Characteristics of COVID-19 related ARDS patients treated with veno-venous ECMO support and conventional management: the ECMO referral Turin hospital experience.

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Background

Veno-venous extracorporeal membrane oxygenation (VV-ECMO) has been proposed as a rescue therapy for severe COVID-19 related ARDS, refractory to conventional management strategies [1-2]; however, its effectiveness in COVID-19 treatment algorithm is still unconfirmed.[3] We report the ECMO referral Turin hospital experience, comparing patients with COVID-19 related ARDS treated with VV-ECMO and conventional management.

Methods

Demographic characteristics and clinical data of all adult patients with severe COVID-19 related ARDS, intubated and mechanically ventilated in the Intensive Care Unit (ICU) at "Città della Salute e della Scienza" Hospital (Turin, Italy), between February and December 2020, were collected retrospectively.

Results

115 patients were admitted to ICU and 35 required VV-ECMO support. VV-ECMO patients were significantly older, with higher BMI and SOFA score at ICU admission. Time between patients' hospitalization to invasive mechanical ventilation (IMV) was longer in ECMO patients (5, IQR:1-11 versus 3, IQR:1-6), similarly to noninvasive support ventilation days. Patients in the ECMO group required more rescue therapies.

The median ICU and hospital length of stay were 11 (IQR:6-22) vs 28 (IQR:18-40) days and 27 (IQR:17-38) vs 34 (IQR:23-46) days in conventional versus ECMO patients, respectively; median length of IMV was higher in the ECMO group (21 days, IQR12-34 vs 9 days, IQR:5-18); the overall mortality was 61.7%, 87.7% and 51.2% in ECMO and in conventional patients, respectively. (Table 1)

Table 1. Comparison between patients with severe COVID-19 related ARDS treated with conventional therapies versus VV-ECMO support.

	TOTAL (N=115)	Conventional Group (N=80)	VV-ECMO Group (N=35)	p-value
Age, years, median (IQR)	63 (55-71)	68 (59-73)	54 (50-61)	**< 0.001**
BMI, median (IQR)	27.8 (26.0-31.6)	27.7 (25.5-31.2)	29.4 (27.6-32.4)	**0.015**
Gender (male), n (%)	91 (79.1)	62 (77.5)	29 (82.9)	0.515
Absence of comorbidity, n (%)	17 (14.8)	10 (12.5)	7 (20.0)	0.297
Cardiomyopathy (no HTA)	16 (13.9)	16 (20.0)	0	**0.003**
Hypertension	68 (59.1)	55 (68.8)	13 (37.1)	**0.002**
Chronic lung disease	14 (12.2)	10 (12.5)	4 (11.4)	1.000
Chronic kidney disease	6 (5.2)	6 (7.5)	0	0.175
Diabetes mellitus	21 (18.3)	17 (21.3)	4 (11.4)	0.296
SOFA at ICU admission, median (IQR)	7 (5-10)	5 (4-8)	9 (7-12)	**< 0.001**
Days from symptoms to hospitalization, median (IQR)	5 (2-7)	6 (1-9)	4 (3-7)	0.210
Days from hospitalization to IMV, median (IQR)	3 (1-7)	3 (1-6)	5 (1-11)	0.034
Days from IMV to ECMO, median (IQR)	-	-	5 (2-7)	-
Non-invasive ventilatory support (NIV-S):				
HFNC, n (%)	17 (14.8)	15 (18.8)	2 (5.7)	0.089
CPAP/NIV, n (%)	93 (80.9)	62 (77.5)	31 (88.6)	0.204
Days of NIV-S, median (IQR)	3 (1-6)	2 (1-5)	5 (2-9)	**0.008**
Rescue therapies, n (%)				
Curarization	106 (92.2)	71 (88.8)	35 (100)	**0.055**
iNO	27 (23.5)	12 (15.0)	15 (42.9)	**0.001**
Prone positioning	81 (70.4)	51 (63.7)	30 (85.7)	**0.018**
Steroids	91 (79.1)	60 (75.0)	31 (88.6)	0.135
Tocilizumab	21 (18.3)	10 (12.5)	11 (31.4)	**0.016**
Hyperimmune serum	11 (9.6)	7 (8.8)	4 (11.4)	0.733
Remdesevir	23 (20.0)	9 (11.3)	14 (40.0)	**< 0.001**
Outcomes:				
Length of IMV, days, median (IQR)	12 (6-24)	9 (5-18)	21 (12-34)	**0.006**
Length of ECMO, days, median (IQR)	-	-	16 (9-23)	-
ICU length of stay, days, median (IQR)	16 (9-27)	11 (6-22)	28 (18-40)	**< 0.001**
Hospital length of stay, days, median (IQR)	28 (18-40)	27 (17-38)	34 (23-46)	0.063
Mortality, n (%)	71 (61.7)	41 (51.2)	30 (85.7)	**< 0.001**

List of abbreviations: COVID-19: Coronavirus Disease 2019; ARDS: Acute Respiratory Distress Syndrome; VV-ECMO: veno-venous ExtraCorporeal Membrane Oxygenation; IQR: Interquartile Range; HTA: Hypertension; SOFA: Sequential Organ Failure Assessment; ICU: Intensive Care Unit; IMV: Invasive Mechanical Ventilation; HFNC: High Flow Nasal Cannula; CPAP: Continuous Positive Airway Pressure; NIV: Not-Invasive Ventilation; iNO: Inhaled Nitric Oxyde.

Conclusions

The results of this preliminary analysis seem to suggest that COVID-19 related ARDS patients treated with VV-ECMO and conventional management are significantly different. This seems to explain the need for more rescue therapies (such as pharmacological ones, but also prone positioning, inhaled nitric oxide) before ECMO and the significantly worse outcome.
However, it should be noted that evidences regarding the use of ECMO for treating COVID-19 related ARDS are still heterogenous [2,4] and a defined consensus on its effectiveness is still lacking [5,6]. Further studies clarifying the role and correct timing of ECMO in COVID-19 treatment algorithm are needed. [3].

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