Addressing the Clotted Access

An esteemed panel of interventional experts shares viewpoints on optimal methods for identifying and treating clotted AV fistulas and grafts.

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How effective is your physical examination in predicting imminent AV access thrombosis?

Dr. Falk: There are two types of arteriovenous access—grafts and fistulas. With grafts, 95% of them thrombose because there is a stenosis at the venous anastomosis; a physical exam is good in predicting a graft's demise because the physical exam changes when a stenosis is present. A fully patent graft demonstrates a pansystolic thrill. As a stenosis develops and progresses, the pansystolic thrill becomes a discontinuous thrill, then a pulse, and then the graft clots.

However, there are other causes of graft thrombosis, such as hypotension. The physical exam would not help us predict graft thrombosis in this case. For example, if patients become hypotensive following dialysis treatment, they could thrombose their graft and we could never predict it.

Fistulas are less likely to clot than grafts; they need less flow to maintain their patency. So, the physical examination is not as strong a tool in predicting pending thrombosis of an arteriovenous fistula.

Dr. Trerotola: People, including myself, have done studies that have correlated the physical examination with flow and findings from fistulography, but to my knowledge, no one has directly correlated physical examination with predicting thrombosis. The closest anyone has come to this is Safa et al,[1] who used a variety of screening tests to reduce the thrombosis rate, and PE was the best predictor of thrombosis. To the extent that we can predict thrombosis with measures such as flow, physical examination should be as good as any other measure in predicting thrombosis.

Dr. Valji: The physical exam is an incredibly useful screening tool for identifying dialysis grafts at risk for

failure. It is perhaps less reliable for evaluation of dialysis fistulas. Our group at UCSD studied this very question in synthetic dialysis grafts several years back.[1] We reported results of a regular surveillance program conducted by a dedicated nephrologist. Regular physical examination led to a substantial reduction in the frequency of graft thrombosis.

In your opinion, what is the best surveillance method for detecting an AV access that is at risk for thrombosis?

Dr. Trerotola: It really depends on the type of access, and even the graft or type of fistula. The physical examination is probably as good as anything else. However, it is likely best to use a combination of factors, such as venous resistance on the machine, flow, and physical examination. As Tessitore et al[2] showed in their article on physical examination, depending on the location of the access, the physical examination is actually as good as or better than flow, such as when it's an upper arm access, where outflow is typically the location of the stenosis. With a forearm access, however, where the inflow is the most common location of the stenosis, the physical examination is not as good. In forearm fistulas, 75% of stenoses are within a centimeter of the anastomosis, and you get what I call a "bad thrill" just downstream from the anastomosis. That thrill is telling you a stenosis is there.

Dr. Valji: NKF-KDOQI recommends measurement of access flow as the best single surveillance method. In practice, however, any accepted method (flow measurements, ultrasound, physical exam) that is applied regularly and consistently is most beneficial for patients.

Dr. Falk: Physical examination—because it's not expensive, correlates to flow rates, and you can train the patients and staff to feel an access and contact you when the physical exam changes. Dr. Trerotola's article, "Screening for dialysis access graft malfunction: comparison of physical examination with US,"[3] demonstrated that patients with a thrill within a graft had volume flows greater than 450 mL/min, and physical examination was a good screening test for ruling out the low flows associated with impending access graft failure.

Agarwal et al described an "axillary buzz."[4] Simultaneous physical examination and flow measurements were performed in dialysis patients with grafts. Average flow rates for patients with an axillary buzz were 1,000 mL/min. Actual flow measurements would be optimal, but many of us do not have access to those, so we rely on our physical exam.

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—Dr. Trerotola

What is your first "go-to" technique for clearing an AV graft clot, and why?

Dr. Trerotola: I use the Arrow-Trerotola percutaneous thrombolytic device (PTD) (Arrow International, a division of Teleflex, Durham, NC). I'll note that I have a conflict of interest related to the device, but it's easy to use and extremely effective, and it's supported by a prospective randomized trial.

Dr. Falk: The cost-effective approach is to give tPA, wait, aspirate the clot with an aspiration catheter or sheath, and treat the underlying stenosis. You do not have to open another device. You have to open a balloon, a wire, or a Fogarty catheter (Edwards Lifesciences, Irvine, CA). With the cost constraints of working in an outpatient center, I try to use as little equipment as possible.

Dr. Valji: On a busy day, I will sometimes declot dialysis grafts using the lyse-and-wait method. I believe it is more efficient than other techniques, and I want interventional radiology fellows to gain some experience with it. In most cases, however, I still prefer pulse spray thrombolysis with multi-sidehole catheters and tPA. I have been using this method for almost 30 years, so it is quick and effective in my hands.

What is your first "go-to" technique for clearing an AV fistula clot, and why?

Dr. Trerotola: As is the case with an AV graft clot, I use the Arrow-Trerotola PTD.

Dr. Valji: For fistulas, I avoid lyse and wait. Again, I prefer pulse spray with tPA.

Dr. Falk: Fistulas are very different from grafts, and the thrombectomy technique depends on clot burden. Before starting the thrombectomy, I perform an ultrasound of the fistula to assess clot burden so I can plan the procedure. If there is a small amount of clot, you can just macerate it with a balloon and a lytic agent, or you can aspirate it without a lytic agent, administer heparin to your patient, and treat the underlying lesion(s).

A medium amount of clot requires some work—including aspiration, maceration, and thrombolysis to eliminate the clot before treating the underlying lesion(s).

Fistulas that are aneurysmal and totally thrombosed present a different type of problem, and you should consider not treating them in an outpatient center because the risk of pulmonary embolism (PE) is higher. For thrombosed mega-fistulas, all thrombectomy techniques may need to be used (including aspiration, maceration, thrombolysis, blocking inflow and outflow to perform a small incision, and removing thrombus with a Kelly clamp). If this cannot be done safely or if the patient has many comorbid factors and is at a high risk for complications, consider surgical thrombectomy and temporary catheter placement.

Although interventionists sometimes use a stent to "trap" thrombus, this is not advisable and is not an indication for stent use.

In which cases do you use pharmacologic thrombolysis (clot dissolution)? What do you use?

Dr. Valji: I use enzymatic lysis with tPA in almost all cases. I will occasionally use the Arrow-Trerotola PTD in order to give interventional radiology fellows some experience with the device.

Dr. Falk: I use it most of the time—40% of patients undergoing a graft thrombectomy will have a positive V/Q scan. Therefore, I prefer to make sure any clot that accidentally gets sent to the lungs is laced with a lytic agent to decrease the risk of symptomatic PE. I use tPA, which costs approximately $50 for 2 mg. This is relatively inexpensive, and with a balloon (to treat underlying lesions and macerate residual thrombus) and aspiration techniques (with a guiding catheter or sheath), one does not need to use a mechanical thrombectomy device and can keep costs low for a thrombectomy procedure.

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>
> —Dr. Falk

Dr. Trerotola: I use pharmacologic thrombolysis when there is very large central clot burden; in this case, I do infusion lysis overnight and clean up the graft or fistula with a PTD the next day. A few of my partners will add a little bit of tPA while they're using the PTD in very large aneurysmal fistulas. Personally, I have not found this necessary, and in limited numbers, it did not seem to change the outcome in our study of the PTD in fistulas.[5]

Which cases would you refer for surgical thrombectomy without attempting percutaneous treatment?

Dr. Falk: If you have declotted the patient's access a number of times, and they keep coming back over a short period of time and hypotension is not the cause, then consider a new access, not a percutaneous or surgical thrombectomy. The only patients I've referred for surgical thrombectomy (two patients in the last couple of months) had mega-fistula declots. One patient refused a catheter placement. This patient came in at 4:00 PM, had not been dialyzed in 5 days, and I was going to need several hours for lysis time and the procedure. I wanted to place a catheter, dialyze the patient and bring him back so I could spend the necessary time needed to perform the procedure under optimal conditions. The patient refused the catheter, so I called a surgeon. The other patient had so many comorbid factors, I thought the possibility of PE (and possible death) was too risky, so I called a surgeon and placed a catheter.

Dr. Trerotola: We don't refer anyone for surgical thrombectomy unless they have an infected graft, which is a strong contraindication to percutaneous declotting. The surgeons don't want to do thrombectomy, so there really isn't anyone doing thrombectomy to speak of, at

least at my institution. There are patients that have very large aneurysms, especially forearm fistulas that have extraordinarily large clot burden, and some people think it's unsafe to declot. Those are patients that you'd like to have a conversation with about possibly doing thrombectomy, but the surgeons always say no. We generally end up trying to declot these, sometimes with a little tPA as noted previously, using the PTD, with external massage and a lot of aspiration to minimize the embolic burden. Depending on the age of the clot, we can get the majority of these open, but it takes longer, and the success rate is definitely lower than grafts and nonaneurysmal fistulas.

If a graft clots within 1 month of placement, it should be surgically revised. It's not so much getting surgical thrombectomy—it's actually doing something new, because we showed that the patency associated with doing that is zero in 90 days.[6] The article we published on this showed that it's multifactorial: bad veins, physical problems with the graft (such as kinks), a smoldering infection that nobody knows about, etc. The main reason is just that the patency is poor, and I don't think anyone knows exactly why.

Dr. Valji: I'll refer patients to a vascular surgeon for revision or replacement in the following circumstances: thrombosed and infected access, freshly placed access (< 1 week), early thrombosis after surgical placement/revision (< 30 days), risk factor for full-dose anticoagulation, and known right-to-left shunt.

At what point during a procedure do you decide to stop because success is unlikely?

Dr. Valji: I hardly ever terminate a dialysis access thrombolysis procedure once I begin. I always evaluate the access outflow with venography before I start. If the outflow looks unsuitable or not amenable to repair, I don't do thrombolysis. On very rare occasions (usually in patients with thrombophilia), ongoing thrombosis eclipses clot lysis despite large doses of anticoagulation. In that situation, I will stop.

Dr. Falk: In experienced hands, if you are not making progress in 45 minutes, stop. If it takes me more than 45 minutes to progress during a thrombectomy, there is something wrong. The longer the procedure time, the higher the risk of complications. If you can't get across an occlusion, stop the case. You should be making progress at a slow but steady rate, and if you are not, then get out, place a catheter, and bring the patient back for another approach (eg, an inferior approach if the superior approach has failed).

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>
> —Dr. Valji

If it's a complicated case that I think I'm not going to be able to do quickly, or in a patient who has not been dialyzed in 5 days and I don't want to put him or her on the table—I'll put in a catheter and bring the patient back. I want the patient to receive an adequate dialysis before I intervene, because it's going to be a long procedure.

Dr. Trerotola: If I am not making headway, I consider the patient's other options and occasionally give up—the fewer the remaining options, the more aggressive and patient I will be in trying to restore that access. Generally, if you can't get a [nonaneurysmal] graft or fistula open within an hour, your success rate drops precipitously. I assiduously avoid stenting to accelerate declotting, something I have seen a lot of people do in my area, with adverse results on the long-term viability of the access. If I do give up, I do a complete venous mapping (and of course, place a tunneled catheter) before the patient leaves, so he or she is ready to get a new access placed.

What complications do you worry about the most during AV access declotting?

Dr. Falk: It depends on the comorbid factors of the patient. If the patient is relatively young and "healthy," and if the access is a graft (not much clot burden), then you can afford to send a little bit of clot to the lungs and not worry about cardiac or pulmonary complications.

If it's an elderly patient with many comorbid factors, including a history of heart attack, stroke, diabetes, congestive heart failure, hypertension, and amputation, you cannot afford to send one iota of clot to the lungs because you could have a symptomatic PE or worse. If you open an elderly patient's access, you could give him or her a myocardial infarction, because the demand on the heart (cardiac output) will go up incredibly.

Dr. Valji: Arterial embolization. The best way to handle this event is to avoid it using careful manipulation of wires, catheters, and balloons around the arterial or AV anastomosis.

Dr. Trerotola: I don't worry that much about complications because they are extremely rare during access declotting if it is done carefully. Some people worry about PE, but if you are using a mechanical thrombectomy device according to the instructions for use, it has been shown that the incidence of PE is essentially zero. I don't worry about PE because I use my device according to the instructions for use. People who are doing other techniques may be more concerned about emboli than I am.

Arterial emboli occur in about 5% of all declots, and almost none of them are symptomatic. In experienced hands, arterial emboli generally happen less frequently. So, I don't worry too much about those. They can be avoided with careful technique, and if they do occur, they are easy to treat.

Are there any special considerations to keep in mind for treating clotted AV fistulas? What tips can you offer for achieving complete and complication-free restoration of flow and function in a clotted AV fistula?

Dr. Falk: It's all about clot burden and understanding and planning your case before you begin.

Dr. Trerotola: You need to make sure that you give heparin beforehand so that it's on board. Heparin works on the serotonin cascade in the lungs because any small emboli that do occur cause vasospasm and bronchospasm. Even a small embolus occluding a big vessel can cause a lot of problems for the patient. Giving heparin helps prevent rethrombosis during the procedure.

I personally am a very strong believer in giving antibiotics during declotting because it's been shown that even clinically uninfected grafts have bacteria in them up to 60% of the time.

Dr. Valji: Fistulas can be more difficult to declot than dialysis grafts. Be prepared to use more than the usual 2 mg of tPA or to consider an adjunctive lytic method if the first method is only partially successful. Consider brachial or radial artery access if the AV anastomosis cannot be crossed from the access itself. Expect obstructions to occur at multiple sites. Most importantly, be patient and persistent.

Do you have a postthrombectomy follow-up protocol beyond ongoing surveillance at the dialysis unit? If so, what is your protocol?

Dr. Valji: No, we don't have a specific postthrombectomy protocol. However, we do have a monthly system-wide vascular access meeting to discuss difficult or complex cases. The conference is attended by nephrologists, dialysis nurse practitioners and coordinators, interventional radiologists, and vascular surgeons.

Dr. Trerotola: We have very good ongoing surveillance in the dialysis unit, and we do not routinely bring those patients back for evaluation. A patient should not be brought back routinely for fistulography—it is considered screening, and to bill for that is against the law.

We have two different dialysis units. We have one that uses flow and one that uses mostly physical examination and related parameters, such as venous resistance. As far as I can tell, there is no difference between the two, and that's supported by the available literature. I think you have to do what works best in your unit. I have taught physical examination to our unit personnel and our access coordinators with an in-service. We showed in our article correlating examination with flow, in which two of the four examiners were dialysis nurses, that this is easily taught.[3]

Dr. Falk: If it's a difficult declot and I am concerned when I leave the patient, or he or she keeps clotting over and over again, the lesion keeps coming back, or if he or she is clotting because of hypotension, I can't do much about it. I may want to bring the patient back in a week and see how he or she does.

It used to be that for a typical declot (because the patency rates are worse in a thrombectomy than in simple PTA cases), we brought them back in a month. Usually we do 3-month follow-up surveillance. If it's a simple declot and you're pretty confident there are no big problems, treat it like a simple PTA, and bring the patient back in 3 to 4 months. ■

1. Safa AA, Valji K, Roberts AC, et al. Detection and treatment of dysfunctional hemodialysis access grafts: effect of a surveillance program on graft patency and the incidence of thrombosis. Radiology. 1996;199:653-657.
2. Tessitore N, Bedogna V, Lipari G, et al. Bedside screening for fistula stenosis should be tailored to the site of the arteriovenous anastomosis. Clin J Am Soc Nephrol. 2011;6:1073-1080.
3. Trerotola SO, Scheel PJ Jr, Powe NR, et al. Screening for dialysis access graft malfunction: comparison of physical examination with US. J Vasc Interv Radiol. 1996;7:15-20.
4. Agarwal R, McDougal G. Buzz in the axilla: a new physical sign in hemodialysis forearm graft evaluation. Am J Kidney Dis. 2001;38:853-857.
5. Shatsky JB, Berns JS, Clark TW, et al. Single-center experience with the Arrow-Trerotola Percutaneous Thrombectomy Device in the management of thrombosed native dialysis fistulas. J Vasc Interv Radiol. 2005;16:1605-1611.
6. Yurkovic A, Cohen RD, Mantell MP, et al. Outcomes of thrombectomy procedures performed in hemodialysis grafts with early failure. J Vasc Interv Radiol. 2011;22:317-324.