Valvular, Myocardial, Pericardial, Pulmonary, Congenital Heart Disease –
Pulmonary Circulation, Pulmonary Embolism, Right Heart Failure – Epidemiology, Prognosis, Outcome

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Venous lactate predicts adverse outcomes in normotensive pulmonary embolism

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Background/Introduction: Arterial lactate is an established risk marker in patients with acute pulmonary embolism (PE). However, its clinical application is limited by the need for an arterial puncture, a procedure not routinely performed in haemodynamically stable PE patients. In contrast, information on venous lactate can be easily obtained via peripheral venepuncture and might thus be more suitable for risk assessment in normotensive PE.
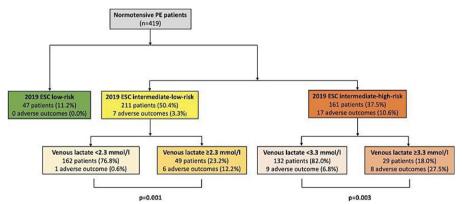
Purpose: To investigate the prognostic value of peripheral venous lactate for outcome prediction in normotensive patients with acute PE.

Methods: Consecutive normotensive PE patients enrolled in a prospective single-centre registry between 09/2008 and 03/2018 were studied. Study outcomes included in-hospital adverse outcome (PE-related death, cardiopulmonary resuscitation or vasopressor treatment) and all-cause mortality. An optimised venous lactate cut-off concentration was identified using receiver operating curve analysis and its prognostic value compared to the established cut-off value for arterial lactate (2.0 mmol/l) and the upper limit of normal for venous lactate (2.3 mmol/l). Furthermore, we tested if addition of venous lactate to the 2019 European Society of Cardiology (ESC) risk stratification algorithm improves risk prediction.

Results: We analysed data from 419 (age 70 [interquartile range (IQR) 57–79] years; 53% female) patients. Patients with an in-hospital adverse outcome had higher venous lactate concentrations than those with a favourable clinical course (3.1 [IQR 1.3–4.9] vs. 1.6 [IQR 1.2–2.3] mmol/l, p=0.001). An optimized cut-off value of 3.3 mmol/l predicted both, adverse outcome (OR 11.0 [95% CI 4.6–26.3]) and all-cause mortality (OR 3.8 [95% CI 1.3–11.3]). Venous lactate ≥2.0 mmol/l and ≥2.3 mmol/l had lower predictive value for an adverse outcome (OR 3.6 [95% CI 1.5–8.7] and OR 5.7 [95% CI 2.4–13.6], respectively) and did not predict all-cause mortality. If venous lactate was added to the 2019 ESC algorithm (Figure), a cut-off concentration of 2.3 mmol/l had high negative predictive value (0.99 [95% CI 0.97–1.00]) for an adverse outcome in intermediate-low-risk patients, whereas levels ≥3.3 mmol/l predicted adverse outcomes in the intermediate-high-risk group (OR 5.2 (95% CI 1.8–15.0).

Conclusions: Even modest venous lactate elevations above the upper limit of normal (2.3 mmol/l) were associated with increased risk for an in-hospital adverse outcome and a cut-off value of 3.3 mmol/l provided optimal prognostic performance predicting both, an adverse outcome and all-cause mortality. Adding venous lactate to the 2019 ESC algorithm seems to further improve risk stratification. Importantly, the established cut-off value for arterial lactate (2.0 mmol/l) has limited specificity in venous samples and should not be used.

Venous lactate for risk stratification