Treating Pulmonary Embolism With Penumbra Lightning Flash 2.0

Vascular Disease Management spoke with vascular surgeon Adel Barkat, MD, from the Oklahoma Heart Institute in Tulsa, Oklahoma, about treating pulmonary embolism (PE) with the Penumbra Lightning Flash® 2.0 computer assisted vacuum thrombectomy (CAVT™) system and how it has changed his practice.

For a patient receiving endovascular treatment for PE, what does the pathway prior to their intervention look like?

From a pathway standpoint, we have a multidisciplinary PE response team that we started about 4 years ago. It took us a little while to refine the pathway, but we wanted to minimize the time between admission, diagnosis of a PE/deep vein thrombosis, and determine the best management approach, whether that's medical management or with an intervention such as thrombectomy.

We've already seen positive results. Take, for example, the ER department. We met with our ER physicians numerous times about the venous thromboembolism (VTE) program and PE response team. So now let's say a patient comes into the ER and the patient is in a high-risk category—they clearly have a larger burden PE, there is right ventricular (RV) strain, there is a troponin leak, and they are sicker than the average patient with a small PE. The first phone call from the ER goes to the interventionists on call.

If the patient falls into the high-risk, or intermediate high-risk category, but they are in subacute shock or undiagnosed shock, that phone call goes straight to our cardiovascular ICU who evaluates and optimizes the patient and sometimes places the patient on ECMO.

We have found that when the ICU is involved early in the sickest of PE patients, prior to management decision, the patients have better outcomes.

What is your primary objective for a PE case and how do you know when the case is complete? Is your focus offloading the RV through establishing perfusion, removing as much clot as possible, or something else?

That's a very tough question and I don't think that's fully answered quite yet. I think the ultimate goal is to offload the RV. Currently, our prognostic indicator for the patient's long-term outcome is restoring RV function. Some of the markers used interprocedurally include tachycardia, tachypnea, shortness of breath, pulmonary artery (PA) pressure, O2 saturations, and the patient's clinical status.

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On average, you're looking at respiratory rate normalization and resolution of tachycardia as clinical markers. PA pressure is a big marker that we use—we check an initial PA pressure and a completion PA pressure in hope of a significant decrease. PA pressure can be deceiving and is not always a reliable acute marker, which can take up to 48 hours to normalize. If the patient tells you they are feeling better clinically—they don't have any shortness of breath or chest tightness, they're not feeling anxious anymore and are able to breathe much more easily—that's the best marker that I have.

What are some of the latest advancements in PE treatment?

Computer assisted vacuum thrombectomy (CAVT) such as Lightning Flash 2.0 is probably the most advanced technology that we have currently in the aspiration thrombectomy realm.

There was a time when you connected a tube to suction and you had to rely on feel and experience to determine if the catheter was in thrombus. You also had to closely monitor the system for thrombus extraction and blood loss.

Now that we're on third-generation devices, a lot of the thinking is done for you. Nowadays, we have to be able to get to the PA, get to the thrombus, and begin clot extraction. A lot of the work and thought process is done for us based on computer assisted algorithms to detect clot and blood flow. Patients with low hemoglobin are not of concern for me with the Lightning Flash 2.0 technology.

How does the Lightning Flash 2.0 work?

Penumbra's Lightning Flash 2.0 has a microprocessor that has algorithms that tell the device when it is in thrombus or not, which is designed to deliver high-power aspiration and potentially minimize blood loss. If you use Lightning Flash 2.0 as a first-time user, you may not appreciate the computer assisted technology as much. But there was a time where it

required 2 to 3 people monitoring the thrombectomy system to determine if blood or thrombus was moving. Now with Lightning Flash 2.0, you essentially have a computer that's detecting flow through sensors. Without having to worry about the canister and blood flow, now I can focus on the patient, look at the hemodynamics and the markers to know whether I am close to being done with the case. The system really does a lot of thinking for you. For me, blood loss is also drastically lower in the realm of 50% to 80%. As a group, we have also seen much faster case times all while doing it with a small French-size system in the pulmonary space.

Do you feel that CAVT technology has advanced the field beyond the first-generation manual large bore aspiration thrombectomy or lytics-only? Why?

Yes, absolutely. It's hard to use first-generation devices in 2024. With the use of this third-generation device, I have been able to get clot out safely without the heart sensing the device from a hemodynamic standpoint. This is important because a lot of these patients are very sick and it doesn't take much to push them over the edge during the procedure. With CAVT, we are heading in the right direction of maximizing clot removal, minimizing blood loss, and really working toward improving the outcome of these patients in the short and long term.

How has the recent technology affected your case times, outcomes, and thrombectomy experiences as a whole?

Our case times are drastically lower, averaging 30 to 45 minutes. This has been reproducible with a short learning curve through the use of the new technology.

With CAVT, the time that the patient is on the table has drastically decreased, blood loss has drastically decreased, and clot extraction has increased. Wire exchanges, which are directly related to the risk of perforations, have also decreased. We normally have 1 wire exchange in the PA for the entire case. Overall, our focus has changed. Rather than focusing on the canister, I can look to the left and see the patient and focus on the vitals, O2 stats, and respiratory rate. Most of the time, the patients are actually watching the procedure with me and I can ask them questions. They can tell me, "my chest tightness is better" and I know that we are probably close to being done. This new CAVT technology is making our lives a lot easier. ■

Interview sponsored by Penumbra, Inc. Dr. Adel Barkat is a consultant for Penumbra, Inc.