Intracranial aneurysms are present in up to 4 percent of the population. These potentially dangerous vascular lesions are being detected with increasing frequency in asymptomatic patients by advances in noninvasive imaging techniques, such as magnetic resonance angiography (MRA). Appearing like blisters on the wall of the brain's blood vessels, aneurysms develop when the blood vessel's native repair ability is exceeded by the mild, but constant, injury created by flowing blood under high pressure. The five most common risk factors for developing an aneurysm are: smoking, female gender, high blood pressure, middle age and family history.

Intracranial aneurysms are complex lesions that require a highly specialized, multidisciplinary approach that is individualized for each patient. Key members of the care team for these patients include endovascular neuroradiologists, neurosurgeons with special expertise in aneurysm surgery and neuroanesthesiologists. Availability of dedicated neurocritical care units is an essential care component. A consensus recommendation by these specialists may include close observation, obliteration of the aneurysm with a surgical clip, or filling the vascular outpouching with filamentous coils that are introduced by endovascular microcatheters via an artery in the leg. This latter process is called “coiling.”

Those aneurysms that have a balloon-like opening, or neck, from the parent vessel are typically good candidates for coiling. Not infrequently, however, the aneurysm's shape does not permit safe coiling. When the aneurysm's neck is wide, it appears more like a molehill than a balloon (see Figure 1). A molehill configuration is often referred to as a “wide-necked aneurysm.” The wide neck allows an unwanted protrusion of coils back into the parent vessel, making coiling more hazardous. Key features of wide-necked aneurysms include a shallow wall, a wide neck, and a balloon-like opening.

Detecting cerebral microemboli with transcranial doppler

Since its introduction in 1982, transcranial doppler ultrasound (TCD) has evolved into a portable, multimodality, noninvasive method for real-time imaging of intracranial vasculature.

The detection of cerebral microemboli is among the more remarkable capabilities of TCD. Emboli create countable signals in the ultrasound display due to the higher reflection of sound waves compared to the blood cells. Experimental models have shown a high sensitivity and specificity for detection of a variety of substrates, including thrombotic, platelet and atheromatous emboli.

Microembolic signals (MES) within the intracranial vasculature are most frequently identified in patients with large-vessel atherosclerotic disease, such as carotid stenosis. They have also been reported in intracranial arterial stenosis, arterial dissection, cardiac disease and atheroaoartic plaque. Additionally, they have been seen in arteries distal to coiled aneurysms.
Launching SNIBlog.com

John W. Henson, M.D., FAAN, Editor, and Susan Allen, Executive Editor, BrainWaves

SNI is leveraging communication tools that deliver information to patients, referring physicians and the public as a crucial part of providing care at the advancing edge of neurological knowledge. The goals of these tools are two-fold. One goal is to update established patients and their doctors regarding the latest developments in our programs and centers. The other is to lower the barrier for patients and physicians who are facing a new neurological problem to discover tertiary subspecialty care.

A new SNI communication tool

Dan Rizzuto, Ph.D., director of SNI research, and John Henson, M.D., recently launched SNIBlog.com to complement other communication efforts and to provide a communication outlet for the staff of SNI. SNIBlog.com offers brief notes about advances in neurological care provided in SNI’s centers, as well as news items about the institute that are of interest to our patients and referring physicians.

Blog content is more dynamic than Web content. Search engines are able to detect targeted key words within each entry, which helps direct highly relevant Web traffic to the blog. This aids in the dissemination of information to patients and physicians. Viewers also can subscribe to an e-mail notification system that will alert them to newly posted material.

As is the case with any communication tool, however, blogs also have limitations. For example, blogs are not able to incorporate the interactive features of social media that exponentiate information transfer to a selected audience. Therefore, SNI will build upon its existing menu of communication tools by launching social media outlets in the near future.

Other SNI communication tools

At SNI we provide print and electronic options to meet the needs of various audiences.

BrainWaves. This print news letter is designed to be an educational resource about neurological topics for physicians in the Pacific Northwest. Each issue focuses on conditions treated at SNI. Staff members author the articles.

Physicians Practice. Swedish has the exclusive contract with this practice management journal to customize content in six issues annually. Although the journal is not exclusively used for SNI information, many neurological topics have been covered in recent issues. Swedish maintains an online library of past content in the Health Professionals section of its website at www.swedish.org.

Swedish Neuroscience Institute website (www.swedish.org/neuroscience). Earlier this year the SNI website took on a new look as part of a project to redesign the entire Swedish Medical Center website. SNI members are now able to directly update information about their programs, and are actively developing online patient resources for each of SNI’s programs. The SNI website is a repository of information about our neurological services, research, clinical trials and professional expertise.

Our goal is to continuously improve access to neurological information and the delivery of that information to interested groups of patients and referring physicians. ❖
Advances in thrombolysis
Bill Likosky, M.D., FAAN, FAHA, Medical Director for Stroke and Telestroke, Swedish Neuroscience Institute

Washington State has one of the highest stroke mortality rates in the nation. To improve this situation, acute intervention- nal therapies for stroke are being employed to restore circulation to ischemic brain tissue that surrounds areas of completed infarction, while avoiding risk of hemorrhage due to reperfusion of large areas of infarcted brain tissue.

Urgent thrombolysis with intravenous alteplase is the only therapy known to improve clinical outcomes following acute stroke. Unfortunately, alteplase has had limited usage because many patients arrive in an emergency department after the three-hour treatment window. The FDA has also approved two clot removal devices based on the ability to restore circulation. These devices are used up to eight hours after symptom onset. Several approaches to improved acute stroke care are now under way, including extension of the thrombolysis window to 4.5 hours, identification of safer thrombolytic agents and research identifying brain at risk of infarction following a stroke.

A recent European study demonstrated the efficacy of alteplase up to 4.5 hours after ischemic stroke in patients younger than age 80 years who have neither diabetes mellitus or prior stroke. The safety profile during this longer window for these patients appears similar to that at three hours.

Another promising advance employs a new thrombolytic agent called desmoteplase. Derived from the saliva of the

Wide-necked aneurysms
(Continued from page 1)

into the artery. This can lead to a number of problems, including failure to obliterate the aneurysm and stroke. Thus, in situations where an aneurysm is not surgically accessible or the patient cannot undergo surgery, no therapeutic options can be offered.

A stent is a tube made of tiny, cross-linked nickel and titanium struts which allows the stent it to pop back into shape after being compressed. The stent is compressed into a catheter with an inner diameter of less than 1/100th of an inch. The combination of the stent’s compressibility, flexibility and low catheter profile makes it navigable into the blood vessels of the brain.

Until recently, wide-neck aneurysms could not be treated by coiling. The U.S. Food and Drug Administration, however, has approved a tubular device called an intracranial stent to be used for such situations.

Once a stent is deployed across the neck of the aneurysm, coils are placed into the aneurysm through the stent wall. The stent struts prevent the coils from falling back into the artery by essentially creating a “chain link fence” across the neck of the aneurysm (see Figure 2).

Stenting, however, produces another set of problems. A stent is a foreign body that can promote formation of a blood clot inside the vessel, which is why patients are placed on two antiplatelet medications to thin the blood, usually aspirin and clopidogrel (Plavix®), after placement of a stent. The length of time required to thin the blood after stent placement is unclear, although stents may become incorporated into the vessel wall and covered with endothelium within weeks.

For more information
The combination of stents and coiling provides a new treatment approach for many patients with wide-necked aneurysm. To discuss this treatment in more detail, contact Yince Loh, M.D., or Joseph Eskridge, M.D., at 206-320-2800.
Recent advances in neuroimaging provide clinicians with multiple modalities for assessing cerebral vasculature in patients with transient ischemic attack (TIA) and stroke. Among these, magnetic resonance (MR) perfusion imaging interrogates the physiological properties of cerebral blood flow and perfusion, thus providing additional information to stroke specialists above and beyond the standard anatomic information derived from routine MRI sequences.

Importantly, this physiological information is provided in the same axial two-dimensional format as routine anatomic images and diffusion-weighted images (DWI), thus allowing excellent anatomic correlation and detection of areas of abnormal perfusion that correspond to arterial territories and with areas of infarction. MR perfusion has quickly become a readily available alternative to traditional methods of perfusion measurement such as PET, SPECT and Xenon CT perfusion.

In perfusion MRI, an intravenous bolus of rapidly-infused gadolinium (Gd) is administered during the serial acquisition of MRI images at 1500 ms intervals. MRI signal loss due to the first passage of Gd through the cerebral vasculature is used to compare the timing of blood passing through all segments of the brain parenchyma. (Gillard, et al.) (see Figure 1) Although there are a number of parameters that can be used to detect changes in blood flow, “time to peak” (TTP) is both a robust and rapid method that provides clinically relevant images that emphasize perfusion within larger brain vessels. The two cases below illustrate the clinical utility of MR perfusion imaging using TTP maps.

**Case 1**

A 75-year-old, right-handed patient with hypertension and type 2 diabetes mellitus was transferred to Swedish Medical Center with new onset of left-sided weakness. The patient had experienced a prior right pontine stroke, and stroke risk factors had been addressed at that time with warfarin for atrial fibrillation, aggressive blood sugar control and high-dose statin therapy. On the day of admission the patient’s existing left hemiparesis worsened abruptly. Examination also revealed left hemineglect. The National Institute of Health Stroke Scale (NIHSS) was 15 (the NIHSS ranges from 0 indicating no signs or symptoms to 42 for the most severe category.)

Diffusion-weighted imaging revealed an area of restricted diffusion in the right hemisphere consistent with a watershed type acute infarct (see Figures 2a and 2b), whereas MR perfusion imaging showed a much larger area of impaired perfusion affecting the right middle cerebral artery (MCA) territory. A severe, 95-percent proximal right MCA stenosis was seen on cerebral angiogram. A self-expanding stent was placed at the site of stenosis. Clopidogrel was added and transcranial Doppler confirmed improved flow in the right MCA territory. The patient showed slight improvement and was discharged to the acute rehabilitation unit on hospital day eight.

**Case 2**

A 62-year-old patient with hypertension, type 2 diabetes mellitus, hyperlipidemia and a history of a prior stroke presented with increased left-side weakness and numbness. The diabetes was diet controlled and the patient was taking a daily aspirin and a statin. Examination confirmed weakness of grip and wrist extension in the left hand, impaired sensation and pronation of the left hand. An initial head CT showed no acute change.

Diffusion-weighted images (see Figures 3a and 3b) showed a small area of restricted diffusion involving the right middle cerebral artery/anterior cerebral artery (MCA/ACA) watershed region. MR perfusion imaging revealed a much larger area of diminished perfusion involving most of the right hemisphere. Magnetic resonance angiography (MRA) of the neck revealed a
dissection with high grade stenosis in the mid-cervical internal carotid artery. Heparin was started. A stent was placed on hospital day two. MRI showed complete resolution of the perfusion defect. The patient’s neurological status returned to baseline and the patient was discharged home on hospital day 10.

**Conclusion**

MR perfusion is a powerful tool that can be performed rapidly to assess relative blood flow in the brain. Areas of the brain with decreased perfusion surrounding a focus of acute infarction represent the “ischemic penumbra,” or surrounding area at risk for conversion to infarction. This data can be used to guide medical and endovascular or surgical management. (Moftakhar, et al.) The perfusion technique used in our practice emphasizes perfusion abnormalities in larger vessels because larger vessels are more amenable to intervention than smaller vessels, as detailed in the two cases above. We are engaged in active collaboration with Stanford Hospital & Clinics in the DEFUSE-2 trial to better understand this technique and optimize its use.

**References**


Emerging concepts in vascular neurology:
TIA clinics help prevent strokes and unnecessary hospital admissions
Michael Fruin, ARNP Swedish Neuroscience Institute

Tom Jaspee placed an anxious call to Dr. Lewis’s office at 9 a.m. sharp. He didn’t give many details, other than to say his wife was worried about problems he was having with his speech the previous night. Later that morning in Dr. Lewis’s office, Tom said he had had trouble getting his thoughts out for a few minutes. He said he felt fine immediately afterwards and didn’t want to raise a ruckus. Tom’s wife added that his right face drooped and the episode took almost 30 minutes to clear up. She was worried that Tom had suffered a stroke.

Dr. Lewis was well aware of Tom’s high risk of stroke following his transient ischemic attack (TIA). Realizing that he could not manage this urgent issue in his office, Dr. Lewis sent the patient to the emergency room and after a six-hour stay, Tom was admitted as an inpatient for a 24-hour observation and evaluation.

This mock case study highlights the role a TIA clinic might have played in avoiding an emergency room visit and hospitalization, while still providing the TIA patient the necessary urgent care.

While hospital admission is appropriate for the subset of patients at high risk for having a stroke after TIA, significant numbers of emergency room visits and admissions could be avoided by a recent advance in evaluating patients in a TIA clinic. TIA clinics are being pioneered in the United Kingdom, where patients with TIA can be seen by a stroke specialist in an urgent-care clinic setting in which a standardized protocol of neurologic evaluation and diagnostic testing is administered.

Cerebral microemboli (Continued from page 1)

There is strong evidence that MES detection predicts future ipsilateral stroke risk in patients with symptomatic carotid stenosis (Markus HS, et al.; King A, et al.). A recent study of patients with asymptomatic carotid stenosis demonstrated that MES predicted subsequent ipsilateral stroke and TIA, and also ipsilateral stroke alone, and that it is helpful in selecting patients who will benefit from carotid endarterectomy (Markus, HS et al.).

Identification of active embolization provides crucial physiologic information to the neurologist and can also aid in the selection of tailored therapy aimed at reducing the risk of stroke. Emboli from different sources have unique compositions and require specific therapy, such as antiplatelet agents for emboli from large artery atherosclerotic plaque and anticoagulants for cardiac emboli.

Future advances in TCD technology will permit full automation and better identification of the composition and size of circulating embolic materials, thus improving its value for patients with cerebrovascular disease.

Contact Colleen Douville, RVT, at colleen.douville@swedish.org or 206-320-4080, for more information about TCD for detection of cerebral microemboli.

References

TCD for Emboli Monitoring

Patient location: Inpatient ward, neurointensive care unit, or outpatient clinic
Set up time: 10 minutes
Typical duration of monitoring: 20 minutes to one hour
Tech supervision during monitoring: Yes
Patient discomfort: Minimal, but must remain still for monitoring period
Special ultrasound equipment required: Yes
Specialized technologist skill required: Yes
PFO closure for migraine

Mark Reisman, M.D., Chief Scientific Officer and Director, Cardiovascular Research & Education; Cindy J. Fuller, Ph.D., Research Scientist; and Jill T. Jesurum, Ph.D., Scientific Director, Swedish Heart & Vascular Institute

Migraine is a primary headache disorder that causes significant suffering in approximately 13 percent of the population of the United States. It accounts for an estimated $23 billion in annual cost to the economy through health-care expenses and lost productivity.

Two major features of migraine are migraine aura (MA) and headache. MA occurs in nearly one-third of migraine patients and consists of one or more focal neurological symptoms that develop gradually over 5-20 minutes and persist for less than 60 minutes. MA typically precedes development of migraine headache.

Several years ago single-center retrospective analyses first reported an apparent association between partial or complete relief of migraine symptoms and transcatheter closure of patent foramen ovale (PFO) for secondary stroke prevention (Reisman M, et al., 2005). The foramen ovale normally serves as a one-way valve in the interatrial septum for physiologic right-to-left shunt in utero. Complete fusion of interatrial septae normally occurs by two years of age. When septae fail to fuse, however, the PFO is a potential tunnel that can be opened by reversal of the interatrial pressure gradient. PFO is the most common form of right-to-left circulatory shunt (RLS).

Studies have shown that as many as 50 percent of individuals with MA will have a PFO, whereas PFO is present in about 25 percent of the general population and in migraineurs without aura (MO). In analyses performed by Swedish researchers, MA patients had a larger RLS than patients with MO, despite similar interatrial anatomy (Jesurum JT, et al., 2007), and were about 4.5 times more likely to have greater than 50 percent reduction in migraine frequency following PFO closure (Jesurum JT, et al., 2008). These observations indicated a potential pathophysiological relationship between migraine and PFO.

The mechanism for this potential relationship is not understood, but investigators have focused on possible interatrial transit of vasoactive chemicals that bypass the pulmonary capillary bed, or on microemboli from the venous circulation which might trigger cortical spreading depression and transient regional hyperperfusion. Migraineurs may have higher platelet reactivity (Jesurum JT et al., 2010) or pro-coagulant state (e.g., protein C or S deficiency) than non-migraineurs, possibly resulting in greater load of microemboli in the arterial circulation. The brains of migraineurs may be more sensitive to circulatory changes than are the brains of those without migraine. The combination of potential triggers and susceptible neuronal substrate may result in an enhanced risk of MA among patients with PFO.

The Migraine Intervention with STARFlex Technology (MIST) trial was a randomized trial of PFO closure in migraine (Dowson A et al.). The failure of the trial to meet its primary endpoint (cessation of headache) and secondary endpoint (>50-percent reduction in headache frequency and days) was surprising. Eligibility criteria for the trial may have excluded those patients who were most likely to benefit from PFO closure. For instance, patients were excluded from MIST if they had a history of stroke or hypercoagulability, and subjects had to fit within a narrow range of headache frequency. If patients with a greater migraine burden or hypercoagulability were more likely to achieve meaningful reductions in headache frequency and severity, these exclusion criteria could have altered the study outcome.

Other trials are in progress or in the pipeline that may better elucidate the effect of PFO closure on migraine. The migraine-PFO association offers opportunities for collaboration between scientists and clinicians in both neurology and cardiology. The long-term goals of collaborative trials are improved quality of life and reduced cerebrovascular sequelae for individuals who suffer from migraine.

References

AROUND SNI

Swedish Neuroscience Institute Staff Photo – 2010
AROUND SNI

TMS: A new way to lift depression

Transcranial magnetic stimulation (TMS) is a Federal Drug Administration-approved therapy for treatment-resistant depression, and may also be effective for depression associated with Parkinson’s disease, tinnitus, chronic pain and other conditions. It uses repetitive pulses from a 1.5-Tesla electromagnet to activate neuronal circuits in targeted cortical regions, such as the left dorsolateral prefrontal cortex, for depression. TMS is part of the services (in addition to electroconvulsive therapy, deep brain stimulation and vagus nerve stimulation) that are offered by Seattle Neuropsychiatric Treatment Center (SeattleNTC) in conjunction with SNI’s Center for Neurological Restoration. For more information, see www.seattlentc.com.

Biking to create a world free from MS

For two days and 150 miles, a team of 102 registered riders – the Swedish Smyelin Babes – took a stand against multiple sclerosis. This year’s Bike MS Ride through Skagit County was a testament to the dedication these riders share as they rode through all kinds of weather – sun, rain and even a bit of hail – to raise money for the National Multiple Sclerosis Society. The team, which raised $76,938.21, was one of the few groups to raise more than 100 percent of its goal. Bike MS helps fund research, education, and support programs and services for individuals diagnosed, their families and friends, and health-care professionals who had dedicated their careers to treating and finding a cure for MS.

Team captain Lily Jung Henson, M.D., MMM, FAAN, reminds Swedish employees, and their friends and families, that it’s not too soon to think about being part of this great effort next year. For more information about the MS Society, or to join next year’s Swedish Smyelin Babes team, go to http://bikewas.nationalmssociety.org./
2000 walkers help fight brain cancer

More than 2,000 people arrived at the Seattle Center’s Mural Amphitheatre Saturday, June 26, to show their support in raising awareness and finding a cure for brain cancer. The 3rd Annual Seattle Brain Cancer Walk, which was hosted by Accelerate Brain Cancer Cure, raised more than $434,000. These funds will benefit multiple local organizations that focus on brain cancer research and patient care in the Pacific Northwest, including the Ben and Catherine Ivy Center for Advanced Brain Tumor Treatment at the Swedish Neuroscience Institute. Working together, these organizations use groundbreaking research and integrative patient care in their search for a cure for brain cancer. Their progress brings hope to the 22,000 Americans – 1,200 in the Pacific Northwest – who are diagnosed with a malignant tumor each year, and to patients’ families and friends. If you would like more information on how you can make a donation and be part of this effort, please contact Davida Pennington at 206-320-3629.

Introducing students to neuroscience research

Six undergraduate and three high-school students participated in the 2010 Summer Research Program at Swedish Neuroscience Institute (SNI). The program, which is in its second year, was presented by Dan Rizzuto, Ph.D., SNI’s research manager and John Henson, M.D., FAAN, director of Neurology at SNI. The 10-week program included training in research ethics and basic neurology, as well as weekly seminars from SNI physicians. Each student was assigned a research project and was individually mentored by a physician investigator. The program has generated at least one publication, entitled “The Impact of Electroconvulsive Therapy on Visuospatial Navigation and Memory,” for submission to the Journal of ECT.

Special thanks to the Swedish project mentors: Annabaker Garber, R.N., Ph.D.; Michael Doherty, M.D.; James Bowen, M.D.; Lily Jung Henson, M.D.; Bart Keogh, M.D., Ph.D.; Kenneth Melman, M.D.; Gregory Foltz, M.D.; Jill Jesurum, Ph.D.; Cindy Fuller, Ph.D.; Nameeta Shah, Ph.D.; John Henson, M.D.; and Philip Mease, M.D.
AROUND SNI

Brain tumor board launches WebEx® remote conferencing

The brain tumor board at Swedish/Cherry Hill successfully launched its first WebEx® conference on Monday, Nov. 29, from a Seattle Science Foundation conference room. Namou Kim, M.D., presented a case remotely from his office at Swedish/First Hill, and a staff member from the Ben and Catherine Ivy Center for Advanced Brain Tumor Treatment attended the conference from a location on the East Coast. The WebEx software allows providers to attend the conference remotely via desktop computer and telephone when a patient they refer is being discussed. It also allows them to present films and pathology to the subspecialists present onsite at the conference. The program will now be offered as a service to physicians throughout the Pacific Northwest. For more information or to present a case, contact John W. Henson, M.D., FAAN, at john.henson@swedish.org or 206-320-2300.

Clinical Neurophysiology Lab receives accreditation

The Laboratory Accreditation Board of the American Board of Registration of Electroencephalographic and Evoked Potential Technologists (ABRET) has granted the Clinical Neurophysiology Lab at the Swedish Neuroscience Institute a five-year accreditation. The lab is the first and only lab in Washington, and one of only 10 labs west of the Mississippi, to receive accreditation.

“We are proud of this accomplishment,” said Colleen Douville, RVT, director of Cerebrovascular Ultrasound and program manager for Clinical Neurophysiology. “In this age of quality, safety and outcome measurement, this is an important step in the right direction.”

ABRET based its award on the lab meeting strict standards, as well as the technical quality of the EEGs performed in the lab and the excellence and competency of the Swedish technologists.

“This accreditation reflects the work of many people,” said Jehuda Sepkuty, M.D., medical director of the Swedish Epilepsy Center and Clinical Neurophysiology. “It is a personal accomplishment for each of us, and underscores the exceptional diagnostic service we are able to provide physicians caring for patients with epilepsy.”

Clinical Neurophysiology Lab

Annually the lab provides long-term video EEG-monitoring for more than 700 adult and pediatric patients, and diagnostic EEG and EP studies for more than 1800 patients.

To refer a patient for testing at the Clinical Neurophysiology Lab, please call the clinic at 206-386-3880 or lab at 206-386-2178.

SNI Grand Rounds

The Swedish Neuroscience Institute Grand Rounds Series provides a forum for physicians and allied health professionals to enhance their diagnostic, clinical and treatment skills regarding current and emerging treatments for neurological conditions. The bi-weekly program offers one-hour didactic lectures on a specific neurology topic with time reserved for questions and answers. Grand Rounds are held the first and third Thursdays of each month at Swedish/Cherry Hill. For a schedule of upcoming presentations, go to www.swedish.org/snigrandrounds. To view recorded programs, go to www.swedish.org/RecordedCMEs, and select Neuroscience Grand Rounds from the Recorded CME Catalog.
SNI Updates

Swedish MS specialists James Bowen, M.D., and Lily Jung Henson, M.D., played an instrumental role in clinical trials leading to recent FDA approval of fingolimod, the first oral agent for multiple sclerosis patients.

William Likosky, M.D., medical director of Stroke and Telestroke at SNI, will head an American Heart Association community effort to provide “My Life Check,” a computerized program available to residents of Snohomish and King County to reduce their personal risk of heart and cerebrovascular disease. www.heart.org/mylifecheck

Lily Jung Henson, M.D., has been appointed to the national board of directors of the National MS Society. She was also a recent guest speaker at the annual luncheon of the MS Society’s Greater Northwest Chapter.

Marc Mayberg, M.D., co-executive director of SNI, has completed the second year of his six-year tenure on the editorial board of the Journal of Neurosurgery.

David W. Newell, M.D., co-executive director of SNI, completed his tenure as president of the Western Academy of Neurosurgery presiding over the organization’s annual meeting in Santa Fe, New Mexico.

John W. Henson, M.D., SNI director of neurology and editor of BrainWaves, was elected president of the Washington State Neurological Society in October.

Michael Doherty, M.D., has been named a fellow of the American Academy of Neurology for demonstrating significant and consistent contribution to the field of clinical neurology.

SNI pediatric neurologist Marcio Sotero, M.D., assumed the position of medical director of the newly opened Swedish Pediatric Neuroscience Center in August. The center is located at 600 Broadway, Suite 400.

SNI member Eugene May, M.D., leads the Washington State NeuroAlliance, a coalition of advocacy groups in Washington state that represent individuals with neurological conditions. The organization met at Swedish/Cherry Hill in September.

Jehuda Sepkuty, M.D., medical director of the Swedish Epilepsy Center, co-directed the Second International Neurology Symposium in September in Mexico City. Among the roster of other internationally renowned speakers were SNI neurologists James Bowen, M.D., Susie Ro, M.D., and Marcio Sotero, M.D.

At the 8th Annual Neurocritical Care Society meeting in September, Arthur Lam, M.D., FRCPC, medical director of Neuroanesthesia and Neurocritical Care, co-directed two workshops on the Utility of Transcranial Doppler in Neurocritical Care.

Dan Rizzuto, Ph.D., director of SNI Research, and John W. Henson, M.D., director of SNI Neurology, launched SNIblog.com in June. (See the editorial on page 2 of this issue.)

“Tiki the Marble Run,” short fiction by SNI’s Michael Doherty, M.D., is the 2010 Rusty Gates Memorial Honorable Mention Story and recipient of the Robert Traver Fly-Fishing Writing Award presented by Fly Rod & Reel. www.flyrodreel.com/fly-fishing/the-marble-run

SNI neurohospitalist and stroke specialist Amer Malik, M.D., and his wife Toba Niazi, M.D., are the proud parents of a beautiful baby girl Zara Malik, born Nov. 28. Zara means “bright as the dawn” in Arabic. ❖

Thrombolysis

(Continued from page 3)

vampire bat, this agent has a longer half life than alteplase and does not break down basement membranes, leading to a lower risk of hemorrhagic complications. The Swedish Stroke Program is part of an international effort to test this drug in a nine-hour window.

Todd Czartoski, M.D., and Bart Keogh, M.D., Ph.D., are collaborating with the stroke team at Stanford University to identify patients with viable ischemic tissue regardless of time from onset of symptoms. Perfusion MRI identifies impaired blood flow in brain (the “penumbra”) surrounding an infarct. In cases where there is a large area at risk, the use of alteplase or clot retrieval may prove beneficial long after the three-hour window has elapsed.

Telestroke is another important development in acute stroke care. This program enables the timely alteplase treatment of patients in emergency rooms around the Pacific Northwest that lack onsite neurological expertise.

For more information about the Swedish Stroke Program, contact Sherene Schlegel, R.N., FAHA, at 206-320-3484. For information about telestroke, contact Tammy Cress, R.N., MSN, at 206-320-3112. ❖
Arteriovenous malformations (AVM) are abnormal, direct connections between the arterial and venous circulations, without intervening capillaries, that usually arise in the pial covering of the brain. When untreated, AVMs carry a risk of devastating intracranial hemorrhage of 2 - 4 percent per year. In a large, long-term study of untreated brain AVMs, it was found that out of 100 patients, one patient would have a fatal hemorrhage and another one patient would be left disabled from a hemorrhage.

Several factors increase the risk of hemorrhage from AVM, including the presence of associated arterial or venous aneurysms within the feeding or draining vessels, venous outflow stenosis, drainage of the AVM to deep intracranial venous structures, and small size. Small size would seem to be counterintuitive, but smaller lesions have higher arterial pressure than larger lesions. A similar consideration occurs during the embolization procedure, when the pressure can increase in the feeding artery as the size of the AVM decreases or if venous outflow is restricted, thereby increasing the risk hemorrhage.

In order to minimize morbidity and mortality that comes with treatment of these difficult brain anomalies, the approach to treatment of an AVM must be individualized for each patient based on the unique pathological anatomy. Prior to treatment, the location of the AVM relative to vital areas of the brain is evaluated using conventional multiplanar angiography and 3D angiography (see Figure 1), computed tomographic angiography (CTA) and MRI. The relative position of the AVM to speech, motor and visual cortex is critical to safe and effective removal. Localization of local brain function can also be facilitated by selective injection of amobarbital into the feeding arteries in and around the nidus of the AVM. Amobarbital suppresses brain function in the perfused arterial territory for about 10 minutes. Neurologic testing can be conducted before and after amobarbital injection to help determine the precise location of language, motor and visual function.

An interesting effect seen with some AVMs is the relocation of brain function to unusual areas during brain development. For instance, language and motor areas can be located many centimeters away from their normal location in patients whose AVMs arise in eloquent cortex. Multilingual patients may have separate language areas, as did one Swedish patient with English anterior to his AVM and native language posterior to the lesion.

Treatment considerations of AVMs include endovascular embolization, neurosurgical resection and Gamma Knife® radiosurgery. Smaller AVMs, under 3 centimeters in size, are amenable to treatment with Gamma Knife. Larger AVMs usually require a combined approach, with embolization to devascularize the lesion prior to surgical resection or to
shrink the nidus so radiosurgery will be more effective.

A variety of embolic agents are employed, depending on the location of the AVM and whether surgery or radiation will be employed. Glues, liquid plastic and plastic particles, coils and even silk suture material are used in selected situations.

Dural AV fistula

Dural arteriovenous fistulas (AVF) are composed of an abnormal direct communication between the arterial and venous circulation that arise in the intracranial or spinal dura. They can cause intracranial hemorrhage, cranial nerve palsies, headaches, glaucoma, vision loss or tinnitus. The signs, symptoms and risks vary with the precise location along the dural structures.

The risk factors for intracranial hemorrhage with dural AVFs include cortical venous drainage, which is the inverse of the situation with pial AVMs as described above, and subfrontal, tentorial and torcular locations. Catheter angiography is needed to determine the presence of cortical venous drainage.

Intracranial dural AVFs can be located anywhere along the dural venous sinuses. Figure 2a shows a patient with proptosis, chemosis and tinnitus. A pulsatile bruit was present over the orbit. CT and MRI revealed a dilated superior ophthalmic vein in the orbit, and on conventional angiography the AVF was composed of multiple small fistulas in the cavernous sinus. This cavernous AVF is distinct from the carotid-cavernous fistula in which a direct communication occurs between the cavernous segment of the internal carotid artery and the cavernous sinus following traumatic dissection of the artery wall. The angiogram (see Figure 2b) revealed drainage of the AVF into the superior ophthalmic vein anteriorly and into the inferior petrosal sinus posteriorly.

Cavernous AVF is treated emergently if there is any vision loss. Treatment is aimed at obliterating the nidus of the AVF which is the focal point where all of the fistulas converge on the draining vein. Complete closure of the AVF occurred after transvenous embolization (see Figure 3a). Coils were placed into the nidus resulting in thrombosis of the fistulas (see Figure 3b). The patient's eye and vision returned to normal over a three–week period.

AVFs near the transverse sinus often result in pulsatile tinnitus and headaches. Lesions in this location rarely undergo hemorrhage. Subfrontal dural AVFs involve the dura just anterior and superior to the orbit. These are supplied by the ophthalmic artery and can sometimes be embolized preoperatively. These lesions drain exclusively into cortical veins of the subfrontal region and therefore bleed frequently.

Tentorial dural AVFs arise from branches of the cavernous carotid posteriorly and drain into cortical veins along the edge of the tentorium. These lesions often present with posterior fossa hemorrhage. Large lesions in this location can be treated with transvenous coil embolization similar to the case in the illustrations. Small tentorial dural AVMs often require transarterial embolization with liquid embolic agents such as cyanoacrylate. Dural AVFs along the torcular are located at the junction of the superior sagittal and transverse sinuses and can be particularly dangerous due to a high rate of posterior fossa hemorrhage. Treatment usually involves a combination of embolization and surgery for complete obliteration.

Dural AVFs can also involve the Vein of Galen, and straight and superior sagittal sinuses. Treatment of these lesions can be difficult. AVFs along the spinal canal can lead to severe spinal cord dysfunction due to high venous backflow pressure in Foix-Alajouanine’s syndrome.

Conclusion

AVMs and AVFs are high-risk lesions because of the resulting neurological deficits and hemorrhage if left untreated. Treatment considerations are highly complex and require advanced diagnostic imaging, as well as formulation of a multidisciplinary treatment approach by subspecialists who are experienced in the endovascular, neurosurgical and radiosurgical treatment of intracranial vascular lesions.
Robust clinical trials enrolment at SNI

Clinical trials are an important component of advanced neurological care for SNI’s patients. The charts to the right show the upward trend in the number of research studies open and in total clinical trials enrollment. Sixteen patients enrolled in trials in October. Dan Rizzuto, Ph.D., Research Manager, Swedish Neuroscience Institute.

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