Masters of Cardiothoracic Surgery

Mitral regurgitation improvement after successful atrial fibrillation ablation by using a 3D mapping system

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Atrial functional mitral regurgitation (atrial MR) is caused by a greatly enlarged left atrium (LA) with geometric changes in the mitral apparatus (1,2). Atrial MR is commonly found in patients with persistent atrial fibrillation (AF) and the magnitude of MR is generally mild-moderate. Nevertheless, atrial MR can be progressive, along with long-year LA remodeling, which can cause adverse hemodynamic effect in patients with AF, despite preserved left ventricular (LV) function. Early intervention for AF by catheter ablation is expected to restore the complex mitral geometry, with improvement in atrial MR (3,4).

Clinical vignette

A 73-year-old female presented with palpitations and dyspnea on exertion. Electrocardiogram (ECG) demonstrated an AF rhythm (80–100 bpm), and transthoracic echocardiography revealed atrial MR with LA enlargement and reduced LV function; LA volume, 52 mL; left ventricular end-diastolic dimension/end-systolic dimension (LVDd/s), 49/34 mm; LV ejection fraction (LVEF), 43%; MR volume, 58 mL. Although the degree of atrial MR was significant, we discussed the possibility of LA reverse remodeling after successful catheter ablation and referred her to catheter ablation.

Surgical techniques

Preparation (preprocedural echocardiography): The patient underwent standard transthoracic echocardiography followed by multiplane 2D and real-time 3D-transesophageal echocardiography (TEE) (full-volume mode). Quantitative analysis of the mitral valve (MV) complex was performed using dedicated analysis software. The mitral annular size, MV leaflet surface area, valve tenting/tethering parameters, and coaptation lengths were calculated at mid-systole. The mitral annulus was automatically tracked by the software, and the annular fraction was calculated. Serial changes in the atrial MR after maintaining sinus rhythm were evaluated.

Exposition

The patient underwent extensive proximal pulmonary vein (PV) isolation guided by 3D mapping system. All four PVs were isolated (video clip). Key technical steps of the extensive PV isolation by catheter ablation (CARTO®3 system, Biosense Webster, CA, USA) entail:

(I) As the initial preparation for the 3D mapping, 3D computed tomography (CT) image is fused with an intracardiac echo image by adjusting the positions of aorta and LA.

(II) An ablation catheter is used to determine the magnetic field in the right atrium (RA) under the guidance of the merged CT image. Firstly, define the superior vena cava position and then shift down the catheter to the lower position of the RA. This process allows an operator to identify the visible sheath (VIZIGO® sheath) without fluoroscopic exposure during the procedure.

(III) A guidewire is inserted into the LA by the Brockenbrough procedure under the guidance of

intracardiac echo.

(IV) By using the ablation catheter, the merged images are adjusted to identify the precise position of the LA. The merged LA images are three-dimensionally confirmed.

(V) Extensive PV isolation: in each ablation point, ablation index (derived by the power, contact force, and ablation time) are carefully checked.

(VI) At the esophageal site, ablation with specific high power and short duration is applied to avoid the esophageal injury.

(VII) Disappearance of the PV potential confirms the completion of PV isolation (both right PV and left PV).

(VIII) Final confirmation of the successful PV isolation with no voltage around the isolated PV area is made by the 3D color mapping system.

Completion

The ablation was ended up after confirming both: (I) persistent PV isolation and (II) no AF with induction of non-PV foci by coronary sinus burst pacing (<360 bpm) and a bolus injection of adenosine triphosphate (ATP) during a bolus and/or continuous infusion of isoproterenol (1–5 μg/kg/min).

Comments

Clinical results

In this particular patient, atrial MR was apparently diminished after maintaining sinus rhythm by catheter ablation. LA volume and mitral annular size decreased in both anterior-posterior (AP) and medial-lateral (ML) diameters. 3D-derived annular contraction recovered in 6 months. Leaflet tenting/tethering parameters did not show significant changes in this case. Further improvement in the degree of atrial MR was seen in 1 year after the procedure. Our case shows the positive effect of radiofrequency catheter ablation (RFCA) on the 3D MV apparatus which reduced the degree of atrial MR.

Advantages

This case shows that MV apparatus remodeling can be reversible at a relatively early stage of persistent AF, and early intervention by catheter ablation can prevent progressive MV complex remodeling and thus severe atrial MR in a later stage of the disease. This may reinforce the clinical importance of the early intervention for AF, from the insights of prevention of future heart failure as well as future cardiogenic stroke.

Caveats

Severe atrial MR along with long-year persistent AF, larger LA size and reduced LA function with greater mitral apparatus remodeling are generally considered as a contraindication of RFCA, and MV surgery should be needed to alleviate the hemodynamic deterioration. It should be noted that medical intervention should be provided before considering catheter ablation or surgical intervention for AF patients with significant atrial MR.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

References

1. Lancellotti P, Go YY. Atrial Secondary Mitral Regurgitation: Often Overlooked, But Never Forgotten. JACC Cardiovasc Imaging 2021;14:809-11.
2. Zoghbi WA, Levine RA, Flachskampf F, et al. Atrial Functional Mitral Regurgitation: A JACC: Cardiovascular Imaging Expert Panel Viewpoint. JACC Cardiovasc Imaging 2022;15:1870-82.

3. Gertz ZM, Raina A, Saghy L, et al. Evidence of atrial functional mitral regurgitation due to atrial fibrillation: reversal with arrhythmia control. J Am Coll Cardiol 2011;58:1474-81.
4. Nishino S, Watanabe N, Ashikaga K, et al. Reverse Remodeling of the Mitral Valve Complex After Radiofrequency Catheter Ablation for Atrial Fibrillation: A Serial 3-Dimensional Echocardiographic Study. Circ Cardiovasc Imaging 2019;12:e009317.

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