MitraClip Insertion to Hasten Recovery from Severe COVID-19

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INTRODUCTION

Coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2, has affected 188 countries worldwide, with a global death toll of more than 1 million.[1] The severe form of the disease is more commonly seen in the elderly and in patients with multiple comorbidities and carries a bad prognosis.[1,2] Patients with valvular heart disease are also at increased risk for adverse outcomes from COVID-19.[3] The MitraClip (Abbott Vascular, Santa Clara, CA) has been approved for functional as well as degenerative mitral regurgitation in the United States.[4-8] We describe the case of a patient with severe COVID-19 with multiple complications who underwent MitraClip implantation to treat refractory pulmonary edema to hasten recovery from this lethal disease.

CASE PRESENTATION

A 67-year-old man with asymptomatic Barlow's syndrome developed COVID-19. Subsequently his prolonged hospital stay (>2 months) was complicated by respiratory failure necessitating tracheostomy, acute renal failure necessitating hemodialysis, a large stage 4 decubitus ulcer, and protein energy malnutrition. All these complications were a result of COVID-19. The patient had difficulty weaning off ventilation because of recurrent pulmonary edema and prolonged sessions of renal replacement therapy. His other major issue was a large decubitus ulcer that necessitated debridement and colorectal surgery to provide a diverting colostomy. Clinical examination was significant for jugular venous distension, bibasilar crackles, and a grade 5 holosystolic murmur at the apex. Electrocardiography demonstrated new-onset atrial fibrillation with a rapid ventricular response. On transesophageal echocardiography (Video 1), the patient was found to have severe mitral valve regurgitation due to P2 prolapse and flail that was likely related to myxomatous degenerative disease. The transmitral gradient was 3 mm Hg. The left and right ventricles were normal in size, with preserved systolic function and moderate pulmonary hypertension (Swan-Ganz catheter mean pulmonary arterial pressure 50 mm Hg, right atrial pressure 10 mm Hg). The patient subsequently underwent transesophageal echocardiography–guided direct-current cardioversion along with therapeutic anticoagulation with intravenous unfractionated heparin. There was no evidence of infective endocarditis or thrombus in the left atrial appendage. The patient was started on intravenous sodium nitroprusside and Swan-Ganz-guided therapy. Chest computed tomography showed large bilateral pleural effusions with adjacent atelectasis, diffuse ground-glass attenuation, pulmonary edema, and bronchiectasis of the peripheral airways (Video 2). In view of refractory pulmonary edema, the patient was scheduled for MitraClip insertion.

All donning and doffing procedures for COVID-19 were undertaken. While implanting the clips under general anesthesia, ventilation was transiently held. This was not well tolerated by the patient because of significant lung damage due to COVID-19. MitraClip placement was performed swiftly and efficiently. Using fluoroscopy and transesophageal echocardiography, two MitraClip NTW devices were successfully placed across the A2/P2 and A1/P1 scallops (Video 3, Figure 1). Ventilation improved remarkably after placement of the clips. Mitral regurgitation was reduced to trivial, with an acceptable gradient of 4 mm Hg (Video 4). Mean left atrial pressure was significantly reduced from 28 to 16 mm Hg, with a systolic blood pressure of 80 mm Hg. After the procedure, the patient's ventilation improved, with resolution of pulmonary edema. Two days later he underwent successful excisional debridement of his stage 4 pressure ulcer and open formation of a diverting end (loop) sigmoid colostomy. Four

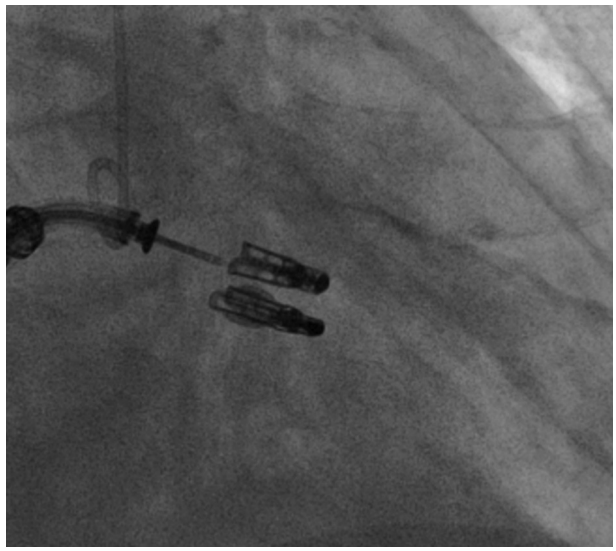

Figure 1 Successful placement of two clips across the mitral valve.

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Conflicts of interest: The authors reported no actual or potential conflicts of interest relative to this document.

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VIDEO HIGHLIGHTS

Video 1: Preprocedural transesophageal echocardiographic two-dimensional and three-dimensional images reveal myxomatous degenerative mitral valve disease in a patient with Barlow's syndrome with P2 prolapse and A2 flail.
Video 2: Chest computed tomography showing large bilateral pleural effusions with adjacent atelectasis, diffuse ground-glass attenuation, pulmonary edema, and bronchiectasis of the peripheral airways.
Video 3: Live three-dimensional multiplanar reconstruction–guided MitraClip placement across A2/P2 scallops.
Video 4: Successfully placed MitraClips across the A2/P2 and A1/P1 scallops with final transmitral gradient of 4 mm Hg.
Video 5: Chest computed tomography 1 month after the procedure showing reduction in pleural effusions and resolution of pulmonary edema.

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weeks later the patient was discharged to a long-term care hospital. Chest computed tomography performed 1 month later revealed reduction in pleural effusions and resolution of pulmonary edema (Video 5).

DISCUSSION

The true impact of severe valvular heart disease in patients with COVID-19 has not described in the literature so far.[3,9,10] Nevertheless, it is clear that patients with severe valvular heart disease often tend to be multimorbid and frail and have a higher mortality rate compared with the normal population.[3] With future data and research, it will become clear that the prognosis of patients with the combination of COVID-19 and severe valvular heart disease will be poor.[3] The acute hemodynamic effects of MitraClip intervention have been well documented by the EVEREST trial investigators.[11] MitraClip implantation leads to increases in cardiac output (from 5.0 ± 2.0 to 5.7 ± 1.9 L/min, $P = .003$) and forward stroke volume (from 57 ± 17 to 65 ± 18 mL, $P < .001$). Decreases in systemic vascular resistance (from 1,226 ± 481 to 1,004 ± 442 dyn · s/cm^5, $P < .001$), left ventricular end-diastolic pressure (from 11.4 ± 9.0 to 8.8 ± 5.8 mm Hg, $P = .016$), and left ventricular end-diastolic volume (from 172 ± 37 to 158 ± 38 mL, $P < .001$) were noted after MitraClip placement.[11] A post hoc subgroup analysis of the EVEREST I feasibility trial and EVEREST II pivotal trial demonstrated that MitraClip procedures performed in patients with hemodynamic decompensation resulted in significant reductions in left ventricular end-diastolic pressure (from 20 ± 5 to 13 ± 5 mm Hg, $P = .002$) and mean pulmonary capillary wedge pressure (from 20 ± 4 to 16 ± 5 mm Hg, $P = .001$) and a significant increase in cardiac index (from 2.0 ± 0.5 to 2.5 ± 5 L/min/m^2, $P < .001$).[12]

CONCLUSION

This is the first reported case of MitraClip insertion in a patient with severe COVID-19. The hemodynamic changes after MitraClip placement assisted in the patient's recovery by reducing left atrial pressures, resolving pulmonary edema, and allowing other necessary medical procedures that were on hold to take place. We are certain that this will be a more frequent occurrence during the coming year as cases of COVID-19 continue to surge across the United States.

SUPPLEMENTARY DATA

Supplementary data related to this article can be found at https://doi.org/10.1016/j.case.2020.10.004.

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