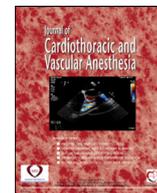


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Invited Commentary

Right Ventricular Failure in Emergent MitraClip Therapy—A Problem Worth Investigating

The MitraClip (Abbott, Santa Clara, CA) has emerged as a safe, effective, and durable treatment for hemodynamically significant mitral regurgitation (MR) refractory to maximally tolerable guideline-directed medical therapy in nonsurgical patients.^{1–9} Hemodynamically, the MitraClip reduces left ventricular volumes, unloads the left atrium and pulmonary circulation, reduces right ventricular afterload (as long as iatrogenic MitraClip-induced mitral stenosis does not develop), and facilitates biventricular reverse remodeling.^{1–8} Multiple large randomized trials enrolling medically optimized patients, such as the EVEREST (Endovascular Valve Edge-to-Edge Repair Study) and the COAPT (Cardiovascular Outcomes Assessment of the MitraClip Percutaneous Therapy for Heart Failure Patients with Functional Mitral Regurgitation) trials, have reported significant improvement in heart failure symptoms, reduction in hospitalizations, improvement in quality of life, and improved survival with MitraClip therapy in both primary (organic) MR and secondary (functional) MR.^{1–3} Based on these trials, the United States Food and Drug Administration approved the MitraClip for elective treatment of MR in medically optimized patients at prohibitive risk for conventional mitral valve surgery.

Recent evidence reflects a growing interest in MitraClip implantation for urgent and/or emergent MR treatment.⁵ Although the clinical benefits of the MitraClip in elective, medically optimized patients have been proven in large-scale trials^{1–3}; there is an ongoing debate about the utility of urgent and/or emergent MitraClip therapy in critically ill, nonoptimized patients with MR. Sparse evidence indicates higher short- and long-term cardiovascular morbidity and mortality rates with urgent and/or emergent MitraClip treatment, but the underlying reasons for such poor outcomes are yet to be determined.⁵ It seems logical to identify predictors of poor cardiovascular outcomes to guide patient selection and management. Doing so may improve outcomes in urgent and/or emergent MitraClip recipients.

In this light, the current case series by Asher et al., describing urgent and/or emergent MitraClip implantation in 2 patients with severe MR, is very enlightening. The first patient (patient A) had moderate left ventricular systolic dysfunction, severe pulmonary

hypertension, and a severely dilated and dysfunctional right ventricle. The second patient (patient B) had a normal left ventricle, with a 55% ejection fraction, and a normal-sized right ventricle with mild systolic dysfunction. Both patients required inotropic support and intra-aortic balloon counterpulsation for cardiogenic shock treatment. MitraClips were implanted in both patients, resulting in acute procedural success, unloading of the pulmonary circulation, and reduced left atrial pressures and V-waves. However, the clinical outcomes of the patients were significantly different. Patient A died 4 days after MitraClip implantation from refractory right ventricular failure, whereas patient B was extubated immediately after MitraClip implantation and made an uneventful recovery. Perhaps, preprocedure right ventricular-dominant cardiogenic shock contributed to the death of patient A, and warrants additional investigation.

To determine the prognostic implications of right ventricular dysfunction on urgent and/or emergent MitraClip outcomes in Asher et al's case series, I calculated the pulmonary artery pulsatility index (PAPi) for both patients to complement the echocardiographic findings. Since a PAPi score ≤ 2.2 has been associated with profound right ventricular dysfunction and poor outcomes in left ventricular assist device recipients,¹⁰ I expected a lower PAPi score in urgent and/or emergent MitraClip recipients to be of prognostic value as well. Patient A had a significantly lower PAPi score of 1.8, indicating the existence of right ventricular-dominant cardiogenic shock. In contrast, patient B had a higher PAPi of 2.4, indicative of preserved right ventricular function. As expected, patient A's terminal right ventricular failure remained refractory to vasoactive therapy and was the cause of death.

I am also curious as to why escalation to a temporary right ventricular mechanical circulatory support (MCS) device, such as the Impella RP (ABIOMED, Danvers, MA) or the ProtekDuo (LivaNova, London, United Kingdom), was not considered in patient A. These temporary MCS devices unload a dysfunctional right ventricle, improve myocardial perfusion, and facilitate right ventricular recovery. Perhaps temporary percutaneous right ventricular MCS may have prevented death in patient A, and should be part of the treatment algorithm in urgent and/or emergent MitraClip recipients with right ventricular-dominant cardiogenic shock.

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Asher et al's case series highlights the importance of comprehensive hemodynamic assessment for patient selection and management during urgent and/or emergent MitraClip implantation. Frequently, most attention is focused on mitral valvular and left ventricular function because of reported complications, such as iatrogenic mitral stenosis and afterload mismatch during MitraClip insertion in elective patients.⁶⁻⁹ However, urgent and/or emergent MitraClip recipients have decompensated heart failure and cardiogenic shock and are phenotypically more complex than elective patients.^{1-3,5} So, right heart failure may cause circulatory failure and contribute to cardiovascular morbidity and mortality.⁵ A multimodal right ventricular analysis with echocardiography, advanced hemodynamic parameters such as PAPI, and biomarkers of right ventricular failure, will provide valuable data for patient selection and treatment.¹⁰ Perhaps careful patient selection and early institution of active MCS for cardiogenic shock treatment may improve outcomes in urgent/emergent MitraClip recipients.⁶⁻⁷ Large randomized trials are needed to determine the prognostic implications of right ventricular failure in urgent and/or emergent MitraClip recipients.

Conflict of Interest

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