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Causes, treatment and prevention of strokes • Clinical research updates • Welcoming new physicians

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ADVANCEMENTS IN NEUROSCIENCE

Aurora Neuroscience Innovation Institute®

Case Study: Collaboration Takes Flight

Working side-by-side in the operating room, neuroradiologists and neurosurgeons in Wisconsin use imaging to map the best course of treatment.

From the American College of Radiology

Not everyone would compare a successful multidisciplinary neurosciences center to the airline industry. However, not everyone is world-renowned neurosurgeon Amin Kassam, MD, who sees parallels between commercial flight and a health care model built on value through risk reduction rather than volume.

"I wanted to build a health care service line that mitigates risk, and the airline industry has done that well," he says. "Flying is a safe event, when you look at the number of flights as opposed to the number of plane crashes. You can look at health care the same way."

With that in mind, Kassam spearheaded the creation of the Aurora Neurosciences Innovation Institute (ANII), a multidisciplinary program of the Aurora Health Care Medical Group in Milwaukee, Wis. The program's goal is to create a collaborative environment where neurosurgeons pilot through brain surgery with navigation from neuroradiologists—all working side-by-side in the OR. Each team member provides support for the competency for which they are best suited.

Typically, imaging would be done in a separate location and provided to neurosurgeons in preparation for surgery. By combining efforts in one location, Kassam says patients benefit from more immediate care. According to Jonathan E. Jennings, MD, section chief of neuroradiology for Aurora Health Care Medical Group and a neuroradiologist with ANII, the overarching goal of the new program is improved outcomes, decreased patient morbidity and reduced length of stay for patients. "In the two years since the program began, we've amassed a significant amount of data about the progress of this multidisciplinary approach," he says.

"Now we're analyzing that information to help us drive better patient outcomes."

MODEL DESIGN

In 2014, Kassam was recruited by Aurora Health Care Medical Group to build its multidisciplinary neurosciences program. Kassam has had extensive experience over the past two decades in building service lines focused on multidisciplinary collaboration, and proposed the concept of integrating neuroradiology as a clinical component of neurosciences. He designed the ORs and clinics to contain reading spaces for radiology. This meant actually seeing patients in the clinic, in the operating room, and in postoperative acute and outpatient venues.

Radiologist Dale J. Lye, MD, who leads Aurora Imaging Services, was also forward-thinking and supportive of establishing the ANII, not only because it provides a higher quality of patient care but also because it is a natural progression in the evolution of how radiology will need to look in the future, particularly as health care moves from volume to value. This open-minded thinking led to a natural collaboration that broke down silos and made implementing the concept much easier.

During the design process, the imaging team analyzed the clinicians' workflow to see where having a radiologist on-site could help improve efficiency. They realized neurosurgeons were spending time weeding through stacks of imaging reports in order to plan their next course of action. In response, they proposed that adding a neuroradiologist to the crew would provide the guidance necessary to complete a surgical flight plan.

"At ANII, neurosurgeons are pilots, radiologists are the navigators and the OR is the cockpit," Jennings says.

(continued on page 7)

> "At ANII, neurosurgeons are pilots, radiologists are the navigators and the OR is the cockpit."
>
> *Dr. Jonathan E. Jennings*

Multidisciplinary Neuro-Oncology Program

With 480 new primary tumors and another 1,200 cases of metastatic brain cancer expected in the state of Wisconsin every year—including 926 new deaths from the disease—Aurora Health Care has made a commitment to the early diagnosis and innovative treatment strategies of primary and metastatic brain tumors of all kinds.

Based on American Cancer Society registry data, 7.4 out of every 100,000 people will be diagnosed with brain cancer next year in Wisconsin, which is more than the 6.6 expected across the United States. It's also more than the expected cases of liver, myeloma, stomach and testicular cancers, as well as some forms of esophageal, laryngeal, oral and thyroid cancers, as well as Hodgkin's lymphoma.

A distinctive feature of the Aurora Neuro-Oncology program is the truly multidisciplinary approach to brain tumor management used at every stage of treatment and diagnosis. Our specialized team of neurosurgeons, neuroradiologists, neuro-oncologists, medical oncologists and radiation oncologists works collaboratively with the added expertise of neuropsychology, head and neck oncology, neurology, pathology and many others, including cancer nurse navigators, neuroscience advanced practice nurses and physician assistants. We treat our patients as members of the care team, keeping them actively involved in all decision-making. When it comes to treating brain tumors and cancers, we believe the patient is the most important shareholder in the decision-making treatment process.

Aurora Cancer Care's Multidisciplinary Clinic (MDC) brings together a team of dedicated brain and spine cancer specialists to provide personalized care using the latest treatments and technologies. From diagnosis to treatment, we coordinate care to ensure the best possible outcome.

We treat many types of tumors that involve the brain, including the following:

- Pituitary tumors
- Oligodendroglioma
- Meningioma
- Gliomas
- Astrocytoma
- Craniopharyngioma
- Ependymoma
- Glioblastoma
- Other tumors that spread to the brain

MDC CLINIC

Our clinic follows the National Comprehensive Cancer Network (NCCN) guidelines, a national organization dedicated to improving the quality and effectiveness of cancer care. Collaboration and communication between primary care physicians and the cancer team …

- Provides comprehensive, coordinated care and personalized treatment plans based on cancer diagnosis and personal status
- Increases access to clinical trials and the latest treatment approaches
- Improves efficiency and follow-up care

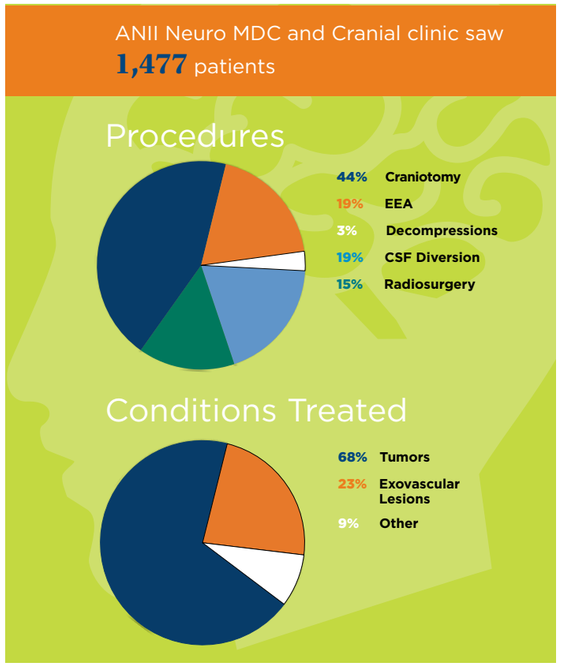
Throughout cancer treatment, primary care doctors remain active members of the team; we encourage them to participate in consultations and to continue managing their patient's care during each phase of treatment.

Another key member of the cancer team is a cancer nurse navigator. These navigators partner with the patient and their family to provide support, advocacy and education based on individual needs—so patients can feel confident with their decisions and take an active role in their care.

When it comes to brain tumors, people want only the most experienced specialists and the most advanced treatments available. Our doctors come from every field and work as a team to provide a coordinated approach that is specific to each patient.

- For convenience, patients will meet with their entire cancer team during their first appointment—making things easier for them and their families.
- After meeting with them, the cancer team will review each case and develop an effective treatment plan based on National Comprehensive Cancer Network (NCCN) guidelines, a national organization dedicated to improving the quality and effectiveness of oncological care. A patient's plan will be personalized to them and their cancer.
- The cancer team will explain test results and discuss recommended treatment options. By listening to the patient's questions, concerns and fears, we will develop a partnership that enables the patient and their family to participate in their plan of care.
- After an individualized treatment plan is in place, the care team will communicate with a patient's primary care doctor for follow-up care.

Multidisciplinary Neuro-Oncology Program (cont.)



A diagnosis of brain tumor can bring about many emotions and questions. The multidisciplinary cancer clinic at Aurora St. Luke's Medical Center (ASLMC) can help. This team of world-class specialists is working together to bring hope and the answers people need. From initial diagnosis and treatment to follow-up care, our coordinated approach is designed to give our patients the very best care, all in one place.

The MDC at ASLMC is committed to providing you with an unparalleled level of care and an exceptional patient and family experience.

TREATMENT OPTIONS: SPOTLIGHT ON SURGERY

Complex access and treatment algorithms have been developed to ensure that all patients, primary and metastatic, are reviewed and considered by the Neuro-Oncology tumor conference team with comprehensive development of care plans. Through innovative approaches to care, the management of brain tumors at Aurora Health Care has evolved beyond just length of life, and has become fully invested in a patient's quality of life. We offer the best of the proven current treatment available today, while bringing the next generation of innovative chemo and surgical treatment applications to our commitment to precision medicine with innovative techniques that adapt to the individual patient.

EXPANDED ENDONASAL APPROACH (EEA)

This revolutionary technique pioneered by our team lets surgeons access the skull base and upper cervical spine in a less invasive way.

During endoscopic endonasal surgery, a neurosurgeon and an otolaryngologist work together to enter the skull base through the nose. This minimally invasive technique eliminates the need for external incisions and brain retraction. By removing the back half of the nasal septum and the bone in front of the nasal sinus, surgeons can reach the skull base.

Tumors are then removed with the help of high-definition optics and an endoscope. Finally, the skull base is reconstructed using a flap of the septal membrane—which seals off the brain from the nose—helping prevent complications.

The Expanded Endonasal Approach allows access to skull base tumors and minimizes the complications that can be seen with open skull base surgery, which include infections associated with large scalp incisions and the side effects seen with brain retraction.

Many patients undergoing EEA spend only one to two days in the hospital, and recovery time at home can be much shorter than for open skull base surgery. In addition, there are many scenarios in which EEA causes less disruption of critical nerves during skull base surgery.

MINIMALLY INVASIVE ROBOTIC NEUROSURGICAL TECHNIQUES

Deep brain tumors (subcortical), areas of bleeding and cysts that were once considered too risky to operate on by many are now often removed through a precise and patient-specific corridor with our unique, integrated surgical techniques. These minimally invasive techniques offer patients hope for better surgical results, as well as improved long-term outcomes. They also allow our patients to reach the goal of zero footprint, or no long-term complications as a result of their tumor or surgery.

Brain Mapping

An invaluable tool for Aurora's neurosurgeons, brain mapping depicts aspects of a tumor and surrounding healthy tissue with enhanced clarity rendered in a three-dimensional space. This imaging technology allows surgeons to preplan a patient-specific, real-time surgical pathway before a brain surgery procedure even begins—which translates into improved outcomes in the operating room and a faster recovery.

Dynamic Navigation

Neurosurgeons use a GPS-like system that gives them real-time guidance deep within the brain. Patients can see their brain tumor removal on the same computer screen that their surgeons use to track the movements of their surgical instruments.

Safe Access

We use a specialized and innovative tool that minimizes damage to surrounding tissue by allowing neurosurgeons to safely displace the natural folds of the brain as they advance to the target site. This is a critical component of a minimally invasive treatment for brain tumors and other deep-seated neurological disorders.

High-Definition Optics

This technology allows neurosurgeons to differentiate tissue types with unprecedented clarity from above the surgical site. Being able to separate diseased tissue from healthy tissue makes it possible to successfully remove what would otherwise be considered inaccessible brain tumors, cysts and other growths difficult to see.

Automated Resection

Using a tool about the size of a pencil, neurosurgeons are able to remove tissue without injury to adjacent healthy brain matter. This technique is another reason Aurora can offer treatment options for conditions such as brain tumors that were previously deemed too risky by many.

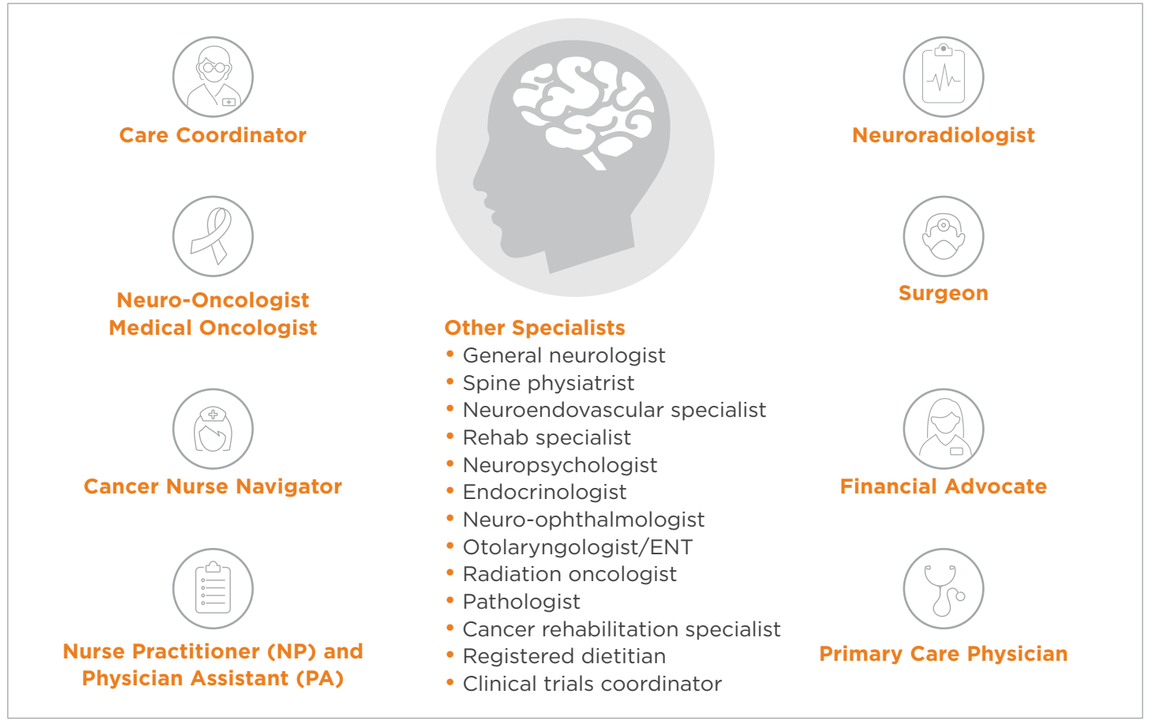
Directed Therapy Options

Neurosurgeons collect and preserve the brain tissue they remove in a sterile, closed-capture device for pathological, molecular and genetic evaluation. These samples provide opportunities to develop personalized treatment regimens for every patient. This is a critical step in advancing treatment paradigms. The ability to capture, grow and implant the tumor tissue enables the team to study and develop new targets for treatment that are brought directly back to the patient in an individualized manner, epitomizing our commitment to precision medicine.

All of this patient and correlated cell data is then compiled into a novel, image-driven data-capture system with the goal of developing predicted informatics power. Aurora was the first institution in the world to install and implement this specific image-driven informatics system.

The culmination of all of these integrated technologies allows for many of our patients to have surgery while awake. However, this is different than the way awake procedures have been commonly done in the past. Our patients often have less anesthesia than even routine, non-neurosurgical procedures, like a colonoscopy. Also, many patients are interacting on their phones or smart devices during surgery, and many go home the next morning.

We believe this has resulted in significant improvements in cognitive outcomes, particularly those that are otherwise difficult to monitor when patients are



Multidisciplinary Neuro-Oncology Program (cont.)

completely asleep during surgery. This philosophy of care has been paramount to our continued pursuit of zero footprint, or no long-term complications.

BRAIN MAPPING
Advanced brain mapping technology lets our team of experts see the precise location of individual brain functions—speech, memory and movement—in order to help determine the most appropriate treatment.

Brain mapping is a critical tool used by neuroscientists to diagnose long-term and chronic conditions like Parkinson's disease; it is also used to plan surgeries for more acute conditions, such as brain tumors.

If surgery is needed, brain imaging technology may be used before and during a procedure to differentiate healthy brain matter from diseased tissue. It can also be used to define a surgical or navigational strategy to help avoid injury to portions of the brain needed for critical functions.

Diffusion tensor imaging with white matter tractography is one type of brain mapping. It uses state-of-the-art technology to create a 3D map of the brain, which shows the location of nerve fibers that control speech, memory, cognition, and thought—all of the things that make you … you!

It provides advanced assistance with:

- Determining the best surgical approach to remove a tumor
- Diagnosing and treating a traumatic brain injury
- Finding breaks in brain fibers that may cause the loss of certain body/memory functions
- Understanding which brain connections are intact and which are damaged
- Other types of brain imaging technology that work like a GPS system during surgery, giving neurosurgeons real-time guidance deep within the brain

Brain mapping is a fundamental element of our minimally invasive methodology for treating subcortical tumors and cysts that were often considered otherwise inaccessible.

Aurora has performed more optical robotic brain surgery than anyone in the world to date, and ANII was the first in the world to deploy a unique 3D brain mapping platform for patient care. ■

To discuss or refer a patient to the clinic or a team member, please call 888-649-6892.

PHYSICIAN PROFILE: DR. STEVEN SANDSTROM

Steven A. Sandstrom, MD, provides general neurology with a subspecialization in epilepsy and the interpretation of electroencephalograms (EEGs). His areas of interest include concussions, headaches, chronic pain and seizures.

Dr. Sandstrom received his medical degree from Finch University of Health Sciences/Chicago Medical School, North Chicago, Ill. He completed his residency in a combined neurology/psychiatry program at Indiana University School of Medicine, Indianapolis, Ind. Board-certified in neurology, clinical neurophysiology and psychiatry, Dr. Sandstrom also completed a fellowship in clinical neurophysiology with an emphasis on EEGs/epilepsy at the Indiana University School of Medicine. ■

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210 Wisconsin American Drive • Fond du Lac, WI 54937

PHYSICIAN PROFILE: DR. SANY KHABBAZ

Sany T. Khabbaz, MD, specializes in interpreting electroencephalograms (EEGs); performing and interpreting electromyographies (EMGs); and providing BOTOX® injections for chronic migraine, dystonia and spasticity. He also conducts skin biopsies for evaluation of neuropathy, as well as lumbar punctures.

Dr. Khabbaz received his medical degree from the American University of Beirut, Beirut, Lebanon. He completed his residency in neurology, along with a fellowship in clinical neurophysiology, at the University of Chicago Medicine, Chicago, Ill. Dr. Khabbaz is board-certified in neurology and clinical neurophysiology. ■

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Case Study: Collaboration Takes Flight (cont.)

PLANNING AND WORKFLOW

The cockpit of this multidisciplinary clinic space comprises a state-of-the-art, four-room operating theater, with a dedicated planning room embedded within the semi-restricted area adjacent to the OR. Neuroradiologists work together with their neurosurgery colleagues within that space.

The need for efficiency in radiology is maintained on the OR floor. At ANII, reading rooms are located within the OR suite and allow neuroradiologists to read nonsurgical cases during downtime. In addition, a network of video communication creates connectivity among the OR, the planning room, clinical offices and the main radiology reading room—essentially creating air traffic control.

With this model, no one service line "owns" the patient. "Just as a plane doesn't have just one pilot, a patient doesn't have just one surgeon taking care of him or her," Kassam says. "There are always two attending doctors with a patient, and we put the radiologist in the cockpit with us, reading images and providing our navigation in real time. In fact, the radiologist generates the flight plan before we even see the patient."

Neuroradiologists also play a direct role with patients within the clinic setting, joining oncologists in discussions with patients about the benefits and risks of surgery. For most complicated discussions, the neuroradiologist reviews the imaging directly with the patient and the rest of the team. Patients have the opportunity to ask questions while all the members of their treatment team are in one place. It's a unique role for radiologists, who historically don't have much patient contact.

Each member of the team brings a different strength to the case at hand, Kassam adds. "A surgeon can put information about a patient's case into the context of the disease, but a radiologist has the data and the ability to present the information at clinic in a way that the patient can understand," he explains.

> **"With this program, we break down the silos and form a collaborative unit."**
> ***Dr. Jonathan E. Jennings***

"As the silos break down between medical specialties, everyone comes up with good ideas. We are fortunate to have been welcomed as integral members of the neurosurgical care team."

THE PATIENT CARE CONTINUUM

Melanie Brown Fukui, MD, a neuroradiologist at ANII, embraces the opportunity to work side-by-side with neurosurgeons. In addition to providing her imaging expertise in the OR, she is in a position to bridge patients' imaging needs from their clinic visit through preoperative planning and into the operative and postoperative phases of their treatment.

"This is a window into neuroscience here that I believe doesn't exist anywhere else," she says. "We're a multidisciplinary unit in which radiology participates in planning and workflow. We are included in the overall work environment. Within this model, having a neuroradiologist immediately available at critical moments during anatomically complex procedures can decrease the potential for adverse outcomes."

According to Fukui, radiologists are involved with the presurgical planning along with the surgeons. They also stay in the OR during "in-flight cross-checks" when the surgeon is working in the brain, following the anatomy in imaging.

"We have come to speak a common language with our partnering neurosurgeons and advanced practice providers," Jennings says. "We directly observe the manner in which imaging is used for operative guidance, and have accordingly designed a set of pathology-specific MR protocols to fit the unique operative approaches and technologies our neurosurgeons use."

COLLABORATIVE IMPACT

Jennings, Fukui and Kassam agree that the collaboration among members of the ANII team strengthens the clinical environment and incrementally improves patient care.

In one instance, during surgery to remove a cluster of blood vessels from the brain of a 36-year-old man who suffered from seizures, imaging guidance in the OR suite provided Kassam with a map to the malformation. It also helped that the patient was kept awake during surgery in order to regulate the effects of the surgery on his functionality.

The culmination of this collaborative process has yielded significant results in a short period of time. The neurosurgical oncology service has posted a 30 to 40 percent reduction in length of stay, mortality and readmission rates as compared to national risk-adjusted rates. This has also translated into a financial benefit, with a 10 percent reduction in cost per case, despite increasing the case complexity in comparison to the pre-ANII era.

The neuroradiologists also benefit from direct and immediate clinical-radiologic correlation, observing surgical procedures in real-time and working in sync with surgeons and other members of the team. This enables imagers to see how their navigation helps the surgeon, and where they can improve the process of providing the right map for surgeons to follow.

Jennings points out that participating physicians share information and learn from each other. "Now, the radiologist is involved at the point-of-care," he says. "We interact with each other in a more natural way, with a more open flow of communication." ■

Strokes: Causes, Treatment and the Importance of Prevention

Stroke is a major health concern in the United States. Not only is it the leading cause of serious, long-term disability, but it's the fifth-leading cause of death, claiming about 130,000 American lives each year, according to the Centers for Disease Control and Prevention. That's about 1 of every 20 deaths.

A stroke is essentially a "brain attack." It can happen to anyone at any time. It occurs when blood flow to an area of the brain is cut off, either by a blood clot in a vessel or by a burst vessel. Brain cells are deprived of oxygen and begin to die. When brain cells die, abilities controlled by that area of the brain are lost. Stroke can result in physical challenges such as paralysis, seizures, muscle tightness, vision loss, stiffness and fatigue. It can affect communication, including speech, language, reading and writing. It also can drastically alter one's emotional and behavioral state.

The risk of stroke doubles every decade after age 55. People with a family history of stroke are also at increased risk. Still, everyone should be informed of stroke risk, the signs and symptoms. This neurological disease threatens millions of Americans from every age group and background. Fortunately, it's largely preventable and treatable.

WHAT SHOULD WE DO IF WE SUSPECT SOMEONE IS HAVING A STROKE?

To quickly identify whether a person is experiencing a stroke, use the acronym B.E.F.A.S.T.

B	E	F	A	S	T
Balance	**Eyes**	**Face**	**Arms**	**Speech**	**Terrible headache**
Sudden change in balance	Sudden change in vision (loss of vision, blurry vision or double vision)	Facial droop	Arm or leg weakness or numbness	Slurred speech, trouble speaking or trouble understanding speech	Sudden onset of terrible headache

Call 911 right away and get emergency help, even if the symptoms stop. These are warning signs that a stroke might be occurring, or that the person in question is at high risk for having one soon.

Avoid stroke by taking care of your health. Here are come common preventive measures:

- Maintaining a healthy blood pressure
- Exercising
- Eating a healthy diet
- Maintaining a healthy weight
- Quitting smoking
- Treating your diabetes ■

Discovery World Camp Visits ANII to Watch Brain Surgery

In August, students from the Discovery World Day Camp visted Aurora St. Luke's Medical Center to witness a live brain surgery. The group of sixth- through eighth-graders watched the surgery from a viewing gallery, then had the opportunity to explore the anatomy lab and interact with the robots used in the surgery, as well as meet with doctors and ask questions.

For these kids, it was definitely a day to remember.

"It's crazy how much technology people can come up with, and that surgeries can happen within one day and they can go back to their families," one student said. "I think it's amazing." ■

Clinical Research Under Way at Aurora Research Institute

AMERICAN HEART ASSOCIATION STROKE STUDY

Open at three Aurora sites, the Mild and Rapidly Improving Stroke Study (MaRISS) research study is tracking outcomes of subjects who have suffered mild and rapidly improving strokes.

Through this American Heart Association research study, sponsored by the University of Miami, Aurora researchers will track the proportion of subjects not independent at 90 days after a stroke.

The trial is supported by investigators/coordinators at each of the three sites:

- **Aurora BayCare Medical Center:** James Napier, MD; Jennifer Homa, MS; and Taylor Romdenne
- **Aurora Medical Center in Grafton:** Rose Dotson, MD; Sue Truchan, BSN; and Stacie Bishop, CCRC
- **Aurora St. Luke's Medical Center:** Khaled Asi, MD; Carol Halliday, RN, BA; and Lynda Yanny, BSN

(clinicaltrials.gov identifier: NCT02072681)

ATRIAL FIBRILLATION STUDY

Development of atrial fibrillation, an abnormal heart rhythm, is a risk for people who have had an ischemic stroke.

Led locally by principal investigator Khaled Asi, MD, researchers are comparing the incidence of atrial fibrillation documented with an implantable continuous cardiac rhythm monitoring device versus standard-of-care monitoring.

Medtronic Inc. is sponsoring the Phase IV trial (clinicaltrials.gov identifier: NCT02700945). Carol Halliday, RN, BA, is serving as site coordinator at Aurora St. Luke's. ■

Aurora Center for Epilepsy Reaccredited as Level 3 Epilepsy Center

The Aurora Center for Epilepsy and Neurology was recently reaccredited as a Level 3 epilepsy center by the National Association of Epilepsy Centers. This information is also sent to the U.S. News & World Report as part of their criteria in ranking America's Best Hospitals.

Level 3 Epilepsy Center: A level 3 center provides the basic range of medical, neuropsychological and psychosocial services needed to treat patients with refractory epilepsy. Level 3 epilepsy centers provide basic neurodiagnostic evaluations, as well as basic medical, neuropsychological and psychosocial services. Some level 3 centers offer noninvasive evaluation for epilepsy surgery, straightforward resective epilepsy surgery and implantation of the vagus nerve stimulator. These centers do not perform intracranial evaluations or other more complex epilepsy surgery. ■

Dr. Ofer Zikel

A Life-Saving Operation: Spinal Surgery Gets Merton Man Back on Track

Jonathan Richie, special to the Freeman

A Merton man said his surgeon has the "hands of an angel" after performing a difficult operation that could have left him paralyzed.

Nathan Holschbach, a married father of two, enjoyed an active lifestyle that included running and lifting weights in the Lake Country area prior to a traumatic accident.

THE FALL

In mid-July, Holschbach slipped on the stairs at his home, falling backward and knocking him unconscious. He was rushed to an emergency room at the hospital as his arms and legs remained numb.

"They said, 'here are some painkillers, we're going to run some scans,' but that's it," Holschbach said. "I got checked out and was sent home that day."

Ofer Zikel, MD, a spine specialist and neurosurgeon at Aurora Medical Center in Summit, said he saw Holschbach's CAT scan during a follow-up exam two days later, and knew something far more serious was the problem.

"They believed the fracture was stable initially," Zikel said. "But his spine was slipping and literally being squashed."

THE OPERATION

Holschbach had two fractured vertebrae in his spine as a result of the fall. The damage to his body required a two-part operation that had to be performed with extreme accuracy in order to avoid further damage.

First, the fractured vertebrae had to be reduced, and then a discectomy and fusion had to be performed to relieve the intense pressure on his spine.

"There was absolutely a possibility of paralysis and doing further damage to his spine," Zikel said. "We were operating, basically, directly on top of the spinal cord."

> "There was absolutely a possibility of paralysis and doing further damage to his spine."
>
> *Dr. Ofer Zikel*

Holschbach said Zikel had the "hands of an angel" during the operation and he felt tremendously humbled that it was a success.

"I was flattered and honored to hear him say that," Zikel said. "We hear those types of comments often and there is no better reward than seeing these great results firsthand."

RECOVERY

Because of the incident and surgery, Holschbach now lives with a metal plate and a few screws holding his spine together. He also had to wear a neck brace for about 16 weeks. After the operation, he said he had no other choice but to lie around his house because his muscles were so weak he was unable to open a plastic water bottle.

"I was then walking around mornings and evenings for blood circulation," Holschbach said. "Slowly but surely, I was gaining more strength."

Holschbach has continued to gain strength and continues to meet with Zikel about his progress, hoping to get back to the active lifestyle he lived before the incident.

"It's about finding the way to get farther down the road and setting goals, like with my running before I fell," Holschbach said. ■

PHYSICIAN PROFILE: DR. KESSARIN PANICHPISAL

Kessarin Panichpisal, MD, provides interventional and vascular neurologic care for her patients, including cerebral angiogram, endovascular stroke treatments, aneurysm coil embolization, AVM/AVF liquid, stenting, epistaxis embolization, WADA testing, balloon test occlusion, head and neck tumor embolization, petrosal sinus sampling, carotid stent and kyphoplasty.

Dr. Panichpisal earned her medical degree at Chiang Mai University, Chiang Mai, Thailand. She completed her internal medicine residency at Texas Tech University Health Sciences Center, Lubbock, Texas, and her neurology residency at SUNY Downstate Medical Center, Brooklyn, NY. Dr. Panichpisal went on to complete a fellowship in Vascular Neurology at SUNY Downstate Medical Center and an Interventional Neurology Fellowship with the Asia Pacific Comprehensive Stroke Institute. She is board-certified in internal medicine, psychiatry and neurology, and vascular neurology.

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Stroke Program Certifications and Accolades

2016 brought successful stroke recertification for a number of Aurora hospitals, and we also received a number of quality awards. These accolades confirm Aurora's commitment to providing the most comprehensive stroke care for all patients, including those with the most complex cases.

Silver Plus Quality Award
Aurora West Allis Medical Center*
Aurora Medical Center in Kenosha*

Silver Plus–Target Stroke
(*Honor Roll Elite Plus*)
Aurora St. Luke's South Shore*

Gold Plus Quality Award
Aurora Sinai Medical Center*
Aurora Medical Center in Manitowoc*
Aurora Lakeland Medical Center*
Aurora Memorial Hospital in Burlington*
Aurora Medical Center in Grafton*

Gold Plus–Target Stroke
(*Honor Roll Elite Quality*)
Aurora St. Luke's Medical Center**
Aurora Sheboygan Memorial Medical Center*

*Primary Stroke Certification recognizes hospitals for going above and beyond the standard of care to ensure ischemic stroke patients receive the highest level of treatment options and quality measures.

**In addition to this, some hospitals may also qualify for Comprehensive Stroke Certification, which meets all of the primary requirements as well as sets the highest standards for the care of hemorrhagic patients and the most complex stroke patients eligible for surgical or endovascular intervention. ■

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aurora.org/neuro

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