

Gadolinium

Rationale: Patients with moderate to severe kidney disease may develop nephrogenic systemic fibrosis (NSF) after administration of gadolinium-based contrast media.

Screening: All patients do *not* necessarily need a serum creatinine determination before an exam with iodinated contrast (Frequently Asked Questions: Iodinated Contrast Agents *Radiographics*: 2004; 24:S3-S10). All patients should be screened for the following risk factors of contrast nephrotoxicity (Adapted from the ACR Manual on Contrast Media, 2004):

- History of “kidney disease”, including surgery, tumor and transplant.
- Family history of kidney disease
- Myeloma
- Diabetes
- Potentially nephrotoxic medications (e.g. metformin, chemotherapy, long term nonsteroidal anti-inflammatory drugs), please refer to document entitled “Contrast Media Drug-Drug interactions” for a more comprehensive list of medications.
- ≥ 70 years of age

A serum BUN and creatinine will be obtained in all patients with any of the above stated risk factors. Normal values less than 2 months will be adequate. Abnormal values less than 10 days old will be adequate. Otherwise they should be repeated. These are guidelines and may vary based upon a certain clinical situation.

Serum creatinine has limitations as an accurate measure of renal function, affected by a patient’s age, gender and muscle mass. A more reliable renal function assessment is to estimate GFR. There are a number of formulas for estimating adult creatinine clearance (eGFR). We will use the simplified MDRD calculation for adult patients over 18 years of age.

$$186 \times \frac{1}{\text{Creat}^{1.154}} \times \frac{1}{\text{Age}^{0.203}} \times 1 \text{ if male (or } 0.742 \text{ if female)} \times 1 \text{ if non-black (default) or } 1.21 \text{ if black}$$

This will be simplified in daily use by accessing any of a number of calculators on the internet. These can also be downloaded as well. The first link also has a pediatric calculator for those up to 18 years of age, based on the Schwartz equation.

The third link has a Cockcroft Gault calculation, which is an alternative to the MDRD calculator, which some prefer to use in elderly and/or heavy patients, but work essentially the same for screening purposes.

http://www.kidney.org/professionals/KLS/gfr_calculator.cfm
http://nkdep.nih.gov/professionals/gfr_calculators/orig_con.htm
<http://nephron.com/cgi-bin/CGSI.cgi>
http://www.kidney.org/professionals/KDOQI/gfr_calculator.cfm
<http://mdrd.com/>

The estimated glomerular filtration rates calculated will be reported to the radiologist if below 60 mL/min/1.73m²

Table 10. Stages of Chronic Kidney Disease

Stage	Description	GFR (mL/min/1.73 m ²)
1	Kidney damage with normal or ↑ GFR	≥90
2	Kidney damage with mild ↓ GFR	60–89
3	Moderate ↓ GFR	30–59
4	Severe ↓ GFR	15–29
5	Kidney failure	<15 (or dialysis)

Chronic kidney disease is defined as either kidney damage or GFR <60 mL/min/1.73 m² for ≥3 months. Kidney damage is defined as pathologic abnormalities or markers of damage, including abnormalities in blood or urine tests or imaging studies.

Recommendations: (Based of estimated GFR)

eGFR > 60: (Stages 1 and 2*: Normal to mild decreased GFR)

- Avoid Omniscan
- DOSE: MR-0.1mmol/kg standard agent MRA-0.1 to 0.2mmol/kg standard agent

eGFR – 30-59: (Stage 3*: Moderate decreased GFR)

- Avoid Omniscan
- Patient to sign consent
- Radiologist approval of medical necessity of contrast.
- Maximum recommended dose is 0.1mmol/kg gadolinium, with a maximum of 20 ml of gadolinium chelate.
- Delaying scan if patient has had gadolinium in the past 5 days

eGFR < 30: (Stage 4 and 5*: Severe decreased GFR to kidney failure)

- Gadolinium based contrast is not recommended as a routine first line imaging study. Use of intravenous gadolinium in these patients will need to be determined on a case basis, after exploring other alternative imaging/testing options or possible MR without contrast. Contrast usage and dose will require approval of the radiologist.
- Avoid Omniscan
- Patient to sign consent
- Radiologist approval of medical necessity of contrast.
- Recommend renal consultation prior to study
- Maximum recommended dose is 0.1mmol/kg gadolinium, with a maximum of 20 ml of gadolinium chelate. Consider lower strength contrast dose.
- Delaying scan if patient has had gadolinium in the past 5 days

*(Based on the National Kidney Foundation K/DOQI Stages of Chronic Kidney Disease)

Dialysis Patients:

Patients with renal failure on chronic dialysis are also at risk for developing NSF. Alternative tests or MR without gadolinium should be considered. If gadolinium is necessary, the dose should be limited to 0.1mmol/kg gadolinium, with a maximum of 20 ml of gadolinium chelate. Dialysis should be performed promptly, within 2 hours if possible after the MR study.

If the patient is on peritoneal dialysis, their nephrologist should be consulted and prompt hemodialysis is recommended. If needed, dialysis vascular access is recommended prior to the MR study.

(Adapted from the ACR Guidance Document for Safe MR Practices: 2007 *AJR*:**188**,June 2007)