Figure 2. A, Transesophageal 2-chamber view. AML, Anterior mitral leaflet; LAA, left atrial appendage; LV, left ventricle. B, Transesophageal-transgastric long-axis view. PM, Papillary muscle; LA, left atrium; AV, aortic valve.

function of the aortic valve and no further growth or additional tumor growth after cardiac surgery.

Discussion

This case describes a patient with the unusual finding of multiple cardiac fibroelastomas involving the mitral valve and the LVOT in addition to an altered aortic valve after prior valve endocarditis. We hypothesize that the local accumulation of mobile structures might be, at least in part, because of the congenital altered bicuspid aortic valve and consecutive inflammatory alteration. Furthermore, accelerated by aortic regurgitations, jet lesions in the subvalvular region of the mitral valve and the adjacent left ventricle might have contributed to the development of the tumor. After surgical replacement of the formerly infected aortic valve, tumor growth appeared to discontinue.

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Facile conversion from mechanical to bioprosthetic composite aortic root replacement

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Aortic root replacement with a composite valve graft mechanical prosthesis has become established therapy for acute and chronic pathology that eventually leads to enlargement, dissection, or rupture of the aortic root. Although minimal early and late morbidity and mortality have been

reported, some patients will require operative reintervention on the neo-aortic root, with the goal of conversion from a mechanical to a xenograft aortic valve prosthesis.

We describe an easily reproducible technique that aims at minimizing the degree of complexity of such reintervention while still achieving the goal of freedom from anticoagulation.

Clinical Summary

A 38-year-old man with a history of Marfan syndrome and intravenous drug abuse presented to our institution in 1999 with symptomatic aneurysmal dilation of the aortic root and aortic regurgitation and underwent aortic root replacement with a 27-mm composite mechanical valved prosthesis (St Jude Medical, St Paul, Minn). Despite enrollment in a drug rehabilitation program, the

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Figure 1. The Dacron graft has been incised, and a 30-mL Foley catheter has been inserted in the left ventricular outflow tract. The leaflets have been unhinged from the housing of the mechanical aortic root prosthesis.

Figure 2. Double-loaded, horizontal, mattress braided sutures are then placed circumferentially in the Dacron graft along a horizontal plane between the nadir of the coronary ostia and the superior margin of the valve housing.

patient was lost to follow-up and presented in September of 2003 with congestive heart failure. Reportedly, he had discontinued oral anticoagulation for 6 months while continuing intravenous drug abuse. Preoperative workup revealed his mechanical prosthesis to be frozen in the open position, with massive aortic regurgitation and an estimated ejection fraction of 15%. Blood culture results were negative.

At the time of the operation, the aortic root was exposed after redo sternotomy and takedown of very tenacious adhesions. Rather than proceeding with root replacement with a xenograft or a homograft with coronary reimplantation, a less-conventional approach was chosen. The Dacron graft was opened, exposing the mechanical prosthesis, immobilized by a well-organized clot. To follow, a 30-mL Foley catheter was inserted within the left ventricular outflow tract and pulled against the inferior margin of the mechanical prosthesis (Figure 1). The valve leaflets were then grasped with a clamp and unhinged from the prosthetic housing; the few prosthetic fragments that were left on the convexity of the exposed balloon were easily retrieved with suction. The Dacron portion of the composite valve graft visible below the coronary ostia was then rimmed with interrupted, horizontal mattress 2-0 braided sutures (Figure 2). The sutures were then passed through the sewing ring of a 23-mm bovine pericardial valve (Edwards Lifesciences, Irvine, Calif), which was lowered in place in the subcoronary position (Figure 3). Cardiopulmonary bypass time and crossclamp time were 38 and 59 minutes, respectively. The postoperative course was unremarkable, and the patient was discharged home on postoperative day 6. He is alive and free from embolic complications 2 years and 7 months postoperatively.

Discussion

Aortic root replacement with a mechanical prosthesis has been widely used in the treatment of proximal aortic pathology, with excellent short- and long-term outcomes and limited need for operative reintervention.¹

There are, however, patients who require reoperation and, in particular, conversion from a mechanical to a biological prosthesis because of issues most often related to oral anticoagula-

tion. Poor compliance with warfarin therapy, recurrent thrombosis, and anticoagulation-related hemorrhage are the most frequent clinical issues that prompt consideration for conversion to a bioprosthesis. In patients with valve thrombosis without intolerance to anticoagulants, thrombolysis and thrombectomy are the only alternatives to replacement.

Reintervention to replace an aortic root prosthesis is often a challenging undertaking because of dense adhesions and the need for reimplantation of the coronary ostia, and although good outcomes have been reported in contemporary series,^{2,3} bleeding or coronary ischemia in the postoperative phase are distinct possibilities in repeat aortic root replacement. Furthermore, in patients with decreased myocardial function, such as the patient described, an expeditious operation with reduced myocardial ischemic and perfusion times is desirable.

Harada and colleagues⁴ reported extirpation of a Björk–Shiley mechanical valve, root enlargement, and insertion of a mechanical prosthesis within the cuff of the valve, a concept also reported in reoperative mitral and aortic replacement by Geha and coworkers.⁵ In the latter report, the bioprosthetic struts were amputated, and a mechanical valve was sutured to the prosthetic sewing ring (valve-

Figure 3. A 23-mm bovine pericardial prosthesis has been implanted, and the mechanical housing is visible in the subvalvar position.

on-valve technique). With the technique described herein, the mechanical prosthesis is not removed in its entirety because the valve housing is left in situ, and the leaflets are simply unhinged. We have found this not to be an issue with thrombus formation in this and in 2 additional cases performed at our institution because the smooth surface of the housing and the high flow within the left ventricular outflow tract are most likely protective against recurrent thrombosis after removal of the leaflets.

The technique reported is reliable, easily reproducible, and offers reduced crossclamp time, potential for bleeding, and coronary malperfusion to this challenging group of reoperative patients.

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Bovine jugular vein as a shaped alternative patch material for aortic augmentation in the Norwood procedure

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The Norwood procedure is commonly performed with a patch augmentation of the neo-aorta. Homograft pulmonary conduits are used, but the opportunity cost of this scarce resource has prompted the evaluation of alternatives. We have used bovine jugular vein as an alternative aortic patch augmentation material with early success.

Clinical Summary

The Medtronic Contegra bioprosthesis (Medtronic, Inc, Minneapolis, Minn) consists of a bovine jugular vein with a trileaflet venous valve. It is preserved under minimal pressure (<3 mm Hg) in a 0.25% buffered glutaraldehyde solution and is terminally sterilized in a formulation of glutaraldehyde and isopropyl alcohol. It is available in a range of sizes (12–22-mm internal diameter) and is between 7- and 10-cm long with the valve centered on the prosthesis. We have used this patch technique in 3 cases of hypoplastic left heart syndrome, applying the technique described by Norwood with the Sano modification.¹

The Contegra graft is prepared by being rinsed in normal saline for 15 minutes. No thawing or preclotting is required. While the patch is cooling, the surgeon prepares it as shown in Figure 1.

The reconstruction was satisfactory and bleeding was within expected limits in all 3 patients. Delayed sternal closure was adopted and none required reintervention for bleeding. Echocardiographic studies postoperatively demonstrated good anatomic reconstruction, and they have all survived to hospital discharge and are awaiting the second stage of palliation.

Discussion

The original Norwood procedure did not use a patch to reconstruct the aorta. This was instead proposed by Jonas and associates² in 1986 in a successful attempt to address the commonly associated hypoplastic arch and aortic coarctation. Contemporary attempts have even been made to reconstruct the aorta without the use of any graft material.³ However, the applicability of this technique is limited by the anatomy of the child. Fifteen percent of patients in the Ishino series³ required patch material. This group has subsequently moved to a patch aortic augmentation technique for this reason and because of the technical difficulty of a patchless technique. In addition, the neo-aorta reconstructed at this time is expected to endure for life, and a final shape with physiologic flow characteristics should continue to be the surgical aim.

Synthetic material for patch aortic augmentation has not been widely reported, and there are no randomized comparisons between synthetic material and pulmonary homograft. This may reflect the perceived established benefits of biological material as a vascular patch material. Pulmonary homograft for the reconstruction of the aorta is considered the ideal material because of its good hemostatic and handling properties and the appropriateness of using a vessel graft for vascular reconstruction. However, limited availability of pulmonary homografts has motivated the search for alternatives. Allograft material is also associated with calcification and may reduce the transplantation options, as allograft material used in Norwood procedures is associated with the generation of cytotoxic antibodies.⁴

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