

EDITORIAL

Pulmonary Embolism — a Short- to Long-term Approach

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Acute pulmonary embolism (PE) remains a potentially life-threatening condition in the acute phase and continues to be associated with a high mortality risk in the long-term. Studies performed in the acute phase indicated a direct correlation between mortality and several clinical parameters such as the presence of hemodynamic instability upon admission, cardiogenic shock, the need for cardiopulmonary resuscitation or acute right heart failure due to a sudden increase in right ventricular loading. The long-term outcome has been shown to be dependent on patient-related risk factors and comorbidities, including malignant pathologies or sepsis associated with an underlying cardiovascular disease.^{1,2}

The diagnosis of pulmonary embolism is based on the complex integration of clinical, laboratory and imaging biomarkers.³ The clinical characteristics of PE are not specific; symptoms include dyspnea, chest pain, loss of consciousness or hemoptysis, as well as signs of deep vein thrombosis. In uncertain conditions, the clinical probability of PE is assessed using two validated prediction rules: the Wells score³ and the revised Geneva rule.⁴ The primary laboratory biomarker used to exclude PE is the D-dimer test, due to its high negative predictive capacity. A normal value of D-dimers is unlikely to occur in PE or deep vein thrombosis.⁵ Also, D-dimer assay can be used for risk stratification in the case of a normotensive patient with PE.⁶ Electrocardiographic changes in acute PE consist of signs of right ventricular strain, right bundle branch block, right QRS axis deviation and S1Q3T3 pattern, although the ECG may be entirely normal.⁷ The imaging techniques include CT Pulmonary Angiography (CTPA), the current gold standard in the diagnosis of PE,⁸

and transthoracic echocardiography, which possesses low diagnostic sensitivity, but it is used in risk stratification because it identifies right ventricular dysfunction and increased RV loading conditions.⁹

Two clinical risk models have been validated for the assessment of short-term prognosis of pulmonary embolism, including the Geneva risk score⁴ and the Pulmonary Embolism Severity Index (PESI).¹⁰ The PESI score has been validated for the prediction of both short- and long-term outcomes in acute pulmonary embolism, and it includes eleven clinical variables, including patient demographics, associated illnesses, as well as clinical findings, pulse, systolic blood pressure, respiratory rate, temperature, oxygen saturation and mental status. The score groups patients into five risk classes.¹¹

In the current issue of JCE, a study by Opincariu *et al.*, "Factors Associated with One-year Mortality in Patients with Acute Pulmonary Embolism Who Survived the Acute Event"¹² addresses a crucial topic related to the long-term prognosis of patients with acute pulmonary embolism who survived the first month following the acute phase. The majority of risk-prediction studies used in-hospital mortality or 30 days all-cause mortality as primary endpoints, focusing on the short-term outcomes.^{13,14}

So far, only a few studies assessed the long-term prognosis of PE. Therefore Opincariu's study is valuable as it aims to identify possible factors correlated with one-year mortality following an acute PE episode. Interestingly, the results of the paper indicated a lower overall mortality rate at one year, compared to European and American statistics.^{15,16} The main clinical factors that were positively associated with a higher mortality rate at one year were

older age, higher body weight, the presence of associated pulmonary pathologies and chronic kidney disease, and left axis deviation upon ECG examination. As expected, hemodynamically unstable patients, including those with cardiogenic shock, inotropic requirement or the need for cardiopulmonary resuscitation, had a significantly higher death rate at one year following an acute PE episode.

Furthermore, the study showed that patients who had a lower left ventricular ejection fraction (LVEF) at baseline, assessed by echocardiography, had a higher mortality compared to patients that had a normal LVEF. This could indicate that patients with an impaired systolic function of the left ventricle, before the pulmonary embolism, have a worse outcome. An interesting finding of the study was the higher presence of left QRS axis on the baseline electrocardiogram. The main ECG changes in PE are related to the increased right ventricular load, which is expressed as the presence of right QRS axis, right bundle branch block, and S1Q3T3 patterns.^{7,17}

The literature results have shown that the association of malignant conditions with pulmonary embolism leads to a worse outcome, due to increased bleeding and a high risk of embolism recurrence.¹⁸ Opincariu's study did not find any correlations between the presence of cancer and mortality rates.

Venez and colleagues have shown, in a study published in the American Journal of Hematology, that thirty-day mortality was higher in PE patients who had an increased white blood cell count.¹⁹ This was in agreement with Opincariu, indicating that an enhanced inflammatory status during the acute phase is linked with a poorer outcome at one year.

It would be interesting to continue the observation of survivors of pulmonary embolism over a longer period of follow-up, to observe whether factors that predict one-year mortality could be associated with a worse outcome in the long-term. Also, it would be interesting to analyze the factors that predict mortality in this study, in the context of previously designed prognostic scores. This could be a new research topic for the authors in the future.

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