

## **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 and Technical Skills:**

##### **PCTS1: Consultant**

- Demonstrate knowledge of the ACR practice guidelines and technical standards for CT

##### **PCTS2: Competence in Procedures**

- Familiarity with the operation of CT equipment
- Develop a knowledge of the preparation and aftercare required for the common examination

#### **Medical Knowledge:**

##### **MK1: Protocol Selection and Optimization of Images**

- Observe and learn the techniques and protocols to achieve high-quality diagnostic examinations of the gastrointestinal and genitourinary tracts as well as the peritoneal cavity and retroperitoneum.
- Become knowledgeable about the different contrast agents available and begin to recognize abnormalities that are demonstrated on abdominal CT studies of the alimentary tract
- Explain the impact of the radiology findings on patient care, including what imaging studies may/may not be appropriate
- Demonstrate the ability to recommend additional imaging studies as appropriate to better

- assess findings on abdominal imaging studies
- Recognize the clinical question and the studies prescribed to answer the question

**MK2: Interpretation of Examinations**

- Learn the basic physics and principles of radiography, CT, and spinal CT, especially as it pertains to phases of enhancement of the liver and kidney
- Develop knowledge of normal and abnormal anatomy of the abdomen, pelvis, and peritoneal/retroperitoneal spaces as demonstrated on contrast studies. In addition, venous anomalies of the IVC and other variants will be recognized
- Develop a knowledge of the differential diagnoses of the more commonly encountered abnormalities
- Demonstrate the ability to recognize and describe common medical conditions depicted on abdominal imaging studies
- Develop an approach to ruling in or out an abscess

**SBP2: Health Care Economics**

- 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 differing clinical entities

**Practice-Based Learning and Improvement:**

**PBLI1: Patient safety: contrast agents; radiation safety; MR safety; sedation**

- Aware of the basic principles of radiation protection in order to reduce as much as possible the radiation dose to the patient and reduce exposure to healthcare providers
- Understand the indications for and contraindications to use of intravenous radiographic contrast, and be able to monitor its administration
- List the risk factors for allergic reaction to intravenous contrast media
- Recognize and treat reactions to intravenous contrast
- State the proper assessment and treatment for allergic reactions to contrast media
- Understand the indications and contraindications to the different types of contrast, dosages, side effects, and the differences and relative merits of single and double contrast studies

**PBLI2: Self-Directed Learning**

- Show evidence of independent study using material from 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
- Demonstrate understanding of protocols specific to each part of the body
- Able and willing to participate in 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

**Professionalism:**

**PROF1: Professional Values and Ethics**

- Demonstrate respect for patients, families, and all members of the healthcare team and be able to discuss significant radiologic findings
- 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, including arriving immediately after morning and noon conference.

**Interpersonal and Communication Skills:**

**ICS1: Effective Communication with Patients, Families, and Care Givers**

- Communicate with the patient at all times during the examination to ensure that patient remains comfortable
- 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

**ICS2: Effective Communication with Members of the Health Care Team**

- 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 when reviewing cases involving radiographs and abdominal imaging studies and show ability to provide preliminary readings, follow up with attending radiologists, formulate a plan of complex cases, and communicate any changes to referring clinicians
- Use the PACS, voice recognition systems, and hospital information systems to become proficient in dictating reports of significant radiographic findings in a concise and clear manner

**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 a consensus evaluation of performance from faculty on service. 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, case logs, multi-source professional evaluations, structured case discussion, review of patient outcomes, and other performance evaluation methods as determined by the program.

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

The objectives for Year 1 above, as well as the following:

**Patient Care and Technical Skills:**

**PCTS1: Consultant**

- Demonstrate knowledge of ACR practice guidelines and technical standards for CT examinations
- Familiarity with available medical records and how to access them for the purposes of patient care
- Serve as a consultant and review studies with referring clinicians as well as showing initiative in planning and performing interventional procedures

**PCTS2: Competence in Procedures**

- Learn skills for performing CT examinations, and tailor examinations to answer all questions being asked by the clinician; anticipate those questions that should have been asked but were not
- Develop a knowledge of the preparation and aftercare required for more complex procedures
- Plan and monitor all body CT exams with a fellow or attending radiologist available at all times for consultation

**Medical Knowledge:**

**MK1: Protocol Selection and Optimization of Images**

- Recommend the appropriate study based on the clinical scenario
- Understand the physics of radiation protection and how to apply it to routine studies
- Protocol cases, in consultation with the attending, to assure that the CT examination is appropriate and of sufficient quality to address the clinical concerns of the patient and referring physician
- 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)
- Decide whether IV contrast is needed and determine the appropriate dosage and delivery rate. Repeat scans with repositioning or reinjection may be needed to resolve issues

**MK2: Interpretation of Examination**

- Familiarity with the anatomy of the organs examined in every case
- Familiarity with imaging findings of common acute and chronic chest, abdomen, pelvis and peritoneal/retroperitoneal space diseases evaluated with CT
- Identify pathology in order to interpret routine CT studies with accuracy appropriateness to the level of training when presenting to the attending
- Review all studies with the supervisor faculty attending
- Distinguish between normal and abnormal abdomen, pelvis and peritoneal/retroperitoneal space anatomy to level of training when presenting to the attending
- Determine whether old exams are available and review them when possible prior to the patient's CT examination
- Understand solitary liver mass, pancreatic neoplasms, adrenal masses, staging renal cell cancer, as well as cancers of the endometrium, cervix, vagina, and the prostate

**Systems-Based Practice:**

**SBP1: Quality Improvement (QI)**

- Familiarity with departmental procedures, contrast safety, and sedation required in the performance of examinations
- Make suggestions to improve methods and systems utilized in radiology whenever appropriate

**SBP2: Health Care Economics**

- Demonstrate knowledge of ACR appropriateness criteria and cost-effective imaging evaluation of abdominal disorders

**Practice-Based Learning and Improvement:**

**PBLI2: Self-Directed Learning**

- 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
- Recognize the role that CT plays in the management of acute and chronic diseases

**Professionalism:**

**PROF1: Professional Values and Ethics**

- Demonstrate respect for patients and all members of the healthcare team (CT 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
- Observe ethical principles when recommending further work-up
- Promptness and availability at work are required of every resident
- Dress appropriately for work

**Interpersonal and Communication Skills:**

**ICS1: Effective Communication with Patients, Families, and Care Givers**

- Appropriately obtain informed consent
- Obtain consent for more complex procedures and answer all questions the patient may have
- Explain the nature of the examination or findings in an examination to patients and their families when needed

**ICS2: Effective Communication with Members of the Health Care Team**

- 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
- Competent in using PACS, voice recognition systems, and the hospital patient information systems in the daily accomplishment of the workload and instruct others in their use
- 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)
- 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

### **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 a consensus evaluation of performance from faculty on service. 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, case logs, multi-source professional evaluations, structured case discussion, review of patient outcomes, and other performance evaluation methods as determined by the program.

### **Educational Goals and Objectives (Third Year Residents):**

The above objectives for Year 1 and 2, as well as the following:

#### **Patient Care and Technical Skills:**

##### **PCTS1: Consultant**

- Demonstrate knowledge of ACR practice guidelines and technical standards for abdominal CT
- Familiarity with available medical records and how to access them for the purposes of patient care
- Act as a consultant in abdominal radiology to the clinical services

##### **PCTS2: Competence in Procedures**

- Refine diagnostic examination techniques and be very skilled and efficient in performing and interpreting all diagnostic and interventional procedures performed in CT
- Show involvement in CT-guided intervention involving the abdominal and assist the attending radiologist as appropriate
- Continue to develop skills in interventional procedures under the guidance of more experienced radiologists
- Know the proper preparation of patients for diagnostic and interventional procedures and the appropriate follow-up afterwards

**Medical Knowledge:**

**MK1: Protocol Selection and Optimization of Images**

- Protocol cases, in consultation with the attending, to assure that the CT examination is appropriate and of sufficient quality to address the clinical concerns of the patient and referring physician
- 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)
- Recognize the role that CT plays in the management of acute and chronic diseases

**MK2: Interpretation of Examinations**

- Develop a thorough knowledge of the differential diagnosis of CT abnormalities
- Relate the imaging findings to the clinical condition and its pathology
- Familiarity with the anatomy of the organs examined in every case
- Familiarity with imaging findings of common acute and chronic abdomen, pelvis and peritoneal/retroperitoneal space diseases evaluated with CT
- Identify pathology in order to interpret CT imaging studies with accuracy appropriate to the level of training when presenting to the attending
- Distinguish between normal and abnormal abdominal anatomy particularly as seen on CT images, with high accuracy appropriate to the level of training when presenting to the attending and demonstrate improvement compared to the prior rotation
- Proficient in detecting abnormalities on abdominal plain radiographs and CT studies while in progress
- Development of appropriate differential diagnostic lists will be well advanced
- Obtain a broad understanding of abdominal and alimentary tract diseases, their clinical features, radiographic manifestations, and current modes of treatment
- Review all studies with the supervising faculty attending

**Systems-Based Practice:**

**SBP1: Quality Improvement (QI)**

- Familiarity with departmental procedures, contrast safety, CT safety, and sedation required in the performance of examinations
- Make suggestions to improve methods and systems utilized in radiology whenever appropriate

**SBP2: Health Care Economics**

- Demonstrate knowledge of ACR appropriateness criteria and cost effective imaging practices in the evaluation of chest, abdomen, pelvis and peritoneal/retroperitoneal space disorders

**Practice-Based Learning and Improvement:**

**PBLI2: Self-Directed Learning**

- 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
- Understand the clinical management of the conditions encountered
- Complete final preparations to pass the certifying examination of the American Board of Radiology

### **Professionalism:**

#### **PROF1: Professional Values and Ethics**

- Demonstrate respect for patients and all members of the healthcare team (CT 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 of findings in 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
- Dress appropriately when reporting to work

### **Interpersonal Skills:**

#### **ICS1: Effective Communication with Patients, Families, and Care Givers**

- Appropriately communicate results to patients and clinicians whenever needed. For emergent studies, this will be done in a timely manner.

#### **ICS2: Effective Communication with Members of the Health Care Team**

- 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
- Competent in using PACS, voice recognition systems, and the hospital patient information systems in the daily accomplishment of the workload and instruct others in their use
- 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
- 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)
- Dictate and correct reports in a timely fashion to avoid delay in patient disposition

### **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 a consensus evaluation of performance from faculty on service.

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, case logs, multi-source professional evaluations, structured case discussion, review of patient outcomes, and other performance evaluation methods as determined by the program. In addition, practical exams will be given to residents toward the end of the rotation with feedback provided to residents regarding the progress made.

## 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; 4<sup>th</sup> 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 Angina](#). (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.)
  - Sebastião, 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.)

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