

# Thrombolytic Treatment of Simultaneous Pulmonary Embolism and Impending Paradoxical Embolism Through a Patent Foramen Ovale: A Different Thrombolytic Regimen

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A 72 year-old woman was admitted with a one-week history of weakness, right limb pain and progressive breathlessness. Her blood pressure was 60/40 mmHg, ECG showed inverted T waves in the precordial leads and incomplete right bundle branch block (RBBB). Transthoracic echocardiography revealed a large serpentine mobile mass across the atrial septum and mitral valve extending into the left ventricular cavity. The right ventricle was dilated and peak systolic tricuspid annular velocity (RV-Sm) was 6.5 cm/sn, indicate right ventricular systolic function was severely depressed. Transoesophageal echocardiography showed a large, mobile thrombus in the foramen ovale, extending into the left atrium and ventricle. As the patient was in a haemodynamically compromised condition, high dose rapid infusion of streptokinase was administered. However, the thrombus did not fully resolve with this intervention. Therefore, low dose continuous streptokinase infusion was administered for an additional 72 h resulting in full resolution of the lesion by the third day of therapy. The optimal management of impending paradoxical embolism remains unclear. Prolonged continuous thrombolytic infusion may be a option for patients who do not experience full resolution of high risk thrombi with conventional thrombolytic therapy.

(Heart, Lung and Circulation 2012;21:225–228)

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**Keywords.** Impending paradoxical embolism; Thrombolytic; Intracardiac thrombus; Pulmonary embolism

## Introduction

Pulmonary embolism (PE) is most often caused by migration of a deep venous thrombosis (DVT) of the lower limbs through the vena cava and right heart cavities resulting acutely elevated pulmonary arterial and right atrial pressure and opening a foramen ovale and entrapment of a sizable piece of thrombus. Thrombus can be trapped migrating from the right to the left atrium producing an impending paradox embolism [1]. Paradoxical embolism across the patent foramen ovale (PFO) is a rare clinical entity and it is extremely uncommon that the thrombus becomes lodged passing through the PFO [2]. The optimal management of impending paradoxical embolism with a thrombus in both atria and the left ventricle is unclear. In a recent published review,

it has been emphasised that surgical thromboembolectomy significantly reduces systemic embolisation and overall mortality when compared with anticoagulation alone [1]. We present a patient case of a serpentine thrombus entrapped in a PFO successfully treated with an alternative regimen of conventional high-dose streptokinase followed by prolonged continuous infusion of streptokinase.

## Case report

A 72 year-old woman was admitted with a one-week history of weakness, right limb pain and progressive breathlessness. Her blood pressure was 60/40 mm Hg, saturation was 80% at presentation, ECG showed inverted T waves in the precordial leads and incomplete RBBB. Transthoracic echocardiography revealed a large serpentine mobile mass across the atrial septum and mitral valve extending into the left ventricular cavity (Fig. 1). The right ventricle was significantly dilated and systolic function was severely depressed. The peak systolic tricuspid annular velocity (RV-Sm) was 6.5 cm/sn. Transoesophageal

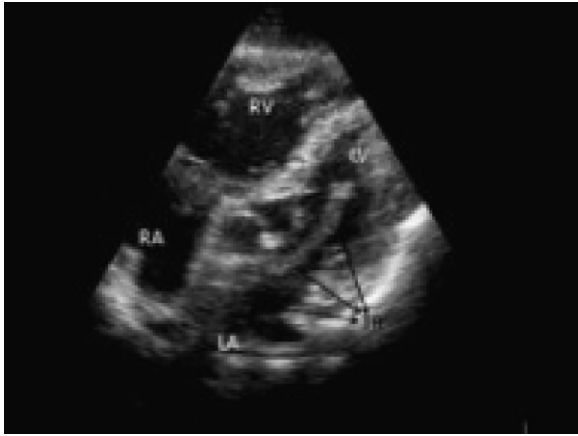
Received 18 July 2011; received in revised form 26 September 2011; accepted 3 October 2011; available online 13 November 2011

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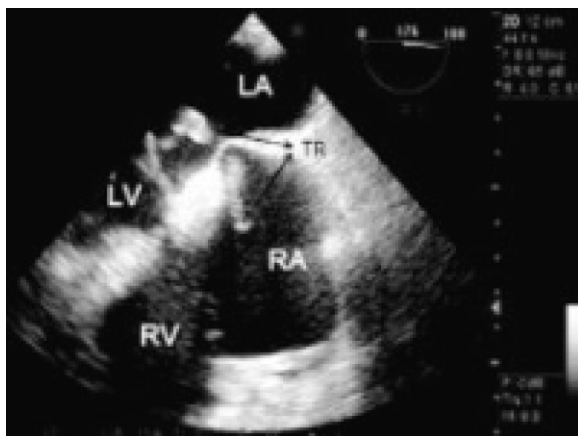
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doi:10.1016/j.hlc.2011.10.001

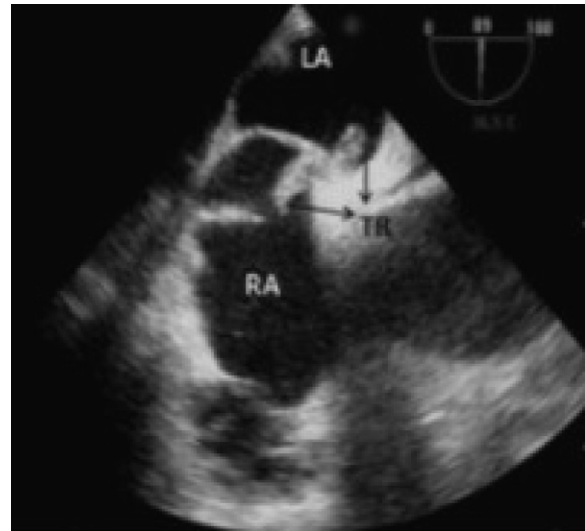


**Fig. 1.** Transsthoracic echocardiography demonstrated a serpentine thrombus in the left atrium and ventricle (LV, left ventricle; LA, left atrium; RV, right ventricle; RA, right atrium; TR: thrombus; AO: aorta).

echocardiography showed a large, mobile thrombus in the foramen ovale, extending into the left atrium and ventricle (Figs. 2 and 3). Because of the patient's haemodynamically compromised condition, 1,500,000 international units (IU) of streptokinase was infused after administration of 5000 IU heparin, over a two-hour period. After the completion of this infusion via a central vein, the patient's haemodynamics did improve with an increase in her systolic blood pressure to 85/60 mmHg. However, repeat echocardiogram did not reveal resolution of the entrapped thrombus. Streptokinase was subsequently continued at 60,000 IU/h for an additional 72 h until full thrombus resolution was achieved and confirmed by echocardiographic imaging (Figs. 4 and 5). The patient was haemodynamically stable and there were no other side effects of thrombolytic therapy during streptokinase infusion. Unfractionated heparin, administered by continuous infusion adjusted to achieve activated partial thromboplastin time (APTT)



**Fig. 2.** Transoesophageal echocardiography demonstrated a thrombus entrapped through a patent foramen ovale, lodged in both atriums and extended to the mitral valve.



**Fig. 3.** Transoesophageal echocardiography demonstrated a thrombus entrapped through a patent foramen ovale and lodged in both atriums.

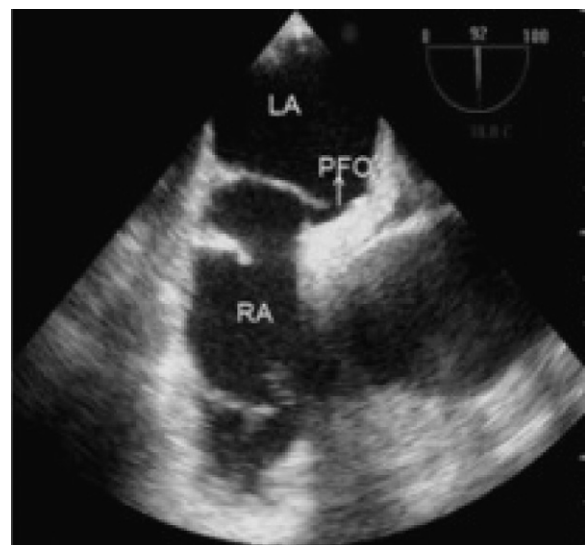
greater than 1.5, was started at 18 IU/kg/h, at the same time warfarin 5 mg/day was commenced (A target INR range of 2–3).

After haemodynamic stabilisation of the patient, spiral CT with pulmonary embolism (PE) protocol was performed and revealed bilateral pulmonary thromboemboli. Additionally Dopplers of the lower extremities detected deep vein thromboses in bilateral popliteal veins.

The patient was fully recovered and discharged 11 days after the hospital admission with warfarin 5 mg daily.

## Discussion

The incidence of deep vein thrombosis (DVT) in the general population is nearly 1 in 5000. One-third of



**Fig. 4.** Transoesophageal echocardiography revealed no thrombus and PFO after thrombolytic treatment.

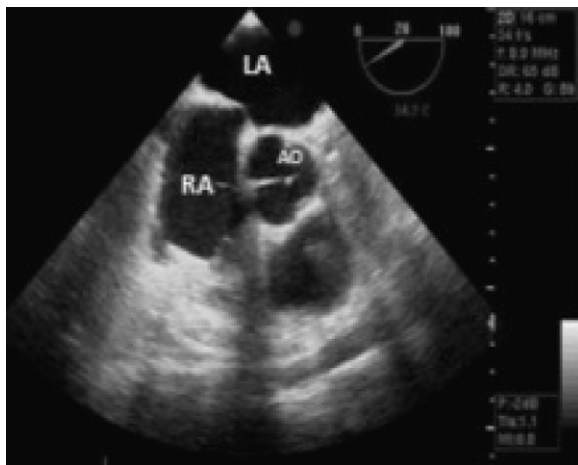


Fig. 5. Transoesophageal echocardiography revealed no thrombus.

patients with venous thromboembolism can present with PE and have a mortality of approximately 12% [3]. On review of the literature, there are multiple cases reported in which intracardiac right-sided thrombi were detected incidentally in the setting of acute pulmonary thromboembolism [4,5]. Pulmonary emboli with a thrombus entrapped in the PFO is rarely reported [6,7]. Impending paradoxical emboli may be temporarily lodged in the PFO [1]. In the evaluation of a haemodynamically unstable patient with suspicion for possible pulmonary embolism, echocardiographic examination has great importance in the evaluation of right ventricular function and assessment for intracardiac thrombus. In the present case, transthoracic echocardiography revealed a serpiginous thrombus extending from the right atrium to the left atrium and left ventricle through a PFO. The involvement of thrombus into the PFO and right atrium was detected by transoesophageal echocardiography.

The best treatment for a pulmonary embolism with an entrapped thrombus in PFO is unclear. Recent reviews emphasise that surgical thromboembolectomy significantly reduced systemic embolism compared with thrombolytic treatment. Thrombolysis is more frequently chosen in the higher risk group and is associated with the highest mortality [1,8]. However the optimal approach will depend on patient characteristics and available hospital resources and expertise [1]. In the present case, the selected therapeutic option could have been surgical thromboembolectomy; however, due to the patient's haemodynamic instability, it was felt her surgical risk exceeded the benefits. After consideration of all options, thrombolytic therapy was chosen. Conventional dosing streptokinase was infused over 2h followed by a continuous infusion of streptokinase over the subsequent 72h and there were no major bleeding or systemic embolisation.

PFO closure and inferior vena cava (IVC) filter devices are still controversial in patients with PE and paradoxical emboli because there is not enough data regarding their long-term effects [9]. At present temporary IVC filters have a role in the prevention of PE only if anticoagulation is absolutely contraindicated or in case of recurrence in spite of medical treatment. Closure of the foramen ovale might be indicated in patients with recurrent paradoxical embolism despite antithrombotic therapy and in patients with contraindication to anticoagulants [10]. In the present case, IVC filter or PFO closure devices were not used because there was no contraindication for anticoagulation and no recurrence of PE.

In conclusion, in patients in a haemodynamically unstable condition, echocardiographic examination is essential for detecting possible right heart failure and intracardiac thrombus. Although surgical intervention for thromboembolectomy is reported to reduce morbidity and mortality in patients with impending paradoxical embolism, all individuals may not be appropriate candidates this approach. Conventional thrombolytic therapy followed by continuous IV infusion with close monitoring may be an alternative strategy for high risk patients with intracardiac thrombi and risk for paradoxical embolism.

#### Conflict of interest

No conflict of interest

#### References

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