

Dalhousie University Neurosurgery

Resident Rotation Objectives: Neuroradiology

Neurosurgery residents are expected to progressively develop their abilities to interpret imaging studies of the skull and brain, head and neck, and the spinal cord column. They should learn the relative value of each modality, enabling them to choose the appropriate study for each patient. The residents should also acquire a basic understanding of the science that underlies clinical neuroradiology, in particular the physical principles of CT, MR, plain radiography, and digital angiography.

During their actual rotation they will observe & assist in the performance and interpretation of invasive procedures including cerebral angiography, myelography, spinal canal puncture, and image-guided biopsies. They will learn the indications and contraindications, dosage and appropriate techniques for contrast administration, and to recognize and treat adverse reactions.

Medical Expert

Imaging Technology – CT

1. Be able to describe imaging parameters, including window and level settings, slice thickness and the typical CT density of commonly occurring processes (such as edema, air, calcium, blood and fat).
2. Learn the principles and utility of multi-planar reconstruction and CT angiography

Imaging Technology – MRI

1. Learn the basic physical principles of MR and become familiar with standard MR protocols. Learn the intensity of normal tissues and that encountered in hemorrhage, fat and calcium on routine pulse sequences.
2. Understand the role of more advanced imaging techniques such as MR angiography, fat suppression, diffusion/perfusion, activation studies, and MR spectroscopy.
3. Interpretation of Normal and Abnormal Radiological Anatomy

Intracranial

Normal

1. Be able to identify major cranial and intracranial structures as visualized on plain films, axial CT and MR scans. Be able to identify all major structures as well as fine anatomic details of the subdivisions and components of the brain, ventricles and subarachnoid space and vascular structures, sella turcica, and cranial nerves.

Abnormal

1. Learn to interpret plain films of the skull and spine, CT and MR scans with a particular emphasis on studies performed in acute clinical situations (infarction,

spontaneous intracranial hemorrhage, aneurysmal subarachnoid hemorrhage, traumatic brain injury, infection, hydrocephalus, and brain herniation).

2. 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.
3. Learn to identify and differentiate diffuse intracranial abnormalities (e.g. hydrocephalus and atrophy).
4. Learn 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).

Head and Neck

Normal

1. Learn the anatomy of the calvarium, skull base and soft tissues of the neck as displayed on plain radiographs. Become familiar with the anatomy of the orbit, petrous bone, skull base and soft tissues of the neck as displayed on CT and MR in multiple planes and be able to identify all key structures.

Abnormal

1. Learn to identify and characterize common acute lesions i.e. the plain film and CT appearance of (a) traumatic (fractures and soft tissue injuries) of the orbit, skull base, face and petrous bones and (b) inflammatory (sinusitis, orbital cellulitis, otitis, mastoiditis, cervical adenitis and abscess) lesions. (c) airway compromise and obstruction.
2. Learn the differential diagnosis and identification of neoplastic masses arising in the orbit, skull base, petrous bone and soft tissues of the neck. Be able to use standard anatomic classification schemes to accurately describe the location of mass lesions.

Vascular

Normal

1. Learn to identify the main vessels of the cervical and intracranial regions (carotid, vertebral and basilar arteries, jugular veins, dural venous sinuses, cortical and deep cerebral veins) as they appear on routine CT,MR,ultrasound and angiographic studies of the head and neck.
2. Learn the indications, limitations, risks and benefits for each technique used for visualization of vascular anatomy and pathology.
3. Observe the performance of diagnostic angiograms of the cervical and cranial vessels. Learn the basic techniques of arterial puncture and catheter manipulation. Assist senior residents, fellows, and attendings in the performance of angiograms. Learn to safely position catheters within extra-cranial vessels. Learn the appropriate dose of contrast material for angiography of each vessel.
4. May have the opportunity to perform diagnostic angiography under the supervision of an attending radiologist.

Abnormal/Interventional

1. Learn the angiographic protocols for the evaluation of a variety of disease processes (e.g. aneurysmal subarachnoid hemorrhage).
2. Learn to recognize the angiographic features of extra-and intracranial atherosclerosis utilizing catheter angiography, MRA and sonography.
3. Learn the angiographic appearance of aneurysms, vasospasm, vascular malformations, occlusive diseases and neoplasms.
4. Learn the indications, risks, benefits for neurointerventional procedures including: Coiling, stenting and balloon occlusion for aneurysms, angioplasty and treatment of vasospasms, carotid stenting and acute stroke intervention including intra-arterial thrombolysis and embolization of tumours and AVMs.

Spine

Normal

1. Become familiar with the normal appearance of the spine on plain radiographs and multi-planar axial Ct and MRI scans.
2. Be able to assess spinal alignment and be able to identify osseous components, intervertebral discs, support ligaments and the contents of the thecal sac (spinal cord and nerve roots) on CT, MR, and myelography of the spinal canal.

Abnormal

1. Learn the appearance of traumatic lesions on plain radiographs with an emphasis on findings of spinal instability.
2. Become familiar with the CT and MRI findings of degenerative disease.
3. Learn the imaging findings that allow for the differentiation of inflammatory and neoplastic lesions.
4. Learn the CT, MRI and myelographic findings on all three modalities that allow for accurate spatial localization of spinal lesions (extra-dural, intra-dural, extra-medullary, and intra-medullary).
5. Learn the imaging features of intraspinal processes, including syringomyelia, arachnoiditis and spinal dysraphism.
6. Learn to recognize post-surgical and other treatment-related findings.

Image-guided Procedures

1. Learn to perform fluoroscopically guided punctures of the lumbar spinal canal for the purpose of myelography, spinal fluid collection, and intrathecal injection of medications.
 2. Assist senior residents, fellows and attending physicians in the performance of image-guided biopsies.
 3. Be able to perform myelography under the supervision of an attending radiologist.
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Pediatrics

1. Learn to recognize the normal appearance of the brain (e.g. myelination), spine (e.g. ossification) and head and neck (e.g. sinus development) encountered in the newborn, infant and child.
2. Be able to identify the features of hydrocephalus and common congenital lesions and malformations on CT and MRI.
3. Be able to identify and differentiate acquired lesions (traumatic, ischemic, inflammatory and neoplastic) of the newborn, infant, child and adolescent.

Communicator and Collaborator

Patient Care

1. Learn to obtain informed consent and be able to explain to patients and their families the risks and benefits of contrast-enhanced CT/MR procedures, angiography, spinal punctures, myelography and image-guided biopsies.
2. Learn to write pre- and post-procedure orders. Be able to evaluate the clinical status of patients prior to, during and after the procedure.
3. Learn to recognize complications of these procedures and to initiate appropriate treatment.

Decision Making/Value Judgment Skills

1. Learn the appropriate format for dictation of neuroradiologic imaging studies.
2. Assist in providing consultations for house staff and referring physicians on imaging studies and provisional interpretations after reviewing the exam with an attending neuroradiologist.
3. Learn to select the choice of imaging modality and protocol for neuroradiologic studies and to identify those cases that require the additional expertise in assessment of imaging studies.

Leader

1. The resident must learn to manage time effectively in order to prioritize clinical activities, learning needs, administrative responsibilities, and research endeavours.
2. The neurosurgical resident should be prepared to provide advice and set an example to juniors on the efficient and appropriate use of neuroradiological resources.

Health Advocate

1. Use available resources to assist with patients' educational, socio-economic, and psychological challenges. Facilitate the learning of patients and their families, colleagues, and other health care professionals.

Scholar

2. Participation in the Neuroscience and Neurovascular Rounds is expected.
3. Demonstrate self-directed learning with critical appraisal of relevant literature.

Professional

1. Demonstrate the characteristics of integrity, honesty, compassion, and ethical conduct.
2. Meets deadlines, is punctual, monitors patients according to the needs of their condition, and provides follow-up.
3. Understand any limitations of knowledge or skill, accepts constructive feedback and corrects deficiencies appropriately.