

## High Rate Of Right Ventricular Dysfunction After Negative Computed Tomographic Pulmonary Angiography

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**Background:** Prior work found that 20% of patients with persistent dyspnea have right ventricular (RV) dysfunction. Many patients with suspected pulmonary embolism (PE) who have a negative CTPA have persistent yet unexplained dyspnea. We hypothesized that a substantial proportion of these patients have unrecognized RV dysfunction. We sought to estimate this proportion and develop criteria to predict RV dysfunction on echocardiography after CTPA negative for PE.

**Methods:** This was a four-center, prospective study of patients with  $\geq$ one symptom or sign and  $\geq$ one risk factor for PE, and CTPA scan performed. To assess potential predictors of RV dysfunction, we recorded 82 clinical predictors in real time. These included clinical findings, 12-lead electrocardiography (ECG), exhaled volumetric CO<sub>2</sub>/O<sub>2</sub>, plasma D-dimer and fibrinogen measurements. Patients underwent echocardiography within one week. Isolated RV dysfunction was defined as normal LV function with either moderate-severe RV hypokinesis, or estimated RV systolic pressure  $>35$  mmHg. To assess if RV dysfunction led to symptoms that prompted reevaluation, we compared the frequency of repeat CTPA within 90 days. CTPA scans were interpreted by two independent radiologists. Predictors of RV dysfunction were assessed using a univariate ( $P<0.1$ )-multivariate ( $P<0.05$ ) statistical approach.

**Results:** 647 patients were enrolled; 120 with CPTA positive for PE were excluded, and 97 were excluded because of lack of persistent dyspnea. Of the 430 remaining patients, 184 underwent echocardiography, which demonstrated isolated RV dysfunction in 34% (95% CI: 30-41%). 27% of patients with isolated RV dysfunction had repeat CTPA within 90 days, a significantly higher rate than in patients without echocardiography (4%,  $P=0.03$ , Chi Square) or a normal echocardiogram (5%,  $P=0.02$ ). No repeat CTPA scan showed PE. Of 82 candidate predictors of examined, univariate analysis found only 6 significant: active malignancy, normal CTPA, right bundle branch block on ECG, T-wave inversion in V1-V2 on ECG, history of COPD, and fibrinogen concentration. Of these six, multivariate logistic regression analysis found only normal CTPA as a significant predictor of isolated RV dysfunction.

**Conclusion:** Patients with persistent dyspnea who have a normal CTPA performed for suspected PE have a high rate of unexplained isolated RV dysfunction on echocardiography. These patients are more likely to have persistent symptoms leading to unnecessary repeat CTPA in the short term. These findings form the starting point for a screening protocol to select patients with negative CTPA scanning for formal echocardiography and specialist referral to evaluate for pulmonary hypertension or other treatable causes of RV dysfunction.

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