

Title:

Beyond Clot Removal: Location Matters for Biventricular Recovery

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Abstract:

Background: Large-bore mechanical thrombectomy (LBMT) improves haemodynamics in acute pulmonary embolism (PE), yet the determinants of procedural success and mechanisms underlying biventricular recovery remain incompletely understood. We investigated whether the anatomical location of thrombus removal determines right ventricular (RV) unloading and how this translates into improved left ventricular (LV) filling.

Methods: In a retrospective single-centre cohort of 50 patients with intermediate-high- or high-risk PE undergoing LBMT, paired computed tomography and invasive haemodynamics were used to quantify location-specific thrombus removal and biventricular remodelling. In a nested subgroup of 26 patients, interventricular septal geometry and LV filling dynamics were additionally investigated.

Results: LBMT significantly reduced pulmonary artery pressures and RV volumes while increasing LV-volumes (all $p < 0.001$ in the overall cohort). Despite significant thrombus removal throughout the pulmonary arterial tree, only peripheral clearance independently predicted RV unloading ($\beta = 5.87$, 95% CI 2.73–9.01; $p < 0.001$), whereas central clearance did not ($p = 0.77$). Intraprocedural systolic pulmonary artery pressure (sPAP) reduction identified effective peripheral clearance (AUC 0.79, 95% CI 0.64–0.94). In the nested subgroup, RV unloading was accompanied by normalization of septal curvature, increased LV volume (+16.15 mL; $p = 0.006$), and improved diastolic filling (E/e' ; $p = 0.0002$). Changes in septal curvature correlated strongly with sPAP reduction ($r = -0.84$; $p < 0.001$), while mediation analysis suggested that septal geometry accounted for approximately 64% of the association between pulmonary pressure and LV filling pressure.

Conclusions: The haemodynamic benefits of LBMT appear to depend predominantly on peripheral rather than central thrombus removal. Effective distal reperfusion is associated with RV unloading and restoration of ventricular interdependence, ultimately improving LV filling. Intraprocedural sPAP reduction may provide a readily available marker of effective reperfusion and a potential physiological endpoint for guiding thrombectomy. These findings challenge the conventional focus on central clot extraction and suggest that haemodynamic rather than angiographic endpoints may better reflect procedural success during mechanical thrombectomy.