Atrioventricular Disruption Managed by Ex-Situ Repair and Autotransplantation

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Atrioventricular groove disruption remains one of the most devastating complications following mitral valve replacement. Herein are described two cases that were successfully managed by ex-situ repair and autotransplantation.
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In spite of substantial improvements in mitral valve surgery, atrioventricular disruption remains one of the most feared complications following mitral valve replacement (MVR), with a typical mortality rate exceeding 50% (1). Much of the related literature is based on case reports which describe different management strategies (2-7) and can be broadly classified into external (2,3) and internal approaches (4-7). In both situations the tear is managed by sutures, different tissues adhesives, strips/patches of Teflon/pericardium, or combinations of these.

Herein are presented two cases of atrioventricular disruption following MVR that were successfully managed by ex-situ patch exclusion and autotransplantation.

Case reports

Case 1

A 75-year-old woman who presented with a prosthetic mitral valve dysfunction and severe aortic stenosis was admitted for double valve replacement. At surgery, a 23 mm CarboMedics mechanical aortic valve prosthesis and a 27 mm St. Jude Medical mechanical mitral valve prosthesis were implanted in epiannular fashion, using interrupted pledgeted mattress sutures. Following an uneventful operative course and first postoperative hour, a progressive fall in blood pressure and increased need for catecholamines at 2 h postoperatively led to the diagnosis of a tamponade. Following rethoracotomy and the removal of a large hematoma from behind the heart, the need for catecholamines fell dramatically. Exposure of the posterior surface of the heart revealed a left ventricular rupture.

Cardiopulmonary bypass (CPB) was re-established and the decision for autotransplantation and ex-situ repair taken. The heart was harvested for a bicaval autotransplantation. The mitral valve was removed, and a 3-cm tear in the posterior atrioventricular groove was identified and subsequently repaired by patch exclusion using a 4×3-cm patch of bovine pericardial tissue. The limits between the tear/hematoma and healthy endocardium were easily identified, and the patch was attached to that rim with a continuous suture of 4-0 Prolene. Fibrin glue was injected into and onto the tear from the outside, after which the mitral valve was reimplanted in epiannular fashion using interrupted pledgeted mattress sutures. In order to avoid later tethering on the patch by the valve, the sutures were placed along the atrial rim of the patch, attaching it to healthy viable tissue. The heart was then reimplanted in the usual manner. The remainder of the operation proved to be uneventful, and bleeding was minimal when the patient was weaned from CPB. The patient left the operating room in a hemodynamically stable condition, with minimal dosage of noradrenaline and dobutamine that were discontinued within the next 12 h. Following extubation on the second postoperative day and an uneventful postoperative course, the patient was discharged to rehabilitation on day 14. Transesophageal echocardiography showed normal valve function, with no paravalvular leakage and intact left ventricular function.

Case 2

A 62-year-old male presented with acute mitral valve endocarditis, cerebral embolization and sepsis. Exploration of the mitral valve revealed an extensive

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involvement of both leaflets and the chordae tendineae; hence, both leaflets were resected and the valve was replaced with a 29-mm Edwards Mira mechanical prosthesis. The patient was weaned uneventfully from CPB, but the pericardium suddenly filled with arterial blood. Exploration revealed an epicardial hematoma and a left ventricular rupture, whereupon CPB was re-established and the decision taken to perform an autotransplantation and ex-situ repair. A tear of 5 mm length along the posterior annulus was repaired in similar fashion to that used in Case 1. The overall CPB time was 309 min, and the cross-clamp time 229 min; weaning from CPB was uneventful. On transfer to the intensive care unit (ICU), the patient was receiving moderate-dose catecholamines, and was extubated on day 2 following surgery. The subsequent ICU stay was prolonged due to a temporary renal failure that necessitated repeated hemofiltration; the patient also contracted pneumonia with subsequent respiratory insufficiency and reintubation. The patient was discharged to a rehabilitation center at six weeks after surgery. At the time of discharge, he was mobilized under assistance and showed normal organ function. Before discharge, a pacemaker was implanted because of third-degree heart block. Echocardiography showed a normal valve function with no paravalvular leakage and a reduced ejection fraction of 30%.

Discussion

Despite substantial advances in mitral valve surgery during the past few decades, left ventricular rupture remains a dire complication that cannot be totally avoided and is still associated with a very high mortality.

Previous reports have referred to three different types of left ventricular rupture, in accordance with a classification proposed by Treasure and associates (8). The problem with these references is that tears are not always restricted to a certain region, and consequently the location and size of the endocardial and epicardial defects do not always correspond. In general, repairs can be classified as either 'external' or 'internal', depending on the approach used.

External repairs have been attempted with interrupted deep buttressed sutures, with Teflon strips and mattress sutures (2), by using various types of tissue adhesive with patches of Teflon/pericardium, or combinations of these (3). Although these approaches may be successful there are several points of criticism. First, the external approach is always associated with traction required to expose the posterior surface of the heart; this may not only trigger further damage but also oppose tension-free suturing. Second, because of limited exposure, the circumflex artery and coronary sinus are prone to injury. Moreover, as the repair targets the exit rather than the entry of the tear, it can never be a universal solution for all patients.

Internal repair aims at exploring the tear from the inside, after removing the valve and isolating the tear and lacerated tissues by suturing a pericardial patch to the rims of viable endocardium (4) or direct closure with multiple horizontal mattress stitches buttressed with felt (5,6). The main drawbacks of this approach are a limited exposure (which cannot be achieved without traction) that hinders identification of the limits between hematoma and viable myocardium, in addition to the time-consuming procedure. The advantage is that internal repair targets the entry, excluding it from the circulation, and is therefore technically sounder.

Yaku et al. (6) postulated that the avoidance of mechanical stress by the prosthesis on the repaired site was crucial to a successful outcome, and therefore reconstructed a new posterior annulus above the repair; this was referred to as a 'partial translocation of the mitral annulus'. In the present patients, the same goal was achieved by suturing the valve along the upper rim of the patch.

Chronologically, Case 2 was the first in which the above-mentioned procedure was utilized, as the choice of autotransplantation was based on a very difficult exposure on implantation and again on visualizing the tear, despite transection of the superior vena cava. In Case 1, the choice of autotransplantation was based on good experience with Case 2, and the assumption that the problem could not have been solved without explanting the aortic valve (which would have been equally time-consuming).

Internal repair and autotransplantation combine the benefits of a sound repair and an unhindered exposure that guarantees identification of the margins of viable endocardium, as well as a tension-free exposure/repair whilst excluding the risk of damage to the circumflex artery and coronary sinus. Although the procedure is time-consuming, the time lost is compensated by the ease of repair, valve explantation and reimplantation. The fact that Wei et al (7) have reported successful autotransplantation in two similar cases shows that these results should be reproducible, though additional studies must be conducted to validate this proposal.

In conclusion, it is believed that the aim of a sound repair should be to re-establish a firm atrioventricular continuity capable of withstanding the shearing forces of ventricular activity. Moreover, although time-consuming and technically challenging, autotransplantation and external repair offers the best

possibility of accomplishing this aim. It is hoped that this report will encourage others to follow a similar approach, hopefully with the same good results.

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