Impact of temporary mechanical circulatory support on mortality in cardiogenic shock: an emulated target trial with a prospective, multicenter, French cohort study

A. Ughetto[1], J. Eliet[1], N. Nagot[2], H. David[1], F. Bazalgette[3], G. Marin[2], M. Mourad[1], S. Kollen[4], P. Gaudard[1], P. Colson[1]

[1]University Hospital Arnaud de Villeneuve, Department of Anesthesiology and Critical Care Medicine, Montpellier, France; [2]University of Montpellier, Epidemiology and Clinical Research, Montpellier, France; [3]University Hospital of Nimes, Department of Critical care medicine, Nimes, France; [4]Perpignan Hospital Centre, Department of Critical care medicine, Perpignan, France

Funding Acknowledgement: Type of funding sources: None.

Background: The field of temporary mechanical circulatory support (TMCS) has advanced in last decade justifying that TMCS is increasingly used for treatment of refractory cardiogenic shock (CS). Nevertheless, the efficacy of TMCS (extracorporeal life support (ECLS) and Impella) in CS remains controversial due to the lack of high-quality evidence. The aim of this prospective multicenter observational study simulating a randomized trial was to assess the impact of TMCS on the hospital mortality in patients with CS.

Methods: This study (ClinicalTrials.gov ID: NCT03528291) was conducted at 3 TMCS centers organized in a cardiac assistance network, one as a level 1 TMCS center (expert center), and 2 as level 2 centers (hub centers). The study was designed and led by the heart team of the expert center with input from the hub centers.

All patients admitted to an intensive care unit between July 2017 and May 2020 either directly at the TMCS centers or after transfer from a non-specialized hospital, were screened for TMCS indication provided they were admitted for CS. CS was defined according to the European Society of Cardiology criteria. Were excluded patients younger than 18 years, CS after cardiac surgery, or after cardiac arrest if it was refractory or with a no flow >3 min and/or out-of-hospital cardiac arrest with non-shockable rhythm, or CS in the context of myocardial infarction complications, massive pulmonary embolism, and if TMCS was contraindicated

TMCS indication was decided after a multidisciplinary discussion carried out by the "heart team". Implantation of TMCS resulted from an agreement of the heart team within the first 24 hours after admission mainly based on the initial severity of the CS, or if CS was refractory to the medical treatment.

The primary outcome was in-hospital survival. A propensity score-weighted analysis was done for treatment-effect estimation. This method, which weights each patient according to their propensity score, includes all participants in the analysis.

Results: 246 patients with CS were included in the study: 121 in TMCS group (72% ECLS, 14% Impella, 14% both ECLS and Impella) and 125 in control group. After adjustment by a propensity score, hospital mortality was comparable in the two groups (32% TMCS group vs 27% control group; Odds ratio with TMCS, 1.28; 95% confidence interval, 0.87 to 1.88; p=0.21). Mortality at D180 was also similar in the two group (33% vs 30% respectively; p=0.51). Thromboembolic events were significantly higher in the TCMS group (14% vs 4%; p<0.01) as well as the transfusion rate ((median (IQR); 4.0 (0.0; 9.0) vs 0.0 (0.0; 0.0); p<0.01).

Conclusion: In our study, the use of TMCS does not seem to improve hospital survival in patients with cardiogenic shock. Thus, TMCS, which are iatrogenic side effects providers, should be reserved for the most severe patient and discussed by a multidisciplinary team.

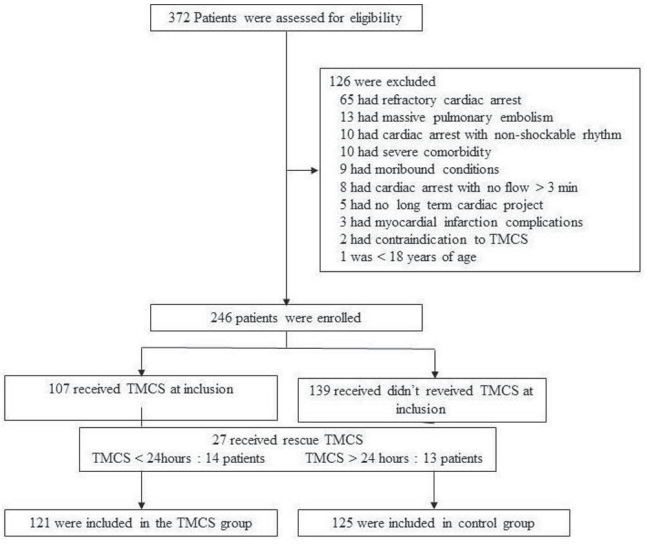

Figure 1: Eligibility, Inclusion and Follow up of study patients

Flow chart

Table 2. End Points and Adverses Events– inverse probability of treatment weighted data

End Point	TMCS Group (N=121)	Control Group (N=125)	P Value
Primary end point : hospital mortality — no. (%)	39 (32.1)	33 (27.0)	0.21
Secondary end points			
Mortality at 28 days — no. (%)	38 (31.6)	32 (26.4)	0.20
Mortality at 180 days — no. (%)	40 (33.1)	37 (30.3)	0.51
Median length of stay (interquartile range) — days			
In the ICU	11.0 (7.0 ;23.0)	5.0 (0.0 ;11.0)	< 0.01
In the hospital	29.0 (16.0 ;49.0)	15.0 (10.0 ;24.0)	< 0.01
Median length of mechanical ventilation (interquartile range) — days	9.0 (3.0 ;16.0)	1.0 (0.0 ;6.0)	< 0.01
Renal replacement therapy — no. (%)	2 (1.6)	3 (2.6)	0.44
Quality of life — (SF36 score)	54.0 (36.0 ;80.0)	63.0 (36.0 ;79.0)	0.73
Event			
Bleeding			
RBC transfusion (median(IQR)	4.0 (0.0 ;9.0)	0.0 (0.0 ;0.0)	< 0.01
FFP transfusion (median(IQR)	0.0 (0.0 ;2.0)	0.0 (0.0 ;0.0)	NA
Platelets transfusion (median(IQR)	0.0 (0.0 ;0.0)	0.0 (0.0 ;0.0)	NA
Arterial thrombo embolic events	26 (21.0)	11 (9.0)	< 0.01
Stroke — no. (%)	9 (7.4)	7 (5.6)	
Digestive ischemia — no. (%)	2 (1.6)	1 (0.8)	
Leg ischemia — no. (%)	10 (8.3)	3 (2.4)	
Hemolysis — no. (%)	17 (14.0)	5 (4.0)	< 0.01
Blood Infection — no. (%)	8 (6.8)	0 (0.0)	< 0.01