

# ECMO and Impella in Cardiogenic Shock: Choosing the Right Mechanical Circulatory Support to Improve Clinical Outcomes

**Objective:** To evaluate the outcomes of patients supported with temporary mechanical circulatory support (MCS) in patients with cardiogenic shock and assess the impact of a decision algorithm as a tool for outcomes improvement.

**Methods:** Patients implanted with temporary MCS for cardiogenic shock locally between January 2010 and December 2020, and who were supported by either an Impella (CP and 5.0) or VA-ECMO were reviewed. Patients with postcardiotomy shock or out-of-hospital cardiac arrest were excluded. A local decision algorithm recommends Impella in cardiogenic shock with isolated left ventricular failure and ECMO in cases of biventricular or multi-organ failure. The clinical outcomes of patients who were managed according to the decision algorithm (Per protocol: PP group) with those who didn't (Off-protocol: OP group) were compared. **Results:** Among the 75 patients included, 15 (20%) were in the OP group, with 11 patients being supported with Impella instead of VA-ECMO, and 4 patients being supported with VA-ECMO instead of Impella. In the OP group, patients tend to be older ( $58\pm 10$  vs.  $51\pm 13$ ,  $p=0.06$ ), but with less severe disease, as demonstrated by less frequent biventricular failure (13% vs 59%,  $p=0.001$ ), lower bilirubin level ( $16\pm 12$  vs  $30\pm 33$ ,  $p=0.04$ ) and a higher proportion of patients in SCAI stage D (60% vs 32%,  $p=0.04$ ) compared to stage E (27% vs 52%,  $p=0.08$ ). Other baseline characteristics were comparable between the two groups. The rates of successful weaning (33% vs 40%,  $p=0.62$ ), 30-day survival (47% vs 55%,  $p=0.58$ ), and discharged home at 30 days (27% vs 32%,  $p=0.71$ ) were similar between the groups. According to adherence to the decision algorithm (OP group), patients who received an Impella instead of an ECMO had significantly worse outcomes (Successful weaning: 9 vs 62%,  $p=0.01$  and 30-day survival: 23 vs 77%,  $p=0.04$ , for OP and PP groups respectively). By contrast, the four patients in the OP group who initially received a VA-ECMO instead of an Impella were all alive at 30 days.

**Conclusions:** In cardiogenic shock, adherence to a decision algorithm for temporary MCS selection (Impella in case of isolated left ventricular failure and ECMO for biventricular or multi-organ failure) is associated with improved outcomes. Only deviation from protocol using an Impella instead of ECMO is associated with dismal outcomes. Our simple algorithm can help direct shock teams towards support strategies for optimal outcomes.

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Variables Mean $\pm$ SD or n (%)	All (n=75)	PP (n=60)	OP (n=15)	p-value
Biventricular failure	37 (49)	35 (59)	2 (13)	<b>0.001</b>
SCAI score				
SCAI score C	12 (16)	10 (17)	2 (13)	0.71
SCAI score D	28 (62)	19 (32)	9 (60)	<b>0.04</b>
SCAI score E	35 (47)	31 (52)	4 (27)	0.08
Arrest modifier	27 (36)	23 (38)	4 (27)	0.43
First shockable rhythm	17 (63)	15 (65)	2 (50)	0.28
ROSC time	25 $\pm$ 20	27 $\pm$ 20	16 $\pm$ 11	0.23
Type of MCS				
Impella CP	11	7 (12)	4 (27)	0.15
Impella 5.0	13	6 (10)	7 (47)	<b>&lt;0.001</b>
Upgraded to ECMO	2 (3)	1 (8)	1 (9)	0.90
VA-ECMO	51	47 (78)	4 (27)	<b>&lt;0.001</b>
Concomitant IABP	47 (63)	37 (62)	10 (67)	0.72
Outcomes				
Successful weaning $\S$	29 (39)	24 (40)	5 (33)	0.62
LVAD or HTx	18 (24)	16 (27)	2 (13)	0.26
30-day Survival	40 (53)	33 (55)	7 (47)	0.58
Out-of-hospital 30-day survival	23 (31)	19 (32)	4 (27)	0.71

$\S$  Successful weaning indicates removal of the device with a survival of at least 24h, without the need for a new temporary mechanical support device, long term ventricular assist device or transplant. Significant p-values are indicated in bold, with a threshold for statistical significance at 0.05