NYU HOSPITALS CENTER
DEPARTMENT OF RADIOLOGY
POLICY AND PROCEDURES

Subject: CT IV Contrast Administration
Original Date of Issue: February, 2000

Reviewed	**10/00, 1/03**	**3/04, 6/04**	**11/04, 02/06**	**10/08, 07/09**	**12/09, 4/10**
Revised	**10/00, 1/03**	**6/04**	**11/04**	**10/08, 07/09**	**12/09, 4/10**

Administration of Intravenous Contrast Media in CT

I. Practice Guidelines

All cases requiring contrast administration are documented in the Administration logbook. The following is recorded: patient name, date of birth, date of procedure, type of procedure, patient's medical record number, personnel administering contrast, type of contrast, amount of contrast, dose rate, and if any complications occurred. Each room has a logbook, which is kept at the console.

Numerous societies have published guidelines and standards for IV contrast administration. The NYU Department of Radiology uses the guidelines approved by the American College of Radiology and the Technology Assessment arm of the University Health Consortium. Only low osmolar contrast media (LOCM) is used. In order to assure that contrast media is administered in a safe process, the following quality assurance steps have been established.

II. Risk Factor Assessment:

Information regarding patient risk can be obtained from the following sources:

1. The patient's referring physician
2. The patient's chart
3. The Contrast Media Questionnaire
4. Patient interview prior to scan. All risk factor should be discussed with the patient prior to initiating the injection.

Radiology based MDs, RNs, PAs or technologists are required to complete the contrast media questionnaire prior to contrast administration. Based on the results of the interview and chart review, if there are any questions regarding the safety of contrast, house staff will be notified. If the Radiologist determines that IV contrast is inappropriate for the patient, the referring physician and/or referring House staff should be notified. Potential limitations of the study should be addressed and possible alternative diagnostic methods discussed.

Risk factors for IV contrast reaction (idiosyncratic/cytotoxic):

1) History of prior reaction to contrast media
2) Known or suspected renal disease
3) Dehydration
4) History of asthma (Premedication with steroids is only recommended if the patient is actively wheezing or the patient's asthma is so severe as to have required intuabation in the past.
5) History of multiple myeloma (specifically in the setting of dehydration or known proteinuria)
6) History of sickle cell disease (may promote a crisis)

NYU HOSPITALS CENTER
DEPARTMENT OF RADIOLOGY
POLICY AND PROCEDURES

Subject: CT IV Contrast Administration
Original Date of Issue: February, 2000

Reviewed	**10/00, 1/03**	**3/04, 6/04**	**11/04, 02/06**	**10/08, 07/09**	**12/09, 4/10**
Revised	**10/00, 1/03**	**6/04**	**11/04**	**10/08, 07/09**	**12/09, 4/10**

Risk of CIN

Assessment:

Contrast induced nephropathy (CIN) is a rare event in patients with normal renal function. The primary underlying conditions that predispose to CIN are pre-existing renal failure and diabetes mellitus. (Other risk factors to consider include dehydration, cardiovascular disease, advanced age, myeloma, nephrotoxic drugs, and hyperuricemia.)

Consequently, eGFR (estimated glomerular filtration rate) or serum Creatinine is required for all inpatients and ER patients. For inpatients, lab data should be obtained within the past week. For ER patients, if creatinine/eGFR is not available and the patient has no history of renal failure or diabetes, lab results prior to exam may be waived at the discretion of the ED attending. Finally, for outpatients, eGFR or serum Creatinine is only required prior to administration of IV contrast material (lab results within past one month acceptable) if the patient has any of the following clinical history:

1. Patients with a history of renal disease, including surgery, tumor or transplantation
2. History of diabetes
3. Sickle cell disease++
4. Collagen vascular disease
5. Patients taking nephrotoxic drugs, nonsteroidal anti-inflammatory drugs, metformin (Glucophage)

For all outpatients without any of the above clinical history, it is assumed that they fall into category one.

++ For myeloma patients, staff should contact a radiologist or resident on call.

Patients will then be divided into risk categories, based upon the risk assigned by this value. It is important to note that any diminution in eGFR greater than 10 mL/min/1.73m^2 in twenty-four (24) hours or 20 mL/min/1.73m^2 in forty -eight (48) hours **or** any rise in serum creatinine greater than 0.5mg/dl in 24 hours or 1mg/dl in 48 hours should be considered indicative of acute renal insufficiency and the guidelines below should be followed:

Category I eGFR > 60 **or** serum creatinine < 1.5

Category II eGFR 30-60 **or** serum creatinine 1.5- 2.0

Category III eGFR < 30 **or** serum creatinine >2.0

Suggested Risk Reduction Strategies:

Patients in Category I are considered to be normal. In these patients, hydration is the primary methodology to reduce CIN. Normal fluid intake by mouth is recommended.

Patients in Category II: Adequate oral hydration should be administered either by mouth or intravenously before and after the exam (500ml to one liter.) In addition, for patients with eGFR 30-60 **or** serum creatinine 1.5-2.0, the dose of iodinated contrast material should not exceed 75 cc.

Patients in Categories III: If an urgent study is required for patients in this category, a direct communication should occur between the referring clinician and the radiologist as to whether to proceed with a contrast-

enhanced study. One other consideration is the use of Visipaque as an intravenous contrast agent for this patient category, although the efficacy is unclear. Any patient with diminished eGFR **or** elevated serum creatinine needing intravascular contrast material requires a discussion of the heightened risks involved. A physician note should be placed in the chart that explains the necessity for the exam and documents the discussion about potential risks and alternatives.

Note that diabetics who are on Glucophage (Metformin) should be instructed to hold the medication for 48 hours following the CT. Outpatients will also be given a written form instructing them as such. For inpatients, CT staff will contact the floor and inform the RN of the need to hold the medication as well as document this on the Ticket-to-Ride form. As an additional measure, pharmacy will also contact the patient's referring clinician to recommend that the medication is put on hold.

III. Guidelines for Delivery of Contrast and Patient Monitoring

A. Delivery of Contrast

1. The Licensed Independent Practitioner, Registered Nurse, or New York State injection-certified Radiologic Technologist performs the injection. It is the responsibility of the individual performing the injection to verify that the contrast media questionnaire has been completed.
2. A LIP will document a patient-specific contrast dose on the contrast media questionnaire.
3. Pharmacy will clear all orders for contrast media that veer from the establishing dosing protocols herein.
4. Iopromide 300mg/ml (ULTRAVIST®) is the CT IV contrast media of choice for all patients. Dosage of CT contrast is as follows:
    a. **For adults**. Category I Patients. Contrast dose is weight based at 1.5 ml/kg. Category II patients receive the lesser of 1.5ml/kg. or 75 cc. For category III patients, no contrast should be administered without consultation with a radiologist.
    b. **For Pediatric Patients**. Category I Patients under 20 kg. receive weight-based contrast dosing at 2.0 ml/kg. Category I Patients over 20 kg. receive weight-based contrast dosing at 1.5 ml/kg. For Category II and Category III pediatric patients, no contrast should be administered without consultation with a pediatric radiologist.
5. Study Delays Times:
    a. **For adults**. 2 hours after anything but clear liquids.
    b. **For Pediatric Patients**. 2 hours after anything but clear liquids for non-anesthesia cases; 6 hours after anything but clear liquids for anesthesia cases.
    c. **Note**: For any emergent cases, staff should consult with a radiologist.

6. IV contrast for CT is preferably delivered through a 20g angiocath; however, certain cases may require a 22g angiocath. **Maximum flow rates** are as follows:
    - 20g peripheral catheters --------- up to 5.0ml/sec
    - 22g peripheral catheters --------- up to 3.0ml/sec
    - 24g peripheral catheters --------- up to 1.5ml/sec
    - Triple lumen catheter----------2ml/sec (proximal port preferred; line must flush easily)
    - PICC line ----------1ml/sec
    - Mediport line ----------1ml/sec (access by trained staff only; line must flush easily)

Subject: CT IV Contrast Administration
Original Date of Issue: February, 2000

Reviewed	**10/00, 1/03**	**3/04, 6/04**	**11/04, 02/06**	**10/08, 07/09**	**12/09, 4/10**
Revised	**10/00, 1/03**	**6/04**	**11/04**	**10/08, 07/09**	**12/09, 4/10**

- Broviac/Hickmans ----------1ml/sec

7. All catheters must be attached to the injector connecting tubing using a 3-way stopcock. The presence of the stopcock allows for IMMEDIATE venous access should the patient experience any form of reaction.
8. Rates have been established by the attending physicians in the Department of Radiology based on the required scan. Rate protocol reference books are located in the CT control area.
9. An individual authorized herein to perform injections must remain with the patient at the scanner directly palpating the injection site to minimize the risk of extravasation. If extravasation is detected the injection must be immediately stopped. Injectors have abort switches in both the scan room and the console room so that the injection can be terminated immediately.

B. Untoward Events

1. Contrast Reactions

a. In the event of any reaction, radiology house staff is notified to assess the patient. Each CT room (on the 2nd floor and in the ER/Radiology Suite) is equipped with an emergency box. Boxes are checked by Nursing on a daily basis for expired medication. The radiology department is also equipped with an airway cart, as per nursing policy. It is routinely stored in the post-procedure monitoring area. The airway cart for the ED/Radiology Suite is located in the CT Scanner room.

b. **Documentation:** Details of the nature, treatment, and outcome of any reaction are to be entered into the hospital's electronic reporting system. The classifications are listed below:

i. Classifications

Mild reactions: They are usually self-limited, of short duration and are not life threatening.

1. Nausea, vomiting
2. Cough
3. Warm sensation
4. Headache
5. Dizziness
6. Shaking
7. Altered taste
8. Itching
9. Pallor
10. Flushing
11. Chills
12. Sweating
13. Rash
14. Nasal Stuffiness
15. Eye swelling
16. Anxiety

Moderate Reactions: Similar to the mild reactions, however, to a moderate degree. This category also includes some systemic symptoms, including:

1. Pulse change
2. Hypotension
3. Hypertension
4. Dyspnea/wheezing
5. Disseminated uticaria
6. Bronchospasm
7. Laryngospasm

Severe Reactions: Potentially life threatening. May include some moderate reactions to a more severe degree.

1. Unresponsiveness
2. Convulsions
3. Clinically manifested arrhythmia
4. Cardiopulmonary arrest
5. Anaphylaxis

c. Practice Guidelines for patients with a history of an anaphylactic reaction to iodinated contrast material

i. The Radiologist and Referring Clinician agree that use of IV contrast is warranted despite the patient's history of anaphylaxis to contrast material and this is documented in the chart.
ii. The Radiologist documents their discussion with the patient.
iii. The patient is pre-medicated and receives LOCM
iv. The radiologist will be present in the CT suite during the injection and procedure.
v. Consideration may be given to requesting "anesthesia on standby"for the procedure.

d. **Management of Contrast Reaction**

The following treatment guidelines are based on 2008 published ACR guideline for treatment of contrast reaction Emergency equipment is readily available at all times.

Mild Reactions –

i. Discontinue injection if not completed.
ii No treatment needed in most cases. Patient reassurance.
iii Call Radiology house staff and, if in doubt, call MRT at x33911.
iv. Diphenhydramine (Benadryl) 25mg-50mg PO/IV
v. Maintain IV
vi. For nausea and vomiting: stop or slow injection and reassure patient.
vii. For uticaria give diphenhyramine (Benadryl) 25-50 mg PO/IM/IV

Moderate Reactions-

i. Contact Radiology house staff and MRT at x 33911.
ii. Always maintain IV if possible. If patient does not have an IV infusing, prepare NS or D5W at KVO.
iii. Notify radiology house staff and /or medial/surgical house staff. If reaction progresses acutely, the RN should administer SC epinephrine (1:1,000), as discussed below while waiting on the physician. This is to avoid further complications.
ivi. For all reactions initiate 0_2 6-10L/min via face mask and obtain vital signs.
v. **For severe uticaria** epinephrine (1:1,000) SC 0.1-0.3mg can be given. Contraindicated in severe cardiac disease.
vi. **For facial/laryngeal edema:**
- give epinephrine (1:1,000) 0.1-0.2mg SC
- If there is evidence of hypotension give epinephrine (1:10,000) 0.1mg or 1cc slowly IV. IV epinephrine should be administered by the MD, unless the RN is certified in ACLS. Repeat PRN up to a maximum of 1mg.
- Notify radiology house staff and MRT at 33911 If patient is not responding to therapy or obvious laryngeal edema (acute), the Airway Team at 33911

vi. **For bronchospasm:**
- Contact Medical Respond Team at 33911
- Administer beta agonist inhalers such as metaproteranol (Alupent) or albuterol (Proventil).
- For mild bronchospasm give 0.1-0.3mg epinephrine SC.

If bronchospasm advances acutely administer epinephrine (1:10,000) slowly IV, 0.1-0.3mg to a maximum of 1mg. IV epinephrine should be administered by the MD, unless the RN is certified in ACLS. Once again if the patient is not responding to the treatment call anesthesia.

vii. **Severe Reactions/Anaphylaxis**
- Contact Radiology house staff and the Airway Team at x 33911
- For all patients maintain IV and provide fluid replacement of LR or NS.
- For all patients initiate 0_2 at 6-10 L/min via face mask.

viii. **For hypotension with bradycardia (possible vagal reaction)**
- Elevate legs up to 60 degrees or more (preferred) or Trendelenberg position.
- Administer 1L normal saline IV
- Prepare 0.6 – 1 mg atropine for IV administration. Repeat atropine up to a dose of 2 mg (for adults).

ix. **For seizures/convulsions** protect the patient's airway and contact MRT or Airway Team (x33911) as appropriate.

x. **For anaphylaxis**
- Give epinephrine (1:10,000) slowly IV, 0.1-0.3mg to a maximum of 1mg.
- give IV fluids
- engage LIP. If they are not immediately available, call Airway at x33911.
- Transfer patient to appropriate unit.

e. **Discharge of patients following contrast reaction**

i. Minor/mild reactions
- Nurse to discharge patient
- Instruct patient about his/her sensitivity to contrast for future reference
- All patients receiving Benadryl need to arrange an escort for assistance home.
- Give patient prep sheet for future studies
- Log pertinent information on contrast reaction form and in the hospitals electronic incident reporting system.

ii. Moderate/severe reactions
- The patient's attending physician is responsible for discharge if the patient was transferred to the emergency room or Tisch Hospital.

B. Untoward Events (continued)

2. Contrast Extravasations

a. Radiology house staff must evaluate the site. Observe the following guidelines
i. Apply cold compresses or ice immediately
ii. Assess pulse. Any dampening of the pulse requires immediate consultation with a vascular or hand surgeon
iii. Intradermal extravasation requires a plastic surgeon referral
iv. This severity usually occurs when compartment syndrome or high volume

extravasations occur (> 50 ml)

b. **Documentation**: Details of the nature, treatment, and outcome of any reaction are to be entered into the hospital electronic incident-reporting tool.

c. **Discharge Instructions:**
   i. Explain discharge instructions to patient.
   ii. Patient or person responsible for the patient must sign discharge instructions. White copy to be given to patient and Yellow copy to be attached to consent form and PPF.

IV. Pre-medication Policy

A. Note that no routine pre-medication is required for a history of seafood allergy, mild to moderate asthma, or history of allergy to medications unless there was a concomitant history of severe reaction.

B. Indications for steroid preparation
Steroid preparation along with LOCM is indicated for the following patients:
1. Patients with a history of a moderate or severe reaction to contrast media or to other agents. (Mild reactions may also be pre-medicated to prevent undo discomfort to the patient (i.e. itching, rash)
2. Asthmatic patients that are actively wheezing.
3. Asthmatic patients with a history of an asthmatic event requiring intubation.
4. Prior life-threatening reaction to any allergen.

C. Role of steroid preparation. NOTE: For patients requiring stat (emergent) studies that have a prior history of anaphylactic contrast reactions, LIP must obtain an anesthesia consult.

- **Corticosteroid (Prednisone)/antihistamine**, 50mg orally (PO), 13, 7 and 1 hour before injection **plus diphenhydramine (Benadryl)**, 50 mg any route (intramuscularly, oral or IV) 1 hour before injection
  OR
- **Hydrocortisone** 200mg IV

Note the minimum time interval between the first steroid dose and IV contrast administration is 6 hours, but not to exceed 24 hours.

All outpatients should be advised that diphenhydramine (Benadryl) may cause drowsiness; therefore, they will require assistance at discharge.