INSTRUCTIONS FOR USE

This Clinical Guideline provides assistance in interpreting UnitedHealthcare benefit plans. When deciding coverage, the enrollee specific document must be referenced. The terms of an enrollee's document (e.g., Certificate of Coverage (COC) or Summary Plan Description (SPD)) may differ greatly. In the event of a conflict, the enrollee's specific benefit document supersedes this Clinical Guideline. All reviewers must first identify enrollee eligibility, any federal or state regulatory requirements and the plan benefit coverage prior to use of this Clinical Guideline. Other Policies and Coverage Determination Guidelines may apply. UnitedHealthcare reserves the right, in its sole discretion, to modify its Policies and Guidelines as necessary. This Clinical Guideline is provided for informational purposes. It does not constitute medical advice.

BENEFIT CONSIDERATIONS

Where the use of a mechanical circulatory support device is deemed unproven, benefits may be available under Certificates of Coverage or Summary Plan Descriptions that describe coverage for promising but unproven treatments for life-threatening illnesses and coverage for clinical trials. The enrollee-specific benefit document must be consulted to determine coverage.

E&I
- The Guideline applies to all plans

C&S
- The Guideline applies to those plans with Medical Necessity language and that apply UnitedHealthcare Medical Policy when making coverage determinations.

M&R
- The Guideline does not apply. The National Coverage Determination must be followed. (CMS). Publication 100-03 National Coverage Determination (NCD) for ARTIFICIAL HEARTs and Related Devices (20.9), Published December 8, 2010. Available at: http://www.cms.gov/medicare-coverage-database/

Some state mandates and benefit designs allow for out-of-network coverage of mechanical circulatory support devices that supersede the guidance in this clinical guideline. The enrollee-specific benefit document must be consulted to determine the availability of out-of-network coverage.

Enhancements to already implanted mechanical circulatory support devices that are functioning well are not covered. Replacement and repair of already implanted mechanical circulatory support devices is subject to individual case review.

The enrollee specific benefit document must be consulted to determine the ability to apply facility-based criteria in making coverage determinations.
GENERAL INFORMATION

This guideline describes the indications, minimum evaluation requirements, contraindications, and special considerations for the use of long-term, durable mechanical circulatory support devices (MCSD). In addition, there are appendices with important supplemental information useful when applying the directions contained within this guideline and the references used in constructing the guideline.

Devices that ARE in-scope include:

- At this time, the only FDA approved artificial heart that is in-scope for this Guideline is the 70 cc Syncardia Total Artificial Heart®
- The following MCSDs for use in adults when used in accordance with the FDA approved indications: Thoratec HeartMate II®, Thoratec PVAD™, Thoratec® IVAD™ and HeartWare® Ventricular Assist System.
- Other permanently implantable MCSDs intended for use in adults subject to the benefit language within the coverage document.

Devices that are NOT in-scope include:

- All non-permanent cardiac assist devices including but not limited to:
  - Intra-Aortic Balloon Pump (IABP)
  - Impella 2.5
  - Impella 5.0
  - CentriMag
  - Tandem Heart
  - Circulte
- Pediatric MCSDs
- The AbioCor Implantable Replacement Heart is unproven as an alternative to heart transplantation (United Healthcare Medical Policy Number: 2013T0384J, TOTAL ARTIFICIAL HEART, Effective Date: April 1, 2013)
- Automatic Intracardiac Defibrillators (AICD), with or without synchronous pacemaker
- Pacemakers of any description

GLOSSARY OF TERMS

BTT: BTT refers to Bridge to Transplant. Patients so designated have been fully evaluated for transplant, have been found to be suitable candidates for transplant, have met all of the Indications
for MCSD contained within the Guideline and have been placed on the UNOS list as active candidates. See UNOS Listing.

**DT:** DT refers to Destination Therapy. Patients so designated have been fully evaluated for transplant and are not transplant candidates for whatever reason but meet all of the other Indications for MCSD contained within this Guideline.

**BTD:** BTD refers to Bridge to Decision and Bridge to Candidacy (BTC). Patients so designated have been fully evaluated for transplant. These patients may not be transplant candidates for any reason but could be a transplant candidate in the future following remediation of a disqualifying condition. Patients in this category meet all of the other Indications for MCSD contained within this Guideline. These patients will be categorized as DT in the future if the underlying condition that prevents listing for heart transplant cannot be remediated. These patients will be listed with UNOS by the programs as Status 7. Medicare does not recognize this category.

**MCSD:** MCSD as specifically used in this Guideline refers to a mechanical circulatory support device that is intended for non-temporary use. Examples of such devices are listed in the Section labeled Devices in Scope. Terms frequently used to describe a MCSD include VAD, LVAD, TAH, RVAD, IVAD and PVAD (when used to describe the Thoratec PVAD, not a peripheral, non-permanent assist device such as those listed above).

**Indication:** All criteria that must be met to document that the implantation of a MCSD is medically necessary.

**Contraindication:** A Contraindication is a circumstance or condition that, when present, is sufficient reason to conclude that the use of a MCSD is not medically indicated because it is not safe and effective. Alternative therapy must be considered.

**Designated Facility:** A Designated Facility has entered into an agreement with us, or with an organization contracting on our behalf, to render Covered Health Services for the treatment of specified diseases or conditions. A Designated Facility may or may not be located within the member’s geographic area. The fact that a Hospital is a Network Hospital does not mean that it is a Designated Facility.

**Special Consideration:** A Special Consideration is a circumstance or condition that by itself is not necessarily a Contraindication to the implantation of a MCSD. Special Considerations are frequently referred to as Relative Contraindications. When a Special Consideration is found, additional information must be provided that, when taken into account, may indicate that it is both safe and advisable to proceed with MCSD implantation. Frequently, when a Special Consideration exists, a subspecialty consultation will be required to assess the safety and medical appropriateness of MCSD implantation.

**Minimum Patient Evaluation Requirements:** These tests are required prior to approval of MCSD implantation. Certain outcome parameters or “flags” are included in the descriptions of Minimum
Patient Evaluation Requirements. If these "flags" are uncovered, additional information must be provided in the form of an explanation by the requesting physician. We may require that this explanation include a consultation by the appropriate sub-specialty consultant with clearance by the consultant.

United Network for Organ Sharing (UNOS) Listing: A patient will be considered to be actively listed when listed with UNOS as Status 1A, 1B or 2. Status 7 is an inactive status and does not satisfy the proposed Medicare requirement for active listing. This is a proposed change to the Medicare NCD (August 2013). Active listing is not a requirement for the application of this Guideline. As transplant candidacy frequently is not known until after a period of months following implantation, Optum will allow Bridge to Decision. As a practical matter, many programs will decide to list a patient who is otherwise a suitable candidate for MCSD therapy with UNOS as Bridge to Transplant (BTT) and then place the candidate in Status 7 while stability and suitability for transplant are being determined.

BACKGROUND

Heart failure (HF) is a complex clinical condition in which the heart fails to adequately pump blood. According to the American College of Cardiology (ACC) and the American Heart Association (AHA), "heart failure is a complex clinical syndrome that can result from any structural or functional cardiac disorder that impairs the ability of the ventricle to fill with or eject blood. It is defined as a clinical syndrome that is characterized by specific symptoms (dyspnea and fatigue) in the medical history and signs (edema, rales) on the physical examination. There is no single diagnostic test for HF because it is largely a clinical diagnosis. Heart failure can be a progressive disease with increasing symptoms over time despite optimal medical management (OMM), though the time course is difficult to predict (Schiller et al). Eventually, the heart fails completely and can no longer pump enough blood to sustain life. At this end-stage, eligible patients can undergo heart transplant; however, only around 2,000 heart transplants are performed annually in the United States (HRSA, 2012). In addition, older patients are often not eligible for heart transplant due to comorbid conditions which greatly the increase the risk of poor outcomes.

Mechanical circulatory support devices (MCSD), also referred to as ventricular assist devices (VAD), are mechanical blood pumps that are surgically attached to one or both intact ventricles of a damaged or weakened native heart to assist in pumping blood. For durable long-term devices, the pump is implanted in the abdomen or chest allowing patient mobility and hospital discharge. All devices require a driveline that goes from the pump to an external power source and control unit. Patients with heart failure who may be candidates for MCSD implantation undergo extensive clinical evaluation to ensure an adequate severity of heart failure but acceptable severity of comorbidities. The evaluation seeks to balance the benefits that might be achieved by MCSD implantation with the significant risks of the surgery itself as well as prolonged device support. Durable, long-term devices were initially used in patients on the heart transplant waitlist as a "bridge to transplant (BTT)" since the duration of support was intended to be finite.
Mechanical Circulatory Support Device (MCSD)
Clinical Guideline
Effective January 1, 2014

With donor hearts for transplant in limited supply and additional clinical experience in managing HF, devices were subsequently implanted as "destination therapy (DT)" in patients ineligible for heart transplant who required permanent support. Patients who are neither BTT nor DT are referred to as bridge to decision (BTD). This indication provides opportunity for remediation of reversible conditions which may be hindering transplant eligibility. The use of MCSDs has continued to evolve. The purpose of this guideline is to identify the characteristics of those patients most likely to benefit from the use of mechanical circulatory support.

INDICATIONS

Indications addressed in this guideline include bridge-to-decision (BTD), bridge-to-transplant (BTT) and destination therapy (DT).

Transplant evaluation is required for all members being considered for non-temporary mechanical circulatory support. The transplant evaluation must be done at a Medicare-approved heart transplant program that is a Designated Facility. However, members may have out-of-network transplant benefits that can be applied.

MCSD implantation is limited to facilities that have the necessary infrastructure and experience as documented by having been awarded Advanced Certification in Ventricular Assist Device by the Joint Commission.

All Criteria Must Be Met:

- Patient has symptoms consistent with New York Heart Association class IV functional limitations. Use of MSCD in patients with less advanced symptoms (NYHA functional class I-III) is not supported by the clinical evidence. (Khazanie P and Rogers JG)

- The patient has been evaluated for heart transplant at a Medicare-approved heart transplant program (ISHLT, 2013). The following additional criteria must be met:
  - The evaluating heart transplant program must be a Designated Facility AND
  - There is documentation that a decision has been reached regarding the patient's candidacy for heart transplant AND
  - A recommendation to implant a MCSD is made by the Patient Selection Committee as part of the Committee's recommendation AND
  - If found to be a heart transplant candidate, the patient must be listed with UNOS at a Designated Facility.
Patient has an anticipated survival benefit (Joint Commission 2013, Canadian Heart Failure Guideline/ Arnold et al., Heart Failure Society of America)

Left ventricular ejection fraction (LVEF) is < 25% (ACCF and AHA/Yancy et al.) [See SPECIAL CONSIDERATIONS]

Long-term MCSD for patients who are in acute cardiogenic shock should be reserved for the following: Refer to Medical Director.

- Patients who are deemed too ill to maintain normal hemodynamics and vital organ function with temporary MCSDs, or who cannot be weaned from temporary MCSDs or inotropic support.
- Patients whose ventricular function is deemed unrecoverable or unlikely to recover without long-term device support.
- Patients with the capacity for meaningful recovery of end-organ function and quality of life.
- Patients without irreversible end-organ damage.

Functional limitation with a peak exercise oxygen consumption of ≤ 14 ml/kg/min in those patients who can safely exercise.

Documented failure of optimal medical management (OMM) (ISHLT/ Feldman et al). ACCF/AHA refers to OMM as guideline-directed medical therapy (GDMT). OMM/GDMT includes:

- Beta blocker AND Angiotensin-converting enzyme inhibitor (ACEI) or Angiotensin-receptor blocker (ARB)
- Loop diuretics (bumetanide, furosemide and torsemide) for volume overload; Thiazide diuretics for hypertensive HF patients
- Hydralazine-Nitrates for persistently symptomatic African Americans
- Aldosterone Receptor Antagonists for patients with ejection fraction ≤ 35%

For Destination Therapy (Jacques)

- Failure of OMM as documented above, OR
- Patient has been balloon pump-dependent for 7 days, OR
- IV inotrope-dependent for 14 days.

For Bridge to Transplant or Bridge to Decision for patients listed with UNOS regardless of listing status, ONE of the following is required:
Mechanical Circulatory Support Device (MCSD)  
Clinical Guideline  
Effective January 1, 2014

- Failure of management with intravenous inotropic agents to maintain systemic perfusion and preserve end-organ performance. These agents include adrenergic agonists (dopamine and dobutamine) and/or PDE inhibitor (milrinone). Failure of management with intravenous inotropes is indicated by **ONE** of the following:
  - On continuous intravenous inotropes with an initial favorable response but now showing signs of end-stage organ damage as measured by new onset decreased renal, hepatic, neurological function, etc. **OR**
  - On continuous intravenous inotropes with no hemodynamic response as demonstrated by no improvement in end-organ function and functional capacity

- Anticipated long wait time to obtain an acceptable donor heart. Circumstances that can be taken into consideration include the following:
  - Body habitus
  - PRA
  - UNOS region
  - Blood group "O"
  - SRTR reported time to transplant for waitlist patients

**MINIMUM PATIENT EVALUATION REQUIREMENTS**

Documentation of all of the following is required:

- NYHA functional class (See Appendix A)
- Complete psychosocial evaluation with documented clearance
- Patients with a history of significant psychiatric illness should undergo a psychiatric evaluation to identify potential risk factors or significant psychiatric barriers. Clearance must be documented by the evaluating psychiatrist. Examples of significant psychiatric barriers include, but are not limited to:
  - Inability to operate the MCS device pump or respond to device alarms
  - Inability to recognize and report signs and symptoms of physical compromise, device malfunction or other health care issues
- Chest radiograph with no active disease demonstrated
- Pulmonary function testing (PFT): If abnormal, pulmonary consultation and clearance is required.
  - FVC ≥ 50%
  - FEV1 ≥ 50%
  - DLCO (corrected) 40% for adults (≥ 50% for children). If abnormal, pulmonary consultation and clearance is required.
• Liver function tests (LFT): If abnormal, hepatology consultation and clearance is required. An elevated MELD score may result in the patient being ineligible to be considered for a MCSD.
  o Transaminases ≥ 2 x upper limit of normal
  o Total bilirubin ≥ 2.5mg/dL
  o Calculated MELD score

• All patients with congenital heart disease should have recent imaging to fully document cardiac morphology, assess for the presence of shunts or collateral vessels, and the location and course of their great vessels.

• All patients with known atherosclerotic vascular disease or significant risk factors for its development should be screened for peripheral vascular disease prior to mechanical circulatory support. If present, intervention and/or clearance are required.

• All patients being considered for mechanical circulatory support should have a carotid and vertebral Doppler examination as a screen for occult vascular disease.

• Patients with a history of coronary artery bypass grafting should have a chest computed tomography (CT) scan to provide the location and course of the bypass grafts to guide the surgical approach and to evaluate the degree of aortic calcification.

• Echocardiography or CT, with contrast when necessary, should be used pre-operatively to screen for intracardiac thrombus, intracardiac shunts and valvular heart disease.

• All patients being considered for mechanical circulatory support should have an invasive hemodynamic assessment of pulmonary vascular resistance, cardiac filling pressures, and cardiac output.

• All patients should be screened for diabetes with a fasting glucose and hemoglobin A1C prior to mechanical circulatory support.
  o All patients with an abnormal fasting glucose or hemoglobin A1C should be assessed for the degree of end organ damage (retinopathy, neuropathy, nephropathy, and vascular disease).

• Patients with poorly controlled diabetes should have endocrinologist clearance prior to mechanical circulatory support.

• Assessment of frailty and cognitive function (Afilado; Jacobs). See Appendix B.

• Quality of life should be assessed with a standardized assessment tool before and after MCSD implantation to help guide patient decisions.

CONTRAINDICATIONS
THESE ARE ABSOLUTE CONTRAINDICATIONS FOR THE IMPLANTATION OF A LONG-TERM OR DURABLE MCSD. THESE ARE BASED ON THE 2013 ISHLT GUIDELINES FOR MECHANICAL CIRCULATORY SUPPORT, UNLESS OTHERWISE NOTED.

Except as noted, authorization for the implantation of a MCSD will not be given if any of the following are present:

- AIDS-Defining Conditions (See APPENDIX C for a list of these conditions)

- Heart failure that can be reasonably expected to recover without MSCD. (Khazanie and Rogers)

- Coagulopathies (AHA/Peura) Patients exhibiting any ONE of the following should be excluded from consideration for MCSD implantation:
  - INR ≥ 2.5 (in the absence of concurrent anticoagulation therapy)
  - Platelet count ≤ 50,000
  - Diagnosed coagulopathy including but not limited to, Factor V (Leiden) or Heparin Induced Thrombocytopenia (HIT)
  - A history of intolerance to anticoagulation

- Carotid artery disease that could result in an adverse neurological event if left untreated (Khazanie and Rogers)

- History of gastrointestinal (GI) bleeding or other known GI problem that would limit the ability to tolerate anticoagulation. Active peptic ulcer disease, active diverticulitis and known arteriovenous malformations (AVM) are examples.

- Permanent dialysis when the indication is DT

- Active malignancy and a life expectancy of < 2 years

- Major comorbid illness that is anticipated to limit survival to < 2 years (AHA/Peura) such as:
  - An advanced malignancy
  - Severe or irreversible hepatic disease; i.e., cirrhosis or an increased Model for End Stage Liver Disease (MELD) score.
  - Severe lung disease (including pulmonary arterial hypertension that is not related to chronic heart failure, not World Health Organization group II) [See Appendix B]
  - Severe neurological or neuromuscular disorder

- Active systemic infection (Slaughter, 2010)
• Acute valvular infective endocarditis with bacteremia

• Impaired cognitive function or other issues that could prevent or reduce ability to function (AHA/Peura). See SPECIAL CONSIDERATIONS section for detailed information.

• History of non-adherence with demonstrated inability to comply with medical recommendations on multiple occasions that has not been successfully remediated.

• Active alcohol or substance abuse within the past six months

• Neuromuscular disease that severely compromises the ability to use and care for external system components or to ambulate and exercise

• Current pregnancy

SPECIAL CONSIDERATIONS

THESE MAY OR MAY NOT REPRESENT CONTRAINDICATIONS TO IMPLANTATION OF A MCSD AND DEPEND UPON INDIVIDUAL PATIENT CIRCUMSTANCE, THE TOTALITY OF THE CLINICAL PRESENTATION AND RESULTS OF A COMPREHENSIVE EVALUATION. THESE ARE BASED ON THE 2013 ISHLT GUIDELINES FOR MECHANICAL CIRCULATORY SUPPORT, UNLESS OTHERWISE NOTED.

• Patients with a significant history of significant psychiatric illness should undergo psychiatric or psychological evaluation of potential risk factors for chronic impairment. Examples of significant psychiatric or psychosocial barriers include patients who:
  
  o Are unable to physically operate their pump or respond to device alarms
  
  o Are hindered or unable to report signs and symptoms of device malfunction or other health care issues.

• Challenging housing and social issues. All of these are barriers to success with a MCSD. The assessment of these barriers does not require an on-site visit by a Social Worker. A thorough psychosocial assessment is sufficient as long as it addresses all of these areas and a reasonable effort is made to document and remediate deficiencies. Documented deficiencies in any of the areas listed below that have not been remediated are Contraindications to the implantation of a permanent MCSD:
Mechanical Circulatory Support Device (MCSD) Clinical Guideline Effective January 1, 2014

- Lack of dedicated and committed caregiver support for MCSD management. This person must accompany the patient to all visits, completes an assessment interview by trained personnel, attends all education sessions and agrees to a care contract.

- Inadequate financial resources for out-of-pocket expenses such as travel, dressing supplies, and temporary housing prior to MCSD

- A safe living environment requires:
  - Patient’s physical surroundings provide adequate shelter
  - Grounded electrical outlets are available
  - Access to phone
  - Clean and clutter free environment
  - Environmental accessibility to patient, support network and emergency services personnel

- MCSD implantation in patients who have been bacteremic should have documented clearance of the bacteremia for at least 5 days on appropriate anti-microbial therapy. The anti-microbial therapy should include a total duration of at least 7 total days prior to MCSD implantation. Infectious Disease clearance is required. (ISHLT, 2013).

- Previous history of Heparin-induced thrombocytopenia (HIT). If this is present in the patient’s history, confirmatory testing is required with hematology clearance.

- A MCSD is not recommended in patients with active psychiatric illness that requires long-term institutionalization or who have the inability to care for or maintain their device. Psychiatric consultation and clearance is required with expectation that the patient has a favorable prognosis and can take care of themselves upon discharge.

- History of malignancy:
  - Patients with a history of a treated cancer in long-term remission or are considered free of disease may be a candidate for BTT, with the involvement of an oncologist to determine risk of recurrence or progression. Oncology clearance is required.
  - Patients with a history of recently treated or active cancer who have a reasonable life-expectancy (> 2 years) may be candidates for DT if evaluated in conjunction with an oncologist to determine risk and prognosis. Oncology clearance is required.

- Past history (> 6 months in the past) of alcohol, crystal meth, heroin, cocaine, methadone, narcotics, etc., requires program documentation of surveillance including but not limited to drug testing,
Mechanical Circulatory Support Device (MCSD)  
Clinical Guideline  
Effective January 1, 2014

chemical dependency/substance abuse evaluation and evaluation of hepatitis exposure. The patient should be evaluated for substance abuse. Refer to the specialist evaluation for guidance.

- Malnutrition and debilitation. If evidence of malnutrition is present, a nutritional consultation is indicated and will be required prior to approval. Markers of severe malnutrition include (Slaughter et al 2010):
  - BMI < 20 kg/m2
  - albumin < 3.2 mg/dl
  - pre-albumin < 15 mg/dl
  - total cholesterol< 130 mg/dl
  - lymphocyte count < 100

- Chronic renal failure (modified from Eason). Nephrology clearance is required.
  - CKD with GFR ≤ 50 ml/min
  - Patients with acute renal insufficiency and dialysis ≥ 8 weeks
  - Evidence of CKD and kidney biopsy demonstrating > 30% glomerulosclerosis or 30% fibrosis

- Patients over age 80. Refer to Medical Director.

- Permanent dialysis for BTT candidates. Transplant center must have on-site dialysis unit or have made arrangements in advance with an outpatient dialysis unit that is capable of managing the patient while waiting for transplant.

- Mechanical circulatory support may be contraindicated in the setting of diabetes-related proliferative retinopathy, very poor glycemic control, or severe nephropathy, vasculopathy, or peripheral neuropathy. Refer to Medical Director
Appendix A

New York Heart Association Classification of Heart Failure

Doctors usually classify patients' heart failure according to the severity of their symptoms. The table below describes the most commonly used classification system, the New York Heart Association (NYHA) Functional Classification. It places patients in one of four categories based on how much they are limited during physical activity.

<table>
<thead>
<tr>
<th>NYHA Class</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Patients with cardiac disease but resulting in no limitation of physical activity. Ordinary physical activity does not cause undue fatigue, palpitation, dyspnea or anginal pain.</td>
</tr>
<tr>
<td>II</td>
<td>Patients with cardiac disease resulting in slight limitation of physical activity. They are comfortable at rest. Ordinary physical activity results in fatigue, palpitation, dyspnea or anginal pain.</td>
</tr>
<tr>
<td>III</td>
<td>Patients with cardiac disease resulting in marked limitation of physical activity. They are comfortable at rest. Less than ordinary activity causes fatigue, palpitation, dyspnea or anginal pain.</td>
</tr>
<tr>
<td>IV</td>
<td>Patients with cardiac disease resulting in inability to carry on any physical activity without discomfort. Symptoms of heart failure or the anginal syndrome may be present even at rest. If any physical activity is undertaken, discomfort increases.</td>
</tr>
</tbody>
</table>

http://www.heart.org/HEARTORG/Conditions/HeartFailure/AboutHeartFailure/Classes-of-Heart-Failure_UCM_306328_Article.jsp. Accessed August 30, 2013.
Appendix B

Assessment of Frailty

Assessment of frailty would be indicated by:

- Gait speed for 5-meters. [Abnormal would be a gait speed ≥ 6 seconds]
- Assessment of the following components of the Nagi scale: [Abnormal results would be any difficulty performing 3 or more of the following.]
  
  o Pulling or pushing a large object like a living room chair
  o Bending over, crouching or kneeling
  o Raising the arms above the head
  o Picking up or handling small objects with the fingers
  o Lifting something that weighs over 10 pounds (5 kilos)
  o Walking up or down a flight of stairs
  o Walking one mile (1.5 kilometers)

- Grip strength of dominant hand- average of 3 trials using dynamometer (Fried, as cited in Makary et al. 2010). Weakness would be indicated by the following metrics.

<table>
<thead>
<tr>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤29 kg for BMI ≤24</td>
<td>≤17 kg for BMI ≤23</td>
</tr>
<tr>
<td>≤30 kg for BMI 24.1-28</td>
<td>≤17.3 kg for BMI 23.1-26</td>
</tr>
<tr>
<td>≤30 kg for BMI 26.1-28</td>
<td>≤18 kg for BMI 26.1-29</td>
</tr>
<tr>
<td>≤32 kg for BMI &gt;28</td>
<td>≤21 kg for BMI &gt;29</td>
</tr>
</tbody>
</table>

Screening of cognitive function with tools such as (Holsinger, et al. 2012):

- Mini-Cog™ [Memory recall score of 0 OR memory recall score of 1-2 with abnormal clock drawing test per Mini-Cog™ show cognitive dysfunction ]
- Mini Mental State Exam
- Memory Impairment Screen
### Appendix C

**World Health Organization (WHO) Classification of Pulmonary Hypertension (PH)**  
(Simonneau et al)

<table>
<thead>
<tr>
<th>WHO group</th>
<th>Group Descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Pulmonary veno-occlusive disease (PVOD) and/or pulmonary capillary hemangiomatosis (PCH)</td>
</tr>
<tr>
<td>II</td>
<td>Pulmonary hypertension owing to left heart disease</td>
</tr>
<tr>
<td>III</td>
<td>PH owing to lung disease and/or hypoxia</td>
</tr>
<tr>
<td>IV</td>
<td>Chronic thromboembolic PH</td>
</tr>
<tr>
<td>V</td>
<td>PH with unclear or multifactorial etiologies</td>
</tr>
</tbody>
</table>
Appendix D

AIDS-Defining Conditions

Certain serious and life-threatening diseases that occur in HIV-positive people are called "AIDS-defining" conditions. When a person gets one of these illnesses, he or she is diagnosed with the advanced stage of HIV infection known as AIDS.

The Centers for Disease Control and Prevention (CDC) has developed a list of these conditions (see below). No single patient is likely to have all of these problems. Some of the conditions are rare.

- Bacterial infections, multiple or recurrent*
- Candidiasis of bronchi, trachea, or lungs
- Candidiasis of esophagus†
- Cervical cancer, invasive§
- Coccidioidomycosis, disseminated or extrapulmonary
- Cryptococcosis, extrapulmonary
- Cryptosporidiosis, chronic intestinal (>1 month's duration)
- Cytomegalovirus disease (other than liver, spleen, or nodes), onset at age >1 month
- Cytomegalovirus retinitis (with loss of vision)†
- Encephalopathy, HIV related
- Herpes simplex: chronic ulcers (>1 month's duration) or bronchitis, pneumonitis, or esophagitis (onset at age >1 month)
- Histoplasmosis, disseminated or extrapulmonary
- Isosporiasis, chronic intestinal (>1 month's duration)
- Kaposi sarcoma†
- Lymphoid interstitial pneumonia or pulmonary lymphoid hyperplasia complex*†
- Lymphoma, Burkitt (or equivalent term)
- Lymphoma, immunoblastic (or equivalent term)
- Lymphoma, primary, of brain
- Mycobacterium avium complex or Mycobacterium kansasii, disseminated or extrapulmonary†
- Mycobacterium tuberculosis of any site, pulmonary, disseminated,† or extrapulmonary†
- Mycobacterium, other species or unidentified species, disseminated† or extrapulmonary†
- Pneumocystis jirovecii pneumonia†
- Pneumonia, recurrent†§
- Progressive multifocal leukoencephalopathy
- Salmonella septicemia, recurrent
- Toxoplasmosis of brain, onset at age >1 month†
- Wasting syndrome attributed to HIV

* Only among children aged <13 years. (CDC. 1994 Revised classification system for human immunodeficiency virus infection in children less than 13 years of age. MMWR 1994;43[No. RR-12].)
† Condition that might be diagnosed presumptively.
§ Only among adults and adolescents aged ≥13 years. (CDC. 1993 Revised classification system for HIV infection and expanded surveillance case definition for AIDS among adolescents and adults. MMWR 1992;41[No. RR-17].)
Appendix E

Pre-operative optimization is directed toward minimizing the frequency and severity of adverse events following implantation of mechanical circulatory support devices. Results of a complete systematic assessment should be considered during the review process. The following table lists pre-operative goals for relevant metabolic markers as suggested by Slaughter (2010). These parameter values should be used as a guide during the review process and when considering referral to the Medical Director.

**Minimal Pre-operative Optimization Goals**

<table>
<thead>
<tr>
<th>Renal</th>
<th>Desired Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood urea nitrogen</td>
<td>&lt; 40 mg/dl</td>
</tr>
<tr>
<td>Serum creatinine</td>
<td>&lt; 2.5 mg/dl</td>
</tr>
<tr>
<td>Estimated GFR</td>
<td>&gt; 50 ml/kg/min</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hematology</th>
<th>Desired Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>INR</td>
<td>&lt; 1.2</td>
</tr>
<tr>
<td>Hemoglobin</td>
<td>&gt; 10 g/dl</td>
</tr>
<tr>
<td>Platelets</td>
<td>&gt; 150,000/mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nutritional</th>
<th>Desired Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-albumin</td>
<td>&gt; 15 mg/dl</td>
</tr>
<tr>
<td>Albumin</td>
<td>&gt; 3 g/dl</td>
</tr>
<tr>
<td>Transferrin</td>
<td>&gt; 50 ml/kg/min</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hepatic</th>
<th>Desired Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total bilirubin</td>
<td>&lt; 2.5 mg/dL</td>
</tr>
<tr>
<td>ALT, AST</td>
<td>&lt; 2 times normal</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hemodynamic</th>
<th>Desired Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right atrial pressure</td>
<td>&lt; 15 mm Hg</td>
</tr>
<tr>
<td>PCWP</td>
<td>&lt; 24 mm Hg</td>
</tr>
</tbody>
</table>

ALT, alanine aminotransferase; AST, aspartate aminotransferase; GFR, glomerular filtration rate; INR, international normalized ratio; PCWP, pulmonary capillary wedge pressure
### Appendix F

**INTERMACS Clinical profiles (AHA/Peura)**

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Hemodynamic Status</th>
<th>Time Frame for Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Critical cardiogenic shock, “crash and burn”</td>
<td>Persistent hypotension despite rapidly escalating inotropic support and eventually IABP, and critical organ hypoperfusion</td>
<td>Within hours</td>
</tr>
<tr>
<td>2</td>
<td>Progressive decline on inotropic support, “sliding on inotropes”</td>
<td>Intravenous inotropic support with acceptable values of blood pressure and continuing deterioration in nutrition, renal function or fluid retention</td>
<td>Within days</td>
</tr>
<tr>
<td>3</td>
<td>Stable but inotrope dependent, “dependent stability”</td>
<td>Stability reached with mild to moderate doses of inotropes but demonstrating failure to wean from them because of hypotension, worsening symptoms, or progressive renal dysfunction</td>
<td>Elective over weeks to months</td>
</tr>
<tr>
<td>4</td>
<td>Resting symptoms, “frequent flyer”</td>
<td>Possible weaning of inotropes but experiencing recurrent relapses, usually fluid retention</td>
<td>Elective over weeks to months</td>
</tr>
<tr>
<td>5</td>
<td>Exertion intolerant, housebound</td>
<td>Severe limited tolerance for activity, comfortable at rest with some volume overload and often with some renal dysfunction</td>
<td>Variable urgency, dependent on nutrition and organ function</td>
</tr>
<tr>
<td>6</td>
<td>Exertion limited, “walking wounded”</td>
<td>Less severe limited tolerance for activity and lack of volume overload, fatigue easily</td>
<td>Variable urgency, dependent on nutrition and organ function</td>
</tr>
<tr>
<td>7</td>
<td>Advanced NYHA III “symptoms, placeholder”</td>
<td>Patient without current or recent unstable fluid balance, NYHA class II or III</td>
<td>Not currently indicated</td>
</tr>
</tbody>
</table>
REFERENCES


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