

# Treating Venous Outflow Stenosis and Pseudoaneurysm in Dialysis Access Grafts

A minimally invasive method using the Viabahn endograft to treat pseudoaneurysm and venous outflow stenosis: a 2-year follow-up study.

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Graft aneurysms in chronic renal patients are a serious and disabling complication that can cause ruptures, infections, thrombosis, and eventually the loss of an access. The prevalence of aneurysms in this patient population is 5% to 8%.<sup>1</sup> Conventional treatment consists of excising the aneurysm and replacing it with a bridge graft. The procedure requires hospital admission and general anesthesia; there is then a delay in the use of the access for a period of 3 to 4 weeks waiting for maturation, involving the insertion of a catheter. Ultimately, there is a tremendous cost for the patient, hospital, and insurance company.

Venous stenosis is a common cause of graft failure in patients undergoing dialysis. The rate of stenosis ranges from 35% to 80% per year.<sup>2</sup> Stenosis is conventionally treated with balloon angioplasty and/or surgical revision. Failed grafts that are treated with balloon angioplasty have a 65% chance of restenosis within 6 months, requiring frequent angioplasties.<sup>3</sup>

The use of a covered stent in the exclusion of pseudoaneurysm is sporadic and has traditionally been limited to single case reports.<sup>4</sup> Studies have shown that stent grafts are superior to angioplasties in treating venous outflow stenosis, achieving a patency rate of 53% in 6 months.<sup>5</sup> The use of the Viabahn endoprosthesis (Gore & Associates, Flagstaff, AZ) in treating graft aneurysms

and venous outflow stenosis is a simple procedure that can be performed percutaneously under local anesthesia on an outpatient basis, and the access can be used immediately after surgery without the need to insert a catheter.

Between May 2004 and May 2006, 40 patients (18 male and 22 female) received Viabahn grafts for treating venous outflow stenosis and pseudoaneurysm (Table 1).

## PROCEDURE DETAILS

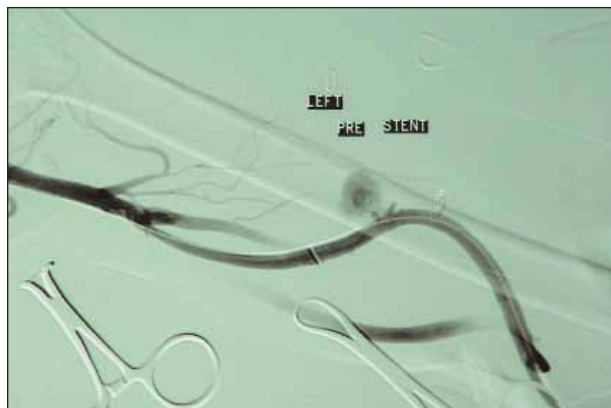
For aneurysm and venous outflow stenosis with a functional graft, a percutaneous needle is inserted into



Figure 1. Graft with a 9-F sheath inserted as an access for endograft insertion.

TABLE 1. CLINICAL STATISTICS OF GRAFTS

Patient Statistics			Cardiac status (continued)	Unstable angina, symptomatic/ poor controlled ectopy, arrhythmia, congestive heart failure, ejection fraction <25%, or MI within 6 months	1			
Sex	18 Men	22 Women						
Age	30 to 40	2	Renal status	No known, normal creatinine  Moderately elevated, <2.4 mg/dL  2.5 to 2.9 mg/dL  >6 mg/dL, on dialysis, kidney transplant  3 to 5.9 mg/dL	0  0  1  39  0			
	41 to 50	8						
	51 to 60	6						
	61 to 70	13						
	71 to 80	6						
	81 to 90	5						
Weight	Morbidly obese	0	HIV	Positive  Negative  Unknown	6  20  14			
	Obese	16						
	Normal weight	18						
	Under weight	6						
Diabetes mellitus	None	15	Graft Statistics					
	Adult onset with diet or oral agents	10	Year	1998 (Revised in 2004)  2001  2002  2003  2004  2005	1  4  4  12  11  8			
	Adult onset with insulin control	15						
	Juvenile onset	1						
Tobacco use	None/none in the last 10 years	26				Location	Right arm  Left arm  Left forearm  Right thigh  Left thigh	4  32  2  1  1
	None current but smoked in the last 10 years	2						
	Current, <1 year, <1 pack/day	3						
	Current, >1 pack/day	9						
Hypertension	None	1	Type	Loop  Jump	19  21			
	Controlled with single drug	12						
	Controlled with two drugs	20	Size	Gore-tex 6-mm standard (Gore & Associates)  4 mm to 6 mm	37  3			
	Uncontrolled/controlled with three drugs	7				Pathology	Stenosis  Aneurysm  Stenosis and aneurysm  Bleeding aneurysm	21  2  16  1
Hyperlipidemia	Within normal levels for age	15	Causes for primary intervention	Clotted grafts  Stenosis and aneurysm (not clotted)  Bleeding aneurysm	26  13  1			
	Mild elevation, readily controlled by diet	6						
	Moderate elevation requiring strict dietary control	6						
	Cardiac status	Moderate elevation requiring strict dietary and drug control	13					
Asymptomatic		16						
Asymptomatic with remote MI, occult MI, or fixed defect		13						
	Stable angina, significant reversible perfusion, silent ischemia, ejection fraction= 25% to 45% controlled ectopy, well-compensated arrhythmia	10						

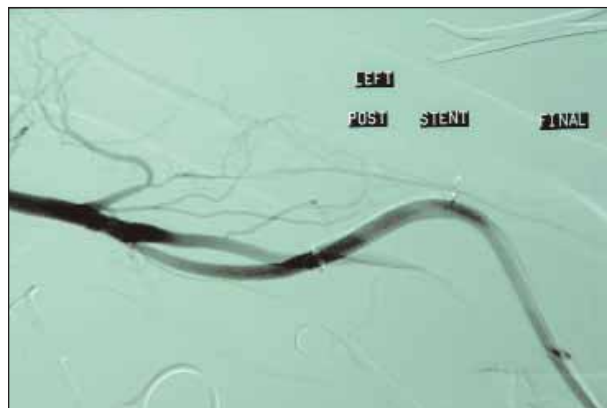


**Figure 2.** Fistulogram showing a pseudoaneurysm of arm AV graft fistula.

the arteriovenous (AV) graft, followed by a 9-F sheath (Figure 1). Fistulography is then performed to determine the extent of the stenosis and the size and length of the aneurysm. To treat aneurysms, a bridge graft is inserted through the sheath across the site of the aneurysm. The endograft is dilated with a 7-mm X 40-mm balloon. A fistulogram is taken first to determine the extent and location of the venous outflow stenosis, which is then ballooned with a 6-mm balloon at 12 to 15 atm. Completion venography is performed, and a Viabahn graft is then inserted at the site of the stenosis, which is also dilated with a 7-mm X 40-mm balloon. Completion venography is performed to ensure 100% lumen size. The sheath is then removed, and the entry site is closed with a 3-0 nylon purse string suture. The presence of thrill is expected to confirm the patency of the graft (Figures 2 through 4).

**“The arterial side of the graft should be declotted, and arteriography should be performed to make sure there is no arterial stenosis.”**

For clotted AV grafts, a cutdown is made over the graft and transverse arteriography is performed. A 9-F sheath is inserted toward the venous anastomosis after declotting the venous side. Venography is performed, and the venous outflow stenosis is identified. The stenosis is dilated with a 6-mm balloon for 2 minutes. A Viabahn endoprosthesis is inserted across the stenotic graft-venous suture line. A completion venogram is obtained, and results showing <90% lumen patency are not acceptable. If the patency is <90%, the graft should



**Figure 3.** Completion fistulogram after insertion of endograft across the aneurysm showing complete aneurysm exclusion.



**Figure 4.** A Viabahn stent placed across the pseudoaneurysm.

be ballooned by a 20% oversized balloon.

The arterial side of the graft should be declotted, and arteriography should be performed to make sure there is no arterial stenosis. If any arterial stenosis at the suture line is found, the stenosis is to be ballooned with the appropriate balloon. The sheath is then removed, and the arteriotomy is closed with a 6-0 prolene continuous suture. Subcutaneous tissue is closed with 3-0 vicryl suture, and the skin is closed with a 3-0 nylon. The presence of thrill is expected to confirm patency (Figures 5 and 6).

## RESULTS

The primary patency rate of the aneurysms ranged from 1.9 to 6.6 months (mean, 4.2 months); the secondary patency rate for new aneurysms in the same graft ranged from 1.5 to 12 months (mean, 6 months). Furthermore, the mean for combination aneurysms and stenosis was 8.2 months (range, 2.7 to 18.2 months). Stenosis lasted an average of 6.87 months (range, 2.7 to 18.2 months). If we exclude the four patients with



Figure 5. Fistulogram showing severe stenosis at the venous outflow anastomosis.



Figure 6. Completion fistulogram after insertion of a Viabahn stent graft across the venous outflow stenosis.

severe arterial disease of the upper extremities, the patency rate increases to 7.82 months.

Secondary intervention was required for various reasons, including clotted grafts caused by graft stenosis (nine patients), arterial stenosis (three patients), venous outflow stenosis (nine patients), aneurysm (one patient), and Viabahn stent primary stenosis (one patient); new aneurysms (eight patients); and poor dialysis kinetics detected by duplex and fistulogram and caused by graft stenosis (three patients), venous stenosis (seven patients), and Viabahn stent primary stenosis (three patients). There were 47 secondary interventions.

Follow-up of 40 patients treated with Viabahn stents occurred between May 11, 2004, and May 30, 2006. To date, 23 patients have had patent grafts, one patient had a ruptured aneurysm, two patients had removal of infected grafts that were patent, and two patients had interruption of patent grafts due to subclavian occlusion and subsequent edema. One patient had interruption of a patent graft due to gangrene. Two patients had clotted grafts that could not be salvaged; these grafts had to be converted to basilic vein transposition. Nine patients died with a functioning graft between December 21, 2004, and April 13, 2006. The average intervention per patient was 2.75 procedures over the course of 2 years.

## CONCLUSIONS

Our experience has shown that the Viabahn stent endograft improves the patency of dialysis access grafts and prevents thrombosis an average of 8.2 months of primary patency for our series (2.7 months to 18.2 months). Stenosis inside the endograft causing clotted access has been found to be rare. One of the 40 patients was found to have stenosis causing thrombosis and was amenable to angioplasty alone. Venous outflow stenosis

causing thrombosis in dialysis access grafts occurred distal to the endograft and accounted for 22% of patients in our series. They were subsequently treated with an extension Viabahn endograft. Graft pseudoaneurysms are commonly associated with venous outflow stenosis. Forty percent of the patients in the study demonstrated this combination. Graft pseudoaneurysms can be expected to return to dialysis immediately. ■

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1. Acipayam M, Canbaz S, Duran E. The pseudoaneurysm at the graftotomy site in arterio-venous access graft. *Internet J Thorac Cardiovasc Surg*. 2003 Vol. 6. Available from: [Internet Scientific Publications, Sugarland, TX](http://www.ispub.com/ostia/index.php?xmlFilePath=journals/jitcvs/vol6n1/pseudo.xml). Accessed January 4, 2006.
2. Stent graft outperforms balloon angioplasty. *News-Medical.Net*. April 4, 2006. Available at: <http://www.news-medical.net/?id=8920>. Accessed January 4, 2006.
3. Peck P. SIR: Stent superior to angioplasty for dialysis-access patent. *Medpage Today*. April 5, 2005. Available at: <http://www.medpagetoday.com/Radiology/2005SIRMeeting/tb/828>. Accessed January 4, 2006.
4. Najibi S, Bush RL, Terramani TT, et al. Covered stent exclusion of pseudoaneurysm. *J Surg Res*. 2002;106:15-19.
5. Stent graft outperforms balloon angioplasty. *News-Medical.Net*. April 4, 2005. Available at: <http://www.news-medical.net/?id=8920>. Accessed January 4, 2006.