Advanced Stroke Imaging in the Emergency Room: Saving Precious Time and Improving Patient Outcomes

VDM speaks with neurointerventional surgeon Ryan A. McTaggart, MD, on the unique clinical pathway for stroke patients at Rhode Island Hospital, in Providence, Rhode Island. Dr. McTaggart shares the strategy behind installing a biplane angiography system within the hospital's emergency room, and how this technology has supported the hospital's comprehensive stroke program.

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How long have you been performing neurointerventional procedures?

I have been in practice for about 15 years at Rhode Island Hospital, and I am the Director of Interventional Neuroradiology and Co-Director of the Stroke Center. I am also the chair of the Rhode Island Stroke Taskforce.

How many thrombectomies does your center perform annually?

Our center performs approximately 250 mechanical thrombectomies per year. I perform a third of those.

What trends have you seen in the diagnosis and intervention for acute ischemic stroke?

For the first five years of the mechanical thrombectomy era, the goal was to improve systems of care and workflow for acute ischemic stroke patients, because when it comes to stroke, "time is brain".

The initial goals were focused on getting door-to-tPA times of 30 minutes, door-to-groin puncture times of 60 minutes, and door-to-recanalization or reperfusion times within 90 minutes of arrival. When I wrote a review article on the subject in 2016, I tried to get our guidelines committee to agree on those ideal metrics. There was a lot of controversy, but fast forward to five years later and the recently published ESCAPE NA-1 clinical trial, and we see that many of the sites were able to achieve these goals. In fact, the median door-to-tPA puncture and reperfusion times hovered around exactly that: 30, 60, and 90 minutes. These times are achievable and the best-performing high-volume centers are meeting these time windows.

Since then, we have had another paradigm shift in technology with what the ARTIS icono (Siemens Healthineers) brings to the table. We can actually achieve even greater efficiency by skipping the emergency room.

How long have you had the Siemens ARTIS icono biplane installed?

We've had the system about 7 months now. The ARTIS icono has been a game-changer for us, both from an image quality perspective, as well as from the fact that it is physically located in the emergency department of the hospital. Our previous biplane suite was problematic. It was located about a half-mile from the emergency department and there were inefficiencies in our system that we just simply couldn't overcome. Currently, I think that we are the only comprehensive stroke center in the world that has a state-of-the-art biplane neuroangiography suite in an emergency department.

Why is biplane technology the accepted standard for imaging cerebral vascular disease?

Mechanical thrombectomy can be performed with a single-plane fluoroscopy unit, but in order to really put patients first, you need to prepare for the worst-case scenario. For more complicated cases, there is no doubt that two views are better than one. For that reason, if you are serious about treating patients with neurovascular disease and large-vessel occlusion stroke, there is no substitute for a biplane neuroangiography suite. I believe that in 2021, there is no better angiography unit out there than the Siemens ARTIS icono.

Why was it important to have the biplane system installed directly in the hospital's emergency room?

When a capital investment was made in a biplane room 15 years ago, it was placed half a mile from the emergency department, within the radiology or imaging department. More recently, however, there has been a paradigm shift in stroke care delivery. We need to offer patients quick access to the mechanical thrombectomy procedure. Due to the high volume of patients in our department, the logical choice was to place the ARTIS icono biplane in the emergency department, in order to get patients early and quick access to a room that is required to treat the most

time-dependent disease in medicine. That is an important thing to emphasize. There is no other disease that is as time-dependent as large-vessel occlusion stroke. Minutes matter. Anything you can do to cut those minutes down means a lot to the patients and the healthcare system, not only because time is brain, but also because it saves downstream healthcare dollars. A minute saved can help patients gain approximately a week of independent living. Also, for every minute gained, we save the healthcare system a little over a thousand dollars in downstream healthcare costs.

How has this technology helped overcome some of the challenges of treating stroke patients?

The real gain has been that we now have the icono biplane in the emergency department and our most immediate win was the reduction in our door-to-groin puncture time, numbers that we have already seen in our data acquisition that we get for every patient. The truly exciting aspect is the opportunity to capture superior quality images. In keeping with the system's superior image quality, there is also faster image acquisition. The ARTIS icono acquires images more quickly, with little to no detriment to image quality. In fact, I believe the image quality is better and with lower dose. The ARTIS icono acquires images more quickly, with no detriment to image quality.

In 2021, there is no substitute for the ARTIS icono. We used to have perform 20-second acquisitions to get decent image quality with cone beam computed tomography (CT), but we now can acquire better imaging in 8 seconds. This is especially advantageous when patients are moving. If they move during those 20 seconds, the image capture is completely corrupted and the image becomes non-diagnostic. Now that the image quality is so superior and the ARTIS icono has faster acquisition times, patient movements aren't as detrimental to diagnostic imaging quality. We are now able to conceive of bringing these patients from the front door of the emergency department directly to the biplane neuroangiography suite. Once again, achieving greater efficiency because we can skip that stop in the hospital emergency department CT scanner. That is another elimination of a bottleneck. The entire large-vessel occlusion stroke care delivery game is about eliminating bottlenecks. One bottleneck was the half-mile walk to our old room. We eliminated that bottleneck by putting the ARTIS icono in the emergency department. As compared to our previous situation, it makes us quicker and more efficient, because the image quality in the room can be used as our initial acute stroke imaging platform.

Can you talk more about the importance of image quality and what you are seeing?

Not only is that 8-second image acquisition a win, but Siemens, unlike any other vendor, also has something called DynaCT Sine Spin acquisition. The method by which the imaging is acquired is a little different than it has been historically. Sine Spin eliminates artifacts at the base of the skull to make the image quality even better. Another thing that distinguishes Siemens from any other vendor is that if a hospital wants to take care of its community — it doesn't matter if it is a comprehensive stroke center, a thrombectomy-capable center, or a stroke center that is positioned in a rural area — ARTIS icono offers versatility to these hospitals, because one machine can be positioned in a neuro configuration, body IR, and a cardiac configuration. If you are going to buy a system that is designed to reduce risks of death and disability from large-vessel occlusion, stroke and ST-segment elevation myocardial infarction (STEMI), and that has the best image quality, there is no question that you want to put an ARTIS icono in your emergency department, because the cardiologists can also use it in a cardiac configuration. Physicians performing neurointerventions can use it in the neuro configuration. I think that is another game-changer and another big win for this system. For any administrator or facility that is looking at purchasing a new imaging system for STEMI, cardiac, and stroke patients, there is no question that the ARTIS icono should be their choice.

Figure 1. Dr. McTaggart (far left) and team members.

Why did you decide to go with Siemens versus other competitors? What were the value items that mattered?

The reason we partnered with Siemens and put the ARTIS icono in the emergency department is because there is no

substitute for what this system is capable of doing. In addition, there is no comparison for where Siemens is going with technology and making it better. Then there is no comparison for customer dedication and relationships. When you look at Siemens, there are three factors that place it above the competition: (1) the basic and advanced applications; (2) the future of remote technology capabilities; (3) the relationships. Let's launch into each of those. As far as the basic and advanced applications of this system, this 8-second image acquisition that enables us to do acute stroke imaging in the biplane neuroangiography suite, and bypass the ER CT scanner is a big deal. The novel Sine Spin image acquisition technology that gives greater image quality and makes the imaging more diagnostic with cone beam CT is also a game changer. Siemens also has a co-marketing agreement with RapidAI. RapidAI specializes in artificial intelligence on a stroke detection platform. The icono biplane is able to perform multiphasic imaging that, along with the RapidAI "Rapid for Angio" advanced application, provides information directly from the icono biplane to the RapidAI platform.

The second reason Siemens adds value in a partnership is where they are going. Not every hospital can do everything. Is there a way that a specialized team at one hospital can do something at another hospital, or cover a more rural facility? Siemens' acquisition of Corindus Vascular Robotics, which involved the acquisition of a robot that allows you to perform endovascular procedures to improve quality and safety, is also potentially able to do these procedures telerobotically. The Corindus CorPath robotic angioplasty system has already been used telerobotically to perform cardiac procedures from a distance. In the future, the goal is to be able to do neurointerventional procedures telerobotically. Carotid stenting has already been performed with the CorPath system, as well as aneurysm coilings. Siemens is in a position where they can enable those physicians who are most experienced at performing these procedures to do them at a geographical distance, so that more patients can benefit.

Finally, I don't think there is any other company that invests in relationships like Siemens does. I can tell you from my personal experience, I am in constant contact with the Northeast Zone Area Vice President. I have his cell phone number and he regularly checks in on me. There is no other company I have dealt with that has shown that sort of customer dedication.

Any final thoughts?

Mechanical thrombectomy is a somewhat common procedure as we improve our systems of care, providing access to lifesaving therapies for large-vessel occlusion in stroke. However, aneurysms and other neurovascular conditions are relatively rare. It is best that those cases are performed by physicians having significant experience from which to draw.

It is exciting that we're moving ahead with robotic-assisted endovascular therapy, but it is just as important to move forward with the telerobotic-assisted endovascular therapy so that treatment access for these complex diseases can be democratized.

Figure 2. The ARTIS icono biplane (Siemens Healthineers).

Siemens is pushing the frontier and engaging in research so that we can combine all these horizon technologies and get them here that much sooner so that our patients can benefit. ■

Ryan A. McTaggart, MD, is Assistant Professor at The Warren Alpert Medical School of Brown University and Director of Neurointerventional Radiology at Rhode Island Hospital.

His research interests are focused on minimally invasive therapy for neurovascular disease, including acute ischemic stroke. In addition, he is passionate about transforming systems of care for stroke patients to improve timely access to mechanical thrombectomy. Dr. McTaggart's work has been published in more than 100 peer-reviewed journals, books, and book chapters. He is a senior member of the American Society of Neuroradiology and the Society of NeuroInterventional Surgery, and serves on the Standards and Guidelines Committee of the Society of NeuroInterventional Surgery. Dr. McTaggart is a graduate of the College of Physicians and Surgeons at Columbia University and completed his residency at The Warren Alpert Medical School of Brown University. He completed a diagnostic neuroradiology fellowship and an interventional neuroradiology fellowship at Stanford University, and specializes in neurointerventional surgery.

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