Impact of fluid balance on mortality of patients treated with veno-arterial extra corporeal membrane oxygenation

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Background and goal of study: Veno-Arterial Extra Corporeal Membrane Oxygenation (VA ECMO) is a mechanical support for refractory cardiogenic shock. Mortality observed for these patients remains high. Contrary to sepsis or ARDS, the impact of fluid balance is little studied, despite an intense inflammation and the need for fluid resuscitation. The purpose of this study was to identify fluid balance as a predictor for mortality in patients under VA ECMO.

Material and Methods: Single-center, retrospective and observational investigation in the cardiac surgical ICU of Rouen University Hospital. Patients requiring VA ECMO between March 2013 and May 2016 were included. Pregnant women, patient under 16 years old, patients deceased before 24 hours of admission in ICU and ECMO for ARDS were excluded. The primary outcome was the relationship between 1-day fluid balance and 28-day mortality. Secondary outcomes were the association with other biological and clinical pertinent characteristics during first day: RIFLE score, use of Renal Replacement Therapy (RRT) and troponins, bilirubin, transminases and creatinin during first 24h. Logistic regression (logit model) and Fisher or T-test were performed with MedCalc software. Univariable analysis presenting a p value < 0.1 were included in the multivariable analysis with a backward procedure (p< 0.05 was considered significant). Results are presented with mean or odds-ratio with 95% confidence intervals.

Results: 88 patients were included. Demographic data are presented table 1 Overall 28-day mortality was 53%. In dead patients, fluid balance at 1-day was higher (48.6 [30.9-66.3] vs 13.8 [4-23.6] mL/kg, p< 0,0001), weight gain (2.46% [1.06-3.87] vs 0.12 [-0.81-1.07]) and troponins were 5-fold higher (11469 [5829-17109] vs 2098 [1134-3060] ng/L, p=0,002). A good correlation was observed between day 1 weight gain and fluid balance (r=0.76, p<0.0001, figure 1). Multivariable analysis (figure 2) identified fluid balance>8.8 mL/kg (OR=7.4 [2-27.2]), SAPS-2>69 (OR=5.6 [1.7-18.1]), MDRD (OR=0.9 [0.95-0.99]) and troponin elevation>2611 ng/mL (OR=5.8 [1.9-17.7]) as statistically associated with mortality. Interest for fluid management is growing in critical patients. Nevertheless, no study has yet investigated its impact in selected patients with cardiogenic shock treated with VA ECMO. Our study suggested a possible association between fluid overload and mortality.

Conclusions: Fluid management is a key therapy during VA ECMO but fluid overload could be associated with worsen outcomes. Further studies are warranted before considering fluid restriction trials.

	Survivor (n=41)	Non-survivor (n=47)	p
Age (years)	51 (47-56)	53 (49-57)	0.53
Sex (M/F, %)	68/32	72/28	0.82
BMI (kg/m²)	28.1 (26-30)	27.2 (25.8-28.6)	0.45
SPAS-2	57.2 (51.3-63.1)	69.3 (63.4-75.1)	0.005
Indications for ECMO (%)			0.012
Myocardial stroke	2.4	8.9	
Poisoning	12.2	2.2	
Myocarditis	14.6	8.9	
Post cardiac bypass dysfunction	22	22.2	
Terminal cardiac failure	7.3	2.2	
Cardiac arrest	17.1	46.7	
Post cardiac arrest syndrome	12.2	11.1	
Worse TGO (IU/L)	928 (467-1389)	1661 (613-2709)	0.22
Worse TGP (IU/L)	497 (277-717)	648 (249-1050)	0.52
Worse bilirubin (mmol/L)	32 (22-42)	26 (19-33)	0.34
Worse troponin (ng/ml)	3051 (1135-3061)	11470 (5829-17110)	0.003
Worse MDRD (ml/min/m²)	46 (39-54)	37 (31-42)	0.03
Hemofiltration (%)	24	40	0.11
Day 1 weight variation (%)	+0.12 (-0.81-1.07)	+2.46 (1.06-3.87)	0.009
Day 1 fluid balance (ml/kg)	+13.82 (4-23.6)	+48.6 (31-66.3)	0.01

Table 1 demographic data and univariable results

Figure 1: Pearson correlation between day 1 weight gain and fluid balance

Figure 2: Multivariable analysis of predictors of 28-days mortality. Odds-ratio with 95% confidence intervals