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Short Communication

Key Considerations for Heart Failure Patients Undergoing Transcatheter Mitral Valve Replacement

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DESCRIPTION

Severe Mitral Regurgitation (MR) and Heart Failure with Reduced Ejection Fraction (HFrEF) are seldom mutually exclusive. The latter, in the presence of severe MR, portends a dismal prognosis. This includes, but is not limited to, a 3-year mortality rate in excess of 40% [1]. The past decade has borne witness to exponential growth in transcatheter repair and replacement systems for the management of severe MR in patient populations with prohibitive surgical risk. Increasingly, Transcatheter Mitral Valve Replacement (TMVR) systems are favored amongst innovators in patients whose complex mitral anatomy means they may be unsuitable or unlikely to achieve <1 + MR reduction using a Transcatheter Edge-To-Edge Repair (TEER) strategy. In these patients, TMVR has the distinct advantage of MR elimination rather than reduction, a factor that has previously been associated with improved survival in surgical and Transcatheter Edge-To-Edge Repair (TEER) cohorts [1]. With feasibility studies completed, but real world results somewhat lagging, the focus now shifts to peri-procedural Heart Failure (HF) management in TMVR patients. In the following commentary, we present key considerations for the peri-procedural management of TMVR patients with HF. In particular, we seek to reinforce the need to more closely mimic guideline directed medical and device therapy in existing HF populations so as to improve patient outcomes [2].

Pre-procedural considerations

Optimizing heart failure and frailty: More than 80% of patients in existing TMVR registries and feasibility studies have reported New York Heart Association (NYHA) functional class III/IV heart failure prior to intervention [3-5]. It has been learned from the TEER experience, meticulous optimization of guideline-directed medical therapy, and correction of iron deficiency and consideration of cardiac resynchronization therapy have now been advocated for TMVR cohorts [2,6]. A period of cardiac rehabilitation, involving physical conditioning and optimal diuresis may also be required to avoid significant peri-procedural shifts in volume [2,7,8].

Optimizing hemodynamics: Left ventricular dysfunction is not only a cause, but more often than not, a consequence of untreated chronic severe MR [3,4]. Unlike other advanced HF populations, there remains a paucity of detailed hemodynamic data to corroborate echocardiographic findings in these patients. Once again it has been suggested that TMVR operators draw from experiences in the advanced HF populations, where a right atrium to Pulmonary Capillary Wedge Pressure (PCWP) ratio <0.630 and/or cardiac index (CI) <2.0 L/min/m^2 are considered higher risk for cardiogenic shock [9,10]. Consequently, full hemodynamic evaluation with right heart catheterization is suggested to obtain and address peri-procedural risk of cardiogenic shock. Once hemodynamic information is obtained, pre-procedural optimization to mitigate cardiogenic shock can be considered with guideline directed medical and device therapy, optimization of fluid status with diuretic prescriptions, and in more advanced cases, the use of cardio-selective β1 agonists (e.g. dobutamine) or calcium sensitizers (e.g. levosimenden) pre-procedurally.

Intra-procedural considerations

Mitigating acute right and left ventricular dysfunction: The left ventricular hemodynamic changes that occur during TMVR have been demonstrated to be transient, with return to baseline after a median time of 17 minutes [11]. This correlates clinically with hypotension during the final delivery phase for most TMVR devices that is short-lived and can most often be managed with a cautious conservative approach, including close communication between anesthetics and TMVR implant teams. Hungerford recently proposed a treatment algorithm for acute right and left ventricular dysfunction during or following TMVR2 with a focus on cardio-selective β1 agonists (e.g. dobutamine) and advanced

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hemodynamic monitoring in the first instance, followed by escalation to non-selective adrenoceptor agonists (e.g. adrenaline), intravenous pulmonary vasodilators (e.g. PDE inhibitors) or inhaled prostacyclin's (e.g. iloprost) and then finally consideration of appropriate assist devices (e.g. VA-ECMO, IABP, Impella) as required [2].

Mitigating risk of left ventricular outflow tract obstruction: Deployment of TMVR has an associated risk of Left Ventricular Outflow Tract Obstruction (LVOTO), and so it remains critical to identify hemodynamically significant LVOTO early with subsequent repositioning or recapture. Hemodynamic monitoring with a left ventricular pigtail catheter and pull-back gradient may be useful to assess for LVOTO intra-procedurally. Methods to mitigate LVOTO during Trans apical delivery include device repositioning, arterialization, lateral device rotation ('off-clocking') or device retrieval [7]. Where these methods cannot be used or are unsuccessful, alternative measures to stabilize the patients include a combination of volume resuscitation, increasing afterload and beta-blockade to minimize tachycardia. Other therapeutic options in patients with LVOTO and hemodynamic instability include intentional laceration of the anterior mitral valve leaflet and alcohol septal ablation [12,13].

Post-procedural considerations

It is now recommended that TMVR patients be managed in a similar fashion to surgical MVR patients, that is, with an algorithmic handover to higher dependency unit [7]. This handover should include clear hemodynamic goals (e.g., mPAP, CI) and vigilant inspection for procedural site complications (e.g., apical site bleeding or femoral hematoma). Serial transthoracic echocardiogram to determine baseline mitral valve function and ventricular parameters is key, and patients should be recommenced on optimal tolerates guideline-directed medical therapy and anticoagulated with warfarin prior to discharge [14].

CONCLUSION

Undoubtedly, HFrEF is commonplace amongst sick, inoperable patient cohorts referred for TMVR. Careful optimization of HF therapy, evaluation of pre and intra-procedural hemodynamics, and close attention to post-operative HF optimization remains the key to improving patient outcomes as TMVR devices move from the feasibility to real-world stage.

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