



Neuroscience Institute

OVERVIEW AND OUTCOMES REPORT 2009



ABBOTT
NORTHWESTERN
HOSPITAL

Allina Hospitals & Clinics

NEUROSCIENCE INSTITUTE

Overview and Outcomes Report 2009

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On the Cover: Diffusion tensor images of the brain.
See page 13 and the inside back cover.

DOUGLAS H. YOCK JR, MD
Chairman, Neuroscience Physician Advisory Board



Abbott Northwestern Hospital's Neuroscience Institute combines skilled physicians, experienced staff, dedicated facilities, advanced technology and focused programs to provide a comprehensive resource for the care of any neurological condition.

The collaboration of more than 50 neurologists, neurosurgeons, neuroradiologists and rehabilitation physicians within the Institute offers a full range of subspecialized knowledge and skill. For 23 years, these physicians have worked together to develop exceptional programs in neurosurgery and neurology, including expert treatment for patients with strokes, seizures, brain tumors and spinal disorders. Care at the Neuroscience Institute is delivered by a team of 200 experienced neuroscience nurses and occurs primarily within a dedicated neuroscience unit with 46 private rooms.

Abbott Northwestern Hospital receives more referrals of patients with neurological conditions and performs more neurosurgical procedures than any other hospital in the Twin Cities. This large volume of experience reinforces the skill of our nurses and physicians. At the same time, the concentration of neuroscience cases enables Abbott Northwestern to continue to invest in specialized personnel and equipment.

During the past year there have been continued additions to the physician capabilities of the Neuroscience Institute. Benjamin Crandall, MD, joined our interventional neuroradiology group, working with David Tubman, MD, and John Perl, MD. Hart Garner, MD, joined the neurosurgical staff, working with Gregg Dyste, MD, and Robert Roach, MD.

The Neuroscience Institute has also continued to fulfill its role as a resource for information and education about care for neurological disorders. In 2008, we presented the 21st annual Front Line Neurology Symposium for primary care providers, and we sponsored a Regional Neuroscience Conference for neurologists and neurosurgeons. We also hosted several dozen community education sessions, clinics and screening events throughout the metropolitan area and at outstate locations.

Based on the resources available within the Neuroscience Institute, the volume and complexity of the cases we treat and the results we have obtained, Abbott Northwestern Hospital is consistently cited among the top hospitals in the country for neurology and neurosurgery by U.S. News & World Report. For the past seven years, our neuroscience program has been ranked among the top 50 in the nation.

Several specific strengths of Abbott Northwestern's Neuroscience Institute are worth emphasizing and are reviewed in more detail in the following pages. Cranial and spinal neurosurgery are supported by five dedicated operating rooms, advanced operating microscopes, computer-guided surgical navigation systems, intra-operative electrophysiology for real-time monitoring of nerve function and intra-operative computed tomography (CT) and magnetic resonance image (MRI) scanning. These technologies enable our neurosurgeons to maximize both safety and effectiveness.

Again in 2008, neurosurgeons at the Neuroscience Institute performed more than 400 brain operations, including about 200 procedures for removal of brain tumors. Abbott Northwestern Hospital is also one of the country's leading centers for spine surgery, with neurosurgeons and orthopaedic surgeons combining to perform nearly 4,000 spinal operations each year.



Another major strength of the Neuroscience Institute is care for patients with strokes and other vascular disorders of the brain. Abbott Northwestern's Stroke Program is certified as a Primary Stroke Center by the Joint Commission. Excellent stroke care is supported by our co-location and partnership with Sister Kenny® Rehabilitation Institute, the region's leading provider of services to restore neurological function. Through our NETwork Program, we are working successfully with hospitals and physicians outside of the metropolitan area to coordinate and streamline urgent care for outstate patients with neurological emergencies.

In addition, the Neuroscience Institute is home to a highly experienced Interventional Neuroradiology Service. These subspecialty physicians guide catheters into the arteries of the brain to treat aneurysms or strokes without surgery. In 2008, they accomplished the successful occlusion of more than 100 intracranial aneurysms without exposing patients to the risks of an open craniotomy.

The MINCEP Epilepsy Care Program at Abbott Northwestern Hospital is one of the largest in the United States, distinguished by outstanding results and a national and international reputation. The rapidly growing Brain Tumor Program, a collaboration between the Neuroscience Institute and Abbott Northwestern's Virginia Piper Cancer Institute™, is linked to neuro-oncology centers across the country, participating in multiple clinical trials to offer patients access to the most advanced treatment regimens. Both of these programs are supported by sophisticated diagnostic neuroimaging, including functional MRI studies performed on our 3.0 tesla scanner to localize areas of important brain activity prior to surgical intervention.

In summary, the past year has been a period of continued investment, advances, leadership and recognition for neurological care at Abbott Northwestern Hospital. As has been true for two decades, the high clinical volumes in our multiple programs continue to build skills and judgment. Together, the capabilities and experience of the Neuroscience Institute provide an outstanding regional resource for the treatment of neurological disorders.

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The Foundation for Excellent Care

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Neuroscience Inpatient Unit

The Neuroscience Inpatient Unit (H8000) is located on the top floor of Abbott Northwestern's Heart Hospital building. This award-winning space provides a complete healing environment, with care centered on the needs of neuroscience patients and their families.

Each of the 46 private rooms includes amenities for patients and visitors: a refrigerator, safe, DVD/VCR player and a family area with a separate phone, computer jack, reading lamp and seating that converts to a bed, allowing a family member to spend the night. For patient safety and comfort, each room has an overhead track with a lift that can be used to reposition patients or move them from the bed to the bathroom or a chair. Each private bathroom is equipped with grab bars, a lipless shower, a shower chair and several other safety features.

The epilepsy monitoring area of H8000 includes 11 rooms, nine of which have integrated video EEG capability. Four additional portable video EEG units can be

used in any room. Three of the epilepsy monitoring rooms feature special electrical circuits to ensure the safety of patients with intracranial monitoring grids. Because many individuals undergoing epilepsy monitoring are not acutely ill, they are encouraged to wear regular clothing and spend time outside of their rooms. A day room with games, puzzles and DVDs, a laundry room and group activities all contribute to an environment focused on health rather than illness.

This award-winning space provides a complete healing environment, with care centered on the needs of neuroscience patients and their families.



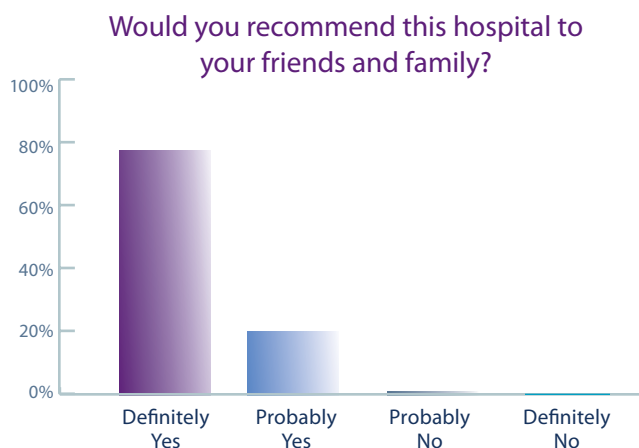
In addition to well-designed patient rooms, H8000 has two attractive waiting areas for patients and family members. The solarium features a fireplace, microwave oven, coffee maker, refrigerator and ample seating. The atrium offers a sense of tranquility, including a cascading water wall and two-story windows with an expansive view.

Two rehabilitation areas are incorporated into the unit to enable early assessment and initiation of treatment. The occupational therapy room includes a full kitchen and bathroom to allow patients to practice activities of daily living. The physical therapy room contains state-of-the-art rehabilitation equipment, including a driving simulator.

The Neuroscience Unit is staffed by 80 highly dedicated registered nurses. During the first year of employment on H8000, each nurse attends about 30 hours of classes focused on the care of patients with neurological illness or injury. Ongoing education is provided each year for all neuroscience nurses.

Inpatient Satisfaction Survey

The inpatient satisfaction survey instrument used by the Neuroscience Unit is HCAHPS (Healthcare Consumer Assessment of Hospital and Provider Services), which is recommended by the Centers for Medicare & Medicaid Services. The HCAHPS survey allows direct comparison of Abbott Northwestern's patients' experience to results from other institutions.



Neuroscience Critical Care Unit

Twelve beds in Abbott Northwestern's Medical/Surgical Intensive Care Unit (PB2000) have been designated and specially equipped to care for patients with severe neurological disorders. The Neuroscience Critical Care Unit (NCCU) provides the most advanced treatment available for critically ill neurological patients. State-of-the-art technologies, including video-EEG recording capability in each room, provide the constant monitoring necessary to accomplish the best possible outcomes for patients.

The NCCU is staffed by more than 140 registered nurses and 10 in-house intensivist physicians, 24 hours a day. Ongoing education programs and regular neuroscience teaching rounds promote the continuous introduction of new knowledge.

In addition to providing optimal patient management, the NCCU and its specialized staff enable the Neuroscience Institute to introduce promising new therapies and participate in national research protocols.

Hospital-based Neurology Service

OVERVIEW BY SARA LANGER, MD



Abbott Northwestern's hospitalist neurologist service provides timely consultation to patients in all sections of the hospital. There are three neurologists in the hospital every day to ensure optimal management of emergencies, provide initial evaluations of inpatients and direct consistent follow-up care.

Together with the other 50 physicians at Abbott Northwestern's Neuroscience Institute, the hospital-based neurologists evaluate and treat the entire spectrum of neurological disease. Consultations range from urgent assessment and treatment of stroke patients in the Emergency Department to referrals for evaluation and management of neuromuscular, movement and demyelinating disorders.

In 2008, the hospitalist neurologist service performed more than 2,200 consultations.

The NCCU is staffed by more than 140 registered nurses and 10 in-house intensivist physicians, 24 hours a day.





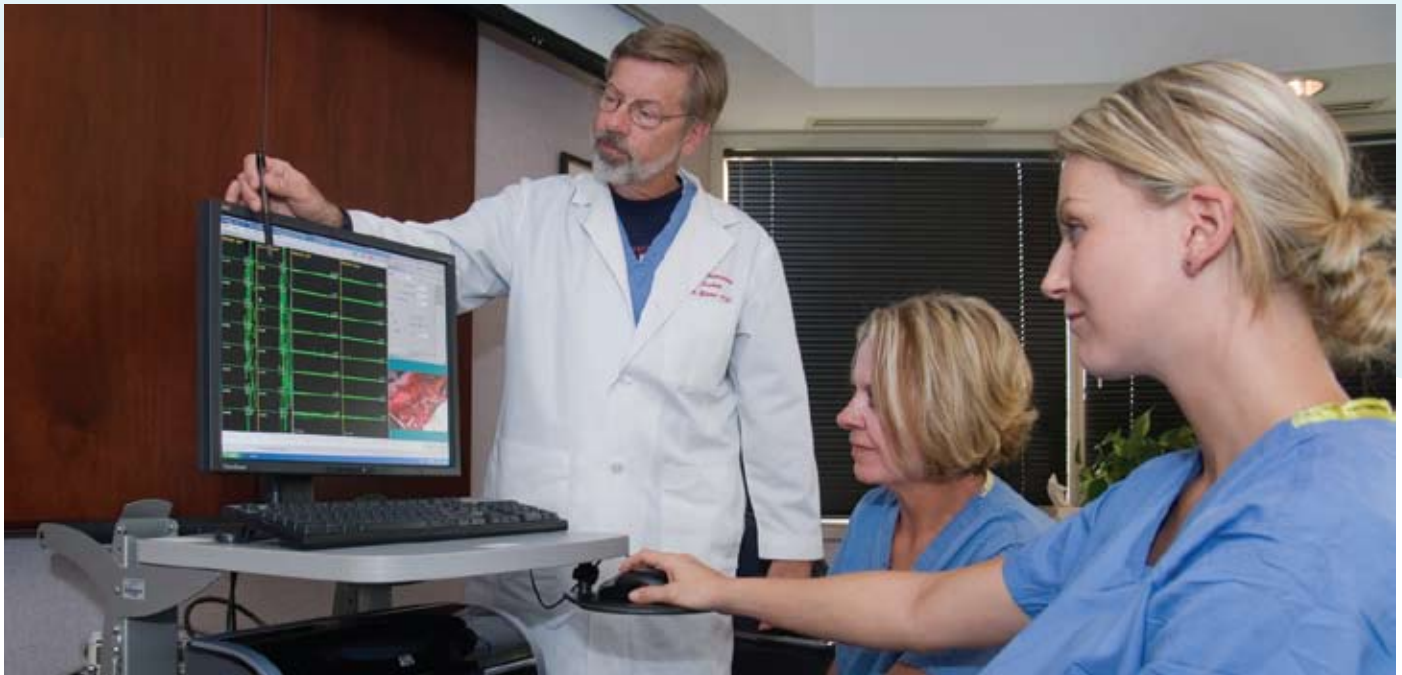
Neurosurgical Operating Rooms

The five dedicated neurosurgical operating rooms at Abbott Northwestern Hospital are supported by a specialty team of 30 perioperative and operative staff members. The team is highly experienced in the care of patients during complex neurosurgical procedures, performing more cranial and spinal neurosurgeries than any other hospital in the Twin Cities.

The neurosurgical operating rooms are equipped with advanced operating microscopes and computerized navigation systems. Intraoperative monitoring of cranial nerves and spinal cord function is routinely performed to protect patients from neurological injury. Portable O-arm intraoperative CT scanning is available, and one neurosurgical operating room is equipped with a moveable high field intraoperative MRI scanner (see page 14).

The combination of experienced personnel and leading-edge technology enables neurosurgeons at Abbott Northwestern to offer patients the best possible care for their condition.

The team is highly experienced in the care of patients during complex neurosurgical procedures, performing more cranial and spinal neurosurgeries than any other hospital in the Twin Cities.



Neurophysiology

OVERVIEW BY STANLEY SKINNER, MD,
MEDICAL DIRECTOR



The Neurophysiology Program performs a full spectrum of electrodiagnostic studies, including electroencephalography (EEG), evoked potentials (EP), electromyography (EMG) and intraoperative neuromonitoring (IONM). Two physician neurophysiologists staff the neurosurgical operating rooms.

Program professionals focus on both comprehensive clinical care and ongoing neurophysiology research, especially the development of advanced methods in electromyography and evoked potentials. These techniques have enabled our

intraoperative team of neurophysiologists and certified technologists to diagnose and intervene early during the evolution of intraoperative neural dysfunction, preventing or minimizing post-operative neurological deficits.

We are also actively involved in education, providing hands-on training and didactic instruction for departmental technologists and students from local neurophysiology programs. We have presented our experience nationally, and we have integrated the experience of other leading centers within our program. Our latest results and recommendations are published in *Clinical Neurophysiology*, April 2009.

The Institute's dedication to high quality neuro-physiological services has led to a significantly increased demand for EEG, EP, EMG and IONM studies as shown on the next page. Each study, whether in the diagnostic lab or in the operating room, is tailored to the patient. In particular, we believe our individualized approach to IONM is exceptional among neuromonitoring services, and we take pride in this distinction.

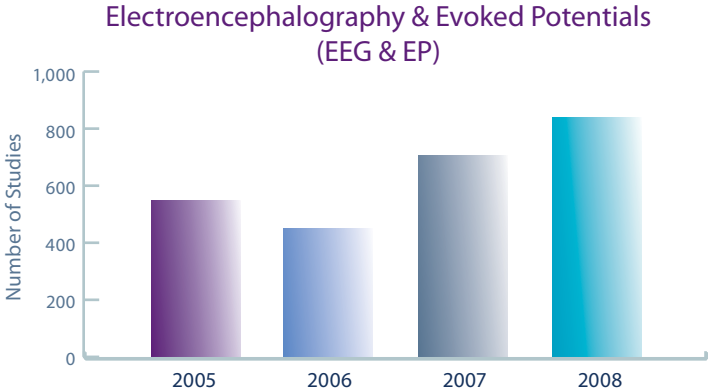
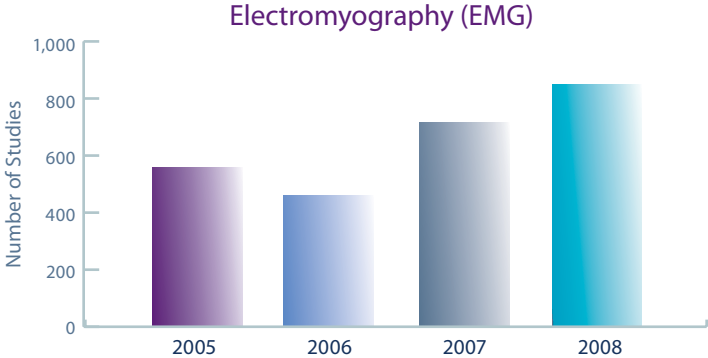
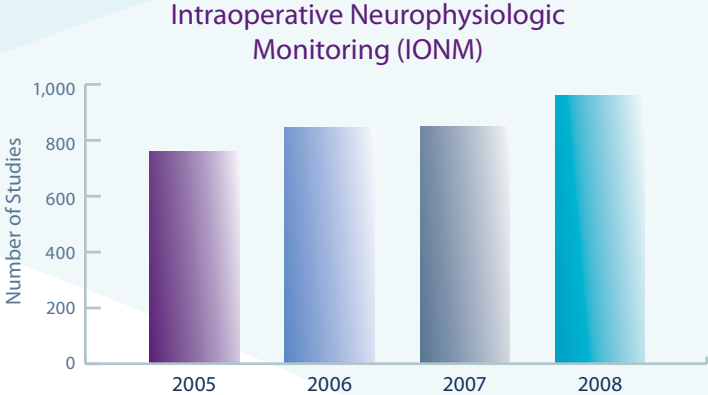
Our Commitment to Referring Physicians and Their Patients

We will:

- meet the highest standards of laboratory and intraoperative neurophysiology
- provide timely, accurate and pertinent reports to referring physicians
- improve the understanding and application of clinical neurophysiology through basic and clinical research.

Neurophysiology

VOLUME, QUALITY AND OUTCOME MEASURES



Diagnostic Neuroradiology

OVERVIEW BY NEERAJ CHEPURI, MD



The Diagnostic Neuroradiology Program is staffed by eight fellowship-trained neuroradiologists. They are responsible for interpretation of MRI and CT scans of the head, neck and spine and for performing CT- and fluoroscopically-guided biopsies, aspirations and injections.

Abbott Northwestern's Radiology Department has four high-field MRI scanners, three of which operate at a field strength of 1.5 tesla. The fourth scanner operates at 3 tesla. A fifth high field MRI scanner (moveable, wide bore, 1.5 tesla) is installed in one of the neurosurgical operating rooms to provide intraoperative imaging.

About 12,500 neurological MRI exams are performed annually, including anatomical MRI, MR angiography and physiological MRI.

Anatomical MRI scans provide images of the structure of the brain, neck and spine. The high contrast between normal and abnormal tissues on these scans allows the radiologist to detect and define most pathologies with greater sensitivity and accuracy than any other imaging technique. Additional diagnostic information can be generated by intravenous injection of a gadolinium-based contrast agent. The accumulation of contrast in abnormal tissue helps locate and characterize pathology.

MR angiography (MRA) depicts the anatomy and flow characteristics of blood vessels. MRA can be accomplished using a gadolinium-enhanced technique or a technique based on flow velocities that requires no intravenous contrast. The images resemble those from a conventional (catheter) angiogram, without the expense and potential risk of an invasive procedure.

Physiological MRI scans generate images based on physiological processes. This category of MRI scanning is more demanding of the equipment, the technologists performing the examination and the radiologists interpreting the examination. Physiological MRI includes:

- MR spectroscopy—an analysis of the biochemical composition within an area of brain tissue
- CSF flow imaging—demonstrating the circulation of cerebrospinal fluid within and around the brain and spinal cord
- MR perfusion imaging—analyzing the blood flow and blood volume in brain tissue
- diffusion tensor imaging and fiber tracking—showing the pattern of nerve fibers
- functional MRI—conducted while a patient performs a task inside the MRI scanner, with images showing the area of activated brain tissue.

Intraoperative MRI scans allow neurosurgeons to view the progress of resection during brain tumor surgery. This guidance enables more complete tumor removal, with less risk of damage to adjacent tissues.

The combination of preoperative functional MRI and intraoperative MRI has been performed several hundred times in the past year, contributing to the safe resection of the maximum amount of tumor. A diagnostic neuroradiologist is present during all intraoperative MRI procedures, collaborating with the neurosurgeon to optimize surgical results.



Neuroscience

Comprehensive Programs

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Cranial Neurosurgery Program

OVERVIEW BY MAHMOUD G. NAGIB, MD,
CHAIRMAN OF THE NEUROSCIENCE
DEPARTMENT



Clinical and academic neurosurgeons in several separate groups combine their expertise to provide outstanding care at Abbott Northwestern Hospital. Each year, nearly 2,000 neurosurgical procedures are performed at Abbott Northwestern, making it the busiest neurosurgical center in the Twin Cities.

The range of surgical procedures encompasses the entire spectrum of general neurological surgery, neuro-oncology, skull base surgery, cerebrovascular surgery, epileptology, congenital disorders and functional neurosurgery, as well as neuro trauma and its sequelae. Complex spinal neurosurgery of the entire neuraxis is also performed, as well as peripheral nerve surgery.

The neurosurgeons at Abbott Northwestern are supported by several important resources. We enjoy a longstanding collegial relationship with one of the busiest interventional neuroradiology groups in North America, allowing a high level of expertise in the management of complex cerebrovascular disorders. Combined procedures (endovascular and surgical) are frequently performed for optimal outcomes.

The presence of two full-time world-class neurophysiologists in the operating room provides real time monitoring of cranial or spinal nerves. This allows safe neurosurgical approaches for even the most complex skull base and spinal cord lesions.

Our neurosurgical operating rooms are equipped with advanced neuronavigation systems. Portable intraoperative CT scanning is available for cranial or spinal procedures. In addition, one of our neurosurgical suites houses a large-bore, high field, moveable intraoperative MRI scanner, providing outstanding real-time visualization and guidance for brain surgery.

More than 300 procedures, 28 percent of which involved pediatric patients, have been completed using the intraoperative MRI scanner since it was installed at Abbott Northwestern in June 2007. The intraoperative MRI suite has been visited by neurosurgical teams from across the country and by several international teams.

Functional neurosurgery is becoming increasingly important in the treatment of many conditions, including movement disorders. Abbott Northwestern is fortunate to have a skilled functional neurosurgeon with particular interest in the management of movement disorders.

A comprehensive epilepsy program has long been an integral part of the neurosurgical capabilities at Abbott Northwestern. Procedures include intraoperative cortical mapping, implantation of electrodes for long-term seizure monitoring on our epilepsy unit, microsurgical resection of epileptic foci, callosotomies and hemispherectomies.

The Neuro-Oncology Program at Abbott Northwestern Hospital is large and growing. Expert medical oncology and radiation therapy combine with neurosurgery to offer patients comprehensive treatment. A number of brain tumor protocols and trials have been developed. The presence of a dedicated neuropathologist on site has been a major contribution to diagnostic accuracy and treatment planning.

Together, these resources, capabilities and volumes constitute one of the leading neurosurgical centers in the country. We are pleased to report our results for 2008, and we look forward to continued advances in expert care for our patients.





In many cases, intraoperative scans have led to more complete and accurate resection of a tumor than would have been accomplished without this guidance.

Innovation in Cranial Neurosurgery

Intraoperative Magnetic Resonance Imaging

More than 300 brain operations have been performed in the intraoperative MRI suite at Abbott Northwestern Hospital. This moveable, wide bore, 1.5 tesla scanner has provided excellent image quality. In many cases, intraoperative scans have led to more complete resection of a tumor than would have been accomplished without this guidance. The result is reduced risk of tumor recurrence, reduced operative complications and reduced need for repeat craniotomies.

Intraoperative MRI offers several important advantages. Because of high tissue contrast, MRI can define the borders of some tumors and the location of some normal brain structures better than the surgeon's inspection or other available imaging techniques. MRI provides a full field of view for the surgeon, which is helpful when direct visualization is limited by the operative exposure (e.g., transphenoidal pituitary surgery).

MRI performed intraoperatively demonstrates the movement or shift of brain tissue that has occurred during surgery, providing a real-time update to the spatial information from preoperative scans. At the end of an operation, MRI can confirm that the surgical objectives have been accomplished and that no complications have developed before the craniotomy is closed.

High resolution iMRI is particularly valuable for:

- resection of tumors located close to key functional areas
- removal of pituitary tumors and other masses along the skull base
- procedures for epilepsy
- functional neurosurgery targeting precise locations—e.g., placement of electrodes for deep brain stimulation to treat movement disorders.

Diffusion Tensor Imaging

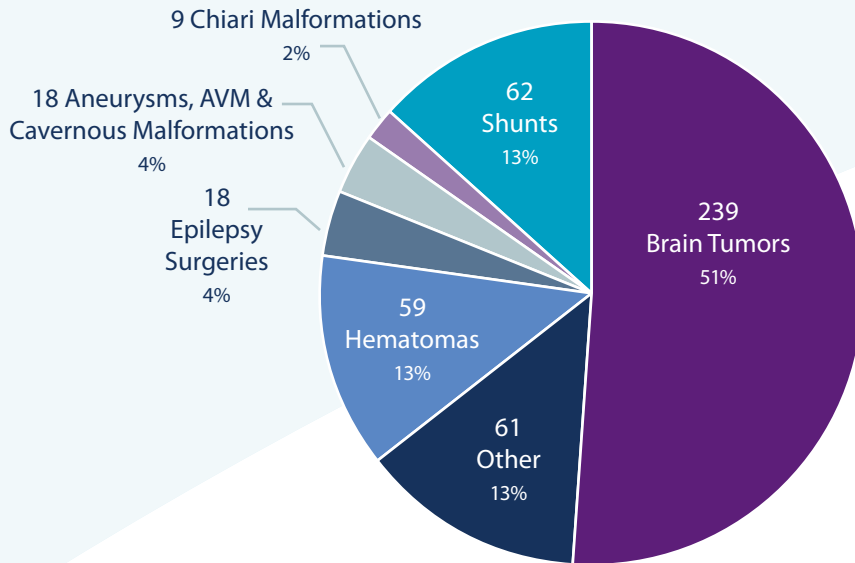
Diffusion tensor imaging (DTI) is a relatively new MRI technology available at Abbott Northwestern. It helps neurosurgeons plan surgery by localizing a brain tumor in relation to adjacent white matter tracts.

DTI maps the manner in which water molecules move through the brain. This movement has directionality, reflecting the structure of nerve fiber bundles within the white matter. DTI is preferentially performed on our 3 tesla MRI scanner because the greater signal-to-noise ratio of this unit provides clearer images.

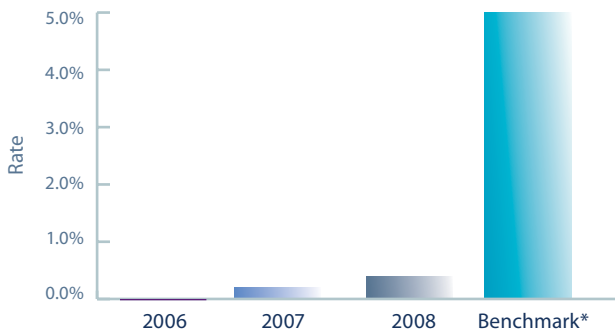
Neuroradiologists at Abbott Northwestern are studying several additional applications for DTI, including its use in assessing multiple sclerosis, traumatic brain injury and psychiatric disorders.

Cranial Neurosurgery Program

Cranial Neurosurgery Volumes, 2008
466 Cases

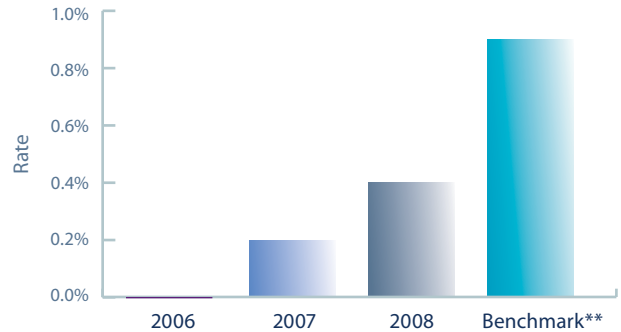


Deep Vein Thrombosis
in Cranial Neurosurgery



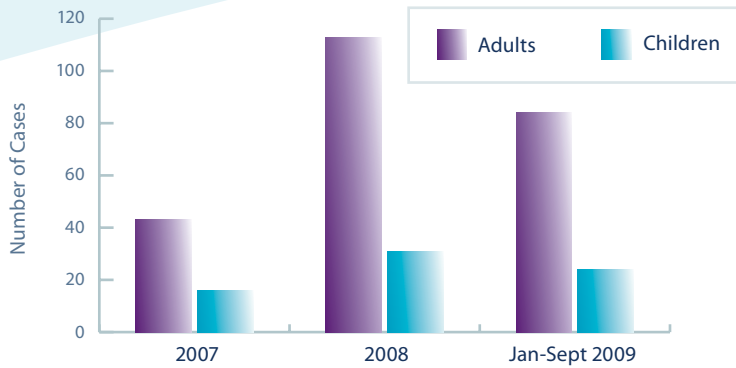
*Geerts WH, Pineo GF, Heit JA, Bergquist D, Lassen MR, Colwell CW, Ray, JG. Prevention of Thromboembolism: The Seventh ACCP Conference on Antithrombotic and Thrombolytic Therapy. *Chest*. 2004;126:338S-400S.

Surgical Site Infection
in Cranial Neurosurgery



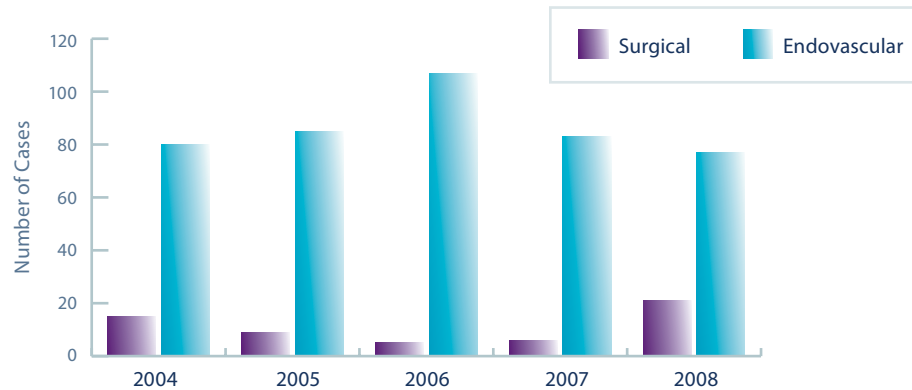
**National Nosocomial Infections Surveillance (NNIS) System Report, Data Summary from January 1992 through June 2004. *Am J Infect Control*. 2004;32:470-85.

High Field iMRI

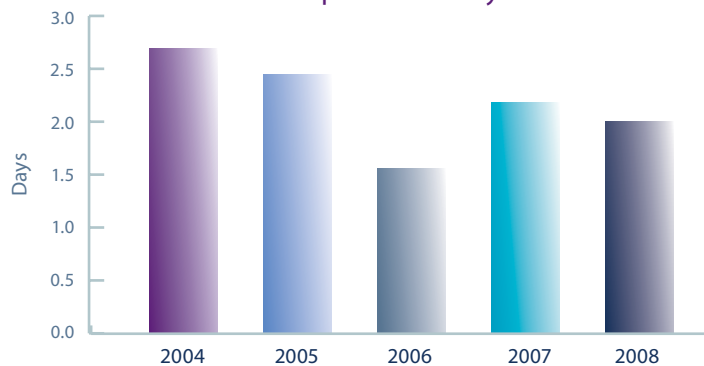


More than 300 procedures have been completed using the intraoperative MRI scanner since its introduction on the Abbott Northwestern campus in June 2007. The intraoperative MRI suite has been visited by neurosurgical teams from across the country and by several international teams.

Treatment of Unruptured Aneurysms



Average Length of Stay Unruptured Aneurysms



For data and outcomes regarding brain tumors, please see the section on neuro-oncology on pages 22-25.

Spinal Neurosurgery Program

OVERVIEW BY THOMAS A. BERGMAN, MD



The Spinal Neurosurgery Program is one of the many strong divisions of Abbott Northwestern Hospital's Neuroscience Institute. Multiple specialties work together to provide a comprehensive resource for patients with spine disorders. Services range from outstanding physical therapy at the Sister Kenny® Rehabilitation Institute to skilled surgical care by experienced

neurosurgeons. The Spinal Neurosurgery Program is an important part of Abbott Northwestern Hospital's Spine Institute, which includes our orthopaedic spine colleagues. This very large spine center is one of the busiest in North America, performing about 4,000 major procedures each year.

The Spinal Neurosurgery Program has steadily increased in volume and experience over the past decade. All types of spinal problems and every level of complexity are encompassed, from minimally invasive spinal procedures to the most complicated reconstructive cases. Surgery is guided by stereotactic navigation systems, O-arm intraoperative computerized tomography, and intraoperative monitoring of nerve conduction. An emphasis on careful planning and surgical decision-making ensures safe, accurate and effective operations.

We are proud of our outcomes, which attest to our attention to detail. One example is our low infection rate, which is well below benchmark standards; another is the rate of deep venous thrombosis, which is also well below benchmarks for a program of this size (see graphs on page 17). These excellent outcomes are due to minimally invasive surgery, timely mobilization of patients and well-designed protocols that are closely followed.

In summary, the Spinal Neurosurgery Program is proud to be part of Abbott Northwestern Hospital. We work to constantly improve patient care, both in the operating room and at the bedside. Our goal is to continue to advance as one of the leading neurosurgical spine programs in the country.

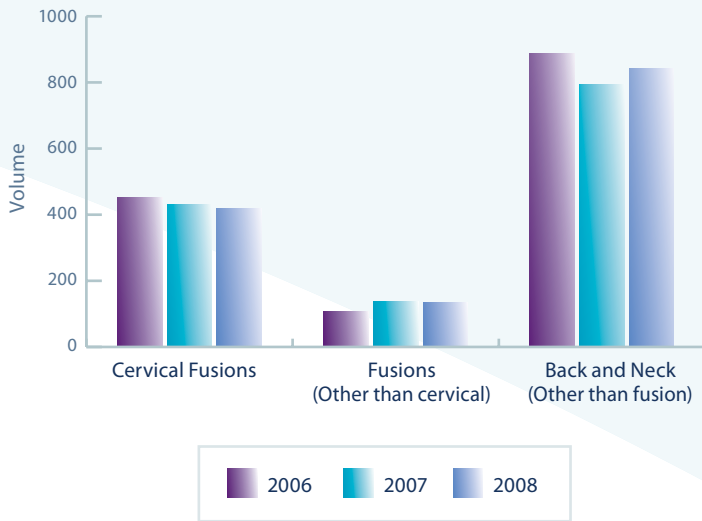
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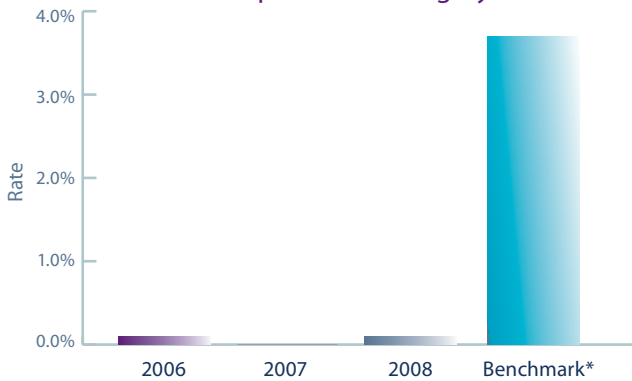
Spinal Neurosurgery Program

VOLUME, QUALITY AND OUTCOME MEASURES

Spinal Neurosurgery Volumes

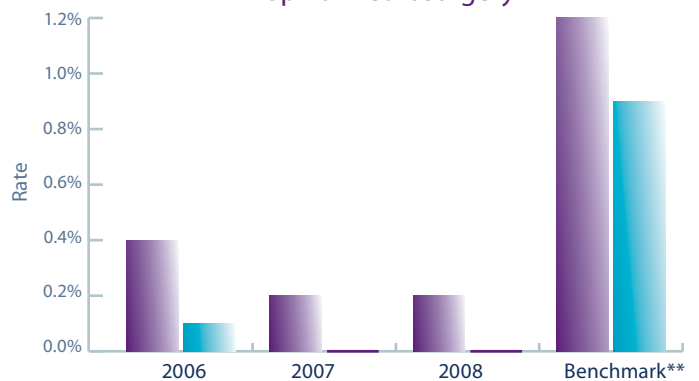


Deep Vein Thrombosis in Spinal Neurosurgery



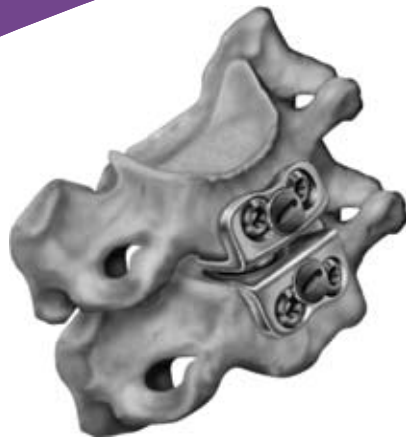
*Geerts WH, Pineo GF, Heit JA, Bergquist D, Lassen MR, Colwell CW, Ray JG. Prevention of Thromboembolism: The Seventh ACCP Conference on Antithrombotic and Thrombolytic Therapy. *Chest*. 2004;126:338S – 400S.

Surgical Site Infection in Spinal Neurosurgery



**National Nosocomial Infections Surveillance (NNIS) System Report, Data Summary from January 1992 through June 2004. *Am J Infect Control*. 2004;32:470-85.





Abbott Northwestern Hospital is the first hospital in Minnesota to offer a new U.S. Food and Drug Administration (FDA)-approved cervical spine implant as an alternative to fusion.

Innovation in Spinal Neurosurgery: Cervical Disc Replacement Surgery

Abbott Northwestern Hospital is the first hospital in Minnesota to offer a new U.S. Food and Drug Administration (FDA)-approved cervical spine implant as an alternative to fusion. Neurosurgeons at Abbott Northwestern have begun using this new surgical technique, offering some patients with radiculopathy and myelopathy from disc disease an alternative to fusion—and a chance to maintain greater motion in their necks.

Cervical degenerative disc disease, or cervical spondylosis, is the most common cause of spinal nerve root and spinal cord dysfunction in patients older than 55. It is present radiographically in 90 percent of men older than 50 and women older than 60. Cervical spondylosis accounts for 2 percent of all U.S. hospital admissions and results in an estimated 200,000 operations per year.

Surgery has been the treatment of choice for patients who fail conservative pain management (usually a combination of epidural steroid injections, physical therapy and traction), or patients with a significant neurological deficit. The goal of surgery has been to decompress spinal nerve roots and the spinal cord while preserving normal anatomic function.

The artificial cervical disc was engineered to maintain motion and flexibility while replacing a diseased disc. The implant uses a stainless steel ball-and-trough design that allows for a variable center of rotation, replicating the motion of the naturally functioning cervical spine.

The artificial cervical disc underwent a prospective, multi-center, randomized clinical trial comparing cervical disc replacement to anterior cervical discectomy and fusion with instrumentation. Those patients receiving the artificial disc demonstrated a significant improvement in neck disability and a median return-to-work that was 26 percent faster than those patients receiving anterior cervical discectomy and fusion with instrumentation. No cervical fractures, breakage or failure of the implant, or implant migrations were reported.

Currently, the artificial cervical disc is approved by the FDA for reconstruction of cervical disc spaces from C3 through C7 following single level anterior discectomy and decompression for intractable radiculopathy and/or myelopathy. In 2008, neurosurgeons performed 23 artificial cervical disc procedures for selected candidates at Abbott Northwestern Hospital. The patients had a hospital stay of one day; excellent outcomes were observed, with no complications and no revisions.

Interventional Neuroradiology Program

OVERVIEW BY JOHN PERL II, MD; DAVID TUBMAN, MD; BENJAMIN CRANDALL, DO



One of the nation's busiest and most sophisticated interventional neuroradiology practices is located at Abbott Northwestern Hospital, with three full-time interventional neuroradiologists. The program has a 24-year history at Abbott Northwestern, and the current neuroradiologists have 47 years of combined interventional neuroradiology clinical experience. The program is enhanced by an experienced nurse practitioner and a nurse clinician with 30 years of combined neurology experience, a patient care coordinator and a dedicated research coordinator to assist in ongoing research studies and clinical outcomes tracking. The Interventional Neuroradiology Program coordinates care with colleagues in neurosurgery, neurology, neuro-oncology, intensive care and otolaryngology.



The scope of the practice includes inpatient and outpatient consultative and therapeutic services. Conditions evaluated and treated include ischemic and hemorrhagic stroke, extracranial carotid and intracranial occlusive disease, cerebral aneurysms, arteriovenous malformations and fistulas, head and neck vascular malformations, and spine and spinal cord vascular malformations. In addition, adjuvant treatments are provided to assist the neurosurgeon, neuro-oncologist and head and neck surgeon in the treatment of brain and head and neck tumors.



A variety of procedures to manage spinal and sacral pain are also performed, including vertebral augmentation (vertebroplasty and kyphoplasty) and sacralplasties for symptomatic pathologic and osteoporotic compression fractures, and therapeutic injections for relief of radiculopathy.

The technically demanding nature of this specialty requires appropriate resources to provide an optimal procedural environment. Abbott Northwestern operates two biplane neurointerventional suites with modern 3D vascular imaging and on-the-fly CT imaging. Also integral to our advanced imaging capabilities are post-processing workstations that help compute physiologic measurements, such as cerebral blood flow, and provide non-invasive angiographic imaging. In 2008,

we enhanced the protocol for advanced imaging of patients with acute strokes to improve outcomes while more efficiently using system resources.

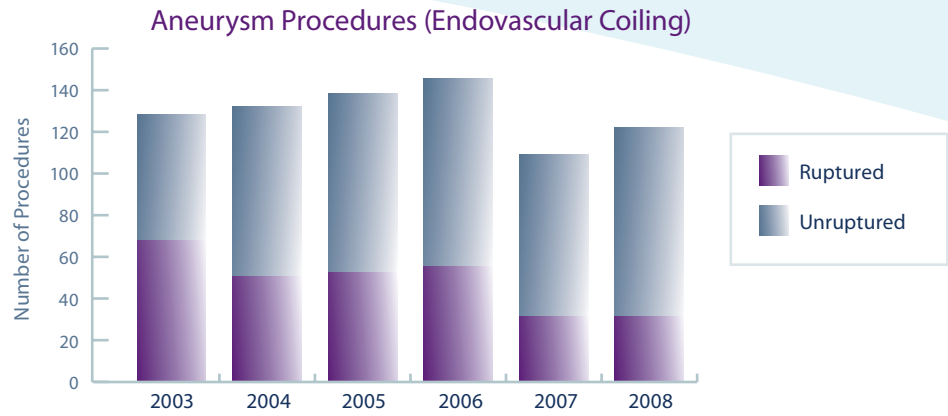
Advances in the field and improved results for patients are derived from volume-based expertise in clinical care and continuing incorporation of new information. The Interventional Neuroradiology Program maintains competence through educational programs and clinical research. Abbott Northwestern's interventional neuroradiologists have given more than 35 local, national and international lectures in the past three years, and have authored six abstracts and three peer-reviewed manuscripts. The service is currently conducting eight Institutional Review Board-sponsored clinical trials, registries and research projects.

The Interventional Neuroradiology Program coordinates care with colleagues in neurosurgery, neurology, neuro-oncology, intensive care and otolaryngology.



Interventional Neuroradiology Program

For additional data and outcomes regarding treatment of intracranial aneurysms, please see page 15.



Aneurysm Procedures 2003-2008

Average Length of Stay

Unruptured, 489 2.2 days

Ruptured, 276 16.4 days

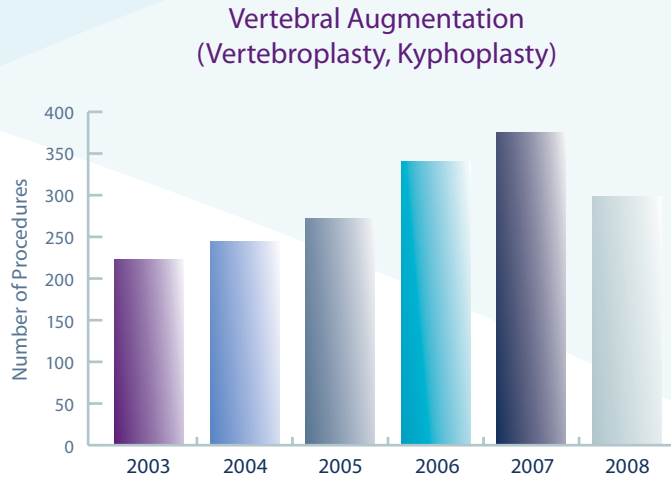
Outcomes

Re-bleed 0.32%

Retreated 6.10%

Other Procedures

	Intra-arterial Thrombolysis	Intracranial Stents	Extracranial Stents	Intra-arterial Chemo	Diagnostic Angiography
2003	73	5	33	22	1,302
2004	107	5	41	45	1,322
2005	74	4	49	66	1,341
2006	77	15	44	77	1,102
2007	76	9	21	194	1,286
2008	204	5	13	204	2,934



Advancement in the field and improved patient outcomes are derived from volume-based expertise in clinical care and continuing incorporation of new information and developing clinical pathways.

Vertebral Augmentation

Pain Relief Rate at 3 to 5 Days Post-Procedure

Complete Relief	9%
Relief Greater than 50%	68%
Some Relief	12%
No Relief	11%

Data (n=185) reflect cases June 2007 to present;
13% (27 patients) lost to follow-up.



Neuro-Oncology Program

OVERVIEW BY JOHN E. TRUSHEIM, MD,
MEDICAL DIRECTOR OF NEURO-ONCOLOGY



A Strong Partnership in the Treatment of Brain Tumors

The management of brain tumors is complex and requires the full expertise of a large team of specialists, sub-specialists and dedicated staff. Abbott Northwestern Hospital's nationally recognized Neuroscience Institute and Virginia Piper Cancer Institute partner to

offer the hospital's Neuro-Oncology Program. This unique service provides comprehensive care for patients with tumors of the brain and spine. In addition to a highly specialized group of neurosurgeons, our team includes neuroradiologists, neuropathologists, neuro-oncologists and radiation oncologists.

Neurosurgery—Advanced Technology for Improved Precision

Neurosurgical expertise is required for the successful management of nearly all brain tumors. The neurosurgeons associated with the Neuro-Oncology Program combine excellence in training and ongoing education with a depth of experience.

Our neurosurgeons have the advantage of working in one of the world's most advanced intraoperative MRI suites. This allows the surgeons to use the resolution of MRI to guide an operation, enabling unparalleled precision of resection while maintaining a critical margin of safety.

The neurosurgeons are also supported by sophisticated diagnostic imaging, including functional MRI scans which allow pre-operative mapping of critical structures to be preserved during surgery. As greater precision allows more tumor to be safely and accurately removed, the patient benefits from a more complete resection. Further treatment, when required, can then be directed at a smaller target.

Radiation Therapy—Equipment and Expertise for Increasing Focus

No organ requires greater precision in the delivery of radiation than the brain. At Abbott Northwestern Hospital, highly precise stereotactic radiosurgery and stereotactic radiotherapy are performed with the most current technology for the treatment of brain tumors: the Varian Trilogy linear accelerator. As radiotherapy techniques evolve, the Neuro-Oncology Program will continue to use the most innovative and effective means of treatment.

Chemotherapy —A New Frontier for Targeted Treatment

Chemotherapy has been used for decades in the treatment of brain tumors, but with only modest success in most cases. Recent research has begun to show the promise of new drugs specifically developed for use in brain tumors, rather than adopted from regimens for other cancers.

We have entered the era of investigating individual tumor characteristics and genetics to allow for the potential tailoring of therapies to specific patients. The Neuro-Oncology Program is at the forefront of this new phase of investigation, partnering with industry leader TGen of Arizona for the genetic analysis of

tumors. Patient tumor samples are submitted for state-of-the-art gene array review, with the goal of developing a database of important genetic abnormalities that may be targeted with specific new chemotherapies.

We frequently enhance the delivery of chemotherapy to brain tumors by intra-arterial administration. This technique allows the effective concentration of a drug within the tumor to be substantially increased without increasing the systemic toxicity of the agent. We combine this targeted delivery of tumoricidal therapy with drugs proven to limit the development of blood vessels within a tumor, thereby stunting its growth.

Neuroradiology—Better Imaging For Better Understanding

Imaging of the brain or spinal cord is central to all informed discussions in neuro-oncology, whether it is during preliminary diagnosis and surgical planning or during assessment of the patient's response to ongoing therapy. Neuro-imaging today is multifaceted, providing accurate views of tumor location and morphology and demonstrating (by functional MRI) the relative proximity of critical brain functions that should not be placed at risk during surgery. Additional sophisticated MRI techniques demonstrate chemical composition (spectroscopy), blood flow or water shifts (perfusion and diffusion studies), and the interruption or displacement of key brain circuits within or adjacent to tumors (diffusion tensor imaging).

Putting It All Together—Clinical Care Conferences

The Neuro-Oncology Program holds bi-weekly case conferences, which provide focused discussion of individual cases. This results in thoroughly informed patient care, as each subspecialty contributes perspectives about optimal treatment and the potential benefits and risks of any proposed intervention. The conference includes a full review of pathology results and imaging studies, as well as assessments from a variety of involved services ranging from rehabilitation to genetic counseling.

Comprehensive Resources For Patients and Caregivers

A comprehensive Neuro-Oncology Program must provide for the ongoing needs of the patient and the patient's caregivers. Patients benefit from the skill and efforts of rehabilitation specialists, dedicated social workers and a fully committed staff of specialized neuro-oncology nurses and nurse practitioners.

The Neuro-Oncology Program offers a dedicated social worker to help patients and their families manage the complexity of initial diagnosis, ongoing treatment discussions and restructuring of relationships and expectations. Another important resource is our well established support group, which sponsors frequent gatherings of our patients and their families for mutual encouragement, education and discussion of a wide variety of topics addressing their needs.

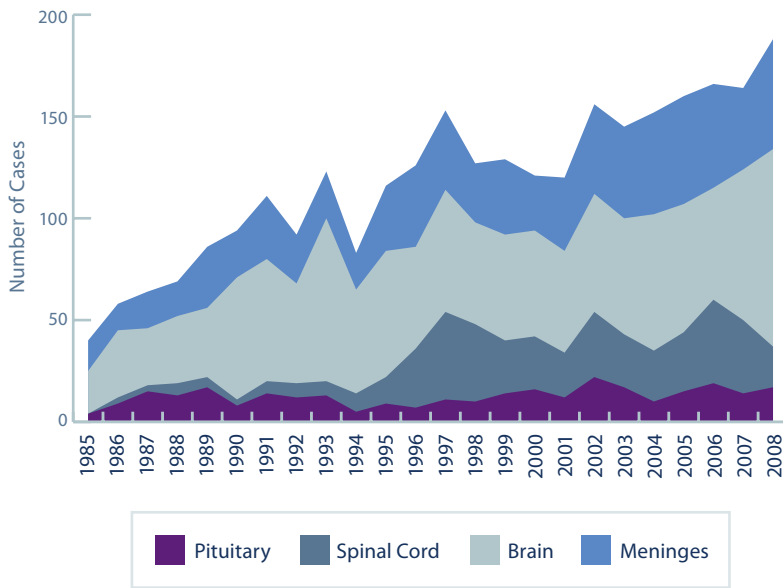
Our staff is also recognized for expertise and compassion in providing for aftercare and hospice coordination. This resource eases the burden of patients and families as they move through uncertain territory. Knowing that the staff will provide support and services throughout the entire course of illness is an important source of reassurance and comfort for patients and their families.

Abbott Northwestern Hospital's nationally recognized Neuroscience Institute and Virginia Piper Cancer Institute partner to offer the hospital's Neuro-Oncology Program. This unique service provides comprehensive care for patients with tumors of the brain and spine.

Neuro-Oncology Program

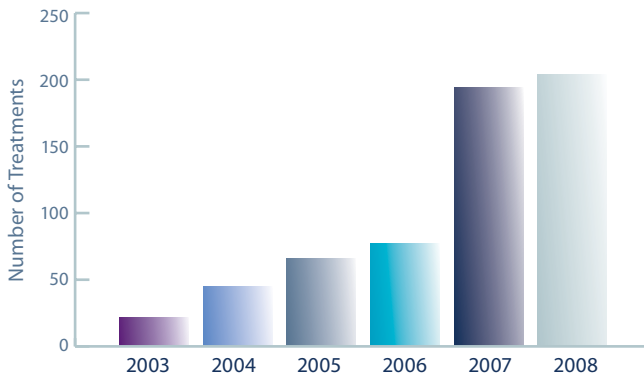
The Neuro-Oncology Program at Abbott Northwestern Hospital continues to grow.

Primary CNS Tumors at Abbott Northwestern Hospital



Data from VPCI Cancer Registry

Intra-Arterial Chemotherapy Procedures For Brain Tumor Patients

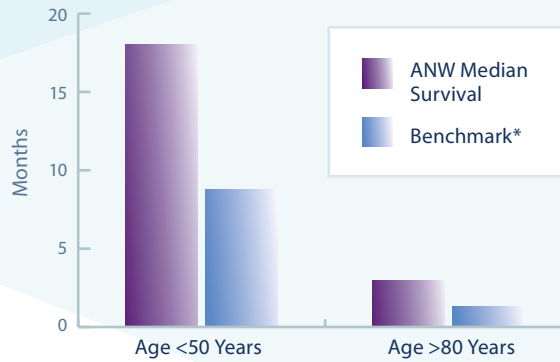


Brain Tumors 2008

Glioblastoma and variants	37
Anaplastic astrocytoma	6
Diffuse astrocytoma, grade 2	2
Pilocytic astrocytoma	7
Oligoastrocytoma, grade 2	6
Oligodendroglioma, grade 2	5
Recurrent tumors, all types	30
Primary CNS Lymphoma	3
Pituitary adenoma	15
Craniopharyngioma	2
Schwannoma	20
Neurofibroma	1
Medulloblastoma	3
Capillary hemangioblastoma	1
Ependymoma, grade 2	1
Meningioma, all grades	42
Metastases	28
Other	30
Total	239

VOLUME, QUALITY AND OUTCOME MEASURES

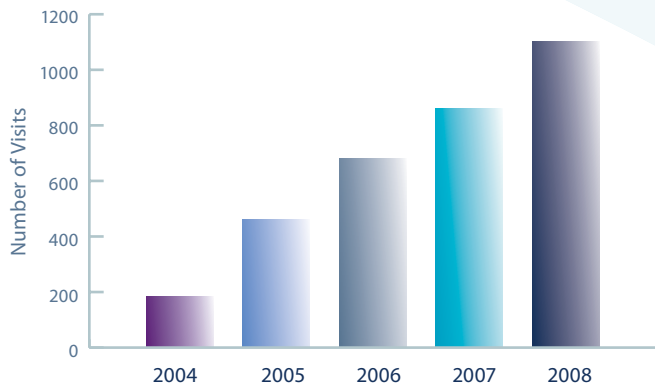
Duration of Survival for Patients with Glioblastoma Multiforme 1995-2005



Data from Abbott Northwestern's Pathology Department

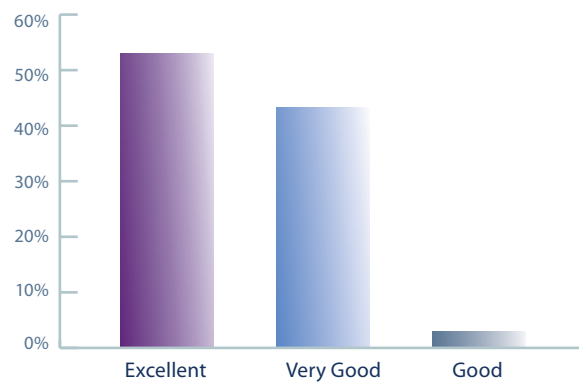
*Ohgaki H, Kleihues P. Population-based studies on incidence, survival rates and genetic alterations in astrocytic and oligodendroglial gliomas. *J Neuropathol Exp Neurol.* 2005 Jun;64(6):479-489.

Neuro-Oncology Clinic Visits



PATIENT SATISFACTION SURVEY

Thinking of your overall stay, how would you rate the overall quality of care and services?





Stroke Program

OVERVIEW BY RICHARD SHRONTZ, MD, AND RON TARREL, DO,
CO-MEDICAL DIRECTORS OF ABBOTT NORTHWESTERN
HOSPITAL'S STROKE PROGRAM



Abbott Northwestern's Stroke Program, established in 1998, is one of the oldest and most comprehensive stroke programs in the region. Abbott Northwestern is certified as a Primary Stroke Center and has earned the Gold Seal of Approval™ for stroke care from the Joint Commission.



Stroke care is urgent and complex and requires expertise and participation from many disciplines and departments. Our Emergency Department physicians and nurses, stroke neurologists, interventional neuroradiologists, neurosurgeons, hospitalists, intensivists and more than 200 registered nurses trained in the care of patients with neurovascular disorders are available 24 hours a day. Physicians, nurses, rehabilitation therapists, pharmacists and many others work collaboratively in our Emergency Department, Neuroscience Critical Care Unit and Neuroscience Inpatient Unit to provide state-of-the-art care through all phases of treatment for stroke patients.

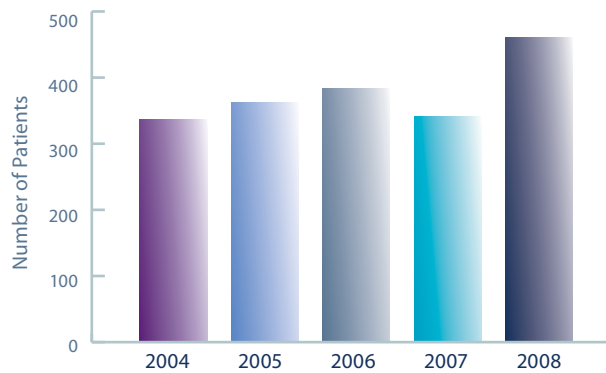
Physicians, nurses, rehabilitation therapists, pharmacists and many others work collaboratively in our Emergency Department, Neuroscience Critical Care Unit and Neuroscience Inpatient Unit to provide state-of-the-art care through all phases of treatment for stroke patients.

Key components of our Stroke Program include emergent and ongoing treatment to reduce or reverse neurologic injury, monitoring and management to avoid post-stroke complications, and identification and control of risk factors to reduce the likelihood of another stroke. Physicians and therapists from Sister Kenny Rehabilitation Institute, the region's leading provider of services to restore neurological function, are involved early in stroke care at Abbott Northwestern to optimize the patient's recovery.

Stroke Program

VOLUME, QUALITY AND OUTCOME MEASURES

Patients Treated for Ischemic Stroke or TIA



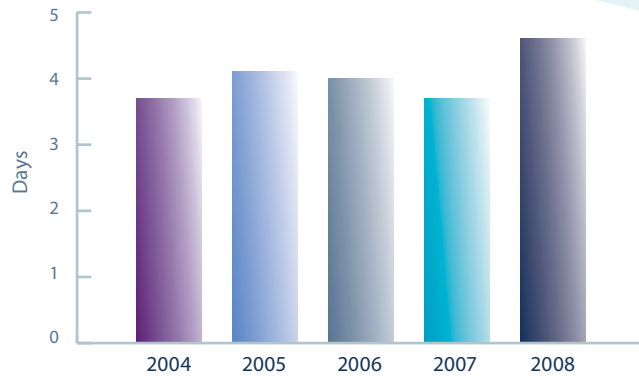
Joint Commission Stroke Performance Measures	2008 Compliance Rate	Benchmark*
IV rt-PA given if criteria met and patient presented within 120 minutes of symptom onset	85%	63%
Antithrombotic agent administered by the end of hospital day 2	97%	96%
Discharged on antithrombotic agent	99%	97%
Discharged on warfarin if in atrial fibrillation	100%	93%
Discharged on lipid lowering agent	94%	82%
Swallow screen prior to any oral intake/ medications	89%	69%
DVT prophylaxis by the end of hospital day 2 if not ambulatory	88%	92%
Smoking cessation counseling/treatment provided	98%	94%
Documentation that stroke education was provided	68%	65%
Evaluated for rehabilitation needs	99%	94%

* Benchmark from GWTG-Stroke Patient Management Tool

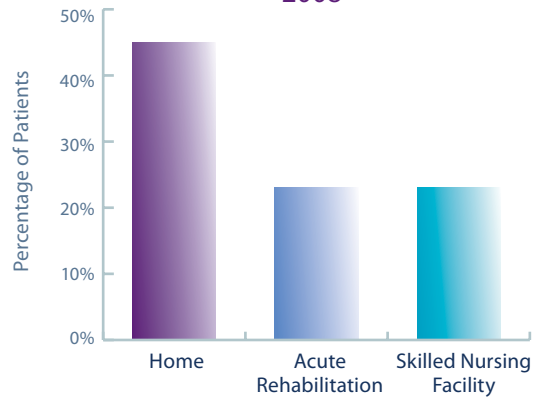
Stroke Program

Stroke care is urgent and complex and requires expertise and participation from many disciplines and departments. Our Emergency Department physicians and nurses, stroke neurologists, interventional neuroradiologists, neurosurgeons, hospitalists, intensivists and more than 200 registered nurses trained in the care of patients with neurovascular disorders are available 24 hours a day.

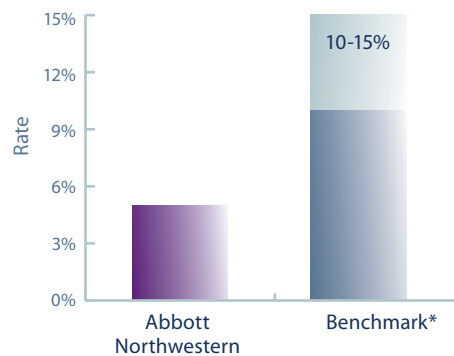
Average Length of Stay for Patients Admitted with Ischemic Stroke or TIA



Discharge Disposition for Patients Admitted with Ischemic Stroke or TIA 2008



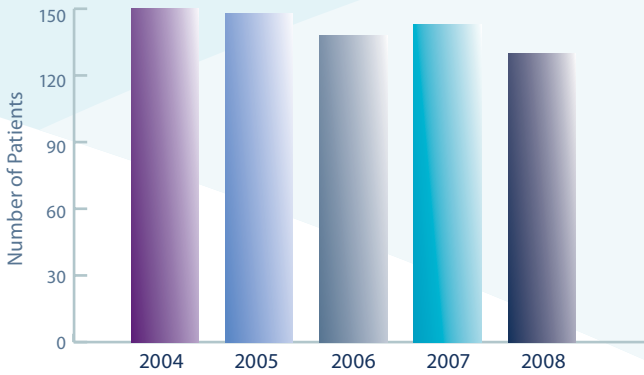
Ischemic Stroke Mortality 2008



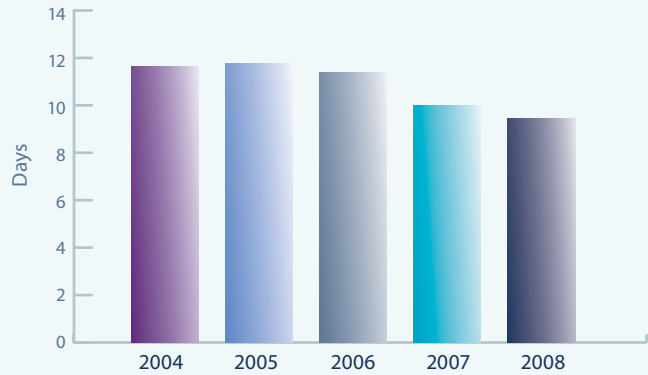
* Agency for Healthcare Research and Quality

VOLUME, QUALITY AND OUTCOME MEASURES

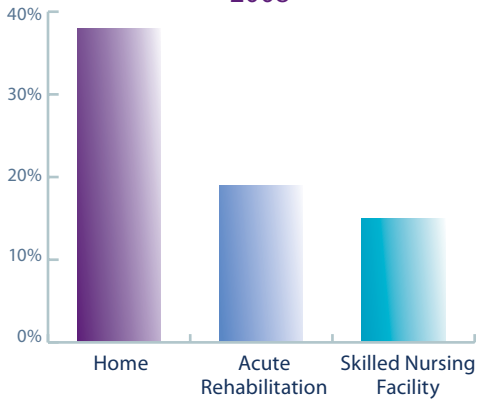
Patients Treated for Hemorrhagic Stroke



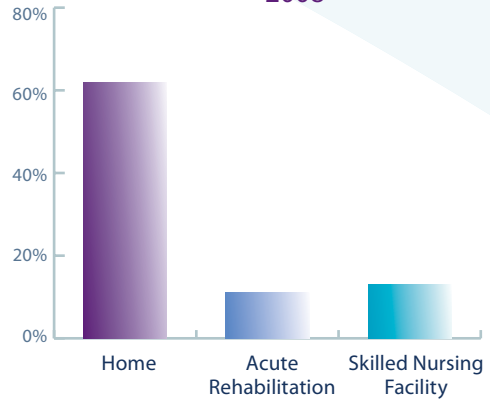
Average Length of Stay for Patients Admitted with Hemorrhagic Stroke



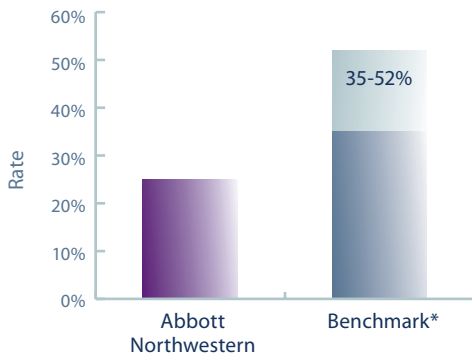
Discharge Disposition for Patients Admitted with Intracerebral Hemorrhage 2008



Discharge Disposition for Patients Admitted with Subarachnoid Hemorrhage 2008

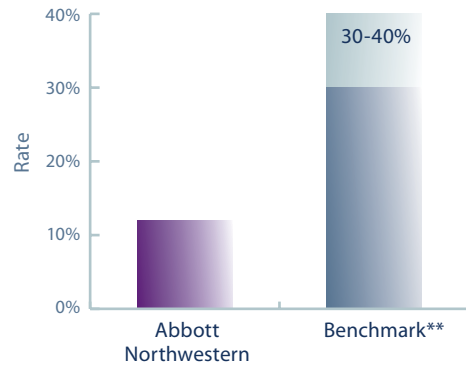


Intracerebral Hemorrhage Mortality 2008



*Agency for Healthcare Research and Quality

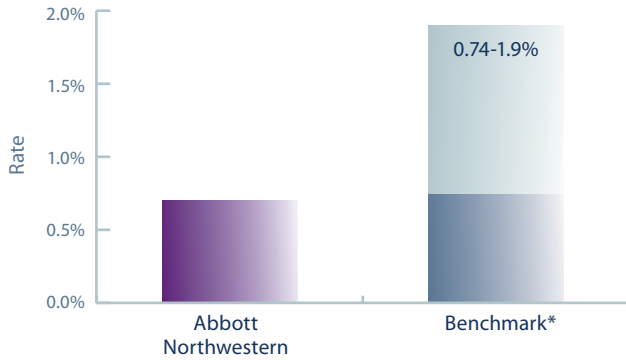
Subarachnoid Hemorrhage Mortality 2008



**American Stroke Association

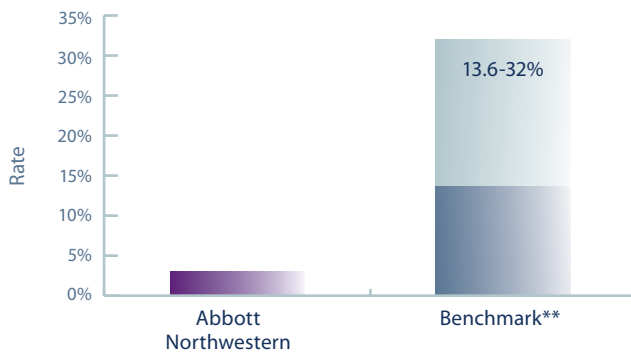
Stroke Program

Deep Vein Thrombosis in Stroke Patients
2008



*Skat E, Stein PD, Beemath A, Sanchez J, Bustamante MA, Olson RE. Venous thromboembolism in patients with ischemic and hemorrhagic stroke. *Am J Cardiol.* 2005;96(12):1731-3.

Aspiration Pneumonia in Stroke Patients
2008

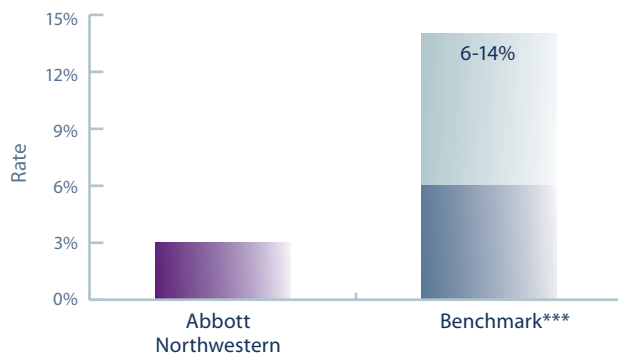


**Aslanyan S, Weir CJ, Diener HC, Kaste M, Lees KR. GAIN International Steering Committee and Investigators. Pneumonia and urinary tract infections after acute ischemic stroke: a tertiary analysis of the GAIN International trial. *Eur J Neurol.* 2004;11(1): 49-53.

Perry L, Love CP. Screening for dysphagia and aspiration in acute stroke: a systematic review. *Dysphagia.* 2001;16(1): 7-18.

Mann G, Hankey G, Cameron D. Swallowing function after stroke: prognosis and prognostic factors at 6 months. *Stroke.* 1999;30(4):744-748.

Readmission Due to Stroke or TIA Within One Year
2008



***Tsvigoulis G, Spengos K, Zakopoulos N, Manios E, Xinos K, Vassilopoulos D, Vemmos KN. Twenty four hour pulse pressure predicts long term recurrence in acute stroke patients. *J Neurol Neurosurgery Psychiatry.* 2005;76(19):1360-1365.

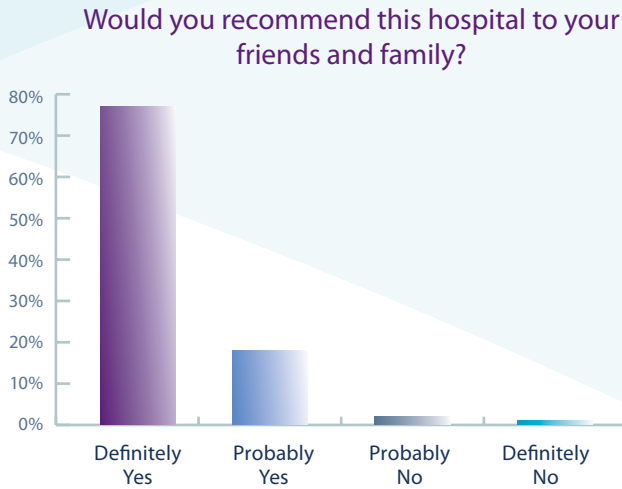
Soda T, Nakayasu H, Maeda M, Kusumi M, Kowa H, Awaki E, Saito J, Nakashima K. Stroke recurrence within the first year following cerebral infarction—Tottori University Lacunar Infarction Prognosis Study (TULIPS). *Acta Neurol Scand.* 2004;110(6):343-349.

Lee AH, Somerford PJ, Yau KK. Risk factors for ischemic stroke recurrence after hospitalization. *Med J Aust.* 2004;181(5):244-246.

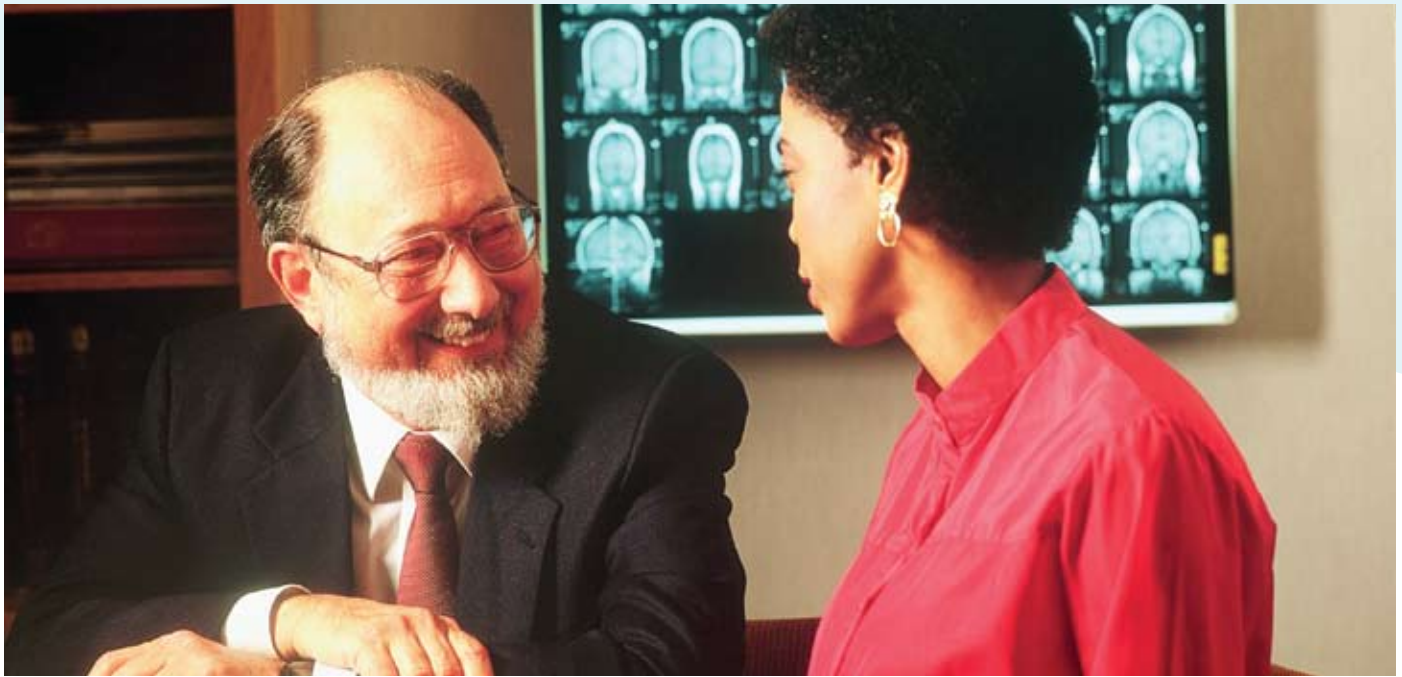
Yokota C, Minematsu K, Hasegawa Y, Yamaguchi T. Long-term prognosis, by stroke subtypes, after a first-ever stroke: a hospital based study over a 20 year period. *Cerebrovasc Dis.* 2004;18(2):111-116.

Stroke Program

INPATIENT SATISFACTION SURVEY 2008



Abbott Northwestern has been certified as a Primary Stroke Center since 2006, having earned the Gold Seal of Approval™ for stroke care from the Joint Commission.



The MINCEP Epilepsy Care Program

OVERVIEW BY ROBERT GUMNIT, MD



MINCEP Epilepsy Care was founded in 1964. It is the oldest comprehensive epilepsy program in the United States, and one of the most prestigious. Three of the six epileptologists at MINCEP previously headed university epilepsy centers.

While many epilepsy centers focus primarily on surgical treatment, MINCEP emphasizes comprehensive medical treatment to the same extent as its large and very experienced surgical program. Patients are directly managed by an experienced epileptologist who personally directs all aspects of care, including history, evaluation of the current situation, medications, any procedure and coordination of care after discharge.

MINCEP provides the full spectrum of medical, pharmacological and psychological evaluation. All pertinent neurophysiological monitoring and imaging techniques are used, including ictal and inter-ictal SPECT studies, PET studies and ultra-high resolution MRI examinations.

As an international referral center, MINCEP is capable of diagnosing and treating the most complicated patients, but also maintains a local focus to provide the highest quality and most efficient care for patients who live in our geographic area. MINCEP's website, www.mincep.com, provides additional information.

As an international referral center, MINCEP is capable of diagnosing and treating the most complicated patients, but also maintains a local focus to provide the highest quality and most efficient care for patients who live in our geographic area.

The MINCEP Epilepsy Care Program

VOLUME, QUALITY AND OUTCOME MEASURES

Morbidity: There have been no surgical deaths within the MINCEP Program at Abbott Northwestern Hospital.

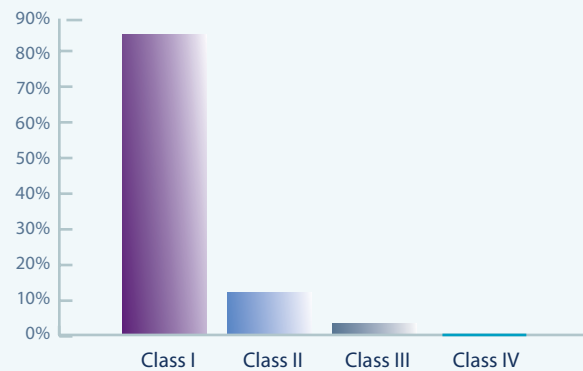
Seizure Control: Seizure control is difficult to quantify. One useful classification is that proposed by J.J. Engel:

- Class I is complete seizure freedom.
- Class II is an isolated breakthrough seizure that does not significantly affect the patient's life, or a 90 percent reduction in seizure frequency.
- Class III are those patients who have had a substantial reduction in seizures but still have disability as a result of their epilepsy.
- Class IV is no improvement.

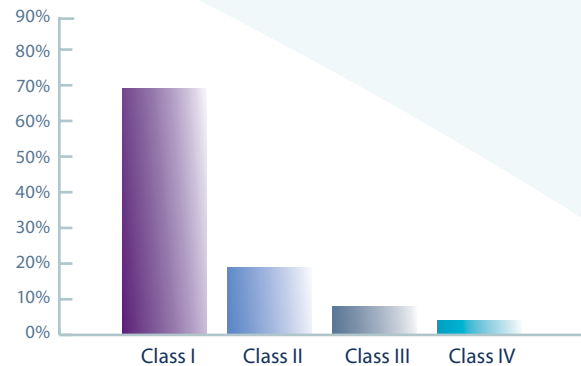
Anterior temporal lobectomy is the most commonly performed epilepsy surgery. In the MINCEP program, 85 percent of patients who undergo this procedure are seizure-free, and 97 percent are Class I or II at the end of one year.

Resective surgery of the epileptogenic cortex requiring mapping with intracranial electrode arrays (grids) is a much more difficult diagnostic and therapeutic challenge. MINCEP's overall results are 57 percent seizure-free and 63 percent Class I or II. This compares favorably with nationally published figures, particularly when considering that MINCEP's referrals include some of the most complicated patients, and large resections involving more than one lobe of the brain are often necessary.

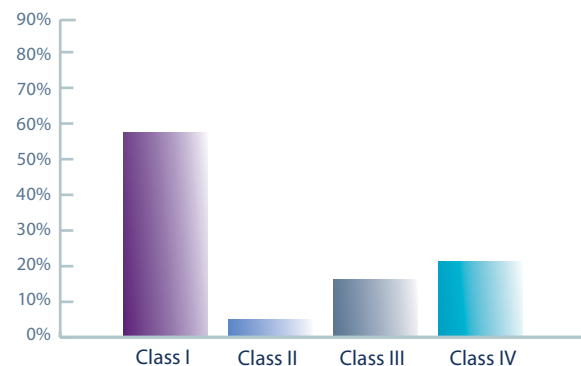
Seizure Control, Routine Anterior Temporal Lobectomy (No Invasive Monitors), 2004-2007



Seizure Control, Complex Anterior Temporal Lobectomy (With Grids), 2004-2007



Seizure Control, Extra Temporal Cortical Resections 2004-2007



Neurological Emergency Treatment NETWORK

Abbott Northwestern's Neurological Emergency Treatment NETWORK was established by the Neuroscience Institute in 2007. The program partners with non-metro hospitals to provide expert care for patients who are experiencing neurological emergencies such as stroke, intracranial hemorrhage or seizures.

The NETWORK program ensures an immediate, round-the-clock connection between outstate hospitals and Abbott Northwestern's Emergency Department to enable rapid and appropriate treatment, regardless of a patient's location. Education and triage protocols are shared with physicians, nurses and emergency medical services personnel in communities throughout the region to aid in the effective management of neurological emergencies. The program also facilitates expedited transfer of patients to Abbott Northwestern Hospital when specialized resources are needed.

In 2008, Abbott Northwestern Hospital received more than 450 patients experiencing neurological emergencies from 66 referring hospitals throughout Minnesota, Wisconsin, North Dakota and South Dakota.

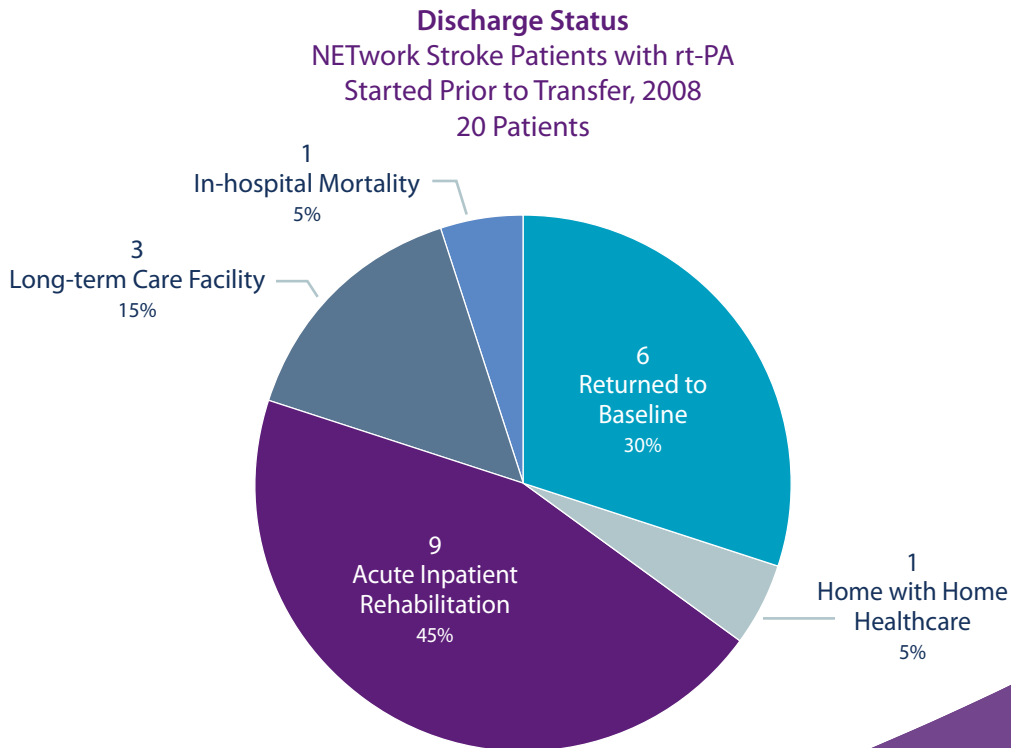
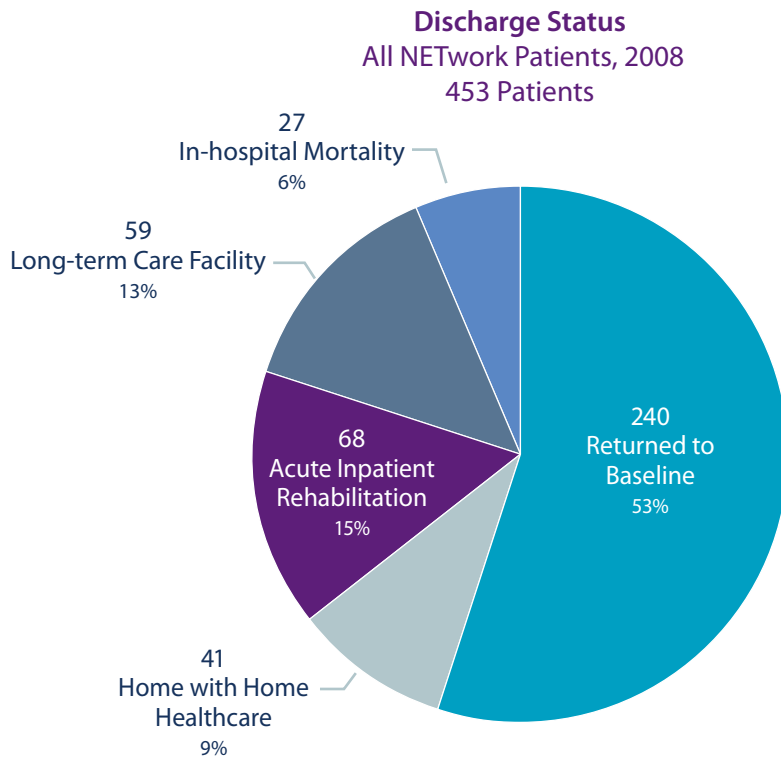
Reducing "Door-to-Needle" Time

The length of time between the onset of stroke symptoms and the initiation of medical treatment can directly affect a patient's neurological outcome. Patients who present within four and one-half hours of symptom onset may be considered for intravenous administration of rt-PA (alteplase), a clot-dissolving drug. The NETWORK Program helps non-metro hospitals to act within this therapeutic window and reduce the door-to-needle time: the time from a stroke patient's arrival at the hospital to the administration of intravenous rt-PA. Once intravenous rt-PA is initiated, many rural hospitals choose to transfer the patient for additional work-up and monitoring. Follow-up with the referring hospital includes a joint analysis to evaluate if there are opportunities for further improvement in the timeliness of brain-saving treatment.

Education

Continuing education for physicians, nurses and emergency medical service (EMS) personnel throughout Minnesota and western Wisconsin is integral to the NETWORK Program. In 2008, the Program provided on-site education for four EMS companies, the Minnesota State Colleges & Universities (MNSCU) EMS instructors, and the medical and nursing staff at 11 hospitals. In addition, the Program jointly hosted an all-day EMS conference with the Minneapolis Heart Institute® for emergency medical technicians and paramedics from throughout Minnesota. Through these efforts, the NETWORK Program trained nearly 600 individuals to be better prepared to help patients with urgent neurological conditions.





Sleep Center

OVERVIEW BY THEODORE BERMAN, MD,
MEDICAL DIRECTOR, SLEEP CENTER



Abbott Northwestern's Sleep Center has been accredited by the American Academy of Sleep Medicine for more than 20 years. Patients receive comprehensive services for sleep apnea and other sleep disorders including insomnia, narcolepsy, parasomnias, restless leg syndrome and circadian disorders.

The Sleep Center is led by three physicians accredited in sleep disorders who assess patients, order appropriate testing and follow up to make certain that patients have all the information necessary to benefit from treatment. The Center provides overnight sleep studies for sleep apnea and multiple sleep latency and maintenance wake testing as indicated. Appointments and testing facilities are both located at Abbott Northwestern Hospital.

Our clinics and sleep laboratory are staffed by committed, long-term employees who are dedicated to providing excellent service. Experienced full-time nurses coordinate care and follow-up for patients. We are proud of our customer satisfaction survey results and continue to look for opportunities to improve our care.

The Sleep Center also offers a Behavioral Sleep Medicine Program led by a psychologist who is board certified in the behavioral treatment of insomnia and related sleep disorders. The program provides cognitive behavioral therapy for a range of sleep problems including insomnia, circadian rhythm disorders and shift work issues.

Sleep clinicians participate in monthly conferences to review policies and procedures, patient satisfaction surveys, journal articles and quality initiatives to improve patient care.

Sleep Center staff also provide education to professionals and the community at large, including free in-service sessions on sleep disorders for particular patient populations or work sites. We teach bi-monthly sessions on obstructive sleep apnea for patients in the Joint Replacement Center and present information for primary care physicians on insomnia and other sleep disorders throughout the year.

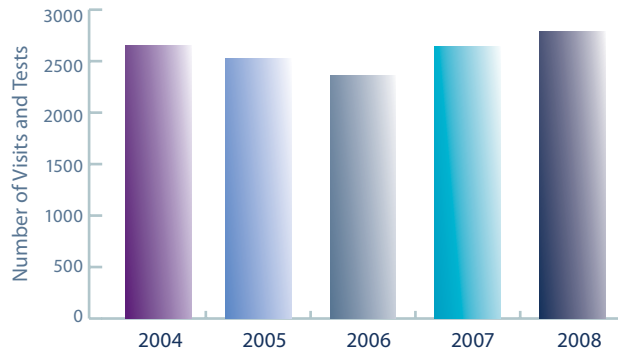
Abbott Northwestern's Sleep Center has been accredited by the American Academy of Sleep Medicine for more than 20 years.



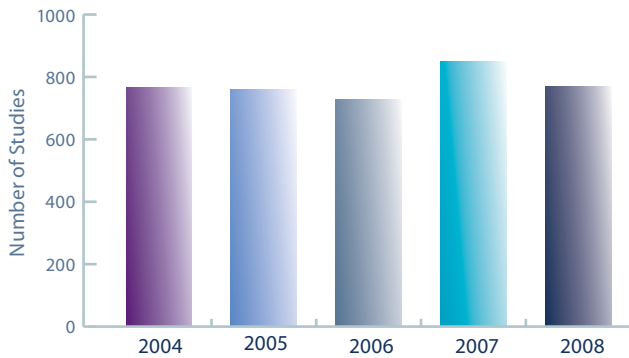
Sleep Center

VOLUME, QUALITY AND OUTCOME MEASURES

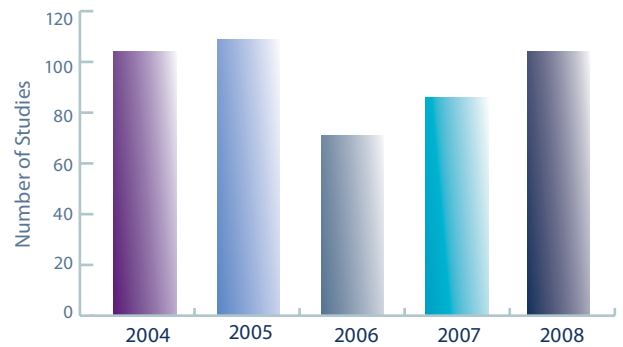
Clinic Visits and Testing



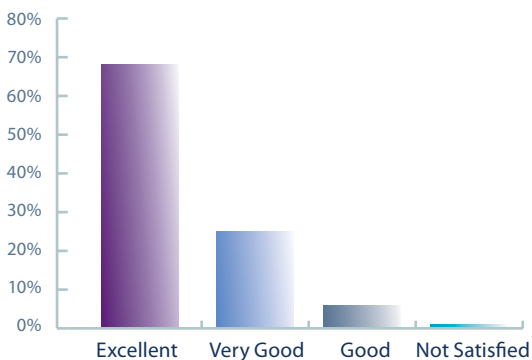
Polysomnograms



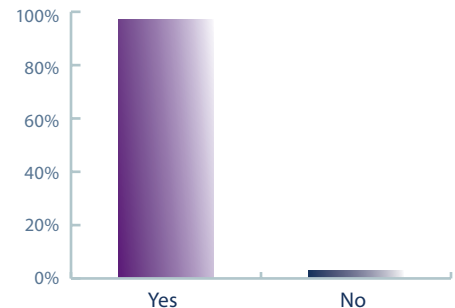
Multiple Sleep Latency Testing



How satisfied were you with our service?



Would you recommend our services to your family and friends?



Neuroscience Education

As the Twin Cities' leading provider of neurological care, Abbott Northwestern Hospital's Neuroscience Institute provides education about neurological disorders to physicians, nurses, other health care providers and the community. Educational events are offered at the hospital and throughout Minnesota.



In 2008, the Neuroscience Institute presented the 21st Annual Front Line Neurology Symposium to an audience of more than 150 nurses and primary physicians. Attendees came from 50 health care institutions throughout Minnesota, South Dakota, Iowa and Wisconsin.

Abbott Northwestern Hospital's Neuroscience Institute is the home of the American Parkinson Disease Association (APDA) Information and Referral Center of Minnesota. The Parkinson's Center works collaboratively with numerous hospitals and clinics to provide education about Parkinson's disease to patients throughout the state. Free patient information, referrals, conferences, public forums, newsletters and 20 support groups are offered for individuals with Parkinson's disease, their caregivers and allied health professionals. The Parkinson's Center at Abbott Northwestern is part of a nationwide network of APDA centers with the mission: "To Ease The Burden, To Find The Cure," through fundraising, research, patient and caregiver support and education.

The Neurological Emergency Treatment or NETwork Program, described on page 34, is another important educational focus for the Neuroscience Institute. In addition to education for health care providers, the NETwork Program and the Abbott Northwestern Stroke Program offered several community stroke awareness presentations throughout 2008.

The Neuroscience Institute also participates in fundraising and educational events in support of the Minnesota Stroke Association, the Epilepsy Foundation and the Alzheimer's Association.

Ongoing education is provided to patients with brain tumors and their family members through the Brain Tumor Support Group, which meets twice each month. During 2008, patients and their family members made more than 440

support group visits and participated in the National Brain Tumor Foundation Caregiver Conference, co-hosted by the Neuroscience Institute.

Sleep Center staff members provide education about sleep disorders to patient groups at Abbott Northwestern Hospital, primary care physicians, other health care professionals and the community.

For more than 20 years, Abbott Northwestern Hospital has been the Twin Cities' leader in providing expert services and accurate information to meet the needs of patients with neurological conditions. We remain committed to professional and community education as part of this continuing mission.

As the Twin Cities' leading provider of neurological care, Abbott Northwestern Hospital's Neuroscience Institute provides education about neurological disorders to physicians, nurses, other health care providers and the community.



Ongoing Research Studies

Interventional Neuroradiology Program

1. Neuroform Stent for Wide-Neck Aneurysms

These stents are placed as an adjunct to coil embolization of wide-neck intracranial aneurysms. Use of the stent allows treatment of aneurysms that cannot be managed by coiling alone.

2. Enterprise Stent for Wide-Neck Aneurysms

These stents are placed as an adjunct to coil embolization of wide-neck intracranial aneurysms. Use of the stent allows treatment of aneurysms that cannot be managed by coiling alone.

3. Wingspan Stent for Intracranial Stenosis

The Wingspan stent system with angioplasty balloon catheter is a neuro-specific stent used to expand the lumen of cerebral arteries in patients with intracranial atherosclerotic disease that is refractory to medical therapy.

4. Safety and Efficacy of NeuroFlo™ Technology in Ischemic Stroke (SENTIS)

The SENTIS trial is a prospective, controlled, randomized, single-blind study of NeuroFlo treatment plus standard medical management versus standard medical management alone. The objective of the study is to demonstrate the safety and efficacy of the NeuroFlo catheter in augmenting cerebral perfusion and improving neurological outcome in patients with acute ischemic stroke.

5. The Study of Care Intensity and Outcomes of NeuroFlo (SCION)

The SCION study compares how patients receiving NeuroFlo therapy with medical management versus medical management alone move through the following care settings in the post-acute period:

- hospital intensive/critical care
- hospital step-down care or general ward
- hospital inpatient rehabilitation facility
- long-term supportive (only) care facility
- skilled nursing facility
- assisted living facility
- home with home health care attendant(s)
- home without professional assistance.

6. NeuroFlo Perfusion Augmentation for Symptomatic Cerebral Vasospasm

The objective of this study is to demonstrate the safety and efficacy of the NeuroFlo catheter in augmenting cerebral perfusion and improving neurological outcome in patients with symptomatic vasospasm secondary to subarachnoid hemorrhage.

7. Neurointerventional Outcomes Database and Research

The purpose of this study is to monitor procedural data and patient outcomes to enhance the effectiveness of procedures performed in the department to improve overall quality of care.

8. Onyx® Liquid Embolic Agent for Wide-Neck Aneurysms

The Onyx liquid embolic system is another tool for treating wide-neck intracranial aneurysms. Liquid Onyx is delivered into the aneurysm by a controlled injection through a micro catheter. Onyx is a polymer that solidifies within five minutes, thereby occluding the aneurysm.

9. Spinal Epidural Hematoma Study

The purpose of this study is to determine the incidence, volume and extent of postoperative spinal epidural hematomas resulting in compression of the thecal sac, and to correlate risk factors with hematoma volumes.

MINCEP Epilepsy Care Program

1. Impact of Anticonvulsant Use on Bone Mineral Density in Elderly Men

This is an analysis of the effect of anticonvulsant drug use on bone mineral density as measured during the Study of Osteoporotic Fractures in Men that was performed with Kristine Ensrud, MD, at the Osteoporosis Center at the Minneapolis VA Medical Center. Results were presented at the Academy of Neurology meetings in April 2008, and are under review in *Neurology*.

2. Effect of Phenytoin Use on Vitamin D Metabolism in the Elderly

This is a proposed five-year study that has been submitted as a National Institute of Health Research Project Grant Program (R01) with Ilo Leppik, MD, as co-primary investigator. The proposal has been reviewed and has not yet been scored.

3. Anticonvulsant Use and Fracture Risk in Elderly Nursing Home Residents

This is an analysis of the incidence of fractures in a large group of elderly nursing home residents in the Beverly Nursing Home system, being performed in conjunction with the University of Minnesota.

4. Falls in People with Epilepsy

A prospective study of falls in people with epilepsy admitted to the MINCEP Epilepsy Monitoring Unit at Abbott Northwestern Hospital.

5. Felbamate Adverse Effects Study

Felbamate is a highly effective anti-epileptic drug (AED) in patients with even the most severe epilepsy. Adverse effects of felbamate include liver failure and aplastic anemia, which are more commonly associated with felbamate than with other AEDs. MINCEP recently reviewed its greater-than-20-year experience with felbamate. The study was published in *Epilepsia*, November 2007.

6. Zonisamide Adverse Effects Study

Zonisamide is an AED useful in a wide range of epilepsy syndromes. Known side effects include cognitive impairment and severe adverse behavioral changes. Little information is available about the frequency or risk factors for developing these adverse events. This study has been accepted as a platform presentation at the American Epilepsy Society Meeting, December 2009.

7. Evaluation of the Safety of a New Intravenous Formulation of Topiramate

Topiramate is an effective AED, but it is not currently available in intravenous form. MINCEP is working in collaboration with the University of Minnesota to evaluate the safety of a new intravenous formulation of topiramate.

8. Development of a Method to Provide Subspecialty Consultation for Low Incidence Disease to Low Population Density Regions

Non-metro patients with low incidence disorders (epilepsy, for example) often require expert care not available in their home communities. This study seeks to evaluate a method by which subspecialty expertise can be delivered to geographically remote locations.

9. Pharmacokinetics of Antiepileptic Drugs

Examination of the pharmacokinetics of AEDs metabolized by oxidation or glucuronidation using stable labeled isotope technology (supported by the National Institutes of Health).

10. Development of Intravenous Carbamazepine for Human Use

Carbamazepine is among the most commonly used AEDs, but it is not available in intravenous form. MINCEP is working in collaboration with the University of Minnesota to evaluate the safety of a new intravenous carbamazepine formulation.

Neuro-Oncology Program

1. Phase II Study of Vorinostat (SAHA) in Patients with Progressive or Recurrent Glioblastoma Multiforme

This Phase II trial is studying the effectiveness of vorinostat in treating patients with progressive or recurrent glioblastoma multiforme. Vorinostat may stop the growth of tumor cells by killing the cells or by preventing them from dividing. Vorinostat may also arrest the growth of tumor cells by blocking enzymes needed for cell growth. Administering vorinostat before surgery may make the tumor smaller and reduce the amount of tissue that needs to be removed. Giving vorinostat after surgery may kill any remaining tumor cells.

2. Phase II Study of Sorafenib and Temozolomide in Patients with Recurrent Glioblastoma

This phase II trial is studying the side effects and best dose of temozolomide when given with sorafenib to determine how well the combined regimen works in treating patients with recurrent glioblastoma. Sorafenib may stop the growth of tumor cells by blocking blood flow to the tumor. Temozolomide may stop the growth of tumor cells by killing the cells or by preventing them from dividing. Both drugs may also arrest the growth of tumor cells by blocking enzymes needed for cell growth.

3. Phase I/II Study of Imatinib Mesylate in Patients with Recurrent Oligodendroglioma or Mixed Oligoastrocytoma

This phase I/II trial will study the effectiveness of imatinib mesylate in treating patients who have recurrent brain tumors that have not responded to previous surgery and radiation therapy. Imatinib mesylate may stop the growth of tumor cells by blocking enzymes necessary for tumor cell growth.

4. Phase II Study of Rituximab in Combination with Standard Chemotherapy Comprising Methotrexate, Vincristine, Procarbazine Hydrochloride and Cytarabine in Patients with Primary Central Nervous System Lymphoma

This phase II trial is studying the effectiveness of rituximab in combination with standard chemotherapy in patients with primary central nervous system lymphoma. Monoclonal antibodies such as rituximab can block cancer growth by directly attacking cancer cells, by carrying cancer-killing substances to them, or by interfering with the ability of cancer cells to grow and spread. Standard chemotherapeutic agents such as methotrexate, leucovorin, vincristine, procarbazine, dexamethasone and cytarabine work in different ways to stop the growth of cancer cells, either by killing the cells or by preventing them from dividing. Giving rituximab together with combination chemotherapy may augment cell death within the tumor.

5. Study of DCVax®-Brain to Treat Newly Diagnosed Glioblastoma Multiforme (GBM)

This Phase II trial is designed to evaluate the safety, clinical response and survival of patients following treatment with DCVax-Brain, an immunotherapy agent for GBM. The experimental therapy uses a patient's own tumor lysate and white blood cells from which precursors of dendritic cells are isolated. The white cells are made into dendritic cells and "taught" to recognize brain cancer cells, thereby activating an immune response to the tumor.

6. Cilengitide for Subjects With Newly Diagnosed Glioblastoma Multiforme and Methylated MGMT Gene Promoter—A Multicenter, Open-Label, Controlled Phase III Study, Testing Cilengitide in Combination With Standard Treatment (Temozolomide With Concomitant Radiation Therapy, Followed by Temozolomide Maintenance Therapy) Versus Standard Treatment Alone (CENTRIC)

This is a Phase III clinical trial assessing efficacy and safety of the investigational integrin inhibitor, cilengitide, in combination with standard treatment versus standard treatment alone in newly diagnosed glioblastoma multiforme (GBM) patients with a methylated promoter of the methylguanine-DNA methyltransferase (MGMT) gene in the tumor tissue. Methylation of the MGMT gene promoter has been found to be a predictive marker for benefit from temozolomide (TMZ) treatment. CENTRIC is structured as a 1:1 randomized trial in which subjects in the cilengitide group will be treated with cilengitide (twice weekly) in combination with standard therapy for eight months, followed by a 10-month cilengitide maintenance treatment. Subjects in the control group will receive standard therapy only.

7. Cilengitide in Subjects With Newly Diagnosed Glioblastoma Multiforme and Unmethylated MGMT Gene Promoter—a Multicenter, Open-Label Phase II Study, Investigating Two Cilengitide Regimens in Combination With Standard Treatment (Temozolomide With Concomitant Radiation Therapy, Followed by Temozolomide Maintenance Therapy) (CORE)

CORE is a Phase II clinical trial in patients with newly diagnosed glioblastoma multiforme (GBM) in patients with an unmethylated promoter of the methylguanine-DNA methyltransferase (MGMT) gene in the tumor tissue. The MGMT gene promoter is a section of DNA that acts as a controlling element for a specific NDA product (MGMT). Methylation of the MGMT gene promoter has been found to be a predictive marker for benefit from temozolomide (TMZ) treatment.

The trial is currently in a safety run-in period to determine the safety and tolerability of cilengitide given as an intense treatment in combination with the first part of standard therapy. Thereafter the trial will investigate the overall survival and progression-free survival in patients receiving two different regimens of cilengitide in combination with standard treatment versus standard treatment alone.

Neuropathology

1. Glioblastoma Immunotherapy: An Autopsy Study

This is a Phase II clinical trial evaluating the effectiveness of DCVax®-Brain, autologous dendritic cells pulsed with tumor lysate, for the treatment of glioblastoma multiforme (GBM). The purpose of the study is to add postmortem examination of the brain to the tertiary objectives in the DCVax-Brain trial. Autopsy will be performed to correlate with premortem neuroimaging and evaluate tumor progression, immune response to tumor and possible autoimmune findings. (IRB application in draft; funding not yet obtained)

2. Tissue Microarray for Validation of a New Immunohistochemical Panel for Pituitary Adenoma

Tissue microarrays of pituitary adenomas will be assembled in order to rapidly evaluate several new antibodies for the diagnosis of pituitary adenoma. The goal is to provide a more efficient and reproducible testing algorithm than is currently available.

Neurophysiology

1. Investigation of a new method for intraoperative monitoring of the genitofemoral nerve during surgery involving lateral exposure of the lumbar spine

2. Laboratory investigation of chronically injured nerves to better understand the pathophysiology of "injury discharges" (neurotonics) in the operating room

3. Investigation of EMG monitoring for detection of early reversible injury to the spinal cord (1) in animal trials and (2) during spinal procedures in patients (manuscripts in preparation)

4. Development of a new method to more efficiently check spinal cord motor function during spinal operations

5. Development of a new method to more sensitively detect all "injury discharges" within at-risk myotomes



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2006-2008

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We're proud of what we offer the community: exceptional physicians, nurses and support staff; a commitment to research, education and outcomes; a foundation of clinical partnerships that span the region; and a cultural enthusiasm for growth and improvement.





About Abbott Northwestern

Abbott Northwestern and its Medical Staff are dedicated to providing outstanding care and service to patients and their families.

Abbott Northwestern Hospital is the largest not-for-profit hospital in the Twin Cities area, with 633 available beds and 65 bassinets. Each year, the hospital provides comprehensive health care for more than 200,000 patients and their families from the Twin Cities area and throughout the Upper Midwest. More than 5,000 employees, 1,600 physicians and 550 volunteers work as a team for the benefit of each patient served.

Abbott Northwestern Hospital is a part of Allina Hospitals & Clinics, a family of hospitals, clinics and care services in Minnesota and Western Wisconsin.

For more than 125 years, Abbott Northwestern has had a reputation for quality services. The hospital is well known for its centers of excellence:

- cardiovascular services in partnership with the Minneapolis Heart Institute®
- Mental Health Services
- medical/surgical services
- Neuroscience Institute
- Orthopaedic Institute
- physical rehabilitation through the Sister Kenny Rehabilitation Institute
- Spine Institute
- Virginia Piper Cancer Institute
- perinatology, obstetrics and gynecology through WomenCare.

Abbott Northwestern and its Medical Staff are dedicated to providing outstanding care and service to patients and their families. We're proud of what we offer the community: exceptional physicians, nurses and support staff; a commitment to research, education and outcomes; a foundation of clinical partnerships that span the region; and a cultural enthusiasm for growth and improvement. Brought together in one institution, these factors create an energetic and sophisticated environment that inspires caregivers to collaborate in new ways for the benefit of patients.

Our passion for finding new and better approaches to care drives extensive research efforts in clinical areas across the hospital. This ensures that new treatment advances benefit patients as quickly as possible, supports a dynamic environment for medical and nursing education, and is the catalyst for our outcomes measurement program.

To Admit a Patient to Abbott Northwestern Hospital

PHYSICIAN-TO-PHYSICIAN PROGRAM

1-800-828-8900. Available 24 hours a day, seven days a week.

One number access to:

- telephone and telemedicine consultations
- hospital admissions and specialist appointments
- transportation to Abbott Northwestern Hospital and affiliated physician clinics
- the Hospitalist Program
- specialty services that might not be available in your community.

EMERGENCY DEPARTMENT-TO-EMERGENCY DEPARTMENT (ED TO ED)

For urgent consultation and transfer assistance call 612-863-4233.

This program includes:

- ED to ED transfers
- ED-facilitated direct admissions
- ED physician triage and consultation
- Urgent stroke neurologist telephone consultation

MINNEAPOLIS HEART INSTITUTE® AT ABBOTT NORTHWESTERN

For referring physicians, we offer:

- one of the largest cardiology outreach and mobile diagnostic programs in the US, with regular cardiology consultations in more than 30 communities across Minnesota and the Upper Midwest
- physician follow-up with primary care or referring physicians to help them ensure patients are receiving a continuum of quality care before, during and after their experience with the Minneapolis Heart Institute®.

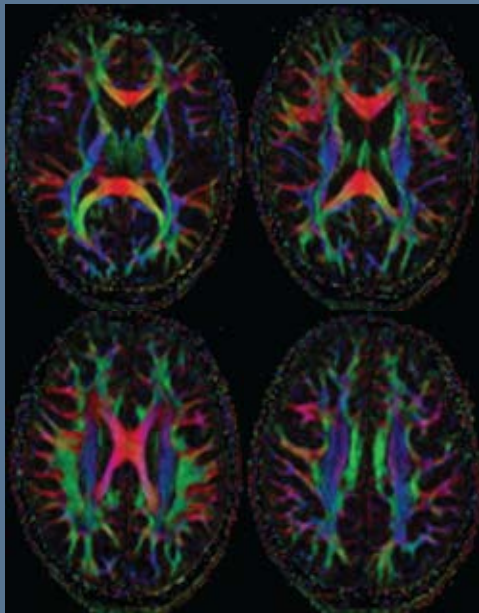
To make an appointment at our Minneapolis location or to determine which Minneapolis Heart Institute® location is most convenient for your patient for a cardiology consultation or diagnosis, please call the Minneapolis Heart Institute® at 612-863-3900 or toll-free at 1-800-582-5175.

To learn more about Abbott Northwestern Hospital, visit www.abbottnorthwestern.com or call 612-863-4000.

To contact the Neuroscience Institute, call 612-863-3200.

IN APPRECIATION

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On the Cover:

Axial images (transverse sections) from a diffusion tensor MRI scan showing the pattern of nerve fibers within the brain. The data represent the degree to which the diffusion of water molecules in brain tissue is organized rather than random. These maps of “fractional anisotropy” are colorized to depict the direction of fiber bundles. Red indicates water diffusion paralleling nerve axons that are oriented in a transverse (right/left) direction. Green indicates anterior/posterior (front/back) direction. Blue indicates superior/inferior (top/bottom) direction.



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