DIAGNOSTIC NEURORADIOLOGY

ROTATION #2

Typical Day
The morning is spent with Dr. Jim Wood at the VAMC. The afternoon is spent with the Methodist Neuroradiologist as listed on the MRPC work schedule.

In the afternoons your goal is to dictate 5 Brain MR studies and 5 Spine MR studies daily.

STAFF RESPONSIBILITIES

1. Review the Goals and Objectives with the resident at the beginning of the month.
2. Please provide the resident with written feedback of quality of dictated reports utilizing the form on provided on the website. The resident may print this off for you if you so request
3. Provide a verbal mid-rotation evaluation of the resident with any instructions on how to improve. Please inform Dr. Somogyi about the performance of the resident. He will try to give the resident feedback in a mid-month Meeting and again on the Faculty Evaluation at the end of the month.

GOALS

1. By the end of the Second Diagnostic Neuroradiology Rotation, residents are expected to expand and cultivate skills and knowledge learned during previous training and to achieve the following objectives based on the six general competencies. The resident should exhibit an increasing level of responsibility and independency as he or she progresses throughout the year.

COMPETENCE-BASED OBJECTIVES

Patient Care

1. **Second rotation:** Learn to write pre- and post-procedure orders. Be able to evaluate the clinical status of patients prior to, during and after the procedure. Learn to recognize complications of these procedures and to initiate appropriate treatment.

Medical Knowledge

2. Complete the following RSNA/AAPM Physics Modules @ http://www.rsna.org/Education/physics.cfm

a. Magnetic Resonance
b. MRI: Image Formation
c. MRI: Instrumentation
d. MRI: Pulse Sequences
e. MRI Siting and Environmental Protection

3. Demonstrate knowledge of the following topics using your favorite comprehensive neuroradiology text as reference:

I) Anatomy:

A. Intracranial

Second rotation: Develop more detailed knowledge of intracranial anatomy as displayed on multi-planar images. Be able to identify subdivisions and fine anatomic details of the brain, the ventricles, subarachnoid space, vascular structures, sella turcica and cranial nerves.

B. Head and Neck

Second rotation: Become familiar with the complex anatomy of the orbit, petrous bone, skull base and soft tissues of the neck as displayed on CT and MR in multiple planes. Be able to identify all key structures and have knowledge of established anatomic classification systems for each area.

C. Spine

Second rotation: Be able to identify all normal structures on multi-planar images.

D. Vascular

Second rotation: Be able to identify all important extra- and intra-cranial arteries (secondary and tertiary branches of the carotid and basilar arteries) and veins (cortical and deep cerebral veins) on all imaging modalities.

II) Pathology and Pathophysiology:

Learn the basic pathology and pathophysiology of diseases of the brain, spine, and head and neck.

Second rotation: Learn the pathologic and histologic features that allow for characterization of neoplastic lesions and learn the accepted classification system (WHO) of tumors.

III) Imaging Technology:

A. CT

Second rotation: Learn the principles and utility of multi-planar reconstruction and CT angiography. Learn the appropriate imaging protocols used for assessment of the full range of lesions encountered in Neuroradiology.

B. MR

Second rotation: Learn to protocol complex clinical cases. Become familiar with more advanced imaging techniques such as MR angiography, fat suppression, diffusion/perfusion, activation studies, and MR spectroscopy.

IV) Image interpretation:

A. Intracranial

Second rotation: Develop the ability to use imaging findings to differentiate different types of focal intracranial lesions (neoplastic, inflammatory, vascular) based on anatomic location (e.g., intra- vs. extra-

axial), contour, intensity and enhancement pattern. Learn to identify and differentiate diffuse intracranial abnormalities (e.g., hydrocephalus and atrophy). Lean to recognize treatment-related findings (e.g., post-surgical and post-radiation). Become familiar with the utility of new MR sequences (diffusion/perfusion, functional MR and MR spectroscopy).

B. Head and Neck

Second rotation: Learn the differential diagnosis of mass lesions. Understand and be able to identify patterns of disease spread within and between areas of the head and neck (e.g., perineural and nodal spread). Learn to recognize treatment- related findings (e.g., post-surgical and post-radiation). Learn to identify pathologic processes on multi-planar MR studies.

C. Spine

Second rotation: Learn the imaging findings that allow for the differentiation of inflammatory and neoplastic lesions. Learn the imaging features of intraspinal processes, including syringomyelia, arachnoiditis and spinal dysraphism. Learn to recognize post-surgical and other treatment-related findings.

D. Vascular

Second rotation: Learn the indications, risks and benefits for neurointerventional procedures including embolization, angioplasty and stenting.

V). Head and Neck Radiology

A. Paranasal sinuses

1. Anatomy of paranasal sinuses
2. Congenital disease
    - § Dermal sinus tract
    - § Encephalocele
    - § Choanal atresia
    - § Dacrocystocele
3. Inflammation/infection
    - § Acute sinusitis
    - § Chronic sinusitis (allergic, fungal, granulomatous)
    - § Polyposis
    - § Mucocele
4. Benign sinus tumors
    - § Osteoma
    - § Antrochoanal polyp
    - § Juvenile angiofibroma
    - § Inverted papilloma
5. Malignant sinus tumors
    - § Squamous cell carcinoma
    - § Esthesioneuroblastoma
    - § Lymphoma

- Metastases
- Lethal midline granuloma

B. Oral cavity, oropharynx, hypopharynx
1. Anatomy, contents
2. Masses
   - Squamous cell carcinoma
   - Dermoid/epidermoid
   - Lingual thyroid
   - Ranula
   - Hemangioma
3. Infection
   - Cellulitis, abscess (Ludwig's angina)

C. Parapharyngeal space
1. Location, contents, anatomy and importance in relation to other spaces
2. Pharyngeal mucosal space (anatomy, contents)
   - Infection (tonsillar abscess, adenitis)
   - Pleomorphic adenoma (minor salivary glands)
   - Squamous cell CA
   - Non-Hodgkin's lymphoma
   - Thornwaldt cyst
3. Masticator space (anatomy, contents)
   - Tumors (mesenchymal)
   - Infection
4. Parotid space (anatomy, contents)
   - 1st brachial cleft cyst
   - Infection
   - Lymphoepithelial lesions
   - Sjogren's
   - Pleomorphic adenoma
   - Warthin's tumors
   - Mucoepidermoid carcinoma
   - Adenoid cystic carcinoma
   - Metastases
   - Lymphoma
5. Carotid space (anatomy, contents)
   - Paragangliomas (glomus tumors)
   - Schwannoma
   - Neurofibroma
   - Nodal metastases
6. Retropharyngeal space (anatomy, contents)
   - Neoplastic and reactive lymph nodes
   - Infection ("Danger space")

D. Perineural spread

E. Larynx
1. Squamous cell carcinomas
   - Staging

- § Supraglottic, glottic, subglottic
- § Treatment effects (surgery and radiation)
- § Airway obstruction

2. Trauma (laryngeal fractures)

F. Thyroid

1. Masses
   - § Multinodular goiter
   - § Adenoma
   - § Cyst
   - § Carcinoma

G. Cystic neck masses

1. Second brachial cleft cyst
2. Thyroglossal duct cyst
3. Cystic hygroma
4. Laryngocele, internal, external
5. Abscess
6. Ranula
7. Dermoid/epidermoid

H. Lymphadenopathy

1. Graded by level and/or anatomic space
2. Size criteria for pathologic nodes
3. Etiology
   - § Lymphoma
   - § Metastases (aerodigestive carcinoma)
   - § Cat scratch fever
   - § Atypical mycobacterium
   - § Mononucleosis
   - § Castleman's disease

I. Temporal bones

1. Imaging techniques (Multi-planar CT/MR)
2. Anatomy/embryology
3. Trauma
   - § Transverse and longitudinal fractures
   - § CSF leaks, brain herniation
4. Tumors
   - § Schwannoma
   - § Vestibular (8th) (common)
   - § Facial (7th) and trigeminal (5th)
   - § Meningioma
   - § Lipoma
   - § Dermoid/epidermoid
   - § Metastases
5. Pulsatile tinnitus
   - § Glomus tympanicum
   - § High riding/dehiscent jugular vein
   - § Ectopic carotid

- AVM, AV fistula
- Atherosclerotic disease
- Dissection
- FMD

6. Inflammatory disease
    - Otitis media
    - Mastoiditis
    - Cholesteatoma (acquired or congenital)
    - Malignant external otitis
    - Cholesterol granuloma
    - Hemorrhage or inflammation cochlea, vestibule (labyrinthitis)
7. Congenital anomalies
    - External ear atresia/hypoplasia (ossicular anomalies)
    - Enlarged vestibular/cochlea aqueducts
    - Cochlear/vestibular aplasias-hypoplasias
    - Internal auditory canal anomalies

F. Orbits

1. Imaging techniques
2. Anatomy/embryology
    - Lesion localization based on relationship to muscle cone
3. Lacrimal gland tumors
    - Epithelial
    - Pleomorphic adenomas
    - Carcinomas
    - Lymphoma
    - Dermoid
    - Metastases
4. Extra-conal masses
    - Orbital wall or sinus neoplasms with extension
    - Subperiosteal abscess/orbital cellulitis from
    - sinusitis/osteomyelitis
    - Metastases
    - Lymphoma/leukemia/myeloma
    - Lymphangioma/hemangioma
    - Rhabdomyosarcoma
    - Histiocytosis
    - Pseudotumor and granulomatous disease
5. Extra-ocular muscles (conal)
    - Graves' disease
    - Orbital myositis (pseudotumor)
    - Granulomatous disease
    - Lymphoma/leukemia
    - Metastases
    - Carotid cavernous fistula
6. Intra-conal lesions
    - Related to optic nerve

- Glioma
- Meningioma
- Optic nerve
- Increased intracranial pressure
- Pseudotumor
- Graves' disease
- Meningeal carcinomatosis
- Leukemia
- Separate from optic nerve (well-defined)
- Cavernous angioma, capillary angioma
- Varix
- Neurofibroma/Schwannoma
- Meningioma
- Pseudotumor
- Lymphoma
- Separate from optic nerve (ill-defined – infiltrative)
- Infection
- Metastases
- Pseudotumor

7. Intra-ocular
    - Adult
    - Melanoma
    - Metastases
    - Drusen
    - Child
    - Retinoblastoma
    - Retrolental fibroplasia
    - Coat's disease
    - Primary hypertrophic persistent vitreous (PHPV)
    - Any age
    - Metastases
    - Retinal detachment
    - Infection and inflammation (endophthalmitis), AIDS
    - Phthsis bulbi
8. Trauma
    - Fractures of the orbital wall
    - Extra-ocular muscle entrapment
    - Orbital emphysema
    - Intra-orbital hematoma
    - Penetrating soft tissue injuries
    - Laceration of the optic nerve or muscles
    - Ocular – ruptured globe, intra-ocular hemorrhage, dislocated lens
    - Foreign body

VI). Spinal Imaging

A. Anatomy and Biomechanics

1. Vertebral bodies
2. Facet joints and transverse processes
3. Lamina and spinous processes
4. Support ligaments
5. Specific characteristics of cervical, thoracic, and lumbar segments
6. Cranio-vertebral and lumbo-sacral junctions
7. Normal stability and motion

B. Imaging Modalities

1. Role and relative merit of noninvasive imaging studies
   - § Plain radiography, CT, MR, nuclear medicine, PET imaging
2. Role of invasive procedure
   - § Myelography (including CT) angiography, biopsies, facet injections, nerve root blocks, discography

C. Trauma

1. Mechanism of injury
   - § Flexion
   - § Extension
   - § Axial loading
   - § Compression
   - § Distraction
   - § Rotation
2. Stable fractures and ligamentous injuries
   - § Compression fracture
   - § Isolated anterior column
   - § Isolated posterior column
   - § Unilateral locked facet
   - § Hyperextension, teardrop
   - § Clay Shoveler's (spinous process C7)
3. Unstable injuries (involvement of the middle column and ligaments)
   - § Hyperflexion teardrop
   - § Facet joint disruption and dislocation (bilateral locked facets)
   - § Hyperflexion ligamentous injury without fracture
   - § Odontoid fracture
   - § Distration fracture (Hangman's) (C2/C3)
   - § Chance
   - § Burst
4. Traumatic disc herniation
5. Extrinsic cord compression
6. Cord contusion
7. Intra-spinal hemorrhage
   - § Epidural hematoma (EDH)
   - § Subdural hematoma (SDH)
   - § SAH subarachnoid hemorrhage (SAH)
   - § Cord hematoma (hematomyelia)
8. Post-traumatic abnormalities
   - § Instability with spondylolithesis

- Syringomyelia
- Arachnoiditis
- Pseudomeningocele and root avulsion

D. Degenerative disease
1. Epidemiology
2. Disc degeneration
3. End plate degeneration
4. Disc herniation
   - Distribution
   - Imaging findings
5. Spinal stenosis
   - Distribution
   - Imaging findings
6. Postoperative changes
   - Epidural scar
   - Arachnoiditis
   - Recurrent herniation or stenosis

E. Inflammatory and demyelinating disease
1. Discitis/osteomyelitis
   - Acute (spontaneous and postoperative)
   - Epidural and paravertebral abscess
   - Chronic low grade discitis
2. Vertebral body tuberculosis (Potts Disease)
3. Meningitis (arachnoiditis)
   - TB, sarcoid, CMV, AIDS
4. Spinal cord lesions
   - Abscess, granuloma
   - Transverse myelitis
   - Multiple sclerosis
   - ADEM

F. Neoplastic disease
1. Osseous
   - Primary tumors – benign
   - Hemangioma
   - Osteoid osteoma/osteoblastoma
   - Chondroid tumors
   - Giant cells
   - Aneurysmal bone cyst (ABC)
   - Chordoma
   - Primary tumors –malignant
   - Osteoid
   - Chondroid
   - Metastases
   - Lymphoma
   - Myeloma
   - Leukemia

2. Extradural
    - § Neurofibroma
    - § Lymphoma
    - § Metastases
3. Intradural extramedullary
    - § Meningioma
    - § Schwannoma
    - § Neurofibroma
    - § Dermoid
    - § Lipoma
    - § Epidermoid
    - § Epidermal inclusion cyst
    - § Metastases (carcinomatous meningitis)
    - § Lymphoma
4. Intramedullary
    - § Ependymoma
    - § Astrocytoma
    - § Hemangioblastoma
    - § Metastases
    - § Lymphoma

G. Cystic lesions

1. Extradural
    - § Meningocele
    - § Pseudo-meningocele (postoperative and post-traumatic)
    - § Root sleeve cysts (Tarlov) and terminal meningocele
2. Intradural extramedullary
    - § Arachnoid cyst
    - § Post-inflammatory and post-hemorrhagic arachnoiditis
3. Intramedullary
    - § Syringomyelia/hydromyelia
    - § Chiari malformation, post-traumatic, post-infectious, neoplastic

H. Vascular lesions

1. Dural venous fistula
2. AVM
3. Cavernous angioma
4. Spinal cord infarct

I. Developmental spine disease

1. Normal embryologic development of spine
2. Open dysraphisms
3. Myelomeningocele
4. Lipomyelomeningocele (tethered cord)
5. Myelocele
6. Diastemometamyelia
7. Occult spinal dysraphisms
8. Tight filum, thick filum
9. Intradural lipoma

10. Dorsal dermal sinus

Practice-Based Learning and Improvement

1. The resident should demonstrate evidence of independent reading and learning through the use of printed and electronic sources. In particular the resident should utilize Stat Dx, RSNA Physics Modules, & online teaching files.
2. The resident should be competent in using the PACS in the daily accomplishment of the work load and instruct others in its use.

Interpersonal and Communication Skills

1. The resident should be able to communicate effectively results of studies to referring clinicians whenever needed. For emergent studies, reports to referring clinicians should be made in a timely manner. Such communication should be documented in the dictation or preliminary note with the date, time, and name of doctor or nurse.
2. The resident should be able to effectively convey the findings of examinations through accurate dictation of reports. The resident should incorporate feedback from staff concerning the quality of dictated reports.

Professionalism

1. Residents should observe ethical principles when recommending further work-up for cases.
2. Promptness and availability at work are expected of every resident.
3. Residents should dress appropriately at work, wearing a name badge at all times.
4. Patient confidentiality should be observed at all times.
5. Nuclear Medicine technologists and other health workers should be treated with respect and part of the health care team.

Systems-Based Practice

1. Residents should dictate and correct their reports in a timely fashion to avoid delay in patient disposition.
2. Residents should assist in facilitating examinations whenever possible.
3. Resident should recognize the role that radiology plays in the management of patient's illness and make proper recommendations when needed.
4. Suggestions to improve methods and systems utilized in radiology should be made whenever appropriate.