Cardiovascular Update

November 2017 | Volume 2, Issue 6

A newsletter from the BayCare Cardiovascular Service Line

LVAD: Mechanical Circulatory Support

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Heart failure is a growing epidemic in the United States. It's estimated that 5.7 million people are currently affected by heart failure.[1] The rate of heart failure increases with age as well, and it's estimated that there are 670,000 new cases of heart failure diagnosed each year in the United States. Even worse, 50–100,000 people are deemed to have New York Heart Association Class IV heart failure which means they have become unresponsive to medical therapy. When you combine these facts with the prediction that by the year 2030, the incidence of heart failure will increase by 46 percent and therefore effect some eight million people, it's understandable why we call this an epidemic. These are sobering statistics that make both patients and physicians worried about what the future holds when someone is diagnosed with heart failure.

However, physicians have answered the call to develop new and innovative treatments for patients who develop severe heart failure. In the 1950s, research began into the development of an artificial pump that could function in place of the heart. In fact, the first implantation of a ventricular assist device was performed in 1966. The field of mechanical support had begun. This set off a wave of research that continues to this day. However, as quickly as it started, a new medical breakthrough occurred and relegated the field of mechanical circulatory support to the proverbial backseat. That new breakthrough was heart transplantation. The first human heart transplantation occurred in December 1967. The first heart transplant performed in the U.S. was done in January 1968 by Dr. Norman Shumway. This pioneering achievement which has continued to develop over the last 50 years has become the gold standard in the treatment of patients with advanced heart failure. Unfortunately, there were only 3,100 heart transplants performed in the U.S. in 2016. When you think of the fact that 50-100K people are diagnosed each year with advanced heart failure, the disparity becomes obvious. This is why the field of mechanical support has been rejuvenated.

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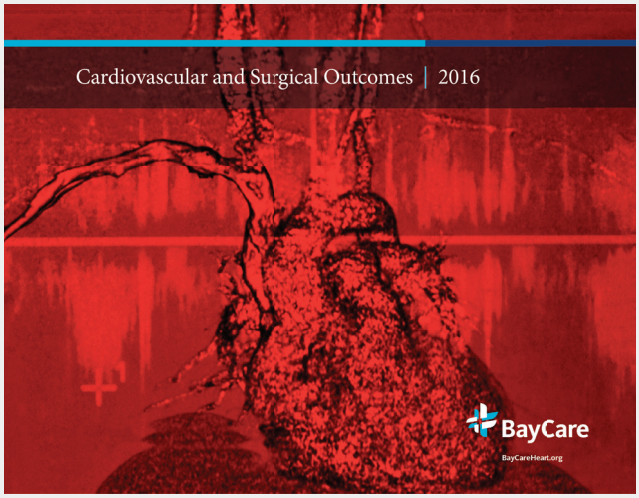

As a system of community hospitals within West Central Florida, BayCare is committed to being a leader in providing superior heart care. The BayCare Cardiovascular and Surgical Outcomes book for 2016 is available, detailing our volume and outcomes data, as well as highlighting some of our world-class programs including our heart failure clinics, fast-growing structural heart and arrhythmia programs, and the many clinical research trials available across the system.

Download a copy of our 2016 outcomes book today.

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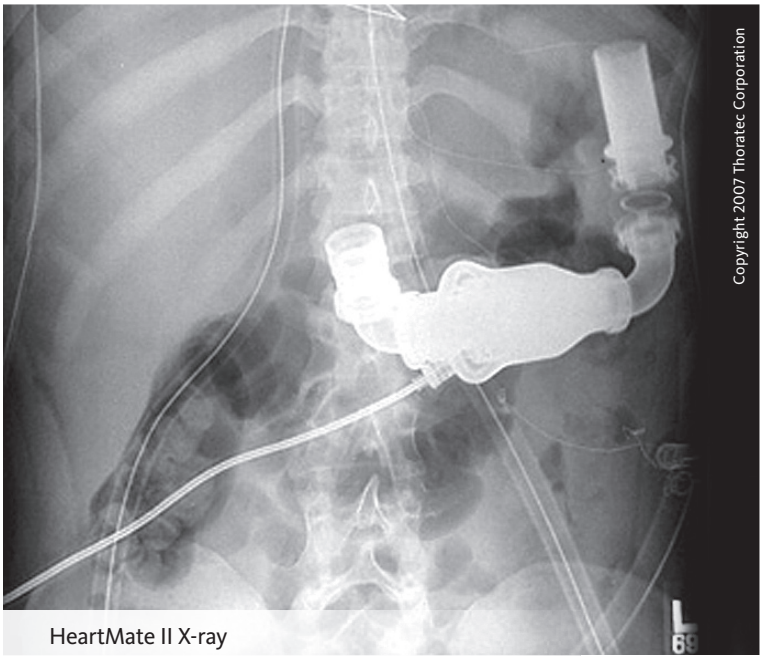
A left ventricular assist device (LVAD) is an implantable mechanical pump that works with the heart to deliver adequate blood flow to the body. Several pumps have developed over time. The device most currently studied and used is the Heartmate II. Implantation began in 2003 and it was approved as a bridge to transplant device in 2008. In 2010, it was approved for destination therapy. Destination therapy is defined as those patients who require mechanical support but who are not candidates for transplantation. This is currently the largest group of patients receiving LVAD therapy.[2] The improvement in a patient's quality of life and improved survival however, must be weighed against the increased risk of infection, bleeding, neurologic events and pump malfunction that's due principally to pump thrombosis. This has led to newer pump designs and further studies.

The Heartmate II is an axial-flow pump connected to the patient's left ventricle. It then draws blood into the LVAD, where it's pumped through a graft connected to the patient's aorta. The device is powered by a driveline that's brought out of a small incision and connected to a battery. This pump which weighs approximately 375 grams and is approximately 2.5 inches long, can deliver up to 10 liters of blood per minute.

Two more recent studies have demonstrated encouraging results with smaller devices. The Heartmate III has been in trial in the U.S. and its results published in the New England Journal of Medicine in February 2017. In the MOMENTUM-3 trial, it was concluded that the magnetically levitated centrifugal-flow pump (Heartmate III) was associated with better outcomes at six months when compare to axial-flow pumps.[3] This was primarily due to the lower reoperation rate for pump malfunction in the Heartmate III group. This study is still ongoing but appears promising.

In the ENDURANCE trial, again a smaller centrifugal-flow pump (Heartware) was compared to the Heartmate II. This newer LVAD was found to be noninferior in terms of survival, freedom from disabling stroke or the need to replace the device secondary to pump malfunction.[4]



HeartMate II X-ray

Left ventricular assist devices are revolutionizing the way we treat patients with advanced heart failure. This technology continues to develop and expand and it's rivaling heart transplantation survival in the short term. As the pumps become smaller, implantation becomes more minimally invasive and with a host of other advances occurring in this field, the survival and quality of life should continue to increase for our patients with severe heart failure.

In contrast, patients who develop acute heart/lung failure need rapid support of their cardiac and/or lung function. This requires the ability to quickly implement mechanical support that can help deliver adequately oxygenated blood to the body while allowing for a "rest" period. It's this period of time that is vital to provide adequate heart/lung function to patients to prevent multisystem organ failure. This allows for treatment of the underlying cause of heart/lung failure and recovery of the patient's own intrinsic function. Extracorporeal membrane oxygenation (ECMO) allows us to do this.

There are two types of ECMO. Venoarterial ECMO (VA ECMO) is often used for patients with cardiac or cardiopulmonary failure. This can be caused by myocardial infarction, post-cardiotomy shock, myocarditis or cardiopulmonary failure. Blood is removed from the venous system via a cannula; it in turn goes through an oxygenator and is then pumped back into the patient's arterial system via another cannula. It essentially takes over the work of the heart and lungs during this time period. Again, this allows time for the heart and/or lungs to recover their native function so that the patient can then be weaned from ECMO.

Venovenous ECMO (VV ECMO) is another strategy of support that can be used for patients with respiratory failure. These are typically patients who have suffered pulmonary failure from pneumonia, influenza or aspiration. VV ECMO is used when patient heart function remains normal and we use it as well as our circuit to deliver appropriately oxygenated blood to the patient. These patients can remain on VV ECMO, yet be extubated and allowed to mobilize, which can improve their recovery.

Currently, BayCare is investing heavily in both destination LVAD therapy and ECMO programs. This will allow us to offer significant technology and expert care to these patients. We're currently enrolling patients at St. Joseph's Hospital Advanced Heart Failure Clinic who may be candidates for destination LVAD therapy. Destination LVAD therapy will be offered at St. Joseph's Hospital and we welcome any patients from the entire BayCare network of hospitals to be evaluated for this life-saving technology. With regard to our use of ECMO, both St. Joseph's and Morton Plant hospitals currently offer both VA and VV ECMO.

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