Prisma Health–Midlands
Vol. 5 Issue 1 Winter 2019

Neuroscience Journal

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As physician co-leaders of Prisma Health–Midlands’ neuroscience service, we share a vision to provide the most advanced neurology and neurological surgery treatments available to the residents of South Carolina. We are excited to share this latest edition of our neuroscience journal featuring articles about Prisma Health Richland Hospital’s certification by the Joint Commission as a Comprehensive Stroke Center, the evolution of stroke management that led to our advanced certification plus how the Holy Stroke program is helping raise awareness of stroke prevention in our state.

Souvik Sen, MD, MS, MPH
Chair of Neurology,
Palmetto Health-USC Neurology
Professor of Neurology,
University of South Carolina School of Medicine

Roham Moftakhar, MD
Chief of Neurosurgery,
Prisma Health Richland Hospital
Medical Director,
Palmetto Health-USC Neurosurgery
Associate Professor of Clinical Surgery,
University of South Carolina School of Medicine
Our subspecialized service offers:

• Patients seen within two business days following referral
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• Cutting-edge technology
• Prompt development of individualized treatment plan

Call 803-360-0023 for brain and spine tumor referrals.

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Call 800-75-SHOCK (74625, option 1) for ischemic stroke and brain trauma transfers

Speak directly with a neurosurgeon or neurologist.
As of Jan. 16, 2019, Prisma Health Richland Hospital (formerly Palmetto Health Richland) is the 176th out of 6,210 hospitals in the United States to earn the Joint Commission’s Gold Seal of Approval® and the American Heart Association/American Stroke Association’s Heart-Check mark for Advanced Certification for Comprehensive Stroke Centers.

Our hospital became an official Advanced Primary Stroke Center in 2011, and from 2016 to 2018 it was the recipient of the highest American Heart Association National Get With The Guidelines® award: The Gold Plus Target Stroke—Honor Roll Elite Plus. This most recent accreditation in 2019 as a Comprehensive Stroke Center is the culmination of years of dedication and commitment to our patients, the community, and the state of South Carolina.

To be eligible, hospitals must not only demonstrate the highest quality of care but also meet many additional requirements, including those related to advanced imaging capabilities, 24/7 availability of specialized treatments, and providing a multidisciplinary medical staff with the unique education and competencies to care for complex stroke patients.

Our teams, technologies and medical staff help us achieve the following stroke center goals:

- Provide compassionate health care.
- Solve complex stroke questions through research.
- Work together as a multidisciplinary team.
- Prepare the next generation of vascular neurologists.
- Serve our community through stroke education and awareness.

(Left to right) Blease Graham, MD, neurointerventional radiologist, Pitts Radiology; Roham Moftakhar, MD, medical director, Palmetto Health-USC Neurosurgery; Jay Hamm, Chief Operating Officer, Prisma Health Richland Hospital; Anil Yallapragada, MD, medical director, Prisma Health Richland Hospital Stroke Center; Amanda Cotter, RN, MSN, MS, SCRN, manager, Prisma Health Richland Hospital Stroke Center.
Our four vascular neurologists provide expertise in the care of all stroke patients. A formal inpatient stroke service has been established with patients being managed 24/7 by a specialized team. The team is led by an attending vascular neurologist and includes a vascular neurology fellow plus neurology residents. TeleStroke and supportive services are also provided 24/7 for complex and acute stroke patients in surrounding hospitals and facilities. In addition, a team of general neurologists and a robust hospitalist–internal medicine program are actively involved and supportive in the care of our stroke patients.

Vascular neurologists oversee patients’ medical evaluation and management, investigating the risk factors, the exact mechanisms and corresponding appropriate treatments and interventions. As part of this investigation they utilize multi-modal neuroimaging in the management and evaluation of most every patient. They also interpret and utilize transcranial Doppler and other ultrasound technologies to assess patients.

The neurology residents at Prisma Health Richland Hospital serve an integral role in the delivery of stroke care. They are in-house around the clock and respond to all inpatient and Emergency department stroke codes/brain attacks within minutes. They work closely to help facilitate communication and plans of care within a vast multidisciplinary team.
Neuroradiology support through multimodal neuroimaging techniques is core to the understanding and management of our stroke patients. Most stroke patients on initial evaluation will receive a non-contrast head CT to assess any ischemic or hemorrhagic changes. Further evaluation and management protocols will follow from this scan including repeat scans to study evolution of any insult. Patients who suffer from ischemic or hemorrhagic stroke also will commonly get imaging of their intracranial vessels. This is to look for pathologies such as intracranial atherosclerosis, vascular malformations, vasospasm, or vasculitis. Modalities used for assessing intracranial vessels include CTA, MRA, transcranial Doppler, or cerebral angiogram. In the acute ischemic stroke management, pathway cerebral perfusion imaging (RAPID imaging) has become a major game changer in the selection of patients who might be candidates for large vessel endovascular thrombectomy.

The Neuroscience Critical Care Unit is a state-of-the-art 16-bed unit where board-certified neuro-intensivists and advanced practice providers care for our most critical and complex stroke patients, such as those with subarachnoid hemorrhage, intracranial hemorrhage, large hemispheric ischemic strokes and cerebellar infarctions, as well as post-cerebrovascular procedure patients. This is the only dedicated neuro-critical care unit in the Midlands, and patients cared for in this type of unit have better outcomes. Stroke patients may also be cared for in the Medical and Trauma Intensive Care Units by medical or trauma intensivists with neurosurgery and neurology support. All units that care for stroke patients have dedicated nursing staff specifically trained to care for this specialized group of patients.
Neuro-intervention

Prisma Health Richland Hospital features two neuro-interventional suites, two endovascular neurosurgeons, one interventional neuro-radiologist and three interventional radiologists. Specially trained interventional nurses and techs support the physicians in procedures such as: diagnostic angiogram, coil embolization of aneurysms, flow-diverting stent placement for aneurysm treatment, carotid and vertebral stent placement, intracranial stent placement, mechanical thrombectomy for acute stroke with stent retrievers and aspiration device, and embolization of arteriovenous malformations. An interventional nurse participates in all acute stroke codes to help with coordination for any potential patients who are candidates for mechanical thrombectomy procedures.

Cerebrovascular Neurosurgery

Neurosurgeons, advanced practice providers and surgery staff are available every day around-the-clock to perform procedures such as placement of external ventriculostomy drains, evacuation of intracerebral hematomas using minimally invasive technologies, resection of vascular malformations, microsurgical aneurysmal clipping, craniotomies, craniectomies and carotid endarterectomies.

A special MD-to-MD Brain Line (844-64-BRAIN) provides 24/7 neurosurgical emergency support for surrounding hospitals and facilities.

Prisma Health Richland Hospital has the region’s only neuro-interventional hybrid operating suite. It is equipped for both endovascular and open neurosurgical cases, and this room allows surgeons to combine the two techniques or use them simultaneously. State-of-the-art fluoroscopy and 3D rotational angiography can now be incorporated into open surgery such as craniotomy for clipping of intracranial aneurysm or obliteration of AV fistulae to confirm the procedure is complete before the patient leaves the operating room.
Cardiology, Cardiovascular Surgery and Vascular Surgery

The stroke program at Prisma Health Richland Hospital works closely with cardiology, cardiovascular surgery and vascular surgery. We collaborate with Cardiology in screening for cardiovascular risks prior to surgery or procedures, as consults for aberrant heart rhythms and for screening and placement of loop recorders for potential atrial fibrillation or atrial flutter patients. Cardiovascular Surgery and Vascular Surgery provide services such as carotid stent placement and carotid endarterectomies.

Emergency Department

The most frequent entry point for patients who are experiencing a stroke is via the Emergency Department (ED); thus, department staff, nurses and physicians conduct the first assessments and evaluations. A disciplined and evidenced based approach to management allows for prompt treatment. “Time is Brain!”

Patients diagnosed with a transient ischemic attack on initial evaluation transition to a 24-hour Clinical Decision Unit (CDU), an observation unit where they can have a complete evaluation performed in an expedited protocol-driven assessment, including 24-hour telemetry monitoring, echocardiogram, intracranial/extracranial vessel imaging and brain MRI.

Stroke Research

Located in the heart of the “Stroke Belt,” Prisma Health Richland Hospital is well positioned to participate in and conduct valuable clinical research in stroke. Selected as the only Southeastern site of 38 participating research centers in the National Institutes of Health-funded DEFUSE 3 clinical trial, Palmetto Health (now Prisma Health) was part of a team of investigators that set a new guideline increasing the window of time for blood clots to be mechanically removed from vessels supplying the brain.

Dr. Souvik Sen is a SmartState Endowed Chair in clinical stroke research within the South Carolina SmartState Center of Economic Excellence. The program participates in the National Institutes of Health StrokeNet as a regional center through our coordinating site, the Medical University of South Carolina. Current trials and registries include:

- PREMIERS: PeRiodontal Treatment to Eliminate Minority Inequality and Rural Disparities in Stroke.
- POLAR: Prediction of Outcome of Language Rehabilitation.
- SE-CoAST: South Carolina Collaborative Alliance for Stroke Trials.
- Young ESUS: Longitudinal Study of Young Patients with Embolic Stroke of Undetermined Source (ESUS).
- YSQ: Prospective Young Stroke Questionnaire Validation.
- DESIRE: Disparities in Intracerebral Hemorrhage Study.
- ARCADIA: AtRial Cardiomyopathy and Antithrombotic Drugs in Prevention After Cryptogenic Stroke.
- PACESETTER: Program to Avoid Cerebrovascular Events through Systematic Electronic Tracking and Tailoring of an Eminent Risk-factor.
• CSPC: A Phase 2, Multicenter, Randomized, Double Blind, Placebo-Controlled, Add on to Standard-of-care Study of n-Butylphthalide (NBP) Softgel capsules for treatment of Mild to Moderate Acute Ischemic Stroke in Adult Subjects.
• MOTIVE–Pilot study: MRI for Observing Thrombectomy-Induced Vascular Effects.

Trials undergoing Institutional Review Board (IRB) approval as this time include:

• BMS: A Global, Phase 2, Randomized, Double-Blind, Placebo-Controlled, Response-Adaptive Dose-Ranging Study of BMS-986177, an Oral Factor Xa Inhibitor, for the Prevention of New Ischemic Stroke or New Covert Brain Infarction in Patients Receiving Aspirin and Clopidogrel Following Acute Ischemic Stroke or Transient Ischemic Attack (TIA).
• SleepSMART: Sleep for Stroke Management and Recovery Trial.
• IMPROVE: IMplementation of Best PRactices fOr acute stroke care – deVEloping and optimizing regional systems of stroke care will initially focus predominantly on optimizing prehospital and early emergency care leading to thrombolysis with alteplase and/or removal of clot via mechanical thrombectomy.

Writing publications and abstracts for prestigious medical journals and conferences is integral to the rich academic tradition of Prisma Health Richland Hospital and the faculty and staff within the stroke program. This February, the International Stroke Conference in Honolulu, Hawaii, featured four abstracts from the stroke program. The titles of these presentations were:

• Early and extended time window prehospital large vessel occlusion scale application: A retrospective analysis
• Is low heart rate variability, a marker of autonomic dysfunction, the missing link between migraine with visual aura and cardioembolic stroke?
• Incidence and prevalence of headache in cranio-cervical artery dissection patients
• Early anticoagulation or antiplatelet therapy is critical in cranio-cervical artery dissection: Results from the COMPASS Registry

The care of each stroke patient begins with a review of the most recent stroke guidelines and development of evidence-based treatment protocols that align with the guidelines. The Prisma Health Richland Hospital Stroke Center Administrative Team is committed to ensuring that each treatment protocol is up to date. The team performs quality reviews, develops and implements quality improvement initiatives and reports this data regularly at a monthly multidisciplinary Stroke Performance Improvement Committee meeting. The team is also dedicated to serving our community by providing education on the signs, symptoms and prevention of stroke at schools, company health fairs, sporting events and other opportunities each year.

The team also teaches basic and advanced care of stroke patients to nursing staff responsible for caring for stroke patients. It is our goal to ensure all nursing staff are knowledgeable regarding the specific needs of this population of patients. We developed the Prisma Health Acute Stroke Course (PHASE), a full-day class that incorporates didactic lessons with simulation training. Our team also provides patients and families with the necessary education and resources they will need as they transition to home, rehabilitation center or nursing home.

Our main responsibility is to ensure all of the teams work cohesively to provide excellent and compassionate patient care with our ultimate goal being the best outcome for each of our stroke patients. ▶
A lot of innovation has led to Prisma Health Richland Hospital’s certification as a Comprehensive Stroke Center

Prisma Health Richland Hospital’s Stroke Center has been awarded The Joint Commission (TJC) elite status of Certified Comprehensive Stroke Center. This new designation is the result of a coordinated effort of a large multidisciplinary team to offer world-class levels of care in the Midlands of South Carolina and beyond to even the most complex cases of cerebrovascular patients. Stroke centers and regional networks are undergoing rapid evolution as newer strategies and opportunities for prevention and treatment of stroke are emerging. This is especially true and noticeable in South Carolina. Prisma Health Richland Hospital’s Comprehensive Stroke Center is proud to not only participate in this evolution but to also serve as a leader in the movement by continuing to innovate and train the next generation of leaders in stroke medicine.

For thousands of years, the disease of stroke was attributed to a supernatural origin such as a curse, a divine punishment, an omen, or a result of karma. More than 2,400 years ago during the time of Hippocrates, the Greeks used the term apoplexy, meaning ‘to be struck down by lightening’ or ‘to be struck down violently by the gods,’ to describe an acute paralytic affliction. One of the oldest written descriptions (around the time of the Babylonian Empire ca. 586 B.C.E.) of a proposed stroke mechanism is found in the Hebrew Bible (Psalms 137:5–6): “If I forget thee, O Jerusalem, let my right hand forget its cunning. If I do not remember thee, let my tongue cleave to the roof of my mouth.”

It was not until the mid-1600s that Swiss pathologist Jacob Wepfer found that patients who were deceased from apoplexy had associated bleeding in the brain. He also discovered that a blockage in one of the brain’s blood vessels was associated with the disease. This resulted largely in the birth of our understanding that “apoplexy,” or as we know it today as “stroke,” is a neurological disorder. Over the following centuries more and more scientific inquiry led to an enhanced understanding and appreciation of cerebrovascular anatomy, physiology and pathology. Strokes not only became categorized into two main types—hemorrhagic and ischemic—they also started to be labeled into various subtypes depending on etiology and mechanism. The location of a stroke identified on brain autopsy was correlated with clinical symptoms that the patient historically experienced while living. Brain function was literally discovered one stroke at a time and the culmination of this knowledge led to the reverse application: the ability to identify (localize) what part of the brain was being affected in a living patient depending on their symptoms. Furthermore, careful retrospective analysis into the lives and conditions of these cerebrovascular patients allowed for identification of common patterns and medical risk factors which would eventually lead to our current strategic targets of primary and secondary prevention.

Despite the abundant knowledge accumulated over centuries, acute stroke remained a mighty Goliath to be reckoned with as recently as the early half of the 1990s. For a very long time, stroke remained a disease that could be diagnosed precisely but not managed effectively. The last few decades, however, have witnessed a revolution in stroke management—the ability to provide for the most intuitive strategy in the treatment of a blocked vessel in the brain: recanalization. The earliest milestone in this regard was the National Institute of Neurological Disorders and Stroke (NINDS) r-tPA Stroke Study Group Trial, 1995. The NINDS trial showed that eligible patients who receive intravenous (IV) recombinant tissue plasminogen activator (r-tPA) within 3 hours of acute ischemic stroke onset are nearly 30 percent more likely to have better neurological outcomes after three months as compared to those who do not receive IV thrombolysis. Clear-cut guidelines have since been established to identify patients eligible for
IV r-tPA. As a result, nearly 600,000 patients in the United States alone have received this treatment.

Subsequently, it was discovered that the therapeutic window for IV r-tPA could be extended in some patients up to 4.5 hours after stroke onset with maximum benefit reaped primarily when administered within 90 minutes of symptom onset. Clearly, in stroke management, "time is brain." Even after establishing a viable therapeutic option for stroke, access to timely reperfusion therapy remained a bugbear in stroke care. In efforts to surmount this issue, increased emphasis on community education, pre-hospital management and telemedicine have yielded promising results.

The popular “Act F.A.S.T for stroke” strategy was initially conceptualized in the United Kingdom to help with faster stroke identification and management. The appearance of stroke symptoms such as facial drooping, arm weakness and speech difficulties warrant the timely call for help as rapid reperfusion is the key to a successful recovery. Many screening tools for faster stroke recognition have been developed to aid personnel in the pre-hospital setting. Upon swift identification of stroke, the patient is transported to stroke support hospitals or specialized stroke centers whenever available. By the end of the last decade, more than 850 primary stroke centers had been established in the United States. The American Stroke Association’s Target: Stroke initiative has successfully seen median door-to-needle times of 60 minutes or less in participating hospitals following strengthening of the pre-hospital and emergency room stroke management protocols.

Telemedicine technologies dubbed “Telestroke” have further hastened treatment times and have helped reduce regional disparities in stroke care. The concept of mobile stroke treatment units is now being explored to further expedite diagnosis and treatment.

Even with these advances, cases with blood clots that were seemingly larger were unable to be reliably dissolved with IV thrombolysis therapy. Despite timely treatment, recanalization continued to be difficult to achieve with patients having very devastating strokes, if they survived. An exciting and new stroke management paradigm has been developing since the last decade, such as intra-arterial treatments for acute ischemic stroke and, in particular, mechanical thrombectomy. This has led to the advent of a new endovascular era in stroke care.

One of the earliest forays into the area of intra-arterial thrombolysis was the Prolyse in Acute Cerebral Thromboembolism (PROACT) II Trial in 1999. This trial was undertaken to estimate the effectiveness of intra-arterial thrombolysis with prourokinase. The unfavorable benefit-versus-risk ratio prevented Food and Drug Administration (FDA) approval for intra-arterial prourokinase as a universal treatment modality for acute ischemic stroke. Subsequently, endovascular devices for mechanical thrombectomy were explored.

Endovascular treatment devices are used in the treatment of proximal arterial occlusions. The device is introduced via the femoral artery up to the occlusion site under angiographic guidance where, depending on the device being used, one of three different mechanisms is then employed to establish reperfusion. Earlier generation devices, the coil retriever (the coil wraps around the thrombus for extraction) and aspiration device (removes thrombus via suction) failed to demonstrate any significant improvement in functional outcomes in the Interventional Management of Stroke (IMS) III Trial, 2013, a Phase 3 randomized clinical trial (RCT). However, five RCTs comparing the efficacy of newer stent retriever endovascular devices (the stent being expanded at the occlusion site to trap and extract the thrombus) with medical treatment of strokes have shown better 90-day functional outcomes. The earliest of these trials, MR CLEAN, 2014, compared outcomes of endovascular treatment with either IV r-tPA or no thrombolysis. More than three-quarters of the patients receiving endovascular treatment reported greater than 50 percent vessel recanalization. While the incidence of hemorrhage was marginally more in the endovascular cohort, the benefit far outweighed the risk thus making the MR CLEAN trial the forerunner of the endovascular era. The SWIFT PRIME, 2015, trial showed overwhelming benefit as compared to IV r-tPA with number needed to treat (NNT) as low as 2.6. The endovascular technique was found to be so efficacious that the ESCAPE, EXTEND-1A, and SWIFT PRIME trials,
comparing mechanical thrombectomy with IV thrombolysis, had to be halted midway! Patients with large vessel occlusions could now be treated up to 6 hours after onset. According to Definitive Healthcare’s data, 13,000 thrombectomies were performed in 2014 and by 2017 that number increased to 27,000 in the United States, with 90,000 performed worldwide.

Within the past year the field of stroke achieved another major leap forward with two exciting positive clinical trials: the DAWN\textsuperscript{8} and the DEFUSE-3\textsuperscript{9} trial. Using cutting-edge neuroimaging perfusion analysis via RAPID software, the treatment window for large vessel occlusion (LVO) with selected criteria was extended beyond the 6-hour time window up to a 24-hour period. Current research with modern neuroimaging techniques is also showing promise that certain patients with selected criteria may also benefit in such extended time periods.

Along with the recent advancements in both acute ischemic and hemorrhagic stroke treatments and overall understanding of cerebrovascular pathophysiology, entire stroke treatment systems and networks have been challenged to grow and reorganize. Nationally, community education, pre-hospital care, inpatient and critical care, acute to subacute management, recovery, rehabilitation and stroke secondary prevention have advanced measurably and exciting progress continues. Prisma Health Richland Hospital’s Comprehensive Stroke Center Team offers cutting-edge expertise in stroke care. We are dedicated to supporting Midlands’ patients and serving as a bridge to health care facilities in our region that receive stroke patients needing the most advanced care. 

References
Holy Stroke – preventing strokes one church at a time

By Jillian Prier, MS, TQ Davis, MA, and Anil Yallapragada, MD

South Carolina is located in a part of the country with the highest incidence of stroke, an area known as the “Buckle of the Stroke Belt.”

In 2016, strokes resulted in 16,484 hospitalizations in the state. Approximately 40 percent of the patients affected in our state are considered young strokes (below age 65). Though we are developing our statewide capabilities in treating stroke patients with better equipped and organized stroke center facilities, the sad truth is resources are limited and too many individuals are afflicted by largely preventable lifestyle conditions.

Obesity rates in South Carolina have climbed from 12 percent in 1990 to 31 percent in 2013. Childhood obesity has become so prevalent that it has been labeled a national security threat with approximately one-third of young adults between their late teenage years and their early 20’s in the overweight or obese range. The 2015 SC DHEC Cardiovascular Risk Assessment showed a 20 percent rate of smoking, a 39 percent rate of hypertension, and a 39 percent rate of high cholesterol. Heart disease and stroke has not only surged in our communities, but it is feared this is just a foreshadowing of things to come. Something must be done to address the roots of these diseases at the community level to spur a reduction in our population.

In addition to being in the Stroke Belt, South Carolina is also a part of the Bible Belt. In many of our state’s towns and cities, the church serves as the core of the community. People regularly attend the same church weekly with their families, friends and neighbors. Not only does the church serve as a spiritual epicenter, but it also can be a valuable venue for education and social interaction. With the current state of health care, the current culture of health, and the need for a new intervention beyond the walls of a hospital or clinic, we decided to create the program known as Holy Stroke. Our motto: to prevent strokes one church at a time.

To engage people outside typical health care settings, we created a collaborative effort, beginning with Carolina Health Outreach, a group of University of South Carolina undergraduates interested in health care professions and advocacy. They recruited fellow students to participate in the Holy Stroke initiative. Students lined up to volunteer, learning how to take blood pressures, calculate BMIs and provide screening forms to churchgoers. The Prisma Health Office of Community Health supplied nurses and phlebotomists to perform blood draws to check hemoglobin A1c (for diabetes) and lipid levels. Participants received their results by mail to see their cardiovascular profile. In addition, Prisma Health supported the publication of a small booklet with information on stroke signs, symptoms, risk factors and primary prevention strategies. The booklets were subsequently given out to thousands of churchgoers. Furthermore, each Holy Stroke event involved a stroke education lecture delivered as part of the weekly church sermon.

Through our outreach at 15 churches, we found averages of Stage 1 hypertension, pre-diabetes and obesity across the Midlands. Our data confirmed church congregations are a perfect venue for intervention in communities with an incredible need for primary prevention screening and education.

By harnessing the power of the church community, we hope to fight the stroke epidemic at the community level and initiate a grassroots wave of change, not only within the Midlands of South Carolina but also throughout the entire state and across the Stroke Belt.
Contact us for more information or to refer a patient

**Palmetto Health-USC Neurosurgery**

3 Richland Medical Park Dr., Suite 310, Columbia, SC 29203
9 Richland Medical Park Dr., Suite 640, Columbia, SC 29203 (pediatric office)
300 Palmetto Health Pkwy., Suite 200, Columbia, SC 29212
Phone: 803-434-8323
Fax: 803-434-8326
PalmettoHealth.org/Neuroscience

**Palmetto Health-USC Neurology**

8 Richland Medical Park Dr., Suite 420, Columbia, SC 29203
300 Palmetto Health Pkwy., Suite 200, Columbia, SC 29212
Phone: 803-545-6050
Fax: 803-933-3005
PalmettoHealth.org/Neuroscience

Call 844-64-BRAIN (27246) for emergent neurosurgical transfers.