

Extracorporeal Membrane Oxygenation In Management Of High-risk Pulmonary Embolism: A Single-Center Experience

Collaborators:

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Objective

- To evaluate the outcomes of patients with high-risk pulmonary embolism (PE) treated with extracorporeal membrane oxygenation (ECMO) at our institution.

Background

- Pulmonary embolism (PE) is the third leading cause of cardiovascular mortality in the United States, with high-risk PE carrying especially high mortality.
- A systematic review including 301 patients with high-risk acute PE showed that 65% of patients cannulated for ECMO survived.
 - Six-fold increased risk of death if cannulation occurred during CPR.
 - Three-fold increased risk of death in patients > 65 years old
- Standard therapy (thrombolysis):
 - Reduces mortality but is often contraindicated
- This study examined the outcomes of patients with high-risk PE managed with ECMO at our institution.

Methods: Study Design & Data Collection

- **Study Design:**

- Retrospective single-center cohort study of a quaternary referral center in Los Angeles, California
- Data was collected manually by comprehensive chart review

- **Data Points Collected:**

- Demographics
- Clinical presentation & risk assessment
- Comorbidities
- Hemodynamic parameters
- Cardiac function
- Laboratory values
- Interventions/Management
- Hospital Course
- Outcomes

Methods: Outcomes

- **Primary Outcomes:**
 - Duration of ECMO
 - ICU Length of Stay (LOS)
 - In-hospital mortality
 - 1-year mortality
 - Bleeding complications

Methods: Population

Inclusion Criteria:

- Patients admitted to Cedars-Sinai Medical Center between 2014 and 2024 with confirmed high-risk pulmonary embolism (PE) who received extracorporeal membrane oxygenation (ECMO) support as primary treatment.

Exclusion Criteria:

- Patients who died prior to obtaining sufficient clinical data for analysis.

Final Cohort:

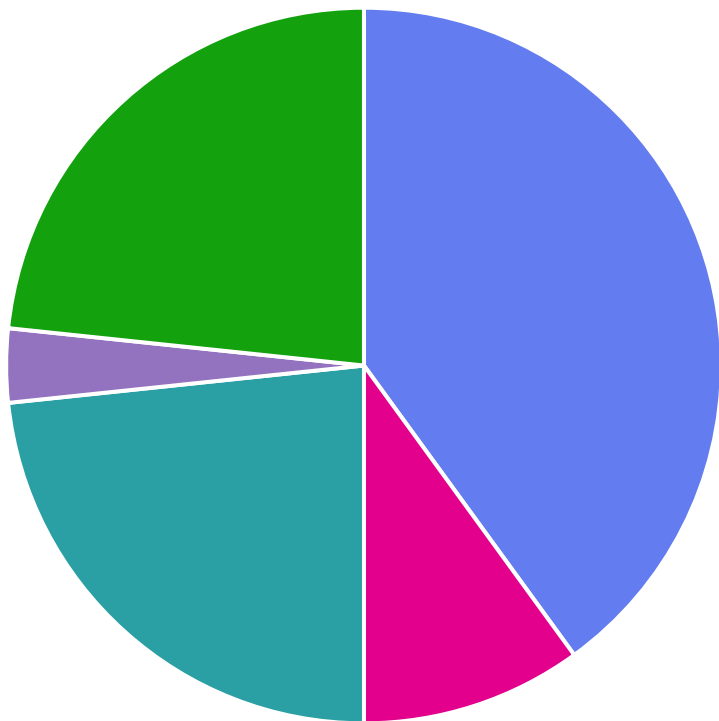
- 30 patients cannulated for VA-ECMO

Results – Demographics/Baseline Characteristics

Demographics	
n	30
Female	36% [11]
Age (Median)	58.5
Ethnicity	
White	66%
Black	16%
Other/Unknown	18%

Baseline Characteristics	
SAVE Score Median [IQR]	-5 [-9, -2]
SDI Median [IQR]	5 [3, 7]
RV Strain on TTE	90% [27]
Confirmed PE	73% [22]
DVT Present	30% [9]
Clot-In-Transit	26% [8]
Cardiac Arrest	43% [13]
ICU LOS Median [IQR]	11 [3.75, 20.5]
Hospital LOS Median [IQR]	18 [4.75, 35]

Results – Interventions in Addition to ECMO



- Catheter thrombectomy alone (40%, n=12)
- Systemic thrombolysis alone (10%, n=3)
- Systemic thrombolysis + Thrombectomy (23%, n=7)
- Catheter-Directed Thrombolysis alone (3%, n=1)
- None (23%, n=7)

Results

ECMO Duration

	<=5 days	>5 days	<i>p-value</i>
n	13	17	
Male	9 (69%)	10 (58%)	0.71
Age >60	4	8	0.47
RV Dysfunction	11 (84%)	16 (94%)	0.56
Cardiac Arrest	7 (53%)	8 (47%)	1
Mortality	9 (69%)	6 (35%)	0.14
Thrombectomy + t-PA	2 (15%)	5 (29%)	0.19
Thrombectomy alone	5 (38%)	7 (41%)	
CDT alone	0	1 (5%)	
t-PA alone	2 (15%)	1 (5%)	
No intervention	4 (30%)	3 (17%)	

ICU LOS

	<= 10 days	>10 days	<i>p-value</i>
n	15	15	
Male	12 (80%)	7 (46%)	0.13
Age >60	5	7	0.67
RV Dysfunction	12 (80%)	14 (93%)	0.6
Cardiac Arrest	8 (53%)	7 (46%)	1
Mortality	12 (80%)	3 (20%)	0.003 OR 16
			(2.7,95.8)
Thrombectomy + t-PA	2 (13%)	5 (33%)	0.4
Thrombectomy alone	5 (33%)	7 (46%)	
CDT alone	0	1 (6%)	
t-PA alone	3 (20%)	0	
No intervention	5 (33%)	2 (13%)	

Results

In-hospital Death			
	Survivors	Non-Survivors	p-value
n	16	14	
Male	8	11	0.14
Age >60	8	4	0.28
RV Dysfunction	15	12	0.59
Cardiac Arrest	8	7	1
Thrombectomy + t-PA	5	2	0.03 OR 11.3 (1.15,110.47)
Thrombectomy alone	8	4	
CDT alone	1	0	
t-PA alone	1	2	
No intervention	1	6	

Results

- Significant associations:
 - In-hospital death was more likely without catheter thrombectomy: OR 11.3 (95% CI 1.15 – 110.47, $p = 0.03$).
- Non-significant associations:
 - No significant differences were seen for sex, age, RV dysfunction, or cardiac arrest across ECMO duration, ICU LOS, or survival outcomes.
 - ECMO duration (≤ 5 vs. > 5 days) was not significantly associated with mortality ($p = 0.14$) or other clinical factors.
- Only two patients had bleeding complications (one major - requiring operative repair of an aneurysm, and one minor).

Conclusion

- **VA-ECMO was the predominant support modality** used for patients with high-risk PE, reflecting their severity and hemodynamic instability.
- **Most patients required emergent ECMO due to cardiac arrest,**
 - Underscores ECMO's role as a life-saving bridge to therapies like thrombolysis or thrombectomy.
- Only 6.2% of patients received reperfusion intervention prior to ECMO cannulation, highlighting
 - The severity of their clinical presentations
 - The need for ECMO as an initial resuscitative measure when immediate intervention is not possible.
- Despite low median SAVE scores the observed outcomes were
 - In-hospital mortality: 46%
 - One-year survival: 50%

Conclusion

- Median ECMO duration was short with favorable survival rates
 - Once stabilized on ECMO, patients may benefit from delayed but definitive reperfusion strategies.
- Low incidence of major bleeding complications indicates
 - ECMO can be safely implemented alongside adjunctive therapies like thrombolysis.
- **Findings support VA-ECMO as a viable and effective bridge to reperfusion therapy in critically ill patients with high-risk PE**
- Future directions: Multicenter studies are needed to
 - Validate these results
 - Optimize patient selection
 - Refine timing of intervention
 - Improve management strategies in this high-risk population

Thank You!

