

Elements of a Comprehensive ECMO Program*

Mazen Odish, MD



*Hint it's not just placing them on ECMO



Who gets ECMO?

- Scarce and resource intensive
- Access may not be equal
- Ensure equitable care
- Regional Disaster Planning
- Triage of ECMO resources
 - ECMO center cooperation
- ECMO indications by survival and duration of support

Regional Planning for Extracorporeal Membrane Oxygenation Allocation During Coronavirus Disease 2019



Matthew E. Prekker, MD, MPH; Melissa E. Brunsvold, MD; J. Kyle Bohman, MD; Gwenyth Fischer, MD; Kendra L. Gram, MD; John M. Litell, DO; Ramiro Saavedra-Romero, MD; and John L. Hick, MD

Chest. 2020 Aug; 158(2): 603–607.



How do you provide ECMO fairly?

- **San Diego County ECMO Consortium** addresses the needs of our large county and neighbors
 - 4 ECMO centers share equipment, expertise
 - Distribution of patients
- **Uniform inclusion/exclusion** that varies based on available resources (stricter as resources dwindle)
- **>300 patients evaluated, 95 placed on ECMO**



How do you get to ECMO?

One Hundred Transports on Extracorporeal Support to an Extracorporeal Membrane Oxygenation Center

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“Mobile ECMO”

- Minimal complications
- Required training with transport and cannulation team



Mobile ECMO at UCSD

- 19 patients with COVID-19 in the last 6 months
- 4 southern California counties, 12 hospitals
- **Challenges**
 - Eyeball test
 - Unknown neurologic status



Who provides bedside ECMO care?

http://www.abcp.org/pd/ann_rep.pdf
also.org



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Who provides bedside ECMO care at UCSD? -> RNs

- Expanded Capacity
- Non-inferior outcomes
- Cheaper

A cost-reducing extracorporeal membrane oxygenation (ECMO) program model: a single institution experience

NC Cavarocchi, S Wallace, EY Hong, A Tropea, J Byrne, HT Pitcher and H Hirose

Perfusion 2015 Mar;30(2):148-53. doi: 10.1177/0267659114534288.

| | Perfusionist-Run | Nurse-Run |
|---------------------------------------|------------------|-------------|
| Year | 2017 | 2018 & 2019 |
| ECMO specialists (n) | 8 | 56 |
| Total ECMO cases (number of VA-ECMO) | 30 (23) | 99 (60) |
| Survival to discharge – total (%) | 8/29 (27.5%) | 49/94 (52%) |
| Complications per ECMO day, mean ± SD | 0.42 ± 0.52 | 0.34 ± 0.49 |



How to set the ventilator on ECMO



How to set the ventilator on ECMO

ELSO Guidelines

- RR 4 – 10
- Driving Pressure <15 cm H₂O
- P_{plat} ≤ 25
- PEEP 10 – 15
 - We titrate via esophageal manometry

Lung rest initially

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ELSO Guidelines

Extracorporeal Life Support Organization Coronavirus Disease 2019 Interim Guidelines: A Consensus Document from an International Group of Interdisciplinary Extracorporeal Membrane Oxygenation Providers

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<https://www.else.org/COVID19.aspx>



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Proning on ECMO

- Safe
- During lung rest
- NMB not necessary



Should we rest the lung further?

- Unclear
- Biomarker evidence that lower ventilator pressures are better
- No large studies
- Active research

Ultra-Protective Ventilation Reduces Biotrauma in Patients on Venovenous Extracorporeal Membrane Oxygenation for Severe Acute Respiratory Distress Syndrome*

Sacha Rozenchwajg, MD^{1,2}; Amélie Guihot, MD, PhD^{3,4}; Guillaume Franchineau, MD^{1,2}; Mickael Lescroat, MD¹; Nicolas Bréchet, MD, PhD^{1,2}; Guillaume Hékimian, MD^{1,2}; Guillaume Lebreton, MD, PhD^{1,5}; Brigitte Autran, MD, PhD^{3,4}; Charles-Edouard Luyt, MD, PhD^{1,2}; Alain Combes, MD, PhD^{1,2}; Matthieu Schmidt, MD, PhD^{1,2}

Effect of Driving Pressure Change During Extracorporeal Membrane Oxygenation in Adults With Acute Respiratory Distress Syndrome: A Randomized Crossover Physiologic Study

Lorenzo Del Sorbo, MD¹⁻⁴; Alberto Goffi, MD¹; George Tomlinson, PhD^{5,6}; Tommaso Pettenuzzo, MD¹; Francesca Facchin, MD, PhD¹; Alice Vendramin, MD¹; Ewan C. Goligher, MD, PhD^{1,3}; Marcelo Cypel, MD^{2,3,7}; Arthur S. Slutsky, MD^{1,8}; Shaf Keshavjee, MD^{2,3,7}; Niall D. Ferguson, MD^{1,3,4,5,9}; Eddy Fan, MD, PhD^{1,3,4,5,9}; for the International ECMO Network (ECMONet)



Mobilizing patients on ECMO

Safety and Feasibility of Early Physical Therapy for Patients on Extracorporeal Membrane Oxygenator: University of Maryland Medical Center Experience*

Chris L. Wells, PhD, PT, CCS, ATC^{1,2}; Jenny Forrester, PT, DPT¹; Joshua Vogel, PT, DPT¹; Raymond Rector, CCP, LP¹; Ali Tabatabai, MD²; Daniel Herr, MD, FCCM²

- Safe even with femoral cannulation
- Minimal complications
- Lacking data on mortality and length of stay



Mobility and Physical Therapy

- Nurses with in-bed mobility
- PT/OT with out of bed mobility
- Limited to patient room
 - COVID-19 precautions
- Minimizing sedation
- Mobilized 22/35 (62%) of our COVID-19 patients

*** May be limited by PPE**



Continuing improvement of an ECMO program

Quality Improvement and Patient / Family Experience

- ECMO committee monthly meeting
- Daily expert rounding
- Scheduled weekly family meetings – on zoom*
- Automated palliative care consult

Education

- Bimonthly multidisciplinary rounds
 - Discuss cases, education, and literature review
- Monthly ECMO labs for nurse ECMO specialists
- Annual seminar for critical care and cardiology providers
- Quarterly ECMO course and hands-on session



It takes a team of dedicated professionals to run an ECMO Program

- Travis Pollema, DO – ECMO Director
- Cassia Yi, RN, MSN – ECMO Coordinator
- Robert Owens, MD
- Perfusionists
- Nurse ECMO specialists
- CT Surgery
- Pulmonary and Anesthesia Critical Care
- Cardiology
- Physical and occupational therapy
- Palliative care
- Pharmacy
- Pulmonary Vascular Teams (PAH/CTEPH/PE)
- Heart and Lung Transplant Teams



To Recap: Elements of a Comprehensive ECMO Program

- Equitable care
 - Disaster / pandemic planning
 - Regional cooperation
 - Mobile ECMO
- Nurse-run ECMO with perfusion backup
- Ventilator management – rest the lung
- Minimizing sedation and maximizing mobility on ECMO
- Quality improvement and education
- Team approach to comprehensive ECMO care



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