CASE REPORT

Serpentine thrombus in the heart: a rare case of trapped thrombus in patent foramen ovale

Dominika M Zoltowska,¹ Yashwant Agrawal,² Jagadeesh K Kalavakunta³¹Department of Internal Medicine, Western Michigan University School of Medicine, Kalamazoo, Michigan, USA²Western Michigan University Homer Stryker School of Medicine, Kalamazoo, Michigan, USA³Borgess Medical Center/ Michigan State University, Kalamazoo, Michigan, USA

Correspondence to

Dr Dominika M Zoltowska, dominika.zoltowska@med.wmich.edu

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SUMMARY

A 77-year-old Caucasian woman with recent abdominal surgery was diagnosed with multiple paradoxical systemic emboli in the mesenteric and renal circulation. Diagnosis was made by direct visualisation of a serpentine thrombus traversing both atria through patent foramen ovale (PFO) by transesophageal echocardiogram (TEE). Concomitantly, the patient was found to have deep venous thrombosis and pulmonary embolism. A decision was made to pursue cardiothoracic surgery preceded by inferior vena cava filter placement. She was started on intravenous anticoagulation. Repeat TEE was negative for thrombus and the patient did not present any new clinical signs of embolisation by this time. Consequently, the treatment plan was modified and the patient received oral systemic anticoagulation followed by PFO closure with the use of St. Jude Amplatzer Cribiform septal occluder device. During the outpatient follow-up the patient was asymptomatic and there was no significant flow through the device on transthoracic echocardiogram.

BACKGROUND

Patent foramen ovale (PFO) is a common finding on echocardiography. Prevalence is estimated as 25% in general population.¹ In majority of cases, this is an incidental finding without clinical significance. Nevertheless, in certain situations this condition can be associated with a phenomenon of paradoxical embolisation. While the proposed mechanism of paradoxical embolisation as a consequence of thrombus migration from venous to systemic circulation via communication in between the atria is generally accepted, causative relationship of these two findings is difficult to be proven.

This is a case of a 77-year-old woman diagnosed with multiple paradoxical systemic embolisation in the mesenteric and renal circulation. Diagnosis was made by direct visualisation of a serpentine thrombus traversing both atria through the PFO in the context of concomitant deep venous thrombosis (DVT) and pulmonary embolism (PE). This is a rarely documented finding with high risk of complications, predominantly reported in the setting of simultaneous PE.^{2–8}

CASE PRESENTATION

A 77-year-old Caucasian woman presented with progressively worsening abdominal and chest pain. Physical examination was pertinent for lower extremity oedema, a diffusely tender abdomen

and absence of cardiac murmur. The ECG showed normal sinus rhythm (figure 1). She was found to have small-bowel obstruction on X-ray. Transthoracic echocardiogram (TTE) obtained during pre-surgical clearance revealed an ejection fraction of 60%–65%, mild-to-moderate pulmonary hypertension and a cylindrical mass in the left atrium suspicious for a thrombus or tumour. She was taken to the operating room where a 10 cm ischaemic appearing terminal ileum was removed.

INVESTIGATIONS

Cardiology was consulted for further evaluation of interatrial finding. Transesophageal echocardiogram (TEE) revealed a large 6 cm × 1 cm serpentine thrombus in both the left and right atrium traversing through the PFO (figure 2, video 1). CT revealed filling defects in the right basilar pulmonary vessels, non-occlusive thrombi in the superior mesenteric artery and numerous renal infarcts. Ultrasound scan of the lower extremities revealed acute thrombi in the left femoral, popliteal and posterior tibial veins. Cardiac monitoring did not register any episodes of atrial fibrillation during the admission.

DIFFERENTIAL DIAGNOSIS

Differential diagnosis of the initial finding on TTE included thrombus or intracardiac mass, which could represent either primary tumour, most commonly myxoma, or metastatic lesion. Peripheral embolisation visualised on CT likely represented paradoxical embolisation through the PFO, but could also be the consequence of atrial fibrillation.

TREATMENT

Post TEE she was started on a heparin drip. Cardiothoracic surgery was consulted for possible thrombus intervention and closure of the PFO. A decision was made to place an inferior vena cava (IVC) filter and perform repeat TEE before the possible cardiothoracic procedure. The IVC filter was placed without complications. Repeat TEE revealed a tunnel-like PFO without thrombus. By this time, no new clinical signs of peripheral embolisation were observed. In this context, cardiothoracic surgery was cancelled and the patient remained on systemic anticoagulation with resolution of chest pain, followed by successful transcatheter PFO closure with a 35 mm St. Jude Amplatzer Cribiform septal occluder device (St. Jude Medical, St. Paul, MN) after few weeks. As the episode of DVT

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Figure 1 ECG with normal sinus rhythm.

was classified as non-provoked, the patient qualified for life-long anticoagulation.

OUTCOME AND FOLLOW-UP

During postprocedural cardiology outpatient follow-up visit, the patient remained asymptomatic from cardiac standpoint and did not present any signs of repetitive systemic embolisation. TTE showed no significant flow across the device.

DISCUSSION

PFO is an embryological remnant of physiological connection in between the left and right atrium in fetal circulation. In majority

of cases, the foramen ovale closes within the first 2 weeks postnatally. In 20%–25% of cases though, the foramen ovale persists.¹ The gold standard of diagnosis includes TEE with agitated saline contrast. Sensitivity can be additionally enhanced by performing a Valsalva manoeuvre during the procedure.⁹ Contrast-enhanced transcranial Doppler is an innovatory, low-cost, non-invasive diagnostic alternative.¹⁰ It is important to distinguish PFO from atrial septal defect (ASD), which is a structural lesion, resulting from developmental failure of the septum primum or secundum in heart embryogenesis starting in the fifth week of gestation.¹¹ PFO though may coexist with any anatomical defect including ASD or septum aneurysm. Usually in asymptomatic patients, PFO is an incidental finding without any clinical implication. Nevertheless, PFO is associated with certain medical conditions including paradoxical embolisation, migraine, especially with aura, caisson disease and orthodeoxia syndrome.¹²

Figure 2 TEE mid-oesophageal AV short-axis. Red arrows pointing thrombus traversing both atria via interatrial communication. AV, aortic valve; LA, left atrium; RA, right atrium; RV, right ventricle; TEE, transesophageal echocardiogram.

Video 1 Transesophageal echocardiogram mid-oesophageal aortic valve long-axis revealing longitudinal 6 cm thrombus in left.

The epidemiology of paradoxical embolisation is not established yet. It has been proposed that increased risk for paradoxical embolisation may be associated with the PFO size and the presence of atrial septal aneurysm, prominent Eustachian valve, Chiari network and hypercoagulability.¹³ Apart from Valsalva manoeuvre, PFO-related events may be provoked by other situations enhancing shunting by increase in right atrial pressure, including mechanical ventilation,¹⁴ diving,¹⁵ pulmonary embolisation¹⁶ or a right-sided cardiac tumour.¹⁷ It is implied in the literature that <1% of myocardial infarctions are caused by paradoxical embolism via an interatrial communication.¹⁸

The most important from a clinical perspective is the association between PFO and cryptogenic stroke. Consequently, the beneficence of PFO closure as secondary stroke prevention is being intensively investigated.^{19–20} Large PFO closure studies included CLOSURE I, PC-Trial, RESPECT and the most recent CLOSE and REDUCE trials.^{21–25} All trials are directed towards superiority of PFO closure versus medical therapy alone, nevertheless neither CLOSURE nor PC-Trial achieved the level of statistical significance. Long-term follow-up of RESPECT trial was the first study showing the advantage of PFO closure for secondary prophylaxis of cryptogenic stroke. As a result, the US Food and Drug Administration (FDA) in October 2016 approved the use of Amplatzer PFO occluder in patients between 18 and 60 years old with cryptogenic stroke. More recently, CLOSE and REDUCE trials also revealed the superiority of PFO closure over medical treatment.

Current guidelines of the American Heart Association and American Academy of Neurology recommend against routine PFO closure in cryptogenic stroke. There are certain special circumstances where percutaneous closure of the PFO may be offered, including recurrent stroke of unknown mechanism despite adequate antiplatelet therapy and PFO with concomitant DVT with high risk of reoccurrence.^{26–27}

The finding of trapped thrombi in the PFO as presented in our case adequately supports its causative role in the pathogenesis of systemic embolisation. Potential risk factors for the patient for PFO-related complications included hypercoagulability complicated with DVT and PE. Additionally, the patient's clinical situation was problematical due to intestinal ischaemia requiring emergent surgery, which furthermore increased the patient's risk for paradoxical embolisation in the light of temporal need for mechanical ventilation. As trapped-in PFO thrombus is a rare finding, no standardised treatment has been established yet. There are reported cases of successful treatment with both conservative and surgical approach.^{2–8} It was implied though that surgical approach is associated with a lower overall incidence of post-treatment embolic events and a lower 60-day mortality compared with systemic thrombolysis or anticoagulation.¹⁶ Prophylactic PFO closure should also be considered in the presence of hypercoagulable state.²⁸ Surgical approach was our initial plan, which was modified in the view of subsequent

negative TEE findings for thrombus. Fortunately, the patient did not develop any new signs of ischaemia at that time and further treatment with systemic anticoagulation followed by percutaneous PFO closure appeared to be successful.

In conclusion, the above case presents a rarely documented phenomenon of trapped thrombi in PFO with finding of multiple paradoxical emboli. This is an exceptional occurrence, beyond current guidelines, where prompt treatment should be applied to prevent further complications, including stroke.

Contributors DMZ and YA were resident physicians admitting and following up the patient during the hospitalisation. JKK was the attending cardiologist performing TEE and following up the patient during the admission and in outpatient cardiology clinic.

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Learning points

- ▶ Patent foramen ovale (PFO) is a potential, but rare cause of systemic embolisation.
- ▶ Thrombus trapped in PFO is an uncommon finding requiring prompt treatment.
- ▶ Current American Heart Association and American Academy of Neurology guidelines recommend against routine PFO closure for secondary stroke prevention.

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