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Strategies for Approaching Vascular Graft Thrombectomy

Insights on the best tactics for declotting arteriovenous grafts.

WITH SCOTT O. TREROTOLA, MD

Thrombosis can be a common event with arteriovenous grafts (AVGs), frequently due to intimal hyperplasia at the venous anastomosis or in the outflow vein. Are there advantages to declotting an AVG relatively soon after a thrombotic event?

Within a 2 or 3 day period, there is no advantage at all. There is no urgency in terms of success rates. Of note, there are reports of the grafts being declotted much later (eg, weeks to months).

After a week or so, it becomes more difficult to declot a graft, especially if there is any clot within the venous outflow, because the longer that clot is in contact with the vein wall, the greater the adherence of the clot. If the clot is limited to the graft, it is not usually a problem even after a week or more.

Does it have to be declotted the exact day the thrombosis occurs? No, that's not the case. There is no difference in outcomes between declotting it that day and declotting it 48 to 72 hours later. It does become an issue later. After 1 to 2 weeks, the success rate goes down, but it goes down incrementally—maybe from the high 90s to the mid 80s.

Are there differences in how you address a fresh thrombus versus an old thrombus?

For the most part, you're treating fresh clot because you usually declot grafts within a couple days from when it clotted. It doesn't come up all that often, but sometimes you treat an older clot that is wall adherent. The older the clot, the more difficult it may be to treat. You are then more likely to need to use wall-contact mechanical thrombectomy devices if you are not a physician who uses them anyway. You may have more difficulty clearing that clot, so you may have to use stent grafts, which is something I avoid if possible in declots.

How often do you see an arterial plug during a thrombectomy procedure? What is the best technique for removing an arterial plug percutaneously?

In graft thrombectomy, you always see arterial plugs. Some physicians mistakenly dilate the arterial anastomosis thinking there's a stenosis there, when it's almost always the arterial plug. It's there 100% of the time.

In my practice, I use the TELEFLEX® ARROW-TREROTOLA Percutaneous Thrombectomy Device® (PTD) to treat the arterial plug. Most people who aren't using the TELEFLEX ARROW-TREROTOLA PTD use an EDWARDS LIFESCIENCES FOGARTY® Balloon Catheter or an angioplasty balloon, but I don't recommend using the latter because you want a compliant balloon, not a noncompliant balloon, to dislodge that plug and avoid injury to the artery.

Caution should be used when dislodging the plug at the arterial anastomosis to minimize the risk of arterial embolization. What tips can you offer in order to minimize possible arterial embolization?

There is a great deal of misconception regarding the genesis of arterial emboli (AE) during declots. First of all, AE are common (~5%) in all declots and if asymptomatic, they are often clinically inconsequential; they are also easily treated with backbleeding and other techniques. That said, AE occur far more commonly due to the operator pressurizing a graft (eg, flushing, contrast injection) that is not yet fully declotted than by dislodgement of the arterial plug during removal. If you're careful with injection, AE will be very uncommon in your practice. Regarding dislodging the plug, we've seen that the TELEFLEX ARROW-TREROTOLA PTD had fewer AE than an EDWARDS LIFESCIENCES FOGARTY Balloon Catheter, but both have low AE rates. Again, it's not the plug removal that causes most AE.

For the over-the-wire (OTW) mechanical thrombectomy devices, what cautions should be used when declotting vascular grafts?

Some physicians think OTW devices, of which there are only a few, may decrease AE but there's no proof

of this. In general, for graft thrombectomy, OTW devices are not necessary except in rare situations. For fistula declotting, they are more often needed. OTW versus non-OTW is more often than not an operator preference.

There are times when it is difficult to remove all of the thrombus from the wall of the AVG, and on an angiogram, there is residual clot. Why might this be, and what techniques do you employ to completely clear out the residual clot?

There are different types of residual clot, but all need the same treatment: wall contact. You often find areas of what I call cannulation site lesions, because they're not really aneurysms and they're not pseudoaneurysms; it's a graft, but some people call them aneurysms or aneurysmal dilatation of a graft. You get laminar clot buildup along the wall that is layers upon layers of mature, organized clot—it's not fresh clot.

You can also get this type of clot lining older grafts even without dilatation of the graft. If you are declotting old thrombus, the best way to manage it is mechanical thrombectomy, specifically wall-contact mechanical thrombectomy devices. Often, you need to apply external pressure with your hand or an ultrasound probe to bring the clot into contact with the device. Non–wall-contact devices that use suction or related principles will not work on this type of clot.

Sometimes it's impossible to get the graft to become patent, and the AVG keeps reclotting. Why do you think this might be, and what do you suggest in this situation?

I think the most common reason for that is an underlying infection within the graft. When I start to see this, I first make sure that my anticoagulation is good and I'm not missing something, such as stenosis or residual clot at my sheath entry sites. However, if you see a patient in whom you get good flow and then it just clots in front of your eyes, my purely anecdotal experience has been that when those patients are sent to the operating room for thrombectomy, infection is found. I think that's a common and underrecognized cause for that problem.

I also think that there are times when you fall behind in the patient's anticoagulation, and this causes rethrombosis; if it happens, you want to check the activated clotting time and make sure that the patient's heparin levels are adequate. Different patients need different doses of heparin. Also, make sure that the sheaths are not crossed and they are not creating some sort of an artificial obstruction to flow by the various access devices.

In the clot management device market, what devices are used most often for thrombectomy of AVGs? What are the features and benefits of each device? Are there any limitations of each device?

I believe the ARGON® CLEANER XT Rotational Thrombectomy System, the TELEFLEX ARROW-TREROTOLA PTD, and the BOSTON SCIENTIFIC ANGIOJET Thrombectomy System are currently used for dialysis grafts in the United States, but it is hard to keep up with this area so there may be more. The TELEFLEX ARROW-TREROTOLA PTD and the BOSTON SCIENTIFIC ANGIOJET Thrombectomy System were both studied in randomized trials leading to their approvals in the 1990s, and both have multiple subsequent published studies supporting their use in this area.[1-3]

The big difference between the BOSTON SCIENTIFIC ANGIOJET Thrombectomy System and the others is that the BOSTON SCIENTIFIC ANGIOJET Thrombectomy System is not a wall-contact device. Non-wall-contact devices have great difficulty clearing wall-adherent material and can't be used to treat the arterial plug.

Are there times when a lytic agent is required? What are the benefits and drawbacks of thrombolysis?

Some physicians prefer to use a lytic agent such as in the "Lyse and Wait" technique, but if you're using a mechanical thrombectomy device, you may never need to use a lytic agent, as it just increases the cost and prolongs the hemostasis time. There's an excellent randomized trial by Vogel et al who compared the TELEFLEX ARROW-TREROTOLA PTD to the "Lyse and Wait" technique with tissue plasminogen activator (tPA) and found that there was no difference in immediate outcomes, but importantly no difference in the in-room procedure time.[4] Physicians think they are reducing the room time using lyse and wait, but they're actually not according to this randomized trial. So in fact, the time taken to do the lytic injection beforehand prolongs the overall procedure compared to using the TELEFLEX ARROW-TREROTOLA PTD.

The only time we ever use a lytic agent is when a patient has extensive central venous thrombosis. One of my partners uses the BOSTON SCIENTIFIC ANGIOJET Thrombectomy System in this setting. I prefer to place an infusion catheter and lyse them overnight with tPA. This is very effective. In terms of drawbacks, using a lytic agent prolongs hemostasis and has rare risks of bleeding

complications. In my view, if you don't need to use a lytic agent to get the job done with a mechanical device, why take on those risks?

If the thrombectomy fragment basket or device wire amplitude is 9 mm, how does this function in a 6 mm or 4 to 7 mm vascular graft lumen?

The 9 mm is the maximum diameter of the present TELEFLEX ARROW-TREROTOLA PTD. The device is self-adjusting to the size of the graft—that's the beauty of it.

Is there a difference between a mechanical thrombectomy device with a rotator drive unit that is 3,000 RPM versus 4,000 RPM?

That hasn't been studied in a head-to-head fashion, so I don't think anyone knows the answer. I think it is highly unlikely. As noted, there is copious evidence including a randomized controlled trial for 3,000 RPM, but little or nothing is published for 4,000 RPM.

Although rare, mechanical thrombectomy devices have been known to damage the luminal wall of an arteriovenous fistula or AVG. What advice do you have to prevent this?

I'm not sure that is really true. I don't know of any published paper showing that, and in fact the opposite has been repeatedly shown. Mechanical thrombectomy devices are extraordinarily safe, and the TELEFLEX ARROW-TREROTOLA PTD has been found to be less injurious than an EDWARDS LIFESCIENCES FOGARTY Balloon Catheter.[5] Obviously, misuse of any device can result in trauma to a vessel or a graft. Regarding the TELEFLEX ARROW-TREROTOLA PTD, it is meant to be used in a pullback fashion. Using the device in a back-and-forth or "toothbrush" fashion to address refractory clot can result in the tip becoming caught in the vessel or graft wall. ■

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