

A visualized pulmonary arterial thrombus by using a new echocardiographic view in an intermediate-risk acute pulmonary embolism patient: a case report

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Abstract

Acute pulmonary embolism (APE) is a life-threatening disease. Rapid and accurate diagnosis is crucial for the clinical management. We report a case of a 74-year-old man diagnosed intermediate-risk APE as several pulmonary emboli in pulmonary artery were seen in multidetector computed tomographic pulmonary angiography with normal blood pressure and echocardiographic right ventricular overload. And we found a pulmonary artery clot in the right pulmonary artery through transthoracic echocardiography by using a new view. The view could provide correct diagnoses by identifying the clot size and location visually. Knowledge of the echocardiography results of APE would aid the diagnosis.

Background

Venous thromboembolism clinically manifested as deep vein thrombosis or pulmonary embolism^[1, 2]. It is globally the third major cause of acute cardiovascular death^[2] as a major health problem. Rapid and accurate diagnosis is crucial for the clinical management of patients with acute pulmonary embolism (APE). However, APE encompasses a wide clinical spectrum of severity^[3, 4], ranging from asymptomatic disease to hemodynamic instability and shock. Due to the nonspecific clinical signs and symptoms, a diagnosis of APE is frequently extremely challenging^[3].

In patients with suspected PE, multidetector computed tomographic pulmonary angiography (CTPA) is the preferred method for imaging the pulmonary vasculature^[1]. Echocardiography examination is not a routine diagnostic procedure in hemodynamic stable APE patients^[5], but might detect an increase in right ventricular wall thickness or a jet velocity of tricuspid insufficiency beyond values compatible with acute right ventricular pressure overload^[6]. In addition to these indirect signs, emboli in the pulmonary artery may occasionally be found in certain nonstandard echocardiographic views^[1]. Herein, we report 1 case of intermediate-risk APE patient with visualized pulmonary arterial thrombus by transthoracic echocardiography.

Case presentation

A 74-year-old man was admitted to our hospital with a 12-day history of decreased exercise capacity and dyspnoea. At presentation, he was afebrile with a blood pressure of 130/110 mmHg, heart rate of 80/min and respiratory rate of 20/min. The physical examination was within normal limits. Electrocardiography showed sinus rhythm with first degree atrioventricular block, S wave in lead I, q wave and inverted T wave in lead III (Figure 1). Laboratory evaluation was significant for elevated D-dimer of 4450.08 ng/ml and brain natriuretic peptide level of 4398 ng/l. Complete blood count and coagulation studies were within normal limits. Transthoracic echocardiography was performed. Right ventricular (RV) dysfunction was defined as

dilatation of the right ventricle (right/left ventricle diameter ratio 1.2 in the apical four chamber view) combined with elevated systolic gradient through the tricuspid valve (53mm Hg), lack of relevant left ventricular (LV) dysfunction or valvular heart disease. Further evaluation with transthoracic echocardiography revealed a pulmonary artery clot of about 19.8mm*32.2mm seen at the right pulmonary artery, 21mm from the bifurcation of the pulmonary artery (Figure2. Panels A and B, Video 1, 2). Meanwhile, venous Doppler studies of bilateral lower extremities showed right popliteal vein thrombosis. Computed tomography pulmonary angiography (CTPA) revealed several pulmonary emboli in right pulmonary artery (Panel C).The patient was diagnosed intermediate risk APE as systemic systolic blood pressure on admission [?]90 mmHg with echocardiographic right ventricular overload and elevated serum levels of BNP. The patient was started on anticoagulation with low molecular weight heparin and oral warfarin. Transthoracic echocardiography was re-evaluated after 11 days. The RV diameter was decreased combined with pulmonary artery thrombus decreased to 10.9mm*13mm (Panels D and E, Video 3, 4). The systolic gradient through the tricuspid valve was 43mm Hg. The patient showed significant clinical improvement and was discharged home after being transitioned to oral warfarin.

Discussion and conclusion

It is very unusual to visualize a pulmonary artery thrombus on transthoracic echocardiography (TTE). This is the first case of a visualized pulmonary arterial thrombus in an intermediate-risk APE patient by transthoracic echocardiography. In this case report we demonstrate how transthoracic echocardiography permits to obtaining a new view, which allows real visualization of the moving thrombosis during the cardiac cycle. First, two dimensional echocardiograms of the parasternal long axis view were obtained. The right pulmonary artery view was obtained by placing the transducer inclination 30-45 degree to the chest wall at the second intercostal space immediately to the right of the sternum (Figure3). Thus, we propose the new transthoracic echocardiography view as the tool of choice to evaluate the change of the thrombosis and treatment effect.

Role of Echocardiography in Evaluation of PE

Echocardiography is not a diagnostic method for PE^[5] but is used for patient risk stratification^[1, 7]. TTE provide noninvasive assessment of RV and LV size, systolic function, regional wall motion, valvular abnormalities, and hemodynamic assessment of filling pressure and right-heart pressures.

However, echocardiography has some inherent limitations in the diagnosis of APE. First, the ultrasound beam loses energy as travelling through tissue; therefore the structures away from the chest wall may not be well showed by TTE^[8]. As a result, structures that may be important sources of embolism, such as the posteriorly located left atrium and its appendage, the interatrial septum, and the thoracic aorta, may be suboptimally visualized by TTE. Besides, it should be noted that signs of RV overload are not specific for PE and that acute and chronic RV abnormalities may be due to concomitant cardiac or respiratory disease^[1, 9], such as chronic obstructive pulmonary disease, obstructive sleep apnea, pulmonary hypertension, right-heart failure, and right-sided myocardial infarction, among others.

The new echocardiography view

We propose the new transthoracic echocardiography view as the tool of choice to evaluate the change of the thrombosis and treatment effect. We recommend a new view which is right parasternal view and different with suprasternal view. It requires tilting the patient into a steep left lateral decubitus position. It provides the unique opportunity to view the ascending aorta and distal right pulmonary artery by placing the transducer inclination 30-45 degree to the chest wall at the second intercostal space immediately to the right of the sternum.

List of abbreviations

APE: Acute pulmonary embolism;

PE: Pulmonary embolism;

CTPA: computed tomographic pulmonary angiography;

RV: Right ventricular;

LV: Left ventricular;

TTE: transthoracic echocardiography;

TEE: Transesophageal echocardiography

Declarations

Ethics approval and consent to participate:

This case report was approved by the Clinical Research Ethics Committee of the Second Hospital of Tianjin Medical University.

Consent for publication:

All the data in this case report, including any individual details, images or videos have consent for publication from the patient.

Competing interests:

The authors declare that they have no competing interests.

Authors' contributions:

GM and HF conceived of the case report and its design. FL, BZ and XC worked on acquisition of data and analysis. GM and HF drafted the manuscript. HF and GL revised the manuscript critically. All authors read and approved the final manuscript.

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Figure legends

Figure1:Electrocardiography of the patient. shows sinus rhythm with first degree atrioventricular block, S wave in lead I, q wave and inverted T wave in lead III.

Figure2:Imaging examinations of the patient. (A) Two-dimensional transthoracic echocardiographic image in an off-axis four-chamber view demonstrates a venous clot in transit (arrow) in the right atrium. Video 1 corresponds to (A). (B) Two-dimensional TTE at the level of pulmonary artery shows embolus (arrow) in the right PA (RPA). Video 2 corresponds to (B).(C)CTPA shows pulmonary emboli in right pulmonary artery from the transverse plane and the coronal plane respectively.(D) and (E) show decrease in RV diameter and pulmonary artery thrombus after 11-days treatment. Video 3 corresponds to (D).Video 4 corresponds to (E).Ao, Ascending aorta.

Figure3:Acquirement of the new view.shows the transducer inclination 30-45 degree to the chest wall at the second intercostal space immediately to the right of the sternum.





