

# Direct implantation of balloon expandable transcatheter aortic valve to treat intraoperative homograft valve dysfunction



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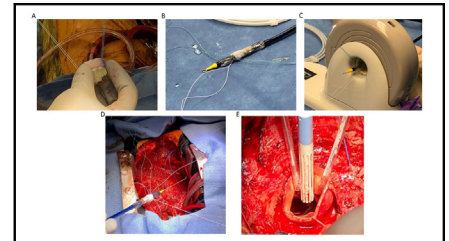
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The commissures of the THV were oriented to those of the homograft.

## CENTRAL MESSAGE

We describe the technique of direct implantation of a balloon-expandable transcatheter heart valve to salvage acute intraoperative homograft dysfunction.

▶ Video clip is available online.

## CLINICAL SUMMARY

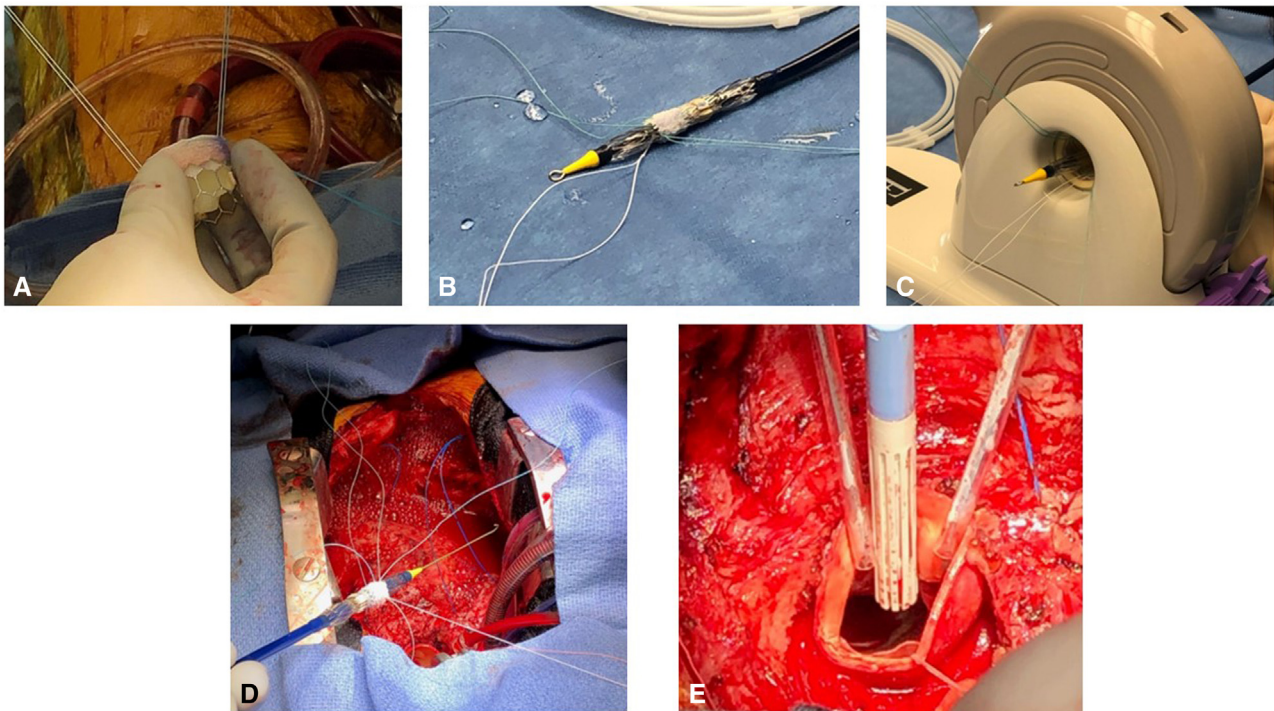
A 33-year-old male with history of intravenous drug abuse and two prior surgical bioprosthetic aortic valve replacements (bioAVR) presented with recurrent MSSA endocarditis. His first bioAVR was complicated by valve dehiscence, which required redo bioAVR with aortic annulus and LVOT reconstruction using a Dacron graft in the subannular position, and supracoronary ascending aortic replacement.

Transesophageal echocardiography (TEE) showed severe biventricular dysfunction (LVEF 20%), bioAVR stenosis (mean gradient 45mmHG) and severe bioAVR insufficiency. CT demonstrated an aortic root pseudoaneurysm and paravalvular abscess. After a multidisciplinary discussion with our Drug Use Endocarditis Team (DUET), we proceeded to perform redo aortic root replacement.<sup>1</sup> Informed consent for publication of study data was obtained as part of surgical consent prior to the procedure. IRB approval was not required.

Intraoperatively, the aortic valve was noted to have massive vegetations on the leaflets. Because of the previous LVOT graft below the valve, there was a tunnel of scar tissue that extended down towards the patient's

native LVOT and the anterior leaflet of the mitral valve (Figure E1). All prosthetic material (bioAVR, LVOT graft, ascending aorta graft) was explanted. Coronary buttons were fashioned, and a 25 mm homograft was implanted at the level of the true aortic annulus and aortomitral continuity. After removing the crossclamp, TEE demonstrated that the homograft was compressed by the LVOT and subvalvar scar tissue along the right and the noncoronary sinus leading to an asymmetric aortic valve, causing significant flow acceleration and stenosis (mean gradient 40mmHG). Given the challenge of re-implanting and re-performing the aortic root, we decided to place a transcatheter heart valve (THV) into the homograft under direct visualization.

While the patient was maintained on cardiopulmonary bypass, the structural heart team was emergently assembled and a 26-mm Edwards SAPIEN 3 balloon expandable THV was selected for implant based on homograft size, TEE, and direct inspection. To orient the THV in the homograft annulus to optimize future coronary access and minimize future coronary occlusion risk, three 2 to 0 Tevdek sutures were placed through the stent frame of the Sapien valve corresponding to the nadir of each leaflet, and the needle on the superior tail was cut (Figure 1, A and B). The THV was then



**FIGURE 1.** A and B, The THV was oriented in the homograft annulus to optimize future coronary access and minimize future coronary occlusion risk. Three 2 to 0 Tevdek sutures were placed through the stent frame of the Sapien valve corresponding to the nadir of each leaflet, and the needle on the superior tail was cut. C, The THV was then crimped onto a transaortic/transapical delivery system. D, The homograft leaflets were excised to further reduce risk for coronary occlusion by THV. The commissures of the THV were oriented to the commissures of the homograft. Using the remaining needle, the sutures previously placed in the THV were passed through the homograft tissue a few mm below the nadir of each sinus to ensure proper height of the THV relative to the homograft annulus. E, These sutures were pulled up to lower the valve to the annulus, while maintaining THV position and orientation. Under direct visualization, the THV was deployed over a wire placed in the left ventricle. The positioning sutures were removed and three tacking sutures were placed through the stent frame of the THV to the homograft.

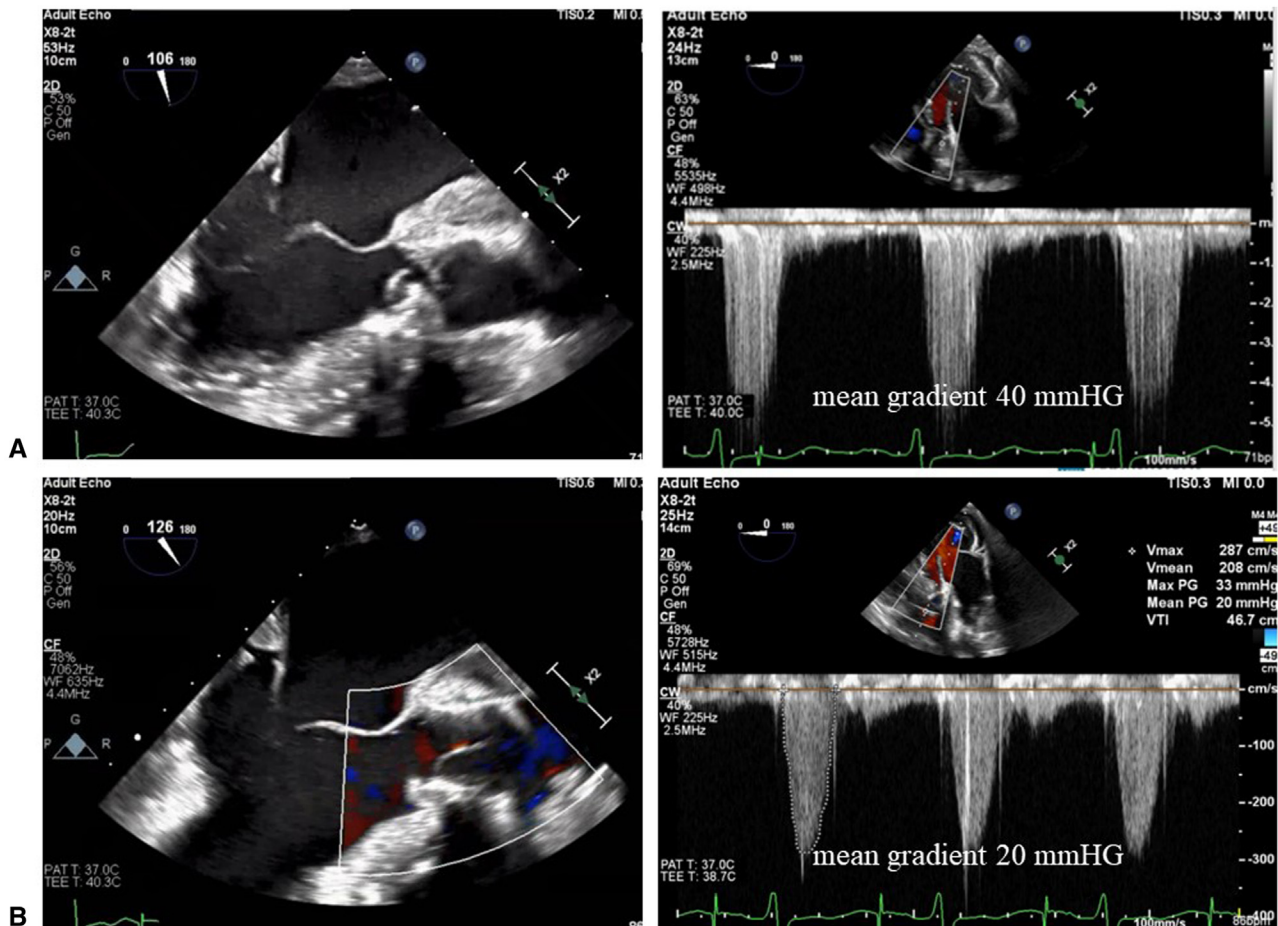
crimped onto a transaortic/transapical (Certitude, Edwards Lifesciences) delivery system (Figure 1, C). The heart was re-arrested, and the aorta was opened. The homograft was confirmed to be compressed at the level just above the LVOT scar tissue. The homograft leaflets were excised to further reduce risk for coronary occlusion by THV. The commissures of the THV were oriented to the commissures of the homograft. Using the remaining needle, the sutures previously placed in the THV were passed through the homograft tissue a few mm below the nadir of each sinus to ensure proper height of the THV relative to the homograft annulus (Figure 1, D). These sutures were pulled up to lower the valve to the annulus, while maintaining THV position and orientation. Under direct visualization, the THV was deployed over a wire placed in the left ventricle with 21 mL (2 mL less than the nominal inflation volume) to minimize the risk of perforation (Figure 1, E). The positioning sutures were removed (to avoid the risk of deforming the Sapien frame while tying) and three tacking sutures were placed through the stent frame of the THV to the homograft. The aortotomy was

closed and the patient was weaned off bypass. TEE showed much improved gradients (mean 20 mmHG), no paravalvular leak, wide open LVOT and improved cardiac function (Figure 2 and Video 1).

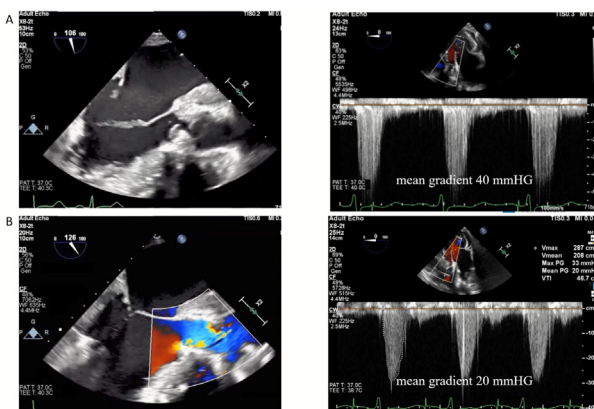
Post-operatively, the patient was extubated on POD 5, transferred to stepdown on POD 7, discharged on POD 28 after a long course of IV antibiotics. Repeat echocardiogram showed well-seated THV without paravalvular leak, mean gradient of 21 mmHG, and improved LVEF at 47%.

## DISCUSSION

Bioprosthetic endocarditis is a challenging surgical problem and redo operations can be difficult.<sup>2,3</sup> In our case, homograft distortion led to a malfunctioning aortic valve. Surgical options at that point included homograft explant, and replacing with a smaller homograft, a Bentall using a stented bioprosthesis, or excision of the homograft leaflets with implantation of the surgical valve.<sup>4</sup> Any of these options would have been difficult in an already challenging case.



**FIGURE 2.** A, Intraoperative transesophageal echocardiogram (TEE) demonstrating that the homograft appeared compressed along the right and the non-coronary sinus leading to an asymmetric aortic valve causing residual flow acceleration and a mean gradient of 40 mm Hg. B, The final postprocedure TEE showed that the gradients were much improved (mean gradient 20 mm Hg) with no paravalvular leak, a wide open left ventricular outflow tract, and improved cardiac function.

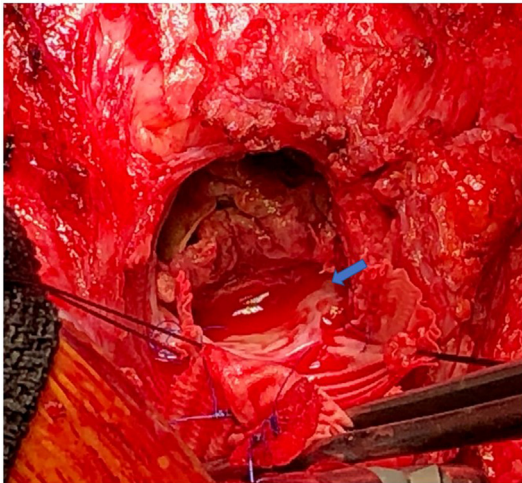


**VIDEO 1.** A, Intraoperative transesophageal echocardiography (TEE) demonstrated that the homograft appeared compressed along the right and the noncoronary sinus leading to an asymmetric aortic valve causing residual flow acceleration and a mean gradient of 40 mm Hg. B, The final post procedure TEE showed that the gradients were much improved (mean gradient 20 mm Hg) with no paravalvular leak, a wide open left ventricular outflow tract, and improved cardiac function. Video available at: [https://www.jtcvs.org/article/S2666-2507\(23\)00192-X/fulltext](https://www.jtcvs.org/article/S2666-2507(23)00192-X/fulltext).

With the help of a multidisciplinary team, we decided to excise the homograft leaflets and place a THV to stent open the LVOT in addition to addressing the valve dysfunction. A SAPIEN valve (balloon expandable) was chosen over a self expandable valve because its superior radial strength and fixed size would more likely overcome the external compression caused by the LVOT scar. Using techniques adapted from transatrial insertion of THV in the mitral position, stable orientation and successful implantation of the valve was facilitated by the guiding sutures passed through the THV prior to crimping the valve.<sup>5</sup> These sutures allowed for optimal positioning of the THV within the homograft as usual radiographic guidance used for THV placement was not available. Access to well-functioning and easily convened multidisciplinary Heart Team, and increasing facility with THVs amongst cardiac surgeons enabled intraoperative deployment of THV under direct visualization, allowing the patient to successfully separate from cardiopulmonary bypass and salvaging a difficult intraoperative situation.

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**FIGURE E1.** Massive vegetations on the aortic valve leaflets and tunnel of scar tissue that extended down toward the patient's native left ventricular outflow tract (LVOT) caused by the patient's previous LVOT graft. The *blue arrow* identifies start of LVOT scar.