Two Cases of Acute Bioprosthetic Mitral Valve Thrombosis Immediately After Mitral Valve Replacement

Nobuyuki Kagiyama, MD; Hiroyuki Okura, MD, PhD; Shintaro Nezu, MD; Takahiro Kawamoto, MD, PhD; Takashi Murakami, MD, PhD; Yuji Hashimoto, MD, PhD; Kazuo Tanemoto, MD, PhD; Kiyoshi Yoshida, MD, PhD

Prosthetic valve thrombosis (PVT) is a rare complication, and most of PVT occurs in patients with mechanical valves. We present 2 extremely rare cases of acute bioprosthetic mitral valve thrombosis immediately after mitral valve replacement under veno-arterial extracorporeal membrane oxygenation (VA-ECMO) and anticoagulant therapy.

In Case 1, a 75-year-old woman underwent aortic valve replacement and mitral valve replacement with 23- and 29-mm bioprosthetic valves, respectively. On postoperative day 2, VA-ECMO was started because of hemodynamic compromise. At the initiation of VA-ECMO, transthoracic echocardiography indicated normal bioprostheses (Figure 1; see Movie I in the online-only Data Supplement). On postoperative day 9, transesophageal echocardiography revealed severely stenotic bioprosthetic mitral valve, but the bioprosthetic aortic valve was normal (Figure 2; see Movies II and III in the online-only Data Supplement). Emergent percutaneous mitral valvuloplasty was performed, resulting in partial improvement of hemodynamic state. On postoperative day 17, re-mitral valve replacement was performed. The left atrial side of the retrieved bioprosthetic valve leaflet was covered with thrombus, resulting in leaflet fusion (Figure 3).

In Case 2, a 70-year-old man underwent emergent mitral valve replacement with a 27-mm bioprosthetic valve attributable to acute myocardial infarction with rupture of a papillary muscle. During the procedure, VA-ECMO was started and continued. Two days later, transesophageal echocardiography revealed that the bioprosthetic valve was thickened and its opening was restricted (Figure 4; see Movies IV and V in the online-only Data Supplement). Intravenous infusion of urokinase at a dose of 10000 U/h was started and continued for 3 days. After thrombolysis, transesophageal echocardiography thinned the thickened valve ameliorated and its opening improved (Figure 5; see Movies VI and VII in the online-only Data Supplement). His hemodynamic state improved, and he could be weaned off VA-ECMO.

In Case 1, histological examination revealed thrombus formation on the bioprosthetic valve. In Case 2, echocardiographic and clinical findings strongly implicated that thrombosis caused prosthetic valve stenosis. In both cases, PVT developed despite the use of intravenous heparin to maintain the ACT above 150 seconds.

Risk factors for PVT have been reported as left atrial dilatation, atrial fibrillation, hypercoagulability, and low cardiac output. In our cases, low cardiac output was 1 possible cause of PVT. Recently, cases with left ventricular or bioprosthetic valve thrombosis during VA-ECMO were reported. VA-ECMO is a device that provides circulatory and pulmonary support with draining blood from the inferior vena cava and sending the blood to the femoral artery. Because it increases left ventricular afterload and decreases preload, cardiac output from the native heart is reduced or completely abandoned, and thereby it may increase the risk of thrombosis in the left heart. PVT in our cases may also be developed as a result of decreased blood flow through the prosthetic valves. Adequate device adjustment, or keeping low flow of VA-ECMO using intra-aortic balloon pumping or percutaneous left ventricular assist device, would be useful to prevent thrombosis. In a patient with prosthetic valve under VA-ECMO, more aggressive anticoagulant therapy would also reduce the risk of thrombosis.

Disclosures

None.

References

Figure 1. Transthoracic echocardiographic image at the initiation of veno-arterial extracorporeal membrane oxygen in case 1. Laminar flow through the bioprosthetic mitral valve and continuous-wave Doppler tracing indicated normal valve function. LA indicates left atrium; LV, left ventricle; MPG, mean pressure gradient; PV, peak velocity; PHT, pressure-half time; RA, right atrium; and RV, right ventricle.

Figure 2. Transesophageal echocardiography (TEE) images of the stenotic bioprosthetic valve in case 1. TEE showed severely reduced opening of the bioprosthetic mitral valve. The leaflet tips were tightly fused, whereas leaflet mid and base portions had some mobility (A and B). Transmitral continuous-wave Doppler tracing showed elevated mean pressure gradient (13.9 mmHg; C). LA indicates left atrium; LV, left ventricle; MPG, mean pressure gradient; PV, peak velocity; PHT, pressure-half time; RA, right atrium; and RV, right ventricle.

Figure 3. Retrieved prosthetic mitral valve in Case 1. Leaflets of the retrieved bioprosthetic valve were tightly fused with thrombus (A). Histological section revealed that left atrial side of the leaflet was covered with thrombus. Neovascularization was observed within the thrombus (B; magnification x40; C, x200). LA indicates left atrium; and LV, left ventricle.

Figure 4. Three-dimensional transesophageal echocardiography (TEE) image and color Doppler image in Case 2. Three-dimensional TEE revealed that 2 of 3 leaflets of the bioprosthetic valve kept closed (A). A color Doppler image during diastole showed convergence flow proximal to the valve orifice and mosaic signal distal to the orifice, indicating severe prosthetic valve stenosis (B).
Figure 5. Transesophageal echocardiographic images before and after thrombolysis in case 2. Marked thick mitral prosthetic valve was observed before thrombolysis (A). After thrombolysis, the prosthetic valve became thin and opened more smoothly (C). Transmitral continuous-wave Doppler tracing also showed clear improvement of the prosthetic valve stenosis (B and D). LA indicates left atrium; LV, left ventricle; MPG, mean pressure gradient; PV, peak velocity; and PHT, pressure-half time.
Two Cases of Acute Bioprosthetic Mitral Valve Thrombosis Immediately After Mitral Valve Replacement
Nobuyuki Kagiyama, Hiroyuki Okura, Shintaro Nezuo, Takahiro Kawamoto, Takashi Murakami, Yuji Hashimoto, Kazuo Tanemoto and Kiyoshi Yoshida

*Circulation*. 2014;129:e328-e330
doi: 10.1161/CIRCULATIONAHA.113.005583
*Circulation* is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2014 American Heart Association, Inc. All rights reserved.
Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://circ.ahajournals.org/content/129/6/e328

Data Supplement (unedited) at:
http://circ.ahajournals.org/content/suppl/2014/02/21/129.6.e328.DC1

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in *Circulation* can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to *Circulation* is online at:
http://circ.ahajournals.org/subscriptions/
Movie Legend

**Movie 1.** Transthoracic echocardiographic image at the initiation of VA-ECMO in case 1. Laminar flow through bioprosthetic mitral valve indicated normal valve function. Best viewed with Windows Media Player.

**Movie 2.** TEE image of the bioprosthesis in case 1. Transesophageal echocardiography (TEE) showed severely reduced opening of the bioprosthetic mitral valve. Best viewed with Windows Media Player.

**Movie 3.** Three-dimensional TEE image of the bioprosthesis in case 1. The leaflet tips were tightly fused, while leaflet mid and base portions had some mobility. Best viewed with Windows Media Player.

**Movie 4.** Three-dimensional TEE image of the bioprosthesis in case 2. Three-dimensional transesophageal echocardiography (TEE) revealed that 2 of 3 leaflets of the bioprosthesis valve kept closed. Best viewed with Windows Media Player.

**Movie 5.** A color Doppler image in case 2. A color Doppler image during diastole showed convergence flow proximal to the valve orifice and mosaic signal distal to the orifice, indicating severe prosthetic valve stenosis. Best viewed with Windows Media Player.

**Movie 6.** Mitral bioprosthesis before thrombolysis in case 2. Marked thick mitral prosthetic
valve was observed before thrombolysis. Best viewed with Windows Media Player.

**Movie 7.** Mitral bioprosthesis after thrombolysis in case 2. After thrombolysis, the prosthetic valve became thin and opened smoother. Best viewed with Windows Media Player.