Alternative methods to overcome the challenging anatomy of the coronary sinus during percutaneous mitral annuloplasty procedure

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Introduction

Dilated cardiomyopathy (DCM) is usually associated with variable degrees of functional mitral regurgitation (FMR), which contributes to higher morbidity and mortality. At present, the optimal management strategy for FMR is not clearly defined in the guidelines. A variety of percutaneous valve interventions to improve patients’ quality of life and decrease morbidity and mortality have been developed recently. The CARILLON Mitral Contour System is a fully transvenous approach using the anatomical proximity of the coronary sinus (CS) to the mitral annulus. In this technique, a device consisting of distal and proximal anchors linked by a flexible nitinol clip is introduced via the CS to encircle around two thirds of the mitral annulus, thereby, creating a tension constricting the mitral annulus (1). When properly deployed within the CS, it can lead to marked symptomatic and functional improvement with a low rate of major adverse events (1-3).

Case Report

A 74-year-old female with ischemic heart failure with New York Heart Association class III dyspnea was referred to our clinic. Despite optimal medical treatment, the patient was still symptomatic. ECG showed normal sinus rhythm. There were left ventricular dilatation, very poor LV systolic function (ejection fraction 15%), and severe FMR on transthoracic echocardiography. Similarly, a transesophageal echocardiogram showed severe FMR with a dilated mitral annulus measuring 49 cm, vena contracta of 10 mm, and no structural abnormality of the mitral valve apparatus. Because of the high surgery risk, the heart team of our institute decided on percutaneous mitral annuloplasty with CARILLON Mitral Contour System (Cardiac Dimensions Inc., Kirkland, WA, USA).

The procedure was done with local anesthesia. Venous access is obtained with a 10 Fr sheath in the right internal jugular vein. Adequate heparinization with 10,000 IU was achieved. The venous phase of the left coronary angiogram was used as an angiographic guide for CS ostium location. We tried to later cannulate the CS using the standard techniques of telescoping system of the 9 F delivery catheter, 6 F MPA-1 diagnostic catheter, and 0.035” hydrophilic guidewire. Despite many attempts, we did not succeed in cannulating the CS ostium with this equipment mostly probably owing to the highly dilated right atrium, the delivery catheter did not provide the support and direction that we needed. As an alternative method, we tried to cannulate the CS with a 6F diagnostic AL-1 catheter through the 9F delivery catheter and inflated to 8 atm (half inside and half prolapsing outside the tip of the delivery catheter) (a) and final image of the successfully deployed CARILLON Mitral Contour System (b).
advanced through the delivery catheter. A 3.0 × 20 mm coronary balloon was inflated to 8 atm (half inside and half prolapsing outside the tip of the delivery catheter); and subsequently, the delivery catheter was easily advanced to the distal end of the CS (closer to the great cardiac vein/ anterior interventricular vein junction) (Fig. 2a, Video 2). The process was then carried out in a standard manner. After venography with a marked pigtail catheter, an appropriately sized implant (13×20×70 mm device) was selected (Fig. 2b). Adequate tension with traction of the delivery system facilitated the plication of the peri-mitral annular tissue resulting in a decrease in the degree of MR on echocardiography (Fig. 3a, 3b, Videos 3, 4). Before completion of the procedure, coronary angiography was performed to ensure lack of coronary artery compression by the device. The total duration of the procedure was 84 minutes. The total fluoroscopy time was 46 minutes.

**Discussion and Conclusion**

The percutaneous mitral annuloplasty technique using CS faces some anatomic challenges, which might limit the success of the procedure. The main limitation is the variability in coronary venous anatomy, such as the presence of venous valves within the coronary veins and the variability of the crossing point of the great cardiac vein and circumflex artery (4, 5). In addition, an enlarged right atrium in the setting of DCM may result in difficulty to advance the catheters into the CS possibly owing to insufficient support. Alternative methods such as using AL-1 diagnostic catheter instead of MPA-1 for cannulating the CS ostium and/or using balloon-assisted tracking technique for advancing the delivery catheter through the CS can overcome the challenging CS anatomy. We also believe that these alternative methods can be easily used in other CS based interventions to increase the success of the procedure.

**Informed consent:** Informed consent was obtained from the patient for this manuscript.

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