ECMO for Adult Respiratory Failure, the ELSO Registry, and What We Have Learned About ECMO Use in COVID-19

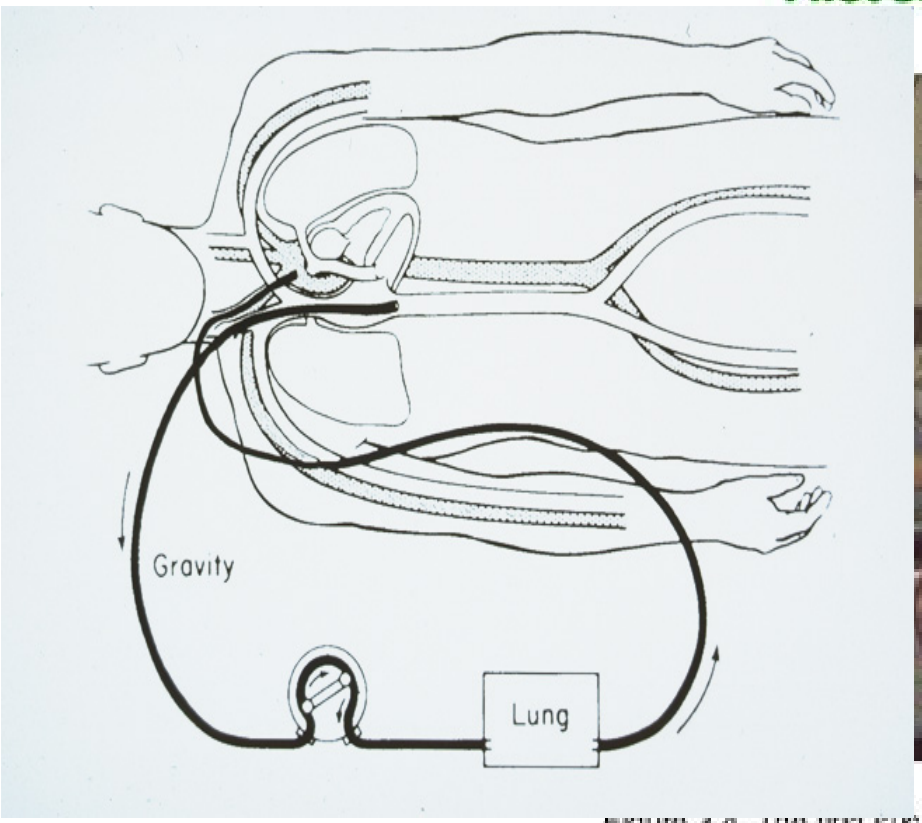
Jonathan Haft, MD

Department of Cardiac Surgery

University of Michigan

ECMO Background

First successful ECMO patient in1971



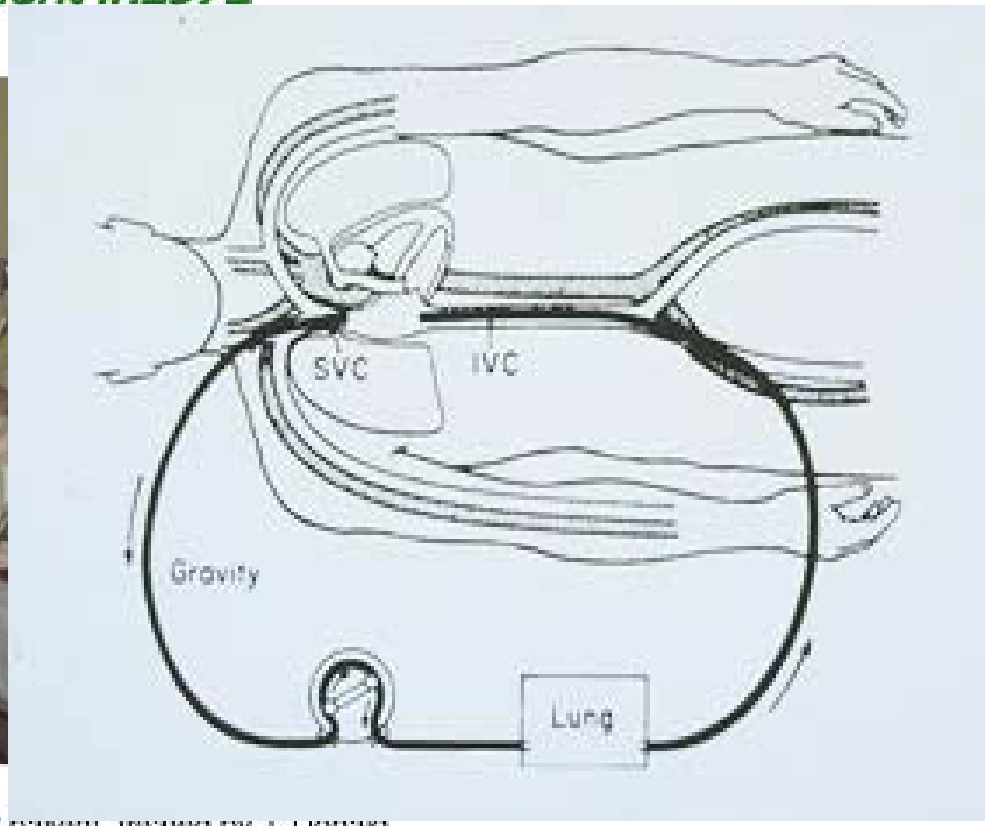
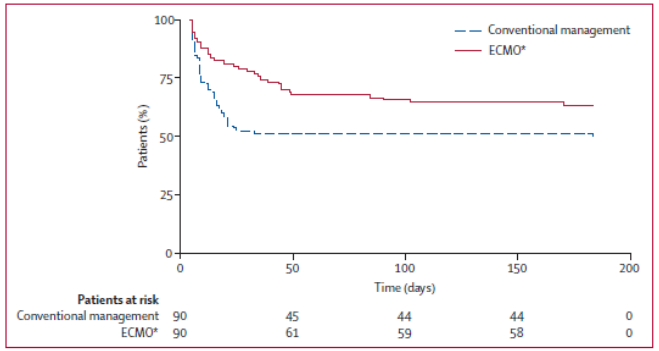


Figure 3.4. The first successful extracorporeal life support patient, treated by J. Donald Hill using the Bramson oxygenator (foreground), Santa Barbara, 1971.

Efficacy and economic assessment of conventional ventilatory support versus extracorporeal membrane oxygenation for severe adult respiratory failure (CESAR): a multicentre randomised controlled trial

Giles J Peek, Miranda Mugford, Ravindranath Tiruvoipati, Andrew Wilson, Elizabeth Allen, Mariamma M Thalanany, Clare L Hibbert, Ann Truesdale, Felicity Clemens, Nicola Cooper, Richard K Firmin, Diana Elbourne, for the CESAR trial collaboration



	ECMO group (n=90)*	Conventional management group (n=90)
All patients		
Critical care (days)	24·0 (13·0–40·5)†	13·0 (11·0–16·0)
Hospital (days)	35·0 (15·6–74·0)	17·0 (4·8–45·3)
Patients who died‡		
Critical care (days)	11·0 (2·0–28·0)†	5·0 (2·0–13·5)
Hospital (days)	15·0 (3·0–40·5)	5·0 (2·0–13·5)

Data are median (IQR). ECMO=extracorporeal membrane oxygenation. *Patients were randomly allocated to consideration for treatment by ECMO, but did not necessarily receive this treatment. †Excludes one patient whose notes are still with the coroner. ‡Data for 33 patients receiving extracorporeal membrane oxygenation, and 45 patients receiving conventional management.

Table 4: Length of stay

Extracorporeal Membrane Oxygenation for Severe Acute Respiratory Distress Syndrome

A. Combes, D. Hajage, G. Capellier, A. Demoule, S. Lavoué, C. Guervilly, D. Da Silva, L. Zafrani, P. Tirot, B. Veber, E. Maury, B. Levy, Y. Cohen, C. Richard, P. Kalfon, L. Bouadma, H. Mehdaoui, G. Beduneau, G. Lebreton, L. Brochard, N.D. Ferguson, E. Fan, A.S. Slutsky, D. Brodie, and A. Mercat, for the EOLIA Trial Group, REVA, and ECMONet*

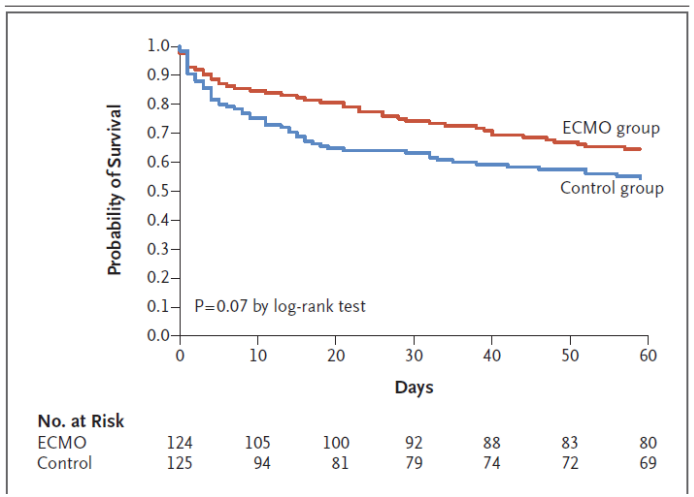


Table 2. End Points.*

End Point	ECMO Group (N=124)	Control Group (N=125)	Relative Risk or Difference (95% CI)†	P Value
Primary end point: mortality at 60 days — no. (%)	44 (35)	57 (46)	0.76 (0.55 to 1.04)	0.09
Key secondary end point: treatment failure at 60 days — no. (%)‡	44 (35)	72 (58)	0.62 (0.47 to 0.82)	<0.001
Other end points				
Mortality at 90 days — no. (%)	46 (37)	59 (47)	−10 (−22 to 2)	
Median length of stay (interquartile range) — days				
In the ICU	23 (13–34)	18 (8–33)	5 (−1 to 10)	
In the hospital	36 (19–48)	18 (5–43)	18 (6 to 25)	
Median days free from mechanical ventilation (interquartile range)§	23 (0–40)	3 (0–36)	20 (−5 to 32)	
Median days free from vasopressor use (interquartile range)§	49 (0–56)	40 (0–53)	9 (0 to 51)	
Median days free from renal-replacement therapy (interquartile range)§	50 (0–60)	32 (0–57)	18 (0 to 51)	
Prone position — no. (%)¶	82 (66)	113 (90)	−24 (−34 to −14)	
Recruitment maneuvers — no. (%)¶	27 (22)	54 (43)	−21 (−32 to −10)	
Inhaled nitric oxide or prostacyclin — no. (%)¶	75 (60)	104 (83)	−23 (−33 to −12)	
Glucocorticoids — no. (%)¶	80 (65)	82 (66)	−1 (−13 to 11)	

September 21-26, 2020
Hilton Waikoloa Village, Hawaii, US
Waikoloa , HI

Centers of Excellence Center Map

International Summary - January, 2020

ECLS Registry Report

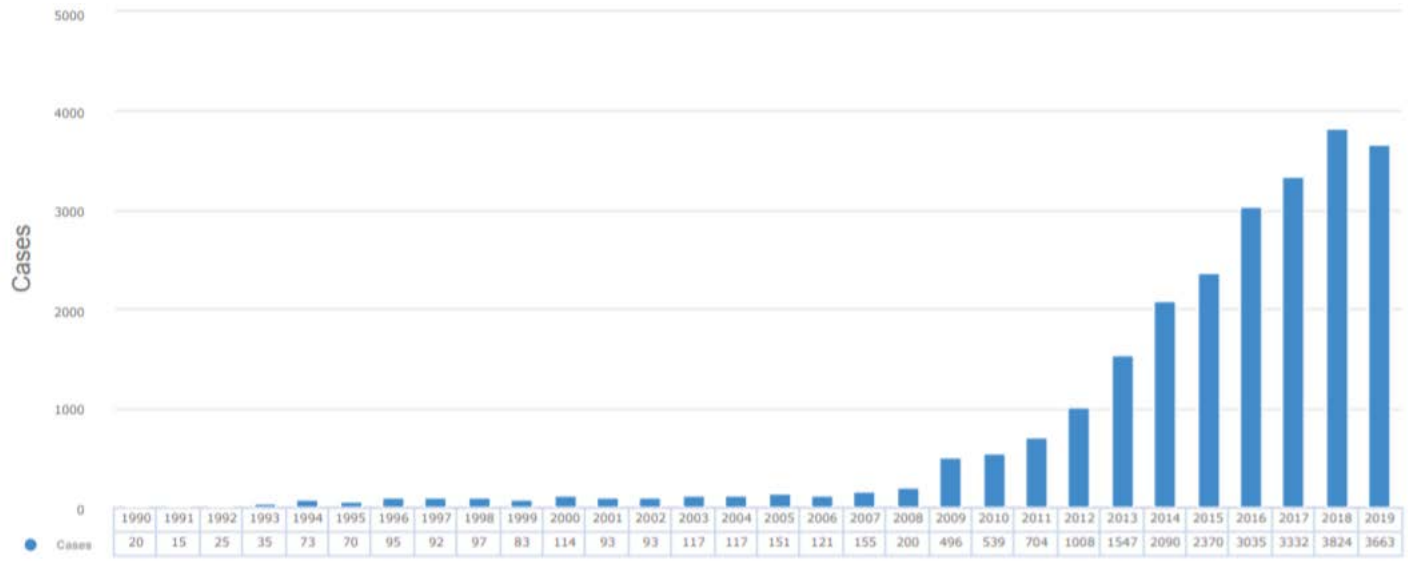
International Summary

January, 2020

Extracorporeal Life Support Organization
2800 Plymouth Road
Building 300, Room 303
Ann Arbor, MI 48109

Adult Respiratory (18 years and over)

Annual Respiratory Adult Runs



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Cases	20	15	25	35	73	70	95	92	97	83	114	93	93	117	117	151	121	155	200	496	539	704	1008	1547	2090	2370	3035	3332	3824	3663

ELSO Reg

COVID-19 Cases on ECMO i

COVID-19 Suspected or Confirmed	COVID-19 Confirmed Cases
520	514

Total counts of COVID-19 confirmed patients and count of C

COVID-19 ECMO counts

	Total (n)	Still on ECMO
All ELSO	520	302
North America	348	212
Europe	140	74
Asia Pacific	16	7
Latin America	12	7
SWAAC	*	

* not reporting cases where n < 5

Reports counts of ECMO-supported suspected or confirmed COVID-19 cases by

	Statistics	Counts (n)	Range
cases			
Age, years (median)	4		
Male	387 (7		
Weight, kg (median)	9		
Intubation to ECMO, hours (median)	9		
ECMO Support Type			
Respiratory	501 (9		
Cardiac	14 (2		
ECPR	5 (0		
ECMO Mode			
VV	479 (9		
VA	19 (3		
VVA	4 (0		
Conversion	17 (3		
Positve end expiratory pressure (median)	15 cm		
PF ratio (median)	7		
Co-Morbidity			
Patients with asthma	51 (9		
Patients with diabetes	102 (1		
Patients with obesity	232 (44%)	520	
Chronic Renal Insufficiency	10 (1%)	520	
Patients still on ECMO	302 (58%)	520	

This section includes all patients with confirmed or suspected COVID-19 entered into the ELSO Registry and ELSO COVID-19 addendum. These patients can be (a) still on their ECMO run, (b) off ECMO and still hospitalized or (c) discharged alive or dead from the hospital.

COVID-19 ECMO Statistics, for all cases that have completed their ECMO run

	Statistics	Counts (n)	Range	
cases		218	25th Percentile	75th Percentile
ECMO run time, hours (median)	188.00	218	1 0	279
Stroke	1 (0%)	218		
Intracranial Hemorrhage	12 (5%)	218		
Renal Failure	49 (22%)	218		
Patients off ECMO and still in Hospital	90 (41%)	218		

This section includes the subset of patients from above who either (b) completed their first ECMO run and are still hospitalized or (c) were discharged alive or dead from the hospital. For these patients we can report ECMO run time and ECMO complications.

COVID-19 ECMO Statistics, for only cases those cases discharged from the hospital

	Statistics	Counts (n)	Range	
cases		108	25th Percentile	75th Percentile
Discharged alive*	46 (42%)	108		
Length of hospital Admission, days (median)	14.00	108	7	21
Length of intubation, days (median)	3.00	108	1	5

*Does not include the patients Discharged on ECMO - 2 (1%)

This section includes the subset of patients from above who have (c) completed their ECMO run AND been discharged alive or dead from the hospital. For this table we can report survival, length of hospital stay and length of intubation.

Summary

- ECMO is an efficacious strategy for severe and reversible acute respiratory failure
- The ELSO Registry is essential for quality, investigative, and clinical decision making information
- Early data from the ELSO registry suggests that ECMO may be an appropriate strategy for severe respiratory failure in carefully selected patients with COVID-19