PHILIPPINE PEDIATRIC RADIOLOGY FELLOWSHIP TRAINING CURRICULUM

I. OVERVIEW AND GENERAL BACKGROUND

A. WHAT IS A PEDIATRIC RADIOLOGIST?

A pediatric radiologist is a physician who is an expert in the diagnosis of various illnesses in infants, children and young adults utilizing Imaging. The imaging modalities used include x-ray, ultrasound (US), computerized tomography (CT), magnetic resonance imaging (MRI), and nuclear imaging. As an expert, the pediatric radiologist is not only responsible for interpreting the results of these imaging studies, but he/she also makes sure that the appropriate study is performed correctly and safely.

"*Children are not small adults.*" The diseases and disease manifestations in children are generally different from that of adults. For example, a child's body mechanics and response to injury or stress could be different from an adult. Children have an immature immune system making them a lot more prone to infections. In addition to acquired illnesses, a unique group of abnormalities such as congenital malformations are also common in pediatric population. Not only is there a difference in the disease entity itself, the approach to therapy and care of an ailing child is also different from that of an adult. Having gone thru specialized training, a pediatric radiologist is equipped with the general knowledge of childhood diseases as it relates to imaging. Pediatric radiology practitioners not only deal with their patients, but they also have to learn how to deal with the parents as well as the pediatricians or primary care providers of their patients.

II. DURATION OF TRAINING, QUALIFICATION, AND REQUIREMENTS

A. Pediatric radiology is a relatively new subspecialty in the Philippines, but many radiologists have developed special interest in the field, and some even had observership or preceptorship with practicing pediatric radiologists both locally and abroad. Applicants for the subspecialty training in pediatric radiology come with various levels of training and experience, and these are taken to account when the duration of the fellowship training is assigned.

B. In general, all trainees should be appropriately licensed physicians who graduated from an accredited medical school and must have graduated from an accredited Diagnostic Radiology residency.

C. The subspecialty training program in pediatric radiology should be for at least six (6) consecutive months comprising of forty (40) hours per week of clinical work. At least half a day of the week must be dedicated to research and/or academic activities.

D. The duration of training may be extended should the fellow need additional time to complete the requirements and/or if the performance of the fellow is deemed insufficient/unsatisfactory as determined by the basic knowledge, skills, and aptitude expected of a pediatric radiologist. This will be determined by the program director and the instructors.

E. The trainee shall have a maximum of two (2) weeks off as vacation with adjustments for sick time, conference time, and time for research.

F. Cases and procedures can be observed or performed with supervision. Should there be insufficient number of cases, these can be augmented by radiology teaching files in physical or digital format (with proof of completion and access), pediatric radiology webinars, or through inter-hospital academic activities, provided that a proof of participation be shown.

G. Minimum required number of cases per system and modality during the minimum 6-month training period are as follows:

	X-ray	Ultrasound	CT	MRI
Neuro and Head & Neck	50	100	50	50
Chest (Pulmo, Cardio)	500	25	25	5
GIT and GUT	200	200	50	10
MSK and soft tissues	300	20	10	20

F. Minimum number of fluoroscopic procedures that should be performed (with supervision) or observed in actual by the trainee during the minimum 6-month training period are as follows:
- Barium enema - 10
- Esophagram, with or without evaluation of the airways - 10
- Upper gastrointestinal series* with or without small intestinal series follow through - 10
- Voiding cystourethrography - 5

** Esophagram, which is included in the upper gastrointestinal series, may also be added to the count/census of esophagram.*

G. Image-guided interventional procedures such as biopsy and catheter placements are not required, but are good additional exposure to the trainee if available.

H. The rotations should be completed during the six (6) months of training, except for electives. Rotations include, but are not limited to:
- Plain radiography
- Fluoroscopy (including studies for gastrointestinal and genitourinary tracts and imaging of the airways)

- Neuroradiology (all modalities)
- Body imaging (all modalities)
- Fetal/Neonatal Imaging (all modalities)
- Chest/Cardiac (all modalities)
- Musculoskeletal (all modalities)
- Electives: Nuclear Medicine, Interventional Radiology

I. Research projects are required during the course of training as well as mentoring by staff pediatric radiologists. A case series, meta-analysis, or an original research are all accepted. These may be presented in local or international conferences, provided that the protocol is approved by the institutional scientific and ethics review boards of the corresponding hospital, or its equivalent.

J. Conferences/Lectures and other educational activities:
   - Journal Club: at least three (3) sessions during a six-month long training course;
   - Lectures/Reporting: at least one (1) lecture/reporting every month during a six-month long training course. This can also be a case report augmented with sources or a case series. Presentations may eventually be developed into a manuscript.;
   - Multidisciplinary conferences: trainee should present in at least two (2) multidisciplinary conferences during the course of training
   - Interesting case reports may be presented in local or international conferences, provided that the protocol is approved by the institutional scientific and ethics review boards of the corresponding hospital, or its equivalent.

III. JOB DESCRIPTION OF THE TRAINEE

During the training program, the fellow must:

1. Follow the responsibilities set during a specific rotation. These include, but are not limited to:
   a. Preliminary interpretation of all radiologic studies done for pediatric patients;
   b. Schedule special pediatric imaging procedures including the necessary preparations;
   c. Check for appropriateness, quality, and adequacy of imaging studies being done for pediatric patients;
   d. Reports and documents and critical finding/s to the attending/referring physician/s or other involved medical staff in the care of the patient;
   e. Supervision and/or performance as well as interpretation of fluoroscopic and US studies including those done in the bedside;
   f. Triage and check protocols for pediatric patients undergoing CT and MRI studies;

g. Application of appropriate radiation safety protocols and proper utilization of contrast materials in pediatric patients;
h. Neonatal intensive care unit (NICU) rounds at least once a week; and
i. Pediatric intensive care unit (PICU) rounds at least once a week.

2. Participate in conferences of other departments/hospitals/institutions involving pediatric patient/s with an imaging study.

3. Conduct a pediatric radiology conference once a week to show and review all interesting cases from the previous week.

4. Give lecture/s at least once a month on any pediatric imaging topic assigned by the program director/staff.

5. Additional learning experiences are encouraged through various web-based instructional programs.

6. Construct and conduct retrospective/prospective research studies, which shall be performed in cooperation with the attending pediatric radiologists. The research project may be utilized for a scientific paper or exhibit in local or international conferences.

7. Log interesting cases as teaching files for future review.

8. Submit a log of cases to the program director/training officer (*Please refer to Appendix I*). The logs should reflect the approximate number of cases in all the different radiologic modalities as well as include the conferences attended, lectures given, and book and journal readings.

9. Submit a summary report and assessment of the training program to the program director/instructor a week after the fellowship has ended.

10. Supervise, assist and/or teach radiology residents in performing various fluoroscopic procedures and ultrasound examinations, as well as in the interpretation of all pediatric studies.

IV. TRAINING PROGRAM FACULTY

A. Qualifications:

1. The program directors and instructors must be certified radiologists with subspecialty training in Pediatric Radiology.
2. The head/program director must be a fellow/full members of the Philippine Society for Pediatric Radiology (PSPR) in good standing.

3. Other members of the training committee or instructors may be associate members of PSPR.
4. The medical staff may be active, part time, visiting, or contractual.

B. Responsibilities:

1. The program directors and instructors have the authority in directing the subspecialty fellowship training program of the institution.
2. The program directors and instructors shall assure that the fellow completes the training program requirements within the training period.
3. The program directors and instructors shall provide the fellow with all the documents pertaining to the training program as well as the requirements for the satisfactory completion of the program.
4. The program director shall be required to submit quarterly program reports to the head of the department.
5. At least one (1) member of the training committee must supervise all the procedures and interpretations being performed by the trainee at all times.

V. INSTRUCTIONAL DESIGN

A. OBJECTIVES

The subspecialty training in Pediatric Radiology consists of that area of medical practice which includes the acquisition, interpretation, and reporting of medical images obtained by ionizing and non-ionizing studies and the application of radiological skills in aid of diagnosis and treatment of disease in neonates, children, and young adults.

The general objectives of a fellowship training program are to:

a. Provide continuity of didactic and clinical experience that will enable the fellow to become proficient in radiologic skills and interpretation of imaging studies involving neonates, children, and young adults.; and

b. Introduce the fellow to basic research and clinical applications in pediatric radiology.

B. PROGRAM-SPECIFIC OUTCOMES

The National Curriculum for Pediatric Radiology Fellowship in the Philippines would serve as a guide or baseline to maintain a degree of standardization among various Pediatric Radiology training programs in the country. It is understood, however, that exact instructions will vary in each training hospitals, considering the variability in department infrastructure, number of radiologists/mentors, number and types of cases encountered, among others. Each training program has its own unique strengths, but at

the same time, areas of improvement should be identified so that PSPR can provide advice or assistance when necessary.

The outcome-based approach to instructions focuses primarily on enhancing the trainee's knowledge, skills, and attitudes regarding important concepts in Pediatric Radiology. There is a list of information that a trainee must be able to learn, which are important in the practice of the profession. Similarly, radiologic procedures and skills particularly for the care of pediatric patients must be developed or enhanced. In addition to knowledge and skills, a trainee's attitude and behavior towards patients and their families, staff, peers, referring physicians, and mentors are all taken into account during training. This is to help instill the values of empathy, integrity, teamwork, and professionalism.

Although the training curriculum is subdivided into various organ systems, the process of learning these information actually occur simultaneously as the daily cases for imaging and interpretation are of various disease processes in different parts of the body. Still, a specific list of must-know information and corresponding program outcomes are expected. Regular assessments will be done to assure of the trainee's progress and attainment of the expected goals. A final assessment would be the Board Examination administered by the Philippine Society for Pediatric Radiology. But, ultimately, the overall goal is for the subspecialist to gain the necessary knowledge, skills, and attitude required to independently function as a Pediatric Radiologist.

ORGAN SYSTEMS	KNOWLEDGE	SKILLS	ATTITUDES
1. Neuroradiology and Head and Neck radiology	1. Various imaging modalities and its use, which includes radiation protection (ALARA), contrast safety, sedation, and other safety practices; 2. Anatomy, normal anatomical variants, and physiology of various organ systems in children and how it differs from adults; 3. Understanding of embryology in	1. Performance and/or supervision of various imaging studies and procedures (x-ray, fluoroscopy, ultrasound, CT, MRI, PET-CT/MRI) 2. Utilization of particular imaging studies for its appropriate indications; 3. Observe and prioritize patient safety in imaging, which includes radiation protection	1. Practice professionalism in the workplace; 2. Enhance inter-professionalism by being able to work with multidisciplinary teams; 3. Attentiveness and ability to accept suggestions and criticisms; 4. Enhance participation in discussions within radiology and with other subspecialties; 5. Participate in
2. Chest and airway radiology			

ORGAN SYSTEMS	KNOWLEDGE	SKILLS	ATTITUDES
3. Cardiovascular imaging 4. Gastrointestinal radiology 5. Genitourinary imaging 6. Musculoskeletal radiology	relation to congenital/ developmental disorders, which are common in children; 4. Understand the mechanics and imaging findings of both non-accidental and accidental trauma; 5. Knowledge of infectious and inflammatory conditions; 6. In-depth knowledge of clinical presentation, imaging manifestations, and overview of treatment for various benign and malignant neoplastic conditions; 7. For specific list of items, please refer to Appendix III: Pediatric Core Curriculum.	(ALARA), contrast safety, sedation, and other safety practices; 4. Interpretation and construct reports of all radiologic studies and procedures in children; 5. Ability to relate and communicate to the pediatric patient, as well as to the family or guardian; 6. Discuss imaging findings and develop rapport with pediatricians and other clinical subspecialties; 7. Gain knowledge in preparing and presenting lectures, medical literature or case discussions to learn, educate others, and practice public speaking skills; 8. Enhance ability to appraise medical literature; and 9. Gain experience in the conduct of medical research and case analysis.	teaching medical students, residents, and peers; 6. Imbibe the culture of quality and safety; 7. Ability to supervise staff in profession; 8. Attention to privacy and confidentiality; 9. Empathy towards patients, families, and coworkers; and 10.Nationalism

C. TEACHING-LEARNING ACTIVITIES

The general educational content of the program shall include:

1. One-on-one continuous instruction and supervision of the trainee by the pediatric radiologist/s during interpretation of radiologic imaging studies on a daily basis.
2. The attending pediatric radiologists provide formal lectures to the trainee on a regular biweekly basis.
3. Exposure of the trainee to the concept of clinical radiology, which is integration and correlation of medical imaging with other departments such as surgery, pathology, and pediatrics, among others. Most of all, the trainee is taught the value of clinical radiology as the integration of the imaging interpretation with the patient's clinical condition.
4. Opportunities for the trainee to follow patients in the pediatric ward, intensive care unit (ICU), nursery, or in surgery for the purpose of correlating radiologic findings. The trainee should also have the opportunity to follow the cases to pathology and correlate the gross and microscopic findings of tissues in cases of special interest to the department and to improve better patient care.
5. Opportunities to participate in any departmental clinico-pathologic and tumor conferences that involve pediatric patients.
6. Retrospective or prospective studies shall be performed in cooperation with the attending pediatric radiologist/s, approved by the research committee and institutional ethics review board of the hospital/institution. The research project may be utilized for scientific paper or exhibit in both local and international events.
7. The program must provide suitable arrangements for outside rotations, if necessary, to ensure the complete education of the fellow and for broadening the scope of training.

C. RESOURCES (TECHNOLOGY AND LEARNING MATERIALS)

1. Reference materials may be in physical or electronic format, in its latest or immediate prior edition. They should be original copies and not re-printed or photocopied.

2. Must-have primary reference:

   Pediatric Radiology: Practical Imaging Evaluation of Infants and Children (1st edition, 2017) by Edward Y. Lee, Lippincott Williams and Wilkins

3. Secondary References (at least three of the following):
   - Caffey's Pediatric Diagnostic Imaging (13th edition, 2018) by Brian Coley, Elsevier

- Pediatric Thoracic Imaging (1st edition, 2018) by Edward Y. Lee, Lippincott Williams and Wilkins
- Pediatric Neuroimaging (6th edition, 2018) by A. James Barkovich and Charles Raybaud, Wolters Kluwer
- Pediatric Body CT (2nd edition, 2007) by Marilyn J. Siegel, Lippincott Williams and Wilkins
- Pediatric Sonography (5th edition, 2018) by Marilyn J. Siegel, Lippincott Williams and Wilkins
- Pediatric Body MRI: A Comprehensive Multidisciplinary Guide (1st edition, 2020) by Edward Y. Lee (ed), M Liszewski, Gee, Daltro, Restrepo (associate editors), Springer

4. Subscriptions in pediatric radiology journals by the applying institution and/or by any consultant of the training center are required. The following are the minimum needed journal subscriptions:
    a. Pediatric Radiology
    b. Radiologic Society of North America (RSNA) journals: Radiology and Radiographics

5. Supplementation by web-based learning or through teaching files may also be done:
    a. Teaching files may be hard copies on film or in digital archive format.
    b. At least 5 different cases for each organ system in every modality must be available for trainees to view at any time during the training.
    c. Reputable sources of teaching files may be obtained from Society for Pediatric Radiology (SPR), European Society of Pediatric Radiology (ESPR), Asian Oceanic Society for Pediatric Radiology (AOSPR), World Federation of Pediatric Imaging (WFPI), RSNA, etc.

D. 360° EVALUATION

The trainees will be evaluated by faculty, and *vice versa,* on a quarterly basis. A standardized form provided by the training institution's office of medical education or equivalent office/department.

Oral reports will also be evaluated. (*Please refer to Appendix II*)

VI. GRADUATION REQUIREMENTS

The fellow of Pediatric Radiology shall fulfill the following requirements for him/her to be considered eligible for graduation:

1. Attendance of not less than 90% of total days;
2. Exit examination with a grade of not less than 75%;

3. At least one scientific paper accepted and presented (oral or poster) in a local or international meeting;
4. Attendance in at least one local or international pediatric conference; and
5. Completion of the minimum required number of cases seen during the training period of at least six (6) months.

APPENDIX I: CASE LOG FORM

<NAME OF INSTITUTION>

CASE LOG

Month and Year: _____
Name: _____

Interesting Cases:

Date	PIN	Age/Sex	Modality	Findings

Case Presentation / Report:

Date Reported	Title of Report

Fellow: Evaluator:

_____ _____

(Signature above printed name) *(Signature above printed name)*

APPENDIX II: ORAL REPORT EVALUATION FORM

<NAME OF INSTITUTION>

ORAL REPORT EVALUATION FORM

Date: _____
General Topic of Report: _____
Title of Report: _____
Reporter: _____

Criteria	Percentage	Grade
Mastery on topic	30	
Clarity of report	20	
Review of literature	20	
Relevance of topic	10	
Visual presentation	10	
Audience impact	10	
TOTAL	100%	

Other remarks:

_____

_____

_____

Faculty Evaluator:

_____
(Signature above printed name)

APPENDIX III: PEDIATRIC RADIOLOGY CORE CURRICULUM

NEURORADIOLOGY

I. Imaging Modalities
   - A. Plain radiographs
   - B. CT
   - C. MR/Spectroscopy
   - D. Ultrasound
   - E. Myelogram
   - F. Angiogram

II. Normal variants

III. Skull
   - A. Congenital
     1. Craniofacial syndromes
     2. Congenital dermal sinus
     3. Craniosynostosis
        a. Dolichocephaly (sagittal suture)
   - B. Lytic skull lesions
     1. Epidermoid
     2. Langerhan cell histiocytosis
     3. Leptomeningeal cyst
     4. Hemangioma
     5. Metastasis
     6. Osteomyelitis
   - C. Inflammatory
     1. Osteomyelitis
   - D. Trauma
     1. Caput succedaneum
     2. Subgaleal hemorrhage
     3. Cephalohematoma
     4. Fractures
   - E. Sinusitis
   - F. Mastoiditis

IV. Spine
   - A. Congenital
     1. Absence or hypoplasia of odontoid
     2. Os odontoideum
     3. Segmentation anomalies
     4. Klippel-Feil anomaly
     5. Sprengel's deformity
     6. VACTERL syndrome
     7. Butterfly vertebra
     8. Spinal dysraphism
     9. Diastematomyelia
     10. Sacral dysgenesis (caudal regression)

11. Curarino triad

B. Wormian bones
    1. Osteogenesis imperfecta
    2. Rickets
    3. Cleidocranial dysostosis
    4. Down's

C. Inflammatory
    1. Discitis
    2. Tuberculous spondylitis

D. Neoplasm
    1. Ewing sarcoma
    2. Aneurysmal bone cyst
    3. Osteoblastoma
    4. Osteoid osteoma
    5. Langerhan cell histiocytosis (LCH)
    6. Metastasis

E. Trauma
    1. Fractures
    2. Spondylolysis/spondylolisthesis

F. Vertebra Plana
    1. Langerhan cell histiocytosis (eosinophilic granuloma)
    2. Leukemia/lymphoma
    3. Trauma
    4. TB
    5. Metastasis

G. Miscellaneous
    1. Sheuermann disease
    2. Scoliosis

V. Brain

A. Congenital
    1. Defects of dorsal induction
        a. Anencephaly
        b. Cephaloceles
        c. Chiari malformations (I, II, III)
    2. Defects of ventral induction
        a. Holoprocencephaly
            - alobar
            - semilobar
        b. Absence of septum pellucidum
            - Septo-optic dysplasia
    3. Posterior fossa cysts/defects
        a. Dandy-Walker malformation
        b. Dandy-Walker variant
        c. Mega cisterna magna
    4. Sulcation/Migrational disorders
        a. Lissencephaly

        b. Pachygyria
        c. Polymicrogyria
        d. Schizencephaly
        e. Heterotopia
    5. Anomalies of the corpus callosum
        a. Complete absence of Corpus callosum
        b. Partial absence of Corpus callosum
    6. Hydranencephaly
    7. Aqueductal stenosis
    8. Neurocutaneous syndromes
        a. Neurofibromatosis I
        b. Neurofibromatosis II
        c. Tuberous sclerosis
        d. Sturge-Weber syndrome
        e. Von Hippel Lindau
B. Inflammatory
    1. Bacterial infections
        a. Meningitis
        b. Cerebritis
        c. Abscess
    2. Tuberculosis infections
    3. Viral infections
        a. TORCH infections
        b. Herpes
        c. AIDS
C. Neoplasms
    1. Posterior fossa
        a. Medulloblastoma (Primitive Neuroectodermal Tumor [PNET])
        b. Ependymoma
        c. Astrocytoma
        d. Brainstem glioma
    2. Supratentorial
        a. Pineal region tumors
        b. Craniopharyngioma
        c. Astrocytoma
        d. Oligodendroglioma
        e. PNET
        f. Choroid plexus tumors
    3. Retinoblastoma
D. Cerebral infarction/ischemia
    1. Arteritis
    2. Sickle cell
    3. Carotid occlusion
    4. Venous sinus thrombosis
    5. Hypoxic/ischemic injury
        a. Periventricular leukomalacia

E. Germinal matrix hemorrhage
F. Trauma
    1. Cerebral injury in shaken baby syndrome (non-accidental trauma)
    2. Subdural hematoma
    3. Epidural hematoma
    4. Subarachnoid hemorrhage
    5. Parenchymal hemorrhage
G. Vascular Malformations
    1. Venous angioma (developmental venous anomalies)
    2. Cavernous angioma
    3. Arterio-venous malformations
    4. Capillary telangiectasia
    5. Vein of Galen malformation
H. Aneurysm
I. Metabolic brain disorders
    1. Leukodystrophies

VI. Spinal Cord
A. Congenital
    1. Myelomeningocele/ meningocele
    2. Lipomyelomeningocele
    3. Diastematomyelia
    4. Tethered cord
    5. Dermal sinus
    6. Intradural lipoma
    7. Hydrosyringomyelia
B. Tumors
    1. Neurofibroma
    2. Astrocytoma
    3. Ependymoma
    4. Metastasis
    5. Neuroblastoma
    6. Sacrococcygeal teratoma
C. Infection/Inflammation
    1. Transverse myelitis
    2. Acute disseminated encephalomyelitis (ADEM)
    3. Multiple sclerosis
D. Trauma
    1. spinal cord contusion
    2. spinal cord hemorrhage

CHEST AND AIRWAY

I. Imaging Modalities
   A. Plain radiographs
   B. CT including high resolution
   C. Bronchography
   D. Ultrasound
   E. Fluoroscopy
   F. Esophagram
   G. MRI
II. Normal Variants
III. Upper airway
   A. Congenital
      1. Cystic hygroma
      2. Brachial cleft cyst
      3. Thyroglossal duct cyst
      4. Tracheomalacia/bronchomalacia
      5. Laryngeal stenosis/atresia
      6. Laryngomalacia
      7. Choanal atresia
   B. Inflammatory
      1. Tonsillar enlargement
      2. Adenoidal hypertrophy
      3. Croup
      4. Epiglottitis
      5. Bacterial tracheitis (membranous croup)
   C. Neoplasm
      1. Juvenile angiofibroma
      2. Subglottic hemangioma
      3. Laryngeal papillomatosis
   D. Trauma
      1. Foreign body
      2. Acquired subglottic stenosis
IV. Diaphragm abnormalities
   A. Congenital diaphragmatic hernia
   B. Diaphragmatic paralysis
   C. Eventration
V. Chest
   A. Congenital
      1. Agenesis/hypoplasia
      2. Bronchial atresia
      3. Bronchopulmonary foregut malformation
         a. sequestration
         b. bronchogenic cyst
         c. cystic adenomatoid malformation
         d. congenital lobar emphysema

4. Tracheal bronchus

B. Inflammatory
    1. Infections
        a. Bacterial pneumonia (streptococcus, staphylococcus, pertussis, chlamydia, mycoplasma, Haemophilus)
        b. Viral pneumonia (RSV, adenovirus, Varicella, measles)
        c. Tuberculosis
        d. Pneumocystis
        e. Fungal infections
    2. Round pneumonia
    3. AIDS
    4. Reactive airways disease (asthma)
    5. Bronchiectasis
    6. Cystic Fibrosis

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
    3. Metastatic lung disease
    4. Chest wall neoplasm

D. Trauma
    1. Contusion
    2. Air leak
        a. Pneumothorax
        b. Pneumomediastinum
        c. Pulmonary interstitial emphysema
        d. Bronchopleural fistula

E. Unique problems in neonates
    1. Hyaline membrane disease (respiratory distress syndrome)
    2. Transient tachypnea of newborn
    3. Neonatal pneumonia
    4. Congenital diaphragmatic hernia
    5. Bronchopulmonary dysplasia
    6. Meconium aspiration
    7. ECMO therapy

F. High Resolution Chest CT

G. Miscellaneous
    1. Airway foreign body
    2. Spontaneous pneumothorax

3. Cardiogenic and noncardiogenic pulmonary edema
4. Histiocytosis

CARDIOVASCULAR SYSTEM

I. Imaging Modalities
   A. Chest radiographs
      1. limitations
   B. Angiocardiography
      1. Indications
   C. Echocardiography
   D. Computed Tomography
   E. MRI
   F. Nuclear cardiology

II. Congenital Heart Disease (CHD)
   A. CHD with decreased pulmonary blood flow (right to left shunt)
      1. Tetralogy of Fallot
      2. Ebstein Anomaly
      3. Tricuspid atresia
   B. Cyanotic CHD with increased pulmonary blood flow (left to right shunt)
      1. Truncus arteriosus
      2. Transposition of the great arteries
      3. Single ventricle
      4. Total anomalous pulmonary venous return
      5. Endocardial cushion defect (Atrioventricular canal [AVC])
   C. Acyanotic CHD with increased pulmonary blood flow (left to right shunt)
      1. ASD
      2. VSD
      3. PDA
      4. Endocardial cushion defect
   D. CHD 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. Heterotaxy syndrome
   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

III. Acquired heart disease
    A. Infectious/Inflammatory
        1. Pericarditis
        2. Myocarditis
        3. Rheumatic heart disease
        4. Kawasaki disease
IV. Cardiac Surgeries
    A. Palliative
        1. Glenn shunt
        2. Blalock–Taussig
        3. Waterston shunt
    B. Operative repair
        1. Norwood procedure
        2. Arterial switch
        3. Fontan
V. Syndromes associated with CHD
    A. Aorta
        1. Turner: coarctation
        2. Williams: supravalvar aortic stenosis
        3. DiGeorge: interrupted arch (transposition of great arteries)
    B. Pulmonary stenosis
        1. Noonan
        2. Rubella
    C. ASD
        1. Holt-Oram
        2. Ellis van Creveld
    D. TOF, VSD, AVC (endocardial cushion defect)
        1. Down's syndrome

GASTROINTESTINAL SYSTEM

I. Imaging Modalities
    A. Plain radiographs
    B. UGI/SBFT
    C. Enteroclysis
    D. BE/air enema
    E. US
    F. CT
    G. MRI
    H. ERCP
    I. Nuclear medicine
II. Normal Variants
III. Biliary system

A. Congenital
    1. Biliary atresia
    2. Neonatal hepatitis
    3. Choledochal cyst
B. Acquired
    1. Cholecystitis
    2. Cholelithiasis/choledocholithiasis

IV. Liver
A. Infection
    1. Abscess (including chronic granulomatous disease)
    2. Ascending cholangitis
B. Tumors and tumor-like conditions
    1. Benign
        a. Mesenchymal hamartoma
        b. Hemangioma
        c. Hemangioendothelioma
    2. Malignant
        a. Hepatoblastoma
        b. Hepatocellular carcinoma
        c. Embryonal sarcoma
        d. Metastasis
C. Trauma
    1. Laceration
    2. Subcapsular hematoma
    3. Contusion
D. Portal hypertension
    1. Cavernous transformation of the portal vein

V. Spleen
A. Congenital
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. Pancreatic divisium
B. Pancreatitis (and pseudocyst)

1. Causes
    a. Trauma
    b. Congenital anatomic abnormalities
        - Pancreatic divisum
        - Choledochal cyst
    c. Familial pancreatitis
    d. Cholelithiasis
    e. Duodenal inflammation

VII. Pharynx and Esophagus
A. Congenital and developmental anomalies
    1. Esophageal atresia and TE fistula
B. Inflammatory lesions
    1. Retropharyngeal abscess/ cellulites
C. Trauma
    1. Foreign body
    2. Iatrogenic pharyngeal perforations
D. Miscellaneous
    1. GE reflux

VIII. Stomach
A. Congenital
    1. Duplications
    2. Antral webs
B. Gastric outlet obstruction
    1. Hypertrophic pyloric stenosis
C. Inflammatory
    1. Corrosive ingestion
    2. Chronic granulomatous disease
    3. Menetrier's disease
    4. Gastritis
D. Miscellaneous
    1. Bezoars
    2. Volvulus

IX. Small Bowel
A. Congenital
    1. Malrotation
    2. Duodenal, jejunal, ileal stenosis or atresia
    3. Annular pancreas
    4. Meconium ileus
    5. Meconium peritonitis
    6. Mesenteric and omental cysts
    7. Duplication cysts
    8. Meckel diverticulum
    9. Hernia
    10. Anomalies of abdominal wall
        a. Omphalocele
        b. Gastroschisis

B. Neoplasms
    1. Benign
        a. Polyposis syndromes
    2. Malignant
        a. Lymphoma
C. Malabsorption
    1. Cystic Fibrosis
        a. Meconium ileus equivalent
    2. Cow's milk allergy
D. Miscellaneous
    1. Necrotizing enterocolitis
    2. Ischemic bowel
    3. Intussusception
    4. Henoch-Schonlein purpura

X. Colon
A. Congenital
    1. Imperforate anus
    2. Duplications
    3. Colonic atresia
B. Microcolon
    1. Ileal/colonic atresia
    2. Meconium ileus
    3. Hirschsprung's disease
    4. Meconium plug /neonatal small left colon
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
C. Shock bowel syndrome
D. Crohn disease
E. Ulcerative colitis

GENITOURINARY SYSTEM

I. Imaging Modalities
A. Plain radiographs
B. IVP
C. VCUG
D. Retrograde urethrogram

E. Nephrostogram
F. Retrograde ureterogram
G. US
H. CT
I. MRI
J. Nuclear medicine
K. Interventional techniques

II. Normal Variants
III. Kidneys
A. Congenital anomalies
1. UPJ
2. Duplication
3. Multicystic dysplastic kidney
4. Agenesis
5. Hypoplastic kidney
6. Cross fused ectopia
7. VACTER syndrome association
8. Cystic renal disease
a. Autosomal recessive
b. Autosomal dominant
c. Cysts associated with other malformations
B. Inflammatory
1. Acute pyelonephritis
2. Reflux nephropathy
C. Neoplasms
1. Wilms tumor
2. Nephrogenic rests
3. Mesoblastic nephroma
4. Multilocular cystic nephroma
5. Leukemia/Lymphoma
6. Angiomyolipoma
D. Trauma
1. Subcapsular hematoma
2. Laceration
3. Contusion
E. Miscellaneous
1. Renal vein thrombosis
2. Urolithiasis
3. Nephrocalcinosis
4. Renovascular hypertension
IV. Adrenal gland
A. Neoplasms
1. Neuroblastoma
2. Pheochromocytoma
B. Trauma

1. Hemorrhage and adrenal calcification

V. Bladder, ureter and urethra
   A. Congenital
      1. Posterior urethral valve
      2. Ureterovesical junction obstruction
      3. Primary megaureter
      4. Bladder diverticuli
      5. Ureteral duplication
      6. Ureterocele
      7. Urachal abnormalities
      8. Hypospadias
      9. Epispadias/extrophy
      10. Prune belly syndrome
   B. Inflammatory/Infectious
      1. UTI
      2. Cystitis
   C. Neoplasm
      1. Rhabdomyosarcoma
   D. Miscellaneous
      1. Vesicoureteral reflux and grading system
      2. Neurogenic bladder
      3. Dysfunctional voiding

VI. Male genital tracts
   A. Testicular torsion
   B. Inflammatory/Infectious
      1. Orchitis
      2. Epididymitis
   C. Neoplasms
      1. Germ cell tumors
   D. Miscellaneous
      1. Testicular microlithiasis

VII. Female genital tracts
   A. Congenital
      1. Congenital vaginal occlusion
      2. Mullerian duct abnormalities
      3. Cloacal anomalies
   B. Neoplasm
      1. Ovaries
         a. Ovarian cysts (including torsion)
         b. Germ cell tumors
      2. Uterus and vagina
         a. Rhabdomyosarcoma

MUSCULOSKELETAL SYSTEM

I. Imaging Modalities
   A. Plain radiographs
   B. CT
   C. MRI
   D. Ultrasound
   E. Nuclear medicine
   F. Arthrogram
   G. Angiogram
II. Normal Variants
III. Congenital
   A. Bone dysplasia
      1. Dysplasias affecting growth of tubular bones and spine identifiable at birth
         a. Achondroplasia
         b. Thanatropic dysplasia
         c. Asphyxiating thoracic dystrophy (Jeune's syndrome)
      2. Dysplasias affecting growth of tubular bones and spine identifiable later in life
         a. Metaphyseal chondrodysplasias
         b. Multiple epiphyseal dysplasia
      3. Dysplasias with disorganized development of cartilage and fibrous components of skeleton
         a. Multiple cartilaginous exostosis
         b. Enchondroma
         c. Fibrous dysplasia
         d. Neurofibromatosis
      4. Abnormalities of cortical diaphyseal structure and metaphyseal remodeling
         a. Osteogenesis imperfecta
         b. Osteopetrosis
         c. Pylnodysostosis
         d. Diaphyseal dysplasia
         e. Metaphyseal dysplasia
   B. Limb reduction abnormalities
   C. Amniotic band syndrome
   D. Congenital foot deformities
      1. Pes planus
      2. Pes cavus
      3. Talipes equinovirus
      4. Metatarsus varus
   E. Developmental dysplasia of the hip
IV. Infection/Inflammatory
   A. Osteomyelitis

B. Septic Arthritis
C. Toxic synovitis of the hip
D. Tuberculosis
E. Syphilis
F. Juvenile rheumatoid arthritis
G. Hemophiliac 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. Langerhan cell histiocytosis of the bone
7. Osteoid osteoma
8. Osteoblastoma
9. Chondroblastoma
10. Chondromyxoid fibroma

B. Malignant
1. Ewing sarcoma
2. Osteogenic sarcoma
3. Leukemia/lymphoma
4. Metastasis

VI. Trauma
A. Fractures
1. Accidental trauma
a. Salter-Harris fractures
b. Greenstick
c. Bowing
d. Buckle
2. Non-accidental trauma (child abuse)
a. Metaphyseal corner fractures
b. Posterior rib fractures
c. Scapula fractures
d. Spinous process fractures
e. Sternal fractures
f. Multiple fractures with different ages of healing
g. Epiphyseal separation
h. Vertebral body fracture
i. Skull fracture
3. Slipped capital femoral epiphysis (SCFE)
4. Osteochondritis dissecans

VII. Metabolic/Endocrine
A. Rickets
B. Renal osteodystrophy
C. Hyperparathyroidism

D. Hypoparathyroidism
E. Hypophosphatasia
F. Scurvy

VIII. Miscellaneous
A. Scoliosis
B. Leg-Perthes disease
C. Caffey's disease
D. Kohler disease
E. Frieberg's disease
F. Blount's disease
G. Soft tissue calcification
1. Dermatomyositis
2. Myositis ossificans

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