Hypoperfusion markers identify patients with acute pulmonary embolism at highest risk for an adverse outcome

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Topic(s):
Pulmonary Circulation, Pulmonary Embolism, Right Heart Failure – Epidemiology, Prognosis, Outcome

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Background/Introduction: According to the European Society of Cardiology (ESC) 2014 guideline, systemic hypotension (HT) is the critical variable defining high-risk in patients with pulmonary embolism (PE). However, signs of organ hypoperfusion might more adequately identify PE patients with cardiogenic shock due to right ventricular (RV) failure.

Purpose: We investigated whether hypoperfusion markers provide superior prognostic information for identifying PE patients at highest risk of early adverse outcomes.

Methods: Consecutive PE patients enrolled in a prospective single-centre registry between 09/2008 and 03/2018 were included. We analysed the predictive value of symptoms and findings suggesting hypoperfusion for in-hospital adverse outcome (catecholamine treatment, resuscitation or PE-related death) and in-hospital all-cause mortality.

Results: We analysed 814 patients, including 83 (10.2%) ESC 2014 high-risk patients. Patients presenting with cardiac arrest (CA, 4.5%) were a priori defined as high risk. Markers suggesting hypoperfusion of the brain (altered metal status, odds ratio [OR] 8.2 [95%CI, 4.2-16.0]), lung (respiratory insufficiency, 25.0 [9.4-66.7]) and tissue (venous lactate =2.2 mmol/l, 6.4 [3.2-12.9]) as well as HT (13.5 [6.7-27.2]) predicted an adverse outcome. The risk for an adverse outcome increased with the number of positive markers (AUC 0.86 [0.80-0.93]). Patients with ≥3 positive hypoperfusion markers had an OR of 42.9 (11.0-167.3) and patients defined as high-risk by the ESC 2014 an OR of 17.2 (8.8-33.3) with regard to an adverse outcome (Figure 1; Table 1).

A new definition of high-risk (CA or ≥3 hypoperfusion markers) was associated with an OR of 73.2 (31.3-171.1) for an in-hospital adverse outcome and 26.2 (12.1-56.7) for in-hospital mortality.

Conclusions: Markers of organ hypoperfusion have high predictive value for early adverse outcomes in acute PE. Risk increases with the number of positive markers and is critically elevated in patients presenting with CA or ≥3 markers.
Abstract:
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<table>
<thead>
<tr>
<th>Hypoperfusion marker</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>LR+</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥1 hypoperfusion marker</td>
<td>1.1%</td>
<td>21.0%</td>
<td>91.9%</td>
<td>68.2%</td>
</tr>
<tr>
<td>≥2 hypoperfusion markers</td>
<td>4.7%</td>
<td>50.0%</td>
<td>48.6%</td>
<td>95.5%</td>
</tr>
<tr>
<td>≥3 hypoperfusion markers</td>
<td>6.5%</td>
<td>75.0%</td>
<td>24.3%</td>
<td>99.3%</td>
</tr>
<tr>
<td>ESC 2014 high-risk</td>
<td>5.7%</td>
<td>51.1%</td>
<td>35.0%</td>
<td>96.9%</td>
</tr>
<tr>
<td>Cardiac arrest</td>
<td>8.4%</td>
<td>86.5%</td>
<td>33.0%</td>
<td>99.3%</td>
</tr>
</tbody>
</table>

Table 1: Prognostic performance of hypoperfusion markers. Abbreviations: LR+: positive likelihood ratio, OR: odds ratio, CI: confidence interval.