

Percutaneous Closure of 2 Paravalvular Leaks and a Gerbode Defect

after Mitral Valve Replacement for
Infective Endocarditis

Jorge Peñalver, MD
Wassim Shatila, MD
Guilherme V. Silva, MD, FACC

Surgical valve replacement after infective endocarditis can result in local destructive paravalvular lesions.

A 30-year-old woman with infective endocarditis underwent mitral valve replacement that was complicated postoperatively by 2 paravalvular leaks. During percutaneous closure of the leaks, a Gerbode defect was also found and closed. We discuss our patient's case and its relation to others in the relevant medical literature. To our knowledge, we are the first to describe the use of a percutaneous approach to close concomitant paravalvular leaks and a Gerbode defect. (Tex Heart Inst J 2017;44(2):153-6)

Paravalvular leak (PVL) can be a severe sequela of surgical cardiac-valve replacement. Other defects and abnormal communications can be caused by manipulation, inflammation, and friability of the surrounding tissue. In patients who are poor surgical candidates, percutaneous closure of PVLs has proved to be feasible. Imaging techniques are helpful in planning the procedure and in navigating repair devices. We present the case of a patient with infective endocarditis in whom we performed percutaneous closure of 2 PVLs and a Gerbode defect after surgical mitral valve replacement.

Key words: Cardiac catheterization/instrumentation/methods; endocarditis, bacterial/complications; heart valve diseases/diagnostic imaging; heart valve prosthesis implantation/methods; mitral valve insufficiency/surgery; postoperative complications; risk factors; treatment outcome

From: Department of Cardiology (Drs. Peñalver, Shatila, and Silva), Texas Heart Institute; and Department of Medicine, Section of Cardiology (Drs. Shatila and Silva), Baylor College of Medicine; Houston, Texas 77030

Address for reprints: Guilherme V. Silva, MD, Baylor College of Medicine, 6620 Main St., Suite 1225, Houston, TX 77030

E-mail: gvsilva@bcm.edu

© 2017 by the Texas Heart® Institute, Houston

Case Report

In June 2014, a 30-year-old woman with bacterial endocarditis underwent mitral valve replacement with use of a 27-mm mechanical valve (St. Jude Medical, Inc.; St. Paul, Minn). Postoperatively, she displayed symptoms of heart failure (New York Heart Association functional class III). A transesophageal echocardiogram (TEE) showed severe paraprosthetic valvular regurgitation. Medical management was unsuccessful, so we considered percutaneous closure of the PVL. Repeat TEE showed a semilunar leak in the anterosseptal portion of the mitral commissure, between the left atrial appendage and the aorta (Fig. 1). A cardiac ECG-gated computed tomographic angiogram revealed the defect (diameter, 5.9 × 5.4 mm; cross-sectional area, approximately 0.3 cm²) between the aortic root and the mitral prosthesis (Fig. 2).

The patient was placed under general anesthesia for percutaneous closure of the leak. An intraprocedural TEE revealed a second mild-to-moderate PVL near the ventricular anterior septum (Fig. 3). We attained femoral access and made a transeptal puncture with use of an AGILIS™ NxT Steerable Introducer deflectable-tip sheath (St. Jude Medical). We crossed the newly identified anterior leak, using an angled 0.035-in Glidewire® Hydrophilic Coated Guidewire (Terumo Medical Corporation; Somerset, NJ). A 6 × 6-mm AMPLATZER™ Duct Occluder II (St. Jude Medical) did not fit, so we deployed a 14-mm AMPLATZER™ Vascular Plug (AVP) II (St. Jude Medical). Subsequently, we crossed the anterosseptal PVL with use of an angled 0.035-in STORQ® Steerable Guidewire (Cordis, a Cardinal Health company; Fremont, Calif) and deployed a 12-mm AVP II. Adequate function of both prosthetic valves was confirmed when TEE showed no increase in the transmitral gradients.

Upon further imaging, we identified a significant shunt from the left ventricle into the right atrium—a Gerbode defect (Fig. 4). The patient's right atrial pressure was 24 mmHg. After we crossed the defect with use of an 0.035-in STORQ guidewire,

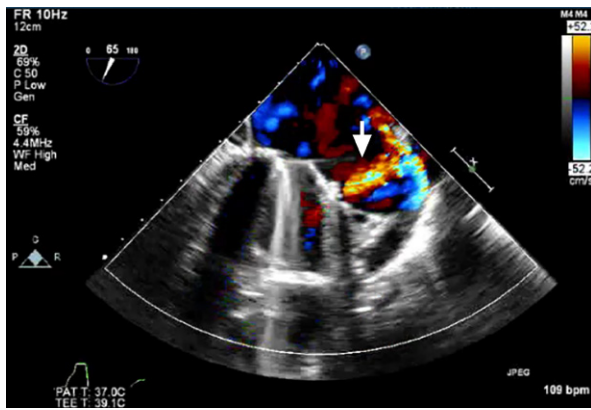


Fig. 1 Preprocedural transesophageal echocardiogram (color-flow Doppler mode) shows the semilunar paravalvular leak (arrow) in the anteroseptal portion of the mitral commissure, between the left atrial appendage and the aorta.

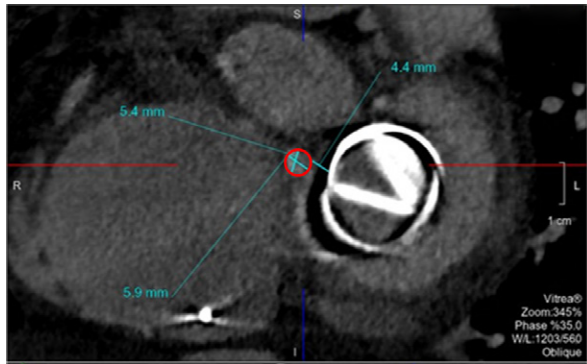


Fig. 2 Electrocardiographic-gated computed tomographic angiogram shows a 5.9 × 5.4-mm paravalvular leak (red circle) between the aortic root and the prosthetic mitral valve.

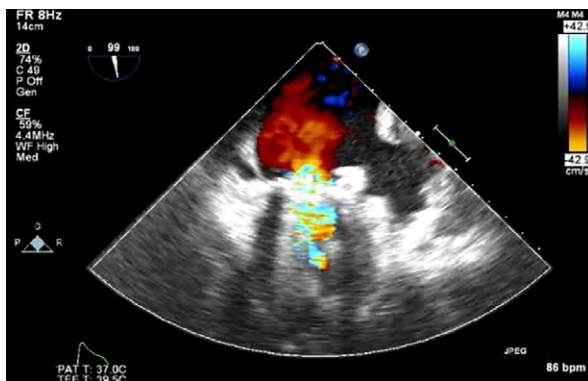


Fig. 3 Intraprocedural transesophageal echocardiogram (midesophageal 2-chamber view in color-flow Doppler mode) shows the second paravalvular leak.

Supplemental motion image is available for [Figure 3](#).

we placed a 7-mm AVP IV device (St. Jude Medical), which did not effectively close the shunt. We then introduced a 110-cm Flexor® Shuttle® 6F guiding sheath

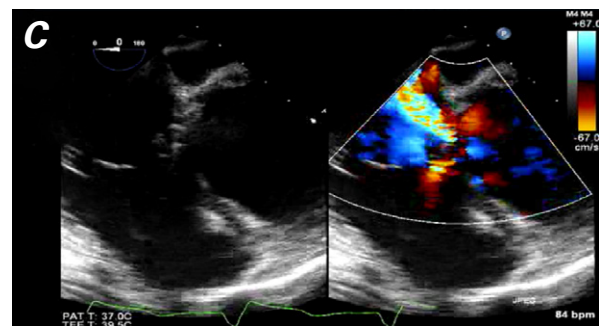
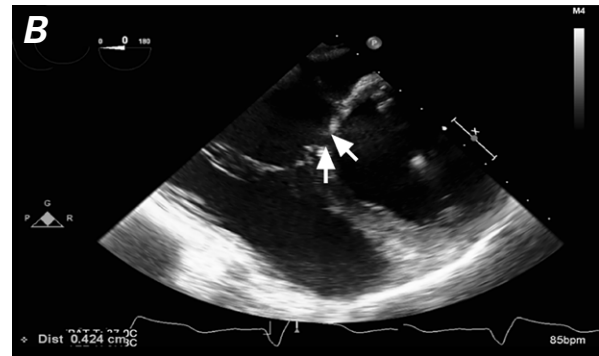
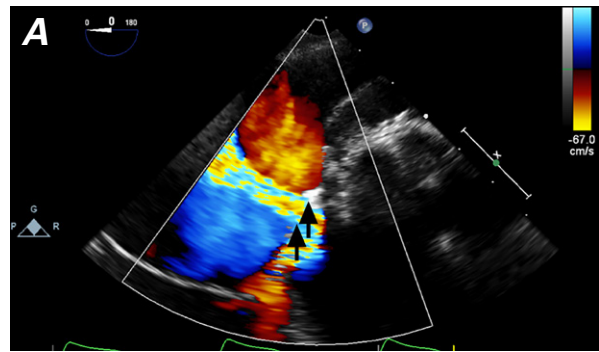


Fig. 4 Transesophageal echocardiograms (midesophageal 4-chamber views). **A)** Blood flow (blue, in color-flow Doppler mode) is seen through the Gerbode defect (arrows). **B)** Standard image shows the 0.424-cm Gerbode defect. **C)** Images with less zooming; color-flow Doppler mode shows blood flow from the left ventricle through the Gerbode defect into the right atrium.

Supplemental motion image is available for [Figure 4C](#).

(Cook Medical, Inc.; Bloomington, Ind) over the STORQ guidewire into the left ventricle and deployed an 8-mm AMPLATZER™ VSD Occluder (St. Jude Medical). This nearly abolished the shunt (Figs. 5 and 6), and the right atrial pressure decreased to 10 mmHg. The patient tolerated the procedure well.

Four days postprocedurally, TEE showed a severely enlarged left atrium (>39 mL/m²) and global depression of right ventricular systolic function; in comparison with previous findings, the mitral regurgitation had decreased in severity. During the patient's hospital stay, self-resolving hemolysis developed and was managed medically. As of March 2017, she had not had a repeat hemolytic event or been hospitalized.

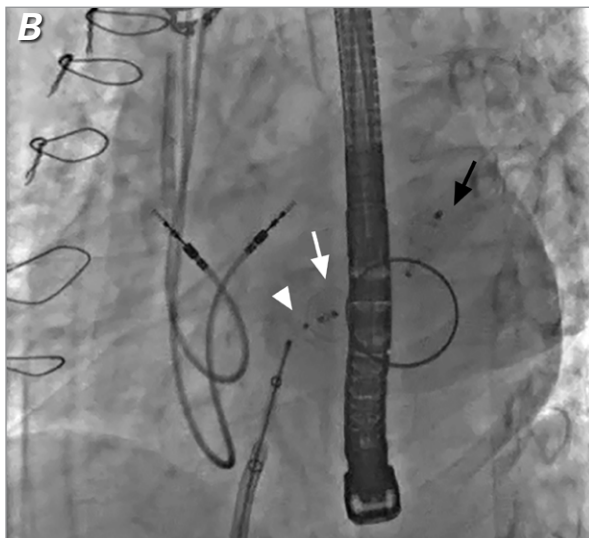
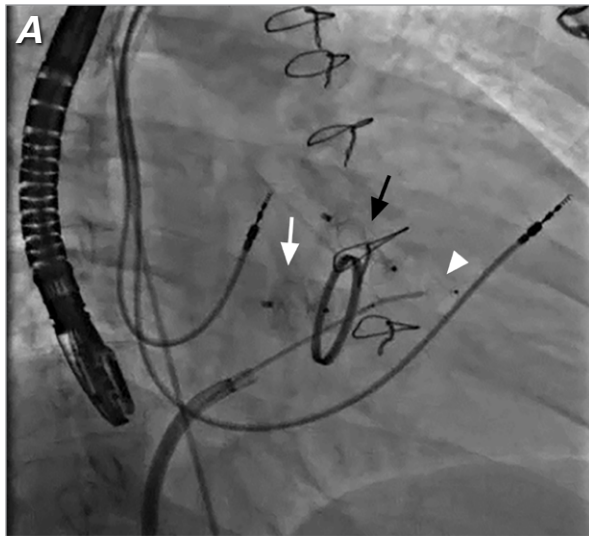


Fig. 5 Fluoroscopic images show the Gerbode defect (arrowheads) **A**) after failed deployment of a 7-mm AMPLATZER Vascular Plug (AVP) IV device, and **B**) upon deployment of an 8-mm AMPLATZER VSD Occluder. Also seen are the 14-mm AVP II used to close the anterolateral leak (black arrows) and the 12-mm AVP II used to close the anteroseptal leak (white arrows). **C**) Final image shows the vascular plugs in place and deployment of the VSD occluder.

Supplemental motion image is available for [Figure 5C](#).

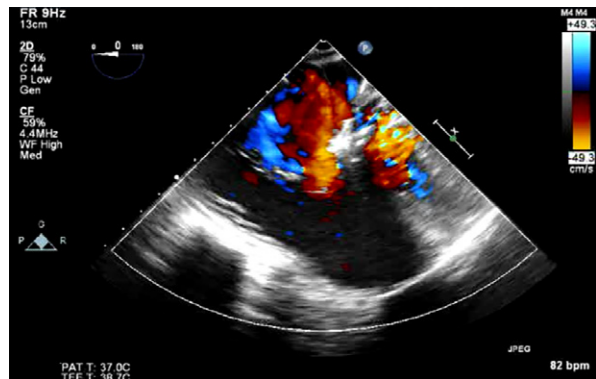


Fig. 6 Intraprocedural transesophageal echocardiogram (color-flow Doppler mode) shows the devices deployed in the corrected paravalvular leaks and Gerbode defect.

Supplemental motion image is available for [Figure 6](#).

Discussion

The reported incidence of PVL after surgical mitral valve replacement is 7% to 17%.^{1,2} Most PVLs are small and clinically silent; however, 1% to 5% of patients have significant PVL associated with hemolysis, endocarditis, or heart failure.³ Surgical repair is recommended for PVL, but reoperation is associated with a mortality rate of approximately 16%, which rises upon further surgical attempts.⁴ In 1992, Hourihan and associates⁵ reported the first transcatheter percutaneous closures in patients with aortic PVL; since then, this approach has often been a viable alternative for high-risk patients with this sequela. Although reported success rates for percutaneous closure range from 60% to 90%, up to 40% of patients with PVL might need reintervention.³ Device deployment failure, device interference with neighboring structures (such as valve leaflets), residual leaks, and device embolization are reasons for unsuccessful closure.^{3,5} Various devices approved for other pathophysiologic conditions have been used off-label for treating PVL, and AMPLATZER devices are among those used most frequently.⁶

In our patient, we also diagnosed a Gerbode defect and closed it percutaneously. This anomaly was first reported by Buhl⁷ in 1854 and cited by Meyer⁸ in 1857. Gerbode,⁹ assisted by colleagues, was first to repair this type of shunt successfully. Surgery is the treatment of choice; however, percutaneous closure with septal occluders has been used as an alternative.^{10,11} Sinisalo and colleagues¹⁰ and Rothman and associates¹² reported using AMPLATZER Duct, VSD, and ASD Occluders that had waist diameters slightly larger than the diameters of their patients' Gerbode defects. In our patient, closure with use of a 7-mm AVP IV device failed; an 8-mm AMPLATZER VSD Occluder better fit the anatomy of the defect.

To our knowledge, this is the first report of using a percutaneous approach to close concomitant PVLs and a Gerbode defect.

Acknowledgment

We thank Sonya E. Fogg, MLS (Manager, Library and Learning Resource Center, Texas Heart Institute), for verifying and providing links to our historical references.^{7,8}

References

1. Hammermeister K, Sethi GK, Henderson WG, Grover FL, Oprian C, Rahimtoola SH. Outcomes 15 years after valve replacement with a mechanical versus a bioprosthetic valve: final report of the Veterans Affairs randomized trial. *J Am Coll Cardiol* 2000;36(4):1152-8.
2. Ionescu A, Fraser AG, Butchart EG. Prevalence and clinical significance of incidental paraprosthetic valvar regurgitation: a prospective study using transoesophageal echocardiography. *Heart* 2003;89(11):1316-21.
3. Pate GE, Al Zubaidi A, Chandavimol M, Thompson CR, Munt BI, Webb JG. Percutaneous closure of prosthetic paravalvular leaks: case series and review. *Catheter Cardiovasc Interv* 2006;68(4):528-33.
4. Echevarria JR, Bernal JM, Rabasa JM, Morales D, Revilla Y, Revuelta JM. Reoperation for bioprosthetic valve dysfunction. A decade of clinical experience. *Eur J Cardiothorac Surg* 1991;5(10):523-7.
5. Hourihan M, Perry SB, Mandell VS, Keane JF, Rome JJ, Bittl JA, Lock JE. Transcatheter umbrella closure of valvular and paravalvular leaks. *J Am Coll Cardiol* 1992;20(6):1371-7.
6. Kim MS, Casserly IP, Garcia JA, Klein AJ, Salcedo EE, Carroll JD. Percutaneous transcatheter closure of prosthetic mitral paravalvular leaks: are we there yet? *JACC Cardiovasc Interv* 2009;2(2):81-90.
7. Buhl. Kommunikation der linken Herzkammer mit dem rechten Vorhofe [in German]. *Zeitschrift für rationelle Medizin, N.F.* 1854;5(1):1-8. Available from: <https://hdl.handle.net/2027/mdp.39015023952511?urlappend=%3Bseq=9> [cited 2017 Mar 14].
8. Meyer H. Über angeborene Enge oder Verschluss der Lungenarterienbahn [in German]. *Arch Pathol Anat Physiol Klin Med* 1857;12(6):532. Available from: <https://hdl.handle.net/2027/chi.77590184?urlappend=%3Bseq=550> [cited 2017 Mar 14].
9. Gerbode F, Hultgren H, Melrose D, Osborn J. Syndrome of left ventricular-right atrial shunt; successful surgical repair of defect in five cases, with observation of bradycardia on closure. *Ann Surg* 1958;148(3):433-46.
10. Sinisalo J, Sreeram N, Qureshi SA. Transcatheter closure of acquired left ventricle to right atrium shunts. *Catheter Cardiovasc Interv* 2013;82(6):E809-14.
11. Trehan V, Ramakrishnan S, Goyal NK. Successful device closure of an acquired Gerbode defect. *Catheter Cardiovasc Interv* 2006;68(6):942-5.
12. Rothman A, Galindo A, Channick R, Blanchard D. Amplatz device closure of a tortuous Gerbode (left ventricle-to-right atrium) defect complicated by transient hemolysis in an octogenarian. *J Invasive Cardiol* 2008;20(9):E273-6.