Cardiothoracic Radiology Rotation:

Goals and Objectives based on Core Competencies

Introduction:

Components of a cardiothoracic radiology curriculum may practically occur during one or more organ-specific or technology-specific rotations during residency, including rotations in chest radiology, cardiac radiology, pediatric radiology, nuclear medicine, magnetic resonance imaging, computed tomography and/or vascular and interventional radiology (e.g. lung biopsy procedure skills) and fluoroscopy and include training and experience in plain film interpretation, computed tomography, magnetic resonance imaging, ultrasonography, angiography, and nuclear radiology examinations related to pulmonary, pleural, mediastinal and cardiovascular disease.

Through the 2010-11 academic year, the chest radiology rotations at DHMC were based on plain film radiology and computed tomography, with a separate single 4-week rotation in Cardiac CT and MR. Non-cardiac chest MR is typically covered by the Body MR service. Chest interventional procedures occur during the vascular and interventional rotations and the CT rotations. Education in chest MR and chest interventional procedures remains unchanged.

Beginning with the 2011-2012 academic year, chest and cardiac imaging rotations will now be combined into Cardiothoracic Radiology Rotations throughout radiology residency and for those Body/Cross-sectional Fellows choosing a cardiac imaging elective. This change in emphasis reflects the proposed guidelines for core curriculum as laid out by the Residency Restructuring Committee of the Association of Program Directors in Radiology ([J Am Coll Radiol 2010;7:507-511](#)) which our Dr. Chertoff co-authored.

The new radiology resident curriculum is based on at least three 4-week rotations. During the first rotation, emphasis is primarily on chest radiography but also with significant exposure to the entire gamut of chest CT examinations. During the second rotation, greater emphasis is placed on chest CT and an introduction to cardiac MR and CT. The third rotation focuses on cardiac MR and CT, with less emphasis on chest radiography and CT.

Resident Responsibilities:

Residents/fellows on the cardiothoracic rotation should begin review of cases by 8 a.m. (unless there is a preceding conference which does not permit an 8 a.m. start time). All pertinent previous imaging studies shall be reviewed thoroughly but quickly and be
available. If prior examinations are not immediately available for review, the resident/fellow will work with File Room personnel and others as needed for rapid retrieval of prior examinations. For Cardiac examinations, pertinent clinical information, including prior test results (echocardiography, cardiac catheterization/coronary angiography, stress myocardial perfusion scintigraphy, etc) as well as prior interventions (stenting, coronary bypass, valve repair, etc.) shall be reviewed.

All CT requisitions for study interpretation and requisitions requiring protocolling for upcoming chest and cardiac CT and MR will be picked up from the acrylic Chest box in the CT post-processing lab before arrival in the reading room in the morning. After completion of protocolling, CT and MR requisitions should be returned to their respective boxes in the same post-processing room. Although most work is completed at approximately 5 pm, it is expected that the resident (unless on-call beginning at 5 pm or unless approved in advance by the attending on duty that afternoon, the chief resident, and the residency program director) stays until all work is complete, including signage of transcribed reports.

Any and all Critical Tests and Critical Findings (see departmental lists posted in the Reading Room) will be brought to the attention of an attending radiologist for review and results communicated to the referring clinician as quickly as possible. Documentation of findings and communication in dictated reports and/or CIS per posted departmental protocol is required.

Attendance is expected at the following conferences:

- ICU rounds (daily, start times vary, Chest reading room)
- Comprehensive Thoracic Oncology Conference [tumor board] (weekly, Tuesdays 8-9 am, Radiology large conference room)
- Didactic resident Chest lecture series (monthly noon conference, Radiology large conference room)
- Didactic resident Cardiac lecture series (monthly noon conference, Radiology large conference room)
- Pulmonary-Radiology Conference (monthly, first Thursday, 8-9 am, Radiology large conference)
- For senior residents/fellows (2\textsuperscript{nd} & 3\textsuperscript{rd} rotations), as long as there is no conflict with Radiology conferences that take precedent:
  - Cardiology cath conference (weekly, Wednesdays, 7:30-8:30 am, Cardiology conference room, 5\textsuperscript{th} floor)
  - Cardiac Imaging conferences for Cardiology Fellows (Nuclear Medicine and CT/MR, twice monthly on varying Mondays, 12:15 pm – 1 pm, Cardiology conference room)

Performance assessment will consist of global ratings by faculty (using E-value software) for all of the Core Competencies, formal dictation evaluation (one evaluation of 6 dictated reports per rotation), and feedback from other staff, including technologists. Evidence of your accomplishments are placed in your portfolio.
Comprehensive Goals

To acquire the knowledge, technical skills, and judgment necessary to successfully perform, interpret and communicate the results of chest radiographs and CTs, as well as cardiac CT and MRI examination, it is expected that the radiology resident by the end of residency, through clinical training, didactic conferences, and self-directed learning, will:

- have gained a thorough knowledge of normal anatomy and be able to recognize normal variants of the lungs, airways, pleura, other mediastinal structures, heart, aorta, pulmonary arteries and coronary arteries, and thoracic osseous structures
- be proficient in the recognition of pulmonary, cardiovascular, and other thoracic pathology and be able to formulate a differential diagnosis
- learn how to generate a concise diagnostic radiology report
- communicate effectively with referring physicians, medical students, house-staff, patients and their family members
- understand the appropriate indications, limitations, and contraindications to cardiac MR and CT and be able to advise referring physicians as to their appropriate use
- obtain pertinent patient information relative to chest and cardiac imaging examinations
- be able to protocol chest CT and cardiac CT and MR examinations
- understand technical imaging standards, such as proper patient positioning, for all chest and cardiac examinations
- understand radiation and MR safety principles as they apply to chest and cardiac imaging for proper study selection and protocolling, including discussion with referring physicians
- be able to recognize and communicate problems with study quality (including problems with general image quality and with technical performance of examinations)
**First Rotation**

(This is not an exhaustive list, rather, a partial list showing the depth and breadth of skills and knowledge representative of the rotations):

**Patient Care**

**Skills/Goals**
- Demonstrate basic knowledge of PACS, RIS, and (when available) VR utilization
- Demonstrate ability to select the correct protocol for diagnostic chest CTs based on clinical information (signs, symptoms, and medical history; renal function; allergy history; and other clinical considerations) and prior imaging results; this includes accurate data-gathering
- Demonstrate knowledge of the items on the departmental lists of Critical Tests and Critical Findings pertinent to cardiothoracic imaging
- Understand indications for thoracic interventional procedures
- Demonstrate ability to recognize image quality problems for Quality Assurance and when images should be repeated /patient re-called

**Education/Objectives**
- Interactive participation with faculty in examination interpretation
- Aid technologist in performing the following safely and responsibly, using the ALARA principle
- Accompany radiologic technologist for portable chest radiography
- View chest radiography in the Core
- View chest CT at the operator console
- Attend daily ICU rounds, weekly CTOP conference and monthly Pulmonary-Radiology conference and be prepared to discuss chest imaging findings and their relevance to patient care

**Medical Knowledge**

**Skills/Goals**
- Demonstrate understanding of the physical principles of chest radiography and CT
- Demonstrate ability to recognize normal radiographic and cross-sectional chest anatomy, including cardiovascular structures
- Demonstrate understanding of normal physiology and pathophysiology of pulmonary and cardiovascular systems
- Demonstrate ability to recognize appropriate positions for tubes, catheters, and other medical devices on chest radiography
- Demonstrate ability to recognize common conditions (e.g. collapsed lobe) and life-threatening conditions (e.g. tension pneumothorax) on chest radiographs
• Demonstrate ability to select special radiographic views (e.g. decubitus, lordotic, etc) and select special CT series (e.g. expiratory, prone, etc) when clinically appropriate for diagnosis and management.
• Demonstrate ability to properly protocol non-contrast and contrast-enhanced chest CT examinations
• Understand how to estimate CT radiation dose from dose report.

Education/Objectives
• Required reading [although these books are available in the Chest reading room, residents are expected to have their own copies]
  ○ Miller SW, Boxt L. Cardiac Imaging: the Requisites. 3rd ed.
• Review current articles related to thoracic imaging in AJR, Radiology, and Radiographics. For example,
  ○
• Didactic lecture series (approximately 48 over 2 years)

Practice-Based Learning and Improvement

Skills/Goals
• Engage in self-directed education via a variety of available resources above and beyond assigned materials
• Synthesize assigned educational materials and discusses accrued knowledge with students and health care professionals in both formal presentation and informal venues, such as read-out session
• demonstrate critical assessment of the scientific literature pertaining to chest radiology
• demonstrate knowledge of and apply principles of evidence-based medicine

Education/Objectives
• Use textbooks, peer-reviewed literature, and other media such as DVDs, as well as on-line sources of knowledge
• Share good learning cases and missed diagnoses with others in the department
• Use the PACS based radiologic technologist QA folders to submit cases
• Consider doing a cardiac or thoracic imaging related QI project
• Demonstrate ability to search the literature according to the “EBM pyramid”
• Active participation in monthly journal club and “at-the-workstation” medical student teaching

Interpersonal and Communication

Skills/Goals
• Generate a clear and concise report, containing all relevant information and properly structured, reviewed and edited in a timely manner, and promptly revised based on attending feedback
• Provide direct and rapid communication to referring providers or their appropriate representatives for critical, emergent, and important unexpected findings with supporting documentation in the dictated report (preferably) or in a separate CIS (in the future, EPIC) note.
• Demonstrate verbal and non-verbal skills for effective listening to and speaking with physicians, families, and support personnel.
• Demonstrate effective teaching of medical students and other trainees and/or observers

Education/Objectives
• Review formal dictation evaluations
• Direct observation
• Feedback from technologists, providers, other staff

Professionalism

Skills/Goals
• Demonstrate altruism, compassion, honesty, integrity, confidentiality, and ethical behavior
• Demonstrate positive work habits, including punctuality, timely report editing and signage
• Demonstrate sensitivity and responsiveness to the cardiac imaging needs and concerns of the individual patient
• Understand the broader societal ramifications and ethical principles surrounding decision-making with respect to the utilization and application of cardiac imaging examinations
• Demonstrate HIPAA compliance

Education/Objectives
• Direct observation
• Feedback from technologists, providers, other staff

Systems-Based Practice Skills

Skills/Goals
• Demonstrate ability to plan cost-effective imaging diagnostic workup and to plan cost-effective imaging surveillance

Education/Objectives
• Review consensus statements on Cardiac CT and MR
• Review ACR Appropriateness Criteria Cardiac and Thoracic imaging sections
Second and Third Rotations

All of the Skills/Goals and Education/Objectives of the First Rotation as well as the following (This is not an exhaustive list, rather, a partial list showing the depth and breadth of skills and knowledge representative of the rotations):

Patient Care

Skills/Goals

• Gather essential and accurate information regarding patients scheduled for cardiac MR and CT imaging examinations
• Demonstrate knowledge of the clinical indications, contraindications
• Demonstrate competency in protocolling, supervising, and interpreting cardiac MR and CT imaging examinations, including high-resolution CT
• Demonstrate knowledge and application of principles of CT radiation safety and MR safety during planning and performance of examinations
• Demonstrate competency in performing post-processing of cardiac MR and CT imaging data on GE ADW workstations (ReportCard for MR, SmartScore and other cardiac software for CT) as well as on thin-client software (currently Visage).
• Integrate cardiac MR and CT examination results into a management strategy

Education/Objectives

• Case log of all Cardiac MR and CT cases
  o “live” cases: direct supervision at the time of the examination in the MR or CT suite, followed by post-processing and interpretation
  o “non-live cases”: e.g. PACS-based teaching file, on-line/web-based cases, other resources/media
  o Place case log in portfolio
• Required reading:
• Review current articles (assigned and unassigned) related to cardiac imaging in AJR, Radiology, and Radiographics. For example,
Medical Knowledge

Skills/Goals

• Demonstrate knowledge of physical principles and technical aspects of cardiac imaging studies
• Exhibit sound reasoning and analysis of cardiac imaging literature, including application to image interpretation and patient management
• Demonstrate advanced knowledge of congenital heart disease, including pathophysiology, imaging findings, and palliative and/or corrective surgeries
• Discuss and recognize differences and similarities between aortic atheromatous plaque, dissection, intramural hematoma, and penetrating ulcer
• Identify and describe the imaging evolution and differential features of interstitial pneumonitides on chest radiography and CT
• Describe the imaging evaluation and management of the solitary pulmonary nodule
• Demonstrate the ability to staging lung cancer with CT (in conjunction with PET) via the revised TNM system
• Describe features of large and small airways disease on CT, including inspiratory and expiratory imaging
• Describe and differentiate the morphologic subtypes of emphysema versus cystic lung disease

Education/Objectives

• Required reading:

Practice-Based Learning and Improvement

Skills/Goals

• Demonstrate ability to select contemporary peer-reviewed pulmonary and cardiac imaging literature that results in self-directed learning
• Analyze and develop improvement plans in the clinical practice, including knowledge, observation, and procedural skills
Education/Objective

- Assist other residents with Journal Club presentation if Chest or Cardiac topic that month
- Start or continue a scholarly project in cardiothoracic radiology, such as a case report, research project, or poster exhibit with faculty and, if appropriate, interested medical student
- Start or continue a QA/QI project that directly affects cardiothoracic imaging practice

Interpersonal and Communication Skills/Goals

- Supervise cardiac MR and CT examinations via effective communication with performing technologists
- Effectively communicate with patients and referring physicians during both information sharing before imaging examination performance and results communication after imaging examination interpretation
- Demonstrate ability to present cases or other materials at conferences in other departments/settings (e.g. ED)

Education/Objectives

- Act as contact person for radiologic, CT, and MR technologists for managing patient and imaging issues
- Perform consultations for pulmonologists, thoracic oncologists, thoracic surgeons, cardiologists, cardiac surgeons, and other health care providers
- Teach junior residents, medical students, other trainees/observers
- Conduct daily ICU rounds
- Provide cross-sectional imaging consultation
- Give at least one Grand Rounds–style presentation on a thoracic or cardiac topic to a mixed audience (e.g. Radiology and Cardiology or Pulmonary or Oncology)

Professionalism Skills/Goals

- Demonstrate sensitivity and responsiveness to the cardiac imaging needs and concerns of the individual patient
- Understand the broader societal ramifications and ethical principles surrounding decision-making with respect to the utilization and application of cardiac imaging examinations

Education/Objectives

- Direct observation
- Feedback from technologists, providers, other staff
Systems-Based Practice Skills

Skills/Goals

• Apply evidence-based imaging principles and methodology, such as appropriateness criteria, in the analysis of utilization of cardiac imaging technologies
• Select cardiac imaging modality in a manner consistent with the most cost-effective health care delivery without jeopardizing the quality of care.
• Demonstrate knowledge of funding sources and reimbursement methods.

Education/Objectives

• Review ACR appropriateness criteria and multi-society expert consensus statements
• Review ACR/APDR Initiative for Residents in Diagnostic Radiology Modules