

**Analysis of 153 consecutive patients with COVID-19 and Severe Pulmonary Compromise
treated with Extracorporeal Membrane Oxygenation (ECMO):
Outcomes and Trends Over Time**

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Abstract (WORD COUNT Limits)

- **Purpose: 47 words out of 50 words allowed**
- **Methods: 98 words out of 100 words allowed**
- **Results: 150 words out of 150 words**
- **Conclusions: 50 words 50 word**

OBJECTIVES: The role of extracorporeal membrane oxygenation (ECMO) in the management of severely ill patients with COVID-19 continues to evolve. The purpose of this abstract is to review our clinical experience in 153 patients with confirmed COVID-19 treated with ECMO and to document trends in management over time.

METHODS: A multi-institutional database was created and utilized to assess all patients with COVID-19 who were supported with ECMO at 28 institutions. We report data collected between March 17, 2020, when our first COVID-19 patient was placed on ECMO, and August 6, 2020., Data analyzed included patient characteristics, pre-COVID-19 risk factors and comorbidities, confirmation of COVID-19 diagnosis, features of ECMO support, specific medications utilized in an attempt to treat COVID-19, and short-term outcomes through hospital discharge. Differences by mortality group were assessed using chi-square tests in categorical variables and Kruskal-Wallis rank sum tests and Welch's ANOVA in continuous variables.

RESULTS: During the five months of this study, 153 consecutive patients with COVID-19 were placed on ECMO. At the time of analysis, 36 remain on ECMO, 56 died prior to hospital discharge, and 61 are alive after separation from ECMO. Of 61 survivors after separation from ECMO, 36 are discharged from the hospital.

Table 1 compares survivors and non-survivors. Survivors had lower median age (45 versus 56.5 years, $p < 0.001$) and shorter mean time on ECMO (14 versus 20 days, $p = 0.02$). Of 110 patients receiving only veno-venous ECMO and separated from ECMO, 59 (53.6%) survive. Of 7 patients receiving veno-arterial ECMO and separated from ECMO, 2 (28.6%) survive.

Adjunctive therapies in the 61 survivors included: intravenous steroids (n=34 patients), anti-interleukin-6-receptor monoclonal antibodies (Tocilizumab or Sarilumab) (n=30 patients), Convalescent Plasma (n=26 patients), antiviral medications (Remdesivir) (n=22 patients), hydroxychloroquine (n=22 patients), and Prostaglandin (n=21 patients). The figure documents trends of utilization of these therapies.

CONCLUSIONS: ECMO facilitates salvage and survival of select critically ill patients with COVID-19. Survivors tend to be younger and have shorter duration of ECMO support. Survival of decannulated patients supported with only veno-venous ECMO is 54%. Substantial variation exists in drug treatment of COVID-19, but ECMO offers a reasonable rescue strategy.

Table 1. Overview of Patients with COVID-19 treated with ECMO and no longer on ECMO, comparing the characteristics of the 61 survivors to the 56 non-survivors

	Level	Non-survivors	Survivors	P
N		56	61	
Days from COVID Diagnosis to Intubation (mean (SD))		6.22 (6.41)	4.37 (4.10)	0.15
Days from COVID Diagnosis to Intubation (median [IQR])		3.50 [1.00, 12.25]	4.00 [1.00, 7.00]	0.50
Days from Intubation to Cannulation (mean (SD))		4.29 (3.97)	4.46 (3.85)	0.86
Days from Intubation to Cannulation (median [IQR])		4.00 [1.00, 7.75]	4.00 [1.00, 6.00]	0.83
Days on ECMO (mean (SD))		19.76 (17.53)	13.80 (9.57)	0.02
Days on ECMO (median [IQR])		14.00 [8.00, 27.75]	10.00 [8.00, 15.00]	0.12
Hours on ECMO (mean (SD))		462.50 (421.47)	322.07 (229.03)	0.03
Hours on ECMO (median [IQR])		327.00 [172.25, 649.00]	227.00 [188.00, 343.00]	0.15
Hours on ECMO (minimum, maximum)		31.00, 2175.00	61.00, 1092.00	No Test
Age (mean (SD))		53.88 (11.53)	45.57 (12.80)	<0.001
Age (median [IQR])		56.50 [46.00, 61.25]	45.00 [36.00, 56.00]	<0.001
Gender (Count (%))	Female	16 (28.6)	23 (37.7)	0.40
	Male	40 (71.4)	38 (62.3)	
Asthma (Count (%))	Yes	12 (22.2)	11 (18.0)	0.74
Hypertension (Count (%))	Yes	20 (37.7)	26 (42.6)	0.74
Obesity (Count (%))	Yes	31 (56.4)	38 (62.3)	0.65
Diabetes (Count (%))	Yes	23 (41.8)	21 (34.4)	0.53
Heart Disease (Count (%))	Yes	8 (14.5)	5 (8.2)	0.43
Cancer (Count (%))	Yes	3 (5.5)	3 (4.9)	1.00
Chronic Renal Failure (Count (%))	Yes	2 (3.8)	2 (3.3)	1.00
One or More Comorbid Conditions (Count (%))	Yes	45 (81.8)	48 (78.7)	0.85
Prone Position Before ECMO (Count (%))	Yes	37 (67.3)	42 (68.9)	1.00
CVVH or CRRT Used (Count (%))	Yes	18 (32.7)	15 (24.6)	0.45
ECMO Type (Count (%))	VA	5 (8.9)	2 (3.3)	0.37
	VV	51 (91.1)	59 (96.7)	
Anticoagulation Type (Count (%))	Argatroban	5 (9.1)	5 (8.2)	0.68
	Bivalirudin	6 (10.9)	4 (6.6)	
	Heparin	44 (80.0)	52 (85.2)	
Steroids (Count (%))	Yes	30 (56.6)	34 (57.6)	1.00
Anti-Interleukin-6 Medication (Count (%))	Yes	18 (34.6)	30 (51.7)	0.11
Convalescent Plasma (Count (%))	Yes	21 (45.7)	26 (48.1)	0.96
Anti-Viral Medication (Count (%))	Yes	15 (27.8)	22 (37.9)	0.35
Hydroxychloroquine (Count (%))	Yes	18 (32.7)	22 (36.1)	0.86
Flofan (Prostaglandin) (Count (%))	Yes	20 (38.5)	21 (35.0)	0.86

Table 1 provides detailed data about 117 patients with COVID-19 treated with ECMO and no longer on ECMO and compares the characteristics of the 61 survivors to the 56 non-survivors.

Figure 1: Trends of Utilization of Medications and Adjunctive Therapies in COVID-19 ECMO patients while on ECMO

Percent of COVID ECMO Cases Using Six Medications and Adjunctive Therapies by Cannulation Date Among 117 Decannulated Cases

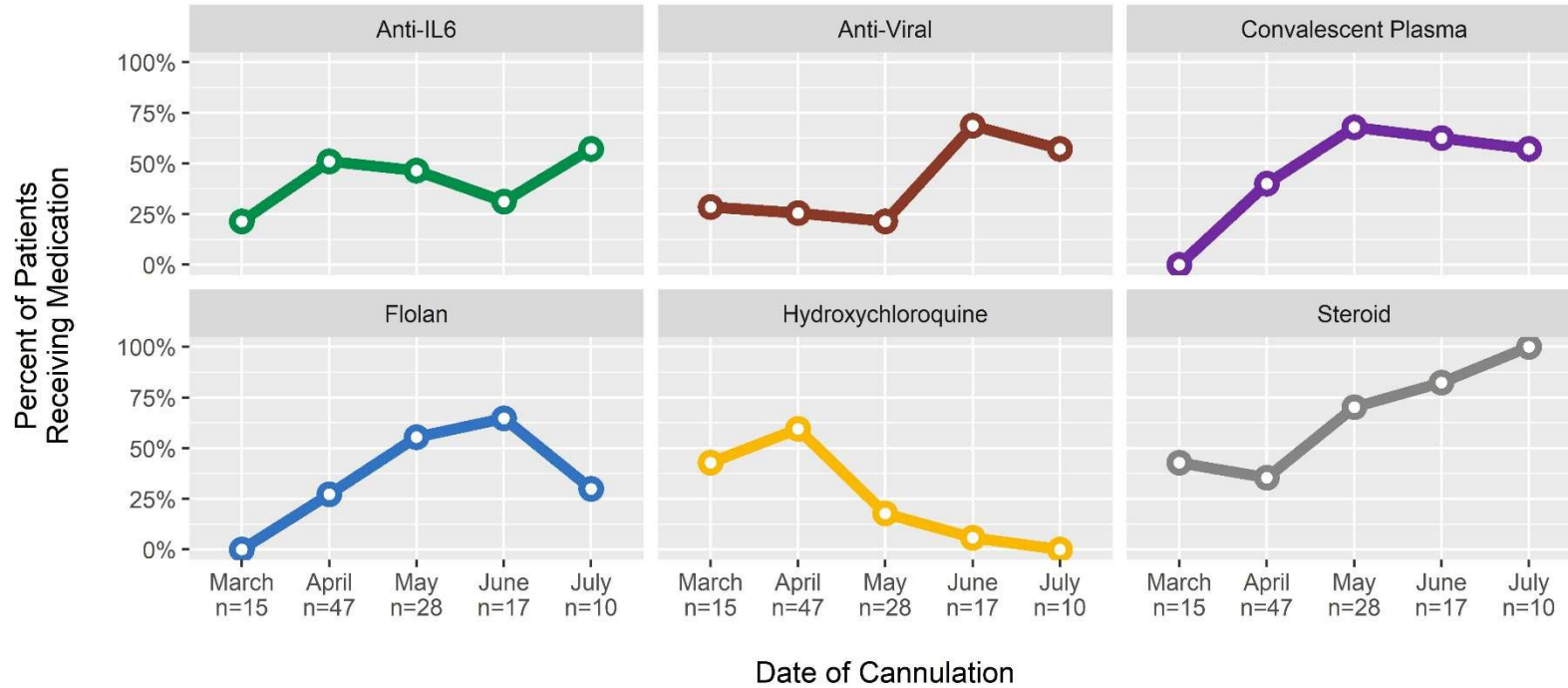


Figure 1 depicts the trends over time in the utilization of medications in patients with COVID-19 while on ECMO.

Green line = anti-interleukin-6-receptor monoclonal antibodies (Tocilizumab or Sarilumab)

Brown line = antiviral medications (Remdesivir)

Purple line = convalescent plasma

Blue line = Flolan (Prostaglandin)

Yellow line = Hydroxychloroquine

Gray line = intravenous steroids