

# Redefining World-Class Stroke Care

A leading South Carolina stroke program offers insight on process improvement, next-generation technologies, and artificial intelligence.

Stroke is a leading cause of disability and, as of 2016, the second leading cause of death worldwide, with 5.5 million attributed deaths.<sup>1</sup> Level I evidence supports the use of mechanical thrombectomy (MT) to treat ischemic stroke in patients who are considered nonsurgical candidates. Future studies will need to focus on the expansion of MT in new patient cohorts, including large core infarcts, low National Institutes of Health Stroke Scale (NIHSS) scores, low Alberta Stroke Program Early CT Score (ASPECTS), and longer time to treatment.

With rising procedure demand and time constraints (ie, “time is brain”) for MT, the “supply” or number of comprehensive stroke centers/MT-capable centers is growing. Although stroke experts estimate  $\geq 20\%$  of patients with severe strokes are MT candidates, only 2% of eligible patients receive MT in some areas.<sup>2</sup>

In 2018, four new physicians joined Prisma Health–Upstate in South Carolina with a vision to improve access to MT and other advanced neurointerventions (Figure 1). Upon starting at Prisma Health–Upstate,



**Figure 1.** From left to right: Andrew Walker, MSN, RN, Manager Invasive Cardiovascular Services; Aquilla Turk, DO; Jan Vargas, MD; Raymond Turner, IV, MD; Imran Chaudry, MD; Shannon Sternberg, MBA, MSN, RN, CNRN, SCR Manager, Stroke Program Cerebrovascular & Stroke Center.

“Stroke is an epidemic in this region. We analyzed the data, which clearly demonstrated this was an under-resourced region regarding endovascular care. We had no doubt we could positively impact this community.”

—Raymond Turner, IV, MD,  
Neuroendovascular Surgeon at Prisma Health–Upstate  
and Professor of Surgery at the University of  
South Carolina School of Medicine Greenville

the physicians developed a three-year strategic plan for stroke care. This article provides a high-level view of initial process improvements as well as the technology upgrades completed and plans for the future.

There was a significant opportunity in Prisma Health’s Upstate affiliate, which includes South Carolina and outlying areas in North Carolina and Georgia.

## THE THREE-YEAR PLAN

For stroke, the likelihood of a better outcome depends on faster admission to hospitals with experienced resources and rapid access to a neurovascular angiography suite. Initial changes included partnering with facilities outside the service area to improve access, triage processes, and streamline transfers to Prisma Health–Upstate for patients requiring advanced care. Standardizing imaging requirements was a key component for faster interhospital transfers, while using artificial intelligence (AI) technologies for information sharing and communication between teams. Within Prisma Health–Upstate, stroke triage processes were redesigned



Figure 2. The ARTIS icono biplane system.

to reflect not only the American Stroke Association guidelines but to also account for the latest peer-review data on stroke care. Neuro Endo Surgery, the emergency department (ED), and emergency medical services

“Our intent is to be best-in-class on a global scale while providing unparalleled stroke care in South Carolina and our local community. The addition of technologies to support improved patient flow should increase access to MT in our region, improve clinical outcomes, and optimize process metrics for stroke treatment at Prisma Health–Upstate.”

—Imran Chaudry, MD,  
Neuroendovascular Surgeon at Prisma Health–  
Upstate and Professor of Surgery at the University of  
South Carolina School of Medicine Greenville

(EMS) partnered to create an ED/CT bypass model that moves prescreened patients directly to the neurovascular angiography suite for interventional care. As part of phase one of this strategic plan, Prisma Health–Upstate made an investment in available resources through increased education for EMS, a restructured staffing model, the addition of a fellowship program, the use of radial artery access, and active participation in seven clinical trials, with eight more trials in the startup phase.

Within the first year, these changes yielded a 270% increase in patients treated with MT in our community and an increase in our stroke service area to 60 miles, which included extension into North Carolina and Georgia. Currently, approximately 40% of Prisma Health–Upstate’s transfer patients receive MT. In addition, > 50% of Prisma Health–Upstate’s transfer patients bypass the ED, which results in a 45% reduction in median door-to-groin times. The end result is patients receive appropriate care faster with fewer complications and quicker recovery times.

### SETTING THE STAGE FOR PHASE TWO

Effective stroke treatment requires an optimized workflow, which can be supported by innovative technolo-

## ARTIS ICONO SYSTEM

Sponsored by Siemens Healthineers

“Being able to deliver expert endovascular care to a patient having an acute stroke who otherwise has no access to stroke care is exciting. But realizing it may be on a patient 50 or 5,000 miles away can be uncomfortable for many surgeons. I am certain our predecessors felt similarly the first time we treated a heart attack through the femoral artery or removed a ruptured appendix relying on a camera for visualization. Advancing health care is about better outcomes, less disability, and improved quality of life. Improving health care through innovation requires a certain level of angst, doubt, and dreams in order to get there.”

—Aquila Turk, DO,  
Neuroendovascular Surgeon at Prisma Health–  
Upstate and Professor of Surgery at the University of  
South Carolina School of Medicine Greenville

gies. Many advanced comprehensive stroke centers are evaluating technology such as the ARTIS icono biplane systems (Siemens Healthineers).

Imaging can have a significant impact on stroke diagnosis and treatment. The ARTIS icono system can help streamline workflow processes and there is potential to see previously unseen pathology (Figure 2). New DynaCT technologies allow for visualization of collateral vessels and artifact reduction of the bony structures to achieve more consistent three-dimensional (3D) image quality over the entire brain. The new architecture eliminates the need to move the lateral plane when switching from two-dimensional to 3D acquisitions resulting in faster diagnosis and shorter time to treat.

### THE CURRENT IMPACT OF ROBOTICS AND TELEMEDICINE

Prisma Health–Upstate’s cardiac catheterization lab currently uses the CorPath GRX vascular robotic system (Corindus, A Siemens Healthineers Company), which enables interventional cardiologists to perform robotic-assisted percutaneous coronary intervention (PCI) without being at the table, resulting in less radiation exposure. Available since 2012, this technology is progressing to a long-distance, tele-robotic-assisted application that may one day be applied to emergent procedures such as heart attack and stroke.<sup>3,4</sup> ■

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4. Patela PM, Shaha SC, Pancholy SB. Long distance tele-robotic-assisted percutaneous coronary intervention: a report of first-in-human experience. *EClinicalMedicine.* 2019;14:53–58.