

Tracheostomy on Extracorporeal Life Support

Varun Puri, MD, MSCI



Disclosures

- None



Important Questions

- Is Tracheostomy on ECLS different than in other scenarios?
- What is the optimal approach?
- What is the optimal timing?
- Are there unique considerations for COVID ECMO?
- Technical tips and tricks?

Fundamental differences between Tracheostomy with or without ECLS

Tracheostomy	Not on ECLS	On ECLS
Preoperative planning and coordination	Lower	Higher
Resource utilization	Lower	Higher
Ability to tolerate apnea ***	Lower	Higher
Bleeding and other complications	Lower	Significantly higher
Risk of reoperation	Lower	Higher

Important Questions

- Is Tracheostomy on ECLS different than in other scenarios?
- What is the optimal approach?
- What is the optimal timing?
- Are there unique considerations for COVID ECMO?
- Technical tips and tricks?

Stephan Braune
Susanne Kienast
Johannes Hadem
Olaf Wiesner
Dominic Wichmann
Axel Nierhaus
Marcel Simon
Tobias Welte
Stefan Kluge

Safety of percutaneous dilatational tracheostomy in patients on extracorporeal lung support

- Retrospective cohort study: 2 University hospitals in Germany
- 2007-13, n=118
- Heparin paused peri-procedurally, 20% received platelets/FFP
- No perioperative clotting of circuit
- Minor bleeding 31%, Major 2%
- Recommendations
 - Experienced operators
 - Careful optimization of the coagulation state

Safety of Percutaneous Dilatational Tracheostomy During Veno-Venous Extracorporeal Membrane Oxygenation Support in Adults With Severe Respiratory Failure

Stavros Dimopoulos, PhD¹; Holly Joyce, MBBS²; Luigi Camporota, PhD^{1,2}; Guy Glover, FFICM¹; Nicholas Ioannou, FFICM¹; Christopher J. Langrish, FFICM¹; Andrew Retter, MBBS¹; Christopher I. S. Meadows, FFICM^{1,2}; Nicholas A. Barrett, FCICM^{1,2}; Stephen Tricklebank, FFICM¹

- Single center, retrospective cohort
- 2010-15, n=65 VV ECMO
- 15% major complications, 29% minor complications
 - Bleeding
 - ECMO circuit dysfunction
- Patients who developed complications had significantly lower ECMO postoxygenator Po₂ prior to tracheostomy

Tracheostomy in Patients on Venovenous Extracorporeal Membrane Oxygenation: Is It Safe?

Katherine M. Kelley, MD^{1,2}, Samuel M. Galvagno, DO, PhD^{1,2}, Marianne Wallis, MD², Michael A. Mazzeffi, MD², Kristopher Deatrick, MD², Richard Betzold, MD^{1,2}, Thomas Scalea, MD^{1,2}, and Jay Menaker, MD^{1,2}

- Single center, retrospective cohort
- 2015-19, n=96
- Percutaneous n= 51, Open n=24, Hybrid n=21
- Major bleeding n=9, Minor bleeding n=19, Overall mechanical complications in 35%
- Bleeding complications more frequent with Percutaneous approach

Important Questions

- Is Tracheostomy on ECLS different than in other scenarios?
- What is the optimal approach?
- What is the optimal timing?
- Are there unique considerations for COVID ECMO?
- Technical tips and tricks?

Safety of Surgical Tracheostomy during Extracorporeal Membrane Oxygenation

Hye Ju Yeo¹, Seong Hoon Yoon¹, Seung Eun Lee¹, Doosoo Jeon¹, Yun Seong Kim¹, Woo Hyun Cho¹, and Dohyung Kim²

¹Department of Pulmonology and Critical Care Medicine, ²Department of Thoracic and Cardiovascular Surgery, Pusan National University Yangsan Hospital, Research Institute for Convergence of Biomedical Science and Technology, Yangsan, Korea

- Single center, retrospective series
- 2012-16, N=38, All patients underwent surgical tracheostomy

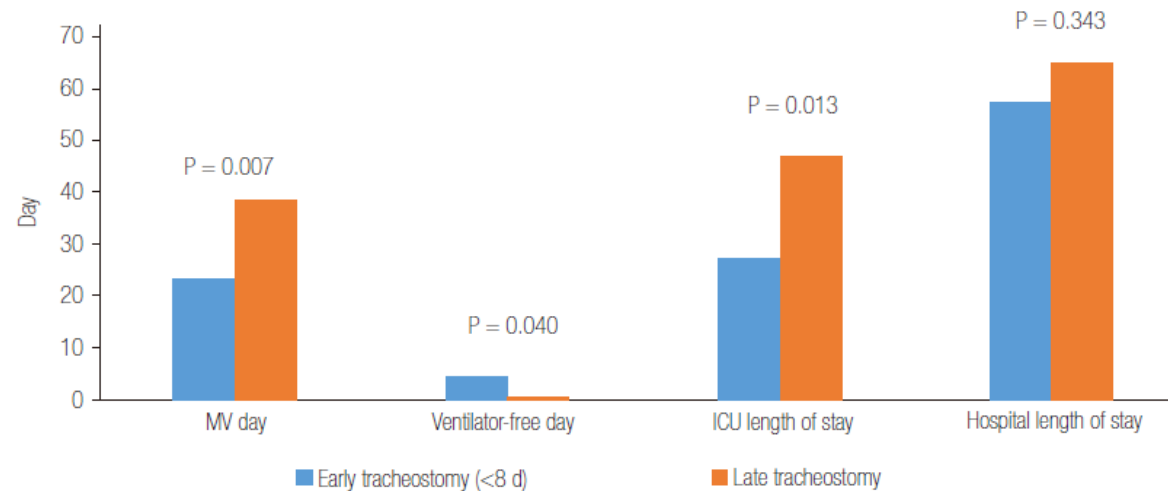


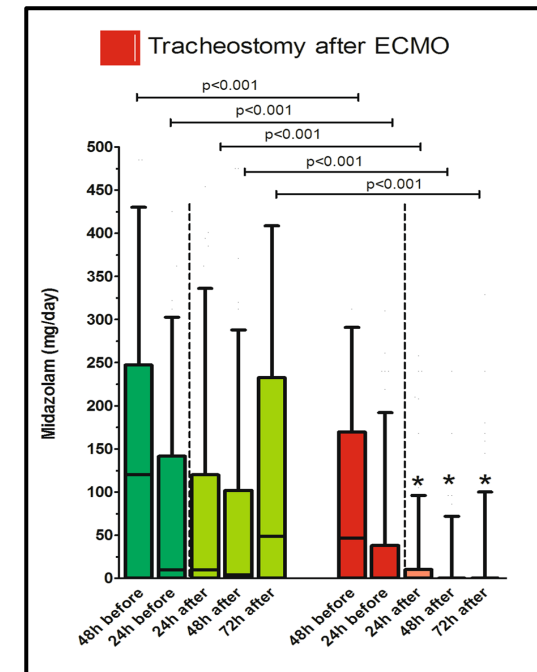
Figure 1. Differences in clinical outcomes between early and late tracheostomy in patients on extracorporeal membrane oxygenation. Values are presented as the median day. MV: mechanical ventilator; ICU: intensive care unit.

Tracheostomy management in patients with severe acute respiratory distress syndrome receiving extracorporeal membrane oxygenation: an International Multicenter Retrospective Study

Matthieu Schmidt^{1,2*}, Christoph Fisser^{3†}, Gennaro Martucci⁴, Darryl Abrams^{5,6}, Thomas Frapard², Konstantin Popugaev⁷, Antonio Arcadipane⁴, Bianca Bromberger⁶, Giovanni Lino⁴, Alexis Serra⁶, Sacha Rozencwajg², Matthias Lubnow³, Sergey Petrikov⁷, Thomas Mueller³, Alain Combes^{1,2}, Tai Pham^{8,9} and Daniel Brodie^{5,6} for the International ECMO Network (ECMONet)

- International, multicenter, retrospective study in four large volume ECMO centers during a 9-year period
- N=1168
- No tracheostomy group sicker
- Local bleeding more frequent when tracheostomy performed during ECMO (25% vs 7% after ECMO, $p < 0.01$)
- Major bleeding (apart from the tracheostomy site) more frequent in “during ECMO tracheostomy”

638 patients without tracheostomy	353 patients with tracheostomy during ECMO	177 patients with tracheostomy after ECMO withdrawal	



An International Survey on Ventilator Practices Among Extracorporeal Membrane Oxygenation Centers

CHRISTOPHER L. JENKS,*† JEFFERSON TWEED,‡ KRISTIN H. GIGLI,‡ RAMGOPAL VENKATARAMAN,§ AND LAKSHMI RAMAN‡¶

- Descriptive, cross-sectional 22 item survey of neonatal, pediatric, and adult ECMO centers
- Evaluated ventilator strategies, extubation, bronchoscopy, and tracheostomy practices
- 144/421 (34.2%) centers responded
- Among the centers performing tracheostomies, 45% used the percutaneous method, 19% open, and 10% reported using both

An International Survey on Ventilator Practices Among Extracorporeal Membrane Oxygenation Centers

CHRISTOPHER L. JENKS,*† JEFFERSON TWEED,‡ KRISTIN H. GIGLI,‡ RAMGOPAL VENKATARAMAN,§ AND LAKSHMI RAMAN‡¶

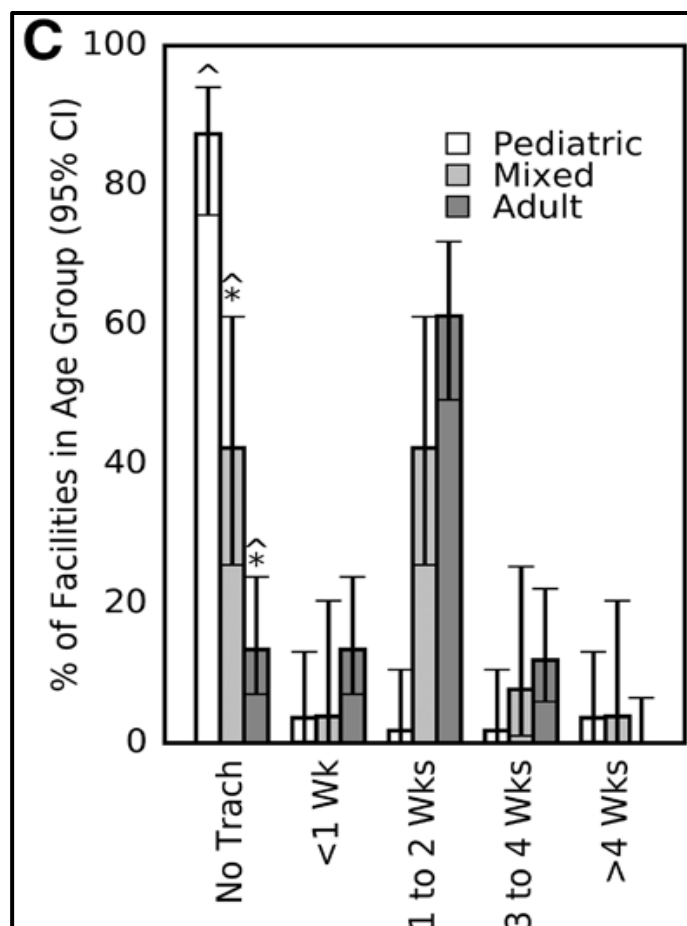


Table 10. Anticoagulation Practices During Tracheostomy Placement During Extracorporeal Life Support

Anticoagulation for tracheostomy, n (%)	Pediatric	Mixed	Adult	All
Decrease heparin by 1/4	0 (0.0)	2 (7.7)	2 (3.0)	4 (2.7)
Decrease heparin by 1/2	3 (5.5)	3 (11.5)	3 (4.5)	9 (6.1)
Decrease heparin by 3/4	0 (0.0)	0 (0.0)	1 (1.5)	1 (0.7)
Stop heparin	15 (27.3)	10 (38.5)	50 (74.6)	75 (50.7)
Reverse heparin	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Start aminocaproic acid up to 48 hours	2 (3.6)	1 (3.8)	0 (0.0)	3 (2.0)
Start aminocaproic acid over 48 hours	2 (3.6)	0 (0.0)	0 (0.0)	2 (1.4)
Stop bivalirudin	0 (0.0)	1 (3.8)	2 (3.0)	3 (2.0)
Stop tranexamic acid	1 (1.8)	1 (3.8)	0 (0.0)	2 (1.4)
Continue anticoagulation without dosage adjustment	3 (5.5)	5 (19.2)	6 (9.0)	14 (9.5)
Other	0 (0.0)	0 (0.0)	1 (1.5)	1 (0.7)
No response	29 (52.7)	3 (11.5)	2 (3.0)	34 (23.0)

Important Questions


- Is Tracheostomy on ECLS different than in other scenarios?
- What is the optimal approach?
- What is the optimal timing?
- Are there unique considerations for COVID ECMO?
- Technical tips and tricks?

Percutaneous Dilatational Tracheostomy in COVID-19 ECMO Patients: A Case Series

- 1 of 5 designated ECMO centers in UK
- N=38 (March-May 2020)
- Average time of intubation before tracheostomy: 12 days
- No transfusion for tracheostomy bleeding, 2 patients needed additional skin sutures for skin bleeding




Apneic Tracheostomy in COVID-19 Patients on Veno-Venous Extracorporeal Membrane Oxygenation

Matteo Rossetti, Chiara Vitiello, Valeria Campitelli, Raffaele Cuffaro, Claudia Bianco, Gennaro Martucci ,
Giovanna Panarello, Federico Pappalardo and Antonio Arcadipane *

- Single center, retrospective cohort
- N=32, bedside procedure, percutaneous approach
- ECMO flow optimized with albumin infusion (mean 4L/min), sweep gas flow retested (mean 6L/min)
- Apnea during bronchoscopy and technical portions of procedure
- No need for interventions for hypoxia or hemodynamics
- No difference in pH, blood gas values, or ECMO parameters before and after procedure

Brief Communication

Optimal timing of tracheostomy in patients on veno-venous extracorporeal membrane oxygenation for coronavirus 2019: a case series

Takeo Matsuyoshi,  Keiki Shimizu, Hitoshi Kaneko, Daiyu Kohsen, Hiroaki Suzuki, Yuichi Sato, and Jun Hamaguchi

Department of Critical Care and Emergency Medicine, Tokyo Metropolitan Tama Medical Center, Fuchu, Tokyo, Japan

- Single center case series
- N=9
- 4 patients underwent tracheostomy on ECMO, 5 after ECMO weaning
- All cases done on ECMO had hemorrhagic or circuit related complications, no complications in other group
- No patients experienced the “traditional” benefits of early tracheostomy

Our Experience (PI: Dr. Masood, unpublished data)

- Patients who received ECMO support for COVID-19 and underwent tracheostomy
- N=37
- Tracheostomy during ECMO support associated with higher mortality
- Delayed tracheostomy (after day 20) associated with better survival
- 3 patient required re-exploration for major bleeding

Current selection criteria for patients with COVID-19 supported by ECMO
No blood transfusions within 48 hours
O2 sats 88% or greater
No increased ECMO settings x 24 hours (exception of attempted wean and turned back up to prior settings)
INR < 2
Plt > 100
Tidal Volumes > 100 (OR > 72 hours of complete stability on all other criteria)

Important Questions

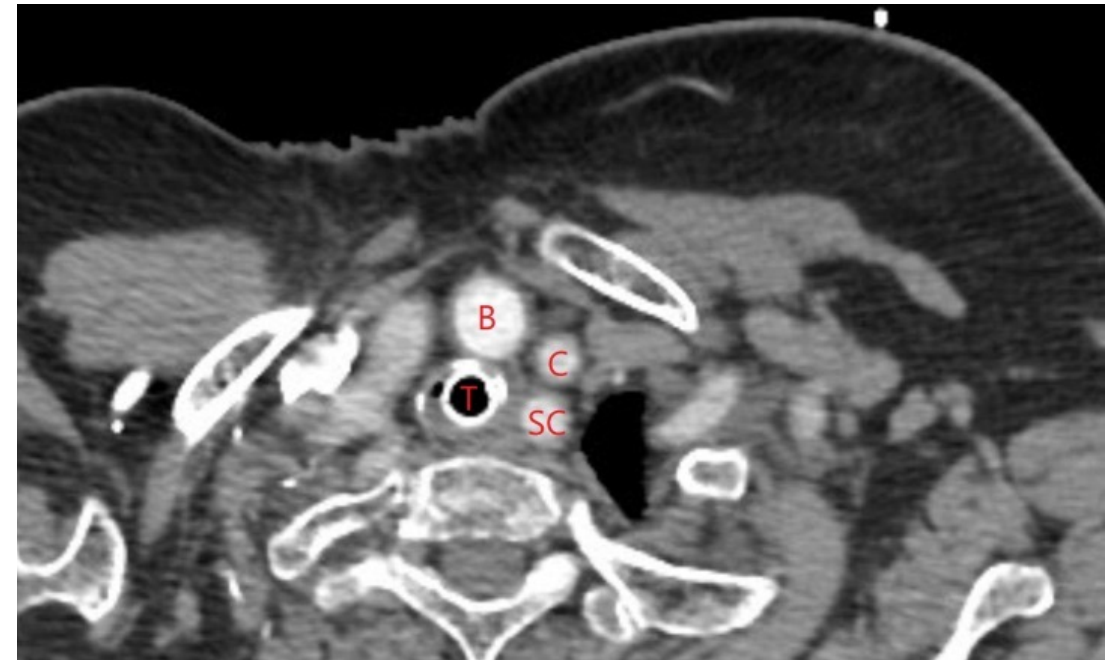
- Is Tracheostomy on ECLS different than in other scenarios?
- What is the optimal approach?
- What is the optimal timing?
- Are there unique considerations for COVID ECMO?
- Technical tips and tricks?

Perioperative Management: Anticoagulation

- Heparin infusion: Stop 1-4 h before (some centers do not stop), Resume 1-6 h post procedure
- If bleeding complications are encountered: Thromboelastometry (TEM) useful
 - Cryoprecipitate
 - Prothrombin complex concentrate
 - Platelet transfusion
- Aminocaproic acid reduced surgical site bleeding due to fibrinolysis in a large series of pediatric ECMO patients

Technical Points

- Ultrasound/CT to evaluate for anatomically high innominate artery, particularly on VA ECMO
- Avoiding bleeding
 - Avoid skin incision with scalpel, if possible
 - Purse-string suture in skin
 - Use electrocautery
 - Local hemostatic agents

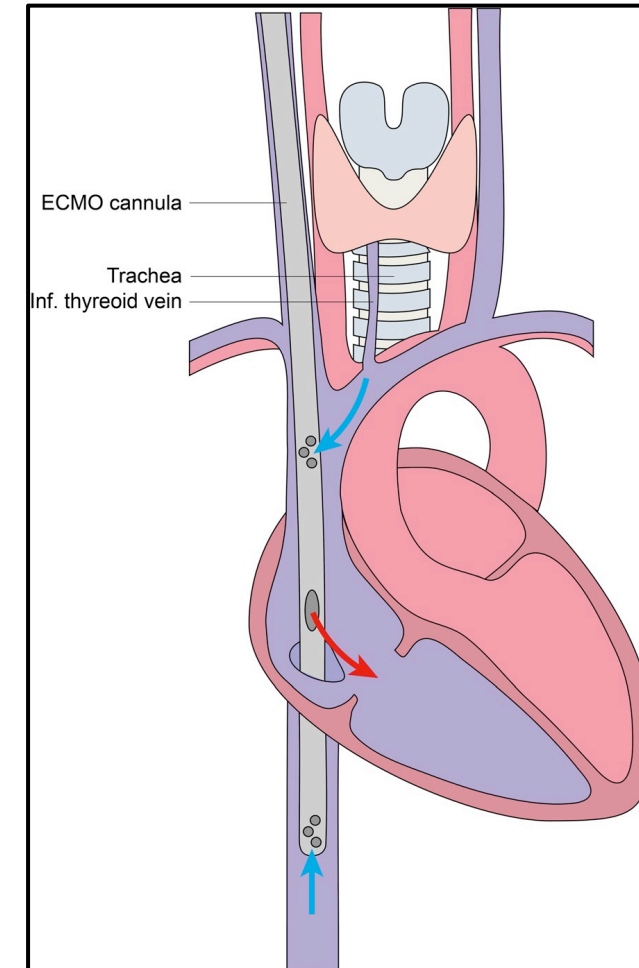


High-riding Innominate artery

Fatal air embolism as complication of percutaneous dilatational tracheostomy on venovenous extracorporeal membrane oxygenation, two case reports

Achim Lothar¹, Tobias Wengenmayer¹, Christoph Benk², Christoph Bode¹ and Dawid L. Staudacher^{1*}

- AVALON ELITE bi-caval cannula
- Considerations
 - During tracheostomy, reduce ECMO blood flow (and thus negative suction pressure).
 - Perform tracheostomy in a head down position.
 - Cover puncture site at all times with wet compresses.



Conclusions

- Early tracheostomy associated with shorter ICU stay in ECMO patients (except COVID ECMO)
- Percutaneous technique common with acceptable (but notable) complication risk
- Individualized decision making important
 - Timing of the procedure
 - Management of coagulopathy
 - Minimizing risk of circuit and oxygenator thrombosis

Thank you!

