CASE REPORT

Pulmonary embolism and infarction with a paradoxical thrombus visualised in both atria

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SUMMARY

A 59-year-old woman presented with a sudden onset of breathlessness and chest pain. An echocardiography and CT scan showed pulmonary embolism and infarction with a paradoxical thrombus visualised in both atria. For haemodynamically stable patients, the optimal management strategy is poorly defined. Three main strategies were considered: surgical thrombectomy, thrombolysis and anticoagulation. Surgery with reversal of anticoagulation may lead to further coagulation and increased risk of bleeding complications. The significant pulmonary hypertension and right ventricular infarction raised the prospect of difficult weaning from cardiopulmonary bypass following thrombectomy. Thrombolysis, which has significant mortality rate, and systemic embolisation including pulmonary infarction with haemorrhagic transformation were also contraindications. A multidisciplinary approach was adopted and anticoagulation was therefore believed to be the safest and effective approach. Here, the use of anticoagulation alone was fortunately successful but could as easily end in disaster. This approach should be considered the ideal paradigm to yield optimum outcomes.

BACKGROUND

Paradoxical embolism is a life-threatening condition; unfortunately, its management remains a dilemma with no clear treatment strategies defined. The management of such cases should be patient-specific; that is, early involvement of a multidisciplinary team to define the treatment plan according to the patient's clinical presentation is the key. In this case, the treatment strategy was formulated according to the patient's condition and comorbidities, with input from multiple disciplines, which subsequently resulted in an excellent outcome.

Video 1 Apical four-chamber view.

CASE PRESENTATION

A 59-year-old woman was admitted with a 2-week history of worsening shortness of breath and pleuritic chest pain. Doppler ultrasound of the right leg had demonstrated deep vein thrombosis, and the patient had been initiated on warfarin. Medical history included psoriatic arthropathy, for which she was treated with disease-modifying antirheumatic drugs, including methotrexate and prednisolone, and 2 months earlier was started on leflunomide. Leflunomide is an immunosuppressive, pyrimidine synthesis inhibitor that works by blocking dihydroorotate dehydrogenase used in active moderate-to-severe psoriatic arthropathy. The patient was 6 years postmenopause with no history of hormonal therapy, immobilisation, surgery or recent long-distance travel. Her mother had suffered from 'blood clots' and her father suffered a stroke after the age of 60 years. The patient was breathless at rest but haemodynamically stable on presentation, with blood pressure of 125/76 mm Hg, heart rate of 78 beats/min and oxygen saturation of 96% on 21% oxygen. Cardiac auscultation revealed no murmur and her chest was normal.

Figure 1 Transthoracic echocardiogram: thrombus (arrow) across the right atrium, right ventricle and left atrium.

Figure 2 Transthoracic echocardiogram: raised pulmonary artery pressure exhibited by high tricuspid regurgitation velocity jet (arrow).

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Video 2 Parasternal long axis view: thrombus.

INVESTIGATIONS

Transthoracic echocardiography (TTE) was performed on arrival and demonstrated a serpiginous mass in both the atria and the left ventricle ([figure 1](#)) ([video 1](#)), with elevated pulmonary artery (PA) pressure (60–65 mm Hg) ([figure 2](#)). Colour flow Doppler across the atrial septum was suspicious for a patent foramen ovale (PFO). McConnell's sign (right ventricular (RV) dysfunction with characteristic sparing of the apex) was evident, suggesting pulmonary thromboembolism^{1–3} ([video 2](#)). A CT scan of the chest, abdomen and pelvis, including a pulmonary angiogram, demonstrated bilateral pulmonary emboli ([figure 3](#)), extending into the segmental arteries, and a right-sided pulmonary infarct ([figure 4](#)). There was no evidence of malignancy and a complete thrombophilia screen showed normal results.

TREATMENT

The management of this patient was discussed at the departmental multidisciplinary meeting and hence conclusion was reached (see discussion of treatment options below). The clinical

Figure 3 CT pulmonary angiogram: right pulmonary emboli (arrow).

Figure 4 CT pulmonary angiogram: right pulmonary infarct (arrow).

team responsible for the patient opted for treatment with unfractionated intravenous heparin as the international normalised ratio was subtherapeutic and warfarin was continued. After discussion with the rheumatology team and on the patient's request, leflunomide was discontinued. Serial TTEs during the inpatient stay showed a progressive decrease in thrombus size and improving RV function and PA pressure that correlated with the patient's clinical status. No complications were encountered during the treatment.

OUTCOME AND FOLLOW-UP

On day 13 there was no evidence of intracardiac thrombus, and the RV size and function and PA pressure had normalised ([video 3](#)). The patient was then subsequently discharged from the hospital on warfarin and with long-term follow-up arranged. Follow-up with a transthoracic echocardiogram at 2 months and a year later continued to demonstrate normal RV function and PA pressure.

DISCUSSION

A paradoxical embolus (PDE) is a thrombus that passes from the right to the left side of the heart through an intracardiac defect, such as the patent foramen ovale. The first PDE case was reported in 1877 by Cohnheim, a German pathologist, who followed the path of the emboli through the patent foramen ovale during post-mortem studies and found the thrombus of venous origin in the left atrium.^{4–6} A PDE may pass into the systemic circulation where it can cause stroke or other serious thromboembolic events. Transthoracic echocardiogram is a quick and effective point-of-care tool to detect PDE and right-sided cardiac effects of pulmonary embolism.

Paradoxical embolisms can be life-threatening, and an optimal treatment strategy commonly poses a dilemma, especially for haemodynamically stable patients at risk of recurrent pulmonary and systemic thromboembolism. Three main strategies were considered to treat this patient: surgical thrombectomy,^{7,8} systemic thrombolysis and catheter direct interventions,^{9,10} and lastly anticoagulation.¹¹ Surgery with reversal of anticoagulation may lead

Video 3 Complete resolution of the thrombus.

to further coagulation, if previously anticoagulated with elevated risk of bleeding complications, transient ischaemic attacks and cardiac tamponade.¹² The significant pulmonary hypertension and RV dysfunction raised the prospect that the patient might not tolerate weaning from cardiopulmonary bypass following thrombectomy. There is increasing evidence that catheter techniques are essential and effective; however, there is no randomised controlled trial comparing their efficacy with systemic thrombolysis and anticoagulation for pulmonary embolism. Furthermore, a potential disadvantage of mechanical thrombectomy includes significant procedure time and risk of injury to the surrounding pulmonary vasculature.¹³ The treatment options were therefore limited to anticoagulation or thrombolysis. Thrombolysis has been used in paradoxical embolism with favourable outcomes.^{14–16} However, a significant mortality rate (16%–20%) associated with post-treatment systemic embolisation from segments of the large thrombus was considered a contraindication while the patient was clinically stable.¹⁷ The presence of pulmonary infarction and the risk of haemorrhagic transformation with thrombolysis were considered a significant risk. As a result, anticoagulation was selected by the clinical team caring for the patient after departmental multidisciplinary discussion of the case (a consensus between the treatment options, as all were felt to pose a potential risk), as the patient was haemodynamically stable. Thrombosis is not usually a feature of psoriatic arthritis; the patient did not display any additional features of connective tissue disorders. There are case reports of thromboembolism following initiation of leflunomide^{18 19}; hence, for this case, the drug was discontinued on advice of the rheumatology team.

The choice of anticoagulation alone was strongly debated, but in this case it was fortunately successful. Despite numerous case

reports and studies, the management of PDE remains a dilemma to which there is no correct solution for all situations.

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Learning points

- A multidisciplinary team input from specialists is the key to provide primary care fundamentally in poorly defined management strategies.
- Identification of the triggers of thromboembolism is crucial to prevent disease progression and recurrence.
- In pulmonary embolism with or without infarction in haemodynamically stable patients, anticoagulation should be considered as first-line therapy to yield optimum outcomes.

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