

Ultrasound-assisted Catheter-directed Thrombolysis for High-Risk Pulmonary Embolism: A Single-center Experience

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Abstract

Introduction. Systemic thrombolysis for high-risk pulmonary embolism (PE) is effective but carries significant bleeding risk. Ultrasound-assisted catheter-directed thrombolysis (USAT) may offer effective reperfusion in selected patients and have a more favorable safety profile. We evaluated USAT for high-risk PE associated with hypotensive or normotensive shock.

Methods. This retrospective single-center cohort included 50 consecutive patients with high-risk PE receiving USAT, 2018-2026. Patients presented with hypotensive shock requiring vasopressors (n=41, 82%) or normotensive shock defined by lactate ≥ 2 mmol/L and National Early Warning Score 2 ≥ 9 (n=9, 18%). Outcomes included hemodynamic parameters, in-hospital death, and major bleeding (ISTH criteria).

Results. Among 50 patients, the median dose of alteplase used during USAT was 20 mg with approximately 20% of the patients receiving a 10-mg alteplase bolus. USAT reduced mean pulmonary artery pressure by 13.5 mmHg (95% CI: -16.0 to -11.0; $p < 0.001$ for before-after comparison). Complete resolution of right ventricular dysfunction occurred in 67% of patients at 24 hours. Early decompensation occurred in one patient within 7 days. In-hospital mortality was 6% (3/50). Major bleeding occurred in 8% (4/50) of patients with no intracranial hemorrhages. Among patients with normotensive shock, no adverse events were recorded, including death, bleeding, or early decompensation. **Table 1**

Conclusion. USAT appears to be feasible, effective, and safe for selected patients with acute high-risk PE. Future trials should confirm these preliminary findings and determine whether USAT may represent a treatment option for hemodynamically unstable patients in whom improvement over several hours, rather than within minutes, is clinically acceptable.

Table 1. Clinical and Safety Outcomes

Outcome	Total (n=50)	Hypotensive Shock (n=41)	Normotensive Shock (n=9)
In-hospital all-cause mortality, n (%)	3 (6)	3 (7.3)	0 (0)
Early decompensation/rescue ≤7d, n (%)	1 (2)	1 (2)	0 (0)
Decompensation/rescue ≤30d, n (%)	3 (6)	3 (7)	0 (0)
Stroke, n (%)	0 (0)	0 (0)	0 (0)
Major bleeding (ISTH), n (%)	4 (8)	4 (10)	0 (0)
Non-major bleeding, n (%)	1 (2)	1 (2)	0 (0)
VTE recurrence, n (%)	0 (0)	0 (0)	0 (0)
Hospitalisation			
ICU admission post-USAT, n (%)	33 (66)	30 (73)	3 (33)
Length of hospitalisation (days), median (Q1–Q3)	8.0 (5.0–15.0)	8.0 (5.0–16.0)	6.0 (3.0–7.0)

Table 1. Data are median (Q1–Q3) for continuous variables and n (%) for categorical variables. n=number; IQR (Q1–Q3): interquartile range; ISTH: International Society on Thrombosis and Haemostasis; VTE: venous thromboembolism; ICU: intensive care unit; USAT: ultrasound assisted catheter directed thrombolysis