Techniques

Retrograde Transcatheter Closure of Mitral Paravalvular Leak through a Mechanical Aortic Valve Prosthesis:

2 Successful Cases

Daxin Zhou, MB
Wenzhi Pan, MD
Lihua Guan, MB
Juying Qian, MD
Junbo Ge, MD, FACC

The presence of a mechanical aortic valve prosthesis has been considered a contraindication to retrograde percutaneous closure of mitral paravalvular leaks, because passing a catheter through the mechanical aortic valve can affect the function of a mechanical valve and thereby lead to severe hemodynamic deterioration. We report what we believe are the first 2 cases of retrograde transcatheter closure of mitral paravalvular leaks through a mechanical aortic valve prosthesis without transseptal or transapical puncture. Our experience shows that retrograde transcatheter closure of mitral paravalvular leaks in this manner can be an optional approach for transcatheter closure of such leaks, especially when a transapical or transseptal puncture approach is not feasible. This technique might also be applied to other transcatheter procedures in which there is a need to pass a catheter through a mechanical aortic valve prosthesis. ***(Tex Heart Inst J 2016;43(2):137-41)***

Key words: *Heart valve diseases; heart valve prosthesis; mitral valve, mechanical; paravalvular leaks/transcatheter closure*

From: *Department of Cardiology, Shanghai Institute of Cardiovascular Diseases, Zhongshan Hospital, Fudan University, Shanghai 200032, People's Republic of China.*

Drs. Guan, Pan, and Zhou contributed equally to this work.

Address for reprints: *Junbo Ge, MD, Department of Cardiology, Zhongshan Hospital, 180 Fenglin Rd., Shanghai 200032, PRC*

E-mail: *ge.junbo2@zs-hospital.sh.cn*

Transcatheter closure of paravalvular leaks is an attractive treatment option in symptomatic patients who are at high risk for repeat surgery.[1] Yet the presence of a mechanical aortic valve (AV) prosthesis has been considered a contraindication to retrograde percutaneous closure of a mitral paravalvular leak (MPVL).[2,3] In one case of MPVL with a mechanical AV prosthesis,[4] a retrograde approach was attempted but failed, because one of the discs of the prosthesis was repeatedly blocked as the catheter advanced through the AV prosthesis, which led to severe hemodynamic deterioration. Other investigators have reported the feasibility of transcatheter closure of MPVL through a transseptal puncture approach, by constructing an arteriovenous wire loop through a mechanical AV.[5]

Here we report what we believe are the first 2 cases of transcatheter closure of MPVL in the presence of a mechanical AV without transseptal or transapical puncture. To our knowledge, the method discussed here has not been reported in patients with MPVL and a mechanical AV prosthesis.

Technique

The procedure was carried out with use of local anesthesia in each of 2 female patients. First, the effect of a 0.035-in wire and a 6F catheter on the function of the mechanical AV prosthesis was tested via an antegrade approach to transcatheter closure of an MPVL (Fig. 1). We found that the wire itself caused only minor aortic regurgitation and slightly decreased the patients' blood pressure (BP). When the 6F catheter was passed through the mechanical AV, it completely blocked one of the prosthetic discs and caused severe aortic regurgitation and moderate hypotension; yet the BP could be maintained at a relatively stable level (systolic BP, >80 mmHg) and the patients could tolerate the regulation and drop in BP for at least 5 minutes. Then we attempted a retrograde approach to transcatheter closure of MPVL. In doing so, we crossed the mechanical AV with a 0.035-in × 260-cm hydrophilic wire (Terumo Inc.; Tokyo, Japan). To evaluate the MPVL, we next performed angiography using a 6F pigtail catheter (Fig. 2A). The MPVL was crossed by a 0.035-in × 260-cm hydrophilic wire (Terumo) with

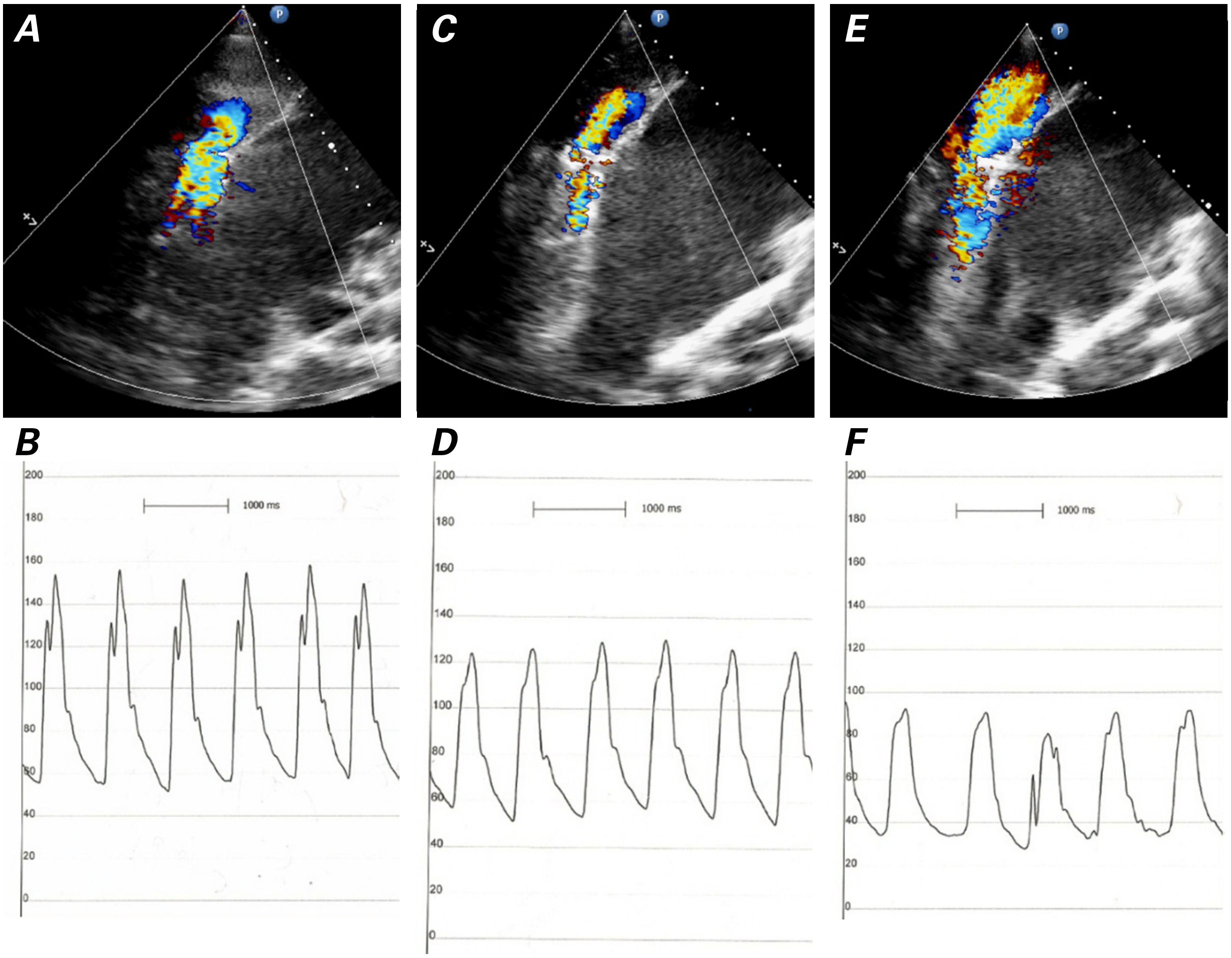

Fig. 1 *Two-dimensional transthoracic echocardiograms in color-flow Doppler mode, alternating with blood-pressure graphs, show the effect on the function of a mechanical aortic valve of passing a wire or catheter retrograde. At baseline,* ***A****) trivial aortic regurgitation existed and* ***B****) the blood pressure was not low. When a 0.035-in wire passed through the aortic valve,* ***C****) minor aortic regurgitation occurred and* ***D****) blood pressure fell slightly. When a 6F catheter passed through the aortic valve,* ***E****) aortic regurgitation turned moderate-to-severe, and* ***F****) blood pressure severely decreased.*

the guidance of a Judkins right 4 diagnostic catheter (Fig. 2B). When we could not cross the MPVL within 5 minutes upon our first attempt, we withdrew the diagnostic catheter into the aorta to allow the patient's BP to rise for several minutes; then we made a further attempt. After crossing the MPVL, we exchanged this wire for a 0.038-in × 260-cm Super Stiff® wire (Boston Scientific Corporation; Natick, Mass), the tip of which we carefully shaped before we placed it in the left atrium. A vascular plug (Shanghai Shape Memory Alloy Ltd.; Shanghai, PRC) was loaded into an 8F × 110-cm Flexor® Ansel Guiding Sheath (Cook Medical Inc.; Bloomington, Ind) and delivered to the left atrium, then released and positioned in the channel of the MPVL (Fig. 2C). Echocardiography was performed to analyze the efficacy of the closure, the stability of the plug, and the functioning of the prosthetic leaflets. If these were satisfactory, we released the plug. These steps (delivering the guiding sheath to the left atrium through the AV, then delivering, opening, and releasing the vascular plug) should be performed in under 5 minutes, in order to avoid severe deterioration of the patient's hemodynamic condition. If our first attempt reached the 5-minute limit without completion, we retracted the equipment and the guiding catheter into the ascending aorta and awaited a further attempt. Upon completion of the procedure, we again performed angiography, this time to evaluate the efficacy of closure (Fig. 2D).

Using the above technique, we successfully treated these 2 patients who had MPVL and mechanical AV prostheses. In each case, we chose not to close the MPVL through a transseptal puncture approach, because of our past failures at transseptal puncture itself, even after many attempts. Nor did we take the transapical approach in these 2 cases, for that would have required the help of cardiac surgeons, and we had not set up a multidisciplinary team. Our department itself had no experience with the transapical approach in the performance of transcatheter procedures.

Table I shows the patients' clinical characteristics and procedural results. Transcatheter closure reduced to trivial the degree of MPVL regurgitation (Fig. 3), and neither patient experienced intraprocedural sequelae. As shown by echocardiography and fluoroscopy, the mechanical AV prostheses were not functionally impaired by the procedure.

Discussion

Mitral paravalvular leak associated with a mechanical AV prosthesis can be closed via the transapical approach or by passing a wire loop through the mechanical AV via the antegrade approach.[4,5] However, because the transapical approach is more traumatic, general anesthesia is needed in its performance; and the antegrade approach via a wire loop requires transseptal puncture, which in itself can induce sequelae.

Here we report what we believe are the first 2 cases of retrograde transcatheter closure of MPVL through a mechanical AV prosthesis without transseptal or transapical puncture. Compared with those last 2 methods, our technique can reduce costs, fluoroscopy times, and sequelae.[5,6] Moreover, the transapical or the transseptal approach might not be feasible in some conditions. We suggest the retrograde transcatheter approach as an optional method.

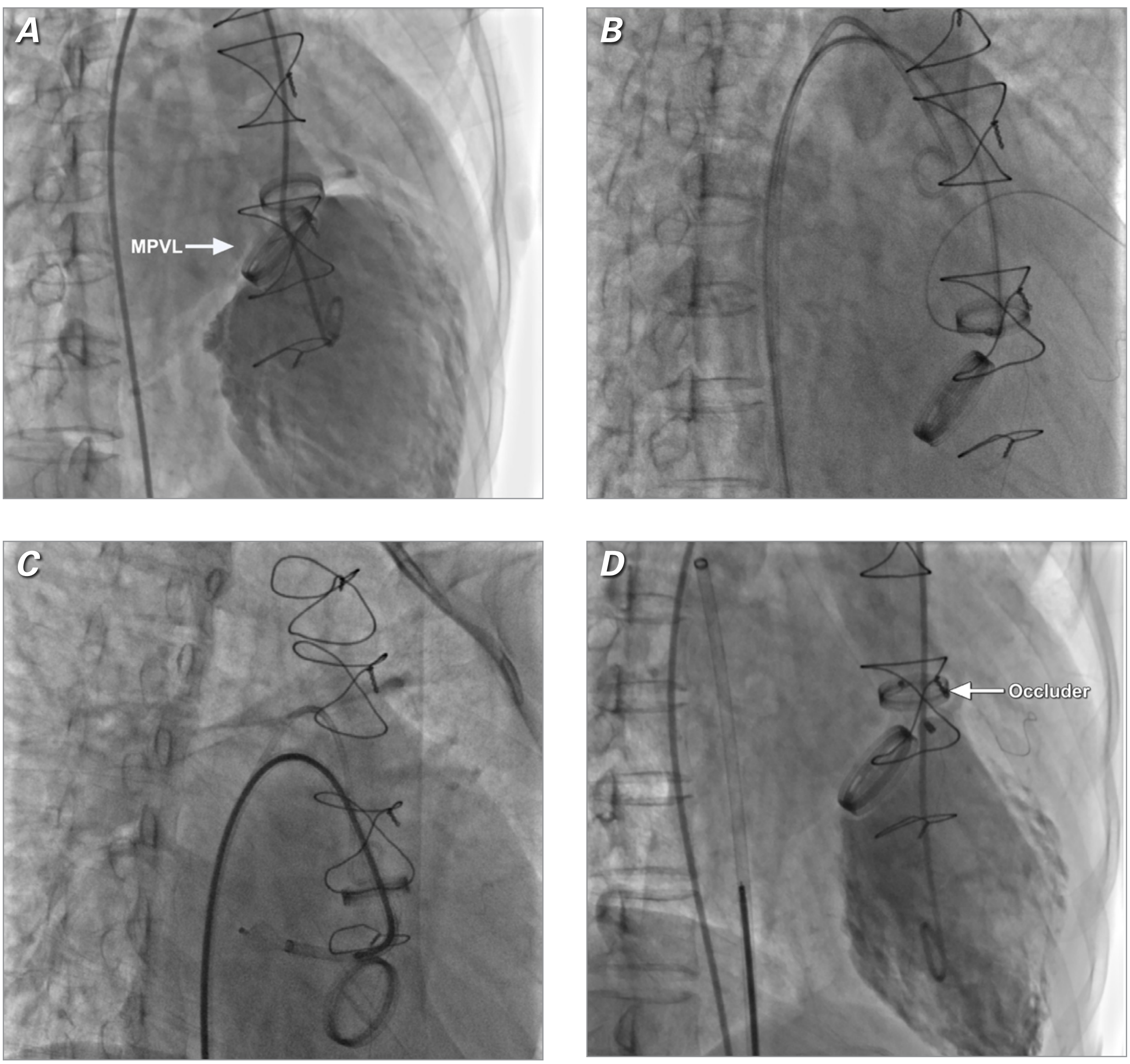

Fig. 2 *Angiograms show the process:* ***A****) evaluating the mitral paravalvular leak (MPVL) with use of a 6F pigtail catheter;* ***B****) crossing the MPVL with a hydrophilic wire with the guidance of a Judkins right 4 catheter;* ***C****) delivering a vascular plug to the left atrium with use of a guiding sheath, and releasing the plug; and* ***D****) evaluating the efficacy of closure.*

TABLE I. Clinical Characteristics and Procedural Results in the 2 Patients

Variable	Patient 1	Patient 2
Sex	Female	Female
Age (yr)	64	46
Time since surgery (yr)	10	1
Aortic prosthesis size (mm)*	21	19
Mitral prosthesis size (mm)*	25	25
Indication	Heart failure	Heart failure
NYHA functional class	II	III
LVEF	0.54	0.50
MPVL localization	Posterolateral	Anterolateral
MPVL size (mm)	8.2	9.2
8F delivery sheath size (cm)	110	110
Occluder size (mm)	16	16
Baseline MR	Moderate-to-severe	Severe
Postprocedural MR	Trivial	Trivial
Baseline AR	Trivial	None
Postprocedural AR	Trivial	None
Fluoroscopy time (min)	22	18
Intraprocedural sequelae	None	None

AR = aortic regurgitation; LVEF = left ventricular ejection fraction; MPVL = mitral paravalvular leak; MR = mitral regurgitation; NYHA = New York Heart Association

*Mechanical bileaflet heart valve (Sorin Group S.p.A; Milan, Italy; now LivaNova PLC; London, UK)

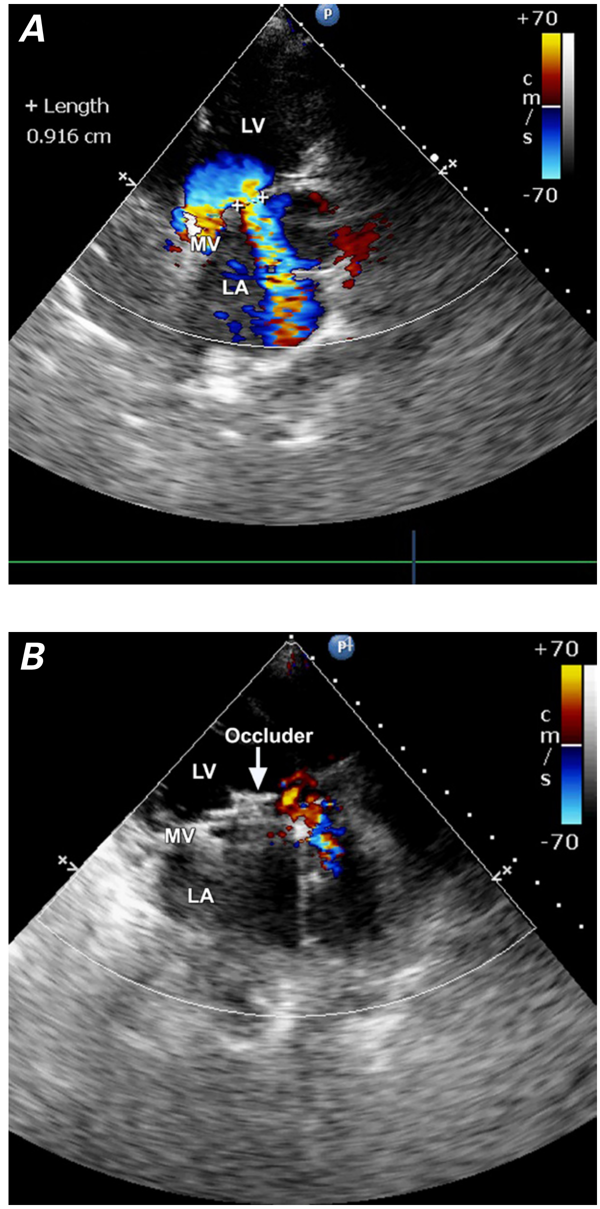

Fig. 3 *After transcatheter closure, 2-dimensional transthoracic echocardiograms in color-flow Doppler mode show the reduction of mitral paravalvular leak regurgitation from* ***A****) severe to* ***B****) trivial.*

LA = left atrium; LV = left ventricle; MV = mitral valve

There is a caveat associated with our suggestion: the patient must be able to tolerate the acute aortic regurgitation and the severe drop in blood pressure associated with the catheter's effect on the function of the mechanical AV prosthesis for up to 5 minutes. The total operative time can of course be much longer. We chose 5 minutes as the cutoff time, because, in our limited experience, a period of at least 4 minutes was required to deliver the guiding sheath to the left atrium through the AV, to deliver and open the occluder, to evaluate the occluder's performance via echocardiography, and to release the occluder. In theory, our technique could be applied to other transcatheter procedures that require passage through a mechanical AV prosthesis. But this would call for an operator with experienced hands and a patient whose cardiac function is good enough to tolerate the procedure.

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