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Case Report

Transcatheter Mitral Valve Edge-to-Edge Repair with the New MitraClip XTR System for Acute Mitral Regurgitation Caused by Papillary Muscle Rupture

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ABSTRACT

Treatment of patients presenting with cardiogenic shock due to acute mitral regurgitation related to papillary muscle rupture poses significant challenges, owing to the high risk associated with conventional surgery. We hereby report successful transcatheter mitral valve edge-to-edge repair with the new Mitraclip XTR device (Abbott Vascular, Santa Clara, CA) in a patient with acute myocardial infarction and cardiogenic shock. Although surgical intervention remains the standard of care, the new MitraClip XTR system offers a novel treatment option for patients with papillary muscle rupture by overcoming the anatomic challenges often seen in this pathology.

RÉSUMÉ

Le traitement des patients qui subissent un choc cardiogénique secondaire à une régurgitation mitrale aiguë liée à la rupture du muscle papillaire pose d'importants défis en raison du risque élevé associé à l'intervention chirurgicale traditionnelle. Par la présente, nous rapportons la réussite d'une réparation bord à bord de la valve mitrale par cathéter à l'aide du nouveau dispositif MitraClip XTR (Abbott Vascular, Santa Clara, Californie) chez un patient ayant subi un infarctus aigu du myocarde et un choc cardiogénique. Bien que l'intervention chirurgicale demeure la norme de soins, le nouveau système MitraClip XTR offre une nouvelle option de traitement destinée aux patients ayant subi une rupture du muscle papillaire qui surmonte les difficultés liées à l'anatomie et souvent observées dans cette pathologie.

Acute mitral regurgitation (MR) caused by papillary muscle rupture is a rare and often lethal complication of myocardial infarction (MI), characterized by profound hemodynamic instability and shock. Although surgical management is the standard of care, it is associated with high operative mortality.[1] Transcatheter edge-to-edge mitral valve repair represents a novel treatment modality that offers significantly lower procedural risk; however, the MitraClip NT device (Abbott Vascular, Santa Clara, CA) has had limited applicability, because of the inability to address the large coaptation gaps and flail segments often seen in these patients. The new MitraClip XTR device, which has longer clip arms (3 mm longer than NT), has the potential to overcome these anatomic challenges.

Case

A previously healthy 55-year-old man presented with an inferior ST-elevation MI, pulmonary edema, and cardiogenic shock, which required intubation and vasopressors. Emergency coronary angiography revealed single-vessel disease. Percutaneous coronary intervention on the right coronary artery was performed with intra-aortic balloon-pump support. Despite rapid reperfusion, he developed acute kidney injury and continued to require mechanical ventilation and vasopressors. On day 3, a transesophageal echocardiogram (TEE) demonstrated severe MR due to papillary muscle rupture, with an anteriorly directed, eccentric regurgitation jet with a coaptation gap of 1.0 cm. The mitral valve area was 6.2 cm^2, with a mean gradient of 3 mm Hg, and the ejection fraction was 55%. Surgical mitral valve replacement was considered; however, given the excessive operative mortality in this scenario, our heart team recommended an attempt at percutaneous repair with a plan for surgical bailout if unsuccessful.

Because of the lack of atrial dilatation, an adequate trans-septal puncture height was difficult, resulting in a puncture 3.5 cm above mitral annular plane. After performing

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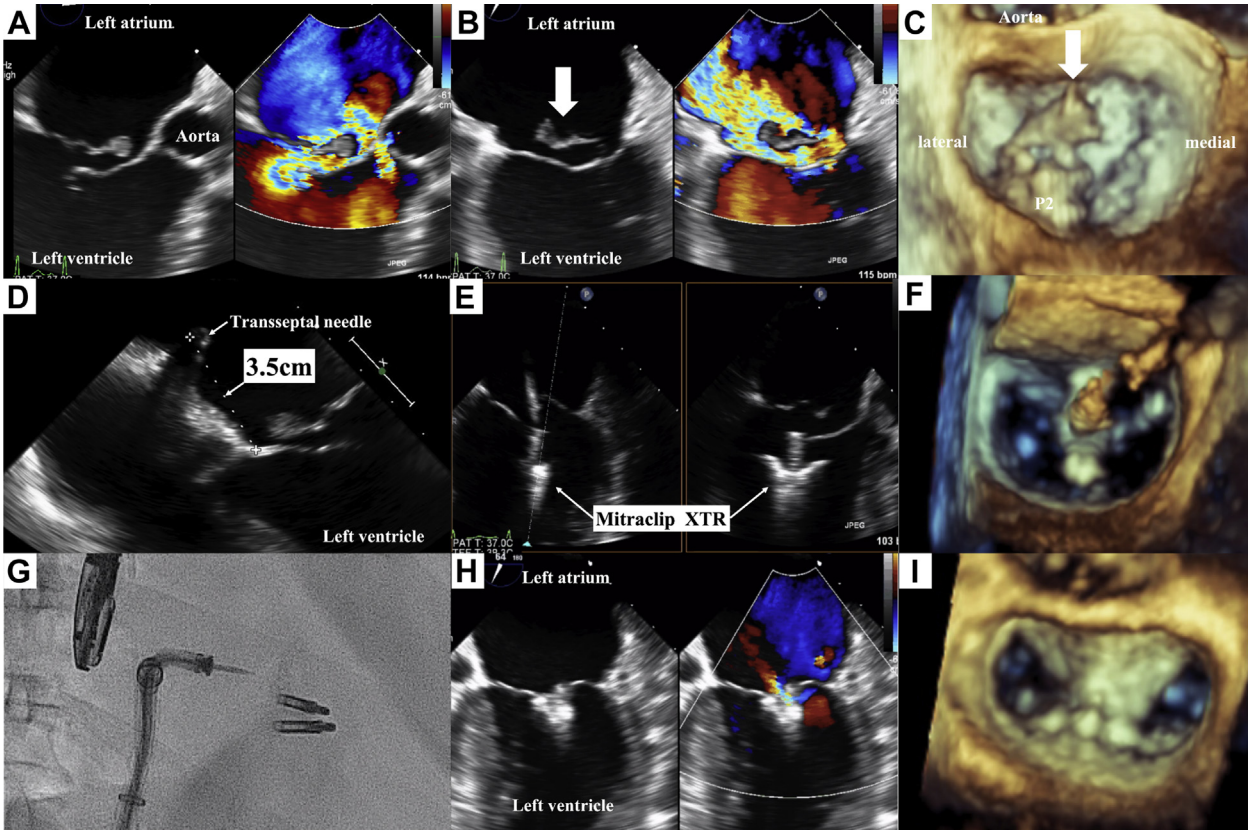

Figure 1. Transesophageal echocardiogram images. Pre-midesophageal (ME) long-axis view (**A**), ME bicommissural view (**B**), and 3D image of mitral valve (**C**). Torn papillary muscle (**white arrow**); 3.5-cm septal puncture height (**D**). X-plane view (**E**) and 3D image (**F**) of implantation of first MitraClip XTR device. Fluoroscopic image after implantation of 2 clips (**G**). Postrepair ME bicommissural view (**H**) and 3D image (**I**).

maneuvers to gain height (performed by turning the "A" nob), 2 MitraClip XTRs were successfully implanted at A2-P2. This reduced the MR to mild-moderate, with a mean gradient of 3 mm Hg and a mitral valve area (MVA) of 2.94 cm^2. There was also a significant reduction in the V wave from 50 mm Hg to 17 mm Hg (Fig. 1; see Video 1 view video online). The procedure led to rapid hemodynamic improvement and successful hospital discharge. At 3-month follow-up, the patient has moderate eccentric residual MR without heart failure symptoms.

Discussion

Successful treatment of papillary muscle rupture was reported previously in case reports and 1 case series with 5 patients, using the MitraClip NT device.[2,3] However, the anatomic challenges often observed in these cases, including large flail segments and large coaptation gaps, limits the broader application of transcatheter mitral valve repair with the MitraClip NT. In contrast, the longer arms of the XTR are able to overcome these challenges, facilitating more leaflet insertion and a broad grasp of the leaflets, creating a larger tissue bridge, resulting in successful reduction in MR. However, technical caution should be employed in acute MR cases. Lack of atrial dilatation leads to lower trans-septal puncture, necessitating careful maneuvering to achieve adequate height above the annulus. In addition, the XTR system may increase the risk of entanglement inside the ventricle and the risk of iatrogenic mitral stenosis. Nonetheless, our case demonstrates that the emergence of the MitraClip XTR will expand the application of transcatheter edge-to-edge repair for the treatment of acute MR.

Although surgical intervention remains the standard of care for papillary muscle rupture, and the efficacy of the MitraClip system is unproven in clinical studies, the new MitraClip XTR system offers a novel treatment option for patients with papillary muscle rupture by overcoming the anatomic challenges often seen in this pathology.

Disclosures

Dr Eric Cohen received consulting fees and speaking honoraria from Abbott Vascular and Medtronic. Dr Gideon Cohen received consulting fees from Edwards and speaking honoraria from Abbott Vascular, St Jude, Medtronic, and Edwards. Drs Komatsu and Czarnecki has no conflicts of interest to disclose.

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Supplementary Material

To access the supplementary material accompanying this article, visit the online version of the *Canadian Journal of Cardiology* at www.onlinecjc.ca and at https://doi.org/10.1016/j.cjca.2019.06.024.