

The Role of ECMO in High-Risk PE: A Retrospective Cohort Study

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Background

- Pulmonary embolism with cardiac arrest or shock has a high mortality rate, up to 52% in one registry study.¹
- Extracorporeal membrane oxygenation (ECMO) can provide hemodynamic support in patients with right ventricular failure and shock.²
- There is no consensus on the role of ECMO in patients with high-risk PE.³
- We compared clinical outcomes among patients with high-risk PE who were treated with and without ECMO.

Methods

- **Inclusion:** Patients with high-risk PE admitted to the University of Utah Hospital between May 1, 2018, and February 1, 2024.
- **High risk PE:** Patients with ICD-10 code for PE and SBP < 90 mm Hg for at least 15 minutes or need for vasopressors
- **Exclusion:** Patients without objectively confirmed PE on imaging study
- **Primary outcome:** in-hospital mortality
- **Secondary outcomes:** major bleeding, minor bleeding, clinically relevant non-major bleeding, and hospital length of stay
- **Statistical analysis:** Baseline characteristics and outcomes were compared using a t test for continuous values and a chi squared test for categorical values.

Results

Table 1. Baseline characteristics of patient with high-risk PE

| | No ECMO n=29 | ECMO n=20 | |
|---|-----------------|--------------|----------|
| Age in years, mean (SD) | 66.4 (13.4) | 48.8 (16.5) | p <0.001 |
| Female, n (%) | 11 (44.8) | 9 (45) | p=0.990 |
| Race/ethnicity, n (%) | | | p=0.366 |
| American Indian/Alaskan | 0 | 1 (5) | |
| Asian | 0 | 1 (5) | |
| Black or African American | 1 (3.4) | 0 | |
| Hispanic or Latino | 1 (3.4) | 0 | |
| Unidentified | 1 (3.4) | 3 (15) | |
| White or Caucasian | 24 (82.8) | 14 (70) | |
| Charlson Comorbidity, median (IQR) | 4 (1-7) | 2 (1-3.5) | p=0.061 |
| Sustained hypotension > 15 minutes, n (%) | 24 (82.8) | 20 (100) | p=0.050 |
| Treatment with pressors, n (%) | 23 (79.3) | 19 (95) | p=0.123 |
| Cardiac Arrest, n (%) | 7 (24) | 15 (75) | p <0.001 |
| Reperfusion Therapies, n (%) | | | |
| Systemic tPA | 13 (44.8) | 9 (45) | p=0.990 |
| Catheter directed therapy | 15 (51.7) | 11 (55) | p=0.821 |
| Surgical embolectomy | 0 | 3 (15) | |
| No reperfusion therapy | 0 | 4 (20) | |
| Anticoagulation, n (%) | | | |
| Unfractionated heparin | 27 (93) | 20 (100) | p=0.230 |
| Enoxaparin | 14 (48.3) | 6 (30) | p=0.201 |
| Apixaban | 12 (41.4) | 8 (40.0) | p=0.923 |
| Warfarin | 5 (17.2) | 10 (50) | p=0.014 |

Table 2. Clinical outcomes of patient with high-risk PE

| | No ECMO | ECMO | |
|------------------------------------|------------|---------|----------|
| In hospital mortality, n (%) | | | |
| All patients | 11 (37.9%) | 5 (25%) | p=0.343 |
| Patients with cardiac arrest* | 5 (71.4%) | 3 (20%) | p=0.020 |
| Major bleeding | 27.60% | 90% | p<0.0001 |
| Minor bleeding | 17.24% | 0 | p=0.07 |
| Clinically relevant minor bleeding | 6.90% | 0 | p=0.507 |
| Length of stay (days) | 8.4 | 17.2 | p=0.0154 |

* 22 total patients with cardiac arrest

Conclusions

- Among patients with high-risk PE there was no significant difference in in-hospital mortality for patients treated with or without ECMO, but the subgroup of patients presenting with cardiac arrest due to PE who were treated with ECMO had significantly lower in-hospital mortality.
- Patients treated with ECMO had higher rates of major bleeding and longer length of stay.
- Patients with cardiac arrest secondary to PE may benefit from treatment with ECMO, but randomized studies are needed.

References

1. Kucher N, Rossi E, De Rosa M, Goldhaber SZ. Massive pulmonary embolism. *Circulation*. 2006;113(4):577-582. doi:10.1161/CIRCULATIONAHA.105.592592
2. Meneveau N, Guillon B, Planquette B, et al. Outcomes after extracorporeal membrane oxygenation for the treatment of high-risk pulmonary embolism: a multicentre series of 52 cases. *Eur Heart J*. 2018;39(47):4196-4204. doi:10.1093/eurheartj/ehy464
3. Konstantinides SV, Meyer G, Becattini C, et al. 2019 ESC Guidelines for the diagnosis and management of acute pulmonary embolism developed in collaboration with the European Respiratory Society (ERS). *Eur Heart J*. Jan 21 2020;41(4):543-603. doi:10.1093/eurheartj/ehz405