Comprehensive Care for Children:
The Practice of Pediatric Neurological Surgery at UCSF

Pediatric neurosurgical care at UCSF has expanded substantially during the past five years. “Our long-term goal is to develop comprehensive treatment for complex neurological disorders that require a large team of pediatric specialists,” says Nalin Gupta MD, PhD, chief of pediatric neurological surgery. By integrating translational research with a multidisciplinary approach to patient care, these specialists can bring new therapies into clinical practice. Here are some of the areas of expertise that are growing with a new arsenal of techniques and equipment and the addition of faculty with rare expertise.

Epilepsy

Approximately 1.3 million children worldwide have epilepsy and nearly 200,000 of them have symptoms that can not be controlled with medication. “If children do not respond after being treated with two different medications, they should be referred to an epilepsy center to determine if they are surgical candidates,” says Joseph Sullivan MD, an expert in treating refractory pediatric epilepsy. Sullivan joined UCSF in 2007, bringing with him unique experience from Children’s Hospital of Philadelphia where he was a fellow in pediatric epilepsy.

Surgery, which involves the removal of seizure ‘hot-spots,’ or foci, has dramatically changed the outlook for pediatric patients with epilepsy; 50% of patients have their seizures controlled and can go on to live without medications. Because younger children usually have a greater chance of functional recovery, an early referral for surgery is best. To determine if a child is a good surgical candidate, the team at UCSF’s Epilepsy Center uses a variety of tools to help determine the exact location in the brain where seizure foci are located. These include video electroencephalogram (EEG) recordings and a powerful 3 Tesla (3T) MRI scanner to provide exquisite anatomical detail. Physicians may also use recordings from a magnetic encephalogram (MEG), which is similar to EEG, but uses a magnetic field to study brain waves. An MEG can be done in just 24 hours, which is a significant advantage over the weeks of hospitalization required for standard EEG.

If seizure foci are located in eloquent cortex (areas of the brain required for language and hand movement), more detailed information is obtained by placing subdural grids directly on the brain surface to map electrical activity as precisely as possible. “Subdural grids allow us to map the foci in pediatric patients who would not be able to tolerate awake surgery,” says Gupta. “This decreases morbidity that can result from surgery and increases the safety.” Subdural grids, however, do require a two-stage operation and often mean a two-week stay in the hospital.

Recently, UCSF has begun using functional MRI (fMRI) techniques to localize language and motor centers in the brain. “fMRI is a noninvasive method of determining whether epileptic foci reside in the eloquent cortex,” says Sullivan. “It could replace Wada testing and determine early if patients are surgical candidates.” The pediatric epilepsy center is also bringing a neuropsychologist on board in 2008 who will take into account various cognitive factors and how patients function in their daily lives to determine the best treatment plan for each patient.

Cerebrovascular Disorders

The most common cause of spontaneous brain hemorrhage in children is an arteriovenous malformation (AVM) — a tangle of blood vessels and arteries that have the potential to burst open, often without any warning. AVM rupture can lead to major neurological problems and death in some cases. A study conducted at UCSF, however, has confirmed that children with AVMs can look forward to better functional outcomes than adults.2 The study revealed that factors such as KPS score, location, and severity made little difference when comparing the outcomes of adults with children following microsurgery. Pediatric

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Pediatric neurosurgery at the University of California, San Francisco (UCSF) is entering a period of exciting change in the next several years. First, a new UCSF Children’s Hospital will begin construction on the Mission Bay campus, next to downtown San Francisco. This state-of-the-art facility will incorporate cutting-edge surgical and monitoring devices that are designed to meet the unique healthcare needs of children. The new location will also be the home of the Helen Diller Family Comprehensive Cancer Center, which will, for the first time, house all members of the Brain Tumor Center, including researchers and clinicians specifically working on problems related to pediatric brain tumors.

The new Children’s Hospital will focus on creating an environment that will emphasize clinical research and the development of new treatments for pediatric diseases with a particular emphasis on the neurosciences. The developing nervous system is highly vulnerable to early injury, but can also rapidly adapt by assigning function to alternate areas of brain tissue from unnecessary injury. As risky, open surgeries become less feasible as children get older, minimally invasive techniques are being developed. Fetal surgery for myelomeningocele — which, according to Harrison, is the first non-life-threatening problem taken on using fetal surgery — is performed before the disorders in pediatric brain tissue from unnecessary injury. Should the abnormality be serious, investigators can then compare the outcomes of infants treated in utero to those treated after birth. Investigators hypothesize that treating the anomaly before birth has the potential to decrease mortality associated with spina bifida. “Our hope is that early closure of the spinal cord will reduce the secondary injury that occurs in utero and this may potentially reduce some of the lifelong disabilities associated with spina bifida,” says Gupta.

Fetal Surgery
Perhaps one of the most exciting advances in recent medical history, fetal surgery has the potential to treat patients before they are born. The Fetal Treatment Center at UCSF, founded by Michael Harrison MD, of the Department of Pediatrics, was the first of its kind and remains a leading center of innovation for evaluation of fetal anomalies and treatment using minimally invasive techniques.

In a recent interview with Jeff Miller of UCSF’s Science Cafe, Harrison described how endoscopic techniques are revolutionizing the field. While operating, surgeons consult sonograms for cross-sectional views of the fetus as well as an endoscope for viewing the instrumentation. As risky, open surgeries become replaced by safer, minimally invasive ones, surgeons are able to tackle conditions such as myelomeningocele — which, according to Harrison, is the first non-life-threatening problem taken on using fetal surgery.

Currently, the Fetal Treatment Center is participating in the first clinical trial of fetal surgery for myelomeningocele — a condition which may cause paralysis, deformity, or hydrocephalus and is usually discovered during the second trimester. The Management of Myelomeningocele Study (MOMS) is a randomized trial that will compare the outcomes of infants treated in utero to those treated after birth. Investigators hypothesize that treating the anomaly before birth has the potential to decrease mortality associated with spina bifida. “Our hope is that early closure of the spinal cord will reduce the secondary injury that occurs in utero and this may potentially reduce some of the lifelong disabilities associated with spina bifida,” says Gupta.

Further information:
1. To find out more about care for pediatric patients with epilepsy at UCSF, visit: http://www.ucsfhealth.org/childrens/medical_services/neurology/epilepsy/IID.html
2. To hear the episode "Translating Science: A Conversation with Pioneering Fetal Surgeon Michael Harrison," visit the website of UCSF’s award-winning Science Cafe: http://www.ucsf.edu/sciencecafe/2008/10/02.html
3. A fetal MRI image showing hydrocephalus in the fetal brain at 4-6 weeks. The image was obtained using a Fetal MRI in the animal imaging center at UCSF.
4. A Fetal MRI image showing a myelomeningocele sac (arrow) protruding from the posterior spine.
5. An open myelomeningocele defect is seen during fetal surgery.
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Finally, the continued success of our partnership with Children's Hospital and Research Center in Oakland (CHRCO) ensures that we are training the next generation of academic neurosurgeons to have strong backgrounds in pediatric neurosurgery and the residency rotation at CHRCO gives Department of Neurological Surgery residents exposure to a wide variety of cases. Peter Sun MD, director of neurosurgery at CHRCO, is vital member of our team and we are proud to partner with him in serving the community of Oakland.

patients uniformly did better, leading the authors to conclude that neural plasticity is the most important factor in recovery and making the case for aggressive microsurgical treatment to ablate the anomaly. “Pediatric AVMs are rare entities and we look forward to treating them because in general pediatric patients do very well,” says Michael Lawton MD, chief of cerebrovascular surgery. Surgical procedures for cerebrovascular disorders are done in conjunction with neurointerventional radiologists who perform preoperative AVM embolization — closure of large AVM vessels through a small catheter threaded into a major artery in the leg. For lesions affecting the vasculature that are inoperable, or for patients who can not tolerate surgery, Gamma Knife® radiosurgery provides a noninvasive option that delivers high-dose radiation directly to the abnormality while sparing surrounding brain tissue from unnecessary injury. Stroke is another disease that, while exceedingly rare in children, requires a multidisciplinary team to treat the myriad of morbidities associated with it. UCSF neurologist and pediatric stroke expert Heather Fullerton MD is an important member of the pediatric cerebrovascular team and has expertise in recognizing the symptoms of stroke in children and identifying effective treatment for each one.

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Gupta is also a co-investigator in the NIH-funded Fetal Myelomeningocele Trial (see page 2), a national randomized clinical trial evaluating the efficacy of fetal surgery for spina bifida. Finally, through collaborations with the Hydrocephalus Association and the Division of Neuropediatrics, ongoing investigations are beginning to define the incidence, prevention, and potential treatment options for patients developing hydrocephalus in childhood.

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selected publications


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The nonprofit organization Meningioma Mommies has recently awarded the Department of Neurological Surgery a $60,000 grant to support translational research into the genetic changes underlying the development of meningiomas and the use of this information to develop new therapies. On January 8, Liz Holman, co-founder of the organization, presented the check to Michael McDermott MD, professor of neurological surgery and Robert and Ruth Halperin Endowed Chair in Meningioma Research, and Arinta Lal PhD, assistant professor of neurological surgery and principal investigator of the UCSF Meningioma Research Laboratory. The program will fund a clinical database to capture patient data and further support long-term translational research on the disease.

For more information on Meningioma Mommies, visit their Web site at: http://www.meningiomamommies.org.

• The Department of Neurological Surgery has installed the newest model of the Leeksa Gamma Knife radiosurgery systems: the Gamma Knife Perfections®. The new machine has greater flexibility and reach than the previous model, allowing treatment of more areas of the head and neck. Neurosurgeons at UCSF have treated more than 3,000 patients with Gamma Knife radiosurgery since 1991.

• The Pediatric Low Grade Astrocytoma (PLGA) Foundation has awarded a grant to members of the Brain Tumor Research Center in honor of Jake Galen (www.btresearch.org) to study the possible stem-cell origin of PLGAs and explore new treatment options. The principal investigators of this new program are C. Michael Chang MD, professor and Berthold and Nile N. Guggenheim Endowed Chair of neurosurgical oncology; Graham Hodgson PhD, assistant professor of neurosurgical oncology; and David Rowitch MD, PhD, professor of pediatrics and neurosurgical oncology. For more information on the PLGA Foundation and the project funded at UCSF, please visit: http://www. fitlight.org/research.

• The Department of Neurological Surgery is pleased to welcome two new members. Biostatisti-


cian Mei-Yin Polley PhD, assistant adjunct professor of neurosurgical oncology, has joined the Brain Tumor Research Center and supplies input into the design, analysis, and reporting of new studies. Mariah AGHI MD, PhD, has joined the Department as assistant professor of neurosurgical oncology. Aghi specializes in surgery for adult brain tumors, with a special interest in pituitary surgery, and is leading a research project focused on understanding the neuro-ophthalmic corridor, with specific tumor types.

Mitchell S. Berger MD, Kathleen M. Plant Distinguished Professor and chair of the Department of Neurological Surgery, has been elected to the Board of Directors of the American Association of Neurological Surgeons (AANS). He has also been elected as a member of the American Board of Neurological Surgery.

Christopher Ames MD, assistant professor of neurological surgery, has been named the Cervical Spine Research Society in recogni-

tion of contributions to the study of the cervical spine.

Nicholas Barbaro MD, professor of neurological surgery, was the lecturer at the 2007 Sidney A. Hojn, MD Endowed Professorship at the Mount Sinai Hospital. He also gave the Annual William H. Sweet Lecture on Functional Neurosurgery and Pain at Massachusetts General Hospital.

Michael Beattie PhD, professor of neurosurgical oncology, has been appointed to the scientific advisory board of the Charles H. Neilsen Foundation.

Suzan Chang MD, professor and Lai Wan Endowed Chair of neurosurgical oncology, has been elected president of the Society of Neuro-Oncology.

Adam Ferguson PhD, postdoc-

torial scholar in the Department of Neurological Surgery, has been given the Michael McDermott Endowed Chair at the National Neurotrauma Symposium for work performed in the laboratories of Michael Beattie PhD and Jacqueline Brennan MD.

John Fike PhD, professor of neuro-

surgical oncology, has been appointed chief research officer of the Radiology and Biology Study Section at the National Institutes of Health (NIH).

John Forsayeth PhD, associate researcher in the Department of Neurological Surgery, has received a Michael J. Fox Foundation Rapid Response Innovation Award for a 12-month pilot project to evaluate a novel glioma-targeted treatment of Parkinson’s disease.

Graeme Hodgson PhD, assistant professor of neurological surgery, has received a junior faculty award from the UCSF Research Evaluation and Allocation Committee to study RNA interference therapeutics in pediatric brainstem gliomas.

Geoffrey Manley MD, PhD, associ-

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Michael McDermott MD, professor of neurological surgery, has been appointed chairman of the AANS-CNS joint section on tumors. Dr. McDermott and David Larson MD, PhD, professor emeritus of radiation oncology, also co-chaired the 2007 International Stereotactic Radiosur-

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Andrew Parsa MD, PhD, associate professor of neurological surgery, has been awarded the Reza and Georgian Khcht Endowed Chair in Skull Base Tumor Surgery.

Claudia Petrich PhD, assistant re-

search biochemist in the Department of Neurological Surgery, has received a grant from the Oligo Brain Tumor Fund of the National Institute of Neurological Disorders and Stroke. He has also been awarded a Research Fellowship by the ANNS Neurosurgery Research Education Foundation and the Kaiser Award for Clinical Research by the San Francisco Neurological Society. Dr. Sanai was additionally asked to serve as a guest editor for Neurosur-

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Philip A. Starr MD, PhD, associate professor and Dotoves Cavebrook Endowed Chair in neurological surgery, and Jill Ostrem MD, assistant professor of neurology, have been awarded a grant by the Benign Essential Blepharospasm Foundation to fund a clinical trial of deep brain stimulation for cranioce-


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surgery Clinics of North America.
The non-profit organization Meningioma Mommies has recently awarded a grant to the Department of Neurological Surgery a $60,000 grant to support translational research into the genetic changes underlying the development of meningiomas and the use of this information to develop new therapies. On January 8, 2008, Liz Holm, co-founder of the Foundation, presented the check to Michael McDermott MD, professor of neurological surgery and Robert Ruth Haldenreich Endowed Chair in Meningioma Research, and Anila Lal PhD, assistant professor of neurological surgery and principal investigator of the UCSF Meningioma Research Program. The program will fund a clinical database, evaluate patient data and further support long-term translational research on the disease. For more information on Meningioma Mommies, visit their website at: http://www.meningiomammoms.org.

The Department of Neurological Surgery has installed the newest model of the Leksell Gamma Knife radiosurgery systems: the Gamma Knife Perfexion®. The new machine has greater flexibility and reach than the previous model, allowing treatment of more areas of the head and neck. Neurosurgeons at UCSF have treated more than 3,000 patients with Gamma Knife radiosurgery since 1991.

The Pediatric Low Grade Astrocytoma (PLGA) Foundation has awarded a grant to members of the Department of Neurological Surgery in honor of Jake Gaynor (www.jakegaynor.org) to study the possible stem-cell origin of PLGAs and explore new treatment options. The principal investigators of this new program are C. Thomas James PhD, professor and Berthold and Belle N. Guggenheim Endowed Chair of neurosurgery; Graeme Hodgson PhD, assistant professor of neurosurgery; and David Rowitch MD, PhD, professor of pediatrics and neurological surgery. For more information on the PLGA Foundation and the project funded at UCSF, please visit: http://www.fight4plga.org.

The Department of Neurological Surgery is pleased to welcome two new members: Biostatistician Mei-Yin Polley PhD, assistant adjunct professor of neurosurgical surgery, has joined the Brain Tumor Research Center and supplies input into the design, analysis, and report of new studies. Marsha Aggi MD, PhD, has joined the Department as assistant chief professor of neurosurgical surgery. Aggi specializes in surgery for adult brain tumors, with a special interest in pituitary surgery, and is leading a research program focused on oncologic and functional vector therapies for glioblastoma.

Mitchel S. Berger MD, Kathleen M. Plant Distinguished Professor and chair of the Department of Neurological Surgery, has been elected to the Board of Directors of the American Association of Neurological Surgeons (AANS). He has also been elected as a member of the American Board of Neurological Surgery.

Christopher Ames MD, assistant professor of neurosurgical surgery, has been elected to the Cervical Spine Research Society in recognition of contributions to the study of the cervical spine.

Nicholas Barbaro MD, professor of neurological surgery, was the lecturer at the 2007 Sidney A. Hohn, MD Endowed Neurosurgical Chair at the Mount Sinai Hospital. He also gave the Annual William H. Sweet Lecture on Functional Neurosurgery and Pain at Massachusetts General Hospital.

Michael Beattie PhD, professor of neurosurgical surgery, has been appointed to the scientific advisory board of the Charles H. Nelson Foundation.

Susan Chang MD, professor and La Wan Endowed Chair of neurosurgical surgery, has been elected president of the Society of Neurological Surgery.

Adam Ferguson PhD, postdoctoral scholar in the Department of Neurological Surgery, has been given the Michael Goldberg Award at the National Neurotrauma Symposium for work performed in the laboratories of Michael Beattie PhD and Jacqueline Brennan MD.

John Fike PhD, professor of neurosurgical surgery, has been appointed chairperson of the Radiotherapie and Biology Study Section at the National Institutes of Health (NIH).

John Forsaith PhD, assistant researcher in the Department of Neurological Surgery, has received a Michael J. Fox Foundation Rapid Research Innovation Award for a 12-month pilot project to evaluate a novel treatment for Parkinson’s disease.

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Michael Sughrue MD, resident in the Department of Neurological Surgery, has been awarded a National Research Service Award and a Research Training Grant by NIH-NINDS (National Institute of Neurological Disorders and Stroke). He has also been awarded a Research Fellowship by the UCSF Neurosurgery Research Education Program and the Kaiser Award for Clinical Research by the San Francisco Neurological Society. Dr. Sughrue also asked to serve as a guest editor for Neurosurgery Clinicals of North America.

Philip A. Stad MD, PhD, associate professor and Dorothy Cardarelli Endowed Chair of neurosurgical surgery, and Jill Ostrem MD, assistant professor of neurology, have been awarded a grant by the Benign Epilepsy Research Foundation to fund a clinical trial of deep brain stimulation for craniofacial dystonia.

Michael Sanai MD, resident in the Department of Neurological Surgery, has been awarded a National Research Service Award and a Research Fellowship by the AANS for his presentation “The Natural History of Untreated Acoustic Neuroma.”

James Waldron MD, resident in the Department of Neurological Surgery, has been awarded a National Research Service Award by the NIH to fund his research “Inhibiting the AKT and Phosphatase Pathway in Malignant Glioma by Convection Enhanced Delivery.”

Charles B. Wilson MD, professor emeritus and former chairman of the Department of Neurological Surgery, was honored with the 2008 Cushing Medal at the AANS annual meeting on April 28, 2008. The Cushing Medal is the highest honor presented by the AANS and it was given to Dr. Wilson in recognition of his many years of outstanding leadership, dedication, and contributions to the field of neurosurgery.

Isaac Yang MD, resident in the Department of Neurological Surgery, has been awarded the Dandy Fellowship by the Congress of Neurological Surgeons.
selected recent publications from the department of neurological surgery


