Mechanical circulatory support in fulminant myocarditis: a single center experience

Lucija Grbić[1], Dubravka Šipuš[2]*, Luka Perčin[2], Dora Fabijanović[2], Marijan Pašalić[2], Hrvoje Jurin[2], Ivo Planinc[2], Jure Samardžić[1,2], Maja Čikeš Vodušek[1,2], Boško Skorić[1,2], Davor Miličić[1,2], Daniel Lovrić[2]

[1]University of Zagreb, School of Medicine, Zagreb, Croatia
[2]University Hospital Center Zagreb, Zagreb, Croatia

RECEIVED:
October 13, 2024
ACCEPTED:
October 31, 2024

KEYWORDS: myocarditis, extracorporeal membrane oxygenation.
CITATION: Cardiol Croat. 2024;19(11-12):553-4. | https://doi.org/10.15836/ccar2024.553

***ADDRESS FOR CORRESPONDENCE**: Dubravka Šipuš, Klinički bolnički centar Zagreb, Kišpatićeva 12, HR-10000 Zagreb, Croatia. / Phone: +385-91-7344-878 / Email: dubravka.sipus@gmail.com

ORCID: Lucija Grbić, https://orcid.org/0009-0009-0013-9858 • Dubravka Šipuš, https://orcid.org/0000-0002-5631-0353
Luka Perčin, https://orcid.org/0000-0003-0497-6871 • Dora Fabijanović, https://orcid.org/0000-0003-2633-3439
Marijan Pašalić, https://orcid.org/0000-0002-3197-2190 • Hrvoje Jurin, https://orcid.org/0000-0002-2599-553X
Ivo Planinc, https://orcid.org/0000-0003-0561-6704 • Jure Samardžić, https://orcid.org/0000-0002-9346-6402
Maja Čikeš, https://orcid.org/0000-0002-4772-5549 • Boško Skorić, https://orcid.org/0000-0001-5979-2346
Davor Miličić, https://orcid.org/0000-0001-9101-1570 • Daniel Lovrić, https://orcid.org/0000-0002-5052-6559

Introduction: Fulminant myocarditis (FM) is a severe and rapidly progressive cardiac inflammatory disease which has historically high mortality rates of >50%. However, recent improvements in treatment options, especially in mechanical circulatory support (MCS), have significantly enhanced survival rates[1,2]

Patients and Methods: We retrospectively analyzed data from patients who required MCS for FM from the beginning of 2023 to the present. We used descriptive statistical methods to analyze demographic and epidemiological data, treatment options, laboratory data and outcomes.

Results: Since the beginning of 2023, eight patients admitted for FM required MCS. 50% were male, median age 40 years (range 18 – 55 years). The cause of FM was *Influenza* in 4 cases, *SARS-CoV-2* in 1 case, *S. pyogenes* in 1 case, while the etiology remains unknown in 2 cases. Before the initiation of MCS, median lactates were 10.55 mmol/L (range 2 – 13.6 mmol/L) and median mean arterial pressure was 68.5 mmHg (range 45 – 85 mmHg). All patients were on inotropic support with dobutamine (median dose 9.72 mcg/kg/min, range 4.48 – 16.6mcg/kg/min) and two received additional milrinone at a dose of 0.5 mcg/kg/min. Four patients required support with norepinephrine (median dose 0.26 mcg/kg/min, range 0.11 – 0.4 mcg/kg/min) and two required additional support with argipressin and angiotensin II. Upon admission, laboratory findings showed a median NT-proBNP of 18,069 ng/L (range 3,373–25,252 ng/L), median troponin I of 3,929.5 ng/L (range 8.5–>50,000 ng/L), and median CRP of 69.3 mg/L (range 2.60–268.7 mg/L). Three patients were placed on venoarterial extracorporeal membrane oxygenation (VA-ECMO) for transport to University Hospital Center Zagreb. In total, 6 patients required VA-ECMO support, of whom 4 needed left ventricular unloading (2 with Impella and 2 with ProtekSolo), and 2 required reconfiguration of the ECMO circuit to VAV ECMO due to poor oxygenation. One patient was solely on Impella CP support, and one patient was solely on VV ECMO support. Median MCS support time was 216 hours (range 98 – 480 hours). All patients were successfully weaned from MCS, although one patient died due to MCS complications. In one case, heart function did not recover, leading to the implantation of long-term MCS. Full patients' data are shown in **Table 1** and **Figure 1**.

Conclusion: Our data support the finding that MCS should be considered in FM and that MCS can be associated with promising results.

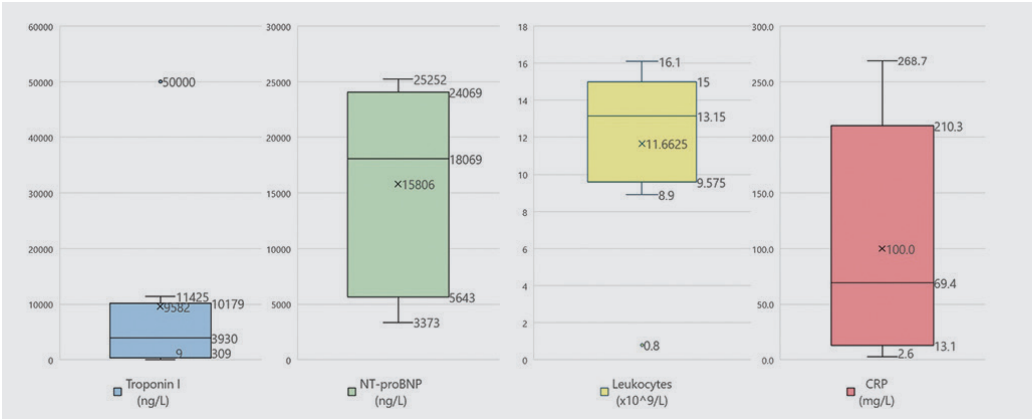

FIGURE 1. Laboratory parameters.
NT-proBNP = N-terminal prohormone of brain natriuretic peptide; CRP = C-reactive protein

TABLE 1. Patient characteristics.

	1	2	3	4	5	6	7	8
Gender	Male	Male	Male	Male	Female	Female	Female	Female
Age (years)	52	52	21	29	18	41	55	38
BMI (kg/m^2)	24.3	22.5	26.5	28.8	18.4	20.3	29.4	16.6
Comorbidities	Asthma Gastritis	Emphysema Gastritis Smoking	/	Smoking	/	Scleroderma Smoking	Hypertension Hypothyroidism	Asthma Smoking
Etiology	Influenza B	Influenza A	?	Influenza B	?	SARS-CoV-2	Influenza A	S. pyogenes
ECHO, admission:								
EF (%)	20	10	15	35	35	15	35	40
TAPSE (mm)	/	5	11	10	/	26	18	12
MAP (mmHg)	80	49	81	85	45	70	67	48
Lactate (mmol/L)	/	13.5	/	4.6	12	9.1	13.2	2
Inotropes/ vasopressors	**Dobutamine** 7.84 mcg/kg/min **Levosimendan**	**Dobutamine** 10.26 mcg/kg/min **Norepinephrine** 0.31 mcg/kg/min	**Dobutamine** (unknown dose)	**Dobutamine** 4.48 mcg/kg/min **Milrinone** 0.5 mcg/kg/min	**Dobutamine** 16.6 mcg/kg/min, **Norepinephrine** 0.33 mcg/kg/min	**Dobutamine** 9.72 mcg/kg/min **Milrinone** 0.5 mcg/kg/min	**Dobutamine** 11.1 mcg/kg/min **Norepinephrine** 0.4 mcg/kg/min **Argipressin** **Angiotensin II** 20 ng/kg/min	**Dobutamine** 9 mcg/kg/min, **Norepinephrine** 0.11 mcg/kg/min **Argipressin** **Angiotensin II** 40 ng/kg/min
MCS	VA ECMO Impella	VAV ECMO	VAV ECMO Impella	VA ECMO ProtekSolo	VA ECMO ProtekSolo Impella	Impella	VAV ECMO Impella	VV ECMO
MCS duration (h)	98	480	135	240	321	192	480	100
Hemodialysis/ filters	/	CVVHDF + Oxiris	Cytosorb	/	CVVHDF Cytosorb+Seraph	/	CVVHDF + Cytosorb	CVVHDF + Oxiris
Corticosteroids	Methylprednisolone	Methylprednisolone Hydrocortisone	Methylprednisolone Hydrocortisone	Methylprednisolone	Methylprednisolone Hydrocortisone	Methylprednisolone	Methylprednisolone Hydrocortisone	Methylprednisolone Hydrocortisone
Immunoglobulins	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Complications	Death	Sepsis GI Bleeding Limb ischemia	Harlequin syndrome	Sepsis	Sepsis	/	Impella thrombosis	Limb ischemia
ECHO, discharge:								
EF (%)	50	50	40	58	15	63	45	50
TAPSE (mm)		13	18	20	5	26	18	12
Outcome	Death	Discharged	Discharged	Discharged	LVAD implantation	Discharged	Discharged	Discharged

BMI = body mass index; CVVHDF = continuous venovenous hemodiafiltration; ECHO = echocardiography; EF = ejection fraction; LVAD = left ventricular assist device, MAP = mean arterial pressure; MCS = mechanical circulatory support; TAPSE = tricuspid annular plane systolic excursion; VA/VAV/VV ECMO = veno-arterial/veno-venous/veno-venous extracorporeal membrane oxygenation

LITERATURE

1. Hang W, Chen C, Seubert JM, Wang DW. Fulminant myocarditis: a comprehensive review from etiology to treatments and outcomes. Signal Transduct Target Ther. 2020 Dec 11;5(1):287. https://doi.org/10.1038/s41392-020-00360-y
2. Mody KP, Takayama H, Landes E, Yuzefpolskaya M, Colombo PC, Naka Y, et al. Acute mechanical circulatory support for fulminant myocarditis complicated by cardiogenic shock. J Cardiovasc Transl Res. 2014 Mar;7(2):156-64. https://doi.org/10.1007/s12265-013-9521-9