Body Imaging rotation

The overall goal of the Body Imaging rotation is to provide the structure, framework, experience, and education a diagnostic radiology resident will need to correctly prescribe, perform, and interpret CT & MRI exams of the abdomen and pelvis. A key factor in successful interpretation is an understanding of the fundamentals of CT and MR imaging and the ability to tailor imaging protocols to address specific clinical questions. Residents will also develop the patient care and procedural skills to manage contrast reactions and infiltrations, and administer rectal or intracavitary contrast agents.

At the end of four years of training, the resident will be proficient at each of the following:

1. Interpretation of all body MRI/ CT exams
2. Performing/ prescribing CT and MRI protocols
3. Describing CT scan acquisition techniques, multiplanar reformatting and perform basic 3D reformatting techniques
4. Describing MRI scan acquisition techniques, sequences used for body MRI and MRA studies, and 3D reformatting techniques
5. Correctly utilizing intravenous contrast agents & preventing and treating contrast reactions
6. Managing contrast extravasations & adverse reactions to iv contrast agents

The curriculum described here concentrates on the abdomen and pelvis, although residents on rotation will also prescribe and interpret limited CT and MRI of the thorax as well. (The curricula and goals and objectives for Chest CT, high resolution chest CT and cardiac imaging, are covered in the Chest and Cardiac Curricula. Please refer to the goals and objectives for the chest rotation).

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Body CT Rotation #1, year one

Goals and Objectives: General Competencies

Medical Knowledge

The first rotation focuses on CT imaging. Residents must demonstrate knowledge about established and evolving biomedical, clinical, and cognitive sciences and the application of this knowledge to patient care. By the end of this rotation, residents are expected to:

- Discuss the basic methods of CT scanning, including acquisition, standard reformats, phases of imaging, normal organ enhancement characteristics
- Describe Hounsfield units, window and level settings, lung, soft tissue and bone algorithm.

- Differentiate normal CT anatomy of the chest, abdominal, and pelvis from pathology
- Appropriately protocol standard algorithm CT and CTA of the chest, abdomen and pelvis based on clinical indication.
- Identify common pathology on CT scans of the chest, abdomen, pelvis:
    - Inflammation: diverticulitis, appendicitis, pancreatitis
    - Bowel obstruction & ileus
    - Solid organ masses
    - Lymphadenopathy-size criteria by location
    - Renal calculi & hydronephrosis
    - Vascular aneurysm and occlusions
    - Intraperitoneal & retroperitoneal fluid & hemorrhage
- List the indications and uses of intravenous and oral contrast material

Patient Care

Residents must be able to provide patient care that is compassionate, appropriate, and effective for the diagnosis and treatment of health problems. Residents are expected to:

- communicate effectively and demonstrate caring and respectful behaviors when interacting with patients, families and colleagues.
- gather essential and accurate medical and radiologic history pertinent to the patients current issue
- work with all health care professionals to provide patient-focused care
- Discuss the indications, contraindications, risks, benefits, and alternatives of common abdominal imaging studies with referring providers and patients
- Discuss the indications, contraindications, risks, benefits, and alternatives of intravenous and oral contrast agents
- Prescribe oral & IV steroid preps
- Recognize and treat mild contrast reactions
- Recognize and treat iv contrast extravasations
- Assimilate relevant history, signs and symptoms, physical exam findings to present a clear and relevant clinical history

Practice-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. Residents are expected to:

- apply knowledge of study designs and statistical methods to the appraisal of clinical studies and other information on the diagnostic effectiveness of CT/MRI and their role in patient care
- use information technology to investigate, access on-line medical information, and support their own education
    - Identify the electronic sites which are accurate and peer reviewed
    - Discuss the concept of medical literacy in the age of technology
    - List sites/apps which are NOT appropriate resources for medical knowledge, and discuss why
- Teach & facilitate the learning of students and other health care professionals
- demonstrate knowledge and use of medical informatics in patient care and education

Interpersonal and Communication Skills

Residents must demonstrate interpersonal and communication skills that result in effective information exchange with technologists, referring physicians, and other medical personnel. Residents are expected to:

- Dictate normal CT reports, with pertinent positives and negatives tailored to the clinical indication, devoid of errors.
- Dictate basic abnormal CT reports, with appropriate descriptors of organs and diseases, pertinent positives and negatives.
- Interact professionally and effectively with other health care professionals, including technologists, schedulers, nurses, students, residents, attendings, and advanced practice providers.
- Interact effectively and sensitively with patients and family including
    - Greeting them appropriately & Introducing yourself and your role
    - Explain imaging exams clearly, answer questions, and discussing results if indicated
- Communicate findings effectively with the referring clinicians. Document the communication of critical findings with medical personnel in a timely fashion. Describe the protocols for reporting:
    - Unexpected findings
    - Critical results

Professionalism

Residents must demonstrate a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient and professional population. Residents are expected to:

- demonstrate respect, compassion, and integrity
- maintain an appropriate professional demeanor and bearing, including professional attire, name badge and/or white coat
- be punctual & work diligently
- demonstrate personal responsibility for:
    - Completing the daily workload
    - Taking charge of the section; fielding phone calls, running the service
    - Education-addressing deficits in knowledge
- Discuss and adhere to ethical principles pertaining to clinical care, confidentiality of patient information, and business practices
- Recognize personal limitations as resident
- demonstrate a commitment to excellence and on-going educational and professional development and a commitment to self-directed study and learning
- demonstrate sensitivity and responsiveness to patients' culture, age, gender, and disabilities
- work with health care professionals, including those from other disciplines, to provide patient-focused care

Systems-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. Residents are expected to:

- Describe how their professional practice affects other health care professionals, the health care organization, and the larger society, and how these elements affect their own practice
    - Describe how their CT reports will directly and indirectly impact patient care

- Practice cost-effective health care and resource allocation that does not compromise quality of care.
    - When appropriate, suggest alternative, less costly imaging tests which could answer the clinical question.
- Evaluate each request for imaging as regards cost, effectiveness, and appropriateness, and to facilitate performance of an alternative study if indicated.
- Be able to locate and use the ACR Appropriateness Criteria

Body CT Rotation # 2, year one

Goals and Objectives: General Competencies

Medical Knowledge

Residents must demonstrate knowledge about established and evolving biomedical, clinical, and cognate sciences and the application of this knowledge to patient care. By the end of this rotation, residents are expected to:

- Describe & identify the CT manifestations of common disease entities & their complications
    - Pancreatitis, appendicitis, diverticulitis, inflammatory bowel disease
    - Organ and luminal ischemia
    - Traumatic injury to the abdomen & pelvis
    - Vascular dissection, aneurysm rupture
    - Cysts and solid masses in the solid organs.
        - How to risk stratify cystic lesions in the kidneys
        - How to characterize adrenal masses.
    - Lymphadenopathy- locations, definitions, differential diagnosis.
    - Abscess, fluid collections, hemorrhage
    - Hernias and bowel ischemia
- Discuss methods for dose reduction in CT
- Describe how to manage incidental findings in the solid abdominal organs and what resources guide these decisions
- Quickly recognize emergent findings, including pneumothorax, hemoperitoneum, free intraperitoneal air, intestinal ischemia, active contrast extravasation
- Discuss the basic principles of CT angiography and the basic protocols of 3D reformatting
    - Describe how a CTA scan is acquired (planes, slice thickness, timing)
    - Describe the methods used to create 3D reformats
        - Define centerline reformat, curved planar reformats and when each is used
    - Observe a technologist performing 3D reformats; at least 3 cases
- Describe how and when to use the oral pre-medication protocol for IV contrast, and how to handle emergent IV contrast enhanced CTs in the patient with an allergy history
- Independently protocol CT examinations based on history and clinical indication, and explain the basis for each protocol
    - Explain when and why multiphase protocols are used in the solid abdominal organs
    - Define hypovascular and hypervascular tumors, list types, describe how this impacts diagnosis.
- Identify advanced anatomy:

- Differentiate body compartments-peritoneal cavity, retroperitoneal spaces, extraperitoneum, and how they contribute to spread of disease in the abdomen.

Patient Care

Residents must be able to provide patient care that is compassionate, appropriate, and effective for the diagnosis and treatment of health problems. Residents are expected to practice all elements of patient care outlined in Rotation #1, above.

Practice-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. Residents are expected to practice all elements of learning and improvement outlined in Rotation #1, above, and

- Facilitate the learning of students and other health care professionals (medical students, residents from other disciplines, and college students will periodically rotate through body imaging)
    - Teach learners as outlined in 'Resident Duties on Rotation', teaching medical students section

Interpersonal and Communication Skills

Residents must be able to demonstrate interpersonal and communication skills that result in effective information exchange with technologists, referring physicians, and other medical personnel. Residents are expected to practice all elements of communication skills outlined in Rotation #1, above, and.

- Be able to present a concise, clear summary of patient history, physical findings, lab parameters, and previous diagnostic workup relevant to the imaging study before it is interpreted
- Create clear, concise, intelligible radiology reports and recognize and address any errors
    - Discuss the pros and cons of using report templates
    - Differentiate what material belongs in the findings vs impression of a report
    - Make appropriate recommendations for follow up or additional imaging
- Be able to discuss CT imaging in pregnancy
    - With the patient, with discussion of risks/benefits and alternatives
    - Obtain consent from the patient
    - With the physician ordering the exam/caring for the patient.

Professionalism

Residents must demonstrate a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient and professional population. Residents are expected to practice all elements of professionalism outlined in Rotation #1.

Systems-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. Residents are expected to practice all elements of patient care outlined in Rotation #1, above, and

- Describe how their professional practice affects other health care professionals, the health care organization, and the larger society, and how these elements affect their own practice

- Describe the potential impact of incidental findings on the patient, their care, potential invasive procedures or additional imaging exams
- Use the recommendations of the ACR white paper on incidental findings

Body CT Rotation 3, year two

Goals and Objectives: General Competencies

Medical Knowledge

Residents must demonstrate knowledge about established and evolving biomedical, clinical, and cognitive sciences and the application of this knowledge to patient care. During this rotation, residents are expected to:

- Identify advanced anatomy:
  - Segmental liver anatomy and be able to correctly describe the location of a lesion
  - Define the omentum, mesentery, mesenteric root, spaces of the retroperitoneum
- Analyze and diagnose focal liver lesions on CT and MRI including:
  - hemangioma, adenoma, focal nodular hyperplasia
  - hepatocellular carcinoma (incorporating LIRADS)
  - hypervascular and hypovascular metastatic disease
- Analyze and diagnose diffuse liver disease on CT including:
  - Fatty infiltration, hepatitis, hemochromatosis, cirrhosis
- Analyze and diagnose focal pancreatic, splenic, adrenal and renal lesions on CT including:
  - Differentiating benign and malignant masses
  - Cystic masses (using the Bosniak classification when pertienent)
  - Hemorrhage
- Identify and accurately report the findings pertinent to a vascular surgeon for each of the following:
  - AAA- pre and post treatment
  - Acute aortic syndromes – dissection, penetrating ulcer, intramural hemorrhage
- Appropriately protocol standard MRI exams of the abdomen and pelvis and explain the utility of each pulse sequence: MR enterograpy, dynamic liver, pancreas, renal, adrenal, MRCP, female pelvis, prostate
- Describe the screening process used at DHMC for identifying patients with high risk of renal insufficiency, to determine who needs a pre-CT creatinine checked
- Be proficient at the manipulation of both the PACS system and the Visage/Vital images workstation for the reconstruction of images for viewing in a multiplanar format.

Patient Care

Residents must be able to provide patient care that is compassionate, appropriate, and effective for the diagnosis and treatment of health problems. Residents are expected to practice all elements of patient care outlined in Rotation #1, above, and

- Recognize, manage, and document contrast extravasations and contrast reactions

Practice-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. Residents are expected to practice all elements of learning & improvement outlined in Rotation #1, above.

Interpersonal and Communication Skills

Residents must be able to demonstrate interpersonal and communication skills that result in effective information exchange with technologists, referring physicians, and other medical personnel. Residents are expected to practice all elements of communication skills outlined in Rotation #1, above, and

- Create clear, concise, intelligible radiology reports with NO errors
    - Effectively use report templates, organizing the information into logical sections
    - Include pertinent positives and negatives in the 'findings' section to tailor the report to the clinical question
    - Draw a conclusion and give a differential diagnosis in the 'impression' section

Professionalism

Residents must demonstrate a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient and professional population. Residents are expected to practice all elements of professionalism outlined in Rotation #1, above, and

- demonstrate a commitment to excellence and on-going educational and professional development and a commitment to self-directed study and learning
- demonstrate a commitment to quality and improvement

Systems-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. Residents are expected to practice all elements of systems based practice outlined in Rotations #1 &2, above, and

- Teach medical students and junior residents
    - On appropriate protocol selection
    - On patient care, including extravasations and contrast reaction management.

Body CT Rotation 4, year three

Goals and Objectives: General Competencies

Medical Knowledge

Residents must demonstrate knowledge about established and evolving biomedical, clinical, and cognate sciences and the application of this knowledge to patient care. During this rotation, residents are expected to:

- Attend multidisciplinary conferences and be prepared to discuss cases, as well as using the information from conference to tailor patient exams
- Analyze focal and diffuse pathology in the abdomen and pelvis and create a differential diagnosis
- Prescribe and interpret all body MRI examinations, including more complex cases involving the female pelvis, prostate and MRA
- Describe the pathways of disease spread within the abdomen & pelvis
    - Normal patterns of LN drainage
    - Normal patterns of venous drainage; portal and systemic
    - Recesses of the peritoneal cavity and their role in disease spread

- Appropriately recommend the use of MRI in the evaluation of indeterminate findings on CT, specifically:
    - Evaluate focal liver lesions, renal lesions, pancreas, uterine and adnexal pathology.
    - Compare and contrast the strengths and limitation of MRI and CT in the evaluation of masses in the solid abdominal organs.
- Describe the CT appearance of neoplastic and non-neoplastic processes of the mesentery and omentum.
- Explain the CT staging for common malignancies of the gastrointestinal tract
- Describe how a virtual colonoscopy is performed, including patient prep, CT technique, methods of interpretation. Be able to discuss the role of CT colonography with referring clinicians.

Patient Care

Residents must be able to provide patient care that is compassionate, appropriate, and effective for the diagnosis and treatment of illnesses of the chest, abdomen and pelvis. Residents are expected to practice elements of patient care outlined for prior rotations.

Practice-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. Residents are expected to practice elements of practice based learning and improvement as outlined for prior rotations.

Interpersonal and Communication Skills

Residents must be able to demonstrate interpersonal and communication skills that result in effective information exchange with technologists, referring physicians, and other medical personnel. Residents are expected to practice elements of communication skills outlined for prior rotations.

Professionalism

Residents must demonstrate a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient and professional population. Residents are expected to have achieved all of the defined components of professionalism outlined for the first 3 body imaging rotations. In addition, by the end of their fourth rotation, they should:

- demonstrate personal responsibility for:
    - Running all facets of the body imaging service and relevant patient care
- work with all health care professionals to provide patient-focused and most appropriate care:
    - Consult with ordering providers to recommend the best imaging test
    - Address patient questions and concerns
    - Document these communications in the medical record, as appropriate
- Strive to function at a fellowship level in terms of protocols, choice of contrast agents, relevant patient care issues (steroid preps, extravasation, contrast reactions), scan monitoring, dose reduction, communications, etc.

Systems-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. Residents are expected to practice elements of systems based practice outlined for prior rotations.