

Resident Core Curriculum

Abdominal Radiology: Body CT

General Goals: The goals include objectives required for every level of training with graduated levels of supervision and responsibility. All aspects of abdominal imaging are incorporated into the residency with a focus on CT imaging and diagnosis of the gastrointestinal and genitourinary tracts as well as the peritoneal cavity and retroperitoneum. During every training rotation, the resident will read the required literature and study the teaching file in abdominal radiology. Over time, the resident will become progressively more knowledgeable about normal radiographic anatomy, physiology of abdominal organs, and the radiological appearances of abdominal diseases. In addition, the resident will demonstrate a progressively increasingly 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 abdominal imaging will be available for consultations by CT technologists, clinicians, and other health care providers, except during conference times, when the attending or faculty or fellows 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 examinations will be dictated by the end of every working day.
5. Residents will check and sign his/her reports in a timely fashion prior to final verification by supervising faculty.
6. Residents must be familiar with the operation of all CT equipment.
7. 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.
8. Residents must check examinations before the patient leaves the department if requested to do so by the supervising faculty.
9. Residents must become proficient at detecting abnormalities demonstrated by CT and be able to generate meaningful differential diagnosis.
10. Residents will become knowledgeable about the use of different CT radiographic contrast agents (including their indications, contraindications, dosages, and side effects).
11. Residents will acquire an understanding of the proper preparation of patients for examinations and appropriate follow-up afterward. At the start of every working day, the resident will be familiar with the patient schedule and anticipate 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. Absent clinical indication or seemingly inappropriate requests will be clarified and discussed with the referring physician and/or radiology attending.
12. Residents will do in-depth reading and study, along with a review of teaching file cases, to become knowledgeable about the normal anatomy and physiology of abdominal

organs and the radiologic appearances of gastrointestinal and genitourinary tracts as well as the peritoneal cavity and retroperitoneum, and gain a general understanding of the disease entities, their clinical presentations, and certain modes of treatment.

13. 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 clinicians.
14. Residents will become prepared to pass the core examination of the American Board of Radiology.
15. Residents will teach and share knowledge to medical students, radiologic technologists, technology students, and junior residents.
16. Residents will participate in the preparation and presentation of imaging studies at the weekly Wednesday morning interesting case conference.

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 cases 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:

PC1: Reporting

- **Level 1**
 - Generates reports with appropriate elements for coding
 - Generates reports with appropriate elements for coding
- **Level 2**
 - Efficiently generates clear and concise reports that do not require substantive correction
 - Uses lexicons and structured reporting that do not require substantive correction
- **Level 3**
 - Efficiently generates clear and concise reports that rarely require correction
 - Uses lexicons and structured reporting that rarely require correction
- **Level 4**
 - Generates tailored reports meeting the needs of the care provider and complex interventional reports with appropriate elements for coding
 - Proficiently uses lexicons and structured reporting to provide accurate and timely reports that do not require correction
- **Level 5**
 - Generates tailored reports meeting the referring subspecialty needs

PC 2: Image consultation

- **Level 1**
 - Uses electronic health record (EHR) to obtain relevant clinical information
- **Level 2**
 - For emergent and routine imaging consultations, delineates the clinical question, obtains appropriate clinical information, uses evidence-based imaging guidelines, and recommends next steps, with assistance
- **Level 3**
 - For complex imaging consultations, delineates the clinical question, obtains appropriate clinical information, uses evidence-based imaging guidelines, and recommends next steps, with assistance
- **Level 4**
 - Manages imaging consultations independently, taking into consideration cost effectiveness and risk benefit analysis
- **Level 5**
 - Provides comprehensive imaging consultation at the expected level of a subspecialist

PC 3: Image Interpretation

- **Level 1**
 - Identifies primary imaging findings
- **Level 2**
 - Identifies secondary and critical imaging findings and formulates differential diagnoses
- **Level 3**
 - Prioritizes differential diagnoses, and recommends management options
- **Level 4**
 - Provides a single diagnosis, when appropriate, with integration of current guidelines to recommend management
- **Level 5**
 - Demonstrates expertise and efficiency at a level expected of a subspecialist

PC 4: Pre-Procedural Consultation

- **Level 1**
 - No CT procedures
- **Level 2**
 - Gathers a focused history and performs a physical
 - Formulates a preprocedural assessment and plan with minimal guidance from a faculty member
- **Level 3**
 - Chooses appropriate preprocedural laboratory and imaging studies
 - Independently formulates a pre-procedural assessment and plan for common disorders
- **Level 4**
 - Adjusts procedural plan based upon preprocedural laboratory and imaging results
 - Independently formulates a preprocedural assessment and plan for complex

disorders

- Level 5
 - Mentors other learners in the pre-procedural consultation
 - Develops patient care protocols/teaching materials

PC 5: Performance of Procedures

- Level 1
 - No CT guided procedures
- Level 2
 - Performs advanced basic procedures- CT guided biopsies of large abdominal lesions and drainages
- Level 3
 - Performs moderately complex procedures- CT guided biopsies of smaller abdominal lesions, lung biopsies, drainages
- Level 4
 - Performs moderately complex procedures- CT guided biopsies of smaller abdominal lesions, lung biopsies, drainages
- Level 5
 - Performs moderately complex procedures- CT guided biopsies of smaller abdominal lesions, lung biopsies, drainages

PC 6: Post- Procedural Patient Care

- Level 1
 - No CT guided procedures
- Level 2
 - Manages post-procedural care with minimal guidance
 - Manages minor postprocedural complications
- Level 3
 - Formulates and implements postprocedural imaging and clinical follow-up for patients after basic procedures
 - Manages major postprocedural complications
- Level 4
 - Formulates and implements postprocedural imaging and clinical follow-up for patients after complex procedures
 - Anticipates and mitigates postprocedural complications
- Level 5
 - Mentors other learners in post-procedural care and management of complications
 - Develops a clinical pathway or guideline for post-procedural care

Medical Knowledge 1: Diagnostic Imaging Knowledge

- Level 1
 - Demonstrates knowledge of imaging anatomy
 - Demonstrates knowledge of pathophysiology of disease processes
 - Demonstrates knowledge of cellular and molecular systems
- Level 2
 - Applies knowledge of anatomy to make common imaging diagnoses

- Applies knowledge of pathophysiology to make common imaging diagnoses
- Applies knowledge of cellular and molecular systems to make common imaging diagnoses
- Level 3
 - Applies knowledge of anatomy to make uncommon imaging diagnoses
 - Applies knowledge of pathophysiology to make uncommon imaging diagnoses
 - Applies knowledge of cellular and molecular systems to make uncommon imaging diagnoses
- Level 4
 - Proficiently integrates knowledge of anatomic and molecular imaging with pathophysiology to formulate a diagnosis
- Level 5
 - Proficiently integrates knowledge of anatomic and molecular imaging with pathophysiology to formulate a diagnosis at the expected level of a subspecialist

Medical Knowledge 2: Physics, Protocol Selection, and Optimization of Images

- Level 1
 - Discusses the basic physics for imaging and image-guided intervention
 - Discusses the protocols and contrast agent/dose for imaging and image-guided intervention
- Level 2
 - Demonstrates knowledge of basic medical physics and radiobiology in imaging and image-guided intervention
 - Selects appropriate protocols and contrast agent/dose for emergent and routine imaging and image-guided intervention
- Level 3
 - Applies knowledge of basic medical physics and radiobiology to imaging and image-guided intervention
 - Selects appropriate protocols and contrast agent/dose for complex imaging and image-guided intervention
- Level 4
 - Applies physical principles to optimize image quality, including dose reduction strategies
 - Modifies protocols and contrast agent/dose as determined by clinical circumstances
- Level 5
 - Teaches physical principles to optimize image quality to other specialties
 - Develops imaging and image-guided intervention protocols

MK 3: Imaging Technology and Image Acquisition

- Level 1
 - Discusses imaging technology and image acquisition
- Level 2
 - Demonstrates knowledge of basic image acquisition and image processing, and recognizes common imaging artifacts and technical problems

- Level 3
 - Demonstrates knowledge of instrument quality control and image reconstruction, troubleshoots for artifact reduction
- Level 4
 - Proficiently optimizes image acquisition and processing in collaboration with the technology/imaging team
- Level 5
 - Presents or publishes research on imaging technology

Medical Knowledge 4: Imaging Technology and Image Acquisition

- Level 1
 - Discusses imaging technology and image acquisition
- Level 2
 - Demonstrates knowledge of basic image acquisition and image processing, and recognizes common imaging artifacts and technical problems
- Level 3
 - Demonstrates knowledge of instrument quality control and image reconstruction, troubleshoots for artifact reduction
- Level 4
 - Proficiently optimizes image acquisition and processing in collaboration with the technology/imaging team
- Level 5
 - Presents or publishes research on imaging technology

Medical Knowledge 5: Procedural Anatomy

- Level 1
 - Does not do CT procedures
- Level 2
 - Identifies normal anatomy during procedures
 - Identifies anatomic variants during procedures
- Level 3
 - Articulates the implications of varying anatomy for procedural planning
- Level 4
 - Identifies post-operative anatomy and its implications for procedures
- Level 5
 - Develops simulation models or other resources

Medical Knowledge 6: Pharmacology

- Level 1
 - Demonstrates basic knowledge of the contrast agents used in CT
- Level 2
 - Demonstrates knowledge of dosing and drug choice for sedation and other commonly used pharmacologic agents
- Level 3
 - Demonstrates knowledge of the indications, contraindications, sideeffects, and

- complications of pharmacologic agents
- Level 4
 - Applies functional knowledge of pharmacology to CT procedures and periprocedural care
- Level 5
 - Develops pharmacologic protocols or departmental guidelines

Systems-Based Practice 1: Patient Safety

- Level 1
 - Demonstrates knowledge of common patient safety events
 - Demonstrates knowledge of how to report patient safety events
- Level 2
 - Identifies system factors that lead to patient safety events
 - Reports patient safety events through institutional reporting systems (simulated or actual)
- Level 3
 - Participates in analysis of patient safety events (simulated or actual)
 - Participates in disclosure of patient safety events to patients and families (simulated or actual)
- Level 4
 - Conducts analysis of patient safety events and offers error prevention strategies (simulated or actual)
 - Discloses patient safety events to patients and families (simulated or actual)
- Level 5
 - Actively engages teams and processes to modify systems to prevent patient safety events
 - Role models or mentors others in the disclosure of patient safety events

Systems-Based Practice 2: Quality Improvement

- Level 1
 - Demonstrates knowledge of basic quality improvement methodologies and metrics
- Level 2
 - Describes local quality improvement initiatives
- Level 3
 - Participates in local quality improvement initiatives
- Level 4
 - Demonstrates the skills required to identify, develop, implement, and analyze a quality improvement project
- Level 5
 - Creates, implements, and assesses quality improvement initiatives at the institutional or community level

Systems-Based Practice 3: System Navigation for Patient-Centered Care

- Level 1
 - Demonstrates knowledge of care coordination in radiology CT procedures

- Performs safe and effective transitions of care/hand-offs in basic clinical situations
- Level 2
 - Coordinates care of patients in routine radiology imaging/ procedures effectively using the roles of the interprofessional teams
 - Performs safe and effective transitions of care/hand-offs in moderately complex clinical situations
- Level 3
 - Coordinates care of patients in complex radiology imaging/ procedures effectively using the roles of the interprofessional teams
 - Performs safe and effective transitions of care/hand-offs in complex clinical situations
- Level 4
 - Role models effective coordination of patientcentered care among different disciplines and specialties
 - Role models safe and effective transitions of care/hand-offs
- Level 5
 - Analyses the process of care coordination and leads in the design and implementation of improvements
 - Improves quality of transitions of care within and across health care delivery systems to optimize patient outcomes

Systems-Based Practice 4: Multidisciplinary Conferences

- Level 1
 - Does not attend multidisciplinary conferences
- Level 2
 - Does not attend multidisciplinary conferences
- Level 3
 - Does not attend multidisciplinary conferences
- Level 4
 - Presents patients at multidisciplinary conference, and is responsible for comprehensive discussion
- Level 5
 - Leads a multidisciplinary conferences

Systems-Based Practice 7: Contrast Agent Safety

- Level 1
 - Demonstrates knowledge of contrast reactions and commonly used pre-medication regimens
- Level 2
 - Recognizes contrast reactions (simulated or actual)
- Level 3
 - Manages contrast reactions, with supervision (simulated or actual)
- Level 4
 - Independently manages contrast reactions (simulated or actual)
- Level 5

- Leads educational experience in simulation laboratory for contrast reaction

Systems-Based Practice 8: Radiation Safety

- Level 1
 - Demonstrates knowledge of the mechanisms of radiation injury and the ALARA (“as low as reasonably achievable”) concept
 - Wears lead apron and dosimeter at all times when in CT scanner room
- Level 2
 - Applies principles of ALARA in daily practice
 - Uses radiation protection devices, including shielding, as appropriate, with guidance
- Level 3
 - Accesses resources to determine exam-specific radiation dose information
 - Independently uses radiation protection devices, including shielding, as appropriate
- Level 4
 - Communicates the relative risk and benefits of exam-specific radiation exposure to patients and practitioners
 - Counsels colleagues and allied health staff regarding radiation exposure
- Level 5
 - Creates, implements, and assesses radiation safety initiatives at the institutional level
 - Participates in radiation safety education and research

Practice-Based Learning and Improvement 1: Evidence-Based and Informed Practice

- Level 1
 - Demonstrates how to access and use available evidence to guide routine patient care
- Level 2
 - Articulates clinical questions and elicits patient preferences and values in order to guide evidence-based care
- Level 3
 - Locates and applies the best available evidence, integrated with patient preference and values, to care for complex patients
- Level 4
 - Critically appraises conflicting evidence to guide care, tailored to the individual patient
- Level 5
 - Coaches others to critically appraise and apply evidence for complex patients; and/or participates in the development of guidelines

Conference Schedule:

Wednesday 8 AM: Interesting Case Conference

Wednesday 3:00 PM: GYN Conference

Thursday 7:00 AM: GI Tumor Board

Reading List for Each Year

First Year

1. W. Richard Webb, William E. Brant, and Clyde A. Helms. *Fundamentals of Body CT*, W. B. Saunders Company, 2006.

Second Year

2. Joseph K.T. Lee, Stuart S. Sagel, and Robert J. Stanley. *Computed Body Tomography with MRI Correlation*. Lippincott Williams & Wilkins; 4th Edition, 2003
3. Slone RM. Fisher, AJ., Pickhart PJ, Guitierrez F, Balfe DM; *Body CT: A Practical Approach* McGraw-Hill Professional; 1st edition (December 1, 1999) Elias Zerhouni, *CT & MRI of the Thorax*. Churchill and Livingstone, 1990.

Additional Selections

- Barbaric, Zoran L. [Principles of Genitourinary Radiology](#). Preview pages available from Google. (2nd edition, ISBN 978-0-865-77493-3, 520 pp, Thieme Medical Publishers, 1994.)
- Bennett, GL et al. [Gynecologic Causes of Acute Pelvic Pain: Spectrum of CT Findings](#). (RadioGraphics 2002; 22:785801.)
- Boudiaf, M et al. [CT Evaluation of Small Bowel Obstruction](#). (RadioGraphics 2001; 21: 613-624.)
- Cademartiri, F et al. [MultiDetector Row CT Angiography in Patients with Abdominal Aneurysm](#). (RadioGraphics 2004; 24: 969-984.)
- Dunnick, NR, CM Sandler, JH Newhouse, and ES Amis. [Textbook of Uroradiology](#). (4th edition, ISBN 978-0-781-76750-7, 608 pp, Lippincott Williams & Wilkins, 2007.)
- Eisenberg, Ronald L. [Gastrointestinal Radiology: A Pattern Approach](#). Wonderful organization, giving differentials based on appearance. (4th edition, ISBN 978-0-781-73706-7, 1356 pp, Lippincott Williams & Wilkins, 2002.)
- Eisenberg, Ronald L. [Gastrointestinal Radiology Companion](#). (ISBN 978-0-781-71946-9, 433 pp, Lippincott Williams & Williams, 1999.)
- El-Serag, Hashem B. [Hepatocellular Carcinoma](#). Nice review of HCC (NEJM 2011; 365:1118-1127)
- Gervais, DA et al. [Complications after Pancreatoduodenectomy: Imaging and Imaging-guided Interventional Procedures](#). (RadioGraphics 2001; 21: 673-690.)
- Halpert, Robert D. [Gastrointestinal Imaging: The Requisites](#). 2nd edition in Holmes Library. (3rd edition, ISBN 978-0-323-03221-6, 384 pp, Mosby (Elsevier), 2006.)
- Hamer, OW et al. [Fatty Liver: Imaging Patterns and Pitfalls](#). (RadioGraphics 2006; 26: 1637-1653.)
- Hoeffel, C et al. [MultiDetector Row CT: Spectrum of Diseases Involving the Ileocecal Area](#). (RadioGraphics 2006; 26:13731390.)
- Hoon, J et al. [Hepatic Imaging with Multidetector CT](#). (RadioGraphics. 2001; 21: S71-S80.)
- Horton, KM et al. [CT Evaluation of the Colon: Inflammatory Disease](#). (RadioGraphics 2000; 20: 399-418.)

- Israel, GM and MA Bosniak. [How I Do It: Evaluating Renal Masses](#). (Radiology 2005; 236:441450.)
- Jayaraman, MV et al. [CT of the Duodenum: An Overlooked Segment Gets Its Due](#). (RadioGraphics 2001; 21: 147S-160S.)
- Kim, SH et al. [Esophageal Resection: Indications, Techniques, and Radiologic Assessment](#). (RadioGraphics 2001; 21: 1119-1137.)
- Kim, YH et al. [Adult Intestinal Intussusception: CT Appearances and Identification of a Causative Lead Point](#). (RadioGraphics 2006; 26: 733-744.)
- Kim, YH et al. [Imaging Diagnosis of Cystic Pancreatic Lesions: Pseudocyst versus Nonpseudocyst](#). (RadioGraphics 2005; 25: 671-685.)
- Lubner, M et al. [Blood in the Belly: CT Findings of Hemoperitoneum](#). (RadioGraphics 2007; 27: 109-125.)
- Lucey, BC et al. [Mesenteric Lymph Nodes Seen at Imaging: Causes and Significance](#). (RadioGraphics 2005; 25: 351-365.)
- Miller, JC. [Incidentally Detected Adnexal Masses](#). Summary of algorithm for incidental adnexal masses detected on CT. (MGH Radiology Rounds, March 2007.)
- Mortel, KJ and PR Ros. [Cystic Focal Liver Lesions in the Adult: Differential CT and MR Imaging Features](#). (RadioGraphics 2001; 21: 895-910.)
- Sahani, DV et al. [Cystic Pancreatic Lesions: A Simple Imaging-based Classification System for Guiding Management](#). (RadioGraphics 2005; 25: 1471-1484.)
- Saokar, A et al. [Cross-Sectional Imaging in Acute Pancreatitis](#). (Radiol Clin North Am. 2007 May; 45(3):447-460.)
- Sebasti?, C et al. [Portomesenteric Vein Gas: Pathologic Mechanisms, CT Findings, and Prognosis](#). (RadioGraphics 2000; 20: 1213-1224.)
- Singh, AK et al. [Acute Epiploic Appendagitis and Its Mimics](#). (RadioGraphics 2005; 25: 1521-1534.)
- Takeyama, N et al. [CT of Internal Hernias](#). (RadioGraphics 2005; 25: 997-1015.)
- To'o, KJ et al. [Pancreatic and Peripancreatic Diseases Mimicking Primary Pancreatic Neoplasia](#). (RadioGraphics 2005; 25: 949-965.)
- Webb, WR, WE Brant and NM Major. [Fundamentals of Body CT](#). Nice introductory text for both chest and abdominal CT(3rd edition, ISBN 978-1-416-00030-3, 429 pp, Saunders (Elsevier), 2005.)
- Wittenberg, J et al. [Algorithmic Approach to CT Diagnosis of the Abnormal Bowel Wall](#). (RadioGraphics 2002; 22: 1093-1107.)
- Zagoria, Ronald J. [Genitourinary Radiology: The Requisites](#). In Holmes Library. (2nd edition, ISBN 978-0-323-01842-5, 448 pp, Mosby (Elsevier), 2004.)