Successful surgical treatment of clot in transit with impending paradoxical embolism: A case report

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Disclosures: The authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

Received for publication July 15, 2020; revisions received July 15, 2020; accepted for publication July 28, 2020; available ahead of print July 31, 2020.

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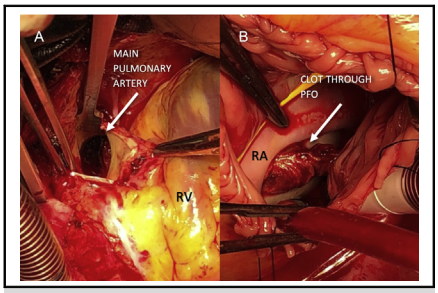
JTCVS Techniques 2020;4:140-2
2666-2507

https://doi.org/10.1016/j.xjtc.2020.07.019



Images showing the presence of thrombus in the main pulmonary artery and through the PFO.

CENTRAL MESSAGE

Massive pulmonary embolism is an often-fatal condition that, with an atrial septal defect, constitutes a syndrome known as impending paradoxical embolism (IPDE), which further increases mortality risk.

See Commentaries on pages 143 and 145.

Video clip is available online.

Massive pulmonary thromboembolism remains a morbid and often-fatal event for which reperfusion treatment options have not changed over time: systemic thrombolysis, catheter-directed percutaneous thrombolysis, surgical thromboembolectomy, and systemic anticoagulation.[1] Paradoxical embolism is a rare phenomenon, accounting for less than 2% of all arterial embolisms.[2] Impending paradoxical embolism (IPDE), in which a thrombus extends across an atrial septal defect, is a clinical syndrome that is usually diagnosed incidentally but in the context of pulmonary hypertension secondary to pulmonary embolism becomes a life-threatening condition that requires immediate interdisciplinary management to guarantee a more favorable outcome.

CASE DESCRIPTION

We present the case of a 49-year-old male patient with a history of bilateral deep vein thrombosis on warfarin therapy who presented with dry cough and dyspnea at rest that worsened 2 days before admission. The patient was hemodynamically stable on admission, with moderate hypoxemia (oxygen saturation 87% with fraction of inspired oxygen 50%). Computed tomography showed massive bilateral pulmonary embolism, as well as thrombosis of the left subclavian artery. Transesophageal echocardiography (TEE) revealed a highly mobile elongated mass in the right atrium that crossed the patent foramen ovale (PFO) into the left atrium, with concomitant pulmonary hypertension (Figure 1). Anticoagulation with intravenous heparin was started as soon as the diagnosis was made.

Urgent surgical management was indicated, and bilateral pulmonary and atrial thromboembolectomy were performed, plus PFO closure with autologous pericardium (Figure 2). Total cardiopulmonary bypass time was 3 hours and 16 minutes; aortic crossclamp time was 2 hours and 21 minutes with 20 minutes of hypothermic circulatory arrest. Intraoperative TEE showed improvement in pulmonary hypertension, preserved biventricular function with mild tricuspid regurgitation, and satisfactory closure of the foramen ovale. In the intensive care unit, the patient presented with moderate hypoxemia due to reperfusion edema that was managed according to protocol.

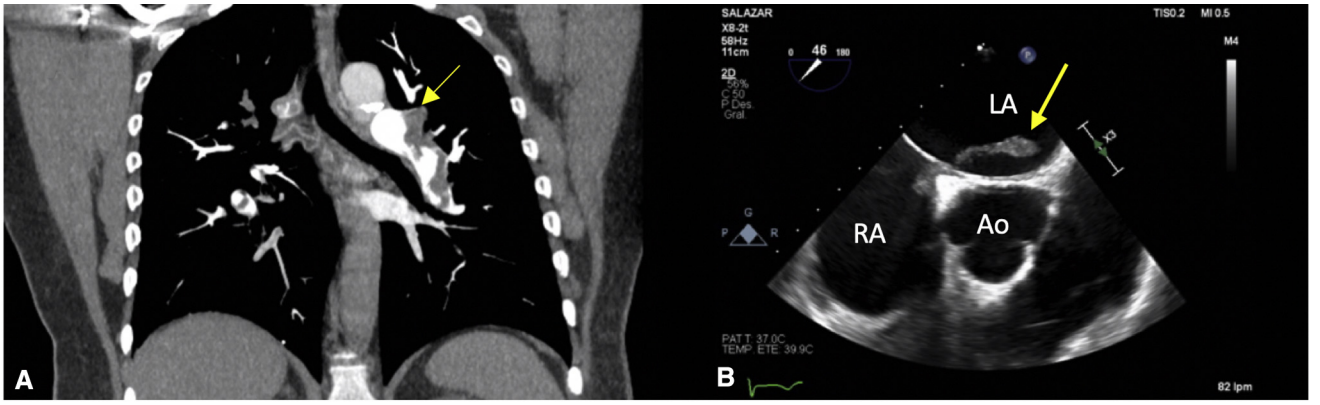


FIGURE 1. A, Preoperative angiography by pulmonary computed tomography of the embolism involving bilateral main pulmonary arteries (*arrow*). B, Transesophageal 2-dimensional echocardiography showing a large thrombus entrapped in patent foramen ovale (*arrow*). *LA*, Left atria; *RA*, right atria; *Ao*, aorta.

Anticoagulation was started 24 hours after surgery, with intravenous heparin, transitioning to warfarin for a target international normalized ratio of 2.5 to 3.5 (Video 1).

The postoperative period was uneventful; follow-up 1 week after discharge revealed no need for supplemental oxygen as well as adequate perfusion of his left arm. Oral anticoagulation plan was continued indefinitely, pending further study of his prothrombotic condition.

The patient's informed consent regarding the publication of the study data was received and approved.

DISCUSSION

A clot in transit (CIT) with massive pulmonary embolism is an almost uniformly fatal condition with indication for surgical management in high-risk patients in whom thrombolysis is contraindicated or has failed (R I Level C).[1,3] IPDE is an additional poor prognostic indicator, making a multidisciplinary approach and surgery the treatment of choice.

TEE is usually the study of choice, which also provides other essential data such as ventricular function, pulmonary artery pressure, other septal defects, as well as the identification of thrombi in the systemic circulation. In a systematic review by Seo and colleagues,[4] TEE was superior to transthoracic echocardiography for direct thrombus visualization and should be considered in patients who develop pulmonary embolism with a paradoxical embolic event. It should be noted that, in our case, computed tomography played a very important role in the diagnosis, since it documented not only the characteristics of the pulmonary embolism but also the presence of thrombogenic obstruction of the left subclavian artery, which sharpened the diagnosis and efficiency of the intervention.

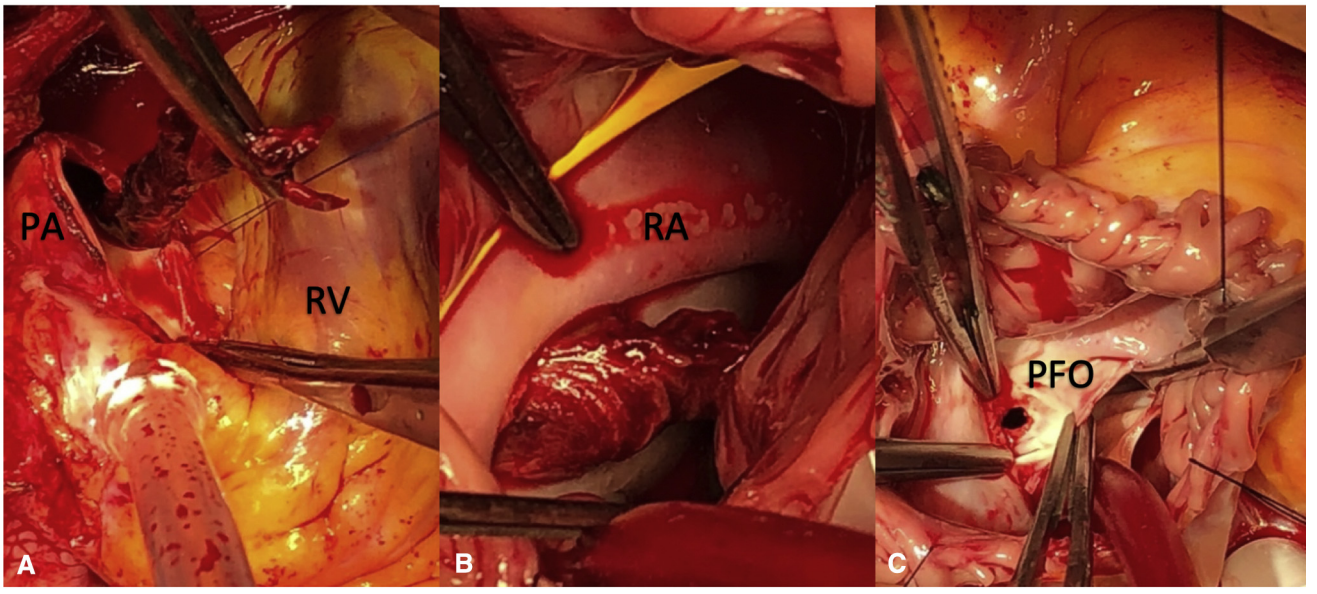
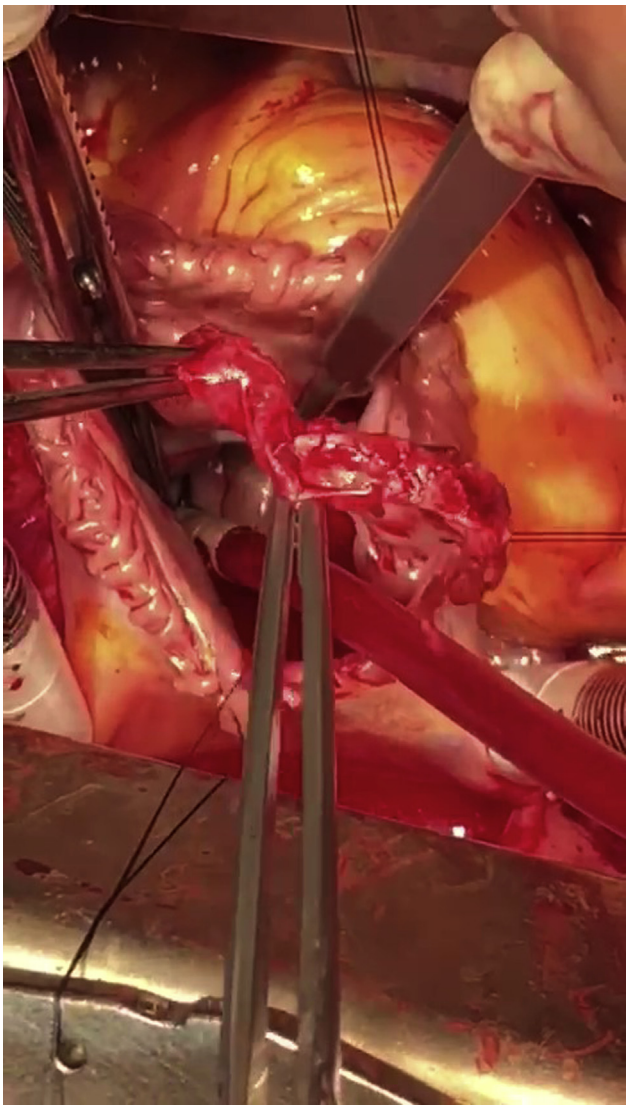


FIGURE 2. A, Intraoperative images of bilateral pulmonary thrombus. B and C, Before and after atria thromboembolectomy with patent foramen ovale, in a right atrial view. *PA*, Pulmonary artery; *RV*, right ventricle; *RA*, right atria; *PFO*, patent foramen ovale.



VIDEO 1. Removal of the large thrombus through the foramen ovale in a right atrial view. Video available at: https://www.jtcvs.org/article/S2666-2507(20)30357-6/fulltext.

The association of CIT and IPDE is a rare condition, with a few reports in the literature. The only 2 systematic reviews of IPDE[4,5] conclude that surgical thromboembolectomy is associated with lower mortality from systemic embolism compared with anticoagulation and thrombolysis. Seo and colleagues[4] suggest that surgery is the most appropriate treatment option for a hemodynamically stable patient with thrombus trapped in a PFO, whereas thrombolysis should be used in patients with hemodynamic instability who cannot tolerate surgery.[4]

More recently, AngioVac suction aspiration followed by transcatheter PFO closure might be considered in a case like this, but the evidence suggests that the effectiveness of catheter-based treatment of CIT and/or the IPDE is very limited, and no comparative data or clinical trials exist. Moreover, emergent surgical embolectomy is recommended for patients with a CIT entrapped in a PFO, given the impending risk of systemic embolization and the opportunity to simultaneously repair the PFO.[1,3,4]

In conclusion, urgent surgical pulmonary embolectomy for CIT with acute massive pulmonary embolism and IPDE is safe and can be performed with excellent outcomes. Individualized assessment by a multidisciplinary team constitutes the cornerstone for its diagnosis and timely management.

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