To Lyse or Not: The Role of Half-Dose Thrombolysis in Right Ventricular Clot Associated with Sub-Massive Pulmonary Embolism

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September 02, 2024

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Abstract

Right heart thrombi are rare and associated with significantly increased mortality, with rates reported to be 27% to 45% despite treatment and rates near 100% in untreated patients. Right ventricular (RV) thrombus can be treated with anticoagulation, thrombolysis, and/or surgical thrombectomy. Though there are different options, no concrete recommendations or studies exist for the ideal treatment option. In our case, a 43-year-old male presented with shortness of breath. His echocardiography revealed an RV thrombus, and the Computed Tomography chest showed a bilateral pulmonary embolism. Furthermore, a lower limb Doppler study revealed bilateral deep vein thrombosis. The patient was treated with half-dose thrombolytic therapy with a good response. Follow-up echocardiography revealed complete resolution of the RV thrombus and considerable improvement in the right heart function. No bleeding events were recorded.

Keywords : Pulmonary embolism; Thrombolytic therapy; Right heart thrombi; Right ventricular thrombus; Deep vein thrombosis

Key Clinical Message:

Right heart thrombi are rare but carry high mortality risks, with untreated cases nearing 100%. Treatment options include anticoagulation, thrombolysis, and surgical thrombectomy, though no definitive guidelines exist. In this case, a 43-year-old male with an RV thrombus and bilateral pulmonary embolism responded well to half-dose thrombolytic therapy, with complete thrombus resolution and no bleeding events.

INTRODUCTION

RV thrombus is a rare finding usually found with concurrent emboli and associated with significant mortality [1]. Recognition of intracardiac thrombus and immediate intervention help prevent the disastrous consequences, which include sudden death [2]. The ideal management of intraventricular thrombi is not clear. Although there are a large number of clinical trials suggesting different treatment options, the existing evidence is controversial.

We present a case report addressing the uncertainty of using a half-dose thrombolytic regimen. This approach has shown promising results in resolving thrombi, improving right heart function, and reducing the risk of bleeding.

Case History/Examination

A 43-year-old male with a history of uncontrolled diabetes mellitus, chronic smoking, and COPD/asthma (not previously investigated) presented with a 3-day history of shortness of breath and cough. Upon admission, he was found to be hypoxic on room air, with oxygenation improving upon administration of 40% Venturi support. Hemodynamics were stable.

Methods (Differential Diagnosis, Investigations, and Treatment)

Initial chest CT revealed multiple filling defects in the distal main pulmonary artery, descending and upper lobar arteries, extending into the lobar and segmental arteries, with signs of right ventricular strain, evidenced by the dilatation of the main pulmonary artery (3.3 cm) and flattening of the interventricular septum toward the left ventricular cavity (Figure 1). A Doppler ultrasound of the lower limbs showed a bilateral deep vein thrombus. Echocardiography conducted upon admission identified a moderately dilated right ventricle with moderately reduced function, along with a mobile thrombus attached to the mid-right interventricular septal wall, severe pulmonary hypertension (RVSP 60 mm Hg), and evidence of RV pressure overload (Figure 2). Further RV strain analysis confirmed impaired function, with global RV strain at -8.3%, RV free wall strain at -8.4%, and tricuspid annular plane systolic excursion at 1.3 cm (Figure 3).

The patient was initially managed with oxygen therapy and intravenous heparin infusion to target an aPTT value of 50, adjusted from a baseline of 25. This was later switched to therapeutic enoxaparin at 120 mg BID. On the second day, due to the presence of the RV thrombus, lack of clinical improvement, and increasing trends in Pro BNP (1549 to 2048), troponin T (37 to 99), and D-dimer (3.67 to 5.04), thrombolytic therapy with 50 mg alteplase administered intravenously over 2 hours was initiated, followed by a return to heparin infusion (Figure 4). The cardiothoracic team was consulted, and they recommended continuing anticoagulation without intervention. The patient was subsequently transferred to a tertiary care center for further management.

Conclusion and Results (Outcome and Follow-up)

On the third day, a repeat echocardiogram showed the disappearance of the RV mobile thrombus, with mildly reduced RV function, moderate dilatation of the RV chamber, and an RVSP of approximately 45 mm Hg. By the fourth day, Pro BNP had decreased to 274, and D-dimer levels decreased to 4.13, though cardiac markers (troponin) remained elevated. The patient was discharged on the sixth day with a prescription for rivaroxaban 15 mg BID.

Discussion

Venous thromboembolism has a broad spectrum of clinical syndromes associated with varying clinical outcomes [1-2]. Right heart thrombi (RHT) are uncommon but probably underdiagnosed in patients with pulmonary embolism [1]. Mobile right-heart thrombi are detected in range from 2.6% to 18% [5].

RHT had a higher prevalence in patients with a history of chronic heart failure, cancer, immobilization, or recent major bleeding compared with those without RHT [2]. Three RHTs (A, B, and C) are described, suggesting specific etiologies [3]. Type A describes a highly mobile serpiginous thrombus, often trapped in right heart cavities, representing the result of a migration of thrombi [3]. Hence, type A thrombi are associated with DVT and PE. Type B thrombi are fixed, formed in situ, and associated with cardiac abnormalities [3]. Type C assumes intermediate characteristics [3]. Stasis in the dilated right heart due either to acute severe pulmonary embolism, pre-existing congestive heart failure, or both seems to enhance the risk of RHT, regardless of whether it is due to in situ thrombosis or to entrapment of transiting thrombi [2].

There is a lack of comprehensive data on the prevalence, predictors, and prognostic significance of RHT in pulmonary embolism [2]. When compared to patients without RHT, patients with RHT are more hemodynamically compromised, with lower systolic blood pressure, higher heart rate, and more frequent hypoxemia and syncope [2]. A patent foramen ovale also increases the risk of ischemic stroke due to paradoxical embolism [4]. The literature review suggests that patients with acute pulmonary embolism and RHT had a significantly higher cumulative mortality than patients with acute pulmonary embolism without RHT [2]. Among low-risk PE patients with RHT, the risk of death was about seven times higher than in patients without RHT [2]. Among patients with low and intermediate risk of pulmonary embolism (i.e., right ventricular dysfunction), those with RHT had an increased mortality compared with those without RHT [2]. Our patient was thus considered to have having higher mortality risk.

Primary treatment includes optimizing oxygenation and ventilation status, volume optimization, and vasopressors and inotropes as needed [4]. Further therapeutic options in these patients consist of anticoagulation, thrombolysis, or surgical embolectomy [2]. However, the optimal treatment of right heart thrombi remains unclear, as no randomized studies exist. Current available data show that in patients who received anticoagulation alone, the risk of death was about three times higher in those with RHT than in those without RHT [2]. Data also suggested that normotensive patients with PE and coexisting RHT had a threefold increased risk of short-term death compared with patients without RHT [5]. It was thus concluded that anticoagulation is not enough as the sole treatment of pulmonary embolism with RHT [1], and the feasibility of thrombolysis was considered in our patient.

In normotensive patients with intermediate-risk PE, defined as the presence of RV dysfunction and elevated troponin levels, the impact of thrombolytic treatment was investigated in the Pulmonary Embolism Thrombolysis (PEITHO) trial, which showed a significant reduction in the risk of hemodynamic decompensation or collapse. Still, an increased risk of severe extracranial and intracranial bleeding parallelled this [4]. The efficacy of "half-dose" or "safe dose" thrombolytic therapy in the resolution of five cases of FRHT was presented in a case series [6]. Here, half-dose thrombolytic therapy (50 mg of alteplase) was administered to the patients and followed up with an echocardiogram that revealed complete resolution of the FRHT and considerable improvement in the right heart function with no bleeding events [6-7]. Hence, in our case, we perform thrombolysis with half dose to further reduce the risk of bleeding.

Declarations

Ethics approval: Following local or national guidelines, ethical approval was not required for this case. However, the Medical Research Center at Hamad Medical Corporation (MRC-04-24-475) approved the case for publication.

Funding: None.

Conflict of Interest Statement: None.

Data Availability Statement: All data generated or analyzed in this study are included in this published article. Further inquiries can be directed to the corresponding authors.

Authors' contributions: Nasreldin A. Hamza, Wasfy J. Hamad, Shamim K. Vakkulathil, Vimalraj Sundaram, Haidar M. Hadi, Abdulqadir J. Nashwan: Writing – original draft; writing – review and editing. All authors have read and approved the final manuscript.

Acknowledgments: Open Access funding was provided by the Qatar National Library.

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Figures

Figure 1 shows a dilated RV with pressure overload and flattening of the interventricular septum (IVS) towards the left ventricle.

Figure 2 shows dilated RV and evidence of a 1.5X2 cm mass (RV thrombus) attached to mid-IVS from the RV side (arrow).

Figure 3 RV strain analysis showing evidence of RV dysfunction with RV global starin= -8.3%, FWS=-8.4%, and TAPSE=1.3 cm.

Figure 4 shows the complete resolution of RV thrombus post half-dose lysis.