

Management of Low-Risk Pulmonary Embolism



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KEYWORDS

- Pulmonary embolism • Diagnosis • PE risks stratification • Low-risk PE • Subsegmental PE
- Incidental PE • Medical management • Outpatient

KEY POINTS

- The stratification of patients into risk strata can be complicated and involves assessment of the accuracy of the diagnosis of pulmonary embolism as well as objective clinical factors.
- Although clinical gestalt is effective in identifying high-risk patients with pulmonary embolism, the identification of intermediate-risk and low-risk patients can be accurately derived by the combination of biomarkers, imaging, and risk stratification scoring systems or criteria.
- Once patients have been identified as low risk, candidates of outpatient management can be identified by evaluation of bleeding risk, cardiopulmonary reserve, patient adherence, and capabilities.
- Subsegmental pulmonary embolism can be challenging to diagnose because of the difficulty of imaging. Management decision requires close examination of imaging quality and criteria, pretest probability, presence of deep venous thrombosis, bleeding risk, and other risk factors.
- Incidental pulmonary embolism is not an uncommon problem. It is typically managed in the same manner as symptomatic pulmonary embolism with anticoagulation after assessment of bleeding risks.

INTRODUCTION

Pulmonary embolism (PE) occurs when thrombi form in deep veins or the right atrium and then embolize to the pulmonary artery. PE is closely linked with deep venous thrombosis (DVT) and should be considered a different manifestation of the same disorder: venous thromboembolism (VTE).¹ Classically, 90% of emboli originate from proximal lower extremity venous thrombosis.² In patients with a high probability of PE, DVT was detected in 48.6%.³ Indicators of DVT include lower extremity findings, such as edema, leg and calf tenderness, erythema, venous cords, and Homan signs. Because of the nonspecific

symptoms of PE and VTE, there can be substantial delays in seeking medical attention.⁴

PE is a leading cause of morbidity and mortality in the United States, and between 5% and 10% of hospital deaths are attributable to PE.⁵ From 1998 to 2005, the number of patients discharged from US hospitals with a diagnosis of PE increased from 126,546 to 229,637.⁵ Over this period of time, the hospital case fatality rate decreased from 12.3% to 8.2% ($P < .001$).⁵ The length of stay decreased, but hospital charges for these patients increased nearly 100% ($P < .001$). In the United States, 300,000 deaths occur annually from acute episodes of PE.⁶ The incidence rates reported for

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PE (with or without DVT) range from 29 to 78 per 100,000 person-years.^{7,8} Because of the disease being underrecognized or misdiagnosed, most deaths are discovered on autopsy^{9,10} even with numerous diagnostic tests and treatment modalities.^{5,11} However, the risk of death decreases with diagnosis and effective treatment.¹² PE can present along a spectrum from the asymptomatic individual incidentally diagnosed to patients presenting with cardiogenic shock.¹³

The diagnosis of acute PE is ultimately guided by the clinician's index of suspicion for the disease and augmented by diagnostic tests. The recognition of the signs and symptoms of PE is the most important initial diagnostic step. A careful clinical history and physical is crucial to identify the patients at risk and to assess the pretest probability. In a review of the Prospective Investigation of Pulmonary Embolism Diagnosis (PIOPED I) data, dyspnea is the most common symptom followed by pleuritic chest pain, cough, lower extremity edema, hemoptysis, palpitations, wheezing, and anginalike pain,¹⁴ with pleuritic chest pain and hemoptysis occurring more commonly in the setting of pulmonary infarction.^{1,14} However, pulmonary infarction does not occur often because of the dual circulation from the bronchial and pulmonary arteries.¹³ Nonspecific symptoms and signs, such as tachycardia, tachypnea, and fever, should also be considered as signs of PE. In Stein and Henry's¹⁴ study, tachypnea is the most common physical examination finding followed by crackles, tachycardia, and increased pulmonic heart tone. Other examination findings were found in between 6% and 14% of patients and include evidence of DVT, fever greater than 38.5°C, diaphoresis, wheezing, and a pleural friction rub.¹⁴

Based on symptoms as well as comorbidities, patients can be classified as low, intermediate, or high risk. With the advent of the multidetector computed tomography (CT) scanners, the sensitivity of detecting PEs has increased, with increased detection of subsegmental and incidental PEs. The diagnosis and management of these issues are discussed.

CLINICAL SUSPICION AND CLINICAL DECISION RULES

The clinician's suspicion of PE and DVT assists in making the diagnosis. Numerous studies have demonstrated failures or delays in the diagnosis of PE lead to the increase in morbidity and mortality.¹⁵⁻¹⁹ More patients are undergoing evaluation with imaging for PE, but the diagnostic yield of these tests can be as low as 3.1% in the absence of clinical prediction rules.²⁰

RISK STRATIFICATION AND PRETEST PROBABILITY

Patients can be stratified into low, moderate, or high-risk categories using structured clinical prediction rules or by empirical assessment for diagnostic pretest probability.²¹ Structured clinical prediction rules standardize the approach to pretest assessment of probability and remove the variability found in clinical practice. There are numerous clinical prediction scores, including the Wells Score, Simplified Wells Score, Geneva Score, Revised Geneva Score, Simplified Revised Geneva Score, Pulmonary Embolism Rule Out Criteria, and other scoring systems.²¹⁻³⁵ The most commonly used and validated scores include the Wells Score, Simplified Wells Score, and the Geneva scores.²⁷ These scoring systems can be used with high sensitivity D dimer to further stratify patients and limit the number of diagnostic imaging.^{35,36}

LOW-RISK PULMONARY EMBOLISM

PEs are usually categorized into low, intermediate, or high risk; these are based on the criteria that are outlined in this section. Patients with hypotension, marked impairment of oxygenation, and syncope are classified as high risk.²² Intermediate-risk patients are hemodynamically stable but could have end-organ damage, such as cardiac ischemia, right heart strain, and/or encephalopathy.²² Hemodynamically stable patients without end-organ damage are categorized as low-risk PE.²² Low-risk PE is defined by the American College of Cardiology as acute PE without clinical markers defining massive or submassive PE.³⁷ However, clinicians may view low-risk PE and recurrent VTE differently and may classify patients based on a cancer diagnosis and its staging. Prandoni and colleagues³⁸ classified patients without malignancy as low risk, whereas intermediate-risk patients had local or recently resected cancer and those with locally advanced or distant metastases were considered high risk. Patients with low-risk PE have a 1-year survival rate of more than 95%, whereas those with high-risk PE have a 40% mortality rate within 90 days.^{22,39}

Different scores have been developed so patients with low-risk PE can be assessed for safe outpatient management. The Pulmonary Embolism Severity Index (PESI) and Hestia are two examples. The PESI (**Table 1**) was developed as a clinical prediction rule to classify patients with PE into classes of increasing mortality.⁴⁰

These classes are divided into 5 groups based on a point system.^{40,41} The original score

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