patients were discharged to home and none required reintervention during follow-up. Median postoperative length of hospital stay was much shorter in the robotic surgery group than in the video-assisted surgery group (4 vs 7 days, $P < .001$).

Despite representing the initial experience, which includes the entire learning curve, our results are satisfactory and in line with those of series published by highly experienced centers[4–6] and with our own results for video-assisted mitral valve surgery. We believe that the learning curve was minimized by the extensive previous experience of the entire team with video-assisted surgery, which permitted a very high level of safety and quality from the outset, as shown by the absence of conversions to sternotomy, the superb rate of mitral valve repair, and the low incidence of postoperative complications.

In conclusion, robotic cardiac surgery in selected patients enables the performance of a wide variety of cardiac surgical interventions with excellent results and short postoperative hospital stay. Robotic surgery is currently the least invasive surgical option but involves a highly complex technique with a steep learning curve that can be minimized by extensive prior experience with video-assisted surgery.

FUNDING

Without any external funding.

AUTHORS' CONTRIBUTIONS

E. Sandoval: manuscript drafting and editing of tables and figure. A. Muro: data collection and final revision of the manuscript. R. Navarro: final revision of the manuscript. A. García-Álvarez: final revision of the manuscript. M. Castellà: final revision of the manuscript. D. Pereda: conceptualization, figure editing, critical revision, and final revision of the manuscript.

CONFLICTS OF INTEREST

None of the authors have a conflict of interest to declare in relation to this study.

Elena Sandoval,[a] Anna Muro,[a] Ricard Navarro,[b] Ana García-Álvarez,[c,d] Manuel Castellà,[a] and Daniel Pereda[a,c,*]

[a]*Servicio de Cirugía Cardiovascular, Hospital Clínic, Barcelona, Spain*
[b]*Servicio de Anestesiología, Hospital Clínic, Barcelona, Spain*
[c]*Servicio de Cardiología, Hospital Clínic, Barcelona, Spain*
[d]*Centro de Investigación Biomédica en Red de Enfermedades Cardiovasculares (CIBERCV), Spain*

[*] Corresponding author.
E-mail address: dpereda@clinic.cat (D. Pereda).

Available online 12 May 2023

REFERENCES

1. Carpentier A, Loulmet D, Aupècle B, et al. Computer assisted open heart surgery. First case operated on with success. *C R Acad Sci III.* 1998;321:437–442.
2. Mohr FW, Falk V, Diegeler A, Autschback R. Computer-enhanced coronary artery bypass surgery. *J Thorac Cardiovasc Surg.* 1999;117:1212–1214.
3. Cerny S, Oosterlinck W, Onan B, et al. Robotic Cardiac Surgery in Europe: Status 2020. *Front Cardiovasc Med.* 2021;8:827515.
4. Ascaso M, Sandoval E, Quintana E, Vidal B, Castella M, Pereda D. Early and mid-term outcomes of mitral repair due to leaflet prolapse in a national referral center. *Rev Esp Cardiol.* 2021;74:462–476.
5. Mihaljevic T, Koprivanac M, Kelava M, et al. Value of robotically assisted surgery for mitral valve disease. *JAMA Surg.* 2014;149:679–686.
6. Suri RM, Taggarse A, Burkhart HM, et al. Robotic mitral valve repair for simple and complex degenerative disease. Midterm clinical and echocardiographic quality outcomes. *Circulation.* 2015;132:1961–1968.

https://doi.org/10.1016/j.rec.2023.03.017

Percutaneous transcatheter mitral valve repair: combining devices for challenging anatomies

Reparación percutánea de la válvula mitral: combinación de dispositivos para anatomías difíciles

To the Editor,

Percutaneous heart valve interventions have emerged as an alternative in patients at high or prohibitive risk for surgery. Mitral transcatheter edge-to-edge repair (M-TEER) is currently a well-established treatment for functional mitral regurgitation (MR)[1,2] and can also be considered a valid option in degenerative or acute MR for patients at high risk. M-TEER has, however, procedural limitations[3] in complex anatomies, and no other specific reparative options are currently available. There have been some reports of the use of vascular plugs in combination with M-TEER for challenging anatomies,[4] but the use of Amplatzer Vascular Plug III (AVP III) (Abbott, United States) has been less described. AVP III is specifically designed for paravalvular leak closure but, because of its asymmetrical shape with a thick neck, it is also appropriate for treating localized residual MR jets after M-TEER.[5] We describe our experience of combined treatment with M-TEER and AVP III for challenging mitral anatomies.

Patients treated in our center with M-TEER were retrospectively reviewed to identify those needing a combined therapy with occluders. Patients signed the consented inform for the intervention and all reported data were anonymized.

Since 2012, 242 patients have been treated at our center with M-TEER (MitraClip [Abbott, United States] or PASCAL [Edwards Lifesciences, United States]). Throughout this period, 5 patients required implantation of an additional plug after M-TEER. In addition, although other options are available to treat recurrent MR after edge-to-edge therapy, such as the ELASTA-Clip, we chose this technique because of the presence of a localized MR and the lesser invasiveness of the plug implantation.

The clinical and procedural characteristics of the 5 patients are described in table 1. All of the patients had severe symptomatic MR at the moment of the plug implantation. The patients also had challenging anatomies for M-TEER: *a)* ischemic MR due to papillary muscle rupture with prolapse of the posterior leaflet initially treated with 2 MitraClip NT; *b)* mixed etiology MR with P1 and anterior commissure prolapse with severe calcification at that level; *c)* degenerative MR with a wide prolapse of the anterior leaflet (A2-A3); *d)* combined etiology MR with dilated cardiomyopathy and A2 prolapse with chordal rupture treated with 2 MitaClip NT, new heart failure onset (5.5 years later) due to new A3 prolapse with chordal rupture and interclip MR; *e)* myxomatous degeneration of the mitral valve with prolapse of the posterior leaflet due to chordal rupture.

Table 1
Clinical and procedural characteristics of the treated patients

Patient	#1	#2	#3	#4	#5
Sex and age at 1st intervention	Man, 59 y	Woman, 77 y	Man, 82 y	Man, 70 y	Man, 84 y
Acute MR	Yes	Yes	Yes	Yes	No
Hemodynamic instability	Yes	No	Yes	Yes	No
MR mechanism	Ischemic, papillary muscle rupture	Degenerative, P1 and lateral commissure prolapse	Degenerative, A2-A3 prolapse	Mixed, functional + A2 prolapse	Degenerative, myxomatous degeneration + A2-A3 prolapse
Clips and position (1st intervention)	MitraClip NT x 2 (A2-P2)	MitraClip NT x 1 (A1-P1)	MitraClip XTx2 + NTx1 (A2/A3-P2/P3)	MitraClip NT x 2 (A2-P2)	MitraClip NT x 2 (A2/A3-P2/P3)
Plug implantation (1st intervention)	no	no	AVP III 14x5 mm Medial commissure	no	no
Intervention duration, min	162	106	142	101	67
Initial residual MR	Moderate	Severe	Mild to moderate	Mild	Moderate-severe
Mean gradient after the intervention, mmHg, and HR, bpm	7 (117)	6.5 (96)	4.5 (110)	2 (60)	1.8 (75)
Time to reintervention, mo	11	4	-	66	3
Mechanism of residual MR	Interclip	Commissural prolapse (lateral)	-	A3 prolapse + interclip	Commissural (medial) + central
Clips and position (2nd intervention)	None	None	-	MitraClip NT (A3-P3)	None
Plug implantation (2nd intervention)	AVP III 14 x 5 mm inter-clip	AVP III 14 x 5 mm lateral commissure	-	AVP III 14 x 5 mm inter-clip	AVP III 14 x 5 mm medial commissure
2nd intervention duration, min	85	26	-	157	102
Residual MR (2nd intervention)	Mild to moderate	Mild to moderate	-	Trace	Moderate (central)
Mean gradient after the 2nd intervention, mmHg and HR, bpm	2.8 (59)	4.1 (69)	-	1.7 (68)	5.5 (81)
Maximal follow-up after plug implantation, mo	34	11	-	3	3
Residual MR (follow-up)	Mild to moderate	Moderate	-	Mild	Moderate
Mean gradient at follow-up, mmHg and HR, bmp	2.9 (60)	2.4 (67)	-	1.8 (65)	6 (90)

HR, heart rate, MR, mitral regurgitation.

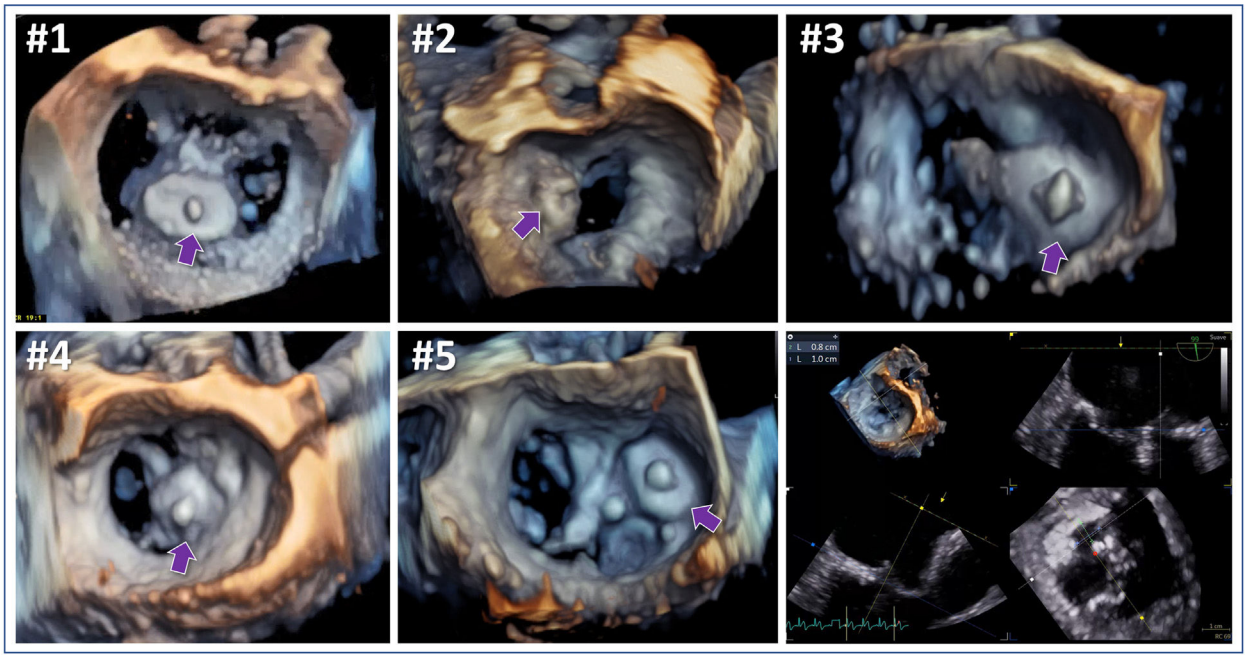

Figure 1. Three dimensional (3D) echocardiographic images of the mitral valve of the patients (#1 to #5) after AVP III implantation. Bottom right panel shows 3D measurements of the orifice to treat patient #2. Purple arrows point to the AVP III device. Pre- and postinterventional echocardiographic videos of patient #1 (video 1A-D of the supplementary data) and #2 (video 2A-D of the supplementary data) are available.

In all except 1 of the patients (n = 4; 80%) AVP III implantation was delayed after M-TEER to promote clip stability after endothelization. Although 3 of these patients presented with acute MR (2 with hemodynamic instability), initial M-TEER was sufficient to stabilize and discharge them (one of them was stable for 5.5 years before requiring reintervention). For delayed interventions, AVP III was implanted (2 interclips and 2 commissural, figure 1) at least 3 months after the initial M-TEER. The intervention was planned with a baseline 3-dimensional measurement of the target area by 3-dimensional TEE (Figure 1 bottom right panel). All 4 interventions were successful with a good acute result that was maintained at the follow-up and with good clinical outcome and no hemolytic anemia (in 1 patient, #5, the residual MR was moderate but originated far from the plug implantation).

Patient #3 (n = 1; 20%) presented with an acute MR secondary to massive flail of the posterior leaflet due to chordae rupture and cardiogenic shock. Although M-TEER was performed, severe residual MR in the medial commissure with hemodynamic instability required implantation of an additional AVP III during the same intervention. Despite initial technical and echocardiographic success, the device embolized in the left atrium within the first 24 hours, requiring percutaneous extraction. The patient died during hospital admission due to hemodynamic instability and sepsis.

The longest interventions were those with clip and plug implantation during the same session (table 1).

In conclusion, the placement of an interclip or commissural AVP III occluder device after M-TEER may be a valid option for patients with challenging anatomies and significant symptomatic residual MR after M-TEER with no additional options. A 3-month delay between M-TEER and AVP III implantations seems to be reasonable to promote clip endothelization and avoid clip dislodgement or plug embolization. Further series will be needed to evaluate the short- and long-term results of these procedural alternative in complex mitral anatomies.

FUNDING

No funding.

AUTORS' CONTRIBUTIONS

L. Sanchis and X. Freixa: conception and design. L. Sanchis, and C.I. Morr: data collection. L. Sanchis: drafting the manuscript. A. Regueiro, C.I. Morr, M. Sitges, X. Freixa: reviewing and editing the final version.

CONFLICTS OF INTEREST

L. Sanchis, A. Regueiro, M. Sitges and X. Freixa are proctors for Abbott. M. Sitges has received consulting fees from Abbott. L Sanchis is associate editor of Rev Esp Cardiol. The journal's editorial procedure to ensure impartial handling of the manuscript has been followed.

APPENDIX. SUPPLEMENTARY DATA

Supplementary data associated with this article can be found in the online version, at https://doi.org/10.1016/j.rec.2023.03.010

Laura Sanchis,[a,b,*] Ander Regueiro,[a,b] Carlos Igor Morr,[a,b] Marta Sitges,[a,b] and Xavier Freixa[a,b]

[a]*Instituto Clínic Cardiovascular, Hospital Clínic, Barcelona, Universitat de Barcelona, Barcelona, Spain*
[b]*Institut d'Investigacions Biomèdiques August Pi i Sunyer (IDIBAPS), Barcelona, Spain*

[*] Corresponding author.
E-mail address: lsanchis@clinic.cat (L. Sanchis).
@lsanchisruiz

Available online 29 March 2023

REFERENCES

1. Stone GW, Lindenfeld J, Abraham WT, et al. Transcatheter Mitral-Valve Repair in Patients with Heart Failure. *N Engl J Med.* 2018;379:2307–2318.
2. Cruz-González I, Estévez-Loureiro R, Barreiro-Pérez M, et al. Mitral and tricuspid valve disease: diagnosis and management. Consensus document of the Section on Valvular Heart Disease and the Cardiovascular Imaging, Clinical Cardiology, and Interventional Cardiology Associations of the Spanish Society of Cardiology. *Rev Esp Cardiol.* 2022;75:911–922.
3. Boekstegers P, Hausleiter J, Baldus S, et al. Percutaneous interventional mitral regurgitation treatment using the Mitra-Clip system. *Clin Res Cardiol.* 2014;103:85–96.
4. Kubo S, Cox JM, Mizutani Y, et al. Transcatheter Procedure for Residual Mitral Regurgitation After MitraClip Implantation Using Amplatzer Duct Occluder II. *JACC Cardiovasc Interv.* 2016;9:1280–1288.
5. Sanchis L, Cepas PL, Pérez Fuentes PR, et al. Amplatzer Vascular Plug III and Interclip Mitral Regurgitation: A Good Alternative When Another Clip Doesn't Fit. *JACC Cardiovasc Interv.* 2021;14:e9–e10.

https://doi.org/10.1016/j.rec.2023.03.010

Initial experience of same-day discharge after transcatheter aortic valve implantation

Experiencia inicial de protocolo ambulatorio de implante percutáneo de válvula aórtica

To the Editor,

Transcatheter aortic valve implantation (TAVI) has become the mainstay treatment for severe symptomatic aortic stenosis in patients older than 75 years. Because this technique is minimally invasive, it reduces both hospital stays and health care resource utilization. The growing number of procedures,[1] however, has placed increasing pressure on coronary care units and cardiology wards. Procedural advances and a better understanding of associated complications have opened a new chapter in which same-day discharge can be safely considered in selected patients undergoing TAVI.[2] The aim of this study was to describe our initial experience with a same-day post-TAVI discharge protocol for pacemaker carriers. Informed consent was obtained from all patients for publication of case details. The study was approved by the ethics committee of our hospital.

We analyzed a 2-month period in which 51 patients underwent TAVI. Three patients (5.8%) were eligible for discharge within the same-day post-TAVI discharge program of the hospital and were included in this study. The inclusion and exclusion criteria and follow-up steps specified in the protocol are shown in Figure 1. The baseline characteristics of the 3 patients discharged on the same