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Guest Editorial *Cardiovascular*

CardioMEMS Device: Sensing the Heart's Clues and Redefining the Management of Heart Failure

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Heart failure (HF) is a chronic and progressive condition that affects millions of people worldwide. It is a leading cause of morbidity and mortality worldwide in both sexes. Constituting 1–2% of the general population in developed countries, an estimated 64.3 million people are afflicted with HF. By 2030, it is expected that HF incidence shall increase by 46%, half of which shall be due to HF with preserved ejection fraction. Unlike coronary heart disease, by the age of 40, both men and women have equivalent lifetime risks of developing HF with the incidence of one in five. The incidence of new HF rises with age, with the increment being greater in women than men (about double from 65 to 85 years in men vs. triple in age-matched women). Although men lead the overall incidence of HF in the younger age group, it equalizes in either sexes by 80 years. In fact, the incidence of HF is almost 20% in octogenarian males and even more so in females.[1]

Given its complexity, a pivotal part of HF management in either sex is close monitoring of the patient's clinical condition. Patients with HF have a high risk of readmission and hospitalization. Conventionally, HF patients have been managed through periodic clinic visits and the use of subjective measures such as symptoms and physical examination findings. However, these methods are not sensitive enough to detect early changes in the patient's condition. In this regard, the Cardio MEMS device has been a game changer for early detection in changes in volume status of these patients before hemodynamic decompensation, thereby preventing hospitalization.

The CardioMEMS device has been the subject of many clinical studies and has been shown to significantly reduce hospitalization rates and thereby improve quality of life for HF patients. This editorial discusses the importance of CardioMEMS and its impact on the management of HF.

CardioMEMS is a novel medical device which has revolutionized that the way HF patients are managed by providing real time data on changes in pressure within the pulmonary artery. Using the information provided by CardioMEMS devices, clinicians can detect changes in a patient's condition much earlier, thereby allowing for timely intervention and improved outcomes.

Patients who are candidates for CardioMEMS implant are symptomatic and should have been hospitalized at least once in the previous 12 months or have elevated natriuretic peptides or both.

The CardioMEMS device is a small, wireless implantable sensor that is placed within the pulmonary artery through a catheter-based approach. It measures about the size of a paper clip. Usually, the preferred location is the left descending pulmonary artery; however, at the discretion of the implanting physician, the sensor may be inserted into the right pulmonary artery as well, depending on the patient's anatomy. Once implanted, the sensor provides continuous monitoring

of the pressure within the pulmonary artery. This pressure reading is transmitted wirelessly to a receiver that is placed in the patient's home. The receiver then sends the data to the patient's health-care provider, who can use it to monitor changes in patients, clinical condition. The CardioMEMS HF system is contraindicated for patients with an inability to take dual antiplatelet or anticoagulants for 1 month post-implant.

Several clinical trials have shown that the use of CardioMEMS reduces hospitalization rates and improves quality of life for HF patients. Its use has shown promising results in reducing HF hospitalizations in both patients with HF with reduced ejection fraction as well as in patients with HF with preserved ejection fraction. In the GUIDE-HF study published in Lancet in 2021,[2] Lindenfeld *et al*. showed a significant 19% reduction in the primary endpoint of HF hospitalization, all-cause mortality, and urgent HF visits in the pre-COVID analysis primarily driven by a 28% reduction in HF hospitalizations. A recent meta-analysis[3] including HF with reduced ejection fraction patients from CHAMPION, GUIDE-HF, and LAPTOP-HF studies showed significantly improved survival over control in these patients at 24 months with 36% decrease in HF hospitalization at 12 months.

CardioMEMS device has had a significant impact on the management of HF as it helps clinicians to use objective data which can be used to monitor changes in a patients, clinical condition early on leading to earlier interventions and improved outcomes.

HF costs in the United States are currently in billions of dollars with an expected exponential increase over the next several years. HF hospitalizations and readmissions account for a large portion of the healthcare cost. By reducing hospitalization rates, the use of CardioMEMS devices can lead to significant cost savings for the health-care system.

Despite the promising results, there still remain some challenges to the widespread use of this device. Not only is the device expensive but also specialized training is needed for its Implantation and management. Transmitting the readings requires Wifi and, hence, may limit its use in areas which do not have this service available. Since it can be implanted only by physicians trained to do so; this limits its widespread availability. Post-procedure, patients need to be on antiplatelet agents for a month which may prevent its use in patients with history of gastrointestinal bleed or contraindication to the use of blood thinners. The device's long-term durability and safety need to be further evaluated.

Moreover, with well-known delayed presentation of women and poor access to treatment, CardioMEMS may be a boon to women with HF. An early recognition of worsening HF may help intensify the HF therapy in them avoiding unnecessary hospitalization. DeFilippis *et al*. reported similar reductions in pulmonary artery pressure from baseline in women and men enrolled in the CardioMEMS post approval study (PAS) over 1 year with similar reductions in HF hospitalizations Moreover, hemodynamic monitoring provided similar benefit as regards HF events in either sex.[4]

In conclusion, CardioMEMS device appears to be a promising tool that has been a game changer in the management of HF with improved clinical outcomes and reduced health-care costs in both men and women. Its use has revolutionized that the way HF patients have been managed. CardioMEMS device represents a significant step forward in HF management and should be utilized to its maximum potential in the deserving HF patients.

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