



A ticker that ticks!

The decision in October 2003 by the Centers for Medicare and Medicaid Services (CMS) to approve the use of a heart-assist device as a destination therapy in patients with end-stage heart failure opens a new era for the devices, which previously had been used only as a bridge to transplantation.

UPMC Artificial Heart Program experts are actively pursuing and testing the next generation of heart-assist devices. They are testing a range of new systems: some designed at UPMC, some designed at several medical device companies.

In July, UPMC became the first hospital in the United States to use the CardiacAssist Inc. TandemHeart percutaneous trans-septal ventricular assist (PTVA) system under FDA-approved short-term use. Unlike most current heart-assist devices, a PTVA pumps blood out of the left side of the heart and returns it to the body through a connection to the femoral artery in the leg.

The method makes open-chest surgery and implantation of the device within the chest unnecessary. Because of this, it is performed as a relatively low-risk procedure by cardiologists experienced with catheterization — rather than by cardiac surgeons. Doctors hope that the PTVA may be particularly gentle on patients who would be too sick to undergo internal heart-assist-device implantation. Dr. Peter Counihan, director of Cardiac Catheterization Research at UPMC Presbyterian, performed the first PTVA implant.

“We have since given PTVAs to several patients who otherwise wouldn’t have been offered cardiac surgery,” said Dr. Larry L. Shears, assistant professor of surgery, who performed the bypass operation. “This device may revolutionize the way we treat some of these very ill patients.”

The TandemHeart is unusual in another way, Dr. Counihan explains: It uses a six-bladed propeller to impel blood. Doctors hope that this innovation, which is being pursued in a number of new assist devices, might damage the blood less than the bellows-style pumps used in the currently FDA-approved assist devices.

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patients at UPMC have been supported to heart transplantation by artificial heart devices since 1985.

The Next HeartMate

UPMC physicians and engineers are also working with Thoratec to test the next generation of HeartMate, the HeartMate II. Researchers at UPMC’s McGowan Institute for Regenerative Medicine designed a sophisticated control system for the HeartMate II that senses when to increase or decrease the rate of blood flow.

This automated system would be a big improvement over present systems, which require manual adjustment. Dr. James Annali, a McGowan Institute member who is also a faculty member at Carnegie Mellon University, conceived the idea for the system and headed the design of its algorithm — the logical rules that underlie its programming.

“This algorithm is essentially the intelligence of the system,” says Dr. Kormos. “Engineers don’t need to stand at the patient’s side in order to adjust the device.”

The HeartMate II was implanted for the first time in the United States in November by surgeons at the Texas Heart Institute in Houston. UPMC is one of four centers that will test the device as a bridge for heart-transplant candidates.

The procedure launched a pilot study of the new device, which like the TandemHeart uses a miniature rotary pump instead of a bellows to impel blood. At 12 ounces and 1.5 by 2.5 inches in size, it’s much smaller, and even more portable, than the roughly 3-pound, current-generation devices like the HeartMate XVE.

Over the Horizon

Nor will UPMC’s heart-assist experts be satisfied with the success of the next generation of devices. Two elusive, and partly independent, goals remain: an artificial heart that can completely replace the heart’s function, and a permanent, natural replacement for the human heart.

HeartMate II

UPMC physicians and engineers are working with Thoratec to test the next generation of HeartMate, the HeartMate II, shown above at actual size. At 12 ounces and 1.5 by 2.5 inches in size, it’s much smaller, and even more portable, than the roughly 3-pound, current-generation devices like the HeartMate XVE.



The first goal may be more realistic in the short term. The CMS approval of the HeartMate XVE marks, in essence, the first permanent heart-assist device. But a safe and effective, full-capacity artificial heart doesn’t yet exist. While an assist is all that most patients need, a true artificial heart could help those whose hearts have essentially lost all function.

“This is truly an exciting time for investigating end-stage heart failure treatment,” says Dr. Kormos. A number of promising technologies stand before researchers, if they can collect the necessary expertise to exploit the options. “We have all the elements for the necessary collaborations right here at UPMC.”