QUICK REFERENCE HANDBOOK

CHILDREN'S NATIONAL HEALTH SYSTEMS
DIVISION OF DIAGNOSTIC IMAGING AND RADIOLOGY
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PEDIATRIC RADIOLOGY MANUAL

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Pediatric Radiology Manual

General Reference

A.1 Call Hours and Attending Read-Out Schedule A.1

WEEKDAYS Mon-Fri 5:00 PM to 8:00 AM

WEEKEND Sat-Sun 9:00 AM to 8:00 AM

ON-CALL READOUTS

9:30 PM - Neuro over phone (also late afternoon readout on **weekends**)

Body in house (attendings in house until 10:00PM on weekdays only)

MORNING READOUTS

7:30 AM --- Body

8:00 AM --- Neuro

A.2 Phone and Pager Numbers A.2

Radiology Department	Phone	Pager
On-Call Resident/Wet Desk	4687/3921	58643
Resident On-Call Room	3684	--
Radiology Front Desk	5073	--
Digital Imaging Lab	3426	--
Scheduling Office	4700	--
Purple Conference Room	3884	--
On Call CT Tech	4579	Front Desk
On Call US Tech	3410	Front Desk
On Call IT Person	--	50621
Yolanda Jones	4252	0464
Morgan Best	4292	--
James Bynum	2934	--
Angelique Norfles	4291	--

Radiology Service	Doc Phone	Doc Pager	Tech Phone	Nurse Phone
CT - 2nd Floor	2949	58644	5085	3004
CT - ED	4687	58643	6595	--
Fluroscopy	4599	--	3694	3902
IR	3791	58646	3791	3791
MRI Body	2949	58644	2930	2927
MRI Neuro	2988	58645	2920	2927
Nuclear Medicine	3889	--	5091	--
Ultrasound	3417	--	3410	--
X-Ray 2nd Floor	4687	58643	3429	--
X-Ray - ED	4687	58643	6494	--
X-Ray - Ortho	4687	58643	3062	--

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General Reference

Service/Location	Phone	Pager
ED Main	5203	
ED Doctor	5265	
ED Follow Up Doctor	8982	
NICU Fellow	8743/7933	
PICU Fellow	8038/8040	
CICU Fellow	8002	
Surgery Fellow	8204/8205	
Surgery Resident	8208/8209	0673
Ortho Resident	8203	8443
Anesthesiology	2025	1425
Urology Resident		8041/8042
Hematology/Oncology		8139
GI Resident	7164	
AT1 Resident	7180	
AT2 Resident	7185	
AT3 Resident	7191	

Outside Service	Phone
UMC ED Doctor	202-741-4100
UMC QA Tech	202-741-6581
HSC Doctor	202-832-4400 x 5439
CNI - Main	301-765-5700
CNI - Rad MD	301-765-5708

Miscellaneous Service	Phone
Security/Parking	2065
Engineering Control	6040
Environmental	1153
Bed Control	5005
TCD Pager (x6600)	4617
Occupational Health	2035

Inpatient Floors	Inpt Unit	Room #'s	Phone
2nd Floor Main	PACU		2031
	OR		2015
3rd Floor East	PICU	300-313	2010
	CICU	314-324	6670
	HKU	325-344	5195/5114
4th Floor East	HCU	400-437	5180
4th Floor Main	SSU		5145
5th Floor East	SCU	501-530	5170
	NCU	531-548	5150
6th Floor East	NICU	612-659	5040
	GI	600-611	7494
7th Floor East	RCU/MCU		5120/5140

Faculty Name	Initials	Pager
Bunmi Adeyiga	AA	0942
Anjum Bandarkar	ANB	1845
Anna Blask	AB	8165
Dorothy Bulas	DB	8166
Zarir Khademian	ZK	0235
Judyta Loomis	JL	4318
Bruce Markle	BMM	8173
Jonathan Murnick	JM	3770
Hansel Otero	HO	0331
Eva Rubio	ER	2990
Eglal Shalaby-Rana	ESR	8176
Karun Sharma	KS	5213
Raymond Sze	RS	0534
Jason Tsai	JT	1487
Ranjith Vellody	RV	0888
Gilbert Vezina	GV	8179
Pranav Vyas	PV	0186
Matthew Whitehead	MW	2149
Bhupender Yadav	BY	1765

Revised: 11/2/2015

GENERAL REFERENCE

A.3	DOCUMENTATION OF FINDINGS	A.3

ALL studies should have:

- Mandatory: a written NOTE in Synapse (ED turnover time <30 minutes)
- Mandatory: Time of communication (can use synapse NOTE time stamp if note is entered at the same time as communication happened)
- Mandatory: First and Last name of person receiving the communication
- Optional: Job title of person receiving the communication (physician, NP, PA, resident, fellow etc)

To contact referring MD:

- For *ED* - call **5203 / 5265**
- For *inpatient/ICU* - call (ASCOM number is fastest) or page using numbers in A.2 above
- For *floor* – call or page using numbers from directory or find from patients Cerner chart (see A.4)

1. **HOW TO FOLLOW-UP ON AND DOCUMENT CHANGES TO THE PRELIMINARY INTERPRETATION**

   A. Critical change - call ED and document in report as well as fax notes (follow-up doc at **8982**)
   B. *Minor* changes - document in fax notes
   C. Change of Shift - ED prelim notes faxed at about 9:00am each morning after read-out with attending.

2. Which Neuroimaging Studies To Dictate And Which To Review With Only A Preliminary Report

A. Neuroimaging CT

Action	ED patients	Inpatients/other
Briefly review and QA exam while patient is on exam table; if additional images need to be obtained/repeated, inform technologist	YES	YES
Review all available images, including thin images and multi-planar reconstructions if they have been generated	YES	YES
Document a preliminary interpretation with a NOTE in synapse	YES	YES
Dictate examination in Powerscribe	YES	NO

Who is my attending for dictation purposes?

- Exams dictated *before* late evening readout: on call neuroradiologist on call schedule
- Exams dictated *after* late evening readout: AM read-out radiologist for overnight cases - this is the neuroradiologist listed second on the next day's work schedule
- If there is a question regarding dictating attending, clarify during 9.30 pm or 8 AM read-out.

B. Neuroimaging MRI

- Refer to section, "G.2 How to Set up an Emergency MRI"

3. WHICH BODY STUDIES TO DICTATE

A. All US and CT studies done on call should be QA'd and dictated by the resident/fellow.
B. Emergency body MRI exams (eg. rule out osteomyelitis), should be QA'd and dictated by resident) fellow.

GENERAL REFERENCE

4. WHICH CONVENTIONAL STUDIES TO DICTATE

A. Dictate all ER cases between 5:00 PM and 11:00 PM (weekdays) and 8:00 AM to 11:00 PM (weekends)
B. Dictate ER cases between 11:00 PM and 8:00 AM when called to give prelim read.
C. Dictate inpatient studies, when you are called asking for a preliminary read.

GENERAL REFERENCE

	How to Reach the Ordering Physician or Licensed Independent Practitioner (PA, NP)	A.4

ED PATIENTS (24/7)

CNMC **x5203**
UMC **(202) 741-4100**

INPATIENTS

- **PICU, CICU, NICU** (24/7): Call ASCOM phone for fellows (see section A.2)
- Page **on call physician for referring service**
  a) Identify service taking care of patient (if patient has been admitted)
    - Open "Bear Tracks"
    - Login CERNERWORKS
    - Click BINOCULAR SYMBOL upper right
    - Type in MRN, and then click SEARCH in upper right corner
    - When patient is correct, click OK
    - Go to highlighted blue ADMIT TO
    - Under this category find order name "Admit to" and read- should containing admitting service, diagnosis and attending.
    - If there is no "admit to" order name listed yet, go to menu (left), clinical documents, Emergency Department, ED Inpatient bed Request, read which service is going to take care of this patient.
  b) Look up service phone/pager in CNMC on-call schedule
    - http://spsbedb.cnmc.org/ConsultLists/DisplayCL.aspx
    - Go to intranet
    - Click on HELPFUL LINKS (top right yellow)
    - Choose ON-CALL SCHEDULE
    - Choose date/week day
  c) Look up inpatient pediatrician/hospitalist teams

GENERAL REFERENCE

- http://intranet.childrensnational.org/healthcare-professionals/residents/Documents/Rosters/resident-weekly-roster.doc
- Go to intranet
- Click on HEALTHCARE PROFESSIONALS (top menu bar)
- Choose RESIDENTS
- Choose WEEKLY ROSTER AND CROSS OVER SCHEDULE
- Open document

OUTPATIENTS

- **CNMC clinics**
  a) Page physician who signed radiology order
    - Go to Synapse jacket
    - Click on REPORT tab
    - Click on paper clip symbol
    - Scroll through documents to look for referring physician name/phone number (frequently not the person listed in Synapse jacket as REQUESTER)

  b) Page physician who last saw patient in clinic
    - Open Citrix App => Bear Symbol Tracks
    - Click "Bear Tracks"
    - Login CERNERWORKS
    - Click BINOCULAR SYMBOL upper right
    - Type in MRN, then click SEARCH
    - When patient is correct, click OK
    - Choose CONSULTING PHYSICIAN
    - Click on DOCUMENTS (on left)
    - Then CLINICAL DOCUMENTS folder
    - Then CONSULTS, look up most recent and who signed it
- **Non-CNMC referring physicians**
    - Generally listed under REPORT tab
    - Scroll to bottom
    - Click on REQUESTER to bring up phone #

- If no number listed:
  - Look up order form in Synapse (usually has contact info)
  - Call Margret Graves/on-call COR
- **HSC physicians**
  - Call HSC Attending line 202.832.4400, x5439 (also see C.3)

ALTERNATIVE WAYS TO FIND INPATIENT PHYSICIANS

a) Find out which service patient is admitted to
   - Open Citrix App => Bear Symbol Tracks
   - Click "Bear Tracks"
   - Login CERNERWORKS
   - Click BINOCULAR SYMBOL upper right
   - Type in MRN, then click SEARCH
   - When patient is correct, click OK
   - Choose CONSULTING PHYSICIAN
   - YELLOW AREA STATES SERVICE TAKING CARE OF PATIENT after "Acct Number"

b) Call operator at **x5000**

c) Call admissions **x4068** to find out which room the patient is admitted to and have them connect you with the nursing station

d) Find physician in Synapse/ Page physician who placed order
   - Open Synapse
   - Open REPORT tab in jacket
   - Scroll to bottom
   - See REQUESTER

e) Find physician who last took care of this patient
   - Open Citrix App => Bear Symbol Tracks
   - Click "Bear Tracks"
   - Login CERNERWORKS
   - Click BINOCULAR SYMBOL upper right
   - Type in MRN, then click SEARCH

- When patient is correct, click OK
- Choose CONSULTING PHYSICIAN
- Now in the top menu choose CHART, then on the bottom CHART ASSESSED BY, then MOST RECENT

f) Look up physician name in Cerner

- Open Citrix App => Bear Symbol Tracks
- Click "Bear Tracks"
- Login CERNERWORKS
- Click BINOCULAR SYMBOL upper right
- Type in MRN, then click SEARCH
- When patient is correct, click OK
- Choose CONSULTING PHYSICIAN
- Click on DOCUMENTS (on left)
- Then CLINICAL DOCUMENTS folder
- Then CONSULTS, look up most recents and who signed it

g) Call nursing station to find out who is physician in charge (nursingstation numbers see section A.2)

A.5 Hours of in House Technologist Coverage A.5

US

24/7 except

Sat	12:00AM – 7:00AM	&	7:30PM – midnight
Sun			6:30 PM- midnight

We will be totally 24/7 in November 2015

MRI

Weekday	6:30 AM to 11:00 PM
Weekend	7:30 AM to 6:00 PM
Holiday and After Hours:	on call coverage

IR

Weekday	6:30 AM to 4:00 PM
Weekend, Holiday and After Hours	on call coverage

GENERAL REFERENCE

NUCLEAR MEDICINE

Weekday	7:00 AM to 5:00 PM
Weekend, Holiday and After Hours	on call coverage

CR AND CT TECH

24/7

NURSE COVERAGE

Weekday	7:00 AM to 7:30 PM
Sedate Saturday	7:00 AM to 4:30 PM
Non-Sedate Saturday	7:30 AM to 4:00 PM
Sunday	8:00 AM to 4:30 PM
Holiday and After Hours	on call coverage

A.6 UMC Troubleshooting A.6

- If a UMC study is <u>not</u> appearing in Synapse…

    1. Call the UMC ED at **(202) 741-4100** and ask to speak with the charge nurse. Ask that the images be manually pushed to Synapse.
    2. Look for the patient in the "All Studies" folder. Use as a filter "0" (zero) in the *Accession No* field, and today's date in the *Study Date Time* field. Leave other fields blank.

- If the study still does not appear in Synapse, inform the UMC ER attending that you are unable to see the images. At this point the only option is for them to burn a CD and send it to CNMC by courier.
- In the past, the UMC PACS allowed us to login remotely, but this functionality is no longer available.

GENERAL REFERENCE

A.7 How to Protocol Studies Using Centricity

Bold Arial = hit this button or tab

Worklist
Technologist

 For Performing Resource(s):

Next

 For Resource Lookup:

Select "Resources" in second column: CT1 & CT2 for CT; MRI1 & MRI2 for MR **Ok**
Find studies of interest under Code column
If patient has a paperclip icon () they have scanned documents (prescription); click the box; click the paperclip that appears right upper quadrant; click box to right of ID; click **view** to see document

Click **blue accession number** under ACC column
If you want to see prior report click **blue accession number** under ACC column in bottom window

 For Protocol:

Select desired protocol within the available Dictionary  to add the protocol

 to see protocol details

Comments section for details (IV or PO, slice thickness), modifications, messages to technologists

Close

If you want to protocol for studies in the future:

Primary filters
Select dates
Search

POLICIES

B.1	BUN and Creatinine	B.1

Which **outpatients** should get screened with a BUN and creatinine?

- For outpatient **without** any prior medical antecedents, BUN and creatinine is not required unless there is a reason to suspect renal disease.
- If an **outpatient** has sickle cell disease, known kidney disease, care by nephrologist or urologist, renal transplant, or nephrectomy, currently on dialysis, or is undergoing chemotherapy, BUN and creatinine should be ordered before contrast administration unless one is available within 6 weeks of the examination.

Which **inpatients** should get screened with a BUN and creatinine?

- ALL **inpatients** require screening with BUN and creatinine. Exceptions include medical alert patients, or patients in which the radiologist determines the benefit outweighs the risk of continuing without a BUN and creatinine.

What are normal ranges for creatinine at CNMC?

Age	Creatinine Range*
0	0.7-1.2
7 days	0.3-0.8
1 month	0.2-0.5
1 year	0.2-0.8
10 years	0.5-1.1
19 years	0.6-1.3

How should I proceed if I am **concerned about the safety of administering contrast** due to the patient's renal status?

- We are currently collaborating with nephrology to achieve uniform policies based on GFR values. In the meantime, if you have questions about the safety of contrast administration due to renal status, please consult with the

nephrology team or on call physician. You can find their contact information on the hospital intranet page by navigating to the "On-call schedule" under "Helpful Links." Look under the "renal" section on the appropriate call list.

- Patients currently on dialysis – please consult Radiologist

How is **screening** for contrast safety achieved?

- Technologist and/or Nursing staff will complete a contrast screening form prior to administering contrast. <u>It is the radiologist's responsibility to ensure this step is completed.</u>

What about patients with **sickle cell disease**?

- Patients with sickle cell disease should be screened with a BUN and creatinine before receiving CT or MR contrast. Contrast should only be administered when clinically indicated. However, in our opinion, sickle cell disease in itself should not be considered a contraindication to receiving CT or MR contrast.

What about patients with **diabetes**?

- Diabetes in itself is not a contraindication to receiving contrast. Patients taking metformin should be instructed to hold this medication for 24 hours and should also have a BUN and creatinine drawn.

What about patients with **asthma**?

- Asthma in itself is not a contraindication to receiving contrast and does not ordinarily necessitate premedication.

Which patients should be **premedicated**? (Refer to B.3)

- Premedication should be considered for patients with prior severe reactions to contrast.

Which patients should receive **isoosmolar contrast**?

- Isoosmolar contrast (**Visipaque**) should be considered for transplant patients, patients with sickle cell disease, patients with borderline normal or wavering renal status, and premature neonates.

POLICIES

When should patients receiving contrast be **hand injected**?

- Only peripheral IVs should be power injected. PICC lines should only be power injected when specifically designed for this purpose. "Power PICCs" have their maximum flow rate clearly indicated on them. At CNMC, most "power PICCs" are purple in color.
- Port-a-caths should not be power injected.
- Hand injections should be performed If < 10 cc contrast is being administered, if a patient is < 10 kg, or if the available access is tenuous.
- Central Line Contrast Administration
- Scrub the Hub – 30 Sec wet/30 sec dry with Chlorhexidine

Which contrast should we use for CTA examinations.

- **Omnipaque** or **Visipaque 320**

What is our policy on giving contrast twice within 24 hours?

- Our policy is to NOT inject contrast twice within a 24 hour period.

B.2 Contrast Extravasation B.2

IMMEDIATE CARE

1. Attempt to remove contrast (gently pull back)
2. Elevation of extremity above level of heart
3. Cold compress (e.g. ice pack wrapped in dry towel) to site
4. Monitoring for signs/symptoms
   - If *outpatient*, monitor in radiology department x 2 hours. On discharge, clear instructions to patient/family to seek prompt medical care if new or worsening signs or symptoms
   - If *inpatient*, advise clinical care team of need for close follow-up for several hours, and surgical consult if concerning clinical signs or symptoms are present.
   - Signs and symptoms to assess for:
     - skin blistering or ulceration
     - altered tissue perfusion (decreased capillary refill)
     - progressive pain or swelling
     - change in sensation

POLICIES

If any of these signs and symptoms is present, immediate plastic surgery consult is indicated.

CHECKLIST

1. Notify attending. Include details of incident in exam dictation.
2. Write incident report (via RL Solution) immediately, including type and amount of contrast extravasated, physical findings, and phone number that patient can be reached (MD and RN #s if inpatient). Phone # needed for follow-up phone call in 24 hours following.
3. For *outpatients*, notify referring physician. For *inpatients*, call complete report to care provider.
4. 24 hour follow-up call to check on status of patient (inpatient or outpatient) by Radiology RN. Follow-up note to incident report will be completed by Radiology Nursing.

Refer to ACR manual on contrast media (ver. 8, 2012) for detailed information

B.3	**Contrast: Premedication for Prior Contrast Reaction**	B.3

To be ordered by referring physician:

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

POLICIES

Management of Radiologic IV Contrast Extravasations

Immediate Care

- Attempt to remove contrast (gentle pull back)
- Ice pack wrapped in dry towel
- Elevation of extremity

Monitor in Radiology Department x2 hours

- Estimate amount of contrast extravasation
- Assess for presence of:
  a) Skin Blistering
  b) Altered tissue perfusion (⬇cap refill)
  c) Increasing pain
  d) Change in Sensation
- Obtain Plastic Surgery Consult if any signs are present

Checklist:

☐Notify Radiology attending (weekdays, evenings or weekends); include details of incident in dictation of examination.

☐Document electronic Safety Event Report immediately to include:

- Patient's phone#
- Amount of contrast extravasated
- Physical findings and immediate care

☐For all in house patients, hand-off a complete report to patient's care provider on the in-patient unit. (nurse, resident, fellow, attending).

☐Radiology Nursing will make a 24hr follow-up phone call to parent, or inpatient unit to check on status of child-document f/u note on electronic Safety Event Report.

An in-patient may return to the floor to be monitored provided all physician and nurse contact numbers are on the Incident Report

B.4 Critical Results Documentation B.4

WHEN TO DOCUMENT CRITICAL RESULTS

- o Testicular torsion
- o New Intracranial hemorrhage
- o Brain herniation
- o Tension Pneumothorax

NOTE: These results must be documented as "critical result – discussed with _____at _____on _____"

B.5 Outside CDs B.5

Policy:
We render official reports on outside studies accompanying ED patients, as well as PICU direct admit patients.
Exclusions: We do not provide interpretations of outside fluoroscopy studies or outside ultrasound studies. An exception may be made for studies more than 1 week old if approved by the radiologist.

Process:
1. The ED uploads the images to LifeImage, enters a Cerner request for a Second Read, and calls the Radiology front desk to notify them.
2. The Radiology front desk completes the order and uploads the study to Synapse from LifeImage, placing the study in the ED folder.
3. The Wet Desk radiologist interprets the study and renders the report (this applies 24/7, to simplify the process).

Backup and issues:
If uploading to Synapse fails…
The Lead Tech in X-ray may be able to help.
The IT team is available for backup, questions, difficult disks.
Please review the images for the clinical team using LifeImage, and place a written note in the black & white notebook at the wet desk.
http://lifeimage/inbox/login.jsp

POLICIES

B.6	Pregnancy	B.6

Pregnancy evaluation should be done for ALL female patients ≥ 10 years of age. Patients pregnancy status and date of LMP must be documented in Centricity.

OUTPATIENTS, INPATIENTS, AND ROUTINE ED PATIENTS

A. Interview patients and/or check inpatient chart to determine:
   1. If the patient has started her menses – if YES, document date of last menstrual period (LMP)
   2. If patient has a negative pregnancy test within the last 24 hours or if negative pregnancy test since date of admission.

B. Proceed with exam if:
   1. Patient has not started menses
   2. Had a menstrual cycle in the past 10 days
   3. Negative pregnancy test in past 24 hours or
   4. Patient is otherwise biologically incapable of conceiving.

C. Direct Radiation to Abdomen/Pelvis
   1. If the radiograph does not require direct radiation to the abdomen/pelvis, (ie: head, neck, chest and all extremities except femurs that include hips) shield patient and proceed with exam without pregnancy testing.
   2. Perform Pregnancy Test for:
      a) Patients requiring a CT or is a radiograph that requires direct radiation to the abdomen/pelvis
      b) Patient has started menses
      c) Patient LMP was greater than 10 days prior to exam.

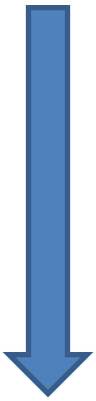
D. If patient is known to be pregnant or patient/parent refuses pregnancy test:
   1. Ordering physician must be notified by Radiologist to determine the necessity of exam.
   2. If exam deemed necessary, the patient must be informed of potential radiation effects to an unborn fetus and sign a waiver form document.

E. Outpatient pregnancy tests can be performed by the radiology nurses:
   Monday – Friday 0700 – 1900
   Saturday and Sunday 0700 – 1530
   Pregnancy tests on inpatients and ED patients should be performed by their respective units.

POLICIES

No Contrast = No Pregnancy Test

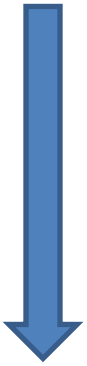
Contrast Ordered



(Patient menarche/10 days post menses)
RN Education to Patient and Family
Goal: Encourage testing for best study

Perform Pregnancy Test

Denied by Patient/Patient
No Contrast will be administered
Goal: Encourage testing for best study



Call Radiologist for Plan of Care

1) Scan w/o Contrast
   (Requires an order)

2) Scan with Contrast
   (Requires Radiologist Assistance)

POLICIES

CONSENT FORM FOR OUTPATIENTS, INPATIENTS AND ROUTINE ED PATIENTS

The "Consent for CT/X-Ray during Pregnancy" form must be completed for patients who need the exam based on clinical indication and are known to be or could potentially be pregnant. Consent forms are available from the technologist.

TRAUMA STAT ATTENDING, TRAUMA STAT AND MEDICAL ALERTS

- Pregnancy tests can be waived without question by the Trauma Stat Attending, trauma PTY4 resident, ED attending, or ED fellow.
- Trauma nurse will identify the trauma level as "trauma stat attending", "trauma stat" or "medical alert"
- CT technologist or X-ray technologist will document the patient's trauma status and the name of trauma nurse and attending physician in Centricity patient notes. The information provided by the trauma nurse suffices.

B.7	Sedation	B.7

Evening or weekend sedation will be performed by the referring **physician** or **inpatient floor**. No sedation services are routinely available in Radiology on weekends or evenings.

If anesthesia for MRI or IR is required, on call radiology nurse (call **ext. 5073** front desk) should be also called in.

☐Sedation Hours by RN's 8:00 – 4:00

- Sedation Flow Sheet
- Sedation Order
- Sedation Consent
- Contrast Screening Form
- Medication Reconciliation

☐Medication Sheet – Reference Tool

Agent	Indication	Route	Dosage	Onset	Recovery time	Complications
Chloral Hydrate	Hypnotic Sedative **<15 Kg or 3yr**	P.O.	50mg/kg/dose (<6mos age) Max dose 1000mg 75mg/kg/dose (>6mos age) Max dose 1000mg	10-20 min.	30 min to 2 hrs. Half-life 7-11 Hrs	**Paradoxical excitement** Epigastric distress Nausea/Vomiting Respiratory depression Hypotension Cardiac arrest
Versed (Midazolam)	Sedative Anxiolytic Amnesia prior to procedure **>6mos age**	P.O. I.V.	0.5mg/kg/dose (max dose 20mg) 0.1 mg/kg/dose May repeat x1 after 5 min.	10-20 min 1-5 min	20-30 min Half-life 2-7 Hrs	**Paradoxical reaction:** Aggressive behavior Hyperactivity Respiratory depression Hypotension Cardiac Arrest
Nembutal (Pentobarbital)	Hypnotic Sedative Anticonvulsant Anesthetic **>2y.o.**	I.V.	3mg/kg/dose Max dose 5mg/kg or 200 mg May repeat four times 0.5 mg/kg/dose	1-15 min	30 min-1hour Half-life 15-50 Hrs	**Sensory Sensitivity** Respiratory depression Hypotension Ataxia Confusion
Fentanyl	Synthetic opioid/ analgesic	I.V.	1-2 mcg/kg (1-12yr) Max dose 100mcg 0.5-1mcg/kg (>12yr) Max dose 100mcg	1-2 min	20-30 min Half-life 4 Hrs	Respiratory depression Hypotension Muscle rigidity

CONVENTIONAL RADIOGRAPHY

C.1 Aspirated Foreign Body C.1

- Classic scenario – children from 6 months to 4 years of age with new onset respiratory distress, wheezing and cough

1. First step is to start with a dedicated frontal and lateral CXR which will serve as baseline. Soft tissue lateral view of the neck often serves as a useful adjunct
   - Since inspiratory-expiratory views are difficult to obtain in young children, bilateral decubitus views (both in inspiration) could be used to show air trapping
2. Decubitus radiographs - compare the relative deflation of dependent lung, the dependent side appears denser due to decreased lung volume and the hemi diaphragm on the dependent side will be elevated compared to the contralateral dome
3. When available, chest fluoroscopy may be the preferred imaging technique. Confer with your attending to decide
4. Remember to call the ED physician with the x-ray results and use this opportunity to obtain/confirm patient's history, get a clinical perspective and discuss further management. Document this important conversation in your report

C.2 Child Abuse Skeletal Survey C.2

1. AP view of every bone, with segmental views of the four extremities (humeri separate from forearms separate from hands)
2. Lateral of skull and entire spine
3. Bilateral posterior oblique views of the ribs (to include opposite ribs) in children $\leq$ 2 yrs to better see the costo-vertebral regions
4. ALL studies are done in the department - not in the ED, to use our CR and not DR units

5. If you see an abnormality in the extremities, you may request dedicated 2-views of that body part for better evaluation - call the technologist to add it as part of the skeletal survey

C.3 How to Manage an HSC Radiograph C.3

1. Technologist will call you to check patient images.
2. Check images for adequacy and let the technologist know if you need any additional images.
3. Once you have determined that no further views are needed, call the HSC physician at **(202) 832-4400 ext. 5439** to give them a verbal wet read and document who received the reading.
4. Review the case with your attending during the next read out.
    - If there is any significant change in the interpretation, communicate that verbally and document that communication in your report.
5. Correct your report and send to your attending for final approval. **All HSC cases should be read within 24 hours** (per contract with HSC).

C.4 How to Manage an Outpatient Radiograph C.4

- STAT; General Pediatrician; Specialty Clinics; After Hours reporting

CARDIAC STAT

- Realize that EVERY exam done from the cardiology clinic is marked "STAT", but that almost NONE of these studies are actually stat.
- Obviously, if there is a large effusion or flagrant CHF, or a non-cardiac problem (such as a pneumonia, PTX, or rib fracture/chest wall infection/osteomylelitis), you should call the Cardiology clinic and speak to the referring physician during regular hours; after hours, contact the CICU fellow (8002), who covers 24/7.

CONVENTIONAL RADIOGRAPHY

NON-CARDIAC STAT

- These should be tagged with an alarm bell in Synapse. You should give a preliminary interpretation on these ASAP, and attempt to speak to the referring physician (under "Report" tab in Synapse, hover over the attending or requesting physician line, and then left click to get their phone number, otherwise it will be on the paper request or in scanned documents in Synapse or Centricity accessible via the paper clip).
- For negative or non-urgent findings, trying to make contact is good enough and leaving a phone message on voicemail or with an answering service is OK.
- For urgent or STAT findings (significant fracture, pneumonia, PTX, aspirated foreign body, etc.), please try to call the referring physician and get their management input. This usually consists of "take the patient to the ED." If you cannot speak to the referring physician, try to leave a message or document your attempts to contact in your dictation. Call the attending in the ED with the report, and tell them you are sending the patient to the ED for further management. Please also call the TRIAGE NURSE in the ED to tell them the patient is coming along with diagnosis and radiographs already obtained. The same procedure should be followed for unexpected findings on non stat/wet read requested studies.

GENERAL PEDIATRICIAN: is a wet reading/telephone report requested?

- **No** - QA study if needed, and read in routine fashion
- **Yes** - Telephone clinician with interpretation ASAP; ask for attending to read out study before contact with clinician. For urgent findings, ask if they want the patient sent to our ED. Call the ED attending at **5265** or **5203** detailing name and medical record of patient and problem, and inform them that you are sending the patient to the ED for further care. After doing that, call the Triage nurse at **5203** and inform them the patient is coming down from Radiology with relevant demographic and diagnostic information, including X-rays already taken.

CONVENTIONAL RADIOGRAPHY

SPECIALTY CLINICS (such as **Orthopedics** or **GI**):

- With rare exceptions, these are routine in nature. If urgent or unexpected findings are present, contact the clinic to give report.

AFTER HOURS REPORTING (What if it is after hours and I can't get hold of the clinician/clinic to give report?)

- For routine findings: leave a message on referrer's voicemail or with their answering service
- For urgent and/or unexpected findings: leave a message on referrer's voicemail or answering service and then call the ED attending at **5265** or **5203** detailing name and medical record of patient and problem, and inform them that you are sending the patient to the ED for further care. After doing that, call the Triage nurse at **5203** and inform them the patient is coming done from Radiology with relevant demographic and diagnostic information, including X-rays already taken.

COMPUTERIZED TOMOGRAPHY

D.1 How to Reach the On-Call in House CT Technologist D.1

1. On call CT technologist is in house 24/7 and available on phone **x4576**. They do not carry a pager.
2. On call CT tech can also be reached on **x5085** (2nd floor) and **x6595** (ED CT)
3. If unable to reach by phone, please call radiology front desk **x5073** and ask for help (technologist can be paged overhead)

D.2 Contrast: When and Why to Use Oral and/or IV Contrast D.2

1. Do you need **EXOGENOUS** contrast to answer the clinical question posed? If you have high **ENDOGENOUS** contrast between the body tissues in question, the answer is usually <u>NO.</u>
   - ƒ When does this happen?
     - o Discrete or diffuse pathology on a background of pulmonary parenchyma
       - So NO contrast to look for metastatic disease, fungal disease, bronchiectasis, or interstitial lung disease.
       - Simple pneumonia does not require IV contrast and rarely requires CT at all. If, however, the patient may have pneumonia complicated by necrosis, parapneumonic effusion, or lymphadenopathy, CT with IV contrast is indicated.
     - o Focal cortical bony abnormality such as fracture or geographic textural abnormality CT with NO contrast. For diffuse/permeative bony lesions, CT is usually a bad choice! Use MRI instead.
     - o Urolithiasis screening

2. Now that you are confronted with a CT request that requires contrast (i.e. not the situations outlined above), make sure you use contrast correctly.

COMPUTERIZED TOMOGRAPHY

3. Make sure patient passes IV contrast screening questions in which the technologist/nurse asks the patient/caregiver include inquiry about renal disease, allergies, and previous reactions to IV contrast *before* signing contrast order. If you decide patient needs premedication, a 24 hr regimen is available (please see **B.1 BUN/Cr**).

4. 4 varieties of IV contrast are available in our formulary: **Optiray 240** and **320**; **Visipaque 270** and **320**.
   - The vast majority of patients will receive the default contrast (**Optiray 240**) which is a LOCM with osmolarity of 600 mOsm.
   - **Visipaque** is an IOCM with osmolarity of 300 mOsm, and is preferred for those with sickle cell anemia and renal dysfunction, BUT this is more anecdotal rather than evidence-based.
   - The higher iodine concentration contrast (**Optiray 320** and **Visipaque 320**) is reserved for CTA. In the ED setting this usually means a PE study or less often a vascular injury study in a trauma patient.

5. Dose of IV contrast for almost all indications is 2 cc/kg; for CTA, up to 3 cc/kg can be used, up to 150 ml total.
   - Use a normal saline flush for all patients, ranging from 1 cc – 10 cc (just use patient age: each yr of age = 1 cc, with 1 cc min and 10 cc max)

6. Does the patient need ORAL contrast?
   - If opacification of the GI tract would help make the diagnosis, the answer is usually YES!
   - Exceptions include 1) abdominal trauma, where speed is of the essence and there is usually very impaired peristalsis and 2) suspected appendicitis. Only with your AT's approval.

7. Oral contrast on our formulary consists of 2 agents: **Gastroview** and **Omnipaque 240**.

COMPUTERIZED TOMOGRAPHY

- **Gastroview** tastes TERRIBLE but is cheaper and may give more uniform enteral contrast. For patients with NG or NJ tubes, and older otherwise healthy patients, this is usually the way to go.
- **Omnipaque** tastes PRETTY GOOD but is more expensive and we at CNMC have had some difficulty with variable opacification. For younger patients or patients with nausea (GI disease or chemo/tumor), this is the way to go. **Omnipaque 240** does have a specific labeling usage for oral CT evaluation
- For both, the technologists use a standard dose based on patient weight. For many patients, especially those with GI distress, whatever the patient can tolerate is the ideal dose.

8. Specify duration of oral contrast.
   - Standard is oral contrast over 1 hour. If you are only interested in stomach and C-sweep/proximal jejunum, 30 minutes in right decubitis position before placing patient supine is fine. If the colonic contrast is needed, either specify 90 minutes or ask for contrast per rectum.
   - If you are asked to do a G-tube check CT for possible dislodged G-tube, inject 1 cc/kg of DILUTE **Omnipaque 240** through the G-tube port and scan using low dose technique from the lung bases to 15 cm below the G-tube. No IV or oral contrast is needed.

9. Place orders in Centricity in comment box, e.g."2cc/kg Optiray 240 IV contrast with standard dose of Gastroview p.o over 1 hr with 5 cc NS IV flush"

10. Sign contrast order sheet! Make sure that what you write on the sheet corresponds with your comments in Centricity.

COMPUTERIZED TOMOGRAPHY

D.3	Contrast Reaction: How to Manage	D.3

Reference: ACR manual on contrast media - Version 8, 2012, available online at http://www.acr.org/Quality-Safety/Resources/Contrast-Manual. See **Chapter 12**: Treatment of Contrast Reactions.

IMMEDIATE CARE

1. Discontinue contrast injection.
2. Initial assessment
   - ƒ Airway - How does the patient look? Can the patient speak? How does their voice sound? **If airway is not secure, call code (x2222).**
   - ƒ Breathing - How is the patient breathing?
   - ƒ Circulation - What is the patient's pulse strength and pulse rate? What is the patient's blood pressure?
3. Monitoring – pulse oximeter, blood pressure, EKG

MANAGEMENT OF SPECIFIC REACTIONS (ADAPTED FROM ACR MANUAL ON CONTRAST MEDIA - VERSION 8, 2012)

A. Epinephrine

1. Regarding epinephrine: if you are at a point where you are considering giving epi, you should already have called a code! If you are not comfortable giving epi before the code team arrives, that is fine. If it is a true arrest situation, the best thing you can do is practice basic life support techniques (**C**irculation, **A**irway, **B**reathing) until the code team arrives.
2. Epinephrine IV (1:10,000) is available in the code cart. Epinephrine SQ (1:1000) is available in the code cart (brown bottle) and the Pyxis, but only the IV dosage information is listed here to simplify things. If you are using the dosages listed here, make sure it is epinephrine IV (1:10,000).
3. There are four code carts located:
   a. PICC room w/ defibrillator b.
   Nuc Med w/o defibrillator

c. CT-PET w/o defibrillator
d. MRI recovery room w/ defibrillator

B. Urticaria

1. Observation. No treatment needed in most cases.
2. For moderate itching, Benadryl PO/IM or slow IV push 1-2 mg/kg, up to 50 mg. If after hours when there is no nurse available to get Benadryl (usually after 7pm), return patient to floor or ED for continued observation/management.
3. If severe itching or widely disseminated, coordinate with referring physician (outpatient) or clinical service (inpatient) regarding continued care.

C. Facial Edema

1. Secure airway and O2 6-10 L/min by mask (NOT nasal cannula).
2. If mild and there is no progression, observation alone may be adequate.
3. Consider Benadryl PO/IM or slow IV push 1-2 mg/kg, up to 50 mg.
4. **If severe or progressive, call code (x2222).**
5. May consider epinephrine (1:10,000) IV 0.1 mL/kg slow push over 2–5 minutes, maximum 3 mL/dose. Repeat in 5–30 minutes as needed.

D. Bronchospasm

1. Secure airway and O2 6-10 L/min by mask (NOT nasal cannula).
2. **If progressive or not responsive to therapy, call code (x2222).**
3. Consider inhaled beta-agonist (bronchiolar dilator such as albuterol [Proventil or Ventolin]), 2–3 puffs from metered dose inhaler. Repeat as necessary.
4. May consider epinephrine (1:10,000) IV 0.1 mL/kg slow push over 2–5 minutes, maximum 3 mL/dose. Repeat in 5–30 minutes as needed.

E. Laryngeal Edema

1. Secure airway and O2 6-10 L/min by mask (NOT nasal cannula).
2. **If severe or progressive, call code (x2222).**
3. May consider epinephrine (1:10,000) IV 0.1 mL/kg slow push over 2–5 minutes, maximum 3 mL/dose. Repeat in 5–30 minutes as needed.

F. Hypotension with Tachycardia (Anaphylactic Shock)

1. Secure airway and O2 6-10 L/min by mask (NOT nasal cannula).
2. Legs elevated 60° or more (preferred) or Trendelenburg position.

3. Keep patient warm.
4. **If severe or not responsive to therapy, call code (x2222).**
5. Give rapid infusion of IV normal saline or Ringer's lactate.
6. May consider epinephrine (1:10,000) IV 0.1 mL/kg slow push over 2–5 minutes, maximum 3 mL/dose. Repeat in 5–30 minutes as needed.

G. Hypotension with Bradycardia (Vagal Reaction)

1. Secure airway and O2 6-10 L/min by mask (NOT nasal cannula).
2. Legs elevated 60° or more (preferred) or Trendelenburg position.
3. Keep patient warm.
4. **If severe or not responsive to therapy, call code (x2222).**
5. Give rapid infusion of IV normal saline or Ringer's lactate. Caution should be used to avoid hypervolemia in children with myocardial dysfunction.
6. Consider atropine IV 0.02 mg/kg. Minimum initial dose of 0.1 mg. Maximum initial dose of 0.5 mg (infant/child), 1.0 mg (adolescent). May repeat every 3–5 minutes up to maximum dose up to 1.0 mg (infant/child), 2.0 mg (adolescent).

SUMMARY OF CONTINUED MANAGEMENT

<u>Mild Reactions</u>

1. Requires observation to confirm resolution or lack of progression, but usually no treatment. Patient/family reassurance is helpful.
2. Maintain IV until patient discharge.
3. If outpatient, monitor in radiology department 1 to 2 hours. On discharge, give clear instructions to seek prompt medical care if new or worsening signs or symptoms. In older patients who have received Benadryl and were planning to drive home, they must have surrogate driver (Benadryl can cause drowsiness). If inpatient, call complete report to care provider.

Moderate/Severe Reactions

1. Requires prompt treatment and close observation for possible progression. If not comfortable with immediate management, **call code (x2222).**
2. If outpatient, coordinate plan of care with referring physician and ED. If inpatient, coordinate plan of care with inpatient MD.

For all types of reactions, notify attending. Use common sense. If patient symptoms qualify as mild but you are not comfortable sending the patient home, then don't! Coordinate with referring physician; perhaps close observation in the ED is what is needed.

CHECKLIST

1. Notify attending. Include details of incident in exam dictation.
2. For outpatients, notify referring physician. For outpatients who will be sent to the ED or admitted, call complete report to the relevant provider and notify the referring physician. For inpatients, call complete report to inpatient provider.
3. Write incident report immediately, including type of contrast used, type and severity of reaction, course of management, and phone# that patient can be reached (MD and RN #s if inpatient). Keep this until follow-up phone call in 24 hours is made.
4. Make sure the contrast bottle is saved, so that lot number and expiration date are available for future reference.
5. 24 hour follow-up call to check on status of patient. Add follow-up note to incident report, and submit to Laurie Hogan as soon as possible.

COMPUTERIZED TOMOGRAPHY

D.4	**Creatinine: When is it needed for IV Contrast Enhanced CT scans**	D.4

ALL inpatients require a **current creatinine level*** (within 1 week) or **estimated glomerular filtration rate (eGFR)** prior to an IV contrast enhanced CT

Outpatients being scheduled for a CT with IV contrast WILL NOT require a serum creatinine unless they meet one of the following criteria (for those listed below a Cr within 6 weeks is requested):

- Over 65 years old
- Diabetic treated with insulin or other provider-prescribed medications
- (e.g., metformin)
- Receiving chemotherapy or an aminoglycoside within the last 1 month
- Diagnosis of a collagen vascular disease
- Diagnosis of a paraproteinemia syndrome or disease (e.g., multiple myeloma)
- History of "chronic kidney disease" including tumor, surgery, single kidney or kidney transplantation. For Wilm's tumor, pts 5 years out?
- History of end stage liver disease
- History of severe congestive heart failure

NOTE: These parameters are intended to serve as guidelines. Medical necessity may mandate performing a scan prior to getting a measure of renal function.

***Current creatinine level** is defined as obtained within 6 weeks for outpatients and one week for inpatients

COMPUTERIZED TOMOGRAPHY

D.5	Portable CT: Indications for Use	D.5

PORTABLE HEAD CT INDICATIONS

- Physiologically too sick to move:
  - active fluid resuscitation
  - severe metabolic acidosis
  - receiving poisoning antidotes
  - febrile and actively cooling
- Patients on extracorporeal life support:
  - dialysis
  - IABP
  - LVAD
  - RVAD
  - prone Ventilation
  - therapeutic Cooling devices
  - temporary pacemaker
- Respiratory instability:
  - FIO2 >80%
  - PEEP>12cms H2O
  - Prone ventilation
  - VDR ventilator
  - BiVent
- Cardiovascular instability:
  - hypotension <110 mmHg on high dose inotropes and vasopressors
  - Swan-Ganz catheters in place
  - hypertension on high dose vasodilator therapy
  - unstable arrhythmia on rate control medications
- Neurological Instability:
  - vasospasm
  - burst suppression coma
  - therapeutic cooling devices
- Medically significant
  - Obesity >BMI 35 or >180 Kg

FLUOROSCOPY

E.1 How to Coordinate a Fluoroscopy Study E.1

1. When you get called for a fluoroscopy study on call, try to get a sense of how urgent the study is and note the following:
   - Patient's name
   - MRN
   - Clinical history
   - Ordering physician's name and contact number
2. Check if patient has any recent imaging studies in the system. For example, in case of request for UGI/ Contrast enema, know that at least a baseline abdomen radiograph should have been performed.
3. Residents should page/call the on call Radiology attending to discuss the case. Attending will come in to help you perform the study.
   - ƒ Radiology Fellows can perform fluoroscopy studies on their own after discussion with their attending and if they have sufficient experience.
4. Important numbers:
   - 4290 to reach the radiography lead technologist at any hour
   - 5073 is the front desk – back up number in case 4290 does not answer

E.2 Airway Fluoroscopy for Aspirated Foreign Body E.2

Airway fluoroscopy is a quick, noninvasive, and dynamic study of the entire airway.

INDICATIONS

- o Assessment of prevertebral soft tissues when the lateral soft tissue neck x-ray is suboptimal and there is concern for retropharyngeal abscess based on apparent thickening.
- o In cases of stridor, croup, or tracheomalacia

FLUOROSCOPY

- To evaluate air trapping in case of aspirated foreign bodies (most are radiolucent) when decubitus series is inconclusive
- To assess diaphragmatic motion/ eventration/ paresis.

PATIENT PREPARATION

None

CONTRAST

None

TECHNIQUE

1. Patient is awake – younger patients may be secured to octagon board.
2. Observe the patient's airway and thorax during inspiration and expiration. Look for diaphragmatic movement and aeration of the lungs. (Watch both diaphragms simultaneously!)
3. Signs favoring aspirated FB are paradoxical motion, air trapping, and mediastinal shift.

FLUOROSCOPY

E.3 Contrast: What to Use and Why E.3

Indication	Contrast	Rationale
Gastrointestinal Contrast		
UGI +/- SBFT: 1. NOT neonates/NICU 2. NOT for Inflammatory Bowel Disease	Thin barium	Least expensive; main focus is for malrotation and hiatal hernia; less concern about small bowel/terminal ileum pathology
UGI +/- SBFT: 1. Neonates/NICU 2. Tracheoesophageal fistula diagnosis and post repair	Visipaque 270	Isosmolar is safer for neonates in case of aspiration; less risk of fluid shifts; more radiodense than Cysto-conray II
UGI + SBFT: 1. Inflammatory Bowel Disease	Visipaque 270	More radiodense than other water soluble contrast. No flocculation.
Enema: Diagnostic 1. Newborn distal bowel obstruction 2. Intussuception reduction (either initially or after failed air reduction) attempt)	Cysto-conray II	Hyperosmolar draws fluid and helps move/"dislodge" tenacious stool
Enema: (Therapeutic) 1. Cystic fibrosis with meconium ileus 2. Prior to reanastomosis	Gastroview, dilute! 3 water:1 contrast or 4 water:1 contrast if preemie. Ask about hydration status.	Discuss dilution with technologist
Tube checks	Omnipaque 240	Relatively inexpensive
Genitourinary Contrast		
VCUG	Cysto-conray II	
Retrograde urethrogram	Omnipaque 240	

FLUOROSCOPY

E.4	**Contrast: How to Manage Request for Contrast on the Inpatient Unit**	E.4

WHAT TO DO FIRST

1. Call the ordering clinician and establish the reason for the request
   - ƒ G-tube confirmation: it is preferred that this be done under fluoroscopy. Please do not do these at the bedside unless the ICU attending confirms that it is absolutely necessary (such as a critical airway). The crosstable lateral views at the bedside are often obliqued and suboptimal.. *(G-tubes less than 90 days old that have been replaced by a clinician at the bedside do require a fluoroscopy check, and should be considered a study to be done promptly, not necessarilyemergently unless the clinical team indicates it could be an emergency). Lateral images should be 90 degrees perpendicular to the tube.*
   - ƒ Central line evaluation: easily done at the bedside
   - ƒ NJ or GJ tube tip confirmation: easily done at the bedside
2. Trainees should contact the attending to inform them of the request.

HOW TO PREPARE

1. Find the radiography tech who will be helping you with the study (call **4290** to speak to the radiography lead tech at any time). Call 5073 (front desk) if you cannot find anyone although someone should alwys answer 4290.
2. The radiography tech will have you fill out a 'Radiology Contrast Media Order' form.
3. An MD (or RN) needs to inject – and that *might* be you. Here is what to take (or send) to the bedside: Unopened bottle of contrast material, unopened empty 10 or 20 mL syringe, blunt tip needle, unopened saline syringe.
   - ƒ G-tube confirmation: **Visipaque 270**, approx. 10 mL
   - ƒ Central line evaluation: **Optiray 240**, approx. 5 mL
   - ƒ NJ or GJ tube tip confirmation: **Optiray 240**, approx. 5 mL

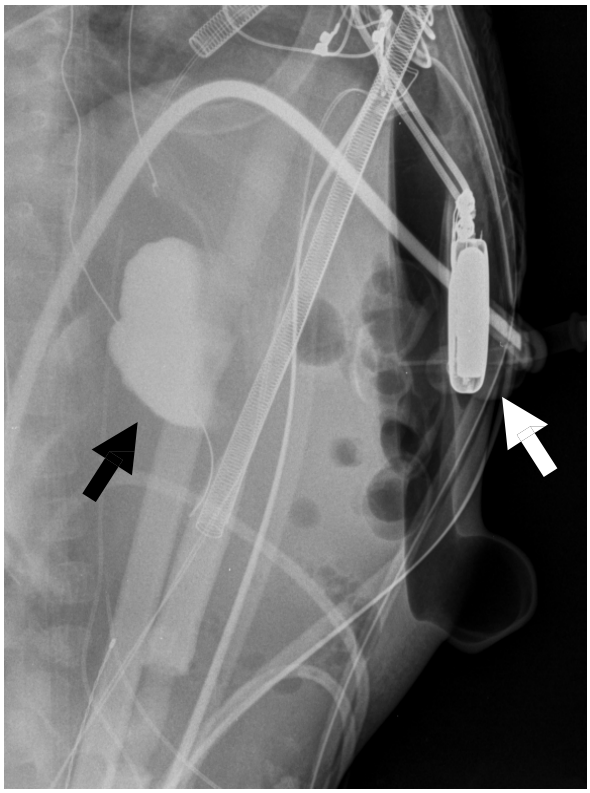
FLUOROSCOPY

THE PROCEDURE

- For each of the following:
  - ƒ G-tube confirmation: I recommend going to the bedside with the tech – your assistance with obtaining a good cross table lateral may help. Inject and shoot. Flush afterwards with saline.
  - ƒ Central line evaluation: Clinician or nurse may be comfortable performing these: inject and shoot as the last bit of contrast is being injected. Flush afterwards with saline.
  - ƒ NJ/GJ tip confirmation: Clinician or nurse may be comfortable performing these: inject and shoot. Flush afterwards with saline.

PROCEDURAL PEARLS

- Even though requests for these studies might not appear to be a priority at first glance, they often are. Do not let these requests languish.
- Goopy extravasated contrast pooling in the peritoneal cavity can fool you into thinking it's intraluminal – be careful, make sure it's really intraluminal. See following example…



Extraluminal contrast at the bedside. The **white arrow** indicates that upon close inspection the G-tube retention balloon is *not* within the stomach bubble, although the image as obtained is not optimally tangential.
The **black arrow** indicates extraluminal contrast material. This patient subsequently expired. Please treat bedside contrast studies as potential emergencies.

FLUOROSCOPY

E.5	Enema for Distal Obstruction	E.5

WHAT TO DO FIRST

1. Establish how the diagnosis was made – review prior radiographs (if there are none, request a 2 view abdomen be ordered). Also ask if there is any prenatal information available.
2. Talk to surgery – possibly going straight to the surgery fellow, who will understand the full clinical story. Ask about stooling pattern/lack thereof, age, delivery details (premature? difficult? magnesium sulfate?). Not every distal enema needs to be done emergently in the middle of the night . Your differential diagnosis includes:
    - Anal or colonic atresia
    - Hirschsprung
    - Meconium plug
    - Meconium ileus
    - ileal atresia
    - Distal jejunal atresia
    - Total colonic Hirschsprung
3. Trainees should contact the attending on call to make them aware of the request.

HOW TO PREPARE

1. Find the radiography technologist, who will help you with the procedure (4290 is the phone for the lead radiography tech at any time).
2. Have the radiography technologist set up for a contrast enema with a Foley catheter.

- Which contrast?
    - For *diagnostic* enemas, use **Cystoconray II**. This includes for suspected meconium ileus, diagnostic portion. Have the tech warm the contrast. (See contrast table, above, in E3)
    - For meconium ileus *therapeutic* enema, use dilute warmed **gastrograffin**, 4:1 (very small babies) or 3:1. Be careful; for the therapeutic enemas babies must be well-hydrated and preferably monitored. Talk to the clinical team.

FLUOROSCOPY

THE PROCEDURE

1. Obtain standard views; the true lateral view is key (make sure the femurs are properly overlapping).
2. I recommend removing the catheter at the end of the procedure and allowing the baby to spontaneously evacuate the contrast material – demonstrating that they can adequately evacuate on their own is useful information.
    - If they cannot spontaneously evacuate, after waiting a reasonable amount of time, replace an enema tip and drain the contrast material.
    - Do not send babies away after the procedure with a colon full of contrast, as this can make them very ill.

PROCEDURAL PEARLS

- Clinical stability in these babies is *crucial* – consider hydration, suction availability, hypothermia risks (use warming lights), and the risk of Hirschsprung colitis. Be prepared.
- Some of these babies present with bilious emesis.
- Total colonic Hirschsprung should be considered whenever you find yourself puzzled by a particularly weird enema. It's uncommon and therefore almost never diagnosed prospectively. You could be a rock star.
- Do not send babies away after the procedure with a colon full of contrast, as this can make them very ill. (Note that this is repeated from above.)

FLUOROSCOPY

E.6	Esophagram for Foreign Body	E.6

WHAT TO DO FIRST

1. Establish how the **diagnosis** was made – review available radiographs. Chest and soft tissue neck radiographs are recommended.
2. **Contact the attending** on call and inform them of the request.

HOW TO PREPARE

1. Find the radiography technologist who will help you with the procedure (4290 is the number for the lead radiography tech at all times).
2. Have the radiography technologist set up for a water soluble esophagram. Bottle/syringe for babies, straw for older kids.

THE PROCEDURE

1. I recommend bilateral oblique views; AP and lateral views are also okay. Multiple frames/sec setting can be helpful for assessing rapid swallows.
2. The procedure may be performed standing or lying down, depending on the patient and comfort.
3. Use water-soluble **Visipaque 270**. You probably will not need barium, as Visipaque is sufficiently dense to produce optimal images and is safe in the event of esophageal perforation with extravasation.

PROCEDURAL PEARLS

- Talking to the patient and family is <u>key</u> – if the patient is a normal teenager who feels like something is "stuck in their throat" but has no recollection of an appropriate antecedent event, then the pre-test probability is low. If they are a neurologically impaired patient with a history of eating objects, or if they are a normal patient and they know that they swallowed a chicken bone at 5:47 PM at Applebee's, then the pre-test probability is high.
- Autistic patients present us with cooperation issues – to the extent that this can potentially become a safety issue. Coordinate carefully with the clinical team.

FLUOROSCOPY

Intussusception Reduction

HOW TO PREPARE

1. Find the radiography technologist who will help you with the study (4290 is the number for the lead radiography tech who will identify the technologist who will help with the exam).
2. Have the technologist set up the room, but inspect the set-up before the patient and parents arrive.
3. Find the Intussusception Checklist at the wet desk and work your way through all the pre-procedural steps.
4. Call the ED and make sure they are on board with all the steps of the checklist, including providing nursing monitoring.

THE PROCEDURE

1. Please fill out the Intussusception Checklist as you go along.
2. Place the completed checklist back in the folder upon conclusion of the procedure. The consent form should be left on the fluoro nurse's desk.

PROCEDURAL PEARLS

- Warn the parents that their child might throw up, best for them to know in advance. Also, discuss failure or recurrence.
- Have suction ready for use - don't place the patient at risk with disorganized scrambling if they vomit and need suctioning.

FLUOROSCOPY

E.8	Malrotation with Midgut Volvulus	E.8

Time critical - do not delay for other images/studies

NO NEGOTIATIONS ABOUT THE EXAM

1. Patient name, location, name of referring physician with *contact number*, and brief history
2. Review conventional radiographs of the abdomen immediately
   - If no radiographs, request KUB and decubitus or cross table lateral views
3. Trainees should call the attending immediately - discuss and find out time of arrival
   - If pediatric radiology fellow, discuss if study can be performed with attending on standby
4. Find out if the patient has nasoenteric tube in place
5. Call fluoro technologist to prepare room for procedure – may include heat lamp
6. Instruct tech to prepare contrast in a syringe - usually **Visipaque 270**
7. Arrange for patient transport to fluoroscopy corresponding to arrival time of the attending radiologist
8. After completions of study, immediately notify the ER physician, surgeon and/or referring doctor of results of study
   - By phone - if positive, indicate name, date, and time in report (electronic note too)
   - Electronic note OK if study is negative

FLUOROSCOPY

E.9	Tube Check and Placements after hours	E.9

In general, evaluation and replacement of malfunctioning or dislodged gastrostomy and gastrojejunostomy tubes are not emergent procedures. However, in some cases, there is good reason to perform these procedures somewhat urgently. Most of the urgent requests are generated through the Emergency Department. Some common scenarios for these requests include the following:

- Patient on medications that can only be given per tube (no reasonable i.v. options).
- Patient with metabolic syndrome on enzyme replacement that can only be given per tube
- Patient dependent on enteral feeding (per tube) with no reasonable alternative for parenteral nutrition (PPN and TPN)

Having said this, each request should be evaluated on a case-by-case basis and the response may depend on the available operator's comfort level/expertise with these procedures. If you are unsure of the urgency of a specific request, please follow the steps listed below to gather the relevant information and trainees should call the on-call attending to discuss further.

1. What is the patient's history and what is being requested?
   - What is the patient's underlying condition? Why does he/she have a tube in place?
   - What is needed? Tube evaluation vs. exchange vs. replacement

2. What type of tube does the patient have and what is wrong with it?
   - Gastrostomy (G tube) vs. Gastrojejunostomy (GJ tube)
   - What is wrong with the tube? (occlusion, dislodgement, leaking etc…)
   - How long has this been going on?
   - If dislodged, when did this occur and is something in the entry site to maintain patency?
   - When was the tube placed or last exchanged?

FLUOROSCOPY

3. Look at the previous report and imaging on Synapse/Cerner to find the following:
   - What type of tube was placed
     - ƒ Tube diameter in French
     - ƒ Tube length in cm
     - ƒ Low profile (button type) vs. Conventional type
   - Where was the tip placed at the end of the previous study
   - Were any problems encountered during the previous exchange?

Decide on a plan of action:

G tube checks are per protocol above (less than 90 days old shoud be check under fluoroscopy. Note, we check G tubes but we do not stock or manage them. Clinicians will need to obtain the G tube from Central Supply.

GJ tube replacement after hours is per current policy - which is currently in flux

NJ tube replacement after hours is decided on a case by case basis – trainees should check with the attending.

Steps for **tube check**:

Obtain AP and Lateral scout image to evaluate balloon position
If G tube, inject contrast through the tube to document position and exclude gastric outlet obstruction by the balloon.
If GJ tube, inject the G tube port to confirm position in the stomach and exclude gastric outlet obstruction. Then inject the jejunal port to ensure that the tube is patent, intact without leaks, and that the tip is in the small bowel

INTERVENTIONAL RADIOLOGY

F.1	Emergency Procedures	F.1

In general, emergent IR procedures (vascular and nonvascular) are performed on clinically unstable patients or patients who are at a high likelihood of becoming unstable. Listed below are some specific examples of emergent procedures. This is **not** meant to be an exhaustive list and you should not hesitate to call the IR attending on call to discuss any emergency procedure request if you have any questions regarding a specific request (See F.2).

I. Arterial emergencies:

1. Solid organ trauma – Liver, Spleen or Kidney laceration (especially active extravasation)
2. Vascular injury –traumatic or iatrogenic dissection, transection, active extravasation
3. GI bleeding – Hemodynamically significant bleeding refractory to endoscopic treatment
4. Massive hemoptysis – i.e. bronchial artery bleeding in Cystic Fibrosis

II. Venous emergencies:

1. IVC FILTER PLACEMENT in patients with DVT/PE who cannot be anticoagulated
2. DVT THROMBOLYSIS in patients with acute, symptomatic proximal DVT (Common femoral vein or higher).
3. Vascular Access (i.e. PICC lines) is generally NOT AN EMERGENCY. However, if there is a compelling reason, we are happy to place after an ATTENDING TO ATTENDING discussion.
    a. Examples of emergent vascular access needs are the following:
        i. Emergent hemodialysis is needed
        ii. Treatment of acute transplant rejection AND peripheral access in not adequate
        iii. Multiple failed attempts
        iv. Unsafe to perform without image guidance (severe coagulopathy, body habitus etc…)

III. Nonvascular emergencies:

1. Abscess drainage in patients who are septic or hemodynamically unstable (in the ICU).
2. Percutaneous Nephrostomy Tube placement in patients with pyonephrosis.
3. Cholangiogram/Biliary drainage in unstable patients with suspected biliary sepsis.
4. Image-guided Chest Tube Placement in patients with respiratory distress
    a. Failed Chest tube insertion or nonfunctioning existing chest tube

F.2	How to Schedule an Emergency Procedure	F.2

Once the decision has been made to perform an emergent procedure, follow the step-by-step checklist below:

1. Obtain the **patient name, DOB, MRN, location and NPO status (NPO since when)**
2. Obtain the caller name, service and contact pager/phone number
    a. Ask them to enter an **order for the procedure in Cerner** (CHECK THAT IT IS THERE)
    b. Ask them to inform the patient/family of the planned procedure
3. Find out **who will provide consent** for the procedure and how they can be reached
    a. If at bedside – ask that they stay there until consent is obtained
    b. If by phone – make sure that we have a working phone number
4. Ensure that the referring team has completed a **SPC (SURGICAL PLAN of CARE) form**
    a. Surgery teams are familiar with SPC forms but medical teams may not know what this is
    b. If the primary team is unable to do this, the IR attending will take care of it

INTERVENTIONAL RADIOLOGY

5. Contact the **Anesthesia Hall Monitor (phone # -8346)** to see if they are aware of the case
6. Review any pertinent radiology **imaging**
7. Review any pertinent **labs** in Cerner (CBC, COAGS-PT,PTT,INR, Chemistries)
8. **Call the On-Call IR attending** and discuss the case a. IR attending contact information:
    i. Karun Sharma – pager: 202-259-5213
    ii. Ranjith Vellody– pager: 202-259-0888
    iii. Bhupender Yadav – pager: 202-259-1765
    b. The IR attending will inform the on-call team (technologist and nurse)
    c. The IR attending will obtain informed consent

MAGNETIC RESONANCE IMAGING

G.1 Emergency Studies for MRI Technologist Call Back G.1

1. Get following information from requesting MD:
   - Patient name and age
   - Reason for the study
   - Indication for the emergent request – how will study change patient management
   - Determine patient's current condition (physical exam, stability); request pregnancy test if appropriate
   - Determine time line – how soon does study need to be done (e.g. next hour, next 6 hours, next 12 hours)
   - Need for sedation (usually necessary under age 7, or older if in pain or with altered mental status)
     - NPO status if sedation needed
       - See "How to Schedule a Sedated Study" G.3
   - *Name* and *contact phone number* of requesting MD
2. Contact radiologist on-call to confirm if requested study is emergent
   - *Neuroradiologist* for brain/spine study
   - *Body Radiologist* for all other studies
3. Call front desk to have MRI RT paged
4. Give RT patient's <u>name,</u> <u>location,</u> <u>type of MRI,</u> and <u>timeline</u> of study.

G.2 How to Schedule an Emergency Study G.2

- For MRI emergency off hours that <u>does not</u> require sedation/anesthesia:

1. Primary team and the radiologist (resident/fellow and attending) should communicate and agree that emergent MRI is needed as it will immediately impact patient care

2. The radiologist (resident/fellow) will coordinate the arrival of the MRI technologist.

- Primary team is responsible for arrival of the patient (and parents) to the MRI suite at the designated time
- Radiology team is responsible for having the MRI technologist available to receive the patient in the MRI suite

G.3 How to Schedule a Sedated Study G.3

1. Primary team and the radiologist (resident/fellow and attending) should have communicated and agreed that emergent MRI is needed as it will immediately impact patient care (e.g. cord compression).
2. The MRI case should be booked through the OR as an emergency by the primary team, with the primary team available to intervene or follow-up. (The OR booking procedures should be followed).
3. Primary team contacts anesthesia attending on call at **8346** to give patient's history and reason for the emergency study.
4. Anesthesia attending will give the approximate time of start of MRI to the primary team.
5. The primary team will re-contact the radiology resident/fellow concerning the start time. The radiologist resident/fellow will coordinate the arrival of the MRI nurse and technologist.
6. Primary team is responsible for arrival of the patient (and parents) to the MRI suite at the designated time.
7. Radiology team is responsible for having the MRI technologist and nurse available to receive the patient in the MRI suite.
8. Anesthesia team is responsible for providing sedation or anesthesia at the specified time and getting CONSENT from parents.
9. The on-call MRI nurse will be available to help with sedation/anesthesia. The crisis nurse can be used as needed and may be helpful in bringing the patient down for the scan. However the on-call MRI nurse MUST be present to assure all safety protocols are

met. There is an MRI nurse and MRI tech coverage 24/7/365. Radiology front desk number **5073** can be used to get phone numbers of on-call MRI personnel.

10. The after hours emergency MRI patients should all be recovered in the PACU.

G4 How to Inject MRI IV Contrast G.4

1. Verify patient ID and review screening form (renal function issues, allergies, previous history of reaction to contrast material, etc.).
2. Verify patient weight and calculated IV contrast dose.
3. Sign contrast order form.
4. Draw up contrast in a syringe (this may already have been done for you).
   - If contrast has been prepared, verify contrast type, expiration date and dose within the syringe. The syringe should be labeled with contents.
5. Check yourself for MR safety prior to entering the scanner room. If needed, there are lockers just outside of the area where you can store your belongings.
6. Verify patient ID band. Unclamp the IV line and clean the IV with alcohol swab. Flush IV with normal saline while palpating the site to check for extravasation and also watch for signs of pain. If OK, then try to draw back slightly. If there is blood return, then proceed.
7. Clean contrast syringe, then connect and push the dose in slowly. Pushing too fast can cause nausea. Follow with normal saline flush, then re-clamp the line. Make sure the patient is OK before leaving the scanner room.

NUCLEAR MEDICINE

H.1 Emergency Studies for Nuclear Medicine Call Back H.1

Emergent Indications

- o Brain death (H.3)
- o VQ scan (H.4)
- o GI Bleeding Study (H.5)
- o Diuresis renography on weekend daytime for Dietl's crisis (H.6 - if requested by Urology)

H.2 How to Schedule an Emergency Study H.2

CALL COVERAGE

Mon-Fri	5:00 PM to 6:00 AM
Sat-Sun	24 Hours

Call **ext 5073** and ask for the nuclear medicine technologist on-call to be paged.

H.3 Brain Death H.3

- Transcranial US may be done prior to the Tc-pertechnetate scan
- Patient is brought to nuclear medicine
- Imaging sequence: flow and static images - is there intracranial blood flow?

NUCLEAR MEDICINE

H.4 VQ Scan H.4

- Only if there is contraindication for CT:
  - Elevated creatinine
  - Allergy to iodinated contrast
  - IV access: inability to get a 22 gauge or larger IV line
- Xenon for ventilation imaging, followed by Tc-mAA for perfusion imaging.

Note: The radiopharmaceutical will usually take 2 – 3 hours to arrive.

H.5 GI Bleeding Study H.5

- Child must be bleeding at the time of the exam to see positivity.
- Image for 1 full hour on the scanning table
- May reimage within 24 hours of injection if the child rebleeds and initial imaging is negative

H.6 Diuresis Renography on Weekend for Dietl's Crisis H.6

- Needs to be requested by Urology
- A child with UPJ or less commonly UVJ obstruction (may or may not be previously diagnosed), presenting with acute abdominal pain and vomiting
- Can be done within 24 hours of presentation and still yield a diagnostic study
- Do not need a bladder catheter in place

ULTRASOUND

I.1	**Emergency Studies for Sonographer Call Back**	I.1

EMERGENCY STUDIES:

- Acute abdominal trauma
- Testicular Torsion
- Cranial US for ECMO
- Renal transplant
- Ectopic pregnancy
- Ovarian Torsion (for emergent pelvic US, Foley catheter to be placed by
  - ED to fill bladder)
- DVT
- Intussusception
- Appendicitis
- Acute Renal Failure
- Dropping Hematocrit

POTENTIAL EMERGENCY STUDIES:

Need to be cleared with attending prior to calling on call sonographer:

- Pyloric stenosis
- GB/renal calculi
- Other studies may be appropriate – discuss with attending

BEFORE CALLING ON CALL ATTENDING PLEASE KNOW:

Patient's Name, Location, History

Ordering physician name and contact number

** If sonographer states they do not come in for this indication, please call attending and clarify if study is to be done**

ULTRASOUND

I.2	How to Reach On-Call Sonographer	I.2

- Call radiology front desk at **x5073**
  - Give patient name and study required
  - Patient's location
  - Request that they page the On-Call US Technologist
- Sonographer pager/home/cell phone numbers available at front desk and on-call schedule (on call sonographer **required** to carry their pager).
- If sonographer cannot be reached within 15 minutes, page the body attending on call. The Administrator on call should be paged (front desk x5073 will know who is on call).
- On call radiology resident/fellow is responsible to check on status of planned arrival of sonographer. If delay greater than 1 hour call attending and attempt to perform exam when possible.

ULTRASOUND

I.3	How to Turn on the US Machine	I.3

CHECKLIST FOR TURNING ON GE LOGIC E9

1. **Power On** – upper left side, above keyboard
2. **Patient Data** – upper left side of Touch Screen
3. Enter patient name, MRN, and Accession number.
   - Accession number is available from front desk.
4. Press exit button to save using track ball
5. Select **Transducer** – across top of touch screen; select transducer, then exam preset
6. Select **Depth** – right side of control panel, gray knob; toggle to adjust depth
7. Adjust **Focal Zone** – knob under touch screen; far right – toggle to adjust focal depth, turn to change number of zones
8. Adjust **Gain Settings** – Slide Pods on far right to adjust the gain for near, middle, far fields. Use overall gain knob located below Slide Pods to adjust gain for whole image
9. **Print Image** – P2, right lower panel, next to freeze button
10. **Measure** – caliper button above track ball; set button right of track ball
11. **End Exam** – lower left side of touch screen; touch "end exam" then touch "End current exam"

ULTRASOUND

CHECKLIST FOR TURNING ON PHILLIPS IU22

1. **Power On** – upper left side, behind control panel
2. **Patient Data** – upper left side of control panel
3. Enter patient name, MRN, and Accession number.
   - Accession number is available from front desk.
4. Press patient data button to exit
5. Select **Transducer** – left of patient data button; select: Use Touch Screen to select transducer, then exam preset
6. Select **Depth** – right side of control panel, gray knob; turn to adjust depth.
7. Adjust **Focal Zone** – right side of control panel above the depth knob (2 function control); turn knob to adjust focal depth, press then turn to adjust size of focal zone
8. Adjust **Gain Settings** – Slide Pods on far right to adjust gain for near, middle, far fields. Use overall gain knob below Slide Pods to adjust gain for whole image. Press "i-scan" button on far right lower corner when lit, to optimize (also works for Doppler)
9. **Print Image** – right lower, next to track ball
10. **Measure** – caliper button left side near track ball; press to select cursor, place, press again to select the cursor
11. **End Exam** – lower left side of control panel next to transducer button; press to end exam

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