

Blockage of a Mechanical Aortic Valve Leaflet with BioGlue: A Case Report

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ABSTRACT

Mechanical aortic valve dysfunction is a very rare event and is usually due to thrombosis, pannus overgrowth, or both. BioGlue as a cause for such a complication has been reported only occasionally. We describe a case of a 63-year-old woman who underwent operation for symptomatic tight aortic stenosis. After implantation of an aortic valve (AGN-751, size 19; St. Jude Medical, St. Paul, MN, USA) because of a transverse tear of the aortic wall above the annulus occurring during the suturing of the aortotomy, a triangular Vascutek Dacron patch (Vascutek/Terumo, Inchinnan, Scotland, UK) was included. To secure hemostasis, BioGlue (CryoLife, Kennesaw, GA, USA) was applied. A transthoracic echocardiography (TTE) examination performed after signs of ischemia appeared in the electrocardiogram on postoperative day 5 revealed an aortic transvalvular gradient of 74/38 mm Hg and a functional valve area of 1.0 cm². No coronary lesions were revealed in a coronarography evaluation, but cinefluoroscopy (CF) examination revealed immobility of 1 valve leaflet. The reoperation revealed a thick, rough layer of the glue on the inner side of the patch. This glue had run down to the valve, blocking a mechanical leaflet. Cleaning the valve was not possible, and the valve had to be changed. The subsequent postoperative course was uneventful. The transvalvular gradient was 39/20 mm Hg, and the functional valve area was 1.2 cm². We believe that the use of BioGlue and other surgical sealants is justified to secure complex suture lines and for maintaining hemostasis in cardiac surgery, but some precautionary rules must be respected. Authors have indicated that the glue enters through the needle holes in such cases, but our findings suggest it can also pass to the Dacron patch itself. CF is superior to TTE and transesophageal echocardiography for analyzing movement of the mechanical valve leaflet, and cardiac catheterization is rarely needed.

Received May 26, 2012; accepted November 8, 2012.

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INTRODUCTION

Mechanical heart valve dysfunction is a rare but potentially fatal complication. In only a small number of cases has the use of biological glue as an adjunct to surgical hemostasis been reported as a cause of such an event. We describe a case of BioGlue occlusion of one of the mechanical aortic valve leaflets.

CASE REPORT

A 63-year-old woman presented with complaints of dyspnea, uneasiness in her chest, and dizziness on exertion. Her comorbidities were hyperlipidemia, osteoporosis, and a previous balloon dilatation of the right subclavian artery. The physical examination was significant only for a precordial systolic murmur. An electrocardiogram showed a normal sinus rhythm. A transthoracic echocardiography (TTE) evaluation revealed a hypertrophic left ventricle with a good systolic function and a slightly depressed diastolic function, tricuspid thickening, and a thickened and stenotic aortic valve with a functional area of 0.6 cm², a maximal gradient of 87 mm Hg, and mild regurgitation. Mild mitral and tricuspid valve regurgitation and initial pulmonary hypertension were also present. The results of a coronarography examination were normal. After all necessary preoperative investigations were completed, the patient was scheduled for aortic valve replacement.

The heart was exposed through a midline sternotomy. Cardiopulmonary bypass was instituted with ascending aortic and right atrial cannulation. The myocardium was protected with moderate systemic hypothermia (31.7°C), with antegrade and retrograde cold blood cardioplegia. Through an oblique aortotomy, we exposed a functional, bicuspid, heavily fibrous, and moderately calcified aortic valve. The valve was excised, and a mechanical prosthesis (AGN-751, size 19; St. Jude Medical, St. Paul, MN, USA) was implanted via standard techniques. Because of a transverse tear of the aortic wall above the annulus of the aortic valve leaflet at the closure of aortotomy, a triangular Vascutek Gelsoft Plus patch (Vascutek/Terumo, Inchinnan, Scotland, UK) was included. Hemostasis at the suture line was reinforced with BioGlue (CryoLife, Kennesaw, GA, USA). At first, the postoperative

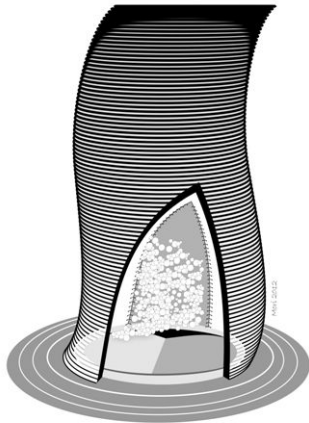
course was uneventful, but ischemic changes observed in the electrocardiogram on postoperative day 5 prompted a TTE examination, which showed a high transaortic gradient (74/38 mm Hg), a functional aortic area of 1.0 cm², and good left ventricular function. It was not possible to evaluate movement of the aortic leaflet. A coronarography examination revealed that the epicardiac arteries were without stenoses or occlusions but also showed that one aortic valve leaflet was moving normally and another was immobile.

On postoperative day 7, the patient underwent reoperation with the same technique. An intraoperative transesophageal echocardiography (TEE) examination showed immobility of one aortic valve leaflet and normal movement of another.

We reopened the aortotomy and on the inner side of the aortic patch we observed an uneven layer of glue. The glue had run down to the annulus of the prosthetic valve and anteriorly over the valve annulus and onto the anteriorly positioned leaflet, blocking the leaflet in the closed position (Figure). The other leaflet was moving freely. It was not possible to clean the valve, and we had to change it. This time, we implanted a smaller St. Jude Medical valve (AGN-751, size 17).

The patient's postoperative course was uneventful. A TTE examination conducted 6 days later showed normal function of the prosthetic aortic valve, with a gradient of 39/20 mm Hg and a functional area of 1.2 cm². The systolic function of the concentrically hypertrophic left ventricle was good; its diastolic function was slightly impaired.

After the second operation, the patient was discharged in a good condition on postoperative day 10.



Drawing representing the findings at reoperation. On the inner side of the aortic Dacron patch was a rough layer of glue running down to the sewing ring of the prosthetic valve and over it to 1 leaflet, thereby blocking it in the closed position.

DISCUSSION

Malfunction of a mechanical heart valve is a rare event. Over a period of more than 10 years, 53 such cases were reported to the German Medical Devices Vigilance System [von Mallek 2008]. Causes included 17 cases of leaflet breakage, 12 of leaflet dysfunction, and 4 of damage to the suture

ring. The aortic valve was involved in 32 cases. Mechanical valve leaflet dysfunction is most often due to pannus formation, thrombosis, or a combination of both. The reported incidence of mechanical aortic valve thrombosis is 0.2% per patient-year [Bridgman 2006]. Suture material obstructing the closure mechanism [Kidher 2009] and intermittent jamming of the mechanical valve leaflet in the absence of any apparent extrinsic cause [Russhard 2011] have also been reported. Occlusion or dysfunction of the valve prosthesis caused by biological glues or sealants has been reported infrequently [Goldberg 2009]. Our case is the first such experience at our institution. After an initially uneventful postoperative course, the first sign of the problem was ischemia in an electrocardiogram performed on postoperative day 5. In some cases, the dysfunction of the valve is already apparent intraoperatively, and the problem can be resolved at that time [Karimi 2005; Shapira 2006]. For cases that are discovered later, the clinical presentation can be aortic stenosis, aortic regurgitation (depending on the position of the jammed leaflet or leaflets), or myocardial ischemia, as in our patient.

The intraoperative diagnosis in the previously reported cases was based on TEE, which cannot always show mechanical disc motion accurately [Goldberg 2009]. In addition to TTE and TEE, cinefluoroscopy (CF) may provide a better evaluation of disc motion [Montorsi 2000; Khouzam 2007; Chhatrwalla 2009], and cardiac catheterization is rarely needed [Barbeteas 1998].

Our patient's TTE results showed only a high transvalvular gradient; the leaflet immobility was confirmed later by CF. Because the leaflet was completely occluded, we decided for immediate reoperation and did not insist on confirming or excluding possible valve thrombosis. In cases of thrombosis in addition to valve re-replacement, some reports have described the use of successive thrombolysis [Jelinek 2005; Kaya 2008].

At reoperation, we found a quite thick layer of glue on the inner side of the aortic patch. The glue blocked the anteriorly positioned valve leaflet. Some authors have reported success with cleaning the valve [Karimi 2005]. That was not possible in our case, and we had to change the valve. Authors have maintained that the glue enters through the needle holes in the autologous tissues and grafts. This view is supported by an *in vitro* study by the Houston group [LeMaire 2005]. They have recommend applying the glue after securing hemostasis, releasing the glue slowly, and stopping the suction on the vents to reduce active suction of liquid glue through the suture line.

Our findings prompt us to wonder whether the glue can also enter the aortic lumen through the Dacron graft itself.

In conclusion, jamming of a prosthetic aortic valve leaflet by glue is extremely rare; but it can happen and is potentially catastrophic. One should be cautious to avoid this problem with this use of glue, which is justified to reduce the potential for hemostatic problems. The glue should be applied slowly with the aorta cross-clamped and with the cardiac vents turned off. Echocardiographic methods are very important for diagnosing this condition and excluding the possibility of valve thrombosis, but CF evaluation is superior for evaluating the motion of mechanical valve leaflets.

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