



## Acute Pulmonary Thromboembolism with Associated Right Atrial Thrombus Extending Across Patent Foramen Ovale

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### Abstract

Acute Pulmonary Thromboembolism (PTE) can be associated with free floating thrombi in right heart with substantial increase in mortality. Rarely a right atrial thrombus can extend into left atrium through a patent foramen ovale. These thrombi require prompt diagnosis and treatment due to associated risk of pulmonary and systemic embolism. We report an unusual case of floating thrombus in right atrium extending across a patent foramen ovale in a patient of acute pulmonary embolism, diagnosed on transthoracic echocardiography and computed tomography.

**Keywords:** Pulmonary thromboembolism; Atrial thrombus; Transthoracic echocardiography

### Introduction

Floating thrombi in right heart can be seen in 7% to 18% cases of pulmonary embolism [1-3]. As echocardiographic examination is not routinely done in all cases of pulmonary embolism, it can be assumed that the exact incidence is underreported [4]. Prompt diagnosis of these free floating thrombi is of utmost importance as they can embolize at any moment and thus require emergency treatment. Rarely these thrombi can extend into left atrium across a patent foramen ovale [5,6]. We report an unusual case of acute pulmonary embolism with presence of a floating thrombus in right atrium with extension into left atrium through a patent foramen ovale.

### Case Presentation

A 54 years old male patient presented in emergency department of our institute with chief complaints of sudden onset shortness of breath (NYHA class IV) for last eight hours. On examination patient had tachycardia (pulse rate of 120 beats per min) and tachypnea (respiratory rate of 28/min) with hypotension (blood pressure: 90/62 mmHg). Electrocardiography (ECG) showed sinus tachycardia with non-specific ST/T changes. Troponin-I and D-Dimer values were raised. Transthoracic echocardiographic examination showed dilated right atrium (RA), right ventricle (RV) and main pulmonary artery. There was RV systolic dysfunction [Tricuspid Annular Plane Systolic Excursion (TAPSE) =16] and moderate tricuspid regurgitation (TR gradient =75 mmHg). A large right atrial thrombus was seen (Figure 1A-1C) which was oscillating into right ventricle in diastole via tricuspid valve (Figure 1B). Another thrombus was seen in left atrium (Figure 1D) with presence of a defect in interatrial septum likely suggestive of patent foramen ovale (Figure 1C). However continuity of thrombus across patent foramen ovale could not be demonstrated on echocardiographic examination.

Followed by this, patient underwent non ECG gated CT pulmonary angiography, which demonstrated a large partially occlusive thrombus in main pulmonary artery extending into right and left pulmonary arteries (Figure 2A). A linear hypodense filling defect was seen in right atrium and ventricle (Figure 2B) suggestive of thrombus. In addition filling defect was also noted in left atrium (Figure 2C). On coronal reformatted images, continuity of thrombus across right and left atrium was demonstrated through a defect in interatrial septum (Figure 2D). Doppler ultrasound for bilateral lower limbs did not show any evidence of deep venous thrombosis.

Based upon echocardiography and CT findings, a diagnosis of floating right atrial thrombus with extension across a patent foramen ovale with acute PTE was made. Patient was started on intravenous anticoagulation (low molecular weight heparin) and referred to higher center for surgical embolectomy, in view of high risk of systemic embolization. However, repeat transthoracic

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Received Date: 29 Apr 2019

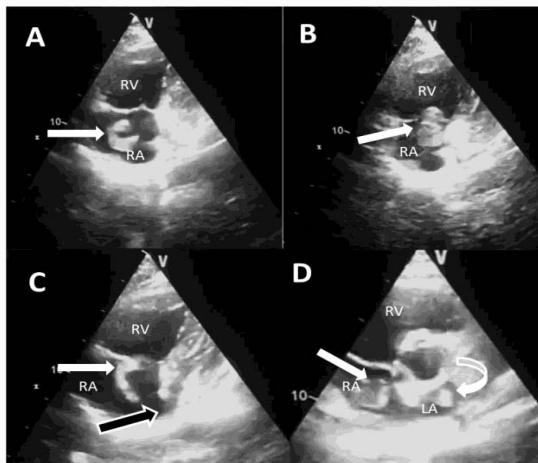
Accepted Date: 20 May 2019

Published Date: 27 May 2019

#### Citation:

Dev M, Sharma M, Bharath K. Acute Pulmonary Thromboembolism with Associated Right Atrial Thrombus Extending Across Patent Foramen Ovale. Clin Case Rep Int. 2019; 3: 1104.

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**Figure 1(A-D):** Transthoracic echocardiography images showing floating echogenic thrombus (white arrow) in right atrium (RA). The thrombus was seen oscillating into right ventricle (RV) through tricuspid valve in diastole (1B). In addition a defect was seen in interatrial septum (black arrow) with presence of echogenic thrombus (curved arrow in D) in left atrium (LA).

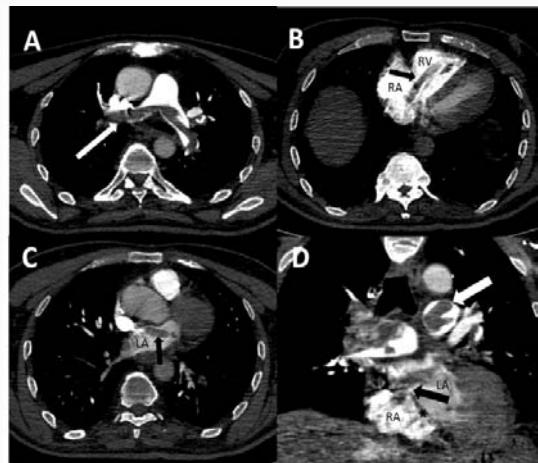
echocardiography in higher center showed marked reduction in size of thrombus. Subsequently the patient was managed with systemic thrombolysis with injection tenecteplase with no evidence of systemic embolization. Patient improved clinically and was discharged after one week stay in hospital.

## Discussion

Acute Pulmonary Thromboembolism (PTE) is a medical emergency with high mortality and morbidity. Combination of various diagnostic tests like plasma D-dimer levels, ventilation/perfusion lung scan, and spiral computed tomography and lower limb venous Doppler can be used to establish a diagnosis of acute PTE [7]. In addition to the above mentioned diagnostic tests, it has been shown that transthoracic echocardiographic examination can help in early risk stratification in acute PTE, thereby influencing the management [8]. Echocardiography gives valuable information about pulmonary arterial hypertension, RA, RV dilation and RV hypokinesia.

Also, echocardiographic examination can demonstrate right heart thrombi in a patient of pulmonary embolism with a reported prevalence of 7% to 18% [1,2]. Floating right heart thrombi are accompanied by severe pulmonary embolism and it has been shown that presence of right heart thrombi is predictive of worse outcome in cases of acute PTE [2,8]. These thrombi are thought to be in transit from peripheral venous system to pulmonary circulation. In extremely rare cases these thrombi can extend into left atrium through a patent foramen ovale. It has been proposed that increased pressure in right atrium due to RV overload can cause right heart thrombi to protrude across a patent foramen ovale [6]. This condition is life threatening due to imminent risk of pulmonary and paradoxical embolism. Although the diagnosis of a free floating thrombus is straight forward on real time echocardiographic examination, occasionally it can be difficult to differentiate from other conditions like Chiari network, persistent eustachian or thebesian valves, atrial septal aneurysms or intracardiac tumors [3].

Floating right heart thrombus is a therapeutic emergency and any delay to treatment could be lethal (with reported mortality upto 40%) [9]. Treatment options include anticoagulation, thrombolytic



**Figure 2 (A-D):** CT pulmonary angiography axial maximum intensity projection (MIP) images demonstrating partially occlusive thrombus in main pulmonary artery (white arrow) extending into right and left pulmonary arteries (A, D). A linear hypodense thrombus was seen in RA and RV (black arrow in B) as well as in LA (black arrow in C).

\*On coronal reformed images continuity of thrombus in RA and LA was demonstrated (black arrow in D) through a defect in interatrial septum.

therapy and surgical embolectomy [10], but there is no consensus on ideal treatment. Thrombolytic and anticoagulant therapy is simple, rapid, non invasive and widely available. However, it may cause a fixed thrombus to dislodge, leading to pulmonary embolism and may also lead to paradoxical systemic embolism in a case of entrapped thrombus in patent foramen ovale (as in our case). Also, thrombolytic therapy is associated with risk of significant bleeding. Surgical embolectomy on the other hand is invasive and associated with inherent delay, complications of general anesthesia and inability to remove thrombus beyond central pulmonary arteries. However a patent foramen ovale can be repaired at the time of surgery thereby reducing the risk of paradoxical embolism.

To conclude, right heart thrombi can be seen in association with acute pulmonary embolism and in extremely rare cases can extend across patent foramen ovale. A diagnosis can be made on transthoracic echocardiography. Treatment options include anticoagulation, thrombolysis and surgery or a combination of above.

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