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Case report - Assisted circulation

Percutaneous circulatory support for myocardial recovery in cardiogenic shock for late acute rejection

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Abstract

We present a case of a transplanted patient with late acute myocardial rejection, complicated by cardiogenic shock. A long cardiopulmonary resuscitation was required. Only the circulatory support necessary to stabilize vital signs was used. Thirteen days of support resulted in complete myocardial and clinical recovery.

Keywords: ECMO; Acute late rejection; Cardiac transplantation; Circulatory assistance

1. Introduction

The frequency of rejection decreases with time after transplantation, with the highest risk during the first year. In spite of this, some patients develop acute late rejection, often, with sudden onset of low cardiac output and its consequences, frequently, evolving to cardiogenic shock. Because of the acute presentation, rapid and extensive hemodynamic support is needed for these compromised patients. Predictors of late graft rejection include subtherapeutic levels of immunosuppression, and young recipients [1–4].

We report a case of a young male, who developed late rejection >3A, presenting with cardiogenic shock, following a brief symptomatic period of cardiac failure, caused by non-compliance with medication. The patient was treated with percutaneous femoro-femoral Extra-Corporeal Membrane Oxigenator (ECMO) circulatory support for 13 days. Immunosuppression was re-established with antirejection medication, allowing a complete recovery of myocardial function.

2. Materials and methods

A 26-year-old man was transplanted because of idiopathic dilative cardiomyopathy. Three years later, he was referred to our department, with clinical suspicion of acute myocardial rejection. The patient was clinically stable (NYHA class I), with asthenia as the only symptom, and no other evidence or cardiac failure. Previous biopsies never documented rejection more than 2A. On this admission, chest X-ray demonstrated massive cardiomegalia and pulmonary venous congestion (Fig. 1). Endomyocardial biopsy was performed and it documented the presence of acute late rejection (3B Grade rejection with Type A Quilty lesions) [1] (Fig. 2A). Anti-rejection therapy was started: first a 7-day induction course with thymoglobuline (100 mg/day) and prednisone (125 mg, 3 times/day), followed by triple drug regimen of cyclosporine (1 mg/kg 2 times/day), Micofenolato Mofetil (1.5 g, 2 times/day) and metilprednison (1 mg/kg/day) [2].

Fig. 1. Chest X-ray during acute phase.

The following day, he collapsed in ventricular fibrillation. CPR was instituted per ACLS protocol, re-establishing sinus rhythm. Pulmonary catheter was placed and initial hemodynamic measurements were as follows: right atrial pressure 25 mmHg, pulmonary artery pressure 35/20 mmHg, pulmonary capillary wedge pressure of 26 mmHg, cardiac index 1.7 l/min·m^2, and systemic vascular resistance more

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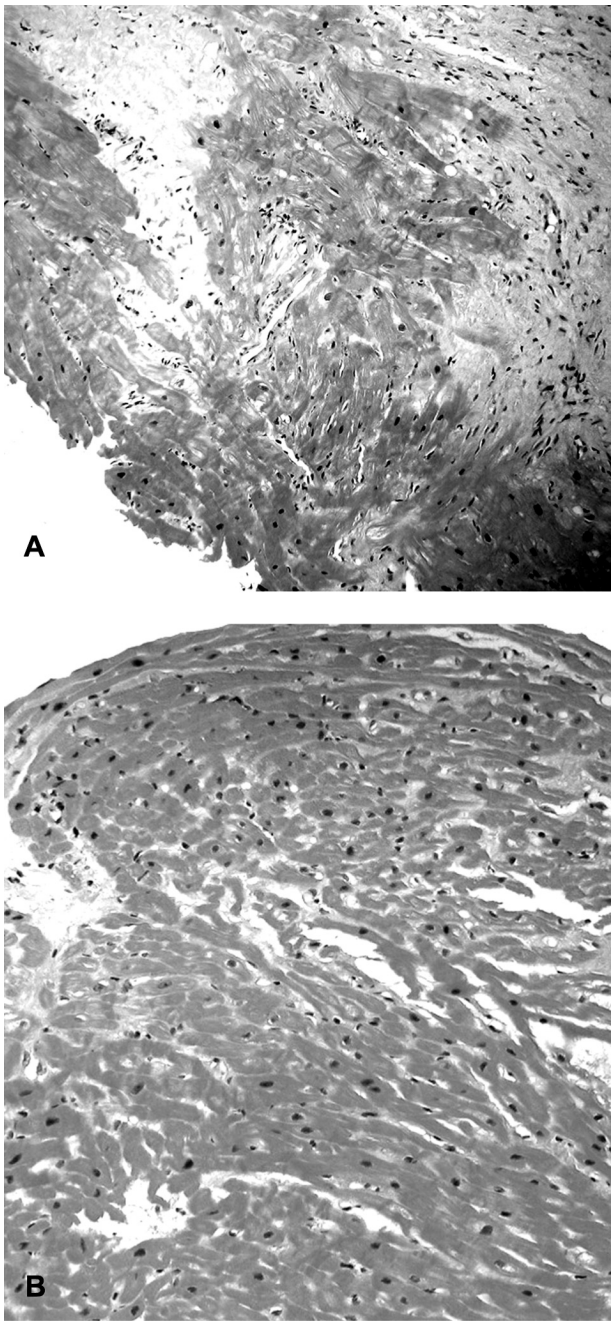

Fig. 2. A. Endomyocardial biopsy with 3B grade rejection. B. Endomyocardial biopsy after ECMO and antirejection therapy.

than 1000 dyn·cm^{-5}. After 3 h, and despite maximal inotropic drugs support (dopamine, adrenaline and nordadrenaline), the patient remained severely hypotensive without improvement in hemodynamic parameters. TEE documented a diffuse and marked bi-ventricular hypokinesia with left and right ventricular EF of 15%.

For mechanical support, he was cannulated for ECMO. A long (50 cm) 21-F cannula (Biomedicus-Medtronic, Inc.) was inserted percutaneously via the right common femoral vein to the right atrium under transesophageal echocardiographic control. An arterial 18-F cannula, 18 cm long (Biomedicus-Medtronic, Inc.) was placed in the left common femoral artery. ECMO circuit was comprised of: Heparined-bonded tubes (Jostra® A.G.), centrifugal pump (Rotaflow Jostra® A.G.) and a membrane oxigenator (Quadrox D BE-HMOD1010). The Szefner protocol for anticoagulation management was instituted: Heparine, aprotinin and dipiridamole [5]. The circulatory assistance started with 4.5 l/min. The patient became well perfused, urine output re-started, arterial blood gases were satisfactory and stable hemodynamic conditions were achieved. Activated coagulation Time (ACT) was maintained around 200 min.

3. Results

Twenty-four hours after ECMO started, acute renal failure was present. Ultrafiltration was then instituted, lasting 2 days after ECMO was stopped. After one week of circulatory support, TEE demonstrated recovery of the bi-ventricular contractility with left and right ventricular EF of 55% and 50%, respectively. The centrifugal pump outflow and inotropic support were progressively weaned. Complete recovery of renal failure was obtained. No other complications occurred.

The circulatory assistance was removed after 13 days. Three hours later the patient was weaned from ventilator and extubated. Transthoracic echocardiography documented a left and right ejection fraction of 50% and 40%, respectively. No lower extremity compromise occurred.

Endomyocardial biopsy was repeated one month later demonstrating a Grade 0 myocardial rejection (Fig. 2B).

One year later, the patient is in good clinical condition, NYHA class I, EF of 50% and creatinine of 1.5 mg/dl.

4. Discussion

Mechanical Circulatory Support Devices (MCSDs) have been advocated for support of patients with advanced heart failure as a 'bridge to cardiac transplantation', a 'bridge to recovery', or as an alternative to transplantation (i.e. destination therapy). ECMO has similarly been used for the first two indications [6–9]. The current devices available on the market, provide many options ranging from short to intermediate and long term duration. The devices can be also divided in mono-ventricular and/or biventricular support. From a technical point of view, pumps can be implanted paracorporeal or intracorporeal.

Most acute rejection episodes after heart transplantation occur in the first 6 to 12 months after transplantation, especially in younger and non complaint patients [4,8].

The rapidity of onset and the need to establish aetiology often precludes semi-elective or even urgent re-operation for placement of VADs. ECMO has been used extensively for rescue in the perioperative pediatric setting [7,9]. Percutaneous cannulae reduce the time necessary for cannulation and initiation of support too. The percutaneous femoral approach may reduce risks of infection and/or bleeding as compared to the re-sternotomy approach, but it does increase the risk of lower extremity hypoperfusion. The latter can be minimized by cannulating separate limbs for venous and arterial access, as in our case. ECMO support significantly unloads the right ventricle, indirectly unloads

the left ventricle and reduces pulmonary damage from pulmonary hemorrhages or mechanical ventilatory injury. IABP might be used in order to reduce left ventricle afterload allowing ventricular salvage.

During ECMO, repeated TEE monitoring confirmed optimal right atrium drainage and absence of LV distension.

In conclusion, acute late rejection is a reversal situation with prompt and adequate antirejection therapy, but, if not taken on time, can be a disastrous condition and could jeopardize the patient's life, as in the present case. ECMO may be extremely useful in these cases. The percutaneous peripheral cannulation allows a rapid implant of ECMO, with minimal risks. The procedure can be easily performed in the intensive care unit and lasts minutes. By cannulating a separate limb, low extremity ischemia may be reduced. There are many reports in literature about the use of ECMO in pediatric patients. Its use may be advised in adult patients, as a bridge to transplantation or recovery since it guarantees good organ perfusion and unloads left and right hearts. ECMO should be available in cardiac departments since it can be extremely useful in different situations of cardiogenic shock.

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