

# Silent embolism of a large thrombus in transit through the patent foramen ovale: a case report

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## Background

Detection of a thrombus in transit through a patent foramen ovale (PFO) is extremely rare due to the transient nature of the process. We report an unusual case of a large, paradoxical embolus in transit seen on echocardiography through a PFO that was not found upon atriotomy.

## Case summary

An 80-year-old woman presented to the emergency room with shortness of breath and right leg pain. She was haemodynamically stable on presentation, and her physical exam was unremarkable. An ultrasound of her right leg revealed a deep vein thrombus in the posterior tibial vein, and chest computed tomography angiography showed saddle pulmonary emboli. Transthoracic echocardiogram identified a large thrombus in transit through a PFO, which was confirmed with a transoesophageal echocardiogram (TOE). She underwent an emergency embolectomy. The thrombus in transit was confirmed by TOE prior to bypass initiation; however, no thrombi were found in any chambers of the heart following atriotomy. Her postoperative recovery was uneventful. She had no focal neurological deficits or any apparent signs of large vessel embolization.

## Discussion

Cases of silent embolism have been reported in the literature, although they are rare. To our knowledge, this is the first case of a large thrombus in transit through a PFO in an elderly female that was confirmed by an intra-operative TOE but could not be found following atriotomy, with no obvious clinical signs of embolization.

## Keywords

Silent embolization • Thrombus in transit • Pulmonary embolism • McConnell's sign

## Learning points

- In patients with pulmonary embolism, the presence of thrombi in the right heart chambers must be excluded by echocardiography. Only rarely is a thrombus caught while in transit through a patent foramen ovale (PFO), representing a life-threatening condition.
- Continuous transoesophageal echocardiogram (TOE) monitoring during surgery for an intracardiac thrombus in transit through a PFO could aid in determining the precise fate of the thrombus after heparin bolus and bypass cannulation. This could even prevent extensive surgical exploration if the thrombus propagates, fragments, or dissolves during these perioperative procedures.

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## Introduction

Detection of a thrombus in transit through a patent foramen ovale (PFO) is an extremely rare phenomenon due to the transient nature of the process. Before the era of echocardiography, it was mostly found on autopsy. The first reported case of a clot in transit through a PFO detected with echocardiography was in 1985 by Nellesen *et al.*<sup>1</sup> However, even in the era of echocardiography, this remains a rare finding. Here, we report an unusual case of a large paradoxical embolus in transit through a PFO that disappeared before atriotomy.

## Timeline

7 days before presentation	The patient 'binge-watched' television for long hours for 3 days in a row with minimal ambulation.
5 days before presentation	Onset of symptoms
Initial presentation (IP)	Right leg pain and dyspnoea on exertion
4 h after IP	Started on heparin drip after diagnosis of deep vein thrombosis
6 h after IP	Diagnosis of saddle pulmonary embolism established on computed tomography angiography.
8 h after IP	Transthoracic echocardiogram identified a thrombus in transit through a patent foramen ovale (PFO) and right heart strain.
10 h after IP	Transoesophageal echocardiogram (TOE) performed to confirm the diagnosis of a clot in transit
20 h after IP	The patient was taken to the operating room for thrombo-embolectomy.
21 h after IP	The patient was intubated in the operating room, and TOE confirmed the presence of the thrombus in transit through the PFO.
22 h 30 min after IP	Atriotomy was performed. No thrombi were found in any of the cardiac chambers.
Day 4	The patient underwent abdominal, pelvic, and head computed tomography.
Day 8	Discharged to acute rehabilitation
6-month follow-up	Normalization of pulmonary pressures, remains on apixaban for life

## Case presentation

An 80-year-old woman with a history of obesity, hypertension, and obstructive sleep apnoea requiring CPAP presented to our emergency room with pain and swelling in her right leg along with shortness of breath with exertion. Notable vital signs included a heart rate of 94 b.p.m. and blood pressure of 140/90 mmHg. Her physical exam

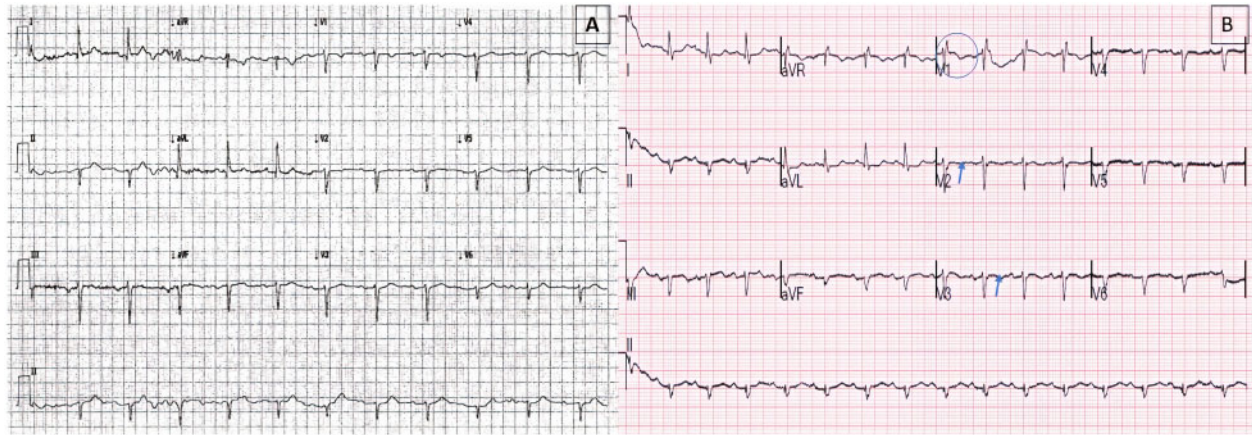
was unremarkable. Her laboratory workup revealed elevated pro-BNP and troponin T. Electrocardiogram revealed a new incomplete right branch bundle block (Figure 1). A venous Doppler of her right leg identified an occlusive deep vein thrombus (DVT) extending from the proximal posterior tibial vein to the distal posterior tibial vein (Figure 2). Computed tomography (CT) angiography revealed extensive bilateral pulmonary embolism (PE) with a saddle thrombus in the main pulmonary artery and evidence of right ventricular strain (Figure 3). A transthoracic echocardiogram (TTE) demonstrated a large, highly mobile thrombus in the left atrium attached to the interatrial septum (Video 1A and B). Both the right atrium and right ventricle were dilated with moderate right ventricular dysfunction. The right ventricle demonstrated a positive McConnell's sign (a distinct regional pattern of right ventricular dysfunction, with akinesia of the middle portion of the free wall but normal motion at the apex), and pulmonary pressures were severely elevated. A transoesophageal echocardiogram (TOE) showed a large, protruding, mobile thrombus starting in the right atrium that went through a PFO into the left atrial cavity (Figure 4, 5). The thrombus was 1.5 cm long in the right atrium and 6.5 cm long in the left atrium. The left atrial segment intermittently protruded through the mitral valve with the cardiac cycle (Video 1C–F).

The patient was taken for an emergency pulmonary and intracardiac embolectomy with primary closure of the PFO. An intraoperative TOE performed after the induction of anaesthesia and before initiation of cardiopulmonary bypass confirmed the presence of thrombus in transit through the PFO. However, on atriotomy, there were no thrombi found in any of the cardiac chambers. It was presumed that the thrombi had migrated through the PFO and embolized. The time from TOE to atriotomy was <90 min, making it highly unlikely for such a large thrombus to completely dissolve. On pulmonary artery exploration, multiple large thrombi were removed from the main, right, and left pulmonary arteries. Once the patient was decannulated, a post-procedure TOE was performed, which confirmed the absence of an intracardiac thrombi and successful closure of the PFO.

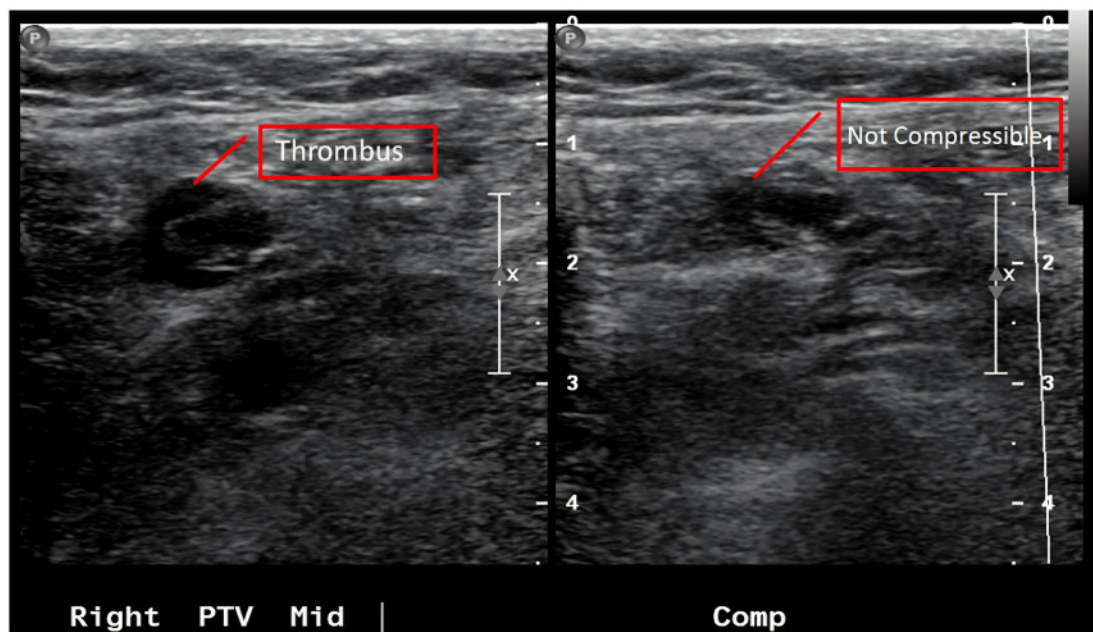
Her post-operative recovery was uneventful. She had no focal neurological deficits or any apparent signs of large vessel embolization. Computed tomography venography found no thrombus in the inferior vena-cava or iliac veins. An abdominal, pelvic, and head CT did not reveal any detectable emboli. At 6-month follow-up, TTE showed normalization of both pulmonary artery pressures and right ventricular function. Her workup for DVT and PE remained negative, and so she remains on life-long anticoagulation therapy with apixaban 5 mg twice a day for unprovoked DVT and PE.

## Discussion

The first reported case of a thrombus in transit through a PFO detected by echocardiography was in 1985 by Nellesen *et al.*<sup>1</sup> It is a life-threatening condition with a high mortality rate. Treatment options include anticoagulation, thrombolysis, or surgical embolectomy. There are no guidelines on the management of patients with thrombus in transit. In previous review studies, it was found that thrombolysis, which is primarily used in elderly and unstable patients, is associated with a significant risk of clot fragmentation and systemic embolization. Haemodynamically stable, elderly patients are usually treated with systemic anticoagulation. Surgical options are reserved



**Figure 1** Electrocardiogram upon presentation to Emergency Room showing a new incomplete right bundle branch block.



**Figure 2** Right leg venous Doppler revealing an occlusive thrombus spanning from the proximal posterior tibial vein to the distal posterior tibial vein.

for younger patients who are haemodynamically unstable.<sup>2,3</sup> Our patient underwent surgical thromboembolectomy, despite her age, and had an excellent outcome.

An interesting finding in our patient was that, despite the intra-operative TOE confirming the thrombus in transit (CIT) prior to bypass initiation, there was no thrombus found in the right or left atrium on atriotomy. Most likely, the thrombus propagated through the PFO to the left atrium during bypass cannulation, then fragmented and embolized without any obvious clinical consequences. The second

possibility is that the thrombus fragmented with the heparin bolus administered during the procedure with embolization of the right and left atrial fragments to the pulmonary artery and systemic circulation, respectively. Although the dissolution of a thrombus by a short course of heparin has been described in the literature,<sup>4,5</sup> we do not believe that the thrombus dissolved completely in our case. Intra-operative TOE performed after the induction of anaesthesia confirmed the presence of a large thrombus in transit through the PFO. She then received 11 000 units of heparin prior to bypass initiation, and her RA was

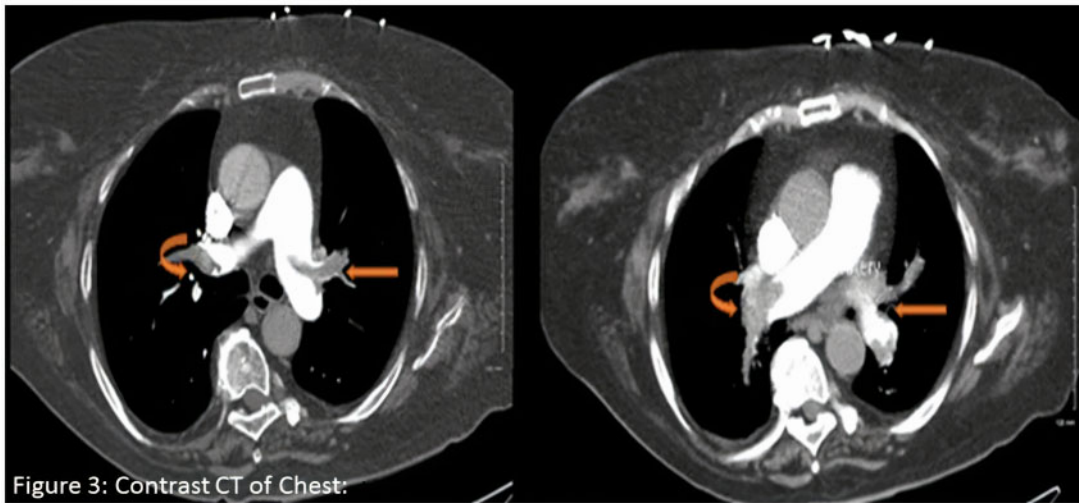
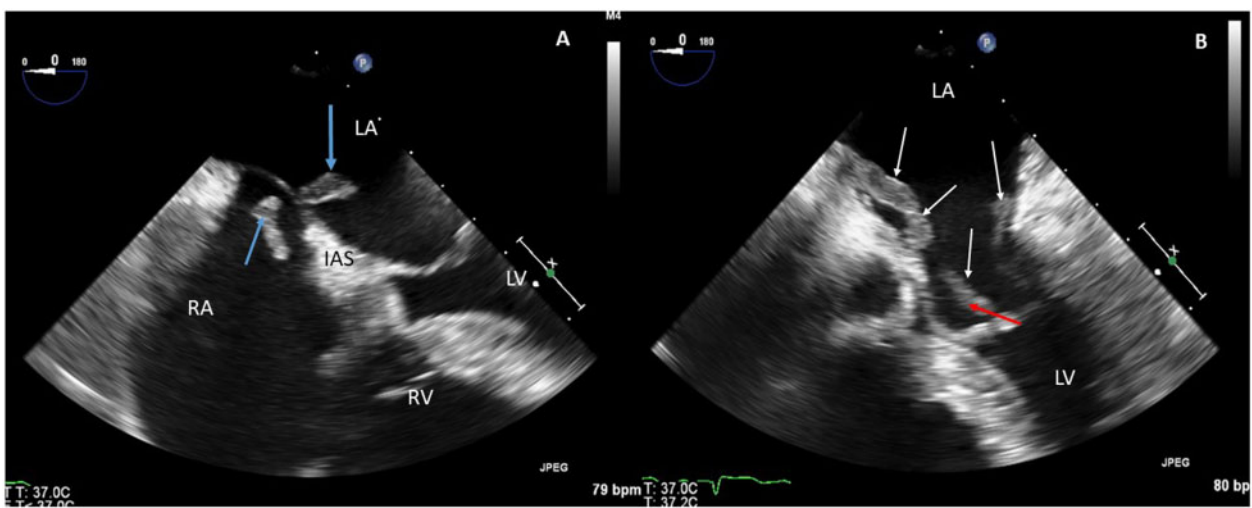


Figure 3: Contrast CT of Chest.

**Figure 3** Computed tomography angiography showing extensive bilateral PE (orange arrow) with a saddle thrombus in the main pulmonary artery and evidence of right ventricular strain.



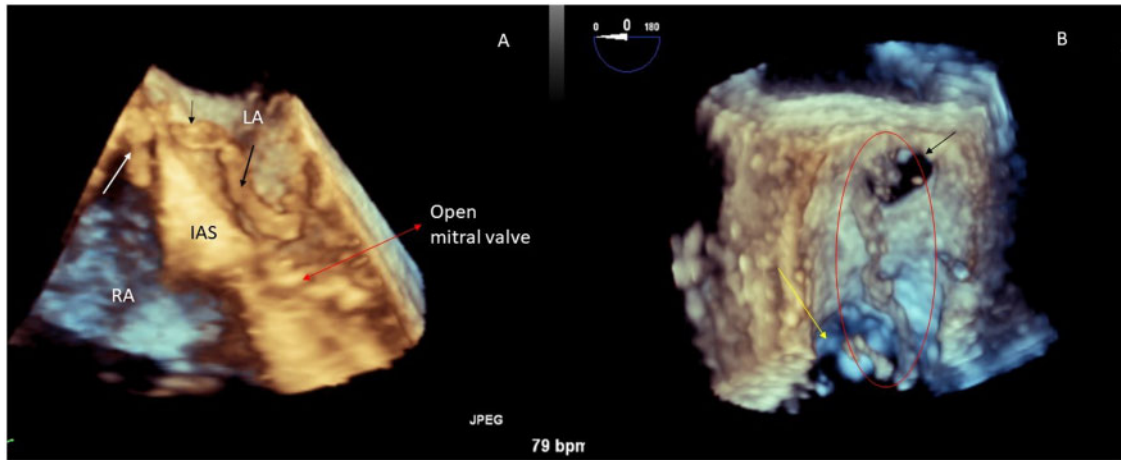
**Figure 4** (A) Still image from transoesophageal echocardiography at the mid-oesophagus, 0°, with focus on inter-atrial septum, showing the right atrium, left atrium, left ventricle, and mitral valve (red arrow). Also seen is the thrombus in transit going from the right atrium to left atrium (blue arrows) through a patent foramen ovale and prolapsing into the left ventricle through the mitral valve in diastole. (B) Focused view of left atrium and left ventricle in the beginning of the diastole shows the long serpentine thrombus in left atrium (white arrow).

opened within an hour of receiving heparin. It is highly unlikely for such a large thrombus to dissolve completely within 1 h.

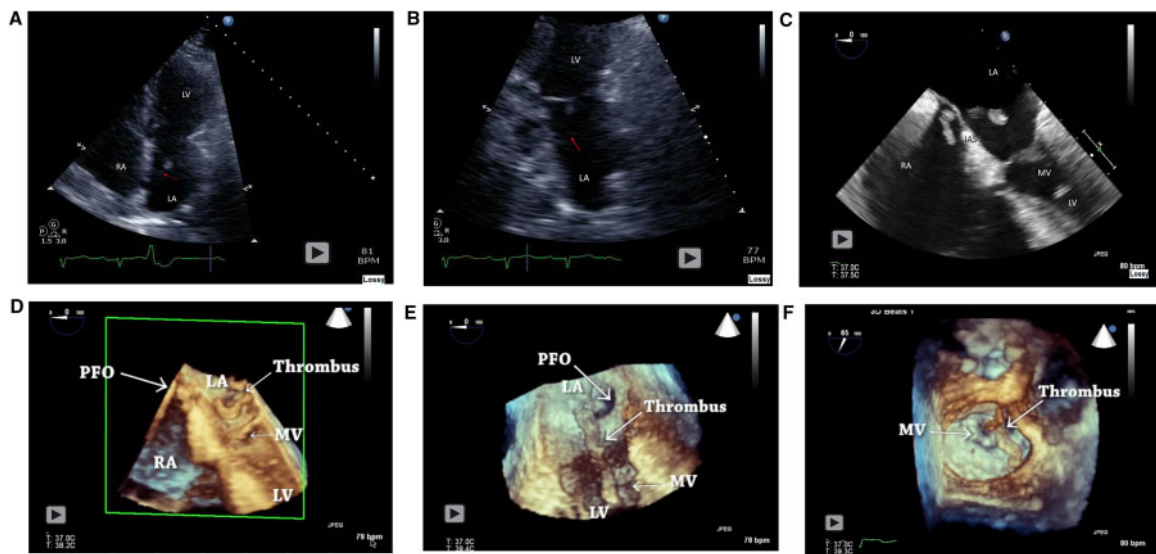
Cases of silent embolism have been reported in the literature,<sup>4</sup> although they are rare. Embolization from a large, left-sided thrombus usually tends to be symptomatic secondary to abrupt vascular occlusion that does not allow enough time for the collaterals to develop. Asymptomatic, silent embolization from the left atrium is very rarely encountered.<sup>5-7</sup> In our patient, the majority of the clot was in the left side of the heart, making clot fragmentation and embolization highly likely. She did not have any obvious clinical signs of

arterial embolization, and there were no infarcts detected by non-contrast CT of the abdomen, pelvis, and head.

The pressures between the right and the left atrium are known to be responsible for thrombus propagation through a PFO. During cannulation and bypass initiation, these pressures are altered, which could influence a thrombus in transit. Therefore, repeating the TOE after connecting the patient to bypass could have avoided invasive surgical exploration of our patient. To avoid unnecessary surgical procedures, we propose continuous intra-operative TOE of patients undergoing surgery for intracardiac thrombus in transit through a PFO.



**Figure 5** Three-dimensional transoesophageal echocardiography showing thrombus in transit through the patent foramen ovale. (A) Three-dimensional transoesophageal echocardiography frozen in diastole, shows the right atrium, left atrium, inter-atrial septum, and open mitral valve. Also seen is the thrombus crossing from right atrium (white arrow) to left atrium (black arrow) through the patent foramen ovale. (B) Three-dimensional transoesophageal echocardiography view as seen from the lateral side of the left atrium showing patent foramen ovale (white arrow) with a long serpentine thrombus (red circle) crossing over to left atrium and prolapsing through the open mitral valve (yellow arrow).



**Video 1** (A) Transthoracic echocardiogram four-chamber view showing right atrium, left atrium, interatrial septum, and left ventricle. An echogenic density is visualized (red arrow) in left atrium attached to the site of IAS at the site of patent foramen ovale, which is most likely a thrombus in transit. (B) Transthoracic echocardiogram two-chamber view showing left atrium and left ventricle. An echogenic density (most likely a thrombus in transit) is visualized (red arrow) in left atrium which on close observation is seen prolapsing into the left ventricle in diastole. (C) Transoesophageal echocardiogram at mid-oesophageal 0°, shows right atrium, left atrium, interatrial septum, and left ventricle. A large thrombus in transit is seen crossing the patent foramen ovale into the left atrium and prolapses into left ventricle with the opening of the mitral valve. (D) Three-dimensional transoesophageal echocardiography at mid-oesophageal level at 0° showing thrombus in transit through the patent foramen ovale and intermittent protrusion of the thrombus into left ventricle through the mitral valve. (E) Three-dimensional transoesophageal echocardiography view from left side of heart showing a large patent foramen ovale and a thrombus through it. (F) Three-dimensional transoesophageal echocardiography view showing the mitral valve as seen through the unroofed left atrium- showing a large serpiginous thrombus protruding into the left ventricle through the mitral valve with each beat.

## Conclusion

To our knowledge, this is the first case of silent embolization of a large thrombus in transit through a PFO in an elderly female. The disappearance of the thrombus in transit that was clearly seen with intra-operative TOE before initiating cardiopulmonary bypass highlights the importance of continuous intra-operative TOE monitoring during surgery for intracardiac thrombus in transit through a PFO. It should be noted that we did not use magnetic resonance imaging or computed tomography angiography to look for asymptomatic micro-embolisms, as their clinical significance is not clearly defined, and it would not have affected the current management of our patient.

## Lead author biography



Dr Shruti Hegde was born in Bangalore, India. She completed her Medical School at Kasturba Medical College, Mangalore, India. She worked in India for 2 years before starting her residency at St. Elizabeth's Medical Center, Boston, MA, USA. Currently, she is in the final year of Cardiovascular Fellowship at St. Elizabeth's Medical Center. Her areas of interest include Cardiac Imaging, Heart Failure, and Preventive Cardiology.

## Supplementary material

[Supplementary material](#) is available at *European Heart Journal - Case Reports* online.

**Slide sets:** A fully edited slide set detailing this case and suitable for local presentation is available online as [Supplementary data](#).

**Consent:** The authors confirm that witnessed verbal consent for submission and publication of this case report including images and associated text has been obtained from the patients detailed in this case report. This has been discussed with the editors.

**Conflict of interest:** None declared.

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