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Importance of LV Venting after ECMO Implantation in Post-Cardiotomy Syndrome: A Case Report

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Abstract

Prolonged cardiorespiratory support can be achieved with ECMO that may provide time for myocardial recovery, prevent multiorgan dysfunction and reduce mortality. Left ventricle (LV) distension can worsen already distended and hypocontractile heart. Early recognition and aggressive management of LV distension are essential for the treatment of patients with low cardiac output. The case report presented intends to show advantages of left ventricular venting on ECMO after post-cardiotomy shock. With direct flow measurements on bypass-grafts before and after the vent implantation, it was possible to clearly demonstrate the importance of venting for myocardial perfusion.

Keywords

Extracorporeal Membrane Oxygenation (ECMO), Left Ventricle Vent, Cardiac Distension, Post-Cardiotomy Syndrome

1. Introduction

Venoarterial extracorporeal membrane oxygenation (VA-ECMO) provides temporary cardiorespiratory support for patients in cardiogenic shock despite high-dose inotropic therapy. Post-cardiotomy cardiogenic shock has an incidence of 2% - 6% after routine adult cardiac surgery [1]. Prolonged cardiorespiratory support can be achieved with ECMO that may provide time for myocardial recovery, prevent multiorgan dysfunction and reduce mortality [2]. Left ventricle (LV) distension can worsen already distended and hypocontractile heart. Early recognition and aggressive management of LV distension are essen-

tial for the treatment of patients with low cardiac output [3].

2. Case Presentation

A 61-year-old male was referred from another institution, after suffering from acute myocardial infarction (MI). At the time of admission, the patient was stable and showed no signs of cardiogenic shock but severe LV dysfunction (LV ejection fraction [LVEF] 15%) on transthoracic echocardiographic (TTE) examination.

A coronary angiography showed triple-vessel coronary artery disease. The institutional Heart Team (including a cardiologist, cardiovascular surgeon, and anesthesiologist) made a decision for surgical revascularization.

A triple coronary artery bypass graft (a left internal mammary artery to the left anterior descending artery and two saphenous vein grafts to the obtuse marginal branch and right coronary artery) was performed. Levosimendan was started intraoperatively due to low EF. The procedure was done under cardiopulmonary bypass (CPB). Despite complete revascularization, CPB weaning was difficult because of bi-ventricular dysfunction but was achieved under high doses of inotropes and vasopressors.

Directly after CPB the patient developed low cardiac output which was refractory to high doses of vasoactive drugs (dobutamine, norepinephrine, and vasopressin). It was decided for central veno-arterial ECMO approach, due to peripheral artery disease (PAD). In order to eliminate bypass-graft failure, Transit Time Flow Measurement (TTFM) of grafts and Transophageal Echocardiography (TEE) were performed. TTFM showed low flow in all bypass-grafts and LV distension was detected on TEE (Figure 1). In order to decompress LV, vent

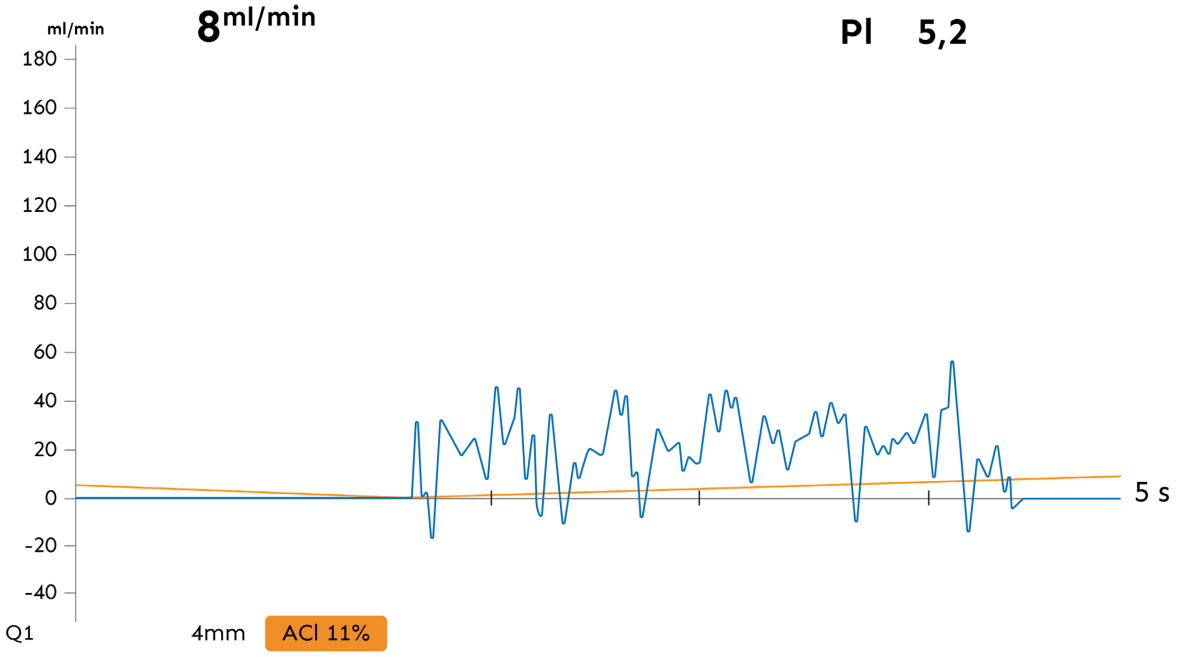

Figure 1. TTFM of bypass-graft on ECMO before venting.

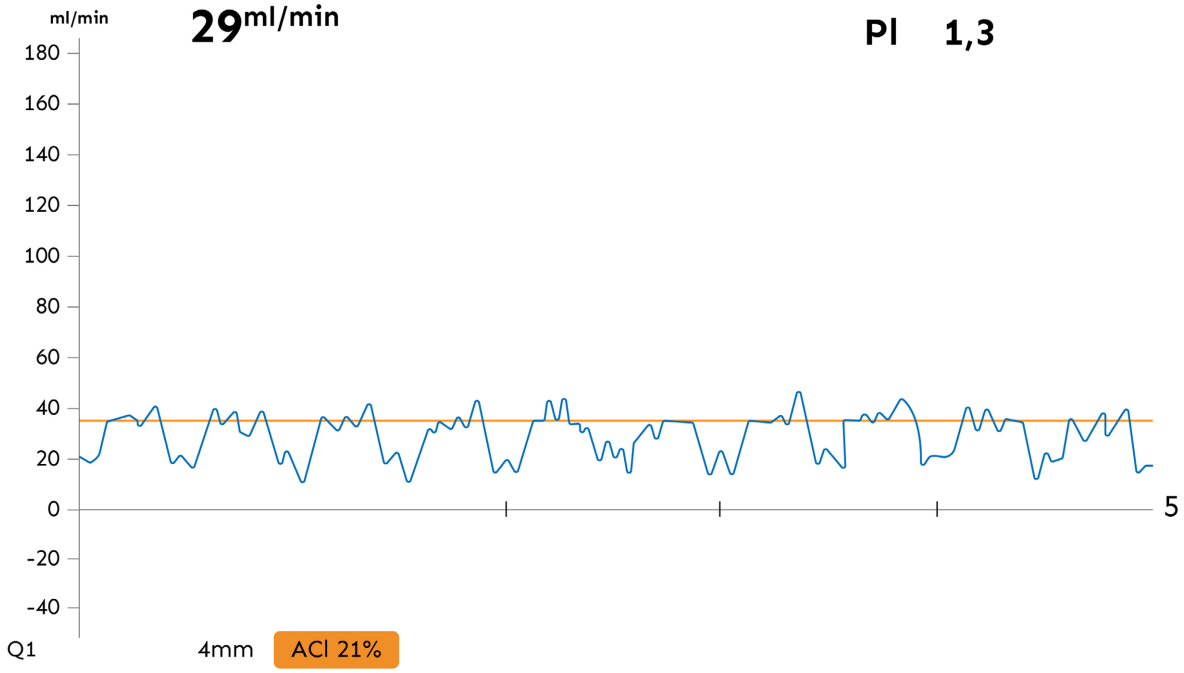

Figure 2. TTFM of bypass-graft on ECMO after venting.

was inserted via right superior pulmonary vein (RSPV). After LV decompression, significantly elevated blood flow was measured in all bypass-grafts (**Figure 2**).

The ECMO device (flow of 3.8 - 4 l/min) was placed for 7 days. While on ECMO, the patient had neither pump-related nor cannulation-related complications. However, LV ejection was maintained under low-dose inotropes with no signs of pulmonary congestion.

Weaning was done using an ultrasound-guided protocol and IV inotropic agent (dobutamine) was given up to 7 days postoperatively.

3. Discussion

LV distension on ECMO support is appreciated widely as treatment strategy [4]. The consequences of LV distension may worsen already distended and hypocontractile LV, making myocardial recovery more difficult. In addition to it, it can also cause pulmonary edema and contribute to LV thrombus formation from blood stasis [3].

As it is clearly shown in our case, one of the reasons for worse myocardial recovery is low coronary perfusion and low flow in bypass-grafts after CABG in distended LV. The use of Transient Time Flowmeter (TTFM) provides data on the flow (ml/min), pulsatility index (PI) and percentage of diastolic flow in grafts with which the graft patency can be assessed [5]. In our patient, we observed low values of flow (<10 ml/min) and high PI (>5) on TTFM, which are the signs of inadequate bypass-graft function, before venting and significantly better values (TTFM flow > 20 ml/min, PI < 2) afterwards (**Figure 1** and **Figure 2**).

It is obvious that chance of myocardial recovery after CABG operation is low if adequate myocardial perfusion will not be achieved. Furthermore, distension seen in our case, can lead to graft failure.

We believe that early ECMO implantation with venting is the best strategy for management of post-cardiotomy cardiogenic shock with LV distension, as it decreases not only preload and after load but also increases myocardial perfusion, as seen in our case [6].

The use of inotropes is the basic venting possibility but causes a modest decrease in LV distension. Mechanical circulatory support such as IABP, TandemHeart and Impella can be used to reduce LV distention. Percutaneous left atrial vents and open surgical placement of LV vent are other venting options that can be used when on ECMO (3).

4. Conclusion

Early recognition and aggressive management of LV distension in patients on ECMO have great importance after post-cardiotomy syndrome, especially, if the etiology of low cardiac output is low myocardial perfusion.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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