

Tromboembolismo venoso: aspetti clinici e diagnostici

PROGNOSTIC IMPACT OF RIGHT VENTRICULAR DYSFUNCTION AND HYPOXEMIA IN HEMODYNAMICALLY STABLE ACUTE PULMONARY EMBOLISM: AN INDIVIDUAL PATIENT DATA META-ANALYSIS

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Background. In hemodynamically stable acute pulmonary embolism (PE), right ventricular dysfunction (RVD) is a key determinant of early risk. Hypoxemia at presentation is common and may reflect ventilation–perfusion mismatch or the worsening of pre-existing respiratory failure due to non-PE causes . Whether hypoxemia adds prognostic information beyond RVD remains uncertain.

Purpose. The aim of this study was to evaluate the independent and combined associations of RVD and hypoxemia with short-term mortality in acute PE.

Methods. We conducted an individual patient data meta-analysis of observational studies including adults with objectively confirmed acute PE (PROSPERO CRD4202238420). Respiratory insufficiency was defined as oxygen saturation <90% on room air at presentation. The primary outcome was short-term all-cause mortality (in-hospital or ≤30 days); secondary outcome was PE-related mortality. Mixed-effects logistic regression models with random intercept for study were used. Patients were classified into three groups: neither condition, either RVD or hypoxemia alone, and both conditions. An interaction term assessed effect modification.

Results. The analysis included 2,218 patients from six studies. Overall, 52.6% had neither condition, 36.4% had one, and 11.0% had both. Short-term all-cause mortality increased progressively across groups (4.5%, 7.8%, and 11.1%). Compared with patients without either condition, the odds of death were higher in those with one condition (OR 1.88, 95% CI 1.29–2.76) and highest in those with both (OR 2.68, 95% CI 1.64–4.37). In the subset with data on PE-related mortality (n=1,844), mortality rose from 1.9% (reference) to 4.0% (OR 2.39, 95% CI 1.30–4.39) and to 7.2%(OR 4.36, 95% CI 2.17–8.75) in the three groups, respectively. Among haemodynamically stable patients (n=2,152), the associations remained consistent (neither condition=reference, one condition: OR 1.86, 95% CI 1.25–2.77; both: OR 2.25, 95% CI 1.31–3.88). Similar results were observed for PE-related mortality. No significant interaction was detected (p=0.43 for all-cause; p=0.67 for PE-related mortality), indicating additive rather than synergistic effects.

Conclusions. In hemodynamically stable acute PE, hypoxemia identifies a clinically meaningful subgroup at increased short-term risk, particularly when combined with RVD. Mortality exceeded 11% in patients presenting with both conditions despite initial stability. Integrating oxygenation status with cardiac imaging markers may refine early risk stratification and support closer monitoring or timely therapeutic escalation.