Ischemic and Hemorrhagic Stroke Intervention

VDM talks with Jeffrey Farkas, MD, Interventional Neuro Associates, Brooklyn, New York.

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Dr. Farkas, can you tell us about your practice and the types of patients you see?

I am a neuroradiologist working in an independent practice with three stroke neurologists who do interventions, along with two stroke neurologists who do not do interventions. We work in the metropolitan area in New York City. I work primarily out of NYU Langone Hospital – Brooklyn, which is a comprehensive stroke center. Our practice has expanded to provide stroke thrombectomy services to the region, including St. Francis Hospital, where we have been treating ischemic stroke for the past two and a half years. Now that their lab is getting biplane equipment, we will be providing a full range of services. Stroke has been the biggest impetus for the growth of our practice, because there are a limited amount of physicians who can perform these procedures. For stroke, time is brain; every second counts. Typically stroke patients are transferred from smaller hospitals to larger hospitals for intervention. Hospitals, even those with well-defined systems of care, have limitations in moving patients back and forth between hospital systems, and it is a significant cause of delay. We believe it is easier for the physician to drive to the hospital where that stroke patient is located while that patient is being moved up to the lab, as opposed to transferring the patient. A hospital can spend an hour and a half delaying care while trying to get patients to another center. In New York State, the EMS techs have recently started taking patients they think are having large vessel strokes directly to hospitals that perform thrombectomy. But that directive has just started, and patients are still reaching hospitals where they ultimately need to be transferred.

How is hemorrhagic stroke intervention developing?

When I started in the field, we were predominantly dealing with hemorrhagic stroke. Intravenous tPA was the mainstay for treatment of ischemic stroke, but for hemorrhagic stroke, neurosurgery offered surgical treatment for brain aneurysms, controlling the intracranial hemorrhage and clot removal for hemorrhage. Over time, we started to evaluate patients who came in with hemorrhagic strokes to find out why the hemorrhagic stroke occurred. If it is a subarachnoid hemorrhage, then it is a brain aneurysm. We identify where the brain aneurysm is located and the aneurysm morphology. Today, 9 out of 10 aneurysms undergo endovascular coiling or other type of endovascular procedure to get rid of the aneurysm, as opposed to going to open neurosurgery. The endovascular components of treatment have gotten very good. The same thing goes for other types of hemorrhages. We are continuing to investigate why patients are having intracranial hemorrhages if they don't have an aneurysm. As we do more angiography, we are able to identify vascular lesions that need to be treated, but would otherwise maybe not have been seen. We now have excellent tools for treating brain aneurysms and can treat vascular malformations that have bled with embolization. Our tools have gotten so good, as compared to the early days, that for unruptured aneurysms, outpatient treatment could be a future possibility. Patients who come in with a bleed, however, still need to have neurointensive care and adequate resources to get them through, but in our experience, the mortality rates that used to happen with brain aneurysms have dropped tremendously.

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What is the role of thrombectomy for ischemic stroke?

Thrombectomy for the treatment of ischemic stroke works, and we know this from the results of randomized, clinical trials of stent retrievers over the past several years. Previously we had looked at the idea of improving outcomes by opening up the blood vessel using devices like the Merci Retriever device. The problem was that we needed the right tool. I like to use the following analogy: if you do a trial for appendectomy and only 50% of patients are successfully treated, this means you might not get a positive outcome for your appendectomy trial, even though we all know appendectomy works. The first effective thrombectomy tool that came out was a stent retriever, which is driven up to the blood vessel and opened; after a few minutes, the clot is ingrained in the stent and the stent retriever is removed with the clot. Today, effective aspiration tools have also been developed. The fact is, use of these devices is not an either/or, but it may be a combination that works the best. I like to first go up with an aspiration tool and try to suck out the clot. If I am successful in that first pass, I save a lot of money, because stent retrievers tend to be on the more expensive side compared to

aspiration catheters. I also find aspiration slightly less invasive to the intima, as opposed to pulling a stent retriever across and sucking up the clot. It also seems to be quicker. However, my colleagues will use stent retrievers alone or use a combination of a stent retriever through an aspiration catheter to get the vessel open. The bottom line is not the device; it is about the experience of the user, what works best for that user, and what they use if it doesn't work. For example, if I use aspiration and it doesn't work, I go to a stent retriever very quickly. My colleagues who use stent retrievers use aspiration when their stent retrievers aren't working. The goal is to achieve the most effective re-opening of the vessel, gain TIMI-3 flow, and in the majority of cases, do that as fast as possible. I am agnostic regarding how to do it. We are no longer in an era where a stent retriever is the only acceptable method. Having all these devices available makes thrombectomy a very good tool for patients with ischemic stroke. You could argue it is better to have a large vessel occlusion and show up at a thrombectomy center where they are experienced than to have a small vessel stroke, leaving you incapacitated where nobody can do anything for you. At least with thrombectomy, you have a shot.

Are you participating in any clinical trials?

We are participating in the ESCAPE NA-1 trial, which I think is really the next step in treatment. Right now, opening up the blood vessel, as long as you can get to the clot, is better than leaving it alone in the majority of patients that don't have drastic changes on the CT scan. We are very aggressive about doing thrombectomy. Now we need to improve on our abilities and fine-tune devices to get the vessels open more frequently and faster, with less device passage. The ESCAPE NA-1 trial involves giving medication at the time of thrombectomy to try and reduce the risk for reperfusion injury. We have enrolled a number of patients in this double-blind trial, so we don't know the outcomes yet. In the past, giving neuroprotection has not been effective. The theory is that it was probably because it was not getting to the area of ischemic brain at the right time, i.e., when the reperfusion hits. We now have the tools to open the vessel and are trying to extend our ability to improve outcomes. The ESCAPE NA-1 trial is fairly far along and it won't be long until data make their way into the literature.

Beyond mortality, what endpoints are important for stroke trials?

To date, trial endpoints have predominantly been 30- and 90-day Rankin scores (ranging in part from 0=no residual symptoms to 6=death), as well as the change in the National Institutes of Health (NIH) stroke scale in the first 24 hours. The truth is that many patients who come in with ischemic stroke aren't in perfect shape to begin with. Some are actually a Rankin of 2 when they present. If those patients can return to their baseline, I think you have done them a big favor, but they will still be a Rankin 2. We think 0-2 is acceptable, but if you are a Rankin 3 and we get you back to normal, you wouldn't be included in a trial. Yet we are making patients better even if we don't get them to Rankin 3. Let's say you have a patient who is aphasic and has hemiplegia, and you are able to take away their aphasia. They are never going to reach a Rankin 2, but you still made some improvement in their life. We need to focus on not only the perfect outcomes, but how we are making patients' lives better overall. If someone comes in with a Rankin 3, many interventionalists might think, this is not a perfect patient, I shouldn't do thrombectomy. Yet if the patient has a quality of life they want back, I think it is important to do the procedure. If you consider the overwhelming power and capability of thrombectomy, we do make a lot of patients better. They may not have zero deficits, but they are still better off having undergone the procedure. The flip side is looking at how to reduce hemorrhagic complications from the procedure. The ESCAPE trial, as one example, might help reduce the complication rate to a point where ischemic stroke treatment becomes like ST-elevation myocardial infarction (STEMI): ST elevations are present, the patient arrives within an appropriate window of time, and undergoes percutaneous coronary intervention (PCI) immediately. That is ultimately where we are going to be with thrombectomy. Ischemic stroke is not as simple; we don't have an EKG tool, for example. But I do think that it is where we should be with the majority of patients, looking at them as a candidate and trying to only exclude patients that definitely won't benefit, as opposed to trying to find the perfect ones and leaving the rest at the side of the road because they are not perfect. Many patients are not being given the opportunity for thrombectomy that would otherwise make them somewhat better. Our philosophy is changing, but a year or two ago, that wasn't the situation.

How are patients being evaluated?

Almost everybody gets a computed tomography (CT) scan. CT angiography (CTA) has become standard as a screening tool. We can see what is going on, correlate it with symptoms, and make decisions about patients. CT perfusion has also been a helpful and useful tool. CT perfusion doesn't have to be done routinely, but it should be applied to the patients that are later in presentation. Many of my colleagues might disagree and believe that it is a worthwhile tool right away, but I think it is all preference-based. CT is a helpful tool, however, particularly when patients come in with a transient ischemic attack (TIA), where the patient had a significant symptomology for 10 minutes and then was better. If you don't do a CTA and send that patient home, they might experience a repeat symptom because of the presence of a critical stenosis or intracranial occlusion in the M1 (middle cerebral artery). It is not impossible that good collaterals are keeping that brain alive and functioning. When you get an IV and lay the patient down, their cerebral pressure improves and they are functional, but when they go home, the TIA can happen again, and they might not be as lucky the next time. CTA has been the mover and shaker for thrombectomy services throughout the country. There are people who advocate for magnetic resonance imaging (MRI), but I don't

think the resources are in place in the majority of the country to incorporate MRI effectively and efficiently. The same information is available on CTA, which is a workhorse of the emergency department. I believe that CT/CTA with perfusion capabilities is the way we will be evaluating all stroke patients in the future. Some of my colleagues are bringing patients directly to the lab and doing CTs on the cath lab table, but in order to do that, you need a dedicated service, because some patients won't have occlusions and then the interventional lab is being used for diagnostic imaging. There are a lot of ways to skin a cat — the reality is that whatever works for you and your system is incredibly important. What works at one hospital won't work at another. Tailor your process so that it works for your hospital and is done properly.

What is your approach for access?

I have been focusing on radial access for neurointerventions for the past several years. Cases have also been reported utilizing direct carotid puncture. One of the major reasons failure occurs for thrombectomy is that the cerebral circulation can't be reached from the femoral artery, whether it is because a patient has bilateral occlusions in the femoral arteries, high grade stenosis, or tortuous aortic arches. Some devices are more difficult to use when you are going radially. I avoid a short sheath in the radial artery, go directly with a 6 French long sheath, and advance it to the carotid through the radial. A balloon guide can be used as part of the process for a stent retriever, but if you want to use a balloon guide, it is limiting from a radial approach. The balloon guides are in a range of 8 French and the balloon guide catheter predominantly goes through a sheath in order to avoid damaging the balloon. It's difficult, but in some patients, the balloon guide can go through the radial artery. I stick with a 6 French long sheath, advance it to the carotid, and can work through that in most cases. In elderly patients with low-lying aortic arches, where you are trying to get to the left side, radial access is a significant advantage and very effective. We are starting to use radial for the hemorrhagic strokes. It can be easier and safer, and radial access is much more comfortable for patients. My diagnostic angiogram patients love it when I go radial; I've never had any complaints about it. There is a learning curve, but once you get through it, radial access is quite effective. Some of my colleagues like to use the term "radial first". It's not such a simple analogy; "radial appropriate" is my preferred term. Noninvasive imaging allows for identification of better radial versus femoral candidates. Sometimes you can spend a lot more time doing a case radially or vice versa, femorally, so choose what is appropriate rather than trying to do everything in the same way.

Any final thoughts?

I work in many different labs. Some places have a dedicated neuro interventional radiology lab associated with interventional radiology and other places are almost purely cardiac cath lab with an interventional lab next door. What I have learned over time, especially at St. Francis Hospital, is that the tools and the knowledge base shared with us by our colleagues in cardiology and vascular make us better as a whole. I really like the surgery model where in one operating room you can have your appendix taken out and in the next room over, you can have brain surgery. I have always wondered why hospital systems didn't create interventional labs under that same paradigm, so that PCI is in one room and in the next it could be neurointerventional. Having everybody together breeds a significant amount of improvement and innovation, as opposed to everybody being in their own silo. It is actually a better model for hospitals, especially those with limited resources for dealing with stroke. We have been using the cardiac cath team at St. Francis and have done a tremendous amount of in-servicing. The fact is that the people who perform and support catheterizations are really excellent at doing thrombectomy. It holds true for any place that does STEMI. In the future, thrombectomies will have a place at any hospital that does STEMI. The technology is so similar; the interventionalist is focusing on a different part of the vasculature, but for the teams, the tools are similar in nature and very easily learnt from the nursing and support staff perspective. It makes sense for hospitals to have one call team for STEMI and stroke, and have a backup team, if necessary. A busy STEMI hospital has a backup team anyway, so adding thrombectomy is a cost-effective solution to treating stroke and providing good care for the patient. I am not saying that having your own dedicated technologist isn't the right answer, but it creates a silo of expense that you don't need. I really love working with the technologists and nurses at St. Francis who spend the whole day doing cardiology, because you can see what's the same and what's different, but ultimately it breeds a better, more capable lab for everybody. It has been a boon for us. ■

Disclosure: Dr. Jeffrey Farkas reports no conflicts of interest regarding the content herein.