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Listen to Your Heart (but DON'T Look at Theirs): Risk Assessment for Home Treatment of Pulmonary Embolism

Outpatient therapy of pulmonary embolism (PE) has gained greater acceptance in the current era of risk stratification and direct oral anticoagulant (DOAC)-based treatment regimens. A growing experience in the medical literature has documented the safety and improved patient satisfaction with outpatient treatment of low-risk PE (1–4). Furthermore, the opportunity to decongest emergency departments and inpatient units, and reduce the overall cost burden of PE on healthcare systems, compels clinicians to select this strategy when feasible (5). The 2019 European Society of Cardiology guidelines for diagnosis and management of acute PE recommend risk stratification to identify low-risk patients who may be considered for home treatment if outpatient care can be arranged and adequate anticoagulation initiated (6). The 2016 American College of Chest Physicians guidelines suggest early discharge or home treatment of PE over hospitalization in low-risk patients whose home circumstances are adequate (7). However, despite tools for identification of appropriate patients, options for safe and effective outpatient treatment, and endorsement by guidelines, patients with low-risk PE are still frequently hospitalized (4).

Current risk stratification strategies for acute PE rely on synthesis of clinical decision rules; cardiac biomarkers, such as troponin and BNP (brain-type natriuretic peptide); and imaging of right ventricular (RV) function (8). Although these tools have been most widely endorsed for prognostication of adverse outcomes, they are also used for identification of low-risk patients who may avoid hospitalization for acute PE. Specific criteria for eligibility for home therapy were assessed by the Hestia investigators in a prospective cohort study of 297 patients with PE (9). The Hestia criteria identified a cohort of patients with acute PE who completed outpatient therapy with a low risk of adverse events, including recurrent venous thromboembolism (2%), all-cause mortality (1%), and major bleeding (0.7%).

Further contributing to a low adverse event rate with outpatient therapy for acute PE is the widespread integration of DOACs into treatment algorithms. Compared with vitamin K antagonists, DOACs provide similar efficacy but enhanced safety with a 40% reduction in major bleeding and 60% reduction in intracranial hemorrhage (10). The relative ease with which the DOACs are initiated and the promise of consistent, safe, and effective anticoagulation without the need for dose adjustment make them preferred for PE treatment and a major advance in the movement toward outpatient therapy (6, 7).

In this issue of the *Journal*, Hendriks and colleagues (pp. 138–141) provide an important perspective on risk stratification in patients with PE who are eligible for outpatient therapy (11). The investigators report a *post hoc* analysis of combined data from the prospective Hestia and Vesta studies to assess the incremental prognostic value of increased computed tomographic–measured right ventricular–to–left ventricular (RV-to-LV) diameter ratio on recurrent venous thromboembolism and mortality. In the analysis of 752 patients with PE treated at home, 30% had RV enlargement (RV-to-LV diameter ratio > 1). Adverse events were infrequent in these otherwise low-risk patients with RV enlargement compared with those without (2.7% vs. 2.3%; odds ratio, 1.2; 95% confidence interval, 0.44–3.2). The investigators concluded that RV enlargement would have excluded a large proportion of their cohort from outpatient therapy without impacting prognosis.

Despite the main limitation of its *post hoc* design, the study findings support previous observations demonstrating that routine assessment of RV function and cardiac biomarkers in low-risk patients identified using clinical criteria provides little prognostic value and may come at the cost of hospitalizing patients who could otherwise be treated at home (Table 1). A previous analysis from the study investigators demonstrated that 35% of patients who were treated at home according to the Hestia criteria had RV dysfunction and were classified as intermediate risk according to the European Society of Cardiology criteria (12). Similarly, other studies from the investigators have shown that increased high-sensitivity cardiac troponin T (13) and N-terminal pro-BNP (14) were associated with a low rate of adverse events in patients with PE determined to be low-risk by the Hestia criteria. One potential explanation for infrequent adverse events in clinically

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Table 1. The Incremental Prognostic Value of Risk Stratification Tools in Patients with Pulmonary Embolism Determined to Be Low-Risk by the Hestia Criteria

Tool	Adverse Event Rate	Odds Ratio (95% Confidence Interval)
hsTnT	Elevated hsTnT, 0.9% vs. normal hsTnT, 0.7%	2.5 (0.22–28)
NTproBNP	Elevated NTproBNP and hospitalized, 0% vs. elevated NTproBNP and discharged, 0%	—
RV-to-LV ratio	RV-to-LV >1, 2.7% vs. RV-to-LV ≤ 1, 2.3%	1.2 (0.44–3.2)

Definition of abbreviations: hsTnT = high-sensitivity cardiac troponin T; LV = left ventricular; NTproBNP = N-terminal pro–brain natriuretic peptide; RV = right ventricular.

determined low-risk patients with PE with RV dysfunction may rest with the ability of DOACs to provide consistent and safe antithrombotic therapy in patients discharged from the emergency department (15).

The Hestia investigators should be commended for their body of work establishing that systematic clinical assessment identifying low-risk patients should be the primary driver in decision-making regarding outpatient therapy for PE and not assessment of RV function or cardiac biomarkers, which in approximately one-third provides a discordant prognostic picture without adding additional precision to risk stratification. In this current era of overcrowding in emergency departments and inpatient wards, the opportunity to manage clinically determined low-risk patients with PE at home should not be dismissed hastily for fear of RV dysfunction or positive troponin. Hopefully, reports such as this one will prompt clinicians evaluating patients with PE in the emergency medicine and urgent care settings to listen to their hearts (and follow their clinical instincts with the aid of tools like the Hestia criteria), lest their eyes deceive them. ■

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