COMPLICATIONS AND LONG-TERM CARE

Rejection

One new concern will be rejection.

Every transplant recipient experiences a rejection episode at some point. The recipient's natural defense system, the immune system, fails to recognize the transplanted heart as its own and tries to protect the body by rejecting the new heart.

When rejection occurs, it can be treated and reversed. To control rejection, additional drug doses or new medications may be given. For severe rejection, a hospital stay will be necessary.

It is very important to watch for signs of rejection in the recipient. These include:

- Fatigue
- Shortness of breath
- Irregular heart beats
- Low-grade fever
- Stomach upset
- Abdominal bloating in conjunction with ankle edema
- Irritability
- Dizziness

It is very important to have the ability to recognize signs of rejection. If any symptoms are detected, the transplant coordinator must be notified at once. The telephone numbers for the heart transplant team are included in the directory in the front of this manual. Most of the time, a heart biopsy is necessary in order to detect rejection. Rejection is usually detected from a biopsy before the recipient becomes symptomatic, allowing treatment to start before the rejection progresses. Therefore, regular biopsies will be scheduled. They will also be done urgently if there is a strong concern for rejection.

Cardiac Biopsy

Cardiac biopsies are the only reliable way to detect rejection of the heart. There will be several biopsies the first year, and then they become less frequent. By the time the recipient is two years out from the transplant surgery, cardiac biopsies will be much less frequent. After five years, they may be done annually. Of course, they will be scheduled urgently if there is ever any question of rejection.

You will be contacted about a week before the scheduled procedure with pre-procedure instructions, including when to stop eating and drinking, and when to hold certain medications.

DO NOT give your child the anti-rejection medicines that morning because a drug level will be checked at the time of the procedure. Bring these medications along so they may be administered afterward. Most of the time, all medications are held before the procedure.

If necessary, a child life specialist is available to accompany the recipient to the CATH Lab, as well as provide distraction and emotional support during the procedure.

The procedure is performed in the catheterization room. A catheter or tube is threaded through a large vein in the neck or groin into the right chamber of the heart. Through this tube, a wire with a pincher (bioptome) on the end is threaded into the heart, where it removes about five pieces of the heart muscle. The pieces are no bigger than a pinpoint. Removing them usually does not damage the heart. The procedure lasts approximately 30 minutes.

After the biopsy, pressure is applied to the puncture site to stop bleeding and then a bandage is applied. The bandage can be taken off after six hours. Soon after the biopsy, the recipient should take all medications and eat. If the biopsy was done through the groin, the recipient will be required to rest the remainder of the day. If the biopsy was done through the neck, the recipient will be able to resume normal activity following his/her clinic appointment.

The biopsy pieces are sent to a pathologist who examines them under a microscope and determines if there are any signs of rejection. The results of the biopsy are available a few days after the procedure. The transplant coordinator will call to discuss the results.

Possible Complications of Heart Biopsy

- Bruising or bleeding at the catheter site
- Damage to the blood vessels used for the biopsy or damage to the nearby nerves
- Damage to a valve in the heart
- Abnormal rhythms (heart beats)
- Perforation (tearing) of the heart, with collection of blood around the heart

Long-Term Complications

Cardiac Allograft Vasculopathy (CAV): This is a form of chronic rejection in heart transplant recipients and is the leading reason for re-transplant. It is a progressive process which becomes worse over time. The cause of this is not precisely known, but researchers think it may be related to the immune system or the medications.

The result of the process is that the coronary arteries (the vessels that supply blood to the heart muscle) become narrow and thick. Thus, they cannot feed the heart very well. As a result, parts of the heart muscle die when they do not get enough oxygen. The symptoms are fainting and/or sudden death.

To monitor the progression of this process, the recipient will undergo coronary artery catheterization at least every two years. If disease is present, sometimes stents and/or balloons can be used to open blockages. Much of CAV is at the ends of the arteries and cannot be reached by a catheter.

Right now, there is no cure for CAV. There are medications that help slow down the process. These will be prescribed to try and slow down the narrowing in the coronary arteries, as well as help prevent blood clots from forming.

There are a few things the recipient can do to help in delaying this process. It is important to get regular exercise, eat a healthy diet, take medications regularly and do not miss any doses. It is also important to maintain a normal body weight, go to all transplant follow-up visits, get labs done on time, avoid smoking/second hand smoke and avoid alcohol use.

Post-Transplant Lymphoproliferative Disorder (PTLD): Heart transplant recipients are more susceptible to cancer. In particular, white blood cell cancers called lymphomas or certain types of skin cancers. To monitor for lymphomas, we do annual chest x-rays and monitor for Epstein-Barr Virus (EBV). To prevent skin cancers, it is recommended to decrease exposure to the sun by wearing protective clothing and sunscreen.

Recognizing Infection

Because medications will be taken every day to suppress the body's natural defenses against bacteria and viruses, the recipient will be more susceptible to infections.

Be alert for signs of an infection, such as a cough, a fever (101.5°F) or chills, shortness of breath, vomiting or diarrhea. Signs in infants may be increased irritability or fussiness, rashes, lethargy, poor feeding or lack of appetite.

Call the transplant coordinator at once if there may be an infection. The signs of infection and rejection are often the same. In either case, call the transplant coordinator if any of these symptoms are recognized.

Precautions should be taken to avoid sources of infection for the recipient. Keep them away from people with the flu or colds. Also, try to avoid other ways that germs are easily spread – in crowds, in cigarette smoke, and in dirty/dusty buildings.

Antibiotic Prophylaxis

Not everyone who has undergone heart transplantation requires antibiotics before a surgical procedure, dental procedure or deep cuts requiring stitches, to prevent against infection. We follow the American Heart Association prevention of bacterial endocarditis guidelines. It is not necessary to take antibiotics for minor scrapes, bruises or immunizations. If there are any questions regarding the need for antibiotics or a prescription for antibiotics before a procedure please do not hesitate to call the transplant coordinator.

Hygiene

Dental Care

Because many infections start in the mouth, dental care is very important. Here are some points that need to be done to promote good dental hygiene:

- Brush the teeth often – at least twice a day.
- Notify your nurse coordinator before making your child's first dental appointment after the transplant. Your child may or may not need to take antibiotics before every dental procedure (examples: cleanings, fillings, and gum surgeries). A prescription can be called into your local pharmacy. Antibiotic prophylaxis (pre-medicine) is used until your child is on only one anti-rejection medicine (i.e., only Prograf).
- Your child should see the dentist every six months.
- Inform your dentist of your child's transplant and the special medicines that your child takes.

Skin Care

- Make sure hair is washed frequently because hair holds bacteria and dust.
- Medications prescribed will make skin more fragile, and thus more susceptible for injury. If any injury does occur, cleanse the area and use clean dry bandages to prevent infection. If it takes an unusually long time to heal, or it becomes red, swollen or infected, notify the transplant coordinator immediately.

- Because your child is taking drugs that suppress the immune system, your child has an increased risk of developing skin cancer. We suggest that your child take precautions, including using sunscreen (SPF 15 or greater), hats and long sleeves (if tolerated). Your child should avoid tanning salons and repeated long unprotected exposure to the sun.

Eye Examination

It is recommended that your child is seen by an ophthalmologist (eye doctor) on a yearly basis after transplant. This is to monitor for any chronic eye changes that can be noted as a result of the anti-rejection medicines.

Hand Washing

Hand washing is one of the best ways to protect yourself and your family from getting sick. Germs that can cause respiratory and diarrheal infections can spread from person to person or from surfaces to people. Remember to wash your hands with soap and water (or hand sanitizer when you cannot use soap and water):

- Before, during, and after preparing food
- Before and after eating food
- Before and after caring for someone at home who is sick with vomiting or diarrhea
- Before and after treating a cut or wound
- After using the toilet
- After changing diapers or cleaning up a child who has used the toilet
- After blowing your nose, coughing, or sneezing
- After touching an animal, animal feed or animal waste
- After handling pet food or pet treats
- After touching garbage

Immunizations

Transplant recipients need to take medications to weaken the immune system and are at risk for infections. Immunization is the best way to protect your child from serious infections. Immunization works best if given before transplantation, and your child will receive a list of immunizations to complete before transplantation. Your child should continue to receive vaccines recommended by CDC after transplantation.

After transplantation, your child should NOT receive immunizations that contain a live virus or bacteria. If a live immunization is given, there is a potential risk that your child will contract that infection. It is necessary that your pediatrician have a copy of the immunizations that your child can receive. The following immunizations contain a live virus or bacteria:

- MMR (measles, mumps and rubella)
- Varicella (chickenpox)
- Rotavirus vaccine
- Small pox vaccine
- Oral polio vaccine (not licensed or available in the US)
- Nasal spray influenza vaccine
- Yellow fever vaccine
- Oral typhoid vaccine
- Cholera vaccine

You Should Know

Your child should NEVER receive immunizations that contain a live virus.

The following are recommended immunization for your child to receive, but you should contact your nurse coordinator or doctor first for individual recommendations:

- Tetanus, Diphtheria, and Pertussis (DTaP, Tdap, or Td vaccines)
- Inactivated polio virus
- Haemophilus Influenzae Type B (Hib)
- Influenza (injected form only)
- Streptococcus pneumoniae (Pneumonia vaccine)
- Hepatitis B
- Hepatitis A
- Human Papilloma Virus (HPV)
- Meningococcus (Meningitis vaccine)
- COVID-19
- MMR, varicella, and rotavirus, BEFORE transplantation (NOT after transplantation)

Members of the household SHOULD get the COVID-19 vaccine and annual influenza vaccine to best protect the persons with weakened immune system. Members of the household CAN, AND SHOULD, get recommended live vaccines.

Flu Shots and Pneumonia Shots

Transplant patients are encouraged to receive a flu shot every year and pneumonia shot every five years. Since high doses of anti-rejection medicines may lessen the effects of these vaccines, transplant patients are recommended to wait approximately three to six months after transplant before getting these or other vaccines. However, during the flu season, flu shots can be given as early as one month post transplantation and the dose can possibly be repeated later.

Pets

Pets can be an important part of family life. Research has shown that pets help relieve stress and have positive physical and psychosocial benefits as well as possibly improving our quality of life.

For people with weakened immune systems, the CDC recommends to avoid getting a new pet/animal that is:

- Sick
- Feral
- Young cats and dogs (under 6 months old) can transmit Campylobacter, Bartonella (kittens) and other diseases

The following animals are considered high risk. People with weakened immune system should avoid contact with:

- Reptiles (lizards, snakes, turtles, frogs) – risk of Salmonella infection
- Backyard poultry (chickens, ducks, turkeys and geese) – risk of Salmonella infection
- Rodents (hamsters, guinea pigs, rats, mice and other small rodents) – risk of lymphocytic choriomeningitis virus infection
- Other exotic pets (monkeys and other wild animals)

In addition, the following guidelines should be followed:

- Wash your hands after handling your pet, especially if you are going to eat, drink or handle any food.
- Your pet should have regular health visits to the vet and receive the required immunizations.
- Groom your pet on a regular basis. The nails of both the dog and cat should be trimmed on a regular basis to avoid scratches to you. If you do get a scratch, clean the wound with soap and water. If the scratch should become infected, seek medical treatment.
- All transplant recipients should avoid your pet's body fluids (urine, stool or vomit). If possible, have someone else clean up the accident or litter box. If necessary, use gloves and clean the area with some disinfectant. Wash your hands with soap or hand sanitizer after the cleaning has been done.

- It is not recommended that a transplant recipient clean the litter box if at all possible. The litter and liner should be replaced frequently. The litter box should be cleaned at least every month with disinfectant soap or hot boiling water.
- Seek urgent medical treatment if your child should be bitten by any animal.
- Avoid having the pet lick your child on the face.

Physical Activity

The most important job for the recipient during the first few days after surgery will be to cough and breathe deeply to keep the lungs clear. Physical therapy will be directed toward conditioning and achieving a higher level of activity. In order to improve endurance and strength, daily walks and riding the stationary bicycle are necessary.

There will be an important change in the heart rate after transplant. There are nerves that connect the heart to the brain. When a person begins moving, the brain instructs the heart to beat faster and stronger to pump more blood to the muscles, but when a person has a heart transplant, the nerves are cut and the new heart is no longer directly connected to the brain.

However, the body has a back-up system. Blood contains chemicals that can also stimulate the heart to beat stronger and faster. The only difference is that it takes a few minutes to activate these chemicals. This means before starting a vigorous activity, the recipient will need to have a short "warm up" session to make the heart ready for exercise.

Children tend to pace themselves well and do only what they are capable of doing. They sit down when they are tired and play when they feel rested. Therefore, restrictions are not routinely placed on their activity. In most cases, a recipient can gradually begin returning to normal activity for his or her age.

After transplant, aerobic exercises will need to become a routine part of life. An aerobic exercise is an exercise that will maintain a target heart rate non-stop for at least 20 minutes. After completing any exercise, a "cool down" will be needed by stretching and allowing the heart rate to gradually return to normal. People who have had heart transplants tell us how good they feel when they continue regular exercises. They are able to return to school or work after months and/or even years of limited activities.

Some heart transplant recipients choose to continue in an unmonitored, but supervised exercise program. Exercise is a life-long pursuit. Each session should include a warm up, about 30 minutes of exercise and a cool down. The recipient should exercise at a level that requires some degree of effort, but never to the point of exhaustion.

Home Environment

When the recipient first arrives home, try to restrict phone calls and visitors. Short walks and brief visits with small groups of family and friends are advised. We encourage walking immediately and to increase daily activity in a sensible fashion.

Transplant recipients should avoid crowds where ventilation is poor and where there may be people with colds. If this is unavoidable, then a mask is to be worn. Masks will also need to be worn when in the hospital. Do not allow visitors who are sick. If the recipient is exposed to an unusual illness (something other than a cold), call the transplant coordinator to discuss the situation.

Follow-Up Visits

Before discharge from the hospital, the recipient will meet with the transplant coordinator to schedule his/her return visit to the clinic.

As an outpatient, the recipient will undergo routine blood tests, cardiac biopsy, ECG echocardiogram, annual chest x-rays and periodic catheterization. Appointments in the Pediatric Cardiology Transplant Clinic will be frequent. Transplant Clinic takes place on Tuesday mornings and catheterization procedures occur any day, Monday through Friday. Do not give anti-rejection medications before the biopsy or clinic visits because blood work will be done that includes immunosuppression levels. Do not give anti-rejection medications before the biopsy or clinic visits because blood work will be done that includes immunosuppression levels. Bring medications to give to the recipient after the blood is drawn.

The primary doctor will be contacted and written information will be provided to the doctor's office regarding the recipient's follow-up care.

Primary Care Follow Up

It is a good idea to have a pediatrician, internist, general practitioner or family doctor see your child for routine medical issues other than his/her heart transplant. Always make sure you inform us if you change your child's personal physician, since we will be staying connected with him/her every time you come for follow-up or are in the hospital.

Be sure to inform your child's personal physician of all the medicines that your child is taking, since some drugs cannot be taken with immunosuppressive medicines. Your transplant coordinator can provide you and your physician a list of all medicines that interact with the immunosuppressive medicines.

School

Your child should be able to return to school or work within three months after transplant. Check with the transplant coordinator and school before his/her return to school. You should notify your child's school to make arrangements for home schooling once your child has been discharged from the hospital. Many times there are forms that need to be completed by the transplant coordinator/doctor that you obtain from your child's school.

Prevention of Respiratory Infections

- Avoid close contact with persons with respiratory illnesses
- Crowded areas can be the sites of transmission of respiratory viruses (including COVID-19) such as:
  - Shopping malls
  - Subways
  - Elevators
- Avoid tobacco smoke; smoking and exposure to environmental tobacco smoke are risk factors for bacterial and viral infections
- Persons with exposure to prisons, jails, homeless shelters, and certain health care settings can be at risk for tuberculosis
- Working in certain settings such as animal care, construction, gardening, landscaping, and farming can be a risk for infection
- Home remodeling projects should be planned cautiously as it may lead to increased risk of fungal infection
- Exposure to plant and soil aerosols, pigeon and other bird droppings, chicken coops, and caves can be a risk for fungal infections
- Consider wearing a mask if the exposures listed above cannot be avoided

Water Safety

- Infections can occur from drinking contaminated water or ingesting water during recreational activities such as swimming, diving, or boating
- If drinking well water, the well should be screened regularly
- Avoid drinking water from lakes, rivers, or pools
- Avoid swimming in water that is likely to be contaminated with human or animal waste

- If you have diarrhea, avoid using public recreational water facilities for 2 weeks after symptoms have resolved
- Keep in mind that hot tubs can be a source of germs
- Standing water in the home or basement that may occur with flooding should be cleaned promptly
- When traveling to countries with poor sanitation, drinking tap water, and eating ice cubes, fresh vegetables/fruits washed with tap water should be avoided
- Skin cut during bathing in ocean or fresh water should be cleaned with uncontaminated water source

Food Safety

- Avoid eating or drinking unpasteurized dairy products (e.g. milk, cheese) and fruit or vegetable juice/cider
- Eating raw or undercooked eggs or foods containing raw eggs such as uncooked cake and cookie batter and some preparations of Caesar salad dressing, mayonnaise, or hollandaise sauce increases the risk of infection
- Eating raw or undercooked meat, poultry or fish (including pate, meat spreads, cold cuts, and smoked seafood) increases the risk of infection
- Eating raw or undercooked seafood (e.g. oysters, clams, mussels) increases the risk of infection
- Avoid contaminating food during preparation

Travel Safety

- Overseas travel can be risky for transplant recipients, particularly during periods of maximal immunosuppression
- If overseas travel is necessary, please consult the Heart Transplant team and Infectious Disease service at least 2 months before the departure date so that appropriate infection prevention instruction can be discussed
- Ensure access to handwashing facilities, and be careful about food and water consumption
- Infectious Disease team can help update routine and/or travel vaccines and consider preventive medications during the travel
- Travelers should take all precaution measures, including protections against insect bite such as insect repellents, covering the skin, mosquito netting, etc.

Sports and Recreation

- There can be risks of hobbies such as hunting, fishing, scuba diving, or spelunking; Heart Transplant and Infectious Disease teams are happy to talk about possible risks.

Special Considerations for Teenagers

- Illicit intravenous or intradermal drug use is a high risk behavior for infections such as hepatitis C, hepatitis B, and HIV
- Body piercing and tattoos create a break in the skin, which can lead to infection
- Smoking tobacco is a risk factor for bacterial and viral infections
- Smoking marijuana can result in Aspergillus and other fungal infections, it can also affect immunosuppression levels
- Always use latex condoms during sexual contact (even in long term monogamous relationships, and consider using condoms during periods of increased immunosuppression)

Medic-Alert Identification

It is recommended that your child wear a Medic-Alert bracelet or necklace. Your transplant coordinator will provide you with a form. The Medic-Alert Identification is ordered through the Kidney Foundation for a small fee. If your child would like one that is "fancier," you can order this for them at a higher cost. The following information is needed:

- Child's Name
- University of Michigan Health
- Heart Transplant
- Name of Transplant Cardiologist
- Phone number 734-764-5176