Extracorporeal membrane oxygenation and mechanical valves: An unfriendly relationship

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Thrombosed mitral valve prosthesis as a side effect of extracorporeal membrane oxygenation.

Central Message

Despite providing immediate support to a rapidly declining patient, ECMO increases the risk of thrombotic complications, necessitating an early and customized reconfiguration of support.

See Editorial Commentary page e107.

Video clip is available online.

Extracorporeal membrane oxygenation (ECMO) can provide immediate support to a rapidly declining patient. In the presence of a mechanical heart prosthesis, however, ECMO increases the risk of thrombotic complications, necessitating an early and customized reconfiguration of support.

CLINICAL SUMMARY

A 24-year-old female patient with Marfan syndrome was admitted to our hospital with palpitations. Her medical history included a mechanical mitral valve replacement at the

age of 14 years. Later, at the age of 22 years, an aortic root replacement with a mechanical prosthesis was required. She had remained free of complications for about 3 years.

Echocardiography demonstrated a severely dilated left ventricle (84/78 mm), with an ejection fraction of 10%. Transplant candidacy evaluation was completed, excluding pulmonary hypertension. Although the patient was initially in stable condition, low cardiac output progressively

FIGURE 1. A, The thrombosed mitral prosthesis is visible on perioperative transesophageal echocardiography (white arrow). B, Photograph shows the resected mitral prosthesis with thrombus lodged in its leaflets.

FIGURE 2. A, Postoperative transesophageal echocardiographic image shows the transseptal cannula (white star) and the space left by the removed mitral prosthesis (white arrow). B, Schematic drawing shows the final configuration of the transseptal cannula (white star), the space left by the mitral prosthesis (white arrow), and the closed aortic prosthesis (white asterisk).

developed, and she required increasing inotropic support and an intra-aortic balloon pump. She was listed for urgent transplantation. Deterioration of perfusion status led to initiation of peripheral venoarterial ECMO under local anesthesia with a 21F femoral venous cannula and a 6-mm Dacron polyester fabric graft anastomosed end to side onto the femoral artery. Adequate perfusion was immediately reestablished.

Peripheral ECMO flow was set at 2.5 L/min to ensure left ventricular ejection and unloading and appropriate systemic oxygen delivery. Despite stable anticoagulation throughout support (partial thromboplastin time >100 seconds), prosthetic mitral thrombosis occurred (Figure 1, A, and Video 1), leading to pulmonary edema 4 days after initiation of ECMO support. To resolve the ongoing pulmonary edema and prevent systemic embolic complications, emergency reconfiguration of support was indicated. Because of

unfavorable chest anatomy, a total artificial heart implantation was judged contraindicated.

A third-time sternotomy followed by bicaval cannulation was performed, and the ECMO circuit was switched over to cardiopulmonary bypass. The heart was arrested, and the aortic valve prosthesis was closed with a bovine pericardial patch sutured to the prosthetic sewing ring¹ (Figure 2, A). We entered the right atrium and created a wide atrial septostomy. The mitral prosthesis was removed, and the raw annular edges were oversewn to minimize further thrombus formation (Figure 1, B). A new 40F single-stage venous cannula was inserted through the right atrial appendage and placed transseptally so that it straddled both atria (Figure 2, B). The cardiopulmonary bypass circuit was then switched back to venoarterial ECMO through the newly inserted venous cannulation and the existing femoral arterial graft. This sole venous cannula allowed biatrial and left ventricular drainage in the absence of a mitral valve. Optimal right- and left-side unloading led to immediate resolution of pulmonary edema. The patient underwent a successful heart transplant 2 days later, and her postoperative course was uneventful.

DISCUSSION

ECMO as a bridge to transplant in the presence of mitroaortic mechanical valves increases the risk of thromboembolic events and secondary pulmonary edema. Patients not suited to total artificial heart therapy may still be safely bridged to transplant. A radical and timely reconfiguration of support by means of elimination of the mitral valve prosthesis,² neutralization of native systemic flow, and atrial septostomy for central ECMO continuation is proposed.

VIDEO 1. Transesophageal echocardiography demonstrates thrombosed mitral prosthesis with locked leaflets. Video available at: [http://www.jtcvsonline.org/article/S0022-5223\(18\)30698-6/fulltext](http://www.jtcvsonline.org/article/S0022-5223(18)30698-6/fulltext).

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