Facile conversion from biologic to mechanical prosthesis: A bailout for a hostile aortic root

Phillip G. Rowse, MD,[a] Alexander C. Egbe, MD, MPH,[b] and Sameh M. Said, MD,[a] Rochester, Minn

From the [a]Department of Cardiovascular Surgery, and [b]Division of Cardiovascular Diseases, Mayo Clinic, Rochester, Minn.

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Address for reprints: Sameh M. Said, MD, Department of Cardiovascular Surgery, Mayo Clinic, 200 First St SW, Rochester, MN 55905 (E-mail: said.sameh@mayo.edu).
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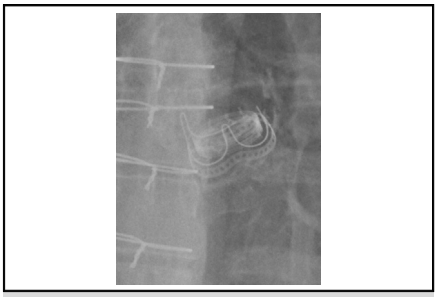


Magnified view of the valve-on-valve observed on a chest roentgenogram.

Video clip is available online.

Central Message

Re-recurrent LVOT obstruction after prosthetic AV replacement is a complex issue. If the root is hostile, a surgical valve-on-valve technique is a viable alternative to extensive reconstruction.

See Editorial Commentary page XXX.

Left ventricular outflow tract obstruction as a result of early prosthetic aortic valve (AV) failure can present a complex reoperative problem, especially in the presence of a hostile aortic root. We present a case of seventh-time sternotomy for re-replacement of the AV with a less conventional approach.

CLINICAL SUMMARY

A 31-year-old man with an extensive surgical history related to congenital bicuspid aortic stenosis presented with symptomatic severe recurrent prosthetic AV dysfunction (effective orifice area, 0.87 cm^2; mean systolic gradient, 73 mm Hg). His surgical history included: (1) balloon valvuloplasty at birth, followed by repeated valvuloplasty at 2 years of age; (2) surgical aortic valvotomy at 2 years of age; (3) Konno-Rastan aortoventriculoplasty with AV replacement with a 19-mm St Jude mechanical prosthesis (St Jude Medical, St Paul, Minn) at 8 years of age; (4) reoperative AV and root replacement with 21-mm Medtronic Freestyle bioprosthesis (Medtronic, Minneapolis, Minn) at 12 -years of age; (5) redo AV replacement with 23-mm bioprosthesis at 12 years of age for significant periprosthetic regurgitation; (6) redo AV replacement with 25-mm Carpentier-Edwards bioprosthesis (Edwards Lifesciences Corp, Irvine, Calif), aortic root revision with patch augmentation, and septal myectomy at 20 years of age.

The decision was made to pursue a seventh sternotomy and AV and aortic root re-replacement with a mechanical prosthesis. Dense calcification of the root, as identified on preoperative computed tomographic angiography of the chest (Figure 1, *A*) ultimately precluded consideration of

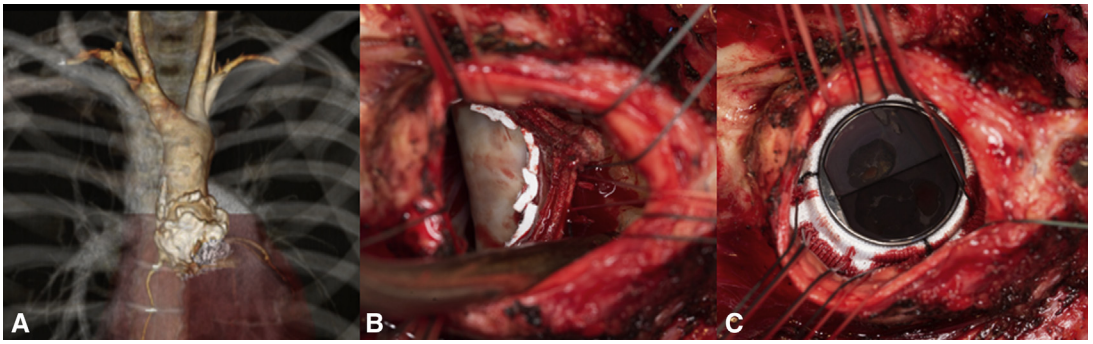
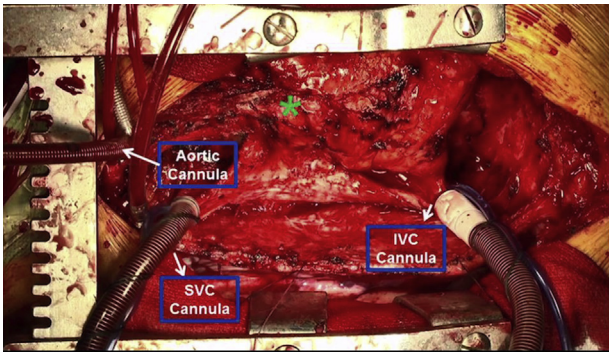


FIGURE 1. A, Calcified aortic root. B, Pledgeted sutures through sewing ring. C, Seated top hat.



VIDEO 1. Video of surgical valve-on-valve procedure. *AVR*, Aortic valve replacement; *CE*, Carpentier-Edwards; *NYHA*, New York Heart Association; *EOA*, effective orifice area; *RCA*, right coronary artery; *IVC*, inferior vena cava; *SVC*, superior vena cava; *POD*, postoperative day; *ASA*, aspirin; *TEE*, transesophageal echocardiography; *LVOT*, left ventricular outflow tract; *CTA*, computed tomographic angiography. Video available at: http://www.jtcvsonline.org.

root re-replacement. Instead, the existing bioprosthetic leaflets were excised, and a 21-mm CarboMedics Top Hat valve (LivaNova, London, UK) was placed inside the frame of the 25-mm Carpentier-Edwards sewing ring (valve-on-valve fashion) with 2-0 Ethibond sutures (Ethicon, Inc, Somerville, NJ) in horizontal mattress fashion with pledgets on the ventricular side (Figure 1, *B* and *C*, and Video 1). We believed that a 21-mm valve would avoid patient prosthesis mismatch, which was a concern because of his body mass index of 19.1 kg/m^2 and body surface area of 1.6 3 m^2. Leaflet mobility was satisfactory, and both coronary ostia were visualized. The aorta was closed in end-to-end fashion.

The postoperative course was uneventful, with dismissal on the sixth postoperative day. A chest roentgenogram (Figure 2, *A*) reveals a magnified view of the valve-on-valve. A dismissal transthoracic echocardiogram revealed an aortic valve gradient of 16 mm Hg, no periprosthetic regurgitation, and no left ventricular outflow tract obstruction. Cardiac computed tomographic angiography revealed normal motion of the prosthetic leaflets with no perivalvular leak (Figure 2, *B*). The patient was dismissed on a regimen of coumadin and aspirin.

DISCUSSION

Reoperation on the aortic root, AV, or ascending aorta after previous surgical intervention constitutes a peculiar subgroup of procedures believed to carry higher surgical risk because of their complexity and variability in anatomic features.[1] Contemporary series, however, indicate that operative re-intervention in this patient population is justifiable given acceptable operative mortality and long-term survival.[2]

Surgical management of the hostile (calcific) aortic root in the setting of re-recurrent severe bioprosthetic AV stenosis can be approached with a variety of surgical options: (1) transcatheter aortic valve replacement, (2) rapid-deployment aortic bioprosthesis, (3) standard re-replacement of the root with valved conduit, and (4) apicoaortic conduit. Transcatheter aortic valve replacement or rapid-deployment aortic bioprosthesis, such as the Edwards INTUITY valve system (Edwards Lifesciences Corp, Irvine, Calif) did not appeal to either the patient or the cardiovascular surgeon because of concerns of valve longevity. Re-replacement of the aortic root with a classic or modified Bentall procedure requires an extensive reconstruction after taking down the entire calcified root, resulting in prolonged cardiopulmonary bypass and increased morbidity and mortality. In our case, the aortic root and annulus were severely calcific, Bentall reconstruction appeared risky and excessive. Another option in the hostile

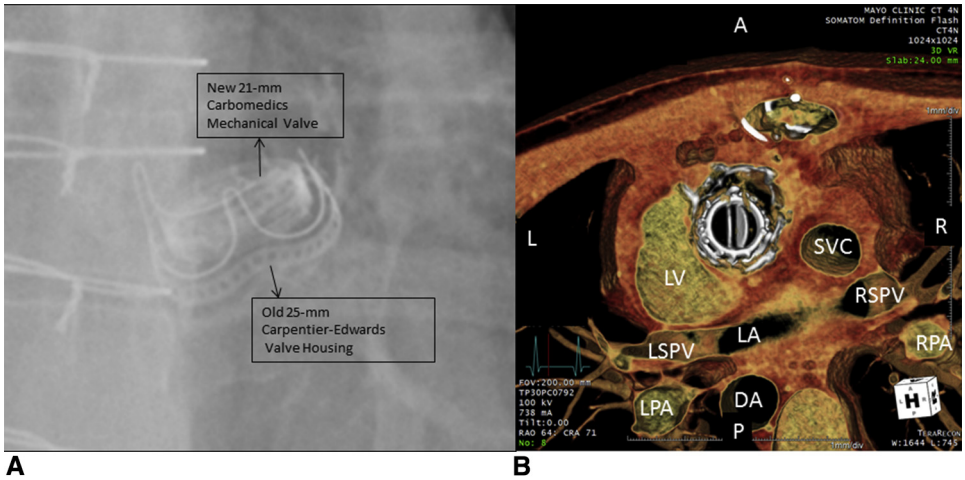


FIGURE 2. A, Chest roentgenogram. B, Functional aortic valve leaflets on cardiac computed tomographic angiography. *A*, Anterior; *L*, left; R, right; *LV*, left ventricle; *SVC*, superior vena cava; *RSPV*, right superior pulmonary vein; *LSPV*, left superior pulmonary vein; *LA*, left atrium; *RPA*, right pulmonary artery; *LPA*, left pulmonary artery; *DA*, descending aorta; *P*, posterior.