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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REFERENCES

1. Blanke P, Naoum C, Dvir D, et al. Predicting LVOT obstruction in transcatheter mitral valve implantation: concept of the Neo-LVOT. J Am Coll Cardiol Img 2016 Mar 9 [E-pub ahead of print].

2. Blanke P, Naoum C, Webb J, et al. Multimodality imaging in the context of transcatheter mitral valve replacement: establishing consensus among modalities and disciplines. J Am Coll Cardiol Img 2015;8:1191–208.

3. Blanke P, Dvir D, Cheung A, et al. Mitral annular evaluation with CT in the context of transcatheter mitral valve replacement. J Am Coll Cardiol Img 2015;8:612–5.

4. Cummisford KM, Manning W, Karthik S, Mahmood FU. 3D TEE and systolic anterior motion in hypertrophic cardiomyopathy [letter]. J Am Coll Cardiol Img 2010;3:1083–4.

5. Abdul-Jawad Altisent O, Dumont E, Dagenais F, et al. Initial experience of transcatheter mitral valve replacement with a novel transcatheter mitral valve: procedural and 6-month follow-up results. J Am Coll Cardiol 2015;66:1011–9.

Cardiac CTA for Evaluation of Prosthetic Valve Dysfunction

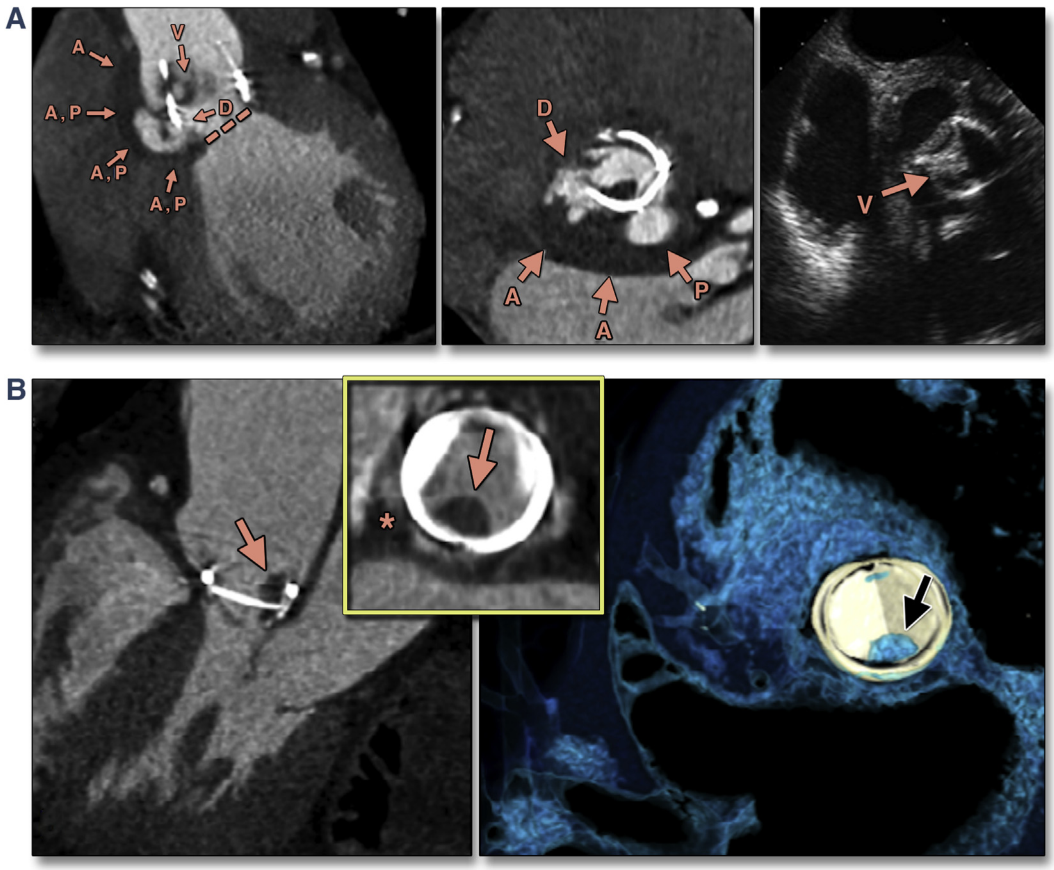
The objective of the study was to evaluate the accuracy of cardiac computed tomography angiography (CTA) for the diagnosis of prosthetic valve dysfunction (PVD) compared with surgery.

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

FIGURE 1 Prosthetic Valve Dysfunction



(A) A 79-year-old man with an infected bioprosthesis. CTA (left/mid) shows paravalvular abscess, A; pseudoaneurysm, P; dehiscence, D; and vegetation, V. Two-dimensional TEE is shown **(right)**. **(B)** A 72-year-old man with a mechanical prosthesis experiencing increased transvalvular pressure gradient. CTA is shown as mixed thrombus/pannus **(arrow)**, MPR **(left)** and 3D-VRT **(right)**. CTA = computed tomography angiography; MPR = multiplanar reformations; TEE = transesophageal echocardiography; VRT = volume rendering technique.

without a surrounding layer of tissue with contrast uptake ("definite") or ("uncertain" >40 HU);

4. mass: hypodense lesion ("vegetation," "thrombus/pannus," or "unclear");
5. dehiscence: loosening of the prosthesis anchor within the annulus (>10°);
6. structural bioprosthetic valve degeneration, leaflet thickening with or without calcification, and "restricted leaflet motion"; and
7. mechanical "stuck valve," resulting in <70° leaflet opening angle.

A total of 51 patients (65.4 ± 12.1 years of age; 23.5% female) with 58 prosthetic heart valves (PHV) (37.5% mechanical, 57.1% bioprosthetic, 5.4% mitral annuloplasty) were included. The time interval between CTA and surgery was 29.2 ± 42.6 days and 4.06 ± 2.8 days between TEE and CTA. Mean PHV age was 7.7 ± 5.2 years (range 0.5 to 27.0 years), and infection rate was 29.4%.

CTA VERSUS SURGERY (N = 51)

The concordance of CTA for diagnosis of PVD was kappa = 0.81 (95% confidence interval [CI]: 0.54 to 1.1) per patient and a kappa = 0.93 (95% CI: 0.83 to 1.03) per lesion.

CTA detected 12 of 13 paravalvular leaks (92.3%) and 10 of 10 pseudoaneurysms (100%). Two pseudoaneurysms were not visualized by TEE (n = 1 large cranial extension/ascending aorta; n = 1 basal/posterior mitral annulus).

CTA identified 10 abscesses (4 false positives rated as "uncertain"), whereas ^{18}F-labeled fluorodeoxyglucose positron emission tomography (2) correctly excluded 2 abscesses.

CTA diagnosed 22 of 25 masses (88%; 13 thrombi/pannus, 8 vegetations, and 1 unclear (ruptured chordae with retracted papillary muscle). Six panni could not be visualized by TEE due to metal reverberation artifacts, although an increased transvalvular pressure gradient was observed. Two panni (n = 1 patient of with 2 bioprosthetic valves) were incorrectly diagnosed by CTA as a "beam hardening artifact" (2 mm) and vegetation (3 mm size), respectively.

Twelve of 12 dehiscences (100%) were correctly diagnosed by CTA. In 4 patients, the full circumferential extent was underestimated by TEE, although "paravalvular leak" was reported.

Sixteen of 17 instances of structural bioprosthetic valve degeneration (94.1%) were detected by CTA, as were 2 of 2 mechanical "stuck valves" (100%) and 3 of 3 abnormalities (100%) after mitral annuloplasty, respectively.

CTA AND TEE VERSUS SURGERY (N = 23)

The accuracy of TEE was c = 0.735 (95% CI: 0.54 to 0.88) and c = 0.912 (95% CI: 0.74 to 0.98; p = 0.003, receiver operating characteristic analysis) for CTA.

In summary, our data show a high accuracy of CTA for detecting PVD, using surgery as the reference standard, particularly for the assessment of paravalvular pathologies (paravalvular leakage, abscess, pseudoaneurysm, or dehiscence) (**Figure 1A**) and identification of thrombi/pannus. CTA further clarified the cause of increased transvalvular pressure gradients (**Figure 1B**, thrombus/pannus) on echocardiography. CTA added value to 2-dimensional TEE for the visualization of the full circumferential extent of dehiscence. In addition, CTA allowed for complementary evaluation of native coronary arteries and bypass grafts.

The study was limited by the absence of 3-dimensional TEE, which should be superior to 2-dimensional TEE for PHV visualization and diagnostic performance.

In conclusion, we advocate TEE as the primary imaging tool for PVD in alignment with the American Heart Association scientific statement (3), with CTA as part of a multimodality diagnostic work-up, with specific recommendations for suspected paravalvular involvement, to characterize pathologies and to fully define the involved anatomic territory; unclear PHV dysfunction on TEE (e.g., increased pressure gradient) without a morphological correlate for thrombus/pannus detection; and PHV mass characterization (thrombus/pannus, vegetation vs. calcification). In view of the high risk of PHV revision surgery, multimodality imaging may be justified in these subgroups.

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REFERENCES

1. Zoghbi WA, Chambers JB, Dumesnil JG, et al. Recommendations for evaluation of prosthetic valves with echocardiography and Doppler ultrasound. J Am Soc Echocardiogr 2009;22:975–1014.

2. Saby L, Laas O, Habib G, et al. Positron emission tomography/computed tomography for diagnosis of prosthetic valve endocarditis: increased valvular (18)F-fluorodeoxyglucose uptake as a novel major criterion. J Am Coll Cardiol 2013;61:2374–82.

3. Baddour LM, Wilson WR, Bayer AS, et al. Infective endocarditis in adults: diagnosis, antimicrobial therapy, and management of complications: a scientific statement for healthcare professionals from the AHA. Circulation 2015;132:1435–86.

^{123}I-MIBG Scintigraphy in the Subacute State of Takotsubo Cardiomyopathy

I read with attention the article by Christensen et al. (1) titled "^{123}I-MIBG scintigraphy in the subacute state of Takotsubo cardiomyopathy." In this article, the authors studied 32 patients with Takotsubo