VISN 22 IMAGING SERVICE
Department of Veterans Affairs Medical Center
Updated December 2013

SUBJECT: CONTRAST AGENTS

1. PURPOSE: To establish guidelines for the safe administration of contrast agents during radiologic studies within the VISN 22 Healthcare System.

2. POLICY: The Imaging Service minimizes the risk to the patient of the administration of contrast agents by ensuring imaging studies are medically necessary, by screening for possible contraindications, and by taking precautionary measures to lower the risk of adverse events. Intravenous and oral contrast agents are frequently administered in Radiology, usually in the setting of Computed Tomography (iodinated contrast) and MRI (gadolinium-based contrast). Each type of contrast has specific indications, contraindications and risks, which in turn depend on the type of examination desired, imaging protocol, preexisting medical conditions, certain medications, and other factors. In order to minimize contrast-related complications and to identify those patients who are at increased risk, all patients who will receive IV contrast are screened by obtaining pertinent historical information from the patient (or authorized surrogate). Ethically, and per VHA Handbook 1004.01, verbal informed consent is required for all treatments and procedures occurring in Radiology Service. In some circumstances, as described herein, signature informed consent is required.

As a result of these considerations, coordination between the referring clinical service and Radiology Service is frequently necessary in order to accomplish the necessary pre-screening studies, mitigate risk, temporarily withhold certain medications following the examination, supervise contrast injections, obtain informed consent and perform other necessary functions. Assistance by the referring service becomes especially important outside of normal duty hours, when in-house Radiologists are not available.

This policy is an attempt to clarify many of the relevant medical and logistical considerations in the use of intravenous contrast, and to provide a multidisciplinary framework for its safe and effective administration both during normal business hours and WHEN hours (weekends / holidays / evenings / nights).

3. RESPONSIBILITIES:

3.1 The Chief of Staff assures overall compliance with procedures outlined in this policy.

3.2 The Imaging Service Chief is responsible for ensuring that all contrast protocols are approved by the Pharmacy and Therapeutics Committee, medications are stored in secure locations, and adverse contrast events are reviewed and trends identified and corrective action taken by the Imaging Quality Improvement Committee.

3.3 The in-house radiologist/radiology resident, whose scope of practice agreement includes the ability to obtain informed consent and who participates substantially in the procedure of contrast administration, is responsible for:

a. Approving the use of contrast for each patient individually, typically in the form of specifying one or more standard imaging protocols.
b. The supervision of the contrast injection during regular business hours.
c. Obtaining i-Med consent for high risk patients during regular business hours.
d. Following the procedures outlined in this policy.

3.4 The ordering provider / resident is responsible for:

a. Ordering any necessary premedication for patients with previous reactions to contrast.
b. Ordering all pre-procedure laboratory tests needed prior to contrast administration.

3.5 The radiology technologist or radiology nurse is responsible for:

a. Reviewing the procedure, risks, benefits and alternatives with patients who receive IV contrast using an approved educational script.
b. The radiology technologist is responsible for identifying the designated line for IV contrast administration in conjunction with nursing and following the intended line to the site of insertion prior to IV contrast injection. The technologist will sign the Patient Questionnaire which will indicate that the selected line is the appropriately labeled line and will serve as the intended injection line. If there is no line appropriate for IV contrast, the technologist will initiate a new IV.
c. Administering intravenous contrast according to protocol and monitoring the patient for evidence of extravasation or adverse reactions. See Appendix A.
d. Complying with all policies and procedures relating to the administration of contrast media and disclosure of adverse events.

3.6 The nursing executive is responsible for ensuring overall compliance of nursing personnel with procedures relating to the administration of contrast media.

3.7 Pharmacy service is responsible for the ordering, procurement and delivery of contrast agents to the specific radiology areas. Pharmacy service is also responsible for the yearly review of the contrast agents utilized in conjunction with the Radiology service. Pharmacy will routinely audit all areas in which contrast agents are stored.

4. DEFINITIONS:

Contrast Agents or contrast media are medications administered during imaging studies to provide enhanced anatomic or functional information. These include oral and rectal barium; oral, rectal, intravascular, intra-joint, and intra-cavitary iodinated agents, and intravascular or intra-joint gadolinium agents. Radiopharmaceuticals used for nuclear medicine studies are outside of the scope of this document. (For currently utilized contrast products. See Appendix B.)

5. PROCEDURES: MEDICATION STORAGE, ORDERING & ADMINISTERING

5.1 Storage and ordering: Contrast agents administered by Imaging Service will be purchased through pharmacy and delivered to Imaging on a pre- determined schedule. Contrast agents will be stored and administered by the Imaging Service, following these guidelines:

5.1.A The agents will be stored either in a locked cabinet, secured room or Omnicell (or similar device). When the cabinet is unlocked, the area is under constant supervision by radiology.

5.1.B In accordance with local pharmacy policy, Pharmacy Service will routinely inspect or audit the storage of all contrast agents by Imaging Service.

5.1.C Standard contrast administration protocols will be written and approved by the Pharmacy and Therapeutics Committee. The protocols include types and volumes of contrast, as well as the screening procedure used to determine whether administration of contrast is safe. Protocol books are placed in

the control room of each imaging suite where contrast is administered. The protocols will be reviewed by Pharmacy and Radiology on an annual basis. Any changes to contrast type will be reviewed by Pharmacy.

5.1.D Before administering contrast agents a pre-screening questionnaire (Patient Questionnaire) will be initiated either by the ordering provider or the technologist. The questionnaire will be reviewed with the patient by the technologist for verification. When there are contraindications, indicated by any questions answered "yes" on the allergy and medical conditions risk assessment, the technologist will refer the questionnaire to the radiologist/ordering provider for review. The questionnaire and review will be completed prior to the procedure and scanned into PACS or CPRS upon completion of the examination as a permanent record. (***Some facilities will not use Attachment A Questionnaire***). The radiologist approves the use of contrast for each patient individually, typically in the form of specifying one or more standard imaging protocols. If the radiologist is off-site and available by phone, this may be done by direct conversation between the radiologist and the technologist, with read back of the verbal instruction using standing order protocol. The name of the protocoling radiologist and the specific protocol given will be noted on the Patient Questionnaire by the nurse or technologist administering the contrast.
** For patients unable to complete the questionnaire, it will be completed by; a member of the medical team (ordering provider, technologist, RN) or an informed family member.

5.1.F A record of adverse medication events will be collected, and analyzed quarterly for trends by the Imaging Service QA/QI Committee. This information will also be reviewed at least quarterly by the Pharmacy Service.

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5.2 Use of contrast warmers.

5.2.A Iodinated Contrast. All contrast warmers will have locks and will be locked during non-operational hours and when unattended. Temperatures will be recorded daily on a control chart, with an upper limit of 40 and lower limit of 30 degrees Celsius. Documentation of regular maintenance for the warming device will be available. A sufficient quantity of iodinated contrast will be maintained in the warmers for one or two days of procedures. (Note: Due to its high viscosity at low temperatures, a sufficient quantity of iodinated contrast will be placed in a lockable contrast warmer each day). The date for all contrast agents placed in the warmer will be written on the bottle. If the bottle is not used within 30 days of heating or if it removed from the warmer, allowed to cool, but not used, it will be discarded appropriately.

5.2.B Gadolinium Contrast. Gadolinium-based contrast media are administered at room temperature according to package inserts.

5.3 Documentation of Contrast Administration

5.3.A The procedure, risks, benefits and alternatives should be explained to patients who receive IV contrast whenever possible. If the patient's condition prohibits this communication, the risks/benefits will be explained to a family member. This will be documented in the patient's chart. This may be done by a physician, radiology nurse or technologist following the standard script. Signature informed consent is required for high risk patients, as described below, and must be obtained by a Radiologist or Ordering Provider.

5.3.B When nursing staff administers an oral contrast agent (to inpatients) a separate order will be entered into CPRS. Nursing staff will administer the contrast using bar-code administration and will record the administration in the patient's medical record. Note: - Any medication in which a patient will

self-administer in a home setting (eg: Golytely, oral contrast, prophylactic medication such as diphenhydramine) must be ordered in CPRS, by the provider and dispensed by Pharmacy.

5.4 Medication reconciliation.

5.4.A Upon entering a request for a contrast procedure, the ordering provider will use a standard protocol which evaluates medications and/or medical conditions that may cause an adverse action/effect when contrast is administered. This is considered a "reverse" medication reconciliation list (Outlined in Section 5.6). Medication reconciliation in the Imaging Service consists of reviewing the procedure request, the medical record and interviewing the patient to ensure contrast media can be administered safely. A full medication list does not need to be documented if a "reverse" list is included in the screening process and reviewed by the radiologist. This protocol is part of the Patient Questionnaire and will be scanned into CPRS as the permanent record.

5.5 Screening Procedures: Oral Contrast Agents:

5.5.A Safety screening for oral contrast agents consists of determining whether the patient has a history of aspiration and/or previous history of iodinated contrast reaction (if using oral iodinated contrast) If the ordering provider or radiologist determines there is a significant risk, the study will be performed without oral contrast, with an alternative contrast, or else the study will be cancelled and the reasons will be documented in the patient's medical record.

5.6 Screening Procedures: Intravenous Iodinated Contrast Agents:

These agents are frequently administered for CT, conventional angiography, and excretory urography. Safety screening is performed as outlined below: Current contrast agents are listed in Appendix B.

5.6.A Allergies/Prior Contrast Reaction.
Patients who have severe asthma requiring corticosteroid inhalers, history of anaphylaxis, or who have had a prior allergic reaction to iodinated contrast must be pretreated as delineated below (See Appendix C) or else an alternative imaging procedure should be used.

5.6.B Labs.
A baseline serum creatinine should be available or obtained before the injection of contrast medium in all patients considered at risk for contrast nephrotoxicity. Those at risk include: Age >60, preexisting renal dysfunction, proteinuria, prior kidney surgery, diabetes mellitus, hypertension and gout. Patients without these risk factors could be reasonably excluded from serum creatinine screening prior to contrast injection.

5.6.C Impaired Renal Function.

5.6C.1 High Risk: A patient is considered at high risk of contrast induced nephropathy (CIN) if they have a Scr equal to or greater than 2.0 mg/dl. The maximum volume of contrast will be limited to <3X eGFR. The patient will be hydrated according to protocol and the radiologist/ordering provider will perform an i-MED consent. (See Appendix D)

5.6C.2 Low Risk: A patient is considered at low risk of CIN if they have a Scr less than 2.0 mg/dl, or have ESRD and are on chronic dialysis. No pretreatment hydration is necessary in these patients.

5.6.D Drug interactions.
If the patient is taking the oral anti-hyperglycemic medication metformin (Glucophage, Glucovance, Avandamet, Metaglip, Diabex, Diaformin, Fortamet, Riomet, Glumetza) the drug will be temporarily

withheld for 48 hours after the procedure. See Appendix E. Laboratory orders will be placed by Radiology at the time of the procedure. Metformin may be reinstated only after renal function has been re-evaluated by a physician or registered nurse and found to be within acceptable range. It will be the Ordering Provider's responsibility to review results and provide follow-up instructions to resume metformin to the patient.

5.6.E. Recent Prior Contrast.
If the patient has received an iodinated contrast injection within 72 hours prior to the procedure, risk of long-term renal impairment is increased. Elective procedures should be postponed until the eGFR returns to baseline. If the procedure is considered an emergency, the ordering provider must consult with the radiologist to determine if the benefits of the procedure outweigh the risk before proceeding. In any case where a study must be performed within the 24 hour period, the ordering provider or radiologist will perform an iMed consent if the total volume of contrast will exceed 3x eGFR. The contrast amount will not exceed more than 3x eGFR unless indicated by the risk/benefit assessment and documented in CPRS.

5.6.F. Pregnancy and Breast-Feeding
Pregnant female patients will have a risk-benefit screening between the Radiologist, Ordering Physician, and the staff OB/GYN to determine if the procedure can be performed. Prior to the procedure an i-MED consent will be performed. If there is a question of pregnancy, Imaging will initiate a urine pregnancy test prior to the procedure

The available data suggests that it is safe for the mother and infant to continue breast-feeding after receiving iodinated contrast. Ultimately, an informed decision to temporarily stop breastfeeding should be left up to the mother after these facts are communicated. If concerned, the mother may abstain from breast-feeding from the time of contrast for a period of 12-24 hours. The mother should be told to express and discard breast milk during that period.

5.7 Screening procedures: Gadolinium contrast agents:

Safety screening consists of identifying those patients who are at risk for Nephrogenic Systemic Fibrosis (also called Nephrogenic Fibrosing Dermopathy) (NSF/NFD) or who have had prior contrast reactions.

5.7.A Allergies/Prior Contrast Reaction.
If the patient has had a prior allergic contrast reaction to gadolinium, the study should be performed without contrast, or the patient should be pretreated according to the guidelines outlined in Appendix C.
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5.7.B Impaired Renal Function

5.8.B.1 High Risk-Non Dialysis. If the eGFR is less than 30 ml/min and the patient is not on dialysis, consider MRI without contrast or use of another modality. If gadolinium contrast is given, use the lowest possible dose.

5.7.B.2 High Risk-Dialysis. If the patient is on dialysis, the use of gadolinium contrast is strongly discouraged. If gadolinium cannot be avoided, use the lowest possible dose. After procedure, patients should be dialyzed as soon as possible. Peritoneal dialysis is not adequate. The decision to use contrast should be made in conjunction with the Nephrology Service.

5.7 C Pregnancy and Breast-Feeding

Pregnant female patients will have a risk-benefit screening between the Radiologist, Ordering Physician, and the OB/GYN staff to determine if the procedure can be performed. No gadolinium contrast will be given to a pregnant patient. Prior to the procedure an i-MED consent will be performed. If there is a question of pregnancy, Imaging will initiate a urine pregnancy test prior to the procedure.

The available data suggests that it is safe for the mother and infant to continue breast-feeding after receiving gadolinium contrast. Ultimately, an informed decision to temporarily stop breast-feeding should be left up to the mother after these facts are communicated. If concerned, the mother may abstain from breast-feeding from the time of contrast for a period of 12-24 hours. The mother should be told to express and discard breast milk during that period.

5.7.D Other contraindications
Contraindications for the performance of MRI, other than renal status, are delineated in the local facility Magnetic Resonance Imaging Safety Policy.

5.8 Informed Consent for IV Contrast Media

5.8.A Iodinated Contrast: The risks and benefits of Iodinated contrast agents will be discussed with the patient by the technologist, physician or registered nurse who reviews the Patient Questionnaire (facility individualized). i-Med consent for iodinated contrast will be required only for patients who have a previous history of reaction to iodinated contrast media, patients who are pregnant, patients with Scr equal to or above 2.0, and when the volume of contrast exceeds 3.7 times creatinine clearance within a 24 hr time frame.

5.8.B Gadolinium Contrast: The risks and benefits of the MRI contrast agents will be discussed with the patient by the technologist, physician or registered nurse who reviews the MRI questionnaire. An i-Med consent for MRI contrast will be required only for patients who have a previous history of reaction to gadolinium contrast media, patients who are pregnant and patients with eGFR < 30 ml/min.

5.9. Administration and documentation of contrast agents.

5.9.A Physicians in the Radiology Service are authorized, per to administer contrast after approval of the Patient Questionnaire and contrast review. A radiology technologist who has been trained by Radiology Service or who possesses license/certification for contrast administration by the State of California may administer contrast after approval of the Patient Questionnaire and contrast review by a radiologist.

5.9.B Technologists may start peripheral intravenous lines for the purpose of contrast administration if they have undertaken training to do so, or have graduated from an American Registry of Radiologic Technologists (ARRT) recognized program that includes intravenous access in its curriculum, and have demonstrated competency by a period of proctoring. (National Radiology On-line guide).

5.9.C The Patient Questionnaire will include the patient's name, date of procedure, type of procedure, medical record number (Social Security Number), the name of the personnel administering the contrast media, type of contrast media and amount, dose and rate, lot number, as well as complications that occur and any required follow up. The Patient Questionnaire will be scanned into the procedure imaging file (PACS) or CPRS.

6. PROCEDURES: OTHER

6.0 Intrathecal Contrast Injections:

6.0.A. Iohexol (Omnipaque) is the only Iodinated contrast agent to be used for intrathecal administration, in strengths of 180 mg/ml, 240mg/ml or 300mg/ml. Providers will follow the Omnipaque package insert with regards to total dosage and volume, rate of injection and other administration issues.

6.0.B. If a gadolinium agent is necessary to use in an intrathecal injection, gadopentetate (Magnevist) is suggested for use.
http://www.ajnr.org/content/29/1/3.full http://www.ncbi.nlm.nih.gov/pubmed/20562454

6.0.C. Adverse reactions: Instructions will be given to the patient in the case of a persistent headache after the procedure to seek care in the ED for possible blood patch.

6.1 NPO Restrictions:

Patients are not required to be NPO prior to IV iodinated contrast administration.

6.2 Responsibilities when in-house Radiologist is not available

6.2A. On off-tours, the radiology technologist will refer to standardized contrast protocols for routine procedures only for low risk patients with no allergy history and Scr <2.0. Contrast orders for all other patients will be discussed with the radiologist prior to administration.

6.2.B. Supervision of contrast injection off tour: The ordering provider/resident physician/ED physician/Code Team must be available to respond in the event of a contrast induced reaction.

6.3 Protocol for the Administration of IV Contrast to Patients Who Cannot Give Permission

If a patient exam is determined to need an IV contrast injection and the patient is unable to understand the risks, benefits and alternatives to the contrast injection the Ordering Provider will follow the i-med consent policy.

6.4 Emergency Treatment Protocols.

A copy of the ACR Manual on Contrast Media, Table 6: Management of Acute Reactions in Adults will be available in each control room or procedure room where intravenous contrast agents are administered. See Appendix F for Management of Acute Reactions.

6.5 Adverse Drug Events

6.5.A All contrast reactions and extravasations will be reported in the medical record in a note or in the procedure report in addition to the required incident report.

6.5.B All contrast reactions and significant extravasations will be reported to the LIP or Imaging Nurse. After hours, events will be reported to covering physician. Allergic reactions or adverse events associated with contrast will be reported through the Vista Adverse Reaction Tracking package, which is accessed through CPRS. Events will be presented to the Imaging Quality Improvement Committee and to the Pharmacy Service. Symptoms of contrast reactions include severe nasal stuffiness, urticaria with or without accompanying itching, swelling apparent in the eyes and face, severe chills or shaking, chest pain, severe hyper/hypotension, wheezing, laryngo/bronchospasm, seizure, cardiac arrhythmias or cardiopulmonary arrest. See Appendix G.

7. REFERENCES:

a. ACR manual on Contrast Media 2013
b. Contrast Induced Nephropathy: Updated ESUR Contrast Media Safety Committee Guidelines 2011
c. VHA Handbook 1004.01 Informed Consent for Clinical Treatments and Procedures

8. RESCISSION: **Current Policy**

APPENDIX A

Guidelines for Injection of Intravenous Contrast

- Intravenous contrast media is to be administered by a physician or radiology technologist. The contrast media will be injected at the rate and total dose per protocols defined for the ordered and approved imaging study via peripheral intravenous lines. A radiology technologist or trained health technologist may prepare the contrast media and prepare the delivery unit, syringe, power injector, etc.

- The supervising physician will prescribe the type, dose and rate of the contrast administration. The patient's risk status will be assessed prior to contrast administration so as to determine the quantity and dose of contrast media to be administered.

- IV contrast media administration for CT is preferably delivered through a 20g or larger Angiocath, although in cases where the veins are small a 22g Angiocath may be substituted.

- Maximum flow rates are as follows:

20g or larger Peripheral catheter	5 ml/sec
22g Peripheral catheter	2.5 ml/sec
Triple lumen catheter	2 ml/sec; proximal port preferred; line must flush easily
Power PICC line 4-6F 18gauge lumen	Power injectable up to limits marked on hub of catheter Usually 5 ml/sec maximum flow rate 300psi injector pressure limit
Power Port line Use 19g (cream colored) or 20g(yellow) Powerloc infusion needle	5 ml/sec maximum flow rate 300psi injector pressure limit
Broviac/Hickman catheter	1ml/sec

- Contrast media via triple lumen catheters, Broviac/Hickman catheters should preferably be administered by hand injection and not by use of the power injector. Injections via these lines should be performed under direct physician or nursing supervision.

- During and following the injection, the administering personnel will remain with the patient directly palpating the injection site for a minimum of 20-30 seconds to minimize the risk of extravasation. If an extravasation or adverse reaction is noted, the injection must be stopped immediately. Injectors have abort switches in both the scan room and the control room so that injections can be stopped immediately.

Appendix B

Contrast Agents and Dosage Protocols
(Imaging and Pharmacy Service is responsible for updating this list routinely)

Oral Contrast Agents		
Agent	Ingredients	Dose
Gastrografin	Iodine-Diatrizoate	
Readi-Cat-2	Barium 2.1%	
Volumen	Barium 0.1%	
Varibar	Barium 40%	

IV Iodinated Contrast Agents-CT		
Agent	Generic	Dose
Omnipaque	Iohexol	120-140cc
Visipaque	Iodixanol	120-140cc

IV Gadolinium Contrast Agents-MRI		
Agent	Generic	Dose
Prohance	Gadoteridol	10-20cc
Multihance	Gadobenate	10-20cc
Eovist	Gadoxetate	10-20cc

APPENDIX C

Guidelines for Pretreatment for Prior Contrast Reaction

I. Elective premedication

A. Protocol 1:
Prednisone 40mg (or methylprednisolone 32mg) by mouth 12 hours and 2 hours before contrast media injection. Plus diphenhydramine 50 mg by mouth 2 hours before contrast. If the patient is unable to take oral medication, 200 mg of hydrocortisone IV may be substituted for oral prednisone and diphenhydramine 50mg may be given IV or IM one hour before contrast.

B. Protocol 2:
Prednisone 50mg by mouth at 13 hours, 7 hours, and 1 hour before contrast media injection, plus diphenhydramine 50mg IV, IM or PO one hour before contrast.

II. Emergency Premedication (In Decreasing Order of Desirability)

A. Protocol 1:
Methylprednisolone sodium succinate (Solu-Medrol®) 40 mg or hydrocortisone sodium succinate (Solu-Cortef®) 200 mg intravenously every 4 hours (q4h) until contrast study required plus diphenhydramine 50 mg IV one hour prior to contrast injection

B. Protocol 2:
Dexamethasone sodium sulfate (Decadron®) 7.5 mg intravenously q4h until contrast study for patients with known allergy to methylprednisolone. Also diphenhydramine 50 mg IV one hour prior to contrast injection.

References:

ACR Committee on Drugs and Contrast Media, Version 9, 2013, Patient Selection and Preparation Strategies, pp. 8-9.

Lasser EC, Berry CC, Talner LB, et al. Pretreatment with corticosteroids to alleviate reactions to intravenous contrast material. *N Engl J Med* 1987; 317:845-849.

Greenberger PA, Patterson R. The prevention of immediate generalized reactions to radiocontrast media in high-risk patients. J Allergy Clin Immunol 1991; 87:867-872.

Greenberger PA, Halwig JM, Patterson R, Wallemark CB. Emergency administration of radiocontrast media in high-risk patients. J Allergy Clin Immunol 1986; 77:630-634.

Appendix D
Pretreatment Hydration for Iodinated Contrast in Patients with Renal Impairment

- Reduce contrast volume. Maximum volume should be limited to <3X eGFR.

Maximal Recommended Volumes of Contrast to prevent AKI Used Contrast Media/eGFR Ratio = 3.7 for Max Volume*				
eGFR (ml/min)	Max Recommended Volume	Gm Iodine/Volume **Iohexol (Omnipaque)** 350mg/ml	Gm Iodine/Volume **Iohexol (Omnipaque)** 300mg/ml	Gm Iodine/Volume **Iodixanol (Visipaque)** 320mg/ml
		Non-Ionic Monomer Osmolality: 500-700 mOsm/kg Viscosity: 11 cP		Non-Ionic Dimer Osmolality: 300 Viscosity 25 cP
70	250ml	87.5g	75g	80g
60	222ml	77.7g	66.6g	71g
50	185ml	64.8g	55.5g	59.2g
40	148ml	51.8g	44.4g	47.4g
30	111ml	38.8g	33.3g	35.5g

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- The most proven prophylactic regimen is to infuse normal saline IV at 1-1.5 ml/kg/hr 12 hours prior and 12 hours following study. This is more effective than simple oral hydration. If patient has advanced cardiac disease, monitor for pulmonary edema. If one cannot wait 12 hours before the imaging study, then infuse for a minimum of 3 hours before study and 12 hours afterwards. Fewer than 3 hours may not be effective. (SD Weisbord, PM Palevsky. Radiocontrast induced acute renal failure. J Int Care Med 2005;20:63-75. CIN Consensus Working Panel et. al. Strategies to Reduce the Risk of Contrast-Induced Nephropathy. Am J of Card. 2006;98:59-77)

- Alternatively, consider IV Sodium Bicarbonate 154 mEq in 1000 ml D5W. Infuse at 3.5 ml/kg/hr for 1 hr pre-contrast (max rate 386 ml/hr). Then 1.2 ml/kg/hr for 6 hours (max rate 132 ml/hr). The IV line should be flushed with normal saline before and after infusing contrast medium. This practice is supported by just one publication. (Merten GJ, Burgess WP, Gray LV, et al. Prevention of contrast induced nephropathy with sodium bicarbonate. JAMA. 2004;291:2328-34.)

APPENDIX E

Guidelines for patients taking the oral anti-hyperglycemic medication metformin (Glucophage, Glucovance, Avandamet, Metaglip, Diabex, Diaformin, Fortamet, Riomet, Glumetza)

- Metformin may be taken on the morning of the examination, but must be withheld for at least the next 48 hours.

- The patient must have Scr lab drawn after the procedure for a renal function check (approximately 48 hours after procedure). Metformin may be reinstated only after renal function has been re-evaluated by a physician or registered nurse and found to be within acceptable range. It will be the Ordering Provider's responsibility to review results and provide follow-up instructions to resume metformin to the patient.

APPENDIX F
Management of Acute Reactions in Adults

Urticaria

1. Discontinue injection if not completed
2. No treatment needed in most cases
3. Give diphenhydramine PO/IM/IV 25–50 mg.

If severe or widely disseminated: epinephrine (epi-pen) IM/SC (1:1,000) 0.1–0.3 ml (= 0.1–0.3 mg) (if no cardiac contraindications).

Facial or Laryngeal Edema

1. Give O2 6–10 liters/min (via mask).
2. Give epinephrine (epi-pen) IM/SC (1:1,000) 0.1–0.3 ml (= 0.1–0.3 mg)

If not responsive to therapy or if there is obvious acute laryngeal edema, seek appropriate assistance (e.g., cardiopulmonary arrest response team).

Bronchospasm

1. Give O2 6–10 liters/min (via mask).

Monitor: electrocardiogram, O2 saturation (pulse oximeter), and blood pressure.

2. Give beta-agonist inhalers (bronchiolar dilators, such as albuterol) 2 to 3 puffs; repeat as necessary. If unresponsive to inhalers, use IM/SC epinephrine.
3. Give epinephrine (epi-pen) IM/SC or (1:1,000) 0.1–0.3 ml (= 0.1–0.3 mg)

Call for assistance (e.g., cardiopulmonary arrest response team) for severe bronchospasm or if O2 saturation <88% persists.

Hypotension with Tachycardia

1. Legs elevated 60o or more (preferred) or Trendelenburg position.
2. Monitor: electrocardiogram, pulse oximeter, blood pressure.
3. Give O2 6–10 liters/min (via mask).
4. Rapid intravenous administration of large volumes of Ringer's lactate or normal saline.

If poorly responsive: epinephrine (1:10,000) slowly IV 1 ml (= 0.1 mg)

Repeat as needed up to a maximum of 1 mg

If still poorly responsive seek appropriate assistance (e.g., cardiopulmonary arrest response team).

Hypotension with Bradycardia (Vagal Reaction)

1 Secure airway: give O2 6–10 liters/min (via mask)

2. Monitor vital signs.
3. Legs elevated 60o or more (preferred) or Trendelenburg position.
4. Secure IV access: rapid administration of Ringer's lactate or normal saline.
5. Give atropine 0.6–1 mg IV slowly if patient does not respond quickly to steps 2–4.
6. Repeat atropine up to a total dose of 0.04 mg/kg (2–3 mg) in adult.

7. Ensure complete resolution of hypotension and bradycardia prior to discharge.

Hypertension, Severe

1. Give O2 6–10 liters/min (via mask).
2. Monitor electrocardiogram, pulse oximeter, blood pressure.
3. Give nitroglycerine 0.4-mg tablet, sublingual (may repeat × 3); or, topical 2% ointment, apply 1-inch strip.
4. If no response, consider labetalol 20 mg IV, then 20 to 80 mg IV every 10 minutes up to 300 mg.
5. Transfer to intensive care unit or emergency department.
6. For pheochromocytoma: phentolamine 5 mg IV (may use labetalol if phentolamine is not available).

Seizures or Convulsions

1. Give O2 6–10 liters/min (via mask).
2. Consider diazepam (Valium®) 5 mg IV (or more, as appropriate) or midazolam (Versed®) 0.5 to 1 mg IV.
3. If longer effect needed, obtain consultation; consider phenytoin (Dilantin®) infusion — 15–18 mg/kg at 50 mg/min.
4. Careful monitoring of vital signs required, particularly of pO2 because of risk to respiratory depression with benzodiazepine administration.
5. Consider using cardiopulmonary arrest response team for intubation if needed.

Pulmonary Edema

1. Give O2 6–10 liters/min (via mask).
2. Elevate torso.
3. Give diuretics: furosemide (Lasix®) 20–40 mg IV, slow push.
4. Consider giving morphine (1–3 mg IV).
5. Transfer to intensive care unit or emergency department.

- **Discharge of Patients Following Contrast Reactions**

1. Discharge following a minor or mild reaction:

a. Only a physician may discharge the patient.

b. Instruct the patient about his or her sensitivity to the contrast for future reference and place a note in the medical record.

c. All patients receiving Benadryl (diphenhydramine) should have an escort for assistance home. This medication may cause drowsiness.

d. Give the patient a contrast reaction discharge instruction sheet *(Attachment C)* for future studies.

2. Discharge following a moderate/severe reaction: The Radiologist or referring clinician is responsible for patient discharge unless the patient is transferred to the Emergency Room for further evaluation and disposition.

APPENDIX G
Management of the Patient after Contrast Extravasation

1. The LIP must evaluate the site if an extravasation occurs.

2. Apply cold or warm compresses (based on facility protocol) immediately and elevate the affected extremity above the heart.

3. The patient or the person responsible for the patient will be given the discharge instructions for extravasation and must sign the contrast infiltration/extravasation discharge instruction sheet before leaving the hospital (Attachment D)

4. Assess the pulse. Any dampening of pulse requires consultation with patient's referring clinician physician or an Emergency room physician.

5. An immediate surgical consultation or referral to ED is required if the following occurs:
   a. Skin blistering
   b. Altered tissue perfusion (decreased capillary perfusion over or distal to the site of extravasation)
   c. Increasing pain after 2-4 hours
   d. Change in sensation distal to the site of extravasation
   e. If none of the above four signs are present, the patient may be sent home from Radiology Service with discharge instructions.

6. Document details, treatment and outcome on an Incident Report and in a VA Adverse Drug Event (ADE) Report form through CPRS.

Attachment A: Example Patient Questionnaire (San Diego Protocol)

PATIENT RISK ASSESSMENT
(To be completed by ordering provider)

Allergy Risk Assessment:

YES NO

Prior severe reaction to IV iodinated contrast media?
(Dyspnea, profound hypotension/marked swelling in eyes/face, generalized urticaria)

Prior reaction to oral contrast media?

Severe allergic reaction to food or any other medication?

History of asthma currently requiring corticosteroid therapy?

If any above boxes checked yes, must order pre-medication

Medical Conditions Assessment:

YES NO

Does patient have diabetes?

Is patient taking any form of metformin? (Stop metformin at time of procedure)

Has the patient had IV contrast in the past 24 hrs?
If yes, what volume? _____

History of kidney disease?

Patient on dialysis?

History of significant cardiac dysfunction?
Unstable angina, severe CHF, recent MI (1 month)

Possible pregnancy? LMP_____

Defer to radiologist for final CT protocol? Yes No
Study area of interest: _____
If there was a recent/similar study, indicate reason for re-exam: _____

RADIOLOGY CT PROTOCOL

To be completed by scheduler:

Pt Name _____ Full SS# _____
DOB _____/_____/_____ Age _____ Wt_____
Scr_____eGFR_____Date of last Scr _____

Allergies _____

Date exam scheduled _____

To be completed by radiologist:

CT Protocol _____ Indication for CT Exam _____

If pre-hydration indicated, type and dose_____

Justification for Iodinated Contrast in the event of iodine allergies:_____

YES NO
i-Med consent for all patients with previous history of reaction to iodinated contrast, Scr equal to or above 2.0, pregnant patients and patients who have received iodinated contrast volume > 3.7 times CrCl within 24 hours of procedure.

IV Contrast to be used:

None
Omnipaque 350 (normal dosing for low risk)
Omnipaque 350 (reduce volume to <3X eGFR for high risk)

Other_____

Volume:_____milliliters

Low risk: Scr less than 2.0 mg/dl, or have ESRD and are on chronic dialysis

High risk: a Scr equal to or greater than 2.0 mg/dl.

Oral Contrast to be used:

None
Gastrografin 37% (Iodine)
Dose: 60ml Gastrografin with 1000ml water or 2 btls Breeza
Readi-Cat Barium Suspension 2.1%
Dose: 450ml/ bottle, give 2 bottles
Volumen Barium Suspension 0.1%
Dose: 450ml/bottle, give 2 bottles

CONTRAST ADMINISTRATION
(To be completed by technologist/imaging staff)

If patient is allergic, pre-medicated with: _____

Allergy Verification (required signatures): Radiologist or Ordering MD_____
Technologist_____

Patient on metformin? Yes No
Metformin held after contrast? Yes No

Oral Contrast used: _____ Lot #_____Dose:_____Time:_____
Oral contrast administered by nursing staff in inpatient

IV DATA (Check appropriate answers)

Patient was verified with two identifiers: Yes No

Status: Existing (less than 20 hours) Started in department by:_____

Gauge: 16 18 20 22 24 Central Line Port

Side: Right Left

Site: Jugular Subclavian Upper Arm Antecubital Fossa Forearm
Wrist Hand Portacath Hickman Other _____

Contrast Media Agent Injected (Check appropriate answers)

Type: Omnipaque 350 Visipaque 320 Other _____

Volume: _____ milliliter(s)

Time: _____ Injected By: _____

Complications: None

Reaction: Hives Wheezing Mild Moderate Other _____
Infiltration: Minor Major
Severity: Mild Moderate Severe Reaction noted in CPRS

Comments:_____

If patient is on metformin, were follow-up labs ordered? Yes No

Technologist Performing CT: _____ _____
Print Name Signature

ATTACHMENT B

INSTRUCTIONS FOR PATIENTS TAKING HYPOGLYCEMIC MEDICATIONS PRIOR TO CONTRAST ENHANCED IMAGING STUDY

You are scheduled for _____CT with Contrast Media

Date_____Time_____

No breakfast on the morning of the procedure if your procedure is scheduled before Noon.

If your procedure is scheduled after 12 Noon you may have a light breakfast.

Metformin/Glucophage/Glucovance/Advandamet/Metaglip should be withheld for 48 hours after the procedure and/or until follow-up lab work done and reviewed by MD.

Your physician will tell you when to resume your diabetic medication.

Your Primary Care Physician will have provided special instructions regarding your insulin and/or oral hypoglycemic pill (e.g., Glyburide, Glipizide). If you do not understand these instructions or forget what they are, contact your Primary Care Physician or ask to speak to a nurse in the Radiology Service.

On the morning of procedure take your other medications as usual with sips of water.

If you are unable to keep your appointment, please call: (insert local numbers)

Radiology Service: Diabetic Patient Instructions

Print Name_____SSN_____

Signature_____Date_____

Patient should return on_____for follow-up lab work.

Copy given to patient**.** ☐

Attachment C

CONTRAST REACTION DISCHARGE INSTRUCTIONS

Patient Name: _____ Last 4 SSN: _____
(Please Print)

Phone #: ( ) _____

Attending or Referring Physician: _____ Beeper: _____

Radiologist: _____

- ❖ You had a mild contrast (dye) reaction.
- ❖ Your symptoms were:
  _____
- ❖ The contrast you received was: _____
- ❖ Your symptoms upon discharge were:_____
- ❖ You need to drink at least 8-10 glasses of water today to flush the contrast out of your body.
- ❖ You should not drink any alcoholic beverages, if Benadryl was taken, as it is an antihistamine, it may cause drowsiness.
- ❖ You should not drive or operate any heavy equipment while taking Benadryl, as it may cause drowsiness/tiredness.
- ❖ If you experience any difficulty breathing, have someone drive you to the nearest Emergency Room or call 911. (This is an extremely rare reaction to the contrast.)
- ❖ Call your physician for any questions/problems. He/she may contact this Radiology Service for further information.
- ❖ Other: _____

BRING THIS FORM WITH YOU SHOULD YOU HAVE TO GO TO ANY EMERGENCY DEPARTMENT OR SEE YOUR DOCTOR.

INFORM STAFF IN ANY IMAGING FACILITY THAT YOU HAD A CONTRAST REACTION PRIOR TO HAVING A CONTRAST EXAMINATION

_____ _____

Patient/Guardian Signature **Radiology Staff Signature/Title**

Attachment D

CONTRAST INFILTRATION/EXTRAVASATION DISCHARGE INSTRUCTIONS

Patient Name: _____ Last 4 SSN: _____
(Please Print)

Phone #: ( ) _____

Attending or Referring Physician: _____ Beeper: _____

Procedure performed by: _____

Contrast type/amount: _____

Intravenous site: _____

Appearance of IV site upon discharge: _____

_____

- Apply ice packs (15 minutes on and 15 minutes off, 3 times/day for 3 days)

- Observe the affected site for:
  - Increased pain or redness
  - Blisters
  - Firmness at site
  - Unusually hot/cold at site
  - Change in sensation of the extremity

- If any of these symptoms occur, notify your physician immediately
- You will receive daily phone calls from Radiology Service asking how your arm feels.
- If this site does not have a normal healing scab or you have a concern about the site, **call your physician.**

Other: _____

BRING THIS FORM WITH YOU SHOULD YOU HAVE TO GO TO ANY EMERGENCY DEPARTMENT OR SEE YOUR DOCTOR.

For Emergencies or Urgent Medical Problems, Call 911.

Discharge instructions have been explained to the patient or guardian, who fully understands these instructions.

_____ _____

Patient/Guardian Signature **Radiology Staff Signature/Title**

Attachment E

MRI QUESTIONNAIRE

MRI cannot be performed unless ALL items are answered

REMINDER: NO PACEMAKERS – NO DEFIBRILLATORS

Patient Name: _____ Date: _____
(Last Name, First Name, MI)

SSN: _____ Phone #: ( ) _____

Attending or Referring Physician: _____Beeper: _____

Pt Weight: _____ MRI Exam Requested:_____

Indications for MRI: _____

Renal Function: Date _____ Creatinine _____ EGFR _____

Female Patients: Are you pregnant? Yes _____ No _____ If yes or suspect speak with an MRI staff.

Previous Studies: CT Yes _____ No _____ Date(s) _____
MRI Yes _____ No _____ Date(s) _____

History of asthma, allergic reactions, respiratory disease, or reactions to any contrast agents or dye used in MRI ? Yes_____ No_____

Does the patient have a defibrillator? Yes_____ No_____ If yes, cannot have MRI

Does the patient have a heart pacemaker? Yes_____ No_____ If yes, cannot have MRI

Did the patient have an eye injury with metal? Yes_____ No_____ If yes, Speak with MRI Staff

Does the patient have stent? Yes_____ No_____ MR Safe? _____

Does the patient have a Cochlear (inner ear) implant?Yes_____ No_____ If yes, cannot have MRI

Does the patient have aneurysm clips? Yes_____ No_____

Does the patient have a Neurostimulator (Tens Unit)? Yes_____ No_____ If yes, cannot have MRI

Does the patient have a Starr-Edwards (Pre 6000) heart valve? Yes____ No___ If yes, cannot have MRI

Does the patient have an Omniphase penile implant? Yes_____ No_____ If yes, cannot have MRI

Does the patient suffer from claustrophobia? Yes_____ No_____ If yes, Speak with MRI Staff

Is or has the patient been a metal worker or welder? Yes_____ No_____ If yes, Speak with MRI Staff

Does the patient have metal rods or wires in body? Yes_____ No_____ If yes, Speak with MRI Staff

Is the patient wearing eye shadow? Yes_____ No_____ If yes, remove

Does the patient have shrapnel or bullets in head or spine? Yes___ No____ If yes, Speak with MRI Staff

Does the patient have Body Piercing? **Yes_____ No_____**

Has the patient had brain surgery? **Yes_____ No_____**

Has the patient had back / spinal surgery? **Yes_____ No_____**

Females: Do you have an IUD? **Yes_____ No_____**

Females: Are you nursing (breast feeding)? **Yes_____ No_____**

Does the patient have eye prosthesis? **Yes_____ No_____**

Does the patient have an Implanted Infusion Pump? Yes_____ No_____

Does the patient have a Vena Cava Filter? **Yes_____ No_____**

Does the patient have Medication Patches? **Yes_____ No_____**

Does the patient have a Swan-Ganz Catheter? **Yes_____ No_____**

Does the patient have Seizure Disorder? **Yes_____ No_____**

Does the patient have a Wanderguard? **Yes_____ No_____**

Does the patient have removable dentures? **Yes_____ No_____**

Is the patient wearing a hearing aid? **Yes_____ No_____**

Does the patient have a history of kidney disease? Yes_____ No _____

Does the patient have a tattoo? Yes_____ No_____ Was it in the past 6-8 weeks? Yes _____ No_____

Has the patient had surgery of any kind over the past 6 – 8 weeks? Yes _____ No _____

Did the patient receive written explanation regarding risk and benefits to receiving an Intravenous Injection of Gadolinium / MRI Contrast. **Yes_____ No_____**

Print Name Of Person Filling Out This Questionnaire _____

Signature Of Person Filling Out This Questionnaire_____

Name and or Signature of Reviewing Health Technologist and or Nurse_____

For MRI Technologist (USE ONLY)

Patient has no known or identifiable contraindications for 1.5T MRI at the time of the examination.
Exam canceled or deferred due to known or suspected contraindications to 1.5T MRI.
Patient responded "yes" to one or more screening items but was cleared for 1.5T MRI by Radiologist (Dr. _____) based on clinical assessment or obtaining additional plain films when appropriate.

Was MD screening reviewed: Yes No - If no explain: _____
_____
_____

Signature of Reviewing Technologist: _____