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Clinical Review

EMERGENCY EVALUATION FOR PULMONARY EMBOLISM, PART 2: DIAGNOSTIC APPROACH

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☐ **Abstract—Background: In part 1 of this two-part review, we discussed which risk factors, historical features, and physical findings increase risk for pulmonary embolism (PE) in symptomatic emergency department (ED) patients. Objectives: Use published evidence to describe criteria that a reasonable and prudent clinician can use to initiate and guide the process of excluding and diagnosing PE. Discussion: The careful and diligent emergency physician can use clinical criteria to safely obviate a formal evaluation of PE, including the use of gestalt reasoning and the pulmonary embolism rule-out criteria (PERC rule, Table 2, part 1). We present published clinical and radiographic features of patients with PE who eluded diagnosis in the ED. D-dimer can be used to exclude PE in many patients, and employing age-based adjustments to the threshold to define an abnormal value can further reduce patient exposure to pulmonary vascular imaging. Moreover, we discuss benefits, limitations, and potential harms of computed tomographic pulmonary vascular imaging relevant to patients and the practice of emergency care. We present algorithms to guide exclusion and diagnosis of PE in patients with suspected PE, including those who are pregnant. Conclusions: Reasonable and prudent emergency clinicians can exclude PE in symptomatic ED patients on clinical grounds alone in many patients, and many more can have PE ruled out by use of the D-dimer. © 2015 Elsevier Inc.**

☐ **Keywords—pulmonary embolism; medicolegal; defensive medicine; decision making; venous thromboembolism; pregnancy; diagnosis; pregnancy**

INTRODUCTION

This second part of a two-part review provides an in-depth analysis of issues critical to deciding when to initiate a formal diagnostic evaluation for pulmonary embolism (PE) in emergency department (ED) patients, and what diagnostic tests, if any, need to be ordered. We explore evidence-based options for excluding PE to a reasonable degree of diagnostic certainty but with minimal exposure to radiation and iodinated contrast material.

DISCUSSION

Decision to Initiate the Work-up and Empiric Treatment

Figure 1 presents an algorithm for the diagnostic evaluation of patients with possible PE. For PE to enter the active differential diagnosis list for any patient, he or she must have at least one possible physiologic manifestation of PE. The physiologic manifestation may be a symptom (e.g., dyspnea, pleuritic chest pain, or new fatigue) or a sign (e.g., heart rate > 100 beats/min or pulse oximetry < 95% near sea level) that is not explained by another cause. Other bedside physiological signs of PE include a low (<30 mm Hg) end-tidal CO_2, measured by capnography, or signs of pulmonary hypertension on 12-lead electrocardiography, including T-wave inversion

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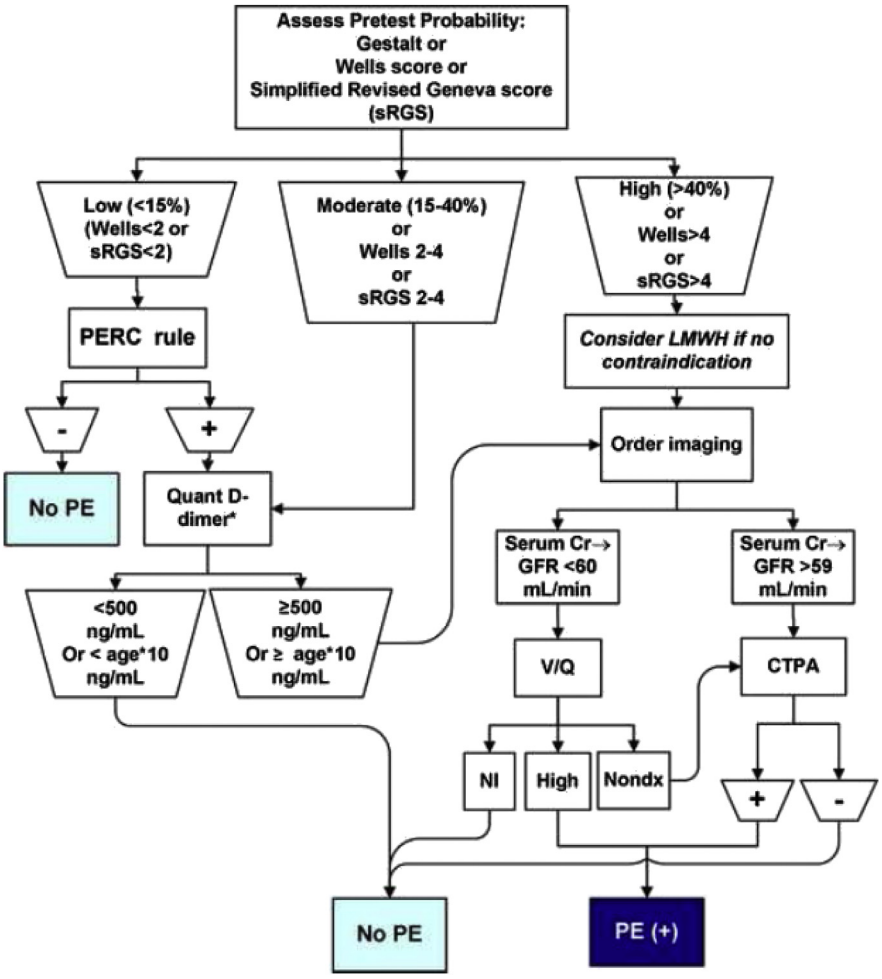

Figure 1. Diagnostic algorithm for pulmonary embolism (PE) in patients who prompt enough clinical suspicion to warrant the documented consideration of PE. *Assumes a cutoff for abnormal of ≥500 ng/mL. Nondiagnostic ventilation-perfusion (V/Q) scan findings require confirmation from results of another test, such as computed tomography pulmonary angiography (CTPA), if benefits outweigh risks. Abbreviations: + = positive for PE; − = negative for PE; Cr = creatinine; GFR = glomerular filtration rate; High = high probability scan findings; LMWH = low-molecular-weight heparin; NI = normal; Nondx = nondiagnostic (any reading other than normal or high probability); PERC = pulmonary embolism rule-out criteria; quant = quantitative, sRGS = simplified revised Geneva score.

in leads V_1 to V_4, incomplete or complete right bundle-branch block, and the S_1-Q_3-T_3 pattern (1,2).

Reasonable and prudent emergency care does not dictate that all patients with a sign or symptom of PE must be tested for PE. Nor does it dictate that a patient with one or more risk factors for PE must undergo testing for PE in the absence of a sign or symptom of PE. However, the authors believe that clinicians should consider PE for patients with a sign or symptom of PE and a known risk factor for PE (see Table 1, in part 1), and at least mentally formulate an explanation why a work-up was not pursued in the event that the patient had PE. If a reasonable alternative disease explains the patient's presentation, testing specifically directed at diagnosing PE need not be ordered. The value of an alternative diagnosis to obviate an evaluation for PE must be decided on a case-by-case basis, and is often a nuanced decision-making process. For example, if an emergency physician cares for a patient with long-standing dyspnea and tachycardia with a known lung cancer and a large pleural effusion, this does not mandate a computed tomographic pulmonary angiogram (CTPA). However, if the clinician was aware that lung mass and effusion were radiographically unchanged, but the patient recently developed new severe dyspnea and tachycardia, this patient may warrant further testing for PE.

The next step is to assess the pretest probability using either gestalt or a validated scoring method, such as the Wells score, or the revised Geneva score (RGS) or the simplified RGS (Tables 3 and 4, part 1) (3–5). Gestalt has the advantage of not requiring any memory aid, and has similar diagnostic performance characteristics and interobserver reliability as the Wells score and RGS (3,6). If a patient has a high pretest probability (from