



## Pediatric Radiology Curriculum

### **Introduction:**

Greetings! Welcome to your pediatric radiology rotation. Whether this is your first trip with us or you are back for additional rotations, your time here should be well spent. Pediatric radiology is an exciting and dynamic field, representing the only radiology subspecialty where you can “do it all.” Each imaging modality is represented in pediatric radiology, and most pediatric radiologists practice all of them, including neuro and nuclear medicine. On behalf of all of the Pediatric Radiology attendings, we welcome you. We love what we do and hope that you will enjoy your rotation in our department.

### **Faculty in Pediatric Radiology:**

Meryle Eklund, MD - *Educational Liaison*  
Jeanne Hill, MD - Director, Division of Pediatric Radiology  
Anil Rao, MBBS  
Paul Thacker, MD  
Cephus Simmons, RA

### **Core Lecture Series in Pediatric Radiology**

#### Introductory Course

1. Pediatric Chest
2. Pediatric Abdomen
3. Pediatric Fractures
4. Pediatric Ultrasound

#### Year 1

1. Child abuse
2. Pediatric Acute Abdomen
3. Pediatric Airway
4. Pediatric Genitourinary Ultrasound
5. Imaging of the Child with Urinary Tract Infection
6. Benign and Malignant Pediatric Bone Lesions
7. Pediatric Mediastinal Masses
8. Pediatric Abdominal Masses
9. Emergent Pediatric Procedures: Lecture/Lab
10. Pediatric Biliary Imaging
11. Fetal MRI
12. Journal Club

#### Year 2

1. Neonatal Respiratory Distress
2. Imaging of Congenital Lung Abnormalities
3. Inflammatory Diseases of the Pediatric Chest
4. Pediatric Musculoskeletal MRI

5. Pediatric Inflammatory Bowel Disease – MRE
6. The Pediatric Foot
7. Trauma in the Pediatric Patient
8. The Pediatric Hip
9. Neonatal Cranial and Spinal Sonography
10. Safety and Pediatric Imaging

**Interdisciplinary Lectures/Conferences-** attendance and participation in interdisciplinary conferences is strongly encouraged and should be prioritized over routine work in the reading room, with rare exception

1. Pediatric Radiology Urology Conference – Monthly on the fourth **Tuesday** at 7am
2. Pediatric Radiology Gastroenterology Conference – Monthly on the fourth **Tuesday** at noon (optional)
3. Pediatric Hematology Oncology Tumor Boards – Weekly on **Wednesday** at 4pm
4. SCAN team (Child abuse) – Weekly on **Wednesday** at 1 pm
5. Surgery Radiology Conference – Weekly on **Thursday** at 3pm

\*the senior resident on rotation is encouraged to prepare and present imaging for the patients being discussed in surgery conference. Cases should be reviewed with the assigned attending radiologist prior to conference.

#### **Evaluations:**

At the completion of the rotation, each resident will receive a single cumulative evaluation which will be derived by faculty consensus. This will be presented to the resident, residency director, and clinical competency committee by E-value. However, our goal is for resident performance to be assessed daily by each faculty with the residents being made aware when a job is well done in addition to any deficiencies which need correcting.

## Pediatric Radiology – Rotation 1

### Goals and Objectives:

#### 1) Patient Care

- a) Residents should have knowledge of the indication for the examination requested. When the reason for the examination is not clear, the resident should effectively communicate with the patient or referring physician until this is clarified.
- b) The resident should be familiar with the available medical records and how to access them for the purposes of patient care.
- c) Communicate effectively and demonstrate caring, respectful behavior when interacting with patients and their families, answering their questions and helping them to understand the ultrasound or fluoroscopic procedure as well as its clinical significance

#### 2) Medical knowledge: At the end of the rotation, the resident should be able to:

- a) Identify normal/abnormal airways on chest radiographs of the infant or older child
- b) Identify abnormalities requiring emergent surgical management. Learn to interpret pediatric chest radiographs in infants and older children.
- c) Identify normal and abnormal skeletal structures.
- d) Describe the proper procedure for fluoroscopy of an infant/older child
- e) Be able to perform the following routine fluoroscopic procedures under direct supervision:
  - i) VCUG
  - ii) Esophagram
  - iii) Modified barium swallow
  - iv) UGI
  - v) Contrast enema
  - vi) Feeding tube placement
- f) Make preliminary review of pediatric outpatient and inpatient/ICU films and discuss findings with the radiologist, then dictate as directed
- g) Assist the technologist in preparation of the patient for fluoroscopic examinations
- h) Be aware of the common indications for pediatric sonographic procedures
- i) Participate in the following sonographic procedures:
  - i) Renal sonography
  - ii) Cranial sonography
  - iii) Hypertrophic pyloric stenosis
  - iv) Fluid localization in the chest and abdomen

#### 3) Practice Based Learning and Improvement

- a) The resident should demonstrate evidence of independent reading and learning through the use of printed and electronic sources
- b) Use information technology to manage information, to access online medical information, and for self-directed learning

#### 4) Interpersonal and Communication Skills

- a) Dictate prompt, accurate, and concise radiologic reports for plain films, basic ultrasound, and fluoroscopic studies using available electronic software applications
- b) Develop effective communication skills with patients, patients' families, physicians, and other members of the health care team

#### 5) Professionalism

- a) Demonstrate honor, integrity, respect, and compassion to patients, other physicians, and other health care professionals
- b) Demonstrate positive work habits, including punctuality and professional appearance

#### 6) Systems-Based Practice

- a) Understand how medical decisions affect patient care within the larger system

### Reading List:

- Donnelly: Pediatric Imaging, The Fundamentals, 2008
  - o Suggest reading 3 times during residency
- Donnelly: Pocket Radiologist – The Top 100 Diagnoses, 2002
- Pediatric Radiology Curriculum Online Modules
  - o <https://www.cchs.net/pediatricradiology/>
  
- Egloff AM, Kadom N, Verzina G, et al. 2009. Pediatric cervical spine trauma imaging: a practical approach. *Pediatric Radiol* 39: 447-456.
- Strouse PJ, 2004. Disorders of intestinal rotation and fixation (“malrotation”). *Pediatric Radiol* 34: 837-851.
- Lonergan GJ, Baker AM, Morey MK, et al. 2003. Child abuse: radiologic-pathologic correlation. *Radiographics* 23: 811-845.
- Kim MD, et al. 2010. Scoliosis Imaging: What Radiologists Should Know. *Radiographics* 30:1823-1842.

### Additional Resources:

-RadPrimer modules – the following modules are pertinent:

- a) Airway
  - i) Approach to the pediatric airway
  - ii) Croup
  - iii) Epiglottitis
  - iv) Retropharyngeal abscess
- b) Chest
  - i) Approach to the pediatric chest
  - ii) Viral lung infection
  - iii) Pneumomediastinum
- c) Neonatal and Congenital Chest Abnormalities
  - i) Meconium aspiration syndrome
  - ii) Neonatal pneumonia
  - iii) Pulmonary interstitial emphysema
  - iv) Surfactant deficiency disease
  - v) Umbilical catheter complications
- d) Gastrointestinal
  - i) Approach to the pediatric gastrointestinal tract
  - ii) Ingested button batteries
  - iii) Ingested multiple magnets
  - iv) Ingested coins
  - v) Hypertrophic pyloric stenosis
  - vi) Ileocolic intussusception
- e) Neonatal GI abnormalities
  - i) Midgut volvulus
  - ii) Necrotizing enterocolitis
- f) Genitourinary
  - i) Approach to the pediatric genitourinary tract
  - ii) Ovarian torsion
  - iii) Trauma, testicles

- iv) Testicular torsion
- g) Musculoskeletal
  - i) Approach to the pediatric musculoskeletal system
  - ii) Child abuse, rib fractures
- h) Brain, head, and neck
  - i) Germinal matrix hemorrhages

-CHOP Ultrasound Tutorials:

- <http://www.choplearningservices.com/radiology/entry/story.html>
- (choprad10)
- Renal, Brain, and Pylorus modules

## Pediatric Radiology – Rotation 2

### Goals and Objectives

#### 1) Patient Care:

- a) Residents should have knowledge of the indication for the examination requested. When the reason for the examination is not clear, the resident should effectively communicate with the patient or referring physician until this is clarified.
- b) The resident should be familiar with the available medical records and how to access them for the purposes of patient care
- c) Communicate effectively and demonstrate caring, respectful behavior when interacting with patients and their families, answering their questions, and helping them to understand the ultrasound or fluoroscopic procedure as well as its clinical significance

#### 2) Medical knowledge: At the end of the rotation, the resident should be able to:

- a) Describe positioning techniques and technical factors leading to optimum chest, abdomen, GI and GU radiographs of the infant and older child
- b) Demonstrate increasing proficiency in the routine fluoroscopic and sonographic procedures named above
- c) Have increasing involvement in more complex fluoroscopic procedures such as:
  - i) Intussusception reduction
  - ii) Gastrojejunostomy tube replacement
- d) Have increasing involvement in more complex sonographic procedures such as:
  - i) Duplex evaluations of the abdominal vasculature/transplant evaluation
  - ii) Spine sonography
  - iii) Hip sonography and hip aspiration
- e) Add to knowledgebase in chest radiology and congenital heart diseases through continued reading of films and case reviews

#### 3) Practice Based Learning and Improvement

- a) The resident should demonstrate evidence of independent reading and learning through the use of printed and electronic sources
- b) Use information technology to manage information, to access online medical information, and for self-directed learning

#### 4) Interpersonal and Communication Skills

- a) Dictate prompt, accurate, and concise radiologic reports for plain films, basic ultrasound, and fluoroscopic studies using available electronic software applications
- b) Develop effective communication skills with patients, patients' families, physicians, and other members of the health care team
- c) Promptly communicate urgent, critical, or unexpected findings to residents, referring physicians or clinicians, and document the communication in the radiologic report

#### 5) Professionalism

- a) Demonstrate honor, integrity, respect, and compassion to patients, other physicians, and other health care professionals
- b) Demonstrate positive work habits, including punctuality and professional appearance

#### 6) Systems-Based Practice

- a) Understand how medical decisions affect patient care within the larger system

### Reading List:

- Donnelly: Pediatric Imaging, The Fundamentals, 2008
  - o Suggest reading 3 times during residency
- Donnelly: Pocket Radiologist – The Top 100 Diagnoses, 2002

- Pediatric Radiology Curriculum Online Modules
  - o <https://www.cchs.net/pediatricradiology/>
- Siegel M. Pediatric Sonography. Lippincott, Williams and Wilkins. Philadelphia, PA 2002
  - o Read head, hip, spine, and pyloric chapters as needed

**Additional resources:**

RadPrimer modules – the following modules are pertinent:

- a) Airway
  - i) Exudative tracheitis
- b) Chest
  - i) Round pneumonia
- c) Neonatal and Congenital Chest Abnormalities
  - i) Congenital diaphragmatic hernia
  - ii) Congenital pulmonary airway malformations
  - iii) Congenital lobar emphysema
  - iv) Transient tachypnea of the newborn
  - v) Bronchopulmonary dysplasia
- d) Cardiac
  - i) Approach to the pediatric heart
- e) Gastrointestinal
  - i) Appendicitis
  - ii) Small bowel intussusception
  - iii) Pancreatitis
  - iv) Penumatosis in older children
- f) Neonatal GI abnormalities
  - i) Duodenal atresia or stenosis
  - ii) Duodenal web
  - iii) Jejunoileal atresia
  - iv) Hirschsprung disease
  - v) Meconium ileus
  - vi) Meconium plug syndrome
- g) Genitourinary
  - i) Posterior urethral valves
  - ii) Ureteropelvic junction obstruction
  - iii) Yelonephritis
  - iv) Epididymoorchitis
- h) Musculoskeletal
  - i) Child abuse, metaphyseal fracture
  - ii) Physeal fractures
  - iii) Supracondylar fractures
  - iv) Slipped capital femoral epiphysis
- i) Spine
  - i) Approach to pediatric spine
  - ii) Tethered spinal cord

-CHOP Ultrasound Tutorials:

- <http://www.choplearningservices.com/radiology/entry/story.html>
- (choprad10)

- Intussusception, Hips, Appendix modules



## **Pediatric Radiology – Rotation 3**

### **Goals and Objectives:**

#### **7) Patient Care:**

- a) Residents should have knowledge of the indication for the examination requested. When the reason for the examination is not clear, the resident should effectively communicate with the patient or referring physician until this is clarified.
- b) The resident should be familiar with the available medical records and how to access them for the purposes of patient care
- c) Communicate effectively and demonstrate caring, respectful behavior when interacting with patients and their families, answering their questions, and helping them to understand the ultrasound or fluoroscopic procedure as well as its clinical significance
- d) Screen, protocol, and supervise (with increasing level of responsibility) most pediatric imaging studies
- e) Understand the bioeffects and safety issues in pediatric radiology and incorporate the ALARA principle to the imaging of children

#### **8) Medical knowledge:** At the end of the rotation, the resident should be able to:

- a) Have progressive independence and responsibility for performing and reporting routine and complex special procedures (fluoro, US, CT, and MRI)
- b) Have an increasing role in consultation with referring physicians
- c) Have an increasing understanding of pediatric disease and imaging to tailor the imaging work-up to provide requested diagnostic information
- d) Have reviewed the pediatric section of the ACR teaching file

#### **9) Practice Based Learning and Improvement**

- a) Facilitate the teaching of medical students, sonographers, other residents, and other health care professionals
- b) Participate in quality assurance programs for technologists, sonographers, and physicians
- c) Be aware of equipment quality assurance programs
- d) Apply basic knowledge of study design and statistical methods to the appraisal of clinical studies and other information on diagnostic and therapeutic effectiveness

#### **10) Interpersonal and Communication Skills**

- a) Dictate accurate and concise reports for the most complex imaging studies with concise impressions including diagnosis and/or differential diagnoses as well as recommendations for further imaging and/or management, when appropriate
- b) Consult effectively with fellows, nurse practitioners, and attending physicians in most aspects of pediatric radiology
- c) Participate in the presentation of cases during Neonatal ICU rounds, Pediatric Surgery Conference, and Tumor Board

#### **11) Professionalism**

- a) Demonstrate honor, integrity, respect, and compassion to patients, other physicians, and other health care professionals
- b) Demonstrate positive work habits, including punctuality and professional appearance

#### **12) Systems-Based Practice**

- a) Practice cost-effective evaluation of pediatric patients requiring imaging that does not compromise patient safety or quality of care

## Reading List:

- Donnelly: Pediatric Imaging, The Fundamentals, 2008
  - o Suggest reading 3 times during residency
- Donnelly: Pocket Radiologist – The Top 100 Diagnoses, 2002
- Pediatric Radiology Curriculum Online Modules
  - o <https://www.cchs.net/pediatricradiology/>
- Kan and Kleinman: Pediatric and Musculoskeletal MRI: A case-based approach, 2007.
- Ebel, Blickman, Willich, and Richter: Differential Diagnosis in Pediatric Radiology, 1999.

## Additional resources:

RadPrimer modules – the following modules are pertinent:

- a) Airway and Chest
  - i) Pseudo-retropharyngeal thickening
  - ii) Lung contusion and laceration
  - iii) Pulmonary sequestration (intermediate)
- b) Gastrointestinal
  - i) Hypoperfusion complex
  - ii) Duodenal hematoma
  - iii) Bowel injury
  - iv) Liver trauma
  - v) Spleen trauma
  - vi) Pancreas trauma
  - vii) Omental infarction
  - viii) Liver transplant complications, general
- c) Genitourinary
  - i) Wilms tumor
- d) Musculoskeletal
  - i) Legg-Calve-Perthes Disease
  - ii) Juvenile Tillaux fracture (intermediate)
  - iii) Triplane fracture (intermediate)
- e) Brain, Head, and Neck
  - i) Germinal Matrix hemorrhage

-CHOP Ultrasound Tutorials:

- <http://www.choplearningservices.com/radiology/entry/story.html>
- (choprad10)
- Scrotal, Right Upper Quadrant, Abdominal modules