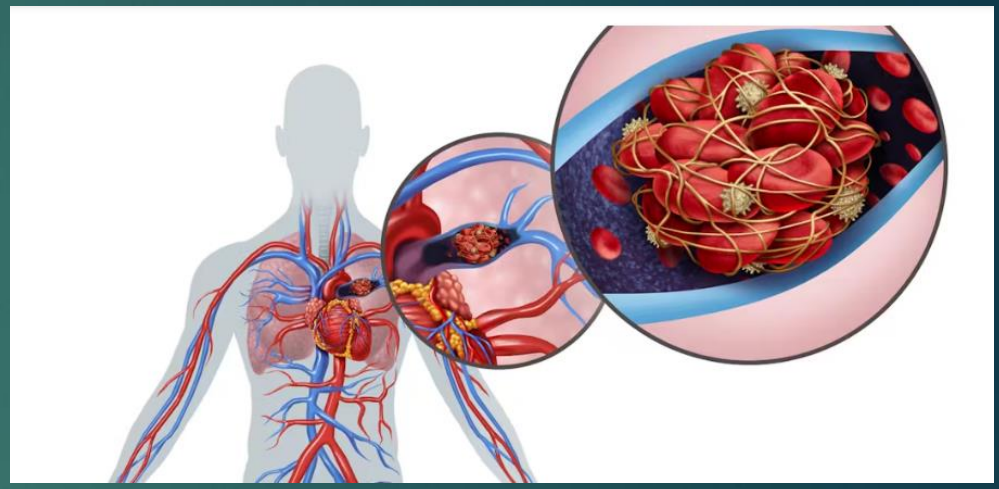
Bilateral Emboli and Highest Heart Rate Predict Hospitalization of Emergency Department Patients With Acute, Low-Risk Pulmonary Embolism



BY THE AMERICAN COLLEGE OF EMERGENCY PHYSICIANS

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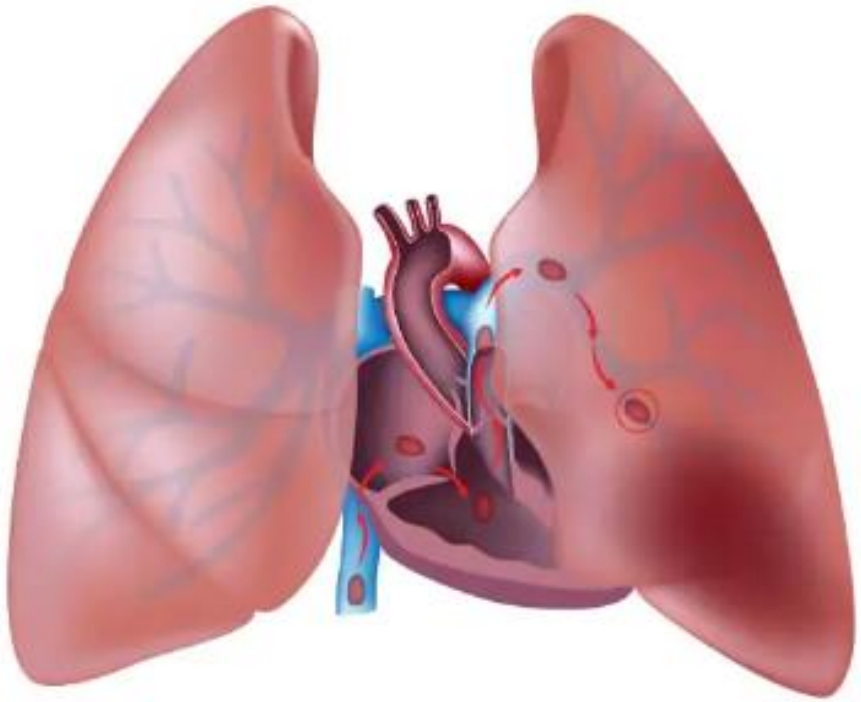
An acute pulmonary embolism, or embolus, is a blockage of a pulmonary (lung) artery. Most often, the condition results from a blood clot that forms in the legs or another part of the body (deep vein thrombosis, or DVT) and travels to the lungs.

What is Pulmonary Embolism?

Pulmonary Embolism (PE) is a serious medical condition in which one or more blood clots enter the pulmonary artery, blocking the flow of blood from the heart to the lungs.

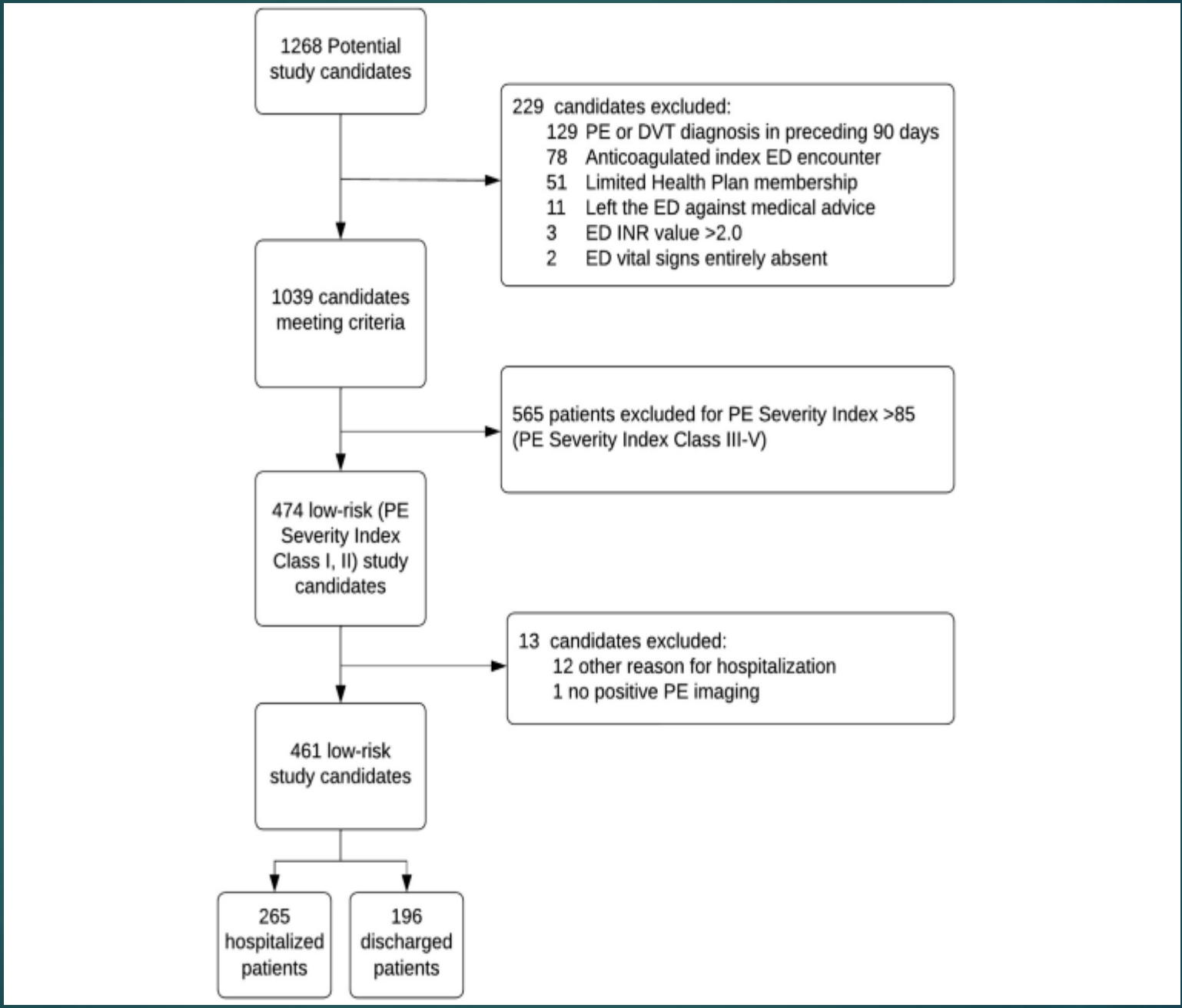


Introduction

- Heart rate (HR) is an important prognostic vital sign for patients with acute PE, and an important component of several clinical decision rules predicting PE likelihood, PErelated mortality, and PE-related clinical deterioration. The PE Severity Index incorporates HR directly into its risk assessment by employing an explicit criterion of 110 beats/min. A recent study demonstrated an association between increased HR and 30-day mortality over a large continuum of HRs (30 to 200 beats/min) in patients with acute PE . The HR is an important reflection of hemodynamic stability and may prompt more hospital admissions when abnormal, even in patients deemed to be low risk by clinical decision rules.

- On the other hand, the prognostic value of the radiographic embolic burden on mortality in acute PE is conflicting. Embolic distribution (unilateral embolism vs bilateral emboli), most proximal embolism location, and degree of arterial obstruction all contribute to embolic burden. The CT obstruction index quantifies embolic burden by considering the number of lung segments affected (1 to 20) and their degree of arterial obstruction (partial or complete).Embolic burden information does not appear in any clinical PE risk stratification tool, and it is unclear to what extent physicians incorporate this readily available radiographic information into their site of care decision making.

- This retrospective cohort study was conducted from January 2019 to February 2020 of all 21 community-based EDs of Kaiser Permanente Northern California, an integrated health system that serves over 4.5 million members representing the surrounding racial, ethnic, and socioeconomic diversity of California. This study included patients 18 years of age or older who had at least one eligible ED visit from 01/2019 through 02/2020 with an ED diagnosis of nongravid PE . Included patients also had an accompanying CT angiography or scintigraphy imaging study that was positive for PE either in the ED or within the prior 12 hours.
- Patients with one of the following were excluded: a diagnosis of acute venous thromboembolism in the previous 90 days, taking anticoagulants, lack of adequate health plan membership in the prior 12 months , leaving the ED against medical advice, absence of any documented ED vital signs , non-PE diagnosis requiring hospitalization and known pregnancy .


1268 Potential study candidates
229 candidates excluded:
129 PE or DVT diagnosis in preceding 90 days
78 Anticoagulated index ED encounter
51 Limited Health Plan membership
11 Left the ED against medical advice
3 ED INR value >2.0
2 ED vital signs entirely absent
1039 candidates meeting criteria
565 patients excluded for PE Severity Index >85 (PE Severity Index Class III-V)
474 low-risk (PE Severity Index Class I, II) study candidates
13 candidates excluded:
12 other reason for hospitalization
1 no positive PE imaging
461 low-risk study candidates
265 hospitalized patients
196 discharged patients

RESULTS

- This study demonstrated that HR >110 beats/min or more and an HR of 90 to 109 beats/ min were independently associated with a likelihood of admission. The presence of bilateral PE (vs unilateralPE) was independently associated with the likelihood of hospitalization.Proximal embolism location (vs distal) was not independently associated with the likelihood of hospitalization .

	Adjusted OR for Hospitalization	95% CI
Highest HR ≥110 (vs <90 beats/min)	3.11	1.07-9.57
Highest HR 90-109 (vs <90 beats/min)	2.03	1.18-3.50
Bilateral PE*	1.92	1.13-3.27
Proximal embolism location†	1.19	0.71-2.00
Age (per 1-year increment)	0.99	0.97-1.02
Female sex‡	0.82	0.48-1.41
Chronic lung disease history	0.77	0.39-1.51
Hospitalization within 30 days	1.78	0.82-4.02
PE Severity Index class II§	1.85	0.90-3.84
Arrival by ambulance	2.48	1.04-6.32
Former intervention site‖	0.39	0.23-0.65
Troponin elevation (≥0.04 ng/L)	2.79	1.09-8.20
RV dilatation by CT angiography	3.55	1.22-13.01
Lowest oxygen saturation <95%	2.76	1.61-4.78
Highest respiratory rate >24 beats/min	2.47	1.33-4.72

*Compared to unilateral PE.
†Compared to distal location. Proximal emboli are those that were clearly lobar in location or more proximal.
‡Patient-reported sex.
§Compared to PE Severity Index Class I.
‖Compared to former control site in our 2015 pragmatic trial.

- We found that a substantial fraction of patients who were low risk by the PE Severity Index (class I or II; fewer than 86 points) had clinical, laboratory, or radiographic findings that might place them at increased risk of adverse clinical events. Additionally, we found that tachycardia and bilateral PE were independently associated with the likelihood of hospital admission.
- In summary, more than half of patients with acute, lowrisk PE were admitted during the study period to a health system well-resourced to facilitate outpatient management. A substantial fraction of these patients had clinical, laboratory, or radiographic findings associated with adverse clinical outcomes, and hospitalization was likely justified. Physicians may perceive patients with higher HRs and bilateral PE to be at elevated risk during disposition decisionmaking.

Thank you for your attention