POLICY ON:
Radiologic Intravascular Contrast

The following document will provide guidelines for the administration of intravascular contrast for both CT and MR examinations. All CT and MR examinations are to be individually protocolled by a radiologist with specific oral and intravenous contrast doses.

COMPUTED TOMOGRAPHY (CT) EXAMINATIONS:

Intravenous Contrast Agents: Standard IV contrast agents include:

- Routine studies
  - Adults: 100 mL of Omnipaque 350
  - Children (18 years of age or under): 1 mL/kg Omnipaque 300
- Angiographic studies
  - Adults: 75 mL of Omnipaque 350 followed by 50 mL saline flush

Creatinine:

- Outpatients:
  - Creatinine should be obtained in the following patient populations within 30 days of the exam:
    - Diabetics
    - History of renal disease (one kidney is not a contraindication)
    - Ongoing chemotherapy
    - Patients 60 years of age and older
- Inpatients and ER patients: ALL REQUIRE A Cr LEVEL PRIOR TO CONTRAST INJECTION.
  - Exceptions: Trauma and high suspicious pulmonary embolus
- Creatinine should be ≤1.8 mg/dl in all patients.
- In patients who IV contrast is necessary but are at high risk for contrast-induced nephropathy, consider reducing the contrast dose OR IV or oral hydration pre and post scan (75-100 mL/hour or 1mL/kg/hr normal saline for 6-12 hours prior to and 4-12 hours following contrast administration).
- Patients with a rapidly rising creatinine, even if less than 1.5, should not receive IV contrast given elevated risk of nephrotoxicity.
- Anuric ESRD patients on dialysis may receive non-ionic IV contrast at any time during the dialysis cycle. ESRD patients requiring only intermittent dialysis should not receive IV contrast.
- Except in emergency settings, no repeat doses of iodinated contrast should be administered within a 24-hour period.

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Other considerations:
- For patients with thyroid cancer who are planning on undergoing radioactive iodine therapy, pretherapy iodinated contrast administration may be contraindicated.
- For hyperthyroid patients, administration of intravascular contrast agents may cause a self-limited delayed hyperthyroidism 4-6 weeks following contrast administration.
- All female patients of child-bearing age should be asked if they could be pregnant. If she is unsure, the ordering physician will be required to obtain a pregnancy test prior to CT examination.
- The ACR indicates that it is safe for mothers to continue to breast feed following iodinated contrast administration.
- For patients taking Metformin:
  - Category 1 – Patients with normal renal function do not need to stop metformin prior to IV contrast administration and do not need to recheck creatinine following the contrast administration.
  - Category 2 – Patients with normal renal function but multiple comorbidities should discontinue metformin for 48 hours from the time of iodinated contrast media administration. Repeat serum creatinine is not mandatory if the patient has normal renal function, is clinically stable and had no intercurrent risk factors for renal damage. Otherwise, a repeat serum creatinine is recommended prior to restarting metformin.
  - Category 3 – Patients with renal dysfunction should suspend the use of metformin at the time of the iodinated contrast media administration and not resume metformin until adequate renal function is reassured.
- Administering iodinated IV contrast to patients in sickle cell crisis or myasthenia gravis crisis may cause acute worsening of symptoms.

Contrast administration will be overseen by a CT technologist. The preferred site of venous access is an antecubital vein or large forearm vein.

IV access:
- Acceptable IV access:
  - Lines that you **CAN** use for power injection (3-5mL/sec):
    - 16g port of a triple lumen catheter
    - Power picc, port (purple, Bard)
    - Single lumen cordis sheath in neck or groin
    - 20g antecubital
      - If 20g antecubital line cannot be obtained, an upper forearm vein may be used with a reduced rate of 2 mL/sec is acceptable for abdominal studies such as dissection, stent graft, aneurysm
    - Additional lines rated to 5 mL/sec.
  - Lines that you **CANNOT** use for power injection (3-5 mL/sec):
    - Hickman
    - Dialysis catheter

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- Portacaths (except power port)
- Arrow single lumen central line
- PICC and mid-lines
- External jugular line (secondary to risk of neck hematoma)
- Any hand vein

Air embolism is rare, but may result in air hunger, dyspnea, cough, chest pain, pulmonary edema, tachycardia, hypotension, or expiratory wheezing. The radiologist should be consulted immediately. Treatment includes administration of 100% oxygen and placing the patient in a left lateral decubitus position.

**Contrast Extravasation Guidelines:** [Iodine and Gadolinium]

Extravasation of contrast medium is toxic to the surrounding tissue, particularly the skin, and can produce an acute inflammatory response. Ulceration and necrosis may result and can be identified as early as 6 hours after the injury.

1. All patients with IV contrast extravasation are to be examined by a radiologist (examination should include a physical examination with evaluation of the extremity, presence of distal pulses, capillary refill, sensation, and motor skills. Document the contrast agent, volume of contrast extravasated and location of extravasation in the radiology report. The ordering physician should also be notified.

2. Treatment protocol:
   a. Elevate arm.
   b. Place hospital cold pack (or ice) adjacent to the region of extravasation. Note - ice to be wrapped in a sheet or towel to reduce the risk of frost bite.
   c. Loosely wrap the affected extremity with ace bandage to hold cold pack or ice in place.
   d. If either at the time of extravasation or at check at 5 and 10 minutes, there is a concern of intense pain and decreased sensation, call plastic surgery for an emergent consult. The 2015 ACR Manual of Contrast Media recommends an immediate surgical consult for the following: progressive swelling or pain, altered tissue perfusion as evident by decreased capillary refill at any time after the extravasation has occurred, change in sensation in the affected limb, and skin ulceration or blistering. It is important to note that initial symptoms of a compartment syndrome may be relatively mild (such as limited to the development of focal paresthesia).
   e. If the injury does not seem severe, continue with steps (a – c) above.
   f. If no appreciable injury, damage or abnormal patient sensation, then the patient can be discharged, at one hour at the earliest. If there is any uncertainty, then patient should be kept and monitored for 3 hours.
   g. When discharging, patient instructions must include to return to the emergency department if arm pain or significant abnormal sensation occurs in the injection site and areas distal to it.
   h. For outpatients, the radiology nurse follows up with the outpatient via a phone call the next day and subsequent days if needed based upon the patient assessment and

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physician orders. For inpatients and ER patients, the clinical team will resume care of the patient

i. Steps (a – c) above are standing orders for nursing staff. Steps (d – g) are to be initiated by a physician or physician assistant in Radiology.

**Contrast Reaction Guidelines:** [Iodine and Gadolinium]

1. **Mild** – Nausea and vomiting, urticarial, erythema, and transient hypotension. Mild reactions do not require treatment according to ACR, 2013, but the patient should be monitored for 20-30 minutes to ensure that the symptoms do not worsen.

2. **Moderate** – Symptomatic urticarial, vasovagal reactions, bronchospasm, tachycardia and mild laryngeal edema. Moderate reactions require close monitoring (vital signs every 5 minutes, pulse oximeter in place and continuous observation by staff). Treatment may include diphenhydramine for symptomatic hives, leg elevation for hypotension, use of a beta-agonist inhaler for bronchospasm, or epinephrine for mild laryngeal edema.

3. **Severe reactions** – Vasovagal reactions, moderate to severe bronchospasm, moderate and severe laryngeal edema, loss of consciousness, seizures, and cardiac arrest. Treatment usually requires an ACLS algorithm.

All contrast reactions and treatment protocols are to be documented in the radiology report and electronic medical record. The ordering physician is to be notified and the patient is to be educated prior to discharge.

Patients with a prior history of a severe contrast allergy such as anaphylaxis, cardiac or respiratory arrest **should not** receive IV contrast; discuss alternative imaging studies with ordering physician.

All patients with moderate contrast allergies, moderate or severe reactions to foods or medications, or asthmatics on medication should be premedicated prior to the study.

- **13 hour prep (PREFERRED)**
  - Prednisone 50 mg po 13 hr, 7 hr, and 1 hr prior to contrast
  - Benadryl 50 mg po 1 hr prior to contrast
  - MUST have a driver

- **4 hour prep (EMERGENCY PREP ONLY)**
  - Solumedrol 125 mg IV 4 hours prior to contrast
  - Benadryl 50 mg PO/IV 1 hour prior to contrast

- For a mild reaction/prior reaction of hives, no pretreatment is required.

If the patient has a break-through reaction to iodinated contrast, future contrast-enhanced imaging should be discussed with the referring physician.

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MAGNETIC RESONANCE IMAGING (MRI)

Gadolinium Contrast (Please see MRI contrast flow chart - Appendix A):

Background:
A separate policy on gadolinium administration is necessary because of the uniquely different associations of iodine and gadolinium contrast agents. The condition nephrogenic systemic fibrosis (NSF) has been associated with prior administration of gadolinium chelate contrast administration, the standard contrast agent used in MRI.

It appears that NSF arises from deposition of free gadolinium into skin connective tissue and connective tissues of other organs, and that gadolinium stimulates the activity of circulating fibrocytes to deposit collagen into these various tissues. The circumstances that result in NSF appear to be the combination of (1) less stable gadolinium chelates use and (2) patients who cannot readily eliminate the agents through glomerular filtration due to compromised renal function. Anyone with substantially diminished renal function may develop the condition. The agents currently in use at UNC are Multihance, Gadavist, Dotarem and Eovist, all of which have no or a very low association with NSF.

Evaluation Prior to Contrast Administration: [Gadolinium Contrast]

Patient Questionnaire for Gadolinium Use

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Do you currently have kidney disease?</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>2. Do you have a history of kidney disease?</td>
<td>□</td>
<td>□</td>
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<tr>
<td>3. Are you on dialysis (hemodialysis or peritoneal dialysis), or have you received a kidney transplant?</td>
<td>□</td>
<td>□</td>
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<tr>
<td>4. Do you have severe high blood pressure for &gt; 10 years?</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>5. Do you have insulin dependent diabetes for &gt; 10 years?</td>
<td>□</td>
<td>□</td>
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<tr>
<td>6. Are you, or could you be, pregnant?</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
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Laboratory Values

UNC Gadolinium Policy

1. No linear nonionic agent is administered to any patient.
2. ½ dose (0.05 mmol/kg) Multihance is to be used on all adult body and MSK subjects. Full dose (0.1 mmol/kg) is to be used on most adult Neuro applications, at the discretion of the

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Neuroradiologist overseeing the study. In select liver studies, 0.025 mmol/kg Eovist is to be used, at the discretion of the body radiologist overseeing the study. Pediatric studies are to be performed with full dose (0.1 mmol/kg) Dotarem. Additionally, full dose Gadavist (0.01 mmol/kg) may be used in patients with acute adverse reactions and as a second line agent in pediatric studies.

3. Patients in stage V chronic kidney disease (eGFR < 15 mL/min/1.73 m²) and acute renal failure or on dialysis will receive ¼ dose (0.025 mmol/kg) Multihance or (0.05 mmol/kg) Dotarem with the latter preferred, at the discretion of the supervising radiologist. As no case of NSF has been associated with the isolated use of Dotarem (>40 million doses) or Multihance (>20 million doses), stage IV chronic kidney disease (eGFR 15-30 mL/min/1.73 m²) is no longer considered a strong contraindication to use of gadolinium-based contrast agents, full dose or half dose. Stage III chronic kidney disease is not a contraindication for gadolinium-based contrast agent use. MR technologists have been informed to evaluate patient history on CIS for evidence of renal compromise, include sCr, eGFR, and other measures.

4. All third trimester pregnant patients in whom gadolinium is deemed necessary will undergo half dose (0.05 mmol/kg) Dotarem, at the discretion of the supervising radiologist.

5. Gadolinium will generally be avoided in 1st and 2nd trimester pregnancies.

6. No double dose gadolinium studies will be performed.

7. No gadolinium will be used as a substitute for iodine contrast in CT, on angiography, or other x-ray procedures.

8. Repeat gadolinium-enhanced MR studies should be avoided within 48 hours. If a repeat study is necessary within 48 hours, more detailed evaluation of renal function will be necessary. If renal function is moderately compromised, repeat gadolinium-enhanced studies will not be performed, and either a non-contrast study or a delay beyond 48 hours will be performed. Currently under assessment is gadolinium-based contrast agent deposition in all patients; therefore, caution is recommended in patients who are to receive multiple gadolinium-based contrast agent enhanced studies over time.

9. Patients with greater than 10-year history of poorly controlled hypertension, greater than 10-year history of insulin-dependent diabetes, and patients older than 70 years of age who are treated for hypertension or diabetes will undergo full dose Dotarem (0.1 mmol/kg).

10. Patients who are already on hemodialysis should undergo hemodialysis as soon as reasonably feasible following gadolinium-enhanced MRI. A second hemodialysis at 24 hours is suggested but not mandatory. No patient should receive hemodialysis that is not already on hemodialysis, if the indication for dialysis is the MRI study alone.

11. Patients who have experienced a moderate to severe reaction with a specific agent (e.g.: Multihance) will receive another formulary gadolinium agent on follow-up study (e.g.: Dotarem, Gadavist).

12. Modifications of this policy may be implemented on a case by case basis when a risk-benefit analysis has been made and the administration of contrast is deemed medically necessary by the attending radiologist. Such determination will be noted in the patient’s record.
APPENDIX A:

MRI CONTRAST FLOW CHART

ORDER FOR CONTRAST RECEIVED

PATIENT AGE

< 18

No concern for NSF

Consult Physician

1/2 DOSE DOTAREM

DOTAREM 0.1 mmol/kg

COMPLETE EXAM

Concern for NSF or free Gad *

Consult Physician

NO CONTRAST

COMPLETE EXAM

> 18

No concern for NSF

Consult Physician

NO CONTRAST

COMPLETE EXAM

Concern for NSF or free Gad *

MULTIHANCE or DOTAREM

COMPLETE EXAM

COMPLETE EXAM

* see UNC protocol for gadolinium-based contrast agent administration

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