A technique for reconstruction of complete circumferential aortic root allograft dehiscence without coronary reimplantation

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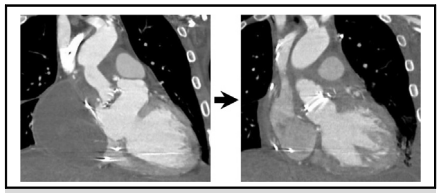

Complete homograft-ventricular discontinuity before and after reconstruction.

CENTRAL MESSAGE

Ventriculoaortic discontinuity is a difficult problem. The challenges are greater when the dehiscence is circumferential and/or when the root is hostile. The author presents a technique for management.

Endocarditis of the aortic valve (AV) can lead to significant structural defects. In these situations, a homograft root replacement is a viable treatment option. Insufficient debridement or infection recurrence may lead to dehiscence of the allograft. This situation presents a number of challenges in exposure and reconstruction due to a hostile aortic root. This is even more treacherous if the dehiscence is circumferential. The author presents a technique for reconstruction that does not require homograft dissection or coronary mobilization.

CASE PRESENTATION

A 56-year-old male patient with a history of AV replacement, followed by tricuspid repair for endocarditis, then an aortic root allograft for prosthetic valve endocarditis, presented to the hospital with shortness of breath. He had a permanent pacemaker for complete heart block. Tomography and echocardiogram showed a large circumferential crown-like pseudoaneurysm completely separating the homograft from the left ventricular outflow tract (LVOT). There was also a large hematoma outside the pseudoaneurysm compressing the right ventricle. Institutional review board approval was not required for this technical report (it does not meet the United States Department of Health and Human Services definition of "research"). The patient provided informed written consent.

TECHNIQUE

Cardiopulmonary bypass was initiated before revision sternotomy via the right axillary artery and femoral vein. Sternotomy was performed uneventfully. The hematoma around the heart was carefully evacuated. There was a small communication between the hematoma and the pseudoaneurysm near the right atrial appendage. Finger pressure was applied there until the aorta was dissected. The aorta was then clamped and cardioplegic arrest was achieved.

The aorta was transected at the native aorta to allograft junction. The allograft was too small for adequate LVOT exposure through the annulus, even after leaflet excision (Figure E1, *A* and *B*). Excision of the allograft with coronary mobilization was considered to allow for LVOT reconstruction followed by a Bentall. However, limited dissection around the allograft and coronaries revealed them to be very densely adherent to the surrounding structures. The strategy was thus modified.

The allograft was incised longitudinally along its vertical axis, starting at the sinotubular junction, extending 5 mm to the left of the right coronary ostium and into the annulus (similar to the Konno–Rastan incision) (Figure E1, *C*). Unlike the Konno–Rastan, which leads into the muscular septum, this incision led into a large circumferential pseudoaneurysm cavity, with the cross section of the true LVOT seen 2 cm deep to the level of the homograft annulus (Figure E1, *C*). The boundaries of the true LVOT were carefully identified, marked, and sized (Figure E1, *D*). An appropriately sized aortic tube graft was parachuted down

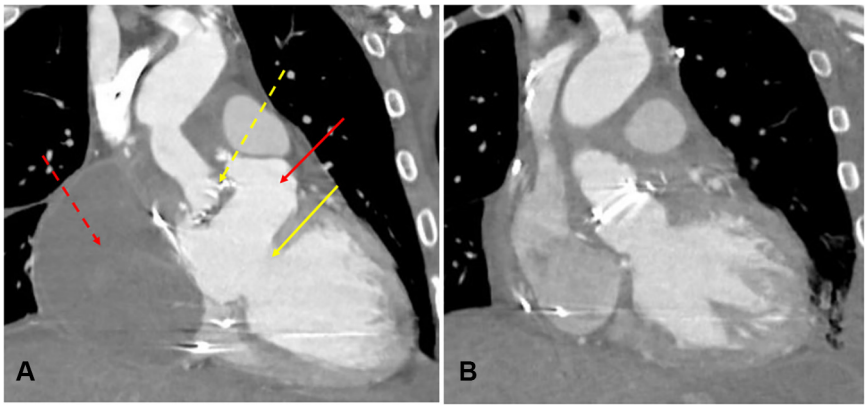

FIGURE 1. CT scans. A, Preoperative showing a 9-cm crown-link pseudoaneurysm (*red solid arrow*) separating the allograft annulus (*yellow interrupted arrow*) and the LVOT (*yellow solid arrow*). This also shows a large hematoma (*red interrupted arrow*) compressing the right heart. B, Postoperative CT scan showing the reconstructed LVOT.

to the true LVOT using 3 sutures, then the graft was inverted toward the apex, to facilitate circumferential suturing (Figure E1, *E*). The graft was sewn to the true LVOT and then pulled back to now represent the neo-LVOT, with exclusion of the pseudoaneurysm cavity (Figure E2, *A* and *B*).

The posterior two-thirds of the tube graft was inside the split allograft. Along this posterior two-thirds, the graft was trimmed at the level of the allograft annulus, and the 2 were sewn together at that level (Figure E2, *C*). Valve sutures were placed in the standard fashion posteriorly, incorporating the allograft annulus and the graft together. In the anterior one-third, valve sutures were placed outside-in on the tube graft alone. A mechanical valve was implanted (Figure E2, *D* and *E*).

A triangular piece of Dacron was used anteriorly to bridge the tube graft anteriorly and to make up the size difference between the new enlarged root and the native aorta (Figure E2, *F*). Figures 1 and 2 demonstrate the reconstruction. The remainder of the procedure was completed in the standard fashion. The patient had initial vasoplegia and subsequently recovered. A follow-up computed tomography scan showed a satisfactory result (Figure 2, *B*).

COMMENT

This technique provides excellent LVOT exposure for complex reconstruction without the need to mobilize and reimplant the coronaries. An additional benefit is annular enlargement. In this patient, the annulus was enlarged from a 20-mm allograft to a 27-mm mechanical valve. It

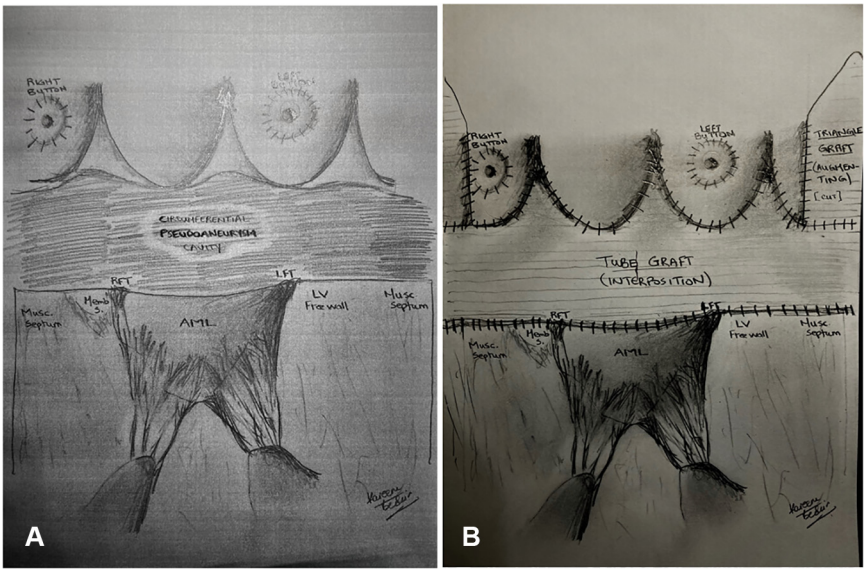

FIGURE 2. An illustrative diagram of the reconstruction before (A) and after (B). *RFT*, Right fibrous trigone; *LFT*, left fibrous trigone; *LV*, left ventricular; *AML*, anterior mitral leaflet.

is critical to take time in identifying and marking the true LVOT, since landmarks are distorted. The trigones and the anterior mitral leaflet serve as a guide. Graft inversion into the apex facilitates sewing, keeping the graft out of the line of vision. Obviating the need to dissect and reimplant the coronary in a densely scarred root is an advantage that makes this technique less hazardous. It is crucial, however, to maintain constant awareness of the orientation of the coronaries. Aggressive annular enlargement may potentially lead to rightwards right coronary artery displacement and kinking. Minimal dissection of the dense scar may, however, be protective.

It is important to note that this technique represents a bail-out strategy in the situation where adequate subannular LVOT exposure is required, but in the setting of a precariously hostile root that makes coronary mobilization unsafe. It is also important to note that active infection should still be identified and devitalized tissues debrided without compromise. In the setting of active infection, a sheet of bovine pericardium fashioned into a tube may be used instead of the Dacron tube graft to minimize synthetic material. Other reports of left ventricular–aortic discontinuity have either described noncircumferential focal defects or did involve coronary mobilization and implantation.[1-5] In addition, these reports addressed native and prosthetic valve endocarditis but not a previous allograft with a hostile root. Our described longitudinal allograft split to expose the pseudoaneurysm without mobilizing the coronaries has, to our knowledge, not been previously reported.

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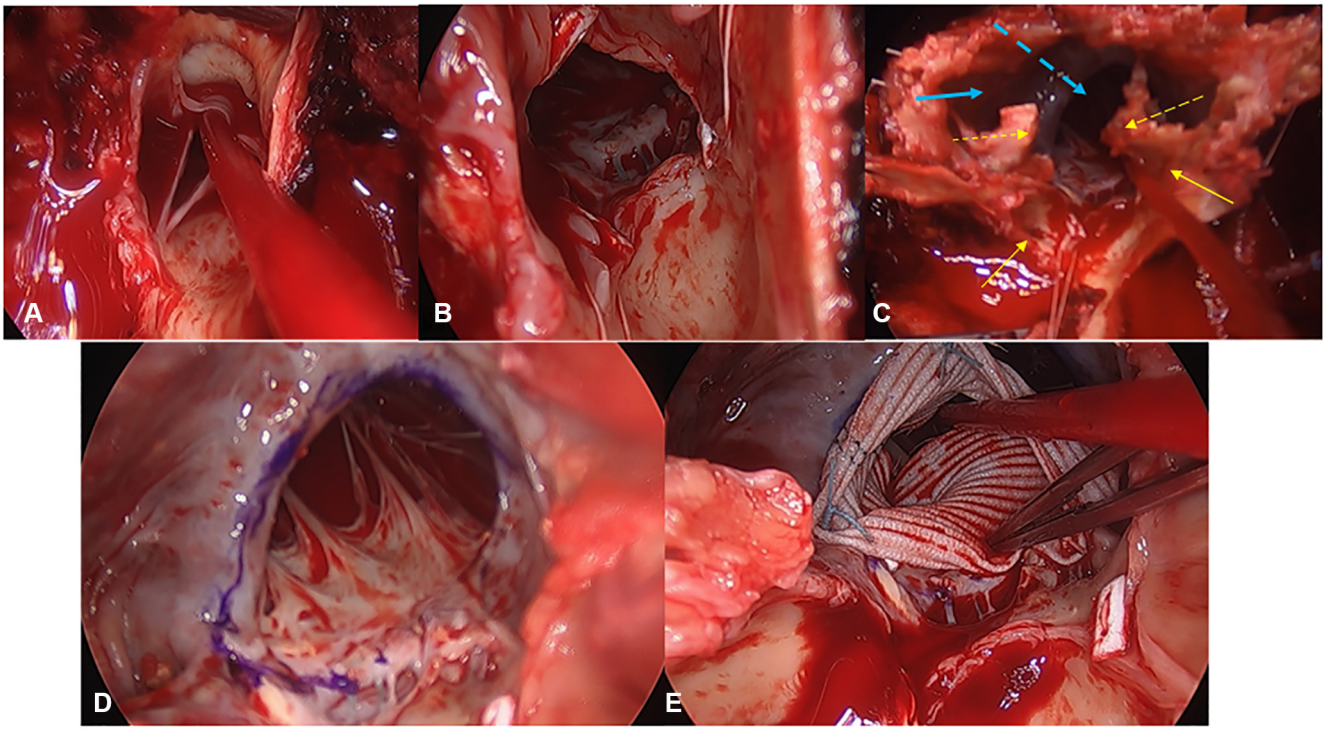

FIGURE E1. A and B, Inspection after opening the allograft and leaflet excision showing limited LVOT exposure but showing dehiscence of the allograft from the aortomitral curtain. C, *Yellow dashed arrows* show the cut edges of allograft, *yellow solid arrows* show the coronary ostia, *blue solid arrow* shows the pseudoaneurysm cavity, and the *blue dashed arrow* shows the true LVOT. D, Identification of true LVOT and marking (the camera is below the homograft annulus in the pseudoaneurysm cavity). E, Tube graft secured to the LVOT with 3 interrupted sutures and inverted towards the apex.

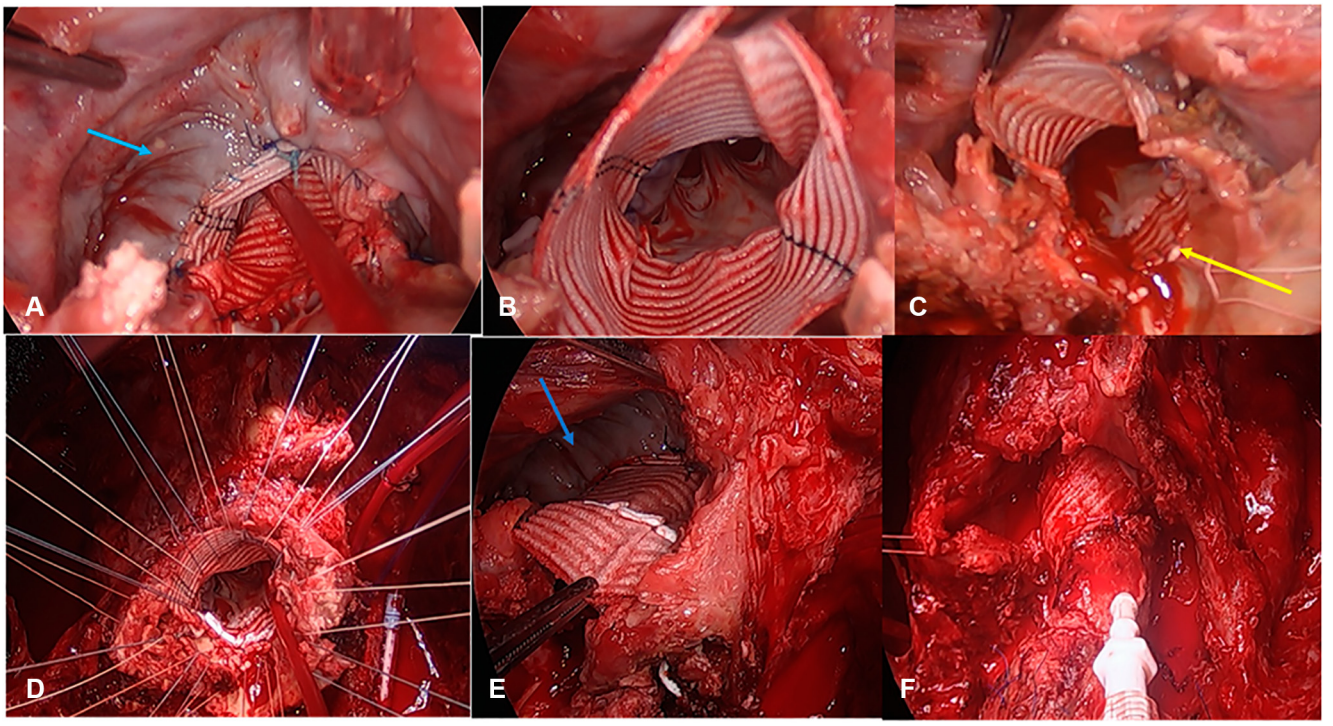

FIGURE E2. A and B, Draft sewn to LVOT circumferentially and then pulled back, excluding the pseudoaneurysm (*blue arrows*) and creating the neo-LVOT. C, The posterior two-thirds of the graft trimmed and sewn to the homograft's divided annulus (*yellow arrow*). D, Valve sutures are placed into allograft annulus/graft posteriorly and to graft anteriorly, and a valve is seated and secured (E). F, The anterior root is reconstructed with another piece of graft to compensate for the enlarged annulus and divided allograft and close the aorta.