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The faculty and staff here at the Department of Radiology, New Jersey Medical School welcome all of you as you embark on this important facet of your training. We are the longest running academic training program in New Jersey, and have trained over 120 residents in the past 30 years. Our trainees have excelled in their chosen areas of practice and have contributed significantly both to patient care and the development of new knowledge in Radiology.

The Department of Radiology at Rutgers NJMS actively participates in the tripartite missions in patient care, education and research. We provide a full spectrum of services across Diagnostic and Interventional Radiology at teaching practice sites. Faculty members provide instruction and perform clinical work in gastrointestinal and genitourinary imaging, chest, breast, musculoskeletal, and pediatric radiology as well as in nuclear medicine, neuroimaging, and interventional radiology. The department is responsible for diagnostic imaging at University Hospital, the Doctors Office Center (DOC) and at our separate on-campus Advanced Imaging Center facility (ADMC Building 5), which houses our PET/CT unit. Residents also rotate at the VA Medical Center in East Orange, NJ.

The Department is committed to undergraduate and graduate training in Radiology and the education of our colleagues in other specialties. Over the years our residents have successfully secured excellent fellowships and excel in private and academic practice.

A majority of our faculty and residents are engaged in clinical investigations. Our Division of Radiation Research has 2 faculty members who have made considerable progress in understanding the biophysical parameters affecting radiation dose.

We wish you well and hope to see you excel during your training here at Rutgers NJMS as well as in your subsequent practice career.
GOALS AND OBJECTIVES

ABDOMINAL IMAGING - GI/GU (Ultrasound, CT, MRI, and Fluoroscopy)

General Goals:

The specific goals include objectives required for every level of training with graduated levels of supervision and responsibility. Almost all aspects of abdominal imaging are incorporated into the residency, including fluoroscopy, radiography, CT, ultrasound, and MRI. During every training rotation, the resident will read the required literature in gastrointestinal and genitourinary radiology. Over time, the resident will become progressively more knowledgeable about normal radiographic anatomy, physiology of abdominal organs, and the radiological appearances of gastrointestinal and genitourinary diseases. In addition, the resident will demonstrate a progressively increasing understanding of disease entities, their clinical presentations, and current modes of treatment.

Resident Daily Work Responsibilities (OVERALL BENCHMARKS/OBJECTIVES for Self-Evaluation)

1. Residents assigned to the sections of abdominal imaging (GI, Ultrasound, DOC, or Body) will be available for consultations by fluoroscopy, CT and MR technologists, clinicians, and other health care providers, except during conference times, when the attending faculty will cover.

2. Resident questions will be referred to the supervising faculty covering abdominal radiology.

3. Resident review of cases with the supervising faculty will be conducted as many times in the day as necessary to keep an efficient workflow.

4. All resident performed fluoroscopy examinations will be dictated by the end of every working day.

5. Residents will ensure all the exams in the Body CT/MR work list are interpreted by the end of the working day in accordance with the departmental time frame cutoffs.
6. Residents will check and sign his/her reports prior to final verification by supervising faculty.

7. Residents must be familiar with the operation of all fluoroscopic equipment.

8. Residents must acquire knowledge of radiation protection and ways to reduce radiation exposure to both patients and hospital personnel. The resident will be supervised to assure that safe practices are followed. Film badges must be worn at all times during fluoroscopic exams.

9. Residents will learn the fluoroscopic techniques for performing high quality diagnostic examinations involving the gastrointestinal and genitourinary tracts. Examinations will be checked by the supervising faculty before the patient leaves the department.

10. Residents must become proficient at detecting abnormalities demonstrated by abdominal plain films, contrast examinations of the alimentary and genitourinary tract, and abdominal/pelvic CT and MR; and be able to generate meaningful differential diagnosis.

13. Residents will become knowledgeable about the use of different radiographic contrast agents (including their indications, contraindications, dosages, and side effects).

14. Residents will acquire an understanding of the proper preparation of patients for examinations and appropriate follow-up. At the start of every working day, the resident will be familiar with the patient schedule and anticipate the need for any procedures. The resident will check requisitions for the next working day to evaluate for appropriateness of the requested procedure or if additional exams/protocols need to be performed. Requests with absent clinical indications or seemingly inappropriate requests will be clarified and discussed with the referring physician.

15. Residents will do in-depth reading and study to become knowledgeable about the normal anatomy and physiology of abdominal organs and the radiologic appearances of gastrointestinal and genitourinary diseases, and gain a general understanding of the disease entities, their clinical presentations, and certain modes of treatment.

16. Residents will serve as a secondary consultant to referring physicians regarding abdominal imaging. This will strengthen the confidence of the resident in the very important role every radiologist must perform throughout his/her career as a consultant to other physicians.
17. Residents will become prepared to pass the core examination of the American Board of Radiology.

18. Residents will teach and share knowledge to medical students, radiology technologist students, and junior residents.

19. Residents will participate in the preparation and presentation of imaging studies at divisional interesting case conferences.

**Supervising Faculty Responsibilities:**

1. Supervising faculty will be available at all times for any questions or consultations needed by the resident.

2. Supervising faculty will review all studies with the residents before the end of the day.

3. Supervising faculty will provide the resident with constructive feedback in any problem areas encountered during the rotation.

4. Supervising faculty will verify resident-generated reports in a timely manner and inform the resident of any major changes made.

**Educational Goals and Objectives (First Year Residents):**

**Patient Care:**

- Adequately explain each examination to the patient in order to ensure that the patient feels comfortable and to provide patient care that is compassionate, appropriate, and effective
- Familiarity with the operation of fluoroscopic equipment
- Aware of the basic principles of radiation protection in order to minimize the radiation dose to the patient and reduce exposure to healthcare providers
- Understand the indications for, and contraindications of, intravenous and enteric radiographic contrast agents, and be able to monitor its administration
- Recognize and treat reactions to intravenous and enteric contrast media
- Understand the indications and contraindications to the different types of contrast material dosages, side effects, and the differences and relative merits of single and double contrast studies.
- Develop a knowledge of the preparation and aftercare required for the common examinations
• Use the PACS, voice recognition systems, and hospital information systems to become proficient in dictating reports of significant fluoroscopic and radiographic findings in a concise and clear manner
• Demonstrate the ability to recommend additional imaging studies as appropriate to better assess findings on abdominal imaging studies

**Medical Knowledge:**

• Learn the basic physics and principles of radiography, ultrasound, fluoroscopy, CT, and MR, especially as it pertains to phases of enhancement of the liver and kidney
• Observe and learn the techniques to achieve high-quality diagnostic examinations of the gastrointestinal and genitourinary tract
• Perform an adequate upper gastrointestinal series, barium swallow, barium enema, voiding cystogram, retrograde urethrogram and cystogram study
• Develop a knowledge of normal and abnormal anatomy of the gastrointestinal and genitourinary tracts as demonstrated on contrast studies
• Become knowledgeable about the different contrast agents available and begin to recognize abnormalities that are demonstrated on fluoroscopic, CT, and MR studies of the alimentary and genitourinary tracts
• List the risk factors for allergic reaction to intravenous contrast media
• State the proper assessment and treatment for allergic reactions to contrast media
• Recognize the more common abnormalities encountered in the GI tract, such as stricture, polyp, ulcer, and mass
• Develop a knowledge of the differential diagnoses of the more commonly encountered gastrointestinal and genitourinary abnormalities
• Demonstrate the ability to recognize and describe common medical conditions depicted on abdominal imaging studies
• Recognize critical findings on emergency CT evaluations of the abdomen and pelvis

**Practice-Based Learning and Improvement:**

• Show evidence of independent study using textbooks from the reading list
• Demonstrate appropriate follow up of interesting cases
• Research interesting cases as directed by faculty
• Identify, rectify, and learn from personal errors
• Incorporate feedback into improved performance
• Efficiently use electronic and print sources to access information

**Interpersonal and Communication Skills:**

• Communicate with the patient at all times during the examination to ensure that patient remains comfortable
• Communicate effectively with all members of the health care team (technologists, medical students, fellows, residents, allied health providers, support staff, and attending physicians/radiologists)
• Call results to the referring physicians and show ability to interact with referring physicians
• Interact with clinicians show ability to provide preliminary readings, follow up with attending radiologists, formulate a plan of complex cases, and communicate any changes to referring clinicians

**Professionalism:**

• Demonstrate respect for patients, families, and all members of the healthcare team and be able to discuss significant radiology findings
• Explain the impact of the radiology findings on patient care, including what imaging studies may/may not be appropriate
• Respect patient confidentiality at all times
• Present oneself as a professional in appearance and communication
• Demonstrate a responsible work ethic with regard to work assignments
• Place needs of patients before self

**System-Based Practice:**

• Able and willing to participate in multidisciplinary clinical conferences in which imaging studies are used to guide patient care/evaluations and be able to demonstrate understanding of how imaging relates to the clinical care of the patient
• Demonstrate knowledge of the ACR practice guidelines and technical standards for fluoroscopy, CT, and MR
• Demonstrate knowledge of ACR appropriateness criteria and cost effective imaging evaluation of common disorders
• Show ability to interact with clinicians regarding cost effective and streamlined evaluation for different clinical entities
Monitoring and Assessment of Resident Performance

The resident’s progress will be monitored by the faculty on the service. At the end of each rotation, the resident will receive an evaluation of performance from each attending. Deficiencies or substandard performance will be discussed personally and privately with the resident and will be brought to the attention of the Residency Program Director by the attending radiologist. Resident performance is also evaluated through direct observation, multi-source professional evaluations, structured case discussion, and other performance evaluation methods as determined.

Educational Goals and Objectives (Second Year Residents):

The objectives above as well as the following:

Patient Care:

- Understand the physics of radiation protection and how to apply it to routine studies.
- Continue to improve skills for performing ultrasound, fluoroscopic, CT, and MR examinations, and tailor examinations to answer all questions being asked by the clinician; anticipate those questions that should have been asked but were not
- Demonstrate knowledge of indications for the examinations requested (when the reason for the examination is not clear, the resident will effectively communicate with the patient and referring physician until clarified)
- Familiarity with available medical records and how to access them for the purposes of patient care
- Protocol cases, in consultation with the attending, to assure that the fluoroscopic, CT, or MR examination is appropriate and of sufficient quality to address the clinical concerns of the patient and referring physician
- Review all studies with the supervising faculty attending
- Provide preliminary reports to all referring clinicians if needed before the final review of cases (when there is a significant discrepancy between the preliminary reading and final reading, the resident will notify the referring clinician immediately)
Medical Knowledge:

- Develop knowledge of the physics of radiography and be able to explain the function of each part of the imaging chain, including the generator, the fluoroscopy unit, grids, and screens.
- Recommend the appropriate study based on the clinical scenario and understand the relative strengths of each modality
- Familiarity with the anatomy of the organs examined in every case
- Familiarity with imaging findings of common acute and chronic geriatric diseases evaluated with fluoroscopy
- Identify pathology in order to interpret routine fluoroscopy, and abdominopelvic CT and MR appropriate to the level of training when presenting to the attending
- Distinguish between normal and abnormal abdomen and pelvis anatomy appropriate to level of training when presenting to the attending
- Detect abnormalities while the fluoroscopic procedures are in progress, such as 1) disease recognition skills will continue to increase on contrast studies, and 2) begin to develop meaningful differential diagnoses for the pathology that is found

Practice-Based Learning and Improvement:

- Identify, rectify and learn from personal errors
- Incorporate feedback into improved performance
- Demonstrate evidence of independent reading and learning through use of printed and electronic resources
- Follow up on abnormal or interesting cases through personal communication with the referring physician or patient medical records
- Become competent in using PACS, voice recognition systems, and the patient information systems in the daily accomplishment of the workload and instruct others in their use

Interpersonal and Communication Skills:

- Appropriately obtain informed consent
- Produce concise reports that include all relevant information
- Communicate effectively with all members of the healthcare team
- Communicate effectively the results of studies to referring clinicians whenever needed (for emergent studies, this will be accomplished in a timely manner)
• Effectively convey the findings of examinations through accurate dictation of reports

Professionalism:

• Demonstrate respect for patients and all members of the healthcare team (technologists, nurses, and other healthcare workers)
• Respect patient confidentiality at all times
• Present oneself as a professional in appearance and communication
• Demonstrate a responsible work ethic in regard to work assignments
• Explain the nature of the examination or findings in an examination to patients and their families when needed
• Observe ethical principles when recommending further work-up
• Promptness and availability at work are required of every resident

Systems-Based Practice:

• Demonstrate knowledge of ACR practice guidelines and technical standards for fluoroscopy, abdominopelvic CT and MR
• Demonstrate knowledge of ACR appropriateness criteria and cost-effective imaging evaluation of gastrointestinal and genitourinary disorders
• Familiarity with departmental procedures, contrast safety, and fluoroscopy safety, required in the performance of examinations
• Use appropriate language in communicating to clinicians through reports or consultations so proper management decisions can be made
• Thorough dictations will be made with indications, techniques, findings, and conclusions
• Dictate and correct reports in a timely fashion to avoid delay in patient disposition
• Recognize the role that fluoroscopy, CT and MR play in the management of acute and chronic diseases of the gastrointestinal and genitourinary tracts
• Make suggestions to improve methods and systems utilized in radiology whenever appropriate
Monitoring and Assessment of Resident Performance

The resident’s progress will be monitored by the faculty on the service. At the end of each rotation, the resident will receive an evaluation of performance from each attending. Deficiencies or substandard performance will be discussed personally and privately with the resident and will be brought to the attention of the Residency Program Director by the attending radiologist. Resident performance is also evaluated through direct observation, multi-source professional evaluations, structured case discussion, and other performance evaluation methods as determined.

Educational Goals and Objectives (Third Year Residents):

The above objectives as well as the following:

Patient Care:

- Familiarity with the utility of contrast studies of the GI and GU tracts, and their relationship to other imaging modalities
- Perfect diagnostic examination techniques and be very skilled and efficient in performing and interpreting all diagnostic procedures performed in the fluoroscopy suite
- Demonstrate knowledge of indications for the examinations requested (when the reason for the examination is not clear, the resident will effectively communicate with the patient or referring physician until clarified)
- Familiarity with available medical records and how to access them for the purposes of patient care
- Protocol cases, in consultation with the attending, to assure that the fluoroscopy examination, CT, or MR is appropriate and of sufficient quality to address the clinical concerns of the patient and referring physician
- Review all studies with the supervising faculty attending
- Provide preliminary reports to all referring clinicians if needed before the final review of cases (when there is a significant discrepancy between the preliminary reading and final reading, the resident will notify the referring clinician immediately)
Medical Knowledge:

- Develop a thorough knowledge of the differential diagnosis of abnormalities encountered on fluoroscopic, CT, or MR examinations of the GI or GU systems
- Develop a thorough knowledge of the differential diagnosis of GI and GU abnormalities
- Relate the imaging findings to the clinical condition and its pathology
- Understand the clinical management of the conditions encountered
- Familiarity with the anatomy of the organs examined in every case
- Identify pathology in order to interpret fluoroscopy imaging studies, CT or MR with accuracy appropriate to the level of training when presenting to the attending
- Distinguish between normal and abnormal abdomen and pelvis anatomy with excellent accuracy according to the level of training when presenting to the attending and demonstrate improvement compared to the prior rotation
- Proficient in detecting abnormalities on fluoroscopic, CT, and MR studies while in progress
- Development of appropriate differential diagnostic lists will be well advanced
- Know the proper preparation of patients for diagnostic examinations
- Act as a consultant in abdominal radiology to the clinical services
- Obtain a broad understanding of abdominal and alimentary tract diseases, their clinical features, radiographic manifestations, and current modes of treatment

Practice-Based Learning and Improvement:

- Identify, rectify, and learn from personal errors
- Incorporate feedback into improve performance
- Demonstrate evidence of independent reading and learning through use of printed and electronic resources
- Follow up on abnormal or interesting cases through personal communication with the referring physician or patient medical records
- Competent in using PACS, voice recognition systems, and the patient information systems in the daily accomplishment of the workload and instruct others in their use
**Interpersonal Skills:**

- Appropriately communicate results to patients and clinicians whenever needed (for emergent studies, this will be done in a timely manner)
- Produce concise reports that include all relevant information and be able to effectively convey the findings of examinations through accurate dictation of reports
- Communicate effectively with all members of the healthcare team
- Assist with supervision and teaching of medical and radiology technologist students

**Professionalism:**

- Demonstrate respect for patients and all members of the healthcare team (technologists, nurses, and other healthcare workers)
- Respect patient confidentiality at all times
- Present oneself as a professional in appearance and communication
- Demonstrate a responsible work ethic in regard to work assignments
- Explain the nature of the examination and/or findings of an examination to patients and their families when needed
- Observe ethical principles when recommending further work-up for cases
- Promptness and availability at work are required of every resident

**Systems-Based Practice:**

- Demonstrate knowledge of ACR practice guidelines and technical standards for abdominal fluoroscopy, CT, and MR
- Demonstrate knowledge of ACR appropriateness criteria and cost effective imaging practices in the evaluation of GI/GU disorders
- Complete final preparations to pass the certifying examination of the American Board of Radiology
- Familiarity with departmental procedures, contrast safety, fluoroscopy, CT and MRI safety required in the performance of examinations
- Use appropriate language in communicating to clinicians through reports or consultations so proper management decisions can be made
- Produce thorough dictations with indications, techniques, findings, and conclusions
- Dictate and correct reports in a timely fashion to avoid delay in patient disposition
• Recognize the role that fluoroscopy, CT and MR play in the management of acute and chronic diseases
• Make suggestions to improve methods and systems utilized in radiology whenever appropriate

Monitoring and Assessment of Resident Performance

The resident’s progress will be monitored by the faculty on the service. At the end of each rotation, the resident will receive an evaluation of performance from each attending. Deficiencies or substandard performance will be discussed personally and privately with the resident and will be brought to the attention of the Residency Program Director by the attending radiologist. Resident performance is also evaluated through direct observation, multi-source professional evaluations, structured case discussion, and other performance evaluation methods as determined.

Reading List

• Davenport. Genitourinary Imaging: A Core Review. 2015

Core Knowledge Presentation Topics

1. Protocols and Contrast Part 1 – departmental protocols, departmental premedication policy, premedication procedure**
2. Protocols and Contrast Part 2 – contrast reactions, contrast induced nephropathy, NSF**
3. Hepatic Depositional, Vascular, and Inflammatory Disease
4. Benign and Malignant Liver Tumors - concentrate on histopathology and CT
5. MRI of the Liver Part 1 – Technique, contrast agents, Diffuse liver disease
6. MRI of the Liver Part 2 – Benign and Malignant Neoplasms
7. Cirrhosis and portal HTN
8. LI-RADS**
9. HCC – imaging appearance of HCC with pathologic correlation
10. Post-treatment assessment of HCC
11. Benign biliary and gallbladder disease – concentration on pathology and CT
12. Gallbladder and Biliary neoplasms – concentration on pathology and CT
13. MRI of the gallbladder and bile ducts
14. Pancreatitis – Acute, Chronic, Groove, and Autoimmune
15. Cystic neoplasms of the pancreas
16. Solid neoplasms of the pancreas
17. MR of the Pancreas and Secretin
18. Imaging of the Spleen (CT and MR)
19. Imaging of the adrenal glands (CT and MR)
20. IVP and RUG – technique and common pathology
21. Cystic Renal Masses including Bosniak classification system
22. Solid Renal Masses
23. MRI of the Kidneys
24. Genitourinary trauma (kidney, bladder, urethra, testicles)
25. Infectious and Inflammatory Renal Pathology
26. Nephrogram Patterns and what they mean
27. Urothelial neoplasms
28. Imaging of the urinary bladder
29. Retroperitoneum – Benign and Malignant disease
30. Peritoneum, Omental and Mesenteric Pathology on CT and MR
31. The abdominal plain film
32. Fluoroscopy of the Esophagus
33. Fluoroscopy of the stomach
34. Fluoroscopy of the Duodenum
35. Fluoroscopy of the Small Bowel
36. Fluoroscopy of the Large Bowel
37. MR enterography and MR of the appendix
38. CT of the acute abdomen**
39. Imaging after bariatric surgery
40. Hernias
41. Bowel Obstruction – small and large bowel including volvulus, closed loop obstruction, internal hernia**
42. Inflammatory bowel disease – Crohn’s and Ulcerative Colitis
43. Imaging of Rectal Cancer – Preoperative and postoperative assessment
44. CT Colonography
45. Muellerian duct Anomalies
46. Fetal MR
47. MRI of the female pelvis Part 1 – Uterus and Adnexa
48. MRI of the female pelvis Part 2 – Vagina and Urethra
49. Hysterosalpingogram – Technique, normal appearance, and pathology
50. Prostate MR
51. Prostate and seminal vesicles - CT
52. Solid organ trauma**
INTERESTING CASE CONFERENCES

1. Chaudhry Interesting Cases GI
2. Chaudhry Interesting Cases GU
3. Sabatino Interesting Cases GI
4. Sabatino Interesting Cases GU
5. Goldfarb Interesting Cases GI
6. Goldfarb Interesting Cases GU
7. Shah Interesting Cases GI
8. Shah Interesting Cases GU
9. Patel Interesting Cases GI&GU

**These lectures will be definitely repeated once per year.

This section was updated 8/14/2017 by Humaira Chaudhry
THORACIC AND CARDIAC RADIOLOGY

The curriculum for Thoracic and Cardiac Radiology will be distributed as pdf files to each resident as we progress through conferences.

Reading material will be assigned and distributed well in advance of conferences.

Demonstration of knowledge based objectives will be assessed with quizzes at conferences. Passing scores are as follows:

First Year Radiology Residents: Average ≥ 50%

All other residents: Average ≥ 60%

YEAR ONE

I. Goals

*After completion of the first thoracic radiology rotation, the resident will be able to:*

1. Demonstrate learning of the appropriate knowledge-based objectives.
2. Accurately and concisely dictate a chest radiograph report.
3. Communicate effectively with referring clinicians and supervisory staff.
4. Understand standard patient positioning in thoracic radiology.
5. Obtain pertinent patient information relative to radiologic examinations.
6. Demonstrate knowledge of the clinical indications for obtaining chest radiographs and when a chest CT or MR may be necessary.
7. Demonstrate a responsible work ethic.
8. Participate in quality improvement/quality assurance and other operational activities.

II. Objectives

A. Knowledge-based

At the end of the first year, the resident will demonstrate learning of at least one-third of the knowledge-based objectives (*see Addendum*) (PC) (MK).

B. Technical, communication, and decision-making skills
By the end of the first year, the resident should have mastered the following technical, communication, and decision-making skills:

1. Dictate accurate and concise chest radiograph reports that include patient name, patient medical record number, date of exam, date of comparison exam, type of exam, indication for exam, brief and concise description of the findings, and short impression (ICS)

2. Communicate with ordering physicians about all significant or unexpected radiologic findings and document who was called and the date and time of the call in the dictated report (IPC) (PC)

3. Obtain relevant patient history from electronic records, dictated reports, or by communicating with referring clinicians (PC)

4. Describe patient positioning and indications for posteroanterior (PA), anteroposterior (A), lateral decubitus, and lordotic chest radiographs (PC) (MK)

5. When assisting referring clinicians with imaging interpretation and patient management, decide when it is appropriate to obtain help from supervisory faculty (P)

6. Arrive for the rotation assignment on time and prepared after reviewing recommended study materials (P)

7. Use appropriate chest radiograph, CT, and MRI nomenclature when dictating reports and consulting with health care professionals (ICS).

**YEAR 2**

**I. Goals**

In addition to those goals listed for Year 1, the resident will:

1. Demonstrate learning of the knowledge-based learning objectives.

2. Continue to build on chest radiograph interpretive skills.

3. Develop skills in protocoling, monitoring, and interpreting chest CT scans.


5. Demonstrate an ability to generate and interpret multiplanar reformatted (MPR) or three-dimensional images of CT or MRI studies as appropriate.
II. Objectives

A. The resident will demonstrate learning of at least two-thirds of the knowledge-based objectives listed.

The resident should be able to identify the following structures on chest CT and chest MRI (MK).

● Lungs—right, left, right upper, middle, and lower lobes, left upper lobe (anteroposterior, anterior and lingular segments), and left lower lobe

● Pleura and extrapleural fat

● Airway—trachea, main bronchi, carina, and lobar bronchi

● Heart—left ventricle, right ventricle, moderator band, left atrium, left atrial appendage, right atrium, right atrial appendage, mitral valve, aortic valve, tricuspid valve, pulmonary valve, coronary arteries (left main, left anterior descending, left circumflex, right, posterior descending), coronary veins, coronary sinus

● Pericardium—including pericardial recesses

● Pulmonary arteries—main, right, left, interlobar, segmental

● Aorta—ascending, sinuses of Valsalva, arch, descending

● Arteries— brachiocephalic (innominate), common carotid, subclavian, axillary, vertebral, internal mammary, intercostal

● Veins—pulmonary, superior vena cava, inferior vena cava, brachiocephalic, subclavian, axillary, internal jugular, external jugular, azygos, hemiazygos, left superior intercostal, internal mammary

● Bones—ribs and costochondral cartilages, clavicles, scapulae, sternum, spine

● Esophagus

● Thymus

● Thyroid gland

● Muscles—sternocleidomastoid, anterior and middle scalene, infrahyoid, pectoralis major and minor, deltoid, trapezius, infraspinatus, supraspinatus, subscapularis, latissimus dorsi, serratus anterior

● Aortopulmonary window

● Azygoesophageal recess
● Gastrohepatic ligament, celiac axis

● Diaphragm

● Lungs—all lobes and segments; secondary pulmonary lobules

● Fissures—major, minor, azygos, accessory (superior and inferior)

● Airway—lobar and segmental bronchi

● Inferior pulmonary ligaments

B. At the end of the second year, the resident will demonstrate the following technical, communication, and decision-making skills, in addition to those listed for Year 1.

1. Appropriately protocol all requests for chest CT to include thin-section images, high-resolution images, expiratory images, or prone images when appropriate, and use of intravenous contrast, given the patient history (PC)

2. Monitor all chest CT examinations and determine if additional imaging is needed before the patient CT examination is completed (when necessary) (PC)

3. Demonstrate the ability to effectively present thoracic radiology cases to other residents in a conference setting by appropriately selecting cases, interacting with residents, and presenting a brief discussion of the diagnosis for each case (PBLI)

4. Demonstrate the ability to manage an intravenous contrast reaction that occurs during a chest CT examination (PC)

5. Act as a consultant for referring clinicians and recommend the appropriate use of imaging studies (ICS)

6. Describe the principles of chest fluoroscopy, including the assessment of the diaphragm (PC)

7. Demonstrate knowledge of CT parameters contributing to patient radiation exposure and techniques that can be used to limit radiation exposure (PC).
YEARS 3–4

I. Goals

After completion of the third year, and in addition to the goals listed for Years 1 and 2, the resident will:

1. Demonstrate learning of the knowledge-based objectives.
2. Refine skills in interpretation of radiographs and chest CT scans.
3. Develop skills in protocoling, monitoring, and interpreting chest MR studies, including cardiovascular MRI.
4. Become a more autonomous consultant and teacher.
5. Correlate pathologic and clinical data with radiographic and chest CT findings.

II. Objectives

A. During the third and fourth years of radiology residency, the resident will demonstrate knowledge of all of the knowledge-based objectives introduced in Years 1 and 2 (MK).

B. Technical and communication skills:

The resident will demonstrate the following technical, communication, and decision-making skills, in addition to those listed for Years 1 and 2.

1. Dictate accurate, concise chest radiograph, CT scan, and MR reports; the reports will contain no major interpretive errors (ICS)
2. State the clinical indications for performing chest CT and MRI (MK) (PC)
3. Describe a chest CT protocol optimized for evaluating each of the following (PC):
   - thoracic aorta and great vessels
   - coronary calcium
   - pulmonary vein anatomy
   - suspected pulmonary embolism
   - tracheobronchial tree
- suspected bronchiectasis
- lung cancer staging
- esophageal cancer staging
- suspected pulmonary metastases
- suspected pulmonary nodule on a radiograph
- shortness of breath
- hemoptysis
- cardiac mass
- coronary arteries
- suspected pericardial disease

4. Understand the technical principles of chest MRI exams and describe a protocol optimized for evaluating each of the following (MK) (PC):

- thoracic aorta
- pulmonary arteries
- thoracic veins (superior vena cava, brachiocephalic veins)
- pericardium
- cardiomyopathy and cardiac and paracardiac masses, including tumors
- ischemic heart disease, including function, viability and perfusion
- valvular heart disease
- right ventricular dysplasia
- congenital heart disease in an adult
- superior sulcus tumor

5. In collaboration with a pathologist, present an interesting cardiothoracic imaging case, with a confirmed diagnosis, correlating clinical history with pathologic and radiologic findings, to residents and faculty (MK) (ICS) (PBLI).
6. Work in the reading room independently, assisting clinicians with radiologic interpretation, and teaching other residents and medical students assigned to thoracic radiology (PC) (ICS) (P) (PBLI).

Knowledge-Based Objectives

Normal Anatomy.—

1. Define a secondary pulmonary lobule.

2. Define an acinus.

3. Name the lobar and segmental bronchi of both lungs.

4. Identify the following structures on the posteroanterior (PA) chest radiograph:

   - Lungs—right, left, right upper, middle and lower lobes, left upper (including lingula) and lower lobes
   - Fissures—minor, superior accessory, inferior accessory, azygos
   - Airway—trachea, carina, main bronchi
   - Heart—right atrium, left atrial appendage, left ventricle, location of the four cardiac valves
   - Pulmonary arteries—main, right, left, interlobar, truncus anterior
   - Aorta—ascending, arch, descending
   - Veins—superior vena cava, azygos, left superior intercostal (“aortic nipple”)
   - Bones—spine, ribs, clavicles, scapulae, humeri
   - Right paratracheal stripe
   - Junction lines—anterior, posterior
   - Aortopulmonary window
   - Azygoesophageal recess
   - Paraspinal lines
   - Left subclavian artery

5. Identify the following structures on the lateral chest radiograph:
• Lungs—right, left, right upper, middle and lower lobes, left upper (including lingula) and lower lobes

• Fissures—major, minor, superior accessory

• Airway—trachea, upper lobe bronchi, posterior wall of bronchus intermedius

• Heart—right ventricle, right ventricular outflow tract, left atrium, left ventricle, the location of the four cardiac valves

• Pulmonary arteries—right, left

• Aorta—ascending, arch, descending

• Veins—superior vena cava, inferior vena cava, Leit brachiocephalic (innominate), pulmonary vein confluence

• Bones—spine, ribs, scapulae, humeri, sternum

• Retrosternal line

• Posterior tracheal stripe

• Right and left hemidiaphragms

• Raider’s triangle

• Brachiocephalic (innominate) artery

Signs in Thoracic Radiology.—

1. Define, identify and state the significance of the following on a radiograph:

• Air bronchogram—indicates a parenchymal process, including nonobstructive atelectasis, as distinguished from pleural or mediastinal processes

• Air crescent sign—indicates a lung cavity, often resulting from fungal infection or saprophytic colonization

• Deep sulcus sign on a supine radiograph—indicates pneumothorax

• Continuous diaphragm sign—indicates pneumomediastinum

• Ring around the artery sign (air around pulmonary artery, particularly on lateral chest radiograph)—indicates pneumomediastinum

• Fallen lung sign—indicates a fractured bronchus

• Flat waist sign—indicates left lower lobe collapse
● Gloved finger sign—indicates bronchial impaction, which can be seen in allergic bronchopulmonary aspergillosis

● Golden S sign—indicates lobar collapse caused by a central mass, suggesting an obstructing bronchogenic carcinoma in an adult

● Luftsichel sign—indicates upper lobe collapse, suggesting an obstructing bronchogenic carcinoma in an adult

● Hampton’s hump—pleural-based, wedge-shaped opacity indicating a pulmonary infarct

● Silhouette sign—loss of the contour of the heart, aorta or diaphragm allowing localization of a parenchymal process (eg, a process involving the medial segment of the right middle lobe obscures the right heart border, a lingular process obscures the left heart border, a basilar segmental lower lobe process obscures the diaphragm)

● Cervicothoracic sign—a mediastinal opacity that projects above the clavicles is retrotracheal and posteriorly situated, whereas an opacity effaced along its superior aspect and projecting at or below the clavicles is situated anteriorly

● Tapered margins sign—a lesion in the chest wall, mediastinum or pleura may have smooth tapered borders and obtuse angles with the chest wall or mediastinum while parenchymal lesions usually form acute angles

● Figure 3 sign—abnormal contour of the descending aorta, indicating coarctation of the aorta

● Fat pad sign or sandwich sign—indicates pericardial effusion on lateral chest radiograph

● Scimitar sign—an abnormal pulmonary vein in venolobar syndrome

● Double density sign—opacity projecting over the right side of the heart, indicating enlargement of the left atrium

● Hilum overlay sign and hilum convergence sign—used to distinguish a hilar mass from a non-hilar mass

2. Define, identify and state the significance of the following on a chest CT:

● Halo sign—suggesting invasive pulmonary aspergillosis in a leukemic patient

● Split pleura sign—a sign of empyema and other inflammatory pleural processes
Interstitial Lung Disease.—

1. List and identify on a chest radiograph and chest CT four patterns (nodular, reticular, reticulonodular, and linear) of interstitial lung disease (ILD).

2. Make a specific diagnosis of ILD when supportive findings are present in the history or on radiologic imaging (eg, dilated esophagus and ILD in scleroderma, enlarged heart and a pacemaker or defibrillator in a patient with prior sternotomy and ILD secondary to amiodarone drug toxicity).

3. Identify Kerley A and B lines on a chest radiograph and explain their etiology.

4. Recognize the changes of congestive heart failure on a chest radiograph—enlarged cardiac silhouette, pleural effusions, vascular redistribution, interstitial or alveolar edema, Kerley lines, enlarged azygos vein, increased ratio of artery to bronchus diameter.

5. Define the terms “asbestos-related pleural disease” and “asbestosis”; identify each on a chest radiograph and chest CT.

6. Identify honeycombing on a radiograph and chest CT, state the significance of this finding (end-stage lung disease), and list the common causes of honeycomb lung.

7. Describe the radiographic classification of sarcoidosis.

8. Recognize progressive massive fibrosis/conglomerate masses secondary to silicosis or coal worker’s pneumoconiosis on radiography and chest CT.

9. Recognize the typical appearance and upper lobe predominant distribution of irregular lung cysts or nodules on chest CT of a patient with Langerhans cell histiocytosis.

10. List causes of unilateral ILD.

11. List causes of lower lobe predominant ILD.

12. List causes of upper lobe predominant ILD.

13. Identify a secondary pulmonary lobule on CT.

15. Recognize findings of lymphangioleiomyomatosis on a chest radiograph and CT.

16. Identify and give appropriate differential diagnoses when the patterns of septal thickening, perilymphatic nodules, bronchiolar opacities (“tree-inbud”), air trapping, cysts, and ground glass opacities are seen on CT.
Alveolar Lung Disease.—

1. List causes of acute alveolar lung disease (ALD).

2. List causes of chronic ALD.

3. Name common pulmonary-renal syndromes.

4. List the most common causes of acute respiratory distress syndrome.

5. Suggest a specific diagnosis of ALD when supportive findings are present in the history or on the chest radiograph (eg, broken femur and ALD in fat embolization syndrome, ALD and renal failure in a pulmonary-renal syndrome, ALD treated with bronchoalveolar lavage in alveolar proteinosis).

6. Recognize a pattern of peripheral ALD on radiography or chest CT and give an appropriate differential diagnosis, including a single most likely diagnosis when supported by associated radiologic findings or clinical information (eg, peripheral lung disease associated with paratracheal and bilateral hilar adenopathy in an asymptomatic patient with “alveolar” sarcoidosis, peripheral lung disease associated with a markedly elevated blood eosinophil count in a patient with eosinophilic pneumonia, peripheral opacities associated with multiple rib fractures and pneumothorax in a patient with acute thoracic trauma and pulmonary contusions).

Atelectasis, Airways, and Obstructive Lung Disease.—

1. Recognize partial or complete atelectasis of the following on a chest radiograph:
   ● right upper lobe
   ● right middle lobe
   ● right lower lobe
   ● right upper and middle lobe
   ● right middle and lower lobe
   ● left upper lobe
   ● left lower lobe.

2. Recognize complete collapse of the right or left lung on a chest radiograph and list an appropriate differential diagnosis for the etiology of the collapse.

3. Distinguish lung collapse from massive pleural effusion on a frontal chest radiograph.

4. Name the types of bronchiectasis and identify each type on a chest CT.
5. Name common causes of bronchiectasis.

6. Recognize the typical appearance of cystic fibrosis on chest radiography and CT.

7. Name the important things to look for on a chest radiograph when the patient history is “asthma.”

8. Define tracheomegaly.

9. Recognize tracheal and bronchial stenosis on chest CT and name the most common causes.

10. Name the three types of pulmonary emphysema and identify each type on a chest CT.

11. Recognize alpha-1-antitrypsin deficiency on a chest radiograph and CT.

12. Recognize Kartagener syndrome on a chest radiograph and name the three components of the syndrome.

13. Recognize and describe the significance of a pattern of mosaic lung attenuation on chest CT.

**Mediastinal Masses and Mediastinal/Hilar Lymph**

**Node Enlargement.**—

1. State the anatomic boundaries of the anterior, middle, posterior, and superior mediastinum.

2. Name the four most common causes of an anterior mediastinal mass and localize a mass to the anterior mediastinum on a chest radiograph, CT, and MRI.

3. Name the three most common causes of a middle mediastinal mass and localize a mass in the middle mediastinum on a chest radiograph, CT, and MRI.

4. Name the most common cause of a posterior mediastinal mass and localize a mass in the posterior mediastinum on a chest radiograph, CT, and MRI.

5. Identify normal vessels or vascular abnormality on chest CT and chest MRI that may mimic a solid mass.

6. Name etiologies of bilateral hilar lymph node enlargement.

8. State the three most common locations (Garland’s triad) of thoracic lymph node enlargement in sarcoidosis.

9. List the four most common etiologies of “eggshell” calcified lymph nodes in the thorax.

10. Recognize a cystic mass in the mediastinum and suggest the possible diagnosis of a bronchogenic, pericardial, thymic, or esophageal duplication cyst.
11. Recognize the findings of mediastinal fibrosis on chest CT.

*Solitary and Multiple Pulmonary Nodules.*—

1. Define the terms pulmonary nodule and pulmonary mass.
2. Name the three most common causes of a solitary pulmonary nodule.
3. Name important considerations in the evaluation of a solitary pulmonary nodule.
4. Name causes of cavitary pulmonary nodules.
5. Name causes of multiple pulmonary nodules.
6. Describe the indications for percutaneous biopsy of a solitary pulmonary nodule.
7. Describe the indications for percutaneous biopsy when there are multiple pulmonary nodules.
8. Describe the role of positron emission tomography in the evaluation of a solitary pulmonary nodule.
9. Describe an appropriate imaging algorithm to evaluate a solitary pulmonary nodule.

*Benign and Malignant Neoplasms of the Lung and Esophagus.*—

1. Name the four major histologic types of bronchogenic carcinoma and state the difference between non–small-cell and small-cell lung cancer.
2. Name the type of non–small-cell lung cancer that most commonly cavitates.
3. Name the types of bronchogenic carcinoma that are usually central.
4. Describe the TNM classification for staging non–small-cell lung cancer.
5. Name the stages of non–small-cell lung cancer that are potentially resectable.
6. Name the most common thoracic locations for adenoid cystic carcinoma and carcinoid tumors to occur.
7. Suggest the possibility of radiation change as a cause of new apical opacification on a chest radiograph of a patient with evidence of mastectomy or axillary node dissection.
8. Describe the acute and chronic radiographic and CT appearances of radiation injury in the thorax (lung, pleura, pericardium, esophagus) and the temporal relationship to radiation therapy.

9. State the role of MRI in lung cancer staging (e.g., chest wall invasion, superior sulcus, Pancoast tumor).

10. Describe the role of positron emission tomography in lung cancer staging.

11. Describe the classification of lymphoma, the role of imaging in the staging of lymphoma and the

12. Describe typical and atypical imaging findings of thoracic lymphoma.


14. Describe the typical chest radiograph and chest CT appearances of Kaposi sarcoma.

15. Describe CT protocol for lung cancer screening and format for the radiology reports.

16. Be familiar with supportive evidence for lung cancer screening and related issues.

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**Thoracic Trauma.**—

1. Identify a widened mediastinum on a trauma radiograph and state the differential diagnosis (including aortic/arterial injury, venous injury, fracture of sternum or spine).

2. Identify and describe the indirect and direct signs of aortic injury on contrast-enhanced chest CT.

3. Identify and state the significance of chronic traumatic pseudoaneurysm of the aorta on a chest radiograph, CT, or MRI.

4. Identify fractured ribs, clavicle, spine, and scapula on a chest radiograph or CT.

5. Name common causes of abnormal lung opacity on a trauma radiograph or CT.

6. Identify an abnormally positioned diaphragm or loss of definition of a diaphragm on a trauma chest radiograph and suggest the diagnosis of a ruptured diaphragm.

7. Recognize and describe the signs of diaphragmatic rupture on a chest CT.

8. Identify a pneumothorax, pneumopericardium, and pneumomediastinum on a trauma chest radiograph.

9. Identify the fallen lung sign on a chest radiograph or CT and suggest the diagnosis of tracheobronchial tear.
10. Identify a cavitary lesion on a posttrauma radiograph or chest CT and suggest the diagnosis of laceration with pneumatocele formation, hematoma or abscess secondary to aspiration.

11. Name the most common causes of pneumomediastinum in the setting of trauma.

12. Recognize and distinguish between pulmonary contusion and laceration.

_Chest Wall, Pleura, and Diaphragm._

1. Name four causes of a large unilateral pleural effusion on a chest radiograph or CT.

2. Recognize a pneumothorax on an upright and supine chest radiograph.

3. Recognize a pleural based mass with bone destruction or infiltration of the chest wall on a chest radiograph or CT and name likely causes.

4. Recognize pleural calcification on a chest radiograph or CT and suggest the diagnosis of asbestos exposure (bilateral involvement) or old tuberculosis or trauma (unilateral involvement).

5. Recognize the typical chest radiographic appearances of pleural effusion, given differences in patient positioning, and describe the role of the lateral decubitus view to evaluate pleural effusion.

6. Recognize apparent unilateral elevation of the diaphragm on a chest radiograph and suggest a specific etiology with supportive history and associated chest radiograph findings (eg, subdiaphragmatic abscess after abdominal surgery, diaphragm rupture after trauma, phrenic nerve involvement with lung cancer).

7. Recognize imaging findings suggesting a tension pneumothorax and understand the acute clinical implications.

8. Recognize diffuse pleural thickening, as seen in fibrothorax, malignant mesothelioma, and pleural metastases.

9. Describe and recognize the radiographic and CT findings of malignant mesothelioma.

10. Describe the difference in appearance of a pulmonary abscess and an empyema on chest CT and how the two are differently managed.

11. Distinguish pleural from intraperitoneal fluid on chest CT.
Infection and Immunity.—

1. Describe the radiographic manifestations of pulmonary tuberculosis.

2. Name the most common segmental sites of involvement for tuberculosis in the lung.

3. Define a Ghon lesion (calcified pulmonary parenchymal granuloma) and Ranke complex (calcified node and Ghon lesion); recognize both on a chest radiograph and CT and describe their significance.

4. Name and describe the types of pulmonary aspergillus disease.

5. Identify an intracavitary fungus ball on chest radiography and CT.

6. Describe the radiographic appearances of cytomegalovirus pneumonia.

7. Name the major categories of disease causing chest radiograph or CT abnormalities in the immunocompromised patient.

8. Other than bacterial infection, name important infections and important neoplasms to consider in patients with AIDS and chest radiograph or CT abnormalities.

9. Describe the chest radiograph and CT appearances of *Pneumocystis carinii* (*jiroveci*) pneumonia

10. Name the four most important etiologies of hilar and mediastinal lymphadenopathy in patients with AIDS.

11. Describe the time course and chest radiographic appearance of a blood transfusion reaction.

12. Describe the radiographic appearances of mycoplasma pneumonia.

13. Describe the chest radiographic and CT appearance of a miliary pattern and provide a differential diagnosis.

14. Name the diagnostic considerations in a patient who presents with recurrent or persistent pneumonias.

15. Name the endemic mycoses and the specific geographic regions where they are found, and describe their radiographic manifestations.

16. Name the most common pulmonary infections seen after solid-organ (ie, liver, renal, lung, cardiac) and bone marrow transplantation.

17. Describe the chest radiographic and CT findings of posttransplant lymphoproliferative disorders.
Unilateral Hyperlucent Hemithorax.—

1. Recognize a unilateral hyperlucent hemithorax on a chest radiograph or CT.

2. Identify the common causes for unilateral hyperlucent hemithorax on a chest radiograph.

3. Give an appropriate differential diagnosis when a hyperlucent hemithorax is seen on a chest radiograph, and suggest a specific diagnosis when certain associated findings are seen (i.e., absence of a breast in a patient after mastectomy, absence of a pectoralis muscle in a patient with Poland syndrome, unilateral bullous disease/emphysema, or air trapping on expiration in a patient with Swyer-James syndrome or an endobronchial foreign body).

Congenital Lung Disease.—

1. Name the components of pulmonary venolobar syndrome.

2. Recognize venolobar syndrome on a frontal chest radiograph, chest CT, and chest MRI.

3. Recognize a mass in the posterior segment of a lower lobe on a chest radiograph and CT and suggest the possible diagnosis of pulmonary sequestration.

4. Describe the differences between intralobar and extralobar sequestration.

5. Recognize bronchial atresia on a chest radiograph and CT and name the most common lobes in which it occurs.

Pulmonary Vasculature.—

1. Recognize enlarged pulmonary arteries on a chest radiograph and distinguish them from enlarged hilar lymph nodes.

2. Recognize enlargement of the central pulmonary arteries with diminution of the peripheral pulmonary arteries on a chest radiograph and suggest the diagnosis of pulmonary arterial hypertension.

3. Name common causes of pulmonary arterial hypertension.

4. Recognize lobar and segmental pulmonary emboli on chest CT.

5. Define the role of ventilation-perfusion scintigraphy, chest CT, and lower extremity venous ultrasound studies in the evaluation of a patient with suspected venous thromboembolic disease, including the advantages and limitations of each modality depending on patient presentation.
6. Describe the anatomy of and identify the right and left superior and inferior pulmonary veins on chest CT and MRI and the use of radiofrequency ablation of pulmonary veins for treatment of atrial fibrillation.

7. Recognize variations in pulmonary venous anatomy, such as a separate right middle lobe vein and common ostium of the left superior and inferior pulmonary veins.

Thoracic Aorta and Great Vessels.—

1. State the normal dimensions of the thoracic aorta.

2. Describe the classifications of aortic dissection (De- Bakey I, II, III; Stanford A, B) and implications for classification on medical versus surgical management.

3. Describe and recognize the findings of, and distinguish between each of the following on CT and MR:
   - Aortic aneurysm
   - Aortic dissection
   - Aortic intramural hematoma
   - Penetrating atherosclerotic ulcer
   - Ulcerated plaque
   - Ruptured aortic aneurysm
   - Sinus of Valsalva aneurysm
   - Subclavian or brachiocephalic artery aneurysm
   - Aortic coarctation
   - Aortic pseudocoarctation
   - Pulsation artifact at aortic root

4. Recognize a right aortic arch and a double aortic arch on a chest radiograph, chest CT, and chest MRI.

5. State the significance of a right aortic arch with mirror image branching versus with an aberrant subclavian artery.

6. Recognize a cervical aortic arch on a chest radiograph and CT.
7. Recognize an aberrant subclavian artery on chest CT.

8. Recognize normal variants of aortic arch branching, including common origin of brachiocephalic and left common carotid arteries (“bovine arch”), and separate origin of vertebral artery from arch on CT and MRI/MRA.

9. Define the terms _aneurysm_ and _pseudoaneurysm_.

10. Describe the cardiac anomalies commonly associated with aortic coarctation.

11. Describe and identify the findings of Takayasu arteritis on chest CT and chest MRI.

12. Describe the advantages and disadvantages of CT, MRI/MRA, and transesophageal echocardiography in the evaluation of the thoracic aorta.

*Ischemic Heart Disease.*—

1. Describe the anatomy of the coronary arteries and identify the following on a coronary arteriogram, MRI, and CT:
   - Right coronary artery
   - Left main coronary artery
   - Left anterior descending coronary artery
   - Left circumflex coronary artery
   - Obtuse marginal
   - Diagonals
   - Acute marginals
   - Septal perforators

2. Describe the clinical significance of coronary arterial calcification on a chest radiograph.

3. Recognize coronary arterial calcification on CT and describe the current role of coronary artery calcium scoring with helical CT.

4. Name the coronary artery that is usually diseased when there is papillary muscle dysfunction.

5. Describe the common acute complications of myocardial infarction, including left ventricular failure, myocardial rupture, and papillary muscle rupture, and recognize radiologic findings indicating each.
6. Describe the common late complications of myocardial infarction, including ischemic cardiomyopathy, left ventricular aneurysm, left ventricular pseudoaneurysm, coronary-cameral fistula, dyskinesis, and akinesis, and recognize radiologic findings indicating each.

7. Identify signs of left heart failure on a chest radiograph and CT.

8. Define ejection fraction, including the normal value for left ventricular ejection fraction.

9. Identify myocardial calcification on CT and describe the etiology and significance of this finding.

10. Describe the difference between a left ventricular aneurysm and pseudoaneurysm.

11. Define and identify myocardial bridging on CT.

12. Define the role of angiography, echocardiography, stress perfusion scintigraphy, chest CT, and chest MRI in the evaluation of a patient with suspected ischemic heart disease as well as stunned myocardium and hibernating myocardium versus areas of infarction, including the advantages and limitations of each modality.

13. Differentiate viable from nonviable myocardium on MRI.

14. Identify myocardial perfusion defects on MRI.

15. Calculate right and left ventricular volumes, including ejection fraction, stroke volume, end-diastolic volume, and end-systolic volume using MRI and CT.

Myocardial Disease.—

1. Define the types of cardiomyopathy (dilated, hypertrophic, restrictive) and list the common causes of each.

2. Define right ventricular dysplasia, describe the role of MRI in its diagnosis, and identify MRI findings that support the diagnosis.

3. Name the most common benign primary cardiac tumors, including myxoma, lipoma, fibroma, and rhabdomyoma.

4. Name the most common malignant primary cardiac tumors, including angiosarcoma, rhabdomyosarcoma, and lymphoma.

5. Distinguish cardiac tumor from thrombus on CT and MRI.

6. Name the most common malignancies to metastasize to the heart, and describe the appearance on a chest radiograph, chest CT and chest MR.
7. Describe the advantages and disadvantages of echocardiography, CT, and MRI for evaluation of cardiomyopathy and cardiac tumors.

Cardiac Valvular Disease.—

1. Identify and describe the findings of each on a chest radiograph:
   - enlarged right atrium
   - enlarged left atrium
   - enlarged right ventricle
   - enlarged left ventricle

2. Describe and recognize the chest radiograph findings associated with each of the following valvular diseases:
   - Mitral regurgitation
   - Mitral stenosis
   - Aortic regurgitation
   - Aortic stenosis
   - Tricuspid regurgitation

3. Recognize an enlarged ascending aorta and aortic valve calcification on a chest radiograph and suggest the diagnosis of aortic stenosis when these findings are present.

4. Recognize an enlarged left atrium, vascular redistribution, and mitral valve calcification on a chest radiograph and suggest the diagnosis of mitral stenosis when these findings are present.

5. State the most common etiologies of the following:
   - aortic stenosis
   - aortic regurgitation
   - Mitral stenosis
   - Mitral regurgitation
   - Tricuspid regurgitation
   - Pulmonary stenosis
6. Name the cardiac diseases associated with mitral annulus calcification

7. Identify endocarditis or complications of endocarditis on a chest radiograph, CT, and MRI.

8. Describe the advantages and disadvantages of echocardiography and MRI for evaluation of valvular heart disease.

9. Describe the pulse sequences and appropriate planes for evaluating cardiac valvular disease and making quantitative measurements including pressure gradients, regurgitant fractions, and valve areas.

Pericardial Disease.—

1. Recognize pericardial calcification on a chest radiograph and CT and name the most common causes.

2. Describe and identify two chest radiographic signs of a pericardial effusion.

3. Name causes of a pericardial effusion.

4. Describe and recognize the findings of each of the following on a chest radiograph, CT, and MR:
   - Pericardial cyst
   - Constrictive pericarditis
   - Pericardial hematoma
   - Pericardial metastases
   - Partial and complete absence of the pericardium
   - Pneumopericardium

5. Describe the role of MRI in diagnosing constrictive pericarditis and differentiating constrictive pericarditis from restrictive cardiomyopathy.

Congenital Heart Disease in the Adult.—

1. Recognize increased vascularity and decreased vascularity on a chest radiograph and name the common causes of each.

2. Describe and recognize the following on a chest radiograph, CT, or MRI.
Heart disease presenting during adulthood:

- Left-to-right shunts and Eisenmenger physiology
- Atrial septal defect
- Ventricular septal defect
- Partial anomalous pulmonary venous connection
- Patent ductus arteriosus
- Coarctation of the aorta
- Tetralogy of Fallot and pulmonary atresia with ventricular septal defect
- Congenitally corrected transposition of the great arteries
- Persistent left superior vena cava
- Truncus arteriosus
- Ebstein anomaly
- Cardiac malposition, including abnormal situs
- Coronary artery anomalies

Heart disease originally treated in childhood:

- Coarctation of the aorta
- Tetralogy of Fallot and pulmonary atresia with ventricular septal defect
- Complete transposition of the great arteries
- Congenitally corrected transposition of the great arteries
- Truncus arteriosus
- Commonly performed surgical corrections for congenital heart disease

3. Define the role of angiography, echocardiography, chest CT, and chest MRI in the evaluation of an adult patient with congenital heart disease, including the advantages and limitations of each modality depending on patient presentation.
Monitoring and support devices—“tubes and lines”—

1. Describe and identify on chest radiography the normal appearance and complications associated with each of the following:

   - Endotracheal tube
   - Central venous catheter
   - Peripherally inserted central venous catheter
   - Pulmonary artery catheter
   - Feeding tube
   - Nasogastric tube
   - Chest tube
   - Intra-aortic balloon pump
   - Pacemaker generator and leads (including triple lead devices)
   - Automatic implantable cardiac defibrillator
   - Left ventricular assist device
   - Atrial septal defect closure device
   - Pericardial drain
   - Extracorporeal life support cannulae
   - Intraoesophageal manometer, temperature probe or pH probe
   - Tracheal, bronchial or esophageal stent

2. Explain how an intra-aortic balloon pump works.

3. Describe the venous anatomy and expected course of veins from the axillary vein to the right atrium relative to anatomic landmarks.

4. Recognize the difference between a skinfold and pneumothorax on a portable chest radiograph.

Revised July 2020 by Pierre Maldjian, MD
BREAST IMAGING

Reading list:

- ACR BIRADS Lexicon Fifth Edition
- Ikeda, Breast Imaging: The Requisites

Goals and Objectives:

1st Year

- The resident will learn the indications for screening mammography and diagnostic mammography to the satisfaction of the supervising attendee (Patient Care)

- The resident will learn to review patient history forms and plan appropriate diagnostic workup algorithms tailored to each patient presenting with the symptoms related to the breast. (Patient Care, Medical Knowledge)

- The resident will demonstrate understanding of the indications and contraindications for different modalities including mammography, breast ultrasonography and MRI to the approval of the supervising attending. (Medical Knowledge, Patient Care, Systems-based Practices).

- The resident will learn the indications, contraindications, and potential complications of interventional procedures including stereotactic core biopsy, ultrasound, fine needle aspiration biopsy, and preoperative wire localization to the satisfaction of the supervising attending. (Medical Knowledge, Patient Care)

- The resident will relate to the supervising attending that he/she is aware of the clinical signs of breast cancer. (Medical Knowledge)

- The resident will observe all image guided breast procedures including preoperative wire localizations, cyst aspirations, ultrasound guided biopsy, and stereotactic biopsy (Patient care)

- The resident will attend the monthly breast tumor board conference. (Patient Care, Professionalism, Communication Skills)

- The resident will become aware of issues related to MQSA and medical audit according to MQSA guidelines to the satisfaction of the supervising attendant. (Systems-Based Practice)

- The resident will demonstrate a collegial interaction with the non-faculty members of the center for breast imaging. (Professionalism, Communication Skills)
• The resident will maintain a mammography exam log. Participation in this requirement will be assessed by the program director. (Patient Care, Medical Knowledge)

• The resident will demonstrate to the supervising attending understanding of the epidemiologic factors and issues related to screening mammography. (Systems Based Practice, Medical Knowledge)

• The resident will demonstrate compassion and humility in interaction with patients and staff members as assessed by 360 degree evaluations. (Professionalism)

• The resident will maintain a professional dress code at all times and be punctual for clinic assignments and conferences to the satisfaction of the faculty. (Professionalism)

• The resident will appropriately wear a film badge and submit the badge to the residency coordinator monthly for dose analysis. (Professionalism)

2nd Year

• The resident will learn to produce clear and concise mammographic reports and ultrasound reports according to ACR BI-RADS guidelines. (Medical knowledge, patient care)

• The resident will learn how to communicate abnormal findings on breast imaging studies to referring physicians, patients, and patients’ families. (Patient Care, Communication Skills, Professionalism)

• The resident will successfully gain the skill to obtain written consent for interventional procedures. (Communication Skills, Professionalism)

• The resident will learn to supervise technologists in the performance of breast imaging studies to the satisfaction of both the attending and staff as assessed on the attending evaluation and 360 degree evaluation. (Practice Based learning, Communication skills, Professionalism)

• The resident will further supplement the log of mammographic exams performed and interpreted by him/her. (Patient Care, Medical Knowledge, Systems based Practice)

• The resident will continue to observe all image guided breast procedures including preoperative wire localizations, cyst aspirations, ultrasound guided biopsy, and stereotactic biopsy and will be given gradual increase in participation of the procedures under direct attending supervision (Patient care)

• To demonstrate compassion and humility in interaction with patients and staff members as revealed in 360˚ evaluations. (Professionalism)
• To follow the appropriate professional dress code at all times and to be punctual for clinic assignments and conferences to the satisfaction of the faculty. (Professionalism)

• To appropriately wear a film badge and submit monthly for dose analysis. (Professionalism)

• To promptly look up information as suggested by the supervising physician in the course of daily education. (Practice-Based Learning)

3rd Year

• The resident will gain enhanced skills in the production of clear and concise mammographic reports and ultrasound reports according to ACR guidelines as assessed by the attending. (Medical knowledge, Patient Care)

• The resident will learn how to communicate abnormal findings on breast imaging studies to referring physicians, to patients, and patients’ families. (Patient Care, Communication Skills, Professionalism)

• The resident will attain facility in overseeing written consent for interventional procedures. (Communication Skills, Professionalism)

• The resident will supervise technologists in the performance of breast imaging studies as assessed by the attending and a 360 degree evaluation. (Practice Based learning, Communication skills, professionalism)

• The resident must now interpret at least 250 mammographic exams under attending radiologist’s supervision. Documentation will be reviewed by an attending radiologist and the program director. (Systems Based Practice, Patient Care).

• The resident will continue to observe all image guided breast procedures including preoperative wire localizations, cyst aspirations, ultrasound guided biopsy, and stereotactic biopsy and will be given gradual increase in participation of the procedures under direct attending supervision (Patient care)

• To demonstrate compassion and humility in interaction with patients and staff members as revealed in 360˚ evaluations. (Professionalism)

• To follow the appropriate dress code at all times and to be punctual for clinic assignments and conferences to the satisfaction of the faculty. (Professionalism)

• To appropriately wear your film badge as assessed periodically by the program director except for US. (Professionalism)
• To promptly look up information as suggested by the supervising physician in the course of daily education. (Practice-Based Learning)

Revised August 2017 by B. Hubbi, MD
INTERVENTIONAL RADIOLOGY GOALS AND OBJECTIVES

Overall rotation goals and objectives:
The Interventional Radiology rotations involve performance and interpretation of diagnostic and therapeutic image-guided procedures. Radiology residents will spend 4---6 (4 core rotations required) months on the interventional radiology service during their residency. All aspects of interventional radiology will be taught during the residency. Specific responsibilities, goals and objectives for each rotation are described in this document. The interventional radiology faculty will provide residents with graded supervision using ACGME guidelines.

Resident responsibilities:
1. Complete competency check lists for basic IR procedures (see below)
2. Be knowledgeable of the daily interventional procedure schedule.
3. Be available to assist with procedures during the day, except during scheduled conferences.
4. Review previous radiology studies and discuss findings with faculty prior to each procedure.
5. Assist with completion of outpatient pre-procedure documentation.
6. Complete the post-procedure note after each procedure.
7. Act as liaison with referring clinicians: evaluate requisitions for appropriateness, discuss findings with referring clinicians.
8. Prepare inpatients for procedures by reviewing diet, coagulation, consent and allergies.
9. Consult supervising faculty when questions arise beyond the scope of the resident's current level of training.

Staff responsibilities:
1. Review the goals and objectives with the resident at the beginning of each rotation.
2. Sign off on resident competencies at the end of each rotation as appropriate.
3. Be available at all times for consultation by the resident.
4. Provide the resident with constructive feedback on their performance during the rotation.
5. Verify resident reports in a timely manner and inform the resident of any major changes.
6. Faculty will complete resident and all program evaluations in a timely professional manner.

Residents are expected to present in the IR suite at 7:30 am every day and go over and prepare for the scheduled and add-on cases for the day in EPIC EMR. Residents are expected to review the clinical and imaging studies for the major cases. Self directed learning is strongly encouraged and expected.
SUGGESTED READING LIST

The Requisites.


Kandarpa, K., Aruny J., Handbook of Interventional Radiologic Procedures. 3rd edition Lippincott Williams & Wilkins.


RadPrimer
SIR Clinical Practice Guidelines

First rotation

Medical

Knowledge:

- Vascular and non-vascular anatomy and physiology including some common variants
- Appropriate use of fluoroscopy, CT-Fluoroscopy and ultrasound equipment and technique including techniques to minimize radiation exposure
- Identify relevant anatomic structures on vascular studies
- Learn basic approach to drainage procedures (GI, GU, and abscess)
- Demonstrate understanding of Seldinger technique.
- Begin reading from books in the suggested list.
- Demonstrate mastery of approximately 1/3 of the Interventional Radiology curriculum from RadPrimer (see below)

Patient-Care Objectives:

Knowledge-based objectives:
- Learning appropriate indications and contraindications, risks and benefits to
vascular and nonvascular procedures (mild to moderate complexity)

- Learning appropriate planning (reviewing imaging, pertinent labs, patient positioning, history and physical, consult write-ups) for vascular and nonvascular procedures (mild to moderate complexity)
- Appropriate work-up for emergency/on-call cases
- Medical management of patients admitted to the IR service
  - Gather clinical and radiological data on vascular and non-vascular patients, and write full consult on inpatients and outpatients
  - Develop diagnostic and treatment plan based on the clinical presentation and prior imaging
  - Consent patient and family for procedures
  - Participate in procedure safely and responsibly
  - Counsel patients concerning findings
  - Demonstrate basic knowledge of EPIC, Nuance, and Centricity PACS

Technical skills objectives:

- Venous access
- Simple CT guided procedures (Biopsies, abscess drainage, chest tube)
- Arterial access
- Basic abscess drainage and tube changes

Decision-making and value judgment skills:

- Work with the health care team in a professional manner to provide patient-centered care,
- Notify referring clinician for urgent, emergent, or unexpected findings, and document in dictation.
- Consistently perform pre-operative work ups on patients undergoing procedures.
- Diligent follow up and rounding on patients who have undergone procedures and management of any post operative complications.

Interpersonal and Communication Skills

*Skills*

- Provide a clear written consult, procedure note, and follow-up notes in the patient's medical record
- Provide an concise and accurate presentation of patients prior to procedure or on patients that the resident did a clinical consult
- Provide a clear dictated report
• Communicate directly with referring physicians, and document communication in
• report
• Demonstrate skills in obtaining informed consent, including effective communication to patients of the procedure, alternatives, and possible complications
• Demonstrate the verbal and non-verbal skills necessary for face to face

**Education**

• Participation as an active member of the radiology team by communicating with clinicians face to face, providing consults, answering phones, problem solving and decision-making
• Act as contact person for technologists and nurses in managing patient and imaging issues
• Practical experience in dictating radiological reports

**Professionalism**

**Skills**

• Mandatory and **timely** attendance at all IR rounds and

  lectures Daily rounds
• Active participation with faculty in patient workup and performing procedures
• Role modeling by faculty
• Preparation of cases for hepatobiliary conference
• Graduated responsibility in performing vascular and nonvascular

• Demonstrate excellence: perform responsibilities at the highest level and active learning throughout one's career
• Demonstrate honesty with patients and staff
• Demonstrate sensitivity without prejudice on the basis of religious, educational differences, and without employing sexual or other types of
• Demonstrate knowledge of issues of impairment
• Demonstrate positive work habits, including punctuality and professional
• Demonstrate the broad principles of biomedical ethics
• Demonstrate principles of confidentiality with all information transmitted patient encounter

**Education**

• Discussion of above issues during daily clinical work
• Role modeling by attending physician faculty
• Participation in hospital based educational activities

Practice Based Learning and Improvement

Skills
• Demonstrate the ability to use the Internet as an educational instrument
• Maintain a case log of all interventional procedures you perform
• Analyze and develop improvement plans in the clinical practice, including knowledge, observation, and procedural skills
• Demonstrate knowledge of and apply the principles of evidence-based medicine in practice
• Demonstrate critical assessment of the scientific literature
• Help teaching of medical students, peers and other health care professionals

Education
• Participate in Journal club, clinical conferences, and independent learning

Systems Based Practice

Skills
• Demonstrate ability to design cost-effective care plans
• Demonstrate knowledge of reimbursement methods

Education
• Review of literature, including ACR Appropriateness Criteria and SIR clinical practice guidelines
• Attendance and participation in multi-disciplinary conference
• Interaction with department administrators
• Membership and participation in local and national radiological societies

Second rotation

Medical

Knowledge:
• Fluoroscopic equipment and technique
o Digital subtraction angiography
o Angiographic interpretation
o Advanced patient management principles
o Complete Recommended Reading for second rotation (see below)
o Mastery of two-thirds of the RadPrimer Interventional Radiology curriculum

Patient care:

Technical skills objectives:

• Basic venous procedures including venograms, IVC filter placement, venoplasty and stenting,
• Basic arterial procedures including diagnostic aortograms and run-offs, mesenteric angiograms and pelvic angiograms
• Advanced drainage procedures, percutaneous biliary access and drainage, nephrostomy tube placement
• Basic chemoembolization techniques and patient management
• Basic RF ablation techniques and patient management
• Basic medical management of patients admitted to the IR service

  o Gather clinical and radiological data on vascular and non-vascular patients, and write full consult on inpatients and outpatients
  o Develop diagnostic and treatment plan based on the clinical presentation and prior imaging
  o Consent patient and family for procedures
  o Participate in procedure safely and responsibly
  o Counsel patients concerning findings
  o Demonstrate basic knowledge of EPIC, Nuance, and Centricity PACS

Decision-making and value judgment skills:

• Work with the health care team in a professional manner to provide patient-centered care
• Notify referring clinician for urgent, emergent, or unexpected findings, and document in dictation.
• Consistently perform pre-operative work ups on patients undergoing procedures.
• Diligent follow up and rounding on patients who have undergone procedures and management of any post-operative complications.

Interpersonal and Communication Skills
Skills

- Provide a clear written consult, procedure note, and follow-up notes in the patient's medical record
- Provide an concise and accurate presentation of patients prior to procedure or on patients that the resident did a clinical consult
- Provide a clear dictated report
- Communicate directly with referring physicians, and document communication in report
- Demonstrate skills in obtaining informed consent, including effective communication to patients of the procedure, alternatives, and possible complications
- Demonstrate the verbal and non-verbal skills necessary for face to face listening and speaking to physicians, families, and support personnel

Education

- Participation as an active member of the radiology team by communicating with clinicians face to face, providing consults, answering phones, problem solving and decision-making
- Act as contact person for technologists and nurses in managing patient and imaging issues
- Practical experience in dictating radiological reports

Professionalism

Skills

- Mandatory and timely attendance at all IR morning rounds and lectures
- Active participation with faculty in patient workup and performing procedures Role modeling by faculty members
- Attend Wednesday afternoon lectures Preparation of cases for hepatobiliary conference
  - Graduated responsibility in performing vascular and nonvascular procedures
  - Demonstrate compassion (be understanding and respectful of patient, their families, and medical colleagues)
- Demonstrate excellence: perform responsibilities at the highest level and continue active learning throughout one's career
  - Demonstrate honesty with patients and staff
- Demonstrate sensitivity without prejudice on the basis of religious, ethnic, sexual or educational differences, and without employing sexual or other types of harassment
- Demonstrate knowledge of issues of impairment
• Demonstrate positive work habits, including punctuality and professional appearance
• Demonstrate the broad principles of biomedical ethics
• Demonstrate principles of confidentiality with all information transmitted during a patient encounter

Education

• Discussion of above issues during daily clinical work
• Role modeling by attending physician faculty
Participation in hospital based educational activities

Practice Based Learning and Improvement

Skills

• Demonstrate the ability to use the Internet as an educational instrument
• Maintain a case log of all interventional procedures you perform

• Analyze and develop improvement plans in the clinical practice, including knowledge, observation, and procedural skills
• Demonstrate knowledge of and apply the principles of evidence-based medicine in practice
• Demonstrate critical assessment of the scientific literature
• Help teaching of medical students, peers and other health care professionals

Education

• Participate in Journal club, clinical conferences, and independent learning
Systems Based Practice

Skills

- Demonstrate ability to design cost-effective care plans
- Demonstrate knowledge of reimbursement methods

Education

- Review of literature, including ACR Appropriateness Criteria and SIR clinical practice guidelines
- Attendance and participation in multi-disciplinary conference
- Interaction with department administrators
- Membership and participation in local and national radiological societies

Third rotation

Medical

Knowledge:

- Fluoroscopic techniques
  Arterial interventional procedures TIPS
  Arterial and venous thrombolysis
- Advanced patient management principles
- How to appropriately select patients for loco regional therapies (Chemoembolization and/or RF ablation)
- How to appropriately select patients for Uterine Fibroid Embolization (UFE)
- Complete Recommended Reading for Third Rotation (see below).

Patient Care:

Technical skills objectives:

- How to perform angiograms, runoffs, and basic arterial stents (renals, iliacs)
- How to perform TIPS
- How to perform chemoembolization and RF ablation
• How to perform UFE
• How to perform arterial and venous thrombolysis and follow up
• Medical management of patients admitted to the IR service

• Gather clinical and radiological data on vascular and non-vascular patients, and write full consult on inpatients and outpatients
• Develop diagnostic and treatment plan based on the clinical presentation and prior imaging
• Consent patient and family for procedures
• Participate in procedure safely and responsibly
• Counsel patients concerning findings
• Demonstrate basic knowledge of EPIC, Nuance, and Centricity PACS

**Decision-making and value judgment skills:**

• Work with the health care team in a professional manner to provide patient-centered care
• Notify referring clinician for urgent, emergent, or unexpected findings, and document in dictation.
• Consistently perform pre-operative work ups on patients undergoing procedures.
• Diligent follow up and rounding on patients who have undergone procedures and management of any post operative complications.

**Interpersonal and Communication**

**Skills**

• Provide a clear written consult, procedure note, and follow-up notes in medical record
• Provide an concise and accurate presentation of patients prior to procedure or on patients that the resident did a clinical consult
• Provide a clear dictated report
• Communicate directly with referring physicians, and document communication in report
• Demonstrate skills in obtaining informed consent, including effective communication to patients of the procedure, alternatives, and possible complications
• Demonstrate the verbal and non-verbal skills necessary for face to face listening and speaking to physicians, families, and support personnel
**Education**

- Participation as an active member of the radiology team by communicating with clinicians face to face, providing consults, answering phones, problem solving and decision-making
- Act as contact person for technologists and nurses in managing patient

**Professionalism**

**Skills**

- Mandatory and **timely** attendance at all IR morning rounds and lectures
- Active participation with faculty in patient workup and performing procedures
- Role modeling by faculty members

**Practice Based Learning and Improvement**

**Skills**

- Demonstrate the ability to use the Internet as an educational instrument
- Maintain a case log of all interventional procedures you perform
- Analyze and develop improvement plans in the clinical practice, including knowledge, observation, and procedural skills
- Demonstrate knowledge of and apply the principles of evidence-based medicine in practice
- Demonstrate critical assessment of the scientific literature
- Help teaching of medical students, peers and other health care professionals

**Education**

- Participate in Journal club, clinical conferences, and independent learning

**Systems Based Practice**

**During each rotation it is mandatory that:**

1. The resident attends and participates in morning rounds (see below)
2. In order to ensure continuing patient care residents might not leave the service to
attend noon conferences if there is a procedure in progress that the resident started earlier and is ongoing or if called for emergently.

3. Participate in all weekly IR conferences
4. All studies should be reviewed with an attending and dictated the same day
5. Residents can leave for the day only after notifying and approval from faculty on service.
6. Although 100% attendance is strongly recommended by the entire faculty, a maximum of 2 days per rotation of vacation/personal days/sick days will be allowed. Chief residents will be responsible for obtaining coverage for absent days. In the event of a sickness or an emergency, additional time will be granted on a case by case basis

**Method of Assessment of Performance:**

- Verbal feedback will be provided to the resident throughout the rotation
- Written evaluation of resident by faculty at the end of each rotation. Evaluations to be completed in New Innovations at the end of each rotation by at least 2 faculty members on service. Performance will be reported on a scale of 1-5, with 1 being deficient and 5 being exceptional. These grades/feedback will help them prepare for their subsequent rotations and help them identify deficiencies proactively
- In view of the educational requirements, any resident who fails to perform at the expected level by their final rotation (Rotation 3, PGY 4) will be required to do an additional 4 weeks of IR in their final year of residency to get them on par with their colleagues
- Interventional procedure case log—to be reviewed by program director at the end of each rotation
- ACR In-Training Service Exam
- ABR examinations

**Recommended Reading**

**FIRST ROTATION**

- *Interventional Radiology: The Requisites*, Kaufman and Lee
- *Handbook of Interventional Procedures*, Kandarpa and Aruny

**SECOND and THIRD ROTATION**

- *Interventional Radiology: The Requisites* Kaufman and Lee
- *Vascular And Interventional Radiology: Karim Valji*

**ADDITIONAL READING**

- *Teaching Atlas of Interventional Radiology: Diagnostic and Therapeutic Angiography: Sadoon Kadir*
Core IR Lecture

Series Tools of the Trade:

1. Pharmacology. Pre-procedural, procedural and post-procedural medications related to conscience sedation, renal insufficiency and allergic contrast reaction.
2. Basic Interventional Technique and Equipment. Needles, catheters, wires, sheaths, balloons, stents, embolic agents, retrieval devices, arterial access, closure devices, biopsy devices, drainage catheters, thrombolytic systems and percutaneous ablation devices.
4. Radiation Safety. Recognition of potential dangers of IR radiation exposure and steps to limit exposure.

Arterial Intervention

8. Mesenteric Ischemia and GI Bleed. Including mesenteric vascular anatomy and anomalies; causes and treatment of acute and chronic ischemia; causes, evaluation and embolics used in GI bleed; and portal venous thrombosis.
9. Acute Hemorrhage. Diagnosis and treatment of a) traumatic vascular injury specific to spleen, liver, kidney, pelvis, peripheral vessels, b) bronchial artery embolization, c) obstetrical hemorrhage.
12. Carotid Artery Disease. Etiology, non-invasive and invasive evaluation, treatment
13. Vascular Variant Anatomy. Commonly seen normal variants to arterial and venous
anatomy, excluding cardiac anomalies.

Venous Intervention

14. IVC Filters. Indication for placement and retrieval. Venous anomalies affecting IVC
filtration. Filter deployment and retrieval technique. Findings on pulmonary
angiography.
15. Deep Venous Thrombosis and Post Thrombotic Syndrome. Venography,
thromblysis, infusion catheters, Trellis, PTA, stenting, recanalization.
16. Vascular Malformations. Etiology, evaluation (clinical and radiographic), treatment
and follow-- up related to the full range of vascular malformations and lymphatic
malformations, with disease-specific discussion of HHT, PAVM, KTW.
17. Central Venous Access. Indications to place or remove CVL. Types and appropriate
access locations of CVL, complications of CVL, central venous stenosis including
SVC syndrome.
18. Portal Hypertension, TIPS & BRTO. Patient evaluation including MELD, procedural
technique and complications, patient follow-up.
19. Hemodialysis. Clinical, non-invasive and radiographic evaluation of dialysis catheters,
grafts and fistula. De-clot technique.
20. Gynecologic and Pelvic Intervention. Female pelvic congestion syndrome. Male
varicocle.

Oncologic Intervention

- Trans arterial Chemoembolization and Radio embolization, Portal Vein Embolization.
  Indication for treatment, patient evaluation and exclusion criteria, tumor lysis
  syndrome, post-embolization symptoms, multidisciplinary approach.
21. Percutaneous Ablation Techniques. RFA, cryoablation, microwave,
  high-intensity ultrasound.

Non-vascular Intervention

22. Biopsy and Abscess Evaluation and Treatment Technique. Patient evaluation, drain
follow-up, and advantages and disadvantages of CT, US, Flouro, MRI assisted procedures.

23. Hepatobiliary Intervention. Biliary disease processes, radiologic evaluation (PTC) and treatment options including PBD/stents, cholecystostomy drains.


25. Enteric Tubes. Indications and techniques for placement of gastrostomy, gastrojejunostomy, jejunostomy, and cecostomy tubes.


27. Unknown and Challenge Cases

28. Senior Review and Mock Boards

### Vascular and Interventional Radiology Curriculum, from RadPrimer:

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39 Abdominal Aortic Aneurysm Dx
40 AAA with Rupture Dx
41 Endoleak Post AAA Repair Dx
42 Aortic Enteric Fistula Dx
43 Infected Aortic Graft Dx
44 Abdominal Aortic Occlusion Dx
45 Abdominal Aortic Dissection Dx
46 Abdominal Aortic Trauma Dx

**MUSCULOSKELETAL GOALS AND OBJECTIVES**

First year: To train the eye of the resident to look at bones properly, and introduce the resident to orthopedic terminology and fracture description

Competency:

A. Knowledge

1. Recognize and name normal anatomic structures, as well as normal variants as seen on radiography. Knowledge will be subject to verbal examination by attending.
2. Describe fractures in a systematic and comprehensive manner. Succinct and precise report dictation of radiographic findings in reports. All reports reviewed by radiology attending, critiqued where appropriate, and corrected by the resident. Appropriate choice of ICD-10 codes will be emphasized.
3. Describe and recognize basic benign bone lesions such as infarcts, osteochondromas, cysts and fibrous dysplasia. Digitized teaching file review of lesions with attending.
4. Recognize the radiographic signs of osteomyelitis/septic arthritis, and be able to competently discuss the appropriate imaging evaluation of osteomyelitis/septic arthritis. Extemporaneous discussions at the PACS workstation will highlight advantages and disadvantages of imaging modalities.
5. Recognize normal CT and MR cross-sectional anatomy of the extremities. Each cross sectional imaging study to be reviewed with attending. Review of pertinent anatomy subject to verbal examination by attending, and additional resident review as deemed necessary.

B. Communications, practice-based learning and patient care:
6. Understand the indications for use of contrast in CT and MR imaging. Know the contraindications for use of contrast and learn appropriate screening questions to ask before injections are performed.

7. Learn hip aspiration/shoulder injection technique. Participation by observation and then fluoroscopy. Learn to obtain informed consent and perform time out procedure. Emphasis on sterile technique and needle positioning under supervision. Respect and empathize with patient during the procedure.


9. Resident will competently perform these procedures after a 3 month rotation, will do at least 2 of each under supervision of an attending.

10. Knowledge of medical devices not permitted in the MR

C. Professionalism

11. To develop a professional rapport with consulting services. Communication of unexpected results to the clinical services will be monitored by attending physician for accuracy and politeness.

12. Attendance at all didactic lectures, and timely arrival each day on the rotation is expected.

13. Gain sensitivity to the demands of referring services, and responsiveness to the complaints of patients.

D. Systems-Based Practice

14. Recognize incorrectly positioned radiographs or radiographs performed using incorrect technique. Learn how positioning can influence the appearance of structures on radiographs and diagnosis.

15. Learn the required views for musculoskeletal system radiographic studies


Evaluation will be done at the PACS system by the attending on a case by case basis. Approximately 250 cases reviewed per week with the resident. Questions on medical knowledge, radiographic evaluation, and findings to be answered by the resident as films are reviewed. At the end of each rotation, all residents will be evaluated by the attending using the comprehensive radiology evaluation form.
Second and third year rotations: Emphasis is placed on expanding basic knowledge and section responsibilities.

Competency:

A. Knowledge:

1. Develop a method of accurately describing the radiographic appearance of bone neoplasms and a complete differential diagnosis for musculoskeletal neoplasms. Review of current and teaching file cases to be done with attending to refine these points.
2. Develop a thorough knowledge of pediatric orthopedic problems as well as congenital dysplasias. Review of current and teaching file cases to be done with attending to refine these points.
3. Recognition of metabolic bone diseases and their causes. Review of current and teaching file cases to be done with attending to refine these points.
4. Know the radiographic characteristics of the arthropathies. Review of current cases and teaching file with attending.
5. Demonstrate satisfactory knowledge of commonly seen disorders such as neurofibromatosis, sickle cell anemia, avascular necrosis, fracture complications, developmental dysplasia of the hip.
6. Progression in ability to recognize abnormal CT and MR findings. By conclusion of 3rd year, competency in interpretation of shoulder and knee MR. Resident to begin dictating MR and CT Imaging in first-second year.
7. Areas of weakness are to be determined by the attending, and followed up by Individual study.
8. Try to interest resident in writing a case report or conducting research.

B. Communications, practice-based learning and patient care:

9. Continued performance of joint injection and aspiration procedures, with attending supervision.
10. Resident should be able to protocol all CT and MR studies by the conclusion of 2nd year. Will participate in annotating studies on EPIC. Appropriateness of imaging choices and radiation exposure will be emphasized.

C. Professionalism

11. Concise dictation of cross-sectional imaging studies to be reviewed and critiqued by the attending physician.
12. Residents should be able to discuss radiographic and cross-sectional imaging findings with consulting medical teams. Develop relationship with department of
Orthopedics and pathology in order to foster research and rapid transmission of imaging findings to the clinician.

13. Attendance at all didactic lectures, and timely arrival each day on the rotation is expected. Residents should be able to teach junior residents and medical students.

14. Try to interest resident in writing a case report or conducting research.

D. Systems-based Practices:

15. While taking call, resident will supervise, protocol and monitor emergency bone and joint CT and MR emergency room cases. Appropriateness of imaging choices and radiation exposure will be emphasized.

16. Resident will notify section chief of any quality issues pertaining to adequate delivery of diagnostic studies on evening or overnight shifts.


Evaluation will be done at the PACS workstation by the attending on a case by case basis. Approximately 250 cases reviewed per week. Appropriate response expected to all questions concerning the radiographic finding, as well as discussion on diseases or syndromes identified. At the end of each rotation, all residents will be evaluated by the attending using the comprehensive radiology evaluation form.

**Fourth Year:** Fine tuning the resident’s exposure to all facets of musculoskeletal radiology.

**Competency:**

A. Knowledge:

1. Discuss current literature as it pertains to the radiologic evaluation of sports injuries, neoplasm, infection and arthropathies.
2. Recognize and diagnose all pathology seen on radiographs.
3. Identify abnormal MR findings. Competency in interpretation of ankle, hip and wrist MR.
4. Run the musculoskeletal section efficiently in the event the attending is otherwise unavailable.
5. Residents should be able to function on a level adequate to pass their boards.
6. All major texts and the syllabi should be read by now and their ability to interpret films should reflect their knowledge.
7. Areas of weakness are to be determined by the attending, and followed up by reading as well as further review at workstation.

B. Communications, practice-based learning and patient care:
8. Residents should be able to supervise and teach junior residents during all procedures.

10. Residents should be able to protocol and interpret studies at a superior level. Appropriateness of imaging choices and radiation exposure will be emphasized.

C. Professionalism

10. Conduct of residents should reflect confidence in their ability, and a pleasant on-going relationship with clinicians.

11. Attendance at all didactic lectures, and timely arrival each day on the rotation is expected.

D. Systems based practice:

12. Residents must recognize a diagnostic cross-sectional imaging study, versus a non-diagnostic one. Ability to critique radiography and imaging studies should be present. Knowledge on how to improve the study should be gained in final year.

13. Communicate CT or MR scan problems to the technologist while scan being done, and suggest imaging changes to optimize the scans. Be able to instruct technologist on correct slice orientation for both CT and MR.

All of the above done under the guidance of the attending, at the workstation, on a case by case basis. At least 250 cases reviewed per week. At the end of each rotation, all residents will be evaluated by the attending using the comprehensive radiology evaluation form.

Reading list: “Musculoskeletal MRI” by P. Kaplan et al, MRI-Essentials.com by Fischer, Guermazi et al.
NEURORADIOLOGY GOALS AND OBJECTIVES

Prepared by Huey-Jen Lee, M.D.

General Goals

The resident rotations in neuroradiology during the four years of Radiology Residency program will vary depending upon the rotational schedule set up by the department of radiology. It is expected that residents will progressively develop their abilities to perform and interpret imaging studies of the central nervous system. The objectives for the rotations during the years of training will be based upon principles in related to patient care, medical knowledge, practiced based learning and improvement, interpersonal and communication skills and professionalism.

1st Rotation

- The resident will demonstrate understanding of normal anatomy of the brain as assessed in a one-to-one evaluation session with the section chief at the end of the rotation. (Medical Knowledge)

- The resident will demonstrate understanding of the vascular anatomy of the head and neck as assessed in a one-to-one evaluation with the section chief in at the end of the session. (Medical Knowledge)

- The resident will demonstrate detailed understanding of the spinal canal, spinal cord and nerve roots and their spatial dimensions as assessed in a one-to-one evaluation session with the section chief at the end of the rotation. (Medical Knowledge)

- The resident will recite to the supervising radiologist the indications and the limitations of the various modalities used in Neuroradiology including radiography, CT, MR, PET CT, angiography and myelography. (Medical Knowledge, Patient Care)

- The trainee will become conversant with the clinical and radiologic finding in the most common neuro imaging related emergencies and demonstrate that knowledge to supervising attendings and senior radiologists on call. (Medical Knowledge, Patient Care)

- The resident will demonstrate to the section chief basic comprehension of image acquisition parameters in CT and MR imaging of the brain and spine. (Medical Knowledge, Practice-Based Learning) To learn the indications, limitations, daily and long term consequences of all major radiologic examinations in their specialty to the satisfaction of the supervising attending with respect to dose deposition and cost with the exception of US and appropriateness to the satisfaction of the program director and to gain a passing score on an examination. (Patient Care)
• To gain skill in the art of radiologic consultation with referring physicians to the satisfaction of all faculty members and senior residents. (Communication Skills, Patient Care)

• To practice competence in collegial interactions, in the service of patients, with referring physicians in the context of after hours emergency duty to the satisfaction of the program director. (Professionalism, Patient Care)

• To demonstrate compassion and humility in interaction with patients and staff members as revealed in 360˚ evaluations. (Professionalism)

• To follow the appropriate dress code at all times and to be punctual for clinic assignments and conferences to the satisfaction of the faculty. (Professionalism)

• To appropriately wear your film badge as assessed periodically by the program director except for US. (Professionalism)

• To promptly look up information as suggested by the supervising physician in the course of daily education. (Practice-Based Learning)

2nd Rotation

• The resident will recite to the supervising neuroradiologist the differential diagnoses of common imaging abnormalities of the brain. (Medical Knowledge)

• The resident will recite to the supervising neuroradiologist the differential diagnoses of common imaging abnormalities of the spine and spinal cord. (Medical Knowledge)

• The trainee will gain knowledge of the role of the various MR imaging sequences and their pertinence to brain and spine abnormality detection and display that knowledge to the section chief. Failure to achieve this goal at the end of the rotation will necessitate remediation through further reading assignments. (Patient Care, Medical Knowledge)

• The resident will demonstrate to the supervising attending the CT features of traumatic brain changes. (Medical Knowledge)

• The resident will demonstrate to the supervising attending the CT features of the various common cerebral infections. (Medical Knowledge)

• The resident will demonstrate to the supervising attending the CT features of common intracerebral neoplasms. (Medical Knowledge) To learn the indications, limitations, daily and long term consequences of all major radiologic examinations in their specialty to the satisfaction of the supervising attending with respect to dose deposition and cost with the exception of US and appropriateness to the satisfaction of the program director and to gain a passing score on an examination. (Patient Care)
• To gain skill in the art of radiologic consultation with referring physicians to the satisfaction of all faculty members and senior residents. (Communication Skills, Patient Care)

• To practice competence in collegial interactions, in the service of patients, with referring physicians in the context of after hours emergency duty to the satisfaction of the program director. (Professionalism, Patient Care)

• To demonstrate compassion and humility in interaction with patients and staff members as revealed in 360° evaluations. (Professionalism)

• To follow the appropriate dress code at all times and to be punctual for clinic assignments and conferences to the satisfaction of the faculty. (Professionalism)

• To appropriately wear your film badge as assessed periodically by the program director except for US. (Professionalism)

• To promptly look up information as suggested by the supervising physician in the course of daily education. (Practice-Based Learning)

**3rd Rotation**

• The resident will recite to the section chief the imaging findings in common neurologic developmental abnormalities having spatial manifestations. (Medical Knowledge)

• The resident will participate in three imaging procedures from among myelography, biopsy, and cisternography. (Patient Care)

• The resident will become familiar, as assessed by the supervising attending, with the detailed anatomy of the various triangles of the neck. (Medical Knowledge)

• The resident will instruct the first year resident assigned with him or her in the operation of the Neuroradiology service. This function will be evaluated by the first year resident. (Professionalism, Systems-Based Practice, 360 Evaluation)

• The resident will participate in conferences with physicians from referring services. (Communication Skills) To learn the indications, limitations, daily and long term consequences of all major radiologic examinations in their specialty to the satisfaction of the supervising attending with respect to dose deposition and cost with the exception of US and appropriateness to the satisfaction of the program director and to gain a passing score on an examination. (Patient Care)

• To gain skill in the art of radiologic consultation with referring physicians to the satisfaction of all faculty members and senior residents. (Communication Skills, Patient Care)
• To practice competence in collegial interactions, in the service of patients, with referring physicians in the context of after hours emergency duty to the satisfaction of the program director. (Professionalism, Patient Care)

• To demonstrate compassion and humility in interaction with patients and staff members as revealed in 360° evaluations. (Professionalism)

• To follow the appropriate dress code at all times and to be punctual for clinic assignments and conferences to the satisfaction of the faculty. (Professionalism)

• To appropriately wear your film badge as assessed periodically by the program director except for US. (Professionalism)

• To promptly look up information as suggested by the supervising physician in the course of daily education. (Practice-Based Learning)

4th Rotation

• The resident will demonstrate detailed knowledge of the range of neuroradiologic abnormalities as manifested by presentations to the faculty and by an acceptable score in the most recent in-service exam. (Medical Knowledge)

• The resident will be able to lead a conference with physicians from referring services demonstrating all imaging findings. (Communication Skills)

• The resident will become conversant with the major abnormal conditions of the neck, jaws and salivary glands as evaluated by the section chief. (Communication Skills)

• The resident will demonstrate to the program director knowledge of the risk and cost of major neuroradiological exams. (Systems-Based Practices, Medical Knowledge)

• The resident will participate in three neuroradiological procedures. (Medical Care)

• To learn the indications, limitations, daily and long term consequences of all major radiologic examinations in their specialty to the satisfaction of the supervising attending with respect to dose deposition and cost with the exception of US and appropriateness to the satisfaction of the program director and to gain a passing score on an examination. (Patient Care)

• To gain skill in the art of radiologic consultation with referring physicians to the satisfaction of all faculty members and senior residents. (Communication Skills, Patient Care)

• To practice competence in collegial interactions, in the service of patients, with referring physicians in the context of after hours emergency duty to the satisfaction of the program director. (Professionalism, Patient Care)
• To demonstrate compassion and humility in interaction with patients and staff members as revealed in 360° evaluations. (Professionalism)

• To follow the appropriate dress code at all times and to be punctual for clinic assignments and conferences to the satisfaction of the faculty. (Professionalism)

• To appropriately wear your film badge as assessed periodically by the program director except for US. (Professionalism)

• To promptly look up information as suggested by the supervising physician in the course of daily education. (Practice-Based Learning)

**Medical Knowledge**

Residents must demonstrate knowledge about established and evolving biomedical, clinical, and cognate (e.g. epidemiological and social-behavior) sciences and the application of this knowledge to patient care.

**(A) Knowledge based objectives**

By the end of rotation, the resident will demonstrate:

• Identification of normal and abnormal anatomy necessary to interpret all CT and MR images, and spatial procedures.

• Analysis of all relevant information before image interpretation in order to tailor exams to specific patient problems and needs.

• Understanding of the advantages and disadvantages of available modalities spatially as they relate to the neurologic disorders.

**(B) Skill based objectives**

By the end of rotation, the resident will demonstrate:

• Recognition of normal and abnormal findings on routine pediatric imaging studies and ability to discuss their implications for diagnosis and treatment.

**Practiced Based Learning and Improvement**

Residents must be able to investigate and evaluate their patient care practices, appraise and assimilate scientific evidence, and improve their patient care practices.

**(A) Knowledge based objectives**
By the end of rotation, the resident will demonstrate:

- Evidence of independent study including textbooks from suggested reading lists, journal articles, and web-based learning
- Appropriate follow-up of interesting cases (looks up biopsy results, gets follow-up from surgeons, etc.)
- Interest in research projects.
- Interest in teaching medical students, other service resident teams, radiologic technologists and RN’s about interesting cases and be able to consult with referring physicians concerning interpretation of neuroradiographic cases

(B) **Skill based objectives**

By the end of rotation, the resident will demonstrate:

- Ability to do a web-based literature search pertinent to Pediatric Radiology.
- Operation of PACS systems.

**Interpersonal and Communication Skills**

Residents must be able to demonstrate interpersonal and communication skills that result in effective information exchange and teaming with patients, their patient’s families, and professional associates.

(A) **Knowledge Based Objectives:**

By the end of rotation, the resident will demonstrate:

- Ability to work as an effective member of the imaging team and contribute to the clinical care of patients when appropriate.
- Discuss imaging results with residents and medical students on telephone and in reading room.

(B) **Skills Based Objectives:**

By the end of rotation, the resident will demonstrate:

- Ability to dictate correct and concise written reports for all studies, after review with staff.
**Professionalism**

Resident must demonstrate a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population.

**Knowledge Based Objectives:**

By the end of rotation, the resident will demonstrate:

- Ability to explain all imaging modalities, techniques, etc. to patients and families with concern for cultural differences
- Commitment to ethical principles espacially to unique problems inherent in the pediatric population (informed consent, confidentiality, radiation exposure)
- Professional dress, demeanor and attitude in the reading room and patient care areas

**System Based Practice**

Residents must demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value.

**(A) Knowledge Based Objectives:**

By the end of rotation, the resident will demonstrate:

- Knowledge of how the timeliness and content of their image interpretation and communication affects patient care
- Practice of techniques for cost effective utilization of supplies and personnel in the Radiology Department
- Use of timely performance and interpretation of studies to decrease length of hospital stay for in-patients.
- Assistance of patients with complexities of the health care system

**(B) Skills Based Objectives:**

By the end of rotation, the resident will demonstrate:

- Ability to use normal code dictations appropriately.
• Ability to use ICD-9 coding appropriately on all studies.

**Resident Evaluation**

**Patient Care**

• Communicate effectively and demonstrate caring and respectful behavior when interacting with patients and families.
• Gather essential and accurate information about patients when appropriate (reviews old films, chart, lab work, calls referring MD)
• Use information technology to support patient care decisions and patient education (looks up needed information in books, on-line)
• Work effectively with other health care professionals including other disciplines to provide patient care (interpersonal skills, calls reports when needed, affable on call)

**Knowledge**

• Demonstrate an investigatory and analytic thinking approach to clinical situations (after gathering necessary history and clinical information, tailors studies to answer clinical questions)
• Know and apply basic and clinical sciences - Physics (radiation biology in daily practice), proper protocol for studies (proper imaging modality, imaging thickness, appropriate repeat of studies)
• Know and apply basic and clinical sciences - Is familiar with proper use of various contrast agents
• Know and apply basic and clinical sciences - Appropriate knowledge of common disease processes
• Visual perception
• Ability to formulate a differential diagnosis
• Knows necessary anatomy
• Performs all invasive procedures appropriate for level of training (manual skills)

**Practice-Based Learning and Improvement**

• Locate and assimilate evidence from scientific studies related to patient problems (shows evidence of independent study and choice of journal club articles)
• Appropriate follow up of cases
• Facilitates learning of students and other health care professionals (teaches others - students, other service residents, techs, nurses, etc.)

**Interpersonal and Communication Skills**

• Work effectively with others as a member of the imaging team (pitches in where and
when needed, comes on time and not a clock watcher.)

- Dictate written reports that are correct, concise, meaningful, quality of dictation - timeliness of signing reports.

- **Professionalism**
- Considers well being of patients and department ahead of personal needs (availability).
- Commitment to ethical principles (pt. Confidentiality, obtaining informed consent, business practices).
- Maintains appropriate professional demeanor in patient care areas and reading room.

- **Systems-Based Practice**
- Understands how their patient care and image interpretation affects patient care and other professionals (and vice versa) (demonstrates timely reporting, faxing, calls to referring MD’s, careful coding)
- Concern for cost-effective operation of department, patient imaging work-up, effect on hospitalization, etc. (adds on studies late when needed, timely reporting, use of most efficient modality to obtain needed information)
- Assist patients with complexities of medical system when possible

**Neuroradiology lectures**

Lectures in Neuroradiology will consist of didactic and case based presentations. Didactic lectures will be given as an hour long and will be repeated twice during a four year cycle. It is expected that case based presentations (unknown or interesting cases) will be based upon the didactic lecture and mainly demonstrate the principles presented during the didactic lectures. All the defined didactic and case based presentations will be presented once a week during the lectures schedule. All the residents are expected to attend these two conferences.

In addition, the rotating residents are encouraged to attend the weekly Neuroradiology conferences with various departments: Monday head and neck tumor board (8-9:30 am), Wednesday neurology (8-10 am) and ophthalmology (6-8 pm), and Friday ENT (8-9 am).

**LECTURE TOPICS**

General Neuroradiology

1. The principal of Neuroimaging.
2. Emergencies in Neuroradiology.
3. Physics of MRI, CT and contrast medium.
4. Recognition of enhancing patterns
5. Differential diagnosis of CNS disorders

Brain
1. Head trauma
2. Non traumatic intracranial hemorrhage
3. Cerebral Neoplasms
4. Cerebral vascular diseases
5. Stroke
6. Infections of the brain
7. Sella and Parasellar Disease
8. White Matter disease
9. Seizures
10. Degenerative brain disease
11. Congenital brain abnormalities
12. Metabolic disease of the brain and miscellaneous

Head and Neck
1. Base of skull
2. Temporal bones
3. Nasal and paranasal sinuses
4. Orbit
5. Nasopharynx
6. Oral cavity and oropharynx
7. Larynx
8. Lymph nodes and soft tissue neck

Spine
1. Low back pain: Degenerative disease of the spine
2. Spine trauma
3. Spine infections
4. Spinal tumors

Board review

Nuclear Medicine: Curriculum Overview and Rotation Goals and Objectives
Part I, Curriculum Overview:

The nuclear medicine curriculum for radiology residents consists of a combination of clinical training/experience (or work experience) in the division of nuclear medicine and didactic classroom and laboratory instruction.

The clinical training and experience consist of 16-week clinical rotations in the division under the direction of the nuclear medicine physicians (faculty), who are authorized users (AU). During these clinical rotations, the resident will observe, participate in, or manage all types of patient imaging performed in the division as appropriate to the resident's level of experience and medical knowledge. Training and experience will also include oral administration of I-131 (for which a written directive is required) for therapy of both benign and malignant thyroid diseases. The scope of patient imaging studies performed in the division is broad and includes evaluation of:

- Cardiovascular system,
- Respiratory system,
- Gastrointestinal/Hepatobiliary system
- Skeletal system
- Genitourinary system
- Endocrine system
- Cerebrovascular system
- Neoplastic diseases
- Infectious and inflammatory diseases

Therapy of benign and malignant thyroid disease as well as for palliative and supportive treatment for skeletal metastasis (from variety of malignancy) is also performed in the division. The clinical training is augmented by didactic classroom and laboratory training. Regularly scheduled classroom sessions cover a broad range of material as it relates to the practice of nuclear medicine including. The nuclear medicine faculty present these classroom sessions.

1. Introduction & History to Nuclear Medicine/Nuclear Cardiology & Molecular Imaging
2. The Lung/PIOPED, and Pulmonary Imaging Update
3. Gastrointestinal Bleeding Assessment with Scintigraphy
4. Hepatobiliary Scintigraphy
5. Radionuclide Brain Death Studies
6. Nuclear Cardiology 1 - Intro, Indications, Radiopharmaceuticals, and Protocols
7. Nuclear Cardiology 2 - Stress Testing, and Image Review, MUGA Basics
8. Nuclear Cardiology 3 - PET Cardiac Perfusion Imaging and Viability
9. Gallium Scintigraphy
10. Functional Brain Imaging – SPECT
11. Renal Scintigraphy
12. Bone Scintigraphy
13. Nuclear Imaging and Therapy of Thyroid Disease
14. Infection Imaging
15. Positron Imaging Tomography - Introduction and Cases – oncology
16. PET Neuro imaging – Dementia, epilepsy & SPECT imaging – DAT scan
17. GI Nuclear Medicine- Gastric Emptying, Liver-spleen scan, liver hemangioma imaging
18. Somatoreceptor Imaging
20. Pediatric Nuclear Medicine
21. Nuclear Renal Imaging
22. NRC

Part II, Rotation Goals and Objectives:

Although goals and objectives more specific to each of the nuclear medicine rotations are outlined below, there are also many general skills that will be continually developed during all rotations under the direction of the senior physician staff. These include:

• To gain skill in the art of radiologic consultation with referring physicians to the satisfaction of all faculty members.
• To practice competence in collegial interactions, in the service of patients and with referring physicians.
• To demonstrate compassion and humility in interaction with patients and staff members.
• To follow the appropriate dress code at all times and to be punctual for clinic assignments and conferences to the satisfaction of the faculty.
• To appropriately wear your film badges.

1st Year

Knowledge Based Objectives:

• The resident must understand the primary modes of radioactive decay and modes of interaction of ionization radiation with matter.
• The resident must be able to list the most common eight radionuclides relevant to nuclear medicine (Tc-99m, In-111, I-123, I-131, Ga-67, Tl-201, F-18, Mo-99), and describe their physical half-lives and major decay products.
• The resident must also recognize the basic biodistribution of each of the F.D.A.-approved radiopharmaceutical and their application to patient care, to the satisfaction of the reviewing attending.
• The resident must know the usual scan appearances of commonly encountered diseases and provide a differential diagnosis for commonly encountered scan patterns to the satisfaction of the attending physician as assessed in the faculty evaluation.
• The resident must understand the principles of operation of standard nuclear medicine equipment used for detecting and measuring radiation, including the gamma-camera, thyroid probe, PET Scanner, dose-calibrator, and well-counter.
Reading and Educational Assignments:


2nd Year

-Observe at least one of each of the different scans routinely performed, as well as infrequently ordered studies.

-Knowledge Based Objectives—at the end of the 2nd year, the resident should be able to:

1. Demonstrate a thorough understanding of the clinical indications, general procedures (including radiopharmaceutical and dose), and scintigraphic findings for:
   a. pulmonary (emboli) ventilation and perfusion imaging
   b. hepatobiliary imaging and functional studies
   c. gastrointestinal blood loss imaging
   d. bone imaging
2. Discuss the basic physical principles of nuclear medicine imaging and instrumentation.
3. Identify the isotopes (including physical and chemical properties) that are used routinely in the compounding of radiopharmaceuticals for nuclear radiology procedures.
4. The resident should be able to review and dictate selected cases with senior physician staff.

-Decision-making and Value Judgment Skills- at the end of the 2nd year, the resident should be able to:

1. Review the pertinent clinical history of patients to be imaged each day to determine the relevance of the ordered study to the clinical question, to assess for any contraindications to the study, and to alert nuclear technologists about anticipated non-standard views or specific parameters of the study that require special attention.
2. Assist nuclear technologists in the determination of radiopharmaceutical or medication dosages when patient conditions do not fall within the criteria for the standard dose.
3. Make a preliminary review of obtained images and advice technologists when additional views or repeat views are needed.
4.

-Reading and Educational Assignments:


3rd Year

-Knowledge Based Objectives—at the end of 3rd year, the resident should be able to:
1. Demonstrate a thorough knowledge of the clinical indications, general procedures (including radiopharmaceutical and dose) and scintigraphic findings in:
   a. renal and urinary tract studies
   b. liver/spleen imaging
   c. gastrointestinal tract imaging and functional studies
   d. thyroid imaging and functional studies
   e. brain imaging and functional studies
   f. tumor and abscess imaging
   g. myocardial perfusion studies
   h. gated cardiac blood pool (MUGA) studies
2. Identify and discuss indications for isotopes used for therapeutic purposes.
3. Describe the protocol for using I-131 in the treatment of hyperthyroidism and thyroid malignancies.
4. Describe accepted indications for and the role of PET/CT imaging.

-Decision-making and Value Judgment Skills—at the end of 3rd year, the resident should be able to:

  1. Interpret and dictate studies under the guidance of the senior physician staff.
  2. Review all scans as they are performed for any significant findings that require prompt attention, and make decisions regarding notification of the referring physician if the nuclear medicine faculty is not immediately available for consultation.

-Laboratory Sessions:

  1. Schedule at least one session with head nuclear technologist; sessions typically in "hot lab," patient areas, and camera rooms.

-Reading and Educational Assignments:


-4th Year

-Knowledge Based Objectives— at the end of the 4th year, the resident should be able to:

  1. Identify normal and abnormal findings on all imaging and functional studies, including nuclear cardiology studies, and PET/CT imaging.
2. Discuss all aspects of nuclear studies, including indications, pathologies, protocols, correlative studies, radiopharmaceuticals used for each study, and various parameters that might interfere with the results of the procedure.

-Decision-making and Value Judgment Skills—at the end of the 4th year, the resident should be able to:

1. Make preliminary decisions on all matters of film interpretation and consultation
2. Comment on anatomical findings, scanning technique, and indications for performing the study to assist in the training of more junior residents or medical students.
3. Independently make a preliminary interpretation and dictate a report after review with the nuclear medicine faculty for all scans performed, including PET/CT.
4. Carry out the practice of nuclear medicine with a level of competence expected for an independently practicing radiologist, with due regard to quality control, quality assurance, and radiation safety for patients and personnel.

-Laboratory Sessions:

1. Schedule a session with the nuclear pharmacist at remote nuclear radiopharmacy. At the end of the session, the resident should have a proper understanding of:
   - Compounding radiopharmaceuticals from kits and do appropriate quality control procedures.
   - Eluting a generator and doing appropriate quality control procedures.
   - Calculating and safely preparing patient doses.

2. Schedule at least one session with head nuclear technologist; sessions typically in "hot lab," patient areas, and camera rooms. At the end of the session, the resident should have a proper understanding of:
   - Appropriate use of a survey meter to monitor radioactivity spills or other sources.
   - A wipe test.
   - Quality control procedures on cameras, well/uptake probes, and dose calibrators.
   - Procedures to handle radioactive sources according to the established guidelines.
   - Appropriate use of a survey meter to monitor radioactivity spills or other sources.

-Reading and Educational Assignments:

2. Related textbooks/references, related current journal articles and online resources.
**PET/CT Specific Goals and Objectives:**

-Knowledge Based Objectives—Relative to the level of knowledge obtained during the required nuclear medicine rotations, at the end of the residency, the resident should be able to demonstrate a more thorough understanding of:

1. PET/CT radiopharmaceuticals.
2. Related physics.
3. Normal variants and image artifacts.
4. Accepted indications and the role of PET/CT in the evaluation of oncologic, neurologic, and cardiac diseases.
5. Proper patient preparation protocols and the variations in radiopharmaceutical biodistribution relating to proper versus improper patient preparation.
6. Limitations of PET/CT imaging.
7. Proper handling of PET radiopharmaceuticals and safety issues particular to these agents.

-Technical Skills—at the end of the rotation, the resident should be able to:

1. Independently assess image/diagnostic quality of an exam.
2. Independently operate the PET/CT workstation for complete image analysis.
3. Provide an interpretation of clinical images at the level expected of an independently practicing radiologist.

-Decision-making and Value Judgment Skills—

1. Consult with referring clinicians regarding the appropriateness and utility of PET/CT imaging for various patients and clinical questions.
2. Effectively integrate PET/CT imaging with other imaging modalities with goals of optimized clinical accuracy and cost-efficiency.

-Laboratory Sessions: At least one session will be scheduled with the nuclear technologists performing the PET/CT exams to gain experience with receiving patient doses from the supplier, safe handling of PET agents in the "hot lab," and safe administration of patient doses.

At the end of 4th Year, the residents are expected to have participated in interpretation and dictation of following number of cases:

1. PET/CT – 30
2. Bone Scan – 30
3. Cardiac stress test – 30
4. Hepatobiliary study – 5
5. V/Q scan – 5
6. Renal scan – 5
7. MUGA scan 5
8. Gallium Scan – 5
9. WBC scan – 5
10. Gastric Emptying -5

Procedure log:

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<th>MR# (if applicable)</th>
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Iodide-131 case experience documentation:

1. Must complete a minimum of three cases that involve administration of ≤ 33 mCi of 131I for therapy.
2. Must complete a minimum of three cases that involve the administration of > 33 mCi of 131I for therapy

NRC Training and Experience Requirements:
Candidates seeking certification for diagnostic radiology must meet the specific training and experience requirements described in 10 CFR 35.290 (c)(1)(i) and (c)(1)(ii); 10 CFR 35.392 (c)(1) and (c)(2); and 10 CFR 35.394 (c)(1), (c)(2), and (c)(3). Radiation safety, radionuclide handling and quality control, and related topics specified in 10 CFR 35.290, 10 CFR 35.392, and 10 CFR 35.394 must be covered. The detailed information regarding 10 CFR 35.290, 35.392, and 35.394 may be found via the NRC Electronic Reading Room, which provides access to the NRC Regulations, Frequently Asked Questions, and other pertinent references.

Specifically, each candidate for AU status through the ABR pathway must have completed a minimum of 700 hours of training and experience in imaging and localization studies, which must include 80 hours of classroom and laboratory training in basic radionuclide handling techniques applicable to both the medical use of unsealed byproduct material for imaging and localization studies and the medical use of sodium iodide 131I for procedures requiring a written directive. In addition, each candidate must also meet the training and experience requirements specified in §35.392 and §35.294 for medical uses of radioiodine 131I (≤ 33 mCi and > 33 mCi, respectively) requiring a written directive. The training and experience must include, at a minimum, the following:

Classroom and laboratory training (minimum of 80 hours) under the direction of an Authorized User in the following areas:

1. Radiation physics and instrumentation
2. Radiation protection
3. Mathematics pertaining to the use and measurement of radioactivity
4. Chemistry of by-product material for medical use
5. Radiation biology

Work experience for imaging and localization studies (§35.290) under the supervision of a preceptor AU who meets the requirements in §35.57, §35.290, or §35.290(c)(1)(ii)(G), or equivalent Agreement State requirements, involving the following:

1. Ordering, receiving, and unpacking radioactive materials safely and performing the related radiation surveys
2. Performing quality-control procedures on instruments used to determine the activity of dosages and performing checks for proper operation of survey meters
3. Calculating, measuring, and safely preparing patient or human research subject dosages
4. Using administrative controls to prevent a medical event involving the use of unsealed by-product materials
5. Using procedures to safely contain spilled radioactive material and using proper decontamination procedures
6. Administering dosages of radioactive drugs to patients or human research subjects
7. Eluting generator systems appropriate for preparation of radioactive drugs for imaging and localization studies, measuring and testing the eluate for radionuclidic purity, and processing the eluate with reagent kits to prepare labeled radioactive drugs
8. Residents must demonstrate hands-on work experience when they perform the supervised work experience requirements. Observation alone is not sufficient.

Work experience for the oral administration of sodium iodide 131I (§35.392 and §35.394), requiring a written directive: Experience under §35.392 must be obtained under the supervision of an AU who meets the requirements in §35.390, 35.392, 35.394, or equivalent Agreement State requirements. A supervising AU who meets the requirements in §35.390 (b) must also have experience in the oral administration of sodium iodide 131I, for which a written directive is required. This work experience must involve the following:

1. Ordering, receiving, and unpacking radioactive materials safely and performing the related radiation surveys
2. Performing quality control procedures on instruments used to determine the activity of dosages and performing checks for proper operation of survey meters
3. Calculating, measuring, and safely preparing patient or human research subject dosages
4. Using administrative controls to prevent a medical event involving the use of unsealed byproduct materials
5. Using procedures to safely contain spilled radioactive material and using proper decontamination procedures
6. Administering to patients or human research subjects doses that include at least three cases involving the oral administration of ≤33mCi and three cases involving the administration of >33mCi of sodium iodide 131I

Authorized User (AU)-eligible Designation:

Iodide-131 case experience documentation

1. Regarding §35.392, the ABR requires that candidates must have completed a minimum of three cases that involve administration of ≤ 33 mCi of 131I for therapy under a preceptor Authorized User (AU) who meets the requirements in §35.390, 35.392, 35.394, or equivalent Agreement State requirements. A supervising AU who meets the requirements in §35.390 (b) must also have experience in the oral administration of sodium iodide 131I for which a written directive is required. A logbook of these therapies must be kept by the resident and submitted to the ABR in the format given below.
2. Regarding §35.394, the ABR requires that candidates must have completed a minimum of three cases that involve the administration of > 33 mCi of 131I for therapy under a preceptor AU who meets the requirements in §§35.57, 35.390, 35.394, or equivalent Agreement State requirements. A supervising AU who meets the requirements in §35.390(b) must also have experience in administering dosages as specified in §35.390(b)(1)(ii)(G)(2). A logbook of these therapies must be kept by the resident and submitted to the ABR in the format given below.

Forms to Be Submitted to the ABR

Two forms are available to document compliance with and completion of the required NRC training and experience. Both completed forms must be submitted on behalf of each candidate for the candidate to be eligible for an ABR Diagnostic Radiology Certificate with the Authorized User (AU)-eligible designation.

1. ABR Form A (Program Director Attestation)
2. ABR Form B (Candidate 131I Case Log)
PEDIATRIC RADIOLOGY

GOALS AND OBJECTIVES

1ST Year

Objectives:

- Be able to appreciate the differences between a technically adequate and inadequate study, especially as it refers to inspiratory/expiratory chest views, proper exposure technique and patient positioning to the satisfaction of the supervising attending. (Systems Based Practice)

- Be able to identify support lines and catheters including umbilical catheters, endotracheal and orogastric tubes, central and PICC lines and ventricular shunts. Be able to differentiate proper from improper placement. (System Based Practice, Practice-Based Learning)

- Learn to perform and interpret standard pediatric fluoroscopic examination including 2 voiding cysto-urethrogram, 2 upper GI and 2 modified barium swallow studies as assessed by the pediatric radiology faculty. (Practice-Based Learning, Patient Care)

- Learn the imaging characteristics of child abuse and be able to recognize suspicious radiographic findings and pass an examination on this subject. (Medical Knowledge, Practice-Based Learning)

- Learn the differential diagnosis for upper and lower GI obstruction and be able to recommend appropriate diagnostic workup to the satisfaction of the supervising attending. (Medical Knowledge, Practice Based Learning)

- Score above the 50th percentile on annual in-service exams. (Medical Knowledge)

- Recognize the normal appearance of pediatric radiographs and their differences compared with adult films, i.e. thymic shadow, unossified epiphyses and apophyses. Recognize pediatric normal variants to the satisfaction of the supervising attending and the Program Director at ER review (Medical Knowledge, Practice Based Learning)

- Recognize manifestations of pediatric skeletal trauma, and appreciate the differences from standard adult fractures. Be able to describe fractures and know Salter Harris classification. (Medical Knowledge)

- To learn the indications, limitations, daily and long term consequences of all major radiologic examinations in their specialty to the satisfaction of the supervising attending with respect to dose deposition and cost with the exception of US and appropriateness to the satisfaction of the program director and to gain a passing score on an examination. (Patient Care)
• To gain skill in the art of radiologic consultation with referring physicians to the satisfaction of all faculty members and senior residents. (Communication Skills, Patient Care)

• To practice competence in collegial interactions, in the service of patients, with referring physicians in the context of after hours emergency duty to the satisfaction of the program director. (Professionalism, Patient Care)

• To demonstrate compassion and humility in interaction with patients and staff members as revealed in 360˚ evaluations. (Professionalism)

• To follow the appropriate dress code at all times and to be punctual for clinic assignments and conferences to the satisfaction of the faculty. (Professionalism)

• To promptly look up information as suggested by the supervising physician in the course of daily education. (Practice-Based Learning)

2nd Year

• Gain competence in the performance of all pediatric fluoroscopic examinations, including contrast enema. (Practice Based Learning)

• Name, describe and know the differential diagnosis of congenital thoracic, gastrointestinal and hepatobiliary abnormalities. Entities include congenital lobar hyperinflation, congenital pulmonary airway malformation, sequestration, bowel atresia, Hirschsprung’s disease, choledochal cyst, etc. to the satisfaction of the supervising attending. (Medical Knowledge)

• Know the imaging findings and grading of vesicoureteral reflux as well as other congenital abnormalities of genitourinary tract, i.e. cloacal extrophy and UPJ obstruction, as graded by the pediatric faculty. (Medical Knowledge)

• AS backup on call resident and during clinical rotations, be confident in reporting abnormal findings in a timely manner as well as in case consultations with referring clinicians. Know which studies to recommend which will provide the most information and least time and/or radiation exposure. (Systems-Based Practice, Communications, Practice Based Learning, Patient Care, Professionalism).

• Gain proficiency in performing ultrasound examination of the abdomen, retroperitoneum, pelvis, scrotum and limited evaluation of hips as assessed by the pediatric radiology attending. When on call, be able to generate a diagnostic exam to assess for: cholecystitis, hydronephrosis, ovarian or testicular torsion, appendicitis, ascites, abscess, hip effusion, etc. (Practice Based Learning, Medical Knowledge, Patient Care)
• Recognize metabolic bone diseases and their causes. Know how to assess a patient’s skeletal maturity using knowledge of ossification centers and bone age evaluation. (Medical Knowledge)

• Score above 50th percentile on annual in-service examination. (Medical Knowledge)

• Know the differential diagnosis and imaging appearance of head and neck soft tissue abnormalities including congenital, neoplastic, infectious, endocrine and inflammatory. (Medical Knowledge)

• Recognize the imaging abnormalities and multi-system involvement of various pediatric diseases including: sickle cell disease, cystic fibrosis, autoimmune and metabolic diseases, heavy metal toxicity, etc. to the satisfaction of the attending as evaluated in their monthly review. (Medical Knowledge)

• To learn the indications, limitations, daily and long term consequences of all major radiologic examinations in their specialty to the satisfaction of the supervising attending with respect to dose deposition and cost with the exception of US and appropriateness to the satisfaction of the program director and to gain a passing score on an examination. (Patient Care)

• To gain skill in the art of radiologic consultation with referring physicians to the satisfaction of all faculty members and senior residents. (Communication Skills, Patient Care)

• To practice competence in collegial interactions, in the service of patients, with referring physicians in the context of after hours emergency duty to the satisfaction of the program director. (Professionalism, Patient Care)

• To demonstrate compassion and humility in interaction with patients and staff members as revealed in 360° evaluations. (Professionalism)

• To follow the appropriate dress code at all times and to be punctual for clinic assignments and conferences to the satisfaction of the faculty. (Professionalism)

• To promptly look up information as suggested by the supervising physician in the course of daily education. (Practice-Based Learning)

3rd Year

Objectives: (in addition to those of the first and second years)

• Be able to confidently protocol all US, CT and MR examinations, tailored towards the patient’s age. For MR, know how to optimize the study to reduce scanning time as evaluated by the supervising attending. (Systems Based Practice, Practice Based Learning)
• Be able to identify the characteristic features of congenital abnormalities of the brain. (Medical Knowledge)

• Residents should be able to teach junior residents and medical students as evaluated by medical student evaluation. (Practice Based Learning, Professionalism)

• Be competent in performing and interpreting neonatal ultrasound examination of the spine and brain. Know the sonographic findings of germinal matrix hemorrhage and their grading as well as hydrocephalus, periventricular leukomalacia and ischemia. (Practice based Learning, Patient Care)

• Be able to successfully perform a diagnostic quality dynamic hip ultrasound to assess for hip dysplasia. Know the differential diagnosis and imaging features of common pediatric hip disorders. (Medical Knowledge, Practice Based Learning, Patient Care)

• Score above 50th percentile on annual in-service examination. (Medical Knowledge)

• Know and identify the characteristic findings of congenital abnormalities involving the great vessels, such as vascular rings and slings. (Medical Knowledge)

• Prepare a short presentation on an area of residual weakness to be determined by the attending physician. (Medical Knowledge)

• Learn the differential diagnosis for common pediatric soft tissue and bone neoplasms, and their imaging characteristics. (Medical Knowledge)

• Be able to confidently hold consultations with referring clinicians in pediatric, surgical and emergency room departments as assessed by 360 degree review and attending review. (Professionalism, Communication Skills, Patient Care)

• To learn the indications, limitations, daily and long term consequences of all major radiologic examinations in their specialty to the satisfaction of the supervising attending with respect to dose deposition and cost with the exception of US and appropriateness to the satisfaction of the program director and to gain a passing score on an examination. (Patient Care)

To gain skill in the art of radiologic consultation with referring physicians to the satisfaction of all faculty members and senior residents. (Communication Skills, Patient Care)

• To practice competence in collegial interactions, in the service of patients, with referring physicians in the context of after-hours emergency duty to the satisfaction of the program director. (Professionalism, Patient Care)
• To demonstrate compassion and humility in interaction with patients and staff members as revealed in 360° evaluations. (Professionalism)

• To follow the appropriate dress code at all times and to be punctual for clinic assignments and conferences to the satisfaction of the faculty. (Professionalism)

• To promptly look up information as suggested by the supervising physician in the course of daily education. (Practice-Based Learning)

LAST EDITED BY DR. TEJ PHATAK ON 1/18/2018
EMERGENCY & TRAUMA RADIOLOGY GOALS AND OBJECTIVES

Prepared by Joshua Dym, MD
August 2017

Mission Statement:
To provide an educational pathway for residents to develop the image interpretation and administrative skills required to manage the provision of radiological services to the emergency department.

General Goals:
1. To develop an understanding and appreciation for the appropriate use of CT, MR, radiography, and ultrasonography in the diagnosis and treatment of acute disease presenting to the emergency department. (Patient Care, Systems-Based Practice)
2. To learn and participate in the performance of the full range of examinations done by the division. This includes:
   a. Learn indications and contraindications for various types of contrast administration, and to recognize and treat adverse contrast reactions. (Patient Care, Medical Knowledge)
   b. Help guide emergency physicians to appropriate examinations with protocols tailored to the clinical indication. (Patient Care, Communication Skills, Systems-Based Practice)
   c. Learn to dictate concise and appropriate reports for the full range of exams performed in the ED. (Patient Care, Communication Skills)
   d. Serve as meaningful, valued consultants to referring emergency physicians. (Patient Care, Communication Skills, Practice-Based Learning)
   e. Provide preliminary interpretations on inpatient radiology studies performed on acutely ill patients. (Patient Care)
3. As the primary contact person for all of radiology during off hours, the residents will demonstrate professional behavior towards other services and ancillary staff at all times, as befits their role as representatives of the department. (Professionalism, Communication Skills)

Workflow:
The following principles guide the nightly work routine for residents:
1. Residents will protocol examinations from the ED, as well as from the inpatient services, as requested. Residents are expected to communicate with the referring clinicians whenever there is uncertainty about the requested examination, or whenever it is possible that another examination may be more appropriate. Examinations which require special attention will be identified beforehand, and residents will communicate with technologists to monitor these exams as needed. (Patient Care, Communication Skills, Systems-Based Practice)
2. Residents will manage the phone line in a professional manner. (Professionalism, Communication Skills)
3. Residents will provide full preliminary dictations for examinations performed in the emergency room, with priority to urgent trauma CTs and BAT examinations, adhering to all applicable departmental and section dictation policies. (Patient Care)

4. Residents should consult educational resources as well as the radiology attending for cases which they are uncertain about but will need urgent communication of results to clinicians. (Practice-Based Learning)

5. Residents will assess the quality of the imaging examinations as they review them, and will proactive in communicating with technologists to optimize the quality of the examinations. This will include joining the ultrasound technologists in the patient rooms to scan and/or guide image acquisition, as well as communicating with technologists in other modalities to address quality problems as they arise, including requests for additional imaging as needed. (Patient Care, Systems-Based Practice)

6. Residents will provide preliminary interpretations for examinations performed on inpatients at the request of the referring services, documenting communication with the requesting clinician. Emergency radiology attendings will be available to provide assistance as necessary. (Patient Care)

7. Exams should be interpreted and signed off expeditiously, with focus on turnaround times. (Patient Care)

8. Residents will provide the primary point of contact for interventional services, fielding requests from referring services and communicating with the interventionalists on call as per their divisional procedures. (Patient Care, Communication Skills)

9. Residents will determine the appropriateness, coordinate and provide preliminary interpretations on nuclear medicine studies, as needed. (Patient Care, Communication Skills, Systems-Based Practice)

Competency-Based Expectations:

The resident should be able to:

By end of 2nd year

1) Recognize normal anatomy on CT, US, and MRI for common imaging studies including abdomen, pelvis, chest, neck, and head. (Medical Knowledge)

2) Independently pre-dictate common radiographs, CT, and US exams including abdomen, pelvis, chest, neck, and head. (Patient Care)

3) Make core observations, generate differential diagnoses, and confidently describe critical imaging findings. Examples of the diagnoses the resident is expected to be able to make at this stage are listed below. (Medical Knowledge, Patient Care, Communication Skills)
   a) Abdomen and Pelvis CT:
      i) Biliary ductal dilatation
      ii) Pneumobilia vs portal venous gas.
      iii) Liver lesions, with the ability to recognize obviously benign lesions including cysts and hemangiomas with classic features.
      iv) Cholelithiasis/Cholecystitis
      v) Hydronephrosis with or without ureteral obstruction
      vi) Pyelonephritis
vii) PID
viii) Acute appendicitis
ix) Acute diverticulitis
x) Small and large bowel obstruction
xi) Colitis/enteritis
xii) Active GI bleeding
xiii) Retroperitoneal hemorrhage
xiv) Intraabdominal abscess
xv) Pneumoperitoneum
xvi) Ascites
xvii) Trauma: Injuries to liver, biliary tree, spleen, pancreas, kidneys, bladder, bowel, mesentery and vasculature; fractures of pelvis, acetabulum and hips

b) Chest CT
i) Acute pulmonary embolism
ii) Pneumonia and distinction from atelectasis
iii) Alveolar and interstitial edema
iv) Pneumothorax
v) Pericardial effusion
vi) Pleural effusion: simple vs complex
vii) Acute aortic syndromes: Dissection, intramural hematoma, penetrating ulcer
viii) Aortic aneurysm and pseudoaneurysm
ix) Pulmonary and mediastinal masses
x) Trauma: Pulmonary contusion and laceration; traumatic aortic injury; airway injury; fractures of ribs, sternum and scapula; scapulothoracic dissociation

c) Head CT
i) Parenchymal, subarachnoid, subdural, epidural, and intraventricular hemorrhage, with ability to distinguish these from each other.
ii) Acute territorial infarct and knowledge of the basic vascular territories.
iii) Distinction of cytotoxic and vasogenic edema
iv) Hydrocephalus: communicating vs non-communicating
v) Findings of brain herniation, including subfalcine, transtentorial, and cerebellar tonsillar herniation
vi) Recognition of the typical appearance of small vessel ischemic disease.
vii) Venous sinus thrombosis
viii) Skull fractures

d) Neck CT
i) Abscess: Subperiosteal orbital, mastoid, masticator space, peritonsillar, retropharyngeal, prevertebral.
ii) Jugular vein thrombosis
iii) Foreign body vs physiologic calcification
iv) Adenopathy.
v) Cellulitis (including distinction of pre- and post-septal in the orbit)

e) Facial CT
i) Identify facial fractures

f) Spine CT
i) Fractures including odontoid fractures, spinous process, burst fractures, extension and flexion teardrop fractures.

ii) Facet dislocation/subluxation

iii) Compression fracture

iv) Diskitis/Osteomyelitis

v) Metastasis and recognition of obviously benign lesions such as hemangiomas

g) Ultrasound

i) General

(1) Recognize the ultrasound diagnostic criteria used to evaluate tissue characteristics, with the ability to recognize the appearances of a cyst, solid structure, fat, air, and calcification.

ii) Abdomen

(1) Liver - abnormal size, shape, echotexture, cyst, hemangioma, hepatocellular carcinoma, metastatic lesions

(2) Gallbladder/Bile Ducts – increased intra- & extra-hepatic duct size, gallstones, acute cholecystitis, biliary obstruction, duct stones

(3) Pancreas - abnormal size, abnormal duct size, acute/chronic pancreatitis, pseudocyst

(4) Spleen - abnormal anatomy/size, focal lesions (cyst/solid)

(5) Kidneys - normal anatomy and size, cysts (simple/complex), cystic diseases, angiomyolipoma, hydronephrosis, stones, hydrourereter +/- stones, renal transplant evaluation (include Doppler)

(6) Peritoneal Cavity - localization/quantification of fluid

(7) Gastrointestinal Tract – appendicitis

(8) Retroperitoneum – aortic aneurysm, lymphadenopathy

iii) Pelvis

(1) Urinary Bladder – abnormal filling, abnormal post void residual, stones, masses

(2) Uterus - physiologic variations, abnormal size or shape, abnormal echogenicity, abnormal endometrial thickness, leiomyoma, adenomyosis

(3) Ovary - physiologic variations, abnormal size or shape or echogenicity, physiologic variations (follicles, corpus luteum cyst) torsion, cystic/solid mass

(4) Fallopian Tube - dilated

iv) Scrotum - normal size, shape, echogenicity of testis and epididymis, cystic/solid testicular and extra-testicular mass, torsion, epididymo-orchitis, varicocele, hydrocele, spermatoccele, testicular carcinoma

v) Obstetrics - spontaneous abortion, embryonic death, blighted ovum, ectopic pregnancy.

h) Pediatrics

i) Identify common acute traumatic injuries in children

(1) Growth plate injuries (salter-Harris classification system)

(2) Specific pediatric fractures

(a) Torus fracture

(b) Greenstick fracture

(c) Plastic bowing

(3) Elbow

(a) Radial head dislocation
(b) Supracondylar fracture
(4) Tibia, ankle, and foot
   (a) Toddler fracture
   (b) Triplane fracture
ii) Identify abnormalities specific for child abuse
iii) Ultrasound
   (1) Intussusception
   (2) Pyloric stenosis
   (3) Appendicitis
   (4) Female pelvis
      (a) Ovarian cyst/solid mass, torsion, hydrosalpinx,
   (5) Scrotum
      (a) Torsion, epididymo-orchitis, hydrocele
   (6) Extremity
      (a) Abscess
   (7) Neck
      (a) Suppurative adenitis.
4) Generate reports that are free of dictation errors, using departmental templates as appropriate. (Communication Skills)
5) It is understood that residents will struggle with the large volume of exams performed in the emergency room, especially on their first rotation. Attendings will assist with dividing the workload as needed.
6) Determine which findings require urgent communication (and documentation) with the ED and communicate those findings effectively over the phone. (Communication Skills, Patient Care)
7) Discriminate emergent from non-emergent clinical indications and triage case performance and dictation. (Medical Knowledge, Patient Care)
8) Protocol routine ED and inpatient exams; recognize the need for additional information and communicate with referring clinicians when necessary. (Patient Care, Communication Skills, Systems-Based Practice)
9) Provide independent preliminary interpretations on routine inpatient examinations upon request. (Patient Care)

By end of 3rd year

1) Generate clear and concise reports that do not require substantive faculty member corrections on routine cases. (Communication Skills)
2) Communicate findings clearly and concisely, and make recommendations for follow up or additional imaging for common abnormalities. (Communication Skills, Patient Care)
3) Select appropriate protocols and contrast agent/dose for intermediate level cases. (Systems-Based Practice)
4) Recognize sub-optimal imaging, and effectively managing the consequences, including communicating with the referring clinician and recommending additional or repeat imaging if necessary. (Systems-Based Practice, Communication Skills)

5) Make secondary observations, narrow the differential diagnosis, and describe management options. By this stage, residents are expected to be able to provide more specific and nuanced descriptions of the pathology they encounter. Residents should also demonstrate improved perceptive abilities, making more subtle or incidental findings. (Medical Knowledge, Patient Care, Communication Skills)

Examples for abdomen and pelvis CT would include but are not limited to:

i) Distinction of perforated and non-perforated appendicitis, with the ability to recognize subtle signs of perforation

ii) Identify common complications of acute diverticulitis including intramural abscess, fistulas, and perforations.

iii) Be more specific in descriptions of bowel obstructions, identifying important subtypes including closed-loop obstructions, and recognizing important complications of obstruction such as bowel ischemia.

iv) Be more proficient in the distinction of benign and malignant lesions encountered on CT.

v) Consistent evaluation of the vasculature, with the ability to make findings such as systemic or mesenteric vein thrombosis, severe stenosis/dissection/or aneurysm in vessels other than the aorta.

6) Residents are expected to be able function at a faster pace during their third year. While failure to make subtle or incidental findings may still occur, significant diagnostic errors should be rare. (Patient Care)

7) Independently pre-dictate MR exams including brain, spine, abdomen, appendicitis in pediatric and pregnant patients. (Patient Care)

8) Provide independent preliminary interpretations on intermediate complexity inpatient examinations upon request, with attending assistance available as needed. (Patient Care)

By end of 4\textsuperscript{th} year

1) Generate clear & concise reports that do not require substantive faculty member correction on common complex cases. (Communication Skills)

2) Able to provide effective verbal communication to the ED and inpatient services for complex cases. (Communication Skills)

3) Select appropriate protocols and contrast agent/dose for complex cases, with the ability to employ advanced imaging or adapt existing protocols to answer specific clinical questions. (Systems-Based Practice)

4) Provides accurate, focused, and efficient interpretations, appropriately narrowing the differential diagnosis. It is expected that the resident will provide a single, specific diagnosis when appropriate. (Communication Skills, Patient Care)

5) Residents should be able to handle busy ED volume. There should be no major diagnostic errors by this stage, and the resident’s ability to make ancillary or subtle findings should have improved such that the majority of these findings are made by the resident. (Patient Care)

6) Able to recommend appropriate follow up/management of common complex conditions.
7) Provide independent preliminary interpretations on complex inpatient examinations upon request, with attending assistance available as needed. (Patient Care)

Medical Knowledge Objectives

To become familiar with the full range of emergency diagnoses as listed in the American Society of Emergency Radiology Core Curriculum Illustration Project: http://www.erad.org/page/CCIP_TOC

Suggested References & Learning Resources: (Practice-Based Learning)

American Society of Emergency Radiology Core Curriculum Illustration Project. Please visit their website for related resources and sample cases at: http://www.erad.org/page/CCIP_TOC


Cornfeld D. Radiology 2.0: One Night in the ED. iphone app. [Available for free on iTunes.]

Professionalism Objectives:

The ED radiology attendings strive to provide an environment where residents can gain independence, synthesize information from various modalities, and ultimately produce coherent reports which have a meaningful impact on patient care.

Achieving these goals is dependent on adherence to certain standards of professionalism. As residents are the first line of contact, the manner in which they conduct themselves sets the tone for how the department is perceived by other services. The following are guidelines for how residents are expected to A.C.T in this setting:

- **Attitude.** This rotation is fast-paced and pressure-filled. However, a positive, courteous attitude will pay dividends by making interactions with people over the phone or in person more pleasurable for all parties involved.

- **Communication.** Throughout the night, residents will have numerous interactions with clinical and support staff. The choice of words can make those encounters helpful and productive or unnecessarily antagonizing. It is important for residents to be mindful of how their communication will be received by the other party. It is prudent to err on the
side of caution when in doubt. For example, speaking colloquially to a resident on the phone may be acceptable, whereas speaking to an attending in a similar manner may be perceived as unacceptable; therefore, residents are encouraged to err on the side of caution and extend the same high level of professionalism and courtesy to everyone.

- **Teamwork.** The ability to deliver excellent radiology services is dependent on the work of others. The clinical staff, technologists, and clerical staff are necessary for residents to do their job, and for patients to receive excellent care. Therefore, it is imperative that residents do not alienate your team members, as this may ultimately interfere with patient care and the learning environment.

Keeping the above in mind, here are a few specific points that the residents will be required to adhere to:

1. Answer phones in a prompt manner. If you are busy with another consult and they will need to wait for a while, apologize and explain that things are busy. Feel free to ask the person to call back if possible, or ask the attending for help if needed.
2. Do not leave consulting clinicians, technologists, or support staff waiting for extended periods of time for your attention.
3. Our mindset should be to assist clinicians in answering their clinical question by facilitating performance and interpretation of the study that their patient needs. If you believe that a study is inappropriate and you are getting “pushback,” ask the attending for assistance rather than risk conflict with the ED or other clinician.
4. If at any time throughout your rotation you encounter a situation which you are unsure how to manage, do not hesitate to seek the assistance or guidance of one of the attendings.

**Evaluation and Feedback: (Practice-Based Learning)**

Assessment of resident performance is performed at the end of the rotation by faculty members who have worked with the resident. Written feedback is offered via formal evaluations. Verbal feedback is given by each attending at the end of their week. Feedback will also be offered throughout the rotation, particularly when the attending feels a resident can learn from a specific case. Feedback may reflect the quality of image interpretation, structure and content of imaging reports, quality of protocol selection, or content of clinical consultation. Feedback may also be offered regarding system-based practice and resident learning. Written feedback may include suggested areas for improvement, but should not be misinterpreted as negative feedback.

**Emergency & Trauma Radiology Lecture Curriculum (as of August 2017)**

**Body:**

- Gastric and duodenal obstruction
- Small bowel obstruction
- Complications of diverticular disease
- Nontraumatic Hepatobiliary Emergencies
• Unusual gallbladder and gallstone-related emergencies
• Air apparent: Pseudopneumoperitoneum and pneumoperitoneum on radiographs
• CT of renal and ureteral emergencies
• Ectopic pregnancy and its mimics on CT & MR
• Emergency complications of benign abdominal and pelvic lesions
• The Emergency Aorta
• Thoracic trauma
• Abdominal trauma
• Satisfaction of search in abdominal imaging
• Global Health Cases: Abdominal Radiology
• Body Blunt Trauma Cases
• Body Penetrating Trauma Cases

**Neuro:**

• Orbital trauma
• Temporal bone trauma
• Cervical spine trauma
• About Face: Causes of Facial Swelling
• Out of sight: traumatic and non-traumatic causes of vision loss
• Different strokes for different folks: the many forms of brain infarction
• Global Health Cases: Neuroradiology
• Head Trauma cases

**Pediatric:** (*some lectures include general pediatric radiology cases)

• Pediatric Radiology, Critical Findings not to miss
• Pediatrics emergency cases
• Pediatric cervical spine injury
• Pediatric ultrasound emergency cases
• Pediatric GI cases*
• Pediatric GU cases*

**Miscellaneous:**

• Emergency Department Laboratory Tests: Their Use to Suggest Appropriate Imaging and Provide an Accurate Differential Diagnosis
• Reflex radiology: When Recommending Another Study is Required for a Complete Diagnosis
• Contrast contraindications, controversies and confusion
• Dictation of emergency radiology reports
DAILY RESPONSIBILITIES INCLUDING POLICIES ON SUPERVISION OF RESIDENTS

Hours of Duty of daily responsibilities and supervision: Residents are to report to their rotations at 8 am, with the exception of the MSK rotation which begins at 7:30 am. The day typically ends at 5 pm after conference, provided the work is completed. If you are unable to finish all assigned work before conference, you must attend conference on time then complete unfinished work. During daily work assignments, the resident must be in an area to allow for Direct Supervision by the attending responsible for that service. That is to say, the attending is physically present with the resident during patient care. At the discretion of the attending, Indirect Supervision with Direct Supervision Immediately Available may be used. That is to say, the attending is physically within the hospital or other site of patient care and is immediately available to provide Direct Supervision. This applies for all levels of training. On Call hours listed in the call section. Residents are required to sign in and out daily with the supervising attending at the EXACT times and are expected to comply with all ACGME regulations regarding duty hours.

For each daily assignment and on call assignment, the supervising attending must provide:

Oversight – The supervising physician is available to provide review of procedures/encounters with feedback provided after care is delivered. This applies to all levels of training.

Progressive authority and responsibility: At the discretion of the supervising attending, conditional independence and a supervisory role in patient care may be provided to the resident, unless a documented remediation plan has been developed for the resident by the program director. In that instance, the resident may only be given graduated responsibility within the framework of the remediation plan. Faculty members functioning as supervising physicians must delegate portions of care to residents based on the needs of the patient and the skills of each resident. Senior residents should serve in a supervisory role to junior residents, at the discretion of the supervising attending, in recognition of their progress toward independence, based on the needs of each patient and the skills of the individual resident. First year radiology residents (R1, PGY-2) may not be assigned on call without a supervising senior resident (R2, PGY-3 or greater).

Duty Hour Documentation: To assure compliance with the ACGME regulations regarding duty hours, residents are required to promptly record all duty hours in New Innovations daily. If hours are not logged on time, reminder emails will be sent daily. If there is continued noncompliance with recording duty hours, the program director will be notified.

Duty Types to Use

Clinical Duties – Any regularly scheduled assignment with patient care responsibilities including on weekday and weekend on call hours- NOT INCLUDING NIGHT FLOAT.

Night Float – This only applies to the night float rotation.
**Day Off** – This applies when you are off from any duties, including weekends and vacation.

**Rotation Schedule:** A yearly rotation schedule will be distributed to all residents at the beginning of each academic year. Any changes to this schedule must be approved by the chief residents.

**Diagnostic Rotations:** Responsibilities while on diagnostic rotations include reviewing and dictating cases with the attending, observing and/or assisting with any procedures, annotating studies, answering phone calls and assisting clinical teams in the reading room. Residents are required to sit in their assigned stations, unless directed to dictate elsewhere by their attending.

**Interventional Rotation:** Residents should report to the interventional radiology suite on C level at 8 am. Responsibilities include consulting with clinical teams, obtaining consents, reviewing relevant laboratory values and imaging prior to a case, assisting on cases, and postoperative checks. Residents should not leave the rotation until dismissed by the interventional attending. There is to be **Direct Supervision** by the attending responsible for that service. That is to say, the attending is **physically present** with the resident during patient care. At the discretion of the attending, **Indirect Supervision with Direct Supervision Immediately Available** may be used. That is to say, the attending is **physically within the hospital or other site of patient care and is immediately available to provide Direct Supervision.** This applies to all levels of training.

**VA Rotation:** Residents are to report to the East Orange VA at 8 am daily. Contact information (pager and/or cell phone) of the resident covering the VA for that day should be given to the front desk or the technologist. Residents should attend 12:30 and 4PM Conferences remotely. The covering VA attending should be made aware of any pending or incomplete cases before the resident leaves.

**Lectures/Conferences:** There are daily conferences are located at 12:30 PM and 4:00 PM (there is no 4:00PM lecture on Fridays). All residents are required to attend lecture except for the night float resident and the interventional resident. Attendance will be tracked.

**Physics curriculum:** Physics lectures will take place at 4pm every Tuesday. All residents who have not passed the physics boards are required to attend

**Pagers:** Residents should be available between the hours of 8 am and 5 pm daily and promptly answer all pages during this time.

**Case Log:** All residents are required to maintain ACGME Case log and cumulative case logs to be submitted on a regular basis (as requested) to the Program Coordinator. Procedure Log (Special Procedures such as biopsies, nuclear medicine therapies, interventional procedures, etc.) and Case Log (all studies interpreted in all rotations, including night float and short call, even if not dictated).

**Nuclear Medicine:** All residents are required to complete 16 weeks of Nuclear Medicine training. Strict documentation of I-131 Sodium Iodine treatment (small and large doses) should be maintained and submitted with the residents case logs.
Mammography: All residents are required to read 240 mammograms within a 6-month period during residency, as required by the FDA.

CALL RESPONSIBILITIES

Schedule:

Call hours are as follows:
Weekdays (except Friday) 4:30pm - 10pm
Fridays 4:30 pm – 10pm
Weekends 8am - 10pm
Night Float Hours: 10pm-8am

Holidays are handled like weekends, so first call is from 8am - 10pm.

Attendance

The first call resident is expected to be in the ER Radiology reading area during the aforementioned times. That means 4:30pm on weekdays and 8am SHARP on holidays and weekends.

If the on call resident will be more than 5 minutes late for a weekend call, he/she must inform the night float resident (973-972-4139) and let the senior resident know ASAP.

If the on call resident is unable to make it to first call, he or she must find a substitution and notify the senior resident on call and the chief residents. The absent first call resident is to payback this substitute by doing a call for them at a later date.

Call Responsibilities:

The junior and senior resident should work together on call to efficiently read out studies and prevent delays in interpretation. It is expected that the senior resident will dictate the more complicated imaging studies while the junior resident concentrates on radiographs and less complicated CT. Studies that must be dictated include:

- All ER studies will be listed under the worklist for titled “ED”.
  1) **All plain films** (chest, abdomen, MSK, peds, etc.)
  2) **All CTs** - except MSK CTs (i.e. CT Knee, etc.), CT angiograms of the extremities, CT Recon Thoracic Spine or CT Recon Lumbar Spine. If there is a CT Thoracic or CT Lumbar spine that is not a recon, it must be dictated.
  3) There are instances when a trauma patient will go straight to the OR and then get a CT afterwards. These cases are to be dictated
• The on call residents are also responsible for protocoling all studies that they are called about, whether the patient is from the ER, observation unit, inpatient, or outpatient.

• IR Procedure Requests: If someone (ER or inpatient) requests an IR procedure (i.e. TIPS, drainage, etc.) take down the patient's name, MRN, location, background info (current/working diagnosis, why they want the procedure), what type of procedure, which attending is requesting the procedure, pertinent labs (i.e. coags, hemoglobin/hematocrit, etc.), vitals (i.e. is the patient stable), if the patient consentable, when the patient is available for the procedure, etc. Then, before calling the IR attending, find out which nurse and technologist will be assisting the attending during the procedure. Then page the IR attending on call and let them know of the situation and above info you collected. He/she will decide if they are going to do the case, etc. Relay this information back to the requesting service (make sure you have a contact number or pager from the requesting service).

• Nuclear Medicine Requests: If requested to perform a nuclear medicine study obtain the patients name, MRN, location, background info (current/working diagnosis, why they want the study), which study and which attending is requesting the procedure. Make sure that the service requesting has already placed the order and then call Dr. Liu or Ghesani.

• GI/Flouro Studies: Occasionally someone (ER or inpatient) will call and ask for a GI/flouro study. The on call resident should let the chief technologist know that a flouro study is pending and when it should be completed.

Second Call (Senior Resident) Call responsibilities:

• Provide documented preliminary reports for all studies from the ED that are not required to be dictated by first call (i.e. CT recon thoracic and lumbar spines, all MSK CTs, CT angiogram of extremities, etc.)
• Dictate all ultrasounds and MRIs that are done through the ED at the discretion of the supervising attending.
• Provide documented preliminary reports for ALL inpatient body CTs within four hours of the exam.
• Provide documented preliminary reports for ALL inpatient chest CTs (especially PE protocol CTs)
• On weekends, dictate all plain films on the chest list until 6pm.

Night Float Responsibilities:

• Everything outlined above as first and second call resident responsibilities.
• Performing any urgent ultrasounds if no ultrasound technologist is available.
• Certain attendings may require that the night float resident sign out the cases with them, please make sure the cases are signed out before leaving.
Attending Call Schedules
The main attending schedule is found on AMION (http://www.amion.com). The password is "deptrad" (case sensitive). The online schedule includes the Neuroradiology Attending Schedule, IR attending call schedule, and Nuclear medicine attending call schedule.

Who to Send Studies to, First/Second Call:

Monday - Friday:
Plain films - send to the attending listed as "evening shift body" for that day.
Body CT scans and US studies - send to the attending listed "evening shift body" for that day.
Neuroradiology studies (CT scans and MRI) – send to attending listed as “evening shift Neuro” for that day.

Saturdays, Sundays, and Holidays:
Plain Films, Body, and Chest CTs - to "Weekend ER" attending listed on the same day.
Neuro CTs and MRI - whoever is listed as Neuroradiology on call that day.

Who to Send Studies to during Nightfloat:
• All plain films, ED Ultrasound cases, ED body CTs, and Neuro CTs except the aforementioned studies above are to be signed out with the overnight emergency radiology attending.

Brain Attacks, a.k.a. "BAT"s
Every time a patient is declared an acute stroke, the ER and stroke service activates a "BAT". This entails that the patient receive a non-contrast head CT and possibly a CT angiogram head and neck. The usual scenario is the neuro/stroke resident brings the patient to the trauma CT scanner and informs the on call resident there is a BAT. Only if the supervising attending does not interpret Neuroradiology cases, the on call resident should page the neuroradiology attending on call and inform them there is a BAT (name, patient symptoms and onset of symptoms). The on call resident should immediately check the noncontrast head CT to determine there is no intracranial hemorrhage. If there is no ICH, the BAT team will likely proceed to the CT angiogram head/neck. The neuro attending will call back with their findings. The on call resident will then relay these findings to the neuro/stroke resident(s). IT IS IMPORTANT TO DOCUMENT THE TIME YOU SPOKE WITH OUR NEURO ATTENDING AND THE NEUROLOGY/STROKE RESIDENT IN YOUR REPORTS.

Documenting Critical Findings:
The on call resident must document communication of all critical findings to the referring provider within one hour of the study. The list of critical findings is determined by the radiology Chief of Service.

**Important Phone Numbers:**
The resident or attending cover the ED cases - x4139
Main ER - x5123, x5124, x5127
Peds ER - x5139, x5140
Trauma ER - x2664, x2665
Observation Unit - x0362

Radiology Front Desk - x4907, x4909
Trauma CT - x0255
Back CT - x0256
MRI Tech - x6966

MSK - x9328
Neuro CT - x9330
Neuro MR - x7966
Peds - x9326
Chest - x9327
Body CT - x9329
US - x7993
IR - 7715
DOC - x0227, x2311

Resident Lounge - x5146
Call Room - x7587
H-level Conference Room - x6700
Maria/Dr. Baker's Office - x5188

PACS Window Presets:
Make sure "Num Lock" is on and use the numeric keypad.
1 - Soft Tissue
2 - Lung
4 - Bone
5 - Blood
6 - Liver / Subdural
7 - Kidneys / Angio
TRAVEL GUIDELINES

Reimbursement for travel related expenses is available to all housestaff that meet the following criteria established by the office of Graduate Medical Education and the Radiology Department.

- Housestaff is presenting a paper, abstract or poster relevant to the specialty in training.
- Housestaff is a first-author in the paper, abstract or poster to be presented.
- Housestaff has not presented the paper, abstract or poster at a previous conference.
- If housestaff has previously received reimbursement for travel he/she is required to provide evidence that previous papers or abstracts presented were submitted for publication in a medical journal (manuscripts or abstracts need not be accepted for publication). If papers or abstracts previously presented at a conference are not submitted for publication, housestaff may submit other work published/submitted for publication to satisfy this requirement. Housestaff must be identified as a first author (exceptions are considered-see procedure below).
- Only 1 resident is eligible for travel reimbursement per presentation.
- Travel expenses must be incurred for payment.

Commonly Reimbursed Expenses

- Expenses for three days (day prior to, day of, and day after presentation) and two nights (day prior to and the day of presentation)
- Airfare to and from conference location
- Hotel - Two nights (the night before and the night of the presentation) including tax and resort fees
- Meals-$60 per diem
- Cab fare to and from airport, to and from conference to hotel
- Parking at airport (for personal car)
- Conference registration fees
- Mileage if driving personal car to conference (at University current rate) [http://www.rutravel.rutgers.edu/autorate.html](http://www.rutravel.rutgers.edu/autorate.html)
- Rental cars
- Other hotel expenses (e.g. spa, dry cleaning, computer access fees etc.)
- Luggage check-in fees

* Expenses Not Reimbursed*

- Alcoholic drinks
- Expenses incurred by a traveling companion
- Unreasonably expensive meals
- Meals included in the cost of conference fees
- Expenses related to personal negligence (e.g. parking tickets, fines, towing, traffic violations etc.)

*Not all reimbursable/non-reimbursable expenses are identified. Please contact the GME Office for further information. It is the housestaff’s responsibility to obtain approval for travel and to submit expense related information after travel within the timeframe outlined below.*
Timeline for Reimbursement

At least 1 month prior to travel:
• Housestaff must submit a Travel Approval (TA) report and other required documents to the program coordinator.
• The program coordinator will obtain approval from the program director and chair.

1-2 months post travel:
• Housestaff or program designee must submit a Travel Expense (TE) form and other required documents (see procedure below) to the program coordinator.
• The coordinator will obtain approval from the program director and chair.
• Housestaff should expect reimbursement for travel related expenses 2-3 pay periods after submitting documentation to the GME office

NOTE:
• Missing documents or submission of incomplete forms will be returned to the resident. It is the housestaff’s responsibility to ensure that all required documentation is submitted to coordinator at the same time within the timeframe identified above.
• Travel advance payments are NOT available.

If you have any questions, please contact the radiology main administrative office (973) 972-5188.

HOUSESTAFF BOOK ALLOWANCE REIMBURSEMENT

Maximum Reimbursement Amount: $600

Reimbursement Form
PLEASE MAKE ALL PURCHASES BEFORE SUBMITTING FORM/RECEIPTS FOR REIMBURSEMENT
1. Complete and sign the form; attach your ORIGINAL receipts or PACKING SLIPS (make a copy of all documents for your record)
2. Submit the form to your Program Director for approval.

PLEASE NOTE: * You must complete the entire form; omissions may result in a decrease in reimbursement

APPROVED/DISAPPROVED Book Allowance Reference List

APPROVED: Medical textbooks, subscriptions to online medical databases (such as Up to Date), educational software, medical society membership fees, electronic tables, or towards USMLE STEP III or COMLEX. The following list provides examples of approved purchases (not a comprehensive list). If you have any questions please contact the program coordinator.
**DISAPPROVED:** Journals (including medical), hardware, non-medical material. The following list provides examples of disapproved purchases (not a comprehensive list). If you have any questions please contact the GME Office or your Program Director.

1. Laptop/Desktop/Computer equipment/All other devices (excluding those listed above)
2. Board Exam Fees
3. PDAs/MP3 or any other audio players (excluding those listed above)
4. Office furniture
5. Office supplies
6. Non-medical books or reference material (e.g. Cook Books, Language Books, etc.)
7. Lab coats, scrubs or any type of clothing (e.g. tee shirts and sweatshirts)
8. Equipment (e.g. stethoscopes, microscopes)
9. Conference fees/travel expenses
10. Newspaper subscriptions/magazines

If you have any questions please contact the Program Coordinator.

**Permit Fingerprinting Reimbursement**

All housestaff officers obtaining a training permit from the NJ Board of Medical Examiners are required to submit to fingerprinting for a comprehensive background check.

- Excludes fingerprinting costs for a NJ medical license
- Complete request for check form and ORIGINAL receipts may be submitted anytime within one year of incurring fees

**Procedure:**

*Housestaff*

- Follow departmental procedure which includes submission of original payment receipt and MorphoTrack application.

**HOLIDAY COMP DAY**

Rutgers/NJMS Compensation Day/Reimbursement form:

Housestaff Officers who work a holiday (including beeper calls) on a scheduled recognized Rutgers University holiday shall be granted an alternate day off. Scheduling of an alternate day off shall be with the approval of the Program Director and Chief Residents, as appropriate. A submission form is located with the program coordinator.
EVALUATIONS

Evaluation of your progress toward the goal of satisfactory completion of residency training is monitored in several ways.

1. At the conclusion of each subspecialty rotation, the responsible faculty will submit an electronic evaluation on New Innovations regarding your performance during that rotation. An example of this form is located with the residency coordinator. This evaluation is placed in your permanent file and is reviewed regularly by the Program Director.

You may review, and if necessary dispute, your evaluations upon request. Such a request should be made to either the Program Director or Program Coordinator. You will have a review of your rotational evaluations with the Program Director twice a year.

2. At least twice per year, each resident is responsible for submitting an electronic evaluation on New Innovations regarding the attending physician’s performance. An example of this form is located with the program coordinator. Evaluation of faculty by residents is taken seriously. You should give constructive suggestions where applicable. Additionally, forms are sent at least once per year out to evaluate the various rotations. These evaluations are reviewed by the administration in the department.

3. Application to sit for the American Board of Radiology examination is possible only with the written confirmation of the Residency Program Director. This certification states that a resident has successfully completed the minimum requirements outlined by the Board and has satisfactorily completed the curriculum as outlined by the individual program.

The Clinical Competency Committee (CCC) for the Department of Radiology is comprised of members appointed by the Program Director.

The Chairman of the CCC is appointed by the Program Director.

Members of the CCC must be members of the residency faculty who work greater than 15 hours/week in the department.

The Clinical Competency Committee will meet at least twice per academic year.

The purpose of the CCC is to:

1. Review all resident evaluations semi-annually
2. Prepare and assure semi-annual reporting of the Milestone evaluations to the ACGME
3. Make recommendations to the Program Director for resident progress regarding promotion, remediation, or dismissal

The CCC will review all evaluations of all residents.
The CCC will review the data in each resident’s portfolio regarding achievement and progress in the training program. This will include evaluations, updated CV, grades for exams or quizzes, resident self-assessment, resident’s learning plan, and procedure logs.

The CCC by consensus will prepare an evaluation for each resident semi-annually regarding achievement of milestones using the Diagnostic Radiology Milestones ACGME Report Worksheet.

The Program Director will then review performance assessment individually with each resident semi-annually.