NEUROtransmitter

A PUBLICATION OF SANTA BARBARA NEUROSCIENCE INSTITUTE AT COTTAGE HEALTH SYSTEM

spring **2010**

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Case Studies in the Next Issue

- Quantitative Blood Flow Analysis
- "Drip and Ship" tPA
- Novalis Tx™ and Cranial Tumors
- PFO Closure—Recent Advances

Dear Colleague,

Welcome to the inaugural edition of *NEUROtransmitter*, a publication of Santa Barbara Neuroscience Institute in collaboration with leading physicians and select scientists.

Three times each year, you will receive a complimentary copy of *NEUROtransmitter*. Our goal is to provide physicians with neuroscience news you can use. The articles—brought to you by members of our physician community—will include case studies to illustrate real-world scenarios and explain how these cases were managed. In addition, we will invite scientists to write neuroscience articles on topics with clinical applications.

The publication comes at an exciting time as we lay the foundation for Santa Barbara Neuroscience Institute. The Institute is the culmination of our efforts to bring together medical professionals with disparate talents but shared interests to work toward a common goal: to improve the quality of care for our patients with neurologic illnesses. For that reason, our initial emphasis will be on our core services—stroke, neurotrauma, neurovascular/endovascular, brain tumor treatment and neurospine. Our aim is to become a neuroscience center of excellence.

We welcome your feedback and hope the *NEUROtransmitter* will become an anticipated part of your professional reading.

Sincerely,

Thomas H. Jones, MD
Neurosurgeon and Medical Director
Santa Barbara Neuroscience Institute

About Santa Barbara Cottage Hospital and Cottage Health System

The not-for-profit Cottage Health System is the parent organization of Santa Barbara Cottage Hospital (and its associated Cottage Children's Hospital and Cottage Rehabilitation Hospital), Santa Ynez Valley Cottage Hospital and Goleta Valley Cottage Hospital.

On the Cover: The cover illustration by Josh Emerson represents an arteriovenous malformation (AVM) in the brain. It portrays the feeding arteries, the nidus as well as the arterialized venous outflow. In addition, the close relationship of the nidus to the ventricular system is highlighted. Featured in this inaugural publication is a case study of the treatment and management of an AVM.

Saving the Brain
2009 Highlights

The agenda for the second annual Saving the Brain Symposium covered advances in neuroscience critical care medicine. Save the date and plan to attend the next conference, coming up on October 2, 2010.

THE SECOND ANNUAL Saving the Brain Symposium was held this past fall at the Fess Parker's DoubleTree Resort in Santa Barbara. Approximately 200 physicians, nurses and ancillary team members attended the conference, which was presented by Santa Barbara Cottage Hospital and the Santa Barbara County Consortium for Continuing Medical Education, to learn more about the latest advances in the neurosciences.

The theme of the 2009 symposium was "Neuro-Critical Care Medicine and Its Role within the Hospital Setting." One presentation, "The Critical Care of Stroke," was given by Stephan Mayer, MD, who addressed emerging trends from the perspective of a critical care neuro-intensivist. In another, Greg Albers, MD, spoke on "Extending the Time Window for Stroke Therapy Using Advanced Imaging Techniques." These and other leading experts from across the United States gathered to deliver a total of 13 presentations.

Now entering its third year, the Saving the Brain Symposium has established itself as a cornerstone for high-level neuroscience education on the Central Coast.

To view videos and slide decks from many of the presentations given at the 2009 symposium, visit our website at www.sbni.org.

"The Saving the Brain Symposium provides an opportunity for medical professionals from multiple subspecialties to share news about advances in the neurosciences. I welcome the chance to confer with colleagues in my field of interventional neuroradiology."

—Fernando Vinuela, MD; professor of radiology; director of interventional neuroradiology division, Ronald Reagan UCLA Medical Center

Plans for the third annual neuroscience conference are now underway. Save the date for the next Saving the Brain Symposium, to be held in Santa Barbara on October 2.

To be placed on an early bird registration list, contact the program committee at neuro@sbni.org.

Presenters at the 2009 Saving the Brain Symposium included (clockwise from bottom left): Gregory Albers, MD; Fernando Vinuela, MD, Alois Zauner, MD, and Sujit Prabhu, MD; Stephan Mayer, MD, FCCM; and J. Claude Hemphill III, MD, MA.

Versatile Platform for **Image-Guided Radiosurgery**

The Novalis Tx™ system has raised the standard for non-invasive, image-guided radiation therapy (IGRT).

> "The Novalis platform was developed for intracranial conditions. However, its larger field size makes it an ideal system to effectively treat early stage lung cancer and tumors of the spine, liver, pancreas and prostate."
>
> —Thomas Weisenburger, MD, FACR, radiation oncologist; medical director, Cancer Center of Santa Barbara

OFFERING CLEAR BENEFITS for physicians and patients, this powerful, state-of-the-art technology is now available through the Cancer Center of Santa Barbara.

"In 2007, we began looking at platforms to replace our linear accelerator," says Thomas Weisenburger, MD, FACR, radiation oncologist and medical director of the Cancer Center of Santa Barbara. "The Novalis Tx was our clear choice based on its efficiencies and applications for radiosurgery, radiotherapy and image-guided radiation therapy."

Compared with other technology options, the Novalis Tx requires shorter treatment times to deliver precisely focused, high-energy radiation to a localized area. This capacity makes it ideal for destroying tumors often judged inaccessible via conventional surgery—malignant and benign lesions, brain metastases and arteriovenous malformations—as well as for conditions such as trigeminal neuralgia.

CURRENT INDICATIONS

The field size of the Novalis Tx enables it to be used to treat tumors in sensitive locations throughout the body, from brain and spine to genitourinary organs. Another reason for broader usage indications is that the equipment can deliver smaller daily doses for several weeks, a method that retains effectiveness yet minimizes the likelihood of treatment-related injury to sensitive locations.

"If a patient requires fractionated treatment of a benign or malignant tumor in or around the brain, our platform has that capability," says Dr. Weisenburger. "We can also provide frameless radiosurgery for most brain tumors, an approach that is considerably more comfortable for the patient."

FURTHER BENEFITS

For delivering IGRT, the platform is unequalled. Its 6-D robotic treatment couch moves in three directions and also tilts and pivots for precise patient positioning. Novalis reduces the time needed to achieve accurate treatment, in most cases from longer than an hour to only minutes.

"As a result of its shortened delivery time, Novalis often eliminates the need to immobilize the patient with a head ring attached to the skull," says Dr. Weisenburger. "It allows us to achieve unprecedented precision when treating patients with cancers involving the prostate, spine, lungs, head or neck."

In addition, shared use of Novalis software facilitates collaboration among radiation oncologists, neurosurgeons and referring physicians during IGRT.

For more information about the Cancer Center of Santa Barbara or to refer a patient, call (805) 682.7300. To learn more about our services, visit www.ccsb.org.

Thomas Weisenburger, MD, FACR, Radiation Oncologist

Lessons Learned on the **Journey to Primary Stroke Center Certification**

In August 2009, Santa Barbara Cottage Hospital became the only facility on the Central coast to achieve Primary Stroke Center Certification from The Joint Commission, demonstrating a solid commitment to meeting or exceeding national standards and guidelines for improving stroke outcomes.

"WE WANT TO MAKE SURE we're doing what's best for patients, and adhering to The Joint Commission's stroke care criteria is in everyone's best interest," says Phil Delio, MD, stroke neurologist and medical director of the stroke program at Cottage. "Paramedics across the country—including those in Los Angeles—are increasingly routing stroke patients to hospitals with a certified stroke center because of the specialized care available at these locations. We recognized and responded to the need to keep pace with this trend and to demonstrate our commitment to stroke care."

At Cottage, a multidisciplinary team of clinicians and nurses worked toward certification for four years. A committee meeting was held every two weeks throughout the process to identify areas for improvement. Cottage implemented a number of changes to its stroke care protocols as a result of the process. They included:

- written protocols for treatment of different types of stroke and triage of patients in the emergency department
- pre-hospital forms for paramedics to use in transit
- order sets and sheets for use once a patient arrives at the hospital dictating how nurses record and chart the patient's progress, how the patient is evaluated and how medications are administered
- quality improvement meetings to review cases that fall below standard

Cottage provides stroke interventions, such as clot retrieval and intra-arterial thrombolytic therapy, that are found primarily in larger medical centers. In addition, Cottage utilizes the expertise of a neurocritical care specialist.

"The most striking difference in our stroke care now compared to pre-certification is that each person involved in caring for patients does so as part of an integrated team rather than in his or her own isolated arena," says Dr. Delio. "Obtaining our Primary Stroke Center Certification truly speaks to the strength of our program and infrastructure."

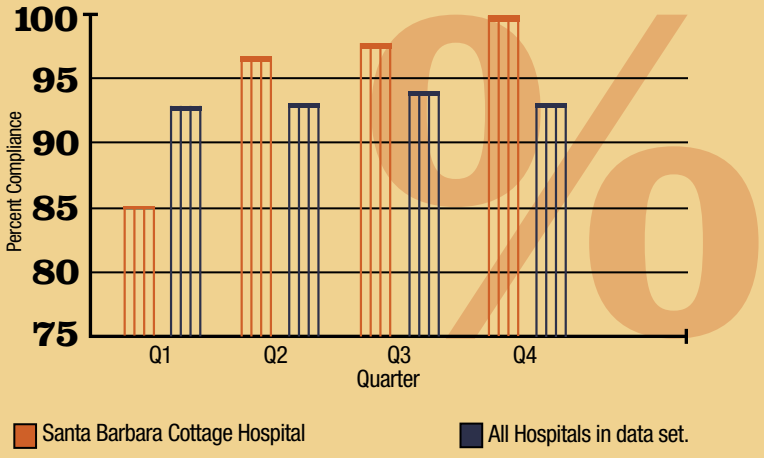
To learn more about Cottage's experience with the stroke certification process or to obtain copies of our protocols and guidelines, e-mail stroketeam@sbch.org.

Phil Delio, MD,
Stroke Neurologist

The Joint Commission requires applicants for Primary Stroke Center Certification to demonstrate excellence in 10 core measures, including deep vein thrombosis prophylaxis, administration of thrombolytic therapy and dysphagia screening. After Santa Barbara Cottage Hospital implemented the infrastructure and process changes necessary to achieve certification, process and outcomes scores rose from the 70 percent range on most measures to nearly 100 percent.

Stroke Composite Scores—2009

The composite quality-of-care measure indicates how well Santa Barbara Cottage Hospital provides appropriate, evidence-based interventions for each patient compared with all hospitals in the American Heart Association's "Get With the Guidelines" database.



Look for more information about neurocritical care at Cottage in the next issue of *NEUROtransmitter*.

Arteriovenous Malformation (AVM) CASE STUDY

Case Presentation: A 40-year-old male patient presented with new onset of grand mal seizures over a two-month period. The initial brain MRI from an outside hospital demonstrated enlarged vessels involving the right temporal lobe consistent with an AVM.

by Alois Zauner, MD, Neurosurgeon and Neurointerventionalist (shown above in the angiosuite)

AVM EMBOLIZATION PROCEDURE

Embolization is done through a microcatheter advanced into feeding arteries. From there, embolic material is injected into the nidus over a certain period of time under fluoroscopic guidance. Onyx® is an FDA-approved alcohol-based liquid and cohesive embolic material now routinely used to embolize cerebral vascular lesions. Each Onyx injection takes 30 to 60 minutes. Generally, two to three feeding arteries are used for each embolization, depending on the microcirculation and anatomical structure of the AVM. Each procedure takes approximately two to three hours and is done under general anesthesia. The patient typically spends one to two days in the intensive care unit for neurological examination and close observation of blood pressure.

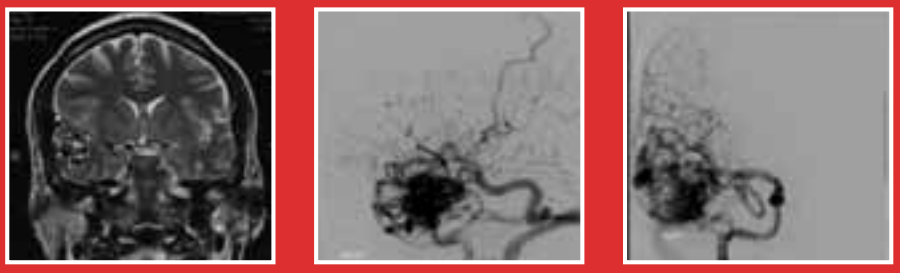


Figure 1: Diagnostic imaging found a Spetzler-Martin Grade III AVM with a diameter of 3 cm x 4 cm, feeding from branches of the right middle cerebral artery, the anterior choroidal artery and the posterior cerebral artery. The venous drainage involved the superficial and deep venous drainage system. In addition, several direct arteriovenous shunts were noted. No arterial or venous aneurysms were associated with the AVM.

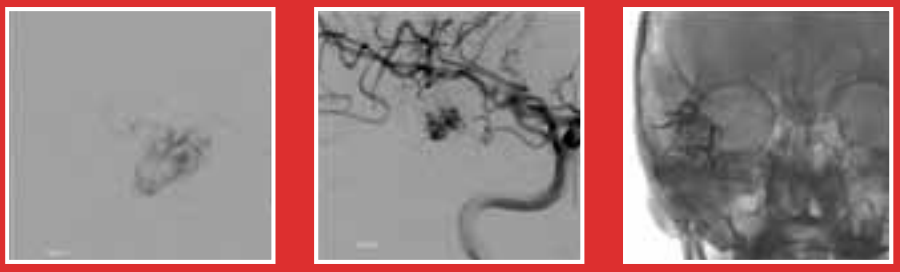


Figure 2: Following two embolization procedures, imaging shows the residual AVM and the "Onyx cast" or embolic material that was injected. The Onyx embolizations closed off more than 90 percent of the nidus without compromising the venous outflow of normal venous blood.

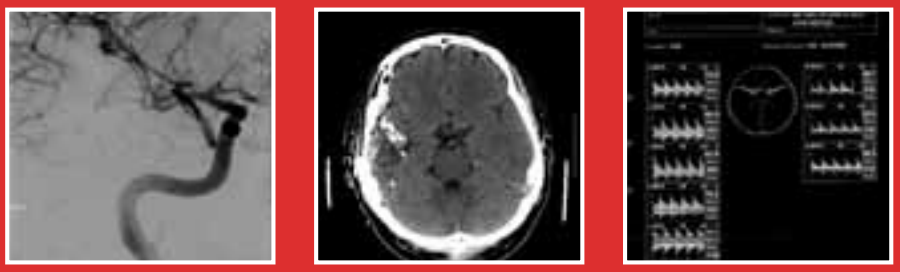


Figure 3: The postoperative CT scan showed no stroke or hemorrhage; only residual embolic material and postoperative changes are seen. The transcranial Doppler flow studies demonstrated normal antegrade flow in the right middle cerebral artery.

FOLLOWING REFERRAL to Santa Barbara Neuroscience Institute, the patient was started on Keppra (levetiracetam) to prevent additional seizures, and a diagnostic cerebral angiography was performed. (The results of the brain MRI and the cerebral angiogram are illustrated in **Figure 1**.) The patient then underwent two Onyx® embolization procedures scheduled approximately one week apart. To reduce the perioperative risks for hemorrhage, only 30 to 45 percent of the nidus (center) of the AVM was embolized in each session.

This patient received a total of three injections through branches and feeding arteries of the right middle cerebral artery and one injection via the basilar artery and the posterior cerebral artery. **Figure 2** demonstrates a microcatheter injection and portions of the nidus prior to embolization. The final angiogram shows less than 10 percent of residual nidus. This portion of the AVM was not embolized, as it would have been at significant risk to the patient. This particular area is fed from the anterior choroidal artery. This artery carries blood not only to the AVM but also to very important normal brain structures, such as the internal capsule and the basal ganglia. Treating this portion of the AVM with surgical resection or radiosurgery would be significantly safer.

AVM ERADICATION OPTIONS

After the second embolization, a discussion with the patient and his family took place on two options for completely eliminating the AVM. The first option would be a craniotomy and surgical resection of the residual nidus, including most of the injected Onyx material. The second option would involve radiosurgery—utilizing either Gamma Knife®, a linear accelerator, or CyberKnife®—to deliver high-dose focal radiation to the residual nidus while shielding the rest of the brain tissue.

In this case, surgical resection was the better choice for several reasons: the patient was young and otherwise healthy; the AVM surgical risks were low after more than 90 percent of the nidus was occluded with embolic material; and the location of the AVM (right side and temporal lobe) was favorable for surgical resection.

A right-sided craniotomy and resection of the AVM was performed using standard neurosurgical and microsurgical techniques. Intraoperative advantage was taken using BrainLAB frameless navigation to localize the residual nidus and the draining veins. The procedure was uneventful. Standard AVM protocols included a postoperative angiogram to be certain the entire AVM was removed and confirm no angiographic signs of early venous drainage. **Figure 3** demonstrates the postoperative angiogram without any evidence for residual AVM.

The patient recovered very well from the surgery and was discharged on postoperative day five without neurological deficits. He returned to work approximately four weeks after surgery.

To access an in-depth video presentation of this case by Dr. Zauner with 3-D rotational angiograms and other cases, and additional images, visit our website at www.sbni.org.

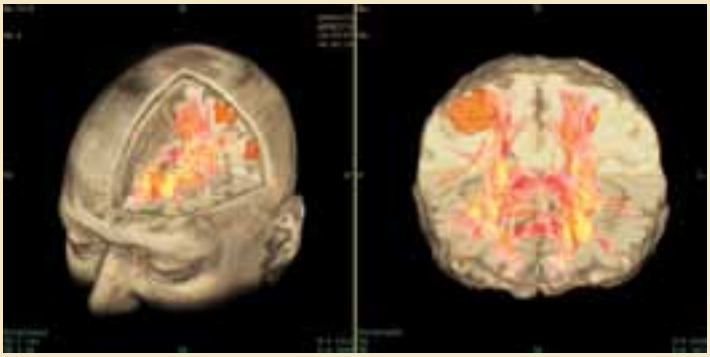
Sean Snodgress, MD, Neuroradiologist

Diffusion Tensor Imaging as a Pre- and Intra-Operative Tool

Magnetic resonance imaging (MRI) has a wide variety of applications in the field of neuroimaging. The plasticity of MRI has resulted in ongoing development of many new applications utilizing this imaging modality, one of the latest of which is the technique of diffusion tensor imaging (DTI), now available for outpatients at the Cottage Center for Advanced Imaging and for inpatients within Santa Barbara Cottage Hospital.

DTI IS RELATED TO diffusion weighted imaging (DWI), a widely used MRI sequence that is the most sensitive technique available for detection of early acute stroke. DWI maps the amount of random motion of water molecules within the brain. Areas of the brain undergoing infarction experience cellular changes that restrict the random motion of water molecules, and this change can be detected with the DWI technique. DTI goes a step further; it maps the net direction of the motion of water molecules within the brain.

"DTI is a technique that allows us to indirectly map white matter tracts—the information highways of the brain," says Sean Snodgress, MD, neuroradiologist at Cottage Center for Advanced Imaging. "Imagine a large number of ping-pong balls moving in random directions in a box. Because the movement is random, no net direction of movement exists. If a series of dividers are placed within the box, however, the motion becomes less random—the balls now preferentially move parallel to the dividers. If we can detect the net direction of movement of the ping pong balls, we can infer the orientation of the dividers.



Three dimensional diffusion tensor images are created to demonstrate the course of white matter tracts within the brain. DTI allows for surgical planning designed to avoid white matter tracts, which convey neural signals crucial for movement, speech, vision and other important brain functions.

"The ping pong balls are analogous to water molecules in the brain, and the dividers to the white matter tracts that connect neurons in the brain and spinal cord," continues Dr. Snodgress. "DTI identifies the direction of movement of those water molecules in high detail, and from that motion we can infer and map the course of the white matter tracts in the brain."

DTI is performed on the 3T magnet at the Cottage Center for Advanced Imaging. The DTI sequence adds approximately five minutes of imaging time to a routine brain MRI.

Once a DTI scan has been completed, the information is transferred to a workstation in the hospital operating room, where the images can be reviewed and manipulated by the neurosurgical staff prior to and during surgeries.

"By using DTI images pre- and intra-operatively, a neurosurgeon can localize the white matter tracts in the area of a tumor or other lesion to be resected," says Dr. Snodgress. "The surgical approach can be altered to spare the white matter tracts responsible for vital functions, such as speech and movement. This can have a very significant effect on the patient's level of functioning following surgery."

COMMITTED TO ADVANCING DIAGNOSTIC TECHNOLOGY

DTI has been available at Cottage for approximately six months.

"The push to get DTI at Cottage was initiated by Dr. Zauner," says Dr. Snodgress, referring to Alois Zauner, MD, neurosurgeon. "It is his goal to equip Cottage with the most advanced technologies in neuroimaging."

The addition of this new technology represents one of many ways radiologists and surgeons at Cottage collaborate to provide the safest and most effective therapy.

"DTI allows us to visualize anatomy that cannot be characterized using any other imaging technique," says Dr. Snodgress. "It provides a tool which can significantly impact patient outcomes."

For more information about DTI and other imaging services available at Cottage Center for Advanced Imaging, visit www.cottageadvancedimaging.com.

Bio-Image Informatics: Better Tools for Neurology and Neurological Research

by Anna Davison, Senior Writer

Imaging advances have provided invaluable insights into the functioning of the human body. Now, powerful tools are being developed to better use this information for diagnosing and treating illness and injury.

CLINICIANS AND RESEARCHERS who study the brain rely on several advanced technologies: magnetic resonance imaging to pinpoint brain tumors and guide neurosurgeons; positron emission tomography to locate amyloid plaques in the brains of Alzheimer's patients; and advanced microscopy techniques to better view biological processes at the cellular and molecular levels. These cutting-edge imaging technologies generate enormous quantities of data that present a considerable challenge to analyze, store and access.

"Digital imaging is pervasive in research and medical applications today, yet much of the analysis is done laboriously by humans," says B.S. Manjunath, PhD, professor of electrical and computer engineering at the University of California, Santa Barbara (UCSB), and director of the university's Center for Bio-Image Informatics, an interdisciplinary research effort encompassing biology, computer science, statistics, multimedia and engineering.

"The infrastructure to manage this information is lagging behind the imaging technology itself," Dr. Manjunath adds. "Much critical-analysis information is not available to the decision makers. Doctors, for example, currently cannot easily search through image records to make comparisons, retrieve pertinent information and arrive at informed decisions."

To maximize the use of these imaging technologies, the UCSB team is developing a system to help manage microscopy images and quantitatively analyze bio-image data. The aim is to advance understanding of biological processes by developing and utilizing advanced techniques incorporating imaging, pattern recognition and data mining.

The Bio-Image Semantic Query User Environment (Bisque) system integrates image analysis with database management functionalities, creating a powerful tool for the exchange and exploration of biological images. Bisque handles up to 5-D images, and allows users to store, access, analyze, annotate and share images and related data with colleagues. Now being used at several laboratories in the United States and overseas, the system's nascent online repository includes more than 13,000 biological images.

> "UCSB and Cottage are in the preliminary stages of developing a joint research program with planned facilities on the campus for translational medical research."
>
> —Prof. Francis J. Doyle III, Associate Dean for Research, College of Engineering

MANAGING METADATA

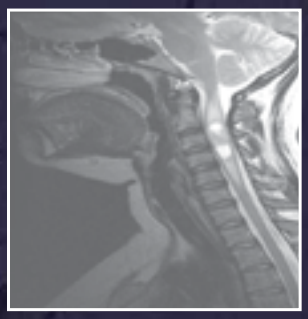
To bridge the gap between microscope and database, researchers with the Center for Bio-Image Informatics have developed another application—Scientist's Digital Notebook—to help users create the metadata required by the Bisque database and rapidly upload images to the system. Now one of the most popular downloads from the center's website, the application allows researchers to manage large collections of biological images and related metadata on local machines and within the Bisque system.

The aim is for tools like these to enable researchers—and future clinicians—to take full advantage of cutting-edge imaging technologies to help patients.

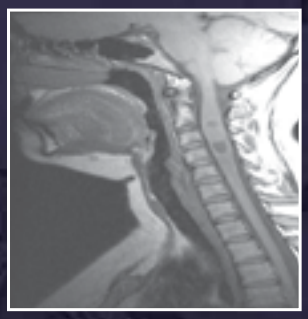
To download the Bisque Database or Digital Notebook applications or learn more about the UCSB Bio-Image Semantic Query User Environment system, visit www.bioimage.ucsb.edu.

Thomas H. Jones, MD, Neurosurgeon and Medical Director, Santa Barbara Neuroscience Institute

These three MRI scans show sagittal images of a patient with an intramedullary ependymoma of the cervical spinal cord.



The first is a T2 weighted sagittal image of the cervical spine showing the tumor surrounded by a typical syrinx (white fluid). Above and below the syrinx is edema in the spinal cord.



The second is a T1 weighted image.

The third is a T1 after gadolinium enhancement revealing the tumor turning white.

Treatment Strategies for Intramedullary Tumors

by Thomas H. Jones, MD, Neurosurgeon and Medical Director, Santa Barbara Neuroscience Institute

Intramedullary tumors (IMT) of the spinal cord are rare, representing only 2 to 4 percent of all CNS intrinsic tumors. However, in the pediatric cohort, they account for 10 percent of CNS neoplasms.

ASTROCYTOMAS, EPENDYMOMAS AND hemangioblastomas, appearing largely benign histologically, represent the majority of intramedullary neoplasms. These lesions are typically slow-growing and expansile, and patients generally present with back pain and/or sensorimotor dysfunction. Astrocytomas represent 90 percent of the IMT in children under age 10 and 60 percent in adolescents. Ependymomas predominate in midlife and after age 60, are roughly statistically equivalent to astrocytomas.

The differential diagnosis of intramedullary mass lesions includes subependymomas, metastases from extraneural cancers, demyelinating disease, vascular malformations, parasitic cysts, sarcoidosis and subacute myelomalacia related to extrinsic compression from spondylosis and/or disc herniations.

DIAGNOSTIC EVALUATION

A thorough history is essential. The physician must look for the clinical signatures of other disease processes. For instance, demyelinating disease is frequently suggested by a history of recurring neurologic events affecting disparate anatomic areas of the CNS. Such historical clues should prompt a diagnostic brain MRI or CSF analysis. Pulmonary symptoms might trigger a more thorough workup looking for evidence of sarcoidosis. A rapidly deteriorating clinical course, particularly in a patient with a history of cancer (esp., small cell lung cancer or melanoma), would raise the specter of an intramedullary metastases.

MRI is the diagnostic tool of choice and, renal function permitting, should be ordered with and without the IV administration of gadolinium. Ependymomas tend to be slightly hyperintense on T2 images, often have clear tumor margins, uniformly enhance with gadolinium and the majority are associated with syringomyelia. Astrocytomas are less likely to enhance or have clear tumor margins and are slightly less likely to have an associated syrinx. Hemangioblastomas are generally smaller, circumscribed, highly vascular lesions which are pia-based, dorsally located and are also commonly associated with large syrinxes.

Remember the increased likelihood of IMT in patients with neurofibromatosis (NF1 or NF2), one of the most common autosomal dominant heritable diseases. Additionally, von Hippel-Lindau syndrome is an autosomal dominant neurocutaneous disease strongly linked to multifocal CNS hemangioblastomas as well as other systemic tumors, including those in the pancreas, kidney and pheochromocytomas.

CLINICAL MANAGEMENT

In symptomatic patients, IMT consistent with ependymoma or astrocytoma should undergo surgical exploration and attempted resection. Typically, most ependymomas can be grossly excised through a midline myelotomy and long-term cure anticipated. In patients with astrocytomas, the surgical treatment hinges on the development of a plane of dissection. In most series, a total gross resection is possible in only 50 to 70 percent. Hemangioblastomas can be resected in most patients, although those with von Hippel-Lindau syndrome, who tend to develop multiple lesions, should be operated upon only if worsening while being followed. A standard surgical approach includes use of microsurgical techniques supplemented by sensory and motor-evoked potentials. Radiation therapy is reserved for incompletely resected astrocytomas, in patients considered too ill for surgery or those who have lost most neurologic function by the time of clinical presentation.

For more information, please e-mail sbni@sbch.org or visit our website at www.sbni.org.

Breakthroughs in REHABILITATION

REHABILITATION HOSPITAL FOUNDATION

Hans S. Keirstead, PhD, Co-Director of the Sue and Bill Gross Stem Cell Research at the University of California Reeve-Irvine Research Center and Associate Professor of Anatomy and Neurobiology

Cottage Rehabilitation Hospital at Santa Barbara Cottage Hospital has long been recognized for innovative clinical care and superior outcomes. As part of a continuing effort to remain on the forefront of medical rehabilitation, Rehabilitation Hospital Foundation, which supports Cottage Rehabilitation Hospital, is hosting a lecture addressing recent advances in stem cell research.

THE GUEST SPEAKER, Hans S. Keirstead, PhD, co-director of the Sue and Bill Gross Stem Cell Research at the University of California Reeve-Irvine Research Center and associate professor of anatomy and neurobiology, will discuss his research into limiting degeneration and enhancing regeneration after spinal cord injury and disease.

"Dr. Keirstead is world-renowned for his numerous and significant strides in the field of stem cell research," says Tom Reeg, administrator of Rehabilitation Hospital Foundation. "We look forward to having such a dynamic and knowledgeable speaker share his perspective on how stem cells may contribute to rehabilitation and future medical cures."

PAVING THE WAY

A pioneer in the use of human embryonic and adult stem cells, Dr. Keirstead is currently working to find treatments for patients with spinal cord injuries and central nervous system diseases, such as multiple sclerosis and amyotrophic lateral sclerosis.

The lecture is open to the public. After the presentation, physicians are invited to join Dr. Keirstead at a small dinner meeting featuring a panel discussion.

To reserve a seat at Dr. Hans Keirstead's lecture and the dinner on June 14, contact Tom Reeg at (805) 569-8999, extension 82143, or treeg@cottagehealthsystem.org.

Cal-Neuro NETWORK

What is the Cal-Neuro Network? The Cal-Neuro Network is a multi-hospital collaborative established by Santa Barbara Cottage Hospital (SBCH) for the care and advanced treatment of neurologic emergencies. As a Certified Stroke Center, SBCH has formed this network to offer its resources to patients and physicians in the surrounding communities and beyond.

Why have a network at all? While the significant investments in neuroscience technology and human resources are not feasible for all hospitals, every patient should have access to the highest levels of care possible.

When do I access the network? It is important to note that the network does not take the place of neuroscience resources in your local hospitals. The network is to be contacted only after consultation with your local on-call neurologist and/or local neurosurgeon.

How do I learn more? Please contact Gary Milgram, Service Line Director at gmilgram@sbch.org or call (805) 682-7111 x82008.

Cal-Neuro NETWORK

Cal-Neuro Network, a multi-hospital collaborative established by Santa Barbara Cottage Hospital

24-HOUR CONSULTATION

Ischemic Stroke, ICH, SAH, AVM, brain aneurysm and other neurovascular emergencies

Transfer Center:
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(1-888-692-2563)

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Cottage Health System is pleased to present

saving the brain

The 3rd Annual Neuroscience Symposium of the Central Coast featuring nationally recognized guest speakers, along with experts in the Neurosciences from Santa Barbara Cottage Hospital

Saturday, October 2, 2010
7:15 AM to 4:15 PM
Fess Parker's DoubleTree Resort
633 East Cabrillo Boulevard
Santa Barbara, CA 93103

mark your calendar