Emory Centers for Heart Failure Therapy and Transplantation
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Outreach Program

Goals and Mission

The Emory Centers for Heart Failure Therapy and Transplantation is happy to announce the launch of its new Outreach Program. This project is part of a collaborative effort initiated by the Emory Transplant Center, with support from the Carlos and Marguerite Mason Trust. The development of this program represents our continuing effort to meet the needs of our patients and healthcare providers throughout Georgia and surrounding communities. Some of the major goals that we expect to accomplish with this program are:

1. Increase availability of educational resources to you and your patients.

2. Improve communications between the Centers for Heart Failure Therapy and Transplantation and our referring community.

3. Identify and address areas of improvement when partnering with our fellow health care providers.

4. Provide training for outside providers interested in adopting a “Center for Heart Failure Therapy” concept within their own facility.
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Referral Process
Referral Information Form

Patient name: ___________________________________________ DOB: _______________

SSN: _______________________________________

Address: ___________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________

Insurance Co:________________________________________________________________________

Home phone: ___________________________ Cell/pager:__________________________________

Work phone: ________________________________________________________________________

Referring MD: _____________________________________________ Phone: ________________

Office contact person: _______________________________________ Fax: __________________

Diagnosis/reason for referral: __________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________

Note: Please help us to acquaint ourselves with your patient by providing the following information (if available) at the time of referral:

_____ History and Physical

_____ Most recent office notes

_____ Current medication list, including allergies

_____ Problem list

_____ Diagnostic tests (cardiac catheterization, echocardiograms, etc.)

Fax or mail to:
Emory University Hospital
Center for Heart Failure Therapy and Transplantation
Suite F508
1364 Clifton Road, NE
Atlanta, GA  30322
Office: (404) 712-7575
Fax: (404) 712-2731
Overview of Center

The Centers for Heart Failure Therapy and Transplantation at Emory University Hospital and Emory Crawford Long Hospital provide evaluation and therapy for adult patients in various stages of heart failure.

The Center’s evaluation and treatment includes options such as medical therapy, FDA-regulated investigational drugs and devices, cardiac catheterization, cardiac surgery and, in select patients, heart transplant. We also have a clinic specializing in the therapy of adults with congenital heart disease.

The Center attempts to coordinate and integrate research, education and patient care. We are also able to offer the option of supporting patients on artificial heart pumps, known as ventricular assist devices, currently used at our Center as a bridge to transplant.

Emory is active in transplant immunology research investigating strategies to stop the rejection of transplanted organs. This research is done in an effort to minimize the toxic side effects of daily immunosuppressant medicines and achieve permanent acceptance of donor organs. Emory’s heart failure program provides therapies that improve heart failure and prevent or delay transplant.

Quick Facts (As of January 2004)

- 2,000 patients followed
- 500 newly diagnosed CHF patients per year
- 360 adults followed with congenital heart disease
- State of the art imaging – cardiac MRI, PET, CT, echocardiography with tissue doppler imaging
- National leader in biventricular pacemaker therapy for the treatment of advanced heart failure
- 27 mechanical ventricular assist devices implanted
- In collaboration with Interventional Cardiology, approximately 50 alcohol septal ablations for hypertrophic cardiomyopathy performed
- 415 primary heart transplants performed
- 25-30 heart transplants performed per year
- 10 combined heart/kidney transplants performed
- Currently 35 patients on Emory’s waiting list for heart transplant

Initial Visit

1. Patient assessment
2. History and Physical
4. Current volume/fluid status
5. May repeat echocardiogram to gain more detailed information (ie. congenital, dyssynchrony)

Treatment Plan Options

1. Non-pharmacological therapies
2. Pharmacological therapies
3. Participation in clinical trials
4. Device therapy
5. Transplantation

Patient Education

1. Introduction to heart failure – cause/effect/treatment
2. Self management
3. Medication instruction
4. Factors that exacerbate symptoms
5. Signs/symptoms to report to MD
The Emory/Sibley Heart Center
Adult Congenital Cardiac Center

The majority of children born with congenital cardiac defects will survive to adulthood. As adults, they will develop issues more suitable to an adult medical setting such as pregnancy, employment and acquired illnesses. The complexities of their congenital cardiac defects and sequelae of prior “corrective” surgeries are best understood by pediatric cardiologists who have extensive training in this area. A combined management team including both adult and pediatric cardiologists, nurses, echocardiographers, interventional cardiologists and electrophysiologists provides the multidisciplinary approach needed to best care for this complex group of patients.

A combined pediatric/adult perspective is also helpful in caring for the patient with congenital defects first detected in adulthood. On occasion, adolescent patients present with “adult” acquired cardiac problems such as atherosclerotic heart disease, myocardial infarction or obesity-related heart failure. These patients are also best cared for with the combined expertise of adult and pediatric cardiologists.

The goal of the Emory/Sibley Adult Congenital Cardiac Center is to provide comprehensive care for adults with congenital heart disease and adolescents with acquired cardiac disease in an adult setting. In addition, the Center strives to provide an environment where adult and pediatric cardiologists can work together to further the education of medical students, residents and fellows and collaborate on research projects, conferences and discussion of patient management issues.

Our Center is physically located within the Center for Heart Failure Therapy and Transplantation at Emory University Hospital. Many patients with congenital heart defects develop failure as adults. The expertise of our heart failure staff is an invaluable asset in the management of the patient.

To contact the Emory/Sibley Adult Congenital Cardiac Center, please call (404)712-2655.
Management Options for Heart Failure
Quick Facts About Heart Failure

- Nearly 5 million Americans are currently living with congestive heart failure (CHF).
- Approximately 550,000 new cases are diagnosed in the U.S. each year.
- Congestive heart failure affects people of all ages, from children and young adults to the middle-aged and the elderly.
- Almost 1.4 million are under 60 years of age.
- CHF is present in 2 percent of persons age 40 to 59.
- More than 5 percent of persons age 60 to 69 have CHF.
- CHF annual incidence approaches 10 per 1,000 population after 65 years of age.
- The incidence of CHF is equally frequent in men and women, and African-Americans are 1.5 times more likely to develop heart failure than Caucasians.
- Heart failure is responsible for 11 million physician visits each year and more hospitalizations than all forms of cancer combined.
- CHF is the first listed diagnosis in 875,000 hospitalizations, and the most common diagnosis in hospital patients age 65 years and older.
- In that age group, one fifth of all hospitalizations have a primary or secondary diagnosis of heart failure.
- Heart failure contributes to about 287,000 deaths a year.
- Sudden death is problematic in patients with CHF, occurring at a rate of six to nine times that of the general population.
- Improved medical, surgical and device therapies are resulting in improved outcomes in heart failure.

**Note:** American College of Cardiology/American Heart Association guidelines recommend consideration of referral to a specialty heart failure program for patients with refractory heart failure symptoms.
Medical Management of Congestive Heart Failure

**Primary Goals:**
1. Improve symptoms
2. Reverse disease progression
3. Reduce hospitalization
4. Enhance life expectancy

**Objectives:**
1. Maintain appropriate volume status
2. Enhance perfusion status (example – vasodilator therapy)
3. Improve neurohormonal environment
4. Improve systolic and diastolic performance
5. Reduce LV dimensions (reverse remodeling)
6. Improve exercise tolerance
7. Prevent embolic complications
8. Reduce sudden death
Evaluation of Heart Failure

I. Initial Evaluation

A. Determine if heart failure present: clinical diagnosis based on symptoms and physical findings [laboratory findings may supplement: ECG, CXR, echocardiogram, BNP (controversial), cardiac catheterization data]

B. Determine etiology – patient specific evaluation with consideration of coronary artery disease, hypertension, substance related (alcohol, other), family history, etc.

C. Diagnostic Tests

- Commonly performed: ECG, CXR, echocardiogram – all patients, CBC, chemistry profile, TSH, liver enzymes, lipid profile, urinalysis.
- Potentially useful: cardiac cath, nuclear testing (thallium, PET, MRI), CPX (cardiopulmonary exercise treadmill), cardiac biopsy (limited value, most commonly done to evaluate for amyloid)

II. Ongoing evaluation at follow-up visits for signs/symptoms of volume and perfusion status.

<table>
<thead>
<tr>
<th>Volume</th>
<th>Low Output</th>
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</thead>
<tbody>
<tr>
<td>Weight change</td>
<td>Fatigue</td>
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<tr>
<td>Neck vein elevation</td>
<td>Cachexia</td>
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<tr>
<td>Hepatomegaly/abdominal tenderness</td>
<td>Hypotension (SBP &lt;80)</td>
</tr>
<tr>
<td>Edema</td>
<td>Cool extremities</td>
</tr>
<tr>
<td>Orthopnea</td>
<td>Tachycardia</td>
</tr>
<tr>
<td>Orthostasis (dry)</td>
<td>Hyponatremia</td>
</tr>
<tr>
<td>Renal dysfunction (dry)</td>
<td>Renal dysfunction</td>
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</table>

Treatment of Heart Failure

Lifestyle interventions (See patient education section).

Therapies based on Stage of Disease (See ACC/AHA recommendations for therapy by stages).
The American College of Cardiology in association with the American Heart Association now recommend the following measures for which there is evidence and/or general agreement that the treatment is useful and effective in the management of CHF:

**Stage A**
Patients at high risk for heart failure (HF) but without structural heart disease or symptoms of HF:
- Control systolic and diastolic hypertension in accordance with ACC/AHA recommended guidelines.
- Treat lipid disorders in accordance with ACC/AHA recommended guidelines.
- Avoid patient behaviors that may increase the risk of heart failure (e.g., smoking, alcohol consumption, and illicit drug use).
- Angiotensin converting enzyme (ACE) inhibition in patients with a history of atherosclerotic vascular disease, diabetes mellitus, or hypertension and associated cardiovascular risk factors.
- Control of ventricular rate in patients with supraventricular tachyarrhythmias.
- Treatment of thyroid disorders.
- Periodic evaluation of signs and symptoms of heart failure.

**Stage B**
Patients with structural heart disease but without symptoms of HF recommendations for asymptomatic systolic dysfunction:
- ACE inhibition in patients with a recent or remote history of myocardial infarction regardless of ejection fraction.
- ACE inhibition in patients with a reduced ejection fraction, whether or not they have experienced a myocardial infarction.
- Beta-blockade in patients with a recent myocardial infarction regardless of ejection fraction.
- Beta-blockade in patients with a reduced ejection fraction, whether or not they have experienced a myocardial infarction.
- Valve replacement or repair for patients with hemodynamically significant valvular stenosis or regurgitation.

**Stage C**
Patients with symptomatic left ventricular systolic dysfunction:
- Diuretics in patients who have evidence of fluid retention.
- ACE inhibition in all patients, unless contraindicated.
- Beta-adrenergic blockade in all stable patients, unless contraindicated. Patients should have no or minimal evidence of fluid retention and should not have required treatment recently with an intravenous positive inotropic agent.
- Withdrawal of drugs known to adversely affect the clinical status of patients (e.g., non-steroidal anti-inflammatory drugs, most antiarrhythmic drugs, and most calcium channel blocking drugs).

**Stage D**
Patients with refractory end-stage HF:
- Meticulous identification and control of fluid retention.
- Referral to a HF program with expertise in the management of refractory HF.
- Referral for cardiac transplantation in eligible patients.

**Note:** The above recommendations were taken from the ACC/AHA Guidelines for the Evaluation and Management of Chronic Heart Failure in the Adult: Executive Summary (JACC, Vol. 38, No. 7, December 2001:2101-13)
Stages in the Evolution of Heart Failure/Recommended Therapy by Stage

**Stage A**
At high risk for heart failure but without structural heart disease or symptoms of HF

- e.g., Patients with hypertension, coronary artery disease, diabetes mellitus or Patients using cardiotoxins with FHx CM

**Stage B**
Structural heart disease but without symptoms of HF

- e.g., Patients with previous MI, LV systolic dysfunction, asymptomatic valvular disease

**Stage C**
Structural heart disease with prior or current symptoms of HF

- e.g., Patients with known structural heart disease, shortness of breath and fatigue, reduced exercise tolerance

**Stage D**
Refractory HF requiring specialized interventions

- e.g., Patients who have marked symptoms at rest despite maximal medical therapy (e.g., those who are recurrently hospitalized or cannot be safely discharged from the hospital without specialized interventions)

**THERAPY**

- Treat hypertension
- Encourage smoking cessation
- Treat lipid disorders
- Encourage regular exercise
- Discourage alcohol intake, illicit drug use
- ACE inhibition in appropriate patients (see text)

**THERAPY**

- All measures under stage A
- ACE inhibitors in appropriate patients (see text)
- Beta-blockers in appropriate patients (see text)

**THERAPY**

- All measures under stage A
- Diuretics
- ACE inhibitors
- Beta-blockers
- Digitalis
- Dietary salt restriction

**THERAPY**

- All measures under stages A, B, and C
- Mechanical assist devices
- Heart transplantation
- Continuous (not intermittent) IV inotropic infusions for palliation
- Hospice care

*Note:* The above recommendations were taken from the ACC/AHA Guidelines for the Evaluation and Management of Chronic Heart Failure in the Adult: Executive Summary (JACC, Vol. 38, No. 7, December 2001:2101-13).
Heart Failure Management: Standard of Care Guide

**Practice Considerations in Therapy of Systolic Dysfunction**

1. ACE inhibitor – titrate to target dose as tolerated.
   - Generally avoid if creatinine > 3.0 mg/dL or if potassium > 5.5 mEq/L.
   - Begin therapy if SBP > 90 mmHG without vasodilator therapy or
   - >80 mmHG and asymptomatic with other vasodilator therapy.
   - Alternatives to ACE inhibitor: hydralazine/nitrate combination or angiotensin II receptor blocker.
   **Note:** Do not withhold vasodilator unless SBP < 80 mmHG or unless there are signs/symptoms of either over-diuresis or poor perfusion.

2. Beta-blocker: Carvedilol (Coreg), long acting metoprolol (Toprol XL)--titrate to target dose as tolerated.
   - Use in NYHA Class I-III patients. May begin in NYHA Class IV patients who are euvolemic without significant signs/symptoms of volume overload.
   **Note:** Do not initiate therapy if history of hepatic failure, bronchospasm, heart block, sick sinus syndrome without permanent pacemaker, overt congestion or symptomatic hypotension.

3. IV/oral loop diuretic for volume overload.
   - Maintenance dosing vs. aggressive dosing with symptoms.
   - Thiazide drugs -- add for synergistic response as necessary.

4. Digoxin -- dose based on weight, age, gender, creatinine clearance and concomitant drugs.
   **NOTE:** generally given at low dose of 0.125 mg to 0.25 mg daily.

5. Spironolactone (25 mg. qd or less), used as an aldosterone inhibitor – add for Class III and IV.

6. If CASHD – consider a statin drug.

7. Cardiac Resynchronization Therapy (CRT through biventricular pacing): QRS duration > 120 msec (consider tissue doppler echocardiogram to define dyssynchrony), NYHA Class III-IV after pharmacologic therapy.

*This sheet is intended as a general guideline to assist in the management of patients with heart failure. It is not designed to replace clinical judgment or the needs of individual patients.*
Newer Therapies For Heart Failure

1. Aldosterone antagonism – spironolactone (25 mg daily)
   Reduced mortality in NYHA Class III-IV patients when added to standard heart failure therapy. Serum potassium needs monitoring.

2. Cardiac resynchronization therapy with biventricular pacemaker devices improve symptoms in medically treated patients with QRS duration >120 msec, LVEF <35%, and NYHA Class III-IV symptoms despite optimal medical therapy.

3. Indications for implantable cardiac defibrillator (ICD) therapy are evolving in patients with systolic dysfunction. Patients with prior MI and LVEF <30 % should be considered for ICD therapy. Recent trial data may broaden indications for patients with non-ischemic etiology.

Clinical Pearls in Managing Heart Failure

- Maintenance of appropriate volume status (diet, daily weights, diuretics) and modulation of neurohormonal activation (ACE I, B-blockade, etc) are the pillars of therapy.
- Neck vein exam (JVD) is the key to volume assessment (rales and edema are insensitive).
- Maintenance of appropriate volume is dependent on patient education.
- A volume overloaded patient who has a brisk response to oral diuretics likely needs dietary changes and not additional diuretics.
- If furosemide does not work, consider torsemide.
- The best ventricular assist device is the weight scale used daily.
- Patients with advanced heart failure often have systolic blood pressures between 85-90. ACE I and beta-blockers can still be used. Symptomatic hypotension is usually due to volume depletion.
- Tachycardia, particularly atrial fibrillation with a rapid ventricular response, is a target for heart failure therapy.
- Patience may be necessary when titrating ACE I and B-blockers in refractory CHF. Focus first on volume status.
- For hospitalized patients: inotropic support should be reserved for refractory heart failure. It is rare to need inotropes when the systolic BP is >110. Vasodilator therapy appears to be preferable.
- A critically ill, hypotensive patient with known severe heart failure is usually volume overloaded and in low output/high resistance failure. Fluids and vasoconstrictors should be avoided in this setting (unless sepsis is suspected).
Surgical Options for Congestive Heart Failure

- **Coronary bypass surgery** – in the setting of ischemic cardiomyopathy with adequate coronary targets, coronary bypass grafting remains the preferred therapy. This often can be performed with relatively low risk with excellent long-term results reducing the subsequent need for heart transplantation.

- Patients with congestive heart failure and severe mitral regurgitation are candidates for **mitral valve repair** with marked improvement in their symptoms of heart failure. Usually this can be performed without the need to replace the mitral valve. These patients often have annular dilatation with essentially normal mitral valve leaflets that fail to coapt properly. By placing a smaller size annular ring, the leaflets are brought into approximation thereby improving the mitral regurgitation. Severe left ventricular dysfunction is not a contraindication to this procedure.

- Ischemic cardiomyopathy with akinetic or dyskinetic anterior wall – these patients are candidates for high-risk coronary bypass surgery with a **modified DOR procedure (left ventricular reconstruction)** to restore the normal geometry of the left ventricle thereby improving symptoms of left ventricular failure and relieving angina.

- **Heart transplantation** – heart transplantation remains an excellent option for patients who have exhausted all medical and surgical therapies for their congestive heart failure. It continues to be limited by donor availability but short and long-term results are outstanding with an expected 60% survival at ten years.

*Note:* There is concern with the use of platelet inhibitors (ie. Plavix) in patients referred for cardiac surgery. We ask that you notify our office if you find it necessary to place your patient on this therapy.
**Additional Surgical Treatment Options**

Ventricular assist devices can be either univentricular (LVAD) or biventricular (RVAD or LVAD) for hemodynamic support. These devices have been used primarily as a bridge to transplant or a bridge to recovery in patients who have acute decompensated heart failure. More recently the HeartMate Left Ventricular Assist Device has been utilized as a permanent device in destination therapy. This has been utilized in patients who are not considered candidates for heart transplantation but have progressive congestive heart failure refractory to maximal medical therapy.

**Indications for Ventricular Assist Device Support**
- Failed medical therapy
- Refractory arrhythmias
- Failure to wean from cardiac bypass
- Reversible end-organ dysfunction due to heart failure
- Reversible acute congestive heart failure

**Considerations in Univentricular Versus Biventricular Support**
- Right ventricular function
- Refractory arrhythmias
- End-organ function
- Amount of pre-implant support required

**Emory Experience**

**Novacor Left Ventricular Assist System (LVAS)**
- 1 bridged to recovery and explant
- 3 expired while on support
- 10 bridged to heart transplant

**Thoratec Ventricular Assist Device (VAD) System**
(1999-2004)
- 1 bridged to recovery and explant
- 10 bridged to heart transplant
- 3 expired while on support (MSOF)
- 1 currently on device
Patient Education for Heart Failure
Patient/Family Education Goals

Patient instruction fosters compliance to the medical regime

Effective heart failure education ....
• involves the patient and family/significant other in self-care
• provides opportunity for self management choices for the patient
• is intense and repetitive
• is targeted to patient’s educational/literacy level
• involves other disciplines as needed to address issues (social services, dietary, pharmacy)
• focuses on quality of life issues that are important to patient
• utilizes a variety of instruction strategies (films, handouts, poster presentations, demonstrations, patient record keeping logs)
• provides practical ways to improve functional limitations that impair activities of daily living
• fosters a partnership in patient-healthcare provider relationships by encouraging patient to report symptoms, progress or other issues to the office
Heart Failure Patient Education

What is heart failure?
Heart failure is a condition in which the heart does not pump as strongly as it should. The heart is weaker than normal and has difficulty pumping blood to the rest of the body. Over time, the weakened heart works harder and harder and adds more stress to the heart muscle walls, causing them to stretch and weaken even more. Fluid that cannot move forward out of the heart into the body backs up into the lungs, arms, legs, feet, abdomen and other parts of the body, causing congestive heart failure.

Unfortunately, the body responds to decreased blood flow by releasing substances (hormones) that cause salt and fluid retention and constriction of blood vessels. Thus, the body responds to congestion the same as it responds to dehydration.

What are some of the symptoms of heart failure?
Symptoms of heart failure vary depending on the condition of your heart. Your body responds to changes in your heart condition and often gives signals when major changes have occurred. You may experience some or all of these symptoms:

- sudden weight gain (2 pounds overnight or 3-4 pounds in 2 days)
- swelling (edema) in your ankles, feet or legs
- swelling or bloating in the abdomen (belly)
- shortness of breath (may occur at rest, and usually worsens with activity)
- difficulty sleeping, especially when lying down
- frequent, dry, hacking cough
- loss of appetite or nausea
- tiredness, weakness or confusion
- rapid or irregular heart rate

What causes heart failure?
Heart failure is caused by many conditions that damage or weaken the heart muscle. Some of the most common causes of heart failure are:

- **High blood pressure (hypertension)** – When blood pressure in the arteries is high, the heart has to pump harder to move blood out of the heart into the rest of the body. If the blood pressure remains high, the heart continues to work hard and becomes weak over time.
- **Coronary artery disease** – Coronary arteries provide blood supply to the heart muscle. Coronary artery disease is a build up of fatty deposits and plaque in the lining of the coronary artery that causes a decrease in blood flow to heart muscle. When a coronary artery suddenly becomes blocked, and blood flow to an area of heart muscle stops, it is called a heart attack. A heart attack can damage heart muscle and cause that area of the heart not to pump.
- **Cardiomyopathy** – Weakness or damage to the heart muscle can be caused by several things, including alcohol, infections, or drugs, but frequently the cause is unknown.
- **Valve disease** – When a heart valve leaks or blocks the normal flow of blood, the heart muscle pumps harder and may result in heart failure.
- **Congenital heart disease** – Heart defects that are present at birth.
How is heart failure treated?

Treatment of heart failure usually involves a combination of medications, diet modification, fluid limitations and some lifestyle changes. In some cases, a biventricular pacemaker or internal cardiac defibrillator (ICD) may be needed. Your doctor will discuss treatment options and determine the method most appropriate for your condition.

Common Medications

- **Angiotensin enzyme (ACE) inhibitors** – ACE inhibitors are medications that dilate (widen) the blood vessels, decrease the blood pressure and make it easier for the heart to pump blood through the vessels.
  Some ACE inhibitors:
  - captopril (Capoten)
  - fosinopril (Monopril)
  - ramipril (Altace)
  - enalapril (Vasotec)
  - quinapril (Accupril)
  - lisinopril (Prinivil, Zestril)
  - benazepril (Lotensin)
  - perindopril (Aceon)
  - trandolapril (Mavik)

- **Angiotensin II blockers** – Other drugs used to relax the blood vessels, frequently used if ACE inhibitors cause coughing. Some angiotensin II blockers are:
  - losartan (Cozaar)
  - irbesartan (Avapro)
  - valsartan (Diovan)
  - candesartan (Atacand)

- **Vasodilators** – May also be used to relax the blood vessels when a person cannot take ACE inhibitors. Some vasodilators are:
  - hydralazine (Apresoline)
  - isosorbide dinitrate (Isordil, Sorbitrate)
  - nitroglycerin (Nitrodur, Transderm)
  - isosorbide mononitrate (Imdur)

- **Beta-blockers** – These drugs reduce heart rhythm problems and may cause the heart to become smaller and stronger.
  - carvedilol (Coreg)
  - metoprolol (Lopressor, Toprol-XL)
  - bisoprolol (Zebeta)

- **Digoxin** – May improve symptoms through a variety of mechanisms.

- **Diuretics** – Commonly referred to as “water pills” because they help the kidneys to rid excess water and salt from the body through the urine.
  - furosemide (Lasix)
  - chlorothiazide (Diuril)
  - bumetanide (Bumex)
  - metolazone (Zaroxolyn)
  - torsemide (Demadex)
  - spironolactone (Aldactone)
  - hydrochlorothiazide (HydroDiuril)

- **Potassium** – Important electrolyte in the body that is often lost with increased urine output. Potassium supplements are frequently needed when taking diuretics.

- **Inotropic therapy** – Intravenous drugs used in end stage heart failure to stimulate the weakened heart to pump more effectively to send blood through the body. These drugs increase the force of the heart’s contractions and relax the blood vessels.
  - dobutamine (Dobutrex)
  - milrinone (Primacor)
Nutritional Guidelines

One of the most important actions that you can take to improve your symptoms of heart failure is to limit your sodium (salt) and fluid intake. Sodium attracts water, and too much sodium causes extra fluid to build up in the body. This extra fluid creates more work for the heart and worsens the heart failure. In addition, you should follow the recommended American Heart Association Diet: Low Fat (less than 30 grams per day), and Low Cholesterol (less than 300 mg per day).

Limit your sodium

It is very important that you limit your sodium intake to 2000-3000 mg (2-3 grams) per day to avoid extra build up of fluid in the body. Sodium is found in many foods and they don’t all taste salty, so it is important to know how much sodium a food contains before you eat it. Salt is very high in sodium so do not cook with salt nor add salt to your food. Use alternative spices to add flavor to your food. Most canned meats, salted canned vegetables, canned soups, sausages, peanut butter, sauces, prepared mixes (pancake, muffins, etc.), and “fast foods” contain a lot of sodium. Some of the foods low in sodium are: fresh or frozen vegetables, fruits, chicken, turkey, fresh or frozen fish, dried beans, cooked cereals (oatmeal, cream of wheat), rice, and graham crackers. Learning how to read food labels will help you choose foods that are low in sodium. Talk with your dietitian to learn about the food contents and how to prepare a well-balanced meal that is low in sodium, fat and cholesterol. (See food tables with approximate sodium contents)

Limit your fluid intake

Your doctor may recommend that you limit your fluid intake to 2 quarts or 8 cups per day. Measure the fluids that you drink and record the amounts so that you do not exceed the recommended amount of fluids each day. Be sure to include all fluids including water, drinks, coffee, jello, ice cream, yogurt, puddings, juices, milk, ice, soups, etc. Avoid alcoholic beverages (beer, wine or liquor). Use the fluid measurement table below to help you measure.

<table>
<thead>
<tr>
<th>Fluid Measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ml = 1 cc</td>
</tr>
<tr>
<td>1 ounce = 30 cc</td>
</tr>
<tr>
<td>8 ounces = 240 cc</td>
</tr>
<tr>
<td>1 cup = 8 ounces = 240 cc</td>
</tr>
<tr>
<td>4 cups = 32 ounces = 1 quart = 1000cc = 1 liter</td>
</tr>
<tr>
<td>8 cups = 64 ounces = 2 quarts = 2000cc = 2 liters</td>
</tr>
</tbody>
</table>
What Additional Things Could You Do To Help Yourself?

There are several other things that you may be able do to help monitor your body and reduce the workload of your heart. Some of those things include: weigh yourself daily, get adequate rest, reduce stress, lose weight if you are overweight, don’t smoke or use tobacco, avoid contact with people who have a cold or the flu, take your medications as prescribed, report significant changes in your condition to your physician promptly, and keep your scheduled appointments. In addition, you need to have a yearly “flu shot” in the fall and a “pneumonia shot” every 5 years.

Weigh yourself every day and record your weight.

Sudden increases in your weight of 3-4 pounds in 1-2 days may be a sign that your body is holding onto excess fluid. Contact your doctor if this occurs. Your doctor may need to adjust your medications. Some important points to remember:

- Weigh yourself every morning at the same time, immediately after using the bathroom and before you eat or drink anything
- Use the same scales each day
- Wear similar type clothing each time you weigh
- Record your weight in a log, diary or calendar
- When to notify your doctor

Notify your doctor if you have any of these symptoms

- sudden weight gain (3-4 pounds in 1-2 days)
- swelling (edema) in your ankles, feet or legs
- swelling or bloating in the abdomen (belly)
- shortness of breath
- chest pain or pressure
- dizziness or fainting
- nausea, vomiting or diarrhea
- persistent cough
## FOOD TABLE WITH COMPARISON OF SODIUM

### BREAKFAST FOODS

<table>
<thead>
<tr>
<th>FOOD</th>
<th>APPROXIMATE SODIUM (mg)</th>
<th>FOOD</th>
<th>APPROXIMATE SODIUM (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacon, pork (2 strips)</td>
<td>202</td>
<td>Doughnut, plain</td>
<td>139</td>
</tr>
<tr>
<td>Link sausages, pork (2)</td>
<td>336</td>
<td>Fried egg, large (1)</td>
<td>162</td>
</tr>
<tr>
<td>Bagel with 1oz. cream cheese</td>
<td>253</td>
<td>Hash browns (1 cup)</td>
<td>54</td>
</tr>
<tr>
<td>Two-egg omelet, ham and cheese</td>
<td>595</td>
<td>Fruit yogurt, low-fat</td>
<td>133</td>
</tr>
<tr>
<td>Cornflakes (1 cup) with low-fat milk</td>
<td>361</td>
<td>Bran muffin</td>
<td>165</td>
</tr>
<tr>
<td>Coffee cake (1 piece)</td>
<td>310</td>
<td>Corn muffin</td>
<td>192</td>
</tr>
<tr>
<td>Tomato juice, canned (1 cup)</td>
<td>882</td>
<td>Grapefruit, half</td>
<td>0</td>
</tr>
<tr>
<td>French toast (2 slices)</td>
<td>514</td>
<td>Orange juice, frozen (1 cup)</td>
<td>2</td>
</tr>
<tr>
<td>Pancakes (2)</td>
<td>320</td>
<td>Coffee, brewed (1 cup)</td>
<td>8</td>
</tr>
<tr>
<td>Danish pastry, plain</td>
<td>249</td>
<td>Tea, brewed (1 cup)</td>
<td>8</td>
</tr>
</tbody>
</table>

### LUNCH FOODS (Continued)

<table>
<thead>
<tr>
<th>FOOD</th>
<th>APPROXIMATE SODIUM (mg)</th>
<th>FOOD</th>
<th>APPROXIMATE SODIUM (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuna salad (1 cup)</td>
<td>434</td>
<td>Green salad, tossed</td>
<td>53</td>
</tr>
<tr>
<td>Hamburger, fast food</td>
<td>500</td>
<td>Fruit salad (1 cup)</td>
<td>9</td>
</tr>
<tr>
<td>Hot dog on bun</td>
<td>671</td>
<td>Chicken noodle soup (low-sodium (1 cup)</td>
<td>36</td>
</tr>
<tr>
<td>Cheese pizza (1 slice)</td>
<td>261</td>
<td>Chicken noodle soup (1 cup)</td>
<td>1107</td>
</tr>
<tr>
<td>Cheeseburger, fast food</td>
<td>750</td>
<td>Potato salad (1 cup)</td>
<td>1323</td>
</tr>
<tr>
<td>Roast beef sandwich</td>
<td>792</td>
<td>Chef’s Salad, ham and cheese (1 cup)</td>
<td>1134</td>
</tr>
<tr>
<td>Dill pickle (1 medium)</td>
<td>928</td>
<td>Cottage cheese, low fat (1 cup)</td>
<td>918</td>
</tr>
</tbody>
</table>
### FOOD TABLE WITH COMPARISON OF SODIUM (Continued)

<table>
<thead>
<tr>
<th>DINNER FOODS</th>
<th>APPROXIMATE SODIUM (mg)</th>
<th>DINNER FOODS</th>
<th>APPROXIMATE SODIUM (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roast turkey breast, without skin (1 cup)</td>
<td>89</td>
<td>Peas and carrots, frozen boiled (1 cup)</td>
<td>110</td>
</tr>
<tr>
<td>Broiled sirloin steak (4 oz)</td>
<td>74</td>
<td>Dinner roll</td>
<td>144</td>
</tr>
<tr>
<td>Green beans, frozen french (1 cup)</td>
<td>17</td>
<td>Spaghetti with tomato-meat sauce</td>
<td>1009</td>
</tr>
<tr>
<td>Broiled codfish (1 filet)</td>
<td>141</td>
<td>Potato, peeled and boiled</td>
<td>7</td>
</tr>
<tr>
<td>Fried chicken breast</td>
<td>385</td>
<td>Beef burrito, fast food</td>
<td>746</td>
</tr>
<tr>
<td>Fettucine Alfredo, frozen (1 portion)</td>
<td>1195</td>
<td>Macaroni and cheese, homemade (1 cup)</td>
<td>1056</td>
</tr>
<tr>
<td>Fish sticks (4 oz)</td>
<td>651</td>
<td>Rice, cooked (1 cup)</td>
<td>4</td>
</tr>
<tr>
<td>Roast chicken breast</td>
<td>138</td>
<td>Carrots, cooked (1/2 cup)</td>
<td>52</td>
</tr>
<tr>
<td>Broiled pork chop</td>
<td>49</td>
<td>Broccoli, cooked (1/2 cup)</td>
<td>20</td>
</tr>
</tbody>
</table>

(*The sodium content in certain food items may vary. Contact your dietitian for more information.)

### FOOD TABLE WITH COMPARISON OF SODIUM (Continued)

<table>
<thead>
<tr>
<th>DESSERTS</th>
<th>APPROXIMATE SODIUM (mg)</th>
<th>DESSERTS</th>
<th>APPROXIMATE SODIUM (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brownie with nuts (1)</td>
<td>50</td>
<td>Orange sherbert (1/2/cup)</td>
<td>44</td>
</tr>
<tr>
<td>Cheesecake (1 slice)</td>
<td>189</td>
<td>Hot fudge sundae (2 scoops)</td>
<td>190</td>
</tr>
<tr>
<td>Pound cake (1 slice)</td>
<td>58</td>
<td>Apple pie (1 slice)</td>
<td>207</td>
</tr>
<tr>
<td>Vanilla ice cream (1/2 cup)</td>
<td>58</td>
<td>Chocolate pudding (1 cup)</td>
<td>335</td>
</tr>
<tr>
<td>Yellow cake with white icing (1 slice)</td>
<td>191</td>
<td>Lemon meringue pie (1 slice)</td>
<td>223</td>
</tr>
<tr>
<td>Devils Food cake with chocolate icing (1 slice)</td>
<td>150</td>
<td>Rice pudding with raisins (1 cup)</td>
<td>188</td>
</tr>
<tr>
<td>Chocolate-chip cookies (2)</td>
<td>76</td>
<td>Fresh strawberries (1 cup)</td>
<td>2</td>
</tr>
<tr>
<td>Oatmeal-raisin cookies (2)</td>
<td>74</td>
<td>Fresh pineapple (1 cup)</td>
<td>1</td>
</tr>
<tr>
<td>Angel Food cake (1 slice)</td>
<td>142</td>
<td>Banana (1)</td>
<td>1</td>
</tr>
</tbody>
</table>

(*The sodium content in certain food items may vary. Contact your dietitian for more information.)
**SAMPLE FOOD LABEL**

The serving size is given in common household measures (cup, slice). Total calories per serving listed.

The sodium, fat and cholesterol contents are listed on food labels per serving size.

<table>
<thead>
<tr>
<th>Nutrition Facts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serving size 1 cup</td>
</tr>
<tr>
<td>Serving per container 2</td>
</tr>
<tr>
<td><strong>Amount Per Serving</strong></td>
</tr>
<tr>
<td>Calories</td>
</tr>
<tr>
<td>%Daily value*</td>
</tr>
<tr>
<td>Total Fat</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Cholesterol</td>
</tr>
<tr>
<td>Sodium</td>
</tr>
<tr>
<td>Total Carbohydrate</td>
</tr>
<tr>
<td>Dietary Fiber</td>
</tr>
<tr>
<td>Sugars</td>
</tr>
<tr>
<td>Protein</td>
</tr>
<tr>
<td>Vitamin A</td>
</tr>
<tr>
<td>Calcium</td>
</tr>
</tbody>
</table>

*Percent Daily Values based on a 2000 calorie diet. Your daily values may be higher or lower.

* Consult your dietician for more information on reading food labels.

**Recommended Patient Educational Resources**

**Book:**
*A Stronger Pump: a guide for people with Heart Failure*

**Organizations:**
Heart Failure Society of America.
Box 258
420 Delaware St. SE
Minneapolis, MN 55455
Phone: (612) 626-3864
Web site: www.hfsa.org

**American Heart Association**
7272 Greenville Avenue
Dallas, TX 75231
Phone: (214) 373-6300 or
1-800-AHA-USA1
www.amhrt.org or
www.americanheart.org/ccf
**Patient/Family Education Goals**

**Patient instruction fosters compliance to the medical regime**

Effective heart failure education ….

- involves the patient and family/significant other in self-care
- provides opportunity for self management choices for the patient
- is intense and repetitive
- is targeted to patient’s educational/literacy level
- involves other disciplines as needed to address issues (social services, dietary, pharmacy)
- focuses on quality of life issues that are important to patient
- utilizes a variety of instruction strategies (films, handouts, poster presentations, demonstrations, patient record keeping logs)
- provides practical ways to improve functional limitations that impair activities of daily living
- fosters a partnership in patient-healthcare provider relationships by encouraging patient to report symptoms, progress or other issues to the office
Referring Your Patient for Cardiac Transplantation
Considerations When Referring Your Patient for Heart Transplant

Patient Assessment for Heart Transplant Eligibility

Transplant Eligibility Criteria:

- End-stage cardiac disease as a result of poor cardiac function or uncontrollable ventricular arrhythmias that can no longer be treated with medications and/or other surgeries.

- Absence of serious systemic illness or other medical conditions which may affect immediate or long-term survival.

- Age 68 or less with a high likelihood of becoming healthy, productive, functional individuals with a life expectancy of at least 5-10 years.

- Full understanding of transplant procedure, it’s limitations and long-term compliance to follow-up requirements.

- Strong social support network, especially family.

- Free from active drug, nicotine or alcohol abuse.

- Weight less than 135% of IBW

Note: All transplant procedures are performed on Emory University’s main campus at Emory University Hospital

HEART TRANSPLANT PATIENT SURVIVAL RATES
Emory University Hospital Policies for Donor and Recipient Candidacy for Cardiac Transplantation

Indications for Heart Transplant
- Poor 12-24 month prognosis without heart transplantation (based on combination of variables).
- LV dysfunction without CAD
  LVEF < 20-25%, LV diameter > 7 cm, poor right heart pressures (CVP > 12, PCWP > 18, PAS > 50, CI < 2.2) on medical therapy, poor exercise tolerance (VO₂ max < 14 ml/kg/min), advanced symptoms.
- LV dysfunction secondary to CAD (not amenable to further revascularization) – more liberal criteria than above based on individual assessment.
- Other – hypertrophic cardiomyopathy, congenital heart disease, valvular heart disease, etc.
- NYHA Class III-IV or intractable severe angina that is not amenable to other therapies.
- Refractory ventricular dysrhythmias.

Absolute Contraindications for Heart Transplant
Factors which place individual at highest risk for poor outcome, poor quality of life or increased mortality
- Intrinsic renal dysfunction – Renal ultrasound will be obtained if creatinine clearance < 50 ml/min to assess for structural abnormalities. Note: heart-kidney transplantation may be considered in carefully selected patients.
- Irreversible liver disease.
- Pulmonary dysfunction (COPD) which is severe.
- Recent pulmonary embolus.
- Complicated diabetes mellitus (poor control, retinopathy, neuropathy, nephropathy).
- Active severe infection.
- Advanced peripheral vascular disease/diffuse atherosclerosis.
- CNS – dementia, active seizure disorder, stroke with poor rehabilitation.
- Cardiac amyloid.
- Patient > 68 years will not be evaluated for heart transplant at Emory University Hospital.
- Active substance abuse – nicotine, ETOH, illicit drugs.
- Severe psychiatric dysfunction.
- Malignancy with high risk of recurrence.
- Non-compliance with medical regimen.
Relative Contraindications for Heart Transplant

Factors which place individual at higher risk for poor outcome, poor quality of life or increased mortality

- Uncontrolled hypertension.
- If age > 60, renal function and relative contraindications evaluated carefully.
- Obesity (> 135% IBW).
- Active systemic illness that would limit long-term survival.
- Inadequate transportation to and from medical appointments.
- Inadequate financial resources to support post transplant needs.
- Inadequate support system including family and friends.

Note: Decision to list patient, remove patient from list or temporarily inactivate from list is made by the Heart Transplant Committee.

Indications for Re-transplantation

Chronic irreversible graft failure or diffuse coronary vessel disease not amenable to PTCA or CABG.

Donor Selection Criteria

The donor should be less than the age of 55 with no previous history of cardiac disease. All general criteria for organ donation must have been met. An echocardiogram should be within normal limits. The potential donor must be hemodynamically stable. Cardiac catheterization is preferred for male donors greater than the age of 40 and female donors greater than the age of 45.

There must be blood group compatibility with a potential donor and there must be no preformed antibodies to the donor. A direct prospective cross-match with the donor is required for any transplant candidate with preformed antibodies as measured by flow bead cytotoxic testing.
Heart Transplant Evaluation Tests and Procedures

- Right heart catheterization with vasodilator challenge when indicated
- Exercise treadmill testing with oxygen consumption determination
- EKG/echocardiogram
- Pulmonary function test w/ bronchodilators and DLCO (patients w/ history of nicotine use, asthma or amiodarone therapy)
- Psychiatric and Social Work consultations
- Hematological profile with differential, platelet count, PT and PTT, CPK, comprehensive metabolic profile, TSH, PSA (if male patient > 50 years old), lipid profile
- Serologic testing for HIV, hepatitis B and C, cytomegalovirus, EBV, ANA, toxoplasma
- Comprehensive urine drug and nicotine screens
- Blood type and screen
- Lymphocytotoxic antibody screen
- 24 hour urine collection for creatinine clearance
- PPD skin test, pneumovax
- Additional tests as indicated

Sample Transplant Evaluation Schedule

Day 1
8:00 a.m.  •  Exercise treadmill test
9:00 a.m.  •  Echocardiogram.
10:00 a.m. •  Transplant education
11:00 a.m. •  Evaluation with Psychiatry.

Day 2
7:00 a.m.  •  Right heart catheterization
10:00 a.m. •  Consultation with Social Services
11:00 a.m. •  Consultation with dietician.
12:00 p.m. •  Lunch
1:00 p.m.  •  Meeting with Financial Coordinator.
2:00 p.m.  •  Pulmonary function test.
Managing Your Patient While Listed for Transplant

We recommend that patients on the heart transplant waiting list be seen by a health care provider monthly to monitor for stability of their cardiac condition.

Those patients on the waiting list will also be scheduled to be seen by the staff of the Center for Heart Failure Therapy and Transplantation at Emory Hospital a minimum of every 2-3 months.

Because the donor heart allocation system is prioritized based upon the severity of illness for patients listed for transplant, the Center for Heart Failure Therapy and Transplantation at Emory needs to be informed should any of the following conditions exist:

Hospitalization
If your patient’s cardiac condition deteriorates prior to transplantation and he/she needs hospitalization, please contact the transplant center. If the patient requires multiple drug inotropic support and/or invasive monitoring, it would be advantageous for him/her to be transferred to Emory Hospital. If a patient is hospitalized in the “listing” hospital, the allocation system allows them to be upgraded to a level that reflects a more critical need (Status 1A).

Infection
Should your patient develop an infection (pneumonia, IV line infection) requiring aggressive po or IV antibiotic therapy, we ask that you notify the transplant center. It may be necessary to place the patient on “inactive” status (Status 7) while the infection is being treated. Subjecting a patient to cardiac surgery and post-transplant immunosuppressant therapy in the face of active infection would be contraindicated in some circumstances.

Other Concerns

Pulmonary hypertension:
Pulmonary pressures are monitored through right heart catheterizations. Treatment with vasoactive drugs to document reversibility of elevated pulmonary pressures pre-transplant are performed at the transplant center at least every 6 months and more frequently if indicated. Elevated, fixed pulmonary pressures will be addressed by the transplant center. Your patient’s transplant candidacy will change if his pulmonary pressures become unresponsive to vasodilator therapy.

Anticoagulation:
To avoid severe coagulopathy during and immediately post-transplant, it is important to maintain tight control of anticoagulation therapy pre-transplant. A target range for INR should be 2.0-3.0.

Conditions that predispose patient to excessive risk for transplant surgery:
Other conditions may also require that a listed patient be placed on “inactive” status. For example, active gastric ulcers, pulmonary emboli or intracranial bleed. The patient will remain “inactive” until these conditions are resolved. Again, the transplant center needs to be informed of these or other conditions that may cause complications during or following transplant surgery.
**Home Inotrope Therapy in Status 1B Patients**

Emory’s heart transplant program makes every effort to consider all aspects of the patient’s life as he or she waits for a heart transplant. The psychological well being of our patients is equally as important as their physical well-being. Hospitalization is associated with increased anxiety and stress levels for both the patient and their family members. If given a choice, most patients would much prefer to wait for their transplant in the comfort of their own home. Emory has established the following criteria, making it possible for select Status 1B patients to wait for their transplant at home.

**Criteria**

1. Must reside locally in the Atlanta area with an estimated travel time to Emory of less than one hour.
2. Must be stable on a single continuous inotropic infusion of less than or equal to 5 mcg/kg/min of dobutamine or 0.4 mcg/kg/min of milrinone.
3. Must have stable volume status on oral diuretics.
4. Must have stable cardiac rhythms.
   (No sustained V-tach, or symptomatic non-sustained V-tach, etc.)
5. If history of angina, must be stable; or anginal symptoms must be relieved by oral medications.
6. Must have adequate support at home to assist with the infusion therapy.
7. Must have sufficient transportation that will enable patients to return to Emory every other week, or more frequently if necessary.

**Follow-up Requirements**

1. Orders are submitted to the Home Health Agency for the prescribed inotrope dosage, PICC line care, weekly basic metabolic panels & magnesium levels, PT & INR (if on coumadin), and where to report results.
2. Patients need follow-up in the CHFT clinic within 1 week of discharge, then every other week, unless otherwise indicated.
3. Right heart catheterization frequency determined on an individual patient basis.
4. Patients are instructed to notify physician’s office if the following symptoms occur:
   - Chest pain/pressure
   - Shortness of breath
   - Persistent cough
   - Dizziness/fainting
   - Swelling: feet, hands
   - Abdominal bloating/pain
   - Palpitations
   - 3-4 lb weight gain (1-2 days)
   - Nausea/vomiting/diarrhea
5. Notify physician if problems occur with PICC line or inotrope access:
   - Line is clotted, leaking, or accidentally removed.
   - Site is red, painful or swollen.
   - Infusion pump malfunction.
   - Patient does not have immediate access to refill if inotrope bag is completely infused.
United Network for Organ Sharing (UNOS)
Organ Allocation Policies

Patients awaiting cardiac transplant will be listed in one of 3 active categories – Status 1A, Status 1B, Status 2. The following guidelines describe the clinical circumstances that determine under which category the patient will be listed.

**Status 1A**
- Mechanical devices (VAD for < 30 days, ECMO, IABP, ventilator)
- VADs > 30 days with device related complications
- High dose single inotropes with pulmonary artery catheter
  - dobutamine at 7.5 mcg
  - milrinone at .5 mcg
- Multiple inotropes with pulmonary artery catheter

**Status 1B**
- VAD for > 30 days
- Inotropic support (regardless of location of patient-ICU without PA catheter, floor or home)

**Status 2**
- All other patients actively listed for heart transplant

**How Will Organs Be Allocated Once Available?**
*(Which patient will get the donor heart?)*
- Donor hearts are matched to recipients according to blood type and body size.
- Available donor hearts will be allocated using the following algorithm:
  - The United Network for Organ Sharing (UNOS) computer will identify all Status 1A patients of the proper blood type and body size in Georgia. The Status 1A patient who has waited the longest as a 1A will receive the donor heart.
  - In the event there are no Status 1A patients listed in Georgia, the donor heart will go to the Status 1B patient in Georgia who has been listed the longest as a 1B.
  - If there are no patients in Georgia of the proper blood type and body size listed as Status 1B, the donor heart will go to the patient who has been listed the longest as a Status 2 in Georgia.
  - If there are no patients listed as Status 2 in Georgia for that particular blood type and body size, the donor heart will go to the patient in the region who has been listed the longest as a Status 1A.
Clinical Management Guidelines for Patients Following Heart Transplantation
Treating Common Complications in Transplant Recipients

Infection
All infections identified in the immunosuppressed transplant recipient should be treated expeditiously to limit sequelae. Patients with persistent low-grade fevers or acute “spiking” fevers (greater than 101°F) should be admitted to the hospital for stabilization and infectious work-up.

The transplant center would like to be informed of any hospitalizations that a recipient requires. We would also appreciate a copy of the discharge summary from each admission.

Simple viral infections that present with “head cold”, rhinorrhea, sore throat without lesions and normal temperature should be treated as follows:

- Claritin (loratadine).
- Gargle with warm salt water as indicated.
- Patient should assess temperature every 4 hours while awake.
- If nasal drainage or sputum is discolored or patient exhibits low-grade fever, treatment with Levaquin 500 mg po QD X 7-10 days is a usually a safe option.

Hypertension
Greater than 75% of heart transplant recipients develop systemic hypertension as an adverse effect when using cyclosporine or Prograf in addition to maintenance steroid therapy. Many patients respond to single antihypertensive therapy but a number of them require multiple agents for adequate control. Immunosuppression doses are also decreased, if possible, to improve renal artery perfusion, thus lowering rennin production. Certain calcium channel blockers (diltiazem, verapamil) increase cyclosporine levels- discuss with transplant center.

Gout
Gout often occurs in the post-transplant patient due to long-term immunosuppression and diuretic therapy. For acute gouty episode, treat as follows:

- Colchicine 0.6 mg every 2 hours until pain resolves or diarrhea develops, decrease dose to BID for 2-4 days, then daily for 2 weeks.
- Immodium 2-4 mg (prn not to exceed package recommendations) may be used to control diarrhea.
- If stable cardiac and renal function, encourage increase in fluid intake.
- Warm compresses to affected joints.
- Provide low-purine diet instructions to patient.

If patient continues to experience ongoing gouty episodes, please consult transplant center. The addition of allopurinol can be considered, but patients on azathioprine (Imuran) should avoid due to risk of pancytopenia.
**Renal Dysfunction**
Calcineurin inhibitors (cyclosporine, Prograf) are moderately potent nephrotoxins and frequently cause dose-related renal dysfunction. This is caused by vasoconstriction of the afferent renal arterioles, thereby decreasing the glomerular filtration rate.

Patients should not be treated with drugs that increase the nephrotoxicity effect of their immunosuppression. These drugs include NSAIDS, indocin, erythromycin or medications that may increase calcineurin inhibitor levels (see “Medications to Avoid” table).

**Hyperlipidemia**
Hyperlipidemia can occur early post-transplant and affects 60-80% of heart transplant recipients due to the effects of cyclosporine and Prograf. HMG-CoA reductase inhibitors are used with care in these patients because of risk of myositis when used in conjunction with calcineurin inhibitors. Patients are placed on Pravachol immediately following transplant for lipid control and it’s beneficial effects on lowering the risk of coronary vasculopathy. Pravachol has been shown to have the lowest incidence of myositis in this population as it is not metabolized through the same pathway as calcineurin inhibitors. (See Guidelines for Cholesterol Management – Post-transplant)

**Malignancy**
Transplant recipients are at increased risk for developing malignancies due to immunosuppressants necessary to maintain allograft function. Skin cancers (basal cell and squamous cell carcinomas) are the most commonly encountered. The treatment of skin cancers can include cryotherapy, excision and reduction in immunosuppression, if possible.

The predominant tumor associated with immunosuppressant effects in transplant recipients is post-transplant lymphoproliferative disorder (PTLD), a non-Hodgkin’s lymphoma. This type of lymphoproliferative disorder is thought to result from upregulated EBV driven B-cell proliferation. Treatment may include reduction in immunosuppression, radiation and chemotherapy where indicated. Even with aggressive therapy, mortality remains high with this diagnosis.
# Post Transplant Potential Infection Timeline

<table>
<thead>
<tr>
<th>(0-30d)</th>
<th>(30-180 d)</th>
<th>180 d+1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bacterial</strong></td>
<td></td>
<td></td>
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<tr>
<td>• IV related</td>
<td>• HSV</td>
<td></td>
</tr>
<tr>
<td>• Pneumonia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Wound</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• UTI</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>EBV, VZV, papillomavirus,</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Listeria</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Legionella, Pneumocystis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CMV, Aspergillus, Nocardia, Toxoplasma</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Months after transplantation

- **0-30d**
  - Cryptococcus
  - EBV, VZV, papillomavirus,
  - Listeria
  - Legionella, Pneumocystis
  - CMV, Aspergillus, Nocardia, Toxoplasma

- **30-180 d**
  - HSV

- **180 d+1**
Acute Cardiac Rejection

- T-cell mediated
- Graded according to degree of lymphocytic infiltration, edema and myocyte injury
- Diagnosed by endomyocardial biopsy
- Clinical presentation may include GI complaints, right heart failure symptoms, fatigue, dyspnea, arrhythmias, tachycardia, low grade fever

Grading System for Acute Rejection
Grade 0  - no acute rejection
Grade 1A - mild lymphocytic infiltration
Grade 1B - mild to moderate lymphocytic infiltration
Grade 2  - focal moderate acute rejection
Grade 3A - multi-focal moderate acute rejection w/ myocyte necrosis
Grade 3B - diffuse acute rejection w/ myocyte necrosis
Grade 4  - severe acute rejection with edema, polys, eosinophils, & hemorrhage

Emory Biopsy Schedule
- Weekly x 4 weeks
- Every 2 weeks for 1 month
- Monthly x 1-2 months
- Every 2 months – through year 1
- Every 3 months – years 1 - 2
- Every 4 months – years 2 – 3
- Every 6 months – years 3 – 7
- After 7 years, biopsy based upon individual’s rejection history
  Note: Patient will be biopsied 1 week after diagnosis of treated rejection to assure treatment has cleared lymphocytic infiltration. Once rejection has cleared, biopsy frequency will follow above intervals based upon rejection history and time post transplant.

Treatment Options for Acute Cardiac Rejection

Solumedrol
- 1 gram IV daily x 3; administered as outpatient if no hemodynamic compromise noted on echocardiogram
- Potential adverse effects: fluid retention, elevated BP, hyperglycemia, GI distress

OKT3 (Orthoclone)
- Murine monoclonal antibody to human T-cell receptors
- 5 mg daily x 10 days
- 3 days inpatient administration & monitoring; may receive as outpatient in Transplant Outpatient Services at Emory Hospital if asymptomatic after day 3/10 of treatment
- Potential adverse effects: anaphylaxis, pulmonary edema, fever, N/V, arthralgias, myalgias

Total Lymphoid Irradiation (TLI)
- Low dose radiation therapy for treatment of refractory acute rejection
- Targets mediastinal and inguinal lymph nodes and spleen
- Two treatments per week for 6 weeks
Transplant Vasculopathy (Graft CAD)

Description
- Related to both immune and non-immune mediated processes
- Vessel deposition of smooth muscle cells results in diffuse myointimal hyperplasia
- Narrowing can either be abrupt, show gradual transition or be diffusely irregular
- Distal narrowing and involvement of artery branches characteristic

Angiographic Incidence
- 1 year – 14%
- 3 years – 36%
- 6 years – 66%
  - Prevalence thought to be higher than reported since arteries with diffuse vasculopathy may appear deceptively normal, lacking focal discrete lesions.
  - By intravascular ultrasound, most vessels show some degree of intimal hyperplasia by 1 year.

Clinical Presentation
- May not have symptoms
- Non-specific complaints (increased fatigue, activity intolerance)
- Symptoms of heart failure (respiratory symptoms w/ cough, diaphoresis, edema, ventricular dysrhythmias, sudden death, vesicular breath sounds, S3 and S4).
- LV dysfunction, evidence of MI on ECG, elevated LVEDP
- Generally don’t experience angina with ischemia due to loss of afferent innervation with transplant surgery. Some patients have, however, shown evidence of afferent pain fiber regeneration resulting in exertional chest pain.

Treatment
- CABG not indicated due to diffuse nature of disease and distal obstruction; mortality high
- PTCA may be performed if lesion is significant, discrete and accessible
- Anti-platelet therapy (aspirin), Pravachol, consider Plavix
- Low-fat diet and exercise, blood pressure control
- Re-transplantation in select group w/ chronic, irreversible graft dysfunction
- Consider rapamycin therapy for anti-proliferative effects
# Common Immunosuppressant Agents

<table>
<thead>
<tr>
<th>MEDICATION</th>
<th>ACTION</th>
<th>ADDITIONAL INFORMATION</th>
<th>POTENTIAL ADVERSE EFFECTS (*denotes most commonly seen; often dose dependent)</th>
</tr>
</thead>
</table>
| Cyclosporine-Sandimmune and Neoral, Gengraf (or generic equivalent) not interchangeable | *Primarily T-lymphocyte selective  
*Inhibits responsiveness of killer T-cells to Interleukin II | *Metabolized by the liver  
*Dosed according to 12 hour trough blood levels and renal function; target level 150-300 depending on interval post transplant  
*IV dose is 1/3 of PO dose. | *renal dysfunction, *HTN, headache, tremors, hirsutism,  
*decreased mg++, gallstone formation, *elevated cholesterol, gingival hyperplasia |
| Tacrolimus (Prograf) | *Inhibits cytokine production (including IL2)  
*Blocks cell division | *Replaces cyclosporine when efficacy, absorption or tolerance is a problem  
*Target level 8-15 depending on interval post transplant  
*IV dose is 1/3 of PO dose. | *renal dysfunction, *HTN, headache, tremors,  
*decreased mg++, gallstone formation,  
*elevated cholesterol, glucose intolerance |
| Azathioprine (Imuran) | *Inhibits RNA & DNA synthesis  
*Decreases T-cell proliferation by inhibiting T-cell responsiveness to Interleukin II  
*Decreases production of WBC’s in bone marrow | *Dosed according to white blood cell count; target level 4-6,000  
*No IV preparation of this drug | leukopenia, hepatic dysfunction, thrombocytopenia,  
*skin cancer  
*avoid allopurinol |
| Mycophenolate Mofetil (Cellcept) | *Inhibits purine synthesis  
*Effective on both T & B lymphocytes | Has been shown to inhibit development of transplant CAD in animal models  
*IV dose is same as PO dose | leukopenia, nausea and abdominal distress |
| Methotrexate | *Inhibits folic acid reductase  
*Inhibits DNA synthesis and cellular replication  
*Decreases production of WBC’s | *Dosed according to white blood cell count - target 4-6,000 | leukopenia, nausea and abdominal distress |
| Sirolimus (Rapamune, Rapamycin) | *Macrocyclic lactone, inhibits IL II signal transduction  
*Effective on both T & B lymphocytes | *Dosing based upon trough level  
*Target level 7-10 | thrombocytopenia, leukopenia, anemia, *hyperlipidemia |
| Methylprednisolone (Prednisone) | *Anti-inflammatory properties | Weaned to a low daily dosage based upon rejection-free biopsies | osteoporosis, hyperglycemia,  
*fluid retention, GI distress,  
*increased BP, cushingoid effect, *increased appetite |

**Note:** Please be aware that missing even brief intervals (1-2 days) of immunosuppressants can be detrimental to transplant recipients. If you have concerns, please contact our office.
**Other Common Post-Transplant Medications**  
(treating the side effects of immunosuppressants)

<table>
<thead>
<tr>
<th>Medication</th>
<th>Indication</th>
<th>Dosing recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspirin</td>
<td>Anti-platelet therapy due to potential for development of transplant CAD</td>
<td>Prescribed 81 mg daily</td>
</tr>
<tr>
<td>Bactrim DS</td>
<td>Prophylaxis for pneumocystis pneumonia in patients on higher doses of immunosuppression early post-transplant</td>
<td>Prescribed 1 tab QMWF for 1 year post transplant; continued at 3X/wk dosing for all patients on methotrexate and rapamycin (dapsone substituted if patient allergic to sulfa)</td>
</tr>
<tr>
<td>Pravachol</td>
<td>Treatment of drug induced hyperlipidemia. Prescribed as a result of data showing reduction in 12-month rejection in transplant recipients. <em>Preferred statin choice due to reduced incidence of myositis and rhabdomyolysis when used in conjunction with cyclosporine or Prograf.</em></td>
<td>Prescribed initially at 20 mg QHS.</td>
</tr>
<tr>
<td>Calcium/ Vit D</td>
<td>Prophylaxis for drug-induced osteoporosis in transplant recipient on maintenance cyclosporine or Prograf and prednisone.</td>
<td>Recommended dosing – 500 mg elemental calcium TID and 400 IU vitamin D BID</td>
</tr>
<tr>
<td>H2 blocker</td>
<td>GI protection from effects of steroids</td>
<td>BID dosing</td>
</tr>
</tbody>
</table>

**Medications to Avoid in Transplant Recipients**  
Without Consultation with Transplant Office  
(potential interactions with immunosuppressant agents)*

<table>
<thead>
<tr>
<th>Medication</th>
<th>Indication</th>
<th>Dosing recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acyclovir</td>
<td>Cieplatin</td>
<td>Ganciclovir</td>
</tr>
<tr>
<td>Allopurinol</td>
<td>Clarithromycin</td>
<td>HMG-CoA Reductase inhibitors (atorvastatin, cerivastatin, simvastatin)</td>
</tr>
<tr>
<td>Aminoglycosides</td>
<td>Danazol</td>
<td>Ibuprofen/NSAIDS</td>
</tr>
<tr>
<td>Amphoterin B</td>
<td>Dapsone</td>
<td>Indivavir</td>
</tr>
<tr>
<td>Antacids</td>
<td>Delavirdine</td>
<td>Itraconazole</td>
</tr>
<tr>
<td>Anticonvulsants (phenobarbitol, primidone, carbamazepine)</td>
<td>Dexamethasone</td>
<td>Ketoconazole</td>
</tr>
<tr>
<td>Bromocriptine</td>
<td>Diltiazem</td>
<td>Mefloquine</td>
</tr>
<tr>
<td>Caspofungin acetate</td>
<td>Efavirenz</td>
<td>Metronidazole</td>
</tr>
<tr>
<td>Celecoxib</td>
<td>Ergotamine</td>
<td>Mizolam</td>
</tr>
<tr>
<td>Chloramphenicol</td>
<td>Erythromycin</td>
<td>Nefazodone</td>
</tr>
<tr>
<td>Chloroquine</td>
<td>Ethinyl estradiol</td>
<td>Nelfinavir</td>
</tr>
<tr>
<td>Chlorotrimazole</td>
<td>Fluconazole</td>
<td>Nevirapine</td>
</tr>
<tr>
<td>Cimetidine</td>
<td>Foscarin</td>
<td>Nicardipine</td>
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</tbody>
</table>

* Can be given with appropriate adjustment in immunosuppression, please consult transplant center first.
Cholesterol Management – Post-transplant

Pravachol 20 mg po qDay

LDL > 100
- Pravachol to 40 mg po q day

LDL > 130
- Pravachol to 80 mg QD
- Add Welchol 1.5 grams/d titrate q 8 weeks
  - 6 tabs with meal and liquid q day
  - OR 3 tabs with meals and liquid bid

LDL < 100
- Continue Pravachol 20 mg

LDL < 130
- Continue Pravachol 40 mg

- Repeat lipids annually

- All have increased risk of myopathy with higher doses
- Do not titrate drugs up

- Simvastatin 10 mg qd
- Atorvastatin 10 mg qd
- *Fluvastatin 40 mg qd
- *Lescol XL 80 mg qd
- *interacts with warfarin

- Deny
- Approve
- Continue Pravachol
Osteoporosis Prophylaxis in Heart Transplant Recipients

Patients post-transplant will be discharged from transplant admission on the following:

- Calcium carbonate 1250 mg (providing 500 mg elemental calcium /tablet) po TID (calcium citrate will be prescribed in patient with GI intolerance to calcium carbonate)
- 2 multivitamins to provide 800U of Vit. D daily
- Fosamax 70 mg qweek

*Consideration should be given to dose reduction in patients with renal insufficiency.*

*(initiate calcium and MVI's pre-transplant if patient waiting in hospital on inotropes)*

Post-menopausal women will be prescribed estrogen when appropriate.

At time of discharge, Physical Therapy will provide instruction using weight bearing exercises with rationale for this type of exercise.

Baseline bone densitometry studies will be done at transplant evaluation and will be repeated at 1 year following transplant. Fosamax therapy will be discontinued at 1 year if bone density study is within normal limits. If bone density is low, continue Fosamax therapy.

Testosterone levels will be measured in male patients at 6 weeks and at 6 months following transplant and replacement therapy initiated when indicated.
Routine Health Maintenance Recommendations
For Heart Transplant Recipients

- *Transplant recipients may resume their vaccination schedule approximately three months after transplant. Live vaccines should be avoided.*
- Annual flu vaccinations.
- Pneumococcal vaccinations every 5 years.
- Tetanus-diptheria booster every 10 years.
- Dental examinations every 3-6 months. Refer to periodontist if indicated for severe gingival hyperplasia. Pre-medicate for all dental visits with Standard American Heart Association prophylactic treatment for SBE.
- Monthly self breast examinations (for men and women).
- Annual eye examinations.
- Annual skin cancer screening.
- Annual gynecological examinations and routine mammograms for female patients.
- Annual prostate examinations for male patients.
- At age 50, we recommend the screening tests listed below:
  - Yearly fecal occult blood test (FOBT)
  - Baseline colonoscopy – repeat frequency based upon findings
  - Double contrast barium enema every five years
- If greater than 45 years old, diabetes testing every 3 years.
Clinical Trials
Clinical Trials

**HF-ACTION**

**Purpose:** This study is a multi-center NIH trial to determine if exercise training is beneficial for heart failure patients. The study consists of two treatment groups that are the Usual Care Group and the Exercise Training Group. Patients in the exercise-training group attend 36 sessions of cardiac rehabilitation and then continue treadmill training at home. Costs including the treadmill machine are paid by the study. Current rehabilitation sites include The Blomeyer Fitness Center at The Emory Clinic, Fitness Forum Department at Newton General hospital, Rockdale Medical Center Cardiac Rehabilitation Center, Wellstar Kennestone Cardiac Rehabilitation Center, and the Georgia Heart Clinic Cardiac Rehabilitation Center. Some of the criteria for inclusion in this study are as follows: LVEF ≤ 35%; NYHA Class II, III or IV; and optimal heart failure therapy.

**A-HEFT:** (BiDil vs. Placebo) BiDil is a vasodilator combination consisting of hydralazine plus isosorbide dinitrate. In a previous study (V-HEFT), the free combination of these drugs has been shown to improve survival and symptoms of patients with heart failure. Data from this suggests that African American patients may particularly benefit from this therapy.

**Purpose:** The purpose of this study is to demonstrate safety and efficacy of BiDil vs. placebo in African-American patients with moderate to severe symptomatic heart failure receiving standard treatment. Some of the inclusion criteria are as follows: African-American ethnicity: LVEF < 35%; and NYHA Class III or IV. Standard therapy with ACE inhibitors and beta-blockers is given to all patients.

**COMPASS:** This study is sponsored by Medtronic, Inc., and involves the use of the Chronicle device that is an implanted homodynamic monitor. The device looks like a pacemaker with a lead that goes in the RV septum near outflow tract. This device estimates pulmonary artery systolic and diastolic pressures based on right ventricular pressure and electrical timing. The patient will download information from the device twice weekly. The information will be assessed and used to advise the patient regarding diuretic and medication management. The pilot of this study suggested significant decrease in the number of patient hospitalizations. This trial is randomized, that is, in half the patients the data will not be seen during first six months but will be available after that date. Some of the inclusion criteria for this study are as follows: NYHA Class III-IV, hospital admission in past 6 months and LVEF within any range.

**ADVANCED REGISTRY (GUIDANT)** This is a registry which includes chronic congestive heart failure patients who have a LVEF < 40% and are being medically managed long term. After the initial patient interview for data collection, all follow-up interviews will be by phone. The plan is to enroll 1500 patients from Emory University Hospital and Emory Crawford Long Hospital.