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DISCUSSION FORUM

Right ventricle assessment in patients with pulmonary embolism: low risk = low yield for systematic echocardiography

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This commentary refers to 'Right ventricle assessment in patients with pulmonary embolism at low risk for death based on clinical models: an individual patient data meta-analysis', by C. Becattini *et al.*, https://doi.org/10.1093/eurheartj/ehab329 and the discussion piece 'Echocardiography for risk stratification in patients with pulmonary embolismat low risk of death: a response', by G. Maraziti *et al.*, https://doi.org/10.1093/eurheartj/ehab779.

Right ventricular (RV) dysfunction is a highly prevalent complication of acute pulmonary embolism (PE): it affects more than one third of patients and contributes to the excessive mortality of PE.[1] The individual patient data meta-analysis of 18 studies published by Becattini and co-workers investigated whether RV assessment by imaging and/or biomarkers in PE patients with low mortality risk as predicted on clinical models might further improve risk stratification in these patients.[2] The analysis confirmed that clinical models are excellent tools to identify low-risk patients: indeed, short-term mortality among the cohort of 5'010 patients was very low (0.7%, 95% confidence interval 0.4–1.3%). The study further showed that evidence of RV dysfunction was associated with an approximately four- to five-fold increased risk of death (both in-hospital/30-day and 3-month all-cause mortality). The authors concluded that routine RV assessment by echocardiography or natriuretic peptides should be considered in all patients with low-risk PE to improve risk stratification.

We struggle with this conclusion, mainly for the three following reasons:

First, the yield of echocardiography in low-risk PE patients to identify RV dysfunction was low: RV function was normal in 75% (1430/1904 patients) of all patients undergoing echocardiography. The mortality rate in this group was 0.5% (7 patients). The cause of death of these patients is unclear. Among the group of patients with RV dysfunction identified by echocardiography, the mortality was 2.8% (13/474 patients). It remains obscure whether PE was causative for the death in all of these cases. Even in the unlikely scenario in which this would be the case, a total of >145 examinations have to be performed to identify one patient with RV dysfunction that will die within 30 days. To date no criteria exist to identify the minority of patients with RV dysfunction that will die despite favourable clinical prediction.[3]

Second, identification is not prevention. In other words: the identification of patients at risk of death does not automatically translate into improved survival rates. Most PE-related deaths occur within the first 24 h and frequently cannot be avoided despite optimal management.[4] Deaths occurring >7 days after the initial thromboembolic event are usually not related to PE. As such, the all-cause 30-day mortality is an inconclusive parameter in this cohort of patients. In the study by Becattini and co-workers, the 3-month mortality was attributed to PE only in half of cases (i.e. all-cause mortality 0.8%; PE-related mortality 0.4%), indicating a high burden of comorbidities in this population. For these reasons, we anticipate that the effective yield of a systematic screening for RV dysfunction is even lower than reported.[5]

Third, the examination of RV function by echocardiography requires the integration of multiple measurements and should be performed by experienced investigators. These experts are unlikely to be available 24/7 in all emergency departments. And, finally, since pre-existing cardiovascular disease is highly prevalent in PE patients, alterations of RV function or elevated natriuretic peptides might arise from the concomitant cardiac conditions (e.g., left-ventricular dysfunction) and are difficult to attribute to PE.

Conflict of interest: none declared.

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Echocardiography for risk stratification in patients with pulmonary embolism at low risk of death: a response

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This commentary refers to 'Right ventricle assessment in patients with pulmonary embolism at low risk for death based on clinical models: an individual patient data meta-analysis', by C. Becattini *et al.*, https://doi.org/10.1093/eurheartj/ehab329 and the discussion piece 'Right ventricle assessment in patients with pulmonary embolism: low risk = low yield for systematic echocardiography', by M. Arrigo and L.C. Huber, https://doi.org/10.1093/eurheartj/ehab762.

We thank Drs Arrigo and Huber for their interest in our study. In 1904 patients with acute pulmonary embolism (PE) at low risk for death by means of pulmonary embolism severity index (PESI) or simplified PESI (sPESI) scores who were investigated by echocardiography we found a 2.8% (1.5–5.2%) vs. 0.5% (0.2–1.1%) mortality rate at 30 days in the presence or absence of right ventricle dysfunction (RVD), respectively.[1] We agree that identifying RVD is different from identifying the cause of death. In fact, small PEs may occur in otherwise sick patients, and the cause of death can be other than incident PE. However, in our meta-analysis in patients with low-risk PE, PE-related mortality at 3 months occurred in 2.3% and 0.09% of patients with and without RVD at echocardiography, respectively. Despite the low yield of echocardiography, these results accounted for a positive association between RVD and PE-related mortality at 3 months. Unfortunately, we could not identify any other additional independent predictor of death besides RVD by sensitivity analyses in this particular patient population. Further studies in the future with a larger sample size are to be conducted to provide data on strategies for identifying the minority of patients with RVD that will die despite favourable clinical prediction.

We agree that identification is not prevention, and it does not automatically translate into improved survival rates. However, identifying PE patients at very low risk of death can inform clinician decision-making about patient disposition. For example, the selection of home treatment directly from the emergency department or after a short hospital stay may be reserved for this prognostic stratum. At the same time, patients at higher risk may be better suited to more watchful management. Our study has 30-day or in-hospital all-cause death as the primary study outcome. All-cause death is the hardest clinical endpoint, and it does not depend on subjective evaluation. Other clinical events such as PE-related death, clinical deterioration or treatment upgrading may vary across studies and by physician judgement. The choice of all-cause death as primary outcome is in agreement with guidelines by major scientific societies, particularly the 2019 european society of cardiology (ESC) Guidelines. We relied on the 2019 ESC Guidelines for prognostic stratification and definition of low-risk patients. Drs Arrigo and Huber attribute the discrepancy between all-cause mortality and PE-related mortality at 3 months (0.8% vs. 0.4%) to a high burden of comorbidities in this population. Though we had no access to complete records of study patients, their qualification as low-risk according to PESI or sPESI means that the prevalence of major cardiovascular, respiratory, and cancer comorbidities was very low.

Our results should be regarded in the current era of point-of-care ultrasonography, where the feasibility of RVD assessment by echocardiography has much improved, even for physicians other than cardiologists.[2,3] RVD parameters such as right ventricle dilatation, right ventricle/left ventricle ratio, decreased tricuspid annular plane systolic excursion and distended inferior vena cava with diminished inspiratory collapsibility are easily identifiable findings for trained non-cardiologist personnel.

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Data availability

The data underlying this letter will be shared on request to the corresponding author after agreement with each individual contributing author.

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