Comparison of mechanical circulatory support with venoarterial extracorporeal membrane oxygenation or Impella for patients with cardiogenic shock: a propensity-matched analysis

G. Chatzis1, N. Patsalis1, B. Markus1, C. Waechter1, F. Ausbuettel1, U. Luesebrink1, K. Sassani1, H. Schuett1, D. Divchev1, K. Karatolios1, B. Schieffer1, S. Syntila1

1Philips University of Marburg, Cardiology, Angiology, Internal Medicine and Intensive Care Unit, Cardiac Arrest Marburg, Marburg, Germany
On behalf of MARPELLA Investigators

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Background: Percutaneous mechanical circulatory support (pMCS) devices are increasingly used in patients with cardiogenic shock (CS) in order to augment cardiac output, stabilize hemodynamics and ensure adequate organ perfusion avoiding or minimizing the detrimental effects of catecholamines to the vasculature. Impella and venoarterial extracorporeal membrane oxygenation (vaECMO) are the main representatives of the available pMCS devices. However, evidence from randomized studies comparing these devices are lacking and optimal choice of the device type in the setting of CS remains unclear.

Purpose: Our aim was to conduct a head-to-head comparison of Impella with vaECMO in the setting of all-cause cardiogenic shock.

Methods: Retrospective single center analysis of patients with CS over a 5-year period. Patients were assisted with either Impella 2.5/CP or vaECMO. Patients supported ultimately with both devices were analyzed according to the first device implanted. Primary outcomes were hospital and 6-month survival. Secondary endpoints were complications. Survival outcomes were compared using propensity-matched analysis to account for differences in baseline characteristics between both groups. Patients with ongoing resuscitation without return of spontaneous circulation on admission were excluded.

Results: A total of 423 patients were included (Impella, n=300 and VA-ECMO, n=123). The main cause of CS was an acute myocardial infarction (372 patients, 87.4% in the Impella group and 83% in the vaECMO group), while 44.7% of the patients were prior resuscitated (39% Impella, 58% vaECMO). Survival rates were similar in both groups (hospital survival: Impella 47.7% and vaECMO 37.3%, p=0.07; 6-month survival Impella 45.7% and vaECMO 35.8%, p=0.07). After adjustment for baseline differences with a propensity scoring matching analysis, survival rates remained comparable between the two device groups (hospital survival: Impella 50.6% and vaECMO 38.6%, p=0.16; 6-month survival Impella 45.8% and vaECMO 38.6%, p=0.43) (Figure 1). Device-associated complications, such as access site bleeding and leg ischemia occurred more frequently in patients with vaECMO (17% versus 7.3%, p=0.004; 17% versus 7.7%, p=0.008). In the subgroup analysis, Impella and VA-ECMO did not demonstrate any statistically significant differences in the survival rates, expect for the group of prior resuscitation, where Impella appeared to be superior than vaECMO (Figure 2).

Conclusions: In the biggest so far single center analysis, treatment with Impella 2.5/CP or VA-ECMO was associated with similar hospital and 6-month survival rates. Device-related access site vascular complications occurred more frequently in the vaECMO group. A randomized trial is warranted to examine the effects of these devices on outcomes and to determine the optimal device choice in patients with CS.
| Variable      | Pat. No | Impella | vaECMO | Relative Risk (95% C.I.) | p   |
|---------------|---------|---------|--------|--------------------------|-----|
| Age <67       | 84      | 16      | 25     | 1.36 (0.57 to 3.2)       | 0.2 |
| Age >67       | 82      | 24      | 26     | 2.4 (0.92 to 6.3)        |     |
| CCI <4        | 87      | 11      | 25     | 2.36 (0.96 to 5.78)      | 0.08|
| CCI >4        | 79      | 31      | 26     | 2.24 (0.76 to 6.54)      |     |
| Prior CPR No  | 91      | 27      | 19     | 0.88 (0.38 to 2.01)      | <0.05|
| Prior CPR Yes | 75      | 14      | 32     | 3.2 (1.2 to 8.5)         |     |
| Lactate <7.13 | 84      | 13      | 21     | 2.14 (0.89 to 5.15)      | 0.4 |
| Lactate >7.13 | 82      | 29      | 26     | 0.74 (0.41 to 1.46)      |     |
| Vasoactive Score <54 | 83 | 14 | 20 | 1.62 (0.67 to 3.9) | 0.67 |
| Vasoactive Score <54 | 83 | 14 | 20 | 2 (0.78 to 5.36) |     |
| pH >7.3       | 73      | 18      | 17     | 1.34 (0.8 to 2.17)       | 0.3 |
| pH <7.3       | 93      | 24      | 31     | 0.56 (0.26 to 1.2)       |     |