POLICY STATEMENT:
Based upon our criteria and review of the peer-reviewed literature, FDA approved ventricular assist devices have been medically proven to be effective and therefore, medically appropriate for the following indications:

I. When used as a bridge to transplantation for patients diagnosed with severe ventricular heart failure who meet all of the following criteria:
   A. Approved as heart transplant candidate by an approved heart transplant center;
   B. An imminent risk of dying before donor heart procurement;
   C. On optimal inotropic (influencing the contractility of muscular tissue) support; and,
   D. On an intra-aortic balloon pump (IABP), unless contraindicated.

II. As a bridge to recovery for post-cardiotomy patients who are unable to be weaned from cardiopulmonary bypass, or for patients with potentially reversible left ventricular dysfunction due to acute cardiogenic shock or acute myocarditis.

III. As destination therapy for patients with chronic end-stage cardiac failure who meet all of the following criteria based on the REMATCH study:
   A. Evaluated as a heart transplant candidate by an approved heart transplant center; but determined to be ineligible for heart transplantation. AND
   B. NYHA class III or IV heart failure for at least 28 days who have received at least 14 days support with an intraaortic balloon pump or are dependent on IV inotropic agents OR class IV end-stage heart failure that has failed to respond to optimal medical management for at least 60 of the last 90 days, AND
   C. Functional limitation with a peak oxygen consumption of less than or equal to 14 ml/kg/min; AND
   D. Appropriate body size to support the LVAD implantation.

Refer to Corporate Medical Policy #7.01.65 regarding Artificial Hearts.

POLICY GUIDELINES:
I. The following guidelines may be used as hemodynamic selection criterion for bridge to transplant:
   A. Either a left atrial pressure of 20m Hg or a cardiac index of less than 2.0L/min/m;
   B. Patients are generally being treated as inpatients and categorized by the American Heart Association, or comparable, as Class IV CHF; and
   C. Classified as Status I by the United Network for Organ Sharing (considered the highest priority for transplantation).

II. Contraindications for bridge to transplant:
   A. Includes conditions which would generally exclude patients for heart transplant:
      1. Chronic irreversible hepatic, renal, or respiratory failure,
      2. Systemic infection, or
   B. Uncorrected valvular diseases, due to the potential problems with adequate function of the ventricular assist device.

III. Individuals considered for VAD implantation, as destination therapy should be evaluated for potential difficulties that would complicate and diminish the success of the implantation including an assessment of patient compliance.
IV. The DeBakey VAD Child has Humanitarian Device Exemption authorization for use in providing temporary left side mechanical circulatory support as a bridge to cardiac transplantation for pediatric patients (5-16 years old, with BSA greater than or equal 0.7 m$^2$ and less than 1.5 m$^2$) who are in NYHA Class IV end stage heart failure, are refractory to medical therapy and who are (listed) candidates for cardiac transplantation. The Berlin Heart EXCOR VAD is indicated for children with severe isolated left ventricular or biventricular dysfunction who are candidates for cardiac transplant and require circulatory support and has also received FDA approval through the humanitarian device exemption (HDE) process.

V. The Food and Drug Administration (FDA) recommends humans factor testing for Ventricular assist-devices.

VI. On August 5, 2015, the FDA released safety communications regarding adverse events with left ventricular assist devices, some of which include thrombosis, stroke, and bleeding. It is recommended that providers perform a comprehensive clinical evaluation, examine the benefit-risk profile of each patient, determine the most appropriate treatment, and if necessary, select a device. Moreover, it is suggested that the current device labeling is reviewed before making treatment decisions if using ventricular assist devices. Finally, it is recommended that the device is returned to the manufacture. If adverse events occur, manufacture evaluation will be crucial to better understand the reasons behind the adverse event.

DESCRIPTION:

Ventricular assist devices (VADs) fit into the general category of mechanical circulatory assist devices. VADs have been developed to provide mechanical support for patients with severe heart failure who are awaiting a heart transplant (bridge to transplant), for patients with post cardiotomy or potentially reversible left ventricular dysfunction (bridge to recovery), and in certain specific instances, for patients with end stage heart failure who are not suitable transplant candidates (destination therapy).

Bridging to heart transplantation involves improving hemodynamics and restoring organ function such that a patient may have a better probability of surviving until a donor heart is available. Destination therapy is used for individuals with end stage heart failure (who are not candidates for heart transplant), who are currently receiving optimal medical therapy with ACE inhibitors, beta-blockers, and inotropic drugs. Left ventricular assist devices (LVADs) are also used temporarily for post-cardiotomy patients who cannot be weaned from cardiopulmonary bypass immediately following surgery. VADs have also been investigated as a bridge to recovery in patients with potentially reversible left ventricular dysfunction due to acute cardiogenic shock or acute myocarditis.

RATIONAL:

VADs can provide an effective bridge to transplantation, allowing patients to survive until a donor heart is available. Published studies report that use of a VAD does not compromise the success of subsequent heart transplantation, and may actually improve post-transplant survival.

The use of VADs as destination therapy is supported by the REMATCH study, a randomized controlled trial that compared LVAD device transplantation with optimal medical management in 129 patients with end-stage heart failure who were not candidates for cardiac transplantation. The trial showed that patients who received a VAD had a longer survival rate than those treated with optimal medical therapy. Median survival was increased by approximately 8.5 months. Although adverse events were more likely in the VAD group, these appeared to be outweighed by better outcomes on function; NYHA class was significantly improved, as was quality of life among those living to 12 months. Two years of additional observation on REMATCH patients (Park, 2005) substantiates the continuing survival benefit of LVAD support. LVAD treatment more than doubled the survival seen at 2 years over optimal medical management.

VADs have been used as bridge to recovery for patients with potentially reversible left ventricular dysfunction. Implantation of VADs provides circulatory support and allows myocardial recovery in post cardiotomy cases where the patient cannot be weaned from cardiopulmonary bypass, and in patients with acute cardiogenic shock or acute myocarditis.
A variety of devices have received approval for marketing from the U.S. Food and Drug Administration (FDA), encompassing both biventricular and left ventricular devices. The type of device used is dependent upon specific FDA-labeled indications. These devices include, but are not limited to:

I. **HeartMate® Sutures Not APplied Vented Electric Left Ventricular Assist System (SNAP VE LVAS)** (Thoratec Corp.);

II. **HeartMate® XVE LVAS (Thoratec Corp.)**;

III. **HeartMate® II LVAS (Thoratec Corp.)**;

IV. **Impella 2.5 (AbioMed Cardiovascular, Inc)**;

V. **Thoratec® Implantable Ventricular Assist Device (VAD) System (Thoratec Corp.)**;

VI. **Thoratec® Implantable Ventricular Assist Device (IVAD) (Thoratec Corp.)** and

VII. **Abiomed BVS® 5000 Biventricular Support System (AbioMed Cardiovascular, Inc.)**.

Two pulsatile devices, the HeartMate SNAP VE LVAS, and the HeartMate XVE LVAS, have received FDA approval as destination therapy. The Heartmate II LVAS, a continuous flow device received FDA approval as destination therapy January 20, 2010. The premarket approval included two-year data from a study cohort of 200 patients randomly assigned 2:1 to either a HeartMate XVE or a HeartMate II. Patients implanted with the HeartMate II device had statistically significant improved two-year survival vs. those implanted with the HeartMate XVE, in addition to improved quality of life. Forty-six percent of the 134 patients implanted with the HeartMate II were still living after two years with no disabling stroke or need for reoperation, device replacement or repair, compared with 11% in the 66 patient control group. Approval was contingent on a post-approval follow-up study involving 247 patients for either two-years or until outcome by Thoratec.

In February 2004, the FDA approved a Humanitarian Device Exemption (HDE) for the DeBakey VAD® Child, a ventricular assist device for home and hospital use, for children aged 5 to 16 awaiting a heart transplant. The FDA approved the HDE for the VAD after reviewing data that showed the device had a reasonable probability of being safe and effective in children. Publications have reported positive outcomes for children using VADs as a bridge to transplantation. Using the UNOS database, Davies, et al. (2008) reported on use of VADs in pediatric patients undergoing heart transplantation. Their analysis concluded that pediatric patients requiring a pretransplantation VAD have similar long-term survival to those not receiving mechanical circulatory support.

Prior to April 2008, only pulsatile LVADS devices were FDA approved for long-term use. Non-pulsatile axial flow devices are smaller in size and have other technical advantages over pulsatile models. The HeartMate II (Thoratec) is the first continuous flow device to receive FDA approval as a bridge to transplant (BTT) for treatment of advanced-stage heart failure. The approval was based on one-year follow-up data from the first 194 HeartMate II BTT patients enrolled in the trial. Results included in the final PMA submission were:

I. The median duration of support was 132 days, and the cumulative patient support in the trial was 109 years.

II. Survival to cardiac transplantation, recovery or ongoing on HeartMate II support was 80 % at six months and 77 % at one year.

III. 84 % of the patients survived to hospital discharge or transplantation.

IV. Significant improvements were observed across all measures of functional status and quality of life as compared to baseline status.

V. The incidence of major adverse events with comparable definitions - including infections, strokes and bleeding requiring surgery - was significantly lower than what was clinically observed in the previous BTT study of the HeartMate VE LVAS.

The Jarvik 2000, a non-pulsatile axial flow blood pump, is in phase II and III clinical trials. The Jarvik 2000 is used by hospitals in the United States as a bridge to heart transplant under an FDA-approved clinical investigation. In Europe, the Jarvik 2000 has earned CE Mark certification for both bridge-to-transplant and lifetime use. As an investigational device, the Jarvik 2000 has been implanted in more than 200 patients dying of heart failure.

AbioMed, Inc announced the FDA 510(k) clearance for its Impella 2.5 cardiac assist device June 2, 2008. The Impella 2.5 is inserted percutaneously via the femoral artery into the left ventricle to provide partial circulatory support for periods up...
to six hours. Up to 2.4 liter of blood per minute is delivered by the pump from the left ventricle into the ascending aorta, providing the heart with active support in critical situations. The PROTECT I trial (Dixon, et al. 2009) evaluated the effectiveness of the Impella 2.5 (n = 20) in patients undergoing high risk PCI at seven centers. Eligible patients had a LEF of less than 35%. The Impella 2.5 device was implanted successfully in all patients. The mean duration of circulatory support was 1.7 ± 0.6 h (range: 0.4 to 2.5 h). Mean pump flow during PCI was 2.2 ± 0.3 l/min. At 30 days, the incidence of major adverse cardiac events was 20% (2 patients had a periprocedural myocardial infarction; 2 patients died at days 12 and 14). There was no evidence of aortic valve injury, cardiac perforation, or limb ischemia. Two patients (10%) developed mild, transient hemolysis without clinical sequelae. None of the patients developed hemodynamic compromise during PCI. Other studies investigating the Impella device, although limited by small sample populations, have demonstrated its efficacy in providing circulatory support during high-risk percutaneous revascularization procedures and in post-cardiotomy patients.

The Society for Heart and Lung Transplantation (Gronda, 2006), published guidelines for the care of cardiac transplant candidates that included considerations for the use of ventricular assist devices. The recommendations for VAD therapy are based on a comparison of short- and long-term survival and QOL outcomes with conventional therapy and are available at: http://www.jhltonline.org/article/S1053-2498(06)00251-8/pdf.

**CODES:**

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<td>Eligibility for reimbursement is based upon the benefits set forth in the member’s subscriber contract.</td>
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<td>CODES MAY NOT BE COVERED UNDER ALL CIRCUMSTANCES. PLEASE READ THE POLICY AND GUIDELINES STATEMENTS CAREFULLY.</td>
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<td>Codes may not be all inclusive as the AMA and CMS code updates may occur more frequently than policy updates.</td>
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**CPT:**

- 33975 Insertion of ventricular assist device; extracorporeal, single ventricle
- 33976 Insertion of ventricular assist device; extracorporeal, biventricular
- 33977 Removal of ventricular assist device; extracorporeal, single ventricle
- 33978 Removal of ventricular assist device; extracorporeal, biventricular
- 33979 Insertion of ventricular assist device, implantable intracorporeal, single ventricle
- 33980 Removal of ventricular assist device, implantable intracorporeal, single ventricle
- 33981 Replacement of extracorporeal ventricular assist device, single or biventricular, pump(s), single or each pump
- 33982 Replacement of ventricular assist device pump(s) implantable, intracorporeal, single ventricle, without cardiopulmonary bypass
- 33983 Implantable intracorporeal, single ventricle, with cardiopulmonary bypass
- 93750 Interrogation of ventricular assist device (VAD), in person, with physician analysis of device parameters (eg, drivelines, alarms, power surges), review of device function (eg, flow and volume status, septum status, recovery), with programming, if performed, and report

**HCPCS:**

- Q0480-Q0509 VAD components (code range)

**ICD:**

- 398.91 Rheumatic heart failure (congestive)
- 402.01 Malignant hypertensive heart disease with congestive heart failure
402.11 Benign hypertensive heart disease with congestive heart failure
404.01 Malignant hypertensive heart and renal disease with congestive heart failure
404.03 Malignant hypertensive heart and renal disease with congestive heart failure and renal failure
404.11 Hypertensive heart and renal disease with congestive heart failure and renal failure
410.00-410.92 Acute myocardial infarction (code range)
422.0 Acute myocarditis in diseases classified elsewhere
422.90 Acute myocarditis, unspecified
422.91 Idiopathic myocarditis
422.92 Septic myocarditis
425.4 Other primary cardiomyopathies
425.9 Secondary cardiomyopathy, unspecified
428.0 Congestive heart failure, unspecified
428.1 Left heart failure
428.40 Combined systolic & diastolic heart failure, unspecified
428.41 Combined systolic & diastolic heart failure, acute
428.42 Combined systolic & diastolic heart failure, chronic
428.43 Combined systolic & diastolic heart failure, acute or chronic
428.9 Heart failure, unspecified
785.51 Cardiogenic shock

ICD10:
A18.84 Tuberculosis of heart
I09.81 Rheumatic heart failure
I11.0 Hypertensive heart disease with heart failure
I13.0 Hypertensive heart and chronic kidney disease with heart failure and stage 1 through stage 4 chronic kidney disease, or unspecified chronic kidney disease
I13.2 Hypertensive heart and chronic kidney disease with heart failure and with stage 5 chronic kidney disease, or end stage renal disease
I21.01-I22.9 ST elevation (STEMI) and non-ST elevation (NSTEMI) myocardial infarction (code range)
I40.0-I41 Acute myocarditis and Myocarditis in diseases classified elsewhere (code range)
I50.1-I50.9 Heart failure (code range)
R57.0 Cardiogenic shock

REFERENCES:


**KEY WORDS:**

Bridge to heart transplant, Assist Devices, ventricular, LVAD, VAD, Destination Therapy.