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EDITORIAL

Is Ambulatory Hemodynamic Monitoring Beneficial to Patients With Advanced Heart Failure?

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Patients with advanced heart failure (aHF) exhibit persistent severe symptoms despite optimal guideline-directed medical therapy, including pharmacologic and cardiac resynchronization therapy (CRT), as indicated and tolerated. Although CRT is a highly effective treatment for drug-refractory heart failure (HF) with reduced ejection fraction (HFrEF), the long-term mortality of these patients is not negligible.[1] The care of this "vulnerable" group of patients requires collaborative efforts by HF and electrophysiology teams.[2] More important, ≈30% of recipients do not benefit from CRT, although this percentage varies depending on the definition of nonresponse.[3] Nonresponse to CRT is a challenging healthcare issue, and some of these patients who are lacking left ventricular remodeling and symptomatic improvement will progress to aHF and may require aHF therapies.[3] Optimization of pharmacological therapies and close monitoring to prevent HF readmissions and detect early progression to aHF are key elements in chronic disease management of these patients. An earlier post hoc analysis of patients with acute HF enrolled in the Evaluation Study of Congestive Heart Failure and Pulmonary Artery Catheterization Effectiveness (ESCAPE) trial suggested that patients with persistently elevated left ventricular filling pressures constitute a group at high risk for death, rehospitalization, or heart transplantation.[4] Therefore, improving filling pressures should be an important goal in the care of patients with aHF. Moreover, invasive hemodynamic assessment may facilitate identification of suitable candidates for advanced cardiac therapies. Because hemodynamic congestion precedes clinical congestion by several weeks,[5] remote hemodynamic monitoring has risen as viable and practical management strategy for selected patients with HFrEF.

See Article by Varma et al.

The wireless CardioMEMS pulmonary artery monitoring device is a battery-free, microelectromechanical system sensor mounted on 2 nitinol coils, implanted into a small branch of pulmonary artery, which was approved by the US Food and Drug Administration in 2014 to monitor pulmonary artery pressure and heart rate in patients with New York Heart Association class III HF who have been hospitalized during the previous year.[6] Safety and efficacy of this approach were evaluated in the prospective, single-blind CHAMPION (CardioMEMS Heart Sensor Allows Monitoring of Pressure to Improve Outcomes in NYHA [New York Heart Association] Class III Heart Failure Patients) trial, in which randomization to active pressure-guided HF management reduced future HF hospitalizations at 18-month average follow-up by 22%.[6] Subsequent commercial use studies[7] reinforced the efficacy of

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this strategy, and post hoc analyses propose that remote hemodynamic monitoring is an additional "therapeutic" measure along with pharmacologic and device therapy, even in left ventricular assist device recipients.[8]

In this context, a post hoc analysis of the CHAMPION trial by Varma and colleagues evaluated the role of remote hemodynamic monitoring in CRT, in their article published in this issue of the *Journal of the American Heart Association* (*JAHA*).[9] The authors analyzed data from 190 patients with CRT with CardioMEMS sensor. To assess the impact of hemodynamic monitoring in CRT recipients, patients assigned to treatment (n=91) and controls (n=99) were compared for HF hospitalization rates over the entire randomized follow-up period, per-protocol HF medication changes at 6 months, progression of pulmonary artery pressure area under the curve, and quality-of-life assessment at 6 and 12 months of randomized follow-up. The group of patients with CRT studied had higher burden of comorbidities and worse renal function than those without CRT. Most important, patients with CRT had worse hemodynamics (low cardiac indexes and high prevalence of group II pulmonary hypertension) with a profile representing a group with aHF despite CRT. Hemodynamic-guided care resulted in 30% statistically significant relative risk reduction of HF hospitalizations with smaller statistically nonsignificant relative risk reduction of first HF hospitalization and all-cause mortality. Reduction in HF remained significant irrespectively of the duration of CRT. Significant up titration of guideline-directed medical therapy was observed in the hemodynamic-guided care group only. Mean pulmonary artery pressures were significantly lower and quality of life improved in the hemodynamic-guided care group.

In aggregate, the results highlight the severity of illness often found among patients with CRT (particularly among nonresponders) and the potential "synergistic" effect of pharmacologic, device therapy and remote hemodynamic guidance in selected patients with HFrEF. In light of several limitations, the findings should be considered hypothesis generating and require validation in larger cohorts. First, this is a highly selected group of patients, and along with the small sample size, the generalizability of these findings remains questionable. The patients were not randomized at the level of CRT implantation, and evaluation of response to CRT is lacking. Specifically, the presence of atrial or ventricular tachyarrhythmias, lead position, percentage of CRT pacing, QRS width, and morphological features following CRT are key elements of CRT optimization and were not available in this analysis. Whether optimization of CRT would improve the hemodynamics of some of the enrolled patients remains unknown, but randomization has attenuated the impact of this limitation. Furthermore, patient enrollment occurred in an era of HF management when contemporary pharmacologic measures, such as angiotensin receptor/neprilysin inhibitors sodium-glucose transport protein 2 (SGLT2) antagonists, were not part of the armamentarium. CRT optimization algorithms and practices have improved since then, along with the availability and favorable outcomes of second- and third-generation left ventricular assist devices; some of these patients may have been candidates for implantation in the contemporary HF era. Finally, the control group per protocol was lacking a standardized management strategy, and adjustment of diuretics and other pharmacologic therapies was based on local practices.

Despite these limitations, which are mostly inherent to the design of this post hoc analysis, important messages arise. With the addition of new therapeutic options, the care of these patients becomes more complicated. The multidisciplinary clinic approach remains the cornerstone of HF care, but instead of treatment of disease progression, the focus must be prevention of hospitalization and adverse remodeling. To achieve these goals in a timely manner before patients with HFrEF reach the stage D of their condition (such as many of the participants in this study, as shown by the prevalence of low cardiac indexes and pulmonary hypertension), prompt initiation and up titration of triple or quadruple medical therapy combinations and optimization of CRT are crucial elements of care. Remote hemodynamic monitoring may expedite treatment decisions and delay or halt disease progression. In the context of a broader disease management program, combined with a telemedicine program, hemodynamic-guided up titration of diuretics and medications may reduce healthcare use and improve quality of life among patients with HFrEF.[10] This strategy can be particularly useful during a period when in-person visits need to be minimized or in rural areas where access to health care may be problematic. A definitive answer about the wide applicability and efficacy of remote hemodynamic monitoring in patients with HFrEF will likely be provided by the results of the GUIDE-HF (Hemodynamic-Guided Management of Heart Failure) trial.[11] However, it is important to consider the need for adequate infrastructure and training to implement and respond to hemodynamic-guided strategies and the cost of the device and the related infrastructure, which is not negligible. These issues may limit the wide adoption of this strategy, particularly in financially challenged healthcare systems.

In conclusion, a remote hemodynamic-guided adjustment of pharmacological therapies may be beneficial in patients with aHF, including those with poor response to CRT. This hypothesis warrants evaluation

and validation in additional independent clinical trials to fill in the gaps that remain in this field.

ARTICLE INFORMATION

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Disclosures

None.

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