**UPMC Radiology Resident Contrast Manual**

 **2nd Edition – July 2015**

**Updated by Christopher Taylor and Joseph Benjamin.**

**Based on UPMC Radiology Policies and the ACR Manual on Contrast Media Version 10 (2015).**

\*ACR and UPMC Policies included are at the time of initial publication and are subject to change.

**Section I. Contrast Premedication**

**Elective Premedication:**

* Prednisone – 50 mg by mouth at 13 hours, 7 hours, and 1 hour before contrast media injection, plus Diphenhydramine (Benadryl®) – 50 mg intravenously, intramuscularly, or by mouth 1 hour before contrast medium.

OR

* Methylprednisolone (Medrol®) – 32 mg by mouth 12 hours and 2 hours before contrast media. An anti-histamine (as in option 1) can also be added to this regimen injection.

If the patient is unable to take oral medication, 200 mg of hydrocortisone intravenously may be substituted for oral prednisone.

**Pediatric**

* Prednisone 0.5-0.7mg/kg PO (up to 50 mg) 13, 7, and 1 hr prior to contrast injection.
* Diphenhydramine 1.25 mg/kg PO (up to 50 mg) 1 hours prior to injection

Note: Appropriate intravenous doses may be substituted for patients who cannot ingest PO medication

**Emergency Premedication (In decreasing order of desirability)**

* Methylprednisolone (Solu-Medrol®) 40 mg or hydrocortisone (Solu-Cortef®) 200 mg IV STAT and every 4 hours until contrast study plus diphenhydramine 50 mg IV 1 hour prior to contrast injection.

OR

* Dexamethasone (Decadron®) 7.5 mg or betamethasone 6.0 mg intravenously q4h until study must be done in patent with known allergy to methylprednisolone, aspirin, or non-steroidal anti-inflammatory drugs, especially if asthmatic. Also diphenhydramine 50 mg IV 1 hour prior to contrast injection.

OR

* Omit steroids entirely and give diphenhydramine 50 mg IV.

**Note:** When urgent regimen is being considered, there must be communication between the ordering physician and radiologist.In the event of an after-hours emergency protocol, notify the Intensivist on Call if the patient has had a prior severe reaction. IV steroids have not been shown to be effective when administered less than 4 to 6 hours prior to contrast injection.

**From the UPP Radiology/Imaging Services Policy on the use of MRI Contrast Media in Patients with Prior Contrast Media Reaction**

* All patients with a history of a prior anaphylactic or life threatening adverse reaction to an iodine-based contrast agent should undergo the full UPMC-prep prior to receiving gadolinium-based contrast.
* All patients with a history of a prior adverse reaction to administration of an iodine-based contrast agent, regardless of severity, who have had a previous MRI with the administration of IV gadolinium-based contrast media **WITHOUT** reaction, may be imaged without prep.

**Section II. Management of Contrast Reactions**

Evaluation of a patient for potential reaction to contrast:

* How does the patient look?
* Can the patient speak? How does the patient’s voice sound?
* How is the patient breathing?
* What is the patient’s pulse strength and rate?
* What is the patient’s blood pressure?

ACR Categories of Acute Reactions (Subjective, sound clinical judgement advised)

**Mild**

* Signs and symptoms are self-limited and without evidence of progression.

**Allergic Like:** limited urticaria / pruritus, limited cutaneous edema, limited “scratchy” throat, nasal congestion, sneezing, conjunctivitis, rhinorrhea

**Physiologic:** limited nausea/vomiting, transient flushing/warmth/chills, headache, dizziness, anxiety, altered taste, mild hypertension, vasovagal reactions that resolve spontaneously.

**Moderate**

* Signs and symptoms are more pronounced and commonly require medical management. Some of these may become severe if untreated.

**Allergic Like:** Diffuse urticaria / pruritus, diffuse erythema with stable vital signs, facial edema without dyspnea, throat tightness or hoarseness without dyspnea, wheezing/bronchospasm with mild or no hypoxia

**Physiologic:** Protracted nausea/vomiting, hypertensive urgency, isolated chest pain, vasovagal reaction that requires and is responsive to treatment.

**Severe**

* Signs and symptoms are life threatening and can result in death or permanent morbidity if not managed appropriately.
* Arrest is a non-specific end result caused by a variety of severe reactions. If it is unclear what caused the arrest, it may be assumed the reaction is/was allergic-like.
* Pulmonary Edema may occur in patients with limited cardiac reserve function or with normal cardiac function. Non-cardiogenic pulmonary edema may be allergic-like or physiologic.

**Allergic-Like:** Diffuse edema or facial edema with dyspnea, diffuse erythema with hypotension, laryngeal edema with stridor and/or hypoxia, wheezing/bronchospasm with significant hypoxia, anaphylactic shock (hypotension + tachycardia)

**Physiologic:** Vasovagal reaction resistant to treatment, arrhythmia, convulsions/seizures, hypertensive emergency.

**Hives**

Adult:

**Mild** (scattered/transient):

* Observation and documentation may be the appropriate course of action.
* If symptomatic, consider Benadryl 25 or 50mg PO or Allegra (fexofenadrine) 180mg PO. Benadryl can cause drowsiness, so the patient must have a driver or be observed in the RPU (generally 4-6 hours).

**Moderate** (more numerous/bothersome):

* Monitor vitals, preserve IV access
* Benadryl 25-50mg PO/IV/IM (IV dose slow over 1-2 min) or Allegra (fexofenadrine) 180mg PO

**Severe** (widespread and/or progressive):

* Monitor vitals, preserve IV access
* Benadryl 25-50mg IM/IV

Pediatric dosing:

* Observe until hives are resolving. Further observation may be necessary if treatment is administered.
* Consider Benadryl 1-2 mg/kg PO/IV/IM. Max=50 mg

**Diffuse Erythema**

* Preserve IV access, monitor vitals, pulse oximeter, Oxygen by mask 6-10 L/min

**Normotensive:**

* No additional treatment usually needed

**Hypotensive:**

* Call condition C or 911

Adult:

* 1 L rapidly of IV 0.9% normal saline or lactated Ringer’s solutions

**If nonresponsive or profoundly hypotensive:**

* IV Epinephrine 1 mL of 1:10,000 dilution (0.1 mg) slowly into an infusion of fluids or with a saline flush. Repeat every few minutes as needed up to 10 ml total dose (1 mg).

OR

* IM Epinephrine 0.3 mL of 1:1,000 dilution (0.3 mg), repeat q5-15 min up to 1 mL total.
* IM EpiPen or equivalent.

Pediatric dosing:

* IV fluids given at 10-20 mL/kg for a maximum of 500-1,000mL
* IV Epinephrine 0.01 mL/kg of 1:10,000 dilution slowly into an infusion of fluids or with a saline flush. Repeat as needed q5-15 min up to 1 mL total dose.

OR

* IM Epinephrine 0.01 mL/kg of 1:1,000 dilution (max 0.30 mL). Repeat as needed q5-15 min up to 1 mL total dose.
* EpiPen Jr (max 0.15mg if less than 30kg; 0.30mg if more than 30kg)

**Bronchospasm**

* Preserve IV access, monitor vitals, pulse oximeter, Oxygen by mask 6-10 L/min.
* Consider sending patient to ED, calling condition C, or 911 based on completeness of response.

Adult:

**Mild:**

* Beta agonist inhaler (Albuterol) 2 puffs (90mcg/puff) for a total of 180 mcg; can repeat.

**Moderate:** Albuterol as above, can repeat up to 3 times.

* Consider IM Epinephrine 0.3 mL of 1:1,000 dilution (0.3 mg), can repeat q5-15 min up to 1 mL total.
* IM EpiPen or equivalent. Can repeat q5-15 min up to 3 times.

OR

* IV Epinephrine 1 mL of 1:10,000 dilution (0.1 mg) slowly into an infusion of fluids or with a saline flush. Repeat every few minutes as needed up to 10 ml total dose (1 mg).

**Severe:**

* IV Epinephrine 1 mL of 1:10,000 dilution (0.1 mg) slowly into an infusion of fluids or with a saline flush. Repeat every few minutes as needed up to 10 ml total dose (1 mg).

OR

* IM Epinephrine 0.3 mL of 1:1,000 dilution (0.3 mg), can repeat q5-15 min up to 1 mL total.
* IM EpiPen or equivalent. Can repeat q5-15 min up to 3 times.

Pediatric Dosing:

**Mild:**

* Beta agonist inhaler (Albuterol) 2 puffs (90mcg/puff) for a total of 180 mcg; can repeat up to 3 times.

**Moderate:** Albuterol as above.

* IM Epinephrine 0.01 mL/kg of 1:1,000 dilution. Max dose 0.3 mL. Repeat as needed q5-15 min up to 1 mL total dose.
* EpiPen Jr if <30 kg. Dose is 0.15 mL (0.15 mg).
* EpiPen adult if >30 kg. Dose is 0.3 mL (0.3 mg).

OR

* IV Epinephrine 0.01 mL/kg of 1:10,000 dilution slowly into an infusion of fluids or with a saline flush. Max dose 0.15 mg (1.5 mL) if <30 kg and 0.3 mg (3 mL) if >30 kg. Can repeat up to 1 mL total dose.

**Severe:**

* IV Epinephrine 0.01 mL/kg or 0.1 mL/kg of 1:10,000 dilution slowly into an infusion of fluids or with a saline flush. Max dose 1 mL (0.1 mg) Repeat as needed q5-15 min up to 1 mg total dose.

OR

* IM Epinephrine 0.01 mL/kg of 1:1,000 dilution. Max dose 0.30 mL. Repeat as needed q5-15 min up to 1 mL total dose.
* EpiPen Jr if <30 kg.
* EpiPen adult if >30 kg

**Laryngeal Edema**

* Preserve IV access, monitor vitals, pulse oximeter, Oxygen by mask 6-10 L/min.
* Call Condition C if airway compromise or no response to therapy

Adult:

* IV Epinephrine 1 mL of 1:10,000 dilution (0.1 mg) slowly into an infusion of fluids or with a saline flush. Repeat every few minutes as needed up to 10 ml total dose (1 mg).

OR

* IM Epinephrine 0.3 mL of 1:1,000 dilution (0.3 mg), repeat q5-15 min up to 1 mL total.
* IM EpiPen or equivalent.

Pediatric:

* IV Epinephrine 0.01 mL/kg of 1:10,000 dilution slowly into an infusion of fluids or with a saline flush. Repeat as needed q5-15 min up to 1 mL total dose.

OR

* IM Epinephrine 0.01 mL/kg of 1:1,000 dilution. Max dose 0.30 mL. Repeat as needed q5-15 min up to 1 mL total dose.
* EpiPen Jr if <30 kg.
* EpiPen adult if >30 kg

**Hypotension (Systolic BP < 90mm Hg)**

Adult:

* Preserve IV access, monitor vitals, oxygen by mask at 6-10 L/min
* Elevate legs at least 60 degrees, consider 1L of rapid IV normal saline or lactated ringers

**Hypotension + Bradycardia (pulse <60 bpm) (Vasovagal reaction):**

**Mild:**

* No additional treatment usually necessary

**Severe** (Symptomatic despite the above measures):

* Call 911 or Condition C.
* Add IV Atropine 0.6-1.0 mg administered slowly into an infusion of fluids; Can repeat up to 3mg total.

**Hypotension + tachycardia (pulse >100 bpm) (Anaphylactoid reaction)**

* Call 911 or Condition C
* IV Epinephrine 1 mL of 1:10,000 dilution (0.1 mg) slowly into an infusion of fluids or with a saline flush. Repeat every few minutes as needed up to 10 ml total dose (1 mg).

OR

* IM Epinephrine 0.3 mL of 1:1,000 dilution (0.3 mg), repeat q5-15 min up to 1 mL total.
* IM EpiPen or equivalent (0.3 mg dose). Can repeat q5-15 min up to 3 times.

Pediatric (minimum normal BP varies by age):

* IV fluids given at 10-20 mL/kg for a maximum of 500-1,000mL

**Hypotension + Bradycardia (pulse varies) (Vasovagal reaction):**

* IV Atropine 0.02 mg/kg (0.2 mL/kg of 0.1 mg/mL solution) administered slowly into fluids

Minimum single dose = 0.1mg; Maximum single dose = 0.6-1.0 mg;

Max total dose = 1 mg for infants/children and 2 mg for adolescents

**Hypotension + tachycardia (pulse varies) (Anaphylactoid reaction)**

* IV Epinephrine 0.01 mL/kg of 1:10,000 dilution slowly into an infusion of fluids. Max dose 1 mL (0.1 mg). Repeat as needed q5-15 min up to 1 mg total dose.

OR

* IM Epinephrine 0.01 mL/kg of 1:1,000 dilution. Max dose 0.15 mg (0.15 mL) if <30 kg and 0.3 mg (0.3 mL) if >30 kg. Can repeat up to 1 mg total dose.
* EpiPen Jr if <30 kg.
* EpiPen adult if >30 kg.

**Hypertensive Crisis: (diastolic > 120mm Hg; systolic >200mm Hg; or symptoms of end organ damage)**

Adult:

* Preserve IV access, monitor vitals, pulse oximeter, Oxygen by mask 6-10 L/min.
* Call Condition C or 911
* Labetalol IV 20mg administered slowly over 2 minutes; Can double the dose every 10 minutes (40 mg 10 min later, 80 mg 10 min after that).

Or

* (if Labetalol is unavailable) Nitroglycerin tablet 0.4mg, can repeat every 5-10 minutes AND Lasix IV 20-40mg administered slowly over 2 minutes.

**Unresponsiveness**

Adult:

* Check responsiveness, activate condition A or call 911
* CPR (30 compressions at 100/minute, then 2 respirations)
* Defibrillator or AED; apply and follow directions on AED
* IV epinephrine 10mL of 1:10,000 dilution (between 2 minute cycles)

Pediatric Dosing:

* IV Epinephrine 0.01 mg/kg of 1:10,000 dilution, Can repeat up to 1mg total

**Pulmonary Edema**

* Preserve IV access, monitor vitals, pulse oximeter, Oxygen by mask 6-10 L/min. Elevate head of bed if possible.
* Call condition C or 911

Adult:

* Lasix 20-40mg IV administered slowly over 2 minutes

Pediatric Dosing:

* Lasix IV 0.5-1.0mg/kg over 2 minutes; max dose = 40mg.

**Seizures/Convulsions**

* Observe and protect the patient, turn patient on side to avoid aspiration, suction airway as needed.
* Preserve IV access, monitor vitals, pulse oximeter, Oxygen by mask 6-10 L/min.

**If persistent:**

* Activate condition team/911

Adult:

* Lorazepam IV 2-4mg administered slowly to max dose of 4mg. (No medication is recommended for children).

**Hypoglycemia**

* Preserve IV access. Oxygen by mask 6-10 L/min.

Adult:

* **If patient able to swallow safely**: 2 sugar packets or 15g glucose tablet/gel or 4oz fruit juice
* **If patient is unable to swallow safely:** 1 ampule D50W IV administered slowly over 2 minutes. D5W or D5NS IV as adjunct therapy administered at a rate of 100 mL/hour.
* **If no IV access:** Glucagon IM 1 mg

Pediatric Dosing:

* **If patient able to swallow safely**: 2 sugar packets or 15g glucose tablet/gel or 4oz fruit juice
* **If patient is unable to swallow safely:** IV D25 2 mL/kg as IV injection over 2 minutes. D5W or D5NS IV as adjunct therapy administered at a rate of 100 mL/hour.
* **If no IV access:** Glucagon IM/SC 0.5 mg if <20kg and 1 mg if >20kg.

**Anxiety (Panic Attack)**

Diagnosis of exclusion. Assess patient for developing signs/symptoms of another reaction.

* Preserve IV access, monitor vitals, pulse oximeter.
* If no developing signs/symptoms and normal oxygenation, reassure patient

**Reaction Rebound Prevention**

* Consider for patients having severe allergic-like manifestations prior to transportation to an ED or inpatient unit.

Adult:

* Hydrocortisone (Solu-Cortef) 200mg IV administered slowly over 2 minutes.
* Or Methylprednisolone (Solu-Medrol) 40mg IV administered slowly over 2 minutes.

Pediatric Dosing:

* Hydrocortisone IV 5 mg/kg administered over 1-2 minutes; max dose 200mg.
* Methylprednisolone IV 1 mg/kg administered over 1-2 minutes; max dose 40mg.

**Section III. Nephrogenic Systemic Fibrosis (NSF)**

* NSF is a fibrosing disease, primarily involving the skin but also the lungs, heart and muscles. Signs and symptoms may develop and progress rapidly. Contractures or joint immobility may develop and in some patients, the disease may be fatal.
* There is a strong association between gadolinium-based contrast agent (GBCA) administration in patients with advanced renal disease and the development of NSF although the exact mechanism remains unknown. It is now generally accepted that GBCA exposure is a necessary factor in the development of NSF.
* It is estimated that patients with ESRD (eGFR 15-29 ml/min/1.73 m2) have a 1-7% risk of developing NSF after one or more exposures to GBCA. There is only 1 published report of NSF occurring with eGFR values above 30 ml/min/1.73 m2
* 12-20% of confirmed cases of NSF have occurred in the setting of acute kidney injury (AKI), most often superimposed on CKD. The ACR views AKI alone as a risk factor in the development of NSF.

For all patients with a history of possible AKI, the MR technician will notify the supervising radiologist for review of medical chart and labs. If the patient is likely to have true AKI, avoidance of GBCAs is recommended if possible. Consent for contrast and documentation of rationale for use are otherwise recommended. Per Dr. Kanal, we are specifically required to confirm that the MRI tech has given the patient/POA the Gd/NSF information sheet and consent form. We need to directly speak with the patient/POA and ask if they have any questions.

Per the ACR, if a contrast-enhanced cross-sectional imaging study is required in an anuric patient with no residual renal function, it would be reasonable to consider administering iodinated contrast media and performing a CT rather than an MRI.

**Patients at risk of NSF:**

1. dialysis patients
2. eGFR values below 30 ml/min/1.73 m2
3. eGFR values 30-40 ml/min/1.73 m2 (eGFR levels may fluctuate significantly day to day)
4. AKI

An eGFR should be obtained in all inpatients within 48 hours of any potential GBCA administration.

**Outpatients at risk of NSF**

1. Age >60
2. History of renal disease including: dialysis, renal transplant, single kidney, prior kidney surgery, history of known cancer involving the kidney or kidneys
3. Hypertension
4. Diabetes
* Dialysis-dependent patients must go straight from MRI to the hemodialysis unit. This should be pre-arranged with the dialysis unit by the MR techs.
* Per UPMC, patients with an eGFR of >30 and <60 are usually administered 50% dose of Gd-based contrast. The ACR contrast manual does not recommend any special precautions in patients with an eGFR of 40-59 ml/min/1.73 m2
* No specific criteria have been established for the pediatric population therefore general precautions advised are the same as for adults.

**When a new eGFR should be obtained in outpatients with risk factor(s) for compromised renal function**

|  |  |  |
| --- | --- | --- |
| **Prior eGFR level** - ml/min/1.73 m2 | **When was last eGFR before MRI?** | **When should new eGFR be obtained prior to MRI?** |
| None available | Not applicable | Within 6 weeks |
| >60 | >6 months | Within 6 weeks |
| >60 | <6 months | New eGFR not needed |
| >60 | <6 months (possible unstable state) | Within 2 weeks |
| 30-59 | >2 weeks | Within 2 weeks |
| <30 | >1 week | Within 1 week |
| On dialysis | Not applicable | Not applicable |

**Section IV. Contrast in Pregnant or Breast Feeding Patients**

* Injected iodinated and gadolinium-based contrast media have been shown to cross the placenta.

**Iodinated Contrast**

* In-vivo tests in animals have shown no evidence of either mutagenic or teratogenic effects with standard contrast media. No well-controlled studies of the teratogenic effects of these media in pregnant women have been performed.
* Given that there is no available data to suggest any potential farm to the fetus from exposure to iodinated contrast medium, the ACR does not recommend withholding the use of iodinated contrast agents in pregnant or potentially pregnant patients when it is needed for diagnostic purposes.
* To date, there has been no documented case of neonatal hypothyroidism from maternal injection of iodinated contrast agents. As neonatal thyroid function testing is routinely performed at birth in all infants, no additional testing is deemed necessary.
* Very little of the iodinated contrast medium is absorbed by the infant from breast milk (0.01% of the maternal intravenous dose) therefore it is considered safe for the patient to continue breast feeding. If the patient is concerned, a pump can be used to remove breast milk before iodinated contrast administration and the patient can express and discard additional breast milk for 12-24 hours before resuming normal breast-feeding. Plasma half-life of iodinated contrast agents is approximately 2 hours; nearly 100% is cleared in 24 hours.

**Gadolinium Based Contrast Agents (GBCA)**

* There have been no known adverse effects to human fetuses when recommended dosages of GBCAs have been given to pregnant women. However, no well-controlled studies of the teratogenic effects of these media in pregnant women have been performed. There is a potential risk of NSF in the child and mother from potential gadolinium accumulation in the amniotic fluid. Because it is unclear how GBCAs will affect the fetus, these agents should be administered with caution.
* The ACR recommends that each case be reviewed carefully by members of the clinical and radiology service groups and GBCAs should be administered ONLY when there is a potential significant benefit to the patient or fetus that outweighs the possible but unknown risk to the fetus. The radiologist should confer with the referring physician and document the following:
1. The information requested from the MRI could not be obtained without contrast or by using other modalities.
2. The information needed will affect the care of the patient and/or fetus during pregnancy.
3. The referring physician believes the information cannot wait until the patient is no longer pregnant.

Informed consent should be obtained from the patient after discussion with the referring physician.

* Very little overall gadolinium is absorbed by the infant from break milk (0.0004% of the maternal intravenous dose) therefore it is considered safe for the mother to continue breast feeding after receiving GBCAs. If the patient is concerned, a pump can be used to remove breast milk before contrast administration and the patient can express and discard additional breast milk for 12-24 hours before resuming normal breast-feeding. Plasma half-life of GBCAs is approximately 2 hours; nearly 100% is cleared in 24 hours.

**Premedication of pregnant patients with prior allergic like reaction to iodinated or gadolinium-based contrast media**

* FDA Category Ratings: Benadryl (B), Prednisone (C), Methylprednisolone (C)
* Expert opinion indicates that the use of steroids in pregnancy is generally safe, although common specific premedication regimens have not been tested.
* The ACR recommends that otherwise indicated premedication regiment not be withheld because the patient is pregnant and that the standard regimens be used.

**Section V. Metformin**

* There is a potential risk of developing lactic acidosis after IV iodinated contrast administration in patients taking metformin, related to renal insufficiency.
1. In patients with normal renal function (No AKI and GFR >30), continue metformin as prescribed.
2. In patients with AKI or severe CKD (GFR <30), discontinue metformin at time of injection and hold for 48 hours. Resume metformin only after renal function has been re-evaluated and found to be normal.
* Patients taking metformin are not at higher risk for post-contrast acute kidney injury.
* It is not necessary to discontinue metformin with gadolinium based contrast agents when used in the usual clinical dosages.

**Appendix A (Courtesy of Dr. Jeff Belair UPMC Class of 2015)**

**UPMC PRESBYTERIAN SHADYSIDE DEPARTMENT OF IMAGING SERVICES**

**POLICY AND PROCEDURES**

**MANAGEMENT OF EXTRAVASATION**

Soft tissue extravasations of nonionic contrast medium rarely results in tissue injury unless a large volume of extravasated fluid produces a “compartment syndrome” (fluid within a confined space that compresses nerves and/or blood vessels). Imaging Services Department policy is application of ice to the affected and elevation of the affected extremity. If extravasation occurs it is the policy of the Imaging Services Department that an Imaging Services Department nurse and radiologist will examine the patient.

**PROCEDURE**

1. Management of Extravasations

a. Discontinue contrast medium.

b. Leave IV needle or catheter in place, do not irrigate catheter.

c. Attach sterile 5cc syringe to needle/catheter hub and attempt to aspirate blood and agent.

d. The examining radiologist will determine if referral to Emergency Department or Plastic Surgery consultation is warranted. The radiologist will determine if a radiograph of the affected extremity is warranted (i.e. if extravasation is detected by injector alarm, nurse or technologist).

**POST-PROCEDURE CARE**

a. Apply ice to affected area; “on” for 15 minutes each hour for up to 24 hours.

b. Avoid applying excessive pressure to suspected infiltration site.

c. Elevate extremity above heart level as frequently as possible for up to 48 hours following suspected extravasation.

d. Estimate amount of contrast extravasation.

e. Refer to Emergency Department (ED) and/or Plastic Surgery consultation for extravasation accompanied by marked pain, swelling, paresthesia, decreased peripheral pulse, skin blistering, or slow capillary refill. Advise patient to return to the ED for evaluation if any of these symptoms develop after initial evaluation in the Imaging Services Department.

**Documentation:**

Document the following in Powerchart (template available in powerchart):

1) Accurate description of extravasation site including size of swelling, location, color, erythema, etc. Document radial and ulnar pulses in affected arm, capillary refill to nail beds of affected arm, and equal hand grasps. This documents that circulatory and neurological parameters were identified and their deficits (if any) at the time of injury were assessed.

2) Patient’s subjective description of discomfort and/or sensation assessment.

3) Name of agent(s), concentration (dosage/dilution) and rate of administration.

4) Type of needle/catheter, size and insertion site.

5) Estimate volume of contrast medium (CM) that was extravasated.

a) Amount of contrast left in syringe subtracted from original syringe volume.

b) Evidence that some contrast entered blood stream (vessel/organ enhancement).

c) Obtain radiograph of affected extremity (e.g., arm)

6) Management of extravasation – what was done for the patient.

7) Follow up assessment of extravasation site with detailed documentation (phone and/or visit within 48 hours, then as needed).

**Appendix B: Additional Information on Contrast Reactions**

* Prior severe reactions are the greatest predictor of additional reaction. Atopic patients and those with bronchospasm are also at an increased risk.
* Intravascular low osmolar contrast media (LOCM) may be relatively contraindicated in patients with myasthenia gravis due to ~6% incidence of symptom exacerbation within 24 hours of injection.
* Shellfish is no longer considered a contra-indication to iodinated contrast.
* A small retrospective study by Bessell-Browne and O’Malley demonstrated no adverse events following IV LOCM administration to patients with pheochromocytomas and paragangliomas.
* The overall reaction rate has decreased in recent years with non-ionic, low osmolality contrasts (~0.2-0.7%). Severe and potentially life-threatening adverse events continue to occur rarely and unpredictably (~0.04%). Nearly all life-threatening contrast reactions occur within the first 20 minutes after contrast medium injection. A review of U.S. FDA and drug manufacturer data from 1990 to 1994 demonstrated 2.1 fatalities per 1 million contrast-enhanced studies using LOCM.
* Studies to date have demonstrated a decrease in overall adverse events after steroid premedication before contrast injection, but no decrease in the incidence of repeat severe adverse events. A recent study on repeat reactions resulted in several important conclusions:

1) Breakthrough reaction severity, signs, and symptoms are most often similar to the index reaction.

2) The majority of low-osmolality contrast injections in pre-medicated patients with a prior breakthrough reaction will not result in a repeat breakthrough reaction.

3) Patients with a mild index reaction have an extremely low risk of developing a severe breakthrough reaction.

4) Patients with a moderate or severe index or breakthrough reaction are at higher risk for developing another moderate or severe reaction should breakthrough occur.

5) Severe allergies to any other substance (which includes IV iodinated contrast) are associated with a somewhat higher risk of developing a moderate or severe breakthrough reaction. This is also true of patients with more than four allergies, any drug allergy, and chronic use of oral corticosteroids

* In a recent study by Wang and colleagues, only 1/442 adult LOCM extravasations resulted in a severe injury (a compartment syndrome), although 3 other patients developed blisters or ulcerations that were successfully treated locally. (~1% requiring treatment).
* Several studies showed that contrast media warming (37o C) resulted in a flow rate improvement ranging from 8-27%, but this has not affected the rate of adverse clinical events. Media warming is recommended if the injection rate is >5ml/second, for viscous solutions (370 and greater), direct arterial injections through small caliber catheters (5F or smaller), in studies in which contrast timing is critical.
* The pediatric population is particularly susceptible to fluid shifts occurring with IV injection of contrast making the injected concentration of greater importance. Particular attention should be paid to the injection sites of neonates and infants as such individuals cannot effectively communicate the possibility of an injection site complication.
* Allergic-like (anaphylactoid) reactions to enteric barium are very uncommon. The frequency of allergic-like adverse reactions has been reported to be 1 in 750,000 examinations, with most of the manifestations being mild. More severe reactions are estimated at around 1 per 2.5 million exposures.
* A small volume of iodinated contrast media (approximately 1% to 2%) is normally absorbed and subsequently excreted into the urinary tract after oral or rectal administration. Because anaphylactoid reactions are not considered to be dose related and can occur with less than 1 ml of intravenous (IV) contrast media, it is generally accepted that allergic-like reactions can occur even from the small amounts of contrast medium absorbed from the gastrointestinal tract.

**UPMC PRESBYTERIAN/UPP DEPARTMENT OF RADIOLOGY/IMAGING SERVICES**

Specific Guidelines for Nonvascular Administration of ICMs

1. Enteric administration of ICMs (esophagrams, UGI, SBFT, Gastrogaffin enemas, enterostomy enemas) to patients with a previous history of ALRs:
2. Use LOCM contrast agent. (See exception for enemas below.)
3. Patients with history of mild ALRs to ICMs do not need to be premedicated. (See attached summary of American College of Radiology (ACR) criteria.)
4. Patients with a history of moderate or severe ALRs to ICMs and/or any other allergen by any route, premedicate as per IV CT guidelines.
5. ICM enemas: Gastrograffin and Gastroview are hypertonic, ionic iodinated agents, however, a search of the literature found no reports of ALRs from ICM enemas, even though it is well documented that ICM is absorbed from enemas. Possibly the routine dilution of ICM for enemas contributes to the lack of ALRs. Therefore, an exception to the use of nonionic contrast in this situation is applicable, but the other pretreatment guidelines (b. and c. above) for enteric contrast should be followed.
6. Nonenteric ICMs administration (cystography, fistulograms, cholecystograms, T-tube studies, urinary diversion loops/neobladder, etc.): The same screening and premedication criteria as used for IV CT should be utilized.

Urgent and Emergent situations:

If a patient with a history of moderate or severe ALR to ICM or prior anaphylactic reaction requires iodinated contrast urgently or emergently, contrast material may be administered as long as:

* 1. The referring physician, in consultation with the radiologist as needed, believes that the benefit of the information obtained will outweigh the risk of performing the procedure without premedication.
	2. The referring physician discusses risks and benefits with the patient and the patient consents to receive contrast.
	3. The referring physician documents this conversation in the patient’s medical record.
	4. The examination is performed with appropriate staff and equipment immediately available to treat an anaphylactic reaction.
	5. When possible, the examination should be delayed long enough to implement the emergency premedication protocol.

**Appendix C: UPP Radiology Policy on Managing Gadolinium-based (GBCA) and Iodinated Contrast (Low Osmolar Contrast Agents, or LOCM) in the Setting of Renal Insufficiency**

Procedure: Technologist reviews current or recent (within the past 6 weeks) glomerular filtration rates (GFR, eGFR) in patients that meet the following criteria:

* Renal disease (including solitary kidney, renal transplant, renal tumor)
* 60 yrs or older
* History of diabetes
* History of hypertension requiring medical therapy
* History of severe hepatic disease, especially pre or post-liver transplantation (For patients in this category, the eGFR assessment should be nearly contemporaneous with the administration of contrast)
* Any other conditions which may pre-dispose the patient to complications, which is determined by the ordering physician or supervising radiologist.

The GFR results are to be reviewed by the technologist, patient care tech, nurse, or radiologist. If eGFR is 60 or greater, proceed with the examination.

If eGFR 30 to 59 ml/min/1.73 m2 on the most recently available laboratory test: a new eGFR result should be obtained within two weeks of anticipated GBCA injection.

If eGFR <30 ml/min/1.73 m2 on the most recently available laboratory test: a new eGFR result should be obtained within 24 hours of anticipated GBCA injection.

If patient is on dialysis, no eGFR needs to be obtained.

For inpatients falling in the above categories, requests for contrast-enhanced MRI examinations, eGFR level should be obtained within 36 to 48 hours prior to GBCA administration. In addition, the ordering health professional should assess inpatients for the possibility of AKI, as eGFR calculation alone has limited sensitivity for the detection of AKI.

The following charts are guidelines and do not preclude the responsible radiologist from changing the dose or protocol for an individual patient.

Standard Intravenous Contrast Table for Computed Tomography

(and other procedures requiring LOCM)

Note: patients receiving diabetic medications containing Metformin with a creatinine >1.4mg/dl should **not** receive IV contrast material.

**Cerner possible AKI alert** – Implement hydration protocol for any patient with this alert.

|  |  |  |  |
| --- | --- | --- | --- |
| Kidney disease stages by GFR | Weight <140 lbs (64 kg) | Weight 140 -240 lbs (64-109 kg) | Weight 240-300 lbs (109-164 kg) |
| Stage 1or 2 (>60ml/min) | 100 ml | 125 ml | 150 ml |
| Stage 3 (30-59)\* | 75 ml | 100 ml | 125 ml |
|  | \*Implement hydration protocol: oral contrast (if required) is adequate hydration. If no oral contrast is required, 480 cc H2O prior to LOCM, and 200 cc 0.9% saline iv, (or 240 cc H2O p.o.) after LOCM. |
| Stage 4 (15-29) | Perform exam without contrast.If contrast is crucial to diagnosis, LOCM is to be administered only after radiologist – referring physician consultation and patient consent. |
| Stage 5 (<15 **not** on dialysis) | Perform exam without contrast.If contrast is crucial to diagnosis, LOCM is to be administered only after radiologist – referring physician consultation and patient consent. |
| Stage 5 (<15 on dialysis) | Generally safe to administer LOCM. Monitor for fluid overload.  |

MR GBCA Guidelines

**Cerner possible AKI alert –** Insure that patients meet **all** of the following 3 conditions before calling radiologist for orders:

* Any patient whose GFR results have not worsened on two consecutive days or consecutive results
* Those who are still producing urine > 500 ml/24 hours (do not have diminished or absence of urine production)
* Those whose GFR >/= 45

Trend GFR results AND speak to the patient’s RN regarding their urine output. **If the patient does NOT meet ALL 3 bullet points above,** refer to the AKI process/policy (which in many cases will become an ordering physician to radiologist consult).

Note: For ED patients without GFR trending, where AKI alerts, refer to most recent creatinine/eGFR values available; if eGFR < normal for age, radiologist approval will be required prior to GBCA administration.

|  |  |
| --- | --- |
| Kidney disease stages by GFR | Recommendations |
| Stage 1 or 2 (>60ml/min) | No mandatory precautions – standard dose (Multihance standard dose: 0.1 mmol/kg or 0.2 ml/kg.) |
| Stage 3 (30-59) | Use lowest dose (e.g. half dose) unless circumstances require different dosing. |
| Stage 4 (15-29) | * Perform exam without contrast; OR

If contrast is crucial to diagnosis, GBCA is to be administered only after radiologist - referring physician consultation. Written documentation of the pressing/ urgent need for the contrast by the requesting/referring physician, *documenting how it might change the care and/or management of that patient*, is ***required***.* Documented informed patient consent by radiologist (phone consent is acceptable). If unable to obtain consent, due to patient condition (unconscious/unresponsive) or the emergent nature of the study, where informed consent might delay therapy, documentation is also required.
* Use lowest reasonable dose (e.g. half dose), unless circumstances require different dosing.
 |
| Stage 5 (<15 and/or on dialysis) | * Perform exam without contrast; OR
* If contrast is crucial to diagnosis, GBCA is to be administered only after radiologist - referring physician consultation. Written documentation of the pressing/urgent need for the contrast by the requesting/referring physician, *documenting how it might change the care and/or management of that patient*, is ***required***.
* Documented informed patient consent by radiologist (phone consent is acceptable). If unable to obtain consent, due to patient condition (unconscious/unresponsive) or the emergent nature of the study, where informed consent might delay therapy, documentation is also required.
* Use lowest reasonable dose (e.g. half dose), unless circumstances require different dosing.
* For those patients *currently* on hemodialysis, send the patient for hemodialysis directly from MRI. Hemodialysis coordination MUST be prospectively coordinated by the MR technologist or other MR support staff.
* Additional hemodialysis should be performed at the discretion of the nephrologist.

.NOTE THAT FOR PATIENTS WITH ACUTEKIDNEY INJURY/ACUTE RENAL FAILURE, IF NOT ON HEMODIALYSIS, THESE PATIENTS SHOULD NOT RECEIVE GBCA UNLESS ABSOLUTELY VITAL AND THE RISKS ARE FAR OUTWEIGHED BY THE POTENTIAL DIAGNOSTIC BENEFITS.BETWEEN 12.5% AND 20% OF NSF PATIENTSWERE IN ACUTE RENAL FAILURE AT THE TIMEOF GBCA ADMINISTRATION. |