Case Report

Biological Glue Application in Repair of Atrioventricular Groove Rupture: A Case Report

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Abstract

Atrioventricular groove rupture is a rare, albeit mortal, complication following mitral valve surgery. Avoidance is the best strategy but it cannot fully prevent the occurrence of this complication. Several repair techniques have been described with varying success rates; however, the rarity of the complication precludes consensus about the safest technique.

Here we report two cases of posterior atrioventricular groove rupture. Both cases were diagnosed immediately after the cessation of cardiopulmonary bypass. Repair was performed successfully with a technique involving the use of biological glue. The postoperative course was uneventful for both of them. Both cases are well with normally functioning mitral prostheses; one with a follow-up time of 5.5 years and the other 10 months. We believe that the glue provides additional hemostasis and support to the repaired area.

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Introduction

Atrioventricular groove rupture has been recognized as the most fatal complication of mitral valve surgery. Luckily, it is a very rare complication and is reported sporadically. Even with preservation of the posterior leaflet, the frequency of left ventricular (LV) rupture is about 1% following mitral valve procedures with the mortality rates of over 50%.[1]

Here we describe two cases of LV rupture following mitral valve replacement surgery. The same surgeon experienced only these 2 cases in his 25-year-period of surgery, with both cases being treated successfully via the same technique.

The study was approved by the Hospital Ethics Committee of Medicana International Ankara Hospital, and written informed consent was obtained from both patients.

Case #1

A 52-year-old female patient was admitted to the hospital with the complaints of dyspnea and fatigue.

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Echocardiographic examination revealed moderate to severe mitral insufficiency and severe tricuspid insufficiency. Intraoperatively, cardiopulmonary bypass (CPB) was established following standard aorto-bicaval cannulation. The mitral valve leaflets were fibrotic, accompanied by severe annular calcification. The anterior and posterior leaflets were excised. A 31-mm ATS mechanical prosthetic valve was positioned with interrupted 2/0 polyethylene terephthalate sutures, reinforced with Teflon pledgets. Concomitantly, De-Vega tricuspid annuloplasty was performed.

Case #2

A 56-year-old female patient was admitted to the hospital with the complaints of dyspnea, fatigue, and chest pain. Echocardiographic examination revealed severe mitral stenosis with 1.2 cm^2 of valve area and moderate to severe mitral insufficiency. Pulmonary hypertension was noted with a pulmonary artery pressure of 90 mmHg. Moderate tricuspid insufficiency was present. She also had restrictive pulmonary disease. Intraoperatively, CPB was established following standard aorto-bicaval cannulation. The mitral valve leaflets were fibrotic, accompanied by severe annular calcification. The anterior and posterior leaflets were excised. A 31-mm St. Jude Medical mechanical valve was positioned with interrupted 2/0 polyethylene terephthalate sutures, reinforced with Teflon pledgets.

In both cases, CPB was successfully ceased without any inotropic support following extensive de-airing maneuvers. Immediately after the cessation of CPB, excessive bleeding occurred from the posterior aspect of the heart. Type 1 atrioventricular groove rupture was determined and CPB was re-established. The valves were replaced with a 27-mm mechanical valve in both patients following the repair described in detail below. CPB was successfully weaned with the assistance of the intra-aortic balloon pump in order to decrease afterload. The postoperative courses were uneventful in both cases. The patients were discharged on the 8^{th} and 10^{th} postoperative days with follow-up periods of 5.5 years and 10 months, respectively. Both cases are well with normally functioning mitral prosthesis.

Repair Technique

Following exposure of the left atrium, the mitral valve prosthesis is removed carefully to avoid further damage, and the interior rupture site is inspected. A fresh autologous pericardial patch is prepared for the internal support of the ruptured area. The pericardial patch is stabilized along the interior margin of the defect with interrupted 4/0 polypropylene sutures, reinforced with large Teflon pledgets cut from the Teflon strip on the ventricular side. Maximum care should be exercised at the circumflex artery site. Deep myocardial sutures from the intact ventricle should be placed at adequate distance to the rupture site in order to provide enough strength to the repaired area since the LV is a high-pressure chamber. When the annulus is accessed on both sides, running polypropylene sutures are employed through the annulus beginning from each side. Just before the last suture is tied, BioGlue® (Cryolife, USA) is applied under the patch (Figure 1). Then a downsized mitral prosthesis is placed with interrupted 2/0 polyethylene terephthalate sutures at the original axis. The left atrium is closed in standard manner.

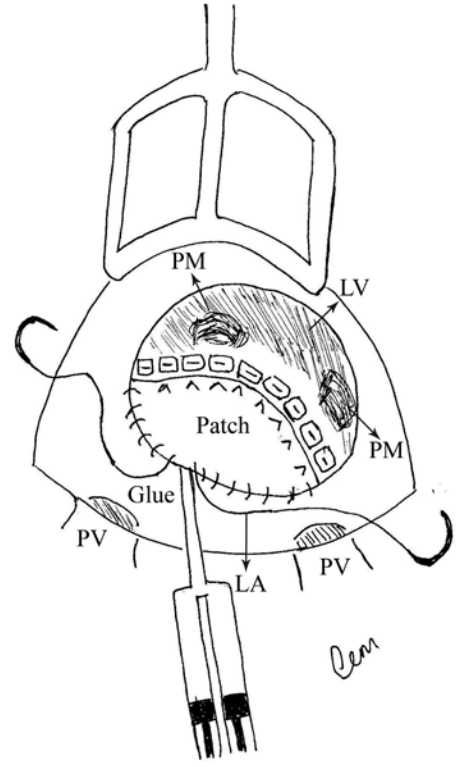

Figure 1. The repair technique. Pericardial patch is stabilized along the interior margin of the defect with interrupted 4/0 polypropylene sutures reinforced with large Teflon pledgets. Deep myocardial sutures from the intact ventricle should be placed at an adequate distance to the rupture site. When the annulus is reached on both sides, running polypropylene sutures are employed through the annulus beginning from each side. Just before the last suture is tied, BioGlue® is applied under the patch.
LA, Left atrium; LV, Left ventricle; PM, Papillary muscle; PV, Pulmonary vein

Discussion

Treasure et al.[2] classified LV rupture following mitral valve replacement into two types based on the location of the epicardial tear. Type 1 is defined as a defect along the posterior atrioventricular sulcus, whereas type 2 refers to the rupture of the LV posterior wall at the base of the papillary muscle. Miller et al.[3] proposed a third type defined as the rupture of the LV posterior wall between the base of

the papillary muscle and the atrioventricular groove. The classification represents the location of the rupture, but it is not adequate for the preference of the repair technique. The primary goal is always survival, but postoperative intracardiac hemodynamics should be preserved for good cardiac status.

The rapid expansion of the tear in most cases precludes definite distinction of the type and it is, therefore, mostly defined as the mixed type. Sometimes the epicardial tear is small with bigger laceration and hematoma of the myocardium.

Excessive decalcification of the mitral valve annulus and use of an oversized prosthesis are usually causative for type 1 rupture. Also, elevation of the LV is another contributing factor, which underscores the importance of the extensive de-airing of the LV. Miller et al.[3] suggested preservation of the posterior mitral apparatus in order to reduce the incidence of rupture. In both cases, the posterior valve leaflets were highly fibrotic and densely calcified and as such could not be preserved.

The most effective repair technique for all types of LV rupture is utilizing an endocardially positioned patch, which is stabilized with interrupted Prolene sutures reinforced with epicardial Teflon pledgets, along the safe myocardial tissue (intracardiac repair) and downsizing the prosthetic valve size. Extracardiac repair techniques and complete explantation of the heart, followed by repair and reimplantation, have also been described.[4]

Tayama et al.[4] reported the use of glue in the atrioventricular groove repair, but they used it in combination with a fibrin sheet in response to continued bleeding following repair only on the external surface. Fink et al.[5] employed biological glue in a nearly similar way on the suture line and also filled the cavity in a few cases of destroyed annulus due to infection. Zehr[6] reported his experience with biological glue use in various cardiac procedures, and described its use along with the cellulose patch or the bovine pericardial patch in the repair of LV rupture. Masroor et al.[7] defined an alternative technique, named endoventricular pocket repair, with the use of Teflon felt, bovine pericardium, and biological glue. The glue application in each method is different.

Briefly, our technique may be defined as intracardiac repair with a pericardial patch, positioned with 4/0 polypropylene sutures. Along with the repair, we recommend the use of biological glue between the pericardial patch and the epicardial rupture area for perfect sealing.

A fresh pericardial patch was used in both cases. Glutaraldehyde-treated pericardium may also be used to increase tensile strength. Yamashita et al.[8] measured the tensile strength of the pericardium and reported that the tensile strength of glutaraldehyde-treated pericardium was four times higher than that of non-calcified aortic valve leaflets. This finding is applicable to LV rupture repair because the aortic leaflets also face similar chamber dynamics. However, since glutaraldehyde fixation is time-consuming and the rupture is a very emergent state, a fresh pericardial patch is preferred.

Conclusion

Atrioventricular groove rupture following mitral valve replacement surgery is a devastating complication that requires prompt and urgent management. Complete repair of the ruptured area, followed by implantation of a smaller prosthesis, is mandatory. Biological glue use together with pericardial patch repair may increase the strength of the repaired area and ease the implantation of the valve.

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