

# What's New in Declots? Management of the Total Access Thrombosis Patient

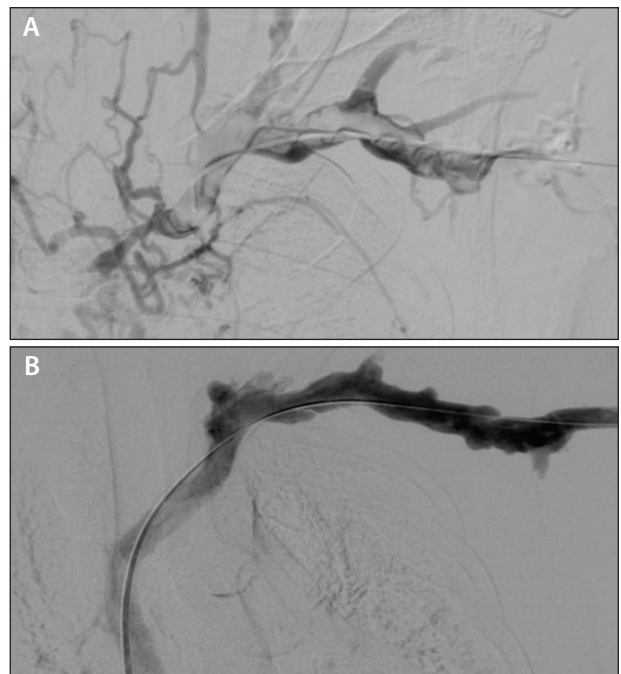
An alternative technique to catheter-directed thrombolysis in the patient undergoing dialysis.

**BY NICHOLAS J. PETRUZZI, MD; JONAS W. REDMOND, MD;  
AND TIMOTHY W.I. CLARK, MD, FSIR**

**R**e-establishing flow through a patient's thrombosed dialysis access, typically referred to as a "declot," is a common procedure in practices that serve the dialysis community. Access thrombosis is more common in grafts than fistulas, but in either case, the extent of thrombosis usually only spans from the arterial anastomosis to the venous anastomosis or peripheral venous outflow. Thrombosis typically does not extend to the central veins. Unfortunately, there is a subset of patients who develop thrombosis of the entire venous circuit from the arterial anastomosis through the ipsilateral central venous system (Figures 1 and 2). Historically, this challenging situation has been managed by either abandoning the access or attempting catheter-directed thrombolysis through one or more catheters. This is because conventional catheter-directed thrombectomy techniques, such as lytic agent instillation followed by balloon maceration, are frequently unable to clear central thrombus and place the patient at higher risk for pulmonary embolism. The use of catheter-directed thrombolysis administered overnight is time consuming, leads to greater resource utilization, higher costs (typically requiring an intensive care unit admission of 1–2 days), usually requires placement of a temporary dialysis catheter, and also incurs a risk of major bleeding complications.

We present an alternative technique to catheter-directed thrombolysis, in which total access thrombo-

sis is managed in a single treatment session consisting of combined rheolytic and rotational mechanical thrombectomy.



**Figure 1.** Example of total access thrombosis before (A) and after (B) a single-session treatment using the AngioJet thrombectomy device.

## TECHNIQUE

Upon initial puncture of the thrombosed dialysis access and placement of a 7-F sheath, a diagnostic catheter is advanced to the axillosubclavian junction and high-resolution, digitally subtracted central venography is performed to determine clot burden and location. The patient is then therapeutically anticoagulated with unfractionated heparin. Next, a directional catheter and steerable guidewire are advanced to the inferior vena cava, and the catheter is removed over an exchange length 0.035-inch guidewire (eg, Rosen guidewire, Bentson guidewire). At this point, the extensive clot burden is laced with a thrombolytic agent such as tissue plasminogen activator (typical dose, 20–25 mg) using the AngioJet Solent Omni device (Boston Scientific Corporation) in power-pulse delivery mode and allowed to dwell for 15 to 20 minutes. Mechanical thrombectomy is performed with the AngioJet device in thrombectomy mode, starting just beyond the dialysis access until the device has reached the leading edge of the clot in the central veins. The device is activated in 15-second increments, typically treating 10-cm venous segments at a time. Short activation times are helpful because bradycardia may occur in some patients. If this occurs, wait 30 to 60 seconds for the patient's heart rate to return to baseline. Atropine is readily available but is rarely needed as long as the device is activated for short intervals of time.

At this point in the procedure, digitally subtracted central venography is repeated. If the central veins are now free of thrombus, thrombectomy of the dialysis access is performed. If residual thrombus is present in the central veins, those areas are treated with additional passage of the AngioJet device. Typically, blood and saline volumes range from 200 to 400 mL in the AngioJet collection bag.

In our experience, the AngioJet can be a challenging device to adequately remove wall-adherent thrombus within the dialysis access itself. For this reason, we change devices at this point and perform thrombectomy of the extremity access using a rotational device (Arrow-Trerotola PTD, Teleflex). This device also enables controlled removal of the arterial plug (the platelet-rich plug occluding the origin of the dialysis access), whereas using the AngioJet device at this location can occasionally result in plug embolization into the artery.

As much of the clot burden is removed as possible prior to treating any peripheral or central venous stenosis. Patients with total access thrombosis harbor a larger clot burden than the few milliliters found in patients who require standard declotting, and it has been shown that there may be a higher prevalence of pulmonary hypertension following thrombectomy in

patients with larger clot burdens. Therefore, it is critical to protect the lungs from potential embolic phenomena as much as possible.

Following clot removal, the arterial plug is removed to restore flow to the dialysis access. Treatment of underlying stenosis is then performed as per a conventional thrombectomy procedure.

## OUTCOMES IN PATIENTS WITH TOTAL ACCESS THROMBOSIS

We retrospectively analyzed the outcomes of 25 patients with total access thrombosis and compared those outcomes to a control group of patients who had thrombosis of the dialysis access only. Total access thrombosis cases were matched at a 1:3 ratio to a control group of 75 patients with thrombosis of the hemodialysis access only and in whom a single device (Arrow-Trerotola PTD) was used. Central lesion presence, technical success rate, clinical success rate, fluoroscopy time, and primary postintervention patency rates were compared to the same variables in the control group.

Fifty-six percent of patients with total access thrombosis had one or more central lesions requiring percutaneous transluminal angioplasty or stenting. There was no clinical evidence of pulmonary emboli in the total access thrombosis group. Technical and clinical success rates in the total access thrombosis and control groups were 92% and 88% compared to 95%

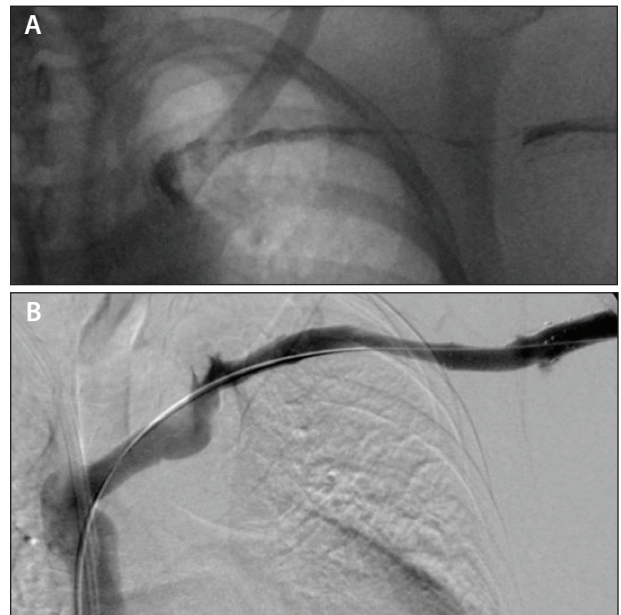


Figure 2. Another example of total access thrombosis before (A) and after (B) a single-session treatment using the AngioJet thrombectomy device.

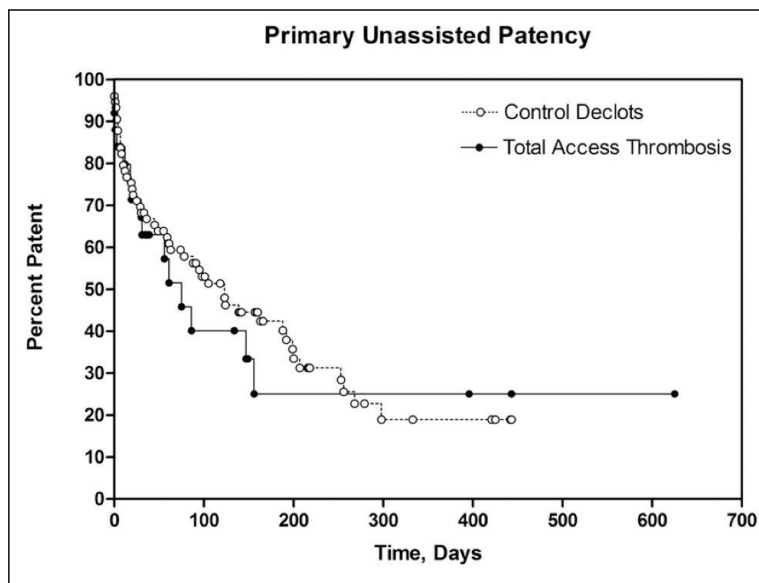


Figure 3. Kaplan-Meier curve showing patency rates of declots in a control group versus a total access thrombosis group. Both groups exceeded the KDOQI threshold of 40% primary patency at 90 days.

and 94%, respectively. Patency rates at 90 days were 40.1% for total access thrombosis group as compared with 56.2% for the control group (Figure 3). Given the greater complexity of the intervention over standard declots, there were significantly longer mean fluoroscopy times in the total access thrombosis group as compared with the control group (24.5 min vs 13.6 min, respectively;  $P = .0002$ ).

### Complications

There was one episode of bradycardia and hypotension in the total access thrombosis group, which resolved following sedation reversal. Two axillary vein ruptures occurred following angioplasty; one was successfully treated using balloon tamponade, and the other was successfully treated with stent graft placement. Notably, there were no bleeding complications or clinical evidence of pulmonary emboli.

### SUMMARY

Total access thrombosis affects a small subset of patients undergoing dialysis. Our experience suggests that total access thrombosis is a failure mode that can be salvaged and successfully treated in a single session. The aforementioned technique can obviate the need for lysis catheter placement, potentially avoiding prolonged hospital admission, additional procedures, and major bleeding complications. Despite the added technical difficulty of declotting patients with total access

thrombosis, our retrospective analysis of 25 patients demonstrated 90-day patency rates exceeding the recommended threshold of 40% as recommended by the Kidney Disease Outcomes Quality Initiative (KDOQI). Limitations of this study include the retrospective design, small sample size, and performance at a single center.

A significant portion of declotting procedures are now performed in stand-alone access centers. No major complications occurred in our treatment group. However, given the large clot burdens typically encountered in the patient with total access thrombosis, the technique described herein is best reserved for physicians with access to the AngioJet device, experience performing rheolytic thrombectomy, and those in practice settings where overnight hospitalization and/or adjunctive catheter lysis remain available options. ■

*Nicholas J. Petruzzi, MD, is at Atlantic Medical Imaging in Galloway, New Jersey. He has stated that he has no financial interests related to this article.*

*Jonas W. Redmond, MD, is at the Division of Interventional Radiology, Department of Radiology, University of Pennsylvania Perelman School of Medicine in Philadelphia, Pennsylvania. He has stated that he has no financial interests related to this article.*

*Timothy W.I. Clark, MD, FSIR, is at the Division of Interventional Radiology, Department of Radiology, University of Pennsylvania Perelman School of Medicine in Philadelphia, Pennsylvania. He has disclosed that he is a consultant to Teleflex and has a royalty agreement with Teleflex. He may be reached at [timothy.clark@uphs.upenn.edu](mailto:timothy.clark@uphs.upenn.edu); (215) 662-9122.*

#### Recommended Reading

Harp RJ, Stavropoulos SW, Wasserstein AG, Clark TW. Pulmonary hypertension among end-stage renal failure patients following hemodialysis access thrombectomy. *Cardiovasc Intervent Radiol.* 2005;28:17-22.

Kakkos SK, Haddad GK, Haddad J, Scully MM. Percutaneous rheolytic thrombectomy for thrombosed autogenous fistulae and prosthetic arteriovenous grafts: outcome after aggressive surveillance and endovascular management. *J Endovasc Ther.* 2008;15:91-102.

National Kidney Foundation. K/DOQI clinical practice guidelines for chronic kidney disease: evaluation, classification, and stratification. *Am J Kidney Dis.* 2002;39(2 Suppl 1):S1-S266.

Swan TL, Smyth SH, Ruffenach SJ, et al. Pulmonary embolism following hemodialysis access thrombolysis/thrombectomy. *J Vasc Interv Radiol.* 1995;6:683-686.

Trerotola SO, Johnson MS, Schauwecker DS, et al. Pulmonary emboli from pulse-spray and mechanical thrombolysis: evaluation with an animal dialysis-graft model. *Radiology.* 1996;200:169-176.

Trerotola SO, Vesely TM, Lund GB, et al. Treatment of thrombosed hemodialysis access grafts: Arrow-Trerotola percutaneous thrombolytic device versus pulse-spray thrombolysis. Arrow-Trerotola Percutaneous Thrombolytic Device Clinical Trial. *Radiology.* 1998;206:403-414.