MECHANICAL UNLOADING OF THE LEFT VENTRICLE USING INTRAAORTIC BALLOON PUMP OR VENT IN VENO-ARTERIAL ECMO THERAPY IN CARDIOGENIC SHOCK

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INTRODUCTION

Cardiovascular diseases are the leading cause of death in the world and in our country. Among them, refractory cardiogenic shock is a condition associated with a high mortality rate in short term (greater than 60%), with early diagnosis and the establishment of an etiological treatment and effective circulatory support to prevent progression to a multiple organ failure that, when it occurs, worsens the prognosis of the disease even more.

ECMO VA therapy emerges as one of the alternatives for the treatment of refractory cardiogenic shock (understood as the persistence of a cardiac index lower than 1.8 l /min / m2 of SC despite support with two or more vasopressors a high doses and more than one inotropic). Depending on the etiology of the shock (ischemic, fulminant myocarditis, post cardiotomy), a central cannulation or peripheral cannulation can be performed.

Although ECMO VA has advantages over other types of circulatory mechanical supports (counter-pulsation balloon, heartmate, Impella) given the possibility of extracorporeal oxygenation and sweep C02, as well as a lower economic cost), this therapy entails the risk of increasing afterload of the left ventricle, which can produce early overdistension, manifested clinically in cardiogenic pulmonary edema and right ventricular failure.

In the literature there are reports of different ways to control the increase in LV afterload as well as multiple discussions about whether in any case of ECMO VA therapy it should be added a ventricular decompression strategy (BCIA, Vent, inotropics, impella).

ECMO VA therapy is what we currently use for the treatment of refractory cardiogenic shock. In our country we don't have Impella, so for the LV decompression we use, intra-aortic counter-pulsation balloon, vent and inotropic therapy. This is our strategy to prevent intracardiac repercussion with the greater risk of cardiac thrombosis, severe dysfunction and failure of ECMO therapy, that causes higher mortality and according to ELSO records is close to 60%.

OBJECTIVES

1. Determine if the ECMO VA therapy in refractory cardiogenic shock used in conjunction with inotropic support, ventilation or counter-pulsation balloon is associated with a better prognosis.
2. Describe the demographic, etiological and main complications of a cohort of patients in refractory cardiogenic shock treated in a 4-level hospital.
3. Describe the use of invasive hemodynamic variables and their association with the hemodynamic behavior and prognosis of patients with refractory cardiogenic shock.

METHODS

Retrospective observational study, we describe the quantitative, demographic and semi-quantitative variables, of patients that had ECMO therapy in the setting of cardiogenic shock.

RESULTS

A total of 18 clinical records of patients with ECMO were analyzed in which decompression of the left ventricle with balloon or Vent was used.

The demographic data of the population are shown in Table 1, were a greater number of men (72.2%), with an age range of 43 years (25-68), the highest percentage of diagnosis of cannulation was cardiogenic shock 66.7%, the most frequent clinical diagnosis was myocardial infarction (44.4%) followed by postoperative thromboendarterectomy (11.1%). The most frequent type of cannulation was peripheral (61%) vs central (38%), balloon was used in 88.9% of cases and vent in 11.1%.

The length of hospital stays showed an average of 23, 22 days with a range of 79 (1.80), evidenced in 61.1% of the cases more frequent renal failure KDIGO I (27.8%), 11.1% required dialysis. The outcome of ECMO weaning 38.9% patients died, the mortality at 30 was 55.6%.

In terms of the ejection fraction, it was evaluated in 3 periods at the beginning with range 60% (10% - 70%), on the first day 45% (10% - 55%) and the final day of therapy 50% (10% - 60%).

Table 1. Overall variables

DESCRIPTIVE STATISTICS ECMO (n=18)		
Variable		Value
Gender n (%)	Male	13 (72.2%)
	Female	5 (27.8%)
Age (years) Avarage ± desviastandard deviation Range (minimum- maximum)		52.33 ± 11.566 43 (25- 68)
Cannulation diagnosis	Cardiogenci Shock	12 (66.7%)
	Postsurgical	6 (33.3%)
Clinical diagnosis	Acute myocardial infarction	8 (44.4%)
	Ventricular collapse tachycardia	1 (5.6%)
	Postoperative CVM + RVM	1 (5.6%)
	Postoperative thromboendarteraectomy	2 (11.1%)
	Postoperative chnge aortic valvular and endocarditis	1 (5.6%)
	Heart transplant	3 (16.7%)
	Mitral valve replacement	1 (5.6%)
	Postoperative myocardial revascularization	1 (5.6%)
Type of cannulation	Peripheral	11 (61.1%)
	Central	7 (38.9%)
Drainage type	BCIA	16 (88.9%)
	Vent	2 (11.1)
Days of therapy (days) Avarage ± desviastandard deviation Range (minimum- maximum)		4.67 días ± 2.000 8 (1- 9) días
Initial ejection fraction of the left ventricle (%) n=15* Avarage ± desviastandard deviation Range (minimum- maximum)		26.00 ± 17.017 60% (10%- 70%)
One day ejection fraction of the left ventricle (%) Avarage ± desviastandard deviation Range (minimum- maximum)		22.72 ± 14.344 45% (10%- 55%)
Final ejection fraction of the left ventricle (%) n=16 Avarage ± desviastandard deviation Range (minimum- maximum)		34.63 ± 15.253 50% (10%- 60%)
Time in intensive care unit (days) Avarage ± desviastandard deviation Range (minimum- maximum)		12.72 ± 15.702 56 (1- 57)
Hospital stay (days) Avarage ± desviastandard deviation Range (minimum- maximum)		23.22 ± 23.785 79 (1- 80)

Table 2. Outcomes

HEMODYNAMIC VARIABLES		
OUTCOME		
Renal failure	No	7 (38.9%)
	KDIGO I	5 (27.8%)
	KDIGO II	3 (16.7%)
	KDIGO III	3 (16.7%)
Dialysis	No	16 (88.9%)
	Yes	2 (11.1%)
Weaning outocme	Dead	7 (38.9%)
	Alive	9 (61.1%)
Complications	No	9 (50%)
	Bleeding	6 (33.3%)
	Thrombosis	1 (5.6%)
	Femoral hematoma	1 (5.6%)
	Infection	1 (5.6%)
Cardiac arrest	No	16 (88.9%)
	Yes	2 (11.1)
30 - Day mortality	No	10 (55.6%)
	Yes	8 (44.4%)

Table 3. Hemodynamic Outcomes

Initial pulmonary artery pulsatiliti index Avarage ± desviastandard deviation Range (minimum- maximum)	1.07 ± 0.681 2.46 (0.36- 2.85)
One day pulmonary artery pulsatiliti index Avarage ± desviastandard deviation Range (minimum- maximum)	0.701 ± 0.326 1.15 (0.25- 1.40)
Final pulmonary artery pulsatiliti index Avarage ± desviastandard deviation Range (minimum- maximum)	1.611 ± 1.024 3.53 (0.22- 3.75)
Initial cardiac power output Avarage ± desviastandard deviation Range (minimum- maximum)	0.747 ± 0.320 1.20 (0.26- 1.46)
One day cardiac power output Avarage ± desviastandard deviation Range (minimum- maximum)	0.807 ± 0.207 0.93 (0.38- 1.31)
Final cardiac power output Avarage ± desviastandard deviation Range (minimum- maximum)	1.805 ± 0.426 1.36 (0.44- 1.80)
Initial pressure right atrium Avarage ± desviastandard deviation Range (minimum- maximum)	10.67 ± 2.990 11 (4- 15)
One day pressure right atrium Avarage ± desviastandard deviation Range (minimum- maximum)	12.25 ± 3.088 11 (5- 16)
Final pressure right atrium Avarage ± desviastandard deviation Range (minimum- maximum)	10.44 ± 3.687 13 (5- 18)

Table 4. Hemodynamic outcomes VS Mortality

MORTALITY CORRELATION

	30 Days mortality
Initial pulmonary artery pulsatility index	-0.537 (p= 0.026)
One day pulmonary artery pulsatility index	-0.334 (p=0.206)
Final pulmonary artery pulsatility index	-0.732 (p=0.001)
Initial cardiac power output	-0.295 (p=0.251)
One day cardiac power output	-0.430 (p=0.125)
Final cardiac power output	0.455 (p=0.111)

Figure 1. Diagnostics

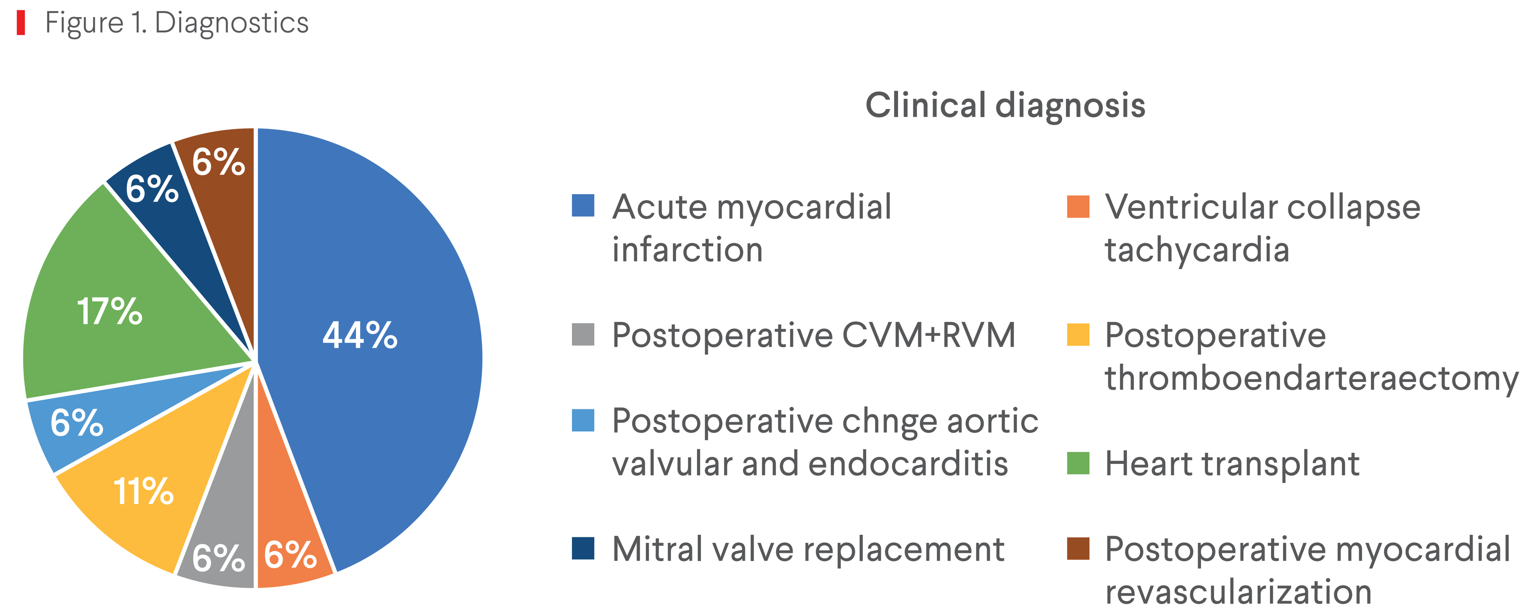


Figure 2. Mortality

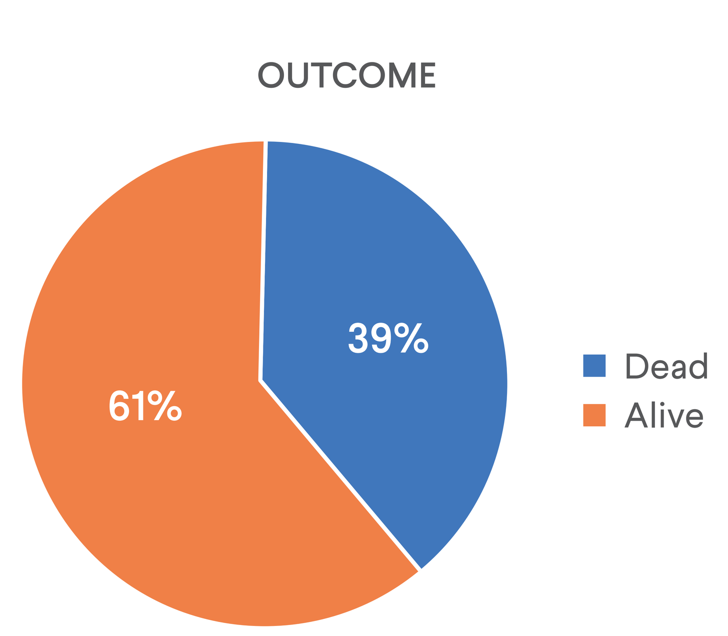
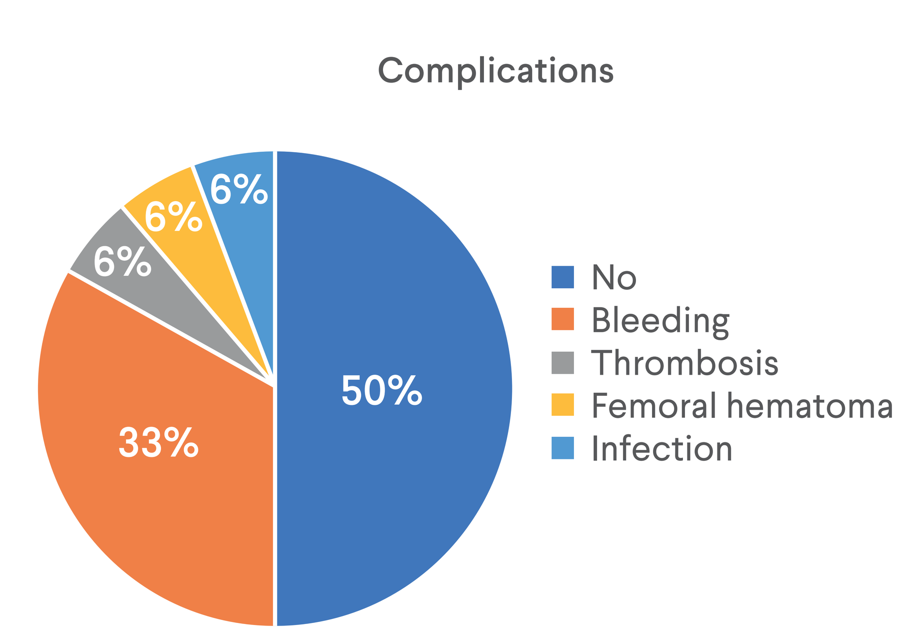


Figure 3. Complications



CONCLUSIONS

- In this retrospective observational study, an association with improvement in the survival of patients in refractory cardiogenic shock was found when they underwent ECMO VA therapy and use of inotropic supports plus mechanical decompression with BCIA or vent.
- We found a direct relation between the hemodynamic variable PApi and early mortality.