

Department of Surgery - In the News

UWMC First in Pacific Northwest to Discharge a Total Artificial Heart Patient

University of Washington Medical Center has become the first hospital in the Pacific Northwest to discharge a patient implanted with the world's only approved Total Artificial Heart. The device, manufactured by SynCardia Systems, is approved for use as a bridge to transplant in the United States, Canada and Europe. The UW Medicine Regional Heart Center is the first Western Washington heart-care service to offer this technology.

The patient, Christopher Marshall, of Wasilla, Alaska, was discharged from the hospital on March 21st. He was implanted with the Total Artificial Heart during a six-hour procedure on February 6th.



Chris Marshall with his "Freedom Pack" portable device and "Big Blue," the machine to which he was connected after the implantation of his artificial heart. With him are his nurse Shauna Andrus and his surgeon Dr. Nahush A. Mokadam.

The surgeon was **Dr. Nahush A. Mokadam**, the hospital's co-director of heart transplantation and director of mechanical circulatory support. He was assisted by Dr. Awori J. Hayanga, chief resident in cardiothoracic surgery. Mokadam is the LeRoss Endowed Professor in Cardiovascular Surgery, UW Department of Surgery.

"Mr. Marshall has done remarkably well on the device. I'm very pleased with its performance and his recovery. We continue to support him as we await his heart transplant," Mokadam said.



The Total Artificial Heart, seen at the lower left, awaits placement during Mr. Marshall's surgery.

Marshall, 51, was admitted to UW Medical Center in January with a heart performing barely well enough to keep him alive, Mokadam said. Marshall had been diagnosed in 1999 with idiopathic cardiomyopathy, a deterioration of heart function with an unknown cause, and ventricular tachycardia, an irregular, fast heartbeat. The conditions progressively reduced his heart muscle's pumping capacity.

Originally designed as a permanent replacement heart, the SynCardia device is approved by the Food and Drug Administration as a temporary solution until a donor heart becomes available. The device is available to patients at risk of imminent death from biventricular failure. This is an irreversible state affecting both chambers that pump blood away from the heart.

In the implantation procedure, the surgeon removes the patient's failing left and right ventricles and all four heart valves. The implanted device consists of two bulbous, polyurethane chambers that act as ventricles. Each chamber has an in-flow and out-flow valve and a four-layer diaphragm. They are sutured into the remaining heart structure: the left and right atria, the aorta and pulmonary artery.

The implanted device has no sensors, motors or electronics. It is powered by a pneumatic driver outside of the patient's body, which is connected by two tubes that exit the patient's abdominal wall. The driver supplies vacuum pressure to pull the diaphragm to the bottom of the ventricle, allowing blood to enter, then produces a precisely calibrated pulse of air that pushes the diaphragm to the top of the ventricle to fully eject the blood.

Currently, the only FDA-approved driver for powering the Total Artificial Heart weighs 418 pounds and confines patients to the hospital while they wait for a matching donor heart. SynCardia's portable driver, which weighs only 13.5 pounds, is undergoing an FDA-sanctioned clinical study to determine whether it can safely be used at home. This driver is battery-powered, rechargeable, and can be carried in a backpack, shoulder bag or rolling caddy.

The manufacturer has certified UW Medical Center to implant the device, and the hospital is a study site for the portable driver. Marshall met study criteria to be switched to the portable driver and was discharged – although to Seattle instead of Wasilla so that he is close by when a donor heart becomes available.

At a press conference, Marshall said, “At first the idea of having my valves and ventricles cut out was unnerving: Do I need all of this? But after I collapsed the day before the surgery, I understood the great need and was able to wrap my mind around it.”



UW Medicine heart transplant surgeon Dr. Nahush A. Mokadam puts the Total Artificial Heart into Mr. Marshall's chest.

Now Marshall is looking forward to taking hikes in the Seattle area with his wife, and his dog who recently was flown down from Alaska, “though I'm limited by my battery power as to how far I can go.” Last Saturday he enjoyed seeing the boats at the Ballard Locks on his first trip out of the hospital since he was admitted in January. He was accompanied by UWMC nurse Shauna Andrus, who has special training in the care of patients with the device.

“Chris has been smiling and upbeat throughout all of this,” said his wife Kathy. “He is my hero.”

For the past 20 years, the supply of donor hearts in the United States has remained flat, averaging about 2,200 per year. At the start of February, more than 3,100 Americans awaited a heart transplant, including 91 in Pacific Northwest states, according to the U.S. Organ Procurement and Transplantation Network and Scientific Registry of Transplant Recipients. Heart transplant candidates can wait months or years due to the shortage of donor organs.

During the 10-year clinical study of the Total Artificial Heart that led to its FDA approval in 2004, 79 percent of patients survived until transplant. The Total Artificial Heart has been implanted in more than 1,000 people worldwide, said Michael Garippa, SynCardia's CEO. The current longest-supported patient received a transplant after 1,374 days with the device.

During the clinical study, 65 percent of patients who received the SynCardia device were out of bed within five days of surgery, and a similar percentage were walking more than 100 feet within 21 days of implant, the company reports.

The implant continues UW Medicine's achievement in advanced heart care:

- Its surgeons have implanted more than 280 patients with bridge-to-transplant, circulatory-support mechanisms, including ventricular assist devices, since 1997. More than 90 percent of implanted patients are successfully transplanted.
- Its surgeons performed the region's first heart transplant, in 1985, and have performed 534 such procedures since 1988, more than any other Pacific Northwest cardiac care service.
- Its surgeons performed the first adult heart-lung transplant in western Washington in 2007.
- Its heart-transplant patients' 1-, 5- and 10-year survival rates are among the best in the United States.

Story by Brian Donohue / Photos by Clare McLean - UW Health Sciences/UW Medicine