The hole of hope: Balloon atrial septostomy for left ventricle unloading during VA ECMO

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ABSTRACT

Veno arterial extracorporeal membrane oxygenation (VA-ECMO) is an established acute rescue therapy for cardiogenic shock (CS)(1). However, the increase in left ventricle (LV) afterload associated with inappropriate LV unloading remains an unsolved problem (2-4). Balloon atrial septostomy (BAS) is an inexpensive and effective procedure with low complication rates (2-6). Our purpose was to understand BAS effect in this setting.

OBJECTIVES

The objective of this study is to evaluate BAS results in patients with ECMO and cardiogenic shock with LV overload, through clinical and haemodynamic parameters.

METHODS

Observational retrospective study, including patients submitted to BAS for LV unload during VA-ECMO support for CS between 2018 and 2019. Inotropic use was evaluated by the Wernovsky inotropic score. Statistical analysis was performed by median comparison with Wilcoxon test for related samples.

RESULTS

Four patients with refractory CS in spite of VA-ECMO and intra aortic balloon pump (n=3) or Impella (n=1) were included. The median age was 55.5 years (IQR 46.8-64.3) and 75% were male. The basal median LV ejection fraction was 29.5%. All had severe mitral regurgitation with ischemic heart disease (n=3) or severe aortic stenosis (n=1). BAS was performed after a median time of 8 days (IQR 5.5-12.0) after ECMO with a dimension of 5 mm (IQR 5.0-5.0). The reduction in left atrial pressure led to resolution of pulmonary edema in all patients. There was hemodynamic improvement with lower inotropic use in 75% of patients (median difference -0,6; p= 1.00), and reduction in pulmonary pressures and lactate levels. An increase in LV outflow tract (LVOT) velocity time integral (VTI) and in PaO2/FiO2 ratio was documented. After a follow-up of 25.5 days (IQR 12.8-45.8) half of the patients were weaned from VA-ECMO or transplanted. One procedure was complicated by a femoral haematoma.

Table 1 – Evolution of patients submitted to percutaneous balloon atrioseptostomy.

Variables	Pre (median)	Pos (median)	p
ECMO flow (ml/min)	3.1	3.0	0.715
LV end-diastolic diameter index (mm/m2)	61.5	62.0	0.593
LV outflow tract VTI (cm)	8.0	11.6	0.109
LA mean pressure (mmHg)	33.5	16.5	0.068
RA mean pressure (mmHg)	9.0	7.0	0.109
LA-RA pressure gradient (mmHg)	23.5	8.5	0.068
Systolic PAP (mmHg)	52.0	29.0	0.465
Diastolic PAP (mmHg)	25.5	15.5	0.144
Medium PAP (mmHg)	35.0	20.0	0.144
Mixed venous saturation (%)	63.5	78.5	0.068
PaO2/FiO2 ratio	145.0	472.5	0.109
Lactate level (mmol/l)	1.95	1.30	0.068

ECMO- extracorporeal membrane oxygenation; LA- left atrium; LV- left ventricle; PAP- pulmonary artery pressure; PaO2- partial arterial O2 pressure in right radial artery blood; RA- right atrium; VTI- velocity time integral.

CONCLUSIONS

Percutaneous BAS is a simple and effective procedure to treat refractory pulmonary edema during VA-ECMO support. The improvement in LV performance, documented by the increase in LVOT VTI, is likely due to improvement in intracavitary pressures and a better oxygenation.

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