functional class ≥III, 53% had a history of coronary artery disease, 78% had hypertension, and 28% had diabetes. From baseline to 1 year post AVR, there was a significant increase in left ventricular end-diastolic (LVED) diameter and volume with a decrease in septum and posterior wall thickness, resulting in a decrease in LV mass (207 ± 44 g vs. 175 ± 37 g, respectively; p = 0.002) and relative wall thickness ratio (0.58 ± 0.11 vs. 0.46 ± 0.06, respectively; p = 0.0004) (**Figure 1**). SVi increased significantly from baseline to 1 year (31 ± 3 ml/m^2 vs. 36 ± 7 ml/m^2, respectively; p = 0.0002) (**Figure 1**), whereas LVEF remained unchanged (63 ± 6% vs. 63 ± 7%, respectively; p = 0.99). Flow was normalized in 56% of the patients at 1 year (SVi >35 ml/m^2) compared with 37% of patients at discharge (p < 0.0001). SVi increased in patients with mild diastolic dysfunction (32 ± 3 ml/m^2 vs. 37 ± 4 ml/m^2, respectively; p = 0.0003), and those with moderate dysfunction (30 ± 4 ml/m^2 vs. 37 ± 5 ml/m^2, respectively; p = 0.03) but not in patients with severe dysfunction (28 ± 6 vs. 27 ± 5, respectively; p = NS). GLS increased significantly from baseline to 1 year (|14.5| ± 3.9% vs. |17.2| ± 4.0%; p = 0.03) (**Figure 1**). There was a significant correlation between baseline-to-post-AVR change in GLS and change in SVi (r = 0.52; p = 0.02). The pre-operative factors independently associated with SVi at 1 year post-AVR were pre-operative SVi (p < 0.0001) and presence of severe diastolic dysfunction (p = 0.008).

The present study shows that AVR is associated with positive LV remodeling and improvement in LV longitudinal systolic function, which in turn, translates into increase in SVi. It is noteworthy that SVi did not improve following AVR in patients with pre-existing severe diastolic dysfunction. Severe diastolic dysfunction is likely a marker for a more advanced stage of myocardial fibrosis, which is probably not reversible after AVR.

This study has several limitations. First, a significant proportion of eligible patients were excluded, which might have introduced a selection bias. Second, the small sample size might have limited the ability to detect other significant effects of AVR on clinical and echocardiographic variables. The sample size also did not allow us to compare surgical versus transcatheter AVR with respect to changes in LV geometry and function.

In summary, the results of this study suggest that the adverse LV remodeling and impaired LV longitudinal function typically seen in PLF-LG AS are reversible following AVR, which may lead to regression of symptoms and improved outcomes. These results provide further support to the clinical guidelines Class IIa recommendation for AVR in symptomatic patients with PLF-LG severe AS (1).

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Identifying Patients at Risk for LVOT Obstruction in Mitral Valve-in-Valve Implantation

Left ventricular outflow tract obstruction (LVOTO) is a potentially devastating complication of transcatheter mitral valve interventions (1). During mitral valve-in-valve (MViV) procedures, superimposition of a transcatheter valve into the existing surgical bioprosthetic mitral valve creates an impermeable valve-stent cylinder that can project into the existing LVOT. This post-MViV ventricular outflow has been described as the "neo-LVOT" (2), and close proximity of existing subvalvular structures to the intraventricular septum may predispose to

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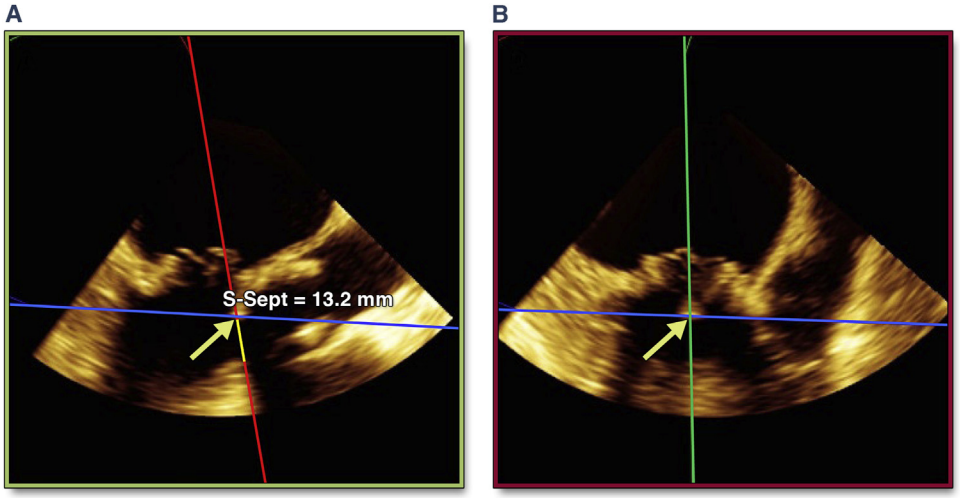
FIGURE 1 3D TEE Multiplanar Reconstruction With Final Plane Position and Measurement of S-Sept



(A) Sagittal plane **(green)** identifies S-Sept distance **(yellow line)** from strut **(yellow arrow)** to interventricular septum. **(B)** Coronal plane **(red)** of LVOT is shown at the level of the proximal bioprosthetic strut. Transverse plane **(blue)** is positioned at the mitral bioprosthetic strut tips. As described in the text, this is a sample image from Philips Qlab 9 software (Andover, Massachusetts), in which multiplanar reconstruction (MPR) planes were initially aligned to correspond with mid-esophageal long axis (sagittal), aortic valve short-axis (coronal), and transgastric basal short axis (transverse) TEE views. These planes were subsequently repositioned to intersect at the tip of the strut most proximal to the IVS creating the image seen here. The S-Sept distance is measured in the sagittal plane **(green)**. The purpose of this figure is to orient the reader to the MPR method used to generate the S-Sept measurement and show the concept of the LVOT in short axis at the level of the strut most proximal to the aortic valve. IVS = intraventricular septum; LVOT = left ventricular outflow tract; S-Sept = struts to the septum; TEE = transesophageal echocardiography.

ventricular outflow obstruction. Pre-procedure computed tomography (CT)-based assessment is being developed to optimize device selection (3) and predict neo-LVOT geometry (1), but identification of at-risk patients remains a challenge.

Transesophageal echocardiography (TEE) is well established in predicting systolic anterior motion following mitral valve surgery, and 3-dimensional (3D) TEE has been used to assess dynamic LVOTO in hypertrophic cardiomyopathy (4). Although its use is described in transcatheter MV replacement (5), TEE has not been investigated for predicting LVOTO following MViV. In this retrospective case series, we used 3D TEE to assess the proximity of MV replacement struts to the intraventricular septum (IVS) and sought to determine the association between this distance and post-ViV LVOT gradients.

We retrospectively studied 17 consecutive MViV patients from July 2012 to April 2016. The proximity of MV bioprosthetic struts to the septum (S-Sept) was assessed off-line in mid-systole using QLab software (Philips Healthcare, Inc., Andover, Massachusetts). To obtain this measurement, we aligned multiplanar reconstruction planes to correspond with midesophageal long-axis (sagittal), aortic valve short-axis (coronal), and transgastric basal short- axis (transverse) TEE views. These planes were then repositioned to intersect at the tip of the strut most proximal to the IVS. The S-Sept distance was subsequently measured in the long-axis plane (**Figure 1**). A mean pressure gradient increase >10 mm Hg was considered significant LVOTO.

Comparison of S-Sept distances with post-ViV LVOTO was assessed by using an assumption-free Wilcoxon sum-ranked test. Categorical variables were compared using Fisher exact test. All tests were 2-sided with a p value of 0.05 based on risk ratio test. The statistical analyses were performed using R version 3.1.2 software (R Foundation for Statistical Computing, Vienna, Austria).

Sixteen patients had 3D TEE gated acquisition datasets adequate for analysis (72.9 ± 15.7 years of age; 31% male). LVOT gradient increase ranged from 0 to 30 mm Hg (mean increase of 7.7 ± 8.9 mm Hg) following MViV. Four patients had an LVOT gradient increase >10 mm Hg following MViV. S-Sept values ranged from 2.7 to 17.6 mm. Pre-MViV S-Sept distances were significantly reduced in patients who developed

increased LVOT pressure gradients (5.3 ± 1.9 mm vs. 11.6 ± 3.4 mm, respectively; p = 0.002). No significant associations were identified between LVOTO and age (66.5 ± 23.7 vs. 75.0 ± 12.8, respectively; p = 0.35), pericardial surgical valve (n = 2 vs. n = 8, respectively; p = 0.60), size of surgical valve (27.5 ± 1.0 mm vs. 26.1 ± 1.3 mm, respectively; p = 0.11), or size of transcatheter valve (26.75 ± 1.50 mm vs. 25.75 ± 2.37 mm, respectively; p = 0.35).

This pilot study found a strong association between reduced S-Sept values and LVOTO. The incidence of LVOTO was notably high, and all patients demonstrating LVOTO had pre-MViV S-Sept distances <7.5 mm. This finding supports that of previous work suggesting that struts and deflected leaflets of the existing bioprosthesis constrain neo-LVOT dimensions following MViV (1). Although additional anatomic factors likely contribute to obstruction, this study suggests that there is a critical proximity threshold of the existing mitral bioprosthesis to the IVS below which obstruction may occur. Conceptually, S-Sept approximates the projected short-axis width of the neo-LVOT as previously described in other imaging modalities (1,2).

In conclusion, pre-MViV S-Sept quantifies the spatial relationship between existing MV bioprosthetic struts and the IVS. This preliminary study identified a strong association between proximity of these structures and elevated LVOT gradients following MViV and supports the role of 3D TEE in these procedures. Research in larger populations and correlation of echocardiographic measurements with CT imaging is warranted to solidify the role of echocardiography in risk stratification during MViV procedures.

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Cardiac CTA for Evaluation of Prosthetic Valve Dysfunction

The objective of the study was to evaluate the accuracy of cardiac computed tomography angiography (CTA) for the diagnosis of prosthetic valve dysfunction (PVD) compared with surgery.

Patients after heart valve repair who were referred for clinically indicated CTA (coronary artery or bypass graft evaluation, suspected PVD with or without paravalvular involvement, or other surgical planning) were included in our retrospective multicenter study (4 centers). All patients underwent surgery. CTA was compared to transesophageal echocardiography (TEE) in a subset of patients who had Core-Lab TEE within 8 days, using a standardized protocol (1) by an observer with >10 years of experience.

A 64- or 128-slice CTA was performed, and images were transferred to the Core-Lab. Multiphase data sets (entire cardiac cycle) were analyzed by 2 independent and blinded observers (>10 years' and >1 year of experience) by using multiplanar reformations (MPR), 3-dimensional volume rendering technique (VRT) and 4-cine loops for:

1. paravalvular leakage: visible contrast agent outflow at the annulus or from above to below (<1 cm);
2. pseudoaneurysm: round cavity of >1 cm filled with contrast agent;
3. paravalvular abscess: dense paravalvular infiltration with 0 to 40 Hounsfield units (HU) with or