Management of bleeding complications from veno-arterial extracorporeal membrane oxygenation (VA ECMO) cannulation

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What is VA ECMO?

Supports both heart and lung function
Blood is taken out of a vein, oxygenated, and returned into an artery
Why are Vascular Surgeons involved?

“Peripheral ECMO...is characterized by a higher rate of vascular complications...and vascular surgery after the complication has manifested.”

Motivation

• Dr. Alexander noticed a trend in bleeding complications for ECMO patients
  • In 2018, 89 patients on ECMO at ANW → 19 of which had bleeding complications

• He wanted to explore the relationship between bleeding complications, treatments, and mortality for patients on VA ECMO
ECMO use is increasing rapidly

Rao P et al., Circulation: Heart Failure, 2018
Objectives

1. Identify and summarize causes of bleeding in VA ECMO access cannulation sites
2. Estimate the association between bleeding complications from VA ECMO cannulation and risk of mortality
3. Develop management strategy for identification of cause and algorithm for treatment
Methods

• Retrospective cohort study of VA ECMO patients at Abbott Northwestern Hospital from January 1, 2010 to January 1, 2020.

• Epic Electronic medical Record System with the ability to capture targeted information via Allina Health’s Electronic Data Warehouse (EDW).
Step #1

1. Collected a list of the total number of VA ECMO patients who had vascular surgery intervention (223 patients)
2. Chart review of Admission/Discharge notes for these patients as well as all procedures that patients had while on VA ECMO
3. Selected patients who had documentation of unexpected bleeding
4. Collected data for all patients who had bleeding complications
Variables

- Demographics
- Time on ECMO
- Indication for placement
- ECMO cannulation characteristics
- Regional stats and coagulopathy labs
- Bleeding characteristics
- Outcomes
Step #2

1. Organized the data in an Excel spreadsheet
2. Calculated summary statistics
3. Calculated the mortality of all VA ECMO patients and VA ECMO patients with bleeding complications
4. Analyzed the collected data and looked for trends
Results
Demographics (n=29)

<table>
<thead>
<tr>
<th>Gender</th>
<th>Male</th>
<th>Female</th>
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Age: 58 ± 15 years  
BMI: 34 ± 11.7
Number of bleeding complications (n=223)

With bleeding complications
Without bleeding complications

Number of patients

13%
VA ECMO cannulation (bleeding, n=29)

Number of patients

- Open
- Percutaneous
- Combined

Cardiac surgeon
Interventional cardiologist

Number of patients

[Graphs showing the distribution of VA ECMO cannulation methods and the number of patients per specialty.]
Causes of bleeding

- Inadequately secured cannulas (41%)
- Movement of cannulas (38%)
- Incorrect cannula placement (38%)
- Other (34%)
  - Systemic anticoagulation
  - Infection
  - Poor recovery after cannulation
Ultrasound-guided placement

When ultrasound guidance was not used for percutaneous cannula placement:

- In 63% of patients, bleeding was found to be caused by incorrect placement
- In 63% of patients, wound breakdown occurred
Transfer patients

- 31% of patients were transfer patients, who received cannulation at a different hospital and were transferred to ANW (9 out of 29 patients)
- 63% of cases where there is no documentation of ultrasound guidance for percutaneous cannula placement (5 out of 8 patients)
Documentation of bleeding complications is increasing every year
What are the consequences of bleeding from VA ECMO access sites?
Hematoma (41%)
Transfusion (100%)
Dialysis (41%)
Limb ischemia (28%) and Compartment Syndrome (21%)
Operative intervention (100%)
Mortality

- VA ECMO patients with bleeding complications: Approximately 40%
- All VA ECMO patients: Approximately 50%

Mortality
Conclusions

Ultrasound guided cannulation may decrease incidence of bleeding.
Conclusions

Bleeding complications if managed quickly do not increase the mortality of VA ECMO
Why a decreased mortality?

• This contradicts previous literature
• Increased mortality is not due to vascular bleeding but other vascular complications
  • Like peripheral ischemia or compartment syndrome
• Strategies of bleeding management at ANW which involve vascular surgery intervention may play a role
What do we need to do next?

• Test a larger sample size (>100 patients)
• Compare data for patients on VA ECMO who had bleeding complications and those who did not
• Develop management strategy for identification of cause
• Create an algorithm
Thank you for your support!

• Dr. Alexander, JoAnne Goldman, and Derek Vang
• Larissa and Brynn
• Jan Dick, Maia Hendel, and the MHIF staff
• Fellow interns
• John and Susan Morrisons
Highlights
My future plans

• Currently applying to medical school for enrollment in fall 2021
• (Hopefully) Returning to college in January 2021
• Graduating from Columbia University in spring 2021