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Letters

Treatment of Secondary Mitral Regurgitation in Chronic Heart Failure

Functional mitral regurgitation (FMR) occurs frequently in patients with systolic heart failure and portends a poor prognosis (1). ARTO (MVRx, Belmont, California) is a transcatheter annular reduction therapy system designed to improve mitral leaflet coaptation and to treat FMR (**Figure 1A**). We previously reported positive 30-day outcomes from the MAVERIC (Mitral Valve Repair Clinical) trial, using the transcatheter ARTO system (2). Because heart failure is a progressive condition and durability of FMR correction is of clinical importance, we report the MAVERIC trial 2-year follow-up of Phase I of the study. Phase II study is ongoing with an additional 34 patients enrolled at 8 sites.

Eleven patients (Phase I) were treated at Pauls Stradins Clinical University Hospital, Riga, Latvia, between October 2013 and May 2014. Key inclusion criteria included: New York Heart Association (NYHA) functional classes II to IV systolic heart failure; FMR grade ≥2+ and no anticipated change in the patient's cardiac medication regimen throughout the course of the study. All participants were deemed to be at high surgical risk by the heart team. There were no procedural safety events in any patient, and device technical success was 100%.

Clinical and echocardiographic follow-up occurred at 30 days, 6 months, and 1 and 2 years. A core laboratory (Cerc, Massy, France) analyzed all echocardiographic data and all clinical events were adjudicated by a Clinical Events Committee. All p values represent paired data.

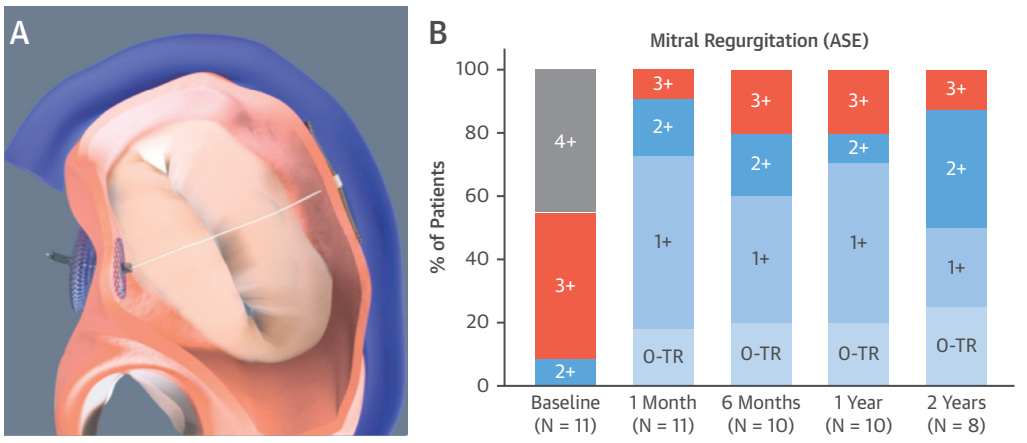
Two major adverse events that occurred in early follow-up (resolved pericardial effusion and dislocation of T-bar/elective mitral replacement surgery) have been previously reported (2). Since that report, 2 deaths occurred at approximately +19 months, both of which were adjudicated as cardiac related but unrelated to the device or procedure. One of the patients also suffered from hepatic biliary cirrhosis and was admitted to hospital 5 days before death for surgical treatment of critical lower-limb ischemia, and the second patient was known to be noncompliant with all medications. There were no other major adverse events.

At 2 years, FMR grade, left ventricular (LV) volumes, mitral annular dimensions, and functional status were improved and were stable or improved compared to 30-day values. A total of 87.5% of patients had a pre-procedure FMR grade of 3 or 4+ at baseline, and at 2 years, 87.5% of patients were grade ≤2+ (**Figure 1B**). Regurgitant volumes, vena contracta, and mitral annular anteroposterior diameter decreased from 39.1 ± 11.6 ml to 14.0 ± 10.3 ml ($p = 0.0009$), 6.5 ± 1.4 mm to 2.9 ± 1.4 mm ($p = 0.0002$), and 45.9 ± 3.1 mm to 39.8 ± 3.3 mm ($p = 0.0006$), respectively. Functional status was 81.8% NYHA functional class III or IV at baseline and improved to 60.0% class I or II at 2 years. Results of the 6-min walk test (6MWT) also improved from baseline to 2 years, from 387 ± 66.6 m (328.4 m for all patients) to 467.0 ± 76.8 m ($p = 0.006$). Importantly, 90.8% of the patients had been hospitalized for heart failure at least once in the 2 years prior to treatment with the ARTO system whereas only 27.2% were hospitalized for the same in the 2 years after treatment ($p = 0.016$).

This report demonstrates the safety, feasibility, and intermediate-term durability of the ARTO system for the treatment of FMR. There were clinically meaningful improvements in NYHA functional class and 6MWT results, a decrease in the number of heart failure hospitalizations, and favorable structural cardiac changes in terms of FMR reduction and positive LV remodeling. Importantly, the safety and efficacy profiles observed at the 30-day time point were essentially unchanged or improved at 2 years, FMR quantification remained unchanged between 30 days and 2 years ($p = 0.89$), and we did not observe any circumflex coronary artery compression, perhaps due to the focal traction on the coronary sinus applied behind the P2 segment of the posterior leaflet.

Unique features of the ARTO system include relatively short procedure times; minimal reliance on transesophageal echocardiography; absence of hemodynamic instability; and lack of interference with future treatments. Additionally, device efficacy

FIGURE 1 The ARTO System



(A) The ARTO system consists of an interatrial septal anchor connected to a coronary sinus T-bar by a polyethylene suture which is tensioned to decrease the anteroposterior diameter of the mitral annulus. Reprinted with permission from MVRx, Inc. (3). **(B)** MR grade from baseline to 2 years. ASE = American Society of Echocardiography.

was seen immediately at time of implantation, and the system can be adjusted prior to device lock and release.

The MAVERIC first-in-human clinical trial of the ARTO transcatheter mitral valve repair system demonstrates a positive safety profile, as well clinically meaningful reductions in mitral regurgitation, LV size, and improvement in NYHA functional class. The 2-year follow-up data in this report show stable safety and efficacy status compared to 30-day findings.

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Coronary Microvascular Dysfunction Identifies Patients at High Risk of Adverse Events Across Cardiometabolic Diseases

Patients with metabolic syndrome (MetS) and diabetes mellitus (DM) are at increased risk for coronary artery disease (CAD) and heart failure (1). Impaired coronary flow reserve (CFR), the ratio of stress to rest myocardial blood flow, is a marker of coronary microvascular dysfunction (CMD) in the absence of obstructive epicardial CAD and associates with adverse outcomes (2). We sought to test the hypothesis that in subjects without overt obstructive epicardial CAD or left ventricular dysfunction, the