



**Duke University Medical Center
Division of Neurological Surgery
Neurosurgery Residency Training Manual**

ORGANIZATION

Primary Institution

Duke University Hospital

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Chairman and Director, Postgraduate Education

Division of Neurological Surgery

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Neurosurgeon-in-Chief
Program Director, Neurological Surgery Residency Training

Former Division of Neurological Surgery Chiefs

Barnes Woodhall, M.D. 1946 - 1960 (Trained at Johns Hopkins by Dandy 1937)
Guy L. Odom, M.D. 1960 - 1976 (Trained by Penfield, M.N.I.)
Robert H. Wilkins, M.D. 1976 – 1996 (Trained by Guy L. Odom, Duke)

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ORGANIZATION OF PROGRAM FOR NEUROSURGICAL RESIDENTS

Each year two physicians complete the Duke neurosurgical residency-training program. The length of time it takes to complete the residency depends on the length of time spent pursuing laboratory or clinical research.

PGY-1

Prior to entering the neurosurgical residency training program the physician completes one year of general surgical training.

- A. The physician should learn to communicate effectively with patients, families, and other health care professionals. The PGY-1 should be able to gather essential and accurate information and begin making informed decisions about diagnostic and therapeutic interventions. The surgeon should demonstrate the ability to work with other health care professionals to provide patient-focused care. PGY-1 level residents should demonstrate an appropriate level of basic science and clinical knowledge. This knowledge should be incorporated in an analytic approach to the patient's problem. The PGY-1 should be able to use information technology to support their education. The physician should analyze practice experience and modify clinical practice base on that experience. During the PGY-1 year the physician is expected to demonstrate professionalism, demonstrating respect, compassion, integrity, sensitivity, and tolerance. The physician should develop interpersonal and communication skills creating a sound relationship with families, and effectively communicating with other members of the health care team. The PGY-1 should demonstrate the ability to practice cost effective medicine and work with the health care team to provide patient care beyond the acute hospitalization. The physician should be able to identify pre-existing or concomitant medical conditions that could potentially complicate a patient's therapy.
- B. The PGY-1 should be able to identify, order, and interpret appropriate diagnostic tests, initiate therapy for postoperative complications.



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PGY 2-3

Following the PGY-1 year, each physician will be provided with 24 months of clinical experience including:

- I. 18 months of clinical neurosurgical experience
- II. 3 months of neurology residency
- III. 3 months of intensive care residency

During this time, residents will continue to develop their patient care skills. They will gather information from patients and their families through the taking of a history and the performing of a physical examination. The junior neurosurgical resident will assess this data to formulate a differential diagnosis and formulate a plan for establishing the correct diagnosis. The resident will order and interpret appropriate tests and develop a patient management plan. The resident will know medical and surgical options and the advantages and disadvantages of each option. The resident will use information technology to support patient care decisions. The PGY 2-3 resident will demonstrate proficiency in basic surgical techniques and know the steps involved in performing basic neurosurgical procedures of evacuation of an epidural hematoma, removal of a herniated disc through a hemilaminectomy. The resident will master the care of neurosurgical trauma and emergency of acute hydrocephalus, transtentorial herniation.

The junior neurosurgical resident will master basic knowledge in the related neurosciences and neurospecialties. The PGY-2 will concentrate on mastering neuroanatomy and neurology. The PGY-3 will continue to study neuropathology, neurophysiology. The Resident Curriculum Guidelines that we have employed for the last five years is included in the Residents' Manual as is a revised version of the Resident Curriculum Guidelines from the Congress of Neurological Surgeons. During the residency lectures, the neurosciences and neurospecialties are given to supplement the resident's individual study. Each resident will be assigned lectures to present. This provides the residents a chance to use information technology to develop their talk, evaluate medical literature using evidence-based criteria, practice speaking before a group of colleagues.

Junior residents will analyze their practice experience to improve in their practice of medicine to learn from their mistakes. They will locate and analyze clinical and scientific literature pertinent to their practice of medicine. Junior residents are encouraged to take part in the writing of case reports, clinical series, and review book chapters.



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PGY-2 and 3 residents are expected to demonstrate respect, compassion, and integrity and responsiveness to the needs of patients that supersedes self-interest. Junior residents should demonstrate a commitment to ethical principles in matters of providing patient care, confidentiality, and medically related business practices. They should be tolerant of patients with different beliefs, lifestyles, and culture backgrounds. Junior residents should partner with health care managers to optimize the patient's care following acute hospitalization.

Most residents will spend at least one-year pursuing laboratory research. During this year the resident will have limited duties in the clinical neurosurgical service. The laboratory-based residents will organize and schedule the residents' basic science conferences, facilitating the learning of students, residents, and attending neurosurgeons. During this time, residents will continue to accrue knowledge of the basic and clinical neurosciences relevant to their research project and the practice of neurological surgery. They will apply knowledge of study designs and statistical methods to their own research and to their review of the literature.

The PGY-5 year will consist of two six-month rotations, one at the Durham Veterans Administration Hospital and a second at the Durham Regional Hospital. At this level residents are expected to demonstrate a greater degree of independence in the development and implication of diagnostic and management plans. They should be able to independently assess patients in the setting of an outpatient clinic and emergency room. PGY-5 level residents are expected to use information technology to know the advantages and disadvantages of treatment options. Residents should be able to outline the steps of most surgical procedures and understand the complications that may occur at each step. They should be able to perform the steps involved in exposure and closure with minimal assistance and several of the more complicated steps with assistance. Residents should be able to assess their own patient outcomes and modify their practices accordingly. With their high degree of independence residents should demonstrate interpersonal and communication skills to create and sustain a therapeutic and ethically sound relationship with patients. Residents should maintain the professionalism of their earlier years as residents. Residents should understand the cost of the patient care they render and strive to be cost effective. The PGY-5 year offers residents an opportunity to work in a single payer health system. The residents also have the opportunity to work in a system where patients' health care is managed by traditional insurance companies and HMO's.

The final year of residency in neurosurgery is the chief resident's year. The chief residents assume independent responsibility for patient care. They assume teaching and administrative responsibilities. The two chief residents alternate between being responsible for the running of the clinical service and being responsible for administrative duties and teaching. The chief resident should be an expert at assessing patients, establishing a differential diagnosis, and developing a plan for establishing a diagnosis. The chief resident should know treatment options and assess their



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advantages and disadvantages for the particular patient being evaluated. The chief resident should be able to assist junior residents in developing and carrying out patient assessment and management plans. The chief resident should be able to break surgical interventions into their component parts. They should be able to tailor the intervention for the patient's particular problem. The chief resident should be able to perform the routine portions of an operation independently and participate in the more complex portions with peer level supervision. The chief resident should be able and willing to assist junior residents with basic neurosurgical techniques and the formulation of surgical intervention. Chief residents should demonstrate an analytic approach to clinical situations and apply knowledge in the basic and clinically supportive sciences when appropriate. They should be willing to probe junior residents' knowledge base and help the junior resident make up for deficiencies. Chief residents should demonstrate the ability and willingness to expand their knowledge base incorporating information technology when appropriate.

Chief residents are responsible for administering the Duke clinical service. They will set resident's schedules honoring the rule of the Duke Health System and the ACGME. They will assist in monitoring the hours the residents work. They will schedule vacations and time away for meetings. They will assist residents in establishing resident-initiated learning strategies. Chief residents will be models of professionalism demonstrating respect, compassion, integrity, and responsiveness to the needs of patients that supersedes self-interest, and tolerance to patients of different cultures, lifestyles, vocations, ages, and genders, and those with disabilities.

Curriculum guidelines have been developed to assist residents in pacing their education. With the limitation of in-house hours the resident must assume a greater responsibility for staying on course. Enclosed is an older, more general set of guidelines that have been in place at Duke University. This is to be followed by a more specific set of guidelines that is a modification of the guidelines developed by the American Congress of Neurological Surgery.



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LABORATORY AND CLINICAL RESEARCH

1. Laboratory clinical research is an integral part of the residency program. It is the Duke philosophy that critical thinking is best developed by physicians gathering their own data to solve identified medical problems.
2. Most residents obtain one or two years of full-time research training. However, trainees pursuing advanced degrees can usually arrange additional time.
3. Successful research training should prepare the trainee to establish his or her own independent research unit upon graduation to undertake clinical research, and to be able to critically evaluate the medical literature.
4. Research training is usually obtained in one of the laboratories of the Division of Neurosurgery at Duke University or in another department at Duke University.
5. Time spent off the clinical services should be funded by external granting agencies. However, funds are available to supplement the resident's salary during this time if required. This requires a lead-time of at least one year for planning and preparation of a research project and submission of proposals to funding agencies.
6. It is important to plan early. Plans should be completed for this research training at least one year in advance of actually starting this research training. The senior staff, led by Dr. Dennis Turner, can assist the resident in identifying a suitable laboratory project and obtaining funding.



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**GENERAL OBJECTIVES OF
THE NEUROSURGICAL TRAINING PROGRAM**

1. To produce fully trained academic neurosurgeons who:
 - (a) have passed the written examination of the American Board of Neurological Surgery and will be eligible to take the oral examination of the American Board of Neurological Surgery to become board certified in neurological surgery.
 - (b) are ready to join the staff of a university teaching hospital, and are ready to establish independent research units in either basic or clinical science or establish a successful practice of clinical neurosurgery, which provides excellent patient care.
 - (c) are clinically competent with:
 - (i) excellent technical competence,
 - (ii) excellent clinical judgment,
 - (iii) a thorough knowledge of related disciplines, including basic neuroscience, neurology, neuropathology and neuroradiology.
 - (d) are able to critically evaluate the neurosurgical literature and evaluate their clinical practices.
 - (e) are able to clearly formulate a hypothesis and collect data to prove or disprove their hypothesis.
 - (f) are capable teachers of neurosurgery.



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SPECIFIC OBJECTIVES FOR NEUROSURGICAL RESIDENTS

Technical competence is achieved through a gradual delegation of earned responsibility for investigative and operative care to penultimate levels. (Drake C., J. Neurosurg. 49:448, 1978). The performance of residents rotating on the clinical neurosurgery service will be evaluated each month. These evaluations are available to the residents to review. Each year the resident's progress will be reviewed. Renewal of the resident's contract will be based on the review.

The development of competence in clinical neurosurgery requires the trainee:

- A) To master the general principles of surgery.
- B) To become familiar with the basic science of the nervous system and the diseases of the nervous system including the anatomy of the brain, spinal cord, and peripheral nerves; neurophysiology; the pathology and pathophysiologic mechanisms of neurologic disease; neuroendocrinology; metabolism and pharmacology of brain, spinal cord, peripheral nerves and muscles; neuropsychology; biophysics.
- C) To be expert in obtaining a detailed and accurate neurologic history and to carry out a thorough and accurate neurologic examination. The resident should be able to assess the patient's level of consciousness, cognition, memory, speech, cranial nerve function, and motor function and sensory function so as to be able to localize, with competence and precision, the anatomical site of the neurologic disease.
- D) To be able to formulate a differential diagnosis based on a critical evaluation of the patient's symptoms and signs.
- E) To obtain a thorough understanding of the techniques, interpretation and proper utilization of the ancillary aids to the diagnosis of neurologic disease to include:
 - (i) neuroradiology: plain radiography, myelography, tomography, computed tomography, magnetic resonance imaging, arteriography, radioactive nuclide imaging and ultrasonography.
 - (ii) neurovestibular testing, cerebral blood flow testing, electroencephalography and electrocorticography, electromyography, evoked potential studies and neuropsychological testing.
- F) To have an understanding of the fundamentals of anesthesia and neuroanaesthesia.



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- G) To formulate nonoperative and perioperative patient management, to include:
 - a) nutritional support, cardiopulmonary support, fluid management
 - b) continuous neurological assessment
 - c) pharmacological management
 - d) functional rehabilitation.
- H) To develop the necessary technical skills to perform neurosurgical procedures. (See section Achievement of Technical Competence).
- I) To learn to relate, and work effectively with, other colleagues in medicine and surgery, and other health professionals.
- J) To develop a keen sense of responsibility and compassion toward patients and their families.
- K) To obtain an understanding of the impact of neurosurgery on society to include medical ethics, health care economics, law, the prevention of disease and the promotion of health.
- L) To develop an understanding of clinical and basic research techniques to include biostatistics and epidemiology and evidence-based analysis of the literature.

Technical competence is achieved through a gradual delegation of earned responsibility for investigative and operative care to penultimate levels. (Drake C., J. Neurosurg. 48:488, 1978). Milestones for accomplishment in the Duke Neurosurgery Training Program are suggested for each six-month period of the clinical neurosurgical rotation. These are outlined in the following section. In order to provide the mechanism for active feedback between the faculty and residents during each of the clinical neurosurgical rotations, each individual resident will be assigned to an individual attending surgeon. To the extent that it is possible, based on the inevitable conflicting duties and responsibilities, the resident will be responsible for formulating and following through with the care of all patients under the direction of that attending surgeon. The resident should not simply follow the attending surgeon's orders, but should formulate a plan of management for each patient and review that plan with the attending surgeon. It is the resident's responsibility to review all of the patients on a given attending service daily with that attending surgeon and to elicit feedback from the attending surgeon as to the appropriateness of the resident's proposed plans of management. The resident and attending surgeon should discuss treatment options and the evidence supporting the plan chosen. At the end of the one-month rotation, the attending will be expected to provide a brief written commentary evaluating the resident's performance to the chief of the neurosurgical service. This report will be reviewed with the resident. The chief of service will evaluate each chief resident's performance at the end of each quarter. In



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addition, the chief resident is obviously encouraged to review his or her cases with the attending surgeon of record.

It is specifically the resident's responsibility to initiate this process of informal positive feedback.

Formal evaluation will occur on an annual basis and be reviewed by the chief of the neurosurgical service.

In addition, each year residents will take the written examination of the American Board of Neurological Surgery, which will act as an in-service evaluation. Residents are expected to have passed this examination for credit prior to completing the neurosurgical residency program.



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ACHIEVEMENT OF TECHNICAL COMPETENCE OBJECTIVES

It will generally be expected that at the end of each of the following levels, residents in the Duke Neurosurgery Training Program will be able to perform the following technical skills.

A) At the end of the PGY-2 year, that is after 12 months of clinical neurosurgery:

1. Evaluate patient's suitability for surgery, regarding not potential medical and neurological co-morbidities.
2. Understand the principles of operating, i.e., patient positioning, prepping and draping.
3. Carry out exploratory burr holes and drainage of a chronic subdural hematoma under supervision.
4. Carry out the soft tissue exposure for a laminectomy in the lumbar, thoracic and cervical region and perform a standard hemilaminectomy and laminectomy with directed guidance. The resident should be able to remove the herniated portion of a lumbar disk with assistance.
5. Place a ventriculostomy unsupervised.
6. Place either the cranial or abdominal end of a ventriculoperitoneal shunt under supervision with the supervising surgeon performing the other end of the procedure.
7. Carry out a carpal tunnel release with directed guidance.
8. Turn a simple standard craniotomy up to the level of, but not including opening the dura unassisted. The resident should be able to perform a craniotomy for a traumatic subdural or epidural hematoma. This does not include more complicated craniotomies such as posterior fossa or a pterional craniotomy. The resident should understand the factors to be considered in placing a craniotomy incision and bone flap.
9. Remove a cervical disk from an anterior approach under supervision.
10. Carry out placement of a central venous line, Swan-Ganz catheter, and intra-arterial catheter.
11. Accurately evaluate the CT scan of the head of a multiple trauma patient and evaluate the spine films of a patient who has sustained severe trauma.



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12. Perform a cranioplasty.
 13. Place V-P shunt under directed guidance including ventriculoscopic ventricular catheter placement.
- B) At the end of the SAR year, that is after 24-30 months of clinical neurosurgery:
1. Perform a craniotomy, open the dura, and actively participate in the resection of a glioma, meningioma, and metastatic tumor.
 2. Perform a pterional craniotomy with minimal supervision.
 3. Remove a posterior fossa hematoma.
 4. Perform a posterior fossa craniectomy and expose the appropriate cranial nerves for microvascular decompression under supervision.
 5. Debride a compound depressed skull fracture with directed guidance.
 6. Expose the anterior cervical spine, carry out removal of the disc and decompress the nerve root with assistance.
 7. Carry out a carpal tunnel release and ulnar nerve transposition under limited direction.
 8. Expose the pituitary via a transsphenoidal approach with directed assistance.
 9. Carry out a stereotactic biopsy with limited supervision.
 10. Provide active assistance for epilepsy surgery.
 11. Expose the brachial plexus and actively participate in its dissection.
 12. Understand the indications and drawbacks of a cervical, upper thoracic or lumbar sympathectomy.
 13. Perform a carotid endarterectomy with assistance and know its proven indications.
 14. Debulk a metastatic tumor of the spine and plan for necessary stabilization.
 15. Understand the indications and arguments for spinal stabilization.



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16. Know the classifications of spinal fractures and the implications of those fractures.
 17. Understand the advantages and limitations of spinal instrumentation systems.
 18. Perform ventriculoscopic IIIrd ventriculostomy.
 19. Close myelomeningocele under guidance.
 20. Release simple tethered cord.
 21. Perform selective dorsal rhizotomy with guidance.
- C) During or at the end of the chief year, that is after 36-42 months of clinical neurosurgery:
1. Plan and perform a craniotomy and removal of tumor abutting the motor or speech fibers using intraoperative physiology to identify eloquent brain.
 2. Plan and perform a craniotomy and clip simple intracranial aneurysms, understand approaches to complex aneurysms, and actively participate in the treatment of complex aneurysms.
 3. Formulate a treatment plan for an intracranial arteriovenous malformation and actively participate in the surgical resection of such a lesion.
 4. Understand treatment options for the resection of a pituitary tumor and actively participate in the transsphenoidal resection of such a tumor.
 5. Understand therapeutic options for the treatment of acoustic neuromas and actively participate in their surgical excision.
 6. Assess cervical, thoracic, and lumbar spinal fractures incorporating appropriate diagnostic studies. Plan and carry out anterolateral and posterolateral decompressions of the spinal canal. Participate in procedures to stabilize the unstable spine.
 7. Demonstrate the ability to diagnose and plan treatment of common peripheral nerve entrapment syndromes.
 8. Perform a peripheral nerve anastomosis under limited supervision.
 9. Diagnose, expose and actively participate in the resection of an intraspinal tumor.



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10. Diagnose and expose and actively participate in the resection of a posterior fossa pediatric tumor.
11. Diagnose and actively participate in the surgical treatment of spinal dysplastic abnormalities.



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**EDUCATIONAL OBJECTIVES FOR CORE (PGY 1 & 2)
SURGERY RESIDENTS ON A NEUROSURGERY SERVICE**

GENERAL AIM

1. To gain knowledge of central and peripheral nervous system physiology and pathophysiology pertinent to the practice of neurosurgery.
2. To gain a working knowledge of central and peripheral nervous system surgery practiced in the 1990.
3. To gain technical expertise helpful to the developing surgeon in any specialty.

EDUCATIONAL OBJECTIVES

(1) Clinical Skills

Given a patient with a neurosurgical condition, the core surgery resident will be able to carry out the following to the satisfaction of his/her supervisor(s):

1. Take a relevant history.
2. Perform an acceptable physical exam concentrating on the relevant areas.
3. Arrive at an appropriate differential diagnosis.
4. Order appropriate laboratory, radiologic and other diagnostic procedures demonstrating knowledge in the interpretation of these investigations, especially plain spinal x-rays and CT scans.
5. Arrive at an acceptable plan of management, demonstrating knowledge in operative and nonoperative management of the condition.
6. Manage patients in the ambulatory setting, demonstrating knowledge of common office techniques and procedure.
7. Manage the patient throughout the entire in-hospital course, demonstrating knowledge of and being able to treat potential complications of disease processes and their operative treatment.
8. Provide a plan for patient follow up.



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(2) Cognitive Knowledge

Given a patient with central and peripheral nervous system disease, the core surgical resident must be able to perform the clinical skills listed in section (1), and be able to demonstrate to the satisfaction of his/her supervisor(s), a fundamental knowledge and understanding of the general areas in section 2(a), and a practical working knowledge of the specific disease processes listed in section 2(b); the core surgical resident's knowledge must be adequate to allow appropriate assessment, investigation, diagnosis, and treatment.

(a) General Areas

1. Anatomy and physiology of the central and peripheral nervous system.
2. Pharmacology as related to diseases of the central and peripheral nervous system.
3. Resuscitation and care of the neurosurgery patient in the critical care setting.

(b) Specific Disease Entities

1. Assessment and acute resuscitation of the trauma patient with head or spinal injuries, or injury to the peripheral nervous system.
2. Assessment and treatment of a patient with raised intracranial pressure.
3. Assessment and treatment of a patient with spinal cord and cauda equina compression.
4. Assessment and investigation of a patient with hemorrhagic or ischemic cerebrovascular disease.
5. Management of patients with acute or chronic seizure disorders.
6. Management of the complications of neurosurgical operative procedures, especially cerebrospinal fluid fistulae.



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(3) Technical Skills

At the end of a rotation on a neurosurgery service, the resident must be able to show technical competence in the following procedures to the satisfaction of his/her supervisor(s).

1. Assisting (both first and second) in the operating room, developing a facility for anticipation of surgical maneuvers, gentle traction on tissues, and an ability to take direction well, to make reasonable suggestions and inquiry, and to contribute to a positive operating room atmosphere.
2. Performance of a lumbar puncture.
3. Insertion of a lumbar subarachnoid catheter for the treatment of cerebrospinal fluid fistulae.
4. Insertion of at least one type of intracranial pressure monitoring device.
5. Application of a halo ring and Gardner-Wells tongs and institution of traction by pulley weights or stabilization by means of a vest for the treatment of cerebrospinal instability.
6. Performance of an elective tracheostomy.
7. Evacuation of a chronic subdural fluid collection by burr holes and subdural drain insertion.
8. Assisting at one or more operations using the operating microscope to appreciate the potential of this technology.
9. Positioning of patients for cranial and spinal/neurosurgical procedures.
10. Application of at least one type of pin fixation headrest used in cranial neurosurgery.



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(4) Professional Qualities

At the end of the rotation, the resident must have demonstrated to the satisfaction of his/her supervisor(s):

1. The ability and willingness to work in a cooperative manner with other health care personnel, being sensitive to their roles and abilities, and to be able to give and receive advice in a manner that is consistent with the harmonious operation of a health care team.
2. The ability to communicate with patients and their families, explaining to them their disease process and the benefits, risks, complications, alternatives of management and recommendations in terms each individual can comprehend.
3. The ability to keep succinct, pertinent, up-to-date medical records.
4. Respect for patients rights to privacy.
5. Sensitivity to the sexual, moral, ethical, or religious characteristics of the patient and family, understanding of the special psychological needs of the patient with neurosurgical disease and the capacity of supportive and compassionate care in the course of terminal disease.
6. Knowledge of the ethical and legal aspects of neurosurgery.
7. Honesty, reliability, and respectfulness in working with patients and colleagues alike.
8. The discipline of continued self-education and the appropriate application of this current knowledge to the clinical setting; the ability to supervise and educate undergraduate and postgraduate students in neurosurgery; the skills to educate colleagues, patients, families, and other health care professionals; the capacity to undertake research, and be aware of the importance of peer review of protocols, ethical considerations, and the limitations of such endeavors.



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**OBJECTIVES FOR NEUROSURGICAL RESIDENTS ON
NEUROPATHOLOGY**

During the course of the residency the trainee should:

- (a) Gain an understanding of the basic pathological processes (general pathology).
- (b) Gain an understanding of the basic processes peculiar to the pathology of the nervous system, such as Wallerian degeneration and regeneration, trans-synaptic degeneration, demyelination.
- (c) Learn the anatomy and functions of the regions, tracts and nuclei of the CNS, taking advantage of the material at hand for brain-cutting and anatomic dissection.
- (d) Learn to recognize and interpret evidence of gross and microscopic disease of the nervous system, and acquire an understanding of the causes and mechanisms of the changes.
- (e) Learn to correlate clinical and pathological findings related to the nervous system, and to relate these to findings in other systems.
- (f) Familiarize himself/herself with basic neuropathological and neuroanatomic texts, and learn to locate and analyze pertinent literature.
- (g) Gain an appreciation for the diagnostic contribution made by the neuropathologist, and for the factors, which may limit this contribution in some situations (e.g., the problems of small specimens or sampling error in the assessment of tumors).
- (h) Gain some familiarity with neuropathological research, and with the contributions to neurosurgical research made with neuropathological techniques.



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OBJECTIVES FOR NEUROSURGICAL RESIDENTS

NEUROLOGY SERVICE

The Neurosurgery resident rotating on Neurology functions as a Junior Assistant Resident (JAR) in Neurology. In general, they rotate monthly on 3 services to assist them in gaining the widest possible exposure to Neurology in a short time frame.

As with all Neurology JARs they follow 80 hour work week and 24+6 rule. They are at most on call every fourth night although if all JARs are present (no vacations or illness) they will not have call on the Duke consult rotation to facilitate their ability to be in house M-F 8am-5pm. We ask they take at most 1 week of vacation since it is a 3 month block and prefer it come from Duke ward time with 2nd option consult time. At all times during their 3 months, all ED consults or nighttime consults they see are presented to and examined by a covering Neurology Chief resident and then presented to an attending. Most outpatient clinic evaluations at Duke or the VA or daytime inpatient consults are presented directly to a Neurology attending. Rarely they will be seen first by a Neurology Chief resident. Thus they have supervision on 100% of patients seen.

1. VA outpatient service- during this month they see exclusively outpatient Neurology cases including new and return patients. They participate in general neurology clinics; and specialty clinics including movement disorders, neuromuscular disease, epilepsy and sleep disorders. They have the opportunity to see EMG done at the VA. These outpatient cases are extremely relevant to their Neurosurgical training.

2. Duke inpatient ward- during this month they lead one of the two inpatient Neurology teams. They work with 2 interns and possibly medical students on the team. They jointly care for patients with a general Neurology attending for the month. They care for patients with common inpatient Neurological disorders including stroke, MS and other autoimmune diseases of the brain and spinal cord, encephalopathy, CNS infections, brain masses, seizures, and severe neuromuscular disorders. They also care for inpatients on a specialty team, usually the epilepsy monitoring team as pre-surgical evaluation is pertinent to their neurosurgical training. They have the opportunity to teach interns and students. They work with affiliated staff such as PT, OT, speech pathology, floor pharmacists, and PRM's for the comprehensive care of patients. They routinely round with the charge nurse on 4100 and 4300.

3. Duke inpatient consult service- during this month they provide daytime Neurology consultation to the Duke ED and non-Neurology services. On this rotation they are first responders to Duke Stroke codes which allows them experience in the acute evaluation and treatment of stroke. They are exposed to common Neurology inpatient consults such as altered mental status, acute peripheral nerve or muscle disorders, neurological complications of surgical procedures, and neurological complications of systemic disease such as cancer, transplantation, renal failure, heart disease and diabetes. A



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Duke general neurology attending is assigned to the Duke consult service in weekly blocks allowing the resident exposure to the educational offerings and different styles of several attendings. Students and residents from other services may be assigned but the Neurology consult resident is the team leader.

All Neurosurgery residents rotating are asked to attend the core lecture series for the Neurology residents. Full description of goals and objectives are attached. Not all of the 1st year (JAR) goals and objectives intended for the Neurology residents can be covered in 3 months for the Neurosurgery residents but the general core competencies listed for the Duke rotations and the VA JAR rotation apply. We do cover the Neurological emergencies. I will be meeting with the new Neurosurgery residents this year before they start to go over these items and the overall schedule. Evaluations come from your program to us to evaluate the Neurosurgery residents performance.

Duke Neurology Residency Program Clinical competencies: Duke ward JAR, clinic and consults

Patient Care

1. Perform and document a complete history including chief complaint, history of present illness, past medical history, review of systems, family history, medication review, and social history.
2. Perform and document a complete physical exam including vital signs, pertinent general exam, and neurological exam including mental status, cranial nerves, motor, sensory, reflexes, and coordination/gait.
3. Develop a formulation of the case for presentation including localization and differential diagnosis.
4. Understand how to do a focused consult evaluation when time is limited.
5. Develop plans for evaluation and treatment of patients in concert with faculty and other team members.
6. Counsel and educate patients and their families.

Medical Knowledge

1. Begin to demonstrate knowledge of common neurological disorders including their pathophysiology, evaluation, and treatment.
2. Be able to evaluate common neurological chief complaints (see list for Year 1).
3. Be able to evaluate and treat common neurological emergencies (see list Year 1).
4. Understand common perioperative neurological issues.
5. Evaluate patients with neurological complications of systemic disease including patients on the cardiology, oncology, obstetrics/gynecology, psychiatry, and surgical services.



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6. Begin to understand the uses and interpretations of ancillary tests used in neurology (see list of tests for residency).
7. Understand the evaluation and prognostic issues for patients with hypoxic/ischemic coma.
8. Be able to perform and interpret a lumbar puncture, edrophonium test, and cold-water calorics.

Interpersonal and Communication Skills

1. Communicate effectively with patients and their families.
2. Develop the ability to obtain and interpret consultations and work with a consulting team in the care of your patient.
3. Serve as an effective consultant when asked, answering a specific question and communicating clearly to the requesting team.
4. Demonstrate the ability to effectively lead a multidisciplinary care/treatment team (team A, B, consults).
5. Educate those around you including students, other house staff, faculty, members of the care team, and patients and families about neurological disorders.

Practice Based Learning and Improvement

1. Demonstrate skills in obtaining information through core texts, libraries, Internet searches, and databases.
2. Participate in the Neurology Residency Core Conferences with attendance to be over 75%.
3. Participate in the Introductory Neurology Lecture Series with attendance to be over 75%.
4. Attend Neurology Specialty Conferences when possible.
5. Attend Neurology Evidence Based Medicine Conference including making presentations for review of articles with attendance to be over 75%.
6. Review neurology practice guidelines when available such as the AAN Guidelines.

Professionalism

1. Respect your role as a member of the Division of Neurology practice by respecting your patients and colleagues.
2. Understand your responsibilities for patient care, documentation, team coverage and sign-out, facilitating continuity of care and emergent evaluation when needed.
3. Realize extra support for the practice may be needed in time of colleague emergency.



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4. Demonstrate ethical and compassionate behavior in the care of patients regardless of the patient's age, culture, gender, religion, socioeconomic status, or sexual orientation.
5. Understand issues of consent, confidentiality and end of life care.
6. Be aware of safety issues in the evaluation and treatment of your patients, working under the creed of "first, do not harm".

Systems-Based Practice

1. Begin to understand issues of clinic-based practice such as patient access, scheduling, and physician time management.
2. Begin to understand issues of hospital-based practice such as responsibilities during transfers, length of stay issues, rehabilitation, hospice and placement.
3. Begin to understand documentation, billing, and collection issues including evaluation and management (E&M) codes, ICD-9 codes, CPT codes, and DRG's.
4. Begin to understand differences in insurance coverage and how it affects patients.
5. Practice cost effective health care by being sure routine labs are needed, not ordering major tests without anticipating the results and deciding if those results will change therapy, and minimizing costs of medications to the patient and the health care location.
6. Work with patient resource managers (PRM's) on the inpatient service and social workers in the clinic to help care for patients.



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Global Neurology Goals for Year 1

1. Be able to complete a new outpatient evaluation in one hour and a return evaluation in 30 minutes.
2. Be able to complete an emergency room or ward neurology consultation in 45 minutes.
3. Be able to complete a clinical note or discharge summary as in the outline provided in the residency handbook, including plan/hospital course by problem and patient education given.
4. Present a succinct case presentation to colleagues.
5. Understand the evaluation of common chief complaints in neurology (Table 1).
6. Understand the evaluation and management of neurological emergencies (Table 2).
7. Review basic anatomy, physiology, pharmacology, and genetics utilizing suggested texts, core lectures, and patient evaluations.
8. Learn how to answer fundamental questions that arise in the care of patients by utilizing resources available and critically reading the material (facilitated by Evidence Based Neurology Lecture Series).
9. Gain confidence and skill as an effective team leader, working with all medical personnel involved in the care of patients.
10. Be professional in your interactions with patients, colleagues, and staff.
11. Assessments: A) Have a supervised history and physical examination performed by your preceptor within the first 4 weeks of the year, utilizing the program evaluation form for this exercise. B) Participate in mock boards in the spring to further evaluate your professionalism with patients, examination and formulation skills, and fund of knowledge. C) Take the RITE exam without studying as a self-assessment tool. D) Review bi-annually rotation evaluations, career plans, and any other issues concerning training with your preceptor.

Table 1: Common chief complaints

Headache, neck/back/limb pain
Loss of vision, blurred vision, double vision
Dizziness, vertigo, hearing loss, tinnitus
Swallowing dysfunction
Slurred speech, language dysfunction
Cognitive changes, memory loss, confusion
Altered or loss of consciousness, seizure
Weakness- focal, multifocal, diffuse
Numbness/tingling- focal, multifocal, diffuse
Incontinence of bowel or bladder
Tremor, shaking
Gait disturbance, coordination problems



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Table 2: Neurological emergencies

Acute stroke, cerebral or subarachnoid hemorrhage
Seizures, status epilepticus
Coma
Cerebral edema or herniation
Delirium
Acute neuromuscular weakness- neuropathy, myopathy, neuromuscular junction disease
Cord compression
CNS infection- meningitis, encephalitis, abscess
CNS trauma- cord, subdural/epidural hematoma

Table 3: Neurological tests

Radiology including MRI of brain and spine, MRA, CT of brain and spine, myelogram, CT angiography and conventional angiography

Methods of review:

1. Discuss indications and usefulness with attendings/residents caring for your patients.
2. Review every study ordered on your patients personally (utilize PACS).
3. Attend Neuroradiology/Interesting Case Conference dedicated sessions monthly.
4. Always present pertinent images on patients presented at conferences.
5. Consider an elective month rotation in Neuroradiology (see goals for Neuroradiology elective).
6. Review useful textbooks like Osborne and journal articles.

Central Neurophysiology including EEG, EP, Polysomnography, MSLT

Methods of review:

1. Discuss indications and usefulness with attendings/residents caring for your patients.
2. Review every study ordered on your patients (in Browser). In year one, ask a senior resident or fellow to show your patient's study to you. Later consider reviewing primary data yourself, particularly if important findings.
3. Actively participate in reading studies during 2-3 month EEG/Epilepsy rotation (see goals for EEG rotation).
4. Review core texts and EEG rotation handbook.
5. Consider spending more time in EEG as an elective in the third year.
6. Attend Resident Core Lectures on these tests and Clinical Neurophysiology Conference weekly.



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Peripheral Neurophysiology including nerve conduction studies, electromyography, autonomic studies

Methods of review:

1. Discuss indications and usefulness with attendings/residents caring for your patients.
2. Review every study you order on your patients (in Browser). In year one, ask a resident or fellow to discuss with you.
3. Actively participate in performing and interpreting these studies during your 3 month EMG/Neuromuscular rotation (see goals for EMG rotation).
4. Review core texts and EMG rotation handbook.
5. Consider spending more time in EMG as an elective in your third year.
6. Attend Resident Core Lectures on these tests and Clinical Neurophysiology Conference weekly.

Neuropsychiatric studies including cognitive evaluations

Methods of review:

1. Discuss indications and usefulness with attendings/residents caring for your patients.
2. Review every study you order. Consider discussing with testing neuropsychologist.
3. Review text information.
4. Attend Neurobehavioral Conference monthly.

Ultrasonography including extracranial duplex and transcranial doppler

Methods of review:

1. Discuss indications and usefulness with attendings/residents caring for your patients.
2. Review every study you order. Consider discussing TCD studies with neurology attending reading study. Radiological studies can be reviewed with housestaff or attending radiologists.
3. Participate in studies being performed during your NICU rotations.
4. Attend lectures on ultrasound in the Resident Core Lecture Series.

Audiometry and Electronystagmogram

Methods of review:

1. Discuss indications and usefulness with attendings/residents caring for with your patients.
2. Review every study you order.
3. Attend lectures on audiometry and ENG in the Resident Core Lecture Series.
4. Consider spending elective time in the ENG lab or Neuro-otology clinic (Dr. Tucci).



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Visual field testing

Methods of review:

1. Correlate formal visual fields with bedside fields when indicated.
2. Review every study you order. Consider discussing with neuro-ophthalmology fellow or attending.
3. Attend lectures on neuro-ophthalmologic evaluation including visual fields in the Resident Core Lecture Series.
4. Consider spending elective time in Neuro-ophthalmology clinic (Drs. Chesnutt and Buono).

Table 4: List of Neurological Disorders

Dementia/behavioral neurology
Epilepsy and related disorders
Neuromuscular diseases
Demyelinating diseases
Cerebrovascular diseases
Infectious diseases of the nervous system
Neoplasia of the nervous system and paraneoplastic disorders
Toxic and metabolic disorders of the nervous system
Acute and chronic pain
Sleep disorders
Emergency neurology
Coma and brain death
Headache and facial pain
Movement disorders



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Duke Neurology Residency Program

Mandatory Neurology Resident Lectures

1. Clinical Neuroscience Grand Rounds (weekly/Bedlack)- all residents
2. Interesting Case Conference (weekly/Morgenlander)- all residents
3. Evidence Based Neurology Lecture Series (monthly/Bushnell)- all residents
4. Neurology Basic Science Review (monthly/Kong)- all residents
5. Morning Report (weekly/Sanders)- Duke chief, EEG and EMG SAR, Duke ward and consult JARs

Suggested Neurology Resident Lectures

1. Clinical Neuro-physiology Conference
2. Behavioral Neurology Conference
3. Stroke Conference
4. Neuro-critical Care Conference
5. Pediatric Neurology Conference

Away Conferences

Residents will usually have financial and schedule support to attend one national neurological conference per year. The American Academy of Neurology conference is especially recommended for PGY2 residents. Many outstanding courses are available to augment educational material in the residency program. Discussion with the program director and other faculty concerning course choices is recommended.

Other national meetings such as the American Neurological Association or American Society for Neuroscience may also be attended. Regional meetings such as the North Carolina Neurological Association may be attended without needing coverage or financial assistance.

During the course of the residency the trainee should:

Patient Care:

- During the course of the residency the trainee should: refine his/her skills in obtaining a complete neurological history and in performing a thorough neurological examination.
- During the course of the residency the trainee should: gain experience in the assessment and investigation of patients in ambulatory settings.



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Medical Knowledge:

- During the course of the residency the trainee should: learn the clinical pharmacology of the principal drugs used in treating diseases of the nervous system, such as anticonvulsants, platelet inhibitor agents and medications to reduce spasticity.
- During the course of the residency the trainee should: learn to recognize those neurological conditions, which are treated without surgery, but are part of the differential diagnosis of surgically treatable diseases, such as motor neuron disease, multiple sclerosis, certain neuropathies and myopathies and cardiogenic stroke.
- During the course of the residency the trainee should: acquire an understanding of the role and interpretation of electrodiagnostic tests, including EEG, EMG and nerve conduction studies, evoked potentials and ENG.
- During the course of the residency the trainee should: gain competence in the diagnosis and treatment of general medical conditions which may present with neurological signs and symptoms, such as thiamine and vitamin B12 deficiency states, neoplastic meningitis, CNS manifestations of AIDS and metabolic coma.

System Based Practices

- During the course of the residency the trainee should: understand the advantages and limitation of rehabilitation in treating patients with neurological diseases.
- During the course of the residency the trainees should: understand different payer systems, facilitate and limit care to patients suffering chronic neurological impairment

System-Based Learning - Continuing Student:

- During the course of the residency the trainees should: Become familiar with the Neurology literature
- During the course of the residency the trainees should: Identify references to review clinical and basic science references for neurological diseases

Interpersonal and Communication Skills



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- During the course of the residency the trainee should: create and sustain an ethically sound relationship with patients suffering from a neurological disease.
- During the course of the residency the trainee should: demonstrate sensitivity to patients of differing cultures, gender, age and disabilities

Professionalism

During the course of the residency the trainee should: maintain high professional standards when interacting with patients, colleagues, and other healthcare workers.



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NEURO ICU

Dear Colleagues,

Welcome to the Duke Neurosciences Intensive Care Unit. I think you will find that the unit is well organized and runs efficiently. Your help in providing clinical care and covering call shifts is essential in maintaining the highest standard of care for our patients. The NICU rotation also provides ample time for a review of topics, including many may be new to you. Please use the following list, adapted from Dr. Stephen Mayer's "Core Curriculum and Core Competencies in Neurological Intensive Care" Appendix A (www.neurocriticalcare.org), to guide your reading. Please also take advantage of the NICU rotation to learn/improve your procedural skills. OR/anesthesia time can be arranged as needed.

Thank you,
David McDonagh, MD, Asst. Clinical Professor

Topics of review primarily for **neurosurgery** residents (**blue** and **green** font)
Topics of review primarily for **neurology** residents (**red** and **green** font)
Topics of interest for **neurosurgery and neurology** residents

I. NEUROLOGICAL DISEASE STATES

A. Cerebrovascular Diseases

- 1. Infarction and ischemia**
 - a. Massive hemispheric infarction**
 - b. Basilar artery occlusion and stenosis**
 - c. Carotid artery occlusion and stenosis**
 - d. Crescendo TIAs**
 - e. Occlusive vasculopathies (Moya-Moya, sickle cell)**
 - f. Spinal cord infarction**
- 2. Intracerebral hemorrhage**
 - a. Supratentorial**
 - b. Cerebellar**
 - c. Brainstem**
 - d. Intraventricular**
- 3. Subarachnoid hemorrhage – aneurysmal and other**
- 4. Vascular malformations**
 - a. Arteriovenous malformations**
 - b. AV fistulas**
 - c. Cavernous angiomas**
 - d. Venous angiomas**
- 5. Dural sinus thrombosis**
- 6. Carotid-cavernous fistulae**
- 7. Cervical and cerebral arterial dissections**

B. Neurotrauma

- 1. Traumatic Brain injury**
 - a. Axonal shearing injury**
 - b. Epidural hematoma**
 - c. Subdural hematoma**
 - d. Skull fracture**
 - e. Contusions and lacerations**
 - f. Penetrating craniocerebral injuries**
 - g. Traumatic subarachnoid hemorrhage**



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2. Spinal cord injury

- a. **Traumatic injury (transection, contusion, concussion)**
- b. **Vertebral fracture and ligamentous instability**

C. Seizures and Epilepsy

1. **Status epilepticus**
 - c. **Convulsive**
 - d. **Non-convulsive (partial-complex and “subtle” secondarily generalized SE)**
 - e. **Myoclonic**

D. Neuromuscular Diseases

1. **Myasthenic crisis**
2. **Guillain-Barre syndrome**
3. **Rhabdomyolysis and toxic myopathies**
4. **Critical illness myopathy and neuropathy**

E. Infections

1. **Encephalitis (viral, bacterial, parasitic)**
2. **Meningitis (viral, bacterial, parasitic)**
3. **Brain and spinal epidural abscess**

F. Neurooncology

1. **Brain tumors and metastases**
2. **Spinal cord tumors and metastases**
3. **Paraneoplastic syndromes**

G. Toxic-metabolic Disorders

1. **Neuroleptic malignant syndrome**
2. **Malignant hyperthermia**
3. **Serotonin syndrome**
4. **Drug overdose and withdrawal**
5. **Temperature related injuries (hyperthermia, hypothermia)**

H. Inflammatory and Demyelinating Diseases

1. **Multiple sclerosis (Marburg variant, transverse myelitis)**
2. **Neurosarcoidosis**
3. **Acute disseminated encephalomyelitis (ADEM)**
4. **CNS vasculitis**
5. **Chemical or sterile meningitis**
6. **Central pontine myelinolysis**

I. Encephalopathies

1. **Delirium**
2. **Hypertensive disorders of pregnancy (eclampsia, HELLP)**
3. **Hypertensive encephalopathy, PRES**
4. **Hepatic encephalopathy**
5. **Hypoxic-ischemic and anoxic encephalopathy**
6. **Mitochondrial encephalopathy**



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J. Neuroendocrine Disorders

1. Pituitary Apoplexy
2. Diabetes insipidus (including triple phase response)
3. Panhypopituitarism

K. Movement disorders

1. Severe dystonia and opisthotonus
2. Acute dystonic reactions

L. Clinical syndromes

1. Coma
2. Herniation syndromes
3. Elevated intracranial pressure
 - a. Hyperosmotic therapy
 - b. Induced hypothermia (methods, indications)
 - c. Barbiturate coma
4. Intracranial hypotension
5. Hydrocephalus
6. Cord compression
8. Brain death
9. Vegetative state
10. Dysautonomia (central fever, hyperventilation, etc.)

L. Perioperative neurosurgical care

1. Post-craniotomy hypertension
2. Post-craniotomy pain
3. Wound CSF leaks
4. Wound infections
5. Post-operative brain edema
6. Post-carotid endarterectomy/stenting hyperperfusion syndrome

II. GENERAL MEDICAL ISSUES IN CRITICAL CARE:

A. Cardiovascular Pathophysiology, and Therapy

1. Shock
2. Acute coronary syndromes
3. Neurogenic cardiac disturbances (ECG changes, stunned myocardium)
4. Cardiac rhythm and conduction disturbances; use of antiarrhythmic medications; pacemakers
5. Pulmonary embolism
6. Pulmonary edema: cardiogenic versus noncardiogenic (including neurogenic)
7. Acute aortic and peripheral vascular disorders (i.e. dissection)
8. Hypertensive emergencies and urgencies
9. Calculation of derived cardiovascular parameters, including systemic and pulmonary vascular resistance, alveolar-arterial gradients, oxygen transport and consumption
10. Therapeutic hypothermia for cardiac arrest

B. Respiratory Pathophysiology and Therapy

1. Acute respiratory failure
 - a. Hypoxemic respiratory failure (including ARDS)
 - b. Hypercapnic respiratory failure
2. Aspiration
3. Bronchopulmonary infections-Hosp/Vent. Acquired Pneumonia



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4. Upper airway obstruction
5. COPD and status asthmaticus
6. Neurogenic breathing patterns
7. Mechanical ventilation
 - a. Positive pressure ventilation (including endotracheal intubation and noninvasive positive pressure ventilation [NPPV])
 - b. Ventilator modes: SIMV, CMV, CPAP, inverse ratio ventilation, pressure support ventilation, pressure control ventilation.
 - c. Barotrauma, volutrauma, lung protective vent. strategies
 - d. Criteria for weaning and weaning techniques
8. Pleural Diseases
 - a. Empyema
 - b. Massive effusion
 - c. Pneumothorax
9. Pulmonary hemorrhage and massive hemoptysis
10. Chest X-ray interpretation
11. End tidal CO₂ monitoring
12. Sleep apnea
13. Control of breathing

C. Renal Physiology, Pathophysiology and Therapy

1. Renal regulation of fluid and water balance and electrolytes
2. Renal failure: Prerenal, renal, and postrenal
3. Derangements secondary to alterations in osmolality and electrolytes
4. Acid-base disorders and their management
5. Principles of hemodialysis
6. Evaluation of oliguria and polyuria
7. Drug dosing in renal failure
8. Management of rhabdomyolysis
9. Neurogenic disorders of sodium and water regulation (cerebral salt wasting and SIADH).

D. Metabolic and Endocrine Effects of Critical Illness

1. Enteral and parenteral nutrition
2. Endocrinology
 - a. Disorders of thyroid function (thyroid storm, myxedema coma, sick euthyroid syndrome)
 - b. Adrenal crisis
 - c. Diabetes mellitus
 - 1) Ketotic and hyperglycemic hyperosmolar coma
 - 2) Hypoglycemia
 - d. Pheochromocytoma
 - e. Disorders of calcium and magnesium balance
3. Tight glycemic control

E. Infectious Disease Pathophysiology and Therapy

1. Antibiotics
2. Infection control for special care units
 - a. Development of antibiotic resistance
 - b. Universal precautions, isolation policies
3. Tetanus and Botulism
4. Hospital acquired and opportunistic infections in the critically ill
5. Acquired Immune Deficiency Syndrome (AIDS)
6. Evaluation of fever in the ICU patient



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F. Pathophysiology and therapy of Acute Hematologic Disorders

1. **Acute defects in hemostasis**
 - a. Thrombocytopenia, platelet dysfunction
 - b. Disseminated intravascular coagulation
 - c. **Acute hemorrhage (e.g., GI hemorrhage, retroperitoneal)**
2. **Anticoagulation and fibrinolytic therapy**
3. **Principles of blood component therapy (blood, platelets, FFP)**
4. **Hemostatic therapy (e.g., vitamin K, aminocaproic acid, protamine, factor VIIa)**
5. **Acute hemolytic disorders including thrombotic microangiopathies, TTP**
6. **Prophylaxis against thromboembolic disease**
7. **Hypercoagulable states**

G. Pathophysiology and Therapy of Acute GI and GU Disorders

1. **Upper and lower gastrointestinal bleeding**
2. **Acute and fulminant hepatic failure (including drug dosing)**
3. **Ileus and toxic megacolon**
4. **Acute perforations of the gastrointestinal tract**
5. **Acute vascular disorders of the intestine, including mesenteric infarction**
6. **Acute intestinal obstruction, volvulus**
7. **Pancreatitis**
8. **Obstructive uropathy, acute urinary retention**
9. **Urinary tract bleeding**
10. **Abdominal compartment syndrome**

H. Immunology and Transplantation

1. **Principles of transplantation (brain death, organ donation, procurement, maintenance of organ donors, implantation).**
2. **Immunosuppression, especially the neurotoxicity of these agents**

I. General Trauma and Burns

1. **Initial approach to the management of multisystem trauma**
2. **Skeletal trauma including the spine and pelvis**
3. **Chest and abdominal trauma - blunt and penetrating**
4. **Burns and electrical injury**

III. GENERAL ASPECTS OF CRITICAL CARE

A. Monitoring

1. **Neuromonitoring**
2. **Prognostic, disease severity and therapeutic intervention scores (i.e. APACHE)**
3. **Principles of electrocardiographic monitoring**
4. **Invasive hemodynamic monitoring**
5. **Noninvasive hemodynamic monitoring**
6. **Respiratory monitoring (airway pressure, tidal volume, pulse oximetry, dead space, compliance, resistance, capnography)**

B. Administrative and Management Principles and Techniques

1. **Organization and staffing of critical care units-- www.leapfroggroup.org/home**
2. **Standards for special care units, JCAHO**
3. **Collaborative practice principles-- multidisciplinary rounds and mgmt**
4. **Emergency medical systems in prehospital care**
5. **Performance improvement, principles and practices, QA**
6. **Principles of triage and resource allocation, bed management**



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7. Post-hospital care and discharge planning
8. Medical economics: health care reimbursement, budget development

C. Ethical and Legal Aspects of Critical Care Medicine

1. Death and dying
2. Forgoing life-sustaining treatment and orders not to resuscitate
3. Rights of patients, the right to refuse treatment
4. Living wills, advance directives; durable power of attorney
5. Terminal extubation and palliative care
6. Rationing and cost containment

B. PROCEDURAL COMPETENCIES

1. General Critical Care

1. Peripheral venous line placement
2. Arterial catheter placement
3. Naso-/oro- gastric tube insertion
4. Central venous catheters—tradition and U/S guided
5. Pulmonary artery catheterization
6. Management of mechanical ventilation, including CPAP/BiPAP ventilation
7. Administration of vasoactive medications
8. CPR and ACLS
9. Maintenance of airway and ventilation in nonintubated, unconscious patients
10. Direct laryngoscopy and endotracheal intubation

2. Advanced General Critical Care Procedures (focus on indications)

1. Hemodialysis, including PD, CVVH, and CVVHD
2. Fiberoptic bronchoscopy
3. Echocardiography
4. Tracheostomy (percutaneous or surgical)
5. Percutaneous gastrostomy
6. Diagnostic pleurocentesis, chest tube insertion
7. Vascath/dialysis catheter placement
8. Abdominal paracentesis
9. ECMO, balloon pumps, ventricular assist devices

3. Neurocritical Care Procedures

1. Lumbar puncture
2. Shunt and ventricular drain tap for CSF sampling
3. Administration of analgesosedative medications, including conscious sedation and barbiturate anesthesia
4. Interpretation of continuous EEG monitoring
5. Interpretation and management of ICP and CPP data
6. Jugular venous bulb catheterization
7. Interpretation of SjvO₂ and PbtO₂ data
8. Management of external ventricular drains
9. Management of plasmapheresis and IVIG
10. Administration of intravenous and intraventricular thrombolysis
11. Interpretation of CT and MR neuroimaging, perfusion studies and angiography
12. Application of systemic moderate hypothermia

4. Advanced Neurocritical Care (focus on indications)

1. Performance and interpretation of cerebral multimodality monitoring (pH, pCO₂, laser Doppler, microdialysis, NIRS, PbtO₂, etc.)



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2. Endovascular neurosurgical training (e.g., GDC coil placement, arterial stenting, angioplasty, intra-arterial thrombolysis)
3. 2-D Duplex ultrasonography (carotid, intracranial)
4. Interpretation of SPECT and PET
5. Ventriculostomy and parenchymal ICP monitors, oximeters, microdialysis probes
6. Lumbar drain insertion
7. Performance and interpretation of transcranial Doppler



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**OBJECTIVES FOR NEUROSURGICAL RESIDENTS IN
NEURORADIOLOGY**

During the course of the residency the trainees should:

- (a) Acquire a systematic approach to the interpretation of imaging studies.
- (b) Become familiar with the vascular and internal anatomy of the CNS as revealed by various imaging studies.
- (c) Learn the advantages, disadvantages and limitations of available imaging techniques for the study of lesions affecting the nervous system.
- (d) Acquire a detailed knowledge of the complications associated with invasive imaging procedures used to assess lesions of the nervous system.
- (e) Familiarize himself/herself with the scope and role of interventional neuroradiology.
- (f) Acquire an appreciation for the role of neuroradiology in the multi-disciplinary approach to patients with neurological disorders.



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CONFERENCE SCHEDULES

Attendance is taken at conferences by a sign-in sheet. While this is not a perfect system, it does document repeated lack of conference attendance. Residents chronically missing conferences are reminded of the important of conferences.

See below for specific topics

DAY/DATE	TIME	CONFERENCE	LOCATION
Monday	7:15 - 8:00 a.m.	Clinical Spine Conference	Radiology Duke North Hospital
Wednesday	6:45 - 7:45 a.m.	Literature Review Conference	Conference Room Duke North Hospital
Wednesday	7:45 - 8:45 a.m.	Multi-Disciplinary Case Conference	Conference Room Duke North Hospital
Wednesday*	7:00 - 8:30 a.m.	NeuroPathology Conference	Conference Room Duke South Hospital
Wednesday	6:00 - 7:00 p.m.	Fundamentals of Neurosurgery Conference	Conference Room Duke North Hospital
Friday	7:00 - 8:00 a.m.	Radiosurgery Conference	Rad-Onc Workroom Duke South Hospital
Saturday**	8:00 - 9:00 a.m.	Morbidity & Mortality Conference	Neurosurgery Library Duke South Hospital
Saturday**	9:00 - 10:00 a.m.	Neurosurgery Division Meeting	Neurosurgery Library Duke South Hospital

*Week 3 of each month only (in place of Literature Review)

**Week 4 of each month only

Description of Conferences

• Spine Conference

This time is spent reviewing interesting cases involving spine surgery. Clinical history, radiological findings, and surgical management are discussed. This conference is for Orthopedic and Neurosurgery residents and attendings; attendance is encouraged but not mandatory.



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- **Literature Review Conference**

This time is spent reviewing relevant topics that have come up on the clinical service in the previous month. The format includes general background, case presentation, literature review, and current practice standards. The goal is to incorporate evidence-based medicine into our clinical practice. Topics are selected on a monthly basis and reviewed to ensure a broad spectrum is maintained. A junior resident is assigned a topic on a rotating basis; One attending and one chief resident on service help lead the conference each week. All neurosurgery residents are expected to attend this conference.

- **Multi-Disciplinary Case Review Conference**

This conference involves a multi-disciplinary review of the most interesting cases on service from the previous weeks. Typically 5-10 cases are discussed in detail, focusing on the clinical history, radiographic findings, surgical approach, and pathological findings. Residents and attendings from neurosurgery, radiology, and pathology participate; all neurosurgery residents are expected to attend this conference.

- **Neuropathology Case Review Conference**

This conference occurs the third Wednesday of every month. The first hour is a lecture given by the neuropathology fellow on a topic pertinent to a current case. The second hour is a multi-disciplinary review of recent cases on service, with a focus on the radiographic and pathological findings. The conference is held in the Neuropathology conference room equipped with a light microscope connected to a projector. Residents and attendings from neurosurgery, neuroradiology, and neuropathology participate; all neurosurgery residents are expected to attend this conference.

- **Fundamentals of Neurosurgery Conference**

This conference focuses on the fundamental areas of knowledge essential to the practice of neurosurgery. The [Conference Schedule](#) is selected six months in advance by the fourth year (research) residents and focuses on teaching the junior residents the neuroanatomy, physiology, pathology, and clinical knowledge pertinent to the field of neurosurgery as outlined in the resident training curriculum. Two attendings are assigned to participate on a rotating schedule. All neurosurgery residents are expected to attend this conference.

- **Radiosurgery Conference**

This conference is held jointly by the neurosurgery and radiation oncology divisions to discuss recent cases and current literature in the use of radiosurgery for the treatment of neurological disease. Participation by the neurosurgery residents is encouraged, but elective.

- **Morbidity & Mortality Conference**

This monthly conference reviews the difficult cases and outcomes from the past four weeks on service, focusing on operative and post-operative care. The cases are presented by the junior residents on service and discussed in detail with the entire neurosurgical staff (residents and attendings). Current literature and standard practice is discussed to determine ways to improve the care of our patients.

- **Neurosurgery Division Meeting**

This monthly meeting is for the residents and attendings to discuss in an open forum any issues concerning the division. The goal is to improve quality, care, and efficiency within the division by encouraging new suggestions and critical feedback. Issues regarding resident training, patient care, and administrative responsibilities are the general focus of this time.

Literature Review and Fundamentals of Neurosurgery Conference



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RESIDENT TRAINEE EVALUATION

Residents on the Neurosurgical Service at Duke Hospital will be evaluated monthly by the attending neurosurgeons with whom the resident is sharing patient care responsibilities. This is a web-based evaluation. The results of these evaluations will be available to the resident being evaluated and to the resident program director and program coordinator.

The entire attending neurosurgical staff at Duke University will evaluate residents biannually. The evaluation will be based on the Curriculum Guidelines and the Six Competencies. Residents will also be evaluated biannually by their peers, patients, and nursing colleagues.

Residents are advanced on an annual basis. Advancement is predicated on the formal assessment conducted by the neurosurgical attending staff.

Probation or suspension during the academic year will follow Duke University Hospital Policy and guidelines.

In General Goals for PGY – 2 are:

1. **PATIENT CARE** – The resident will be able to
 - Perform and document a comprehensive neurological History & Physical examination
 - Formulate a differential diagnosis
 - Select and interpret appropriate laboratory and imaging studies
 - Recognize and begin to manage emergent neurological problems
 - Manage common medical problems encountered in neurosurgical patients
 - Perform basic surgical techniques
 - Plan basic neurosurgical techniques
 - Assist in major surgical procedures and perform sections of the procedure commensurate with level of skill

2. **MEDICAL KNOWLEDGE** – The resident will be able to:
 - Demonstrate a basic level of knowledge in the neurologically related basic sciences (eg anatomy)
 - Demonstrate a basic level of knowledge in neurologically related clinical fields eg. Neurology, Pathology

3. **PRACTICE-BASED LEARNING** – The resident will be able to
 - Use electronic databases to gather data concerning specific patient problems
 - Appraise the quality of studies published in the medical literature



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4. INTERPERSONAL AND COMMUNICATION SKILLS – The resident will be able to:

- Present patient's problems and work-ups to fellow residents
- Communicate with patients of different ages, cultural backgrounds, gender, and socio-economic backgrounds in a professional manner

5. PROFESSIONALISM – the resident will be able to:

- Maintain patient confidentiality
- Foster patient trust
- Demonstrate respect, compassion, and integrity and be responsive to the patient's needs superseding the resident's own self interest

6. SYSTEM-BASED PRACTICES The resident will be able to

- Learn to practice cost effective

In General Goals for PGY – 3 are:

1. PATIENT CARE – The resident will be able to

- Interpret more complex radiographic tests
- Confidently establish a differential diagnosis when evaluating patients with an emergent problem
- Initiate emergency neurosurgical procedures
- Increase ability to plan and participate in basic neurological procedures

2. MEDICAL KNOWLEDGE – The resident will be able to:

- Apply knowledge of basic neurological sciences to patient problem solving
- Understand anatomic basis of moderate to complex neurosurgical approaches

3. PRACTICE-BASED LEARNING – The resident will be able to

- Appraise the medical literature to improve patient care
- Develop strategies for improving knowledge in Neuroradiology, Pathology, and Neurology as applied to conditions seen in neurosurgical patients.

4. INTERPERSONAL AND COMMUNICATION SKILLS – The resident will be able to:

- Present results from literature review to the neurosurgical division
- Communicate effectively with nurses, patient planners, and ancillary hospital staff

5. PROFESSIONALISM – the resident will be able to:

- Communicate effectively with patients and families holding opinions contrary to those of the resident



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- Demonstrate a commitment to ethical principles pertaining to the provision and withholding of care

6. SYSTEM-BASED PRACTICES The resident will be able to

- Know how to partner with healthcare managers and healthcare providers to assess, coordinate and improve healthcare

In General Goals for PGY – 5 are:

1. PATIENT CARE – The resident can:

- Independently carry through a strategy for diagnosing most common and moderately complex neurological patient presentations
- Plan and initiate therapy for relatively complex surgical procedures
- Master basic neurosurgical techniques for spine and cranial neurosurgery

2. KNOWLEDGE BASE

- Know the up-to-date literature in the efficacy of new techniques for spinal surgery.
- Pass the In-service Examination given by the American Board of Neurological Surgeons for credit.

3. PRACTICE-BASED LEARNING AND IMPROVEMENT

- Identify areas of knowledge deficit and fill in the gaps.
- Demonstrate the ability to change practice based on prior poor results.

4. INTERPERSONAL AND COMMUNICATION SKILLS

- Communicate effectively with patients regardless of the patient's age, gender, socio-economic, and cultural background.

5. PROFESSIONALISM – the resident will be able to:

- Maintain a high level of professional ethics while working in different healthcare settings

6. SYSTEM-BASED PRACTICE

- Work effectively in a single payer medical system.
- Work effectively in a private practice setting.
- Understand the limitations placed on medical care by different payers of medical care.
- Serve as the leader of a healthcare team at a government, private, and university hospital



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In General Goals for Chief Resident are:

1. PATIENT CARE – The resident can:

- Develop a strategy for solving difficult or novel clinical problems using clinical skill and knowledge gathered during residency.
- Apply learned and surgical principles to approach complex and novel surgical problems
- Anticipate complications that may be encountered during a surgical procedure.
- Demonstrate basic strategies for mitigating unexpected operative problems.

2. MEDICAL KNOWLEDGE – The resident can:

- Maintain an up to date knowledge base relevant to the treatment of most neurosurgical problems.
- Be able to effectively explain the reasoning behind neurosurgical practices to junior residents.

3. PRACTICE-BASED LEARNING AND IMPROVEMENT

- Modify practice plans based on experience and an enhanced appraisal of the literature.
- Develop a strategy for learning beyond residency.

4. INTERPERSONAL AND COMMUNICATION SKILLS

- Communicate effectively as the leader of a healthcare team.
- Mediate Differences of opinions that occur within a healthcare team.

5. PROFESSIONALISM – the resident will be able to:

- Serve as a role model for junior residents and other healthcare workers.
- Demonstrate a high level of professionalism at all times.
- Demonstrate sensitivity and responsiveness for patient's culture, age, gender, and disability

6. SYSTEM-BASED PRACTICE

- Advocate for quality patient care and assist patients in dealing with system complexities.
- Know how types of medical practice and delivery systems differ from one another, including methods of controlling healthcare costs and all other resources.



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**NEUROSURGERY
SIX COMPETENCIES**

The ACGME had defined six competencies that are the core of residency training. It is the goal of the Neurosurgical Program at Duke to help each resident achieve competency in each of these categories.

PATIENT CARE

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:

1. communicate effectively and demonstrate caring and respectful behaviors when interacting with patients and their families
2. gather essential and accurate information about your patient through a history and physical exam. Identify pre-existing medical conditions that could complicate the patient's treatment. Order and interpret appropriate laboratory tests.
3. make informed decisions about diagnostic and therapeutic interventions based upon patient information.
4. develop and carry out patient management plans
5. counsel and educate patients and their families
6. use information technology to support patient care decisions and patient education
7. Understand the value and limitations of therapeutic options both medical and surgical.
8. Know the steps involved in surgical intervention.
9. Appreciate the possible complications that can take place at each step of surgical intervention.
10. Perform competently surgical procedures appropriate for level of training
11. Identify and initiate therapy for postoperative complications

MEDICAL KNOWLEDGE

Residents must demonstrate knowledge about established and evolving biomedical, clinical, and cognate (e.g. epidemiological and social-behavioral) sciences and the



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application of this knowledge to patient care. Residents are expected to:

1. Demonstrate a level appropriate inventory of medical and basic science knowledge
2. Demonstrate an analytic approach applying this knowledge to clinical situations
3. Know and apply the basic and clinically supportive sciences appropriate to your discipline

PRACTICE-BASED LEARNING AND IMPROVEMENT

Residents must be able to investigate and evaluate their patient care practices, appraise and assimilate scientific evidence, and improve their patient care practices. Residents are expected to:

1. analyze practice experience and perform practice-based improvement activities using a systematic methodology
2. locate, appraise, and assimilate evidence from scientific studies related to their patients' health problems
3. apply knowledge of study designs and statistical methods to the appraisal of clinical studies and other information on diagnostic and therapeutic effectiveness
4. use information technology to manage information, access on-line medical information; and support their own education
5. facilitate the learning of students and other health care professionals

INTERPERSONAL AND COMMUNICATION SKILLS

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

1. create and sustain a therapeutic and ethically sound relationship with patients
2. provide information to patients and their families using explaining skills, questioning skills, and writing skills
3. Communicate clinical and scientific investigations using writing and verbal skills
4. work effectively with others as a member or leader of a health care team or other professional group



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PROFESSIONALISM

Residents must demonstrate a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population. Residents are expected to:

1. demonstrate respect, compassion, and integrity; a responsiveness to the needs of patients and society that supercedes self-interest; accountability to patients, society, and the profession; and a commitment to excellence and on-going professional development
2. demonstrate a commitment to ethical principles pertaining to provision or withholding of clinical care, confidentiality of patient information, informed consent, and business practices
3. demonstrate sensitivity and responsiveness to patients' culture, age, gender, and disabilities

SYSTEMS-BASED PRACTICE

Residents must demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value. Residents are expected to:

1. understand how their patient care and other professional practices affect other health care professionals, the health care organization, and the larger society and how these elements of the system affect their own practice
2. know how types of medical practice and delivery systems differ from one another, including methods of controlling health care costs and allocating resources
3. practice cost-effective health care and resource allocation that does not compromise quality of care
4. know how to partner with health care managers and health care providers to assess, coordinate, and improve health care and know how these activities can affect system performance