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(RESEARCH ARTICLE)

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CardioMEMS device impact on heart failure hospitalization rates: A pre- and post-implantation analysis

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Abstract

Introduction : The CardioMEMS HF System proactively manages heart failure by addressing hemodynamic congestion before overt symptoms appear. This device provides daily pulmonary artery pressure readings, enabling tailored medical therapy. This study investigates CardioMEMS' impact on heart failure hospitalization rates in a community hospital setting.

Methods: A retrospective analysis was conducted on 58 heart failure patients who underwent CardioMEMS implantation. Heart failure-related hospitalization rates were compared one year before and after implantation using electronic health records and paired t-tests.

Results: A statistically significant reduction in heart failure hospitalization rates was observed following CardioMEMS implantation (t-statistic: 3.7540265, p-value: 0.0004156). The average number of heart failure-related hospitalizations per patient per year decreased by 0.67.

Discussion: The findings align with previous studies demonstrating the device's efficacy in proactively managing hemodynamic congestion and preventing hospitalizations. Remote monitoring technologies, like CardioMEMS, facilitate communication between physicians and patients, encouraging active participation. Integrating CardioMEMS into heart failure management programs optimizes its capabilities and promotes timely interventions.

Conclusion: CardioMEMS is associated with a significant reduction in heart failure hospitalization rates in a community hospital, improving patient outcomes and community health.

Keywords: Remote Monitoring; Heart Failure; Community Hospital; Cardiomems; Rehospitalization

1 Introduction

The CardioMEMS HF System represents a significant advancement in the management of heart failure, offering a proactive approach to averting hospitalizations by treating hemodynamic congestion before overt clinical symptoms manifest [1]. This device, implanted via a minimally invasive procedure into the pulmonary artery, furnishes clinicians with daily pulmonary artery pressure readings, enabling tailored medical therapy adjustments [2]. The core objective of leveraging the CardioMEMS device revolves around preemptively addressing increases in pulmonary artery pressure, a key indicator of worsening heart failure, thereby mitigating the likelihood of hospitalizations and enhancing the overall quality of life for patients [3]. As heart failure affects approximately 6.2 million individuals in the United States, contributing to an approximate 42% 5-year mortality rate, it's expected to exceed 8 million cases by 2030, with total

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annual costs escalating to nearly US $70 billion, underscoring the critical need for innovative management strategies [4].

2 Materials and methods

In this study we investigated the impact of the CardioMEMS device on hospitalization rates in patients with heart failure by comparing the rates of hospitalization for heart failure in the year before and after the device implantation, with the goal of evaluating the effectiveness of the device in reducing the burden of heart failure-related hospitalizations. To assess the device's impact, we conducted a retrospective analysis of patients diagnosed with heart failure who underwent CardioMEMS implantation at a community hospital. The data was obtained from electronic health records which included ejection fraction, and hospitalization records. We analyzed patients who had at least one heart failure-related hospitalization in the year preceding device implantation. The primary outcome of interest was the difference in heart failure hospitalization rates within one year pre- and post-implantation. We looked at 58 patients with chronic heart failure and at least one heart failure hospitalization in the previous 12 months prior to implantation. Hospitalization rates were defined as the number of heart failure-related hospitalizations per patient-year. Statistical analysis was performed using paired t-tests to compare pre- and post-implantation hospitalization rates. Python was used to perform the statistical analysis.

3 Results

Our analysis revealed a statistically significant reduction in heart failure hospitalization rates following CardioMEMS implantation. Paired t-test results: t-statistic: 3.7540265 p-value: 0.0004156. The study's findings indicated a substantial decline in the average number of heart failure-related hospitalizations per patient per year, with a mean reduction of 0.67, suggesting a marked improvement in patient management and a decrease in healthcare resource utilization.

4 Discussion

The observed reduction in heart failure hospitalization rates following CardioMEMS implantation aligns with findings from previous clinical trials and real-world studies that have demonstrated the device's efficacy in proactively managing hemodynamic congestion, optimizing medical therapy, and preventing hospitalizations. This proactive strategy contrasts with traditional symptom-guided management, which often leads to delayed interventions and increased hospitalization rates, particularly given the nearly 25% readmission rate for heart failure patients within 30 days of discharge [5]. The preemptive adjustments in medication dosages based on pulmonary artery pressure readings facilitate early intervention, preventing the progression of congestion and averting the need for hospitalization. Remote monitoring technologies, including devices like the CardioMEMS, play a crucial role in fostering communication between physicians and patients, encouraging active patient participation in their own health and decision-making[4]. Such active patient engagement, facilitated by continuous monitoring and timely feedback, underscores the importance of empowering individuals to take a more participatory role in their disease management, especially during the intervals between scheduled clinical visits [6]. The ultimate imperative lies in transforming the wealth of continuously monitored physiological data into clinically relevant interventions, thereby ensuring tangible improvements in patient outcomes and overall well-being. Integrating the CardioMEMS device into comprehensive heart failure disease management programs can ensure the optimal utilization of its capabilities, promoting guideline-directed medical therapy adherence and facilitating timely interventions to prevent hospitalizations [7]. However, obstacles such as geographic barriers and socioeconomic constraints may impede some patients' participation in these programs, leading to the evolution of interventions aimed at enhancing remote patient monitoring within the patient's home [8]. The ability to ensure reimbursement for devices, along with adequate training and education for both patients and staff, is critical for promoting the widespread adoption and successful integration of these technologies into routine clinical practice [8].

5 Conclusion

The study findings suggest that the CardioMEMS device is associated with a significant reduction in heart failure hospitalization rates in real world application at a community hospital. CardioMEMS is useful for decreasing patient hospitalizations as well as contributing to the health of the community.

Compliance with ethical standards

Disclosure of conflict of interest

There are no disclosures or conflicts of interest for any of the authors.

Funding

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Statement of informed consent

This study was a retrospective chart review utilizing only de-identified data obtained from electronic health records, it did not involve the use of Protected Health Information and was therefore exempt from requiring informed consent.

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