Pediatric Neuroradiology Curriculum

Description of Educational Experience

The pediatric neuroradiology fellow will rotate one year on the service at Childrens Medical Center of Dallas (CMC) in pediatric neuroradiology. The rotation will physically be spent at CMC. Additional elective time may be taken as well, during the scheduled elective month. Fellows will learn to perform and interpret basic as well as advanced CT and MRI examinations of the brain, spine, and head and neck performed on pediatric patients with faculty supervision. They will have an opportunity to participate in and perform angiographic procedures. In addition, they will have a didactic presentation bimonthly. At least 2 interdisciplinary clinical conferences occur weekly and the fellow will attend and/or present cases. Additionally, the fellow is encouraged to attend rounds in the neonatal intensive care unit to review head and spine ultrasounds. The fellow will give a monthly case conference to rotating residents and at least 2 didactic lectures to the UT radiology residents. Specific ongoing instruction will include differences in image protocol for CT and MR studies, anatomic development at different ages, and appearances of pathology specific to children. Radiation, intravenous contrast and MR safety will be stressed. A completed research project is expected at fellowships end.

Patient Care

Goal
Pediatric neuroradiology fellows must be able to provide patient care related to evaluation and treatment of diseases of the fetus, neonate, infant and child that is compassionate, appropriate, and effective for the diagnosis and treatment of these conditions and the promotion of health. Fellows are expected to:

Competencies
Clinical competency goals for this curriculum include:

1. Knowledge of the indications and contraindications for contrast administration (MR and CT) in the pediatric patient.
2. Knowledge of appropriate indications for imaging studies in a pediatric patient.
3. Ability to perform preliminary evaluation of pediatric patients requiring imaging evaluation and protocol imaging studies in order to maximize there diagnostic potential.
4. Ability to perform a targeted, procedure appropriate history.
5. Ability to render appropriate management of certain physiological considerations including drug/contrast reactions/premedication.
6. Ability to identify emergent cases requiring urgent intervention and provide immediate referring faculty notification.
7. Ability to modify an exam to reduce radiation exposure.
8. Knowledge of Nephrogenic Systemic Fibrosis and risk factors.

Objectives
The fellow will complete the following during the rotations to effect attainment of the above competencies, all under direct supervision of pediatric neuroradiology faculty:

1. Review pertinent patient history, physical findings and any antecedent imaging studies to determine that the requested examination/procedure is appropriate, and if not, take appropriate steps to contact the ordering physician.
2. Protocol a study to ensure a diagnosis with specific attention to potential radiation exposure, sequence and overall time.
3. Obtain procedural informed consent for pediatric cerebral angiography.
4. Provide appropriate post procedure counseling regarding follow-up and activity.
5. Communicate critical findings to appropriate referring physicians in a timely manner.
6. Complete MR safety course and attend radiation safety lecture.

**Assessment Methods:**
- Quarterly Faculty evaluations
- Technologist evaluations
- Direct observation
- Review of procedure log
- Documented successful completion of MR and radiation safety lectures

**Medical Knowledge**

**Goal**
Fellows must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological, and social-behavioral sciences as they pertain to pediatric neuroimaging, as well as the application of this knowledge to patient care. In pediatric neuroimaging, this competency has technical and cognitive components. Fellows are expected to:

**Competencies**
Technical and cognitive competency goals for this curriculum include:

**Technical Knowledge:**
1. Ability to recognize pertinent anatomy on head ultrasounds in the neonatal intensive care unit and recognize abnormalities.
2. Understanding the hazards of radiation exposure in the child and how to reduce that risk.
3. Ability to protocol CT studies and determine the need for contrast administration.
4. Ability to apply basic principles of image acquisition and reconstruction for multiplanar CT and CT angiography, as well as save those reconstructions in the PACs archive.
5. Ability to protocol MR studies for common indications in children at differing ages.
6. Ability to independently perform image reconstructions, editing, and saving of images to archive for MR angiography acquisitions.
7. Ability to assist in the performance of neuro-interventional procedures.
8. Ability to determine if a child potentially needs sedation.

**Cognitive Knowledge:**
1. Know the indications for performing a head ultrasound and be familiar with the anatomy and pathology in the sagittal and coronal plane for head ultrasounds.
2. Know how to recognize an immature brain, thalamic vasculopathy, intracranial hemorrhage and infarction on head ultrasounds.
3. Know when and how to use Doppler evaluation.
4. Know age related changes on CT including; maturation changes in the first 2 months of life, normal variation in CSF spaces, and range of normal for ventricular size.
5. Know the normal myelination patterns on MR on both T1 weighted and T2 weighted images.
6. Recognize normal developmental findings on MR, including the size of the corpus callosum and appearance of the pituitary gland.
7. Recognize time limits when scanning a sedated pediatric patient and be able to
optimize protocols accordingly.
8. Recognize when additional MR imaging planes, sequences or studies are needed.
9. Know the appropriate coil and resolution needed in order to optimize MR images.
10. Recognize and relate to a referring physician findings seen in common pediatric neuroimaging conditions including; new tumor, progressive tumor, stroke, intracranial hemorrhage, and unstable spine injury.
11. Know the common congenital malformations and metabolic disorders that involve the pediatric head and neck, brain and spine.
12. Recognize and relate to a referring physician any critical test or finding and document that discussion properly in the radiology report.
13. Understand artifacts and other factors that alter image quality and accuracy in head ultrasound, CT, and MR.

Objectives
The fellow will complete the following during the rotations to effect attainment of the above competencies, all under direct supervision of neurointerventional faculty:

1. Review a sufficient number of head ultrasounds under faculty supervision.
2. Actively protocol (epic) and check all MR studies before patient leaves the department.
3. Review and dictate a sufficient number of pediatric CT and MR studies under faculty supervision to attain technical and cognitive competency. This would include studies of the brain, head and neck, and spine.
4. Interpret a sufficient number of pediatric neuro-ultrasound, CT MPR, MR angiographic studies and CT angiographic studies of the head and neck to attain technical and cognitive competency, including 3-D volume rendered analysis, in pediatric patients.
5. Perform preliminary review of all exams to determine clinical and technical adequacy.
6. Monitor and participate in all pediatric neurointerventional procedures.
7. Bimonthly didactic lectures covering the field of pediatric neuroradiology.
8. Attend pediatric neuroradiology conferences which include; neuro-oncology tumor board and pediatric neurology conference. Additional participation in pediatric interdisciplinary conferences with neuroimaging expertise required.
9. Attend a dedicated neonatal head ultrasound lecture to be scheduled by the rotating fellows.
10. Attend pediatric neuroradiology lectures and journal club at UT southwestern.
11. Attend daily interpretation sessions with pediatric neuroradiology faculty involving review of the appropriate findings.
12. Prepare radiologic reports on all studies performed on the service.
13. Complete self directed study of recommended references.

Assessment Methods:
1. Quarterly Faculty evaluations
2. Quarterly fellowship evaluations
3. Protocol evaluation by attending
4. Attendance documentation at interdisciplinary and bimonthly didactic lectures
5. Quarterly review of procedure log and biannual review of dictated studies
6. Attendance at a national or local meeting

Practice- Based Learning and Improvement
Goal
Fellows must demonstrate the ability to investigate and evaluate their care of patients, to appraise
and assimilate scientific evidence, and to continuously improve patient care based on constant self-evaluation and life long learning. Fellows are expected to develop skills and habits to be able to:

**Competencies**
The list below reflects competencies that fall under Practice–based Learning and Improvement.

- Identify strengths, deficiencies and limits in one’s knowledge and expertise
- Set learning and improvement goals
- Identify and perform appropriate learning activities
- Systematically analyze practice, using quality improvement methods, and implement changes with the goal of practice improvement
- Locate, appraise and assimilate evidence from scientific studies related to their patients’ health problems
- Use information technology to optimize learning
- Participate in the education of patients, families, students, residents and other health professionals, as documented by evaluations of a resident’s teaching abilities by faculty and/or learners.
- Participate in a research project

**Objectives**
**Assessment**
1. Global faculty evaluation
2. Fellow conference evaluation
3. Attendance and participation at Journal club
4. Completion of a research project

**Systems Based Practice**

**Goal**
Residents must demonstrate an awareness of and responsiveness to the larger context and system of health care, as well as the ability to call effectively on other resources in the system to provide optimal health care. Residents are expected to:

**Competencies**
The list below reflects competencies that fall under Systems Based Practice.

- Work effectively in various health care delivery settings and systems relevant to their clinical specialty
- Coordinate patient care within the health care system relevant to their clinical specialty
- Incorporate considerations of cost awareness and risk-benefit analysis in patient care
- Advocate for quality patient care and optimal patient care systems
- Work in inter-professional teams to enhance patient safety and improve patient care quality (patient care/clinical conferences)
- Become involved in a Practice Quality Improvement project in conjunction with a faculty member

**Objectives**
**Assessment**
1. Global faculty evaluation
2. Attendance and participation at peer review meetings
3. Attendance and participation at Patient Care conference
4. Involvement in a Practice Quality Improvement project.

**Professionalism**

**Goal**
Residents must demonstrate a commitment to carrying out professional responsibilities and an adherence to ethical principles. Residents are expected to demonstrate:

**Competencies**

The list below reflects competencies that fall under Professionalism.

- Compassion, integrity, and respect for others
- Responsiveness to patient needs that supersedes self-interest
- Respect for patient privacy and autonomy
- Accountability to patients, society, and the profession
- Sensitivity and responsiveness to a diverse patient population, including but not limited to diversity in gender, age, culture, race, religion, disabilities, and sexual orientation

**Objectives**

**Assessment**

1. Global faculty evaluation
2. Patient-parent evaluation
3. HIPAA training completion

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**Interpersonal and Communication Skills**

**Goal**
Residents must demonstrate interpersonal and communication skills that result in the effective exchange of information and teaming with patients, their families, and professional associates. Residents are expected to:

**Competencies**

The list below reflects competencies that fall under Interpersonal and Communication Skills.

- Communicate effectively with patients and families across a broad range of socioeconomic and cultural backgrounds
- Communicate effectively with physicians, other health professionals, and health related agencies
- Work effectively as a member of leader of a health care team or other professional group
- Act in a consultative role to other physicians and health professionals
- Maintain comprehensive, timely, and understandable radiology reports

**Objectives**

**Assessment**

1. Global faculty evaluation
2. Technologist evaluation
3. Evaluation of quality of reports by supervising attending
4. Documentation of attendance at interdisciplinary conferences
5. Resident conference evaluations

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**Teaching Methods**
What teaching methods are you using on this rotation or educational experience? Fellows will learn through active participation under the direct supervision of faculty members. Didactic conferences/teaching are also required as stated below:

1. Self directed reading, see reading list below
2. Clinical conferences at Childrens Medical Center and didactic conferences at UT radiology. Two clinical conferences per week and 1 didactic lecture will be attended bimonthly
3. Participation in Journal club, divisional Patient Care Conference, peer review, and interdisciplinary conferences.
4. Participation in a research project
5. Participation in a Performance Quality Improvement project.

**Assessment Method (fellow)**

How do you measure the fellow’s performance on this rotation or educational experience? As stated above for specific competencies.

1. Faculty evaluation
2. 270 degree evaluation
3. Attendance at lectures and other outlined educational events.
4. Completion of a research project with a goal of presenting at a national meeting.

**Assessment Method (Program Evaluation)**

Evaluation of the educational experience  
1. Fellows evaluate the fellowship quarterly on a competency based evaluation, with the program as well as individual faculty is evaluated  
2. The fellow will meet with the program director quarterly to access the learning environment, discuss progress on requirements of fellowship

**Level of Supervision**

Fellow supervision  
1. The resident is under the direct supervision of a faculty member in attendance from 7:30 to 10:00pm.  
2. The fellow will address calls from residents after hours, with an attending always available for consultation.  
3. The faculty member will be directly involved in all angiography procedures.  
4. A supervision grid for Neuroradiology fellows is distributed at the beginning of the year.

**Educational Resources**

1. Barkovich and Raybaud, Pediatric Neuroimaging
2. Som, Head and Neck imaging
3. Tortori-Donati, Pediatric Neuroradiology Brain
4. Barkovich, Diagnostic imaging: Pediatric Neuroradiology