VASCULAR NEUROLOGY RESIDENCY  
WASHINGTON UNIVERSITY/BJH/SLCH CONSORTIUM PROGRAM

Educational goals and objectives of the program with respect to knowledge, skills and other attributes of residents at each level of training and for each major rotation or other program assignment

CLINICAL INPATIENT ROTATIONS

Barnes-Jewish Stroke Service (3 months)

There will be two levels of responsibility. All Vascular neurology fellows who are not recent graduates of the Washington University Neurology residency will initially, for at least the first month, participate in morning work rounds and teaching rounds with Stroke Service attending neurologist and resident staff. He/she may act in the capacity of Chief Resident for all “short” admissions and cover Emergency Room coverage for tPA during the day. There will be individual case review for each case by the attending. This initial month may be waived or shortened if, in the judgment of the Program faculty, the fellow has sufficient familiarity with the Barnes-Jewish Hospital Stroke Service (e.g. recent graduates of the Washington University Neurology residency) and has demonstrated the knowledge and skill to function at a more advanced level of responsibility. This initial month may be extended if the Program Director, in consultation with the Program Faculty, judges that the fellow requires further training before assuming more independent duties. Extension of this period of training may be mandated in place of research/elective time.

Should the fellow demonstrate sufficient clinical, teaching and organizational skills and the necessary fund of knowledge, the fellow will serve in the role of Stroke Service attending neurologist for one or two months supervising the resident staff with direct line responsibility for patient care. The determination of competency to assume this role will be made by the Program Director in consultation with the program faculty. One of the Stroke Service attending neurologists will personally examine, review and discuss each patient each day with the fellow, except for the one day per week when the fellow is off at which time the attending will round with the other housestaff.

This service admits 15-20 patients per week with all varieties of stroke but primarily ischemic stroke and primary intracerebral hemorrhage. Most are admitted acutely through the emergency room or by transfer from outlying hospitals within a day of onset. Average length of stay is 4-5 days so there is rapid turnover. Rotation on this service will give the fellow opportunities to observe, evaluate, and manage patients of all ages with a wide variety of disorders of the cerebrovascular and nervous systems. [Acute intracranial hemorrhage due to vascular malformations and aneurysms are generally admitted to the Neurosurgical Service in the Neurology-Neurosurgery Intensive Care Unit (NNICU). A separate rotation in the NNICU (see below) will provide experience in caring for these patients.]

By making regular patient management rounds with the attending faculty, trainees will learn about the effectiveness of procedures for inpatient management of patients with stroke, both ischemic and hemorrhagic as well as emergent management of patients
with stroke in the emergency department. Work rounds and teaching rounds encompass extensive discussions regarding appropriate ordering and clinical correlation of diagnostic brain and vascular imaging including cranial and spinal MRIs and CTs, magnetic resonance imaging, cerebral angiography, carotid and intracranial Doppler studies, single photon emission tomography (SPECT), positron emission tomography (PET), transesophageal and transthoracic echocardiography. In addition, the fellows will learn the evidence base for ordering and interpretation of the appropriate biochemical and molecular testing for strokes in patients of different age groups.

Furthermore, the fellow will participation under the supervision of the Stroke Service attending in the delivery of educational programs about stroke and stroke prevention to medical students and residents.

**Neurology Neurosurgery Intensive Care Unit (2 months)**

The vascular neurology fellow will all rotate through the Neurology/Neurosurgery Intensive Care Unit (NNICU). Their experience will be one of graded responsibility. Those who have not completed a rotation which involves primary care responsibility for critically ill neurological and neurosurgical patients, including in-house call, will be required to serve in that capacity for the first month of their experience in the NNICU. During that period of time they will be supervised by both an NNICU fellow and attending and will be integrated into the critical care team and will be responsible for providing primary care on a rotating schedule including in-house coverage at night. They, along with other residents assigned to the rotation, will be responsible for following and providing care for all patients admitted to the unit. They will learn the general principles of respirator management (including the indications for intubation, extubation and weaning) blood pressure management, fluid and electrolyte management, nutritional support, management of infection and the placement of catheters for the supportive care and pharmacological treatment of strokes. During the NNICU rotation they will participate in didactic conferences, which will cover topics including principles of neurologic critical care, diagnosis and management of common diseases seen in the NNICU, nutritional and pharmacological issues in these patients management and a weekly Neurosurgery Grand Rounds.

Any fellow who has already completed such a primary care rotation in the past, or has completed one as part of their vascular neurology residency, may then be eligible to spend the second month in the NNICU as an ICU fellow. Advancement to fellow status will be contingent upon adequate performance contingent in the primary care rotation. This decision will be made by the NNICU Director in consultation with the vascular neurology Program Director. During that time fellow will be supervised and mentored one-on-one by an ICU attending. They will be responsible for the overall management of all the patients in the NNICU and be responsible for supervising residents in the ICU. They will also participate in all the conferences listed above.

Acute intracranial hemorrhage due to vascular malformations and aneurysms are generally admitted to the Neurosurgical Service and cared for jointly with the NNICU team. NNICU admits to the Neurosurgery service each year approximately 50 intracerebral hemorrhages (half of which are due to arteriovenous malformations) and 175 aneurysms (both ruptured and unruptured). Rotation on this service will give the fellow opportunities to observe, evaluate, and manage patients with these conditions.
Rehabilitation Institute of St. Louis (1 month)
The vascular neurology fellow will rotate on the Stroke Rehabilitation Service at the Rehabilitation Institute of St. Louis (RISL), an independent, free-standing facility affiliated with both Barnes –Jewish Hospital and Washington University Medical School. The Stroke Rehabilitation Service is staffed by full-time members of the Washington University Neurology Department. Many of the patients with acute stroke from the Barnes-Jewish Hospital Stroke Service are transferred to RISL for rehabilitation. The fellow will participate in work rounds and teaching rounds with the Stroke Rehabilitation Service attending neurologist and resident staff. The fellow will serve as an adjunct to the attending with responsibilities delegated as the attending sees fit after observing and monitoring the fellow’s performance.

The fellow will assist in evaluating patients for referral to rehabilitation and assist in direct care for patients undergoing neuro-rehabilitation for stroke. They will attend clinical teaching rounds on a daily basis on the rehabilitation service and a weekly conference reviewing pathophysiologic principles underpinning rehabilitation and recovery from injury. They will be involved in teaching medical students and physical medicine and rehabilitation residents that are part of the team. They will also see patients in the outpatient clinic in the course of their outpatient rehabilitation. By doing so, they will become skilled in the evaluation of patients with stroke for their prognosis for recovery and for effectiveness of rehabilitation in enhancing recovery. They will gain understanding about modalities of therapy and support available and their appropriate application to patients with neurologic injury due to cerebrovascular disease.

Interventional Neuroradiology (1 month)
The vascular neurology fellow will spend one month on the Interventional Neuroradiology Service. The Interventional Neuroradiology program at Washington University is very active, treating approximately 100 cerebral aneurysms and 25 arteriovenous malformations and fistulas and performing 25 intracranial and extracranial angioplasty/stent procedures per year for atherosclerosis. Direct intraarterial or intravenous thrombolysis is performed approximately 12 times per year. Tumor embolization, temporary balloon occlusion testing, Wada testing, petrosal sinus sampling, direct puncture sclerotherapy, needle biopsies, and microballoon angioplasty and intra-arterial drug infusion for cerebral vasospasm are also performed. The program performs over 800 carotid and 500 vertebral diagnostic and intra-operative arteriograms per year. It is an ACGME accredited as an Endovascular Surgical Neuroradiology program.

During this time the fellow will participate in the evaluation and treatment of patients, patient rounds for post-operative care, attendance and participation in didactic and working clinical conferences, and call for the clinical service under the supervision of one of the three full-time interventional neuroradiology faculty members. The fellows obtain the clinical history, perform the physical and neurological examination. Neurological findings, clinical history, diagnostic and therapeutic options are discussed with the responsible faculty member. The fellow is responsible for obtaining all related preliminary imaging (MR, CT, and angiographic studies) and laboratory studies prior to endovascular surgical procedure. These studies are reviewed with the responsible faculty member prior to the procedure. They will assist faculty members with the actual performance of interventional and diagnostic cases. Trainees round at least daily on post-procedure patients in the Neurology-Neurosurgery ICU and other hospital nursing
units during the patients’ hospitalization. They will assist in the reading and interpretation of diagnostic arteriograms with the Interventional Neuroradiology faculty.

While on this rotation, the fellows are expected to attend several weekly conferences. Most of these conferences take place at 7:00 am, after morning rounds and before the cases start. Monday, Tuesday, Wednesday and Friday conferences at 7:00 are run by the Neuroradiology Section. The Monday conference is an ENT imaging case review presented by a resident. There are two simultaneous conferences on Tuesday morning from which to choose, a brain imaging case review presented by a resident or a conference that varies from week to week, including didactic presentations by the Neuroradiology faculty, lectures by the faculty from other departments, and a journal club. Topics cover a broad range of neurological disorders and have included pathology of brain tumors, clinical features of MS and Alzheimer’s disease, and surgical options for treatment of aneurysms. The Wednesday morning conference (except for the once monthly combined conference described below) is a presentation by a first-year neuroradiology on several instructive pathologically-proven cases and a discussion of imaging, clinical and pathological features of the disease entities. The Friday morning conference is a clinical conference where instructive cases seen on the brain, spine, pediatric and ESN services that week are presented by residents and discussed.

A combined Neuropathology/Neuroradiology/Neurosurgery conference is held monthly on Wednesdays at 7:00 am. Clinical, imaging, and surgical and pathological aspects of different neurological diseases are discussed. The ESN service runs a Neurosurgery-Interventional Neuroradiology Conference devoted to the management of aneurysms and vascular malformations. This “Vascular Conference” is held on Friday mornings at 8:00 AM and is attended by NNICU, Neurosurgery and Interventional Neuroradiology faculty. The clinical management of recent and upcoming cerebrovascular cases is presented and discussed.

The purpose of this rotation is to provide the fellow with knowledge and experience in the interpretation of cerebral arteriograms and in the techniques available for endovascular treatment of cerebrovascular disease including embolization of arteriovenous malformations, coiling of aneurysms, angioplasty and stenting of atherosclerotic lesions and endovascular thrombolytic therapy for cerebral venous and arterial thrombosis. They will learn the advantages and disadvantages of these therapeutic approaches by participating in patient care and conferences. This rotation is not designed to provide adequate training for the fellow to be able to independently carry out these procedures.
CLINICAL OUTPATIENT ROTATIONS

**Stroke Clinic –One or two 1/2 days per week**

The fellow will attend a regular ½ day per week afternoon stroke clinic. When not engaged in rotations that require morning attendance, the fellow will attend an additional ½ day per week morning clinic. These clinics are staffed by Stroke Service attendings who see their own patients. The fellow will see his/her own individual patients scheduled at specific time slots. This clinical serves as a follow-up clinic for patients admitted de novo to the in-patient Stroke Service as well as outpatient referrals. The fellow will primarily manage at least 50 patients under supervision of the faculty. The fellow will learn evidence-based methods for stroke prevention including anti-thrombotic therapy and risk factor intervention.

**Rehabilitation Clinic  (Four ½ days per week)**

The fellow will attend outpatient rehabilitation clinics during the rehab outpatient rotations. The fellow will learn to evaluate and manage patients with dysfunction caused by central nervous system injury under the supervision of the faculty of the Rehabilitation Section of the Department of Neurology.

RESEARCH ROTATION

**Research- ( 5-6 months, includes vacation)**

After acceptance into the residency and prior to beginning the training year, each fellow will be assigned to one of the Stroke Service attending neurologists who is actively engaged in extramurally funded research. This assignment will be made after consultation with the fellow regarding his/her research interests. The faculty mentor will be responsible for assuring that the fellow actively participates in an ongoing research project broadly related to the field of cerebrovascular disease either in that faculty member’s laboratory or by arrangement with another faculty member at Washington University School of medicine. In addition, the faculty mentor will work with the fellow prior to and early in the training period to design and implement a small independent research project that can be carried out during the one-year time available. The faculty mentor will use this endeavor as an opportunity to teach the principles research design and statistical analysis. The fellow will be expected to present the results of these projects at Stroke Conference, submit abstracts to national meetings and prepare manuscripts for publication.

During this rotation he/she will participate at an off site course for training in ultrasound carotid and transcranial Doppler ultrasound techniques.

ELECTIVE ROTATIONS

All elective rotations must receive prior approval from the Program Director. Elective rotations may be arranged during the research rotation by the following procedure: At least one month prior to the start date of the elective, the following must be submitted to
the program director (1) written goals and objectives of the elective, (2) a letter from the responsible faculty member stating his/her willingness to assume responsibility for insuring that the goals and objectives are carried out and to provide the Program Director with a written evaluation of the fellow's performance and (3) arrangements for any additional financial support, if needed.

CONFERENCES

Evidence-based Treatment of Cerebrovascular Disease (Tuesdays, July to September).
Primary data from benchmark studies covering 16 different topics related to cerebrovascular diseases are presented during this 3-month course.

Clinical Stroke Conference (1st and 3rd Tuesdays)
Specific vascular neurology patient management issues are discussed in depth by the faculty. The vascular neurology fellow will be expected to present at least 2 conferences.

Clinical Neuroscience Series (Wednesdays 12-1)

Neurology Journal Club (Thursdays 12-1)

Neurology Grand Rounds (Fridays 8–9)

Neurology/Neurosurgery Department Research Conference (Mondays 12-1)