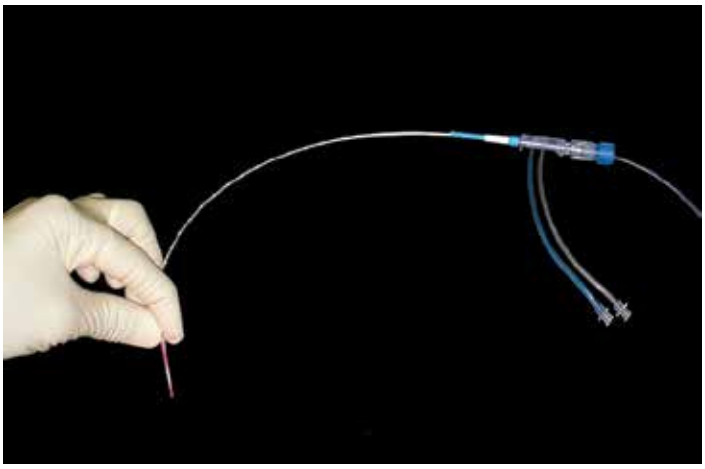
BARROW Neurological Institute
at PHOENIX CHILDREN'S Hospital

Vol. 2 | Issue 2

Advancing Neuroscience with Technology

Commitment to research and investment in advanced technologies that enhance our ability to diagnose, treat, and manage neurological diseases and disorders in children have always been a priority for Barrow Neurological Institute at Phoenix Children's Hospital and is now a priority for the nation. The "BRAIN" (Brain Research through Advancing Innovative Neurotechnologies) Initiative announced on April 2 by President Obama issues a challenge to researchers to "uncover the mysteries of the human brain."

This edition of our quarterly newsletter features the innovative, cutting-edge research already underway at Barrow at Phoenix Children's. We will highlight the state-of-the-art technology available to our patients that sets us apart as a leader in pediatric neurosciences and reinforces our commitment to providing comprehensive, high-quality, patient- and family-centered care.



"Our goal is to deliver the best patient- and family-centered care to each child who comes to us."

INSIDE

PHOENIX CHILDREN'S Hospital®

P. David Adelson, MD
Director, Barrow Neurological Institute at Phoenix Children's Hospital
Chief, Pediatric Neurosurgery/ Children's Neurosciences

From the Director

In February, we announced a joint research initiative with the School of Biological and Health Systems Engineering at Arizona State University (SBHSE). Together with the SBHSE and the Ira A. Fulton School of Engineering Dean's Office, we are funding two projects that promote interdisciplinary collaborations between ASU biomedical engineers and clinical faculty at Barrow at Phoenix Children's. Research to seek to better image and ultimately cure malignant pediatric brain tumors by Ratan Bhardwaj, MD, PhD, a pediatric neurosurgeon and clinician scientist from Barrows at Phoenix Children's with Vikram Kodibagkar, PhD (ASU) and more precise diagnoses of acute traumatic brain injury by Jonathan Lifshitz, PhD, director of translational neurotrauma research with Sarah Stabenfeldt, PhD (ASU) will be the focus of these collaborations. We look forward to sharing the results of these cutting-edge research projects with you in future editions.

Utilizing advanced technological devices and instruments allows us to offer cutting-edge, state-of-the-art treatment options to our patients. Phoenix Children's Division Chief of Radiology Richard Towbin, MD, and the Neuroradiology Department, with funding from the Leadership Circle, recently purchased Cinemavision, a video and audio system that offers an alternative to sedation or in most cases, full general anesthesia for Magnetic Resonance Imaging (MRI). The technology is ideal for children who suffer from claustrophobia, developmental delays, and other behavioral issues which, in the past, have made medical imaging very challenging.

Dr. Bhardwaj, who in addition to his work in pediatric brain tumors, is leading our Neuromodulation and Functional Section, building upon our strong partnerships with leading community partners such as Translational Genomics (TGen) and other medical facilities like Barrow Neurological Institute at St Joseph's Hospital and Medical Center to offer Visualase to our children with brain tumors and intractable seizures. The minimally invasive laser ablation device can be used to treat dysplastic lesions, hypothalamic hamartomas, as well as small tumors in children. This new laser technology has the potential to change the future of neurosurgery and we are helping to blaze the trail into the next generation of neurosurgical innovation.

The use of technology has enriched the lives of our patients by yielding more precise diagnoses that can generate individualized treatment plans to optimize patient outcomes. Patient monitoring units such the Sybil B. Harrington Pediatric Intensive Care Unit (PICU) where the Neurocritical Care Team brings advanced neuromonitoring to children with strokes, traumatic brain injuries, and seizures, as well as the Pediatric Epilepsy Monitoring Unit (PEMU) and the Sleep Study Lab allow physicians to gather a multitude of information, using evidence-based protocols, in a patient- and family-centered environment. Each monitoring unit reinforces collaborative relationships between subspecialties that enhance our ability to provide the best possible care to our patients.

The research, innovation, and investment in advanced technologies at Barrow at Phoenix Children's enriches our ability to fulfill our mission to improve the health and quality of life for children with neurological disorders. The outlook for continued success and evolution in pediatric neuroscience research and technology is optimistic.

It is my privilege to provide you with insight into the amazing care, science and knowledge underway here and I hope you find our newsletters helpful and informative. Please feel free to contact me or the staff if you have any suggestions about improving our newsletter, other topics of interest, or improving our care of children and service to you.

I also encourage you to visit our website at www.phoenixchildrens.com/BNI, to learn more about our programs and accomplishments or like us on Facebook www.facebook.com/BarrowAtPhoenixChildrens.

Thank you very much.

Advancing the Technology of Tomorrow

Barrow Neurological Institute at Phoenix Children's Hospital and the School of Biological and Health Systems Engineering (SBHSE), together with the Ira A. Fulton Schools of Engineering Dean's Office, have offered two competitive pilot grants to promote interdisciplinary collaborations among biomedical engineers and clinical faculty at Phoenix Children's.

The seed grant mechanism was created to target high-priority challenge topics, including, but not limited to, biomarker discovery and validation for nervous system disorders, development of medical devices, and comparative effectiveness of treatments of neurological or musculoskeletal disorders.

Two projects were selected out of five applicants and each was awarded $30,000.

The winning projects are "Extracellular matrix as a biomarker source for acute neurological injury," awarded to Sarah Stabenfeldt, PhD, assistant professor at SBHSE, and Jonathan Lifshitz, PhD, director, Translational Neurotrauma Research Program, Barrow at Phoenix Children's; and "Imaging microstructural changes in response to brain tumor immunotherapy," awarded to Vikram Kodibagkar, PhD, assistant professor at SBHSE, and Ratan Bhardwaj, MD, PhD, neurosurgeon, Barrow at Phoenix Children's.

Identifying Biomarkers

The project led by Dr. Stabenfeldt and Dr. Lifshitz focuses on the complex network of biomolecules, the extracellular matrix, that supports the structure of the nervous system and its integration with the body's vascular system. In cases of injury such as traumatic brain injury, the extracellular matrix could be disturbed and impair neurological function.

"The extracellular matrix is the material that holds the neurons in place," said Jonathan Lifshitz, PhD. "If that matrix breaks down after injury, how can the brain repair itself or even function properly? This research project will determine how much break down occurs in the extracellular matrix."

This project aims to first characterize the extent of changes the extracellular matrix undergoes after acute brain injury and then to correlate the molecular changes with neurological functions. The project will also determine the utility of extracellular matrix changes as biomarkers for acute brain injury.

Harnessing Regenerative Abilities

The project led by Dr. Kodibagkar and Dr. Bhardwaj will seek a cure for malignant brain tumors based on the fundamentals of our body's own immune system. They plan to develop a personalized vaccine that is able to specifically seek and destroy the malignant cells, leaving normal brain cells unharmed.

Kodibagkar and Bhardwaj have proposed pre-clinical experiments, which involve monitoring tumor growth and the response to immunotherapy using magnetic resonance imaging (MRI). Diffusion tensor tractography, a highly specialized MRI technique, will allow them to visualize changes in white-matter tracks in the vicinity of tumors as this therapy method is employed.

If successful, the pre-clinical results will be translated in a safe and efficient manner for clinical studies, with the hope to ultimately harness the human body's immune system in order to safely and effectively kill brain tumor cells. Dr. Greg Turner, director of operations for the Barrow-ASU Center for Preclinical Imaging, will collaborate on the project.

ASU Ira A. Fulton Schools of Engineering
ARIZONA STATE UNIVERSITY

BARROW Neurological Institute | PHOENIX CHILDREN'S Hospital

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Cinemavision:
MRI Video and Audio System

Phoenix Children's Division Chief of Imaging, Richard Towbin, MD, received funding from the Leadership Circle to purchase Cinemavision, a video and audio system used during MRIs to reduce stress and anxiety commonly experienced in the enclosed imaging environment. The system includes a pair of goggles and headgear that are worn by the patient during imagining.

How it works

Video images and audio feeds are transmitted through an imaging safe cable. The entire system of headgear, goggles, and cables, is free from metal parts that could be drawn into the MRI magnet or cause interference with imaging resolution. The headgear is also equipped with a microphone to better facilitate communication between the staff and patient during the procedure.

Patients are transported from the imaging room into their own virtual world while undergoing the procedure. The cinema goggles act as a personal movie theater displaying the patients favorite DVD. The noise from the MRI machine is muted by the headset that can play their favorite CD, audio recording or iPod playlist.

Patient Impact

The technology is anticipated to reduce the amount of general anesthesia cases seen in 8- to 12-year-old patient population. Other patient populations will likely benefit from the uses of the system as well, such as those suffering from claustrophobia and anxiety and patients with developmental delays and other behavioral issues.

The system was installed and available for use on February 13.

"We saw immediate, positive results with the system," Walker said. "On the very first day of the technology's operation, we performed a scan on a 10 year old who had been scheduled to undergo anesthesia. Due to the goggles, she was able to successfully complete the study."

The system has been used on approximately 150 children and the department has already observed a decrease in the number of patients who would have required general anesthesia to complete their MRI scan.

Currently the Cinemavision system is only available at Phoenix Children's main campus.

"Patients, especially our repeat customer, are singing the praises of the Cinemavision system. If we were able to purchase a second system to use in out East Valley satellite location the impact would be even greater," said Walker.

Leadership

Richard Towbin, MD
Radiologist-in-Chief ; Phoenix Children's Medical Group Division Chief

"At just a little over two months since installing, we're already realizing our vision for the utilization of this system," said Lisa Walker, Manager, Diagnostic Imaging. "And that vision was to reduce the amount of anesthesia cases for claustrophobic, developmentally delayed and fidgety teenagers. It has done just that."

Who to Refer:

Cinemavision will be offered to all patients over the age of 8 seen at the Phoenix Children's main campus for imaging. Referring physicians can request Cinemavision to be used on younger patients.

How to Refer

By Fax: (602) 933-1214

Leadership

Ratan Bhardwaj, MD, PhD
Neurosurgeon

Referrals

Dr. Bhardwaj is accepting cases for review.

Who to Refer:

Children harboring a small lesion located within the brain are amenable to this treatment.

Current indications include:

- Dysplastic lesions
- Hypothalamic Hamartomas
- Temporal lobe epilepsy with hippocampal sclerosis.

How to Refer:

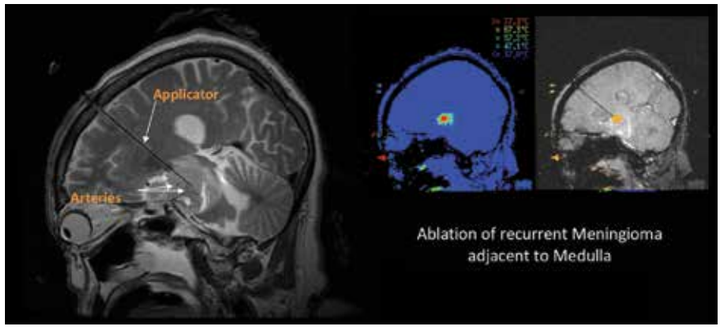
To refer a patient, please send all relevant clinical information to the office of Dr. Bhardwaj.

By Phone: (602) 933-0975
Fax a Referral to: (602) 933-0440

Additional Information:

For additional information about Visualase, visit www.visualaseinc.com.

Visualase: Laser Innovation

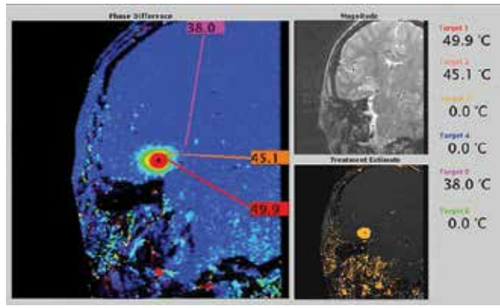


Neurosurgeon Ratan Bhardwaj, MD, is pioneering the use of a new, minimally invasive laser technology, Visualase, for use in neurosurgical cases. This innovative laser ablation technology can be used while the patient remains awake and in most cases has shown a reduction in hospital recovery time.

The device is housed at Barrow Neurological Institute at St. Joseph's Hospital and Medical Center and now ready for clinical use.

How it works

A small flexible laser probe is inserted through a small incision in the skull. The probe is then guided to the intended target area using MRI images and delivers laser-induced interstitial thermotherapy (LITT) to the target area. The laser fibers are delivered through the probe to heat and destroy the targeted, unwanted tissue.



Special software combined with MRI technology generates temperature maps, enabling the physician to monitor the extent of the tissue being destroyed in real time. The physician is able to set temperature safety points around critical structures in the brain that, if triggered, will cause the laser to immediately turn off. Once the unwanted tissue is destroyed the probe is removed and the incision is closed, often requiring as little as a single stitch or small bandage.

Due to the minimally invasive nature of the device, radiation is not required and the procedure is done without a skull flap, the large skull opening needed in traditional craniotomies. The use of the technology does not limit additional or alternative treatments.

"This is a very innovative technology that allows us to lesion a very precise region in the brain in a minimally invasive fashion," said Ratan Bhardwaj, MD. "This will allow us to do certain things in a safer manner and provide an additional quiver in our neurosurgical armamentarium."

Pediatric Monitoring Units

Each unit relies on state-of-the-art technology and video monitoring to provide a more holistic analysis of the patients medical condition.

The specialized pediatric monitoring and care units such as the Sybil B. Harrington Pediatric Intensive Care Unit (PICU), the Pediatric Epilepsy Monitoring Unit (PEMU) and the Pediatric Sleep Lab provide the latest diagnostic technology and state-of-the-art care to patients at Phoenix Children's Hospital.

The Pediatric Epilepsy Monitoring Unit (PEMU) and the Pediatric Sleep Lab are specialized units that combine video surveillance and monitoring devices to enhance individualized diagnostic testing. Each unit relies on state-of-the-art technology and video monitoring to provide a more holistic analysis of the patients medical condition.

Sybil B. Harrington Pediatric Intensive Care Unit (PICU)

The Sybil B. Harrington Pediatric Intensive Care Unit (PICU) at Phoenix Children's is one of the largest pediatric critical care units in the Country and is staffed by 12 pediatric intensives and nearly 200 nursing and ancillary staff. The PICU utilizes a team approach to critical care that includes the patient's family and optimizes physical and emotional outcomes.

The Neurocritical Care Team is made up of specialist with expertise in the care of neurologically critically-ill or injured children. The team uses advanced neuromonitoring technology to assess children with strokes, traumatic brain injuries, and seizures.

Pediatric Epilepsy Monitoring Unit (PEMU)

The Pediatric Epilepsy Monitoring Unit (PEMU) is designed to evaluate infants, children and adolescents with seizures or other spells that might be seizures. The PEMU at Phoenix Children's is part of the comprehensive Pediatric Epilepsy Program at Barrow at Phoenix Children's that was recently recognized as a Level 4 epilepsy center by the National Association of Epilepsy Centers (NAEC).

An estimated 6,100 children in Arizona have epilepsy and 1,800 of those are diagnosed intractable, or hard to treat. The PEMU offers our specialists the advanced diagnostic tools needed to treat and heal children with complex epilepsy.

The PEMU offers eight private patient rooms that are equipped with video and EEG monitoring systems that can capture the seizure event in real time. Our team of specially trained physicians and technologists can then correlate the behavior of the child with the simultaneous EEG recording during the episode, an extremely powerful technique for identifying spells as epilepsy or some other medical condition.

For patients with epilepsy, video-EEG monitoring allows us to identify the exact seizure type, which can lead to an improved treatment plan by helping select the best medications. For those children who are candidates for epilepsy surgery, PEMU monitoring is essential to localize the region of the brain where seizures originate.

Pediatric Sleep Lab

The Pediatric Sleep Lab is part of the comprehensive Sleep Medicine Program at Phoenix Children's, one of only a few such programs in the country. The sleep lab is designed to observe and monitor children experiencing a variety of sleep difficulties including sleep apnea, periodic limb movement disorder, hypersomnia, insomnia, narcolepsy, and delayed sleep phase.

A polysmnogram (PSG) or sleep study is a multi-parametric test that uses state-of-the-art technology to record the biophysiological changes that occur during sleep. The overnight study records the patients sleep patterns, brain waves, breathing and body movements. Additional tests including the multiple sleep latency test (MSLT) and the maintenance of wakefulness test (MWT) may be performed as well. The sleep study provides pertinent data necessary for making an accurate diagnosis of any potential sleep disorder.

The lab has three private patient rooms and offers appointments seven days a week. The lab is staffed with physicians, nurses and technologies that are specially trained in sleep medicine and are committed to providing the best physical and emotional support to these children and their families

Announcements

Phoenix Children's Physicians Appointed to Governor's Council on Spinal and Head Injury

Michael Lavoie, PhD, chief, Psychology and Jonathan Lifshitz, PhD, director, Translational Neurotrauma Research Program, were recently approved for appointment to the Arizona Governor's Council on Spinal and Head Injury. The council works to enhance the health, safety, and quality of life for children and adults with spinal cord injuries and traumatic brain injuries and their families. Congratulations to both Dr. Lavoie and Dr. Lifshitz on their appointments.

Level 4 Epilepsy Center

Barrow at Phoenix Children's was recently recognized by the National Association of Epilepsy Centers (NAEC) as a level 4 epilepsy center. Level 4 epilepsy centers have the professional expertise and facilities to provide the highest level of medical and surgical evaluation and treatment for patients with complex epilepsy.

Recent Publications

The following is a sample of the most recent publications from the physicians and staff of Barrow at Phoenix Children's. For a complete list of publications visit our website www.phoenixchildrens.com/bni.

Thampatty BP, Klamerus MM, Oberly PJ, Feldman KL, Bell MJ, Tyler-Kabara EC, **Adelson PD**, Clark RS, Kochanek PM, Poloyac DM. Hypothermia decreases Cerebrospinal fluid asymmetric Dimethylarginine levels in traumatic brain injury children. Pediatr Crit Care Med. 2013 Feb. [Epub ahead of print]

Rubiano AM, Puyana JC, Mock CN, Bullock MR, **Adelson PD**. Strengthening neurotrauma care systems in low and middle income countries. Brain Inj. 2013; 27(3):262-72.

Badhiwala J, Decker WK, Berens ME, **Bhardwaj RD**. Clinical trails in cellular immunotherapy for brain/CNS tumors. Expert Rec Neurother. 2013 Apr; 13(4):405-424.

Almefty KK, Durcruet AF, Crowley RW, **Bristol R**, Lavine SD, Albuquerque FC. Spinal arteriovenous malformation associated with Schimmelpenning syndrome. J Neurosurg Pediatr. 2013 Mar. [Epub ahead of print]

Albuquerque FC, Ducruet AF, Crowley RW, **Bristol RE**, Ahmed A, McDougall CG. Transvenous to arterial Onyx embolization. J Neurointerv Surg. 2013 Mar. [Epub ahead of print]

Bachstetter AD, Rowe RK, Kaneko M, Goulding D, **Lifshitz J**, Van Eldik LJ. The p38α MAPK regulates microglial responsiveness to diffuse traumatic brain injury. J Neurosci. 2013 April; 33(14): 6143-53

Arrington DK, Ng YT, **Troester MM, Kerrigan JF**, Chapman KE. Utility and safety of prolonged video-EEG monitoring in a tertiary pediatric epilepsy monitoring unit. Epilepsy Behav. 2013 Mar; 27(2):346-350.

Welcome to New Faculty and Staff

Mark Popenhagen, PhD, joined the Division of Psychology in March. Dr. Popenhagen brings with him a strong background in acute and chronic pain management.

Mark Popenhagen, MD
Psychologist

Upcoming Events

Save the Date for the 18th Annual Children's Neuroscience Symposium

March 9-12, 2014

The Ritz-Carlton, Biltmore, Phoenix, AZ

Additional information coming soon. See website for details: www.phoenixchildrens.com/CNS2014

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or

www.phoenixchildrens.com/BarrowEvents

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or scan this code with your smartphone.

Supporting Children's Neurosciences

BARROW Neurological Institute at PHOENIX CHILDREN'S Hospital

Recently, through the generous support of two individual donors, Barrow Neurological Institute at Phoenix Children's Hospital was able to open a new pediatric brain tumor lab in collaboration with Translational Genomics Research Institute to develop new strategies in the fight against pediatric brain cancer.

This investment in our Institute helps us develop new paradigms for clinical care and cures for these children. You can express your support to the Institute in ways that complement your own personal interests as you help us evolve and continue to set new standards in pediatric neurological care.

WHAT PHILANTHROPY SUPPORTS:

- Development/enhancement of existing and/or new clinical programs
- Funding cutting-edge programs in clinical, translational and laboratory/experimental research
- Community and professional educational initiatives
- Institute's infrastructure supporting the Biorepository and Bioinformatics and Data Center.

WAYS TO GIVE:

- Make a memorial or honor gift
- Name an Institute's Fund
- Contribute to the Director's Fund
- Provide funds for Endowed Chairs for research and program leadership

For more information call Bonnie Morgan at **(602) 933-2607**
or visit **www.phoenixchildrens.com/DonateBarrow**