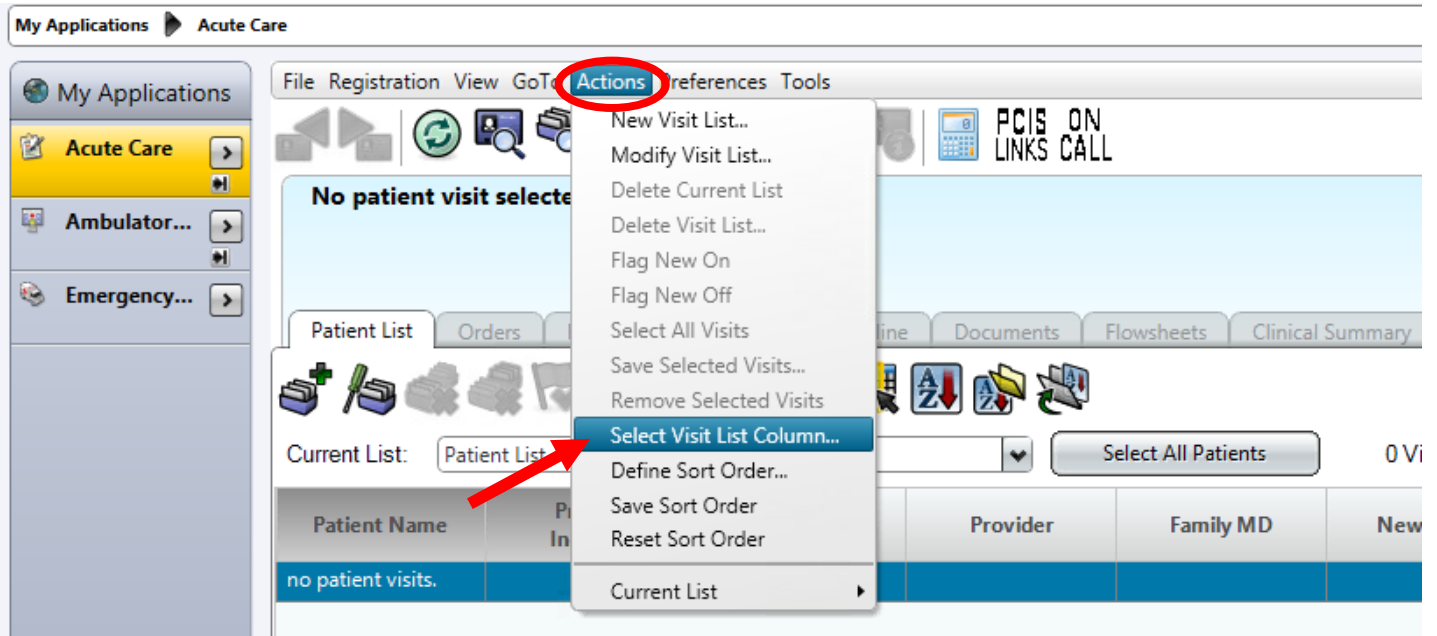
Study inquiries or feedback about the tools and processes?

Dr. Matthew James, Principal Investigator mjames@ucalgary.ca
 Eleanor Benterud, Senior Project Coordinator eleanor.benterud@ucalgary.ca
 Meha Bhatt, Research Coordinator meha.bhatt@ucalgary.ca

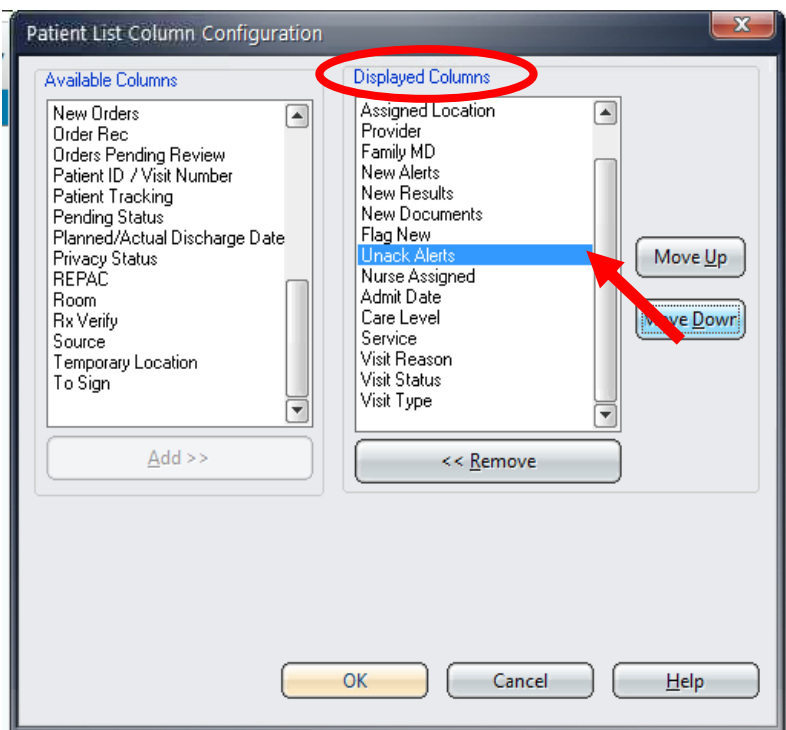
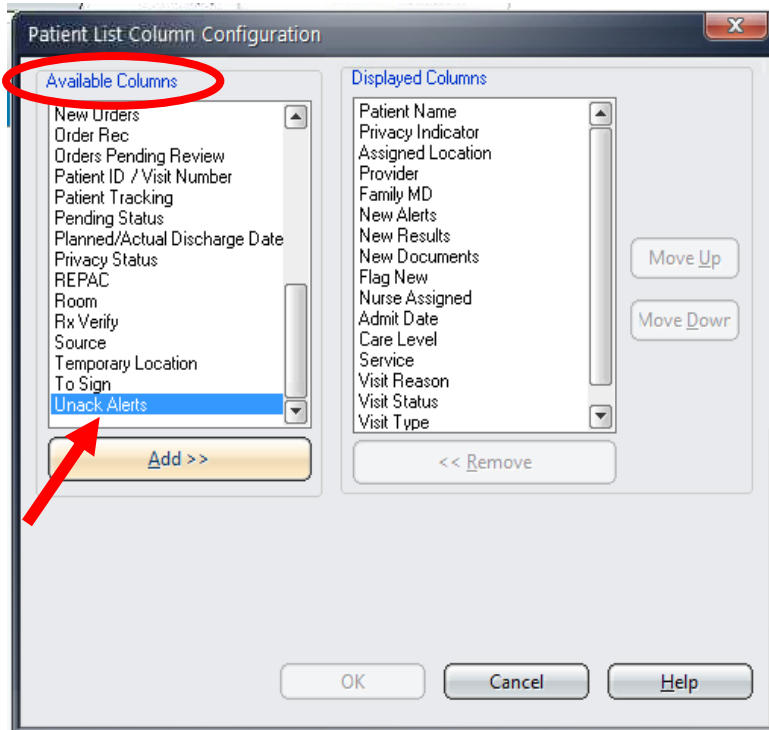
Surgeon Quick Reference Sheet

How to add Unack Alerts column on SCM:

1. Log into SCM. Click **Actions**, followed by **Select Visit List Column**.



2. A pop-up window will appear. Scroll down in the **Available Columns** list to find **Unack Alerts**. Click **Add**, then **Unack Alerts** should appear on the **Displayed Columns** list. You have added the column.



RECOGNIZE

1. Identify Unack Alerts on Sunrise Clinical Manager

Current List: 16 Visit(s)

Patient Name	Privacy Indicator	Assigned Location	Age	Provider	Flag New	New Alerts	Unack Alerts	New Orders	New Res...	New Docu...	To V...	To Sign	ARO/M ...
	Normal											✓	
	Normal											✓	
	Normal											✓	
	Normal											✓	Y
	Normal											✓	
	Normal											✓	
	Normal						1					✓	
	Normal						1					✓	
	Normal											✓	
	Normal											✓	

2. Double-click red flag to determine stage of AKI and medication safety concerns.

Alert Summary

Ac...	Vi...	D...	Alert	Created	Priority	Type	Comment	Scope
✓			STAGE 1 AKI Alert	2016-May-10 09:53	HIGH	WARNING		Chart

Alert: **STAGE 1 AKI Alert**

Message: This patient has met criteria for STAGE 1 Acute Kidney Injury (= 26 mmol/L increase in serum creatinine within 48 hours or 50% increase within 7 days) based upon the serum creatinine value drawn 2016-May-09 09:40:00

[Expand](#)

[References](#)

This patient is current receiving the following medications which may cause or are usually avoided in Acute Kidney Injury:

celecoxib cap, furosemide infusion, ibuprofen tab, indomethacin cap

Status: Unacknowledged By: Acknowledged When:

3. View AKI Clinical Summary for details on volume status, and active medications that may affect kidney function or require due adjustment in AKI.

Patient List Orders Results Patient Info Timeline Documents **Clinical Summary** AB Netcare Portal

view: Acute Kidney Injury 1 week 2017-Dec-15 15:55 To 2017-Dec-22 15:55

AKI Stage	Date Onset	Creatinine Level
STAGE 3 AKI Alert	2017-Dec-19 02:31	379

7 Day Creatinine Urea

Date	Creatinine LEVEL	Urea
Dec-17-2017	270.0	17.2
Dec-18-2017	354.0	21.5
Dec-19-2017	364.8	23.8
Dec-20-2017	339.0	23.2
Dec-21-2017	293.0	
Dec-22-2017	250.0	

AKI Specific Medications

Medication	Order Date	Status	Last Given
MAY CAUSE AKI

IVs and Drips

IV and Components	Rate
+ IV Solution (mL)	

RESPOND

4. Consider using the AKI order set to administer fluid interventions accordingly for hypovolemic, euvolemic, or hypervolemic patients.

For hypovolemic/potentially volume responsive patients, specify and monitor safety parameters and efficacy targets based on risk of fluid overload.

Order		Who	When	Frequency	Additional Information																																																																																																				
<p>Isotonic crystalloids are preferred for initial management for expansion of intravascular volume in patients with AKI. Crystalloids are preferred over colloid solutions in most scenarios - exceptions may include liver failure/suspected spontaneous bacterial peritonitis, and burns.</p>																																																																																																									
<p>Risk of Fluid Overload Causing Cardio-Respiratory Compromise</p> <table border="1"> <tr> <td>Low</td> <td>No history of heart failure. Left ventricular ejection fraction greater than 55%. No history of chronic kidney disease. No third spacing of fluids.</td> </tr> <tr> <td>Intermediate</td> <td>Heart failure (mild systolic dysfunction). Left ventricular ejection fraction 45-55%. History of chronic kidney disease. Minor third spacing of fluids.</td> </tr> <tr> <td>High</td> <td>History of heart failure (moderate or severe dysfunction). Left ventricular ejection fraction less than 45%. History of advanced chronic kidney disease. Significant third spacing of fluids.</td> </tr> </table>						Low	No history of heart failure. Left ventricular ejection fraction greater than 55%. No history of chronic kidney disease. No third spacing of fluids.	Intermediate	Heart failure (mild systolic dysfunction). Left ventricular ejection fraction 45-55%. History of chronic kidney disease. Minor third spacing of fluids.	High	History of heart failure (moderate or severe dysfunction). Left ventricular ejection fraction less than 45%. History of advanced chronic kidney disease. Significant third spacing of fluids.																																																																																														
Low	No history of heart failure. Left ventricular ejection fraction greater than 55%. No history of chronic kidney disease. No third spacing of fluids.																																																																																																								
Intermediate	Heart failure (mild systolic dysfunction). Left ventricular ejection fraction 45-55%. History of chronic kidney disease. Minor third spacing of fluids.																																																																																																								
High	History of heart failure (moderate or severe dysfunction). Left ventricular ejection fraction less than 45%. History of advanced chronic kidney disease. Significant third spacing of fluids.																																																																																																								
<p>Select appropriate solution according to risk for fluid overload</p> <p>Select 0.9% NaCl infusion: <input type="text" value="if intravascular volume expansion WITHOUT alkalization."/></p> <p>Select lactated ringers (LR): <input type="text" value="if intravascular volume expansion WITH alkalization."/></p>																																																																																																									
<p>Patient Care</p> <p>Please specify fluid safety parameters and efficacy targets in the clinical communication orders below.</p>																																																																																																									
<table border="1"> <thead> <tr> <th colspan="2">Order</th> <th>Who</th> <th>When</th> <th>Frequency</th> <th>Additional Information</th> </tr> </thead> <tbody> <tr> <td colspan="6">- Monitoring - 2 item(s)</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>Vital Signs</td> <td></td> <td></td> <td>q1h</td> <td>Perform directly prior to bolus infusion...</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>Monitor Output</td> <td></td> <td></td> <td>q1h</td> <td>Perform directly prior to bolus infusion...</td> </tr> <tr> <td colspan="6">- Safety Parameters - 2 item(s)</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>Clinical Communication</td> <td></td> <td></td> <td></td> <td>Safety Parameters: Stop bolus infusion if...</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>Notify</td> <td>Attending Physician</td> <td>Immediately - when Volume Administration Safety Concerns are...</td> <td></td> <td></td> </tr> <tr> <td colspan="6">- Efficacy Targets - 2 item(s)</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Clinical Communication</td> <td></td> <td></td> <td></td> <td>Efficacy Targets: Stop bolus infusion if...</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Notify</td> <td>Attending Physician</td> <td>Immediately - when Volume Administration Efficacy Targets are...</td> <td></td> <td></td> </tr> <tr> <td colspan="6">- Notify - 1 item(s)</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Notify</td> <td>Attending Physician</td> <td>To re-assess patient if boluses are completed and efficacy targets...</td> <td></td> <td></td> </tr> </tbody> </table>						Order		Who	When	Frequency	Additional Information	- Monitoring - 2 item(s)						<input checked="" type="checkbox"/>	Vital Signs			q1h	Perform directly prior to bolus infusion...	<input checked="" type="checkbox"/>	Monitor Output			q1h	Perform directly prior to bolus infusion...	- Safety Parameters - 2 item(s)						<input checked="" type="checkbox"/>	Clinical Communication				Safety Parameters: Stop bolus infusion if...	<input checked="" type="checkbox"/>	Notify	Attending Physician	Immediately - when Volume Administration Safety Concerns are...			- Efficacy Targets - 2 item(s)						<input type="checkbox"/>	Clinical Communication				Efficacy Targets: Stop bolus infusion if...	<input type="checkbox"/>	Notify	Attending Physician	Immediately - when Volume Administration Efficacy Targets are...			- Notify - 1 item(s)						<input type="checkbox"/>	Notify	Attending Physician	To re-assess patient if boluses are completed and efficacy targets...																														
Order		Who	When	Frequency	Additional Information																																																																																																				
- Monitoring - 2 item(s)																																																																																																									
<input checked="" type="checkbox"/>	Vital Signs			q1h	Perform directly prior to bolus infusion...																																																																																																				
<input checked="" type="checkbox"/>	Monitor Output			q1h	Perform directly prior to bolus infusion...																																																																																																				
- Safety Parameters - 2 item(s)																																																																																																									
<input checked="" type="checkbox"/>	Clinical Communication				Safety Parameters: Stop bolus infusion if...																																																																																																				
<input checked="" type="checkbox"/>	Notify	Attending Physician	Immediately - when Volume Administration Safety Concerns are...																																																																																																						
- Efficacy Targets - 2 item(s)																																																																																																									
<input type="checkbox"/>	Clinical Communication				Efficacy Targets: Stop bolus infusion if...																																																																																																				
<input type="checkbox"/>	Notify	Attending Physician	Immediately - when Volume Administration Efficacy Targets are...																																																																																																						
- Notify - 1 item(s)																																																																																																									
<input type="checkbox"/>	Notify	Attending Physician	To re-assess patient if boluses are completed and efficacy targets...																																																																																																						
<p>Hypovolemic/Volume responsive pt - NaCl</p> <table border="1"> <thead> <tr> <th>Order</th> <th>Bolus</th> <th>Volume</th> <th>Unit</th> <th>Frequency</th> <th>Adjustable Rate</th> <th>Start Priority</th> <th>Stop After</th> <th>Advisory Note</th> <th>Additional Information</th> </tr> </thead> <tbody> <tr> <td colspan="10">- LOW risk - 2 item(s)</td> </tr> <tr> <td><input type="checkbox"/></td> <td>0.9% NaCl infusion</td> <td><input checked="" type="checkbox"/></td> <td></td> <td>mL</td> <td>once</td> <td>Give over 30 minutes</td> <td>STAT</td> <td></td> <td>Recommended: 250 to 1000.. INITIAL bolus. LOW..</td> </tr> <tr> <td><input type="checkbox"/></td> <td>0.9% NaCl infusion</td> <td><input checked="" type="checkbox"/></td> <td></td> <td>mL</td> <td>q1h</td> <td>Give over 30 minutes</td> <td>Routine</td> <td></td> <td>Recommended: 250 to 1000.. REPEAT bolus. If..</td> </tr> <tr> <td colspan="10">- INTERMEDIATE risk - 2 item(s)</td> </tr> <tr> <td><input type="checkbox"/></td> <td>0.9% NaCl infusion</td> <td><input checked="" type="checkbox"/></td> <td></td> <td>mL</td> <td>once</td> <td>Give over 30 minutes</td> <td>STAT</td> <td></td> <td>Recommended: 100 to 500 mL. INITIAL Bolus...</td> </tr> <tr> <td><input type="checkbox"/></td> <td>0.9% NaCl infusion</td> <td><input checked="" type="checkbox"/></td> <td></td> <td>mL</td> <td>q1h</td> <td>Give over 30 minutes</td> <td>Routine</td> <td></td> <td>Recommended: 100 to 500 mL. REPEAT bolus. If..</td> </tr> <tr> <td colspan="10">- HIGH risk - 2 item(s)</td> </tr> <tr> <td><input type="checkbox"/></td> <td>0.9% NaCl infusion</td> <td><input checked="" type="checkbox"/></td> <td></td> <td>mL</td> <td>once</td> <td>Give over 30 minutes</td> <td>STAT</td> <td></td> <td>Recommended: 100 to 250 mL. INITIAL bolus. HIGH..</td> </tr> <tr> <td><input type="checkbox"/></td> <td>0.9% NaCl infusion</td> <td><input checked="" type="checkbox"/></td> <td></td> <td>mL</td> <td>q1h</td> <td>Give over 30 minutes</td> <td>Routine</td> <td></td> <td>Recommended: 100 to 250 mL. REPEAT bolus. If..</td> </tr> </tbody> </table>						Order	Bolus	Volume	Unit	Frequency	Adjustable Rate	Start Priority	Stop After	Advisory Note	Additional Information	- LOW risk - 2 item(s)										<input type="checkbox"/>	0.9% NaCl infusion	<input checked="" type="checkbox"/>		mL	once	Give over 30 minutes	STAT		Recommended: 250 to 1000.. INITIAL bolus. LOW..	<input type="checkbox"/>	0.9% NaCl infusion	<input checked="" type="checkbox"/>		mL	q1h	Give over 30 minutes	Routine		Recommended: 250 to 1000.. REPEAT bolus. If..	- INTERMEDIATE risk - 2 item(s)										<input type="checkbox"/>	0.9% NaCl infusion	<input checked="" type="checkbox"/>		mL	once	Give over 30 minutes	STAT		Recommended: 100 to 500 mL. INITIAL Bolus...	<input type="checkbox"/>	0.9% NaCl infusion	<input checked="" type="checkbox"/>		mL	q1h	Give over 30 minutes	Routine		Recommended: 100 to 500 mL. REPEAT bolus. If..	- HIGH risk - 2 item(s)										<input type="checkbox"/>	0.9% NaCl infusion	<input checked="" type="checkbox"/>		mL	once	Give over 30 minutes	STAT		Recommended: 100 to 250 mL. INITIAL bolus. HIGH..	<input type="checkbox"/>	0.9% NaCl infusion	<input checked="" type="checkbox"/>		mL	q1h	Give over 30 minutes	Routine		Recommended: 100 to 250 mL. REPEAT bolus. If..
Order	Bolus	Volume	Unit	Frequency	Adjustable Rate	Start Priority	Stop After	Advisory Note	Additional Information																																																																																																
- LOW risk - 2 item(s)																																																																																																									
<input type="checkbox"/>	0.9% NaCl infusion	<input checked="" type="checkbox"/>		mL	once	Give over 30 minutes	STAT		Recommended: 250 to 1000.. INITIAL bolus. LOW..																																																																																																
<input type="checkbox"/>	0.9% NaCl infusion	<input checked="" type="checkbox"/>		mL	q1h	Give over 30 minutes	Routine		Recommended: 250 to 1000.. REPEAT bolus. If..																																																																																																
- INTERMEDIATE risk - 2 item(s)																																																																																																									
<input type="checkbox"/>	0.9% NaCl infusion	<input checked="" type="checkbox"/>		mL	once	Give over 30 minutes	STAT		Recommended: 100 to 500 mL. INITIAL Bolus...																																																																																																
<input type="checkbox"/>	0.9% NaCl infusion	<input checked="" type="checkbox"/>		mL	q1h	Give over 30 minutes	Routine		Recommended: 100 to 500 mL. REPEAT bolus. If..																																																																																																
- HIGH risk - 2 item(s)																																																																																																									
<input type="checkbox"/>	0.9% NaCl infusion	<input checked="" type="checkbox"/>		mL	once	Give over 30 minutes	STAT		Recommended: 100 to 250 mL. INITIAL bolus. HIGH..																																																																																																
<input type="checkbox"/>	0.9% NaCl infusion	<input checked="" type="checkbox"/>		mL	q1h	Give over 30 minutes	Routine		Recommended: 100 to 250 mL. REPEAT bolus. If..																																																																																																

5. Manage adverse medications for AKI patients and monitor any Adverse Drug Warning alerts that appear when a nephrotoxic medication is ordered for an AKI patient.

- ✓ Consider **stopping flagged medications that** affect kidney function and can worsen AKI
- ✓ Consider adjusting doses for **renally cleared drugs** for cases of persistent severe AKI (Stage 2 or Stage 3 AKI only)

Consult Lexicomp or phone clinical pharmacist if needed.

Alert Summary

Ac...	Vi...	D...	Alert	Created	Priority	Type	Comment	Scope
✓	✓		AKI Alert	2016-May-13 13:10	HIGH	WARNING	test	Chart

Alert: AKI Alert

Message: **ADVERSE DRUG EVENTS WARNING FOR ACUTE KIDNEY INJURY**

[Expand](#) This patient has developed STAGE 1 Acute Kidney Injury within the last 48 hours 2016-May-13 13:07:31

[References](#) This medication may cause worsening kidney function and/or is usually avoided in Acute Kidney Injury: celecoxib cap, metoLAZONE liquid

REFER

6. The AKI order set provides guidance for consultation with specialists. Refer to [AHS Clinical Knowledge Topic on Acute Kidney Injury](#) for further guidance of AKI management.

Consults

Consider discussing the management of AKI with a nephrologist when one or more of the following are present:

- Possible diagnosis that may need specialist treatment
- AKI of unclear etiology
- Progressive AKI despite correction of pre-renal/post-renal factors
- Kidney Transplant
- Pre-existing advanced chronic kidney disease, eGFR less than 30 mL/min/1.73 m2
- Complications associated with AKI which may require renal replacement therapy (hyperkalemia, metabolic acidosis or fluid overload refractory to medical therapy, symptoms/complications of uremia such as pericarditis, encephalopathy)

In the setting of AKI in conjunction with liver failure or heart failure, hepatology/nephrology or cardiology/nephrology consultations should be considered.. Consider consulting a transplant service when AKI occurs in conjunction with immunosuppression for solid organ transplant.

Consult - Nephrology MD Consult

Consult - Hepatology MD Consult

Consult - Cardiology MD Consult

Consult - Transplant MD Consult