Delayed Presentation of Rupture After Venous Angioplasty

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ABSTRACT

Venous rupture is an uncommon complication resulting from dialysis graft interventions. We present a case in which contrast extravasation occurred following an initially successful balloon tamponade. The rupture site could not be negotiated with a guidewire to provide endovascular treatment, necessitating balloon occlusion of the graft.

KEYWORDS: Venous angioplasty, venous rupture, hemodialysis access thrombosis

Objectives: Upon completion of this article, the reader should be able to (1) recognize complications related to dialysis graft interventions, and (2) describe preferred methods to treat venous rupture.

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With the increasing prevalence of end-stage renal disease, the number of people requiring dialysis continues to climb. Recent statistics from the U.S. Renal Data System report that the dialysis population reached nearly 336,000 in 2004, a 3.4% increase from 2003.¹ Despite the superiority of native arteriovenous fistulas, synthetic grafts remain prevalent within the dialysis community. Dec clotting of synthetic arteriovenous grafts is a common dialysis-related intervention with graft function restoration rates approaching 100% in some studies.² Venous rupture is an uncommon complication resulting from dialysis graft interventions, occurring in between 2% and 5% of procedures.^{3–6}

CASE REPORT

A 71-year-old woman with end-stage renal disease was found to have occlusion of her left forearm dialysis graft by her nephrologist at her monthly outpatient appointment. The woman had had a synthetic tapered polyte-

trafluoroethylene (PTFE) graft placed 11 months earlier for declining renal function and anticipated dialysis, but the graft had not yet been used for dialysis, making the exact time of graft thrombosis unclear.

The arterial and venous limbs of the graft were accessed at the graft apex. Flow was restored after lacing the graft with 4 mg of tissue plasminogen activator (Alteplase; Genentech, South San Francisco, CA). During the procedure there was difficulty advancing a guidewire across the venous anastomosis. A 5F Kumpe catheter (Cook, Bloomington, IN) and hydrophilic angled-tip guidewire (Glidewire; Terumo, Somerset, NJ) were used, and after ~10 minutes of manipulation, the anastomosis was negotiated.

The venous stenosis was dilated with a 7 × 40 mm Blue Max angioplasty balloon catheter (Boston Scientific, Natick, MA). Postdilation venography demonstrated irregularity of the outflow and apparent extravasation at the anastomosis (Fig. 1A). The balloon was reinflated across the area for several minutes, and a repeat venogram

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Figure 1 (A) Post angioplasty venography demonstrates apparent extravasation at the venous anastomosis. (B) Following balloon reinflation, no further extravasation was seen.

was obtained revealing no further extravasation (Fig. 1B). The patient's arm exhibited no swelling, and she reported no pain in the affected region.

Small amounts of clot persisted in the arterial limb of the graft, which were macerated using a 6 × 20 mm Ultrathin balloon catheter (Boston Scientific, Natick, MA). No further intervention was performed on the venous anastomosis. Ultimately, brisk flow was reestablished. Angioplasty balloon catheters were then exchanged over guidewires and for 7F dialysis sheaths (HemoCath; Angiodynamics, Queensbury, NY). A final venogram through the venous sheath then demonstrated an area of contrast extravasation at the level of the elbow (Fig. 2).

A guidewire was reinserted through the arterial sheath, and the sheath was exchanged for an 8 × 40 mm Blue Max balloon catheter, which was inflated to occlude the graft. The venous sheath was exchanged over a guidewire, but the wire could not be advanced into the central veins. Arm swelling was noted on examination, and the patient reported mild to moderate pain of the lower arm. After multiple failed attempts to traverse the area of extravasation with wires via the venous sheath, an 8 × 40 mm Blue Max balloon catheter was then placed into the venous limb and inflated to occlude the graft. After consultation with the access surgeon, the decision was made to maintain balloon occlusion of the graft, admit the patient for observation, and pursue surgical

graft revision at a later time. The patient had good capillary refill in the left hand, Doppler confirmed radial and ulnar artery pulses, and no evidence of ongoing hemorrhage upon transfer to the intensive care unit. She made an uneventful recovery and was discharged the next day. The access was revised surgically.

DISCUSSION

Venous rupture is identified by the spread of contrast beyond the vessel margin into the soft tissues, accompanied by vessel wall irregularity and poor antegrade flow.³ Acknowledged methods to treat venous rupture include simple observation, prolonged angioplasty, stent deployment, or manual graft occlusion. Rundback et al argued in 1998 that the least invasive methods should be tried first, which would include observation and prolonged balloon inflation. If those methods fail, then stent placement should be tried next, before moving to graft occlusion as a last resort.⁴ Alternatively, in a study of 23 patients, Funaki et al immediately used Wallstents (Boston Scientific, Natick, MA) in patients with venous rupture following thrombolysis. These investigators were able to achieve a 100% technical success rate and proved that immediately using stents to treat all ruptures was safe, effective, and sustained the functional status of the graft.³

The rate of venous rupture during dialysis access declotting procedures varies slightly among different institutions. Variables potentially influencing rupture frequency include method of thrombectomy, experience level of the interventionalist, and maturity or age of the graft. In the authors' anecdotal and published experience, rupture is more common in very high-grade stenoses or occlusions and is typically associated with localized pain even after the angioplasty balloon catheter is deflated. This case is unusual in that extravasation appeared to have been successfully treated with prolonged balloon tamponade, only to recur 20 to 30 minutes later. An additional unusual aspect of this case is that the area of rupture could not be successfully negotiated with a guidewire for definitive endovascular

Figure 2 Final venogram through the venous sheath demonstrates an area of contrast extravasation.

treatment. We believe that repeated attempts to cross the lesion at the termination of the case likely led to a dissection that was propagated by guidewire manipulation, exacerbated by both venospasm and an evolving arm hematoma.

As recently as 1999, a thrombosed, immature fistula that had never been used was considered a contraindication to percutaneous treatment.⁵ To our knowledge, no studies have been performed comparing rupture rates between fistula and grafts. Rundback et al reported venous rupture in 7 of 253 (2.8%) patients who underwent hemodialysis access-related angioplasty, although the number of grafts versus fistulae was not disclosed.⁴ Funaki et al reported venous rupture in 23 of 514 (5%) of patients who underwent pharmacomechanical thrombolysis of arteriovenous grafts.³ Turmel-Rodrigues et al reported rupture in 20 out of 526 (3.8%) cases involving treatment of graft stenosis or thrombosis.⁵ In a retrospective review, Welber et al reported rupture in 14 out of 683 (2.0%) angioplasties performed to either recanalize thrombosed or salvage poorly functioning upper extremity PTFE grafts.⁶

REFERENCES

1. United States Renal Data System. USRDS 2006 Annual Data Report: Atlas of End-Stage Renal Disease in the United States. Bethesda, MD: National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases; 2001
2. Gibbens DT, Triolo J, Yu T, et al. Contemporary treatment of thrombosed hemodialysis grafts. *Tech Vasc Interv Radiol* 2001;4:122-126
3. Funaki B, Szyski GX, Leef JA, et al. Wallstent deployment to salvage dialysis graft thrombolysis complicated by venous rupture: early and intermediate results. *AJR Am J Roentgenol* 1997;169:1435-1437
4. Rundback JH, Leonardo RF, Poplausky MR, Rozenblit G. Venous rupture complicating hemodialysis access angioplasty: percutaneous treatment and outcomes in seven patients. *AJR Am J Roentgenol* 1998;171:1081-1084
5. Turmel-Rodrigues L, Pengloan J, Baudin S, et al. Treatment of stenosis and thrombosis in haemodialysis fistulas and grafts by interventional radiology. *Nephrol Dial Transplant* 2000;15:2029-2036
6. Welber A, Schur I, Sofocleous CT, et al. Endovascular stent placement for angioplasty-induced venous rupture related to the treatment of hemodialysis grafts. *J Vasc Interv Radiol* 1999;10:547-551