Synapse

How IU Health connects the latest in neuroscience discovery and technology to advance brain and spine care.

THE STRENGTH IT TAKES

Indiana University Health
At the new Indiana University Health Neuroscience Center, collaboration is more than a buzzword; it is literally part of the blueprint of the six-floor, 270,000-square-foot center and it is realized on a patient-by-patient, daily basis.

The IU Health Neuroscience Center, which opened in August 2012, brings all neuroscience specialties and sub-specialties together in one location, allowing patients faster access to specialists, diagnostic testing and the latest research breakthroughs. It fosters collaboration through regular multidisciplinary meetings and encourages cross-discipline discussions through its creative design and layout. The IU Health Neuroscience Center enables experts of different specialties to work together to help advance the neuroscience field and improve care for people with nervous system disorders. Not only is it the first complex of its kind in Indiana, it is one of only a few such centers in the country.

“Our IU Health Neuroscience Center brings every specialty under one roof and was built with a cross-specialty approach in mind,” says Nicholas Barbaro, MD, Chair of the Department of Neurological Surgery at Indiana University School of Medicine and Medical Director of the IU Health Neuroscience Center. “We have a seamless approach that includes multiple disciplines. It’s literally built into the system.”

“This is one of the most collaborative and truly integrated programs you’ll find anywhere.”

Nicholas Barbaro, MD, Chair of the Department of Neurological Surgery at IU School of Medicine, Medical Director of the IU Health Neuroscience Center
One-stop shop

Every aspect of the IU Health Neuroscience Center was designed with patients’ needs in mind. The Center brings together nationally ranked experts to provide specialized care for a full range of neurological conditions—all in one place. Physicians and researchers work closely to detect and treat issues at their earliest signs.

Once completed, the Neuroscience Research Building will physically connect to the imaging arena faster.

The IU Health Neuroscience Center will bridge directly to the Research Building—fulfilling the vision for researchers and clinicians to work more closely together in order to bring bench research into the clinical arena faster.

"This is one of the most collaborative and truly integrated programs you’ll find anywhere," said Dr. Barbaro. "It is a true differentiator for our program."

Full House

Advanced technology and a collaborative, multidisciplinary approach help keep a professional poker player in the game.

In late 2012, a patient was brought to IU Health after suffering a seizure. An initial scan showed an abnormality in his brain. Treating neurologists suspected it was a brain tumor, but referred him to IU Health Neuroscience specialists for additional neuroimaging tests, including a magnetic resonance spectroscopy (MRS). Unlike traditional MRI, MRS visualizes biochemical changes in the brain. It helps clinicians pinpoint the location and size of a tumor, as well as its type and aggressiveness.

The MRS revealed the patient had a low-grade astrocytoma located at the junction of the frontal and temporal lobes. Because the patient makes his living as a professional poker player—a profession where keen sensitivity to visual stimuli and information is essential—physicians made the decision to manage his seizures with medication, rather than risk potential damage to his visual processing during surgery and watch the tumor for signs of growth or change.

"It is a true differentiator for our program," Dr. Barbaro says. "It is a true differentiator for our program."

Collaboration occurs on a daily basis at the IU Health Neuroscience Center through a variety of formal and informal gatherings. On a weekly basis, physicians and researchers gather for epilepsy and tumor-board conferences. A cross-disciplinary vascular conference also meets every other week. The conferences provide an opportunity to discuss individual cases and treatment plans with a variety of caregivers.

In addition, “collaborative niches” on the clinical floors allow specialists to quickly come together for impromptu meetings to discuss patient status. Large collaboration areas on the west end of the building feature sophisticated video conferencing capabilities and encourage researchers and clinicians on-site and across the region to collaborate and learn from each other.

IU Health Neuroscience Center

Lower Level:
Research & Clinical Imaging
I.S. MRI Scanner
3T MRI Scanner
64-Slice CT Scanner
PET/CT Scanner

First Floor:
Isolation Therapy
Gait & Balance Therapy
Motor Analysis System
Neuroscience Grand Rounds
Tumor & Neurovascular Boards
Neuroscience Auditorium

Second Floor:
Neuropsychology
Psychiatry

Alternative Depression Treatments
Collaborative Psychopharmacology
Collaboration Space
Research and Clinical Studies

Third Floor:
Neurology
Alzheimer/Dementia
Epilepsy/Seizures
Infectious Diseases
Movement Disorders
Neuromuscular Disorders
Auditory Testing Suites
Multiple Sclerosis/Autoimmune Disorders
Ear, Nose & Throat
Physical Medicine and Rehabilitation
Neuromuscular & Neurocritical Care
Vascular & Intensive Care Units
UM Room & Rotary Chair

Fourth Floor:
Administration
IU School of Medicine Department Chairs
• Neurology
• Neurosurgery
• Psychiatry
• Physical Medicine and Rehabilitation

Fifth Floor:
Brain Tumor Clinic & Infection Suite
Neurology Neuroradiology Reading Room
Clinical Research Center (CTSI Certified)
Neurosurgery (Goodman Cerebral Brain and Spine)

The Indiana University Neuroscience Research Building will be opening in Spring 2014 and will provide researchers with state-of-the-art facilities in which to conduct a broad range of neuroscience research in fields such as neurotrauma, dementia, addiction, epilepsy and pain.
“Novel systemic agents and targeted therapies are the key to future progress in glioblastoma.”

Mark McDonald, MD,
Assistant Professor of Radiation Oncology, IU School of Medicine

Glioblastoma multiforme, or GBM, is both the most common and lethal of all primary brain tumors. Of the estimated 22,000 new cases of primary brain cancer diagnosed annually in the United States, 80 percent are gliomas, and the majority of these are GBM. Median GBM survival is just 15 months. The prognosis for patients with recurrent GBM is even more discouraging, with median survival less than a year. Because recurrence rates are so high, many clinicians take a palliative, rather than curative, approach to GBM.

“In the past, there has been a lot of nihilism in the medical community regarding treatment of GBM,” says James Miller, MD, Assistant Professor of Neurological Surgery at IU School of Medicine. “Physicians in the past may have tended to think of GBM treatments as futile.”

But it’s time to rethink that, thanks to the efforts of the leading researchers and clinicians at IU Health Neuroscience. Groundbreaking research is increasing scientists’ understanding of genetic and cellular pathways and leading to new delivery techniques and more targeted treatment. In addition, advanced proton therapy, which is available at only a select few centers, allows physicians to target tumors with very high doses of radiation without the damaging side effects caused by traditional radiation therapy.

With the state’s only neuro-oncology program with formally trained physicians, IU Health Neuroscience offers newly diagnosed and recurrent GBM patients more treatment options and the chance of a better outcome. “Things are changing,” Dr. Miller says, “and there are some exciting new treatment approaches and opportunities for patients with GBM.”

Brain cancer vaccine

One of the most exciting breakthroughs in brain tumor treatment is a vaccine made from a patient’s own tumor cells. Vaccines have been the focus of research for decades, as they offer a less toxic approach than traditional chemotherapy. However, most vaccines to date have fallen short—delivering positive results for a small group of patients, but proving less effective when tested across multiple sites.

Now, with phase I trials showing very positive results for a new GBM vaccine, a phase II, randomized, multicenter study is underway, IU Health Neuroscience is the only center in the region offering access to the DCVax? Brain trial for newly diagnosed GBM.

“What’s exciting to me is that we are using the patient’s own immune system to fight the brain tumor,” Dr. Miller says. “The vaccine is created by taking a patient’s tumor proteins and combining them in the laboratory with the patient’s immune cells to ‘activate’ them. When those activated immune cells are re-infused, they help attack the residual brain tumor cells. It’s a highly personalized treatment.”

The vaccine involves purifying a patient’s dendritic cells from a blood draw. These cells help to direct the entire immune system. Once activated with proteins from a patient’s own tumor, the dendritic cells are returned to the patient and work to recruit and mobilize other cells against the cancer cells. The dendritic cells direct the immune system to specifically attack the cancer cells, without the toxicity or side effects of chemotherapy.

In phase I trials, median survival for patients receiving the vaccine was 33.8 months, and median time to recurrence was more than two years, compared with 6.9 months with standard care. Of patients receiving the vaccine, 33 percent reached four-year survival, 27 percent reached six-year survival, and the longest surviving patient to date exceeds 10 years. “It could really be a game changer for treatment of GBM,” says Dr. Miller.

Investigational therapies for newly diagnosed GBM patients

In the past, most clinical trials focused on recurrent GBM. Given that recurrence occurs in nearly all cases, the lack of alternative therapies for the newly diagnosed was frustrating for physicians and patients alike. Today, a number of trials are focused specifically on newly diagnosed GBM, and IU Health Neuroscience is playing a key role in bringing these therapies to patients.

For example, researchers are exploring the effect of multi-targeted therapies on GBM, and a number of clinical trials are focused on how those new drugs might aid the newly diagnosed. “Historically, GBM has been treated with surgery, radiation, more surgery and more radiation. But the therapies were behind the times because they were more localized therapies and didn’t treat the disease in a systemic fashion,” says Stephanie Wagner, MD, Clinical Associate Professor of Medicine at IU School of Medicine and Director of the Neuro-Oncology program at IU Simon Cancer Center. “The wave of the future is multi-targeted therapy and tailoring one’s treatment based on molecular markers.”

One such therapy is bevacizumab, the only drug approved for GBM patients in the last decade. Bevacizumab works by targeting blood vessels and blocking cells that are important for cancer cell growth. Because it targets only those cells important to tumor growth, the drug spares healthy tissue and results in fewer side effects. The FDA approved bevacizumab in 2009 for treatment of recurrent GBM, making it the first antiangiogenic therapy approved for cancer patients.

Bevacizumab is routinely prescribed to patients with recurrent disease, and now researchers think there is potential benefit for newly diagnosed patients as well. Three phase II studies have shown that bevacizumab in the newly diagnosed patient increases progression-free survival, though its impact on overall survival remains to be determined. In addition, two phase III trials recently closed, though survival data are not yet available.

“Independent of any survival benefit, bevacizumab seems to improve quality of life in newly diagnosed patients by reducing side effects through tightening the blood-brain barrier and decreasing vasogenic edema,” Dr. Wagner says. “There is also evidence that it improves neurocognitive function in recurrent GBM patients.”

Specialized radiation treatment for GBM

Radiation therapy is a mainstay of treatment for GBM patients. When used in conjunction with surgery, radiation therapy has been shown to prolong survival and, in the short term, improve cognitive function in patients with brain tumors. Over the longer term, however, radiation can cause fatigue and serious permanent side effects, including radiation necrosis.

Proton beam therapy, on the other hand, delivers very precise, very high doses of radiation to a tumor site, while sparing the surrounding healthy tissue. A specialized modality of radiation therapy, proton therapy represents a sophisticated treatment option for patients with both newly diagnosed GBM and recurrent disease, according to Mark McDonald, MD, a radiation oncologist at the IU Health Proton Therapy Center and Assistant Professor of Radiation Oncology at IU School of Medicine.

“Novel systemic agents and targeted therapies are the key to future progress in glioblastoma,” Dr. McDonald says. “Treatment modalities like proton therapy allow us to reduce harmful side effects of radiation, and may allow for concurrent use of newer agents that could not be employed with less conformal therapy.”

Proton therapy has the same biological effect as X-ray therapy. Unlike the photons used in traditional X-ray radiation therapy, protons release energy within a well-defined range of penetration. As protons enter the body, they release a low dose of radiation at the surface, followed by a sharp burst of radiation as they near the end of the range—a phenomenon called the Bragg peak. By modulating where the Bragg peak will occur, radiation oncologists are able to deliver a precise dose of energy throughout the tumor site, with minimal dosage to healthy tissue in front of the tumor site and negligible dosage beyond the tumor site.

From investigational studies of proton therapy margins and dosing to investigational therapies, IU Health Neuroscience provides patients with GBM the most advanced and latest treatment options. “We’re working with the nation’s leading researchers to translate the latest discoveries into treatment breakthroughs,” Dr. Wagner says.
Brain mapping: the next frontier

At IU Health Neuroscience, brain mapping is neither new nor futuristic, as researchers utilize neuroimaging to push the boundaries of neuroscience and deepen clinicians’ understanding of brain diseases.

In April 2013, the White House unveiled the BRAIN (Brain Research through Advancing Innovative Neurotechnologies) Initiative, an ambitious $100 million federal research program aimed at developing imaging techniques to better understand neural processes and brain function. A few months earlier, the European Union announced the launch of the Human Brain Project, a 10-year, $1.6 billion supercomputing project designed to increase understanding of the brain’s structure and function.

With these announcements, neuroimaging became the focus of the next wave of scientific discovery and “brain mapping” became one of the planet’s most buzzed-about scientific terms. At IU Health Neuroscience, however, business simply carried on as usual. That’s because the IU Health Neuroscience Center includes a sophisticated neuroimaging center run by the IU School of Medicine. Here, neuroimaging has long been used to increase clinicians’ understanding of the origins and pathology of a number of brain diseases, including Alzheimer’s disease, schizophrenia and more; and researchers use brain mapping every day to advance treatment options and patient outcomes.

“The goal of the IU Health Center for Neuroimaging is to study the brain, its diseases and possible treatments using advanced imaging tools meshed with the power of genomics,” explains Andrew Saykin, PsyD, Director of the Center. “We work on strategies for integrating genomic data from genetic testing with the latest brain imaging techniques, including MRI and positron emission tomography.”

By combining the most advanced neuroimaging technology with leading-edge genomics, the experts at IU Health Neuroscience are advancing neuroscience care today and accelerating treatments of tomorrow. “This is a place where all the neurosciences—from clinical to basic sciences—come together with a focus on translating findings into personalized diagnostics and therapeutics,” Dr. Saykin says.

Neuroimaging as part of trans-discipline collaboration

With its location in the new IU Health Neuroscience Center, the researchers and clinicians of the Neuroimaging Center are able to work in close collaboration with all the experts at IU Health Neuroscience. “We have all the disciplines together under one roof, and it fosters collaboration across disease areas and centers. Few places in the country offer such an interconnected environment,” Dr. Saykin says.

Multidisciplinary collaboration is especially important when it comes to difficult-to-treat brain conditions. “Almost all of the really challenging problems are very trans-disciplinary, where you need not only a neurosurgeon and neurologist, but also a neuropsychologist, neurorehabilitation specialist, people who do genetic biomarkers and computer scientists who can analyze all the data. You need to have them all talking together and working in collaboration,” he explains. “We’re dealing with tremendously complex information and we need to be able to distinguish the signal from the background noise. To do that, we need a trans-disciplinary team.”

How brain mapping is improving patient outcomes today

A current example of cross-discipline collaboration is the use of functional MRI to aid in the removal of certain types of brain tumors. Utilizing highly detailed brain images, neurosurgeons at IU Health Neuroscience can accurately target dissection to remove as much tumor as possible, while protecting crucial areas of the brain.

“It’s a non-invasive technique that allows us to administer sensory/motor or cognitive stimuli while a person is undergoing an MRI scan,” Dr. Saykin explains. “The images we obtain allow us to map areas of brain that are activated. We then provide feedback to the neurosurgeon on what areas are critically involved in motor or cognitive function so those can be avoided, if at all possible, during the surgical procedure.”

How brain mapping is defining future treatments

One of the most promising uses of brain mapping at the Center for Neuroimaging is research into the mechanisms of memory dysfunction. Dr. Saykin, who also serves as Director of the Indiana Alzheimer’s Disease Center (IADC), one of only 29 National Institute on Aging-funded centers in the country, oversees research programs that focus on the use of biomarkers and neuroimaging to aid early detection of Alzheimer’s disease.

For example, in February 2013 a national research team, led by scientists at the IADC, reported the results of a groundbreaking study that combined genetic data with brain imaging to identify the APOE gene—which has been long associated with development of Alzheimer’s. As a result of the study, researchers also uncovered an association with a second gene, called BCHE. The study is believed to be the first genome-wide association study of plaque deposits using a specialized PET scan tracer that binds to amyloid, and the results appear to offer scientists new potential targets for drugs to slow, reverse or even prevent the disease.

Dr. Saykin also leads the genetics core of the I7-site Alzheimer’s Disease Neuroimaging Initiative (ADNI). This long-term national research project is designed to combine genetic information, data from state-of-the-art brain scans, and biomarkers from blood and cerebral spinal fluid samples to find biomarkers that could lead to new therapies for the disease. In addition to Dr. Saykin’s leadership of the genetics core, the National Cell Repository for Alzheimer’s disease at the IU School of Medicine serves as the storage site for the DNA samples collected around the country.

Moving toward personalized care

Through these, and the many other investigational and clinical uses of brain mapping at the Center for Neuroimaging, IU Health Neuroscience experts are advancing neuroscience toward more complete, personalized care.

“The whole field is being propelled toward personalized diagnostics and therapeutics. That means in the future we won’t throw the same diagnostic techniques and therapeutic options at everyone, but instead will try to determine what the profile of abnormality is in a particular patient’s condition, and what targeted, therapeutic option would be most appropriate,” Dr. Saykin explains. “What we’re doing here is some of the fundamental clinical research that will help support the personalized neuroscience medicine of the future.”
Bringing care where, when it's needed most

It is well established that treatment with Tissue Plasminogen Activator (tPA) can determine the likelihood of survival, as well as quality of life after ischemic stroke. However, for optimal results, tPA should be given within three hours of stroke-symptom onset. Many hospitals lack the resources to make a diagnosis within this time frame and cannot transfer the patient quickly enough to enable them to receive this therapy. In fact, a 2010 study showed that nearly half of Americans (45 percent) live more than an hour away from a primary stroke center, hospitals with a dedicated stroke team and a proven record of consistently providing rapid and efficient stroke care.

This is where the IU Health Telestroke Program comes in. Using video-conferencing and image-sharing technology, IU Health Neuroscience Center stroke specialists can examine patients in a remote setting, consult with the on-site care team and recommend a course of treatment. With more than a dozen neurologists supporting the program and using a customized mobile technology platform, physicians and patients in rural and under-served areas can access the expertise of our stroke physicians 24 hours a day. The Telestroke Program brings the preeminent care of the IU Health Primary Stroke Center, as certified by the Joint Commission, to patients without comparable care in their own communities.

Primary Stroke Center pathways

Whether patients are seen remotely or in person by an IU Health Stroke specialist, they will benefit from fast assessment and diagnosis. As a Primary Stroke Center, IU Health stroke specialists are uniquely trained to shorten the time to therapy. Once a stroke is identified, the emergency department begins a specific communication and treatment process that includes working with a neurologist and an interventional neuroradiologist to determine the proper intervention. If the stroke team determines that the stroke occurred beyond the three-hour window for tPA treatment, an interventional neuroradiologist may be able to retrieve the stroke-causing clot through a minimally invasive catheter, lessening the damage caused to the brain.

Experience and expertise

The board-certified stroke specialists at IU Health are able to confidently make prompt treatment decisions because of their specialized training and extensive experience. IU Health Neuroscience stroke specialists treat nearly 1,000 patients each year at the downtown Indianapolis facilities alone. In addition, due to their skill and expertise, IU Health neurointerventional physicians annually perform nearly three times as many endovascular procedures as their peers (according to Medicare volume data).

Focus on quality

With private and government payers placing ever increasing emphasis on outcomes and efficiency, providers throughout the nation are seeking ways to improve clinical practices. In this climate, data and access to quality benchmarks are taking on greater importance. As thought leaders committed to advancing best practices, the neurosurgeons who practice at IU Health Neuroscience are playing an important role in a groundbreaking quality-improvement initiative aimed at defining neurosurgery quality standards and improving care for patients across the country.

The National Neurosurgery Quality and Outcomes Database (N'QOD) is a clinical registry for neurosurgical procedures and practice patterns. Its primary purpose is to track quality of surgical care for the most common neurosurgical procedures. It is among the most comprehensive surgical-outcomes registries ever developed and offers neurosurgeons across the country an unprecedented resource for quality data. IU Health Neuroscience was one of the 17 initial practices to enroll patients in the registry.

"It is an example of our willingness to ask meaningful questions and seek meaningful responses," says Saad Khairi, MD, Assistant Professor of Neurological Surgery at IU School of Medicine, who is practice leader of the N’QOD initiative. "We are not complacent; we are committed to critically examining every aspect of our practice and asking, ‘can this be better? And if it could be better, why shouldn’t it be better?’"
Forward motion

Sophisticated technology aids patients in neurorehabilitation

The Neurorehabilitation and Robotics Lab at the IU Health Neuroscience Center is pushing the boundaries of rehabilitation, providing unparalleled services and therapies to people suffering from brain, spine, nerve and muscle damage. A collaborative effort between IU Health and the Indiana University Department of Physical Therapy, the lab houses some of the most advanced rehabilitative technology available to help patients improve function.

“The equipment we have is very unique. In most cases, it’s the only piece of equipment like it in the state, and very few of those pieces exist in the country,” explains Ryan Cardinal, PT, DPT, Program Manager for Neurorehabilitation and Robotics. “We have brought them into one clinic, where we can truly offer patients the full gamut of advanced technology as it relates to their particular disorders.”

One of the advanced therapies available at the Neurorehabilitation and Robotics Lab is Lokomat® a robotic gait-therapy device that is used for patients recovering from brain and spinal cord injuries, stroke, or neurological and orthopedic conditions. “Lokomat offers us the ability to train patients intensely with repetition and consistency. This allows us to hopefully develop neuroplasticity, which is the brain’s ability to literally rewrite itself,” Cardinal says. “it can actually start to retrain patients in a normal walking pattern.”

The rehabilitation specialists at the Neurorehabilitation and Robotics Lab work in conjunction with a variety of other medical specialists, including the physiatrists of the IU Health Physical Medicine & Rehabilitation Program. Located on the third floor of the IU Health Neuroscience Center, the Physical Medicine & Rehabilitation Program is the largest physical medicine program in Indiana. It offers patients easy access to all the diagnostic capabilities and advanced services of IU Health Neuroscience, including many that are not available elsewhere in the region. Some of the leading-edge therapies and technologies include:

- Upper- and lower-extremity robotic technology
- NeuroCom Balance Master System for balance recovery following a neurological injury
- Vestibular rehabilitation for chronic dizziness and balance disorders
- Augmentative alternative communication for those who have lost the ability to speak
- Motion analysis lab
- Body weight-supported gait training
- Videostroboscopy to identify vocal cord pathology
- Sensory integration

In addition to physiatrists, the multidisciplinary team of rehabilitation experts includes:

- Neurologists
- Neurosurgeons
- Fellowship-trained brain injury specialists
- Fellowship-trained spinal cord injury specialists
- Pain management specialists
- Neuropsychologists
- Physical, occupational and speech therapists

Combining the skills, expertise and advanced technology of the largest physical medicine program in the state with the leading-edge therapies of one of the largest rehabilitation programs in Indiana, IU Health Neuroscience delivers the most comprehensive rehabilitation services to people recovering from neurological diseases, disorders and injuries.

“We can truly offer patients the full gamut of advanced technology as it relates to their particular disorders.”

Ryan Cardinal, PT, DPT, Program Manager, Neurorehabilitation and Robotics

Full House (cont.)

... Functional MRI (fMRI) is a sophisticated neuroimaging exam that looks at blood flow in the brain to detect areas of activity. At IU Health Neuroscience, neuroradiologists and neuroradiologists use fMRI to plan tumor resections, relying on the fMRI images to determine how aggressive they can be without damaging critical language and motor areas of the brain. In some cases, they may have a patient perform language tests during the test so they can identify and distinguish critical parts of the brain from the tumor.

In the case of the poker player, Dr. Barbaro reasoned they could use fMRI to identify the sections of his brain that were activated during poker. Because of the routine collaboration and regular dialogue among the various specialties within the IU Health Neuroscience Center, it was easy for Dr. Barbaro to raise the topic with his peers. “I said, ‘can you test for something pretty unique?’ And the research MRI team was all over it,” Dr. Barbaro recalls.

Working with Dr. Barbaro and a neuropsychologist, neuroradiologists at the IU Health Neuroscience Center performed an fMRI while the patient meditated and worked through various card-playing scenarios. “We mapped the poker part of his brain, just like we can map language parts of the brain,” Dr. Barbaro said. …

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Disc Arthroscopy for Neck Pain

Cervical disc replacement surgery is a relatively new treatment option for degenerative disc disease. Disc replacement provides an alternative to traditional discectomy and fusion and offers the advantage of maintaining range of motion. Pioneers in spinal surgery, the neurosurgeons who practice at IU Health Neurosciences were at the forefront of disc arthroscopy and were the first in Indiana to implant the PCM artificial disc, an FDA-approved motion-preserving device. The PCM disc is approved for use in skeletally mature patients with a degenerated cervical disc at one level from C3-C4 to C6-C7. During disc replacement, surgeons access the spine from a small incision in the neck. They remove the damaged disc, along with any tissue or obstructions that are compressing the nerves or spinal cord. After shaping the edges of the vertebrae to ensure a proper fit, the PCM disc is inserted. The PCM artificial disc utilizes the same metal and plastic materials that are used in hip and knee joint replacements. The surgery lasts approximately one to two hours and most patients leave the hospital the following day.

Designated a Blue Distinction Center for Neck Pain, IU Health helps families make the best decision for their child's future.

Pediatric epilepsy

First-line defense, not last-choice option

Epilepsy affects about 300,000 children under age 15 in the U.S. Most seizures can be controlled with medication and some children outgrow their epilepsy; but about 30 percent of children have medically refractory seizures. For these children, surgery is a treatment option, but it is often viewed as a last resort because of perceived risks. As a result, some children suffer through years of failed treatment before referral to an epilepsy surgeon.

At IU Health Neurosciences, epilepsy specialists recognize that surgery gives certain children the best chance to live seizure-free and advocate for it to be considered earlier in the treatment process. The longer seizures go uncontrolled, the harder they become to manage or cure, explains Jodi Smith, PhD, MD, a pediatric neurosurgeon at the Riley Hospital for Children at Indiana University Health and an Assistant Professor in the Department of Neurological Surgery at IU School of Medicine. Early referral to an epilepsy surgery center can help specialists determine if surgery is a viable treatment option before epileptogenic networks spread and significant cognitive loss occurs.

“It’s important we reach children sooner, before they are delayed by frequent seizures, so we can help them become high-functioning and productive members of society with high quality of life,” Dr. Smith says.

Pointing seizure activity

Not all children with refractory seizures are candidates for surgery. Surgery is most successful in—and can often cure—children with seizures that always originate in the same part of the brain. The earlier epilepsy specialists can determine the type of seizure a child is having, the sooner they can make a recommendation for surgery. As Indiana’s only Level IV Specialized Epilepsy Center, IU Health Neurosciences provides the most comprehensive diagnostic evaluation available. To isolate the exact area of the brain where seizures occur, epilepsy specialists at IU Health carefully review each child’s case and complete an extensive work-up using intraoperative EEG, functional MRI (brain mapping) and PET scan.

If it is determined that the child’s seizures are coming from a specific, non-eloquent area of their brain, neurosurgeons will recommend surgery to remove that area. The most common surgery is a temporal lobectomy, which involves removal of part of the temporal lobe, including a portion of the amygdala and hippocampus. After surgery, about 85 percent to 90 percent of children will be seizure-free, according to Dr. Smith. Some may still require medication, but they will not experience seizures.

More complete treatment

Evaluation by a specialized epilepsy surgeon is also important for children with a brain lesion and seizures. Often, a seizure may be the first indication of a brain lesion. Neurosurgeons may remove the lesion, expecting that to end seizure activity, only to have the patient suffer continued seizures.

“Sometimes, the tissue surrounding the lesion is actually the seizure focus and removing the lesion alone doesn’t cure the seizures,” Dr. Smith explains. “Without a comprehensive seizure evaluation and detailed brain mapping, surgeons won’t know the exact source of the seizure and surgery can be incomplete.”

Dr. Smith encourages pediatricians and neurologists alike to seek consultation from an epilepsy surgeon as soon as an EEG shows abnormality.

Additional treatment options

For children who are not candidates for lobectomy, a Level IV epilepsy surgery center like that at IU Health Neurosciences provides additional treatment options, including vagal nerve stimulation therapy.

In vagal nerve stimulation, a FDA-approved device known as a vagal generator is implanted under the skin near a child’s left breastbone. Thin leads run up the left side of the neck to the vagal nerve and the pulse generator sends occasional electrical impulses along the vagal nerve to the brain.

“The pulses cause a desynchronization of the neuron fringes, disrupting the seizure activity,” Dr. Smith explains. “Kids tend to have about a 50 percent to 75 percent reduction in seizure frequency, and become more alert and interactive.”

Dr. Smith has been performing vagal nerve stimulation at Riley Hospital for Children at IU Health since 2000 and says the procedure is considered very safe. “We’d love to cure all kids completely with surgery, but for kids who aren’t candidates for surgery, this is a very good option,” she says. “Some of these kids were on five or six medications and having daily or every-other-day seizures. The improvement in quality of life is tremendous.”

Refactory seizures have a significant impact on a child’s functioning and quality of life. By presenting the full range of treatment options, including surgery, the epilepsy specialists at IU Health help families make the best decision for their child’s future.

Minimally invasive treatment alternative

Surgery can be an effective therapy for some people whose seizures cannot be controlled by anticonvulsant medications; but open surgery presents risks and involves a lengthy recovery. Radiosurgery, which is used to treat tumors and other brain abnormalities, is a minimally invasive treatment alternative for some people with temporal lobe epilepsy, and IU Health Neurosciences is one of the few centers in the nation to offer it.

IU Health Neurosciences is one of just seven U.S. centers participating in the ROSE (Radiosurgery or Open Surgery for Epilepsy) trial, a National Institutes of Health (NIH) study examining the effectiveness of radiosurgery treatment in people with partial epilepsy. The Gamma Knife® radiosurgery instrument used in this study uses tightly focused beams of radiation to target the seizure focus, rather than removing it with open surgery. Gamma Knife radiosurgery does not require an inpatient hospital stay. The first phase of the trial was so successful, NIH expanded the trial and IU Health Neurosciences is currently enrolling new patients at IU Health University Hospital.

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Dr. Smith encourages pediatricians and neurologists alike to seek consultation from an epilepsy surgeon as soon as an EEG shows abnormality.

For children who are not candidates for lobectomy, a Level IV epilepsy surgery center like that at IU Health Neurosciences provides additional treatment options, including vagal nerve stimulation therapy.

In vagal nerve stimulation, a FDA-approved device known as a vagal generator is implanted under the skin near a child’s left breastbone. Thin leads run up the left side of the neck to the vagal nerve and the pulse generator sends occasional electrical impulses along the vagal nerve to the brain.

“The pulses cause a desynchronization of the neuron fringes, disrupting the seizure activity,” Dr. Smith explains. “Kids tend to have about a 50 percent to 75 percent reduction in seizure frequency, and become more alert and interactive.”

Dr. Smith has been performing vagal nerve stimulation at Riley Hospital for Children at IU Health since 2000 and says the procedure is considered very safe. “We’d love to cure all kids completely with surgery, but for kids who aren’t candidates for surgery, this is a very good option,” she says. “Some of these kids were on five or six medications and having daily or every-other-day seizures. The improvement in quality of life is tremendous.”

Refactory seizures have a significant impact on a child’s functioning and quality of life. By presenting the full range of treatment options, including surgery, the epilepsy specialists at IU Health help families make the best decision for their child’s future.

Surgery can be an effective therapy for some people whose seizures cannot be controlled by anticonvulsant medications; but open surgery presents risks and involves a lengthy recovery. Radiosurgery, which is used to treat tumors and other brain abnormalities, is a minimally invasive treatment alternative for some people with temporal lobe epilepsy, and IU Health Neurosciences is one of the few centers in the nation to offer it.

IU Health Neurosciences is one of just seven U.S. centers participating in the ROSE (Radiosurgery or Open Surgery for Epilepsy) trial, a National Institutes of Health (NIH) study examining the effectiveness of radiosurgery treatment in people with partial epilepsy. The Gamma Knife® radiosurgery instrument used in this study uses tightly focused beams of radiation to target the seizure focus, rather than removing it with open surgery. Gamma Knife radiosurgery does not require an inpatient hospital stay. The first phase of the trial was so successful, NIH expanded the trial and IU Health Neurosciences is currently enrolling new patients at IU Health University Hospital.
Full House (cont.)

... Armed with the results of the fMRI, Dr. Barbaro planned an aggressive resection, confident he could remove the tumor without damaging the patient’s visual-processing skills. He performed the surgery in one of the two dedicated IMRIS neurosurgical suites at IU Health Methodist Hospital. The suites feature the most advanced imaging technologies and surgical navigation systems, including the i7 Integrated Navigation System. The navigational system integrates intraoperative imaging with surgical-planning software and allows neurosurgeons like Dr. Barbaro to quickly and confidently make surgical decisions. IU Health Methodist Hospital is the first hospital in the state to acquire the technology.

To ensure complete removal of the poker player’s tumor, Dr. Barbaro also utilized intraoperative MRI scanner (IMRIS), a powerful imaging tool that provides real-time images of the brain right in the operating room. The IMRIS moves back and forth on rails between two integrated operating rooms, allowing surgeons to bring the MRI technology to the patient, rather than moving the patient. IU Health Methodist Hospital is the only hospital in the state with this advanced technology. ...

Continued on next page 16

Glowing brain tumor

While a “glowing brain tumor” may sound like something out of a science fiction movie, it is a sophisticated reality at IU Health Neuroscience. In fact, the use of glowing brain technology to resect glioblastomas and other brain tumors has put IU Health Neuroscience at the leading edge in the treatment of brain cancer.

Aaron Cohen-Gadol, MD, Associate Professor of Neurological Surgery at IU School of Medicine who practices at the IU Health Neuroscience Center, developed this particular method, which makes both cancerous tumors and the difficult-to-detect surrounding cancerous tissue glow in comparison to healthy brain tissue. Within minutes of intravenously injecting low doses of the glowing compound, fluorescein, into a patient’s bloodstream, Dr. Cohen-Gadol’s newly-invented microscope filter shows the normal brain structures clearing the fluorescein, leaving the tumors stained with the compound and visibly distinguishable from surrounding healthy brain tissue. As a result, the glowing portions provide a roadmap for extremely accurate and thorough tumor resection.

“Generally, it’s very difficult to know where a tumor ends and normal brain starts,” Dr. Cohen-Gadol explains. “By injecting fluorescein, we can find out exactly where the tumor is and remove even the microscopic remnants, while preserving critical parts of the healthy brain.”

This new technology provides minimal risks to the patient while lengthening survival, according to Dr. Cohen-Gadol. One clinical study found that the use of fluorescein results in more patients having gross total resection (GTR), and the extent of resection has a powerful influence on median survival time: 34.3 weeks after partial resection vs. 46.5 weeks after GTR.

Fewer than five medical centers in the country currently provide this groundbreaking surgical treatment. Another experimental procedure currently in trials uses 5-aminolevulinic acid (5-ALA) to make the diseased brain tissue glow. However, 5-ALA has not yet been approved by the U.S. Food and Drug Administration. Fluorescein, which is water soluble, is widely available and has been proven safe through years of use to evaluate and diagnose eye diseases. Furthermore, the strength of Dr. Cohen-Gadol’s microscope filter requires only a low dose of fluorescein to achieve the glowing brain result.

The glowing brain tumor technology is an innovative use of a combination of intraoperative MRI, mapping and endoscopic removal of certain brain tumors.

“At IU Health Neuroscience, we are advancing patient care tremendously, and have contributed technologies that increasingly are being used in other medical centers around the country,” Dr. Cohen-Gadol says.
...“IMRIS showed me I could shave away a bit more of the tumor without entering the cortex,” Dr. Barbaro explains. “It permitted me to be more aggressive than I might have been. In the past, we would have had to close the patient and get a scan to find out if we should have taken out a little more.”

The patient’s final post-operative scan showed no sign of the tumor, as did his two-month scan. As to the card shark’s post-operative success at the gaming table, Dr. Barbaro is not sure; but he is confident that the IU Health Neuroscience team dealt him the best hand possible. “What I love about this case is that it highlights the various advanced technologies at our disposal and how our team approach allows us to use them for best results,” he says.

Real-life CSI

Laura Tormoehlen, MD, describes her neurotoxicology specialty as part medicine, part detective work. “It’s real-life CSI,” she says, explaining how she uses her highly specialized expertise to unravel the mysteries of patients suffering from exposure to unknown toxins.

Dr. Tormoehlen, who is an Assistant Professor of Clinical Neurology and Emergency Medicine at the IU School of Medicine and who oversees the Neurotoxicology Clinic at the IU Health Neuroscience Center, is uniquely qualified to take on such detective work. She is the only physician in Indiana who is board certified in both neurology and toxicology. In fact, she is the only known physician in the country to have dual training in both specialties. “Neurotoxicology is a pretty uncommon specialty, and the fact that we have a Neurotoxicology Clinic is very unique,” she says.

After completing her neurology residency at the IU School of Medicine, Dr. Tormoehlen completed a two-year medical toxicology fellowship with IU Health/Indiana University Medical Center and the Indiana Poison Center. Now, she brings this highly specialized training and knowledge to IU Health Neuroscience for the care and treatment of patients suffering neurologic effects of overdose, poisoning, and exposure to chemicals, metals, pesticides, solvents and pollutants.

Often, she receives referrals for patients who are experiencing neurologic symptoms, such as headaches, dizziness or peripheral neuropathy, with no known cause. She also treats people who have been exposed to metals, mold and carbon monoxide in the past and are wondering if current neurologic symptoms are related to past exposure.

“Patients who seek care at the Neurotoxicology Clinic don’t always know what their exposure was, or the exposure was so remote—months or years ago—that the toxin is gone now and there is no testing to do,” she explains. “Then, it’s a lot of detective work.” In such cases, Dr. Tormoehlen draws on her toxicology training to connect symptoms to possible toxins for appropriate treatment. Similarly, in the case of patients who are brought to the emergency department for poisoning or overdose, she draws on her neurology training to identify symptoms related to the exposure. “The vast majority of overdose patients that I see overdose on substances that have some neurologic effect. It’s very helpful for me to say, ‘yes, this is the kind of confusion I would expect from this drug, or this isn’t quite right.’”

The biggest mysteries involve those patients who present in a “found-down” state. “We don’t always have pill bottles or any information explaining why the person is unconscious,” she says. “Then it’s our job to figure out why this otherwise healthy person is unconscious.” She cites the example of people who became overcome by hydrogen sulfide fumes as one such mystery. “When they get to us, we don’t know what caused them to pass out and they’re unconscious so they can’t tell us. We look for physical clues from the scene, as well as information from rescuers to figure out what the exposure was,” she explains. “We might ask the person who rescued them if it smelled like sulfur. If they happen to have any coins in their pockets, the coins will turn green. A lot of times it’s deductive reasoning.”

As one of the only specialists with her combined training, Dr. Tormoehlen is a frequent lecturer at continuing medical education meetings and contributes to book chapters and review articles. “It’s a pretty narrow specialty,” she admits, “but it gives me an opportunity to educate other physicians and really make a difference.”
IU Health Neuroscience is ranked as one of the top 15 neuroscience programs in the nation by U.S. News & World Report. In addition, IU Health is one of only 18 hospitals in the nation to achieve the Honor Roll ranking—U.S. News & World Report’s highest distinction. IU Health Neuroscience is the only program in the state of Indiana to achieve this ranking.

For more information on the IU Health Neuroscience Center, please visit iuhealth.org/neuroscience-center

THE STRENGTH IT TAKES

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