

CASE REPORT

Combined mitral valve repair and heart transplantation

Anke Sprengel, Wojtek Skwara, Tibor Ziegelhöffer, Ayse Cetinkaya, Markus Schönburg & Manfred Richter 

Department of Cardiac Surgery, Kerckhoff-Clinic, Benekestrasse 2-8, 61231 Bad Nauheim, Germany

Correspondence

Manfred Richter, Department of Cardiac Surgery, Kerckhoff-Clinic, Benekestrasse 2-8, 61231 Bad Nauheim, Germany.
Tel: +496032996-0; Fax: +4960329962507;
E-mail: m.richter@kerckhoff-klinik.de

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Background

The decreasing number of organ donors and the consecutive shortage of donor hearts lead to a situation where organs with extended allocation criteria are considered to treat patients on the waiting list. Even hearts with associated cardiac pathologies can under certain circumstances be transplanted successfully. Mitral valve repair can be performed safely, especially in patients with isolated leaflet or annulus pathology. We report on a patient who received heart transplantation with prior mitral valve repair.

Several studies focused on marginal donor hearts and acceptance criteria [1–4]. Expansion of allograft acceptance toward older donor age [5] or marginal donor hearts with impaired cardiac function or associated cardiac pathologies [6] becomes more and more important to retrieve marginal donor organs to the donor pool. Concomitant valve lesions, such as mitral valve insufficiency, are often considered as exclusion criteria for allograft acceptance. Mitral valve repair can, however, be safely performed and shows excellent mid- to long-term outcomes [7], even in more complex mitral valve pathologies [8, 9]. Thus, we expected that mitral valve insufficiency caused by prolapsed PML can be treated safely with acceptable increase in cold ischemic time and

Key Clinical Message

In times of donor organ shortage, organs with extended allocation criteria, for example, valve pathologies, have to be taken into consideration for transplantation. The donor pool can be extended to hearts with mitral valve insufficiency. Mitral valve repair can rapidly be performed in the donor heart on the back table with excellent results.

Keywords

Donor organ shortage, extended allocation criteria, heart transplantation, mitral valve repair

good clinical outcome in the donor heart immediately prior to transplantation as in the present patient. In-house organ donation, resulting from a rescue allocation by Eurotransplant, helped us to obtain short cold ischemia duration despite additional MVR.

Case Report

A brain-dead organ donor was hospitalized in our institution. Ultrasound showed normal biventricular function and moderate mitral valve insufficiency caused by PML prolapse. In the allocation process, the heart was rejected by the primary centers due to this underlying cardiac pathology and was then offered to us by Eurotransplant via rescue allocation. We accepted this heart for a 58-year-old male patient on LVAD therapy due to end-stage ischemic cardiomyopathy. We anticipated a short ischemic time and decided to perform mitral valve reconstruction immediately prior to heart transplantation on the back table. Mitral valve repair was accomplished using an open annuloplasty ring (Cosgrove-Edwards 30 mm) and plication of the posterior mitral valve leaflet on the P2/P3 segment. Ischemic time prior to heart transplantation was 20 min; cardiopulmonary bypass (CPB) and aortic cross-clamping time were 158 min and 70 min,

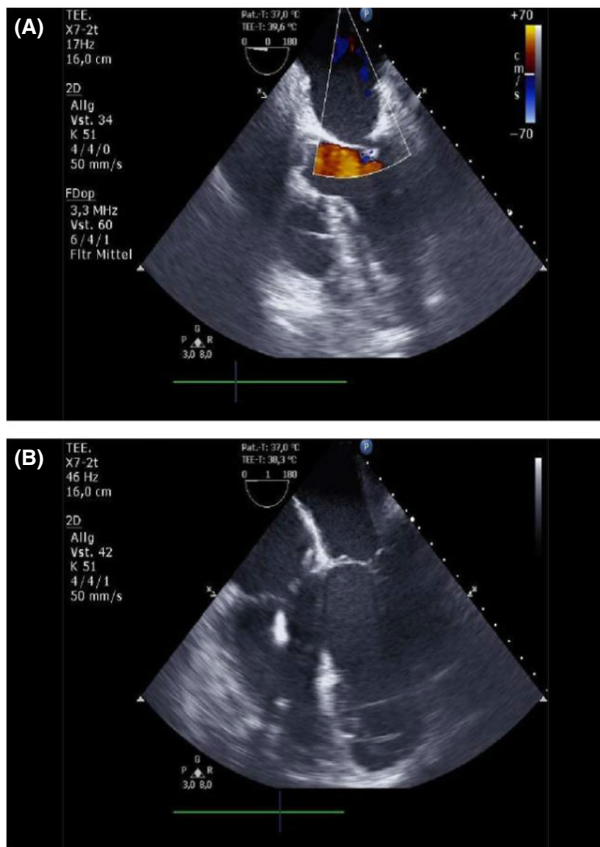


Figure 1. (A, B) Intraoperative TEE.

respectively. Intraoperative TEE after reperfusion showed good left ventricular and slightly reduced right ventricular function and no relevant mitral valve insufficiency (Fig. 1A and B). The patient was successfully weaned from CPB and was transferred to the ICU. Persisting postoperative 3° atrioventricular block occurred, hence a DDD pacemaker implantation had to be performed on POD 6. After having been on antibiotic medication for pulmonary infection, the patient was discharged from ICU on POD 15. More than 1 year after transplantation, the patient presented with good cardiovascular performance in daily life. Transthoracic echo revealed good biventricular donor heart function without any residual mitral valve regurgitation (Fig. 2A and B). Video files of TEE immediately postoperative and TTE nearly 3 and 4 years after transplantation showing excellent short- and long-term results of MVR have been uploaded as Videos S1–S4.

Discussion

Bench repair of the mitral valve prior to transplantation was first described by Rishers et al. [10] in 1994 with

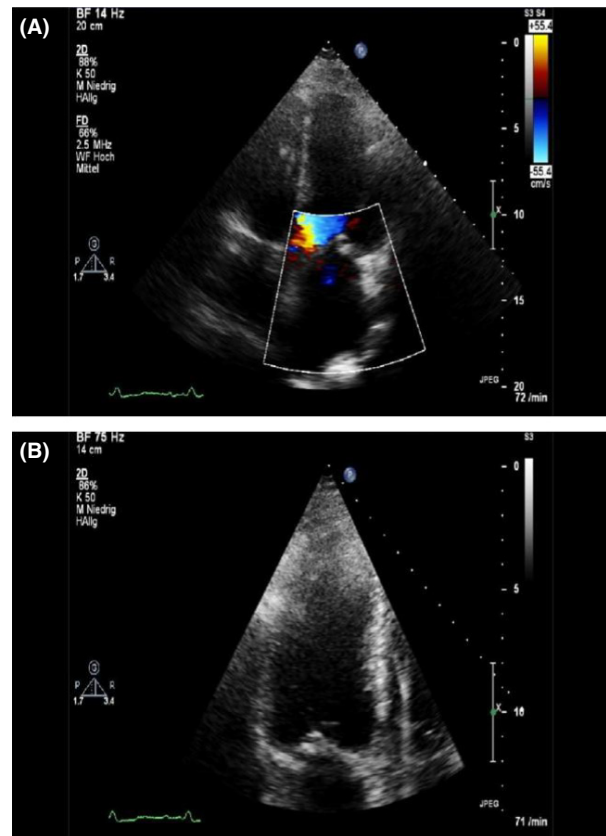


Figure 2. (A, B) Follow-up TTE (17 months post-HTX).

commissurotomy in the donor heart. Within 20 years, only six authors described their experiences with mitral valve repair prior to transplantation [10–15]. Additionally, there are only few reports on mitral valve replacement in the allograft [16, 17]. One of the most commonly described pathologies in donor hearts is annular dilatation, mainly of the posterior annulus which can be surgically addressed by annuloplasty ring implantation [11–13, 15]. Other pathologies include commissurotomy [10, 13, 14] or chorda repair with reimplantation of twisted chordae [14] and division of fused chordae [13]. Leaflet pathologies have been described by several groups, especially slight bileaflet thickening with normal leaflet motion [14, 15] scalloping or tethering of the posterior leaflet [11, 15]. In all cases, annuloplasty could be performed without leaflet plication with good clinical outcome. An overview of cited case reports is summarized in Table 1.

We describe an allograft with a PML prolapse and grade 2 mitral valve insufficiency as the main pathology (Carpentier type II). We decided to plicate the posterior leaflet on P2/P3 segment and stabilized the annulus with a 30-mm annuloplasty band.

Table 1. Comprehensive overview of case reports with MVR in the donor heart.

Author	Year/ cases	Mitral valve pathology of donor heart	Procedure	Postoperative outcome	Follow-up
Risher et al. [10]	1994/1	Moderate mitral stenosis; mitral valve area <2.0 cm ² ; trivial mitral valve regurgitation.	Bench surgery of mitral valve: commissurotomy of the medial and lateral commissures; division of fused chordae of the posterior mitral valve leaflet. (PML)	Postoperative echocardiograms (repeated) showed mildly sclerotic mitral valve with decreased motion of the PML; mild mitral insufficiency; no evidence of stenosis; ejection fraction 0.65–0.70.	One year after transplantation, the patient remained fully active; no evidence of recurrence or progression of mitral valve disease.
Massad et al. [11]	1996/1	Moderate mitral regurgitation with a structurally normal mitral valve.	Bench repair of the mitral valve was performed using a posterior annuloplasty.	Intraoperative transesophageal echocardiography revealed no evidence of mitral regurgitation; donor heart function was excellent.	Twelve months after transplantation, echocardiography showed normal valvular and left ventricular function; 18 months after transplantation, the patient has returned to an active and unrestricted lifestyle.
Michler et al. [12]	2002/2	1: Moderate mitral valve regurgitation; 2: severe mitral regurgitation, annular dilatation.	Mitral valve annuloplasty; 30-mm annuloplasty ring.	Both patients have had an excellent postoperative recovery.	An over 2-year follow-up demonstrated normal mitral valve function without regurgitation.
Antunes et al. [13]	2005/1	Mild-to-moderate sclerotic leaflets of the mitral valve; mild mitral valve insufficiency.	Commissurotomy of the posteromedial commissure; division of fused chordae; posterior annuloplasty with 3, 0 suture from trigone to trigone.	Excellent donor heart function.	Not available.
Prieto et al. [14]	2009/4	1: Mild-to-moderate sclerotic leaflets; 2: slightly sclerotic leaflets and mild mitral regurgitation; 3: torn head of the posterior papillary muscle; 4: central insufficiency.	1: Posteromedial commissurotomy and posterior annuloplasty; 2: posterior annuloplasty; 3: reimplantation of posterior papillary muscle; 4: posterior annuloplasty.	Minimal mitral valve regurgitation.	2 weeks to 57 months: none to mild mitral valve insufficiency; no transvalvular gradient.
Pawale et al. [15]	2012/3	1: Moderate mitral valve regurgitation, dilated mitral valve annulus, posterior jet; 2: moderate central mitral regurgitation, annular dilatation, tethering of P2/P3 (type I/IIb dysfunction); 3: mild-to-moderate mitral valve regurgitation, slight bileaflet thickening).	1: Closure of indentations of posterior mitral valve leaflet, ring annuloplasty 27 mm; 2: Ring annuloplasty 27 mm; 3 : ring annuloplasty 28 mm.	1: re sternotomy due to ventricular fibrillation and biventricular assist device; 2 and 3: uneventful.	24 days to 7 years after transplantation, the patients showed minimal mitral valve regurgitation; two patients described in New York Heart Association (NYHA) Class I; all patients with very good LV ejection fraction.

Mitral valve repair of the donor heart on the bench is a relatively straightforward and easy technique. This is especially true due to the perfect exposure of the mitral valve on the excised heart with a completely opened left atrium. Stable placement of the donor heart during mitral valve repair, however, has to be accomplished with an additional assistant together with intermittent lubricating of the organ. In summary, for an experienced cardiac surgeon, additional mitral valve repair during heart transplantation should be a routine procedure. This will allow all of us to accept some additional hearts during times of shortage in organ donation. Based on our successful one-year outcome this is for the sake of future patients.

Conclusion

Mitral valve repair using different techniques can be safely performed in donor hearts prior to transplantation by experienced surgeons and leads to good short- and intermediate-term outcomes. Extended donor criteria should be established for allografts with good ventricular function and associated mitral valve pathologies to broaden the therapeutic options for heart failure patients in times of general donor shortage.

Conflict of Interest

None declared.

Authorship

AS: performed the literature research and wrote the manuscript. WS and TZ: performed the operation and advised on writing the manuscript. AC: advised on writing the manuscript. MS: critically reviewed the manuscript. MR: designed the study and wrote the manuscript.

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Supporting Information

Additional Supporting Information may be found online in the supporting information tab for this article:

Video S1. TEE directly postoperative 1.

Video S2. TEE directly postoperative 2.

Video S3. TTE about 3 years after HTX4.

Video S4. TTE about 4 years after HTX.