

CASE REPORT

INTERMEDIATE

CLINICAL CASE

A Dangerous Dilemma

Thrombus in Transit During Pregnancy



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ABSTRACT

Pregnancy is associated with venous thromboembolism. Occasionally, thrombus can become entrapped across a patent foramen ovale, with risk of systemic embolism. This report presents a case of a pregnant woman who had thrombus in transit diagnosed by echocardiography, which was successfully removed by surgical thrombectomy. (**Level of Difficulty: Intermediate.**) (J Am Coll Cardiol Case Rep 2019;1:369-71) © 2019 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

HISTORY OF PRESENTATION

A 30-year-old woman, who was approximately 10 weeks' pregnant, presented with 3 days of progressively worsening exertional dyspnea, which abruptly worsened to dyspnea at rest on the day of her presentation to her local emergency department. This was associated with nausea, vomiting, and vague chest discomfort. She was previously at her normal state of health, without any known history of exacerbating factors.

LEARNING OBJECTIVES

- Recognize high-risk patients for VTE disease and maintain a high index of suspicion in appropriate scenarios.
- Recognize the diagnostic echocardiographic findings of thrombus in transit through a PFO.
- Understand the risks and benefits of management options of thrombus in transit.
- Understand the risks and benefits of anti-thrombotic treatment options in pregnancy.

MEDICAL HISTORY

Her medical history was notable for 2 previous pregnancies, the first of which was complicated by development of post-partum deep venous thrombosis approximately 2 months after cesarean section. This was successfully treated with oral anticoagulation, and her second pregnancy was uncomplicated. She had no other known medical or surgical history.

DIFFERENTIAL DIAGNOSIS. The differential diagnosis for progressively worsening dyspnea and vague chest pain includes cardiovascular etiologies such as acute coronary syndrome, structural heart disease, and pregnancy-associated cardiomyopathy, as well as pulmonary etiologies, including pulmonary embolism and pneumothorax. In this young female patient, specific considerations included pulmonary embolism and spontaneous coronary artery dissection.

INVESTIGATIONS

Initial workup at the local emergency department was notable for the following laboratory abnormalities: D-dimer 15,910 ng/ml (reference: 0 to 250 ng/ml);

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ABBREVIATIONS AND ACRONYMS

DVT = deep venous thrombosis

PE = pulmonary embolism

PFO = patent foramen ovale

TTE = transthoracic
echocardiogram

VTE = venous
thromboembolism

troponin T 89 ng/l (reference: ≤ 10 ng/l); N-terminal pro-B-type natriuretic peptide 3,736 pg/ml (reference: ≤ 140 pg/ml); and b-HCG (quantitative human chorionic gonadotropin) 1,520 IU/l (negative < 5 IU/l). Intrauterine ultrasound revealed early gestational age (approximately 10 weeks) pregnancy without concerning findings. Chest x-ray was unremarkable. Chest computed tomography angiography did not show any evidence of pulmonary thromboembolism. A lower extremity ultrasound revealed extensive left leg deep vein thrombosis, and transthoracic echocardiogram revealed thrombus in the right atrium as well as right ventricular dysfunction and was otherwise unremarkable by report. The patient was initiated on intravenous heparin and transferred to our facility. Transthoracic echocardiography upon arrival showed extensive thrombi in the right atrium, extending into the left atrium across a patent foramen ovale (PFO) (Figure 1, Video 1). Thrombi were also visualized in the pulmonary arteries and the inferior vena cava.

MANAGEMENT

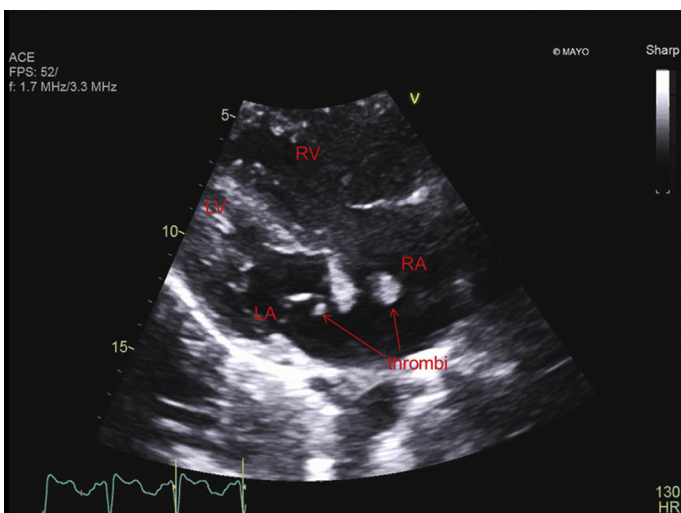
The patient met with a multidisciplinary team that consisted of cardiology, vascular medicine, obstetrics, and cardiac surgery physicians, with extensive discussion of the risks and benefits of management options, including anticoagulation alone, administration of thrombolytics, or surgical pulmonary

thrombectomy. Because of the extensive thrombus burden, as well as worsening tachycardia and hypotension, the shared decision was made with the patient to proceed to urgent surgical thrombectomy. Peri-operative transesophageal echocardiography confirmed the diagnosis of thrombus-in-transit through the PFO (Figures 2A and 2B, Videos 2 and 3). Extensive clots were removed from the pulmonary artery bifurcation extending into both pulmonary arteries, right ventricle, right atrium, the PFO, and left atrium. Her PFO was then surgically closed. Her hemodynamics improved dramatically, and no complications were noted.

DISCUSSION

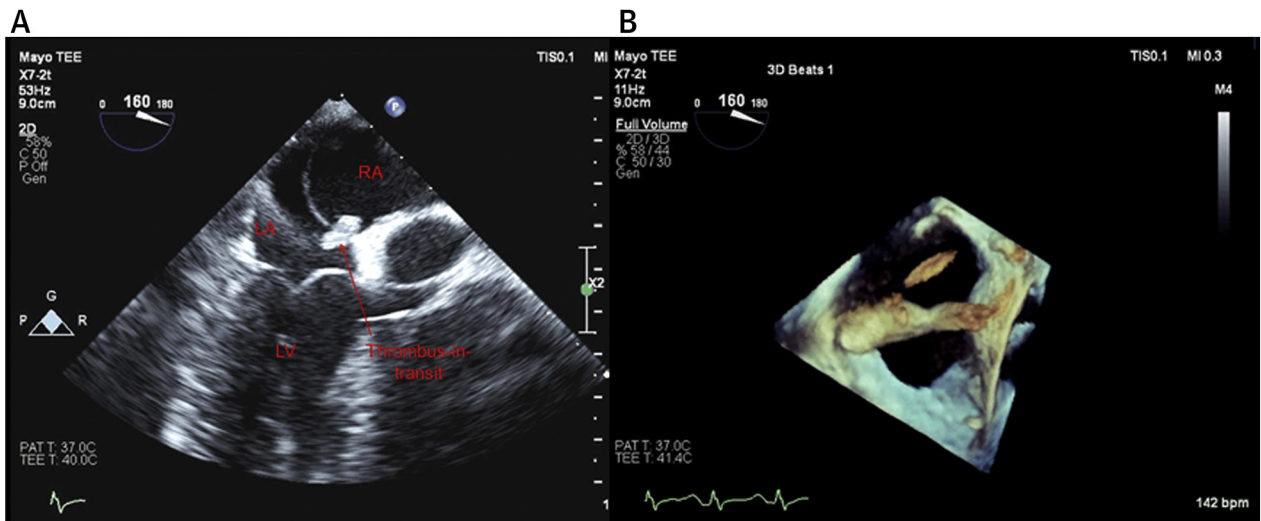
Pregnancy is an independent risk factor for venous thromboembolism (VTE), which, in turn, is a risk factor for maternal and fetal demise. The overall incidence of VTE during pregnancy is approximately 1.4% (1). Occasionally, in the setting of a large pulmonary embolism, the resulting elevation in right heart pressure can lead to a right-to-left shunt through a PFO (present in approximately 25% of the adult population [2]). Even more rarely, large thrombi can become trapped in the PFO and can be visualized in transit from the right atrium to the left atrium by echocardiography. Paradoxical systemic embolization is a feared complication. No preferred treatment guidelines for this scenario have been established. Options include therapeutic anticoagulation alone, administration of thrombolytics, and surgical pulmonary thrombectomy. Studies have shown that thrombolysis and anticoagulation alone are associated with an increased risk of systemic embolization (23.5% and 13%, respectively) compared with surgical thrombectomy (2%) in the setting of thrombus in transit (3). An additional consideration for this patient was fetal health in setting of her pregnancy. Therapeutic anticoagulation with unfractionated or low molecular weight heparin is considered safe in pregnancy because maternal and fetal bleeding complication rates are low, and it is not associated with teratogenicity (4). The data on the use of thrombolysis during pregnancy are less clear due to a lack of randomized controlled trials, but thrombolysis has been used with variable success and does not appear to be associated with increased fetal bleeding complications or teratogenicity, although there is increased risk of maternal hemorrhage (8.1%) (4). Surgical thrombectomy requires cardiopulmonary bypass, which has been associated with significant risk of fetal loss (5). As such, a careful multidisciplinary discussion of the risks and benefits associated

FIGURE 1 RV Inflow View



Right ventricular (RV) inflow view on transthoracic echocardiogram upon arrival, showing mobile thrombi in the right (RA) and left atria (LA). See Video 1. LV = right ventricle.

FIGURE 2 Intraoperative Transesophageal Echocardiogram



Intraoperative transesophageal echocardiogram shows thrombus in transit through a patent foramen ovale, in both (A) 2-dimensional (2D) and (B) 3-dimensional (3D) images. See Videos 2 and 3.

with existing therapies toward both mother and fetus is imperative in determining the best management in these complex situations, which should also feature shared decision-making with the patient.

FOLLOW-UP

Fetal ultrasound and b-HCG at time of discharge were reassuring for fetal viability. Initial thrombophilia workup included negative lupus anticoagulant, beta-2 glycoprotein immunoglobulin-G and -M, and anti-cardiolipin immunoglobulin-G and -M tests. The patient was discharged with therapeutic enoxaparin for the remainder of her pregnancy, which was transitioned to intravenous unfractionated heparin before delivery. She was followed at her local high-risk obstetrics clinic, with her pregnancy noted to be progressing as expected. She eventually underwent scheduled cesarean section delivery at 38 weeks' gestation, without any noted complications and with

no apparent neonatal abnormalities. Her post-partum course was unremarkable, and she was discharged post-partum day 3 on rivaroxaban, with plans to follow-up with her local hematology clinic.

CONCLUSIONS

Thrombus in transit is a rare and dangerous clinical scenario, without established treatment guidelines. Surgical thrombectomy is the usual treatment of choice with pregnancy; however, this is associated with high risk of fetal loss. Careful multidisciplinary discussion of options and shared decision-making are essential in the management of these complex clinical scenarios.

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REFERENCES

1. Meng K, Hu X, Peng X, Zhang Z. Incidence of venous thromboembolism during pregnancy and the puerperium: a systematic review and meta-analysis. *J Matern Fetal Neonatal Med* 2015;28:245-53.
2. 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 Clinic Proc* 1984;59:17-20.
3. Myers PO, Bounameaux H, Panos A, Lerch R, Kalangos A. Impending paradoxical embolism: systematic review of prognostic factors and treatment. *Chest* 2010;137:164-70.
4. Fuller KP, Turner G, Polavarapu S, Prabulos AM. Guidelines for use of anticoagulation in pregnancy. *Clin Lab Med* 2013;33:343-56.
5. Jha N, Jha AK, Chand Chauhan R, Chauhan NS. Maternal and fetal outcome after cardiac operations during pregnancy: a meta-analysis. *Ann Thorac Surg* 2018;106:618-26.

KEY WORDS congenital heart defect, echocardiography, pregnancy, thrombus

APPENDIX For supplemental videos, please see the online version of this paper.