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Editorial

Ambulatory Hemodynamic Monitoring—Don't Forget the Little Ones!

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The management of pediatric patients with heart failure and pulmonary hypertension remains a significant challenge, often requiring frequent hospitalizations and invasive procedures, including cardiac catheterization to monitor disease progression and guide treatment. Monitoring hemodynamic parameters in children with these conditions is critical for optimizing treatment and improving outcomes. The CardioMEMS HF System (Abbott) is an FDA-approved implantable sensor that wirelessly transmits pulmonary artery pressure data, allowing for noninvasive, ambulatory monitoring of hemodynamics.[1–3] The CardioMEMS device has revolutionized the management of heart failure in adults by providing pulmonary artery pressure monitoring, enabling timely intervention, and reducing hospital readmissions. Although the device has been extensively studied and utilized in the adult heart failure population, data on its application in the pediatric setting have been lacking.

In this issue of *JSCAI*, Labrandero et al[4] report the use of the CardioMEMS implantable hemodynamic monitoring device in the pediatric population. The key findings of their study include the following:

1. Feasibility and safety of the CardioMEMS procedure in pediatric patients: the device was successfully implanted in all 8 patients, with the majority (85%) receiving it via femoral access and in the left pulmonary artery. Importantly, no technical complications were reported during the implantation process.
2. Clinical utility in pulmonary hypertension management: the noninvasive hemodynamic monitoring allowed for close monitoring of mean pulmonary artery pressure and guided the intensification of vasodilator therapy, thereby avoiding the need for repeated cardiac catheterizations.
3. Optimization of heart failure treatment: in the heart failure cohort, the hemodynamic data obtained from the CardioMEMS device helped to optimize decongestive treatment prior to heart transplantation.
4. Successful use in complex cardiac conditions: the authors report the successful use of the CardioMEMS device in a patient with a Fontan circulation and in a patient with a left ventricular assist device, highlighting its potential utility in the management of advanced heart disease in the setting of complex congenital heart defects or mechanical circulatory support.
5. Remote monitoring: the COVID-19 pandemic has further underscored the importance of remote monitoring technologies because they can minimize the need for in-person hospital visits and reduce the risk of exposure for these vulnerable patients.

The authors note that the CardioMEMS device allowed for remote pediatric care during the pandemic, decreasing hospital visits during periods of high COVID-19 transmission.

Unlike traditional methods that rely on intermittent assessments during clinic visits or invasive catheterizations, CardioMEMS enables remote monitoring of pulmonary artery pressures. This paradigm shift offers several key advantages in the pediatric population:

1. Early detection and intervention: by providing data on pulmonary pressures, CardioMEMS allows for the early detection of hemodynamic changes, enabling prompt intervention before clinical deterioration occurs. This proactive approach is especially crucial in pediatric patients, where timely management can prevent disease progression and improve outcomes.
2. Tailored treatment optimization: the ability to remotely monitor hemodynamic parameters empowers health care providers to tailor treatment regimens based on individual patient responses. Labrandero et al[4] demonstrate how adjustments in vasodilator therapy guided by CardioMEMS data led to improved pulmonary pressure control without the need for frequent invasive catheterization procedures.
3. Reduced hospitalizations and complications: by facilitating proactive management and preventing hemodynamic decompensation, CardioMEMS has the potential to reduce hospital readmissions and complications associated with heart failure and pulmonary

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hypertension. This not only enhances patient quality of life but also alleviates the burden on health care resources.

4. Patient-centered care: remote monitoring with CardioMEMS promotes patient-centered care by empowering patients and their families to actively participate in disease management. The device's user-friendly interface and wireless transmission capabilities enable seamless data collection without disrupting daily activities, promoting greater patient and family engagement, and adherence to treatment plans.

Some important questions that remain unanswered by the current study include what the lower size limit for this technology is, and what the implications are for potential thrombosis from the device and the effects of flow dynamics on the device in complex circulations (eg, the Fontan circulation). Despite this, Labrandero et al[4] are to be commended for providing an important step toward improving outcomes and enhancing the lives of pediatric patients with heart failure and pulmonary hypertension. The study also underscores the importance of multicenter trials in the pediatric population to validate this technology in pediatrics, to address the performance of the device in unique physiologic and anatomic configurations, and to provide insights to future iterations of this therapy.

Declaration of competing interest

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