Florida Hospital Diagnostic Radiology Residency
Neuroradiology Goals and Objectives
Training Locations: Orlando

Many of the goals and objectives apply to all rotations and are listed below. Those goals that are more specific to a particular rotation are listed separately.

Neuroradiology Imaging Curriculum

The educational curriculum in Neuroradiology is comprised primarily of the rotations through the Neuroradiology Section at FH Orlando and where the Faculty provide direct training and supervision; as well as, a comprehensive series of lectures and conferences in Neuroradiology. Correlation is made on a case-by-case basis with other imaging modalities, facilitated by the PACs system. A series of interdepartmental conferences, grand rounds, Journal Clubs, meetings and other venues are expected to enhance the residents’ knowledge of Neuroradiology.

Because a full outline of disease entities and conditions is provided under each organ system elsewhere in the Radiology Residency Curriculum, a summarized curriculum for the Neuroradiology Section follows:

- A review of the principles of physics and instrumentation/technology that underlie CT, fluoroscopy procedures, and MRI imaging.
- A review of the normal anatomy, physiology, pathology and clinical conditions that are evaluated by CT, MR and fluoroscopy procedures.
- The indications, limitations, contraindications and optimal protocols for the various studies, diseases, conditions, as well as, the optimal sequencing of various imaging studies is reviewed.
- The use, delivery systems, timing and dosages of intraspinal and intravenous contrast material is reviewed including any appropriate patient preparation, indications, contraindications, and the physiology and pathophysiology of contrast materials. The recognition and treatment of any allergic, chemotoxic reactions, or other adverse reactions is reviewed. The characteristic appearance of contrast during imaging in various normal and pathologic conditions is reviewed.
- The ACR appropriateness criteria and the economic implications for the health care system and patient of various diagnostic pathways are reviewed as appropriate.

Training using the ACGME Six-Core Competencies:

Year 1: Neuroradiology

1) Patient Care: Residents should be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health.
   - Shows ability to interact with clinicians when reviewing Neuroradiology studies.
   - Shows ability to recommend additional imaging studies as appropriate to better assess neurologic and neurosurgical abnormalities.
Shows ability to use PACS and hospital information systems.

Monday, Wednesday and Friday focus on Brain and head/neck cross sectional imaging. Tuesday and Thursday, focus on Spine cross sectional imaging. Additionally, at least 2 CTA MRA (brain and/or neck) should be interpreted each shift.

Interpret and dictate approximately 15 studies per shift (the majority of which should be cross sectional studies as opposed to plain spine films)

Milestones include:
- Using established evidence based guidelines such as ACR appropriateness criteria
- Appropriately use the electronic health record to obtain relevant clinical information
- Competently perform basic fluoroscopically guided studies under indirect supervision
- Recognize and manage complications of basic procedures

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

- Demonstrates knowledge of normal/abnormal anatomy as seen on Neuroradiology studies including flouro, CT, plain films and MRI.
- Shows ability to recognize and describe common medical conditions as depicted on Neuroradiology imaging studies.
- Discuss the proper clinical and radiological indications for the following studies:
  a) Lumbar Puncture and Myelography
  b) XR brain, neck and spine
  c) CT brain, neck and spine
  d) MR brain, neck and spine
- State the physiologic properties, proper concentrations and proper indications for the use of the following contrast media:
  a) Ionic intravenous contrast media
  b) Non-ionic contrast media
  c) Gadolinium
- List the risk factors for allergic reaction to intravenous contrast media.
- State the proper assessment and treatment for allergic reactions to contrast media.
- Begin reviewing the core curriculum for Neuroradiology at the end of this document.

Medical Training:
Rotate in the Neuroscience Institute with Dr. Michael Bellow, 1-2 days per rotation
Rotate in the 3D lab at least ½ shift per rotation.

Expected Reading List
- Atlas of Anatomy: Head and Neuroanatomy
- Atlas of Anatomy: Neck and Internal Organs
- Atlas of Fetal and Perinatal Brain MR
- Brain Imaging: Pathology and Anatomy
- Diagnostic Imaging: Brain
- Diagnostic Imaging: Spine
- Expert ddx: Brain and Spine
- Neuroradiology the Requisites
- Neuroradiology Companion
- The Requisites: Neuroradiology

Milestones include:

- Selecting appropriate protocol and contrast agent/dose for basic flouro and CT and MR procedures
- Makes core observations
- Formulate differential diagnoses
- Recognize critical findings
- Differentiate normal from abnormal

3) Practice-Based Learning and Improvement: At the end of the rotation, the resident should be able to:

- Shows evidence of independent study using textbooks from expected reading list.
- Demonstrates appropriate follow up of interesting cases.
- Prepares teaching file of interesting cases.

Milestones include:

- Recognizes and manages contrast reactions
- Describes the mechanism of radiation injury and the ALARA concept
- Documents training in critical thinking skills and research design

4) Interpersonal Skills: Residents must demonstrate skills to:

- Interact with x-ray technologists, medical students, fellow residents, and attending radiologists.
- Interact with clinicians when reviewing cases involving Neuroradiology imaging studies.

Milestones include:

- Communicating information about imaging and examination results in routine, uncomplicated cases
- Obtains informed consent
- Adhere to transfer of care policies
- Generates accurate reports with appropriate elements for coding
- Communicates urgent and unexpected findings according to RSF policy

5) Professionalism: At the end of the rotation, the resident should be able to:

Residents must demonstrate ability to interact with patient/patient’s family/clinician when discussing significance of x-ray findings and their impact on patient care including what imaging studies may or may not be appropriate.

Milestones include:

- Recognizing the importance and priority of patient care and advocates for patient interests
- Fulfils work related responsibilities
- Recognizes personal limitations and seeks help when appropriate
- Responds appropriately to constructive criticism
- Maintains patient confidentiality
- Attends required meetings

6) **Systems-Based Practice:** At the end of the rotation, the resident should be able to:
   - Shows ability to interact with clinicians regarding cost effective and streamlined patient evaluation for differing clinical entities.
   - Able and willing to participate in clinical conferences in which imaging studies used to guide patient care/evaluation.

Milestones include:
- Describes departmental QI initiatives
- Describes the departmental QA system

**Year 2: Neuroradiology**

1) **Patient Care:** At the end of the rotation, the resident should be able to:
   - Refine interpretive skills with complex pathology
   - Better perform the Neuroradiology imaging procedures listed in the first rotation
   - Identify the normal and abnormal anatomy at fluoroscopy and modify the technique or change the patient’s position or obtain special views or perform special maneuvers to obtain diagnostic myelographic images
   - Decreasing fluoroscopic time needed to perform a study without compromising diagnostic acumen
   - Demonstrate more confidence when evaluating and integrating data from studies (CT, MRI, Xray and nuclear medicine) of the head, neck and spine to make recommendations to the referring physician about more appropriate or additional diagnostic studies needed for evaluation of the patient’s abnormality
   - Be able to direct the choice of imaging modality and protocol emergent studies
   - Understand when referral or other imaging modalities is necessary
   - Understand the basic physics of MR including TR, TE, T1W, Spin echo, Gradient Recall Echo imaging, and Inversion Recovery
   - Learn the basic principles of contrast distribution, particularly as applied to arterial and venous phase scanning
   - Protocol and monitor MR studies. Modify protocols when appropriate
   - Understand the principle of a saline chaser
   - Learn to recognize and treat contract reactions
   - Develop skills in interpretation of basic MR pathology
     - Learn the appropriate format for dictation of MR reports
     - Monday, Wednesday and Friday focus on Brain and head/neck cross sectional imaging. Tuesday and Thursday, focus on Spine cross sectional imaging. Additionally, at least 2 CTA MRA (brain and/or neck) should be interpreted each shift.
     - Interpret and dictate approximately 20 studies per shift (the majority of which should be cross sectional studies as opposed to plain spine films)

Milestones include:
- Recommends appropriate imaging of common conditions independently
- Competently performs intermediate procedures (epidural blood patch, steroid injection)
Recognizes and manages complications of intermediate procedures
- Once respective neuroradiology attendings deem the resident competent at performing fluoroscopically guided procedures, the resident may opt out of procedures for the whole or half of the shift in order to focus on reading studies.

2) Medical Knowledge: At the end of the rotation, the resident should be able to:
• Demonstrate review and/or retention of knowledge requirements set forth for the first year rotations.
• Learn the basic concepts of surgical procedures, their indications, their normal radiographic appearance, and finally the radiographic appearance of their complications. In addition to the traditional surgical procedures, this would include new procedures such as new epilepsy surgical procedures.
• Describe and/or discuss Neuroradiology pathology in specific detail.
• Reviewed the entire core curriculum Neuroradiology at the end of this document.
• Learn the radiographic appearance of specific diseases on the following procedures:
  - Xray
  - CT
  - MR
  - Myelography
• Understand the basic physics of MR including TR, TE, T1W, Spin echo, Gradient Recall Echo imaging, and Inversion Recovery.
• Learn the basic principles of contrast distribution, particularly as applied to arterial and venous phase scanning.
• Protocol and monitor MR studies. Modify protocols when appropriate.
• Understand the principle of a saline chaser.
• Develop skills in interpretation of basic MR pathology.
• Learn the appropriate format for dictation of MR reports.

Medical Training:
  Rotate in the Neuroscience Institute with Dr. Michael Bellew, 1-2 days per rotation

Expected Reading List:
• Diagnostic Imaging: Head and Neck
• Diagnostic Imaging: Pediatric Neuroradiology
• Diseases of the Brain, Head and Neck
• Expertddx: Head and Neck
• Head and Neck Imaging
• Neuroimaging Clinics
• Pediatric Neuroimaging
• Spine Imaging: Case review series

Milestones include:
- Selects appropriate protocols and contrast agent/dose for intermediate imaging like basic neuro-MR
- Makes secondary observations
- Narrows differential diagnosis
- Describes management options

3) **Practice-Based Learning and Improvement**: At the end of the rotation, the resident should be able to:
   - Shows evidence of independent study using textbooks from expected reading list.
   - Demonstrates appropriate follow up of interesting cases.
   - Prepares teaching file of interesting cases.
   - Is able and willing to make detailed presentations of Neuroradiology studies at both intra and interdepartmental conferences.
   - Upon request, participates in educational courses for clinicians, medical students, and fellow residents.

Milestones include:
- Re-demonstrates recognition and management of contrast reactions
- Accesses resources to determine exam specific average radiation dose info
- Accesses resources to determine safety of implanted devices and retained metal
- Works with faculty mentors to identify potential scholarly projects

4) **Interpersonal Skills**: Residents must demonstrate skills to:
   - Interact with x-ray technologists, medical students, fellow residents, and attending radiologists.
   - Interact with clinicians when reviewing cases involving Neuroradiology studies.
   - Can participate in administrative and scholarly committees when asked.

Milestones include:
- Communicates under direct supervision in challenging circumstances
- Communicates under direct supervision difficult information such as errors, complications, adverse events, and bad news
- Efficiently generates clear and concise reports that do not require substantive faculty member correction on routine cases
- Communicates findings and recommendations clearly and concisely

5) **Professionalism**: At the end of the rotation, the resident should be able to:
   Residents must demonstrate ability to interact with patient/patient’s family/clinician when discussing significance of Neuroradiology findings and their impact on patient care including what imaging studies may or may not be appropriate.

Milestones include:
- Becomes an effective health care team member
- Continues to demonstrates professional behaviors described under year 1

6) **Systems-Based Practice**: At the end of the rotation, the resident should be able to:
   - Shows ability to interact with clinicians regarding cost effective and streamlined patient evaluation for differing clinical entities.
   - Able and willing to participate in clinical conferences in which imaging studies used to guide patient care/evaluation.
• Is able and willing to organize and present case conferences/didactic sessions as directed and supervised by radiology staff.

Milestones include:
- Incorporating QI into clinical practice
- Participates in the QA department process
- States relative cost of common procedures

**Year 3: Neuroradiology**

1) **Patient Care:** At the end of the rotation, the resident should be able to:

• Perform, interpret, and dictate the Neuroradiology studies with sufficient competence to be able to practice independently.
• Continue to expand the knowledge of CT and MR anatomy and pathology begun in the first two rotations.
• Assist technical staff in the performance of CT angiography and its interpretation.
• Refine MRI interpretive skills with complex pathology.
• Understand the principles of magnetic resonance angiography.
• Be able to identify life-threatening findings, particular with complex brain and spine MRI pathologies
• Provide emergent provisional interpretation as needed.
• Be able to direct the choice of imaging modality and protocol emergent studies.
• Understand when referral or other imaging modalities is necessary.
• Become a more autonomous consultant and teacher.
• Monday, Wednesday and Friday focus on Brain and head/neck cross sectional imaging. Tuesday and Thursday, focus on Spine cross sectional imaging. Additionally, at least 2 CTA MRA (brain and/or neck) should be interpreted each shift.
• Interpret and dictate approximately 35 studies per shift as a third year (the majority of which should be cross-sectional studies as opposed to plain spine films)

Milestones include:
- Recommends appropriate imaging of uncommon conditions independently
- Integrates current research and literature with guidelines, taking into consideration cost effectiveness and risk benefit analysis, to recommend imaging
- Competently performs advanced procedures
- Recognizes and manages complications of advanced procedures
- Independently performs fluoro studies
- During 3rd year, once the respective neuroradiology attendings deem the resident competent at performing fluoroscopically guided procedures, the resident may opt out of procedures for the whole or ½ of the shift in order to focus on reading studies.

2) **Medical Knowledge:** At the end of the rotation, the resident should be able to:

• Demonstrate review and/or retention of knowledge requirements set forth for the first two years.
• Understand the role and basic principles of newly evolving and potential future new examinations such as CT Angiography, CT Perfusion, MR angiography, CT/PET, MR
spectroscopy and MR perfusion and molecular imaging in the evaluation of Neurologic
disease.
- Understand the uses, interpretation, and limitation of techniques that have been replaced e.g.
  air cisternography
- Assist in preparation and presentation of interdepartmental case conferences.

Medical Training:
  Rotate in the Neuroscience Institute with Dr. Michael Bellew, 1 days per rotation

Expected Reading List:
- Brain Imaging: Case review series
- Diagnostic Cerebral Angiography
- Functional Neuroradiology
- Imaging of the Temporal Bone
- Oral and Maxillofacial Radiology
- Oral Radiology
- Teaching Files: Brain and Spine
- Temporal Bone Imaging

Milestones include:
- Selects appropriate protocols and contrast agent/dose for advanced imaging
- Demonstrates knowledge of physical principles to optimize imaging quality
- Independently modifies protocols as determined by clinical circumstances
- Provides accurate, focused, and efficient interpretations
- Prioritizes differential diagnoses and recommends management
- Makes subtle observations
- Suggests a single diagnosis when appropriate
- Integrates current research and literature with guidelines to recommend management

3) Practice-Based Learning and Improvement: At the end of the rotation, the resident should be
able to:
- Shows evidence of independent study using textbooks from expected reading list.
- Demonstrates appropriate follow up of interesting cases.
- Prepares teaching file of interesting cases.
- Is able and willing to make detailed presentations of Neuroradiology studies at both intra
  and interdepartmental conferences.
- Upon request, participates in educational courses for clinicians, medical students, and fellow
  residents.
- Upon request, participates in educational activities at the local/national level.

Milestones include:
- Re demonstrates recognition and management of contrast reactions
- Communicates the relative risk of exam specific radiation exposure to patients and
  practitioners. Applies principles of image Gently and Wisely
- Communicates MR safety of common implants and retained foreign bodies to patients and
  practitioners
- Selects appropriate sedation agent and dose of conscious sedation

4) **Interpersonal Skills:** Residents must demonstrate skills to:
   - Interact with x-ray technologists, medical students, fellow residents, and attending radiologists.
   - Interact with clinicians when reviewing cases involving Neuroradiology imaging studies.
   - Can participate in administrative and scholarly committees when asked.
   - Can serve as a liaison between our department with both other radiology departments and other specialty groups in our institution.

Milestones include:
   - Communicates without supervision in challenging circumstances
   - Efficiently generates clear and concise reports that do not require substantive faculty member correction on all cases
   - Communicates appropriately under stressful situations

5) **Professionalism:** At the end of the rotation, the resident should be able to:
   - Residents must demonstrate ability to interact with patient/patient’s family/clinician when discussing significance of x-ray findings and their impact on patient care including what imaging studies may or may not be appropriate.
   - Can participate in activities relative to the role of Neuroradiology imaging both to the medical community and the general public.
   - Is perceived as a role model for radiology from both within and outside the department.

Milestones include:
   - Is an effective team leader promoting patient welfare, patient autonomy, and social justice
   - Serves as a role model for professional behavior

6) **Systems-Based Practice:** At the end of the rotation, the resident should be able to:
   - Shows ability to interact with clinicians regarding cost effective and streamlined patient evaluation for differing clinical entities.
   - Able and willing to participate in clinical conferences in which imaging studies used to guide patient care/evaluation.
   - Is able and willing to organize and present case conferences/didactic sessions as directed and supervised by radiology staff.
   - Is able and willing to participate in activities at the local/national level under staff supervision.

Milestones include:
   - Identifying and completing a systems based practice project

**Assessment tools for all Neuro Rotations:**
   - Reviewing rotation curriculum, goals and objectives, as a benchmark for progress of resident, and success of faculty, is educating the resident. Discussion regarding the specifics of the document is encouraged to promote improvement of the resident’s
learning and the program’s teaching. Positive points and deficiencies and unfulfilled goals and objectives should be discussed by the residents and faculty

• Global ratings by faculty including rotation evaluation sheet
• Resident’s performance discussing unknown cases in conference (one of the metrics on Global Evaluation sheet is particularly important)
• Placing cases in teaching file (one of the metrics on Global Evaluation)
• Conference attendance logs
• In-service examination
• 360 degree evaluations – supervisory technologists in radiology core
• Fluoroscopy time log submitted by physicist to Program Director
• Self-assessment based on Rad Primer quizzes
• Future plans: evaluation of teaching by medical students

ACGME Required Documentation of Case & Procedure Logs:
- CTA/MRA
- MRI Brain
- MRI Spine
- Lumbar Puncture
- Myelogram
- Discogram
- Epidural Blood Patch
- Steroid Injection

Year 4: Neuroradiology

1) Patient Care: At the end of the rotation, the resident should be able to:
• Perform, interpret, and dictate the Neuroradiology studies with sufficient competence to be able to practice independently.
• Continue to expand the knowledge of CT and MR anatomy and pathology begun in the first two rotations.
• Assist technical staff in the performance of CT angiography and its interpretation.
• Refine MRI interpretive skills with complex pathology.
• Understand the principles of magnetic resonance angiography.
• Be able to identify life-threatening findings, particular with complex brain and spine MRI pathologies
• Provide emergent provisional interpretation as needed.
• Be able to direct the choice of imaging modality and protocol emergent studies.
• Understand when referral or other imaging modalities is necessary.
• Become a more autonomous consultant and teacher.
• Monday, Wednesday and Friday focus on Brain and head/neck cross sectional imaging. Tuesday and Thursday, focus on Spine cross sectional imaging. Additionally, at least 2 CTA MRA (brain and/or neck) should be interpreted each shift.
• Interpret and dictate approximately 50 studies as a 4th year (the majority of which should be cross sectional studies as opposed to plain spine films)

Milestones include:
- Recommends appropriate imaging of uncommon conditions independently
- Integrates current research and literature with guidelines, taking into consideration cost effectiveness and risk benefit analysis, to recommend imaging
- Competently performs advanced procedures
- Recognizes and manages complications of advanced procedures
- Independently performs fluoro studies
- During 4th year the resident will need to perform fluoroscopic procedures independently for the entire shift.

2) Medical Knowledge: At the end of the rotation, the resident should be able to:
   - Demonstrate review and/or retention of knowledge requirements set forth for the first two years.
   - Understand the role and basic principles of newly evolving and potential future new examinations such as CT Angiography, CT Perfusion, MR angiography, CT/PET, MR spectroscopy and MR perfusion and molecular imaging in the evaluation of Neurologic disease.
   - Understand the uses, interpretation, and limitation of techniques that have been replaced e.g. air cisternography
   - Assist in preparation and presentation of interdepartmental case conferences.

Medical Training:
   Rotate in the Neuroscience Institute with Dr. Michael Bellew, 1 days per rotation

Expected Reading List:
   - Brain Imaging: Case review series
   - Diagnostic Cerebral Angiography
   - Functional Neuroradiology
   - Imaging of the Temporal Bone
   - Oral and Maxillofacial Radiology
   - Oral Radiology
   - Teaching Files: Brain and Spine
   - Temporal Bone Imaging

Milestones include:
   - Selects appropriate protocols and contrast agent/dose for advanced imaging
   - Demonstrates knowledge of physical principles to optimize imaging quality
   - Independently modifies protocols as determined by clinical circumstances
   - Provides accurate, focused, and efficient interpretations
   - Prioritizes differential diagnoses and recommends management
   - Makes subtle observations
   - Suggests a single diagnosis when appropriate
   - Integrates current research and literature with guidelines to recommend management

3) Practice-Based Learning and Improvement: At the end of the rotation, the resident should be able to:
   - Shows evidence of independent study using textbooks from expected reading list.
   - Demonstrates appropriate follow up of interesting cases.
- Prepares teaching file of interesting cases.
- Is able and willing to make detailed presentations of Neuroradiology studies at both intra and interdepartmental conferences.
- Upon request, participates in educational courses for clinicians, medical students, and fellow residents.
- Upon request, participates in educational activities at the local/national level.

Milestones include:
- Re demonstrates recognition and management of contrast reactions
- Communicates the relative risk of exam specific radiation exposure to patients and practitioners. Applies principles of image Gently and Wisely
- Communicates MR safety of common implants and retained foreign bodies to patients and practitioners
- Selects appropriate sedation agent and dose of conscious sedation

4) Interpersonal Skills: Residents must demonstrate skills to:
- Interact with x-ray technologists, medical students, fellow residents, and attending radiologists.
- Interact with clinicians when reviewing cases involving Neuroradiology imaging studies.
- Can participate in administrative and scholarly committees when asked.
- Can serve as a liaison between our department with both other radiology departments and other specialty groups in our institution.

Milestones include:
- Communicates without supervision in challenging circumstances
- Efficiently generates clear and concise reports that do not require substantive faculty member correction on all cases
- Communicates appropriately under stressful situations

5) Professionalism: At the end of the rotation, the resident should be able to:
- Residents must demonstrate ability to interact with patient/patient’s family/clinician when discussing significance of x-ray findings and their impact on patient care including what imaging studies may or may not be appropriate.
- Can participate in activities relative to the role of Neuroradiology imaging both to the medical community and the general public.
- Is perceived as a role model for radiology from both within and outside the department.

Milestones include:
- Is an effective team leader promoting patient welfare, patient autonomy, and social justice
- Serves as a role model for professional behavior

6) Systems-Based Practice: At the end of the rotation, the resident should be able to:
- Shows ability to interact with clinicians regarding cost effective and streamlined patient evaluation for differing clinical entities.
- Able and willing to participate in clinical conferences in which imaging studies used to guide patient care/evaluation.
• Is able and willing to organize and present case conferences/didactic sessions as directed and supervised by radiology staff.
• Is able and willing to participate in activities at the local/national level under staff supervision.

Milestones include:
- Identifying and completing a systems based practice project

**Assessment tools for all Neuro Rotations:**
• Reviewing rotation curriculum, goals and objectives, as a benchmark for progress of resident, and success of faculty, is educating the resident. Discussion regarding the specifics of the document is encouraged to promote improvement of the resident’s learning and the program’s teaching. Positive points and deficiencies and unfulfilled goals and objectives should be discussed by the residents and faculty
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**ACGME Required Documentation of Case & Procedure Logs:**
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- MRI Brain
- MRI Spine
- Lumbar Puncture
- Myelogram
- Discogram
- Epidural Blood Patch
- Steroid Injection
Neuroradiology Imaging Curriculum based off the ABR Core Exam

1) Technique and Indications: Understand the Basic Principles Behind and Indications for Use of Methods of Examination

   a) Radiography
   b) CT
   c) MR
   d) Ultrasound
   e) Angiography
   f) Advanced imaging techniques
      i) MRA
      ii) CTA
      iii) CT perfusion
      iv) MR perfusion
      v) Diffusion-weighted imaging
      vi) MR spectroscopy
      vii) MR functional imaging
      viii) Diffusion tensor imaging
      ix) Myelography
      x) Cisternography
      xi) PETCT and other nuclear medicine imaging techniques

2) Brain
   a) Normal anatomy
      i) Brain parenchyma
      ii) Ventricular system
      iii) Extr-axial spaces
iv) Pial and dural coverings
v) Cranial nerves
vi) Arterial and venous structures
vii) Skull and surrounding soft tissues
viii) Intracranial arterial and venous structures on imaging studies (1) CTA  (2) MRA  (3) Catheter angiography  Understand the function of the anatomic structures and how they are affected by various pathologies.

b) White matter disease (inherited)
   i) Adrenoleukodystrophy
   ii) Metachromatic leukodystrophy
   iii) Alexander disease
   iv) Canavan disease
   v) Krabbe disease
   vi) Pelizaeus-Merzbacher disease
   vii) PKU and other amino acid disorders

c) Neurodegenerative disorders
   i) The aging brain
   ii) Alzheimer disease
   iii) Other cortical dementias
   iv) Parkinson disease
   v) Cerebellar degeneration
   vi) Amyotrophic lateral sclerosis
   vii) Wallerian degeneration
   viii) Huntington disease
   ix) Fahr disease
   x) Wilson disease
xi) Hallervorden-Spatz disease

xii) Leigh disease

xiii) Tay-Sachs disease

xiv) Hurler syndrome

xv) MELAS syndrome

d) Infection/inflammation/demyelinating

i) Viral

ii) Bacterial

iii) Mycobacterial

iv) Fungal

v) Parasitic

vi) Prion infections

vii) Congenital and neonatal infections (1) CMV (2) Toxoplasmosis (3) HSV (4) HIV (5) Varicella (6) Rubella (7) Enterovirus

viii) Non-infectious inflammatory processes (1) Chemical meningitis (2) Limbic encephalitis (3) Lymphocytic hypophysitis (4) Granulomatous processes (a) Sarcoidosis (b) Histiocytosis

ix) White matter inflammatory conditions (1) Multiple sclerosis (2) Viral and post-viral demyelination

e) Congenital/developmental

i) Chiari malformations

ii) Cephaloceles

iii) Corpus callosum anomalies

iv) Holoprosencephalies

v) Septo-optic dysplasia

vi) Sulcational and migrational disorders

vii) Posterior fossa malformations
viii) Cysts

ix) Neurocutaneous syndromes
   1. NF I and II
   2. Tuberous sclerosis
   3. Von Hippel-Lindau
   4. Sturge-Weber
   5. Basal cell nevus syndrome
   7. Wyburn-Mason syndrome
   8. Rendu-Osler-Weber syndrome
   9. Ataxia-telangiectasia
   10. Neurocutaneous melanosis

x) Normal patterns of cortical and white matter development, and deviations from normal
   1. Cortical dysplasias
   2. Hemimegalencephaly
   Recognize and be familiar with the imaging appearance and clinical presentation of mesial temporal sclerosis and other seizure-associated conditions.

f) Cyst and hydrocephalus
   i) Communicating and obstructive hydrocephalus
   ii) Arachnoid cyst
   iii) Colloid cyst
   iv) Rathke cleft cyst
   v) Neuroepithelial cyst
   vi) Disorders of CSF hydrodynamics
      1. Increased intracranial pressure from hydrocephalus and shunt malfunction
      2. Intracranial hypotension
      3. Complications of CSF diversion procedures


g) Tumors and Tumor-like Conditions

i) Locations
   1. Parenchymal
   2. Meningeal
   3. Pineal region
   4. Intraventricular
   5. Sellar/suprasellar
   6. Cerebellopontine angle
   7. Skull base
   8. Cavernous sinus
   9. Foramen magnum

   ii) Tumor types
      1. Low-grade and malignant astrocytomas
      2. Glioblastoma multiforme
      3. Gliosarcoma
      4. Gliomatosis cerebri
      5. Pleomorphic xanthoastrocytoma
      6. Pilocytic astrocytoma
      7. Subependymal giant cell astrocytoma
. (8) Oligodendroglioma
. (9) Ependymoma
. (10) Subependymoma
. (11) Choroid plexus tumors
. (12) Meningioma
. (13) Hemangiopericytoma
. (14) Hemangioblastoma
. (15) Ganglioglioma
. (16) Gangliocytoma
. (17) Central neurocytoma
. (18) DNET
. (19) Lhermitte-Duclos
. (20) Germ cell tumors
. (21) PNET
. (22) Lymphoma
. (23) Leukemia
. (24) Myeloma
. (25) Schwannoma
. (26) Neurofibroma
. (27) Malignant peripheral nerve sheath tumor
. (28) Craniopharyngioma
. (29) Pituitary adenoma
. (30) Chordoma
. (31) Chondrosarcoma
. (32) Dermoid
. (33) Epidermoid
. 34) Lipoma

h) Trauma
. i) Subarachnoid hemorrhage
. ii) Epidural and subdural hematoma
. iii) Contusion
. iv) Axonal Injury
. v) Diffuse cerebral edema
. vi) Herniation patterns
. vii) Complications and sequelae of head trauma (1) Ischemia (2) Infarction (3) Secondary hemorrhage (4) Pneumocephalus (5) CSF leak (6) Encephalomalacia
. viii) Non-accidental trauma

i) Vascular pathology: Clinical presentation of, complications from, and treatment options for:
. iii) Stroke (1) Arterial (2) Venous (3) Vasculitic—including specific patterns (4) Hypoxic-anoxic encephalopathy (5) Vasculitis (6) Posterior reversible encephalopathy syndrome (7) Vascular occlusive disease
. iv) Intracranial hemorrhage
. (1) Age of blood products on CT and MRI
. (2) Patterns of hemorrhage with regard to causative factors
   (a) Trauma
   (b) Neoplasm
   (c) Aneurysm
   (d) Vascular malformation
3) Spine
   a) Normal anatomy
      i) Bony vertebral anatomy
      ii) Intervertebral discs
      iii) Facet joints
      iv) Ligaments
      v) Spinal cord
      vi) Nerve roots and plexi
      vii) Meninges
      viii) Intradural and extradural spaces
      ix) Surrounding soft tissues
   b) Congenital/developmental
      i) Chiari malformations
      ii) Spinal dysraphism (open and occult)
      iii) Tethered cord
      iv) Caudal regression syndrome
      v) Spinal lipomas
      vi) Sacral meningocele
      vii) Sacral teratoma
      viii) Split notochord syndrome
ix) Enterogenous cyst

x) Scoliosis

xi) Fusion anomalies

xii) Segmentation anomalies

xiii) NFI

xiv) NFII

xv) Von Hippel-Lindau

c) Degenerative disease

i) Normal aging

ii) Disc degeneration

iii) Disc bulges and herniations (including appropriate descriptive terminology)

iv) Spondylosis

v) Arthrosis

vi) Synovial cyst

vii) Spondylolisthesis

viii) Spondylolysis

ix) Spinal stenosis

x) OPLL

xi) DISH

xii) Scheuermann disease

xiii) Arthritides

xiv) Postoperative spine

d) Infection/inflammatory/demyelinating in specific anatomic sites

i) Arachnoiditis

ii) Diskitis
iii) Osteomyelitis

iv) Epidural infection

v) Subdural infection

vi) Subarachnoid infection

vii) Meningitis

viii) Myelitis

ix) Spinal cord abscess

e) Infection/inflammatory/demyelinating-specific pathologies

i) Bacterial

ii) Mycobacterial

iii) Fungal

iv) Viral

v) Parasitic

vi) Granulomatous

vii) Transverse myelitis

viii) HIV myelopathy

ix) Radiation-induced myelitis

x) ADEM

xi) Multiple sclerosis

f) Trauma

i) Cervical, thoracic, and lumbosacral fracture

ii) Osteoporotic compression fracture

iii) Subluxation

iv) Dislocation

v) Spinal cord injury and its sequelae

vi) Epidural and subdural hematoma

vii) Plexus injuries

g) Vascular

i) Spinal cord ischemia and infarction (arterial & venous)

ii) AVMs

   (1) Dural AVF

   (2) Glomus malformations

   (3) Juvenile type malformations

   (4) Intradural extramedullary AVF

   (5) Cavernous angiomas

h) Tumors and tumor like masses: benign and malignant neoplasms of the vertebral column, spinal cord, and nerves

i) Schwannoma

ii) Neurofibroma

iii) Malignant peripheral nerve sheath tumor
iv) Meningioma
v) Dermoid
vi) Epidermoid
vii) Paraganglioma
viii) Astrocytoma
ix) Ependymoma
x) Hemangioblastoma
xi) Lymphoma
xii) Leukemia
xiii) Myeloma
xiv) Plasmacytoma
 xv) Chordoma
xvi) Chondrosarcoma
xvii) Osteosarcoma
xviii) Fibrosarcoma
xix) Ewing sarcoma
xx) Hemangiomas
xxi) Osteoblastoma
xxii) Osteoid osteoma
xxiii) Osteochondroma
xxiv) Giant cell tumor
xxv) Aneurysmal bone cyst
xxvi) Angiolipoma
xxvii) Eosinophilic granuloma
xxviii) Pathologic fractures
xxix) Metastatic disease

i) Miscellaneous

. i) Arachnoid cyst

. ii) Parameningeal cyst

iii) Spinal cord herniation

4) Extracranial Head and Neck

a) Normal anatomy—bone and soft tissues

   i) Orbits

   ii) Paranasal sinuses

   iii) Facial bones

   iv) Skull base

   v) Temporal bone, including TMJ

   vi) Nasal cavity

   vii) Oral cavity

   viii) Oropharynx

   ix) Nasopharynx

   x) Hypopharynx

   xi) Larynx

   xii) Neck spaces (suprahyoid and infrahyoid)

   . xiii) Classification of lymph node level

b) Normal anatomy—vascular: normal extracranial arterial and venous structures on vascular imaging modalities

   i) CTA

   ii) MRA

   iii) US

   iv) Catheterangiography

c) Infectious/inflammatory/granulomatous

   i) Orbit

     (1) Preseptal cellulitis
(2) Orbital cellulitis
. (3) Subperiosteal phlegmon and abscess
. (4) Extension of fungal sinus disease
. (5) Pseudotumor
. (6) Thyroid orbitopathy
. (7) Sarcoid
. (8) Lacrimal adenitis
. (9) Wegener granulomatosis
. (10) Tolosa-Hunt
. (11) Optic neuritis

ii) Sinonasal cavity/facial bones

. (1) Osteomyelitis
. (2) Acute sinusitis
. (3) Chronic sinusitis
. (4) Complications of sinusitis
. (5) Fungal infection  (a) Immunocompromised and immunocompetent patients  (b) Allergic fungal sinusitis
. (6) Polyps
. (7) Polyposis
. (8) Mucocele
. (9) Retention cyst
. (10) Antrochoanal polyp
. (11) Sarcoid
. (12) Wegener granulomatosis

iii) Skull base and temporal bone
. (1) Osteomyelitis
. (2) Necrotizing otitis externa
. (3) Petrous apicitis
. (4) Otitis externa
. (5) Otitis media
. (6) Mastoiditis
. (7) Cholesteatoma
. (8) Ramsey-Hunt syndrome
. (9) Labyrinthitis
. (10) Labyrinthitis ossificans
. (11) Bell’s palsy
. (12) Otosclerosis

iv) Oral cavity, pharynx, supra- and infrahyoid neck (1) Odontogenic infections (2) Infections of salivary gland origin (3) Tonsillitis (4) Adenoiditis (5) Cellulitis, phlegmon, and abscess involving neck spaces (6) Sjögren’s disease (7) Non-neoplastic lymphadenopathy (a) Viral (b) Bacterial (c) Mycobacterial (d) Granulomatous (8) Thyroiditis (acute and chronic, e.g., Hashimoto)

d) Tumors and tumor-like conditions

i) Orbit (1) Optic nerve sheath meningioma (2) Optic glioma (3) Lacrimal gland tumors (4) Rhabdomyosarcoma (5) Retinoblastoma (6) Ocular hamartoma (7) Uveal melanoma (8) Metastases (9) Cavernous hemangiomas (10) Vasoformative lesions (a) Infantile hemangiomas (b) Lymphatic/venous malformations (11) Lymphoma/leukemia

ii) Sinonasal cavity and facial bones

. (1) Squamous cell carcinoma
. (2) Sinonasal Undifferentiated carcinoma
. (3) Lymphoma
. (4) Melanoma
. (5) Esthesioneuroblastoma
(6) Inverted papilloma
(7) Minor salivary gland neoplasms
(8) Schwannoma, meningioma
(9) Juvenile nasal angiofibroma
(10) Vasoformative lesions (a) Infantile hemangiomas  (b) Lymphatic/venous malformations (c) Arteriovenous malformations
(11) Hemangiopericytoma
(12) Rhabdomyosarcoma
(13) Osteoma
(14) Osteoblastoma
(15) Giant cell Tumor
(16) Rhabdomyosarcoma
(17) Malignant fibrous histiocytoma
(18) Plasmacytoma
(19) Paget disease
(20) Fibrous dysplasia
(21) Ossifying fibroma and other fibroosseous lesions
(22) Myxoma
(23) Chondroma
(24) Chondrosarcoma
(25) Osteosarcoma
(26) Ewing sarcoma
(27) Ameloblastoma
(28) Aneurysmal bone cyst
(29) Odontogenic cysts and tumors
(30) Langerhans cell histiocytosis

(31) Metastases

iii) Skull base and temporal bone

. (1) Hemangiomas
. (2) Angiofibroma
. (3) Schwannoma
. (4) Neurofibroma
. (5) Teratoma
. (6) Dermoid
. (7) Pituitary adenoma
. (8) Germinoma
. (9) Lymphoma
. (10) Nasopharyngeal carcinoma
. (11) Salivary gland tumors
. (12) Chloroma
. (13) Plasmacytoma
. (14) Metastases
. (15) Myeloma
. (16) Chondrosarcoma
. (17) Chordoma
. (18) Endolymphatic sac tumor
. (19) Paraganglioma
. (20) Adenoma
. (21) Neuroma
. (22) Langerhans cell histiocytosis/eosinophilic granuloma
. (23) Osteoblastoma
. (24) Giant cell tumor
. (25) Pigmented villonodular synovitis
. (26) Rhabdomyosarcoma
. (27) Paget disease
. (28) Fibrous dysplasia
. (29) Osteoma/exostosis
. (30) Meningioma

iv) Oral cavity, pharynx, supra, and infrahyoid neck
  . (1) Malignant adenopathy
  . (2) Lymphoma
  . (3) Squamous cell carcinoma
  . (4) Schwannoma
  . (5) Neuroma
  . (6) Neurofibroma
  . (7) Goiter
  . (8) Thyroid neoplasms
  . (9) Parathyroid neoplasms
  . (10) Salivary gland neoplasms
  . (11) Vasoformative lesions  (a) Infantile hemangiomas  (b) Lymphatic/venous malformations  (c) Arteriovenous malformations
  . (12) Paraganglioma
  . (13) Lipoma/liposarcoma

  e) Cystic lesions of the head and neck
    . i) Branchial cleft cysts (Types I-IV)
Thyroglossal duct cyst

Ranula

Dermoid/epidermoid

Thymic cyst

Cystic hygroma (lymphangioma)

Laryngopyocele

Cystic lymph nodes

Trauma

Orbital fractures

Soft tissue injuries of the globe and orbit

Maxillofacial fracture

Mandibular fractures

TMJ fracture/dislocation

Skull base fractures

Temporal bone fractures (including classification systems)

Longitudinal/transverse

Otic capsule spared/involved

Laryngeal fractures

Vascular

Orbit

Venous varix

Hemangiomas

Lymphangioma

Superior ophthalmic vein thrombosis

Carotid-cavernous fistula

Sinonasal cavity/facial bones

Skull base/temporal bone

Dissection

Aneurysm

Pseudoaneurysm

Aberrant internal carotid artery

Persistent stapedial artery

Jugular dehiscence

Jugular diverticulum

High-riding jugular bulb

Oral cavity, pharynx, supra- and infrahyoid neck

Medial course of internal carotid artery

Dissection

Thrombosis

Occlusion

Pseudoaneurysm

Fibromuscular dysplasia

Aneurysm

Congenital
i) Orbit
   . (1) Sphenoid wing dysplasia
   . (2) Septooptic dysplasia
   . (3) Coloboma
   . (4) Congenital glaucoma
   . (5) PHPV
   . (6) Coats disease
   . (7) Toxocariasis
   . (8) Infantile hemangiomas
   . (9) Lymphatic malformation
   . (10) Dermoid

ii) Sinonasal cavity/facial bones
   . (1) Hypoplasia
   . (2) Aplasia
   . (3) Down syndrome
   . (4) Kartagener syndrome
   . (5) Cephaloceles/nasal glioma
   . (6) Choanal atresia

iii) Skull base/temporal bone
   . (1) Cephaloceles
   . (2) Arachnoid cyst
   . (3) EAC atresia
   . (4) Aberrant facial nerve course
   . (5) Congenital cholesteatoma
   . (6) Ossicular deformities
   . (7) Large vestibular aqueduct syndrome
   . (8) Mondini defect
   . (9) Michel aplasia

iv) Oral cavity, pharynx, supra- and infrathyroid neck
   i) Branchial cleft cysts (Types I-IV)
   . i) Thyroglossal duct cyst
   . ii) Lingual thyroid
   . iii) Dermoid/epidermoid
   . iv) Thymic cyst
   . v) Vasoformative lesions
      . (1) Infantile hemangiomas
      . (2) Lymphatic/venous malformations
      . (3) Arteriovenous malformations
NEURORADIOLOGY PROCEDURE COMPETENCY CHECKLISTS

Instructions: All NR forms for competency are to be completed by the end of the 3rd NR rotation. At the end of each 1 month rotation, residents should place these forms in their portfolio. At the beginning of the month a new set of forms may be completed and the data compiled to as to meet all competencies by the end of the 3rd rotation.

Lumbar Puncture

Name of Resident: _____________________   Rotation 1   ____ 2 _____ 3_____4_____

Resident demonstrates ability to obtain informed consent: Yes ___ No__ Faculty sign off

Resident demonstrates ability to use sterile technique:       Yes ___ No __ Faculty sign off

Resident has completed the following required procedure: Lumbar Puncture

(must complete 3 or more)

1. Patient Name: __________ Date of Birth: ________ Procedure Date: __________
   Outcome: ________________________________    Faculty Sign Off: ____________

2. Patient Name: __________ Date of Birth: ________ Procedure Date: __________
   Outcome: ________________________________    Faculty Sign Off: ____________

3. Patient Name: __________ Date of Birth: ________ Procedure Date: __________
   Outcome: ________________________________    Faculty Sign Off: ____________

4. Patient Name: __________ Date of Birth: ________ Procedure Date: __________
   Outcome: ________________________________    Faculty Sign Off: ____________

5. Patient Name: __________ Date of Birth: ________ Procedure Date: __________
   Outcome: ________________________________    Faculty Sign Off: ____________

6. Patient Name: __________ Date of Birth: ________ Procedure Date: __________
   Outcome: ________________________________    Faculty Sign Off: ____________
NEURORADIOLOGY PROCEDURE COMPETENCY CHECKLISTS

Instructions: All NR forms for competency are to be completed by the end of the 3rd NR rotation. At the end of each 1 month rotation, residents should place these forms in their portfolio. At the beginning of the month a new set of forms may be completed and the data compiled to as to meet all competencies by the end of the 3rd rotation.

**Myelogram**

Name of Resident: _____________________   Rotation 1  ___ 2 ___ 3 ____ 4 _____

Resident demonstrates ability to obtain informed consent: Yes ___ No__ Faculty sign off

Resident demonstrates ability to use sterile technique:    Yes ___ No  __ Faculty sign off

Resident has completed the following required procedure: **Myelogram**

*(must complete 3 or more)*

1. **Patient Name:** __________ **Date of Birth:** ________ **Procedure Date:** __________
   
   **Outcome:** ___________________________   Faculty Sign Off: ____________

2. **Patient Name:** __________ **Date of Birth:** ________ **Procedure Date:** __________
   
   **Outcome:** ___________________________   Faculty Sign Off: ____________

3. **Patient Name:** __________ **Date of Birth:** ________ **Procedure Date:** __________
   
   **Outcome:** ___________________________   Faculty Sign Off: ____________

4. **Patient Name:** __________ **Date of Birth:** ________ **Procedure Date:** __________
   
   **Outcome:** ___________________________   Faculty Sign Off: ____________

5. **Patient Name:** __________ **Date of Birth:** ________ **Procedure Date:** __________
   
   **Outcome:** ___________________________   Faculty Sign Off: ____________

6. **Patient Name:** __________ **Date of Birth:** ________ **Procedure Date:** __________
   
   **Outcome:** ___________________________   Faculty Sign Off: ____________
NEURORADIOLOGY PROCEDURE COMPETENCY CHECKLISTS

Instructions: All NR forms for competency are to be completed by the end of the 3rd NR rotation. At the end of each 1 month rotation, residents should place these forms in their portfolio. At the beginning of the month a new set of forms may be completed and the data compiled to as to meet all competencies by the end of the 3rd rotation.

.Miscellaneous – NR Procedures (Discogram, Epidural blood patch, Steroid injection, etc)

Name of Resident: ___________________ Rotation 1 ___ 2 ___ 3 ___ 4 ___

Resident demonstrates ability to obtain informed consent: Yes ___ No ___ Faculty sign off

Resident demonstrates ability to use sterile technique: Yes ___ No ___ Faculty sign off

Resident has completed the following required procedure:
(must complete 3 or more)

1. Patient Name: _______ Date of Birth: ______ Procedure Date: ______
   Outcome: ___________________________ Faculty Sign Off: ___________

2. Patient Name: _______ Date of Birth: ______ Procedure Date: ______
   Outcome: ___________________________ Faculty Sign Off: ___________

3. Patient Name: _______ Date of Birth: ______ Procedure Date: ______
   Outcome: ___________________________ Faculty Sign Off: ___________

4. Patient Name: _______ Date of Birth: ______ Procedure Date: ______
   Outcome: ___________________________ Faculty Sign Off: ___________

5. Patient Name: _______ Date of Birth: ______ Procedure Date: ______
   Outcome: ___________________________ Faculty Sign Off: ___________

6. Patient Name: _______ Date of Birth: ______ Procedure Date: ______
   Outcome: ___________________________ Faculty Sign Off: ___________
FLORIDA HOSPITAL DIAGNOSTIC RADIOLOGY RESIDENCY PROGRAM

CONFIRMATION OF RECEIPT OF

NEURORADIOLOGY GOALS AND OBJECTIVES

2017-2018

By signing this document you are confirming that you have received and reviewed, with your preceptor, the abdominal imaging goals and objectives for this academic year.

This receipt will be kept in your personal file.

Resident Name (please print) __________________________________________________________

Resident Signature _________________________________________________________________

by signing this – you confirm that you have reviewed the G&O with your preceptor

Date _______________________________________________________________

Preceptor Signature ______________________________________________________________

by signing this – you confirm that you have reviewed the G&O with the resident

Date _______________________________________________________________