When Not to Perform Percutaneous Thrombectomy of a Clotted Native Fistula

Ten scenarios in which this therapy may not be the best option for hemodialysis fistula treatment.

BY JONAS W. REDMOND, MD, AND TIMOTHY W.I. CLARK, MD, FSIR

The number of patients requiring hemodialysis due to end-stage renal disease continues to increase. According to the United States Renal Data System, the number of Americans on hemodialysis approached 400,000 in 2011.[1] The overall prevalence of hemodialysis patients in the United States is expected to rise approximately 2% to 4% per year.[2] With this increase comes the challenge of maintaining the dialysis accesses of these patients; native fistulae have become the most common type of vascular access through the combined efforts of Fistula First and other organized initiatives. Although native fistulae are associated with lower all-cause mortality and infection compared to grafts and catheters,[3] a subset will fail over time and present with thrombosis. Over the last 15 years, percutaneous thrombectomy has evolved to become first-line management of clotted dialysis fistulae. A variety of percutaneous thrombectomy techniques are currently employed, for which technical and clinical success rates exceed 90%.[4] However, there are times when percutaneous thrombectomy should not be attempted. We have assembled 10 reasons to consider not performing percutaneous thrombectomy of a hemodialysis fistula.

INFECTED FISTULA

Native fistulae are less prone to infection than synthetic grafts, so fortunately, this is a rare phenomenon.[5] This is an absolute contraindication that includes infection of the fistula and/or the perivenous space. Clot within the fistula is also likely infected, and a thrombectomy procedure has the potential to embolize infected clot to the lungs or extremity. Hard signs of fistula infection, including fever with fluctuance around the fistula, active purulent drainage, or aspiration of purulent fluid from the fistula, make the diagnosis fairly straightforward. However, softer signs such as erythema, tenderness, and warmth over the fistula alone are not specific to access infection, as these are common signs of superficial phlebitis related to thrombosis, which can be seen in these patients. Infectious disease consultation may be needed occasionally in patients with nonspecific signs.

CLOTTED FISTULA IN THE PRESENCE OF IPSILATERAL DISTAL HYPOPERFUSION ISCHEMIC SYNDROME (AKA STEAL)

Distal hypoperfusion ischemic syndrome (DHIS) occurs in approximately 5% to 10% of upper arm

accesses in which the brachial artery is used, which is 10 times the incidence of DHIS when the radial artery is used for forearm accesses. True steal phenomenon occurs when there is excessive flow through the arteriovenous fistula. However, there are other etiologies responsible for this condition, including occlusive disease within the artery supplying the fistula resulting in decreased perfusion to the hand and more diffuse, usually atherosclerotic, disease, resulting in inadequate collateral flow reserve to the hand.[6] Symptoms range from coolness and dysesthesias of the ipsilateral hand while on dialysis to limb-threatening ischemia. Fistula thrombosis occurs infrequently in these patients, as the high flow within the access is protective of thrombosis. When thrombosis does occur (eg, after an episode of hypotension), it is important to refrain from declotting any patient whose steal symptoms are so severe that they result in distal ischemia, such as ulceration of the digits or even dry gangrene, unless this can be immediately followed by a procedure to reverse the ischemia. There are both endovascular and surgical procedures that can correct steal symptoms depending on the underlying etiology, including percutaneous transluminal angioplasty, banding, flow reduction, and distal revascularization interval ligation.

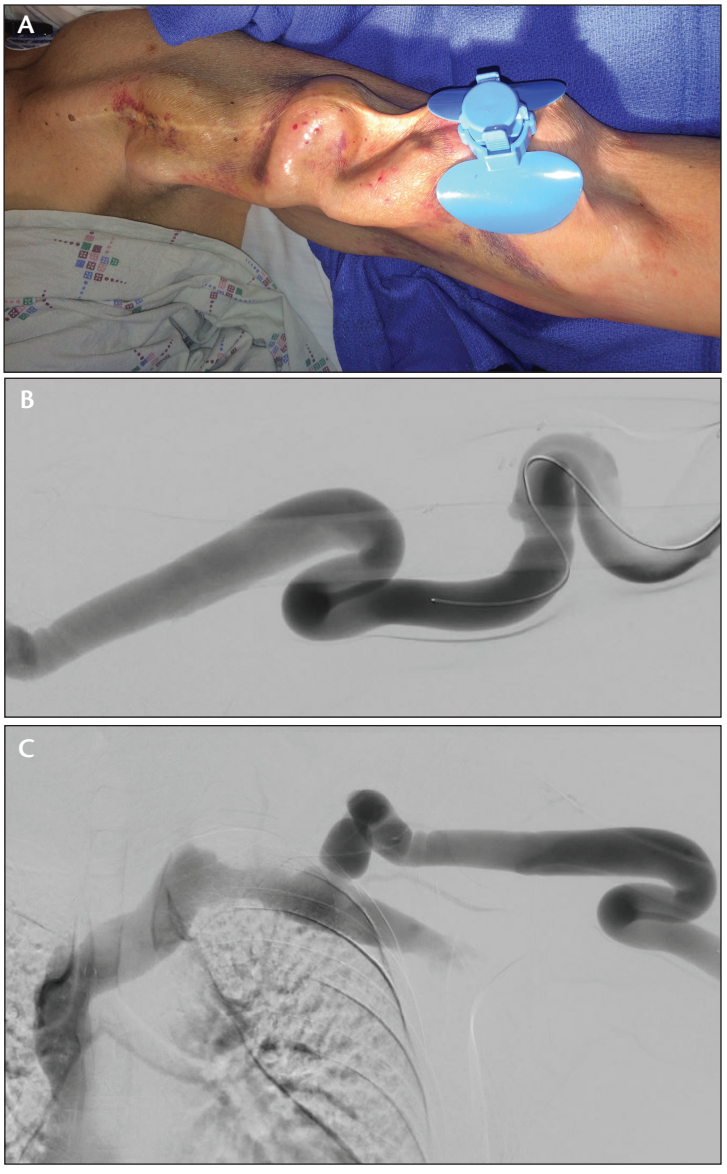

Figure 1. Example of a diffusely enlarged brachiocephalic fistula in a young woman with prolonged puncture site bleeding (A). If this patient's fistula thrombosed, it would contain a clot burden exceeding the ability of most percutaneous thrombectomy techniques and devices. Venous outflow of the same patient, showing tortuosity and enlargement (B). Angiogram of same patient showing diffuse enlargement extending centrally to include cephalic arch (C).

ENLARGED ANEURYSMAL FISTULA WITH EXTENSIVE CLOT BURDEN

Asymptomatic pulmonary embolism (PE) associated with percutaneous thrombectomy procedures is a well-documented occurrence, with studies estimating an incidence up to 59% using perfusion studies and CTA.[7,8] The risk for symptomatic PE increases with larger clot burden. Nonaneurysmal fistulae may harbor only a few milliliters of thrombus, while larger-diameter, aneurysmal fistulae (Figure 1) can contain up to 250 mL of thrombus.[9] Even if percutaneous intervention in these patients is successful and without immediate complication, there is the potential additional risk of repeated thrombectomy procedures resulting in pulmonary hypertension from the cumulative effects of larger amounts of PE.

A retrospective case-control study demonstrated a trend toward increased risk of pulmonary hypertension in patients who underwent at least one hemodialysis access thrombectomy procedure compared to hemodialysis patients without previous thrombectomy.[10] Surgical thrombectomy carries a lower incidence of PE; however, at our institution, these patients will usually have their access surgically revised with an interposition graft or will receive a tunneled dialysis catheter and undergo new access planning.

CLOTTED FISTULA WITH CANNULATION SITE ULCERATION

Although the thrombosed fistula in these patients prevents them from undergoing hemodialysis, the overlying eschar is also protective from the possibility of sudden rupture and exsanguination. In a retrospective study evaluating fatal vascular access hemorrhages from 2000 to 2007, 93% of confirmed cases of native fistula fatal vascular access hemorrhages were secondary to access rupture, and 18 of the 25 cases (72%) of graft/fistula rupture had evidence of access erosion at autopsy.[11] Every patient who presents to our interventional radiology department with a dysfunctional hemodialysis fistula will undergo a physical exam that includes evaluation for skin thinning/ulceration, and if an ulcer with impending rupture is discovered, the patient is referred to vascular surgery for new access planning/revision.

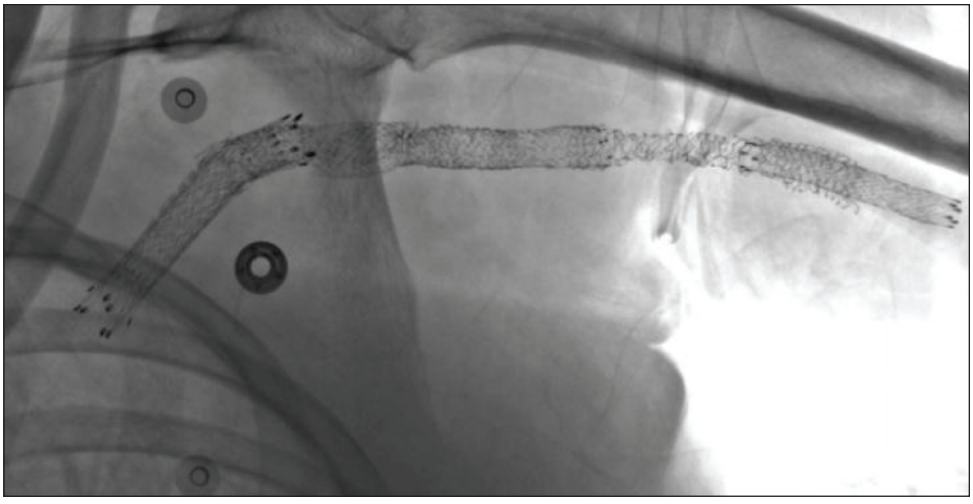

Figure 2. Multiple stents within the venous outflow of a brachiocephalic fistula in a patient who presented with recurrent thrombosis. The fistula was abandoned at this point, and a catheter was placed as a bridge to a new fistula in the opposite arm.

REPEATED THROMBOSIS

Although there is no definitive consensus on the threshold for abandoning a fistula that has required multiple percutaneous declot procedures in a short time, KDOQI guidelines suggest that if a fistula requires more than two angioplasties in a 3-month period, the patient should be referred for surgical revision.[2] At our institution, we will declot an access twice in 1 month, and if it rethromboses a third time, we will refer the patient for surgical revision/new access planning. This is a very general guideline, and multiple scenarios may exist when this may not be appropriate. However, there is constant communication among the interventionists, vascular surgeons, and nephrologists regarding these patients, and the decision to recommend surgical revision is on a case-by-case basis.

RIGHT-TO-LEFT SHUNT

Intracardiac and pulmonary right-to-left shunts are the most common forms of this rare condition. However, whether congenital (atrial septal defect, patent foramen ovale, or pulmonary arteriovenous malformation) or acquired (trauma, chronic pulmonary infection/inflammation), the risk of embolization to the systemic circulation resulting in ischemia or infarction is real. The most devastating complication is emboli traveling into the vertebral or carotid arteries, resulting in stroke. There are case reports suggesting that cerebral infarction has been a complication of declot procedures.[12,13] However, there is also a small series demonstrating the safety of percutaneous thrombectomy in patients with a patent foramen ovale in which there were no cerebral infarctions.[14] Before performing percutaneous thrombectomy on patients with a known right-to-left shunt, the interventionists should have a frank discussion with the patient and his or her family regarding the risk of cerebral infarction so that an informed decision can be made. Ideally, and if possible, any right-to-left shunt should be closed before percutaneous declotting of a fistula.

HEMODYNAMICALLY UNSTABLE PATIENTS

There are times when we are consulted by referring physicians to perform a fistula thrombectomy on a patient who is hemodynamically unstable. Scenarios in which this may occur include the patient undergoing nonaccess surgery who thrombosed his or her fistula due to perioperative hypotension and is now supported on vasopressors or the patient who developed pulmonary embolism during attempted thrombectomy at another facility and is now transferred to our center for further management. In these and other instances of instability, percutaneous throm-

bectomy should be postponed until the patient is off vasopressors and other cardiopulmonary supportive measures. Temporizing procedures, such as placement of a nontunneled dialysis catheter, can serve as a necessary stopgap while the patient is stabilized.

LIMITED CARDIOPULMONARY RESERVE

Patients with normal cardiopulmonary function can usually tolerate small pulmonary emboli that can occur during percutaneous thrombectomy. However, patients with limited cardiopulmonary reserve, particularly in the setting of larger clot burden within the fistula, are at increased risk for life-threatening cardiopulmonary collapse, even when meticulous technique is used to prevent thrombus from escaping the access. Severe chronic obstructive pulmonary disease (particularly requiring continuous supplemental oxygen before sedation), pulmonary hypertension, and cardiomyopathy are examples of conditions that may put the patient at increased risk, even with minimal pulmonary embolism.

THROMBOSED HIGH-FLOW FISTULA IN PATIENTS WITH HIGH-OUTPUT CARDIAC FAILURE

Similar to patients with limited cardiopulmonary reserve and larger clot burden, patients with a known high-flow fistula (typically brachial fistulae with > 2,000 mL/min) and high-output cardiac failure should be approached cautiously. These patients are usually better served with surgical revision of the access or placement of a new access.

CLOTTED FULL METAL JACKET FISTULA

This term refers to fistulas that already have numerous stents (Figure 2), especially if there are signs of stent breakdown/strut fracture, kinking, or if hemodialysis cannulation is occurring through the stents with resultant stent fractures. Anecdotally, these patients do not have a durable outcome from additional repeated angioplasty and/or stenting. Even with the evolution of stent grafts, many of these patients are better served being referred to vascular surgery for new access/revision.

SUMMARY

The counterpoint to "Can I perform this procedure?" is always "Should I perform this procedure?" This list aims to raise scenarios in which patients potentially should not undergo a percutaneous declot procedure. It also underscores the importance of an appropriate preprocedural workup and physical exam of the patient. We acknowledge this list is not exhaustive and does include some rare phenomena. In addition, personal or institutional levels of experience and variations in local expertise or resources may allow some interventionists to successfully and safely treat some of the higher-risk patients listed above. As percutaneous techniques continue to evolve, this list will likely become shorter; however, continuing to approach these patients with a heightened level of caution is important in ensuring successful outcomes. ■

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