

# Redo mitral valve replacement through minithoracotomy on ventricular fibrillation. Bailout for a nightmare Redo

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## Abstract

A 61-year-old woman who has undergone coronary artery bypass grafting 30 years ago, now reveals severe mitral regurgitation. Coronary angiography and computed tomography show patency of the graft. To avoid injuring the graft, mitral valve replacement under ventricular fibrillation without aortic cross clamping was performed through a right minithoracotomy approach.

## Key Clinical Message:

In patients undergoing redo mitral valve surgery with patent bypass grafts, a safe alternative to avoid injuring these is the minimally invasive right thoracotomy with moderate-deep hypothermia and fibrillatory arrest without aortic cross-clamping.

## INTRODUCTION

To avoid a high risk redo sternotomy in patients undergoing mitral valve surgery with patent bypass grafts, an alternative is the right thoracotomy with moderate-deep hypothermia and fibrillatory arrest without aortic cross-clamping. This technique has been reported as safe and effective [1-5] and was therefore successfully used in our case report in order to avoid injuring a very dilated patent saphenous vein graft to the left anterior descending artery.

## CASE REPORT

We report a case of a 61-year-old woman with worsening dyspnea and history of an ALCAPA (Anomalous Left Coronary Artery from Pulmonary Artery) syndrome having undergone coronary artery bypass grafting (saphenous venous graft to left anterior descending artery) 30 years before. Transesophageal echocardiography revealed severe mitral regurgitation due to prolapse of both very thickened leaflets. Coronary angiography showed patency of the graft responsible for the perfusion of the left anterior descending and circumflex arteries. (Figure 1). Even though not mandatory in planning such cases but useful to potentially prevent procedural complications, computed tomography revealed a dilated vein running across the front of the ascending aorta (Figure 2). In order to avoid injuring the graft, we performed the mitral valve replacement (MVR) through a right minithoracotomy approach under ventricular fibrillation (VF) without aortic cross clamping.

Informed consent was obtained from the patient for the procedure and for future publication of the case report.

## SURGICAL TECHNIQUE

A double lumen endotracheal tube was used for intubation and transesophageal echocardiography was placed for cardiac monitoring. The chest was opened through a right minithoracotomy (skin incision [?] 7 cm) under one lung ventilation at the 4th anterolateral intercostal space. The endoscopic port was placed at the right

3rd anterior intercostal space and used as a CO<sub>2</sub> port. Cardiopulmonary bypass was instituted through peripheral cannulation (right femoral artery and vein) using vacuum-assisted venous drainage. A 20mm diameter arterial cannula was used to ensure a mean blood pressure of 70mmHg. After cooling to 22°C in order to induce VF, a left atriotomy between the phrenic nerve and pulmonary veins was performed. MVR was performed in standard fashion using instruments for minimally invasive mitral surgery. After a prosthetic biologic St Jude<sup>7</sup> #33 valve was sewn into place (Figure 2), the left atriotomy was closed with slow filling and de-airing. When rewarming was completed, cardioversion was performed. After recovery to sinus rhythm, cardiopulmonary bypass was terminated and the femoral cannulas removed. A right pleural chest tube was positioned, and the incision was closed. Fibrillation time, cardiopulmonary bypass time and total operation time were 37, 59, and 83 minutes, respectively.

No intraoperative complications were registered. The patient had good in-hospital progression and discharge on postoperative day seven.

## DISCUSSION

Conventional re-operative MVR by median sternotomy has several challenges as it requires dissection to the apex, aortic clamp and myocardial protection. [1-2] In the presence of adhesions, this approach carries increased risk of injury of major cardiac structures (right ventricle, innominate vein and bypassed grafts). [1-2] This case revealed a very dilated vein running close to the sternum and across the front of the ascending aorta. (Figure 1) These anatomical proximities and the fact that this graft is responsible for the perfusion of all left coronary territory, are high predictive factors of surgical risk and mortality in a re-sternotomy.

Minimally invasive mitral surgery is associated with a mortality rate similar to that for sternotomy but reduced length of intensive care unit and hospital stays, fewer blood transfusions, earlier recovery of daily activities, and improved quality of life and a comparable risk of stroke. [1-3] The right minithoracotomy approach can achieve an excellent operative view of the mitral valve without requiring dissection of adhesions and has demonstrated to be safe and with similar results to re-sternotomy. [1-2] By performing the procedure under VF with systemic hypothermia, aortic cross-clamping and interruption of the graft flow is unnecessary, not necessarily compromising myocardial protection, thus, avoiding dangerous dissection around the aorta and the dilated patent graft. [1-2] Even though myocardial protection can still be a concern to surgeons, by ensuring hypothermia and a mean arterial pressure of 70mmHg, safety of MVR under VF is assured, as it has been documented in cases of functioning grafts. [4] Aortic insufficiency can make this technique unfeasible because of retrograde flow obstructing the operative field and inefficient prevention of air embolism. With a competent aortic valve and by keeping the left heart empty and vented to the atmosphere, blood in the left ventricle is preferentially expelled across the mitral valve because atmospheric pressure is much lower than the aortic root pressure and thus air emboli are avoided. Additionally, further actions such as Trendelenburg (head-down tilt) positioning of the patient, CO<sub>2</sub>insufflation and careful deairing procedures throughout surgery until the termination of cardiopulmonary bypass were implemented to avoid air emboli.

Another well reported alternative, that can also be used when there is absence of aortic insufficiency is beating heart normothermic mitral valve surgery. This technique has also been demonstrated to be an effective and safe alternative to prevent aortic manipulation. [5] When compared to the technique under VF, it has the advantage that it can be performed under normothermia and it can be speculated that it provides lower cardiac injury due to constant coronary perfusion. Nevertheless, in this case, by cooling to 22°C and ensuring a constant mean arterial pressure of at least 70mmHg we assured suitable myocardial protection and simultaneously facilitated surgical technique and consequently reduced surgical time, as surgery under VF seems to be less challenging than under a beating heart.

Current knowledge and the success of our case suggest that reoperative MVR under VF without aorta cross clamping through a right minithoracotomy is a safe, reproducible and effective option for patients requiring redo mitral valve surgery, especially when presenting anatomical characteristics that increase the risk of re-sternotomy such as coronary bypass grafts.

## Author Contributions

Joao Pedro Monteiro MD – Main Author, Writing and editing of the manuscript

Sara Simoes Costa MD – Co-author, Writing and editing of the manuscript

Nelson Santos Paulo MD – Revision and editing of the manuscript

Rodolfo Pereira MD – Revision and editing of the manuscript

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Figure 1 – Coronary angiography showing the dilated patent coronary graft (saphenous vein to left anterior descending artery).

Figure 2 - Computed tomography showing the dilated coronary graft (saphenous vein to left anterior descending artery).



