TABLE 2. Details of the occluded saphenous vein grafts

	Preoperative characteristics	Endoscopic harvesting	Sequential grafting	Target coronary artery	Degree of stenosis	Location of the proximal anastomosis
73-year-old man	Diabetes	No	No	RCA	75%	Ascending aorta
49-year-old man	Dialysis, diabetes, CVD	No	No	RCA	90%	Ascending aorta

RCA, Right coronary artery; CVD, cerebrovascular disease.

of SVGs (FitzGibbon grade B) was observed. Of the 38 patients who underwent late graft evaluation, 24 did so at least 2 years after surgical intervention. The 2-year cumulative patency rate was 91.7% (22/24). All the results were evaluated by an experienced radiologist. Details of the occluded SVGs are given in Table 2.

DISCUSSION

Stroke is a devastating complication of CABG. Manipulation of the aorta using techniques such as crossclamping is thought to be a predisposing risk factor. The off-pump technique has brought more attention to reduce this devastating complication. Use of an aortic side clamp requires aortic manipulation, thereby precluding the major advantage of the off-pump technique. Several devices for proximal anastomosis of SVGs to the aorta have been developed and can facilitate clampless proximal anastomosis. Although the results have been satisfactory in terms of neurologic complications, there have been some concerns about early and long-term patency rates. The early patency rate of the previous generation of the proximal anastomosis device, the Symmetry device (St Jude Medical, Inc, Minneapolis, Minn), was satisfactory, but production was discontinued because of the poor midterm and long-term results.³⁻⁵ The PAS-Port device has the potential to yield better results than the Symmetry device for the following reasons: (1) the stents were located outside and not inside the SVG, which did not reduce the total amount of blood exposed to nonintimal surfaces inside the aortic lumen, and (2) the stents were composed of

316L medical grade stainless-steel and not nitinol, which can cause intimal hyperplasia.¹

We realize that the gold standard for the evaluation of graft patency is angiography. It is relatively difficult to assess the details of anastomosis sites with computed tomography. Therefore we might have missed a number of stenotic vessels. In addition, this is a very small cohort of patients.

In conclusion, this study demonstrated the satisfactory results of midterm patency rate after placement of SVGs with a PAS-Port device. This device could be useful for CABG in case the ascending aorta showed the severe atheromatous change to a degree that precluded the use of a side clamp. However, a larger-scale study and a longer follow-up period will be mandatory to confirm the reliability of this device.

References

- Gummert JF, Demertzis S, Matschke K, Kappert U, Anssar M, Siclari F, et al. Six-month angiographic follow-up of the PAS-Port II clinical trial. *Ann Thorac Surg.* 2006;81:90-6.
- Lahtinen J, Biancari F, Ojala R, Mosorin M, Cresti R, Rainio P, et al. Prospective, randomized study of the use of the cardiac PAS-Port aortic connector system in off-pump coronary artery bypass surgery. *Heart Surg Forum.* 2006;9:E568-71.
- Kitamura H, Okabayashi H, Hanyu M, Soga Y, Nomoto T, John H, et al. Early and midterm patency of the proximal anastomoses of saphenous vein grafts made with a Symmetry Aortic Connector System. *J Thorac Cardiovasc Surg.* 2005;130:1028-31.
- Reuthebuch OT, Kadner A, Lachat ML, Turina MI. Graft occlusion after deployment of the Symmetry bypass system. *Ann Thorac Surg.* 2003;75:1626-9.
- Lahtinen J, Biancari F, Mosorin M, Heikkinen J, Rainio P, Juvonen TS, et al. Fatal complications after use of the symmetry aortic connector in coronary artery bypass surgery. *Ann Thorac Surg.* 2004;77:1817-9.

Late rupture of polytetrafluoroethylene neochordae after mitral valve repair

R. Saeid Farivar, MD, PhD,^a Stanton K. Shernan, MD,^b and Lawrence H. Cohn, MD,^c Boston, Mass

From the Division of Cardiac Surgery, Department of Cardiothoracic Surgery,^a Department of Surgery,^c and the Department of Anesthesiology, Perioperative and Pain Medicine,^b Brigham & Women's Hospital, Boston, Mass.

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Address for reprints: Robert Saeid Farivar, MD, PhD, 200 Hawkins Dr Iowa city, IA 52242 (E-mail: robert-farivar@uiowa.edu).

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Mitral valve repair is the procedure of choice to correct mitral regurgitation. The introduction of polytetrafluoroethylene (PTFE) sutures was an important contribution by David¹ and Zussa and colleagues² for the treatment of chordal shortening or for chordal replacement during mitral valve repair. This report describes a patient with acute-onset hematuria 11 years after mitral valve repair who was found to have fractured PTFE neochordae necessitating mitral valve replacement.

FIGURE 1. Real-time 3-dimensional transesophageal echocardiographic en face image of mitral valve from left atrial perspective showing original Cosgrove-Edwards annuloplasty ring (*white arrows*) and flail anterior leaflet (*red arrow*). PMC, Posteromedial commissure; ALC, anterolateral commissure.

FIGURE 2. Real-time 3-dimensional transesophageal echocardiographic image of mitral valve apparatus from left ventricular perspective showing fractured neochordae (*red arrow*). LVOT, Left ventricular outflow tract; PL, posterior mitral valve leaflet; AL, anterior mitral valve leaflet.

CLINICAL SUMMARY

A 57-year-old man was transferred to our hospital with acute onset of hemoglobinuria. A transesophageal echocardiogram revealed a mobile density attached to the mitral leaflet with severe mitral regurgitation. His history was notable for a mitral valve repair in 1996 (11 years previously) by one of the authors (L.H.C.), with PTFE neochordae created for the anterior leaflet for myxomatous disease and the placement of a 30-mm Cosgrove-Edwards annuloplasty ring (Edwards Lifesciences LLC, Irvine, Calif). The patient's myxomatous anterior leaflet had had six ruptured native chordae that were resected, along with a portion of the anterior leaflet. Two PTFE neochordae were then created from the posteromedial and anterolateral papillary muscles in mattress fashion, anchoring the chordae on the papillary muscles with polytetrafluoroethylene pledgets. The patient had been well for 11 years after that procedure, with no cardiovascular symptoms since his initial mitral valve repair and normal results of repeated echocardiograms.

Intraoperative transesophageal echocardiography revealed a flail anterior leaflet with 4+ insufficiency (Figures 1 and 2). The mitral valve was approached through a full sternotomy with ascending aortic cannulation, bicaval venous cannulation, and antegrade blood cardioplegia. The Sondergård groove was developed to approach the left atrium. Valve inspection revealed the two PTFE neochordae in the anterior leaflet to be thickened, stiffened, and fractured midshaft. The native anterior leaflet was diffusely myxomatous, variably thickened, and fibrotic. The valve was irreparable, so the anterior mitral leaflet was resected and the posterior leaflet preserved. The previous ring was removed, and valve replacement was performed with a 27-mm St Jude Medical bileaflet valve with an expanded PTFE cuff (St Jude Medical Inc, Minneapolis, Minn). The patient did well and

was discharged home on postoperative day 5 with anticoagulation.

DISCUSSION

PTFE neochordae have been used for a variety of mitral reconstructive procedures. They were introduced and evaluated experimentally in sheep and shortly thereafter introduced by David¹ and Zussa and colleagues² for patients undergoing mitral valve surgery. PTFE neochordae have since been used in minimally invasive procedures and the pediatric population.

To date, there has been only a single published report, by Butany and associates in 2004,³ of a PTFE neochordal fracture in a patient with mitral neochordae constructed for anterior leaflet pathology in a rheumatic valve. This fracture was noted at reoperation, 14 years after the initial repair. Butany and associates³ postulated that calcification of the PTFE suture had led to fracture, and the patient's valve was replaced as in our case. Similarly, the PTFE suture was calcified and had been degraded.

Although it is known to be extremely durable, the natural history of PTFE suture has not been completely elucidated. PTFE has a greater than 50% porosity. As a linear, nonabsorbent, monofilament polymer, it has a breaking strength almost an order of magnitude greater than that of native chordae (1 kg vs 60–200 mg, respectively). There is some compliance in the suture. It has an electronegative charge, similar to native endothelium. Although thought to repel hematocytes and tissue incorporation initially, eventually it is covered by host fibrosa and endothelium. Finally, calcium has been noted to penetrate the interstices with possible stiffening.³ This gives neochordae the potential for calcification, with the potential for eventual fracture.

Several investigators have documented durability of PTFE neochordae in the midterm (<10 years). David and co-workers⁴ have shown no PTFE fractures in 134 patients at 8 years, and Kobayashi and associates⁵ have shown no PTFE failures in 74 patients at 10 years. Even in children, who have a tendency toward quite rapid calcification of bioprosthetic valves, no fractures have been reported. Stiffening of the PTFE chord has the potential to result in mitral valve insufficiency. Although midterm durability has been excellent, the long-term (>10 y) outcome remains unreported.

Our patient had hemolytic anemia and hemoglobinuria, well-recognized complications of mitral valve surgery that are rare after mitral valve repair. This is the first report of

fractured chordae leading to hemolysis and hematuria as a result of whiplash motion of the chordae and trauma on the patient's red blood cells.

References

1. David TE. Replacement of chordae tendineae with expanded polytetrafluoroethylene sutures. *J Card Surg.* 1989;4:286-90.
2. Zussa C, Frater RW, Polesel E, Galloni M, Valfre C. Artificial mitral valve chordae: experimental and clinical experience. *Ann Thorac Surg.* 1990;50:367-73.
3. Butany J, Collins MJ, David TE. Ruptured synthetic expanded polytetrafluoroethylene chordae tendineae. *Cardiovasc Pathol.* 2004;13:182-4.
4. David TE, Armstrong S, Sun Z. Replacement of chordae tendineae with Gore-Tex sutures: a ten-year experience. *J Heart Valve Dis.* 1996;5:352-5.
5. Kobayashi J, Sasako Y, Bando K, Minatoya K, Niwaya K, Kitamura S. Ten-year experience of chordal replacement with expanded polytetrafluoroethylene in mitral valve repair. *Circulation.* 2000;102(19 Suppl 3):III30-4.