Artificial Heart Pumps and Heart Transplantation

TAO Presentation
Monday, September 17, 2012
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1. Bridge to recovery
2. Bridge to transplant
3. Destination Therapy
Artificial Heart vs. VAD

Replacement Heart replaces diseased ventricles of failing heart

Left Ventricular Assist Device (LVAD) attached to diseased heart
Ventricular Assist Devices

Short Term

Long Term
Definition: LVAD is known as a left ventricular device because it helps the left ventricle circulate blood throughout the body.

- The LVAD is a treatment for long-term support of heart failure patients
- it allows them to leave the hospital and return to active, productive lives.
- The devise consists of a pump that is implanted in the abdomen, which has an electrical cable and air vent that connects to external battery packs.
- The packs are worn on the shoulders and electronic controls are worn on the belt.
LVAD (HeartMate®)

- Implanted pump restores circulatory support
- Extensive experience and incremental improvement with bridge-to-transplant in more than 3,400 patients since 1986
HeartMate® II

HeartMate II
US Pilot Trial
Phase 1

SMH Implant
07/23/2004

http://www.thoratec.com/ventricular-assist-device/heartmate_II.htm
LVAD on Chest X-ray
LVAD Components

- System Driver
- PBU Cable
- System Monitor Cable
- System Monitor
- Power Cord
- Power Base Unit
- Pump
- Wall Outlet
Power Base Unit

- Provides power during tethered operation
- Charges batteries
- System Monitor: Displays pump flow, speed and power.
LVAD Driveline

Hollister Horizontal Tube Holder
Anticoagulation

Patients are typically maintained on:

- Aspirin 325 mg QD
- Coumadin for a goal INR of 1.8-3.0

This protocol can be individualized for each patient.
Nursing Considerations

• Automatic BP’s may be inaccurate.
• Systolic pressure by doppler typically 70-90.
• Important to evaluate how your patient feels, check flows.
• RV failure can still occur.
• Patient may not have a radial or brachial pulse.
• Pt. can not receive CPR (no chest compressions).
• Driveline wound requires sterile dressing change.

URMC Artificial Heart Program
585-273-3760 or 1-800-892-4964
Patient Selection:

- The patient and family must be completely independent and able to demonstrate compliance with the LVAD (controls, power pack, and care of) prior to dc from hospital.
- Family member avail 24/7 to participate in care and monitoring (If bridge to txp needs adherence) may be patient specific.
- Pt and family independent with dsg changes and reordering supplies prior to dc (may have Mcare guidelines to follow)
Levitronix CentriMag®

Magnetically levitated, bearingless motor
9.9 lpm at 5,500 rpm
No valves
No seals
SynCardia TAH-t System

- Implantable TAH-t
- Drivelines
- External Console
Implantable TAH-t Features

- Occupies space of diseased heart
  - Displaces 400 ml
  - Weighs 160 grams
- Blood flow path same as normal heart
  - Inflow <2 cm
  - Blood path <20 cm
- Adjustable ventricle orientation
- No surgical pocket required
Criteria For Transplant

- Refractory heart failure, despite maximum medical therapy and a life expectancy of 6-12 months
- Peak exercise V02 of <14ml/kg/min
- Severe cardiac ischemia, not amenable to bypass or angioplasty
- Recurrent symptomatic ventricular arrhythmias, refractory to all accepted therapeutic modalities.
A heart healthy diet is appropriate for all patients who have a current diagnosis or history of heart failure (home inotropes, VAD support or post-transplant)

- Limit intake of sodium, saturated fat, and trans fat
- Achieve and maintain a healthy weight

**Sodium**

- The average American consumes approximately 3600 mg sodium per day
- About 77% of the sodium in the American diet comes from processed and packaged foods
A sodium restriction of 2000 milligrams per day is recommended

**High sodium foods to limit:**
- Canned foods- soups, sauces, gravy mixes, most canned vegetables
- Packaged starchy foods- seasoned noodle or rice dishes, stuffing mixes, boxed macaroni and cheese
- Meats and cheeses
  - deli meat- bologna, ham, roast beef, turkey
  - cured or smoked meat- sausage, bacon, corned beef
  - processed cheeses such as American, Velveeta®, Cheez Whiz®
- Frozen dinners
- Instant foods- potatoes, cereals, noodles
- Mixes such as cornbread, biscuit, cake and pudding
Sodium

- Condiments and sauces
  - mustard, ketchup, salad dressing, bouillon cubes
  - Worcestershire, barbeque, pizza, steak, soy sauces
  - pickles and olives
  - any seasoning with the word “salt” in the name
    - garlic, onion, celery salt

Lower sodium seasoning ideas

- Herbs and spices- garlic powder, onion powder, salt free seasonings such as Mrs. Dash®
- Tart- lemon juice, lime juice, vinegar
- Hot- pepper, red pepper flakes or a few drops of hot sauce (does contain some sodium, use sparingly)
**Fats**

**Saturated Fat- typically solid at room temperature**
- Butter
- High fat dairy products (whole milk, ice cream)
- Cheese
- Other fats found in meat and poultry (steak, veal, pork, lamb, chicken skin, turkey skin)
- Certain oils (coconut, palm or palm kernel oil)

**Trans Fat- most often found in highly processed foods**
- Stick margarine
- Shortening
- Commercially baked products
- Foods containing hydrogenated or partially hydrogenated oils
### Nutrition Facts Panel

**Serving Size:** 1 cup (228g)
**Servings Per Container:** 2

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<th>Amount Per Serving</th>
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<tr>
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<tr>
<td>Saturated Fat 3g</td>
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<td>Dietary Fiber 0g</td>
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<tr>
<td>Sugars 5g</td>
<td></td>
</tr>
<tr>
<td>Protein 5g</td>
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| Vitamin A           | 4%                    |
| Vitamin C           | 2%                    |
| Calcium             | 20%                   |
| Iron                | 4%                    |

*Percent Daily Values are based on a 2,000 calorie diet. Your Daily Values may be higher or lower depending on your calorie needs:

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Other Nutritional Concerns

**Advanced heart failure population**
- may be obese or underweight
- poor appetite
- early satiety
- gastrointestinal issues such as nausea/vomiting, decreased GI motility and malabsorption
- cardiac cachexia

**Consistent Vitamin K intake for patients on Coumadin**

**Transplant patient**
- food safety
- food/drug interactions
- blood sugar control
Advanced Heart Failure Population

- 2 gram sodium, heart healthy diet
- Fluid restriction if prescribed by physician
- Achieve and maintain a healthy weight

Patients may suffer from symptoms such as decreased appetite, early satiety, unintentional weight loss

- small, frequent meals
- focus on nutrient dense foods
- drink liquids separate from meals
- low fat foods may be better tolerated
- nutritional supplements as needed
VAD Patients

- 2 gram sodium, heart healthy diet
- Achieve and maintain a healthy weight
- Consistent Vitamin K Diet (see attached list for Vitamin K content of foods)

High Vitamin K foods:
- broccoli
- brussel sprouts
- endive
- greens (beet, collard, mustard, turnip)
- kale
- green onions
- parsley
- spinach
- Swiss chard
Transplant Patients

- 2 gram sodium, heart healthy diet
- Encourage protein rich foods to aid in wound healing and recovery from surgery
  - poultry
  - lean beef
  - fish
  - pork
  - dry beans and peas
  - nuts
  - tofu and other soy products
  - eggs
  - dairy products
Transplant Patients

- **Food safety**
  - Wash hands and food preparation surfaces well before cooking and eating
  - Wash fresh fruits and vegetables well before consuming
  - Thaw food in the refrigerator or under cold running water
  - No raw, rare or undercooked fish, poultry, pork, beef or eggs
    - Use a meat thermometer to ensure proper temperatures
  - No unpasteurized milk, cheese, juice, or ciders
  - No fresh sprouts
  - No foods that are spoiled or moldy
  - No foods that are past their “use by” date
  - Discard leftovers that have been at room temperature longer than two hours
  - Reheat leftovers to a minimum of 165° F
  - Avoid cross contamination
Transplant Food Drug Interactions

**Tacrolimus**

- May cause increased serum potassium levels
  - Limit high potassium foods
- May cause magnesium and calcium wasting
  - Consume a magnesium and calcium rich diet
  - Avoid grapefruit/grapefruit juices
Prednisone

- Increased appetite, weight gain
- Elevated glucose levels
  - Consume a diet consistent in the following foods:
    - breads, cereals, crackers
    - pasta, rice and grains
    - starchy vegetables- potatoes, corn, and peas
    - beans and legumes
    - milk, soy milk and yogurt
    - fruits and fruit juices
    - sweets such as cakes, cookies, ice cream, jam and jelly
Questions