Case Report

# Nursing Management Strategies for a Patient With an Aeson CARMAT® Total Artificial Heart: a Case Report

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**Abstract**

**Introduction.** Total artificial heart (TAH) devices are a viable bridge to transplantation in patients with end-stage biventricular heart failure. Among these, the Aeson CARMAT® TAH offers pulsatile flow and biocompatible materials to enhance physiological compatibility and reduce thromboembolic risks.

**Case Presentation.** We describe the case of a 62-year-old male with ischemic cardiomyopathy and NYHA Class IV symptoms, deemed ineligible for immediate heart transplant. The patient underwent Aeson TAH implantation following multidisciplinary evaluation and was admitted to the cardiac surgery intensive care for postoperative management.

Clinical Findings. Postoperative care focused on six core areas: (1) hemodynamic monitoring, including continuous tracking of pressures and device-derived values; (2) anticoagulation and

bleeding control with INR-based dosing; (3) infection prevention via strict asepsis and respiratory therapy; (4) device monitoring, including waveform interpretation and alarm management; (5) patient and caregiver education on device handling and complication signs; and (6) early mobilization to prevent ICU-related complications and support functional recovery.

**Discussion.** The case highlights the nurse's central role in managing TAH patients, integrating technical competence with holistic support. Early identification of complications and structured education contributed to a successful recovery and preparation for transplant listing.

**Keyword:** Aeson CARMAT®, Total Artificial Heart, Nursing Care, Mechanical Circulatory Support, Heart Failure

## Introduction

Heart failure (HF) is a complex clinical syndrome characterized by the heart's inability to pump sufficient blood to meet the body's metabolic demands. Despite advances in pharmacological and device therapies, end-stage HF is still associated with a 1-year mortality rate of up to 70%.[1] Heart transplantation remains the gold standard treatment; however, donor organ shortages have led to the development of mechanical circulatory support systems such as the total artificial heart (TAH) as a bridge to transplant.[2]

Among these, the Aeson CARMAT® is a bioprosthetic device designed to replicate the anatomical shape and physiological function of the native heart, offering pulsatile blood flow and biocompatible materials to reduce thromboembolic risks and improve patient quality of life.[3,4]

Aeson TAH is indicated as a bridge to transplantation in patients with end stage biventricular heart failure (INTERMACS 1-4) who are unresponsive to maximal medical therapy. Patients must have adequate chest measurements to accommodate the device to be eligible for this treatment. The device is certified for 180 days of usage, after which a heart transplant will be necessary.[5]

This case report describes the nursing management of a patient with an Aeson TAH, with a focus on the critical role of nurses in postoperative care, complication prevention, patient and family education.

## Case Presentation

The CARE guidelines were used for the case description.[6]

A 62-year-old male with a history of ischemic cardiomyopathy and progressive biventricular heart failure was admitted to a cardiac surgery unit. The patient was symptomatic with NYHA Class IV dyspnea, fatigue, peripheral edema, and recurrent hospitalizations due to decompensation. He was deemed unsuitable for immediate transplantation due to donor shortage and was evaluated for Aeson TAH implantation as a bridge to transplant.

The Aeson TAH consists of a motor-pump unit with two micropumps that move silicone fluid across membranes to simulate systole and diastole. Each ventricular chamber is divided by a membrane into a blood compartment (made of biocompatible material) and a silicone fluid compartment. Integrated electronics, including microprocessors and sensors, allow the device to autonomously adjust blood flow based on the patient's physiological demands. Like the native heart, each ventricle contains biological prosthetic valves to ensure unidirectional flow and connects to the pulmonary artery and aorta via dacron grafts. A driveline provides power and enables continuous monitoring of key parameters such as ventricular output, heart rate, and systolic/diastolic pressures.[7]

Following a multidisciplinary evaluation, the patient underwent median sternotomy, cardiopulmonary bypass, and implantation of the Aeson TAH. Intraoperative findings included severely dilated ventricles and poor

myocardial contractility. The native ventricles and atrioventricular valves were excised, and the bioprosthetic device was connected to the atrial cuffs and great vessels using Dacron grafts.[7]

The patient was admitted to the cardiac surgery intensive care unit (CICU) and underwent invasive multiparametric monitoring, including invasive blood pressure and central venous pressure. Hourly fluid balance and blood loss were monitored via mediastinal drains. Routine blood tests and serial blood gas analysis were performed. The patient was connected to invasive mechanical ventilation and bladder temperature was monitored via Foley. Respiratory weaning was completed without adverse events and the patient was transferred to the ward after 96 hours of intensive monitoring.

## Clinical Findings

Postoperative nursing management focused on six critical domains: hemodynamic monitoring, infection prevention, anticoagulation management, device assessment, patient and family education and early mobilization.

*Hemodynamic Monitoring*

The nursing team constantly monitored the patient's central venous pressure, invasive arterial pressure, heart rate and oxygen saturation to detect early signs of complications.[8] The Aeson TAH uses an internal electro-hydraulic system that regulates the flow rate based on preload and afterload conditions, ventricular flow rate, heart rate and systolic and diastolic pressure of the left and right ventricles were the main values detected on the device throughout the post- and intra-operative period.

*Anticoagulation and Bleeding Management*

Due to the bioprosthetic nature of the device, anticoagulation was managed cautiously with daily International Normalized Ratio checks and dose adjustments. Strict monitoring was essential to prevent bleeding events, which are common in the early postoperative period.[9]

*Infection Control*

Nurses followed strict aseptic protocols and used personal protective equipment for care and dressing changes, especially near the exit points from the transmission line. Respiratory physiotherapy were implemented to reduce the risk of pneumonia.[10]

*Device Monitoring*

Nurses were trained to assess waveform readings, check for full ejection and partial filling, and recognize alarm signals from the external console. Monitoring included interpreting the COMDU display, which provides flow data based on air displacement through the drive lines.[9]

*Patient and Family Education*

The patient and caregivers received structured training on daily care, alarm management, battery replacement, and signs of complications. Psychological support was offered to address anxiety related to device dependency and altered body image.[11]

*Early Mobilization*

Early mobilization is a key nursing intervention in patients supported with the Aeson TAH. In collaboration with the cardiocirculatory perfusion technician, the patient is mobilized as soon as clinically stable to reduce the risk of immobility-related complications such as deep vein thrombosis, pulmonary complications,

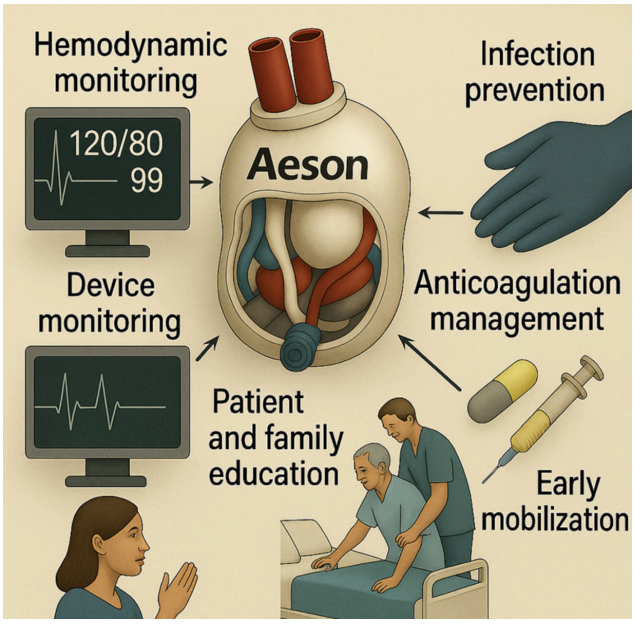


Figure 1. Nursing management of the patient with Aeson TAH - Nursing care priorities in the postoperative management of a patient with the Aeson TAH. The infographic highlights six essential nursing interventions: hemodynamic monitoring, device monitoring, anticoagulation management, infection prevention, patient and family education and early mobilization.

pressure injuries, and muscle deconditioning. Evidence supports that early mobilization in critically ill patients contributes to improved functional outcomes and reduced ICU-related morbidity.[12]

## Discussion

The Aeson TAH distinguishes itself from other devices through its use of biocompatible bovine pericardium for internal surfaces and its physiological pulsatile flow. Nursing care is central to ensuring the success of TAH therapy not only through technical monitoring but also through holistic care addressing emotional, functional, and educational needs.[9]

Evidence supports the role of specialized nursing care in reducing hospital readmissions, promoting early complication detection, and improving long-term outcomes in patients with advanced HF and TAH support.[8,9,12] Primary nursing principles were applied to ensure continuity and individualized care planning throughout the patient's hospitalization.[13]

Nursing surveillance was essential to detect early signs of renal dysfunction, which may result from impaired renal perfusion or hemolysis, and to adapt fluid management accordingly.[8,14,15]

Nutritional assessment and psychological support were also essential, especially during the transition to less ICU.[16,17] At discharge, the patient was clinically stable and awaiting inclusion on the cardiac transplant list, under close follow-up by the heart failure team.

## Conclusion

This case demonstrates the pivotal role of nurses in managing patients with Aeson TAH systems. Their responsibilities range from vigilant monitoring and infection control to detailed patient education and emotional support. TAH therapy is a complex, multidisciplinary process, but nursing care remains the linchpin to successful recovery and preparation for heart transplantation.

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