YALE-NEW HAVEN HOSPITAL
DEPARTMENT OF RADIOLOGY AND BIOMEDICAL IMAGING POLICY AND PROCEDURE MANUAL

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I. Policy

To provide guidelines for the use of intravenous or oral, iodinated and gadolinium based contrast media, as well as the proper response of Radiology staff in the event of a contrast media event.

See policy I.21 for use of IV contrast on breast feeding patients.
See policy II.6 for Emergency Equipment and Contrast Reaction Kits

II. Responsibility

1. IV and oral contrast media agents are considered medications according to the Joint Commission and, therefore, all adherences to the Medication Management Standards and all applicable YNHH drug use policies apply.

2. The patient’s physician, PA, or APRN is responsible to order radiology exams, including those that require contrast media, either by written requisition or via computer order entry system. Inpatient and ED requests for contrast exams must include the patient’s pregnancy status and renal function as appropriate.

3. The radiologist has primary responsibility to review pertinent, available patient history, including eGFR levels, and the appropriateness of the request for contrast media, the dose, and the type of contrast administered prior to assigning imaging protocols.

4. Per YDR and DR administration, the responsibility to protocol CT exams with contrast is limited to radiology physicians and/or advanced practioners. For exams ordered with IV contrast, the patients’ eGFR should be ≥ 30. If the eGFR is < 30, should follow low eGFR workflow listed below.
   a. eGFR results for in-patient and ER patients should be within 48 hours. All inpatients and ER patients require a results value in order to proceed with contrast administration
   b. Please note, any outpatient that answers “Yes” to a renal risk factor question on the CT Oral / IV Contrast Form requires a renal function assessment. Those patients without risk factors do not require renal testing prior to receiving IV contrast. Patients will be given a Point-of-Care test to determine eGFR level if no eGFR/Cr value is available within 6 weeks in EPIC. eGFR levels under 30 are referred to the radiologist as detailed in section 2.5.

5. eGFR work flow for CT-
   If a CT study is ordered WITH contrast and eGFR is OVER 30, you can protocol it with IV contrast.

   If a CT is ordered WITH contrast and eGFR is BELOW 30 when patient arrives:
   a. Technologist will call the appropriate reading room to notify a radiologist. Radiologist then has to review the case and make a decision.
      i. **Give contrast despite eGFR<30**: A few studies have shown NO added risk of deterioration of renal function with IV contrast compared to matched controls regardless of renal function (2, 3, 5), however
one study showed higher risk with eGFR <30 (1). If you have any doubt on best choice, discuss with ordering provider and document reasoning in your report.

ii. **Change CT to WITHOUT contrast:** If clinical question can be answered sufficiently without IV contrast, document the following in your dictation. ie “Current study was initially ordered with IV contrast. However the patient’s eGFR on “date X” was ‘X’. Thus, the exam was switched to without IV contrast to eliminate risk of renal injury.”

iii. **Exam should be canceled/re-scheduled:** If exam canceled, CSA (clinical scheduling assistant) will note the cancel reason as “lab function out of range” in the order history in EPIC.

b. Technologist should document in EPIC study notes the name of radiologist who made decision. If radiologist is ever unclear on what to do, they should discuss case with ordering provider.

If order is being CHANGED (to without contrast or canceled), then technologist will communicate the radiologist’s decision to CSA and ask CSA to contact the ordering physician’s office.

c. CSA, working from an approved script, will communicate the information to the ordering provider (or ordering providers staff) including the eGFR value and the radiologist’s recommendation for the patient’s imaging.

i. If the ordering provider does not agree with the radiologist’s decision, CSA will connect provider to radiologist for discussion. CSA will wait for further direction from the radiologist and/or technologist once that call is completed.

ii. If the ordering provider agrees with the radiologist’s decision, the CSA will edit exam order with ordering provider.

iii. IF CSA cannot get in touch with ordering physician (or surrogate), the radiologist’s decision will prevail. **It is crucial that all our reports have documentation for reasoning to give or withhold contrast for this reason.**

o If the ordering provider agrees with the radiologist decision the CSA will-

  ▪ If changing order to CT WITHOUT contrast:

    ▪ EPIC Provider:

      ❖ CSA will change the order in EPIC to a non-contrast exam and send the order via EPIC in-basket request for co-sign

      ❖ CSA will track the order to ensure co-sign is received

    ▪ Non-EPIC Provider:

      ❖ CSA will change the order in EPIC to a non-contrast exam

      ❖ CSA will request a new requisition from the ordering physician

      ❖ CSA will track to ensure the new requisition is received
- CSA will upload the new requisition into the Media Manager section of EPIC
- Regardless of EPIC or non-EPIC provider, CSA will contact PFAS via PFASDRCHANGES@YNHH.ORG to alert the Pre-service team of the change in procedure code.
- Pre-service team will address any issues with authorization
- CSA to track each order change via the change order excel spreadsheet
  - If cancelling the exam:
    - CSA will cancel the appointment in EPIC and take direction from the ordering physician’s office about reschedule

6. All personnel involved in the administration of contrast media are responsible to be aware of the steps that can be taken to anticipate a contrast reaction in order to try to prevent it, or if one occurs, recognize it and take appropriate measures. Contrast reactions may be dealt with by technologists, nurses, RA, radiologists, code-teams or a combination of the above. See Addendum I.15A Recognition and Response to a Contrast Reaction.

III. Procedure Guidelines for IV Contrast

1. Intravenous contrast will be injected through an intravenous line previously established by the nurse or technologist. See DR Policy 1.17: Medication Administration by Technologists in Diagnostic Radiology.

2. Prior to the administration of IV contrast, the patient’s history including medications, allergies, and questions screening for renal impairment will be reviewed by the technologist in the patient’s medical record, or obtained using the appropriate outpatient questionnaire, and subsequently scanned or entered into the medical record.
   
   a. If no contraindications to contrast are noted, the technologist proceeds with IV contrast administration as per protocol identified by the radiologist.
   
   b. If contraindications are noted, the case is referred to the radiologist for further consideration.
   
   c. An IV line will stay in place during the examination, should IV drug therapy be necessary.
   
   d. A physician must be readily available during the contrast examination.
   
   e. A contrast reaction kit and emergency equipment (including a code cart, if a hospital site), must be readily available.
IV. Point of Care Testing

A. Point-of-Care eGFR testing will be performed by the technologist/technologist aid or nursing as required for Outpatients (and rarely for in-patients), at the time of appointment. This test is inspected by the College of American Pathologists as part of the accreditation of the Department of Laboratory Medicine at Yale-New Haven Hospital. The meter will diagnose the quantitative measurement of creatinine in capillary, venous, and arterial whole blood and convert the creatinine value by means of standard algorithms into estimated glomerular filtration rate (eGFR) in order to evaluate renal function. The eGFR will be recorded in separate dedicated log as well as on the patients' safety sheet.

B. Point of Care Meter:
Will be maintained by the MRI and CT Scan departments and a QA schedule will be strictly adhered to. Staff will be trained in the use of the meter during their orientation and reviewed for competency annuals. “Super users” will be assigned for training of staff members.

C. MRI Patients:

- Please see MRI safety manual for full details.

D. CT Patients:

- Any outpatient that answers “Yes” to the contrast related questions on the CT Oral / IV Contrast Data Form will be given a Point-of-Care test to determine eGFR level if no eGFR/Cr value is available within 6 weeks.
- eGFR levels under 30 are referred to the radiologist as detailed in section 2.5.
## Pre-medication policy for prior allergic like reactions to contrast media

(Formerly Addendum 1.15B)

*Unless in the opinion of the responsible health care professional and supervising radiologist, the potential benefits outweigh the risks i.e. emergency situations. In these instances, specific indications and reason(s) for exception should be documented in the report.*

<table>
<thead>
<tr>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

**Previous reaction to same class of contrast agent going to be given:**

<table>
<thead>
<tr>
<th>Mild (Excluding hives/facial swelling/itching)</th>
<th>Moderate (Including hives/facial swelling/itching)</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>Pre-medicate and use different agent</td>
<td>Do not give contrast*</td>
</tr>
</tbody>
</table>

**Previous reaction to a different class of Contrast agent than type to be given.**

<table>
<thead>
<tr>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

**For Planned Administration of Contrast Agents:**

- Premedication with steroids and Benadryl is now recommended only for patients who have had a reaction to contrast of a similar class (iodinated agents are one class, gadolinium based agents are separate class) to the one planned to be given.
- Prophylaxis for those with reactions to other allergens is no longer necessary.

**This policy decision is based on the following information:**

- Current estimated reaction risk in the general population is about 0.6% (Wang et al.)
- Only patients with a prior reaction to contrast are known to be at higher risk (3-11% reaction rate, with 2% break-through) (Mervak et al.Lasser et al).
- The rate of reaction for patients with prior anaphylaxis to substances other then contrast may be higher than the normal population, but this is not proven.
The current standard of care in the United States is to premedicate patients with steroids and Benadryl to decrease risk of repeat contrast reaction in patients who have had a reaction in the past to a similar class contrast agent.

References:

**Pre-Medication Regimen**

*Premedication order set is now available in EPIC*
Adults:
- 50mg Prednisone PO 13, 7 and 1 hour before the injection.
- 50mg Benadryl (Diphenhydramine) IV/PO within 1 hour of the injection.

In an emergency setting an alternative faster (but less proven) regime is:
- 200mg Hydrocortisone IV 4 hours before injection.
- 50mg Benadryl (Diphenhydramine) IV/PO within 1 hour of the injection.

Pediatrics (For patients less than 50kg):
- Prednisone 0.7 mg/kg (not to exceed 50mg) PO 13, 7 and 1 hour before the injection.
- Prednisolone 0.7mg/kg (not to exceed 50mg) PO 13, 7 and 1 hour before the injection
- Benadryl (Diphenhydramine) 1mg/kg IV/PO (not to exceed 50mg) within 1 hour of the injection.

In an emergency setting an alternative faster (but less proven) regime is:
- Hydrocortisone 1mg/kg (not to exceed 200mg) IV 4 hours before injection.
- Benadryl (Diphenhydramine) 1 mg/kg IV/PO (not to exceed 50mg) within 1 hour of the injection.
V. Documentation of Adverse Events

1. If a contrast event occurs, the radiology nurse or technologist involved must document the details within the patient medical record (Epic). In general nursing should enter allergy into EPIC with details on what occurred and severity of reaction. A note can also be placed by nursing in chart.

Following details should be documented:
   - Contrast agent/dose administered
   - Reaction signs/symptoms
   - Patient management, including drugs administered
   - Patient outcome
   - Provide discharge instructions sheet

2. Details concerning the administration of contrast and the adverse event must also be documented in the radiology report by the radiologist.

3. Techs must also enter a report in RL solutions Event Reporting System.

4. At the radiologist’s discretion, the patient’s clinician will be notified verbally at the time of the event.
CT Contrast Reaction or urgent adverse patient event coverage*

### MONDAY - FRIDAY

<table>
<thead>
<tr>
<th>Patient Location</th>
<th>Day Shift (8am-5pm)</th>
<th>Evenings and night (5pm-8am)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SP2 (usually 7am-430pm)</td>
<td>Chest or Cardiac (S. Pavilion)</td>
<td>ED</td>
</tr>
<tr>
<td>Smilow (Open 7am-8pm)</td>
<td>If neuro case, neuro MR (Smilow)</td>
<td>Neuro</td>
</tr>
<tr>
<td></td>
<td>Otherwise, body CT (Smilow)</td>
<td></td>
</tr>
<tr>
<td>ED</td>
<td>ED</td>
<td>ED</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saint Raphael's (Open 24/7)</td>
<td>Body</td>
<td>ED</td>
</tr>
<tr>
<td>YNHH Nuc med PET/CT (open till 7pm)</td>
<td>Nuclear Medicine</td>
<td>Neuro (smilow)</td>
</tr>
<tr>
<td>SRC Nuc Med PET/CT</td>
<td>Body</td>
<td>ED</td>
</tr>
</tbody>
</table>

### SATURDAY - SUNDAY

<table>
<thead>
<tr>
<th>Patient Location</th>
<th>Day Shift (8am-noon)</th>
<th>Afternoon &amp; Nights (noon-8am)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SP2</td>
<td>Chest if present. Otherwise ED</td>
<td>ED</td>
</tr>
<tr>
<td>Smilow (Open 8am- 430 pm)</td>
<td>If neuro case, neuro MR (Smilow)</td>
<td>Neuro (Smilow)</td>
</tr>
<tr>
<td></td>
<td>Otherwise, body CT (Smilow)</td>
<td></td>
</tr>
<tr>
<td>ED</td>
<td>ED</td>
<td>ED</td>
</tr>
<tr>
<td>Saint Raphael's (open 24/7)</td>
<td>ED</td>
<td>ED</td>
</tr>
</tbody>
</table>
*Non-urgent situations such as contrast extravasation, mild contrast side effects (nausea/vomiting), and falls will be handled by the supervising service during normal business hours.

<table>
<thead>
<tr>
<th>NEURO SMILOW-200-3181</th>
<th>PEDIATRICS-688-6184</th>
<th>ED YNHH-688-6180</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEURO FITKIN- 688-4305</td>
<td>CHEST SP- 688-8811</td>
<td>ED SRC-789-3929</td>
</tr>
<tr>
<td>BODY SMILOW-200-5734</td>
<td>CARDIAC - 688-3570</td>
<td></td>
</tr>
<tr>
<td>BODY FITKIN-688-3171</td>
<td>SRC BODY-789-6092/3</td>
<td></td>
</tr>
<tr>
<td>BREAST-200-5229</td>
<td>SRC MRI-789-4126</td>
<td></td>
</tr>
</tbody>
</table>
ALGORITHM FOR RECOGNITION AND RESPONSE TO CONTRAST REACTION

MAJOR REACTIONS

BREATHING PROBLEMS OR SHOCK

a) Difficulty Breathing
b) Wheezing / Stridor
c) Facial / Neck Swelling
d) Cyanosis / Severe Diaphoresis
e) Unresponsive/hypotensive

NOTIFY RADIOLOGIST AND NURSING

1. Assess air way and lungs
2. Check vital signs - place on monitor
3. Check ability to swallow, patient color, quality of voice
IF PROBLEM- Call CODE

Within Hospital: Call 155
(Code Blue = Adults)
(Code White = Pedi)

Outside New Haven: Call 9-911 (Local EMS)

MINOR REACTIONS/ PHYSIOLOGIC REACTIONS

• Nausea, vomiting
• Warmth
• Dizziness
• Altered taste
• Pallor
• Flushing
• Chills
• Sweats
• Mild nasal stuffiness
• Anxiety

If Asymptomatic

1. Comfort and reassure patient
2. Observe – continue or complete exam
3. If no further problem, can discharge.

If no relief or symptoms persist

1. Maintain and secure IV access
2. Notify radiologist
3. Treated out-patients should be observed for 30-60 minutes before discharge if stable. Patient should be counseled to avoid driving themselves home if Benadryl given.

MANAGEMENT SUGGESTIONS FOR MAJOR ADVERSE EVENTS
ADULT:
ASSESS AIRWAY, HR, BP, SPO₂, AUSCULTATE HEART AND LUNGS, OBTAIN IV ACCESS, OXYGEN, MONITOR

**UNRESPONSIVE**

CALL CODE OR 911

PALPABLE PULSE? RESPIRATIONS?

YES

NO

BEGIN CHEST COMPRESSIONS

REFER TO ACLS ALGORITHM

HYPOTENSIVE?

YES

NO

SEE HYPOTENSIVE ALGORITHM

CHECK FINGERSTICK GLUCOSE

**HYPOTENSIVE**

ELEVATE LEGS, INJECT IN VK 0.5-1ml

OXIGEN AS NEEDED

SECURE AIRWAY

HEART RATE < 60 BPM?

YES

NO

CALL CODE OR 911

ALOEINE 0.5-1mg slowly IV (max 3mg)

Epinephrine 1-3ml 1:10,000 slow IV push over 1-3 minutes (can repeat up to 3 times)

**WHEEZING/BRONCHOSPASM**

OXYGEN AS NEEDED

ELEVATE HEAD OF BED

Albuterol Nebulizer or Inhaler

STILL WHEEZING OR NO RESPONSE

CALL CODE OR 911

ADULT- EpiPen (0.3mg)

1:1,000 IM

**URTICARIA**

CALL CODE OR 911

DIPHENDYHYDRINE (Benadryl)

25-50mg (PO/IV/IM)

or

LORATADINE (Claritin) 10mg PO

**FACIAL/LARYNGEAL EDEMA**

OXYGEN AS NEEDED

ELEVATE HEAD OF BED

ADULT- EpiPen (0.3mg)

1:1,000 IM

**USING THE EPIPEN**

1. Remove EpiPen from box

2. Pull blue safety release cap.

3. Press orange tip FIRMLY against outer thigh until it clicks. Hold for 3 seconds DO NOT PLACE FINGERS OVER ORANGE TIP

CODE TEAMS

YNHH/Bridgeport/Greenwich: 155

L + M: 8888

Westerly: 222
PEDIATRIC:
ASSESS AIRWAY, HR, BP, SPO2, AUSCULTATE HEART AND LUNGS,
OBTAIN IV ACCESS, OXYGEN, MONITOR

UNRESPONSIVE
CALL CODE OR 911
PALPABLE PULSE? RESPIRATIONS?
YES
NO
HYPOTENSIVE?
YES
NO
BEGIN CHEST COMPRESSIONS
REFER TO ACLS ALGORITHM
SEE HYPOTENSIVE ALGORITHM
CHECK FINGERSTICK GLUCOSE

HYPOTENSIVE
ELEVATE LEGS, NEUBULIZER, OXYGEN AS NEEDED
SECURE AIRWAY
HEART RATE < 60 BPM?
YES
NO

FACIAL/LARYNGEAL EDema
OXYGEN AS NEEDED
ELEVATE HEAD OR BED

Epinephrine 0.1mg/kg 1:10,000 into running IV fluids
(max 1.0 ml)
OR
Epinephrine Jr. (0.15mg) for Child <30 kg
OR
EpiPen Jr. (0.3mg) for Child > 30 kg

CALL CODE OR 911

URticaria
Diphenhydramine (Benadryl) 1-2mg/kg
(max=50mg, PO/IV/IM)
OR
Loratadine (Claritin) 10mg PO
for age >6
2 years to <6 y/o, qid:
5mg PO

CALL CODE OR 911

WHEEZING/BRONCHOSPASM
OXYGEN AS NEEDED
ELEVATE HEAD OR BED

Albuterol Nebulizer or Inhaler
STILL WHEEZING OR NO RESPONSE

EpiPen Jr.
(0.15mg) IM
For Children 0-30kg
OR
EpiPen (0.3mg) for Child > 30 kg

CALL CODE OR 911

CODE TEAMS
YNHH/Bridgeport/Greenwich: 155
L + M: 8988
Westerly: 222

USING THE EPiPEN

1. Remove EpiPen from box
2. Pull blue safety release cap.
3. Press orange tip FIRMLY against outer thigh until it "clicks." Hold for 3 seconds
DO NOT PLACE FINGERS OVER ORANGE TIP
<table>
<thead>
<tr>
<th>Radiology Tackle Box Contents</th>
<th>Adult Dosing</th>
<th>Pediatric Dosing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albuterol MDI INHALER 90 mcg/actuation</td>
<td>2 puffs (90mcg/puff) for a total of 180 mcg. May repeat up to 3 times every 20 minutes</td>
<td>2 puffs (90 mcg/puff) for a total of 180 mcg. May repeat up to 3 times every 20 minutes</td>
</tr>
<tr>
<td>Albuterol Nebulizer 0.083% solution</td>
<td>2.5 mg (3 mL) inhaled via a nebulizer over 5-15 minutes</td>
<td>2.5 mg (3 mL) inhaled via a nebulizer over 5-15 minutes. May repeat as needed.</td>
</tr>
<tr>
<td>Atropine 1mg/10mL SYRINGE</td>
<td>0.5 mg IV - Administer slowly, followed by saline flush - May repeat every 3 – 5 minutes up to 3 mg total</td>
<td>0.02 mg/kg IV - May repeat every 3-5 minutes - Follow with saline flush</td>
</tr>
<tr>
<td><strong>Infants/Children:</strong></td>
<td><strong>Adolescents:</strong></td>
<td></td>
</tr>
<tr>
<td>- MINIMUM single dose (for patients &gt;5 kg) = 0.1 mg</td>
<td>- MAX single dose = 0.5 mg</td>
<td></td>
</tr>
<tr>
<td>- MAX total dose = 1 mg</td>
<td>- MAX total dose = 3 mg</td>
<td></td>
</tr>
<tr>
<td>Dextrose 50% 25g/50mL SYRINGE</td>
<td>25g IV - Administer over 2 min</td>
<td>0.5 g/kg IV - Max single dose = 25g - Administer over 2 min</td>
</tr>
<tr>
<td>Diphenhydramine 50mg VIAL</td>
<td>25-50 mg IM or IV - Administer IV dose slowly over 1-2 min</td>
<td>1-2 mg/kg IM or IV - Administer IV dose slowly over 1-2 min - MAX single dose = 50 mg</td>
</tr>
<tr>
<td>Diphenhydramine 25mg ELIXIR/CAPSULE</td>
<td>25-50 mg PO</td>
<td>1-2 mg/kg PO - MAX single dose = 50 mg</td>
</tr>
<tr>
<td>Epinephrine auto-injector (Epi-pen®)</td>
<td>Hives, diffuse erythema, bronchospasm, laryngeal edema, hypotension: 0.3mg IM</td>
<td>Hives, diffuse erythema, bronchospasm, laryngeal edema, hypotension: Weight &lt;30 kg: 0.15 mg IM (Use 0.15 mg auto-injector) Weight ≥30 kg: 0.3 mg IM (Use 0.3 mg auto-injector)</td>
</tr>
<tr>
<td>Anaphylaxis</td>
<td><strong>Use 0.3 mg auto-injector</strong></td>
<td></td>
</tr>
<tr>
<td>Epinephrine 1mg/10mL PREFILLED SYRINGE for IV administration (Anaphylaxis) (1:10,000)</td>
<td>Anaphylaxis (ONLY for very unstable patient: severe hypotension, tachycardia, severe airway edema) 0.1 to 0.3mg SLOW IV push (1 mL to 3mL of 1:10,000 dilution) May repeat every 5 – 15 minutes as needed up to 1 mg total</td>
<td>Anaphylaxis: 0.01 mg/kg IV (0.1 mL/kg of 1:10,000 dilution) MAX individual dose: &lt;30 kg = 0.15 mg (1.5mL) &gt; 30 kg = 0.1 to 0.3 mg (1 mL to 3mL) - May repeat up to 1 mg total dose</td>
</tr>
<tr>
<td>Loratadine (Claritin)</td>
<td>10mg PO</td>
<td>2-5 years: 5 mg PO ≥6 years: 10 mg PO</td>
</tr>
<tr>
<td>Methylprednisolone 125 mg VIAL</td>
<td>125 mg IVP administered over 3 minutes</td>
<td>0.5-1 mg/kg IV push over 3 minutes - MAX dose = 125 mg</td>
</tr>
<tr>
<td>Sodium chloride 0.9% 500 mL</td>
<td>1,000mL rapidly IV</td>
<td>10-20 mL/kg rapidly IV - MAX volume = 500 mL - 1,000 mL</td>
</tr>
</tbody>
</table>

References:
Protocol for Extravasated Contrast Material
(Formerly Addendum I.15C)

Modified from the ACR Manual of Contrast Media Manual

Background:

Extravasated iodinated contrast media is hyperosmolar and toxic to the surrounding tissues. Most patients recover without sequelae but severe adverse events may occur. Extravasation produces an acute local inflammatory response that peaks at 24-48 hrs although ulceration and tissue necrosis may occur as early as 6 hours after the extravasation. Extravasation of a large volume of contrast material can produce a compartment syndrome.

Evaluation and Treatment:

- All patients in which an extravasation has occurred should be evaluated by a radiologist from the service that would be reading the exam.
- All outpatients should be monitored in the department for a minimum of 1 hour even if the patient is asymptomatic.
- Elevation of the extremity and a cold or warm compress should be applied to the site up to four times/day for 1-3 days (This decision is based on radiologist and patient preference)
- If the symptoms improve or the patient remains asymptomatic, they may be sent home but told to go immediately to an ER if symptoms deteriorate or if there are skin/neurologic changes (ulceration, blistering, change in sensation).
- If symptoms have not improved after 2 hours or skin/neurologic changes develop, the patient should be referred to the emergency room.
- For inpatients, the extremity should be elevated and a cold or warm compress should be applied (as above). Inpatients may be sent back to the floor but the house staff must be notified of the incident.
- A plastic surgical consult is frequently not necessary and a reliance of a volume threshold for surgical consultation is unreliable. In general, the need for surgical consultation should be made on the basis of the patient’s signs and symptoms.
- An immediate plastic surgical consultation is indicated with the following:-
  - Increasing swelling/pain after 2-4 hours.
  - Altered tissue perfusion as evidenced by decreased capillary refill
  - Change in sensation of the affected limb
  - Skin ulceration or blistering.

Documentation:

- All extravasation events should be documented in the radiology report and the referring physician should be notified.
- The technologist is responsible to ensure that the extravasation incident is documented in Event Reporting system.

ACR Reference on Contrast Extravasations

"There is no clear consensus regarding effective treatment for contrast medium extravasation. Elevation of the affected extremity above the level of the heart to decrease capillary hydrostatic pressure and thereby promote resorption of extravasated fluid is recommended, but controlled studies demonstrating the efficacy of this treatment are lacking. There is no clear evidence favoring the use of either warm or cold compresses in cases of extravasation. As a result there are some radiologists who use warm compresses and some who use cold compresses. Those who have used cold have reported that it may be helpful for relieving pain at the injection site. Those who have used heat have found it helpful in improving absorption of the extravasation as well as in improving blood flow, particularly distal to the site"
Contrast Extravasation Discharge Instructions  
(FORMERLY Addendum I.15C)

During your test today, you had intravenous contrast material extravasation. This means that some of the IV fluid or contrast material went into the tissues of your arm/hand. This may cause swelling and discomfort. The fluid will be absorbed by your tissues and any symptoms should go away.

The contrast material used was ________________________________

The approximate amount of extravasation was ____________________

Treatment:

- Try to keep the affected extremity elevated above the level of the heart as much as possible.
- You can apply either warm or cold compresses for 15 minutes a few times a day for 3 days or until the symptoms resolve.

Seek immediate medical attention if:

1. your swelling or pain do not improve
2. your skin blisters
3. there is increased firmness at the site
4. your arm or an area on your arm or hand becomes red
5. you experience a change in sensation of your hand or arm such as numbness and tingling

I have read and understand these instructions and received a copy.

Name of patient ________________________________

Signature of patient ________________________________
Radiology Policy Regarding Simultaneous Infusion of Blood Products and Contrast Media

Blood transfusion and all blood related products including FFP, platelets and other cryoprecipitates play a vital role in patient care. Like drugs, these substances may also elicit allergic like reactions and immune responses that can potentially mimic reactions induced by IV injection of iodinated AND gadolinium based contrast media used during CT and MRI scans respectively. In conjunction with Yale/YNHH Transfusion Medicine Services, a joint agreement was made to limit CT and MRI scans WITH CONTRAST for patients actively receiving ANY blood product to STAT or LIFE-THREATING PRIORITY. For these studies, it is felt that the information provided by the rapid imaging outweighs any potential risk and/or uncertainty on which substance may have caused a reaction.

All other scans should be delayed until after the infusion is completed to avoid any misinterpretation of a contrast reaction from a blood product reaction and vice versa. These studies can be performed immediately after the infusion is complete if necessary."
Policies Specific to CT Contrast Media
I. Procedure Guidelines for Oral Contrast

1. All Patients
   a. Prior to the administration of oral contrast, the patient’s clinical history including medications, allergies and sensitivity and drugs, will be reviewed by the technologist in the patient’s medical record, or obtained using the appropriate outpatient questionnaire, and subsequently scanned into the RIS medical record.
   
   b. If no contraindications are noted, the technologist proceeds with oral contrast administration as per protocol identified by the radiologist.
   
   c. All patients routinely receive an iohexol (Omnipaque®) in H20 mixture, prepared according to the radiologist protocol, labeled with patient’s demographics, and provided to the patient or nurse with instructions for administration.
   
   d. If contraindications are noted, the request is referred to the radiologist for further consideration. An oral Barium Sulfate solution may be prescribed for patients allergic to iodinated contrast.
   
   e. A physician must be readily available during the contrast examination.
   
   f. A contrast reaction kit and emergency equipment (including a code cart, if a hospital site), must be readily available. 
      See Policy II.6 – Emergency Equipment & Supplies

2. In-patients
   a. Labeled oral contrast will be delivered to the in-patient floor for administration to the patient by their nurse.

3. Adult ED Patients
   a. After the ED patient’s Pregnancy and eGFR test results are available (for select patients), the ED physician will order the contrast CT exam (Oral or IV) in the RIS, and include pertinent clinical history.
   
   b. CT exams requiring contrast will be reviewed and protocolled by radiology prior to dispensing and administering the contrast agent. The exception to this is for a “FULL Trauma” ED patient.
   
   c. If the study requires oral contrast it will be picked up in Radiology and given to the patient by ED nurse.
   
   d. Patient imaging will begin approximately 45 minutes after the patient begins drinking it. Extended oral preparation may be prescribed by the radiologist at their discretion based on exam indication.
4. **Pediatric ED Patients**
   a. After the contrast request has been reviewed by the radiologist, the appropriate dose will be determined.

   b. Oral contrast will be dispensed to the pediatric ED for administration to the pediatric patient by their nurse.

   c. The patient’s nurse will notify the ED radiology scheduler as the patient finishes drinking the oral contrast to coordinate exam timing.
CT Scan Oral Contrast
(FORMERLY Addendum I.15I)

25ml Omnipaque (Iohexol) in 900ml of Water

Patient Name: ______________________________
MRN: ___________________ Pt. Location_________
Date: ______________ Exp.Date/Time___________
Start Oral: _____________ Finish_____________
Approx. Scan Time: ______________

Please instruct patient to drink contrast over the assigned hour. Please call 8-5639 if you have any questions or the patient cannot follow instruction, so we can expedite the procedure. If the start time is delayed please inform 85639. Inform the MD if the patient experiences any adverse events such as difficulty breathing or itching.

Rev 3/18/10

CT Scan Oral Contrast
Barium Sulfate Suspension (2.1%w/v, 2.0%w/w)

Patient Name: ______________________________
MRN: ___________________ Pt. Location_________
Date: ______________ Exp.Date/Time___________
Start Oral: _____________ Finish_____________
Approx. Scan Time: ______________

Please instruct patient to drink contrast over the assigned hour. Please call 8-5639 if you have any questions or the patient cannot follow instruction, so we can expedite the procedure. If the start time is delayed please inform 85639. Inform the MD if the patient experiences any adverse events such as difficulty breathing or itching.

Rev 3/18/10
Metformin and Iodinated Contrast
Information for patients

This fact sheet provides instructions on how to take your oral diabetes medications containing Metformin after you receive iodinated contrast dye for a CT scan.

Diabetes medications that contain metformin include:
- Metformin (Glucophage/Glucophage XR, Glumetza, Riomet, Fortamet)
- Alogliptin/metformin (Kazano)
- Canagliflozin/metformin (Invokamet/Invokamet XR)
- Dapagliflozin/metformin (Xigduo XR)
- Empagliflozin/metformin (Synjardy/Synjardy XR)
- Ertugliflozin/metformin (Segluromet)
- Glipizide/metformin (Metaglip)
- Glyburide/metformin (Glucovan)
- Linagliptin/metformin (Jentadueto/Jentadueto XR)
- Pioglitazone/metformin (Actoplus Met/Actoplus Met XR)
- Repaglinide/metformin (Prandimet)
- Rosiglitazone/metformin (Avandamet)
- Saxagliptin/metformin (Kombiglyze XR)
- Sitagliptin/metformin (Janumet/Janumet XR)
- Vildagliptin/metformin (Eucreas)

Why should I be taking my metformin differently?
In rare instances, Metformin can cause a severe side effect called lactic acidosis. This may occur more frequently in patients with decreased kidney function. Decreased kidney function is apparent when your estimated glomerular filtration rate (eGFR) is less than 30 mL/min. Contrast dye can increase the chances of metformin causing lactic acidosis in patients with decreased kidney function.

What should I do?
If you have decreased kidney function (eGFR less than 30 mL/min):
- Stop taking metformin or metformin-containing products and contact your doctor within 48 hours before restarting.
- Bring this form with you to the doctor.

If you do not have decreased kidney function (eGFR 30 mL/min or greater):
- Continue taking metformin as originally prescribed.

Questions or concerns
If you have any questions or concerns, talk to your doctor or pharmacist.
Low-Osmolar Iodinated Contrast and Myasthenia Gravis

Low-osmolar iodinated contrast has been shown to have a weak association with exacerbation of Myasthenia Gravis-related symptoms, most commonly respiratory compromise. This association has been discussed with Yale Neurology who feel that the low risk does not merit screening patients for Myasthenia at this point. If a patient declares himself or herself as suffering from Myasthenia Gravis, our policy should be to reassure them that it is highly unlikely that any deterioration in symptoms will occur.
**CT TECHNOLOGIST: Policy for Power Injection**

**CVDs with TPN infusions cannot be used for contrast injection unless TPN has been disconnected and vigorously flushed by RN prior to exam, before patient leaves the floor.**

**NOTE:** No IV medication drips should be stopped or restarted without an RN’s help. Injector should not be used with any IV that has questionable patency. If in doubt, question the radiologist or the patient's care givers.

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### CVD’s – Adult use

<table>
<thead>
<tr>
<th>Catheter</th>
<th>Used for CT Inject.</th>
<th>Lumen Size</th>
<th>Max Injection Rate</th>
<th>Max PSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power PICCS (Bard) or equivalent from other manufacturer</td>
<td>Yes</td>
<td></td>
<td>Check Hub</td>
<td>Check hub</td>
</tr>
<tr>
<td>Power Ports (Bard) or equivalent port from other manufacturer</td>
<td>Yes</td>
<td>6.5-10 French</td>
<td>5cc/sec.</td>
<td>300</td>
</tr>
<tr>
<td>Power Hickmann</td>
<td>Yes</td>
<td></td>
<td>Check hub</td>
<td>Check hub</td>
</tr>
<tr>
<td>Non Power Injectable or unknown&lt;sup&gt;1&lt;/sup&gt; ports</td>
<td>Yes</td>
<td></td>
<td>1 cc/sec</td>
<td>100</td>
</tr>
<tr>
<td>Micropuncture introducers placed by IR</td>
<td>Yes</td>
<td>5 French</td>
<td>5 cc</td>
<td>300</td>
</tr>
<tr>
<td>IV catheters in a foot vein</td>
<td>Yes</td>
<td>18g-22g IV access</td>
<td>1 cc/sec</td>
<td>100</td>
</tr>
<tr>
<td>EJ or IJ - IV access</td>
<td>Yes</td>
<td>18g-22g IV access</td>
<td>2 cc/sec</td>
<td>300</td>
</tr>
<tr>
<td>Triple-Lumen (Arrow)</td>
<td>Yes</td>
<td>16g=brown port, Used whenever possible 18g=blue port</td>
<td>1 cc/sec (unless higher rate listed on hub)</td>
<td>100 (lines that list higher injection rates at hub are usually OK to inject up to 300 psi)</td>
</tr>
<tr>
<td>Power Mid Lines</td>
<td>Yes</td>
<td>4/5 French</td>
<td>5 cc/sec</td>
<td>300</td>
</tr>
<tr>
<td>Quinton/ Non-Power Hickman/ Permacath</td>
<td>NO</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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<sup>1</sup> Review Epic (lines and drains section) to research if type of port is known. If unknown, and need to inject at higher rate can review chest xray or scout image with radiologist to see if port is labeled with “CT” icon denoting power injectable port.
Non- Marked Piccs | NO
---|---

**Process**

1. Following Hand Hygiene Policy at all times: wash or Purell, don gloves, when completed remove gloves, then wash or Purell.

2. *RN must access and de-access all indwelling Ports* – CVD lumen access may be performed by the CT technologist to inject contrast.

3. *Prior to use:* All CVAD lines used for contrast with injector or hand injection must have a 15 sec. hub scrub with approved disinfectant and allowed to air dry (minimum 15 sec.). *(All CVD’s must be checked for patency and blood return, using a 10 cc saline syringe with 3 cc removed. Flush line with 10 cc sterile saline after. A CVD should not be used without verification of blood return.*

4. CT Technologist should monitor injection site for the duration of injection when possible.

5. The contrast for all CVD’s is Omnipaque 350 (except for Pediatrics Omnipaque 300 is used). If prior contrast reaction to Omnipaque, alternative agent like Isovue 370 may be used.

**Script**

**Adult Power Hickman – In-Patients:** Call the floor to check IV status. If the RN states the patient has a Hickman two (2) questions need to be asked:

1. Is the Hickman a **Power Hickman** (Needs to be labeled on the clamp with maximum injection rate, if not Is a P or an X seen within the line on the Chest X-Ray or is there documentation in EPIC.

2. Has there been **TPN** running?
   a. If **Yes:** to flush vigorously now and Disconnect TPN and to clearly mark lumen used for TPN.
   b. **Send patient with no meds running.** (Open flush is allowed)
   c. Instruct RN that the patient will return **without** the catheter being flushed with heparin.
   d. If the TPN cannot be stopped and flushed before leaving the floor, the Hickman may not be used for the contrast injection.
   e. Follow 15 second hub scrub and allow to air dry (min. 15 seconds).
   f. Do not disconnect injector prior to exam completion or the hub scrub will need to be repeated.
   g. **Maximum flow rate will be listed on the lumen clamp.**

**Power Hickman:** *Out-patient:* Follow 15 sec. hub scrub and allow to air dry (minimum 15 sec.) Maximum flow rate will be listed on the lumen clamp. Do not disconnect injector prior to exam completion or the hub scrub will need repeating. Call South Pavilion Core IR RN, Prep Hold RN, or RN in your respected area’s to flush heparin post injection per YNHH policy.

**Injection rate for use of PEDI Injector: Including foot veins**

<table>
<thead>
<tr>
<th>Lumen Size</th>
<th>Flow Rate</th>
<th>PSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>18g, 20g IV access</td>
<td>2 cc / sec</td>
<td>150</td>
</tr>
<tr>
<td>22 g IV access</td>
<td>2 cc / sec</td>
<td>150</td>
</tr>
<tr>
<td>24 g IV access</td>
<td>1.5 cc / sec</td>
<td>50</td>
</tr>
</tbody>
</table>

**Pedi- All Central Lines including Broviac:** *In-Patient patients:* Call the RN. Instruct RN to accompany the patient. Pedi RN will need to follow YNHH hub scrub policy. Pedi RN will hub scrub and access the pediatric patient’s **Central Line** and the technologist will connect the contrast. Omnipaque 300mg. may be injected @ 1 cc / sec. at 100 PSI. With the help of the CT Tech, the Pedi RN will disconnect the injector and follow YNHH heparin flush policy.

**Pedi Broviac:** *Outpatient:* Call Out Patient Pedi Nursing (follow same process as above)
!ALERT!

Attention all technologists who inject contrast. If you see a Pall Posidynne ELD filter or a Baxter INTERLINE System Extension Set (air eliminating filters) hooked up to a patient, please stop the line and let a nurse know before proceeding. These particular filters are used for patients with patent foramen ovale, as any air introduced into their body could result in a very serious reaction. They should NEVER be used with a power injector.

If you have any questions, please contact Deve Facchini:
david.facchini@vnhh.org
203-688-4367
CT Intraosseous Iodinated Contrast Injection Policy

IO lines may be used for power injection of iodinated contrast for CT

1. Flush IO line with 20cc IO saline. If IO line does not flush easily, do not use.

2. If Patient is unconscious, no analgesia is required. If patient is conscious and responsive to pain, IO 2% epinephrine free lidocaine should be administered just prior to contrast as per the protocol below:

**ADULT:**

- Prime EZ-Connect extension set with lidocaine *Note that the priming volume of the EZ-Connect is approximately 1.0ml.*
- Slowly infuse lidocaine 40 mg IO over 2 minutes.
- Allow lidocaine to dwell in IO space for 1 minute.
- Flush with 5 to 10 mLs of normal saline.
- Slowly administer and additional 20 mg of lidocaine IO over 1 minute.

**Pediatric:**

- Usual dose is 0.5mg/kg, not to exceed 40mg.
- Prime EZ-Connect extension set with lidocaine.
- *Note that the priming volume of the EZ-Connect is approximately 1.0ml.*
- Slowly infuse lidocaine over 2 minutes.
- Allow lidocaine to dwell in IO space for 1 minute.
- Flush with 2-5 mLs of normal saline.
- Slowly administer subsequent lidocaine (half the initial dose) IO over 1 minute.

3. Hook power injector tubing directly to IO line hub.

4. Inject contrast through IO line. No guidelines exist on rates for injection so use lowest injection rate possible (up to 5cc/sec) for the study and do not exceed 300 psi.

5. Disconnect power injector tubing from the IO line hub and flush the IO line with 20 cc IO saline.
Patients with a Single Kidney

It has been shown that there are no significant differences in the rate of AKI attributable to contrast enhanced CT in patients with a solitary kidney versus two kidneys. Therefore, patients with a solitary kidney should receive the same amount of IV contrast as those with two kidneys. This can be edited at the discretion of the supervising radiologist in patients with compromised renal function.


Patients undergoing dialysis therapy who require IV iodinated contrast

For patients with end-stage renal disease (ESRD) on long-standing dialysis, iodinated contrast can be used safely. In this setting, residual renal recovery is presumed to be lost and therefore any potential nephrotoxic effect of contrast should not have substantial impact on patient outcome. There is no need to initiate dialysis immediately after receiving IV contrast. Timing of next dialysis session can be decided by patients nephrologist.

Risk-benefit discussion is needed between radiologist and clinical team members if the patient is on dialysis and there is a chance of recovering renal function or the patient is on dialysis but is still making reasonable amount of urine. In this setting iodinated contrast should be avoided (but is not absolutely contra-indicated if a study is needed) to avoid any further injury to kidney.
POLICIES SPECIFIC TO MRI CONTRAST MEDIA

All MRI polices have been moved, and are now centrally located within the YNHH MRI safety manual. Please click the below link to be routed to the manual:

https://ynhh.ellucid.com/manuals/binder/916