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Pulmonary embolism during pregnancy: How to avoid computed tomographic pulmonary angiography?

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Abstract

Pregnancy and the postpartum period are well-established risk factors for venous thromboembolism (VTE). Computed tomographic pulmonary angiography (CTPA) remains the gold standard in the diagnosis of pulmonary embolism (PE), but exposure to teratogenic factors should be avoided in pregnant women. A few years ago the YEARS algorithm was developed, primarily to determine the need for CTPA.

Key words: venous thromboembolism; pulmonary embolism; computed tomographic pulmonary angiography; YEARS algorithm

Pregnancy and the postpartum period are well-established risk factors for venous thromboembolism (VTE). VTE can manifest during pregnancy as a deep venous thrombosis (DVT) or pulmonary embolism (PE).

The risk of VTE is higher in all stages of pregnancy. The identified risk factors include:

- 1) multiple births
- 2) comorbidities (eg, hypertension, other cardiac diseases, diabetes, inflammatory bowel disease, varicose veins)
- 3) hospitalization for non-delivery reasons (particularly those >3 days)
- 4) BMI ≥ 30 kg/m²
- 5) increased maternal age ≥ 35 years
- 6) cesarean section
- 7) urinary tract infections and postpartum infections
- 8) preterm delivery <36 weeks
- 9) obstetric hemorrhage
- 10) stillbirth
- 11) smoking [1].

A wide overlap exists between the clinical symptoms of VTE and symptoms caused by physiological changes in pregnancy, such as tachycardia, swelling of the legs, and dyspnea. The following symptoms should always raise alarm and clinical suspicion of a PE during pregnancy:

- 1) acute-onset dyspnea
- 2) pleuritic chest pain
- 3) hemoptysis
- 4) cough
- 5) sweating [2].

Diagnosis of PE during pregnancy can be challenging as symptoms frequently overlap with those of normal pregnancy. Computed tomographic pulmonary angiography (CTPA) remains the gold standard in the diagnosis of pulmonary embolism, but exposure to teratogenic factors should be avoided in pregnant women. The negative aspects of CTPA include: the exposure of the mammary tissue to greater radiation, the use of iodinated contrast agent may cause allergic reactions, nephropathy and dysthyroidism. What is more, radiological pulmonary vascular opacification can be reduced due to the physiologically increased cardiac output in pregnancy. The demonstration of a filling defect in any branch of the pulmonary artery (main, lobar, segmental, subsegmental) by contrast enhancement is considered diagnostic of PE during pregnancy [3].

During diagnostic process the following pretest probability tools can be performed:

- 1) arterial blood gases: respiratory alkalosis is a very common feature of both pregnancy and PE
- 2) D-dimer: interpretation of D-dimer levels during pregnancy and the puerperium is complicated by a lack of normal reference ranges in this setting – that is why a high D-dimer is not diagnostic of PE, and a low D-dimer (even <500 ng/mL) only modestly lowers the suspicion but does not effectively eliminate PE from the differential diagnosis
- 3) echocardiography: an echocardiogram can be performed to exclude pregnancy-related cardiomyopathy or to evaluate the size of the right ventricle (RV) in a patient with confirmed PE
- 4) chest radiograph: plays a relevant role in the differential diagnosis of pneumonia, pneumothorax, pulmonary edema, some radiographic features that may suggest PE include: Hampton's hump (a shallow wedge-shaped opacity in the periphery of the lung with its base against the pleural surface), sign of Westermarck (the rare localized reduction of pulmonary vascularization) or other features (atelectasis, infiltrates) [4, 5].

Taking into consideration the adverse effects of radiation on both the mother and newborn, less frequent use of CTPA is of great importance. A few years ago the YEARS algorithm was developed, primarily to determine the need for CTPA. The YEARS algorithm includes three clinical criteria:

- 1) clinical symptoms of deep vein thrombosis
- 2) haemoptysis
- 3) PE as the most likely diagnosis

YEARS algorithm also includes one laboratory criterion: the level of D-dimer. PE is ruled out if the three criteria are not met and if the D-dimer level is less than 1000ng / ml or if at least one of the criteria is met and the D-dimer level is less than 500ng / ml [6].

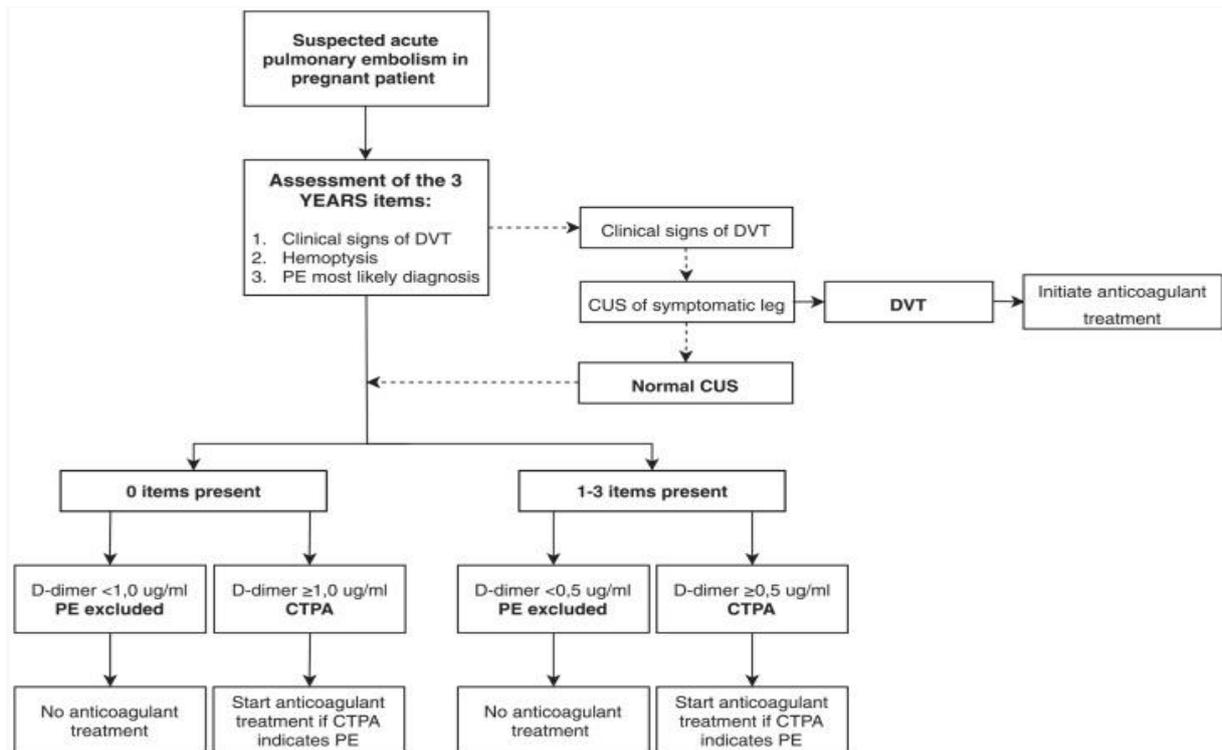


Figure 1. Pregnancy-adapted YEARS algorithm for diagnosis of PE in pregnant women PE [7]

Recent studies indicate that ultrasound of lower extremity, lung and heart as point-of-care ultrasound, may also replace the use of methods with ionising radiation to diagnose PE during pregnancy.

Transthoracic lung ultrasonography might be helpful in diagnosing PE. Peripheral parenchymal consolidations can be visible on lung ultrasonography when an embolic vascular occlusion occurs. These consolidations are due either to necrosis of lung parenchyma or to atelectasis, related to breakdown of surfactant with extravasation of blood [8].

Echocardiography is also a valuable prognostic tool for stratifying PE patients with or without right ventricular dysfunction. In unstable patients, finding clear and undeniable signs of right ventricular dysfunction and pressure overload without other causes of acute right dysfunction, eg, cardiac tamponade or right myocardial infarction, allows emergency primary reperfusion treatment [9].

Lower limb compressive venous ultrasonography may identify a deep vein thrombosis in up to half of patients with PE, and due to its high positive predictive value, finding proximal DVT in a patient suspected of PE allows to start an anticoagulant treatment unless contraindicated, e.g., concomitant bleeding [10].

Low-molecular-weight heparin (LMWH) is the first-choice anticoagulant treatment in pregnancy and should be continued until 6 weeks postpartum and with a minimum of 3 months. Thrombolysis and the use of IVC filters are not routinely recommended in pregnancy as there is less experience and evidence but could be considered in selected cases [11, 12].

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