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Document History:

Title:	Use of Iodinated Contrast Media in CT for Patients with Reduced Kidney Function	Site(s):	Shared Health Diagnostic Services - Provincial
Document #:	**130-10-02**	**Version #:**	**06**
Section:	**Diagnostic Imaging**	**Subsection:**	**General Policies & Procedures**

Approved by: *(approval on file)*	Dr. S. Ying	**Date:**	13-JAN-2025
		Effective Date:	06-FEB-2025

Details of Recent Revision

V05 Notes for revision:

1. Reason for Change Request: Use of iSTAT creatinine in rural sites is causing confusion regarding eGFR calculation and appropriateness.
    a. Description of Desired Changes: Addition of whole blood creatinine eGFR cut-off (35 mL/min/1.73m2) for AKI risk assessment.
2. Revise to add current CAR guidance

V06 Notes for revision:

3.2.2.2 NB: change serum to whole blood

1.0 PURPOSE:

1.1 Radiographic contrast agents have been known to cause acute kidney injury and reduced glomerular filtration rate. As such, it is important to identify and manage patients at risk for possible renal complications from radiological exams requiring intravenous contrast.

2.0 DEFINITIONS:

2.1 Contrast-associated acute kidney injury (CA-AKI) is a condition in which a deterioration in renal function occurs within 48 hours of the intravascular administration of a contrast medium. An increase in serum creatinine (SCr) by > 26.4 µmol/L or ≥ 50% above baseline, or alternatively reduction of urine output to ≤ 0.5 mL/kg/hour for at least 6 hours, meets criteria for acute kidney injury. This includes contrast induced AKI as well as other causes of AKI, such as acute tubular necrosis, acute interstitial nephritis, and atheroembolic disease. The term "associated" makes the distinction that AKI cannot be directly attributed to contrast.

2.2 Estimated Glomerular Filtration Rate (eGFR) is used to screen for and detect early kidney damage, to help diagnose chronic kidney disease (CKD) and monitor kidney status. It is a number based on a blood test for creatinine, a waste product in the blood.

Patients "at risk" of developing contrast induced nephropathy should include, but are not limited to those with:

- History of chronic kidney disease, particularly eGFR <30ml/min/1.73m^2
- Diabetes
- Age 70+
- Organ transplant
- Paraproteinemia syndromes / diseases (e.g. myeloma)
- Patients receiving potentially nephrotoxic medications (e.g. interleukin or other chemotherapy agents that may lead to nephrotoxicity or dehydration, non-steroidal anti-inflammatory drugs, ACE inhibitors or angiotensin receptor blockers, loop diuretics, aminoglycosides, vancomycin, amphotericin B).
- Low perfusion states (eg. dehydration, shock, sepsis, heart failure)
- Prior renal surgery or solitary kidney.

3.0 POLICY:

3.1 Policy Statements:

3.1.1 All patients requiring contrast enhanced CT procedures must be screened to identify the presence of any renal risk factors by the referring practitioner when filling out the requisition.

3.1.2 For **outpatients**, a simple screening questionnaire is sufficient: "Do you have kidney problems or a kidney transplant?" and "have you seen, or are you waiting to see, a kidney specialist or urologist (kidney surgeon)?". eGFR is only required if answering "yes" to either of these questions.

3.1.2.1 Acceptable timeframe of outpatient eGFR values varies on the clinical scenario, but is reasonable to consider bloodwork within 3-6 months as current.

3.1.3 All **inpatient** and **emergency** patients should have a SCr and eGFR calculated from that admission, and the acceptable time interval between assessing SCr and performance of the scan will vary depending on patient history. This is at least within 7 days for an inpatient, or upon presentation for ER patients. It is recommended that for inpatients with fluctuating or impaired renal function, a SCr be drawn within 24 hours of the CT.

3.1.3.1 Contrast use in the setting of known AKI requires assessment of risk-benefit of possible worsening AKI versus benefit to diagnostic capability or intervention.

3.1.4 In emergent situations contrast can be injected without SCr/eGFR at the discretion of the referring physician or radiologist. This should be documented in the patient record.

3.1.5 Patients with chronic kidney failure who are receiving dialysis may receive contrast media as per routine.

3.1.6 Patients with acute kidney injury may receive IV contrast at the discretion of the referring physician, nephrologist or radiologist. This should be documented in the patient record.

3.2 Risk Stratification:

3.2.1 Risk of developing CA-AKIwill be determined from eGFR levels calculated from SCr. The level of risk will be stratified as follows:

- eGFR > 30 low to very low risk;
- eGFR < 30, and/or those with AKI, and/or those receiving a high volume of intra-arterial contrast are at risk.

3.2.2 eGFR values calculated by SH laboratories will be used to determine risk stratification. These values are reported in the blood serum analysis reports and are calculated as follows:

3.2.2.1 The Chronic Kidney Disease Epidemiology Collaboration formula is used for adults (CKD-EPI).

3.2.2.2 The Schwartz formula is used for pediatric patients (< 18 years of age). *eGFR (Bedside Schwartz* Formula) = *41.3 mL/min/1.73m^2(4 year old male. Height: 100 centimeters).*

NB: Whole Blood creatinine values using iSTAT point-of-care testing has poor precision (+/- 7%). For this reason, a threshold for risk will be set at an eGFR >35.

3.2.3 If for any reason the laboratory results do not include eGFR values the following on-line calculators should be used:

3.2.3.1 CKD-EPI GFR calculator (for adults): https://www.niddk.nih.gov/health-information/communication-programs/nkdep/laboratory-evaluation/glomerular-filtration-rate-calculators/ckd-epi-adults-si-units

3.2.3.2 Schwartz GFR calculator (for pediatric patients < 18 years): http://nephron.com/bedside_peds_nic.cgi

3.2.4 Serum Creatinine has limitations as an accurate measure of glomerular filtration rate as it is considerably influenced by patient gender, muscle mass, nutritional status and age. Certain conditions can provide false information regarding eGFR (eg. pregnancy, liver cirrhosis, decreased muscle mass) and must be taken into consideration when determining if contrast media should be used.

Workflow is summarized in appendix A

3.3 Preventative Measures:

Measures for prevention of CIN consist of: choice of contrast media, hydration regimen, Metformin abstinence, alternative imaging procedures, and follow-up on renal function.

3.3.1 Choice of Contrast Media:

It is no longer recommended to use of iso-osmolar ICM for reducing risk of CA-AKI. Decisions about low-osmolar or iso-osmolar contrast media should be made based on other factors (e.g. cost and availability)

3.3.2 Hydration:
- eGFR > 30: No need for hydration
- eGFR <30: There is a lack of evidence for the benefit of volume expansion. For intra-arterial injection, there is also equivocal evidence for hydration and the decision is left to the judgement of the practitioner.

3.3.3 Imaging Considerations:
Consider non-contrast CT and MRI or ultrasound procedures.

If other imaging methods are not suited as replacements to contrast enhanced CT then consider the following:

3.3.3.1 Patients with acute kidney injury who are receiving dialysis may receive IV contrast at the discretion of the referring physician or nephrologists.
3.3.3.2 Scanning with low kV, or use of low kV equivalent dual energy post-processing, can allow for reduced intravenous contrast dosing.

3.3.4 For patients at high risk of developing CIN, eGFR < 30; following examinations which required contrast injection, CT departments will send a letter to the ordering physician informing them of the need to follow-up with the patient and obtain repeat SCr/eGFR results in 48 - 72 hours, or place a note in the chart for inpatients.

3.3.5 Metformin (Glucophage):
The diagnostic imaging / CT department must be made aware of any patients taking any hypoglycemic medication (metformin / Glucophage). When making appointments for intravenous contrast enhanced studies the patient or the referring physician's office will be asked if such medication is being taken. Metformin itself is not nephrotoxic, but increases the theoretical risk of lactic acidosis if PC-AKI occurs.

3.3.5.1 eGFR levels will be used to determine whether the intravenous contrast procedures are done.
3.3.5.2 Stopping Metformin prior to IV administration of contrast media is unnecessary in patients with an eGFR >30
3.3.5.3 For patients with eGFR < 30, withhold Metformin for at least 48 hours after IV administration of contrast media.
3.3.5.4 For all patients whose eGFR was < 30, diagnostic imaging will send a letter to the ordering physician informing them to follow up on SCr/eGFR in 48-72 hours following the examination.
3.3.5.5 The ordering physician will determine if SCr/eGFR levels are acceptable prior to restarting metformin.

3.3.6 N-Acetylcysteine (Mucomist):
In general Acetylcysteine is not contraindicated, but available evidence suggests it is not effective in preventing CIN and it is not to be used as a substitute for hydration.

4.0 References:

4.1 Macdonald DB, Hurrell C, Costa AF, et al. Canadian Association of Radiologists Guidance on Contrast Associated Acute Kidney Injury. Canadian Association of Radiologists Journal. 2022;73(3):499-514. doi:10.1177/08465371221083970
4.2 European Society of Urogenital Radiology Guidelines on Contrast Media, Online source: htpp://esur-cm.org/index.php/en/ ; 2018
4.3 ACR Manual on Contrast Media 2024; Online source: https://www.acr.org/-/media/ACR/Files/Clinical-Resources/Contrast_Media.pdf

5.0 Policy Contact:

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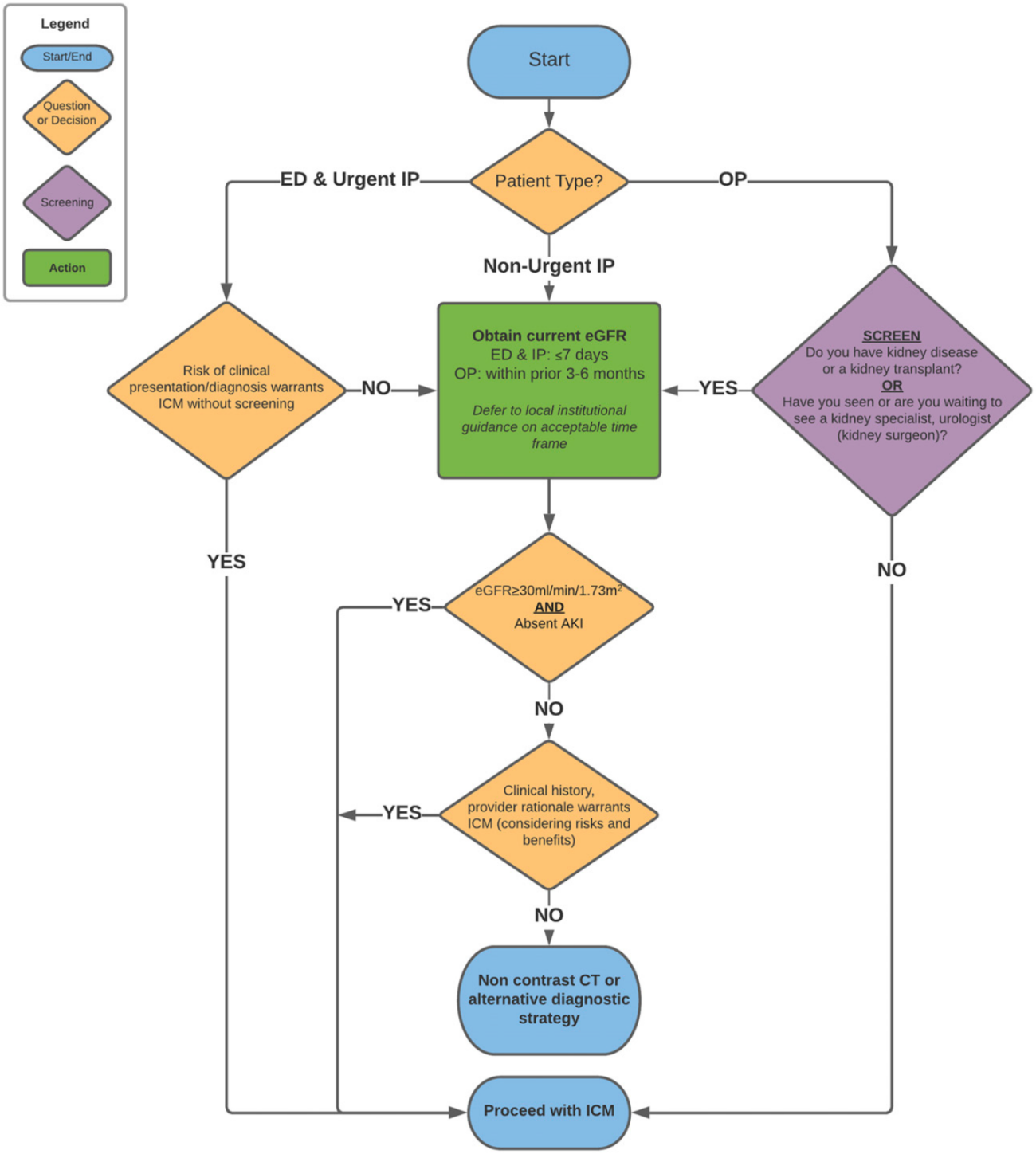
APPENDIX A: From



Any patient requiring diagnosis for urgent and/or life threatening diagnosis should not have their scan delayed for the purposes of screening.

Definitions: eGFR: Estimated Glomerular Filtration Rate, ED: Emergency Department, IP: Inpatients, OP: Outpatients, ICM: Iodinated Contrast Media