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Journal of Cardiothoracic and Vascular Anesthesia

journal homepage: www.jcvaonline.com

Letter to the Editor

Noncoronary Cusp Thrombus on Transesophageal Echocardiography Altering the Surgical Approach

To the Editor:

We would like to present a case report of a patient with congenital cyanotic heart disease (CCHD) in whom an aortic valve (AV) thrombus was incidentally detected on intraoperative transesophageal echocardiography. Etiology, risk factors, and complications of AV thrombosis in patients with congenital heart disease (CHD) are discussed.

A 20-year-old man with a diagnosed case of CCHD, double-outlet right ventricle, subaortic ventricular septal defect (VSD), severe valvular, and subvalvular pulmonary stenosis with mild aortic regurgitation, was scheduled for transright atrial VSD patch closure and pulmonary valvotomy during the COVID-19 pandemic. Preoperative transthoracic echocardiography (TTE) revealed double-outlet right ventricle, unrestricted VSD (right-to-left shunt), severe pulmonary stenosis, bilateral confluent pulmonary arteries, enlarged right atrium and ventricle, with left-sided aortic arch. Aortic, mitral, and tricuspid valves were normal. Embolization of an aortopulmonary collateral vessel arising from the descending thoracic aorta was performed a day earlier.

Preoperative laboratory investigations revealed a high hematocrit of 62%, a platelet count of 150,000/ μ L (normal range, 150,000–450,000/ μ L), a prothrombin time of 14.7 seconds (normal range, 11–13 seconds), and the international normalized ratio of 1.27 (normal range, 0.9–1.1). The patient was wheeled into the operating room for transright atrial intracardiac repair. Standard anesthesia and monitoring protocols for cardiac surgery were followed. After induction of anesthesia and insertion of arterial and central venous catheters, transesophageal echocardiography (TEE) was performed using an X7 2t probe and iE33 Philips ultrasound machine (Philips iE33 model, Bothell, WA).

A two-dimensional midesophageal AV long-axis view revealed a double-outlet right ventricle, with large subaortic VSD and aortic override ([Supplementary Fig S1](#)). An incidental finding of a thrombus covering most of the noncoronary cusp of the aortic valve in the midesophageal AV short-axis view ([Fig 1](#)) was communicated to the surgeons. Therefore, the surgeons changed the surgical approach from right atrial to

transaortic, transpulmonary intracardiac repair with clot removal ([Supplementary Fig S2](#)).

A systematic review¹ that included 74 cases of native AV thrombosis concluded that the most common etiology is a hypercoagulable state (30%), mainly antiphospholipid syndrome (27%), polycythemia (23%), and proteins C and S deficiency (14% each).¹ Congenital heart disease is attributed to 8% of the cases of native AV thrombosis.¹ The prevalence of coagulation abnormalities in CHD patients was found to be 37.1%, with a higher prevalence in children with CCHD (57.1%) compared with acyanotic CHD (17.1%) due to increased hematocrit levels and lower oxygen saturation.² Kajimoto et al. examined 35 patients with CCHD, and demonstrated that patients with CCHD had significantly higher levels of thrombin–antithrombin complex III and P-selectin levels on platelets, whereas protein C activity and thrombomodulin levels in the plasma were found to be low.³ This leads to platelet activation and endothelial dysfunction and, therefore, increased risk of thromboembolic events in patients with CCHD.³ Adults with CCHD have an increased risk of cerebrovascular accidents, as reported in a retrospective study.⁴

The present case is a complex adult CCHD, which is associated with both abnormal coagulation and polycythemia. Additionally, the patient underwent surgery during the COVID-19 pandemic. COVID-19 causes distinctive microvascular abnormalities, including endothelial inflammation, disruption of intercellular junctions, microthrombi formation, and increased cytokines, platelet, and complement activation, leading to a proinflammatory milieu and immunothrombosis.^{5,6} The association between cardiac microthrombi and COVID-19 infection has been established already.⁷ Therefore, we expect a subclinical COVID-19 infection in the population being exposed repeatedly to it, which increases the risk of thrombosis and needs to be evaluated in all patients requiring cardiac surgery. The possible risk factors for developing intracardiac thrombus in the present patient could have been a subclinical COVID-19 infection and cyanotic heart disease predisposing to abnormal coagulation and thrombosis.

The most common cusp involved in AV thrombosis is the noncoronary cusp, as seen in 30% of cases reported in a recent systematic review.¹ Most commonly, AV thrombosis presents as myocardial infarction in 36% and incidental detection in 23% of the cases.¹ In our patient, thrombus on the AV also was detected incidentally on TEE. AV thrombosis is

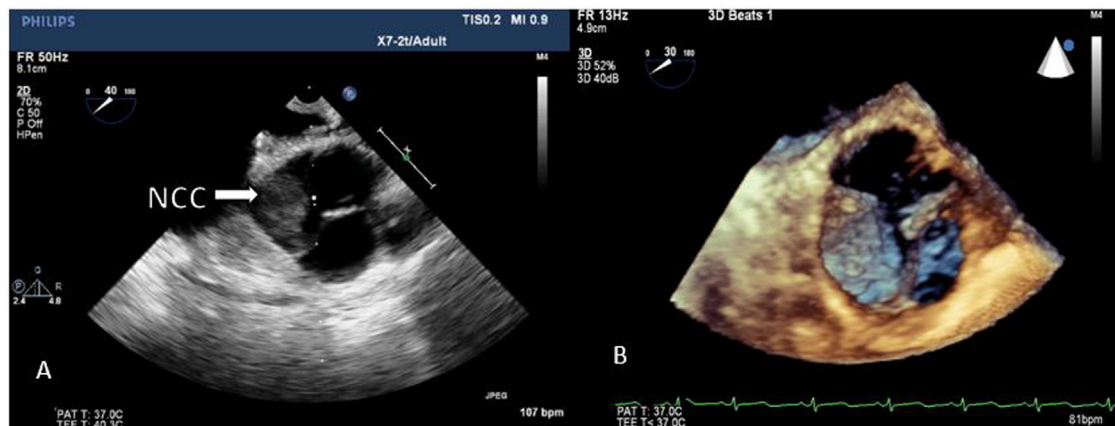


Fig 1. Two-dimensional transesophageal echocardiography image at midesophageal aortic valve short-axis view at 40° showing thrombus on the noncoronary cusp of the aortic valve. (B) Three-dimensional transesophageal echocardiography image at midesophageal aortic valve short-axis view at 30° showing noncoronary cusp thrombus. NCC, noncoronary cusp; TEE, transesophageal echocardiography.

associated with high in-hospital morbidity (38%) and mortality (20%).¹ Yalonetsky et al. reported sudden cardiac death in an adult with complex CHD with no abnormal findings on TTE; however, the autopsy revealed a large thrombus on the AV.⁸ Barandon et al. reported a case of a recurrent acute lower limb ischemia due to native AV thrombosis, which could be diagnosed only after TEE evaluation.⁹

Therefore, early detection of intracardiac thrombi is necessary for reducing morbidity and mortality. Transesophageal echocardiography plays a promising role as a diagnostic imaging modality with 100% sensitivity, especially for cases that are missed in TTE and aortic root angiography.¹ Hence, we emphasize the vital role of TEE in the diagnosis of intracardiac and native valve thrombi, which might get missed on TTE and other imaging modalities and also help to guide the surgical procedure. In our patient, TEE also helped modify the surgical approach from transright atrial to transaortic, transpulmonary repair to facilitate the removal of thrombus and prevent possible catastrophic events.

To conclude, a comprehensive TEE evaluation is of utmost importance in patients requiring cardiac surgery. Anesthesiologists should be aware of the possibility of AV thrombosis in patients with CHD.

Declaration of Competing Interest

None.

Supplementary materials

Supplementary material associated with this article can be found in the online version at [doi:10.1053/j.jvca.2023.11.013](https://doi.org/10.1053/j.jvca.2023.11.013).

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<https://doi.org/10.1053/j.jvca.2023.11.013>