

NEUROLOGICAL SURGERY RESIDENCY PROGRAM CURRICULUM

THE OHIO STATE UNIVERSITY WEXNER MEDICAL CENTER

The curriculum for the Neurosurgical Residency Training Program at The Ohio State University Wexner Medical Center is competency-based and designed to be completed over the duration of the residency. Upon completion of the training program, graduates will have mastered the curriculum and will be compassionate, highly knowledgeable, technically proficient neurosurgeons and academicians who have the potential to be future leaders in Neurosurgery.

The competency-based curriculum is rotation specific:

Year	July to December	January to June
PGY-1	General Neurosurgery Rotation – University Hospital and James Cancer Center (4 months) NeuroOncology Rotation – James Cancer Center (1 month) NeuroAnesthesia Rotation – University Hospital and James Cancer Center (1 month)	General Neurosurgery Rotation – University Hospital and James Cancer Center (2 months) NeuroCritical Care Rotation – University Hospital and James Cancer Center (3 months) Surgical Intensive Care Rotation – University Hospital (1 month)
PGY-2	Junior Clinical Rotation (General) – University Hospital and James Cancer Center (2 months) Junior Clinical Rotation (Vascular) – University Hospital (2 months) Junior Clinical Rotation (Oncology) – James Cancer Center (2 months)	Pediatric Neurosurgery Rotation – Nationwide Children’s Hospital (4 months) Junior Clinical Rotation (Functional/Spine) – University Hospital (2 months)
PGY-3	Pediatric Neurosurgery Rotation – Nationwide Children’s Hospital (4 months) Junior Clinical Rotation (Functional/Spine) – University Hospital (2 months)	Junior Clinical Rotation (General) – University Hospital and James Cancer Center (2 months) Junior Clinical Rotation (Vascular) – University Hospital (2 months) Junior Clinical Rotation (Oncology) – James Cancer Center (2 months)
PGY-4	Academic/Research Rotation (6 months)	Academic/Research Rotation (6 months)
PGY-5	Academic/Research Rotation (6 months)	Academic/Research Rotation (6 months)
PGY-6	Senior Clinical Rotation (Vascular) – University Hospital (2 months) Senior Clinical Rotation (Functional/Spine) – University Hospital (2 months) Senior Clinical Rotation (Oncology) – James Cancer Center (2 months)	Senior Clinical Rotation (Vascular) – University Hospital (2 months) Senior Clinical Rotation (Functional/Spine) – University Hospital (2 months) Senior Clinical Rotation (Oncology) – James Cancer Center (2 months)
PGY-7	Chief Resident (Oncology) – James	Chief Resident (Oncology) – James Cancer

	Cancer Center (6 months) Chief Resident (Vascular) – University Hospital (2 months) Chief Resident (Functional/Spine) – University Hospital (2 months)	Center (6 months) Chief Resident (Vascular) – University Hospital (2 months) Chief Resident (Functional/Spine) – University Hospital (2 months)
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General Neurosurgery PGY 1

Description of Rotation or Educational Experience

- Length: 2-4 months
- Site: University Hospital and James Cancer Center
- Focus: During this rotation, the resident will acquire the general skills necessary for perioperative evaluation, diagnosis of common neurosurgical disorders and care of the neurosurgical patients. The resident will gain knowledge and experience from a diverse population of neurosurgical patients that will provide knowledge related to the principles of the pathophysiology, management and treatment of central nervous system injury and disease. The resident will learn basic neurosurgical techniques.
- Responsible Faculty: Russell Lonser, M.D., Brian Dalm, M.D., Brad Elder, M.D., Frank Farhadi, M.D., Andrew Grossbach, M.D., Doug Hardesty, M.D., Vibhor Krishna, M.B.B.S., John McGregor, M.D., Ehud Mendel, M.D., Shahid Nimjee, M.D., Ph.D., Ciarán J. Powers, M.D., Ph.D., Daniel Prevedello, M.D., Steve Viljoen, M.D., Patrick Youssef, M.D.
- Didactics:
 - Required clinical conferences include weekly Case Conference, monthly M&M Conference and monthly Grand Rounds as well as daily Faculty Teaching Rounds. Additional optional opportunities include weekly Spine Tumor Board, weekly Brain Tumor Board, weekly DBS Conference, weekly Skull Base Conference and weekly Stroke Case Conference.
- Clinical Experience: The resident will receive instruction and acquire experience on the inpatient wards/ICU and in the operating room. The resident will take, on average, 6 12-hour days of in-house neurosurgery call per week where they will be directly involved with the supervised management of neurosurgical patients, admission of neurosurgical patients and performance of consults (including in the Emergency Department). After this rotation, competency in basic procedures (including intra-cranial pressure monitoring, external ventricular drainage, lumbar drainage, lumbar puncture, and cerebrospinal fluid shunt tap) will be assessed by the Chief Resident and/or faculty and written documentation of competence completed.
- Ambulatory Experience: The resident will receive instruction and acquire experience in a weekly half day neurosurgery outpatient clinic.

Patient Care

Goal

Residents must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. Residents are expected to:

Competencies

- Neurotrauma

- Perform and document pertinent history, physical findings, and radiologic findings in a polytrauma patient.
- Differentiate central from peripheral nervous system injuries.
- Insert intravascular monitoring devices for use in the hemodynamic management of critically ill patients, including central venous lines, pulmonary artery catheters, and arterial catheters.
- Insert intracranial pressure monitoring devices, including ventriculostomy catheters and electronic (fiberoptic or miniaturized strain gauge) devices.
- Perform twist-drill or burr-hole drainage of subdural fluid collections.
- Decide appropriately which patients require emergency craniotomy and other procedures.
- Position patients appropriately for procedures/surgery and begin emergency procedures if more experienced neurosurgeons have not yet arrived.
- Assist with opening and closure of craniotomies.
- Perform elective tracheostomies and be able to perform emergency tracheostomies.
- Be able to intubate patients in both emergency and elective situations.
- Obtain ACLS and ATLS certification.
- Demonstrate the ability to perform an initial evaluation and management of critically ill neurosurgical patients.
- Perform the following procedures:
 - orotracheal intubation
 - nasogastric intubation
 - bladder intubation
- Work with the trauma team.
- Demonstrate an ability to manage neurosurgical patients in a critical care setting.
- Diagnose and treat acid-base abnormalities in neurosurgical patients.
- Demonstrate an understanding of the management of complex acid-base disturbances in the critical care setting.
- Neuroradiology
 - Order appropriate radiological evaluations in a timely fashion.
 - Complete radiological requisitions properly.
 - Demonstrate the ability to accurately interpret the radiographic studies of trauma patients.
- Infection
 - Demonstrate the ability to use universal precautions.
 - Demonstrate the ability to use sterile technique.
 - Appropriately diagnose and treat non-CNS infections in neurosurgical patients.
 - Appropriately diagnose and treat CNS infections in neurosurgical patients.
- Practice management, legal and socioeconomic issues
 - Demonstrate an ability to interact effectively, professionally, and respectfully with:

- patients and their families
- fellow residents
- allied health care personnel
- hospital staff
- medical students
- faculty physicians
- referring physicians
- Demonstrate the ability to maintain accurate and current medical records.
- Discuss neurosurgical career options with:
 - faculty
 - peers
 - family
- Accumulate information about post-residency career options.
- Create and keep current a resume/curriculum vitae.
- Record CPT codes for office visits and procedures performed on service.
- Accurately document H&P and consultations according to the AMA-CPT E&M documentation guidelines.

Objectives

- Upon completion of the rotation, the resident will demonstrate competency in basic procedures (including intra-cranial pressure monitoring, external ventricular drainage, lumbar drainage, lumbar puncture, and cerebrospinal fluid shunt tap) as assessed by the Chief Resident and/or faculty and written documentation of competence completed.

Medical Knowledge

Goal

Residents must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological, and social-behavioral sciences, as well as the application of this knowledge to patient care. Residents are expected to achieve the following:

Competencies

- Neurotrauma and General Neurosurgery
 - Describe the systematic assessment of polytrauma patients.
 - Rank management priorities in polytrauma patients appropriately.
 - Discuss principles of resuscitation of polytrauma patients including appropriate fluid resuscitation, and explain the anticipated effects of shock and resuscitation on fluid shifts and on electrolyte balance.
 - Discuss the pathophysiology and management of coagulopathy after head injury.
 - Explain the treatment of posttraumatic seizures.
 - Name the major structures supplied by the major vessels of the brain and spinal cord.

- Discuss the evaluation, treatment, and prognosis of subarachnoid hemorrhage, both traumatic and spontaneous.
- Explain the pathophysiology and treatment of cerebral vasospasm.
- Formulate a diagnostic and treatment plan for patients with cerebral ischemia.
- Explain the evaluation and management of birth-related intracranial hemorrhage, spinal cord injury, and brachial plexus injury.
- Describe a systematic approach to the examination of the peripheral nervous system.
- Describe the basic principles of management of peripheral nerve injuries.
- List principles of rehabilitation of different types of neurosurgical patients.
- Define brain death and discuss methods of making such a diagnosis.
- Describe the pathophysiology of electrical injuries to the nervous system and review treatment of same.
- Describe the clinical presentation, evaluation, and treatment of infections which commonly occur in critical care neurosurgical patients.
- Review the indications for intubation including:
 - loss of patient airway
 - respiratory insufficiency
 - inability to protect airway
- List the signs of acute myocardial ischemia and briefly discuss the emergent treatment of this condition.
- Review the impact of renal insufficiency as it pertains to the management of neurosurgical patients.
- Briefly discuss the diagnosis and management of acute renal insufficiency.
- Describe the diagnosis and management of an ileus. List the differential diagnosis for an ileus.
- review the diagnosis and management principles of the following endocrine disorders:
 - hypo/hyperthyroidism
 - hypo/hyperparathyroidism
 - adrenal cortical excess and deficiency
 - diabetes mellitus
 - diabetes insipidus
- Review the medical and legal definitions of brain death.
- Discuss moral and ethical issues pertaining to critically ill neurosurgical patients including:
 - patient or family requests to withhold or withdraw treatment
 - organ donation.
- Summarize the physiology of hydrogen ion production and excretion.
- Briefly discuss acute and chronic buffering systems.
- Discuss metabolic acidosis and alkalosis.
- Discuss respiratory acidosis and alkalosis.
- Review the effects of acid-base disturbances on the central nervous system and intracranial pressure.

- Neuroanatomy
 - General
 - Review the embryological development of the brain, cerebellum, brain stem, glial elements, spinal cord, conus medullaris, cauda equina, sympathetic and parasympathetic systems and the peripheral nervous system.
 - Discuss the embryologic development of the skull, craniovertebral junction, and spine.
 - Describe and differentiate the different types of neurons.
 - Discuss the microanatomy of the neuron including the:
 - cell body
 - dendritic process
 - axonal process
 - Diagram and describe the microanatomy of the synapse.
 - List the microglial elements and review their microanatomy:
 - astrocytes
 - oligodendrocytes
 - microglia
 - ependyma
 - choroid epithelium
 - Diagram and describe in detail the carotid and vertebral arteries and their branches which provide blood supply to the face, scalp, skull, meninges, brain, brain stem, cerebellum, and rostral spinal cord.
 - Discuss in detail the arterial blood supply to the spinal cord. Include in the discussion the spinal and radicular arteries and the concept of watershed ischemia.
 - Identify and review the venous drainage of the central nervous system.
 - List and identify the bones of the skull.
 - Describe each of the sutures of the skull.
 - Identify each named foramen of the skull and list its contents.
 - Describe the anatomy of the meninges including the:
 - dura mater
 - arachnoid mater
 - pia mater
 - Describe the anatomy of the dura including the falx cerebri and tentorium.
 - Review the layers of the scalp and discuss its innervation.
 - Diagram the cerebral ventricles.
 - Discuss the major arachnoid cisterns.
 - Review the anatomy of the arachnoid villi.
 - Discuss the anatomic correlates pertinent to the production, flow, and reabsorption of cerebrospinal fluid.
 - Identify and describe the gross anatomy of the spine including:
 - atlas

- axis
- subaxial cervical vertebrae
- thoracic vertebrae
- lumbar vertebrae
- sacrum
- coccyx
- intervertebral disc complex
- supporting ligaments of the spine
- List the muscles related to the skull and spine.
- Describe the gross anatomy of the neck.
- Discuss the anatomical basis for the blood-brain barrier in detail.
- Central Nervous System
 - Describe the gross anatomy of the brain, brain stem, cerebellum, cranial nerves, and spinal cord in detail.
 - Describe the anatomy of the cerebral cortex in detail including:
 - cortical layers
 - sensory areas
 - motor areas
 - prefrontal cortex
 - fiber tracts
 - calcarine cortex
 - Describe the anatomy of the olfactory pathways, hippocampal formation and amygdala in detail including:
 - rhinencephalon
 - olfactory pathways
 - anterior commissure
 - hippocampal formation (including cytoarchitecture)
 - amygdala
 - limbic system
 - Describe the anatomy of the corpus striatum in detail including:
 - striatum
 - globus pallidus
 - claustrum
 - subthalamic region
 - striatal afferent and efferent connections
 - pallidal afferent and efferent connections
 - pallidofugal fiber systems
 - Describe the anatomy of the hypothalamus and pituitary in detail including:
 - cytoarchitecture of the hypothalamus
 - afferent and efferent connections of the hypothalamus
 - supraoptic nuclei and tracts
 - hypophysial portal system
 - anatomy of the pituitary stalk

- anterior and posterior pituitary
- cellular organization of the anterior pituitary
- hormonally active cells of the hypothalamus and pituitary
- Describe the anatomy of the diencephalon in detail including:
 - midbrain-diencephalon junction
 - caudal diencephalon
 - epithalamus
 - thalamus (including nuclei)
 - thalamic radiations
 - internal capsule
 - visual pathways
- Describe the anatomy of the cerebellum in detail including:
 - cerebellar cortex including organization
 - deep cerebellar nuclei
 - cerebellar connections
 - cerebellar peduncles
- Describe the anatomy of the mesencephalon in detail including:
 - superior colliculus
 - inferior colliculus
 - pretectal region
 - posterior commissure
 - mesencephalic nuclei
 - oculomotor nerve
 - tegmentum
 - mesencephalic reticular formation
 - substantia nigra
 - crus cerebri
 - ascending and descending tracts
 - Describe the anatomy of the pons in detail including:
 - vestibulocochlear nerve
 - facial nerve
 - abducens nerve
 - trigeminal nerve
 - ascending and descending tracts
- Describe the anatomy of the medulla in detail including:
 - olivary nucleus
 - medullary reticular formation
 - cranial nerves of the medulla
 - ascending and descending tracts
- Review the location and connections of each cranial nerve nuclei. Trace the course of each cranial nerve from nucleus to end organ termination.
- Describe the external topography and landmarks of the fourth ventricle.
- Describe the anatomy of the spinal cord in detail including:

- nuclei and cell groups
- cytoarchitectural lamination (Rexed laminae)
- somatic and visceral efferent neurons
- posterior horn neurons
- descending tracts
- ascending tracts
- upper and lower motor neurons
- somatotopic organization
- Autonomic Nervous System
 - Distinguish pre- and postganglionic neurons.
 - Describe the sympathetic nervous system.
 - Describe the parasympathetic nervous system.
 - Review the visceral afferent fibers.
 - Describe the structure of the autonomic ganglia.
 - Discuss the central autonomic pathways.
- Peripheral Nervous System
 - Differentiate between segmental and peripheral innervation.
 - Diagram the anatomy of the spinal nerve root.
 - Diagram and discuss the cervical, brachial, and lumbosacral plexi.
 - Outline the anatomy of the major peripheral nerves of the upper and lower extremity including:
 - axillary
 - suprascapular
 - median
 - ulnar
 - radial
 - long thoracic
 - musculocutaneous
 - lateral femoral cutaneous
 - femoral
 - obturator
 - sciatic
 - saphenous
 - peroneal
 - tibial
 - Describe the microanatomy of the peripheral nerves in detail.
 - Explain the difference between myelinated and unmyelinated nerves.
 - Review the anatomy of the Schwann cell.
 - List the peripheral afferent receptors and describe the anatomy of each.
 - Segregate peripheral neurons by size and explain the rationale for such a classification scheme.
- Muscle
 - Explain the concept of the motor unit.

- Describe the anatomy of the motor end plate.
- Describe the microscopic anatomy of striated and smooth muscle.
- Discuss the subcellular components of muscle.
- Neurophysiology
 - Review the basic biology of the nerves including:
 - synthesis and movement of proteins in the nerve
 - membrane potential and membrane properties
 - ion channels
 - generation and conduction of an action potential
 - Discuss synaptic transmission including:
 - types of synaptic transmission
 - transmitter release
 - nerve-muscle transmission
 - chemical messengers
 - direct gated receptors
 - second messenger linked receptors
 - Describe the physiology of the sensory systems including:
 - sensory receptor physiology
 - anatomy of somatic sensory system
 - coding of modality specific sensory information
 - pain and analgesia
 - cortical integration of sensory perception
 - auditory system. Within this description review the processing of hearing in the cochlea and the central auditory pathways.
 - olfaction and taste
 - Discuss the physiology of the motor system including:
 - mechanisms of muscle contraction
 - muscle receptors, spinal reflexes
 - spinal reflexes concerned with position
 - brain stem reflexes controlling motion
 - vestibular nuclei control of movement and posture
 - red nucleus control of movement
 - cortical control of movement
 - cerebellar control of movement
 - regional and cellular organization of the cerebellum
 - functional divisions of the cerebellum
 - the role of the cerebellum in planning movement
 - basal ganglia
 - the anatomy of basal ganglia pathways
 - neural transmitters in the circuits within the basal ganglia
 - thalamus
 - Describe the attributes of the autonomic nervous system including both the sympathetic and parasympathetic systems.

- Review the physiological basis of arousal and emotion. Include within this review the:
 - noradrenergic systems
 - limbic system. Include within this review the physiologic basis for emotion and memory.
 - sleeping and sleep states
 - reticular activating system
- Describe the higher cortical functions including:
 - anatomy of language
 - function of association cortex
- Describe the physiological basis for cerebrospinal fluid production and reabsorption.
- Review the physiological control of the cerebral vasculature.
- Discuss, in detail, the physiology of the hypothalamus and pituitary, particularly as related to endocrinology.
- Neuropharmacology
 - Review basic cellular neurotransmission. In the course of this review discuss:
 - the synapse
 - membrane potentials
 - ion pumps
 - ion channels
 - transmitter secretion
 - transmitter identification
 - Define and discuss receptors and receptor pharmacodynamics including:
 - receptor classification
 - receptor identification
 - dose response curves
 - agonists and antagonists
 - receptor modulation
 - Discuss the neurotransmitter acetylcholine in detail. Include within the context of the discussion:
 - cholinergic receptor classification
 - functional aspects of cholinergic receptors
 - synthesis, storage, and release of acetylcholine
 - Discuss the catecholamine neurotransmitters (norepinephrine and dopamine) in detail. Include within the context of the discussion:
 - biosynthesis of catecholamines
 - storage and release of catecholamines
 - anatomy of catecholamine receptors
 - adrenergic receptors
 - dopaminergic receptors
 - Discuss the neurotransmitter serotonin in detail. Include within the context of the discussion:

- anatomy of serotonin receptors
- biosynthesis, storage and release of serotonin
- sub-types of serotonin receptors
- Discuss the neurotransmitter glutamate in detail. Include within the context of the discussion:
 - biosynthesis, storage and release of glutamate
 - ionotropic glutamate receptors
 - NMDA receptors and subunits
 - non-NMDA receptors and subunits
 - metabotropic glutamate receptors
 - Group I metabotropic receptors and subunits
 - Group II metabotropic receptors and subunits
 - Group III metabotropic receptors and subunits
 - role in neurological disorders
- Discuss the neurotransmitters GABA and glycine in detail.
 - synthesis, uptake, and release
 - physiology and pharmacology
 - clinically relevant agonists and antagonists of GABA and glycine receptors
- Discuss the peptide neurotransmitters.
- Describe the pharmacology of each of the drugs used to treat neurological disorders.
- Neuroradiology
 - Describe the precautions which should be taken when performing radiologic examinations.
 - Identify the normal anatomical structures of the skull on antero-posterior, lateral, Towne, and submental vertex radiographs.
 - List the indications for carotid and cerebral angiography.
 - Review the potential complications to intravenous contrast agents and discuss the management of same.
 - Identify the major arteries and veins of the neck and brain on angiograms.
 - Describe the concepts of computerized tomographic (CT) scanning.
 - Identify the normal anatomical structures of the scalp, skull, dura, brain, and cranial vasculature on CT scans.
 - Describe the concepts of magnetic resonance (MR) scanning. Review the various imaging sequences which may be obtained.
 - Identify the normal anatomical structures of the scalp, skull, dura, brain, and cranial vasculature on MR scans.
 - Recognize common traumatic injuries which may be detected by skull radiographs including:
 - linear skull fractures
 - depressed skull fractures
 - pneumocephalus
 - foreign bodies

- Recognize common pathologic conditions which may be detected by skull radiographs including:
 - neoplasms
 - fibrous dysplasia
 - congenital bone diseases
 - metabolic bone disorders
 - infections
- Recognize common traumatic injuries which may be detected by head CT including:
 - skull fractures
 - pneumocephalus
 - intracranial hematomas
 - epidural
 - acute subdural
 - chronic subdural
 - intraparenchymal
 - intraventricular
 - cerebral contusions
 - subarachnoid hemorrhage
 - foreign bodies
- Recognize common pathologic conditions which may be detected by head CT including:
 - ischemic infarction
 - venous infarction
 - hydrocephalus
 - cysts
 - tumors
 - cerebral edema
 - infections
 - congenital abnormalities
 - infections
- Recognize common traumatic injuries which may be detected by head MR scans including:
 - pneumocephalus
 - intracranial hematomas
 - epidural
 - acute subdural
 - chronic subdural
 - intraparenchymal
 - intraventricular
 - cerebral contusions
 - diffuse axonal injury
- Recognize common pathologic conditions which may be detected by head MR scans including:

- ischemic infarction
- venous infarction
- hydrocephalus
- cysts
- tumors
- cerebral edema
- vascular occlusions
- infections
- congenital abnormalities
- Identify the normal anatomical structures of the craniovertebral junction on plain radiographs.
- Review the radiographic diagnoses of platybasia and cranial settling.
- Describe the plain radiographic findings of common traumatic injuries to the craniovertebral junction including:
 - occipital condyle fractures
 - atlanto-occipital dislocation
 - Jefferson fractures
 - posterior atlas fractures
 - dens fractures
 - axis body fractures
 - hangman's fracture
 - atlas and axis facet fractures
 - atlanto-axial rotatory dislocation
- Distinguish between orthotropic and dystropic os odontoideum.
- Describe the common congenital abnormalities of the craniovertebral junction.
- Recognize common spinal congenital abnormalities on plain radiographs.
- Recognize common spinal traumatic injuries which may be detected by plain radiographs including:
 - vertebral body fractures
 - facet fractures and dislocations
 - posterior element fractures
 - transverse process fractures
 - vertebral subluxation/dislocation
- Recognize common spinal degenerative conditions which may be detected by plain radiographs.
- Discuss the indications for CT and MR scanning of the spine in the setting of trauma.
- Describe the CT scan appearance of each of the traumatic spinal lesions previously listed.
- Describe the MR scan appearance of:
 - spinal ligament injury
 - traumatic disc herniation
 - spinal cord contusion

- spinal epidural hematoma
- Recognize common spinal degenerative conditions which may be detected by MR including:
 - disc degeneration
 - disc herniation
 - degenerative spinal stenosis
 - facet hypertrophy
 - osteophyte formation
 - foraminal stenosis
 - degenerative spondylolisthesis
 - degenerative scoliosis
 - ossification of the posterior longitudinal ligament
- Identify spinal and spinal cord tumors on CT and MR scans.
- Discuss the indications for spinal myelography.
- Review the indications for spinal angiography.
- Discuss the use of both the radiographic contrast and radionuclide shuntogram in evaluating neurosurgical patients.
- Infection
 - List the common organisms responsible for meningitis in an age related fashion.
 - List the common CNS infections and describe the populations which are most at risk for each.
 - List the common opportunistic CNS infections and describe the populations which are most at risk for each.
 - Describe in detail the clinical and pathological symptoms and findings associated with CNS infections.
 - Discuss the radiological evaluation of patients with suspected and known CNS infections.
 - Review the indications for alerting individuals at risk for infections based on exposure to a patient with a known CNS infectious process.
 - Review each major class of antimicrobial drugs:
 - describe the potential of resistance to each drug
 - list the potential complications of each agent
 - review the serological monitoring of each antimicrobial agent including the need for monitoring renal, hepatic and hemopoietic function
 - indicate which drugs will traverse the blood-brain barrier and which will not
 - demonstrate a knowledge of the pharmacokinetics of each antimicrobial agent
 - describe the potential complications of each antimicrobial drug and explain how to monitor for and detect same
 - review the rationale for monitoring drug levels and list the therapeutic levels of antimicrobials commonly used to treat neurosurgical infections

- Discuss the advantages and disadvantages of treatment of CNS infections with corticosteroids.
- Review the role of anticonvulsant therapy in the management of CNS infections.
- List the universal precautions for prevention of infection as they pertain to health care workers in general and neurosurgeons in particular.
- Discuss the role of hand washing as the most important method of preventing infection.
- Describe the role of the clinical epidemiologist in tracking infectious disease incidence and potential sources of infection within the hospital and community setting.
- Review the mode of transmission, diagnosis, and treatment of non-CNS infections which may commonly arise in neurosurgical patients such as:
 - respiratory infections
 - urinary tract infections
 - wound infections
- Review the prevention, diagnosis and management of sepsis.
- List the common sources of a postoperative fever.
- Describe the workup for a febrile patient.
- Discuss the use of prophylactic antibiotics.
- Review the symptoms, clinical evaluation and management of patients with shunt infections.
- Discuss prion disease and precautions to be taken when it is suspected.

Objectives

- The PGY-1 resident on this rotation will acquire the basic clinical knowledge needed to manage general neurosurgery patients as assessed by the Chief Resident and faculty evaluations, as well as written in training examination.
- The PGY-1 resident on this rotation will acquire fundamental knowledge in neuroanatomy, neurophysiology and neuropharmacology as assessed by the Chief Resident and faculty evaluations as well as written in training examination.
- The PGY-1 resident on this rotation will acquire the basic clinical knowledge to manage infection in neurosurgical patients as assessed by the Chief Resident and faculty evaluations as well as written in training examination.

Practice- Based Learning and Improvement

Goal

Residents 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. Residents are expected to develop skills and habits to be able to:

Competencies

- Identify strengths, deficiencies and limits in one's knowledge and expertise;

- Set learning and improvement goals.
- Identify and perform appropriate learning activities.
- Locate, appraise and assimilate evidence from scientific studies related to their patients' health problems.

Objectives

- The PGY-1 resident on this rotation will perform pertinent case-based literature reviews for patient health problems as measured by faculty evaluation.
- The PGY-1 resident on this rotation will participate in clinical conferences (including presentation of cases) as measured by conference attendance statistics, presentations at indications conference and M&M conference.

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

- Work effectively in various health care delivery settings and systems relevant to their neurosurgery
- Coordinate patient care within the health care system relevant to neurosurgery

Objectives

- The PGY-1 resident on this rotation will demonstrate the ability to create accurate and appropriate discharge summaries as measured by review of medical documentation by faculty.

Professionalism

Goal

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

Competencies

- Compassion, integrity, and respect for others
- Responsiveness to patient needs that supersedes self-interest
- Respect for patient privacy and autonomy
- Comply with all GME and Departmental regulations regarding duty hour restrictions and report personal schedule in timely and accurate fashion.
- Accurately self-report fatigue in situations that may compromise safety and/or patient care.

Objectives

- The PGY-1 resident on this rotation will demonstrate professional and compassionate care toward patients as assessed by faculty evaluation.
- The PGY-1 resident on this rotation will be compliant with all GME and Departmental regulations regarding duty hour restrictions and report personal schedule in timely and accurate fashion as assessed by duty hours tracking data, weekly review by Program Administrator and review as needed.

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

- Communicate effectively with physicians, other health professionals, and health related agencies
- Work effectively as a member of a health care team or other professional group
- Act in a consultative role to other physicians and health professionals
- Maintain comprehensive, timely, and legible medical records

Objectives

- The PGY-1 resident on this rotation will demonstrate the ability to communicate effectively with other health professionals as assessed by 360-degree evaluation by neurosurgery nurse practitioner, clinic coordinator, Program Coordinator and transcription specialist.
- The PGY-1 resident on this rotation will demonstrate the ability to maintain comprehensive, timely, and legible medical records as assessed medical documentation by faculty.

Teaching Methods

Teaching methods include formal didactic lectures as well as supervision in the operating room appropriate to the resident's level of competency.

Assessment Method (Residents)

- Written faculty evaluation of all 6 competencies.
- 360-degree evaluation of professionalism and communication by Neurosurgery nurse practitioners, Clinic coordinators and the Program Coordinator.
- Review of performance on written Boards examination.
- Progression through Milestones reported by Clinical Competency Committee every six months.

Assessment Method (Program Evaluation)

The experience is considered educational if there is demonstration of improved knowledge and operative skills over the course of the rotation.

Level of Supervision

The resident is supervised by the attending neurosurgeons appropriate to their level of competency.

Educational Resources

Greenberg, M.S. (2010). *Handbook of Neurosurgery*. New York, NY: Thieme.

NeuroOncology PGY 1

Description of Rotation or Educational Experience

- Length: 1 month
- Site: James Cancer Center
- Focus: During this rotation, the resident will be fully integrated into the neuro-oncology program at the James Cancer Center. Residents will develop skills critical for the evaluation and management (clinical and surgical) of neuro-oncology patients. Specific emphasis is placed upon continuity of care and the acquisition of a comprehensive, multi-faceted experience.
- Responsible Faculty: Vinay Puduvalli, M.B.B.S., Pierre Giglio, M.D., Javier Gonzalez, M.D. and Inan Olmez, M.D.
- Didactics:
 - Required clinical conferences include weekly Case Conference, monthly M&M Conference and monthly Grand Rounds as well as daily Faculty Teaching Rounds. Additional optional opportunities include weekly Spine Tumor Board, weekly Brain Tumor Board and weekly Skull Base Conference.
- Clinical Experience: Teaching will occur in all settings of neurologic-oncology patient care to ensure a broad experience integrated with continuity of care. The resident will make rounds daily with faculty on all patients admitted on the neuro-oncology service.
- Ambulatory Experience: The resident will attend a daily multi-disciplinary neuro-oncology clinic where they will see initial and follow-up patients, and learn to assess patients and develop operative and non-operative treatment plans for these patients.

Patient Care

Goal

Residents must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. Residents are expected to:

Competencies

- Neuro-oncology
 - Perform a complete history and physical examination on patients with intracranial neoplasms.
 - Review appropriate radiographic studies with a radiologist and formulate a differential diagnosis for patients with intracranial neoplasms.
 - Prepare patients for cranial tumor surgery.
 - Understand the positioning of patients for craniotomy and craniectomy.
 - Assist in the opening and closing of craniotomies and craniectomies for neoplasms.
 - Place lumbar drains.
 - Demonstrate the ability to open and close scalp incisions.

- Perform ventriculostomies.
- Demonstrate proper postoperative wound care.
- Practice management, legal and socioeconomic issues
 - Demonstrate an ability to interact effectively, professionally, and respectfully with members of the health care team, patients and their families.
 - Demonstrate the ability to maintain accurate and current medical records.
 - Discuss neurosurgical career options with faculty, peers, faculty, non-faculty neurosurgeons and other mentors.
 - Accumulate information about post-residency career options.
 - Create and keep current a resume/curriculum vitae.
 - Record CPT codes for office visits and procedures performed on service.
 - Accurately document H&P and consultations according to the AMA-CPT E&M documentation guidelines.

Objectives

- Upon completion of the rotation, the resident will demonstrate competency in basic neuro-oncology procedures as assessed by faculty.
- Upon completion of the rotation, the resident will demonstrate competency in patient care related practice management, legal and socioeconomic issues as assessed by faculty.

Medical Knowledge

Goal

Residents must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological, and social-behavioral sciences, as well as the application of this knowledge to patient care. Residents are expected to:

Competencies

- Neuro-oncology
 - Summarize the epidemiology, incidence, and risk factors for intracranial neoplasms.
 - Summarize the tenets of tumor biology including genetic factors and biochemical processes associated with invasion. Describe the natural history of intracranial neoplasms.
 - List a differential diagnosis of lesions requiring biopsy and describe their pathophysiology.
 - List the various types of bone tumors involving the calvarium.
 - Describe and differentiate primary and metastatic tumors, including location and common infectious, granulomatous, and cystic lesions that may present in a tumor-like manner
 - Define the cell or origin of meningioma, its common intracranial locations, and the expected presentation for each location.

- Define the embryological origin of arachnoid cysts and their natural history; list the etiologies of other cystic lesions of the brain, including tumoral and infectious.
- Describe the anatomic location, cell of origin, clinical presentation, age at presentation, and natural history of common intrinsic posterior fossa neoplasms, including cerebellar astrocytoma, medulloblastoma, and ependymoma.
- Describe the anatomy of the posterior fossa and the relation of the cranial nerves to the brain stem and skull.
- Illustrate the relationship of the facial, vestibular, and cochlear components of the acoustic nerve at the internal auditory meatus.
- Describe the various tumors that may arise in the cerebellopontine angle.
- Describe the management of a patient with a brain abscess, including the role of stereotactic drainage or open drainage.
- Explain the medical workup of a patient with a diagnosed brain abscess.
- Specify the follow-up and evaluation of the patient with a brain abscess following surgical treatment.
- Describe the embryological origin of craniopharyngioma. List the common locations of the tumor.
- Describe the common presentations of pituitary tumors, including their cell of origin and associated endocrinopathies
- Define the medical management of the secreting pituitary tumors. Explain the role of surgery in each of the tumors above.
- Describe the etiology of fibrous dysplasia, its presentation and general management. List the indications for surgery for benign tumors of bone at the base of the skull, and potential adjuvant therapy.
- List the tumors that may be routinely approached via a transtemporal route.
- Describe the indications for use of lumbar spinal drainage in skull base surgery, and its implementation. List all complications associated with continuous lumbar spinal drainage.
- Illustrate the general principles of stereotaxis and the underlying localization techniques used in the presently used frame-based and frameless systems.
- Discuss the syndromes produced by mass lesions affecting the cranial nerves
- Discuss the radiological evaluation of suspected CNS and spinal infection.
- Practice management, legal and socioeconomic issues
 - Discuss the ethical and moral factors associated with the practice of neurosurgery.
 - Review the role of the neurosurgical leadership in the community and hospital setting.
 - Explain the neurosurgeon's responsibilities in terms of health care cost containment.
 - Review the features and relationships of the healthcare system

- Recite the rules and regulations of the training hospital(s) as they pertain to the practice of neurosurgery.
- Name the institutional and social service agencies in your community and review their role in the overall management of neurosurgical patients.
- Demonstrate knowledge of the rules and regulations of the Ohio State Medical Board.
- Discuss the concept of informed consent.

Objectives

- The PGY-1 resident on this rotation will acquire the fundamental clinical knowledge needed to manage patients with neuro-oncological disorders as assessed by faculty evaluations and the written in training examination.
- The PGY-1 resident on this rotation will acquire the fundamental knowledge in the anatomy, physiology, imaging and pathogenesis of neuro-oncological disorders as assessed by faculty evaluations and the written in training examination.
- The PGY-1 resident on this rotation will acquire fundamental knowledge pertaining to clinical presentation and pathophysiology of common traumatic injuries to the central nervous system as assessed by faculty evaluations and the written in training examination.
- The PGY-1 resident on this rotation will acquire basic knowledge in practice management, legal and socioeconomic issues that face a neurosurgeon as assessed by faculty evaluations and the written in training examination.

Practice- Based Learning and Improvement

Goal

Residents 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 lifelong learning. Residents are expected to develop skills and habits to be able to:

Competencies

- Locate, appraise and assimilate evidence from scientific studies related to their patients' health problems
- Use information technology to optimize teaching
- Participate in the education of patients, families, students, residents and other health professionals

Objectives

- The PGY-1 resident on this rotation will perform pertinent case-based literature reviews for patient health problem and provide education to patients, families, students, residents and other health professionals on these topics in direct interaction and at combined conferences. This will be assessed by

direct faculty observation, evaluation and review of presentations at the combined conferences.

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

- Work effectively in various health care delivery settings and systems relevant to neurosurgery.
- Work in interprofessional teams to enhance patient safety and improve patient care quality
- Participate in identifying systems errors and in implementing potential systems solutions

Objectives

- The PGY-1 resident on this rotation will perform effectively as a member of an interprofessional team to enhance patient safety and improve patient care quality as assessed by faculty.
- The PGY-1 resident on this rotation will identify system errors and propose potential solutions to rotation faculty. This will be as assessed by faculty.

Professionalism

Goal

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

Competencies

- Respect for patient privacy and autonomy
- Sensitivity and responsiveness to a diverse patient population, including but not limited to diversity in gender, age, culture, race, religion, disabilities, and sexual orientation
- Comply with all GME and Departmental regulations regarding duty hour restrictions and report personal schedule in timely and accurate fashion.
- Accurately self-report fatigue in situations that may compromise safety and/or patient care.

Objectives

- The PGY-1 resident on this rotation will demonstrate respect toward patients and demonstrate sensitivity and responsiveness to a diverse patient population as assessed by faculty evaluation.

- The PGY-1 resident on this rotation will be compliant with all GME and Departmental regulations regarding duty hour restrictions and report personal schedule in timely and accurate fashion as assessed by duty hours tracking data, weekly review by Program Administrator and review as needed.

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

- Communicate effectively with physicians, other health professionals, and health related agencies
- Work effectively as a member of a health care team

Objectives

- The PGY-1 resident on this rotation will demonstrate the ability to communicate effectively with other health professionals and work effectively as a health care team member as assessed by 360-degree evaluation by neurosurgery nurse practitioner, clinic coordinator, Program Coordinator and transcription specialist.

Teaching Methods

Teaching methods include formal didactic lectures as well as supervision in the operating room appropriate to the resident's level of competency.

Assessment Method (Residents)

- Written faculty evaluation of all 6 competencies.
- 360-degree evaluation of professionalism and communication by Neurosurgery nurse practitioners, Clinic coordinators and the Program Coordinator.
- Review of performance on written Boards examination.
- Progression through Milestones reported by Clinical Competency Committee every six months.

Assessment Method (Program Evaluation)

The experience is considered educational if there is demonstration of improved knowledge and operative skills over the course of the rotation.

Level of Supervision

The resident is supervised by the attending neurosurgeons appropriate to their level of competency.

Educational Resources

- Textbook of Neuro-Oncology by Mitchel S. Berger, Michael Prados, 2004

- Practical Neuro-Oncology: A Guide to Patient Care by Leslie D. McAllister, John M. Ward, Lisa M. DeAngelis, Susan F. Schulman , 2001
- Cancer of the Nervous System: Principles and Practice of Neuro-Oncology by David Schiff, 2005
- Molecular Makers of Brain Tumor Cells by Bela Bodey, Stuart E. Siegel, Hans E. Kaiser, 2004
- Diagnostic Imaging: Brain by Anne Osborn, Susan Blaser, Karen Salzman, 2004
- Neuropathology: A Reference Text of CNS Pathology by David Ellison, Seth Love, Leila Chimelli, Brian Harding, James Lowe, Harry V. Vinters , 2003

NeuroAnesthesia PGY 1

Description of Rotation or Educational Experience

- Type: Required
- Length: 1 month
- Site: University Hospital and James Cancer Center
- Focus: The resident will gain experience with a diverse population of patients with surgical neurological disorders (for example, brain and spinal cord injury, subarachnoid hemorrhage and intracerebral hemorrhage) during this rotation in this ACGME accredited Anesthesiology Residency Program. Residents will learn the neurological examination, diagnosis and management of patients with neurologic disorders undergoing anesthesia.
- Responsible Faculty: Sergio Bergese, M.D., Brian Dishong, M.D., Michelle Humeidan, M.D., Demicha Rankin, M.D., Gurneet Sandhu, M.D. and David Yehsakul, M.D.
- Didactics:
 - Required clinical conferences include weekly Case Conference, monthly M&M Conference and monthly Grand Rounds as well as daily Faculty Teaching Rounds. Additional optional opportunities include weekly Spine Tumor Board, weekly Brain Tumor Board, weekly DBS Conference, weekly Skull Base Conference and weekly Stroke Case Conference.
- Clinical Experience: The NeuroAnesthesia team consists of five dedicated NeuroAnesthesiologists. The resident will take, on average, 6 12-hour days of in-house NeuroAnesthesia call where they will be directly involved with the supervised management of patients undergoing anesthesia for surgical procedures.
- Ambulatory Experience: The residents will spend one day each week at the Ohio State Comprehensive Spine Center for education on EMG/NCS in the outpatient setting.

Patient Care

Goal

Residents must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. Residents are expected to achieve the following:

Competencies

- Demonstrate the ability to perform an initial evaluation and management of patients undergoing anesthesia.
- Perform the following procedures:
 - endotracheal intubation
 - arterial line placement
 - central venous catheter placement
- Demonstrate an ability to manage neurosurgical patients undergoing anesthesia.
- Demonstrate an ability to perform and interpret EMG/NCS.

Objectives

- Upon completion of the rotation, the resident will demonstrate competency in managing neurosurgery patients undergoing anesthesia as assessed by rotation faculty evaluations.
- Upon completion of the rotation, the resident will demonstrate competency in performing and interpreting EMG/NCS.

Medical Knowledge

Goal

Residents must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological, and social-behavioral sciences, as well as the application of this knowledge to patient care. Residents are expected to:

Competencies

- NeuroAnesthesia
 - Name an initial choice for intravenous fluids for anesthesia patients with the following diagnoses and explain changes in that choice based upon specific changes in the patient's diagnosis, clinical condition, electrolyte and volume status:
 - head injury
 - stroke
 - tumor
 - infection
 - hydrocephalic
 - Propose appropriate initial ventilator settings for patients with different types of common neurosurgical conditions and explain changes in that choice based upon specific changes in the patient's metabolic or pulmonary status.
 - List the mechanisms of action and potential complications of commonly used vasopressors and hypotensive agents.
 - Discuss indications, pharmacologic mechanism, duration of action, and effect on the neurologic examination for sedative, paralytic, and analgesic agents commonly used in the operating room.
 - Explain the indications, advantages, and risks for various hemodynamic monitoring tools (e.g. pulmonary artery catheters, indwelling arterial lines) used in anesthesia patients.
 - Discuss the pathophysiology and management of coagulopathy during surgery.
 - Explain the treatment of intraoperative seizures.
 - Outline basic principles of anesthetic management of patients with spinal cord injury.
 - Name the major structures supplied by the major vessels of the brain and spinal cord.

- Describe the indications and pharmacokinetics for medications commonly used in the operating room including:
 - vasoactive drugs
 - inotropic drugs
 - bronchodilators
 - diuretics
 - antiarrhythmics
 - antihypertensives
 - antimicrobials
 - anticonvulsants
- Review the indications for intubation including:
 - loss of patient airway
 - respiratory insufficiency
 - inability to protect airway
- Discuss commonly used pulmonary values including:
 - measured pulmonary functions
 - rate
 - minute ventilation
 - spontaneous tidal volume
 - forced vital capacity (FVC)
 - functional residual capacity (FRC)
 - maximum ventilatory volume (MVV)
 - ventilator modes and settings
 - pressure versus volume ventilation
 - continuous positive airway pressure (CPAP)
 - intermittent positive airway pressure (IPAP)
 - pressure support
 - assist control
 - intermittent mandatory ventilation (IMV)
 - positive end expiratory pressure (PEEP)
 - rate
 - tidal volume
- Review the indications for weaning patients from ventilatory support. Describe the methods by which this is accomplished and the general pulmonary parameters a patient must demonstrate prior to extubation.
- Discuss the medications used to improve pulmonary function.
- Briefly review the following cardiac function parameters:
 - preload
 - afterload
 - contractility
- Review the indications for implementing the following monitoring devices. Briefly describe how the information obtained is utilized to optimize patient management:
 - arterial catheters

- central venous catheters
- Swan-Ganz catheters
- pulse oximetry
- electrocardiographic monitoring
- end-tidal CO₂ monitors
- List the signs of acute myocardial ischemia and briefly discuss the emergent treatment of this condition.
- Review the impact of renal insufficiency as it pertains to the management of neurosurgical patients undergoing anesthesia.
- review the diagnosis and management principles of the following endocrine disorders:
 - hypo/hyperthyroidism
 - hypo/hyperparathyroidism
 - adrenal cortical excess and deficiency
 - diabetes mellitus
 - diabetes insipidus
- Summarize the physiology of hydrogen ion production and excretion.
- Briefly discuss acute and chronic buffering systems.
- Discuss metabolic acidosis and alkalosis.
- Discuss respiratory acidosis and alkalosis.
- Review the effects of acid-base disturbances on the central nervous system and intracranial pressure.
- **EMG/NCS**
 - Discuss electromyographic (EMG) testing in detail. Describe how the testing is performed and review the diagnostic capabilities of EMG testing. Describe the EMG changes associated with neuromuscular pathology.
 - List the indications for using intraoperative EMG testing and describe in detail how the procedure may be performed.
 - Discuss nerve conduction velocity (NCV) testing in detail. Describe how the testing is performed and review its diagnostic capabilities. List the transmission velocities of the major nerves. Describe NCV changes observed in neuropathy.

Objectives

- The PGY-1 resident on this rotation will acquire the basic clinical knowledge needed to manage patients with neurologic disorders undergoing anesthesia as assessed by rotation faculty evaluations as well as written in training examination.
- The PGY-1 resident on this rotation will acquire the basic clinical knowledge needed to perform and interpret EMG/NCS as assessed by rotation faculty evaluations as well as written in training examination.

Practice- Based Learning and Improvement

Goal

Residents 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. Residents are expected to develop skills and habits to be able to :

Competencies

- Locate, appraise and assimilate evidence from scientific studies related to their patients' health problems
- Use information technology to optimize learning

Objectives

- The PGY-1 resident on this rotation will perform pertinent case-based literature reviews for patient health problems and present them at teaching rounds. This will be assessed by rotation faculty evaluation.

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

- Coordinate patient care within the health care system relevant to neuro-critical care.
- Work in interprofessional teams to enhance patient safety and improve patient care quality.

Objectives

- The PGY-1 resident on this rotation will demonstrate the ability to work in an interprofessional team to enhance patient safety and coordinate anesthesia care as assessed by rotation faculty evaluation.

Professionalism

Goal

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

Competencies

- Compassion, integrity, and respect for others
- Responsiveness to patient needs that supersedes self-interest
- Respect for patient privacy and autonomy

- Comply with all GME and Departmental regulations regarding duty hour restrictions and report personal schedule in timely and accurate fashion.
- Accurately self-report fatigue in situations that may compromise safety and/or patient care.

Objectives

- The PGY-1 resident on this rotation will demonstrate professional and compassionate care toward patients as assessed by faculty evaluation.
- The PGY-1 resident on this rotation will be compliant with all GME and Departmental regulations regarding duty hour restrictions and report personal schedule in timely and accurate fashion as assessed by duty hours tracking data, weekly review by Program Administrator and review as needed.

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

- 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

Objectives

- The PGY-1 resident on this rotation will demonstrate the ability to communicate effectively with other health professionals as assessed by 360-degree evaluation by neurosurgery nurse practitioner, clinic coordinator, Program Coordinator and transcription specialist.
- The PGY-1 resident on this rotation will demonstrate the ability to maintain comprehensive, timely, and legible medical records as assessed medical documentation by faculty.

Teaching Methods

Teaching methods include formal didactic lectures as well as supervision in the operating room appropriate to the resident's level of competency.

Assessment Method (Residents)

- Written faculty evaluation of all 6 competencies.
- 360-degree evaluation of professionalism and communication by Neurosurgery nurse practitioners, Clinic coordinators and the Program Coordinator.
- Review of performance on written Boards examination.
- Progression through Milestones reported by Clinical Competency Committee every six months.

Assessment Method (Program Evaluation)

The experience is considered educational if there is demonstration of improved knowledge and operative skills over the course of the rotation.

Level of Supervision

The resident is supervised by the attending NeuroAnesthesiologist appropriate to their level of competency.

Educational Resources

Greenberg, M.S. (2010). *Handbook of Neurosurgery*. New York, NY: Thieme.
Marino, P.L. (2013). *The ICU Book*. Philadelphia, PA: LWW.

NeuroCritical Care PGY 1

Description of Rotation or Educational Experience

- Type: Required
- Length: 3 months
- Site: University Hospital and James Cancer Center
- Focus: The resident will gain experience with a diverse population of patients with surgical neurological disorders (for example, brain and spinal cord injury, subarachnoid hemorrhage and intracerebral hemorrhage) and medical neurological disorders (for example, myasthenia gravis, Guillain-Barre syndrome, ischemic stroke and status epilepticus) during this rotation. Residents will learn the neurological examination, diagnosis and management of critically ill patients with neurologic disorders.
- Responsible Faculty: Youssef Hanawi, M.D., Brian Gough, M.D., Archana Hinduja, M.D., Shradda Mainali, M.D. and Vanessa Olcese, M.D., Ph.D.
- Didactics:
 - Required clinical conferences include weekly NeuroCritical Care Teaching Conferences and daily Faculty Teaching Rounds.
- Clinical Experience: The neurological ICU is staffed by 4 full-time NeuroCritical Care neurologists and 1 NeuroCritical Care surgeon. The resident will take, on average, 6 12-hour days of in-house NCCU call where they will be directly involved with the supervised management of NCCU patients and admission of NCCU patients.
- Ambulatory Experience: The resident will receive instruction and acquire experience in a bimonthly full-day general neurosurgical outpatient clinic.

Patient Care

Goal

Residents must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. Residents are expected to achieve the following:

Competencies

- Demonstrate the ability to perform an initial evaluation and management of critically ill NCCU patients.
- Perform the following procedures:
 - endotracheal intubation
 - nasogastric intubation
 - bladder intubation
 - arterial line placement
 - central venous catheter placement
- Demonstrate an ability to manage neurology and neurosurgical patients in a critical care setting.
- Diagnose and treat acid-base abnormalities in NCCU patients.

- Demonstrate an understanding of the management of complex acid-base disturbances in the critical care setting.

Objectives

- Upon completion of the rotation, the resident will demonstrate competency in managing critically ill patients with neurologic disorders as assessed by rotation faculty evaluations.

Medical Knowledge

Goal

Residents must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological, and social-behavioral sciences, as well as the application of this knowledge to patient care. Residents are expected to:

Competencies

- Neurology
 - Discuss electroencephalography. Recognize normal and abnormal EEG patterns. Identify specific epileptic conditions by EEG findings.
 - Describe the principles of sensory evoked potential testing (SEPs). Discuss how SEPs may be useful diagnostically.
 - List the indications for using intraoperative SEP monitoring and describe in detail how the procedure may be performed.
 - Describe the principles of visual evoked potential testing (VEPs). Discuss how VEPs may be useful diagnostically.
 - Describe the principles of motor evoked potential testing (MEPs). Discuss how MEPs may be useful diagnostically.
 - List the indications for using intraoperative MEP monitoring and describe in detail how the procedure may be performed.
 - Define delirium and dementia. List the differential diagnoses for each.
 - Define and discuss coma and altered states of consciousness.
 - Describe the evaluation of a patient with syncope.
 - Describe the etiology and pathogenesis of cerebrovascular disease.
 - Review the clinical presentation and discuss the radiographic evaluation, clinical evaluation, and management of the following:
 - transient ischemic attacks
 - cerebral infarction
 - cerebral and cerebellar hemorrhage
 - subarachnoid hemorrhage
 - venous infarction
 - Identify the primary causes of stroke in the pediatric population.
 - Comprehensively discuss the etiology, clinical presentation, diagnostic evaluation, and management of cerebral vasculitis.
 - Differentiate between basal occlusive disease with and without telangiectasia. Review the prognosis and treatment options for each.
 - Describe the acute and chronic effects of ionizing radiation on the central

- nervous system.
- Review the diagnosis and management of pseudotumor cerebri.
 - Discuss the diagnosis and management of normal pressure hydrocephalus.
 - Discuss the management of hyperosmolar hyperglycemic nonketotic diabetic coma.
 - Review the neurological manifestations of altitude sickness.
 - List the neurological manifestations of decompression sickness.
 - Describe autism.
 - Review the general topic of chromosomal abnormalities as they may relate to the central nervous system including etiology, inheritance patterns, penetrance, and laboratory diagnosis.
 - List the major syndromes characterized by obesity and hypogonadism, including Prader-Willi syndrome.
 - Discuss agenesis of the corpus callosum.
 - Discuss anencephaly, microencephaly, and megalencephaly.
 - List the major disorders of amino acid and purine metabolism. Discuss the neurological manifestations of each.
 - Review each of the major storage diseases including:
 - GM₁-Gangliosidosis
 - GM₂-Gangliosidosis
 - Fabry disease
 - Gaucher disease
 - Niemann-Pick disease
 - Farber disease
 - Wolman disease
 - Refsum disease
 - Cerebrotendinous Xanthomatosis
 - Neuronal ceroid lipofuscinoses
 - Review each of the major leukodystrophies including:
 - Krabbe leukodystrophy
 - metachromatic leukodystrophy
 - X-linked leukodystrophies with and without adrenal involvement.
 - Review each of the major mucopolysaccharidoses including:
 - Hurler syndrome (MPS IH)
 - Hunter syndrome (MPS II)
 - Sanfilippo syndrome (MPS III)
 - Morquio syndrome (MPS IV)
 - Maroteaux-Lamy syndrome (MPS VI)
 - Review the disorders of carbohydrate metabolism including:
 - glycogen storage diseases
 - Lafora disease and other polyglucosan storage diseases
 - Discuss hyperammonemia as it relates to neurological dysfunction.
 - Discuss adrenoleukodystrophy as it relates to neurological dysfunction

- including Reye's syndrome.
- Review the major syndromes of dysfunctional copper metabolism including:
 - hepatolenticular degeneration (Wilson disease)
 - trichopoliodystrophy (Menkes' syndrome)
 - Review the pathogenesis, clinical presentation, diagnosis, and treatment of acute intermittent porphyria. List drugs to avoid in patients with porphyria (i.e., sulfa drugs, etc.).
 - Review the pathogenesis, clinical presentation, diagnosis, and treatment of abetalipoproteinemia.
 - Review the disorders associated with xeroderma pigmentosum.
 - List the major cerebral degenerative disorders of childhood including:
 - progressive sclerosing poliodystrophy
 - spongy degeneration
 - infantile neuraxonal dystrophy
 - Hallervorden-Spatz disease
 - Pelizaeus-Merzbacher disease
 - Alexander disease
 - Cockayne syndrome
 - peroxisomal diseases
 - Leigh disease
 - Review in detail the major neurocutaneous disorders including:
 - neurofibromatosis, Type 1 and Type 2
 - encephalotrigeminal angiomatosis
 - incontinentia pigmenti
 - tuberous sclerosis
 - Discuss Leber Hereditary Optic Atrophy.
 - Review the salient features of progressive external ophthalmoplegia.
 - Define peripheral neuropathy, polyneuropathy, mononeuropathy, mononeuropathy multiplex, and neuritis.
 - Review the major inherited neuropathies including:
 - peroneal muscle atrophy
 - Dejerine-Sottas disease
 - Refsum disease
 - hereditary sensory neuropathy
 - porphyric neuropathy
 - Discuss the etiology, clinical presentation, diagnosis, treatment, and prognosis of Guillain-Barre syndrome.
 - List the major acquired neuropathies other than Guillain-Barre syndrome including:
 - chronic demyelinating polyneuritis
 - acute and chronic idiopathic sensory neuropathy
 - acute pandysautonomia
 - tick paralysis

- brachial neuropathy (neuralgic amyotrophy)
- radiation neuropathy
- cold neuropathy
- cryoglobulin neuropathy
- diabetic neuropathy
- hypothyroid neuropathy
- acromegalic neuropathy
- vasculitic neuropathy
- uremic neuropathy
- hepatic neuropathy
- infectious neuropathies
 - leprosy
 - acquired immunodeficiency virus
 - Lyme
 - herpes zoster
- sarcoid neuropathy
- paraneoplastic neuropathy
- amyloid neuropathy
- polyneuropathy associated with plasma cell dyscrasia
- polyneuropathy associated with dietary deficiencies
- neuropathy induced by metals
 - arsenic
 - lead
 - mercury
 - thallium
- drug-induced neuropathy
- neuropathy produced by aliphatic chemicals
- Discuss the major hereditary ataxias including:
 - Friedreich ataxia
 - Levy-Roussy syndrome
 - hereditary cerebellar ataxia
- Review the major noninherited forms of cerebellar ataxia including:
 - acute cerebellar ataxia in children
 - ataxia telangiectasia
 - Marinesco-Sjögren syndrome
 - Ramsay-Hunt syndrome
 - Joseph disease
- Discuss the pathophysiology, clinical presentation, treatment, and prognosis of Alzheimer's disease, Pick disease, and diffuse Lewy body disease.
- Define hemichorea and hemiballismus.
- Review the pathophysiology, clinical presentation, treatment, and prognosis of Sydenham chorea, Huntington's disease, and senile chorea.
- Define myoclonus.

- Review Tourette's syndrome.
- Review the major general and focal dystonic conditions.
- Define benign essential tremor.
- Discuss the pathophysiology, clinical presentation, diagnosis, treatments and prognosis of Parkinsonism in detail.
- Define progressive supranuclear palsy.
- Review the pathophysiology, clinical presentation, diagnosis, and treatment of tardive dyskinesia.
- Discuss hereditary spastic paraplegia.
- List the major generalized and focal forms of spinal muscular atrophy including:
 - Wernig-Hoffmann disease
 - Kugelberg-Welander syndrome
 - benign focal amyotrophy
- Describe the pathophysiology and neurological manifestations of poliomyelitis.
- Review the pathophysiology, clinical presentation, diagnosis, treatment, and prognosis of amyotrophic lateral sclerosis.
- Review the pathophysiology, clinical presentation, diagnosis, treatment, and prognosis of subacute combined degeneration of the spinal cord.
- Review the pathophysiology, clinical presentation, diagnosis, treatment, and prognosis of juvenile and adult myasthenia gravis.
- Review the pathophysiology, clinical presentation, diagnosis, treatment, and prognosis of botulism.
- Review the common muscular dystrophies including:
 - Duchenne muscular dystrophy
 - fascioscapulohumeral muscular dystrophy
 - myotonic muscular dystrophy
 - myotonia congenita
 - congenital muscular dystrophy
- Review the major periodic paralysis syndromes including:
 - familial periodic paralysis
 - hypokalemic periodic paralysis
 - hyperkalemic periodic paralysis
 - paramyotonia congenita
- Discuss polymyositis.
- Review the epidemiology, pathophysiology, clinical presentation, diagnosis, treatment, and prognosis of multiple sclerosis.
- Define Marchiafava-Bignami disease.
- Review central pontine myelinolysis in detail.
- Discuss multiple system atrophy.
- Review the pathophysiology, clinical presentation, diagnosis, treatment, and prognosis of migraine headaches.
- Discuss the diagnosis and management of non-migrainous headache

- syndromes.
 - Review the pathophysiology, clinical presentation, diagnosis, treatment, and prognosis of the common epileptic disorders in detail.
 - Define status epilepticus and discuss the medical treatment of same.
 - Describe the neurological implications of the common collagen-vascular diseases.
 - Describe the neurological implications of alcoholism.
 - Discuss the neurological aspects of pregnancy.
 - Review malignant hyperthermia.
- Critical Care
 - Name an initial choice for intravenous fluids for a newly admitted Intensive Care Unit (ICU) patients with the following diagnoses and explain changes in that choice based upon specific changes in the patient's diagnosis, clinical condition, electrolyte and volume status:
 - head injury
 - stroke
 - tumor
 - infection
 - hydrocephalic
 - Propose appropriate initial ventilator settings for patients with different types of common neurosurgical conditions and explain changes in that choice based upon specific changes in the patient's metabolic or pulmonary status.
 - List the mechanisms of action and potential complications of commonly used vasopressors and hypotensive agents.
 - Discuss indications, pharmacologic mechanism, duration of action, and effect on the neurologic examination for sedative, paralytic, and analgesic agents commonly used in the ICU.
 - Explain the indications, advantages, and risks for various hemodynamic monitoring tools (e.g. pulmonary artery catheters, indwelling arterial lines) used in critically ill patients.
 - Discuss the pathophysiology and management of coagulopathy after head injury.
 - Describe basic principles of nutritional management in neurosurgical critical care.
 - Explain the treatment of posttraumatic seizures.
 - Outline basic principles of ICU management of patients with spinal cord injury.
 - Name the major structures supplied by the major vessels of the brain and spinal cord.
 - Discuss the evaluation, treatment, and prognosis of subarachnoid hemorrhage, both traumatic and spontaneous.
 - Explain the pathophysiology and treatment of cerebral vasospasm.
 - Formulate a diagnostic and treatment plan for patients with cerebral ischemia.

- Explain the evaluation and management of birth-related intracranial hemorrhage, spinal cord injury, and brachial plexus injury.
- Describe a systematic approach to the examination of the peripheral nervous system.
- Describe the basic principles of management of peripheral nerve injuries.
- List principles of rehabilitation of different types of neurosurgical patients.
- Define brain death and discuss methods of making such a diagnosis.
- Describe the pathophysiology of electrical injuries to the nervous system and review treatment of same.
- Define the adult and pediatric patient which would be best served in a critical care setting; include both medical and neurosurgical issues within the context of this discussion.
- Review general medical issues pertinent to the management of neurosurgical patients in a critical care setting including:
 - prophylaxis of gastrointestinal hemorrhage
 - prophylaxis of pulmonary morbidity
 - prophylaxis, diagnosis, and treatment of venous thrombosis and pulmonary embolism
 - skin care
 - eye care
 - physical therapy to maintain strength and joint range of motion
 - universal precautions
 - workup and treatment of sepsis
- Describe the indications and pharmacokinetics for medications commonly used in the management of critically ill neurosurgical patients including:
 - vasoactive drugs
 - inotropic drugs
 - bronchodilators
 - diuretics
 - antiarrhythmics
 - antihypertensives
 - antimicrobials
 - anticonvulsants
- Describe the clinical presentation, evaluation, and treatment of infections which commonly occur in critical care neurosurgical patients.
- Review the indications for intubation including:
 - loss of patient airway
 - respiratory insufficiency
 - inability to protect airway
- Discuss commonly used pulmonary values including:
 - measured pulmonary functions
 - rate
 - minute ventilation
 - spontaneous tidal volume

- forced vital capacity (FVC)
- functional residual capacity (FRC)
- maximum ventilatory volume (MVV)
- ventilator modes and settings
 - pressure versus volume ventilation
 - continuous positive airway pressure (CPAP)
 - intermittent positive airway pressure (IPAP)
 - pressure support
 - assist control
 - intermittent mandatory ventilation (IMV)
 - positive end expiratory pressure (PEEP)
 - rate
 - tidal volume
- Review the indications for weaning patients from ventilatory support. Describe the methods by which this is accomplished and the general pulmonary parameters a patient must demonstrate prior to extubation.
- Discuss the medications used to improve pulmonary function.
- Briefly review the following cardiac function parameters:
 - preload
 - afterload
 - contractility
- Review the indications for implementing the following monitoring devices. Briefly describe how the information obtained is utilized to optimize patient management:
 - arterial catheters
 - central venous catheters
 - Swan-Ganz catheters
 - pulse oximetry
 - electrocardiographic monitoring
 - end-tidal CO2 monitors
- List the signs of acute myocardial ischemia and briefly discuss the emergent treatment of this condition.
- Review the impact of renal insufficiency as it pertains to the management of neurosurgical patients.
- Briefly discuss the diagnosis and management of acute renal insufficiency.
- Describe the diagnosis and management of an ileus. List the differential diagnosis for an ileus.
- review the diagnosis and management principles of the following endocrine disorders:
 - hypo/hyperthyroidism
 - hypo/hyperparathyroidism
 - adrenal cortical excess and deficiency
 - diabetes mellitus
 - diabetes insipidus

- Review the medical and legal definitions of brain death.
- Discuss moral and ethical issues pertaining to critically ill neurosurgical patients including:
 - patient or family requests to withhold or withdraw treatment
 - organ donation.
- Summarize the physiology of hydrogen ion production and excretion.
- Briefly discuss acute and chronic buffering systems.
- Discuss metabolic acidosis and alkalosis.
- Discuss respiratory acidosis and alkalosis.
- Review the effects of acid-base disturbances on the central nervous system and intracranial pressure.

Objectives

- The PGY-1 resident on this rotation will acquire the basic clinical knowledge needed to manage critically ill patients with neurologic disorders as assessed by rotation faculty evaluations as well as written in training examination.
- The PGY-1 resident on this rotation will acquire basic fundamental knowledge in anatomy, physiology and pharmacology as they relate to neurologic disorders and critically ill patients as assessed by rotation faculty evaluations as well as written in training examination.

Practice- Based Learning and Improvement

Goal

Residents 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. Residents are expected to develop skills and habits to be able to :

Competencies

- Locate, appraise and assimilate evidence from scientific studies related to their patients' health problems
- Use information technology to optimize learning

Objectives

- The PGY-1 resident on this rotation will perform pertinent case-based literature reviews for patient health problems and present them at teaching rounds. This will be assessed by rotation faculty evaluation.

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

- Coordinate patient care within the health care system relevant to neuro-critical care.
- Work in interprofessional teams to enhance patient safety and improve patient care quality.

Objectives

- The PGY-1 resident on this rotation will demonstrate the ability to work in an interprofessional team to enhance patient safety and coordinate neurologic and surgical critical care as assessed by rotation faculty evaluation.

Professionalism

Goal

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

Competencies

- Compassion, integrity, and respect for others
- Responsiveness to patient needs that supersedes self-interest
- Respect for patient privacy and autonomy
- Comply with all GME and Departmental regulations regarding duty hour restrictions and report personal schedule in timely and accurate fashion.
- Accurately self-report fatigue in situations that may compromise safety and/or patient care.

Objectives

- The PGY-1 resident on this rotation will demonstrate professional and compassionate care toward patients as assessed by faculty evaluation.
- The PGY-1 resident on this rotation will be compliant with all GME and Departmental regulations regarding duty hour restrictions and report personal schedule in timely and accurate fashion as assessed by duty hours tracking data, weekly review by Program Administrator and review as needed.

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

- 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

Objectives

- The PGY-1 resident on this rotation will demonstrate the ability to communicate effectively with other health professionals as assessed by 360-degree evaluation by neurosurgery nurse practitioner, clinic coordinator, Program Coordinator and transcription specialist.
- The PGY-1 resident on this rotation will demonstrate the ability to maintain comprehensive, timely, and legible medical records as assessed medical documentation by faculty.

Teaching Methods

Teaching methods include formal didactic lectures as well as supervision in the operating room appropriate to the resident's level of competency.

Assessment Method (Residents)

- Written faculty evaluation of all 6 competencies.
- 360-degree evaluation of professionalism and communication by Neurosurgery nurse practitioners, Clinic coordinators and the Program Coordinator.
- Review of performance on written Boards examination.
- Progression through Milestones reported by Clinical Competency Committee every six months.

Assessment Method (Program Evaluation)

The experience is considered educational if there is demonstration of improved knowledge and operative skills over the course of the rotation.

Level of Supervision

The resident is supervised by the attending neurosurgeons appropriate to their level of competency.

Educational Resources

Greenberg, M.S. (2010). *Handbook of Neurosurgery*. New York, NY: Thieme.
Marino, P.L. (2013). *The ICU Book*. Philadelphia, PA: LWW.

Junior Clinical Rotation (General) – University Hospital and James Cancer Center
PGY 2 and PGY 3

Description of Rotation or Educational Experience

- Length: 2 months
- Site: University Hospital and James Cancer Center
- Focus: Oncology, Spine, Functional and Vascular are the components of the PGY 2 and PGY 3 Junior Clinical Rotations in General Neurosurgery. During this rotation, the resident will be fully integrated into the Oncology, Spine, Functional and Vascular programs at the OSUWMC. Residents will develop skills critical for the evaluation and management (clinical and surgical) of patients with spinal, functional and vascular disorders. Specific emphasis is placed upon continuity of care and the acquisition of a comprehensive, multi-faceted experience.
- Responsible Faculty: Russell Lonser, M.D., Brian Dalm, M.D., Brad Elder, M.D., Frank Farhadi, M.D., Andrew Grossbach, M.D., Doug Hardesty, M.D., Vibhor Krishna, M.B.B.S., John McGregor, M.D., Ehud Mendel, M.D., Shahid Nimjee, M.D., Ph.D., Ciarán J. Powers, M.D., Ph.D., Daniel Prevedello, M.D., Steve Viljoen, M.D., Patrick Youssef, M.D.
- Didactics:
 - Required clinical conferences include weekly Case Conference, monthly M&M Conference and monthly Grand Rounds as well as daily Faculty Teaching Rounds. Additional optional opportunities include weekly Spine Tumor Board, weekly Brain Tumor Board, weekly DBS Conference, weekly Skull Base Conference and weekly Stroke Case Conference.
- Clinical Experience: The resident will be provided with a broad experience in oncology, spine, functional and vascular surgery, including routine and complex problems. The resident will round daily on patients on the service and will participate in the surgical procedures during the remainder of the week. The resident will take, on average, 7 24-hour days of in-house neurosurgery call each month where they will be directly involved with the supervised management of neurosurgical patients, admission of neurosurgical patients and performance of consults (including in the Emergency Department).
- Ambulatory Experience: The resident will attend 1 half-day of clinic per week where the resident will gain exposure to the diagnosis and management of patients with diverse neurosurgical problems including operative and non-operative management.

Patient Care

Goal

Residents must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. Residents are expected to:

Competencies

- Spine

- Perform a complete history and physical examination on patients with spinal disorders.
- Interpret plain x-rays, dynamic x-rays, myelograms, CT scans and MR scans of patients with spinal disorders.
- Prepare patients for spinal surgery, including proper positioning, protection to pressure points, and placement of indicated arterial and central venous catheters, indwelling urinary catheters and anti-embolism devices.
- Perform lumbar punctures and placement of lumbar drains.
- Demonstrate the ability to place and manage cranial traction devices for reduction and immobilization of the unstable cervical spine.
- Demonstrate the ability to place and manage a halo vest, including indications for placement and criteria for removal.
- Demonstrate the ability to properly place the Mayfield head holder and other headrests.
- Demonstrate the ability to harvest autologous bone graft from the calvarium, rib, fibula, and anterior or posterior iliac crest.
- Perform dorsal exposure of the spinous processes, laminae, and facets of the cervical, thoracic, and lumbar spine.
- Demonstrate the ability to close dorsal, ventral, and lateral spinal incisions.
- Demonstrate proper postoperative wound care.
- Demonstrate appropriate postoperative management of patients who have undergone spinal procedures.
- Demonstrate the ability to perform, with supervision, a lumbar decompressive laminectomy for spinal stenosis.
- Demonstrate the ability to excise, with supervision, a herniated lumbar disc.
- Demonstrate the appropriate use of the operating microscope.
- Stereotactic / Functional
 - Demonstrate the ability to evaluate patients with movement disorders, epilepsy, spasticity, chronic pain and neuropsychiatric disease in out-patient and in-patient settings.
 - Formulate treatment plans for patients with these disorders utilizing the best available evidence-based studies
 - Demonstrate an understanding of indications for surgical intervention for patients with these disorders.
 - Discuss the appropriate use of medical management for movement disorders and epilepsy.
 - Demonstrate the ability to perform the following procedures or portions of procedures under faculty supervision:
 - Positioning and preparing patients for stereotactic and functional procedures
 - preoperative planning for frame-based and frameless stereotactic procedures including deep brain stimulation
 - Placement of stereotactic frames

- Opening and closure for deep brain stimulation
 - Insertion of depth electrodes
 - Craniotomy for grid placement and exposure for epilepsy surgery
- Demonstrate the ability to write post-operative orders and provide post-operative care for patients undergoing stereotactic and functional procedures.
- Radiosurgery
 - Demonstrate the ability to evaluate patients with disorders referred for consideration for treatment with radiosurgery in out-patient and in-patient settings.
 - Formulate treatment plans for patients with these disorders utilizing the best available evidence-based studies
 - Demonstrate an understanding of indications for radiosurgical intervention for patients with these disorders.
 - Demonstrate the ability to perform the following procedures or portions of procedures under faculty supervision:
 - Placement of stereotactic frame
 - Targeting and Dose Planning for simple metastatic tumor cases
 - Demonstrate the ability to write post-operative orders and provide post-operative care for patients undergoing radiosurgical procedures.
- Pain Management
 - Obtain a pertinent history and perform an appropriate physical examination for a patient with a primary complaint of pain.
 - Formulate and implement treatment plans for simple pain syndromes (e.g., acute postoperative pain, acute low back pain).
 - Evaluate and diagnose a patient with trigeminal neuralgia, trigeminal neuropathic pain, and atypical facial pain.
 - Assist with radiofrequency, glycerol or balloon compression neurolysis of the trigeminal nerve in patients with trigeminal neuralgia.
 - Assist with surgical exploration of the trigeminal nerve, nervus intermedius, or glossopharyngeal nerve for MVD or rhizotomy.
 - Illustrate appropriate patient selection for spinal ablative or augmentative procedures for pain management.
 - Locate the spinal epidural space and place a percutaneous spinal cord stimulation electrode with supervision.
 - Assist with implantation of a plate electrode for spinal cord stimulation.
 - Insert with supervision a spinal catheter for drug administration.
 - Implant with supervision a spinal cord stimulation system pulse generator/receiver and extension wire.
 - Implant with supervision an intraspinal drug infusion pump.
 - Assist with spinal ablative procedure for pain management (cordotomy, myelotomy, DREZ).
 - For peripheral nerve repair, neurectomy, and neurolysis perform, record, and report complete patient evaluation and assessment, including comprehensive neuromuscular examination of affected nerve distribution.

- Evaluate electrodiagnostic studies pertaining to peripheral nerve injury.
- Recognize and treat the potential complications of peripheral nerve repair, neurectomy, and neurolysis including hematoma formation, infection, and local wound problems.
- Assist in surgical treatment of peripheral nerves.
- Assist with implantation of a peripheral nerve stimulation system.
- Perform, record, and report complete patient evaluation and assessment for dorsal root ganglionectomy.
- Recognize and treat the potential complications of dorsal root ganglionectomy including cerebrospinal fluid leak, infection, and local wound problems.
- Assist in foraminotomy and exposure of dorsal root ganglion.
- Assess patients for appropriateness of local anesthetic block(s).
- Perform simple superficial blocks with supervision and assist in complicated procedures. Following such procedures:
 - assess outcome of nerve block
 - recognize and treat complications
 - record and monitor effects of block over a specified time interval
 - assess need for repeat blocks
- Assess patient for appropriateness of ablative neurolysis. Perform simple superficial neurolysis with supervision and assist in complicated procedures. Following ablative neurolysis:
 - assess outcome of procedure
 - recognize and treat complications
 - record and monitor effects of neurolysis over a specified time interval
 - assess need for repeat procedures
- Peripheral Nerve
 - Obtain a history and perform a motor and sensory examination of the peripheral nervous system.
 - Based on history and physical, anatomically localize the lesion.
 - Obtain appropriate ancillary tests:
 - EMG/NCV
 - metabolic screens
 - imaging studies
 - Formulate a differential diagnosis for common entrapments.
 - Position and prep for common entrapment releases.
 - Perform a diagnostic nerve and muscle biopsy.
 - Obtain sural nerve for grafting.
- Vascular
 - Perform a comprehensive neurological history and clinical examination.
 - Perform a comprehensive systemic evaluation.
 - Adapt comprehensive evaluation to specific pertinent positives and negatives with regard to ischemic and hemorrhagic stroke.

- Demonstrate an understanding of urgency and the ability to prioritize during emergent aspects of hemorrhagic and ischemic disease states.
- Demonstrate the ability to manage cardiac and pulmonary complications following cerebrovascular illness and therapy, and review the need for specialty and subspecialty consultations.
- Apply the principles of perioperative care following common endovascular and surgical procedures directed at cerebrovascular disease.
- Demonstrate the ability to be vigilant in the clinical detection of subtle neurological change during the acute and subacute phases of illness.
- Demonstrate the ability to place an arterial catheter, central venous catheter, and pulmonary artery catheter. Perform placement of a ventricular catheter via a burr hole or twist-drill craniostomy.
- Perform lumbar puncture and cerebrospinal fluid (CSF) reservoir tapping.
- Define the proper placement of a craniotomy flap in the planned surgical evacuation of hematoma. This should be performed using both topographical as well as stereotactic-assisted navigation techniques.
- Assist in the opening, exposure and closure of cervical carotid procedures.
- Assist during craniotomy for vascular disease.
- Assist in the performance of intracranial hematoma evacuation.
- Assist in the performance of diagnostic cerebral angiography.
- Demonstrate the ability to keep accurate and timely records.
- Neurotrauma
 - Perform the following surgical procedures in uncomplicated cases:
 - craniotomy for subdural and/or epidural hematoma
 - craniotomy for penetrating head injury
 - craniotomy for intracerebral hematoma or contusion
 - craniotomy for depressed skull fracture
 - decompressive craniectomy
 - repair/cranialization of frontal sinus fracture
 - craniotomy/craniectomy for posterior fossa epidural, subdural, or intracerebral hematoma
 - simple cranioplasty
 - Manage traumatic skull base fractures with CSF leak.
 - Manage infections associated with open CNS injuries.
- Practice management, legal and socioeconomic issues
 - Demonstrate an ability to interact effectively, professionally, and respectfully with members of the health care team, patients and their families.
 - Demonstrate the ability to maintain accurate and current medical records.
 - Discuss neurosurgical career options with faculty, peers, faculty, non-faculty neurosurgeons and other mentors.
 - Accumulate information about post-residency career options.
 - Create and keep current a resume/curriculum vitae.
 - Record CPT codes for office visits and procedures performed on service.

- Accurately document H&P and consultations according to the AMA-CPT E&M documentation guidelines.

Objectives

- Upon completion of the rotation, the resident will demonstrate competency in basic spine procedures as assessed by faculty.
- Upon completion of the rotation, the resident will demonstrate competency in basic stereotactic/functional procedures as assessed by faculty.
- Upon completion of the rotation, the resident will demonstrate competency in basic pain management procedures as assessed by faculty.
- Upon completion of the rotation, the resident will demonstrate competency in basic peripheral nerve procedures as assessed by faculty.
- Upon completion of the rotation, the resident will demonstrate competency in basic radiosurgery procedures as assessed by faculty.
- Upon completion of the rotation, the resident will demonstrate competency in basic vascular procedures as assessed by faculty.
- Upon completion of the rotation, the resident will demonstrate competency in basic neurotrauma procedures as assessed by faculty.
- Upon completion of the rotation, the resident will demonstrate competency in patient care related practice management, legal and socioeconomic issues as assessed by faculty.

Medical Knowledge

Goal

Residents must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological, and social-behavioral sciences, as well as the application of this knowledge to patient care. Residents are expected to:

Competencies

- Spine
 - Review the anatomy of the craniocervical junction, cervical, thoracic, and lumbar spine, sacrum, and pelvis.
 - Interpret plain and dynamic radiographs, bone scans, myelograms, computerized tomographic (CT) scans, and magnetic resonance (MR) scans of patients with spinal disorders.
 - Review the signs, symptoms, and pathophysiology of common syndromes of degenerative spinal disorders: radiculopathy, myelopathy, instability, and neurogenic claudication.
 - Identify the common syndromes of spinal cord injury, including complete transverse injury, anterior cord injury, Brown-Sequard injury, central cord injury, cruciate paralysis, syringomyelia, conus syndrome, and sacral sparing. Describe the pathophysiology of spinal cord injury.
 - Describe the cauda equina syndrome.
 - Recite the differential diagnosis of cervical, thoracic, and lumbar pain.
 - Discuss the indications for cervical, thoracic, and lumbar discectomy.
 - Identify non-surgical spinal cord syndromes including amyotrophic lateral sclerosis, demyelinating conditions, and combined systems disease.

- Review the initial management of spine and spinal cord injured patients including immobilization, traction, reduction, appropriate radiographic studies, and medical management.
- Classify fractures, dislocations, and ligament injuries of the craniocervical region, subaxial cervical spine, thoracic, thoracolumbar junction, lumbar, and sacral spine. Describe the mechanism of injury and classify the injuries as stable or unstable. Review the indications for surgical management.
- Discuss briefly the concept of grading schemes for spinal cord injury and myelopathy.
- Discuss the relationship of the spinal nerves to the vertebral level of exit.
- Diagram the structures comprising the boundaries of the spinal neural foramina.
- Discuss the clinical presentation and neurological deficits associated with common lesions of and injuries to the spinal cord and nerve roots.
- Discuss the role of myelography in the evaluation of neurosurgical patients.
- Stereotactic / Functional
 - Discuss the considerations of stereotactic frame placement in regard to target localization and purpose of procedure (biopsy, craniotomy, functional, radiosurgery).
 - Describe the direct and indirect basal ganglion-thalamocortical motor pathways.
 - Define and distinguish each of the following entities:
 - tremor
 - rigidity
 - dystonia
 - chorea
 - athetosis
 - Describe the pathophysiology of Parkinson's disease and cerebellar tremor.
 - Explain the primary symptoms treated by ventro-lateral (VL) thalamotomy pallidotomy.
 - Discuss the advantages and disadvantages of stereotactic biopsy compared to open biopsy procedures.
 - Discuss the differential diagnosis of a newly discovered ring-enhancing intracranial mass.
 - Discuss the differential diagnosis of a newly discovered non-enhancing intracranial mass.
 - Define different seizure types (partial, partial-complex, generalized, etc).
 - Define medically intractable epilepsy.
 - Describe the anatomy of the mesial temporal lobe.
 - Define brachytherapy.
 - Define conventional care for patients with high-grade gliomas.

- Review the limitations of conventional care for patients with high-grade gliomas.
- Describe the anatomy of the trigeminal nuclei, root, ganglion and divisions.
- Define typical trigeminal neuralgia, atypical trigeminal neuralgia, and trigeminal neuropathy.
- Explain the potential causes for trigeminal neuralgia.
- Define stereotactic radiosurgery.
- Explain the differences between radiosurgery and radiation therapy.
- List the potential indications for radiosurgery.
- List the reported complications of radiosurgery.
- Compare advantages and disadvantages of frame-based or frameless stereotactic craniotomies to non-stereotactic craniotomies.
- Discuss the history of stereotactic surgery as well as the evolution of head frames and frameless technology.
- Discuss preoperative planning for frame-based and frameless stereotactic procedures including deep brain stimulation
- Be able to discuss and assess the accuracy of modern day stereotactic technique by evaluating postoperative imaging.
- Discuss the types of tremor and the theoretical pathophysiology of tremor circuits.
- Understand surgical anatomy of the thalamus and its relevance for complication avoidance in tremor surgery.
- Describe the direct and indirect basal ganglia-thalamocortical motor pathways and their related pathophysiology in Parkinson's disease.
- Discuss the advantages and disadvantages of ablative techniques such as pallidotomy and compare with those of deep brain stimulation.
- Discuss the surgical targets of thalamus, globus pallidum, and subthalamic nucleus and their expected results with movement disorders.
- Understand the classification of dystonia and recognize the appropriate indications for surgery in dystonic patients.
- Discuss the surgical treatment of hemifacial spasm
- Radiosurgery
 - Discuss the advantages and disadvantages of open versus radiosurgical procedures for intracranial and spinal pathologies.
 - Discuss the differential diagnosis of a newly discovered intracranial and spinal structural lesion (e.g. tumors or vascular malformations).
 - Define brachytherapy.
 - Describe the anatomy of the trigeminal nuclei, root, ganglion, and divisions.
 - Define typical and atypical trigeminal neuralgia.
 - Define stereotactic radiosurgery.
 - Explain the differences between radiosurgery and radiotherapy.
 - Discuss the radiobiology of radiosurgery.
 - List potential indications for radiosurgery.
 - List the reported complications of radiosurgery.

- Compare frame based versus frameless radiosurgery.
- Describe factors guiding the choice of neuro-imaging modalities (CT, MRI, angiography) for stereotactic procedures.
- Pain Management
 - Describe the anatomy and physiology of nociception within the peripheral and central nervous system.
 - Differentiate the basic categories of pain syndromes:
 - acute
 - chronic
 - nociceptive
 - neuropathic (including complex regional pain syndromes)
 - myofascial
 - cancer-related
 - postoperative
 - Explain the concept of pain as a biopsychosocial disorder.
 - Discuss the role of rehabilitation in pain management.
 - Describe methods for assessing pain in pediatric patients.
 - Discuss ethical standards in pain management and research.
 - Discuss methods of assessing outcomes of pain treatment and describe common assessment tools.
 - Describe a typical history of a patient with trigeminal neuralgia, trigeminal neuropathic pain, and atypical facial pain.
 - Diagram the anatomy of the following: trigeminal nerve divisions (ophthalmic, maxillary and mandibular nerves), foramen ovale, Meckel's cave, trigeminal (gasserian) ganglion, cistern of Meckel's cave, retrogasserian root, descending tract and nuclei, nervus intermedius, glossopharyngeal nerve.
 - Illustrate the appropriate medical management of patients with trigeminal neuralgia, trigeminal neuropathic pain, and atypical facial pain.
 - Discuss the potential complications of percutaneous procedures for trigeminal neuralgia.
 - Describe the brain stem anatomy and physiology of the spinothalamic and trigeminothalamic systems.
 - Describe the anatomy of the primary sensory cortex (S1), Rolandic fissure, and the relationship of S1 to the primary motor cortex.
 - Describe the functional anatomy of the following thalamic nuclei: ventral posterolateral (VPL), ventralis caudalis externus (Vce), ventral posteromedial (VPM), and ventralis caudalis internus (Vci). Review the functional anatomy of the medial thalamic nuclei (e.g., n. parafascicularis).
 - Identify the primary indications for spinal cord stimulation, peripheral nerve stimulation, and intraspinal (epidural, intrathecal) drug infusion therapy.
 - Diagram the spine anatomy pertinent to SCS and intraspinal drug administration, including the spinous process/intervertebral ligament/spinous process complex, ligamentum flavum and dorsal epidural space. Review

- the different degrees of angulation of the spinous processes at various spine levels in the cervical and thoracic area.
- Diagram the spinal cord anatomy pertinent to spinal ablative procedures for pain management.
 - Recognize complications arising from implantation of pulse generators/receivers and infusion pumps.
 - Describe the anatomy of the major peripheral nerves, brachial plexus, and lumbosacral plexus.
 - Describe the anatomy of the sympathetic nervous system and explain its role in pain.
 - List the common mechanisms of peripheral nerve injury and describe the changes which occur in an injured nerve at both the microscopic and macroscopic level. Explain the theories of pain generation in peripheral nerve injury.
 - Describe the pharmacology of local anesthetic agents (e.g., lidocaine, procaine, tetracaine, bupivacaine) and the use of epinephrine with local anesthetic agents.
 - Discuss the indications for peripheral neural blockade. Explain the principles of blocking procedures including the techniques and expected outcomes. Cite the complications of peripheral neural blockade (including anaphylaxis, neural injury, intravascular or intrathecal administration). List the alternatives to temporary blockade including neurolytic blocks, ablative neurosurgical procedures, augmentative neurosurgical procedures, alternative traditional pain management procedures, and alternative medicine approaches.
 - Review the indications for radiofrequency facet rhizolysis.
 - Discuss the anatomy and biomechanics of the facet complex with emphasis on bone, cartilage, fibrous capsule, synovial fluid, and innervation of this structure.
 - Peripheral nerve
 - Define the peripheral nervous system versus the central nervous system.
 - Discuss the major structural elements of a peripheral nerve:
 - epineurium
 - perineurium
 - endoneurium
 - axon
 - fascicle
 - Schwann cell
 - connective tissue
 - motor end plate
 - sensory receptor
 - Discuss the blood supply of the peripheral nerves.
 - Discuss the blood-nerve barrier.
 - Define axonal transport and differentiate fast from slow.
 - Describe an action potential including the flow of ions.

- Describe the various nerve fibers in terms of size.
- Discuss the significance of fiber size in terms of function (e.g., c-fiber - nociceptive).
- Discuss the various forms of action potential propagation.
- Discuss the pathophysiological response to various injuries by a nerve:
 - compression
 - ischemia
 - metabolic
 - concussive
 - stretch
- Define and discuss apoptosis.
- Define Wallerian degeneration.
- Discuss nerve regeneration:
 - sprouting
 - nerve growth factors
 - rate of growth
 - remyelination
- Define neuroma:
 - axonal tangle
 - mechano-sensitivity
 - neuroma-in-continuity
- Define and discuss the pathophysiology and clinical significance of the Tinel's sign.
- Describe the symptoms and signs of typical nerve injuries:
 - entrapment syndromes
 - stretch injuries
 - laceration injuries
 - concussive injuries
 - injection injuries
- Distinguish upper versus lower motor neuron symptoms and signs in nerve injury:
 - anatomical definition
 - degree of atrophy
 - distribution of weakness
 - reflex changes
 - potential for recovery
- Describe the classification of nerve injury:
 - Seddon classification
 - Sunderland classification
- List the major peripheral nerves of body. Describe the motor and sensory innervation of each.
- Draw the major components of the brachial plexus.
- Describe the rating scales for motor power.
- Describe the various sensory modalities and how to examine each.

- Describe the symptoms and signs of common nerve entrapments:
 - carpal tunnel
 - ulnar entrapment at the elbow
 - lateral femoral cutaneous nerve
 - peroneal at fibular head
- Define EMG and NCV.
- Describe the changes in EMG and NCV in nerve entrapment.
- Describe the nonoperative and operative treatment of entrapment syndromes.
- Define:
 - coaptation
 - neurorrhaphy
 - neurotization
 - nerve transfer
- Discuss the clinical manifestation of injury for each of the major peripheral nerves.
- Describe the anatomy and presentation of common entrapment syndromes of peripheral nerves including:
 - thoracic outlet syndrome
 - carpal tunnel syndrome
 - ulnar nerve entrapment syndrome at wrist and elbow
 - anterior interosseous syndrome
 - posterior interosseous syndrome
 - meralgia paresthetica
 - peroneal nerve palsy
 - tarsal tunnel syndrome
- Describe the surgical exposure of common peripheral nerve entrapments including:
 - carpal tunnel
 - ulnar nerve at elbow
 - ulnar nerve at wrist
 - lateral femoral cutaneous nerve
 - peroneal nerve
- Review MR neurography.
- Describe the appearance of peripheral nerve tumors on MR scans.
- Vascular
 - Describe the anatomy of the extracranial and intracranial vessels, including the carotid, vertebral, and spinal arteries.
 - Describe the location of key perforating arteries involving the anterior and posterior circulation, their target distribution, and the consequence of occlusion or injury.
 - Review the anatomy of the venous circulation as it pertains to the central nervous system.
 - Identify the classic syndromes of vessel occlusion of the following:

- internal carotid artery
- middle cerebral artery
- anterior cerebral artery
- recurrent artery of Heubner
- anterior choroidal artery
- vertebral artery
- posterior inferior cerebellar artery (PICA)
- lower and upper basilar trunk
- Identify the classic brain stem ischemic syndromes.
- Explain the concepts of cerebral blood flow, cerebral autoregulation (hemodynamic and metabolic), ischemic thresholds, intracranial pressure, and cerebral perfusion pressure. Describe the impact of intracranial hypertension with and without mass lesion on cerebral blood flow.
- Recognize the common causes of brain ischemic states including:
 - cardiac embolism
 - embolism from proximal vasculature
 - large vessel occlusion
 - intracranial conducting vessel occlusion
 - small vessel disease
- Associate computed tomography (CT) and magnetic resonance (MR) evidence of ischemic injury with likely anatomic substrate.
- Describe the epidemiology, physiology, and underlying pathophysiology of ischemic brain injury, including concepts of critical therapeutic window.
- Recognize the common causes of intracranial and intraspinal hemorrhage including:
 - aneurysmal disease
 - vascular malformations
 - hypertension
 - vasculopathies
 - degenerative diseases
 - hemorrhagic arterial infarction
 - venous infarction.
- Relate typical imaging characteristics of central nervous system hemorrhagic lesions to probable causes.
- Categorize common causes of intracranial hemorrhage, subarachnoid hemorrhage, and ischemic stroke.
- Explain the principles of fluid and electrolyte resuscitation and maintenance, respiratory physiology, cardiac physiology, and nutritional physiology, as applied to the neurological patient following ischemic or hemorrhagic stroke. Integrate this knowledge with the specific issues of the perioperative period.
- Recognize the need for laboratory evaluation for systemic illness.
- List the appropriate diagnostic neuro-imaging studies utilized to evaluate ischemic and hemorrhagic stroke.

- Recognize the typical clinical course of patients with ischemic and hemorrhagic stroke, including peak risk intervals for edema, vasospasm, re-bleeding, etc.
- Identify the periods of high vulnerability to systemic complications of cerebrovascular illness, including deep venous thrombosis, pulmonary embolism, bacterial pneumonia, aspiration, congestive heart failure, etc.
- Explain the principles of augmentation of cerebral blood flow during cerebral vasospasm.
- Discuss the principles and indications for medical, endovascular, and surgical interventions for ischemic and hemorrhagic stroke.
- Relate the principles of timing of medical, endovascular, and surgical intervention in these same disease states.
- Explain the principles, indications for, and complications of barbiturate coma.
- Recognize the principles and interpretation of normal and common abnormal findings on skull, chest, and abdominal x-rays in the Critical Care Unit.
- Describe the fundamentals of CT scanning, including the typical appearance of acute, subacute and chronic blood, calcification, ventricular anatomy and mass effect.
- Describe the typical CT appearance of hemorrhagic and ischemic stroke. Provide a detailed explanation for the typical delay between the onset of stroke and appearance of confirmatory CT findings.
- Explain the fundamentals of MR imaging. Distinguish between normal and abnormal findings within the realm of cerebrovascular disease. Recognize the classic MR appearance of:
 - arteriovenous malformations
 - venous angiomas
 - cavernous malformations
 - aneurysms
- List the indications for non-invasive vascular imaging, including ultrasound, magnetic resonance angiography (MRA), and CT angiography. Recite the limitations of non-invasive studies.
- Describe the practical application of commonly employed non-invasive studies, such as transcranial Doppler, in the setting of cerebral vasospasm.
- List the indications for catheter angiography. Interpret the findings of angiography in ischemic and hemorrhagic cerebrovascular conditions. Identify the key segments of the internal carotid artery including the upper cervical, petrous, cavernous, and supraclinoid components.
- Describe the principles of localizing focal intracranial and spinal vascular pathology by the use of traditional topographic measurements and the application of stereotactic guidance.
- Describe the surgical anatomy and the principles of exposure of the cervical carotid artery.

- Describe the principles of pterional craniotomy, including scalp and bony anatomy, as well as the anatomy of the sphenoid ridge.
- Explain the principles of cerebrovascular surgery detailed in the previous objectives to medical students and allied health personnel during conferences.
- Review the expected effects of stroke or mass lesion at different locations within the brain stem and cerebellum.
- List the expected effects of destructive lesions in the basal ganglia and cerebellum.
- Describe the expected effects of ischemic or destructive lesions of the white matter tracts of the cerebrum.
- Discuss the expected effect of destructive lesions of specific regions of the cerebral cortex.
- Review the clinical presentation of strokes in the distribution of the supratentorial cerebral blood vessels.
- Identify the common carotid and vertebral circulation congenital variants on angiograms.
- Recognize intracranial aneurysms on angiograms.
- Identify and characterize intracranial vascular malformations on angiograms. Recognize:
 - arteriovenous malformations
 - venous angiomas
 - arteriovenous fistula
 - feeding vessels
 - draining veins
 - associated aneurysms
 - degree of shunting
- Discuss the angiographic evaluation of carotid and vertebral disease.
- Review the role of MR angiography and venography in the evaluation of cerebrovascular disease, neoplasms, and trauma.
- Describe the radiological evaluation of CNS vasculitis.
- Describe the radiological evaluation of spinal vascular malformations.
- Review the findings of normal and abnormal carotid ultrasounds.
- Discuss the use of transcranial doppler ultrasonography in the management of patients with subarachnoid hemorrhage, trauma, and occlusive vascular disease.
- Neurotrauma
 - Describe the pathophysiology of intracranial hypertension and explain a plan for its management, including arguments for and against various treatments.
 - Discuss the clinical presentation in anatomical terms of traumatic syndromes of the brain and its coverings
- Practice management, legal and socioeconomic issues
 - Discuss the ethical and moral factors associated with the practice of neurosurgery.

- Review the role of the neurosurgical leadership in the community and hospital setting.
- Explain the neurosurgeon's responsibilities in terms of health care cost containment.
- Review the features and relationships of the healthcare system
- Recite the rules and regulations of the training hospital(s) as they pertain to the practice of neurosurgery.
- Name the institutional and social service agencies in your community and review their role in the overall management of neurosurgical patients.
- Demonstrate knowledge of the rules and regulations of the Ohio State Medical Board.
- Discuss the concept of informed consent.

Objectives

- The PGY-2/3 resident on this rotation will acquire the fundamental clinical knowledge needed to manage patients with disorders of the spine as assessed by faculty evaluations and the written in training examination.
- The PGY-2/3 resident on this rotation will acquire the fundamental knowledge in the anatomy, physiology, imaging and pathogenesis of spinal disorders as assessed by faculty evaluations and the written in training examination.
- The PGY-2/3 resident on this rotation will acquire the fundamental clinical knowledge needed to manage patients with pain or functional neurosurgical disorders as assessed by faculty evaluations and the written in training examination.
- The PGY-2/3 resident on this rotation will acquire the fundamental clinical knowledge needed to manage patients with disorders commonly managed with radiosurgery as assessed by faculty evaluations and the written in training examination.
- The PGY-2/3 resident on this rotation will acquire the fundamental clinical knowledge needed to manage patients with disorders of the peripheral nervous system as assessed by faculty evaluations and the written in training examination.
- The PGY-2/3 resident on this rotation will acquire the fundamental knowledge in the anatomy, physiology, imaging and pathogenesis of pain, functional and peripheral nerve disorders as assessed by faculty evaluations and the written in training examination.
- The PGY-2/3 resident on this rotation will acquire fundamental knowledge pertaining to clinical presentation and pathophysiology of common cerebrovascular diseases as assessed by faculty evaluations and the written in training examination.
- The PGY-2/3 resident on this rotation will acquire fundamental knowledge pertaining to clinical presentation and pathophysiology of common traumatic injuries to the central nervous system as assessed by faculty evaluations and the written in training examination.

- The PGY-2/3 resident on this rotation will acquire basic knowledge in practice management, legal and socioeconomic issues that face a neurosurgeon as assessed by faculty evaluations and the written in training examination.
- The PGY-2/3 resident is expected to take the American Board of Neurological Surgery written exam for self-assessment.

Practice- Based Learning and Improvement

Goal

Residents 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 lifelong learning. Residents are expected to develop skills and habits to be able to:

Competencies

- Locate, appraise and assimilate evidence from scientific studies related to their patients' health problems
- Use information technology to optimize teaching
- Participate in the education of patients, families, students, residents and other health professionals

Objectives

- The PGY-2/3 resident on this rotation will perform pertinent case-based literature reviews for patient health problem and provide education to patients, families, students, residents and other health professionals on these topics in direct interaction and at combined conferences. This will be assessed by direct faculty observation, evaluation and review of presentations at the combined conferences.

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

- Work effectively in various health care delivery settings and systems relevant to neurosurgery.
- Work in interprofessional teams to enhance patient safety and improve patient care quality
- Participate in identifying systems errors and in implementing potential systems solutions

Objectives

- The PGY-2/3 resident on this rotation will perform effectively as a member of an interprofessional team to enhance patient safety and improve patient care quality as assessed by faculty.

- The PGY-2/3 resident on this rotation will identify system errors and propose potential solutions to rotation faculty. This will be as assessed by faculty.

Professionalism

Goal

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

Competencies

- Respect for patient privacy and autonomy
- Sensitivity and responsiveness to a diverse patient population, including but not limited to diversity in gender, age, culture, race, religion, disabilities, and sexual orientation
- Comply with all GME and Departmental regulations regarding duty hour restrictions and report personal schedule in timely and accurate fashion.
- Accurately self-report fatigue in situations that may compromise safety and/or patient care.

Objectives

- The PGY-2/3 resident on this rotation will demonstrate respect toward patients and demonstrate sensitivity and responsiveness to a diverse patient population as assessed by faculty evaluation.
- The PGY-2/3 resident on this rotation will be compliant with all GME and Departmental regulations regarding duty hour restrictions and report personal schedule in timely and accurate fashion as assessed by duty hours tracking data, weekly review by Program Administrator and review as needed.

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

- Communicate effectively with physicians, other health professionals, and health related agencies
- Work effectively as a member of a health care team

Objectives

- The PGY-2/3 resident on this rotation will demonstrate the ability to communicate effectively with other health professionals and work effectively as a health care team member as assessed by 360-degree evaluation by neurosurgery nurse practitioner, clinic coordinator, Program Coordinator and transcription specialist.

Teaching Methods

Teaching methods include formal didactic lectures as well as supervision in the operating room appropriate to the resident's level of competency.

Assessment Method (Residents)

- Written faculty evaluation of all 6 competencies.
- 360-degree evaluation of professionalism and communication by Neurosurgery nurse practitioners, Clinic coordinators and the Program Coordinator.
- Review of performance on written Boards examination.
- Progression through Milestones reported by Clinical Competency Committee every six months.

Assessment Method (Program Evaluation)

The experience is considered educational if there is demonstration of improved knowledge and operative skills over the course of the rotation.

Level of Supervision

The resident is supervised by the attending neurosurgeons appropriate to their level of competency.

Educational Resources

- Spine
 - Herkowitz Harry N (Ed). Rothman-Simeone, The Spine. Fourth Edition, W. B. Saunders, Philadelphia, 1994.
 - Menezes Arnold H, Sonntag Volker K (Eds). Principles of Spinal Surgery. McGraw-Hill, Inc., New York, 1996.
 - Menezes A. Benzel E. Spine Surgery: Techniques, Complication Avoidance, and Management.
 - Caspar W. Anterior cervical fusion and interbody stabilization with the trapezial osteosynthetic plate technique. #12 Aesculap.
 - Aebi M. Principles in Spine Surgery. AO/ASIF.
 - Turnbull IM. Microvasculature of the human spinal cord. J Neurosurg 35:141-147, 1971.
 - Milhorat TH, Kotzen RM, Anzil AP. Stenosis of central canal of spinal cord in man: incidence and pathological findings in 232 autopsy cases. J Neurosurg 80:716-722, 1994.
 - Menezes, AH, Sonntag VKH, Principles of Spinal surgery. McGraw Hill, NewYork, 1995
 - Rothman, RH, Simeone FA. The Spine. WB Saunders, Philadelphia, 1999
- Stereotactic / Functional
 - Textbook of Stereotactic and Functional Neurosurgery. Gildenberg and Tasker (editors), McGraw Hill 1998, pp. 2157.
 - Microelectrode Recording and Movement Disorder Surgery. Israel and Burchiel (editors), Thieme 2004.

- Surgical Treatment of the Epilepsies. Jerome Engel (editor), Raven Press 1993
- Surgical Management of Pain. Burchiel (editor), Thieme 2002
- Principals of Neurology. Adams, Victor, and Ropper, (editors), McGraw Hill 1997
- Spasticity Management in Youmans Neurological Surgery, 2004
- Peripheral Nerve
 - Birch R, Bonney G, Wynne P. Surgical Disorders of Peripheral Nerves. Churchill-Livingstone, London, 1998.
 - Gelberman R (Ed). Operative Nerve Repair and Reconstruction. I. P. Lippincott Co., Philadelphia, 1991.
 - Kline D, Hudson A. Nerve Injuries: Operative Results for Major Nerve Injuries, Entrapments and Tumors. W. B. Saunders Co., Philadelphia, 1995.
 - Lunborg G. Nerve Injury and Repair. Churchill-Livingstone, New York, 1998.
 - MacKinnon S, Dellon A. Surgery of Peripheral Nerves. Thieme, New York, 1988.
 - Ormer G, Spinner M, Van Beeb A. Management of Peripheral Nerve Problems. Second Edition, W. B. Saunders Co., Philadelphia, 1998.
 - Seddon H. Surgical Disorders of Peripheral Nerves. Second Edition, Churchill-Livingstone, Edinburgh, 1975.
 - Sunderland S. Nerve Injuries and Repair: A Critical Appraisal. Churchill-Livingstone, Edinburgh, 1991.
 - Sunderland S. Nerve and Nerve Injuries. First and Second Editions, E & S Livingston Stone, London, 1968 and 1978.
 - Terzis J (Ed). Microreconstruction of Nerve Injuries. W. B. Saunders, Philadelphia, 1987.
 - Kline D, Hudson A, Kim D. Atlas of Peripheral Nerve Surgery. W. B. Saunders Co., Philadelphia, 2001.
 - Dawson D, Hallett M, Millender *I: Entrapment Neuropathies, 2nd Ed, Little and Brown Co., Boston, 1990.
 - Dellon A: Evaluation of Sensibility and Re Education of Sensation in the Hand, Williams, & Wilkins, Baltimore 1981.
 - Dyck P, Thomas PK, Asbury A, Winegood A, Porte D: Diabetic Neuropathy, W.B. Sanders Co. Phila, 1987.
 - Dyck P, Thomas PK: Peripheral Neuropathy 3 rd Ed., W.B. Saunders Co. Philadelphia, 1993
 - Haymaker W, Woodhall B: Peripheral Nerve Injuries. Principles and Diagnosis, 2nd Ed. W.B. Saunders Co., Phila.
 - 1953.
 - Hawkins J, Reed R: Tumors the Peripheral Nervous System AFIP Atlas of Tumor Pathology – 2nd Series, Fascicle 3, AFIP, Washington, D.C. 1968.
 - Henry AK: Extensile Exposure: Applied to Limb Surgery, Williams and Wilkins, Baltimore, 1945.

- Kempe L: Operative Neurosurgery Vol. 2, Springer, NY, 1970.
- Leffert R: Brachial Plexus Injuries, Churchill Livingstone, Edinburgh 1988.
- Medical Research Council Nerve Injuries MRC was Memorandum No. 7 London, His Majesty's Stationary Office, Balliere Tindall, London 1943.
- Midroni G, Bilbao J, Cohen S: Biopsy Diagnosis of Peripheral Neuropathy Butterworth-Heinemann, Toronto 1995.
- Seddon H: Peripheral Nerve Injuries, MRC Report 282. Her Majesty's Stationary Office, London, 1954.
- Spinner M.: Injuries to the Major Branches of Peripheral Nerves of the Forearm. 2nd Ed., W.B. Saunders, Phila. 1978.
- Woodhall B, Beebe G: Peripheral Nerve Regeneration V.A. Monograph, U.S. Gov't. Printing Office, Washington, DC, 1957.
- Balliere. Aids to the examination of the peripheral nervous system. Tindall, London, 1986
- Aids to the examination of the peripheral nervous system, 4th edition. W. B. Saunders, Philadelphia, 2000.
- Grant GA, Goodkin R, Kliot M. Evaluation and surgical management of peripheral nerve problems. Neurosurgery 44:825-40, 1999.
- Kline DG, Hudson AR. Nerve Injuries. W. B. Saunders, Philadelphia, 1995.
- Neuro-vascular
 - Stroke: Pathophysiology, Diagnosis, and Management. Mohr JP, Choi DW, Grotin JG, Weir B, Wolf PA (eds). Oxford, Churchill Livingstone, 2004
 - Practical Neuroangiography. Morris P (ed). New York, Lipincott, 2007
 - Diagnostic Cerebral Angiography. Osborn AG (ed). New York, Lipincott, 1999
 - Intracranial Aneurysm Surgery: Techniques. Samson DS, Batjer HH (eds). New York, Futura, 1990
 - Management of Cerebral Aneurysms. Le Roux PD, Winn HR, Newell DW (eds). New York, W.B. Saunders, 2004
 - Youmans Neurological Surgery, Volume 2, Fifth Edition. Winn HR (ed). Philadelphia, W.B. Saunders, 2004

Junior Clinical Rotation (Vascular) – University Hospital PGY 2 and PGY 3

Description of Rotation or Educational Experience

- Length: 2 months
- Site: University Hospital and James Cancer Center
- Focus: Cerebrovascular diseases are the components of the PGY 2 and PGY 3 Junior Clinical Rotations in Vascular Neurosurgery. During this rotation, the resident will be fully integrated into the Vascular program at the OSUWMC. Residents will develop skills critical for the evaluation and management (clinical and surgical) of patients with cerebral and spinal vascular disorders. Specific emphasis is placed upon continuity of care and the acquisition of a comprehensive, multi-faceted experience.
- Responsible Faculty: John McGregor, M.D., Shahid Nimjee, M.D., Ph.D., Ciarán J. Powers, M.D., Ph.D. and Patrick Youssef, M.D.
- Didactics:
 - Required clinical conferences include weekly Case Conference, monthly M&M Conference and monthly Grand Rounds as well as daily Faculty Teaching Rounds. Additional optional opportunities include weekly Spine Tumor Board, weekly Brain Tumor Board, weekly DBS Conference, weekly Skull Base Conference and weekly Stroke Case Conference.
- Clinical Experience: The resident will be provided with a broad experience in vascular and endovascular neurosurgery, including routine and complex problems. The resident will round daily on patients on the service and will participate in the surgical procedures during the remainder of the week. The resident will take, on average, 7 24-hour days of in-house neurosurgery call each month where they will be directly involved with the supervised management of neurosurgical patients, admission of neurosurgical patients and performance of consults (including in the Emergency Department).
- Ambulatory Experience: The resident will attend 1 half-day of clinic per week where the resident will gain exposure to the diagnosis and management of patients with diverse neurosurgical problems including operative and non-operative management.

Patient Care

Goal

Residents must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. Residents are expected to:

Competencies

- Radiosurgery
 - Demonstrate the ability to evaluate patients with disorders referred for consideration for treatment with radiosurgery in out-patient and in-patient settings.
 - Formulate treatment plans for patients with these disorders utilizing the best available evidence-based studies
 - Demonstrate an understanding of indications for radiosurgical intervention for patients with these disorders.

- Demonstrate the ability to perform the following procedures or portions of procedures under faculty supervision:
 - Placement of stereotactic frame
 - Targeting and Dose Planning for simple metastatic tumor cases
- Demonstrate the ability to write post-operative orders and provide post-operative care for patients undergoing radiosurgical procedures.
- Vascular
 - Perform a comprehensive neurological history and clinical examination.
 - Perform a comprehensive systemic evaluation.
 - Adapt comprehensive evaluation to specific pertinent positives and negatives with regard to ischemic and hemorrhagic stroke.
 - Demonstrate an understanding of urgency and the ability to prioritize during emergent aspects of hemorrhagic and ischemic disease states.
 - Demonstrate the ability to manage cardiac and pulmonary complications following cerebrovascular illness and therapy, and review the need for specialty and subspecialty consultations.
 - Apply the principles of perioperative care following common endovascular and surgical procedures directed at cerebrovascular disease.
 - Demonstrate the ability to be vigilant in the clinical detection of subtle neurological change during the acute and subacute phases of illness.
 - Demonstrate the ability to place an arterial catheter, central venous catheter, and pulmonary artery catheter. Perform placement of a ventricular catheter via a burr hole or twist-drill craniostomy.
 - Perform lumbar puncture and cerebrospinal fluid (CSF) reservoir tapping.
 - Define the proper placement of a craniotomy flap in the planned surgical evacuation of hematoma. This should be performed using both topographical as well as stereotactic-assisted navigation techniques.
 - Assist in the opening, exposure and closure of cervical carotid procedures.
 - Assist during craniotomy for vascular disease.
 - Assist in the performance of intracranial hematoma evacuation.
 - Assist in the performance of diagnostic cerebral angiography.
 - Demonstrate the ability to keep accurate and timely records.
- Neurotrauma
 - Perform the following surgical procedures in uncomplicated cases:
 - craniotomy for subdural and/or epidural hematoma
 - craniotomy for penetrating head injury
 - craniotomy for intracerebral hematoma or contusion
 - craniotomy for depressed skull fracture
 - decompressive craniectomy
 - repair/cranialization of frontal sinus fracture
 - craniotomy/craniectomy for posterior fossa epidural, subdural, or intracerebral hematoma
 - simple cranioplasty
 - Manage traumatic skull base fractures with CSF leak.
 - Manage infections associated with open CNS injuries.

- Practice management, legal and socioeconomic issues
 - Demonstrate an ability to interact effectively, professionally, and respectfully with members of the health care team, patients and their families.
 - Demonstrate the ability to maintain accurate and current medical records.
 - Discuss neurosurgical career options with faculty, peers, faculty, non-faculty neurosurgeons and other mentors.
 - Accumulate information about post-residency career options.
 - Create and keep current a resume/curriculum vitae.
 - Record CPT codes for office visits and procedures performed on service.
 - Accurately document H&P and consultations according to the AMA-CPT E&M documentation guidelines.

Objectives

- Upon completion of the rotation, the resident will demonstrate competency in basic radiosurgery procedures as assessed by faculty.
- Upon completion of the rotation, the resident will demonstrate competency in basic vascular procedures as assessed by faculty.
- Upon completion of the rotation, the resident will demonstrate competency in basic neurotrauma procedures as assessed by faculty.
- Upon completion of the rotation, the resident will demonstrate competency in patient care related practice management, legal and socioeconomic issues as assessed by faculty.

Medical Knowledge

Goal

Residents must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological, and social-behavioral sciences, as well as the application of this knowledge to patient care. Residents are expected to:

Competencies

- Radiosurgery
 - Discuss the advantages and disadvantages of open versus radiosurgical procedures for intracranial and spinal pathologies.
 - Discuss the differential diagnosis of a newly discovered intracranial and spinal structural lesion (e.g. tumors or vascular malformations).
 - Define brachytherapy.
 - Describe the anatomy of the trigeminal nuclei, root, ganglion, and divisions.
 - Define typical and atypical trigeminal neuralgia.
 - Define stereotactic radiosurgery.
 - Explain the differences between radiosurgery and radiotherapy.
 - Discuss the radiobiology of radiosurgery.
 - List potential indications for radiosurgery.
 - List the reported complications of radiosurgery.
 - Compare frame based versus frameless radiosurgery.

- Describe factors guiding the choice of neuro-imaging modalities (CT, MRI, angiography) for stereotactic procedures.
- Vascular
 - Describe the anatomy of the extracranial and intracranial vessels, including the carotid, vertebral, and spinal arteries.
 - Describe the location of key perforating arteries involving the anterior and posterior circulation, their target distribution, and the consequence of occlusion or injury.
 - Review the anatomy of the venous circulation as it pertains to the central nervous system.
 - Identify the classic syndromes of vessel occlusion of the following:
 - internal carotid artery
 - middle cerebral artery
 - anterior cerebral artery
 - recurrent artery of Heubner
 - anterior choroidal artery
 - vertebral artery
 - posterior inferior cerebellar artery (PICA)
 - lower and upper basilar trunk
 - Identify the classic brain stem ischemic syndromes.
 - Explain the concepts of cerebral blood flow, cerebral autoregulation (hemodynamic and metabolic), ischemic thresholds, intracranial pressure, and cerebral perfusion pressure. Describe the impact of intracranial hypertension with and without mass lesion on cerebral blood flow.
 - Recognize the common causes of brain ischemic states including:
 - cardiac embolism
 - embolism from proximal vasculature
 - large vessel occlusion
 - intracranial conducting vessel occlusion
 - small vessel disease
 - Associate computed tomography (CT) and magnetic resonance (MR) evidence of ischemic injury with likely anatomic substrate.
 - Describe the epidemiology, physiology, and underlying pathophysiology of ischemic brain injury, including concepts of critical therapeutic window.
 - Recognize the common causes of intracranial and intraspinal hemorrhage including:
 - aneurysmal disease
 - vascular malformations
 - hypertension
 - vasculopathies
 - degenerative diseases
 - hemorrhagic arterial infarction
 - venous infarction.
 - Relate typical imaging characteristics of central nervous system hemorrhagic lesions to probable causes.

- Categorize common causes of intracranial hemorrhage, subarachnoid hemorrhage, and ischemic stroke.
- Explain the principles of fluid and electrolyte resuscitation and maintenance, respiratory physiology, cardiac physiology, and nutritional physiology, as applied to the neurological patient following ischemic or hemorrhagic stroke. Integrate this knowledge with the specific issues of the perioperative period.
- Recognize the need for laboratory evaluation for systemic illness.
- List the appropriate diagnostic neuro-imaging studies utilized to evaluate ischemic and hemorrhagic stroke.
- Recognize the typical clinical course of patients with ischemic and hemorrhagic stroke, including peak risk intervals for edema, vasospasm, re-bleeding, etc.
- Identify the periods of high vulnerability to systemic complications of cerebrovascular illness, including deep venous thrombosis, pulmonary embolism, bacterial pneumonia, aspiration, congestive heart failure, etc.
- Explain the principles of augmentation of cerebral blood flow during cerebral vasospasm.
- Discuss the principles and indications for medical, endovascular, and surgical interventions for ischemic and hemorrhagic stroke.
- Relate the principles of timing of medical, endovascular, and surgical intervention in these same disease states.
- Explain the principles, indications for, and complications of barbiturate coma.
- Recognize the principles and interpretation of normal and common abnormal findings on skull, chest, and abdominal x-rays in the Critical Care Unit.
- Describe the fundamentals of CT scanning, including the typical appearance of acute, subacute and chronic blood, calcification, ventricular anatomy and mass effect.
- Describe the typical CT appearance of hemorrhagic and ischemic stroke. Provide a detailed explanation for the typical delay between the onset of stroke and appearance of confirmatory CT findings.
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 - venous angiomas
 - cavernous malformations
 - aneurysms
- List the indications for non-invasive vascular imaging, including ultrasound, magnetic resonance angiography (MRA), and CT angiography. Recite the limitations of non-invasive studies.

- Describe the practical application of commonly employed non-invasive studies, such as transcranial Doppler, in the setting of cerebral vasospasm.
- List the indications for catheter angiography. Interpret the findings of angiography in ischemic and hemorrhagic cerebrovascular conditions. Identify the key segments of the internal carotid artery including the upper cervical, petrous, cavernous, and supraclinoid components.
- Describe the principles of localizing focal intracranial and spinal vascular pathology by the use of traditional topographic measurements and the application of stereotactic guidance.
- Describe the surgical anatomy and the principles of exposure of the cervical carotid artery.
- Describe the principles of pterional craniotomy, including scalp and bony anatomy, as well as the anatomy of the sphenoid ridge.
- Explain the principles of cerebrovascular surgery detailed in the previous objectives to medical students and allied health personnel during conferences.
- Review the expected effects of stroke or mass lesion at different locations within the brain stem and cerebellum.
- List the expected effects of destructive lesions in the basal ganglia and cerebellum.
- Describe the expected effects of ischemic or destructive lesions of the white matter tracts of the cerebrum.
- Discuss the expected effect of destructive lesions of specific regions of the cerebral cortex.
- Review the clinical presentation of strokes in the distribution of the supratentorial cerebral blood vessels.
- Identify the common carotid and vertebral circulation congenital variants on angiograms.
- Recognize intracranial aneurysms on angiograms.
- Identify and characterize intracranial vascular malformations on angiograms. Recognize:
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 - venous angiomas
 - arteriovenous fistula
 - feeding vessels
 - draining veins
 - associated aneurysms
 - degree of shunting
- Discuss the angiographic evaluation of carotid and vertebral disease.
- Review the role of MR angiography and venography in the evaluation of cerebrovascular disease, neoplasms, and trauma.
- Describe the radiological evaluation of CNS vasculitis.
- Describe the radiological evaluation of spinal vascular malformations.
- Review the findings of normal and abnormal carotid ultrasounds.

- Discuss the use of transcranial doppler ultrasonography in the management of patients with subarachnoid hemorrhage, trauma, and occlusive vascular disease.
- Neurotrauma
 - Describe the pathophysiology of intracranial hypertension and explain a plan for its management, including arguments for and against various treatments.
 - Discuss the clinical presentation in anatomical terms of traumatic syndromes of the brain and its coverings
- Practice management, legal and socioeconomic issues
 - Discuss the ethical and moral factors associated with the practice of neurosurgery.
 - Review the role of the neurosurgical leadership in the community and hospital setting.
 - Explain the neurosurgeon's responsibilities in terms of health care cost containment.
 - Review the features and relationships of the healthcare system
 - Recite the rules and regulations of the training hospital(s) as they pertain to the practice of neurosurgery.
 - Name the institutional and social service agencies in your community and review their role in the overall management of neurosurgical patients.
 - Demonstrate knowledge of the rules and regulations of the Ohio State Medical Board.
 - Discuss the concept of informed consent.

Objectives

- The PGY-2/3 resident on this rotation will acquire the fundamental clinical knowledge needed to manage patients with disorders commonly managed with radiosurgery as assessed by faculty evaluations and the written in training examination.
- The PGY-2/3 resident on this rotation will acquire fundamental knowledge pertaining to clinical presentation and pathophysiology of common cerebrovascular diseases as assessed by faculty evaluations and the written in training examination.
- The PGY-2/3 resident on this rotation will acquire fundamental knowledge pertaining to clinical presentation and pathophysiology of common traumatic injuries to the central nervous system as assessed by faculty evaluations and the written in training examination.
- The PGY-2/3 resident on this rotation will acquire basic knowledge in practice management, legal and socioeconomic issues that face a neurosurgeon as assessed by faculty evaluations and the written in training examination.
- The PGY-2/3 resident is expected to take the American Board of Neurological Surgery written exam for self-assessment.

Practice- Based Learning and Improvement

Goal

Residents 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 lifelong learning. Residents are expected to develop skills and habits to be able to:

Competencies

- Locate, appraise and assimilate evidence from scientific studies related to their patients' health problems
- Use information technology to optimize teaching
- Participate in the education of patients, families, students, residents and other health professionals

Objectives

- The PGY-2/3 resident on this rotation will perform pertinent case-based literature reviews for patient health problem and provide education to patients, families, students, residents and other health professionals on these topics in direct interaction and at combined conferences. This will be assessed by direct faculty observation, evaluation and review of presentations at the combined conferences.

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

- Work effectively in various health care delivery settings and systems relevant to neurosurgery.
- Work in interprofessional teams to enhance patient safety and improve patient care quality
- Participate in identifying systems errors and in implementing potential systems solutions

Objectives

- The PGY-2/3 resident on this rotation will perform effectively as a member of an interprofessional team to enhance patient safety and improve patient care quality as assessed by faculty.
- The PGY-2/3 resident on this rotation will identify system errors and propose potential solutions to rotation faculty. This will be as assessed by faculty.

Professionalism

Goal

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

Competencies

- Respect for patient privacy and autonomy
- Sensitivity and responsiveness to a diverse patient population, including but not limited to diversity in gender, age, culture, race, religion, disabilities, and sexual orientation
- Comply with all GME and Departmental regulations regarding duty hour restrictions and report personal schedule in timely and accurate fashion.
- Accurately self-report fatigue in situations that may compromise safety and/or patient care.

Objectives

- The PGY-2/3 resident on this rotation will demonstrate respect toward patients and demonstrate sensitivity and responsiveness to a diverse patient population as assessed by faculty evaluation.
- The PGY-2/3 resident on this rotation will be compliant with all GME and Departmental regulations regarding duty hour restrictions and report personal schedule in timely and accurate fashion as assessed by duty hours tracking data, weekly review by Program Administrator and review as needed.

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

- Communicate effectively with physicians, other health professionals, and health related agencies
- Work effectively as a member of a health care team

Objectives

- The PGY-2/3 resident on this rotation will demonstrate the ability to communicate effectively with other health professionals and work effectively as a health care team member as assessed by 360-degree evaluation by neurosurgery nurse practitioner, clinic coordinator, Program Coordinator and transcription specialist.

Teaching Methods

Teaching methods include formal didactic lectures as well as supervision in the operating room appropriate to the resident's level of competency.

Assessment Method (Residents)

- Written faculty evaluation of all 6 competencies.

- 360-degree evaluation of professionalism and communication by Neurosurgery nurse practitioners, Clinic coordinators and the Program Coordinator.
- Review of performance on written Boards examination.
- Progression through Milestones reported by Clinical Competency Committee every six months.

Assessment Method (Program Evaluation)

The experience is considered educational if there is demonstration of improved knowledge and operative skills over the course of the rotation.

Level of Supervision

The resident is supervised by the attending neurosurgeons appropriate to their level of competency.

Educational Resources

- Neuro-vascular
 - Stroke: Pathophysiology, Diagnosis, and Management. Mohr JP, Choi DW, Grotin JG, Weir B, Wolf PA (eds). Oxford, Churchill Livingstone, 2004
 - Practical Neuroangiography. Morris P (ed). New York, Lipincott, 2007
 - Diagnostic Cerebral Angiography. Osborn AG (ed). New York, Lipincott, 1999
 - Intracranial Aneurysm Surgery: Techniques. Samson DS, Batjer HH (eds). New York, Futura, 1990
 - Management of Cerebral Aneurysms. Le Roux PD, Winn HR, Newell DW (eds). New York, W.B. Saunders, 2004
 - Youmans Neurological Surgery, Volume 2, Fifth Edition. Winn HR (ed). Philadelphia, W.B. Saunders, 2004

Junior Clinical Rotation (Functional/Spine) – University Hospital PGY 2 and PGY 3

Description of Rotation or Educational Experience

- Length: 2 months
- Site: University Hospital
- Focus: Spine, Functional and Peripheral Nerve are the components of the PGY 2 and PGY 3 Junior Clinical Rotations in Functional/Spine Neurosurgery. During this rotation, the resident will be fully integrated into the Spine and Functional programs at the OSUWMC. Residents will develop skills critical for the evaluation and management (clinical and surgical) of patients with spinal, functional and peripheral nerve disorders. Specific emphasis is placed upon continuity of care and the acquisition of a comprehensive, multi-faceted experience.
- Responsible Faculty: Brian Dalm, M.D., Frank Farhadi, M.D., Andrew Grossbach, M.D., Vibhor Krishna, M.B.B.S. and Steve Viljoen, M.D.
- Didactics:
 - Required clinical conferences include weekly Case Conference, monthly M&M Conference and monthly Grand Rounds as well as daily Faculty Teaching Rounds. Additional optional opportunities include weekly Spine Tumor Board, weekly Brain Tumor Board, weekly DBS Conference, weekly Skull Base Conference and weekly Stroke Case Conference.
- Clinical Experience: The resident will be provided with a broad experience in oncology, spine, functional and vascular surgery, including routine and complex problems. The resident will round daily on patients on the service and will participate in the surgical procedures during the remainder of the week. The resident will take, on average, 7 24-hour days of in-house neurosurgery call each month where they will be directly involved with the supervised management of neurosurgical patients, admission of neurosurgical patients and performance of consults (including in the Emergency Department).
- Ambulatory Experience: The resident will attend 1 half-day of clinic per week where the resident will gain exposure to the diagnosis and management of patients with diverse neurosurgical problems including operative and non-operative management.

Patient Care

Goal

Residents must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. Residents are expected to:

Competencies

- Spine
 - Perform a complete history and physical examination on patients with spinal disorders.
 - Interpret plain x-rays, dynamic x-rays, myelograms, CT scans and MR scans of patients with spinal disorders.

- Prepare patients for spinal surgery, including proper positioning, protection to pressure points, and placement of indicated arterial and central venous catheters, indwelling urinary catheters and anti-embolism devices.
- Perform lumbar punctures and placement of lumbar drains.
- Demonstrate the ability to place and manage cranial traction devices for reduction and immobilization of the unstable cervical spine.
- Demonstrate the ability to place and manage a halo vest, including indications for placement and criteria for removal.
- Demonstrate the ability to properly place the Mayfield head holder and other headrests.
- Demonstrate the ability to harvest autologous bone graft from the calvarium, rib, fibula, and anterior or posterior iliac crest.
- Perform dorsal exposure of the spinous processes, laminae, and facets of the cervical, thoracic, and lumbar spine.
- Demonstrate the ability to close dorsal, ventral, and lateral spinal incisions.
- Demonstrate proper postoperative wound care.
- Demonstrate appropriate postoperative management of patients who have undergone spinal procedures.
- Demonstrate the ability to perform, with supervision, a lumbar decompressive laminectomy for spinal stenosis.
- Demonstrate the ability to excise, with supervision, a herniated lumbar disc.
- Demonstrate the appropriate use of the operating microscope.
- Stereotactic / Functional
 - Demonstrate the ability to evaluate patients with movement disorders, epilepsy, spasticity, chronic pain and neuropsychiatric disease in out-patient and in-patient settings.
 - Formulate treatment plans for patients with these disorders utilizing the best available evidence-based studies
 - Demonstrate an understanding of indications for surgical intervention for patients with these disorders.
 - Discuss the appropriate use of medical management for movement disorders and epilepsy.
 - Demonstrate the ability to perform the following procedures or portions of procedures under faculty supervision:
 - Positioning and preparing patients for stereotactic and functional procedures
 - preoperative planning for frame-based and frameless stereotactic procedures including deep brain stimulation
 - Placement of stereotactic frames
 - Opening and closure for deep brain stimulation
 - Insertion of depth electrodes
 - Craniotomy for grid placement and exposure for epilepsy surgery

- Demonstrate the ability to write post-operative orders and provide post-operative care for patients undergoing stereotactic and functional procedures.
- Peripheral Nerve
 - Obtain a history and perform a motor and sensory examination of the peripheral nervous system.
 - Based on history and physical, anatomically localize the lesion.
 - Obtain appropriate ancillary tests:
 - EMG/NCV
 - metabolic screens
 - imaging studies
 - Formulate a differential diagnosis for common entrapments.
 - Position and prep for common entrapment releases.
 - Perform a diagnostic nerve and muscle biopsy.
 - Obtain sural nerve for grafting.
 -
- Neurotrauma
 - Perform the following surgical procedures in uncomplicated cases:
 - craniotomy for subdural and/or epidural hematoma
 - craniotomy for penetrating head injury
 - craniotomy for intracerebral hematoma or contusion
 - craniotomy for depressed skull fracture
 - decompressive craniectomy
 - repair/cranialization of frontal sinus fracture
 - craniotomy/craniectomy for posterior fossa epidural, subdural, or intracerebral hematoma
 - simple cranioplasty
 - Manage traumatic skull base fractures with CSF leak.
 - Manage infections associated with open CNS injuries.
- Practice management, legal and socioeconomic issues
 - Demonstrate an ability to interact effectively, professionally, and respectfully with members of the health care team, patients and their families.
 - Demonstrate the ability to maintain accurate and current medical records.
 - Discuss neurosurgical career options with faculty, peers, faculty, non-faculty neurosurgeons and other mentors.
 - Accumulate information about post-residency career options.
 - Create and keep current a resume/curriculum vitae.
 - Record CPT codes for office visits and procedures performed on service.
 - Accurately document H&P and consultations according to the AMA-CPT E&M documentation guidelines.

Objectives

- Upon completion of the rotation, the resident will demonstrate competency in basic spine procedures as assessed by faculty.

- Upon completion of the rotation, the resident will demonstrate competency in basic stereotactic/functional procedures as assessed by faculty.
- Upon completion of the rotation, the resident will demonstrate competency in basic peripheral nerve procedures as assessed by faculty.
- Upon completion of the rotation, the resident will demonstrate competency in basic neurotrauma procedures as assessed by faculty.
- Upon completion of the rotation, the resident will demonstrate competency in patient care related practice management, legal and socioeconomic issues as assessed by faculty.

Medical Knowledge

Goal

Residents must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological, and social-behavioral sciences, as well as the application of this knowledge to patient care. Residents are expected to:

Competencies

- Spine
 - Review the anatomy of the craniocervical junction, cervical, thoracic, and lumbar spine, sacrum, and pelvis.
 - Interpret plain and dynamic radiographs, bone scans, myelograms, computerized tomographic (CT) scans, and magnetic resonance (MR) scans of patients with spinal disorders.
 - Review the signs, symptoms, and pathophysiology of common syndromes of degenerative spinal disorders: radiculopathy, myelopathy, instability, and neurogenic claudication.
 - Identify the common syndromes of spinal cord injury, including complete transverse injury, anterior cord injury, Brown-Sequard injury, central cord injury, cruciate paralysis, syringomyelia, conus syndrome, and sacral sparing. Describe the pathophysiology of spinal cord injury.
 - Describe the cauda equina syndrome.
 - Recite the differential diagnosis of cervical, thoracic, and lumbar pain.
 - Discuss the indications for cervical, thoracic, and lumbar discectomy.
 - Identify non-surgical spinal cord syndromes including amyotrophic lateral sclerosis, demyelinating conditions, and combined systems disease.
 - Review the initial management of spine and spinal cord injured patients including immobilization, traction, reduction, appropriate radiographic studies, and medical management.
 - Classify fractures, dislocations, and ligament injuries of the craniocervical region, subaxial cervical spine, thoracic, thoracolumbar junction, lumbar, and sacral spine. Describe the mechanism of injury and classify the injuries as stable or unstable. Review the indications for surgical management.
 - Discuss briefly the concept of grading schemes for spinal cord injury and myelopathy.
 - Discuss the relationship of the spinal nerves to the vertebral level of exit.

- Diagram the structures comprising the boundaries of the spinal neural foramina.
- Discuss the clinical presentation and neurological deficits associated with common lesions of and injuries to the spinal cord and nerve roots.
- Discuss the role of myelography in the evaluation of neurosurgical patients.
- Stereotactic / Functional
 - Discuss the considerations of stereotactic frame placement in regard to target localization and purpose of procedure (biopsy, craniotomy, functional, radiosurgery).
 - Describe the direct and indirect basal ganglion-thalamocortical motor pathways.
 - Define and distinguish each of the following entities:
 - tremor
 - rigidity
 - dystonia
 - chorea
 - athetosis
 - Describe the pathophysiology of Parkinson's disease and cerebellar tremor.
 - Explain the primary symptoms treated by ventro-lateral (VL) thalamotomy pallidotomy.
 - Discuss the advantages and disadvantages of stereotactic biopsy compared to open biopsy procedures.
 - Discuss the differential diagnosis of a newly discovered ring-enhancing intracranial mass.
 - Discuss the differential diagnosis of a newly discovered non-enhancing intracranial mass.
 - Define different seizure types (partial, partial-complex, generalized, etc).
 - Define medically intractable epilepsy.
 - Describe the anatomy of the mesial temporal lobe.
 - Define brachytherapy.
 - Define conventional care for patients with high-grade gliomas.
 - Review the limitations of conventional care for patients with high-grade gliomas.
 - Describe the anatomy of the trigeminal nuclei, root, ganglion and divisions.
 - Define typical trigeminal neuralgia, atypical trigeminal neuralgia, and trigeminal neuropathy.
 - Explain the potential causes for trigeminal neuralgia.
 - Define stereotactic radiosurgery.
 - Explain the differences between radiosurgery and radiation therapy.
 - List the potential indications for radiosurgery.
 - List the reported complications of radiosurgery.
 - Compare advantages and disadvantages of frame-based or frameless stereotactic craniotomies to non-stereotactic craniotomies.

- Discuss the history of stereotactic surgery as well as the evolution of head frames and frameless technology.
- Discuss preoperative planning for frame-based and frameless stereotactic procedures including deep brain stimulation
- Be able to discuss and assess the accuracy of modern day stereotactic technique by evaluating postoperative imaging.
- Discuss the types of tremor and the theoretical pathophysiology of tremor circuits.
- Understand surgical anatomy of the thalamus and its relevance for complication avoidance in tremor surgery.
- Describe the direct and indirect basal ganglia-thalamocortical motor pathways and their related pathophysiology in Parkinson's disease.
- Discuss the advantages and disadvantages of ablative techniques such as pallidotomy and compare with those of deep brain stimulation.
- Discuss the surgical targets of thalamus, globus pallidum, and subthalamic nucleus and their expected results with movement disorders.
- Understand the classification of dystonia and recognize the appropriate indications for surgery in dystonic patients.
- Discuss the surgical treatment of hemifacial spasm
- Peripheral nerve
 - Define the peripheral nervous system versus the central nervous system.
 - Discuss the major structural elements of a peripheral nerve:
 - epineurium
 - perineurium
 - endoneurium
 - axon
 - fascicle
 - Schwann cell
 - connective tissue
 - motor end plate
 - sensory receptor
 - Discuss the blood supply of the peripheral nerves.
 - Discuss the blood-nerve barrier.
 - Define axonal transport and differentiate fast from slow.
 - Describe an action potential including the flow of ions.
 - Describe the various nerve fibers in terms of size.
 - Discuss the significance of fiber size in terms of function (e.g., c-fiber - nociceptive).
 - Discuss the various forms of action potential propagation.
 - Discuss the pathophysiological response to various injuries by a nerve:
 - compression
 - ischemia
 - metabolic
 - concussive

- stretch
- Define and discuss apoptosis.
- Define Wallerian degeneration.
- Discuss nerve regeneration:
 - sprouting
 - nerve growth factors
 - rate of growth
 - remyelination
- Define neuroma:
 - axonal tangle
 - mechano-sensitivity
 - neuroma-in-continuity
- Define and discuss the pathophysiology and clinical significance of the Tinel's sign.
- Describe the symptoms and signs of typical nerve injuries:
 - entrapment syndromes
 - stretch injuries
 - laceration injuries
 - concussive injuries
 - injection injuries
- Distinguish upper versus lower motor neuron symptoms and signs in nerve injury:
 - anatomical definition
 - degree of atrophy
 - distribution of weakness
 - reflex changes
 - potential for recovery
- Describe the classification of nerve injury:
 - Seddon classification
 - Sunderland classification
- List the major peripheral nerves of body. Describe the motor and sensory innervation of each.
- Draw the major components of the brachial plexus.
- Describe the rating scales for motor power.
- Describe the various sensory modalities and how to examine each.
- Describe the symptoms and signs of common nerve entrapments:
 - carpal tunnel
 - ulnar entrapment at the elbow
 - lateral femoral cutaneous nerve
 - peroneal at fibular head
- Define EMG and NCV.
- Describe the changes in EMG and NCV in nerve entrapment.
- Describe the nonoperative and operative treatment of entrapment syndromes.

- Define:
 - coaptation
 - neurorrhaphy
 - neurotization
 - nerve transfer
- Discuss the clinical manifestation of injury for each of the major peripheral nerves.
- Describe the anatomy and presentation of common entrapment syndromes of peripheral nerves including:
 - thoracic outlet syndrome
 - carpal tunnel syndrome
 - ulnar nerve entrapment syndrome at wrist and elbow
 - anterior interosseous syndrome
 - posterior interosseous syndrome
 - meralgia paresthetica
 - peroneal nerve palsy
 - tarsal tunnel syndrome
- Describe the surgical exposure of common peripheral nerve entrapments including:
 - carpal tunnel
 - ulnar nerve at elbow
 - ulnar nerve at wrist
 - lateral femoral cutaneous nerve
 - peroneal nerve
- Review MR neurography.
- Describe the appearance of peripheral nerve tumors on MR scans.
- Neurotrauma
 - Describe the pathophysiology of intracranial hypertension and explain a plan for its management, including arguments for and against various treatments.
 - Discuss the clinical presentation in anatomical terms of traumatic syndromes of the brain and its coverings
- Practice management, legal and socioeconomic issues
 - Discuss the ethical and moral factors associated with the practice of neurosurgery.
 - Review the role of the neurosurgical leadership in the community and hospital setting.
 - Explain the neurosurgeon's responsibilities in terms of health care cost containment.
 - Review the features and relationships of the healthcare system
 - Recite the rules and regulations of the training hospital(s) as they pertain to the practice of neurosurgery.
 - Name the institutional and social service agencies in your community and review their role in the overall management of neurosurgical patients.

- Demonstrate knowledge of the rules and regulations of the Ohio State Medical Board.
- Discuss the concept of informed consent.

Objectives

- The PGY-2/3 resident on this rotation will acquire the fundamental clinical knowledge needed to manage patients with disorders of the spine as assessed by faculty evaluations and the written in training examination.
- The PGY-2/3 resident on this rotation will acquire the fundamental knowledge in the anatomy, physiology, imaging and pathogenesis of spinal disorders as assessed by faculty evaluations and the written in training examination.
- The PGY-2/3 resident on this rotation will acquire the fundamental clinical knowledge needed to manage patients with pain or functional neurosurgical disorders as assessed by faculty evaluations and the written in training examination.
- The PGY-2/3 resident on this rotation will acquire the fundamental clinical knowledge needed to manage patients with disorders of the peripheral nervous system as assessed by faculty evaluations and the written in training examination.
- The PGY-2/3 resident on this rotation will acquire the fundamental knowledge in the anatomy, physiology, imaging and pathogenesis of pain, functional and peripheral nerve disorders as assessed by faculty evaluations and the written in training examination.
- The PGY-2/3 resident on this rotation will acquire fundamental knowledge pertaining to clinical presentation and pathophysiology of common traumatic injuries to the central nervous system as assessed by faculty evaluations and the written in training examination.
- The PGY-2/3 resident on this rotation will acquire basic knowledge in practice management, legal and socioeconomic issues that face a neurosurgeon as assessed by faculty evaluations and the written in training examination.
- The PGY-2/3 resident is expected to take the American Board of Neurological Surgery written exam for self-assessment.

Practice- Based Learning and Improvement

Goal

Residents 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 lifelong learning. Residents are expected to develop skills and habits to be able to:

Competencies

- Locate, appraise and assimilate evidence from scientific studies related to their patients' health problems
- Use information technology to optimize teaching

- Participate in the education of patients, families, students, residents and other health professionals

Objectives

- The PGY-2/3 resident on this rotation will perform pertinent case-based literature reviews for patient health problem and provide education to patients, families, students, residents and other health professionals on these topics in direct interaction and at combined conferences. This will be assessed by direct faculty observation, evaluation and review of presentations at the combined conferences.

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

- Work effectively in various health care delivery settings and systems relevant to neurosurgery.
- Work in interprofessional teams to enhance patient safety and improve patient care quality
- Participate in identifying systems errors and in implementing potential systems solutions

Objectives

- The PGY-2/3 resident on this rotation will perform effectively as a member of an interprofessional team to enhance patient safety and improve patient care quality as assessed by faculty.
- The PGY-2/3 resident on this rotation will identify system errors and propose potential solutions to rotation faculty. This will be as assessed by faculty.

Professionalism

Goal

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

Competencies

- Respect for patient privacy and autonomy
- Sensitivity and responsiveness to a diverse patient population, including but not limited to diversity in gender, age, culture, race, religion, disabilities, and sexual orientation
- Comply with all GME and Departmental regulations regarding duty hour restrictions and report personal schedule in timely and accurate fashion.

- Accurately self-report fatigue in situations that may compromise safety and/or patient care.

Objectives

- The PGY-2/3 resident on this rotation will demonstrate respect toward patients and demonstrate sensitivity and responsiveness to a diverse patient population as assessed by faculty evaluation.
- The PGY-2/3 resident on this rotation will be compliant with all GME and Departmental regulations regarding duty hour restrictions and report personal schedule in timely and accurate fashion as assessed by duty hours tracking data, weekly review by Program Administrator and review as needed.

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

- Communicate effectively with physicians, other health professionals, and health related agencies
- Work effectively as a member of a health care team

Objectives

- The PGY-2/3 resident on this rotation will demonstrate the ability to communicate effectively with other health professionals and work effectively as a health care team member as assessed by 360-degree evaluation by neurosurgery nurse practitioner, clinic coordinator, Program Coordinator and transcription specialist.

Teaching Methods

Teaching methods include formal didactic lectures as well as supervision in the operating room appropriate to the resident's level of competency.

Assessment Method (Residents)

- Written faculty evaluation of all 6 competencies.
- 360-degree evaluation of professionalism and communication by Neurosurgery nurse practitioners, Clinic coordinators and the Program Coordinator.
- Review of performance on written Boards examination.
- Progression through Milestones reported by Clinical Competency Committee every six months.

Assessment Method (Program Evaluation)

The experience is considered educational if there is demonstration of improved knowledge and operative skills over the course of the rotation.

Level of Supervision

The resident is supervised by the attending neurosurgeons appropriate to their level of competency.

Educational Resources

- Spine
 - Herkowitz Harry N (Ed). Rothman-Simeone, The Spine. Fourth Edition, W. B. Saunders, Philadelphia, 1994.
 - Menezes Arnold H, Sonntag Volker K (Eds). Principles of Spinal Surgery. McGraw-Hill, Inc., New York, 1996.
 - Menezes A. Benzel E. Spine Surgery: Techniques, Complication Avoidance, and Management.
 - Caspar W. Anterior cervical fusion and interbody stabilization with the trapezial osteosynthetic plate technique. #12 Aesculap.
 - Aebi M. Principles in Spine Surgery. AO/ASIF.
 - Turnbull IM. Microvasculature of the human spinal cord. J Neurosurg 35:141-147, 1971.
 - Milhorat TH, Kotzen RM, Anzil AP. Stenosis of central canal of spinal cord in man: incidence and pathological findings in 232 autopsy cases. J Neurosurg 80:716-722, 1994.
 - Menezes, AH, Sonntag VKH, Principles of Spinal surgery. McGraw Hill, NewYork, 1995
 - Rothman, RH, Simeone FA. The Spine. WB Saunders, Philadelphia, 1999
- Stereotactic / Functional
 - Textbook of Stereotactic and Functional Neurosurgery. Gildenberg and Tasker (editors), McGraw Hill 1998, pp. 2157.
 - Microelectrode Recording and Movement Disorder Surgery. Israel and Burchiel (editors), Thieme 2004.
 - Surgical Treatment of the Epilepsies. Jerome Engel (editor), Raven Press 1993
 - Surgical Management of Pain. Burchiel (editor), Thieme 2002
 - Principals of Neurology. Adams, Victor, and Ropper, (editors), McGraw Hill 1997
 - Spasticity Management in Youmans Neurological Surgery, 2004
- Peripheral Nerve
 - Birch R, Bonney G, Wynne P. Surgical Disorders of Peripheral Nerves. Churchill-Livingstone, London, 1998.
 - Gelberman R (Ed). Operative Nerve Repair and Reconstruction. I. P. Lippincott Co., Philadelphia, 1991.
 - Kline D, Hudson A. Nerve Injuries: Operative Results for Major Nerve Injuries, Entrapments and Tumors. W. B. Saunders Co., Philadelphia, 1995.
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- Kline D, Hudson A, Kim D. Atlas of Peripheral Nerve Surgery. W. B. Saunders Co., Philadelphia, 2001.
- Dawson D, Hallett M, Millender *I: Entrapment Neuropathies, 2nd Ed, Little and Brown Co., Boston, 1990.
- Dellon A: Evaluation of Sensibility and Re Education of Sensation in the Hand, Williams, & Wilkins, Baltimore 1981.
- Dyck P, Thomas PK, Asbury A, Winegood A, Porte D: Diabetic Neuropathy, W.B. Sanders Co. Phila, 1987.
- Dyck P, Thomas PK: Peripheral Neuropathy 3 rd Ed., W.B. Saunders Co. Philadelphia, 1993
- Haymaker W, Woodhall B: Peripheral Nerve Injuries. Principles and Diagnosis, 2nd Ed. W.B. Saunders Co., Phila.
- 1953.
- Hawkins J, Reed R: Tumors the Peripheral Nervous System AFIP Atlas of Tumor Pathology – 2nd Series, Fascicle 3, AFIP, Washington, D.C. 1968.
- Henry AK: Extensile Exposure: Applied to Limb Surgery, Williams and Wilkins, Baltimore, 1945.
- Kempe L: Operative Neurosurgery Vol. 2, Springer, NY, 1970.
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- Seddon H: Peripheral Nerve Injuries, MRC Report 282. Her Majesty's Stationary Office, London, 1954.
- Spinner M.: Injuries to the Major Branches of Peripheral Nerves of the Forearm. 2nd Ed., W.B. Saunders, Phila. 1978.
- Woodhall B, Beebe G: Peripheral Nerve Regeneration V.A. Monograph, U.S. Gov't. Printing Office, Washington, DC, 1957.
- Balliere. Aids to the examination of the peripheral nervous system. Tindall, London, 1986
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- Grant GA, Goodkin R, Kliot M. Evaluation and surgical management of peripheral nerve problems. *Neurosurgery* 44:825-40, 1999.
- Kline DG, Hudson AR. *Nerve Injuries*. W. B. Saunders, Philadelphia, 1995.

Pediatric Neurosurgery PGY 2 and 3

Description of Rotation or Educational Experience

- Length: 4 months
- Site: Nationwide Children's Hospital
- Focus: During this rotation, the resident will be fully integrated into the Pediatric Neurosurgery Surgery services at Nationwide Children's Hospital. Residents will develop skills critical for the evaluation and management (clinical and surgical) of Pediatric Neurosurgery patients. Specific emphasis is placed upon continuity of care and the acquisition of a comprehensive, multi-faceted experience of Pediatric Neurosurgery patients.
- Responsible Faculty: Jeffrey Leonard, M.D., Annie Drapeau, M.D., Jonathon Pindrik, M.D. and Eric Sribnick, M.D.
- Didactics:
 - Required clinical conferences include weekly Case Conference, monthly M&M Conference and monthly Grand Rounds as well as daily Faculty Teaching Rounds, and every Tuesday, neuropathology cases are reviewed with the neuro-oncologists and neuropathologists. Additional optional opportunities include weekly Spine Tumor Board, weekly Brain Tumor Board, weekly DBS Conference, weekly Skull Base Conference and weekly Stroke Case Conference.
- Clinical Experience: During this rotation, the resident will receive instruction and acquire experience on the inpatient wards, in the operating room and in teaching conferences. The resident will take, on average, 3 days of neurosurgery home call each week where they will be directly involved with the supervised management of neurosurgical patients, admission of neurosurgical patients and performance of consults (including in the Emergency Department).
- Ambulatory Experience: The resident will attend a total of one-and-a-half days of Pediatric Neurosurgery clinic per week.

Patient Care

Goal

Residents must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. Residents are expected to:

Competencies

- Pediatric Neurosurgery
 - Perform complete history, physical examination and assessment on newborns, infants, and children.
 - Interpret results of the physical examination, laboratory and radiological studies to arrive at a differential diagnosis.
 - Perform subdural, intraventricular and lumbar punctures in children.
 - Perform a shunt tap.

- Perform a twist drill or burr hole for subdural, parenchymal, or ventricular access or as part of a craniotomy.
- Perform a craniotomy or craniectomy for evacuation of subdural or epidural lesion.
- Perform a craniectomy as part of skull biopsy.
- Perform craniotomy for elevation of depressed skull fracture.
- Place a ventriculoperitoneal, jugular, or pleural shunt.
- Revise a ventriculoperitoneal, jugular, or pleural shunt.
- Perform a cranioplasty with artificial material or homologous material.
- Perform a laminectomy in a patient with normal spinal anatomy.
- Position a patient for intracranial or intraspinal surgery.
- Demonstrate an ability to open and close cranial and spinal wounds to include dural opening and repair.
- Complete a sagittal synostectomy.
- Neurotrauma
 - Perform the following surgical procedures in uncomplicated cases:
 - craniotomy for subdural and/or epidural hematoma
 - craniotomy for penetrating head injury
 - craniotomy for intracerebral hematoma or contusion
 - craniotomy for depressed skull fracture
 - decompressive craniectomy
 - repair/cranialization of frontal sinus fracture
 - craniotomy/craniectomy for posterior fossa epidural, subdural, or intracerebral hematoma
 - simple cranioplasty
 - Manage traumatic skull base fractures with CSF leak.
 - Manage infections associated with open CNS injuries.
- Practice management, legal and socioeconomic issues
 - Demonstrate an ability to interact effectively, professionally, and respectfully with members of the health care team, patients and their families.
 - Demonstrate the ability to maintain accurate and current medical records.
 - Discuss neurosurgical career options with faculty, peers, faculty, non-faculty neurosurgeons and other mentors.
 - Accumulate information about post-residency career options.
 - Create and keep current a resume/curriculum vitae.
 - Record CPT codes for office visits and procedures performed on service.
 - Accurately document H&P and consultations according to the AMA-CPT E&M documentation guidelines.

Objectives

- Upon completion of the rotation, the resident will demonstrate competency in basic neuroendocrine procedures as assessed by faculty.
- Upon completion of the rotation, the resident will demonstrate competency in basic pediatric neurosurgical procedures as assessed by faculty.

- Upon completion of the rotation, the resident will demonstrate competency in basic neurotrauma procedures as assessed by faculty.
- Upon completion of the rotation, the resident will demonstrate competency in patient care related practice management, legal and socioeconomic issues as assessed by faculty.

Medical Knowledge

Goal

Residents must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological, and social-behavioral sciences, as well as the application of this knowledge to patient care. Residents are expected to:

Competencies

- Pediatric Neurosurgery
 - Myelomeningocele and its Variants, Meningocele, Encephalocele, Chiari Malformations, Occult Spinal Dysraphism, Split Cord Anomalies, Segmentation Anomalies, Craniofacial Syndromes and Phakomatosis
 - Review the embryology of the central nervous system (CNS) and its supporting structures.
 - List the abnormalities a neurosurgeon may treat which are congenital/developmental in nature and classify them with respect to their embryology defect.
 - Describe the incidence, epidemiology and inheritance patterns.
 - State other disorders associated with this set of diseases.
 - Describe the anatomic and pathophysiologic parameters which distinguish amongst these diseases.
 - Develop a diagnostic treatment plan along with prognostication of outcome with optimal management.
 - List disorders which may be referred for neurosurgical care but do not require surgery.
 - Display current knowledge of the molecular basis for these diseases where known.
 - Describe the expected outcome if treatment is not undertaken.
 - Hydrocephalus and Other Disorders of CSF Circulation
 - Describe the normal physiology of CSF.
 - Delineate the different etiologies of hydrocephalus and their relative incidence.
 - Explain how to differentiate between CSF collections which require treatment and those which do not.
 - Indicate the various treatment options for the management of hydrocephalus.
 - Distinguish between treatment options for hydrocephalus with normal CSF and contaminated (e.g. infection, blood) CSF.
 - List the complications associated with each treatment option for hydrocephalus and the diagnosis and treatment of same.

- Differentiate between low-pressure and high-pressure hydrocephalus.
- Describe the presentation and diagnostic approach to a patient with suspected shunt malfunction.
- Define how the diagnosis of hydrocephalus is made.
- List nonsurgical diseases which may be mistaken for hydrocephalus but require treatment different than surgery.
- Review the causes of cerebral atrophy.
- Neoplasia
 - Delineate the differences between pediatric and adult tumors.
 - List the common tumor types occurring in children and their typical location.
 - Describe the changing tumor type and location based upon age.
 - Identify lesions which require biopsy as part of the treatment/diagnostic plan.
 - Describe the typical presentations of tumors.
 - Describe appropriate evaluation for patients suspected of having a tumor.
 - Classify tumor types as to degree of malignancy, role of surgical vs. nonsurgical therapy, and outcomes of optimal treatment.
 - Discuss the possible complications associated with specific tumor types.
 - Describe the pertinent anatomy for surgical treatment of midline or hemispheric cerebellar tumors and hemispheric cerebral tumors.
 - Discuss appropriate preoperative management of patients with tumors.
 - Compare the role of biopsy, subtotal resection and total resection in the management of tumors.
 - List possible complications of the treatment options, their diagnostic evaluation and treatment.
- Infection
 - Describe the presentations of a shunt infection.
 - List the indications for ventricular lumbar and subarachnoid CSF sampling.
 - List the common organisms seen in shunt infections.
 - Describe treatment plans for shunt infection.
 - List risk factors and risks of shunt infection and the proper diagnostic protocol to establish the presence of a shunt infection.
 - Describe common presentations of intracranial and intraspinal suppuration.
 - List host risk factors which are associated with CNS infections.
 - Describe appropriate diagnostic protocol to establish the presence of CNS infection.
 - Discuss the timeliness and utility of surgical therapy for the treatment of CNS infection both shunt-related and non-shunt-related.
- Other

- Delineate the various types of spasticity and movement disorders seen in children.
- List seizure types.
- Describe surgical lesions which may be related to seizures.
- Describe surgical and non-surgical treatment options regarding the alleviation of spasticity in children.
- Discuss the pathophysiology of craniosynostosis.
- Review the role of radionuclide scans in the evaluation of patients with suspected cranial and spinal disease.
- Discuss the use of intraoperative radiographs and fluoroscopy.
- List the indications for CT- and MR-guided biopsies.
- Describe the concepts of ultrasonography.
- Review the findings of normal and abnormal neonatal cranial ultrasound.
- Cerebrovascular
 - Delineate the possible causes of an atraumatic intracerebral or subarachnoid hemorrhage.
 - Delineate the possible causes of cerebral infarction/ischemia.
 - Discuss the common locations of arteriovenous shunts and their presentation, evaluation, and treatment (includes dural AVM).
 - Discuss the embryology of the cerebral and spinal vasculature and its possible role in vascular anomalies in children.
 - Describe the common locations and types of aneurysms seen in children and how they differ from those seen in adults.
 - List the possible presentations of Vein of Galen aneurysms, their diagnosis and management.
 - List the possible causes of aneurysms in children which are not congenital in nature.
 - Describe the pathophysiology, treatment, and outcome of intraventricular hemorrhage in the neonate.
- Trauma
 - List the appropriate diagnostic tests to evaluate a child who has sustained multisystem trauma.
 - Describe the Glasgow Coma Scale and its use.
 - List the salient historical and exam features which lead one to the diagnosis of non-accidental trauma.
 - Discuss the management of the cervical spine in a child who is comatose.
 - Describe the anatomy of the child's spine which causes the epidemiology of spinal cord injury to differ from adults.
 - Describe the common injuries seen as a result of birth trauma and discuss their diagnosis and management.
 - Describe the use of antibiotics and anticonvulsants in CNS trauma.
 - Review the evaluation and management of a child who has sustained a head injury with loss of consciousness but is now awake.

- Discuss the management of depressed skull fractures, both open and closed.
- Describe the diagnosis and management of spinal column injury.
- Discuss the diagnosis and management of spinal cord injury without radiologic abnormality (SCIWORA).
- Describe the intracranial pressure (ICP) compliance curve and discuss its utility in the management of head injury.
- List the parameters needed to decide on letting an athlete who has sustained a CNS injury return to activity.
- Discuss the concept of "brain death", its diagnosis and role in organ donation.
- Discuss the importance and interplay between ICP and cerebral perfusion pressure (CPP) in the management of head and spinal cord injury.
- Define the concept of "secondary injury".
- Discuss the role of invasive monitoring in all its forms in closed head injury (CHI).
- Neurotrauma
 - Describe the pathophysiology of intracranial hypertension and explain a plan for its management, including arguments for and against various treatments.
 - Discuss the clinical presentation in anatomical terms of traumatic syndromes of the brain and its coverings
- Practice management, legal and socioeconomic issues
 - Discuss the ethical and moral factors associated with the practice of neurosurgery.
 - Review the role of the neurosurgical leadership in the community and hospital setting.
 - Explain the neurosurgeon's responsibilities in terms of health care cost containment.
 - Review the features and relationships of the healthcare system
 - Recite the rules and regulations of the training hospital(s) as they pertain to the practice of neurosurgery.
 - Name the institutional and social service agencies in your community and review their role in the overall management of neurosurgical patients.
 - Demonstrate knowledge of the rules and regulations of the Ohio State Medical Board.
 - Discuss the concept of informed consent.

Objectives

- The PGY-2/3 resident on this rotation will acquire the fundamental clinical knowledge needed to manage pediatric patients with neurosurgical disorders as assessed by faculty evaluations and the written in training examination.

- The PGY-2/3 resident on this rotation will acquire the fundamental knowledge in the anatomy, physiology, imaging and pathogenesis of pediatric neurosurgical disorders as assessed by faculty evaluations and the written in training examination.
- The PGY-2/3 resident on this rotation will acquire fundamental knowledge pertaining to clinical presentation and pathophysiology of common traumatic injuries to the central nervous system as assessed by faculty evaluations and the written in training examination.
- The PGY-2/3 resident on this rotation will acquire basic knowledge in practice management, legal and socioeconomic issues that face a neurosurgeon as assessed by faculty evaluations and the written in training examination.

Practice- Based Learning and Improvement

Goal

Residents 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 lifelong learning. Residents are expected to develop skills and habits to be able to:

Competencies

- Locate, appraise and assimilate evidence from scientific studies related to their patients' health problems
- Use information technology to optimize teaching
- Participate in the education of patients, families, students, residents and other health professionals

Objectives

- The PGY-2/3 resident on this rotation will perform pertinent case-based literature reviews for patient health problem and provide education to patients, families, students, residents and other health professionals on these topics in direct interaction and at combined conferences. This will be assessed by direct faculty observation, evaluation and review of presentations at the combined conferences.

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

- Work effectively in various health care delivery settings and systems relevant to neurosurgery.
- Work in interprofessional teams to enhance patient safety and improve patient care quality

- Participate in identifying systems errors and in implementing potential systems solutions

Objectives

- The PGY-2/3 resident on this rotation will perform effectively as a member of an interprofessional team to enhance patient safety and improve patient care quality as assessed by faculty.
- The PGY-2/3 resident on this rotation will identify system errors and propose potential solutions to rotation faculty. This will be as assessed by faculty.

Professionalism

Goal

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

Competencies

- Respect for patient privacy and autonomy
- Sensitivity and responsiveness to a diverse patient population, including but not limited to diversity in gender, age, culture, race, religion, disabilities, and sexual orientation
- Comply with all GME and Departmental regulations regarding duty hour restrictions and report personal schedule in timely and accurate fashion.
- Accurately self-report fatigue in situations that may compromise safety and/or patient care.

Objectives

- The PGY-2/3 resident on this rotation will demonstrate respect toward patients and demonstrate sensitivity and responsiveness to a diverse patient population as assessed by faculty evaluation.
- The PGY-2/3 resident on this rotation will be compliant with all GME and Departmental regulations regarding duty hour restrictions and report personal schedule in timely and accurate fashion as assessed by duty hours tracking data, weekly review by Program Administrator and review as needed.

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

- Communicate effectively with physicians, other health professionals, and health related agencies
- Work effectively as a member of a health care team

Objectives

- The PGY-2/3 resident on this rotation will demonstrate the ability to communicate effectively with other health professionals and work effectively as a health care team member as assessed by 360-degree evaluation by neurosurgery nurse practitioner, clinic coordinator, Program Coordinator and transcription specialist.

Teaching Methods

Teaching methods include formal didactic lectures as well as supervision in the operating room appropriate to the resident's level of competency.

Assessment Method (Residents)

- Written faculty evaluation of all 6 competencies.
- 360-degree evaluation of professionalism and communication by Neurosurgery nurse practitioners, Clinic coordinators and the Program Coordinator.
- Review of performance on written Boards examination.
- Progression through Milestones reported by Clinical Competency Committee every six months.

Assessment Method (Program Evaluation)

The experience is considered educational if there is demonstration of improved knowledge and operative skills over the course of the rotation.

Level of Supervision

The resident is supervised by the attending neurosurgeons appropriate to their level of competency.

Educational Resources

- Principles and Practice of Pediatric Neurosurgery. Albright et al, Eds, 1999, Theime.
- Sadler, TW, Langman's Medical Embryology. Williams & Wilkins, 1990.
- Drake and Sainte-Rose, The Shunt Book, Blackwell Science, 1995.
- Brain Trauma Foundation, Pediatric Brain Injury Guidelines
<http://www2.braintrauma.org/guidelines/index.php>
- Medline/Pubmed/MD Consult
- Online full text Journal of Neurosurgery: Pediatrics available through
<http://www.thejns-net.org/>
- Online full text topical Journal with CME credits available through
<http://www.aans.org/education/journal/neurosurgical/default.asp>
- Wahle et al. Neurology in Youman's Neurological Surgery, 2004.

Junior Clinical Rotation (Oncology) – James Cancer Center PGY 2 and PGY 3

Description of Rotation or Educational Experience

- Length: 2 months
- Site: James Cancer Center
- Focus: Spine and Oncologic Neurosurgery are part of this Junior Clinical Rotation. During this rotation, the resident will be fully integrated into the Oncologic Neurosurgery program at the OSUWMC. Residents will develop advanced skills critical for the evaluation and management (clinical and surgical) of patients with neuro-oncologic disorders. Specific emphasis is placed upon continuity of care and the acquisition of a comprehensive, multi-faceted experience.
- Responsible Faculty: Russell Lonser, M.D., Brad Elder, M.D., Doug Hardesty, M.D., Ehud Mendel, M.D. and Daniel Prevedello, M.D.
- Didactics:
 - Required clinical conferences include weekly Case Conference, monthly M&M Conference and monthly Grand Rounds as well as daily Faculty Teaching Rounds. Additional optional opportunities include weekly Spine Tumor Board, weekly Brain Tumor Board, weekly DBS Conference, weekly Skull Base Conference and weekly Stroke Case Conference.
- Clinical Experience: The resident will be provided with an advanced experience in spine and oncologic neurosurgery. The emphasis of this rotation will center on performing outpatient evaluations, developing operative skills, and learning operative nuances that promote complication avoidance in management of complex spine disorders. The resident will round daily on patients on the service and will participate in the surgical procedures during the remainder of the week. The resident will take, on average, 6 12-hour days of in-house neurosurgery call where they will be directly involved with the supervised management of neurosurgical patients, admission of neurosurgical patients and performance of consults (including in the Emergency Department).
- Ambulatory Experience: The resident will attend one half-day of clinic per week where the resident will gain exposure to the diagnosis and management of patients with diverse problems including operative and non-operative management. The resident will be provided with the opportunity to follow patients longitudinally, participating in their non-operative and operative care.

Patient Care

Goal

Residents must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. Residents are expected to:

Competencies

- Spine

- Demonstrate the ability to prepare structural allografts for use in spinal surgery.
- Determine the need for postoperative inpatient or outpatient rehabilitation in patients with spinal disorders.
- Demonstrate the ability to perform a ventral exposure of the cervical spine followed by anterior cervical discectomy.
- Demonstrate the ability to perform an anterior cervical interbody arthrodesis.
- Demonstrate the ability to place anterior cervical instrumentation.
- Demonstrate the ability to perform posterior cervical decompressive laminectomy.
- Demonstrate the ability to perform posterior cervical foraminotomy with or without discectomy.
- Demonstrate the ability to perform medial and lateral approaches to a far lateral lumbar disc herniation.
- Demonstrate appropriate surgical technique in the management of recurrent lumbar disc herniations and recurrent lumbar stenosis.
- Demonstrate the ability to perform posterior lumbar arthrodesis with or without the use of interbody instrumentation.
- Demonstrate exposure of the cervical lateral masses, thoracic and lumbar transverse processes, and the sacral ala.
- Demonstrate the ability to perform posterior/intertransverse arthrodesis in the cervical, thoracic and lumbar regions.
- Demonstrate the ability to perform a laminectomy with or without transpedicular decompression for tumor, infection, or trauma.
- Demonstrate techniques for spinous process arthrodesis of the subaxial cervical spine for fracture or dislocation.
- Demonstrate the ability to manage postoperative complications of spinal surgery including:
 - hematoma
 - infection
 - spinal fluid leak
 - new neurologic deficit
- Demonstrate the ability to perform a tethered cord release.
- Demonstrate the ability to accurately interpret spinal myelograms and post-myelogram CT scans.
- Demonstrate the ability to accurately interpret cranial and spinal CT and MR scans of nontraumatic lesions.
- Neuro-oncology
 - Independently determine a differential diagnosis based on the patient's history, physical examination, and radiographic studies.
 - Position patients for craniotomy and craniectomy.
 - Perform the opening and closing of craniotomies and craniectomies.
 - Assist in the resection of intracranial neoplasms.
- Neuro-endocrine

- Describe the evaluation and management of the common postoperative complications following transsphenoidal surgery including Diabetes Insipidus, SIADH, epistaxis, CSF rhinorrhea.
- Describe the presentation, evaluation, and management of patients with:
 - Craniopharyngioma
 - Lymphocytic hypophysitis
 - Pituitary metastases
 - Empty sella syndrome
- Describe the surgical approaches to the sella and suprasellar regions, both transsphenoidal and transcranial.
- Describe the appropriate evaluation and management of postoperative pituitary axis.
- General
 - Identify at the time of surgery: occipital artery, superficial temporal artery, frontalis muscle, pterion,inion, asterion, coronal suture, sagittal suture, middle meningeal artery, sagittal sinus, transverse sinus, foramen rotundum, foramen ovale, foramen spinosum, superior orbital fissure, jugular foramen, internal auditory canal, superior sagittal sinus, sigmoid sinus, incisura, each cranial nerve, each named cerebral artery and vein, components of the brain stem, named structures on the floor of the fourth ventricle, Foramina of Magendie and Luschka, cerebral peduncles, components of the cerebellum, cerebellar tonsils, brachium cerebelli, vermis, major supratentorial gyri, supratentorial lobes, sylvian fissure, central sulcus
 - Identify at the time of surgery structures visible in the lateral ventricles including: Foramen of Monroe, fornix, caudate, thalamus, choroidal fissure, named veins, glomus of the choroid plexus, hippocampus
 - Identify the parts of the vertebral column, spinal cord, and nerve roots at the time of surgery including: spinous process, , lamina, superior facet, inferior facet, pedicle, pars interarticularis, uncovertebral joint, neural foramen and nerve root, nerve root ganglion, disc space, vertebral artery, dorsal column and lateral column of spinal cord, intradural afferent and efferent rootlets
- Practice management, legal and socioeconomic issues
 - Outline a post-residency career track.
 - Apply for post-residency fellowship if appropriate.
 - Obtain information about specific practice, research, or administrative career opportunities as appropriate.
 - Compose a list of questions to ask and things to see when interviewing for a neurosurgical position.

Objectives

- Upon completion of the rotation, the resident will demonstrate competency in complex spinal procedures, including microneurosurgery, as assessed by faculty.

- Upon completion of the rotation, the resident will demonstrate competency in oncologic neurosurgery procedures including microneurosurgery as assessed by faculty.
- Upon completion of the rotation, the resident will demonstrate competency in neurosurgical anatomy as assessed by faculty and the written in training examination.
- Upon completion of the rotation, the resident will demonstrate competency in patient care related practice management, legal and socioeconomic issues as assessed by faculty.

Medical Knowledge

Goal

Residents must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological, and social-behavioral sciences, as well as the application of this knowledge to patient care. Residents are expected to:

Competencies

- Spine
 - Review the biomechanics of the craniocervical junction, cervical spine, and thoracolumbar and lumbar spine.
 - Review the biomechanics of common internal spinal fixators.
 - Review the definition of spinal instability based upon the principles of Punjabi and White and other authors.
 - Recognize the radiographic signs of degenerative neoplastic, traumatic, and congenital spinal instability.
 - Review the indications for, and uses, and relative effectiveness of common spinal orthoses. Discuss the degree of segmental and regional immobilization these orthoses provide.
 - Review the indications for, and physiology of, intraoperative spinal cord monitoring. Describe the technical aspects of intraoperative spinal cord monitoring.
 - Compare and contrast indications for anterior and posterior approaches to the cervical spine for the treatment of herniated cervical discs, spondylosis, and instability.
 - Discuss the role of corpectomy in the management of cervical disorders.
 - Compare and contrast the indications for anterior cervical discectomy with and without anterior interbody fusion.
 - Discuss the indications and techniques for anterior and posterior cervical spinal internal fixators.
 - Explain the biology of bone healing and options for bone grafting in spinal surgery.
 - Review the diagnosis and management of primary spinal tumors, spinal cord tumors, and spinal metastatic disease including indications for dorsal decompression, ventral decompression, and radiotherapy.

- Discuss the management principles for gunshot and other penetrating wounds to the spine.
- Review the signs, symptoms, and management options in the treatment of the adult tethered cord syndrome and syringomyelia.
- Review management principles for spontaneous and postoperative spinal infections.
- Review the management principles for intraoperative and postoperative cerebrospinal fluid leaks.
- Discuss the surgical management of intradural congenital, neoplastic, and vascular lesions.
- Neuro-oncology
 - Describe appropriate postoperative management with drainage of brain abscess or cyst.
 - Describe the appropriate surgical management and postoperative treatment of bony skull lesions.
 - Describe the role of surgery in arachnoid cysts, infectious cysts, and tumor-related cystic lesions. Describe the adjuvant treatment of parasitic cysts.
 - Explain the rationale and indications for various skull base approaches to the anterior, middle and posterior cranial fossae. Identify the important anatomical landmarks for each approach. Illustrate the general principles used in prophylaxis of CSF leaks employed in skull base surgery.
 - Describe the neurosurgical management for the following tumors involving the anterior cranial fossa:
 - Meningiomas
 - fibrous dysplasia
 - esthesioneuroblastoma
 - osteoma of the frontal sinus
 - chondroma, chordoma
 - mucocele
 - bony metastasis
 - Explain the use of the balloon occlusion test of the carotid artery, its indication for use in skull base tumor surgery, how it is performed, and how the information gained influences surgical management.
- Neuro-endocrine
 - Describe the gross and histopathological features of the following pituitary disorders
 - craniopharyngiomas including adamantinomatous and squamopapillary craniopharyngiomas
 - pituitary involvement by metastatic neoplasms
 - lymphocytic hypophysitis
- Practice management, legal and socioeconomic issues
 - Discuss mandatory reporting laws.
 - Discuss issues pertinent to the topic of the impaired physician.

- Name and describe the local, regional, and national neurosurgical organizations including their purposes, roles, activities, and interactions.
- Discuss the importance of tracking morbidity, mortality, and patient outcomes.
- Review the career options available at the completion of neurosurgical residency in detail including:
 - private practice
 - academic practice
 - subspecialty fellowship
 - research
 - administration
 - military
- Discuss post-residency fellowship training program availability, application process, and career usefulness.

Objectives

- The PGY-2/3 resident on this rotation will acquire the clinical knowledge needed to manage complex spinal disorders as assessed by faculty evaluations and the written in training examination.
- The PGY-2/3 resident on this rotation will acquire the fundamental knowledge in the anatomy, physiology, imaging and pathogenesis of complex oncologic neurosurgery disorders as assessed by faculty evaluations and the written in training examination.
- The PGY-2/3 resident on this rotation will acquire knowledge in practice management, legal and socioeconomic issues that face a neurosurgeon as assessed by faculty evaluations.
- The PGY-2/3 resident is expected to take the American Board of Neurological Surgery written exam for self-assessment.

Practice- Based Learning and Improvement

Goal

Residents 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 lifelong learning. Residents are expected to develop skills and habits to be able to:

Competencies

- Identify strengths, deficiencies and limits in one's knowledge and expertise
- Incorporate formative evaluation feedback into daily practice

Objectives

- The PGY-2/3 resident on this rotation will demonstrate the ability to utilize formative evaluations in a constructive manner to identify, strengths, deficiencies and limits in their knowledge and skills. They will use this

evaluation to improve deficiencies and expand professional limits. This will be as assessed by a multisource 360-evaluation.

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

- Coordinate patient care within the health care system relevant to neurosurgery

Objectives

- The PGY-2/3 resident on this rotation will demonstrate the ability to effectively utilize resources in the system to provide optimal health care as measured by faculty evaluation.

Professionalism

Goal

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

Competencies

- Compassion, integrity, and respect for others
- Respect for patient privacy and autonomy

Objectives

- The PGY-2/3 resident on this rotation will demonstrate professional and compassionate care toward patients and respect for patient privacy and autonomy as assessed by faculty evaluation.

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

- Act in a consultative role to other physicians and health professionals

Objectives

- The PGY-2/3 resident on this rotation will demonstrate sufficient interpersonal and communication skills to be an effective consultant to other physicians and health professionals as assessed by faculty evaluation.

Teaching Methods

Teaching methods include formal didactic lectures as well as supervision in the operating room appropriate to the resident's level of competency.

Assessment Method (Residents)

- Written faculty evaluation of all 6 competencies.
- 360-degree evaluation of professionalism and communication by Neurosurgery nurse practitioners, Clinic coordinators and the Program Coordinator.
- Review of performance on written Boards examination.
- Progression through Milestones reported by Clinical Competency Committee every six months.

Assessment Method (Program Evaluation)

The experience is considered educational if there is demonstration of improved knowledge and operative skills over the course of the rotation.

Level of Supervision

The resident is supervised by the attending neurosurgeons appropriate to their level of competency.

Educational Resources

- Herkowitz Harry N (Ed). Rothman-Simeone, The Spine. Fourth Edition, W. B. Saunders, Philadelphia, 1994.
- Menezes Arnold H, Sonntag Volker K (Eds). Principles of Spinal Surgery. McGraw-Hill, Inc., New York, 1996.
- Rothman-Simeone. The Spine. 1999.
- Clark CR. The Cervical Spine. CSRS.
- Menezes A. Benzel E. Spine Surgery: Techniques, Complication Avoidance, and Management.
- Caspar W. Anterior cervical fusion and interbody stabilization with the trapezial osteosynthetic plate technique. #12 Aesculap.
- Aebi M. Principles in Spine Surgery. AO/ASIF.
- Turnbull IM. Microvasculature of the human spinal cord. J Neurosurg 35:141-147, 1971.
- Lu K, Liang CL, Lee TC, Chen HJ, Su TM, Liliang PC. Changes of bilateral palmar skin temperature in transthoracic endoscopic T-2 sympathectomy. J Neurosurg (Spine 1 Suppl) 92:44-49, 2000.
- Milhorat TH, Kotzen RM, Anzil AP. Stenosis of central canal of spinal cord in man: incidence and pathological findings in 232 autopsy cases. J Neurosurg 80:716-722, 1994.

- Menezes, AH, Sonntag VKH, Principles of Spinal surgery. McGraw Hill, NewYork, 1995
- Rothman, RH, Simeone FA. The Spine. WB Saunders, Philadelphia, 1999

Academic/Research PGY 4/5

Description of Rotation or Educational Experience

- Length: 18 months
- Site: The Ohio State University Wexner Medical Center
- Focus: The resident will gain experience in conducting basic science and/or translational research. During this rotation, the resident will conduct research on a daily basis.
- Responsible Faculty: Russell R. Lonser, M.D. and Ciarán J. Powers, M.D., Ph.D.
- Didactics:
 - Required clinical conferences include weekly Case Conference, monthly M&M Conference and monthly Grand Rounds as well as daily Faculty Teaching Rounds. Additional optional opportunities include weekly Spine Tumor Board, weekly Brain Tumor Board, weekly DBS Conference, weekly Skull Base Conference and weekly Stroke Case Conference.
 - Residents will meet monthly with the Program Director and weekly with assigned research mentors to assist in the design of scientific experiments, assist in the evaluation of data and assist with manuscript writing and development.
- Clinical Experience: The resident will be involved with clinical didactic conference. PGY-4 Residents will cover, on average, two days a month of in house call. PGY-5 Residents will take call, on average, 1.5 days per week from home. While on call, residents will be directly involved with the supervised management of neurosurgical patients, admission neurosurgical patients and performance of consults.
- Ambulatory Experience: The resident will attend a weekly half-day neurosurgical outpatient clinic where they, under supervision, will evaluate, diagnosis and formulate treatment plans for neurosurgical.
- Residents are expected to have achieved at least a score in the 30th percentile on the American Board of Neurological Surgery written exam prior to starting the PGY 4/5 Research Rotation. Residents that have not met this minimum standard will undergo remediation determined by the Program Director, Education Committee and Clinical Competency Committee.

Patient Care

Goal

Residents must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. Residents are expected to:

Competencies

- General
 - Demonstrate the ability to evaluate patients, including clinical research patients, in outpatient and inpatient settings.
 - Formulate treatment plans for patients including clinical research patients, with neurologic disease.

- Practice management, legal and socioeconomic issues
 - Outline a post-residency career track.
 - Apply for post-residency fellowship if appropriate.
 - Obtain information about specific practice, research, or administrative career opportunities as appropriate.
 - Compose a list of questions to ask and things to see when interviewing for a neurosurgical position.
 - Select a proper practice, research, or administrative opportunity if appropriate.
- Practice management, legal and socioeconomic issues
 - Outline a post-residency career track.
 - Apply for post-residency fellowship if appropriate.
 - Obtain information about specific practice, research, or administrative career opportunities as appropriate.
 - Compose a list of questions to ask and things to see when interviewing for a neurosurgical position.
 - Select a proper practice, research, or administrative opportunity if appropriate.

Objectives

- Upon completion of the rotation, this PGY-4/5 resident will be able to effectively evaluate and formulate treatment plans for patients, including clinical research patients, in outpatient and inpatient as assessed by faculty.
- Upon completion of the rotation, the resident will demonstrate competency in patient care related academic career track development, practice management and socioeconomic issues as assessed by faculty.

Medical Knowledge

Goal

Residents must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological, and social-behavioral sciences, as well as the application of this knowledge to patient care. Residents are expected to:

Competencies

- Research
 - Demonstrate Knowledge of Research Project Development
 - Development of a research project/plan for the PGY-4/5 year.
 - Demonstrate knowledge of elective courses as they pertain to project and expansion of neuroscience knowledge.
 - Display an understanding of the principles of hypothesis development and testing, and statistical analysis as applied to clinical research trials, as well as the critique of scientific manuscripts.
- Practice management, legal and socioeconomic issues

- Describe the types and characteristics of surgical practice organizations including:
 - solo practice
 - group practice
 - partnership
 - professional association
 - corporation
 - academic practice
 - Health Maintenance Organizations (HMO)
 - Preferred Provider Organizations (PPO)
 - Individual Practice Associations (IPA)
 - staff model (Kaiser-Permanente type)
 - Federal
 - National Institutes of Health
 - Department of Veterans Affairs
 - Military
 - Public Health Service

Objectives

- The PGY-4/5 resident on this rotation will acquire the fundamental clinical knowledge needed to develop a research plan and project.
- The PGY-4/5 resident on this rotation will acquire the fundamental knowledge in neuropathology as assessed by faculty evaluations and the written in training examination.
- The PGY-4/5 resident on this rotation will acquire basic knowledge and be able to compare and contrast differences in practice management, legal and socioeconomic issues between various practice settings that face a neurosurgeon as assessed by faculty evaluations.
- The PGY-4/5 resident will not be allowed to move on to the PGY-6 year without having passed the American Board of Neurological Surgery written exam.

Practice- Based Learning and Improvement

Goal

Residents 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 lifelong learning. Residents are expected to develop skills and habits to be able to:

Competencies

- Identify and perform appropriate learning activities
- Identify strengths, deficiencies and limits in one's knowledge and expertise;

Objectives

- The PGY-4/5 resident on this rotation will perform pertinent literature reviews for patient health problems and present them at institution conference. The quality of the review and presentation of material will be measured by faculty evaluation.
- The PGY-4/5 resident on this rotation will participate in clinical conferences (including presentation of cases) as measured by conference attendance statistics, presentations at indications conference and M&M conference.

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

- Work effectively in various health care delivery settings and systems relevant to neurosurgery

Objectives

- The PGY-4/5 resident on this rotation will demonstrate the ability to work in various academic settings and system and will be able to compare and contrast differences in practice management, legal and socioeconomic issues between various practice settings that face a neurosurgeon as assessed by faculty evaluations.

Professionalism

Goal

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

Competencies

- Accountability to patients, co-workers, society and the profession

Objectives

- The PGY-4/5 resident on this rotation will demonstrate accountability to patients, co-workers, society and the profession as assessed by faculty evaluation.

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

- Communicate effectively with physicians, other health professionals, and health related agencies

Objectives

- The PGY-4/5 resident on this rotation will demonstrate the ability to communicate effectively with physicians, other health professionals, and health related agencies as assessed by faculty evaluation.

Teaching Methods

Teaching methods include formal didactic lectures as well as supervision in the operating room appropriate to the resident's level of competency.

Assessment Method (Residents)

- Written faculty evaluation of all 6 competencies.
- 360-degree evaluation of professionalism and communication by Neurosurgery nurse practitioners, Clinic coordinators and the Program Coordinator.
- Review of performance on written Boards examination.
- Progression through Milestones reported by Clinical Competency Committee every six months.

Assessment Method (Program Evaluation)

The experience is considered educational if there is demonstration of improved knowledge and operative skills over the course of the rotation.

Level of Supervision

The resident is supervised by the attending neurosurgeons appropriate to their level of competency.

Educational Resources

Residents are encouraged to identify a research mentor within the Department of Neurological Surgery at OSUWMC or NCH.

Senior Clinical Rotation (Oncology) – James Cancer Center PGY 6

Description of Rotation or Educational Experience

- Length: 6 months
- Site: James Cancer Center
- Focus: This rotation will provide the resident an opportunity to further develop their clinical neurosurgical skills.
- Responsible Faculty: Brad Elder, M.D., Doug Hardesty, M.D., Ehud Mendel, M.D., Daniel Prevedello, M.D. and Russell R. Lonser, M.D.
- Didactics:
 - Required clinical conferences include weekly Case Conference, monthly M&M Conference and monthly Grand Rounds as well as daily Faculty Teaching Rounds. Additional optional opportunities include weekly Spine Tumor Board, weekly Brain Tumor Board, weekly DBS Conference, weekly Skull Base Conference and weekly Stroke Case Conference.
- Clinical Experience: On the clinical neurosurgery service, the resident will participate in the pre-admission evaluation of patients in clinic, management of patients in the operating room, daily post-operative patient management and longitudinal outpatient follow-up. For consultations from other services, the resident will evaluate patients under the supervision of an attending physician and provide recommendations for neurosurgical management. Residents will take call, on average, 1.5 days per week from home. While on call, residents will be directly involved with the supervised management of neurosurgical patients, admission neurosurgical patients, operating on patients with urgent neurosurgical problems and performance of consults.
- Ambulatory Experience: The resident will attend a weekly half-day neurosurgical outpatient clinic where they, under supervision, will evaluate, diagnosis and formulate treatment plans for neurosurgical patients.

Patient Care

Goal

Residents must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. Residents are expected to:

Competencies

- General
 - Select a proper practice, research, or administrative opportunity if appropriate.
 - Demonstrate the ability to accurately interpret radiological examinations of neurosurgical patients.
 - Demonstrate the ability to use intraoperative ultrasonography.
- Neuro-oncology
 - Independently determine a differential diagnosis based on the patient's history, physical examination, and radiographic studies.
 - Position patients for craniotomy and craniectomy.
 - Perform the opening and closing of craniotomies and craniectomies.

- Assist in the resection of intracranial neoplasms.
- Neuro-endocrine
 - Describe the evaluation and management of the common postoperative complications following transsphenoidal surgery including Diabetes Insipidus, SIADH, epistaxis, CSF rhinorrhea.
 - Describe the presentation, evaluation, and management of patients with:
 - Craniopharyngioma
 - Lymphocytic hypophysitis
 - Pituitary metastases
 - empty sella syndrome
 - Describe the surgical approaches to the sella and suprasellar regions, both transsphenoidal and transcranial.
 - Describe the appropriate evaluation and management of postoperative pituitary axis.
- Practice management, legal and socioeconomic issues
 - Outline a post-residency career track.
 - Apply for post-residency fellowship if appropriate.
 - Obtain information about specific practice, research, or administrative career opportunities as appropriate.
 - Compose a list of questions to ask and things to see when interviewing for a neurosurgical position.
 - Select a proper practice, research, or administrative opportunity if appropriate.

Objectives

- Upon completion of the rotation, the resident will demonstrate competency in complex neuro-oncology procedures as assessed by faculty.
- Upon completion of the rotation, the resident will demonstrate competency in interpreting imaging of complex neurological disorders as assessed by faculty.
- Upon completion of the rotation, the resident will demonstrate competency in patient care related practice management, legal and socioeconomic issues as assessed by faculty.

Medical Knowledge

Goal

Residents must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological, and social-behavioral sciences, as well as the application of this knowledge to patient care. Residents are expected to:

Competencies

- Neuro-oncology
 - Describe appropriate postoperative management with drainage of brain abscess or cyst.

- Describe the appropriate surgical management and postoperative treatment of bony skull lesions.
- Describe the role of surgery in arachnoid cysts, infectious cysts, and tumor-related cystic lesions. Describe the adjuvant treatment of parasitic cysts.
- Explain the rationale and indications for various skull base approaches to the anterior, middle and posterior cranial fossae. Identify the important anatomical landmarks for each approach. Illustrate the general principles used in prophylaxis of CSF leaks employed in skull base surgery.
- Describe the neurosurgical management for the following tumors involving the anterior cranial fossa:
 - Meningiomas
 - fibrous dysplasia
 - esthesioneuroblastoma
 - osteoma of the frontal sinus
 - chondroma, chordoma
 - mucocele
 - bony metastasis
- Explain the use of the balloon occlusion test of the carotid artery, its indication for use in skull base tumor surgery, how it is performed, and how the information gained influences surgical management.
- Neuro-endocrine
 - Describe the gross and histopathological features of the following pituitary disorders
 - craniopharyngiomas including adamantinomatous and squamopapillary craniopharyngiomas
 - pituitary involvement by metastatic neoplasms
 - lymphocytic hypophysitis
- Demonstrate knowledge of elective courses as they pertain to project and expansion of clinical/surgical skills. Practice management, legal and socioeconomic issues
 - Review the requirements to obtain certification from The American Board of Neurological Surgery.
 - Discuss the available opportunities to obtain continuing medical education credits.
 - Describe the political, economic, and social factors which impact on the practice of medicine generally and neurosurgery specifically.
 - Demonstrate a working knowledge of the International Classification of Diseases (ICD) and the Current Procedural Terminology (CPT) coding and analysis.
 - Discuss the concept of relative values units (RVUs).
 - Summarize the process of impairment determination as it relates to the neurosurgical patient population.
 - Review the availability, requirements, and application procedures for post-residency fellowship if appropriate.

- Discuss the following issues as they relate to planned neurosurgical practice:
 - healthcare delivery systems, including managed care
 - health care economics
 - political and legislative processes in healthcare
- Obtain a demographic profile of potential practice locations to include population and medical demographics.
- Outline the essential business characteristics of neurosurgical practice including:
 - content and interpretation of financial reports
 - management of human resources
 - facility design and maintenance
 - billing and collection processes
- Discuss the key elements of a provider professional services agreement, such as a PPO or HMO contract, and identify provisions that require particular attention.
- Describe the typical provisions and considerations in a physician employment contract including what to look for and what to avoid.
- Describe, compare, and contrast partnership versus corporate practice structures, including the tax and liability advantages and disadvantages of each.
- Describe the advantages and disadvantages of solo, single specialty group, and multispecialty group practice.
- Review the financial issues associated with the neurosurgical career options under consideration.
- Describe the administrative structures and processes required for managing an office practice including:
 - billing and collection for medical services
 - financial accounting and reporting
 - scheduling
 - transcription
 - medical record management
 - appointment scheduling
 - information system
 - facility selection and maintenance
 - secretarial services

Objectives

- The PGY-6 resident on this rotation will acquire the fundamental knowledge in neuro-oncology as assessed by faculty evaluations and the written in training examination.
- The PGY-6 resident on this rotation will acquire knowledge related to practice management, as well as the legal and socioeconomic issues between various practice settings that face a neurosurgeon as assessed by faculty evaluations.

Practice- Based Learning and Improvement

Goal

Residents 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 lifelong learning. Residents are expected to develop skills and habits to be able to:

Competencies

- Locate, appraise and assimilate evidence from scientific studies related to their patients' health problems

Objectives

- The PGY-6 resident on this rotation will perform pertinent case-based literature reviews for patient health problems as measured by faculty evaluation.

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

- Coordinate patient care within the health care system relevant to neurosurgery

Objectives

- The PGY-6 resident on this rotation will demonstrate the ability to coordinate patient care within the health care system relevant to neurosurgery as measured by review of medical documentation by faculty.

Professionalism

Goal

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

Competencies

- Responsiveness to patient needs that supersedes self-interest

Objectives

- The PGY-6 resident on this rotation will demonstrate responsiveness to patient needs that supersedes self-interest as assessed by faculty.

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

- Act in a consultative role to other physicians and health professionals

Objectives

- The PGY-6 resident on this rotation will act in an effective consultative role to other physicians and health professionals as assessed by faculty.

Teaching Methods

Teaching methods include formal didactic lectures as well as supervision in the operating room appropriate to the resident's level of competency.

Assessment Method (Residents)

- Written faculty evaluation of all 6 competencies.
- 360-degree evaluation of professionalism and communication by Neurosurgery nurse practitioners, Clinic coordinators and the Program Coordinator.
- Review of performance on written Boards examination.
- Progression through Milestones reported by Clinical Competency Committee every six months.

Assessment Method (Program Evaluation)

The experience is considered educational if there is demonstration of improved knowledge and operative skills over the course of the rotation.

Level of Supervision

The resident is supervised by the attending neurosurgeons appropriate to their level of competency.

Educational Resources

- Neuro-oncology
 - Textbook of Neuro-Oncology by Mitchel S. Berger, Michael Prados, 2004
 - Practical Neuro-Oncology: A Guide to Patient Care by Leslie D. McAllister, John M. Ward, Lisa M. DeAngelis, Susan F. Schulman, 2001
 - Cancer of the Nervous System: Principles and Practice of Neuro-Oncology by David Schiff, 2005
 - Molecular Makers of Brain Tumor Cells by Bela Bodey, Stuart E. Siegel, Hans E. Kaiser, 2004
 - Diagnostic Imaging: Brain by Anne Osborn, Susan Blaser, Karen Salzman, 2004

- Neuropathology: A Reference Text of CNS Pathology by David Ellison, Seth Love, Leila Chimelli, Brian Harding, James Lowe, Harry V. Vinters , 2003

Senior Clinical Rotation (Vascular) – University Hospital PGY 6

Description of Rotation or Educational Experience

- Length: 2 months
- Site: University Hospital
- Focus: This rotation will provide the resident an opportunity to further develop their clinical neurosurgical skills.
- Responsible Faculty: John McGregor, M.D., Shahid Nimjee, M.D., Patrick Youssef, M.D. and Ciarán J. Powers, M.D., Ph.D.
- Didactics:
 - Required clinical conferences include weekly Case Conference, monthly M&M Conference and monthly Grand Rounds as well as daily Faculty Teaching Rounds. Additional optional opportunities include weekly Spine Tumor Board, weekly Brain Tumor Board, weekly DBS Conference, weekly Skull Base Conference and weekly Stroke Case Conference.
- Clinical Experience: On the clinical neurosurgery service, the resident will participate in the pre-admission evaluation of patients in clinic, management of patients in the operating room, daily post-operative patient management and longitudinal outpatient follow-up. For consultations from other services, the resident will evaluate patients under the supervision of an attending physician and provide recommendations for neurosurgical management. Residents will take call, on average, 1.5 days per week from home. While on call, residents will be directly involved with the supervised management of neurosurgical patients, admission neurosurgical patients, operating on patients with urgent neurosurgical problems and performance of consults.
- Ambulatory Experience: The resident will attend a weekly half-day neurosurgical outpatient clinic where they, under supervision, will evaluate, diagnosis and formulate treatment plans for neurosurgical patients.

Patient Care

Goal

Residents must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. Residents are expected to:

Competencies

- General
 - Select a proper practice, research, or administrative opportunity if appropriate.
 - Demonstrate the ability to accurately interpret radiological examinations of neurosurgical patients.
 - Demonstrate the ability to use intraoperative ultrasonography.
- Neurovascular
 - Perform pterional craniotomy for vascular disease.
 - Demonstrate the ability to make independent management decisions regarding ischemic and hemorrhagic stroke states.

- Supervise care delivered by junior resident physicians for cerebrovascular patients.
- Demonstrate efficient prioritization skills for clinical assessment of multiple simultaneous problems in the same or different patients. Display a clear sense of prioritization regarding timing and urgency of medical and surgical intervention for ischemic and hemorrhagic stroke states. Recognize the impact of systemic conditions on prioritization and timing issues.
- Correctly interpret and respond to changes in patient status related to systemic and neurological parameters.
- Implement patient-care protocols regarding perioperative management.
- Display independence in making decisions regarding the critical care of cerebrovascular patients. Recognize the need for reporting to senior resident and attending staff such decisions.
- Demonstrate the ability to obtain appropriate medical and surgical consultation.
- Display skills in prioritization of diagnostic interventions, including the choice and sequence of studies in the setting of ischemic and hemorrhagic states.
- Interpret invasive and noninvasive diagnostic imaging studies in relationship to cerebrovascular disease.
- Formulate preliminary and surgical planning.
- Perform frameless navigation procedures.
- Perform routine and complicated twist drill or burr-hole procedures for the drainage of the ventricular system or intracranial hematomas.
- Perform exposure of the cervical carotid artery for endarterectomy or proximal arterial control.
- Observe and assist in the performance of plaque removal and arterial closure during carotid endarterectomy.
- Practice microsurgical techniques in the laboratory setting.
- Demonstrate a mature understanding of the planning and performance of pterional craniotomy for intracranial vascular pathology. Perform pterional craniotomy with initiation of microsurgical clinical skills. Observe the microsurgical dissection of the Sylvian fissure and basal cisterns for vascular pathology.
- Perform the surgical approach to vascular structures via a craniotomy other than pterional.
- Supervise and assist junior residents in burr-hole and twist-drill procedures for ventricular access or intracranial pressure monitoring.
- Realize an increasingly progressive teaching responsibility to medical students, interns, and junior residents in the various educational objectives of the cerebrovascular curriculum.
- Supervise the junior residents in the technical performance of cerebrovascular procedures, as well as critical-care catheter procedures commensurate with their level of expertise.

- Organize clinical and teaching rounds and conferences, as well as the presentation of cases.
- Prepare topic reviews in lecture and manuscript formats, including literature summaries and reference compilations.
- Demonstrate the ability to accurately interpret carotid and vertebral angiograms.
- Demonstrate the ability to accurately interpret spinal angiograms.
- Assist with endovascular interventions.
- Radiosurgery
 - Demonstrate the ability to evaluate patients with disorders referred for consideration for treatment with radiosurgery in out-patient and in-patient settings.
 - Formulate treatment plans for patients with these disorders utilizing the best available evidence-based studies
 - Demonstrate an understanding of indications for radiosurgical intervention for patients with these disorders.
- Practice management, legal and socioeconomic issues
 - Outline a post-residency career track.
 - Apply for post-residency fellowship if appropriate.
 - Obtain information about specific practice, research, or administrative career opportunities as appropriate.
 - Compose a list of questions to ask and things to see when interviewing for a neurosurgical position.
 - Select a proper practice, research, or administrative opportunity if appropriate.

Objectives

- Upon completion of the rotation, the resident will demonstrate competency in complex vascular and radiosurgery procedures as assessed by faculty.
- Upon completion of the rotation, the resident will demonstrate competency in interpreting imaging of complex neurological disorders as assessed by faculty.
- Upon completion of the rotation, the resident will demonstrate competency in patient care related practice management, legal and socioeconomic issues as assessed by faculty.

Medical Knowledge

Goal

Residents must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological, and social-behavioral sciences, as well as the application of this knowledge to patient care. Residents are expected to:

Competencies

- Neurovascular

- Recognize controversies regarding the basic neuroscience knowledge concepts mastered during junior residency.
- Explain the principles of ischemic neuronal protection and salvage.
- Review the principles of guideline development and outcome assessment related to the basic knowledge objectives achieved during junior residency.
- Recognize areas of controversy related to management protocols in cerebrovascular patients achieved during junior residency.
- Radiosurgery
 - Describe the limitations of frame-based radiosurgery.
 - Discuss the advantages and disadvantages of ablative versus neuromodulative radiosurgical procedures.
 - Compare the advantages and disadvantages of radiosurgery and open surgery for tumors, functional disorders, and vascular malformations.
- Demonstrate knowledge of elective courses as they pertain to project and expansion of clinical/surgical skills. Practice management, legal and socioeconomic issues
 - Review the requirements to obtain certification from The American Board of Neurological Surgery.
 - Discuss the available opportunities to obtain continuing medical education credits.
 - Describe the political, economic, and social factors which impact on the practice of medicine generally and neurosurgery specifically.
 - Demonstrate a working knowledge of the International Classification of Diseases (ICD) and the Current Procedural Terminology (CPT) coding and analysis.
 - Discuss the concept of relative values units (RVUs).
 - Summarize the process of impairment determination as it relates to the neurosurgical patient population.
 - Review the availability, requirements, and application procedures for post-residency fellowship if appropriate.
 - Discuss the following issues as they relate to planned neurosurgical practice:
 - healthcare delivery systems, including managed care
 - health care economics
 - political and legislative processes in healthcare
 - Obtain a demographic profile of potential practice locations to include population and medical demographics.
 - Outline the essential business characteristics of neurosurgical practice including:
 - content and interpretation of financial reports
 - management of human resources
 - facility design and maintenance
 - billing and collection processes

- Discuss the key elements of a provider professional services agreement, such as a PPO or HMO contract, and identify provisions that require particular attention.
- Describe the typical provisions and considerations in a physician employment contract including what to look for and what to avoid.
- Describe, compare, and contrast partnership versus corporate practice structures, including the tax and liability advantages and disadvantages of each.
- Describe the advantages and disadvantages of solo, single specialty group, and multispecialty group practice.
- Review the financial issues associated with the neurosurgical career options under consideration.
- Describe the administrative structures and processes required for managing an office practice including:
 - billing and collection for medical services
 - financial accounting and reporting
 - scheduling
 - transcription
 - medical record management
 - appointment scheduling
 - information system
 - facility selection and maintenance
 - secretarial services

Objectives

- The PGY-6 resident on this rotation will acquire the fundamental knowledge in vascular and radiosurgery as assessed by faculty evaluations and the written in training examination.
- The PGY-6 resident on this rotation will acquire knowledge related to practice management, as well as the legal and socioeconomic issues between various practice settings that face a neurosurgeon as assessed by faculty evaluations.

Practice- Based Learning and Improvement

Goal

Residents 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 lifelong learning. Residents are expected to develop skills and habits to be able to:

Competencies

- Locate, appraise and assimilate evidence from scientific studies related to their patients' health problems

Objectives

- The PGY-6 resident on this rotation will perform pertinent case-based literature reviews for patient health problems as measured by faculty evaluation.

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

- Coordinate patient care within the health care system relevant to neurosurgery

Objectives

- The PGY-6 resident on this rotation will demonstrate the ability to coordinate patient care within the health care system relevant to neurosurgery as measured by review of medical documentation by faculty.

Professionalism

Goal

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

Competencies

- Responsiveness to patient needs that supersedes self-interest

Objectives

- The PGY-6 resident on this rotation will demonstrate responsiveness to patient needs that supersedes self-interest as assessed by faculty.

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

- Act in a consultative role to other physicians and health professionals

Objectives

- The PGY-6 resident on this rotation will act in an effective consultative role to other physicians and health professionals as assessed by faculty.

Teaching Methods

Teaching methods include formal didactic lectures as well as supervision in the operating room appropriate to the resident's level of competency.

Assessment Method (Residents)

- Written faculty evaluation of all 6 competencies.
- 360-degree evaluation of professionalism and communication by Neurosurgery nurse practitioners, Clinic coordinators and the Program Coordinator.
- Review of performance on written Boards examination.
- Progression through Milestones reported by Clinical Competency Committee every six months.

Assessment Method (Program Evaluation)

The experience is considered educational if there is demonstration of improved knowledge and operative skills over the course of the rotation.

Level of Supervision

The resident is supervised by the attending neurosurgeons appropriate to their level of competency.

Educational Resources

Neuro-vascular

- Stroke: Pathophysiology, Diagnosis, and Management. Mohr JP, Choi DW, Grotin JG, Weir B, Wolf PA (eds). Oxford, Churchill Livingstone, 2004
- Practical Neuroangiography. Morris P (ed). New York, Lipincott, 2007
- Diagnostic Cerebral Angiography. Osborn AG (ed). New York, Lipincott, 1999
- Intracranial Aneurysm Surgery: Techniques. Samson DS, Batjer HH (eds). New York, Futura, 1990
- Management of Cerebral Aneurysms. Le Roux PD, Winn HR, Newell DW (eds). New York, W.B. Saunders, 2004
- Youmans Neurological Surgery, Volume 2, Fifth Edition. Winn HR (ed). Philadelphia, W.B. Saunders, 2004

Senior Clinical Rotation (Spine/Functional) – University Hospital PGY 6

Description of Rotation or Educational Experience

- Length: 6 months
- Site: University Hospital
- Focus: This rotation will provide the resident an opportunity to further develop their clinical neurosurgical skills.
- Responsible Faculty: Francis Farhadi, M.D., Ph.D., Brian Dalm, M.D., Vibhor Krishna, M.B.B.S, Andrew Grossbach, M.D. and Steve Viljoen, M.D.
- Didactics:
 - Required clinical conferences include weekly Case Conference, monthly M&M Conference and monthly Grand Rounds as well as daily Faculty Teaching Rounds. Additional optional opportunities include weekly Spine Tumor Board, weekly Brain Tumor Board, weekly DBS Conference, weekly Skull Base Conference and weekly Stroke Case Conference.
- Clinical Experience: On the clinical neurosurgery service, the resident will participate in the pre-admission evaluation of patients in clinic, management of patients in the operating room, daily post-operative patient management and longitudinal outpatient follow-up. For consultations from other services, the resident will evaluate patients under the supervision of an attending physician and provide recommendations for neurosurgical management. Residents will take call, on average, 1.5 days per week from home. While on call, residents will be directly involved with the supervised management of neurosurgical patients, admission neurosurgical patients, operating on patients with urgent neurosurgical problems and performance of consults.
- Ambulatory Experience: The resident will attend a weekly half-day neurosurgical outpatient clinic where they, under supervision, will evaluate, diagnosis and formulate treatment plans for neurosurgical patients.

Patient Care

Goal

Residents must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. Residents are expected to:

Competencies

- General
 - Select a proper practice, research, or administrative opportunity if appropriate.
 - Demonstrate the ability to accurately interpret radiological examinations of neurosurgical patients.
 - Demonstrate the ability to use intraoperative ultrasonography.
- Stereotactic and Functional
 - Demonstrate the ability to evaluate patients with epilepsy and chronic pain in out-patient and in-patient settings.
 - Formulate treatment plans for patients with these disorders utilizing the best available evidence-based studies

- Demonstrate an understanding of indications for surgical intervention for patients with these disorders.
- Pain management
 - Formulate and implement an appropriate treatment program for complicated pain syndromes (e.g., chronic back pain, "failed back surgery syndrome").
 - Assess the need for multidisciplinary management of pain disorders.
 - Demonstrate appropriate management of psychosocial factors complicating a pain disorder.
 - Employ the Hartel technique to perform radiofrequency, glycerol or balloon compression neurolysis of the trigeminal nerve in patients with trigeminal neuralgia.
 - Implant a plate electrode.
 - Demonstrate appropriate methods for trialing spinal cord stimulation and intraspinal drug administration systems.
- Peripheral nerve
 - Perform pre- and postoperative care of the patient with a peripheral nerve injury.
 - Evaluate a child with birth palsy.
 - Position a patient for nerve surgery:
 - all entrapment sites
 - brachial plexus surgery
- Practice management, legal and socioeconomic issues
 - Outline a post-residency career track.
 - Apply for post-residency fellowship if appropriate.
 - Obtain information about specific practice, research, or administrative career opportunities as appropriate.
 - Compose a list of questions to ask and things to see when interviewing for a neurosurgical position.
 - Select a proper practice, research, or administrative opportunity if appropriate.

Objectives

- Upon completion of the rotation, the resident will demonstrate competency in complex stereotactic/functional, spine, pain and peripheral nerve procedures as assessed by faculty.
- Upon completion of the rotation, the resident will demonstrate competency in interpreting imaging of complex neurological disorders as assessed by faculty.
- Upon completion of the rotation, the resident will demonstrate competency in patient care related practice management, legal and socioeconomic issues as assessed by faculty.

Medical Knowledge

Goal

Residents must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological, and social-behavioral sciences, as well as the application of this knowledge to patient care. Residents are expected to:

Competencies

- Stereotactic and Functional
 - Describe factors guiding the choice of neuroimaging (CT, MRI, angiography) for stereotactic procedures.
 - Explain the rationale for various MRI sequences used for tumor localization and functional procedures.
 - Discuss the benefits and limitations of frame-based stereotactic procedures.
 - Discuss technical considerations to minimize the potential for an intracranial hemorrhage after a stereotactic biopsy.
 - Discuss technical considerations to minimize the potential for a non-diagnostic stereotactic biopsy.
 - Describe the appropriate trajectories to biopsy a lesion in the pineal region, midbrain, pons, and medulla.
 - Compare the advantages and disadvantages of radiosurgery and surgical resection for tumors and vascular malformations.
 - Classify seizure types including partial complex and generalized.
 - Define medically intractable epilepsy
 - Describe the anatomy of the mesial temporal lobe including hippocampal anatomy.
- Pain management
 - Name and differentiate the major classes of medications that are used commonly for pain treatment (opioids, non-steroidals and acetaminophen, antidepressants, anticonvulsants).
 - Review the psychosocial issues that may influence a pain disorder and describe the role of behavioral interventions in pain management.
 - Explain the rationale for multidisciplinary management of pain disorders.
 - Contrast impairment and disability.
 - Explain the basis of chemical, balloon compression, and radiofrequency neurolysis in the treatment of trigeminal neuralgia.
 - Relate subcortical and brain stem sites that appear to be involved in the modulation of nociception to targets for deep brain stimulation (DBS) for pain control.
 - Explain how central neurostimulation (cortical, subcortical) is thought to produce analgesia.
 - Explain the role of ablative brain and brain stem procedures, (e.g., cingulotomy, mesencephalic tractotomy, trigeminal tractotomy) in the management of chronic benign pain and cancer pain.
 - Discuss the possible complications of subcortical and brain stem ablative procedures for deafferentation pain.

- List the primary indications for the following spinal ablative lesions: dorsal root entry zone lesion, open and percutaneous anterolateral cordotomy, myelotomy.
- Discuss spinal cord stimulation (SCS), including types of stimulation systems and electrodes available, basic techniques of insertion of percutaneous and plate electrodes, the rationale and goals of intraoperative SCS testing (paresthesia coverage of painful area, avoidance of undesirable stimulation), the rationale and techniques for trialing SCS, and advantages and disadvantages of different sites of implantation of SCS pulse generator/receiver.
- Explain the key aspects of intraspinal drug administration, including the pharmacology of intraspinal drugs, the various types of infusion systems available, the rationale for trialing intraspinal drug infusions, basic techniques for insertion of intrathecal and epidural catheters, and the proper location for infusion pump implantation.
- Discuss the role of neuroectomy and neurolysis for pain control in nerve injury and compare alternative techniques for pain control.
- Describe the anatomy of the dorsal root ganglion, the bony anatomy of the nerve root foramen and the location of the ganglion within that foramen. Discuss indications for ganglionectomy and describe long-term outcome from ganglionectomy with emphasis on pain recurrence and deafferentation.
- Describe the indications for peripheral nerve stimulation and contrast to spinal cord stimulation.
- Peripheral nerve
 - Define the autonomic nervous system:
 - differentiate sympathetic and parasympathetic
 - discuss anatomic distribution
 - identify the various neurotransmitters
 - discuss Horner's syndrome
 - Compare and contrast a peripheral nerve to a cranial nerve:
 - histology
 - response to injury
 - root entry zone
 - Describe nerve regeneration in terms of:
 - specificity
 - pruning of sprouts
 - end to side sprouting
 - Draw the complete brachial plexus.
 - Discuss the lumbar plexus.
 - Discuss stretch injury, missile injury and avulsion injury:
 - definition
 - typical etiology
 - physical findings
 - electrical findings

- non-operative management
 - indications for surgery
 - intraoperative findings
 - potential for recovery
- Demonstrate knowledge of elective courses as they pertain to project and expansion of clinical/surgical skills. Practice management, legal and socioeconomic issues
 - Review the requirements to obtain certification from The American Board of Neurological Surgery.
 - Discuss the available opportunities to obtain continuing medical education credits.
 - Describe the political, economic, and social factors which impact on the practice of medicine generally and neurosurgery specifically.
 - Demonstrate a working knowledge of the International Classification of Diseases (ICD) and the Current Procedural Terminology (CPT) coding and analysis.
 - Discuss the concept of relative values units (RVUs).
 - Summarize the process of impairment determination as it relates to the neurosurgical patient population.
 - Review the availability, requirements, and application procedures for post-residency fellowship if appropriate.
 - Discuss the following issues as they relate to planned neurosurgical practice:
 - healthcare delivery systems, including managed care
 - health care economics
 - political and legislative processes in healthcare
 - Obtain a demographic profile of potential practice locations to include population and medical demographics.
 - Outline the essential business characteristics of neurosurgical practice including:
 - content and interpretation of financial reports
 - management of human resources
 - facility design and maintenance
 - billing and collection processes
 - Discuss the key elements of a provider professional services agreement, such as a PPO or HMO contract, and identify provisions that require particular attention.
 - Describe the typical provisions and considerations in a physician employment contract including what to look for and what to avoid.
 - Describe, compare, and contrast partnership versus corporate practice structures, including the tax and liability advantages and disadvantages of each.
 - Describe the advantages and disadvantages of solo, single specialty group, and multispecialty group practice.

- Review the financial issues associated with the neurosurgical career options under consideration.
- Describe the administrative structures and processes required for managing an office practice including:
 - billing and collection for medical services
 - financial accounting and reporting
 - scheduling
 - transcription
 - medical record management
 - appointment scheduling
 - information system
 - facility selection and maintenance
 - secretarial services

Objectives

- The PGY-6 resident on this rotation will acquire the fundamental knowledge in stereotactic/functional, spine, pain and peripheral nerve as assessed by faculty evaluations and the written in training examination.
- The PGY-6 resident on this rotation will acquire knowledge related to practice management, as well as the legal and socioeconomic issues between various practice settings that face a neurosurgeon as assessed by faculty evaluations.

Practice- Based Learning and Improvement

Goal

Residents 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 lifelong learning. Residents are expected to develop skills and habits to be able to:

Competencies

- Locate, appraise and assimilate evidence from scientific studies related to their patients' health problems

Objectives

- The PGY-6 resident on this rotation will perform pertinent case-based literature reviews for patient health problems as measured by faculty evaluation.

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

- Coordinate patient care within the health care system relevant to neurosurgery

Objectives

- The PGY-6 resident on this rotation will demonstrate the ability to coordinate patient care within the health care system relevant to neurosurgery as measured by review of medical documentation by faculty.

Professionalism**Goal**

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

Competencies

- Responsiveness to patient needs that supersedes self-interest

Objectives

- The PGY-6 resident on this rotation will demonstrate responsiveness to patient needs that supersedes self-interest as assessed by faculty.

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

- Act in a consultative role to other physicians and health professionals

Objectives

- The PGY-6 resident on this rotation will act in an effective consultative role to other physicians and health professionals as assessed by faculty.

Teaching Methods

Teaching methods include formal didactic lectures as well as supervision in the operating room appropriate to the resident's level of competency.

Assessment Method (Residents)

- Written faculty evaluation of all 6 competencies.
- 360-degree evaluation of professionalism and communication by Neurosurgery nurse practitioners, Clinic coordinators and the Program Coordinator.
- Review of performance on written Boards examination.

- Progression through Milestones reported by Clinical Competency Committee every six months.

Assessment Method (Program Evaluation)

The experience is considered educational if there is demonstration of improved knowledge and operative skills over the course of the rotation.

Level of Supervision

The resident is supervised by the attending neurosurgeons appropriate to their level of competency.

Educational Resources

- Stereotactic / Functional
 - Textbook of Stereotactic and Functional Neurosurgery. Gildenberg and Tasker (editors), McGraw Hill 1998, pp. 2157.
 - Microelectrode Recording and Movement Disorder Surgery. Israel and Burchiel (editors), Thieme 2004.
 - Surgical Treatment of the Epilepsies. Jerome Engel (editor), Raven Press 1993
 - Surgical Management of Pain. Burchiel (editor), Thieme 2002
 - Principals of Neurology. Adams, Victor, and Ropper, (editors), McGraw Hill 1997
 - Spasticity Management in Youmans Neurological Surgery, 2004
- Peripheral Nerve
 - Birch R, Bonney G, Wynne P. Surgical Disorders of Peripheral Nerves. Churchill-Livingstone, London, 1998.
 - Gelberman R (Ed). Operative Nerve Repair and Reconstruction. I. P. Lippincott Co., Philadelphia, 1991.
 - Kline D, Hudson A. Nerve Injuries: Operative Results for Major Nerve Injuries, Entrapments and Tumors. W. B. Saunders Co., Philadelphia, 1995.
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 - Ormer G, Spinner M, Van Beeb A. Management of Peripheral Nerve Problems. Second Edition, W. B. Saunders Co., Philadelphia, 1998.
 - Seddon H. Surgical Disorders of Peripheral Nerves. Second Edition, Churchill-Livingstone, Edinburgh, 1975.
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- Kline D, Hudson A, Kim D. Atlas of Peripheral Nerve Surgery. W. B. Saunders Co., Philadelphia, 2001.
- Dawson D, Hallett M, Millender *I: Entrapment Neuropathies, 2nd Ed, Little and Brown Co., Boston, 1990.
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- Haymaker W, Woodhall B: Peripheral Nerve Injuries. Principles and Diagnosis, 2nd Ed. W.B. Saunders Co., Phila.
- 1953.
- Hawkins J, Reed R: Tumors the Peripheral Nervous System AFIP Atlas of Tumor Pathology – 2nd Series, Fascicle 3, AFIP, Washington, D.C. 1968.
- Henry AK: Extensile Exposure: Applied to Limb Surgery, Williams and Wilkins, Baltimore, 1945.
- Kempe L: Operative Neurosurgery Vol. 2, Springer, NY, 1970.
- Leffert R: Brachial Plexus Injuries, Churchill Livingstone, Edinburgh 1988.
- Medical Research Council Nerve Injuries MRC was Memorandum No. 7 London, His Majesty's Stationary Office, Balliere Tindall, London 1943.
- Midroni G, Bilbao J, Cohen S: Biopsy Diagnosis of Peripheral Neuropathy Butterworth-Heinemann, Toronto 1995.
- Seddon H: Peripheral Nerve Injuries, MRC Report 282. Her Majesty's Stationary Office, London, 1954.
- Spinner M.: Injuries to the Major Branches of Peripheral Nerves of the Forearm. 2nd Ed., W.B. Saunders, Phila. 1978.
- Woodhall B, Beebe G: Peripheral Nerve Regeneration V.A. Monograph, U.S. Gov't. Printing Office, Washington, DC, 1957.
- Balliere. Aids to the examination of the peripheral nervous system. Tindall, London, 1986
- Aids to the examination of the peripheral nervous system, 4th edition. W. B. Saunders, Philadelphia, 2000.
- Grant GA, Goodkin R, Kliot M. Evaluation and surgical management of peripheral nerve problems. Neurosurgery 44:825-40, 1999.
- Kline DG, Hudson AR. Nerve Injuries. W. B. Saunders, Philadelphia, 1995.

Chief Resident (Vascular) PGY 7

Description of Rotation

- Length: 2 months
- Site: University Hospital
- Focus: The Chief Resident will direct (under faculty supervision) neurosurgery services at University Hospital. The Chief Resident on this rotation will serve as the administrative chief responsible for managing the operating room schedule and room assignments for residents and fellows at OSUWMC. The Chief Resident, in addition to faculty, will play a critical role in the education of the junior and senior residents, and the assessment of competence in performing basic procedures.
- Responsible Faculty: John McGregor, M.D., Shahid Nimjee, M.D., Patrick Youssef, M.D. and Ciarán J. Powers, M.D., Ph.D.
- Didactics:
 - Required clinical conferences include weekly Case Conference, monthly M&M Conference and monthly Grand Rounds as well as daily Faculty Teaching Rounds. Additional optional opportunities include weekly Spine Tumor Board, weekly Brain Tumor Board, weekly DBS Conference, weekly Skull Base Conference and weekly Stroke Case Conference.
- Clinical Experience: This is a busy clinical rotation where the Chief Resident sees all patients on the vascular service at the University Hospital and acquires mastery of surgical procedures performed on these services.
- Ambulatory Experience: The Chief Resident will attend a weekly half-day of clinic where the resident gains advanced experience in the diagnosis and management of patients with diverse vascular (including operative and non-operative management) problems.

Patient Care

Goal

Residents must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. Residents are expected to:

Competencies

- Neuro-vascular
 - Review fundamental concepts of cerebrovascular disease during conferences and clinical rounds with the house staff and medical student.
 - Demonstrate a mature clinical judgment related to the spectrum of problems encountered in hemorrhagic and ischemic stroke states.
 - Formulate independent plans for patient assessment and management, including prioritization in cerebrovascular disease while maintaining a clear reporting relationship with faculty.
 - Supervise house staff and medical student team in daily patient assessment and care.

- Identify the indications and controversies of endovascular catheter procedures, perioperative management, and follow-up. Implement and supervise patient care protocols related to these procedures.
- Display a mature and detailed understanding of indications, principles, and interpretation of the full spectrum of neurodiagnostic armamentarium. Formulate independent management plans based on sophisticated interpretation of diagnostic studies for concise presentation to faculty.
- Apply evolving technology and new methods to patient protocols and the education of house staff and medical students.
- Demonstrate a mature understanding of surgical strategies and approaches to common and unusual vascular disease.
- Apply the principles of intraoperative anesthetic management, proximal and distal control, temporary arterial occlusion, brain protective strategies, and intraoperative localization as applied to vascular disease.
- Complete the planning, positioning, and execution of pterional craniotomy for common vascular disease.
- Perform microsurgical dissection of the Sylvian fissure and exposure of the basal cisterns for vascular disease.
- Perform microsurgical exposure and clipping of intracranial aneurysm.
- Complete the planning, positioning, and execution of non-pterional craniotomy for intracranial vascular disease.
- Assist in the microsurgical management of highly complex cerebrovascular disease.
- Plan and execute the craniotomy for the evacuation of intracranial hematomas.
- Supervise other house staff in meeting their surgical objectives.
- Describe the exposure and treatment of intraspinal vascular lesions. Assist in such operations.
- Oversee all aspects of patient care, identification of appropriate cases for database analysis, morbidity, mortality, conferences, and discussions. Supervise medical students and house staff in every aspect of patient care.
- Report appropriate patient care issues to responsible faculty members in a timely fashion.
- Organize and administer teaching conferences.
- Display mature participation in specialty conferences.
- Assign responsibilities to junior residents and residents, with the aim of fulfilling their respective educational objectives.
- Pain Management
 - Recognize and execute intelligent treatment choices for different pain syndromes including nociceptive, neuropathic, and cancer pain.
 - Demonstrate appropriate use of each of the major classes of medications in common use for treating pain.
 - Demonstrate appropriate selection of patients for surgical treatment of pain disorders.

- Perform microvascular decompression and rhizotomy of the trigeminal nerve and glossopharyngeal nerves.
- Assist a junior resident in performing a percutaneous ablative procedure for trigeminal neuralgia.
- Formulate and implement an appropriate treatment plan for management of pain using spinal ablative and augmentative techniques according to pain etiology, pain topography, and status of spinal column (e.g. previous surgery at implant level, scoliosis, stenosis, etc.).
- Select and implant an appropriate SCS system, recognizing how to modify electrode insertion technique and location based upon intraoperative responses.
- Implant a plate electrode in a patient with previous spinal surgery at the same level.
- Demonstrate proficiency with maintenance and programming of spinal drug administration systems and spinal cord stimulation systems.
- Recognize and evaluate malfunctions of SCS and intraspinal drug administration systems.
- Perform surgical revision of SCS and intraspinal drug administration systems.
- Demonstrate proficiency in identification and lesioning of the dorsal root entry zone, even in cases of nerve root avulsion.
- Demonstrate proficiency in performing myelotomy and cordotomy.
- Expose major peripheral nerves and perform closure of extremity incision for peripheral neurectomy/neurolysis.
- Demonstrate proficiency in neurolysis and nerve grafting techniques.
- Plan and execute surgical approaches to injuries of the major peripheral nerves.
- Plan a peripheral nerve reconstruction including exposure, preparation of donor site, and nerve graft.
- Demonstrate proficiency in technique of ganglion resection.
- Incorporate ganglionectomy as one part of an integrated approach to the patient with intractable pain.
- Display appropriate patient selection for local anesthetic blocks.
- Perform simple superficial blocks with minimal supervision. Relative to these blocks perform the following:
 - assess outcome of block
 - recognize and treat complications
 - maintain detailed records of effects of block and follow-up
 - assess need for repeat blocks
- Provide information regarding alternatives for failed nerve block.
- Perform complicated nerve block procedures with direct supervision. Recognize and treat the complications of these procedures.
- Display appropriate patient selection for ablative peripheral neurolysis.
- Perform simple neurolytic procedures with minimal supervision. Relative to these procedures perform the following:

- assess outcome of the procedure
- recognize and treat complications
- maintain detailed records of effects of neurolysis and follow-up
- assess need for repeat neurolysis
- Provide information regarding alternatives for failed neurolysis.
- Perform complicated neurolytic procedures with direct supervision.
- Display appropriate patient selection for radiofrequency facet rhizolysis.
- Perform simple facet blocks with minimal supervision. Relative to these procedures perform the following:
 - assess outcome of the procedure
 - recognize and treat complications
 - maintain detailed records of effects of facet blocks and follow-up
 - assess need for repeat facet blocks
- Provide information regarding alternatives for failed facet blocks.
- Perform complicated facet blocks with direct supervision.
- Perform sympathectomy.
- Neurotrauma
 - Perform neurotrauma procedures in complicated cases.
 - Reconstruct complex cranial defects, with assistance from other specialties as indicated.
 - Reconstruct traumatic skull base defects, with assistance from other specialties as indicated.
 - Explore and repair peripheral nerve injuries.
 - Supervise and teach junior and middle level residents with cases appropriate for their level.
 - Lead the critical care team in the treatment of patients with neurological injuries, either in isolation or in polytrauma patients.
 - Oversee and direct the junior and middle level resident management of critically ill neurosurgical patients.
- Practice management, legal and socioeconomic issues
 - Demonstrate the ability to properly code neurosurgical activities.
 - Accurately assign and justify medical impairment ratings for neurosurgical patients.
 - Read and interpret a financial report.
 - Design a structure for an office practice including a listing of the generic office processes and how to arrange staffing.
 - Prepare lists of neurosurgical instruments/equipment needed for specific operative procedures.
 - Complete license and registration requirements for your chosen location.
 - Complete applications for hospital staff membership and clinical privileges. Complete resident case data sheet for the American Board of Neurological Surgery and have same signed by Program Director.

Objectives

- Upon completion of the rotation, the Chief Resident will demonstrate competency in vascular and pain procedures as assessed by faculty and on the fly evaluations.
- Upon completion of the rotation, the resident will demonstrate competency in complex patient management, legal and socioeconomic issues related to neurosurgery as assessed by faculty.

Medical Knowledge

Goal

Residents must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological, and social-behavioral sciences, as well as the application of this knowledge to patient care. Residents are expected to:

Competencies

- Neuro-vascular
 - Demonstrate a sophisticated understanding of current literature related to basic neuroscience knowledge objectives acquired as a junior and middle resident. Define scientific hypotheses in relationship to controversies and evolving knowledge regarding these same objectives and demonstrate the ability to interpret and adapt new knowledge to evolving patient-care paradigms.
 - Demonstrate a mature fundamental knowledge in clinical and teaching conferences, specialty conferences, and in publications and scientific presentations.
 - Understand the guidelines, protocols, and literature controversies regarding the diagnostic imaging modalities available in cerebrovascular disease
 - Review the indications for interventional endovascular therapies for:
 - aneurysms
 - vasospasm
 - cranial vascular malformations
 - spinal vascular malformations
 - tumor embolization
 - carotid and vertebral stenosis
 - carotid and vertebral dissection
 - Describe the indications and techniques of endovascular trial occlusions.
 - Review the role of quantitative cerebral blood flow studies in the management of neurosurgical patients.
- Pain Management
 - Distinguish the indications for surgical and non-surgical treatment of pain.
 - Construct a management strategy relating to application of percutaneous trigeminal neurolytic procedures, retrogasserian rhizotomy, and microvascular decompression in the care of patients with trigeminal neuralgia.

- Describe and contrast the approaches to the cerebellopontine angle for microvascular decompression or rhizotomy of the trigeminal and glossopharyngeal nerves.
- Identify the various target spine levels for spinal cord stimulation according to the pain topography (simple and complex).
- Identify the various intraspinal structures based on their responses to mechanical and electrical stimulation (dura mater, lateral canal wall, dorsal columns, dorsal roots, ventral roots, motor neurons).
- Compare the different methods of intraspinal drug administration (epidural, intrathecal, tunneled catheter, implanted infusion system).
- Describe the techniques for trialing intraspinal drugs.
- Compare the pharmacodynamics of different drugs delivered intrathecally (e.g., hydrophilic vs. lipophilic).
- Describe the possible complications of spinal cord stimulation electrode or spinal catheter insertion and their evaluation and treatment:
 - paralysis
 - nerve root damage
 - electrode or catheter migration
 - electrode or catheter breakage
 - epidural hematoma
 - cerebrospinal fluid leak
- Describe the common drug side effects associated with intraspinal analgesic administration.
- Describe the correct placement of lesions for DREZ, cordotomy, and myelotomy, including lesion depth and structures affected.
- Discuss the possible neurological sequelae of spinal ablative procedures with both correct and incorrect lesion placement, with anatomical correlates.
- Describe the role of DREZ lesioning in the overall management of the patient with deafferentation pain.
- Describe the techniques for exposure of the major peripheral nerves.
- Demonstrate knowledge of basic principles of nerve grafting, including regeneration, graft length considerations, and use of allograft donor nerves.
- Describe the role and outcomes of ganglionectomy in the management of various pain syndromes, contrasting it with augmentative techniques.
- Discuss in detail the surgical technique of ganglionectomy.
- Describe percutaneous methods of gangliolysis.
- Explain the effects of blocking agents at the membrane and synaptic cleft, and the biochemistry and histology of neurotoxicity.
- Explain the histologic effects of neurolytic agents at the membrane level and display a comprehensive level of understanding with regard to toxicity.
- Describe the histologic effects of radiofrequency lesioning.
- discuss in detail the evaluation and management of a patient selected for radiofrequency lesioning of the facets.

- Discuss the alternatives to radiofrequency lesioning, with particular emphasis on the potential surgical remedies including decompression, instrumentation, and fusion.
- Neurotrauma
 - Discuss management priorities in polytrauma patients with severe neurological and systemic trauma.
- Practice management, legal and socioeconomic issues
 - Describe the meaning of "managed care" and its typical components including:
 - contractual discounts
 - provider risk arrangements
 - utilization management
 - provider report cards
 - practice guidelines
 - restricted access models
 - primary gatekeeper
 - point of service
 - open access
 - List and discuss the ethical issues and conflicts of interest involved in managed care treatment decisions such as:
 - capitation reimbursement
 - risk pools
 - cost saving incentive bonuses
 - Discuss antitrust considerations faced by physicians in payer contract negotiations including the concepts of collective bargaining, price fixing, and group boycott.
 - Describe types of retirement plans and funding considerations and limitations.
 - Explain the differences between occurrence and claims-made professional liability insurance and considerations made in selecting insurer and coverage levels.

Objectives

- The Chief Resident on this rotation will acquire the advanced clinical knowledge needed to manage patients vascular and pain problems as assessed by faculty evaluations.
- The Chief Resident on this rotation will acquire fundamental knowledge in practice management, legal and socioeconomic issues that face a neurosurgeon in practice as assessed by faculty evaluations and the written in training examination.

Practice- Based Learning and Improvement

Goal

Residents 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 lifelong learning. Residents are expected to develop skills and habits to be able to:

Competencies

- 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

Objectives

- The Chief Resident on this rotation will demonstrate the ability to educate patients, families, students, residents and other health professionals as assessed by 360-degree evaluation by a nurse, patient and faculty.

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

- Coordinate patient care within the health care system relevant to neurosurgery

Objectives

- The Chief Resident on this rotation will demonstrate the ability to coordinate patient care within the health care system relevant to neurosurgery as assessed medical documentation by faculty.

Professionalism

Goal

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

Competencies

- Accountability to patients, society, and the profession

Objectives

- The Chief Resident on this rotation will demonstrate accountability to patients, society, and to neurosurgery as assessed by faculty evaluation.

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

- Work effectively as a leader of a health care team or other professional group

Objectives

- The PGY-7 resident on this rotation will demonstrate the ability to work effectively as a leader of a health care team or other professional group as assessed by faculty evaluation.

Teaching Methods

Teaching methods include formal didactic lectures as well as supervision in the operating room appropriate to the resident's level of competency.

Assessment Method (Residents)

- Written faculty evaluation of all 6 competencies.
- 360-degree evaluation of professionalism and communication by Neurosurgery nurse practitioners, Clinic coordinators and the Program Coordinator.
- Progression through Milestones reported by Clinical Competency Committee every six months.

Assessment Method (Program Evaluation)

The experience is considered educational if there is demonstration of improved knowledge and operative skills over the course of the rotation.

Level of Supervision

The resident is supervised by the attending neurosurgeons appropriate to their level of competency.

Educational Resources

- Neuro-vascular
 - Stroke: Pathophysiology, Diagnosis, and Management. Mohr JP, Choi DW, Grotin JG, Weir B, Wolf PA (eds). Oxford, Churchill Livingstone, 2004
 - Practical Neuroangiography. Morris P (ed). New York, Lipincott, 2007
 - Diagnostic Cerebral Angiography. Osborn AG (ed). New York, Lipincott, 1999
 - Intracranial Aneurysm Surgery: Techniques. Samson DS, Batjer HH (eds). New York, Futura, 1990
 - Management of Cerebral Aneurysms. Le Roux PD, Winn HR, Newell DW (eds). New York, W.B. Saunders, 2004
 - Youmans Neurological Surgery, Volume 2, Fifth Edition. Winn HR (ed). Philadelphia, W.B. Saunders, 2004

Chief Resident (Functional/Spine)

PGY 7

Description of Rotation

- Length: 2 months
- Site: University Hospital
- Focus: The Chief Resident will direct (under faculty supervision) neurosurgery services at University Hospital. The Chief Resident on this rotation will serve as the administrative chief responsible for managing the operating room schedule and room assignments for residents and fellows at OSUWMC. The Chief Resident, in addition to faculty, will play a critical role in the education of the junior and senior residents, and the assessment of competence in performing basic procedures.
- Responsible Faculty: Francis Farhadi, M.D., Ph.D., Brian Dalm, M.D., Andrew Grossbach, M.D., Vibhor Krishna, M.B.B.S. and Steve Viljoen, M.D.
- Didactics:
 - Required clinical conferences include weekly Case Conference, monthly M&M Conference and monthly Grand Rounds as well as daily Faculty Teaching Rounds. Additional optional opportunities include weekly Spine Tumor Board, weekly Brain Tumor Board, weekly DBS Conference, weekly Skull Base Conference and weekly Stroke Case Conference.
- Clinical Experience: This is a busy clinical rotation where the Chief Resident sees all patients on the spine and functional services at the University Hospital and acquires mastery of surgical procedures performed on these services.
- Ambulatory Experience: The Chief Resident will attend a weekly half-day of clinic where the resident gains advanced experience in the diagnosis and management of patients with diverse complex spine and functional (including operative and non-operative management) problems.

Patient Care

Goal

Residents must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. Residents are expected to:

Competencies

- Spine
 - Demonstrate the ability to function independently in all phases of management of patients with spinal disorders.
 - Demonstrate the ability to perform occipital-cervical arthrodesis.
 - Demonstrate the ability to properly place sublaminar wires, lateral mass screws, lower cervical/upper thoracic pedicle screws, C2 pars interarticularis screws, and C1-2 transarticular screws for the management of cervical spine disorders.
 - Demonstrate the ability to perform, with assistance if necessary, transoral odontoidectomy.

- Demonstrate common techniques for performing C1-2 arthrodesis.
- Demonstrate the ability to perform anterior cervical corpectomy followed by arthrodesis.
- Demonstrate the ability to perform, with assistance if necessary, transthoracic, thoracoabdominal, retroperitoneal, and transabdominal approaches to the thoracic and lumbar spine.
- Demonstrate the ability to perform costotransverse and lateral extracavitary approaches to the thoracolumbar spine.
- Demonstrate the ability to excise a herniated thoracic disc by use of the above-mentioned approaches.
- Demonstrate the ability to perform vertebral corpectomy of the thoracolumbar spine for tumor, infection, or trauma, utilizing the above-mentioned approaches.
- Demonstrate the ability to perform anterior arthrodesis of the thoracolumbar spine.
- Demonstrate the proper placement of transpedicular screws in the thoracic and lumbar spine.
- Demonstrate the proper placement of laminar, transverse process, and pedicle hooks in the thoracic and lumbar spine.
- Demonstrate the ability to resect intradural spinal neoplasms.
- Demonstrate the ability to perform methylmethacrylate vertebroplasty.
- Demonstrate techniques of open reduction of fractures and dislocations of the cervical, thoracic, and lumbar spine.
- Demonstrate the ability to surgically manage arachnoid cysts and spinal cord syrinx.
- Demonstrate the ability to perform intradural procedures for congenital, neoplastic, and vascular lesions.
- Stereotactic/Functional
 - Demonstrate the ability to evaluate patients with movements disorders, epilepsy, spasticity, chronic pain and neuropsychiatric disease in out-patient and in-patient settings.
 - Formulate treatment plans for patients with these disorders utilizing the best available evidence-based studies
 - Discuss the appropriate use of medical management for movement disorders, neuropsychiatric disorders and epilepsy.
 - Demonstrate the ability to perform the following procedures or portions of procedures under faculty supervision:
 - Craniotomy for epilepsy including amygdalohippocampectomy
 - Vagal nerve stimulation for epilepsy and other techniques such as multiple subpial transections
 - Microvascular decompression for trigeminal neuralgia
 - Glycerol or radiofrequency rhizotomy for trigeminal neuralgia
 - Surgery for deep brain stimulation including microelectrode recording
 - Selective dorsal rhizotomy for spasticity
 - DREZ lesioning

- Insertion of intrathecal pumps and spinal cord stimulators
- Surgery for deep brain stimulation
- Demonstrate the ability to provide comprehensive post-operative care for patients undergoing stereotactic and functional procedures.
- Pain Management
 - Recognize and execute intelligent treatment choices for different pain syndromes including nociceptive, neuropathic, and cancer pain.
 - Demonstrate appropriate use of each of the major classes of medications in common use for treating pain.
 - Demonstrate appropriate selection of patients for surgical treatment of pain disorders.
 - Perform microvascular decompression and rhizotomy of the trigeminal nerve and glossopharyngeal nerves.
 - Assist a junior resident in performing a percutaneous ablative procedure for trigeminal neuralgia.
 - Formulate and implement an appropriate treatment plan for management of pain using spinal ablative and augmentative techniques according to pain etiology, pain topography, and status of spinal column (e.g. previous surgery at implant level, scoliosis, stenosis, etc.).
 - Select and implant an appropriate SCS system, recognizing how to modify electrode insertion technique and location based upon intraoperative responses.
 - Implant a plate electrode in a patient with previous spinal surgery at the same level.
 - Demonstrate proficiency with maintenance and programming of spinal drug administration systems and spinal cord stimulation systems.
 - Recognize and evaluate malfunctions of SCS and intraspinal drug administration systems.
 - Perform surgical revision of SCS and intraspinal drug administration systems.
 - Demonstrate proficiency in identification and lesioning of the dorsal root entry zone, even in cases of nerve root avulsion.
 - Demonstrate proficiency in performing myelotomy and cordotomy.
 - Expose major peripheral nerves and perform closure of extremity incision for peripheral neurectomy/neurolysis.
 - Demonstrate proficiency in neurolysis and nerve grafting techniques.
 - Plan and execute surgical approaches to injuries of the major peripheral nerves.
 - Plan a peripheral nerve reconstruction including exposure, preparation of donor site, and nerve graft.
 - Demonstrate proficiency in technique of ganglion resection.
 - Incorporate ganglionectomy as one part of an integrated approach to the patient with intractable pain.
 - Display appropriate patient selection for local anesthetic blocks.

- Perform simple superficial blocks with minimal supervision. Relative to these blocks perform the following:
 - assess outcome of block
 - recognize and treat complications
 - maintain detailed records of effects of block and follow-up
 - assess need for repeat blocks
- Provide information regarding alternatives for failed nerve block.
- Perform complicated nerve block procedures with direct supervision. Recognize and treat the complications of these procedures.
- Display appropriate patient selection for ablative peripheral neurolysis.
- Perform simple neurolytic procedures with minimal supervision. Relative to these procedures perform the following:
 - assess outcome of the procedure
 - recognize and treat complications
 - maintain detailed records of effects of neurolysis and follow-up
 - assess need for repeat neurolysis
- Provide information regarding alternatives for failed neurolysis.
- Perform complicated neurolytic procedures with direct supervision.
- Display appropriate patient selection for radiofrequency facet rhizolysis.
- Perform simple facet blocks with minimal supervision. Relative to these procedures perform the following:
 - assess outcome of the procedure
 - recognize and treat complications
 - maintain detailed records of effects of facet blocks and follow-up
 - assess need for repeat facet blocks
- Provide information regarding alternatives for failed facet blocks.
- Perform complicated facet blocks with direct supervision.
- Perform sympathectomy.
- Peripheral nerve
 - Perform a consultation concerning a nerve injury.
 - Discuss the risks versus benefits of a surgical repair of a given nerve injury.
 - Determine the parameters confirming anticipated nerve regeneration:
 - anticipated advancing Tinel's sign
 - order of muscle re-innervation
 - Perform a nerve decompression:
 - carpal tunnel
 - ulnar nerve at elbow
 - peroneal nerve
 - Perform a nerve repair:
 - neurolysis
 - internal neurolysis
 - intraoperative nerve conduction
 - placement and suture of nerve graft

- Excise a nerve sheath tumor.
- Expose a brachial plexus injury:
 - determine possible repairs including nerve transfers
 - expose the spinal accessory nerve
 - expose the intercostal nerves
- Neurotrauma
 - Perform neurotrauma procedures in complicated cases.
 - Reconstruct complex cranial defects, with assistance from other specialties as indicated.
 - Reconstruct traumatic skull base defects, with assistance from other specialties as indicated.
 - Explore and repair peripheral nerve injuries.
 - Supervise and teach junior and middle level residents with cases appropriate for their level.
 - Lead the critical care team in the treatment of patients with neurological injuries, either in isolation or in polytrauma patients.
 - Oversee and direct the junior and middle level resident management of critically ill neurosurgical patients.
- Practice management, legal and socioeconomic issues
 - Demonstrate the ability to properly code neurosurgical activities.
 - Accurately assign and justify medical impairment ratings for neurosurgical patients.
 - Read and interpret a financial report.
 - Design a structure for an office practice including a listing of the generic office processes and how to arrange staffing.
 - Prepare lists of neurosurgical instruments/equipment needed for specific operative procedures.
 - Complete license and registration requirements for your chosen location.
 - Complete applications for hospital staff membership and clinical privileges. Complete resident case data sheet for the American Board of Neurological Surgery and have same signed by Program Director.

Objectives

- Upon completion of the rotation, the Chief Resident will demonstrate competency in complex spine, functional, pain, trauma and peripheral nerve procedures as assessed by faculty and on the fly evaluations.
- Upon completion of the rotation, the resident will demonstrate competency in complex patient management, legal and socioeconomic issues related to neurosurgery as assessed by faculty.

Medical Knowledge

Goal

Residents must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological, and social-behavioral sciences, as well as the application of this knowledge to patient care. Residents are expected to:

Competencies

- Spine
 - Describe indications for the use of angiography and endovascular procedures in the management of spinal disorders.
 - Discuss the management of cervical degenerative disease secondary to rheumatoid arthritis. Describe factors which make it different from the management of non-rheumatoid disease.
 - Compare and contrast the treatment options for cervical spondylotic myelopathy and ossification of the posterior longitudinal ligament, including multilevel anterior cervical corpectomy and fusion, laminectomy, laminectomy and fusion, laminoplasty, and nonoperative therapies.
 - Discuss the indications for posterior cervical spinal internal fixators.
 - Compare and contrast the transthoracic, transpedicular, costotransverse, and lateral extracavitary approaches to a herniated thoracic disc, thoracic tumor, or thoracic spinal injury.
 - Discuss the indications for lumbar fusion for congenital disorders, iatrogenic disease, and degenerative disease, ranking indications from least to most controversial.
 - Compare and contrast the indications for anterior or posterior lumbar interbody fusion and intertransverse fusion for lumbar disease.
 - Discuss internal fixation options for posterior lumbar interbody fusion and intertransverse fusion.
 - Summarize the most common types of spinal tumors in the following categories:
 - intradural/intramedullary
 - intradural/extramedullary
 - extradural/extramedullary.
 - Discuss nonoperative and operative treatment options for fractures and dislocations affecting the atlas and axis.
 - Compare and contrast the indications for nonoperative treatment, anterior approaches, and posterior operative approaches for the treatment of fractures and dislocations of the subaxial cervical spine.
 - Describe the indications for anterior, posterior, and posterolateral procedures in the management of thoracolumbar tumor, trauma, or infection.
 - Compare and contrast the indications for anterior and posterior spinal fixators in the management of thoracolumbar tumor, trauma, or infection.
 - Discuss reconstruction options for vertebral body defects after corpectomy for tumor, trauma, or infection.
 - Discuss the indications and technique of discography. Describe the procedure.
 - Discuss the indications for percutaneous vertebroplasty. Describe the procedure.
- Stereotactic / Functional

- Discuss patient selection for VL thalamotomy and pallidotomy.
- Discuss the advantages and disadvantages of ablative procedures.
- List the potential complications of VL thalamotomy, pallidotomy, and bilateral thalamotomies or pallidotomies.
- Identify the microelectrode recordings of the thalamus and globus pallidus.
- Identify the primary indications for medial thalamotomy and cingulotomy.
- Describe the evaluation of a patient with medically intractable epilepsy.
- Discuss the indications for placement of depth electrodes.
- Describe the surgical treatment of epilepsy in detail.
- Discuss the theoretical advantages of brachytherapy over external beam radiation therapy.
- Describe the most common complications of brachytherapy and their treatment.
- Explain the effect of patient selection on the reported results of brachytherapy for high-grade gliomas.
- Describe the methods used to localize and percutaneously penetrate the foramen ovale.
- List the potential advantages and disadvantages for the following trigeminal rhizotomy procedures:
 - glycerol
 - radiofrequency
 - balloon compression
- Discuss the dose-volume relationships for radiation-related complications after radiosurgery.
- Discuss potential sources of inaccuracy for stereotactic procedures.
- Discuss advantages and disadvantages of deep brain stimulation compared to ablative techniques.
- Understand the mechanism of spasticity and be familiar with cerebral and spinal causes.
- Understand the indications of selective dorsal rhizotomy in cerebral palsy.
- Be familiar with the indications for intrathecal baclofen administration as well as its management and potential complications.
- Discuss other ablative procedures for spasticity management including percutaneous rhizotomy, peripheral neurotomy, DREZ lesioning, and myelotomy.
- Pain Management
 - Distinguish the indications for surgical and non-surgical treatment of pain.
 - Construct a management strategy relating to application of percutaneous trigeminal neurolytic procedures, retrogasserian rhizotomy, and microvascular decompression in the care of patients with trigeminal neuralgia.
 - Describe and contrast the approaches to the cerebellopontine angle for microvascular decompression or rhizotomy of the trigeminal and glossopharyngeal nerves.

- Identify the various target spine levels for spinal cord stimulation according to the pain topography (simple and complex).
- Identify the various intraspinal structures based on their responses to mechanical and electrical stimulation (dura mater, lateral canal wall, dorsal columns, dorsal roots, ventral roots, motor neurons).
- Compare the different methods of intraspinal drug administration (epidural, intrathecal, tunneled catheter, implanted infusion system).
- Describe the techniques for trialing intraspinal drugs.
- Compare the pharmacodynamics of different drugs delivered intrathecally (e.g., hydrophilic vs. lipophilic).
- Describe the possible complications of spinal cord stimulation electrode or spinal catheter insertion and their evaluation and treatment:
 - paralysis
 - nerve root damage
 - electrode or catheter migration
 - electrode or catheter breakage
 - epidural hematoma
 - cerebrospinal fluid leak
- Describe the common drug side effects associated with intraspinal analgesic administration.
- Describe the correct placement of lesions for DREZ, cordotomy, and myelotomy, including lesion depth and structures affected.
- Discuss the possible neurological sequelae of spinal ablative procedures with both correct and incorrect lesion placement, with anatomical correlates.
- Describe the role of DREZ lesioning in the overall management of the patient with deafferentation pain.
- Describe the techniques for exposure of the major peripheral nerves.
- Demonstrate knowledge of basic principles of nerve grafting, including regeneration, graft length considerations, and use of allograft donor nerves.
- Describe the role and outcomes of ganglionectomy in the management of various pain syndromes, contrasting it with augmentative techniques.
- Discuss in detail the surgical technique of ganglionectomy.
- Describe percutaneous methods of gangliolysis.
- Explain the effects of blocking agents at the membrane and synaptic cleft, and the biochemistry and histology of neurotoxicity.
- Explain the histologic effects of neurolytic agents at the membrane level and display a comprehensive level of understanding with regard to toxicity.
- Describe the histologic effects of radiofrequency lesioning.
- discuss in detail the evaluation and management of a patient selected for radiofrequency lesioning of the facets.
- Discuss the alternatives to radiofrequency lesioning, with particular emphasis on the potential surgical remedies including decompression, instrumentation, and fusion.

- Peripheral nerve
 - Discuss with the aid of diagrams the anatomy of the peripheral nervous system:
 - common sites of entrapments
 - the brachial and lumbar plexus
 - innervation of the bladder
 - Discuss the use of nerve grafting:
 - types of fixation (suture/glue)
 - types of grafts (nerve, vein, artificial)
 - end to side
 - Discuss entrapment syndromes:
 - thoracic outlet
 - double crush syndrome
 - repetitive strain
 - Discuss ulnar nerve decompression:
 - in situ decompression
 - transposition (subcutaneous/intramuscular/submuscular)
 - medial epicondylectomy
 - Differentiate brachial plexus injury from brachial plexitis.
 - Formulate a management plan for:
 - birth brachial plexus injury
 - acute nerve injury (stretch/compression/laceration/injection)
 - chronic nerve injury
 - failed nerve decompression
 - painful nerve/neuroma
 - Describe the management of nerve tumors:
 - imaging techniques, including MR neurography
 - indications for surgery in NF1
 - operative and adjuvant treatment for malignant peripheral nerve sheath tumors
 - use of monitoring during tumor surgery
 - fascicular dissection
 - Describe adjuvant therapies in nerve injury:
 - muscle and tendon transfers
 - prosthesis
 - joint fusion
- Neurotrauma
 - Discuss management priorities in polytrauma patients with severe neurological and systemic trauma.
- Practice management, legal and socioeconomic issues
 - Describe the meaning of "managed care" and its typical components including:
 - contractual discounts
 - provider risk arrangements

- utilization management
- provider report cards
- practice guidelines
- restricted access models
 - primary gatekeeper
 - point of service
 - open access
- List and discuss the ethical issues and conflicts of interest involved in managed care treatment decisions such as:
 - capitation reimbursement
 - risk pools
 - cost saving incentive bonuses
- Discuss antitrust considerations faced by physicians in payer contract negotiations including the concepts of collective bargaining, price fixing, and group boycott.
- Describe types of retirement plans and funding considerations and limitations.
- Explain the differences between occurrence and claims-made professional liability insurance and considerations made in selecting insurer and coverage levels.

Objectives

- The Chief Resident on this rotation will acquire the advanced clinical knowledge needed to manage patients with disorders of the spine, functional, pain, neurotrauma and peripheral nerve problems as assessed by faculty evaluations.
- The Chief Resident on this rotation will acquire fundamental knowledge in practice management, legal and socioeconomic issues that face a neurosurgeon in practice as assessed by faculty evaluations and the written in training examination.

Practice- Based Learning and Improvement

Goal

Residents 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 lifelong learning. Residents are expected to develop skills and habits to be able to:

Competencies

- 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

Objectives

- The Chief Resident on this rotation will demonstrate the ability to educate patients, families, students, residents and other health professionals as assessed by 360-degree evaluation by a nurse, patient and faculty.

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

- Coordinate patient care within the health care system relevant to neurosurgery

Objectives

- The Chief Resident on this rotation will demonstrate the ability to coordinate patient care within the health care system relevant to neurosurgery as assessed medical documentation by faculty.

Professionalism

Goal

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

Competencies

- Accountability to patients, society, and the profession

Objectives

- The Chief Resident on this rotation will demonstrate accountability to patients, society, and to neurosurgery as assessed by faculty evaluation.

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

- Work effectively as a leader of a health care team or other professional group

Objectives

- The PGY-7 resident on this rotation will demonstrate the ability to work effectively as a leader of a health care team or other professional group as assessed by faculty evaluation.

Teaching Methods

Teaching methods include formal didactic lectures as well as supervision in the operating room appropriate to the resident's level of competency.

Assessment Method (Residents)

- Written faculty evaluation of all 6 competencies.
- 360-degree evaluation of professionalism and communication by Neurosurgery nurse practitioners, Clinic coordinators and the Program Coordinator.
- Progression through Milestones reported by Clinical Competency Committee every six months.

Assessment Method (Program Evaluation)

The experience is considered educational if there is demonstration of improved knowledge and operative skills over the course of the rotation.

Level of Supervision

The resident is supervised by the attending neurosurgeons appropriate to their level of competency.

Educational Resources

- Spine
 - Herkowitz Harry N (Ed). Rothman-Simeone, The Spine. Fourth Edition, W. B. Saunders, Philadelphia, 1994.
 - Menezes Arnold H, Sonntag Volker K (Eds). Principles of Spinal Surgery. McGraw-Hill, Inc., New York, 1996.
 - Rothman-Simeone. The Spine. 1999.
 - Clark CR. The Cervical Spine. CSRS.
 - Menezes A. Benzel E. Spine Surgery: Techniques, Complication Avoidance, and Management.
 - Caspar W. Anterior cervical fusion and interbody stabilization with the trapezial osteosynthetic plate technique. #12 Aesculap.
 - Aebi M. Principles in Spine Surgery. AO/ASIF.
 - Turnbull IM. Microvasculature of the human spinal cord. J Neurosurg 35:141-147, 1971.
 - Lu K, Liang CL, Lee TC, Chen HJ, Su TM, Liliang PC. Changes of bilateral palmar skin temperature in transthoracic endoscopic T-2 sympathectomy. J Neurosurg (Spine 1 Suppl) 92:44-49, 2000.
 - Milhorat TH, Kotzen RM, Anzil AP. Stenosis of central canal of spinal cord in man: incidence and pathological findings in 232 autopsy cases. J Neurosurg 80:716-722, 1994.
 - Menezes, AH, Sonntag VKH, Principles of Spinal surgery. McGraw Hill, NewYork, 1995
 - Rothman, RH, Simeone FA. The Spine. WB Saunders, Philadelphia, 1999
- Stereotactic / Functional

- Textbook of Stereotactic and Functional Neurosurgery. Gildenberg and Tasker (editors), McGraw Hill 1998, pp. 2157.
- Microelectrode Recording and Movement Disorder Surgery. Israel and Burchiel (editors), Thieme 2004.
- Surgical Treatment of the Epilepsies. Jerome Engel (editor), Raven Press 1993
- Surgical Management of Pain. Burchiel (editor), Thieme 2002
- Principals of Neurology. Adams, Victor, and Ropper, (editors), McGraw Hill 1997
- Spasticity Management in Youmans Neurological Surgery, 2004
- Peripheral Nerve
 - Birch R, Bonney G, Wynne P. Surgical Disorders of Peripheral Nerves. Churchill-Livingstone, London, 1998.
 - Gelberman R (Ed). Operative Nerve Repair and Reconstruction. I. P. Lippincott Co., Philadelphia, 1991.
 - Kline D, Hudson A. Nerve Injuries: Operative Results for Major Nerve Injuries, Entrapments and Tumors. W. B. Saunders Co., Philadelphia, 1995.
 - Lunborg G. Nerve Injury and Repair. Churchill-Livingstone, New York, 1998.
 - MacKinnon S, Dellon A. Surgery of Peripheral Nerves. Thieme, New York, 1988.
 - Ormer G, Spinner M, Van Beeb A. Management of Peripheral Nerve Problems. Second Edition, W. B. Saunders Co., Philadelphia, 1998.
 - Seddon H. Surgical Disorders of Peripheral Nerves. Second Edition, Churchill-Livingstone, Edinburgh, 1975.
 - Sunderland S. Nerve Injuries and Repair: A Critical Appraisal. Churchill-Livingstone, Edinburgh, 1991.
 - Sunderland S. Nerve and Nerve Injuries. First and Second Editions, E & S Livingston Stone, London, 1968 and 1978.
 - Terzis J (Ed). Microreconstruction of Nerve Injuries. W. B. Saunders, Philadelphia, 1987.
 - Kline D, Hudson A, Kim D. Atlas of Peripheral Nerve Surgery. W. B. Saunders Co., Philadelphia, 2001.
 - Dawson D, Hallett M, Millender *I: Entrapment Neuropathies, 2nd Ed, Little and Brown Co., Boston, 1990.
 - Dellon A: Evaluation of Sensibility and Re Education of Sensation in the Hand, Williams, & Wilkins, Baltimore 1981.
 - Dyck P, Thomas PK, Asbury A, Winegood A, Porte D: Diabetic Neuropathy, W.B. Sanders Co. Phila, 1987.
 - Dyck P, Thomas PK: Peripheral Neuropathy 3 rd Ed., W.B. Saunders Co. Philadelphia, 1993
 - Haymaker W, Woodhall B: Peripheral Nerve Injuries. Principles and Diagnosis, 2nd Ed. W.B. Saunders Co., Phila.
 - 1953.

- Hawkins J, Reed R: Tumors the Peripheral Nervous System AFIP Atlas of Tumor Pathology – 2nd Series, Fascicle 3, AFIP, Washington, D.C. 1968.
- Henry AK: Extensile Exposure: Applied to Limb Surgery, Williams and Wilkins, Baltimore, 1945.
- Kempe L: Operative Neurosurgery Vol. 2, Springer, NY, 1970.
- Leffert R: Brachial Plexus Injuries, Churchill Livingstone, Edinburgh 1988.
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- Midroni G, Bilbao J, Cohen S: Biopsy Diagnosis of Peripheral Neuropathy Butterworth-Heinemann, Toronto 1995.
- Seddon H: Peripheral Nerve Injuries, MRC Report 282. Her Majesty's Stationary Office, London, 1954.
- Spinner M.: Injuries to the Major Branches of Peripheral Nerves of the Forearm. 2nd Ed., W.B. Saunders, Phila. 1978.
- Woodhall B, Beebe G: Peripheral Nerve Regeneration V.A. Monograph, U.S. Gov't. Printing Office, Washington, DC, 1957.
- Balliere. Aids to the examination of the peripheral nervous system. Tindall, London, 1986
- Aids to the examination of the peripheral nervous system, 4th edition. W. B. Saunders, Philadelphia, 2000.
- Grant GA, Goodkin R, Kliot M. Evaluation and surgical management of peripheral nerve problems. Neurosurgery 44:825-40, 1999.
- Kline DG, Hudson AR. Nerve Injuries. W. B. Saunders, Philadelphia, 1995.

Chief Resident (Oncology)

PGY 7

Description of Rotation or Educational Experience

- Length: 2 months
- Site: James Cancer Center
- Focus: The resident will direct (under faculty supervision) the oncology neurosurgery services. The Chief Resident, in addition to faculty, will play a critical role in the education of the junior and senior residents, and the assessment of competence in performing basic procedures. The Chief Resident on this rotation will serve as the resident responsible for managing teaching conferences at OSUWMC and invited guests.
- Responsible Faculty: Brad Elder, M.D., Doug Hardesty, M.D., Ehud Mendel, M.D., Daniel Prevedello, M.D. and Russell R. Lonser, M.D.
- Didactics:
 - Required clinical conferences include weekly Case Conference, monthly M&M Conference and monthly Grand Rounds as well as daily Faculty Teaching Rounds. Additional optional opportunities include weekly Spine Tumor Board, weekly Brain Tumor Board, weekly DBS Conference, weekly Skull Base Conference and weekly Stroke Case Conference.
- Clinical Experience: This is a busy clinical rotation where the Chief Resident sees all patients on the neurooncology service at the James Cancer Center and acquires mastery of surgical procedures performed on these services.
- Ambulatory Experience: The Chief Resident will attend a weekly half-day of clinic where the resident gains advanced experience in the diagnosis and management of patients with diverse oncologic neurosurgical (including operative and non-operative management) problems.

Patient Care

Goal

Residents must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. Residents are expected to:

Competencies

- Neuro-oncology
 - Demonstrate the capability to function independently in all phases of management of patients with intracranial neoplasms.
 - Perform resection of supra- and infratentorial intra-axial and extra-axial neoplasms.
 - Perform resection of pituitary lesions.
 - Perform or serve as first assistant for skull base procedures.
 - Oversee the pre- and postoperative management of patients with intracranial neoplasms.
 - Assume teaching responsibilities for junior residents as assigned.
 - Assume responsibility for managing the psychosocial aspects of intracranial neoplasms.

- Neuro-endocrine
 - Perform 10 transsphenoidal or transcranial approaches to sellar/suprasellar tumors.
 - Demonstrate the ability to perform all aspects of the operative approach, sellar exposure, and resection of microadenomas and macroadenomas.
 - Demonstrate the ability to repair intraoperative CSF leaks.
- Neurotrauma
 - Perform neurotrauma procedures in complicated cases.
 - Reconstruct complex cranial defects, with assistance from other specialties as indicated.
 - Reconstruct traumatic skull base defects, with assistance from other specialties as indicated.
 - Explore and repair peripheral nerve injuries.
 - Supervise and teach junior and middle level residents with cases appropriate for their level.
 - Lead the critical care team in the treatment of patients with neurological injuries, either in isolation or in polytrauma patients.
 - Oversee and direct the junior and middle level resident management of critically ill neurosurgical patients.
- Practice management, legal and socioeconomic issues
 - Demonstrate the ability to properly code neurosurgical activities.
 - Accurately assign and justify medical impairment ratings for neurosurgical patients.
 - Read and interpret a financial report.
 - Design a structure for an office practice including a listing of the generic office processes and how to arrange staffing.
 - Prepare lists of neurosurgical instruments/equipment needed for specific operative procedures.
 - Complete license and registration requirements for your chosen location.
 - Complete applications for hospital staff membership and clinical privileges. Complete resident case data sheet for the American Board of Neurological Surgery and have same signed by Program Director.

Objectives

- Upon completion of the rotation, the Chief Resident will demonstrate competency in complex neurovascular procedures as assessed by faculty.
- Upon completion of the rotation, the resident will demonstrate competency in complex patient management, legal and socioeconomic issues related to neurosurgery as assessed by faculty.

Medical Knowledge

Goal

Residents must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological, and social-behavioral sciences, as well as the application of this knowledge to patient care. Residents are expected to:

Competencies

- Neuro-oncology
 - Describe the indications for transcranial orbitotomy and list the lesions which require this approach.
 - Discuss the surgical management and postoperative treatment of astrocytomas, gliomas other than astrocytomas, metastatic brain tumors, infectious granulomas, and cystic lesions presenting in a tumor-like manner. Review the role of radiotherapy, chemotherapy, and other adjunctive treatments of these neoplasms.
 - Describe the role of surgery for intracranial meningioma, and the relation between the surgical option and location of tumor. Discuss adjuvant treatments of meningioma and their efficacy.
 - Discuss the surgical treatment of common intrinsic posterior fossa neoplasms, including cerebellar astrocytoma, medulloblastoma, and ependymoma including the role of ventricular drainage, and surveillance imaging. Present adjuvant treatment options and outcomes for the various posterior fossa intrinsic tumors.
 - Address the surgical goals of treatment, complications of surgical treatment, and adjuvant therapy for posterior fossa meningioma.
 - List and illustrate the various approaches for removal of a vestibular schwannoma, and the rationale and indication for each approach.
 - Describe the role of stereotactic radiosurgery and microsurgery in the management of vestibular schwannoma.
 - List the various approaches to the midline clivus and review the indications for each approach. Outline the surgical and medical management of tumors of the clivus and midline skull base.
 - Explain the management goal for a patient with craniopharyngioma, and the risks of surgical treatment and conservative treatment. Describe the various surgical approaches used to resect craniopharyngiomas and the options for adjuvant treatment, including radiotherapy and chemotherapy (systemic and local).
 - Illustrate the transnasal-transphenoidal approach and its indications. Define the options for treatment of recurrent pituitary tumors of all types (including medical management). Describe the risks of the approach and the management of the complication of CSF leak.
 - Illustrate the various skull base approaches to the anterior, middle and posterior cranial fossae in detail, explaining the key anatomical landmarks and strict indications for the approach. List the complications relevant to each approach and the management of each complication.
 - List a differential diagnosis of orbital tumors, their usual location within the orbit, medical and surgical management of the tumor and the approach used to remove the tumor if indicated.
 - List the various tumors and their location in which an orbitocranial approach may be indicated for their removal.
 - Compare and contrast the exposure offered by the pre-and postauricular infratemporal approach, and the indications for each approach.

- Illustrate transposition of the facial nerve during a transtemporal skull base approach.
- Describe the location of meningiomas intracranially which are amenable to preoperative embolization.
- Neuro-endocrine
 - Discuss the suprasellar/cavernous sinus/sellar anatomy with focus on transcranial and transsphenoidal landmarks.
- Neurotrauma
 - Discuss management priorities in polytrauma patients with severe neurological and systemic trauma.
- Practice management, legal and socioeconomic issues
 - Describe the meaning of "managed care" and its typical components including:
 - contractual discounts
 - provider risk arrangements
 - utilization management
 - provider report cards
 - practice guidelines
 - restricted access models
 - primary gatekeeper
 - point of service
 - open access
 - List and discuss the ethical issues and conflicts of interest involved in managed care treatment decisions such as:
 - capitation reimbursement
 - risk pools
 - cost saving incentive bonuses
 - Discuss antitrust considerations faced by physicians in payer contract negotiations including the concepts of collective bargaining, price fixing, and group boycott.
 - Describe types of retirement plans and funding considerations and limitations.
 - Explain the differences between occurrence and claims-made professional liability insurance and considerations made in selecting insurer and coverage levels.

Objectives

- The Chief Resident on this rotation will acquire the advanced clinical knowledge needed to manage patients with neurovascular disorders and neurotrauma as assessed by faculty evaluations.
- The Chief Resident on this rotation will acquire fundamental knowledge in practice management, legal and socioeconomic issues that face a neurosurgeon in practice as assessed by faculty evaluations.

Practice- Based Learning and Improvement

Goal

Residents 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 lifelong learning. Residents are expected to develop skills and habits to be able to:

Competencies

- 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.

Objectives

- The Chief Resident on this rotation will demonstrate the ability to educate patients, families, students, residents and other health professionals as assessed by faculty evaluation.

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

- Coordinate patient care within the health care system relevant to neurosurgery

Objectives

- The Chief Resident on this rotation will demonstrate the ability to coordinate patient care within the health care system relevant to neurosurgery as assessed medical documentation by faculty.

Professionalism**Goal**

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

Competencies

- Accountability to patients, society, and the profession

Objectives

- The Chief Resident on this rotation will demonstrate accountability to patients, society, and to neurosurgery as assessed by faculty evaluation.

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

- Work effectively as a leader of a health care team or other professional group

Objectives

- The Chief Resident on this rotation will demonstrate the ability to work effectively as a leader of a health care team or other professional group as assessed by faculty evaluation.

Teaching Methods

Teaching methods include formal didactic lectures as well as supervision in the operating room appropriate to the resident's level of competency.

Assessment Method (Residents)

- Written faculty evaluation of all 6 competencies.
- 360-degree evaluation of professionalism and communication by Neurosurgery nurse practitioners, Clinic coordinators and the Program Coordinator.
- Progression through Milestones reported by Clinical Competency Committee every six months.

Assessment Method (Program Evaluation)

The experience is considered educational if there is demonstration of improved knowledge and operative skills over the course of the rotation.

Level of Supervision

The resident is supervised by the attending neurosurgeons appropriate to their level of competency.

Educational Resources

- Neuro-oncology
 - Textbook of Neuro-Oncology by Mitchel S. Berger, Michael Prados, 2004
 - Practical Neuro-Oncology: A Guide to Patient Care by Leslie D. McAllister, John M. Ward, Lisa M. DeAngelis, Susan F. Schulman, 2001
 - Cancer of the Nervous System: Principles and Practice of Neuro-Oncology by David Schiff, 2005
 - Molecular Makers of Brain Tumor Cells by Bela Bodey, Stuart E. Siegel, Hans E. Kaiser, 2004
 - Diagnostic Imaging: Brain by Anne Osborn, Susan Blaser, Karen Salzman, 2004

- Neuropathology: A Reference Text of CNS Pathology by David Ellison, Seth Love, Leila Chimelli, Brian Harding, James Lowe, Harry V. Vinters , 2003