

Indications and sustainability of ECMO support during COVID-19 pandemic: the Turin (North Italy) ECMO center experience.

Mariani M¹, Accogli A¹, Montrucchio G^{1,2}, Bonetto C², Simonetti U², Di Vita E¹, Obert C¹, Zagagnoni M¹, Giachetti A¹, Fanelli V^{1,2}, Brazzi L^{1,2}, Sales G²

1. Department of Surgical Science, University of Turin, Italy;

2. Department of Anesthesia, Intensive Care and Emergency, 'Città della Salute e della Scienza' Hospital, Turin, Italy.

Background Venovenous Extra Corporeal Membrane Oxygenation (VV-ECMO) is usually performed in experienced referral centers [1-2]. During COVID-19 pandemic, ECMO demand increased but the acute shortage of health-care resources made it necessary to review the criteria for the use of this technology [3-4]. We evaluated the relationship between indications and sustainability in the context of the requests received by our center during the pandemic.

Methods Demographic and clinical data of all patients proposed for possible treatment with ECMO due to COVID-19 related ARDS at "Città della Salute e della Scienza" Hospital (Turin, Italy), between February and December 2020, were retrospectively collected. ELSO indications [5] were always used as patient selection criteria.

Results During the study period, 118 patients were evaluated for possible treatment with VV-ECMO. In 83 cases no indication was given, while 35 patients underwent ECMO (29 cases from other regional hospitals and 6 in-hospital cases) (Table 1A). At the basis of the non-indication for ECMO treatment there was in 30 cases a prolonged period of mechanical ventilation, in 7 a PaO₂/FiO₂ ratio higher than 80, in 8 the advanced age, in 11 the presence of severe comorbidities, in 7 an advanced COVID-19 related pulmonary fibrosis. (Table 1B) In other 36 cases, ECMO was not indicated given to the patients' clinical improvement obtained after conventional treatment optimization. (Table 1B)

Conclusions Even in the pandemic context, thanks to the increased number of intensive care beds made available by the 'Città della Salute e della Scienza' Hospital, we have been able to answer to all adequate ECMO support requests, treating up to 8 patients at the same time. In the absence of specific criteria, we used those proposed by ELSO to identify the patients who could most benefit from ECMO, adding a particular attention to the length of non-invasive mechanical ventilation prior to endotracheal intubation, according to the preliminary experiences derived from the literature.

Urgent studies are necessary aimed to provide more accurate criteria to be used to select, among patients suffering from severe COVID-19 related ARDS, who may most benefit from VV-ECMO when a rationalization of this resource is required.

References

1. Rafiq M.U., et al. Regional extracorporeal membrane oxygenation retrieval service during the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic: An interdisciplinary team approach to maintain service provision despite increased demand. *Eur J Cardio-thoracic Surg* 2020; 58:875–880;
2. Ma X., et al. Extracorporeal membrane oxygenation (ECMO) in critically ill patients with coronavirus disease 2019 (COVID-19) pneumonia and acute respiratory distress syndrome (ARDS). *Med Sci Monit* 2020; 26:1–10;
3. Abrams D., et al. ECMO during the COVID-19 pandemic: when is it unjustified? *Crit Care* 2020; 24: 507;
4. Namendys-Silva S.A. ECMO for ARDS due to COVID-19. *Hear Lung* 2020; 49:348–349;
5. Shekar K., et al. Extracorporeal Life Support Organization Coronavirus Disease 2019 Interim Guidelines: A Consensus Document from an International Group of Interdisciplinary Extracorporeal Membrane Oxygenation Providers. *ASAIO J* 2020; 707–721.

	Rejected cases N=83	ECMO cases N=35
Age, years, median (IQR)	58 (53 - 63)	54 (50 - 61)
Gender, male, n (%)	69 (83.1)	29 (82.9)
BMI, median (IQR)	29.3 (26.2 - 34.4)	29.4 (27.6 - 32.7)
Comorbidities, n (%)		
Hypertension	20 (24.1)	13 (37.1)
Diabetes Mellitus	8 (9.6)	4 (11.4)
Chronic Pneumopathy	9 (10.8)	4 (11.4)
Chronic cardiovascular disease	10 (12)	0
Organ failure at ECMO request, n (%)		
Cardiovascular shock	9 (10.8)	0
AKI	8 (9.6)	0
Days of non-invasive ventilatory support before IMV, median (IQR)	5 (3 - 9)	6 (3 - 10)
Days of IVM before ECMO request, median (IQR)	7 (4 - 11)	6 (3 - 8)
Days of hospitalization before ECMO request, median (IQR)	12 (8 - 16)	12 (8 - 17)
Ventilatory parameters at ECMO request, median (IQR)		
PaO ₂ /FiO ₂ , mmHg	77 (64.2 - 95)	64.0 (55.0 - 72.0)
PaCO ₂ , mmHg	61.5 (52.3 - 71.8)	56.5 (53.0 - 62.3)
Pplateau, cmH ₂ O	26 (24 - 28)	28 (24 - 31)
Static lung compliance, ml/cmH ₂ O	34.8 (26.6 - 43.4)	27.1 (22.0 - 40.0)
Therapies before ECMO request, n (%)		
Neuromuscular blocking agents	74 (89.2)	35 (100)
Lung recruitment manoeuvres	13 (15.7)	20 (57.1)
Prone position	60 (72.3)	31 (88.6)
iNO	15 (18.1)	14 (40)

Prompt non-indication for ECMO, n (%) *	43 (51.8)
Prolonged days on IVM	30 (36.1)
PaO ₂ /FiO ₂ > 80 mmHg	7 (8.4)
Age > 70 years	8 (9.6)
Multiple severe comorbidities	11 (13.3)
Pulmonary fibrosis due to COVID-19 pneumonia	7 (8.4)
Clinical improvement due to treatment optimization, n (%) *	36 (43.4)
Adjustment of IVM setting	12 (14.5)
Lung recruitment manoeuvres	1 (1.2)
Start of prone position	28 (33.7)
iNO utilization	2 (2.4)
Data not available, n (%)	4 (4.8)

* Percentages were calculated on the overall rejected cases; a case could be rejected due to more than one reason simultaneously.
List of abbreviations: IQR: Interquartile Range; BMI: Body Mass Index; AKI: Acute Kidney Injury; ECMO: Extracorporeal Membrane Oxygenation; IMV: Invasive Mechanical Ventilation; iNO: Inhaled Nitric Oxide; COVID-19: Coronavirus Disease 2019.

