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Surgical reconstruction of a giant left ventricular aneurysm with prior unloading using a microaxial pump

Marta L. Medina Estrada [a], Miriam C. Silaschi[b], Efstratios I. Charitos[c] and Hendrik Treede[a]

[a] Department of Cardiac Surgery, University Hospital Mainz, Mainz, Germany
[b] Department of Cardiac Surgery, University Hospital Bonn, Bonn, Germany
[c] Department of Cardiac Surgery, Kerckhoff Heart Center, Bad Nauheim, Germany

* Corresponding author. Department of Cardiac Surgery, University Hospital Mainz Langenbeckstraße 1, 55131 Mainz, Germany. Tel: +49-17655177915; e-mail: Marta.Medina@unimedizin-mainz.de (M.L.M. Estrada).

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Abstract

A 46-year-old male patient presented with cardiac decompensation due to a giant left ventricular aneurysm combined with a severely reduced left ventricular function after a silent myocardial infarction. Left ventricular unloading was performed with a microaxial pump as a bridge to surgery. Myocardial function in the basal segments was preserved and surgical ventricular reconstruction was performed successfully.

Keywords: Left ventricular aneurysm • Surgical ventricular reconstruction • Myocardial infarction • Cardiogenic shock • Percutaneous microaxial pump

CASE PRESENTATION

A 46-year-old male was admitted to hospital due to cardiac decompensation New York Heart Association (NYHA) functional class IV 2 weeks after silent myocardial infarction complicated by postinfarction left ventricular aneurysm resulting in severely reduced left ventricular function (LVEF). There was no family history of heart disease.

Transthoracic echocardiography and cardiac magnetic resonance tomography showed a giant aneurysm (12 cm × 10 cm × 10 cm) beginning midventricular and affecting the entire apex of the heart.

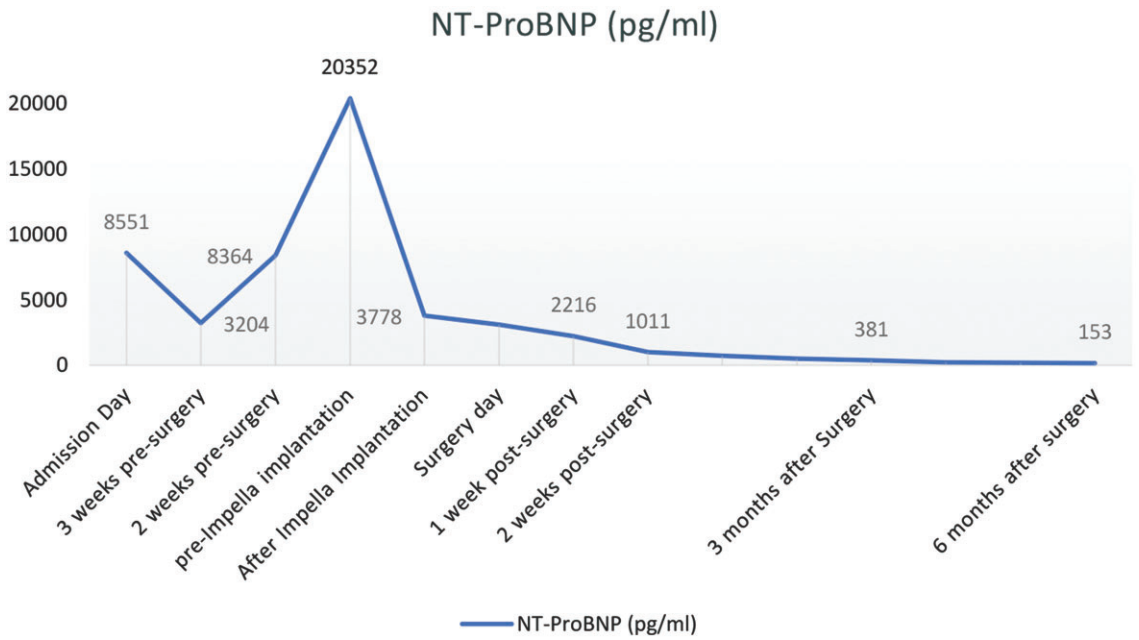
A transmural scar of the left ventricle was observed and LVEF was estimated at 10%.

Cardiac computed tomography showed preserved function of basal left ventricular segments (Video 1). Right ventricular function was preserved. Right heart catheterization showed a severely elevated pulmonary capillary wedge pressure (39 mmHg). Medical therapy was optimized to improve left ventricular filling pressures. However, after 2 weeks the patient developed severe congestive heart failure with an increase in N-terminal prohormone B-type natriuretic peptide levels (Graphic 1), NYHA IV clinical status and still severely elevated pulmonary capillary wedge pressure.

Video 1: Preoperative cardiac computed tomography of postinfarction left ventricular aneurysm showing preserved left ventricular function of the basal segments.

MANAGEMENT

Due to the excessively high surgical risk and progressive deterioration of the patient, we decided to perform temporary left ventricular unloading using a microaxial percutaneous left ventricular assist device as a bridge to surgery. Maximum support level P9 of the Impella 5.0® Support System (Abiomed, Europe GmbH, Aachen, Germany) via surgical access to the left subclavian artery (10-mm Dacron graft) was established.



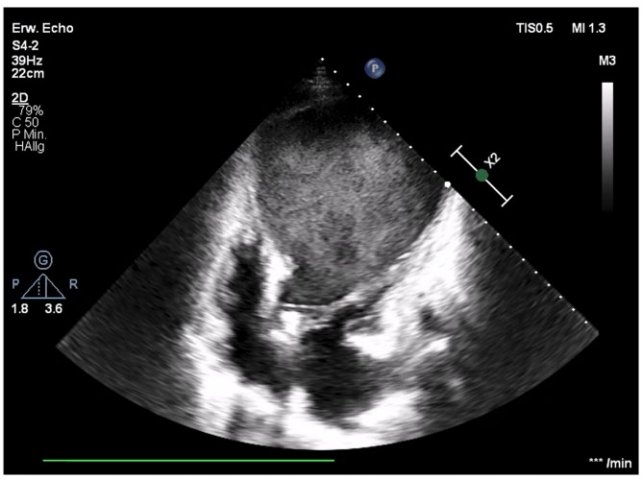
Graphic 1: N-terminal prohormone of brain natriuretic peptide levels (pg/ml) before and after surgery.

The patient's clinical and haemodynamic status improved markedly after implantation of the Impella 5.0 and echocardiography showed improved right ventricular function (Video 2). Sufficient anticoagulation was achieved using continuous intravenous heparin.

Surgical reconstruction of the left ventricle with endoventricular patch implantation (Dor procedure) was performed 8 days after Impella 5.0 implantation [1]. During the operation, we found a big posterolateral true left ventricular aneurysm. After putting the patient on cardiopulmonary bypass and cardioplegic myocardial arrest, a ventriculotomy was performed. The Impella 5.0 was cross-clamped together with the aorta when cardioplegic arrest was initiated and not removed to facilitate continued Impella support during the postoperative period if needed. The left ventricular cavity was opened and the aneurysm bag was resected (Fig. 1). A double-layer patch of Dacron and bovine pericardium was prepared and sutured together. The 7 cm × 4 cm elliptical double-layer patch was sutured using Prolene sutures, at the visual border of vital myocardium (Fig. 2). The Dacron patch was used to stabilize the ventricular wall in case a permanent left-ventricular assist device would be needed and the pericardium patch was used to coat the Dacron patch to avoid thromboembolic complications.

After 127 min, the aortic clamp was released and then, the Impella 5.0 was started again during reperfusion to support the left ventricle. Transoesophageal echocardiography showed significantly improved LVEF after aneurysmectomy and Dor-plasty and weaning from cardiopulmonary bypass was uneventful. In the presence of pulmonary hypertension and reduced right ventricular function, additional inhalative therapy with nitric oxide was initiated.

The patient required mechanical ventilation for 2 days. On the fifth postoperative day, the patient had haemodynamically stabilized and Impella was weaned and explanted. After explantation of the Impella 5.0, the patient was immediately extubated and did not need any inotropic support.



Video 2: Transthoracic echocardiography comparison after Impella 5.0 implantation before surgery and 1 year after Dor procedure.

No postoperative complications were observed. The patient was discharged home 16 days after surgery with LVEF of 50%, mild mitral regurgitation and diastolic dysfunction type I.

At 1-year follow-up, transthoracic echocardiography confirmed the preserved LVEF >50% (Video 2) and showed the reduction of left ventricular volume (left ventricular end-diastolic volume preoperative 646 ml and postoperative 118.5 ml). The patient is in NYHA I and the level of N-terminal prohormone B-type natriuretic peptide was substantially reduced (Graphic 1).

DISCUSSION

Left ventricular aneurysms are rare but serious complications after myocardial infarction [2].

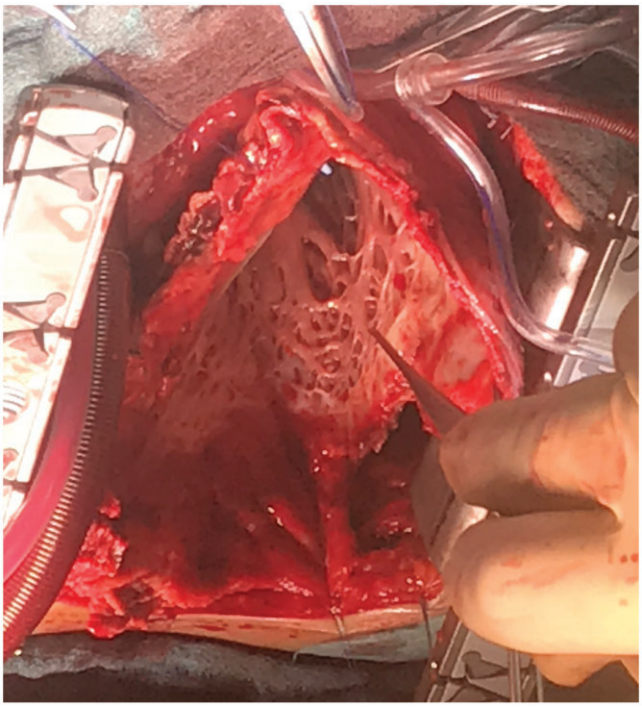


Figure 1: Intraoperative picture of the opening of the aneurysmal left ventricular anterior wall.

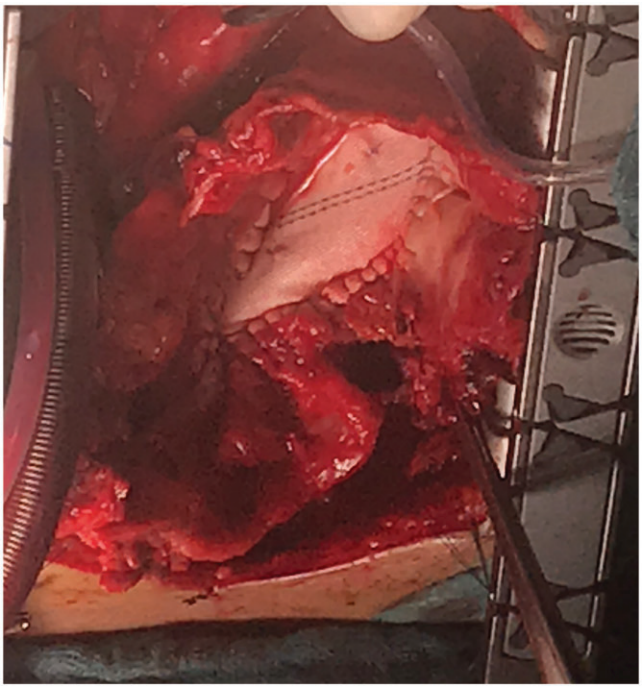


Figure 2: Intraoperative picture of the Dor procedure. The sutured patch is visible.

In most cases, they are accompanied by a permanent reduction in LVEF. In selected cases, surgical ventricular reconstruction is indicated, sometimes in combination with permanent left-ventricular assist device implantation [3]. Surgical reconstruction of the ventricle has shown that restoration of left ventricular volume and normal geometry leads to improved left ventricular function.

Predictors of operative mortality are mitral regurgitation of 2 or more, NYHA class >II and diastolic dysfunction >II [4].

The use of a microaxial percutaneous left ventricular assist device Impella has been recently advocated as a potential option to provide increased cardiac output and left ventricular unloading, achieving haemodynamic stabilization to pre-condition the patient prior to surgery [5].

In this case, we present left ventricular unloading using the Impella device as a safe and effective option to precondition a decompensated patient with giant left ventricular aneurysm prior to surgery. The role of the Impella during the postoperative period contributes to achieve haemodynamic stability and remodelling of the modified ventricular geometry in patients at high risk for postoperative complications. Nevertheless, the use of the Impella was associated with pre-surgical minor bleeding complications (Bleeding Academic Research Consortium 2) and post-surgical bleeding complications classified as a Bleeding Academic Research Consortium 3b due to acquired von Willebrand syndrome. Haemorrhagic complications were handled with the administration of desmopressin and transfusion of plasma-derived von Willebrand factor-containing factor VIII concentrates.

In conclusion, the concept of left ventricular preconditioning and unloading prior to cardiac surgery using microaxial pumps in patients with left ventricular aneurysm is very promising and should be further evaluated in clinical studies.

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Conflict of interest: none declared.

Reviewer information

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