CASE REPORT

Extensive biatrial thrombus straddling the patent foramen ovale and traversing into the left and right ventricle

Adil Sattar, Theingi Tiffany Win, Alex Schevchuck, Abinash Achrekar

Department of Internal Medicine, Division of Cardiology, University of New Mexico School of Medicine, Albuquerque, New Mexico, USA

Correspondence to
Dr Adil Sattar, adil.sattar@hotmail.com

Accepted 26 October 2016

SUMMARY

We report an extremely rare case of an extensive biatrial thrombus straddling a patent foramen ovale (PFO) extending into the bilateral ventricles in a patient presenting with an acute embolic stroke. Our patient further developed a massive saddle pulmonary embolus (PE) with haemodynamic instability during the course of his hospitalisation. The risks of pharmacological thrombolysis or surgical thrombectomy for PE in a haemodynamically unstable patient with recent embolic stroke posed a significant therapeutic dilemma. Ultimately, the decision was made to continue anticoagulation with unfractionated heparin followed by oral Coumadin. The patient responded well to therapy and at 1-month follow-up, a complete resolution of the thrombus was documented on transoesophageal echocardiogram with full clinical recovery of the patient.

BACKGROUND

Right heart thrombi are considered as 'thrombi in transit', whereas a clot straddling the patent foramen ovale (PFO) has been labelled as impending paradoxical embolism (IPDE) in the medical literature. Both these conditions are reported to have a high morbidity, especially even within the first 24 hours of diagnosis, because of high risk of embolism. Concomitant right-sided thrombi traversing a PFO and extending into the left ventricle and right ventricle (RV) are extremely rare. These have been treated in the past with either anticoagulation, pharmacological thrombolysis and/or surgical thrombectomy, but no clear consensus currently exists for management of these straddling thrombi. In cases where the patient becomes haemodynamically unstable, these extensive clots are reported to have very high mortality rates. Our case of extensive biatrial thrombus with concomitant paradoxical embolic stroke and PE causing haemodynamic instability was treated with therapeutic anticoagulation with close clinical monitoring and resulted in complete resolution of the clot, which may represent one option of treatment of such conditions.

CASE PRESENTATION

A man aged 55 years chronic heavy smoker without any other significant medical history presented with dizziness and left-sided homonymous hemianopia. The patient had been sedentary for 2 months prior to presentation due to leg pain following an accidental fall. Initial vitals were normal. Physical examination was remarkable for left

homonymous hemianopia with an otherwise normal neurological examination. Apart from mild leucocytosis and mildly elevated troponin (0.24 ng/mL, normal <0.06), initial laboratory findings were within normal limits.

INVESTIGATIONS

MRI of the brain revealed acute infarct in multiple vascular distributions consistent with embolic phenomena. Initial transthoracic echocardiogram showed poorly defined right and left atrial thrombi, mild pulmonary hypertension, moderately reduced right ventricular (RV) function and normal left ventricular systolic function (figures 1, 2 and videos 1, 2). For

Figure 1 Parasternal long-axis view of the left ventricle zoomed in to the left atrium (LA) showing a large thrombus in the LA.

Figure 2 Parasternal long axis of the right ventricular (RV) inflow tract showing the thrombus in the right atrium traversing through the tricuspid valve into the RV. See video 1.

To cite: Sattar A, Win TT, Schevchuck A, et al. *BMJ Case Rep* Published online: [please include Day Month Year] doi:10.1136/bcr-2016-216761

Video 1 Parasternal long axis of the right ventricular (RV) inflow tract showing the thrombus in the right atrium traversing through the tricuspid valve into the RV.

Video 2 Subcostal four-chamber view showing the extent of thrombus: thrombus in the left and right atrium communicating through a patent foramen ovale and extending into the left and right ventricle.

better characterisation of the thrombus, a transoesophageal echocardiogram (TEE) was performed which showed a very large serpiginous thrombus in the right atrium extending into the left atrium across a PFO and extending into the left ventricle and RV through the mitral and tricuspid valves, respectively (figure 3, video 3).

TREATMENT

Therapeutic anticoagulation was initiated due to multiple embolic strokes. However, immediately post-TEE, the patient developed acute right heart failure and became severely hypoxic with haemodynamic instability needing mechanical ventilation, fluid resuscitation and vasopressor support. Chest CT at this time revealed a massive saddle pulmonary embolism (PE). Lower extremity duplex was remarkable for extensive bilateral deep vein thrombosis (DVT).

Although the current ACCP guidelines recommend thrombolytic therapy in haemodynamically unstable patients with massive PE, the risks of pharmacological thrombolysis and surgical thrombectomy in a haemodynamically unstable patient with recent ischaemic stroke posed a significant surgical risk and a therapeutic dilemma. Thrombolysis was not performed due to risk of haemorrhagic conversion of the acute stroke. Ultimately, after a multispeciality consultation, decision was made to continue anticoagulation with unfractionated heparin drip with close clinical monitoring in the intensive care setting. The patient

Figure 3 Transoesophageal echo view of the interatrial septum showing the thrombus in the right atrium straddling through a patent foramen ovale to the left atrium. See video 3.

Video 3 Transoesophageal echo view of the interatrial septum showing the thrombus in the right atrium straddling through a patent foramen ovale to the left atrium.

responded surprisingly well to the conservative approach with significant improvement in his haemodynamic status over the course of the next 24 hours. He was successfully extubated and weaned off vasopressor support the following day. Heparin drip was switched to enoxaparin injections. The patient remained haemodynamically stable and was discharged home on warfarin with a therapeutic INR after 3 days. An extensive investigation for hypercoagulability and malignancy remained negative.

At 1 month, follow-up TTE and TEE revealed complete resolution of the previously seen biatrial thrombus with normalisation of RV size and function and pulmonary artery pressures (figure 4, video 4). To date, the patient remains clinically stable. Owing to complete resolution of clot on repeat TEE, in concordance with the current guidelines, decision was made not to close the PFO. The patient was treated with a total of 6 months of anticoagulation.

DISCUSSION

Massive biatrial clots extending into the ventricles have been reported to be fatal even when treated in stable patients with cardiothoracic surgery for clot extraction and PFO closure.^{1 2} Similarly, there have been reports of similar clots in haemodynamically stable patients successfully treated with anticoagulants alone.³ Our patient is extremely rare in that he had a

Figure 4 Transoesophageal echo view of the interatrial septum showing complete resolution of the thrombus. See video 4.

Video 4 Transoesophageal echo view of the interatrial septum showing complete resolution of the thrombus.

massive biatrial clot straddling the PFO extending into the RV and left ventricle with complications of a saddle pulmonary embolus (PE), ischaemic embolic stroke and haemodynamic instability, but successfully responded to anticoagulation alone with complete resolution.

Right heart thrombi are considered to be ‘thrombi-in-transit’ and represent a life-threatening situation due to their motility and risk of further embolism. They are typically in transit from the lower extremities to the pulmonary arteries and can embolise at any moment. PFOs are prevalent in about 27%⁴ of the general population and cases of biatrial thrombi with the thrombus straddling a PFO are an uncommon finding reported only rarely in English language literature.^{5 6} These straddling thrombi are also known to cause pulmonary emboli,⁷ paradoxical stroke and other potentially devastating complications. Studies have reported the prevalence of thrombi-in-transit in patients presenting with PE as high as 20%,⁸ which emphasises the importance of screening all patients presenting with PE for PFOs and straddling thrombi. Our patient had bilateral extensive DVT, making lower extremity veins the most likely site of embolism for the large clot in the atria. According to our literature review, cases of biatrial thrombi communicating through a PFO have been reportedly associated with post-transurethral resection of prostate, atrial septal aneurysm, prolonged bed rest, postacute MI, protein C deficiency, paroxysmal atrial fibrillation, possible heparin-induced thrombocytopenia, hip replacement, hospitalisation for pneumonia and spontaneously.

Patients in almost all the previously reported cases have presented with signs of RV strain on echocardiography and right axis deviation and/or right bundle branch block on EKG. Despite the high prevalence of PFOs, paradoxical embolism does not occur commonly. A right-sided mobile thrombus has a 90% risk of embolisation to the lungs.⁹ The propagation of a right atrial clot through the PFO into the left atrium and subsequent paradoxical embolism is seen most commonly in the setting of PE.¹⁰ Acute PE results in pulmonary hypertension, which can lead to elevation of right atrial pressure greater than the left atrial pressure leading to a right-to-left shunt through a PFO and propagation of the clot through the atrial septum. A right-to-left shunt in patients with major PE has previously been shown to carry twice the risk of death when compared with patients with PE without a right to left atrial shunt.¹¹ Elevated right-sided pressures can also be associated with positive pressure ventilation.

A clot stuck straddling a PFO has been referred to in the literature as IPDE with a very high mortality rate. One study reported a 24-hour mortality rate of 11.5% with IPDE,⁷ whereas the in-hospital mortality of a thrombus in transit has been reported around 45%,¹² which strongly supports timely diagnosis and emergent management of these patients.

There have been several reports of successful outcomes in haemodynamically stable patients with straddling thrombi treated with anticoagulation, thrombolysis and/or surgical interventions. Management of these straddling thrombi however has no clear consensus, although surgical intervention has been shown to be better than thrombolysis or anticoagulation.¹³ In another review, patients with these emboli when treated with surgical embolectomy showed a trend towards improved survival and reduced incidence of systemic emboli when compared with anticoagulation, but the authors suggested no difference in mortality over choice of therapy.⁴ Emergent surgery is indicated in cases of unstable patients. Given the risk of systemic embolisation and ‘showering embolisation’ during thrombolysis or anticoagulation, surgical interventions are preferred. In view of very limited (<50) reported cases of straddling emboli, no concrete comments can be made regarding the survival benefit of different treatment modalities in these patients.

Learning points

- ▶ Early echocardiography is critical in diagnosis of right-sided thrombi straddling a patent foramen ovale (PFO) and impending paradoxical emboli.
- ▶ There is no consensus on the preferred mode of treatment for these patients according to the results of the currently available literature, but surgical intervention has shown a trend towards benefit.
- ▶ Unfortunately, surgical intervention and thrombolysis may not be an option due to a patient’s presenting clinical scenario and haemodynamic instability, in which case prompt diagnosis and initiation of anticoagulation is important and can lead to successful outcomes even if the biatrial thrombus is extending into the right and left ventricles as demonstrated by our case.
- ▶ According to current ACC guidelines, patients with ischaemic stroke or transient ischaemic attack and a PFO and DVT should be treated with anticoagulation. Transcatheter PFO closure can also be considered.

According to current ACC/AHA guidelines, in the setting of a PFO and DVT, transcatheter PFO closure can be considered as a class IIb indication, depending on the risk of DVT recurrence. PFO closure is not indicated for patients who had cryptogenic stroke who do not have an evidence of DVT.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

- 1 Kathir K. Communicating massive biatrial thrombus. *Intern Med J* 2003;33:471–2.
- 2 Ibebuogu UN, Khouzam RN, Sharma G, *et al.* A thrombus in transit through a patent foramen ovale. *JAAPA* 2014;27:32–5.
- 3 Chandrala P, Johnson K, Hallani H. Thrombus trapped in patent foramen ovale. *Eur Heart J* 2015;36:1688.
- 4 Hagen PT, Scholz DG, Edwards WD. Incidence and size of patent foramen ovale during the first 10 decades of life: an autopsy study of 965 normal hearts. *Mayo Clin Proc* 1984;59:17–20.
- 5 Bonanni L, Serafini F, Dalla Vestra M, *et al.* Fluttering thrombus in patent foramen ovale with paradoxical and cerebral embolism. *Circulation* 2014;129:e343–4.
- 6 Mathew R, Roy WE. Paradoxical massive pulmonary embolism with a straddling thrombus across a patent foramen ovale. *Intensive Care Med* 2014;40:891–2.
- 7 Chartier L, Béra J, Delomez M, *et al.* Free-floating thrombi in the right heart: diagnosis, management, and prognostic indexes in 38 consecutive patients. *Circulation* 1999;99:2779–83.
- 8 Casazza F, Bongarzone A, Centonze F, *et al.* Prevalence and prognostic significance of right-sided cardiac mobile thrombi in acute massive pulmonary embolism. *Am J Cardiol* 1997;79:1433–5.
- 9 Hunter JJ, Johnson KR, Karagianes TG, *et al.* Detection of massive pulmonary embolus-in-transit by transesophageal echocardiography. *Chest* 1991;100:1210–14.
- 10 Shah DK, Ritter MJ, Sinak LJ, *et al.* Paradoxical embolus caught in transit through a patent foramen ovale. *J Card Surg* 2011;26:151–3.
- 11 Konstantinides S, Geibel A, Kasper W, *et al.* Patent foramen ovale is an important predictor of adverse outcome in patients with major pulmonary embolism. *Circulation* 1998;97:1946–51.
- 12 Rose PS, Punjabi NM, Pearse DB. Treatment of right heart thromboemboli. *Chest* 2002;121:806–14.
- 13 Kinney EL, Wright RJ. Efficacy of treatment of patients with echocardiographically detected right-sided heart thrombi: a meta-analysis. *Am Heart J* 1989;118:569–73.

Copyright 2016 BMJ Publishing Group. All rights reserved. For permission to reuse any of this content visit <http://group.bmj.com/group/rights-licensing/permissions>.
BMJ Case Report Fellows may re-use this article for personal use and teaching without any further permission.

Become a Fellow of BMJ Case Reports today and you can:

- Submit as many cases as you like
- Enjoy fast sympathetic peer review and rapid publication of accepted articles
- Access all the published articles
- Re-use any of the published material for personal use and teaching without further permission

For information on Institutional Fellowships contact consortiasales@bmjgroup.com

Visit casereports.bmj.com for more articles like this and to become a Fellow