

AIRWAY BLEEDING ON ECMO PATHWAY

EXECUTIVE SUMMARY

Physician Owner(s): Jeffrey Salomon, MD, MBA



Primary Objective

Anticoagulation therapy is indicated for patients on Extracorporeal Membrane Oxygenation (ECMO), which increases the risk of bleeding complications. An area of concern includes airway bleeding—oral, nasopharynx, or pulmonary. The purpose of this pathway is to implement evidence-based strategies to mitigate risk and standardize care of ECMO patients with airway bleeding with the intent to reduce mortality and ECMO hours. This pathway will incorporate both internal data as well as comparative data from the Extracorporeal Life Support Organization (ELSO).

Recommendations

Nebulized TXA

- Tranexamic acid (TXA) is a synthetic derivative of the amino acid lysine and binds the 5 lysine binding sites on plasminogen. This inhibits plasmin formation and displaces plasminogen from the fibrin surface. It may also directly inhibit plasmin and partially inhibit fibrinogenolysis at higher concentrations. This can improve clotting and reduce ongoing bleeding in the airways.
- A prospective interventional study evaluated the use of nebulized TXA to avoid a systemic effect in pediatric critically ill patients with pulmonary hemorrhage. They included 19 patients with a median age of 72 months. Pulmonary hemorrhage was resolved in 18 (95%) patients with inhaled TXA. No major adverse events were recorded in any of the patients.⁴
- Other retrospective studies have evaluated nebulized TXA for post T&A hemorrhage and have also shown efficacy in adult and pediatric patients with cessation of hemorrhage in all patients and no adverse events related to nebulized TXA.^{1,2}
- A case report of a patient with recurrent hemoptysis on systemic anticoagulation (Rivaroxaban) not responding to oral TXA improved with nebulized TXA with no effect on systemic anticoagulation.³

Bleeding Score

- The Pediatric ECMO Outcomes Registry (PEDECOR) is a web-based data platform aimed at consistent data collection with one goal to improve anticoagulation practice on ECMO.⁵
- A bleeding score was developed for this registry to standardize bleeding severity on ECMO for all centers in the study with specific criteria to define each scoring level.⁵
- This bleeding score has already been adopted into the current EPIC ECMO flowsheet and serves as a standardized guideline for discussions focused on bleeding in ECMO patients.⁵

Reducing Airway Bleeding

- Airway bleeding is associated with significantly longer duration of ECMO (177 total hours vs 98 total hours), higher cost of ECMO (~\$82,000 vs \$45,000), and increased mortality (32% vs 20%).
- Improved management of airway bleeding is likely to result in reduced duration of ECMO, which has its own improvements in morbidity and mortality, and improved overall ECMO survival.
 - Initially, as mortality is reduced with improved airway bleeding management, we believe length of stay will be longer since these patients are surviving more, but over time the ICU length of stay may also be improved.

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Rationale

This pathway will impact various parts of patient care. Patients requiring ECMO already have a high mortality risk; implementation of this pathway will improve mortality risk specifically related to airway bleeding. When comparing patients on ECMO with airway bleeding to those without, patients with airway bleeding have more hours on ECMO, reduced survival to decannulation, and reduced survival to discharge. The more hours spent on ECMO, the higher the cost (approximately two times compared to patients without airway bleeding). The cost of utilizing nebulized TXA is minimal in comparison to the cost of ECMO for patients with airway bleeding. Potential negative consequences of this pathway include risk of systemic distribution of nebulized TXA, which could increase clot burden.

Metrics

1. Reduce hours on ECMO by 15% (to 150 hours) for patients with airway bleeding by December 2023. (Outcome metric)
2. Reduce mortality on ECMO by 5% (73% survival) for patients with airway bleeding by December 2023. (Outcome Metric)
3. Increase utilization of order set (*once created*) to 80% by December 2023. (Process Metric)
4. Monitoring clot burden for ECMO patients with airway bleeding (on patient or in ECMO circuit) (Balancing Metric)
 - a. Stroke, DVT, PE, circuit component issues with clots, intracardiac clots

Team Members

Champion:

- Jeffrey Salomon, MD, MBA (Intensive Care Physician)

Members:

- Jen Schmoker, BSN, RN, CCRN-K (Comparative Database Outcome Coordinator – ELSO, PEDECOR)
- Sara Mathews, MSN, RN, CNPT, CNML (ECMO Manager)
- Neil Schmedding, BHS-RT, RRT-NPS, RRT-ACCS (RT Educator and ECMO Specialist)
- Amanda Shapland, MSN, RN, CCRN (ECMO Specialist and Educator)
- Kim Glogowski, MS-P, CCP, LP (Chief of Perfusion Services)
- Drew Sankey, PharmD (Pharmacist)
- Kelsey Spackler, DNP, APRN-NP, CPNP-AC/PC (Supervisor, Clinical Effectiveness)
- Abby Vipond, MSN, APRN, FNP-C (Clinical Effectiveness Project Manager)

Evidence

1. Cao, A., Silverman, J., Zahtz, G., & Smith, L. P. (2022). Use of nebulized tranexamic acid in adult and pediatric post-tonsillectomy hemorrhage. *Otolaryngology Case Reports*, 23, 100409. <https://doi.org/10.1016/j.xocr.2022.100409>
2. Dermendjieva M, Gopalsami A, Glennon N, Torbati S. Nebulized Tranexamic Acid in Secondary Post-Tonsillectomy Hemorrhage: Case Series and Review of the Literature. *Clin Pract Cases Emerg Med*. 2021 Aug;5(3):1-7. doi: 10.5811/cpcem.2021.5.52549. PMID: 34437029; PMCID: PMC8373187.



Disclaimer: Pathways are intended as a guide for practitioners and do not indicate an exclusive course of treatment nor serve as a standard of medical care. These pathways should be adapted by medical providers, when indicated, based on their professional judgement and taking into account individual patient and family circumstances.

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3. Eltahir M, Elshafei MN, Elzouki A. Inhaled Tranexamic Acid for Non-Massive Haemoptysis in a Rivaroxaban-Receiving Patient Not Responding to the Oral Form. *Eur J Case Rep Intern Med.* 2020 Dec 30;7(12):001930. doi: 10.12890/2020_001930. PMID: 33585326; PMCID: PMC7875595.
4. O'Neil, Erika R. MD1; Schmees, Lindsay R. PharmD1,,2; Resendiz, Karla PharmD1,,2; Justino, Henri MD3; Anders, Marc M. MD1 Inhaled Tranexamic Acid As a Novel Treatment for Pulmonary Hemorrhage in Critically Ill Pediatric Patients: An Observational Study, *Critical Care Explorations: January 2020 - Volume 2 - Issue 1 - p e0075* doi: 10.1097/CCE.0000000000000075
5. Pediatric ECMO Outcomes Registry. (n.d.). PEDECOR data dictionary and general instructions. Appendix B.
https://orit.research.bcm.edu/CTMS/Documents/PedecorDataDictionaryv6_1.pdf

CLINICAL



EFFECTIVENESS

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