Clinical Experience

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A 69 y/o woman with insulin dependent diabetes, hypertension, and hypercholesterolemia who had dialyzed for five years via a prosthetic left brachio-basilic 6 mm polytetrafluoroethylene dialysis graft presented with a thrombosed graft. Since placement, the graft had previously thrombosed twice, once immediately following placement requiring surgical revision, and the second six months ago, treated by thrombolysis and angioplasty.

On presentation to Interventional Radiology, the graft was pulse-less. In the preprocedure preparation area, a 20 gauge angiocatheter was introduced under aseptic conditions into the graft about 1-2 cm downstream from the arterial anastomosis. The intragraft position of the angiocatheter was confirmed by passage of a .014" guidewire, which was manipulated in a to-and-fro fashion throughout the graft in an attempt to fragment the intragraft thrombus. Thereafter, 3 mg of tissue plasminogen activator followed by 3,000 units of heparin were injected sequentially into the graft during manual compression of the arterial anastomosis and simultaneous but less rigorous compression at the venous anastomosis.

Approximately 30 minutes later, the patient was transferred to the procedure suite. By this time, the entire graft was pulsatile. The angiocatheter was exchanged over a stiff hydrophilic guidewire for an angled diagnostic catheter which was manipulated into the venous outflow. A venogram performed through this catheter demonstrated an 8 cm high-grade basilic/axillary stenosis (Figure 1), and a well-collateralized high-grade focal subclavian stenosis (Figure 2). Contrast injection into the graft demonstrated forward flow with diffuse intragraft mural irregularities and filling defects indicative of retained thrombus. Exchange was made for a 6 French sheath. An 8 mm by 8 cm Conquest™ PTA Balloon Dilatation Catheter was dilated across the basilic/axillary venous outflow stenosis for 60 seconds with full balloon expansion occurring at a pressure of 21 atmospheres (Figures 3a and 3b). The graft was then dilated from the venous anastomosis to the 6 French sheath near the arterial anastomosis using three overlapping 60-second inflations of the 8 mm by 8 cm Conquest™ angioplasty balloon (25 Rated Burst Pressure). Two, high-grade, intragraft stenoses were identified, each requiring 22 to 24 atmospheres of pressure to achieve full balloon inflation (Figures 4a and 4b). During the final balloon inflation, contrast was injected through the sheath and refluxed across the arterial anastomosis. This demonstrated wide patency of the arterial anastomosis and adjacent brachial artery (Figure 5), with no filling defect or luminal narrowing to suggest a retained arterial plug. A contrast study now demonstrated wide patency of the graft and the venous outflow (Figure 6), save for the subclavian stenosis. A minimally pulsatile thrill now extended from the arterial anastomosis to the middle third of the graft with no increase in intensity in the axilla at the venous anastomosis. The intragraft pressure in the venous limb of the graft was 42 mm Hg with a cuffed systolic brachial pressure of 126 mm Hg.

The Centers for Medicare and Medicaid recently established a 66% prevalence goal for autologous fistulas, to be reached by June 2009. Nevertheless, there are still many dialysis patients with prosthetic dialysis grafts as their lifelines. The mean duration of usefulness for grafts, even with intervention, is on the order of 20 months. The most common cause for graft failure is venous stenosis due to intimal hyperplasia which results in thrombosis. Thus, repetitive treatment of thrombosed grafts will be necessary in a significant minority of dialysis patients for the foreseeable future. Herein, we present a straightforward technique to treat thrombosed dialysis grafts without depleting venous real estate by surgical revision or resorting to potentially harmful dialysis catheter insertion.
Discussion

The “lyse and wait” technique was originally described in a 1996 case report using urokinase and subsequently in a feasibility trial using tissue plasminogen activator (tPA) with over 90% immediate success rates. Although purely mechanical declotting methods have been well-described, thrombolysis using a pharmacologic agent or a mechanical device is the most widely utilized non-surgical technique. Following instillation of tPA and heparin, we routinely perform an initial pullback venous outflow diagnostic angiogram until we identify a venous outflow lesion or residual thrombus. As originally described by Beathard, we dilate the entire graft with an 8 mm angioplasty balloon, except for the apex of looped grafts which are rarely stenosed and prone to rupture. Use of the Conquest™ angioplasty balloon to macerate residual thrombus, makes sense since over 90% of accesses have one or more underlying lesions which will need balloon angioplasty.

A majority of graft related lesions require inflation pressures greater than 15 atmospheres and up to 34% greater than 20 atmospheres. With a rated burst pressure of up to 30 atmospheres, the ultrahigh-pressure, noncompliant Conquest™ balloon can completely efface most venous lesions associated with dialysis grafts. Although Conquest™ angioplasty balloons are more expensive than lower pressure angioplasty balloons, initial use of an ultrahigh-pressure noncompliant Conquest™ balloon will save procedure time, radiation exposure, and the cost associated with an additional balloon that occurs when a low-pressure balloon cannot expand a lesion. Further, Conquest™ balloons up to 8 mm in diameter can be passed through a 6 French sheath, similar to lower pressure angioplasty balloons.

Accessing the graft close to the arterial anastomosis obviates the need to perform mobilization of the arterial plug in about one-third of our cases. If there is no flow or pulse after the graft has been treated with an 8 mm by 8 cm Conquest™ angioplasty balloon, or if fibulography reveals filling defect or stenosis at the arterial anastomosis, a Fogarty or angioplasty balloon can be manipulated across the arterial anastomosis to mobilize the arterial plug and facilitate treatment of any inflow stenoses. Some authors have described arterial inflow lesions in up to 29% of grafts; careful analysis of the arterial anastomosis and adjacent arterial inflow should always be performed.

We have also used the technique described above for autologous fistulas, including transposed fistulas which are conceptually identical to the closed system of a dialysis graft. We do not use this technique for autologous fistulas with markedly ectatic venous outflow and large clot burdens. More experience is needed to elucidate the usefulness of this technique for fistulas.

Immediate procedure success in the case presented was evidenced by physical exam criteria as well as venous systolic pressure ratios. Historically, some authors have advocated treating every hemodynamically significant lesion in the dialysis access circuit. Nevertheless, recent experience suggests that treatment of asymptomatic central venous lesions may accelerate their progression. Therefore, with no upper extremity edema, the subclavian lesion was considered asymptomatic and was not treated.

The use of a small dose of a thrombolytic agent combined with a single ultrahigh-pressure angioplasty balloon to macerate residual thrombus and to treat stenoses at or near the venous anastomosis and within the graft is cost-effective. Initial use of a Conquest™ balloon allows effacement of most venous lesions by a single balloon without having to resort to an off-label technique or surgical repair. Outcomes seem to be independent of the method used for the treatment of thrombus; therefore, this straightforward cost-effective method has become our treatment of choice for thrombosed dialysis grafts.

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