Introduction

This curriculum in pediatric radiology is intended as a guideline for training diagnostic radiology residents rotating on pediatric radiology. The resident should have experience with all of the included modalities and clinical entities. It is recognized that it is impossible during a rotation to have hands-on experience with each clinical entity. Therefore, the residents should supplement actual clinical practice with teaching materials (including teaching files and independent reading) as well as conferences.

These guidelines are provided as a framework for the body of knowledge which we would expect a radiology resident to have as part of his/her pediatric radiology training.

More information is available at the Society for Pediatric Radiology’s website, http://www.pedrad.org. For feedback or comments on this curriculum, please e-mail feedback@pedrad.org.
Cardiovascular System

- Imaging Modalities
- Congenital Heart Disease
- Acquired Heart Disease
- Cardiac Operations

I. Imaging Modalities

A. Chest radiographs
   1. limitations

B. Angiocardiography
   1. indications
   2. projections

C. Echocardiography
   1. standard views

D. CT (including ultrafast and helical)

E. MR
   1. indications
   2. anatomy

F. Nuclear cardiology

II. Congenital Heart Disease

A. Congenital heart disease with decreased pulmonary blood flow (right-to-left shunt)
   1. Tetralogy of Fallot
   2. Ebstein anomaly
   3. Tricuspid atresia

B. Cyanotic congenital heart disease with increased pulmonary blood flow (left-to-right shunt)
   1. truncus arteriosis
   2. transposition of the great arteries
   3. single ventricle
   4. total anomalous pulmonary venous return
   5. endocardial cushion defect

C. Acyanotic congenital heart disease with increased pulmonary blood flow (left-to-right shunt)
   1. ASD
   2. VSD
   3. PDA
4. Endocardial cushion defect

D. Congenital heart disease with pulmonary venous congestion or normal pulmonary blood flow
   1. Coarctation of the aorta
   2. Hypoplastic left heart syndrome
   3. Aortic/mitral stenosis
   4. Total anomalous pulmonary venous return below the diaphragm

E. Anomalies of viscero-atrial situs
   1. Asplenia
   2. Polysplenia

F. Vascular rings and other congenital anomalies of the great vessels
   1. Left arch with anomalous right subclavian artery
   2. Circumflex aorta (right aortic arch with left descending aorta)
   3. Anomalous left pulmonary artery
   4. Right aortic arch
   5. Double aortic arch

G. Syndromes with congenital heart disease or vascular disease
   1. Holt-Oram syndrome
   2. Marfan syndrome
   3. Turner syndrome
   4. William syndrome
   5. Trisomy 21
   6. Schone’s syndrome

H. Miscellaneous
   1. Congenital absence of the pericardium

III. Acquired Heart Disease

A. Infectious/Inflammatory
   1. Pericarditis
   2. Myocarditis
   3. Rheumatic heart disease
   4. Kawasaki disease

IV. Cardiac Operations

A. Palliative
   1. Glenn shunt
   2. Blalock-Taussig shunt
   3. Waterston shunt

B. Operative repair
   1. Norwood procedure
   2. Arterial switch
   3. Fontan procedure
   4. RV-to-pulmonary artery conduit

C. Transplant
Gastrointestinal System

- Imaging Modalities
- Normal Variants
- Biliary System
- Liver
- Spleen
- Pancreas
- Pharynx and Esophagus
- Stomach
- Small Bowel
- Colon
- Miscellaneous

I. Imaging Modalities

A. Plain radiographs
B. UGI/SBFT
C. Enteroclysis
D. BE/air enema
E. US
F. CT
G. MR
H. ERCP
I. Nuclear medicine

II. Normal Variants

III. Biliary System

A. Congenital
   1. biliary atresia
   2. neonatal hepatitis
   3. choledocal cyst
B. Acquired miscellaneous
   1. cholelithiasis
   2. hydrops of the gallbladder
IV. Liver

A. Infection
   1. pyogenic abscess (including chronic granulomatosis disease of childhood)
   2. ascending cholangitis

B. Tumors and tumor-like conditions
   1. benign
      a. mesenchymal hamartoma
      b. hemangioendothelioma
   2. malignant
      a. hepatoblastoma
      b. metastases

C. Trauma
   1. lacerations
   2. subcapsular hematoma
   3. contusion

D. Portal hypertension
   1. cavernous transformation of the portal vein

E. Miscellaneous
   1. portal venous gas
   2. glycogen storage disease
   3. transplant

V. Spleen

A. Congenital
   a. abnormal viscerointal situs
   b. wandering spleen

B. Neoplasms
   1. benign
      a. lymphangioma
   2. malignant
      a. lymphoma/leukemia

C. Trauma
   1. laceration
   2. contusion
   3. shattered spleen
   4. subcapsular hematoma

D. Splenic infarction
   1. sickle cell disease

VI. Pancreas

A. Congenital
   1. pancreas divisum
2. cystic fibrosis

B. Pancreatitis (and pseudocyst)
   1. trauma
   2. congenital anatomic abnormalities
      a. pancreas divisum
      b. choledocal cyst
   3. familial pancreatitis

VII. Pharynx and Esophagus

A. Congenital and developmental anomalies
   1. esophageal atresia and TE fistula

B. Inflammatory Lesions
   1. retropharyngeal abscess/cellulitis

C. Trauma
   1. foreign body
   2. iatrogenic pharyngeal perforation (due to NG or ET tube)

D. Miscellaneous
   1. GE reflux

VIII. Stomach

A. Congenital
   1. duplications
   2. antral webs

B. Gastric outlet obstruction – acquired
   1. HPS

C. Inflammatory
   1. corrosive ingestion
   2. chronic granulomatous disease

D. Miscellaneous
   1. bezoars
   2. spontaneous rupture of the stomach (neonates)
   3. volvulus

IX. Small Bowel

A. Congenital
   1. malrotation (including preduodenal portal vein)
   2. duodenal, jejunal, and ileal stenosis and/or atresia
   3. annular pancreas
   4. meconium ileus
   5. meconium peritonitis
   6. mesenteric and omental cysts
   7. duplication syts
   8. Meckel diverticula (including jomphalo-mesenteric band)
9. Omphalocele, gastroschisis
10. Hernias
B. Neoplasms
   1. benign
   2. malignant
      a. lymphoma
C. Malabsorption
   1. CF
   2. Cow’s milk allergy
   3. Intestinal lymphangiectasis
D. Miscellaneous
   1. necrotizing enterocolitis
   2. ischemic blowel
   3. intussusception
   4. Henoch-Schonlein purpura

X. Colon
A. Congenital
   1. imperforate anus
   2. duplications
   3. colonic atresia
B. Functional disorders
   1. Hirschprung disease
   2. Meconium plug/neonatal small left colon syndrome
C. Infection/Inflammatory
   1. appendicitis
D. Neoplasms
   1. benign
   2. malignant
      a. lymphoma

XI. Miscellaneous
A. Lines and Catheters
   1. umbilical arterial catheter
   2. umbilical venous catheter
B. Pneumoperitoneum (signs on plain radiographs)
SPR Pediatric Genitourinary Radiology
Curriculum for Residents

Genitourinary system

- Imaging Modalities
- Normal Variants
- Kidneys
- Adrenal Gland
- Baldders, ureters, Urethra
- Male Genital Tracts
- Female Genital Tracts

I. Imaging Modalities
   
   A. Plain radiographs
   B. IVU
   C. VCUG
   D. Retrograde urethrogram
   E. Nephrostogram
   F. Retrorgrade ureterogram
   G. US
   H. CT
   I. MR
   J. Nuclear medicine
   K. Interventional techniques
   L. Genitography

II. Normal Variants

III. Kidneys

A. Congenital anomalies
   1. UPJ
   2. Duplication
   3. Multicystic dysplasia
   4. Agenesis
   5. Hypoplastic kidney
   6. Ectopia
      a. ptosis
      b. pelvic
c. crossed ectopia
7. relationship of congenital renal anomalies with other congenital anomalies (i.e., VATER association, spinal dysraphism, etc.)
8. cystic renal disease
   a. autosomal recessive
   b. autosomal dominant
   c. cysts associated with malformation syndromes

B. Inflammatory
   1. acute pyelonephritis
   2. reflux nephropathy

C. Neoplasms
   1. Wilms and Wilms variant
   2. Nephrogenic rests
   3. Mesoblastic nephroma
   4. Multilocular cystic nephroma
   5. Leukemia/Lymphoma

D. Trauma
   1. subcapsular hematoma
   2. laceration (including those communicating with the collecting system)
   3. contusion
   4. avulsion of the renal pedicle
   5. UPJ avulsion or laceration

E. Miscellaneous
   1. renal vein thrombosis
   2. urolithiasis/nephrocalcinosis
   3. renal transplantation
   4. renovascular hypertension

IV. Adrenal Gland
   A. Neoplasms
      1. neuroblastoma
   B. Trauma
      1. hemorrhage and adrenal calcification

V. Bladders, Ureters, and Urethra
   A. Congenital
      1. posterior urethral valves
      2. ureterovesical junction obstruction
      3. primary megaureter
      4. bladder diverticuli
      5. ureteral duplication
      6. ureterocele
      7. urachal abnormalities
      8. hypospadias
      9. epispadias/exstrophy
      10. prune belly syndrome
11. urologic sequela of ano-rectal anomalies
   A. Inflammatory/Infectious
      1. urinary tract infection
      2. viral cystitis
   B. Neoplasms
      1. rhabdomyosarcoma
   C. Miscellaneous
      1. vesicoureteral reflux
      2. neurogenic bladder
      3. dysfunctional voiding

V. Male Genital Tracts
   A. Testicular torsion
   B. Inflammatory/Infectious
      1. epididymitis/orchitis
   C. Neoplasms
      1. germ cell tumors
      2. germ cell plus stroma cell tumors
      3. gonadal stromal tumors

VI. Female Genital Tracts
   A. Congenital
      1. congenital vaginal occlusion (hydrometrocolpos, etc.)
      2. fusion anomalies of the mullerian ducts (uterus didelphys, etc.)
      3. cloacal anomalies
   B. Neoplasms
      1. ovaries
         a. ovarian cysts (including torsion)
         b. germ cell tumors
      2. uterus and vagina
         a. rhabdomyosarcoma
         b. clear cell adenocarcinoma
   C. Miscellaneous
      1. differential diagnosis of intralabial masses
         a. prolapsing ectopic ureterocele
         b. obstructed paraurethral gland
         c. imperforate hyman with hydrometrocolpos
         d. urthral prolapse
         e. sarcoma botryoides
      2. Intersex states
         a. differential diagnosis
         b. work-up
SPR Pediatric Neuroradiology
Curriculum for Residents

Neuroradiology

- Imaging Modalities
- Normal Variants
- Skull
- Spine
- Brain
- Spinal Cord

I. Imaging Modalities
   A. Plain radiographs
   B. CT
   C. MR
   D. Sonography
   E. Myelography
   F. Angiography

II. Normal Variants

III. Skull

   A. Congenital
      1. craniofacial syndromes
      2. congenital dermal sinus
      3. premature craniosynostosis
   B. Inflammatory
      1. osteomyelitis
   C. Trauma
      1. caput succedaneum
      2. subgaleal hemorrhage
      3. cephalohematoma
      4. fractures

IV. Spine

   A. Congenital
      1. absence or hypoplasia of the odontoid
      2. os odontoideum
      3. segmentation anomalies
      4. Kippel-Feil anomaly
5. Sprengel deformity
6. VATER association
7. Butterfly vertebrae
8. Spinal dysraphism
9. Diastematomyelia
10. Sacral agenesis (including caudal regression syndrome)
11. Partial absence (including Currarino triad)

B. Inflammatory
1. discitis
2. tuberculosis spondylitis

C. Neoplasms
1. Ewing sarcoma
2. Aneurysmal bone cyst
3. Osteoblastoma
4. Osteoid osteoma
5. Langerhans cell histiocytosis of bone
6. Metastases (including leukemia and lymphoma)

D. Trauma
1. fractures/dislocations
2. atlanto-dens and atlanto-occipital injuries
3. spondylolysis/spondylolisthesis

E. Miscellaneous
1. Scheurmann disease
2. Scoliosis
3. Intervertebral disc calcification

V. Brain

A. Congenital
1. migrational disorders
   a. lissencephaly
   b. pachygyria
   c. schizencephaly
   d. heterotopic gray matter
   e. polymicrogyria
2. holoprosencephaly
3. anomalies of the corpus callosum
4. hydranencephaly
5. Dandy-Walker malformations
6. Chiari malformations
7. Cephaloceles
8. Neurocutaneous syndromes
9. Vein of Galen malformation
10. Aqueductal stenosis

B. Inflammatory
1. bacterial infections (including meningitis, cerebritis, and abscess)
2. tuberculosis infections
3. viral infections (encephalitis)
   a. TORCH infections
b. AIDS

C. Neoplasms

1. posterior fossa
   a. medulloblastoma
   b. ependymoma
   c. brainstem glioma
2. supratentorial
   a. pineal region tumors
   b. craniopharyngioma
   c. astrocytoma
   d. oligodendroglioma
   e. PNET
   f. Choroid plexus tumors

D. Cerebral infarction/ischemia

1. arteritis
2. sickle cell
3. carotid occlusion
4. venous sinus thrombosis
5. hypoxic/ischemic injury in the newborn
   a. inrachanial hemorrhage
   b. periventricular leukomalacia

E. Trauma (including shaken baby syndrome)

1. cerebral injury (including shearing injuries and concussion)
2. subdural hematoma
3. epidural hematoma
4. subarachnoid hemorrhage

F. Metabolic brain disorders

1. leukodystrophies

VI. Spinal Cord

A. Congenital

1. myelomeningocele/meningocele
2. lipomyelomeningocele
3. diastematomyelia
4. tetered cord
5. dermal sinus
6. intradural lipoma
7. hydrosyringomyelia

B. Tumors

1. neurofibroma
2. astrocytoma
3. empendymoma
4. metastases
5. neuroblastoma, ganglioneuroblastoma, ganglioglioma
6. sacrococcygeal teratoma
Chest and Airway
• Imaging Modalities
• Normal Variants
• Upper Airway
• Chest

I. Imaging Modalities
   A. Plain radiographs
   B. CT (including high resolution)
   C. Bronchography
   D. Sonography
   E. Flouroscopy
   F. Esophagography
   G. MR

II. Normal Variants

III. Upper Airway
   A. Congenital
      1. cystic hygroma
      2. branchial cleft cyst
      3. thyroglossal duct cyst
      4. tracheomalacia/bronchomalacia
      5. laryngeal stenosis, atresia, web
      6. laryngomalacia
      7. choanal atresia
   B. Inflammatory
      1. tonsillar enlargement/adenoidal hypertrophy
      2. croup
      3. epiglottitis
   C. Neoplasm
      1. juvenile angiofibroma
      2. subglottic hemangioma
      3. laryngeal papilloma
   D. Trauma
      1. foreign body
      2. acquired subglottic stenosis
IV. Chest

A. Congenital
   1. agenesis/hypoplasia
      a. venolobar syndrome
   2. bronchial atresia
   3. bronchopulmonary foregut malformation
      a. sequestration
      b. bronchogenic cyst
      c. cystic adenomatoid malformation
      d. congenital lobar emphysema
   4. tracheal bronchus
   5. lymphangiectasia

B. Inflammatory
   1. infections
      a. bacterial pneumonia (including streptococcus, staphylococcus, pertussis,
         chlamydia, mycoplasma, H. influenza) including pneumonia, abscess, and post-
         infectious pneumatocele
      b. viral pneumonia (including RSV, varicella, measles)
      c. tuberculosis
      d. pneumocystis infection
      e. fungal infections
   2. AIDS
   3. Reactive airways disease
   4. Bronchectasis
   5. Cystic fibrosis (including immotile cilia syndrome)

C. Neoplasms
   1. Mediastinal neoplasms
      a. lymphoma/leukemia
      b. teratoma
      c. thymoma
      d. neurogenic tumors
   2. primary lung tumors
      a. adenoma
      b. hamartoma
      c. hemangioma
      d. mesenchymal sarcoma (and their association with developmental cystic lesions
         of the lung)
   3. metastatic lung neoplasms
   4. chest wall neoplasms (including Askin tumor)

D. Trauma
   1. contusion
   2. airleak
      a. pneumothorax
      b. pneumomediastinum
      c. pulmonary interstitial emphysema
      d. bronchopleural fistula
      e. fracture of the tracheobronchial treee
f. airway foreign body  
g. post-traumatic bronchial stenosis  
h. post-traumatic diaphragmatic hernia  
i. complications of tubes and lines

E. Unique problems in the neonate
   1. hyaline membrane disease  
   2. transient tachypnea of the newborn  
   3. neonatal pneumonia  
   4. congenital diaphragmatic hernia  
   5. bronchopulmonary dysplasia  
   6. meconium aspiration syndrome  
   7. persistent fetal circulation  
   8. ECMO therapy and its complications  
   9. Chylothorax  
  10. Airleak in the neonate

F. Miscellaneous
   1. idiopathic pulmonary hemosiderosis  
   2. collagen vascular diseases  
   3. spontaneous pneumothorax  
   4. cardiogenic and noncardiogenic pulmonary edema (including ARDS)  
   5. histiocytosis
SPR Pediatric Musculoskeletal Radiology
Curriculum for Residents

Musculoskeletal System

- Imaging Modalities
- Normal Variants
- Congenital
- Infection/Inflammatory
- Neoplasm
- Trauma
- Metabolic/Endocrine
- Osteochondrosis

I. Imaging Modalities

A. Plain radiographs
B. CT
C. MR
D. Ultrasonography
E. Nuclear medicine
F. Arthrography
G. Angiography

II. Normal Variants

III. Congenital

A. Bone dysplasias
   1. Osteochondrodysplasias affecting growth of tubular bones and spine (identifiable at birth)
      a. Thanatophoric dysplasia
      b. Chondrodysplasia punctata
      c. Achondroplasia
      d. Asphyxiating thoracic dystrophy
   2. osteochondrodysplasias affecting growth of tubular bones and spine (identifiable in later life)
      a. metaphyseal chondrodysplasia
      b. multiple epiphyseal dysplasia
   3. osteochondrodysplasias with disorganized development of cartilage and fibrous components of the skeleton
a. multiple cartilagenous exostoses  
b. enchondromatosis  
c. polyostotic fibrous dysplasia  
d. neurofibromatosis  

4. abnormalities of density of cortical diaphyseal structure and metaphyseal modeling  
   a. osteogenesis imperfecta  
   b. osteopetrosis  
   c. pycnodysostosis  
   d. diaphyseal dysplasia  
   e. metaphyseal dysplasia  

B. Limb reduction anomalies (including proximal focal femoral deficiency and radial ray anomalies)  

C. Amniotic band syndrome  

D. Congenital bowing deformities and pseudoarthroses  

E. Congenital foot deformities  
   1. pes planus  
   2. talipes equinovarus  
   3. pes cavus  
   4. metatarsus adductus  

F. Skeletal abnormalities associated with Down syndrome  

G. Skeletal abnormalities associated with mucopolysaccharidoses and mucolipidoses  

H. Developmental dysplasia of the hip  

I. Skeletal abnormalities associated with neuromuscular diseases  
   1. meningomyelecele  
   2. cerebral palsy  
   3. mucolodystrophy  

IV. Infection/Inflammatory  

A. Pyogenic osteomyelitis  

B. Septic arthritis  

C. Toxic synovitis of the hip  

D. Tuberculosis  

E. Syphilis  

F. Juvenile rheumatoid arthritis  

G. Hemophilic arthropathy  

V. Neoplasm  

A. Benign  
   1. osteochondroma  
   2. unicameral bone cyst  
   3. aneurysmal bone cyst  
   4. nonossifying fibroma/fibrous cortical defect  
   5. fibrous dysplasia  
   6. Langerhans cell histiocytosis of bone  
   7. Osteoid osteoma  
   8. Osteoblastoma  
   9. Chondroblastoma
10. Chondromyxoid fibroma
B. Malignant
   1. Ewing sarcoma
   2. Osteogenic sarcoma
   3. Metastases (including leukemia/lymphoma)

VI. Trauma

A. Fractures
   1. Accidental trauma (including Salter-Harris, greenstick, bowing, and buckle fractures)
   2. Nonaccidental trauma (battered child syndrome)
   3. Slipped capital femoral epiphysis
   4. Thermal injury

VII. Metabolic/Endocrine

A. Rickets
B. Renal osteodystrophy
C. Hyperparathyroidism
D. Hypoparathyroidism
E. Hypophosphatasia
F. Scurvy
G. Bone age determination

VIII. Osteochondroses

A. Legg-Perthes disease
B. Kohler disease
C. Freiberg disease
D. Osteochondritis dissecans
E. Blount disease and physiologic bowing