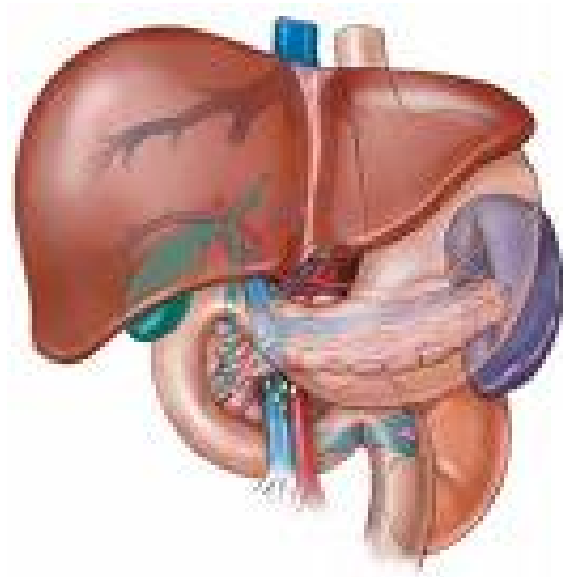


# A Handbook for Liver Transplant Patients

(April 2007)



# Liver Transplantation

## Introduction

This pamphlet was developed to provide information to liver transplant candidates and their families. It is an introduction to liver transplant and is a supplement to the discussions with your doctors and teaching from the nurses involved in your care. This pamphlet may not answer all the questions that you have. It may stimulate new questions. It will be useful to read parts of this at a time or to refer back to this booklet at different points of time.

The pamphlet will introduce you to some of the team members who will be involved in your care.

## The Liver Transplant Team

### Transplant Surgeons

Timothy Pruett, M.D.  
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Robert Sawyer, M.D.  
Timothy Schmitt, M.D.

### Transplant Hepatologists

Abdullah Al-Osaimi, M.D.  
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### Liver Transplant Nurse Coordinators

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### Living Donor Nurse Coordinator

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### Clinical Social Worker

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### Financial Coordinator

Howard Snoddy

### Support Team

Frances Long, LPN-Clinic Nurse  
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### Transplant Office Access

Telephone: 1-800-543-8814 (toll free)      (434) 924-8604 (local number)  
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Hours of operation: Monday- Friday 8:00 AM-4:30 PM

Many other professionals are involved in your care. These include: organ recovery specialists, research coordinators, operating room nurses, intensive care nurses and doctors who provide specialized care immediately after surgery and the nurses on the transplant floor. Additionally, professionals from the blood bank, radiology, the laboratory, respiratory therapy, physical therapy, nutritional services and the pharmacy all make up the team that is dedicated to providing you with excellent care during your stay at the University of Virginia and after discharge.

## **History and Current Trends in Liver Transplantation**

The first attempt at clinical liver transplant was made in 1963. Technical advances have improved operative success. By 1983 the expertise in liver transplantation finally reached a point where it was widely accepted as a suitable clinical option for patients. Since 1985 there has been a rapid increase in the number of centers performing liver transplants. Approximately 6,650 liver transplants were performed in the United States in 2006. As of March 30, 2007, there were 16,946 liver patients awaiting transplantation. The demand for liver transplants is expected to increase in the years to come. It is hoped that organ donation will increase to meet this need. Transplant centers across the nation are currently trying to maximize the donor pool by using living donors, extended criteria donation and donation after cardiac death.

## **What Does a Healthy Liver Do?**

The liver is the largest organ in the body and plays a vital role in regulating many life processes. The liver weighs approximately 3-4 pounds and is roughly the size of a football. It is made up of a sponge-like mass of wedge-shaped sections called lobes. The liver is located in the right side of the abdomen and is protected by the ribcage.

The liver is a very complex organ that performs many functions that are essential for life. These functions include:

- Storing energy in the form of sugar
- Storing vitamins, iron and other minerals
- Making proteins, including blood-clotting factors, to keep the body healthy and growing
- Processing worn out blood cells
- Making bile, which is needed for food digestion
- Helping "clean" the blood by breaking down and removing many medicines and toxins, such as alcohol
- Regenerating its own damaged tissue
- Maintaining hormonal balance
- Aiding in digestion by helping in the absorption of fat and certain vitamins, including vitamins A, D, E and K
- Helping the body resist infection by producing immune factors and by removing bacteria from the bloodstream

A healthy liver also has a remarkable ability to regenerate (grow back), which no other organ in the body is able to do. There are illnesses, however, that can cause severe and irreversible damage to the liver.

The liver has two blood supplies, the hepatic artery supplies oxygen-rich blood to the liver (approximately 25% of the blood supply), and the portal vein, which supplies nutrient-rich blood to the liver (75% of the blood supply).

The gallbladder is attached to the liver and is a sac for storing bile. Bile is helpful in the digestion of food. The gallbladder is not essential for life. The liver is wrapped around the vena cava (the large blood vessel draining blood from the lower part of the body) and the blood leaving the liver drains directly into it. The liver is attached to the back wall of the abdomen, which complicates the operation and may cause significant bleeding during the transplant.

### **What Makes a Liver a "Diseased Liver?"**

- 1) Sudden or acute failure from infection or drug
- 2) Chronic long-term failure due to:
  - a) Ongoing infection
  - b) Repeated injury due to persistent elevation of bilirubin
  - c) Alcoholism
  - d) Autoimmune disease
  - e) Errors in Metabolism
- 3) A liver with cancer (primary liver cancer)

A liver normally has a great ability to heal itself and it can overcome most insults it encounters, such as heavy alcohol ingestion or viral infection. In fact, it is the only organ in the body, which has regenerative capabilities. Occasionally, the liver is so devastated by the insult that all of its cells are destroyed and there are not enough left to regenerate. Some insults are chronic and can lead to scar formation replacing normal liver cells. Some scar formation on the liver can be tolerated but is not reversible. When all normal liver tissue is replaced by scar tissue, this is referred to as cirrhosis of the liver. Liver cirrhosis can occur from a variety of causes. Alcohol abuse or continued exposure to a virus can cause liver cirrhosis. High levels of bilirubin can occur in children with congenital absence of the bile ducts known as biliary atresia. In adults, primary biliary cirrhosis, sclerosing cholangitis or continual high levels of bilirubin can eventually lead to liver cirrhosis.

Two problems arise as a result of cirrhosis of the liver. First is a loss of biochemical function of the liver. This includes functions such as clearing waste products from the blood stream, making proteins necessary for growth, development and body maintenance. The abnormalities are a result of the liver's inability to perform functions at the cellular level. This can result in any or all of the following conditions:

1. Encephalopathy, which is decreased mental functions ranging from fatigue to confusion or coma.
2. Coagulation defects, which result from inadequate supplies of proteins to produce clotting factors. This can lead to significant bleeding.

3. Malnutrition, weight loss, muscle wasting and chronic fatigue result from decreased ability to process nutrients appropriately.
4. The immune system may be impaired as a result of liver failure leading to potentially severe infections.

The second problem that arises is an increased resistance of the flow of portal vein blood through the liver as a result of the scar formation in the liver. This can lead to several potentially life-threatening conditions. The blood that bathes the intestines and absorbs nutrients as they are digested in the gut is the portal blood, which collects in the portal vein and then passes through the liver. This results in a high pressure developing in the portal vein system, causing enlargement of the blood vessels draining the intestines. These enlarged vessels, known as varices, are fragile. The vessels in the esophagus (food pipe) can become eroded and massive and bleeding can occur. The high pressure in the veins in the abdomen also causes plasma to leak from the blood vessels and into the abdominal cavity where it accumulates. The fluid is known as ascites. Both variceal bleeding and ascites are a result of a mechanical problem causing high pressure in the portal vein. If liver function is not too impaired, the pressure in the portal vein can be relieved with an operation. In this operation portal blood is diverted through a shunt from the portal vein directly to the vena cava without having to pass through the liver first. This decreases the pressure in the portal system. Ascites and varices are no longer a problem as long as the shunt stays open. However, in most patients with cirrhosis, liver function is too poor and diverting the portal blood from the liver deprives it of its nutrients leading to further deterioration in liver function.

In children, the most common indication for liver transplant is biliary atresia (the congenital absence of bile ducts). Other types of liver cirrhosis can occur in children such as: inborn errors in metabolism, medication toxicity, or viral illnesses. For these diseases a liver transplant may be indicated.

In adult patients the most common indication for liver transplant is chronic active hepatitis with cirrhosis due to Hepatitis C. Other indications are cryptogenic cirrhosis (where the cause of the cirrhosis is unclear), primary biliary cirrhosis, sclerosing cholangitis, acute hepatitis with liver failure (viral, drug or alcohol induced), and chronic Hepatitis B.

A less common indication for liver transplant is cancer of the liver. Many liver cancers are managed by partial resection of the liver. When liver tumors are located in more than one lobe of the liver, are thought to be aggressive, or are located in an area that cannot be resected, a liver transplant may be recommended. Treatment of the tumors in the form of chemoembolization (local application of chemotherapy), or radio frequency ablation (RFA) is done while the patient is being evaluated for a transplant and during the waiting time for the organ.

### **Where Do Livers for Transplantation Come From?**

Whole organ transplants come from a patient who is brain dead. Once the brain is no longer alive, the body can be maintained on life support machines, but, even with life support machines, the blood pressure will decline and the heart will stop. After brain death has been determined, the family is approached about the option of organ donation. Multiple organs may be recovered from one donor, making it possible for many lives to be saved.

Donation after cardiac death (DCD) is another option for organ procurement . In this circumstance, the potential donor is actually removed from life support. Once natural death has occurred, the donor is brought to the operating room for organ recovery. There are time restraints to this type of donation to ensure quality of organs. Donation after cardiac death is an effective way to meet the increasing need for organ donation.

Many transplant centers are also using extended criteria donation (ECD). ECD organs are organs that may not be in perfect condition. They may be from an older donor, or a donor who has hepatitis B or C, some fat in the liver, or some other imperfection. These organs are not appropriate for all patients, but are a very good option for many patients.

A thorough history of the potential donor is done to make sure the liver is healthy. A liver will not be accepted from an infected donor. The liver tests are evaluated and must be within normal range. The liver is inspected visually as well prior to the transplant operation. If the liver looks healthy and no abnormalities are found, it is prepared for implantation. The liver is kept in a preservation fluid and put on ice. By using this preservation technique, the liver can be maintained for up to 24 hours.

Living donation may be an option for some patients who are in need of a liver transplant. This surgery involves using a segment of the liver from a living person. Not all transplant candidates are eligible for this type of surgery. Please discuss this option with the transplant team at your initial visit.

### **How is a Liver Found for Me?**

After your evaluation is complete and we feel that you are a good candidate, your name will be placed in a database with other patients waiting for liver transplants. When a donor becomes available, this information is entered into the database and the patient is chosen based on several different criteria. These include: severity of illness, blood type, height, weight, and time on the list. This is the most equitable system available to all patients. The most important matching criteria for liver transplant is the blood type. Height and weight of the donor and recipient must be similar as well. Infrequently a liver from a different blood group may be used in an urgent situation.

When a liver is found for you, we will call and ask that you come to the hospital as soon as possible. It is extremely important that we are able to reach you immediately. Please provide us with a list of phone numbers and names so that we will be able to get in touch with you when the time arrives. If you are activated on the transplant waiting list this means that you are **ready and willing to accept a new liver**. If you change your mind or become ill please notify the transplant office so that your name can be temporarily removed from the list. A potential problem is that we may not be able to find a donor liver in time for you. There are some patients who die while waiting for a liver transplant simply because a suitable donor does not become available. In particular, this can sometimes be a problem in children. Finding a small enough liver for a child can be challenging. Sometimes we may elect to use part of an adult liver to transplant into a child. This is referred to as a segmental transplant.

## **Liver Transplant Evaluation**

On the day of your initial transplant clinic appointment, you will meet with several members of the transplant team. Please bring all of your medications (including dosage) and any requested test results with you for the initial visit. During the initial visit, discussion regarding the transplant evaluation process, surgical procedure, complications, medications, and follow up care after transplant will occur.

The following is a list of examinations that will be completed **prior** to consideration for liver transplantation:

- 1) Complete history and physical
- 2) Blood work
- 3) Chest X-Ray (Pulmonary Function Test if necessary)
- 4) Heart tests (age and history will determine the type of tests that will be ordered)
- 5) Social work evaluation
- 6) MRI of the liver, abdominal organs and vessels.
- 7) Colonoscopy
- 8) Endoscopy
- 9) Mammogram and Pap smear for women
- 10) Dental Examination
- 11) PPD (test for exposure to TB)
- 12) Evaluation by a Neuropsychologist

Due to the known damage caused by alcohol and drugs, the expectation for all patients being considered for liver transplantation, is that they will not use these substances. Frequently, we will do blood and urine tests to determine if there is a presence of either alcohol or non-prescribed drugs.

You will meet with one of our transplant Hepatologists on the day of your appointment. This is the time for you to ask specific questions in relation to your medical problem. In some cases your current liver disease may recur in your new transplanted liver. The physician can discuss this aspect with you in more detail.

After your initial evaluation has taken place, we will schedule your required testing. This may necessitate more than one trip back to the University of Virginia, but we will make every effort to coordinate the appointments to minimize the number of visits. Once all testing is completed, your evaluation will be presented to the liver team to determine if you are an appropriate candidate for transplant. Once that decision has been made, you will be notified of the results by phone as well as in writing.

## **What is Involved in a Liver Transplant Operation?**

You will be notified by the transplant nurse coordinator that a liver has become available for you. We should have a number where you can be reached at all times. If you have Call Intercept on your phone, this service must be removed while you are active on the transplant list. You need to plan to come to the hospital as soon as possible. Also at this time, the Blood Bank, the Intensive Care Unit and the Operating Room are notified that a transplant is planned.

You will be admitted to 5-West or 5-Central before your surgery. You will have final pre-operative lab work, EKG and a chest X-ray completed. If these results are acceptable, you will be taken to the operating room.

The surgical team removes the failed liver. This can be the most difficult part of the operation and can take several hours because of the liver's impaired clotting and multiple blood vessels. Prior to the removal of your failed liver, a large tube is placed into the large vein in your leg and another in the portal vein to drain blood from the lower part of the body. This blood passes through a pump and back into the large tube placed in the large vein in the neck to return blood to the heart. A clamp is then placed on the vena cava above and below the liver. Clamps are also placed on the artery to the liver (hepatic artery) and on the portal vein. The liver is cut out and all bleeding is stopped. The donor liver is kept cold while it is sewn in place. This usually takes 1-1 1/2 hours. Five anastomoses must be made (tubes sewn together). The first is the vena cava above the liver, the second is the vena cava below the liver, and the third and fourth are the portal vein and hepatic artery, (not necessarily in the same order in each case). Once all four of these are done, the clamps are released and blood is allowed to flow through the liver. Blood from the lower part of the body passes through the vena cava to the heart once again and the tubes are removed from the groin and neck while the liver is warming up. The fifth and final step involved is sewing the bile ducts together, sometimes placing drainage tubes and closing the incision.

The entire operation usually takes 3-8 hours but can take up to 10 hours. The average blood loss during liver the transplant surgery is 5 units. Some patients have a higher blood loss and require more blood transfusion based on their medical condition prior to the liver transplant operation.

### **What Can I Expect After the Operation?**

After surgery, the liver transplant recipients are taken directly to the Surgical Intensive Care Unit. The average length of stay in the Intensive Care Unit is 2-5 days. During this time, you will be monitored closely and will also have many tubes. In the first 2 postoperative days, many of the tubes will be removed. When your condition stabilizes, you will be transferred to the transplant floor.

Once on the floor, visiting hours are less restrictive and there is more privacy. The average hospital stay is approximately 2 weeks after liver transplant. Patients who are more ill going into surgery, can expect to have a longer recovery period and hospital stay. Maintaining activity and adequate nutrition while waiting for transplant is important for your recovery. While recovering, you will spend time learning how to care for yourself after transplant. We will begin by having you take your own medications as soon as you have recovered enough to do so.

Re-operations following liver transplants are common. Most are short operations. The most common indication for re-operation is bleeding and this usually occurs in the first 2-3 days after the transplant. Bile leaks and infections of the abdomen can also occur, usually about one week after the transplant. Some livers may fail to function properly and need to be replaced with another new liver. When repeat transplant is necessary, the operation is generally much shorter in length.

Two types of problems may develop in the early post-operative period. The first is ischemic injury, which can occur during the recovery and preservation of the donor liver. Signs of this usually develop in the first 7 days post-transplant. A more frequent occurrence is rejection. Rejection can occur at any time after transplant. Approximately 90% of patients who undergo organ transplant will develop some degree of rejection. Rejection can be diagnosed by review of lab results or by liver biopsy. Once rejection occurs, it can usually be reversed with several high doses of steroids. If the rejection is not reversed with steroids, other medications can be used. It is important to know that rejection happens frequently and that in most cases it can be reversed.

### **What Can I Expect After I Go Home?**

Following a liver transplant, you will need to be monitored closely. Enough immunosuppression is needed to keep the body from rejecting the liver, but too much immunosuppression can lead to serious infections. You are most at risk for rejection and infection in the first 90 after transplant. Because you will require higher doses of immunosuppressive medications in the first 3 months, you are also at a higher risk for infection during that period of time. The amount of medication you take will be reduced gradually during the first year post-transplant. You will need to have lab work done twice weekly for the first 2 to 3 months. After 3 months, your lab schedule will be reduced so that at 1 year post-transplant you will need labs done monthly. Your labs can be done at a hospital close to your home.

We will have you return to Transplant Clinic 1-2 weeks after you are discharged from the hospital. Then we will ask that you return every 3 months for the first year. In some cases, you may be required to come more frequently. After the first year, your follow-up appointments need to be annually. We will also ask that you see your referring doctor within 2 weeks of your discharge from the hospital. He or she will remain very important in your follow-up care.

### **Transplant Medications**

It will be necessary for you to take the immunosuppressive medicines for the rest of your life in order to maintain your transplanted liver. If you do not take your medications as prescribed you are at risk for REJECTION of your liver. The following is a list of anti-rejection drugs that are commonly used. The doctor will prescribe those medications which he feels will work best for you.

- 1) Neoral ® or Cyclosporine formulation
- 2) Prograf ®
- 3) Cellcept ®
- 4) Azathioprine ®
- 5) Deltasone ® or Prednisone formulation
- 6) Rapamune

These medications have side effects. Some of those include tremors, increased weight, mood changes, increased blood pressure, vision changes, increased risk of infection increased blood sugar and increased risk of cancer. You will not develop all of these side

effects, however you will develop some. You are encouraged to report these to your transplant nurse.

You will need to take other medications in addition to anti-rejection medicines. Most patients are discharged from the hospital after transplant on an average of 13 different medicines. These medicines will be reduced over time. Other medications that will be prescribed for you are an anti-ulcer drug, an antibiotic and an anti-fungal drug.

## **Finances**

A financial counselor will meet with you to discuss how your transplant operation and post-transplant medications will be managed. If you do not have insurance or if your insurance will not pay for the transplant, other funding options may be explored. Prior to activation on the list or scheduling of a living donor surgery, patients must have a reasonable plan in place to obtain medications after transplant. All questions regarding the finances involved in liver transplantation should be directed to the Transplant Financial Counselor at the University of Virginia Medical Center.

## **Conclusion**

Transplantation is one option for patients with liver disease. The Transplant Team at the University of Virginia will work closely with you and your referring doctor throughout the transplant process. Please contact us at 1-800-543-8814 if you are interested in more information.