LUNG TRANSPLANT SURGERY AND HOSPITAL STAY

The Call – Donor Lung(s) is Available for You

The call for a lung transplant can come any time, day or night. The transplant coordinator will ask you some health questions and give you instructions to have your support person bring you to the hospital. You will be instructed to stop eating and drinking. You will need to bring enough oxygen for travel to and from the hospital. Your travel time will be considered in making the arrangements for your transplant. Please drive safely and wear your seat belt. It is important to remember that occasionally a transplant may get cancelled for a variety of reasons. The lung transplant coordinator will give you instructions to go directly to the intensive care unit.

Bring to the Hospital

- Oxygen, enough to and from the hospital
- A list of your allergies, medicines, and medical conditions
- Medications that you take
- Phone numbers and names of persons you will want your caregiver to contact following your transplant
- Money for parking and meals for your caregiver
- This patient education binder – you will need this after surgery

Once You Arrive at the Hospital Give Your Caregiver

- Your oxygen tanks and any personal items such as your oxygen saturation monitor
- Glasses or other eyewear
- Hearing aides
- Cane, walker, or assistance aids
- Your medications
- Any valuables

Preparing You for Lung Transplant Surgery in the ICU

You will be admitted to the Cardiovascular Intensive Care Unit (ICU) before lung transplant surgery. Do not eat or drink until after surgery. The ICU staff will do a history and physical exam, draw blood, take a chest x-ray, EKG, and get your consent for the transplant surgery. Your caregivers will need to wait in the waiting room during procedures to prepare you for the transplant surgery.

- A pulmonary artery catheter, a special IV line, is placed in a neck or chest vein. It is a large intravenous (IV) catheter for fluids and medications to be delivered. It also allows the medical staff to monitor the pressures and function of the heart throughout the transplant process.
- An arterial line also will be placed before surgery. Usually this is placed in a wrist artery. Arterial blood gas monitoring and continuous blood pressure monitoring is possible with the arterial line.
- An epidural catheter will be used for some patients before surgery and other patients after surgery. The surgeon will decide the timing of this catheter placement. The catheter is for pain management after surgery.

Timing of your lung transplant surgery can vary. There are many factors that influence when your lung transplant surgery will occur. You could go to surgery very soon after arriving to the ICU or you may wait many hours before your surgery. Our center needs to evaluate you and have you ready to proceed with surgery as soon as possible. A delay does not necessarily mean there is a problem. Timing of the surgery will be coordinated with the recovery of donor organs.

Testing is performed on the donor to assure the lungs are healthy for transplant. Our surgeons typically travel to the donor hospital to recover the lungs for transplant. Lung transplant travel distance is limited as lungs have a shorter preservation time between donor and recipient than other organs. Our center will cross state lines to recover lungs. Our center uses ground, helicopter, and airplane transportation to recover lungs from other hospitals.

Risk Criteria for Donor Organs

Some lung donors have had a history of behaviors that place them at risk of developing infections that can be passed onto the lung transplant patient. These types of infections may include hepatitis or HIV. The behaviors that place a donor at risk of developing these infections may include a past history of intravenous drug use, history of same-sex partners, or past history of being in jail or prison. The government requires that we speak to you about

these types of donors and consult with you on the risks and benefits of using lungs obtained from donors with certain behaviors. The government agency that makes recommendations on the types of behaviors that place a person (lung donor) at risk of developing these types of infections is the United States Centers for Disease Control (CDC).

All donors undergo routine testing to make sure that donors do not have active infections such as hepatitis or HIV. Even when the testing of donors shows no active infection, there is still a very small risk that infections such as hepatitis and HIV can be passed onto the lung transplant recipient. You have a right to refuse a lung from a donor with a history of risk behaviors for these infections. Refusing to accept a lung may increase your waiting time. Your risk of dying from your lung disease may be greater with a longer waiting time to receive a lung transplant. You should discuss carefully with your thoracic surgeon and pulmonologist the risks and benefits of using any donor lung offered.

In the Operating Room

Your **anesthesiologist** will deliver fluids and medications to ensure you are asleep and comfortable during the transplant procedure. Your anesthesiologist will monitor you throughout the operation. Once you are asleep, **an endotracheal tube** will be inserted through your mouth to your trachea (also known as your wind pipe). This tube connects to a ventilator which will breathe for you during the surgery.

A **nasogastric tube** (NG tube) is a flexible tube that is inserted through your nose or mouth and into your stomach. The NG tube is placed to keep your stomach empty throughout your surgery.

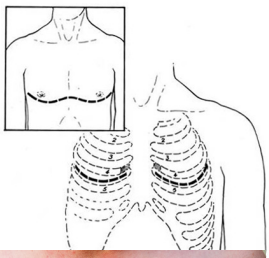
A **urinary catheter** will be placed once you are asleep to drain urine from your bladder, allowing the team to monitor your kidney function.

You will be unconscious, under general anesthesia and supported with mechanical ventilation for the lung transplant surgical procedure. It may be necessary to support you during the surgery with **cardiopulmonary bypass**. **Cardiopulmonary bypass** is a machine that takes over the function of your lungs during the surgery. Its use does increase surgical risk of bleeding and stroke. A longer term use of cardiopulmonary bypass is sometimes needed after lung transplant. This is known as **ECMO** (Extracorporeal Membrane Oxygenation). ECMO is a bypass machine similar to the operating room bypass but is continued in the intensive care unit. As soon as you are stable enough, you will be removed from cardiopulmonary bypass or ECMO.

The Surgical Procedure

The lung that is to be removed will be deflated using a special breathing tube. You will be supported with only one lung. The surgeon will determine if the heart lung bypass machine is necessary during surgery. Your old lung is removed and your healthy donor lung is placed inside your body. For a double lung transplant, this process is repeated on your other side. A blood transfusion may be necessary during the surgery.

The type of surgical incision depends on your unique medical condition and whether you are receiving a single or double lung transplant. For a single lung transplant the surgeon typically will make an incision at the mid-level on the side of your chest, and the incision will continue around to your back. This incision is called a thoracotomy. For a double lung transplant, the incision typically begins at the bottom of your breast bone and extends under each breast area of the front of your chest. This incision is called a clam shell incision. Cutting the breast bone, and possibly the ribs, is necessary for the surgical procedure.



Chest tubes and/or JP (Jackson-Pratt) drains are placed near the surgical incision, helping to keep your lungs inflated and drain fluid away from the surgical sites. You will typically have one or two chest tubes and/or JP drains for each transplanted lung that you receive. Your surgeon will close your incision, and you will be taken to the intensive care unit to begin your recovery.

The lung transplant surgical procedure lasts approximately **six hours** for a single lung and **eight to ten hours** for a double lung transplant. The amount of time can vary due to many factors that can extend the surgical procedure.

Intensive Care Unit (ICU)

You will awake from surgery in the intensive care unit (ICU). Your caregivers will be able to visit you in the ICU based on unit policies and your condition following surgery. You should expect to be in the ICU for at least two to five days. Your length of stay will be determined by your progress following surgery.

When you wake from surgery, you may become aware that you are connected to a ventilator assisting your breathing. You will have a breathing tube in your mouth connected to the ventilator. The ventilator helps you until you can breathe on your own. Stay as calm as possible, and the ICU staff will give you instructions and explain the process to stop using the ventilator. Before the breathing tube can be removed, the ICU team will do some tests to evaluate if you are ready to breathe on your own. Once the breathing tube is removed you will get oxygen through a mask or under your nose.

At first, you will have a dressing in place over your incision. You may have an epidural catheter inserted in your back to deliver pain medication and help with pain control. You will have chest tube(s) and /or JP drain(s) from the same side of the chest as the incision to help drain extra fluid from your chest. If you had a double lung transplant, you will have chest tube(s) and/or drain(s) on each side of your chest. These will be removed based on evaluation of your chest x-ray and drainage amount.

Inpatient Floor

Your pulmonary artery catheter and arterial line will be removed before you are transferred from the ICU to the inpatient floor. You likely will have a peripheral IV, oxygen by nasal cannula, an epidural catheter, chest tubes(s) or chest drain(s) in place when you are transferred to the inpatient floor.

The nursing and physical therapy staff will assist you with getting out of bed and walking a number of times a day. You should wear a mask while walking in the hospital hallways. Coughing and deep breathing exercises and use of an incentive spirometer are important to your recovery after surgery.

Avoiding infections is critical for you after transplant. You will take lifelong medications that will reduce your ability to fight infections. So, it is very important to wash your hands often to avoid infections. Visitors who are sick cannot visit you after transplant.

If you do not have any complications following lung transplant, you should expect to be in the hospital approximately two weeks. Every lung transplant case is unique, and it is possible that the hospital stay will be extended.

Pain

You will have pain at the incision site after lung transplant surgery. After transplant an epidural catheter will help control your pain. The epidural catheter is placed in the back and delivers pain medicine. It is very important that you have enough pain relief so you can perform coughing and deep breathing exercises and tolerate walking many times a day. A few days after surgery the epidural catheter will be removed, and your pain will be controlled with oral pain medications.

Discharge

Before you leave the hospital, staff will teach you and your caregivers about your new medications and how to care for yourself at home. Some patients are able to go home without oxygen. A visiting nurse will come to your home to listen to your lungs and see how your incision is healing. She/he will continue to teach you about your medications, review your blood sugar monitoring (if applicable), and check your blood pressure, heart rate, pulse oximetry, and temperature. The visiting nurse will check with the lung transplant team as needed. The visiting nurse will also draw blood for laboratory monitoring and assist with incision care and dressing changes.

Once you are released from the hospital, follow up appointments will be scheduled for you with your transplant pulmonologist, transplant surgeon, and any other specialist. You also will need to return to the University of Michigan for required testing and procedures, such as pulmonary function tests and surveillance bronchoscopies. At first, you will need to be seen frequently, often weekly. As your medical condition becomes more stable, follow up will be done less often, although follow-up at least every three months and as needed, will be necessary for life.

Before you leave the hospital please make sure:

- You have all new medicines in hand
- Contact phone numbers
- A standing lab order, boxes and mailers for blood testing
- Enough oxygen for the ride home and oxygen available at home (if applicable)
- A compressor and supplies for inhaled medication initially after transplant
- A blood glucose monitor, testing strips, and supplies (if applicable)
- Incision care instructions
- Any drainage tube care instructions (if applicable)
- All of your questions are answered

MICHIGAN MEDICINE
UNIVERSITY OF MICHIGAN

Patient Name: _____

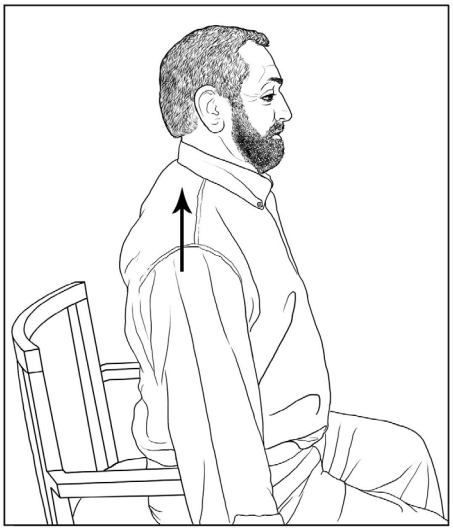
Physical Therapist: _____

FRANKEL CARDIOVASCULAR CENTER
MICHIGAN MEDICINE

Physical Therapy Exercises for Patients with a Clamshell Incision

You may begin these exercises in the Intensive Care Unit. Complete the exercises in a sitting position. Sit upright looking straight ahead with your chin tucked and shoulders pulled back. Make sure that you are relaxed and rested before starting. These exercises are not intended to be a difficult workout for your heart. They will speed your recovery and will prevent pain from developing in your shoulders and trunk. They will also help your breathing. It is important you begin these exercises the day after your surgery and do them daily during your recovery.

Perform the exercises **twice** a day. Repeat each exercise **10** times.



1) Shoulder Shrugs -
Bring your shoulders up to your ears, then relax your shoulders down. Repeat.

2) Shoulder Circles -
Sitting upright, roll your shoulders in a smooth motion up, back and down in a circle. Repeat then reverse direction.

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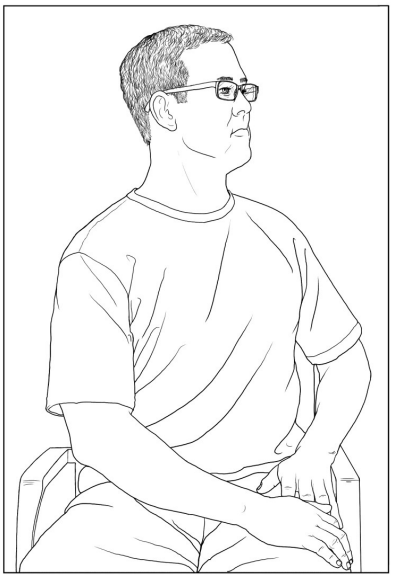
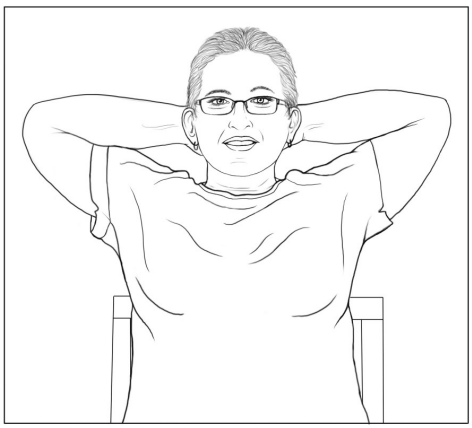


3) Trunk Twists -
Slowly rotate your trunk to the right, looking over your shoulder. Hold and stretch. Then rotate your trunk to the left, hold and stretch. Repeat sequence.

4) Trunk Sidebending -
Hold your arms relaxed at your sides and maintain your trunk upright. Lean to your right side slowly. Hold and stretch. Then lean to your left side, hold and stretch. Repeat sequence.



5) Chest Stretch -
Place your hands behind your head while sitting upright. Move your elbows back until you feel a stretch, hold. Relax elbows forward to rest, then repeat.

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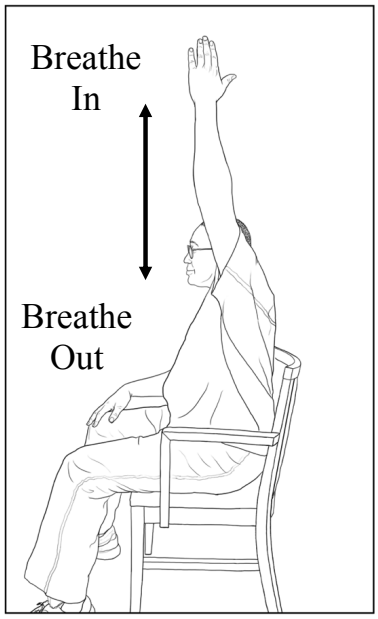
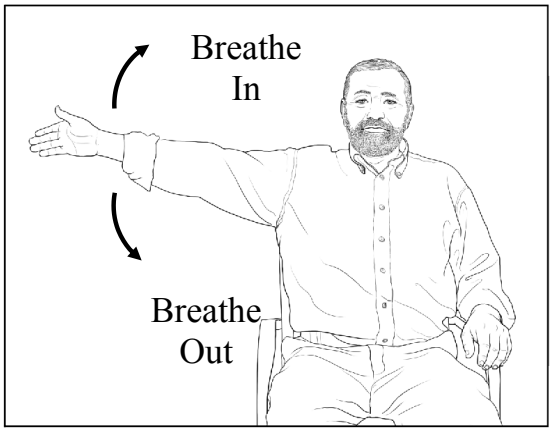
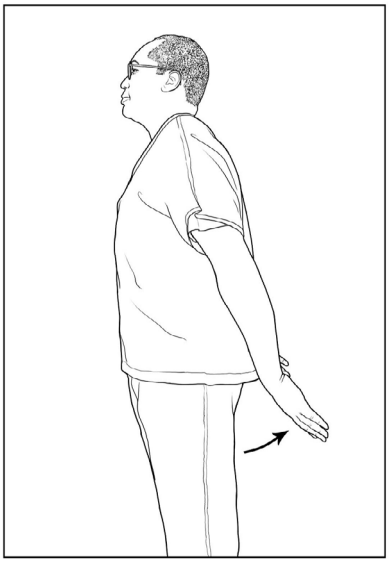


6) Forward Arm Raise -
Sitting with upright posture, straighten your arm with your thumb facing up. Raise your arm up to the front over your head. Your elbow should be next to your ear. Repeat with your other arm.

7) Out, Up and Over -
Hold your arm straight out to your side with your thumb up. Raise your arm up to the side over your head, hold and stretch. Repeat with your other arm.





8) Backward Reach -
With your arms relaxed at your side, elbows straight, reach your arms straight backwards. Hold and stretch. Then repeat.

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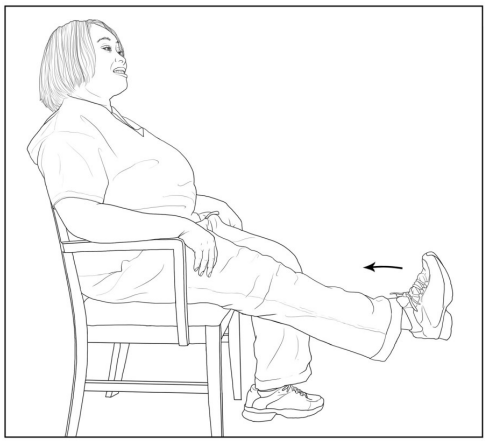
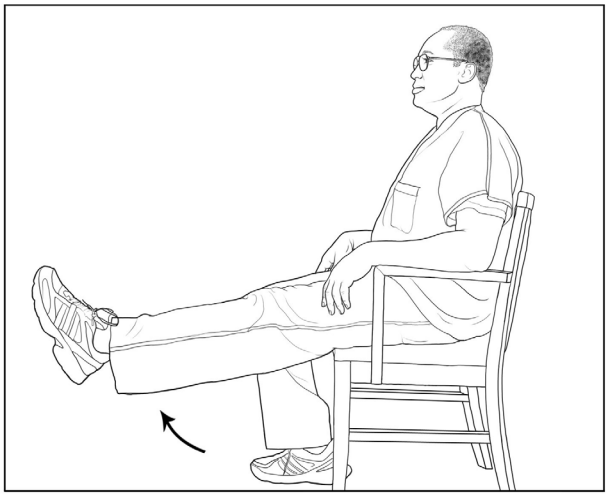
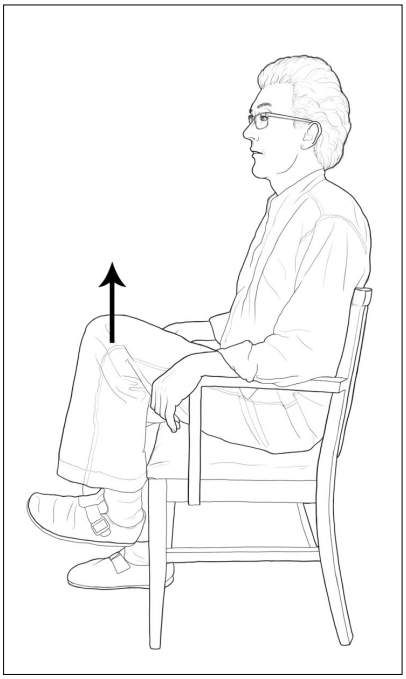


9) Ankle Pumps -
Move your ankle up and down (like pressing and releasing a gas pedal). You may perform this exercise sitting or lying down.

10) Leg kicks -
Sitting with upright posture in a chair or in the bed, kick your leg out straight and slowly. Hold for 3 seconds, then repeat with the other leg.





11) Seated marching -
Sitting with upright posture in a chair, lift your knee up towards the ceiling without leaning backwards. Repeat with the other leg.

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12) Hands behind your back and reach - Grasp your hands together behind the small of your back. Slowly lift your hands off your back. Hold and stretch. Then repeat.

13) Coughing and Breathing Exercises: Remember to use your incentive spirometer 10 times per hour when you are awake. You may use a pillow or blanket to hold over your incision when you cough. This will provide support and decrease pain.

Precautions: (until otherwise stated by your doctor) **No lifting, pushing or pulling greater than 10 pounds with your arms** . This applies when you are climbing stairs, standing up from a chair or getting out of bed. Roll onto your side before sitting when getting out of bed.

How do I begin walking: Begin by walking multiple times daily to build your endurance. Walk at a comfortable speed, timing yourself as you walk so you can continue to walk the same amount of time once you return home. Each day, add another minute to your walk. You can walk inside or outside. When you make it to 30 continuous minutes, increase your pace. Continue walking for 30 minutes 4-6 days a week.

Strengthening: After you have gained full motion in your shoulder(s), progress exercises 6 and 7 by performing them with a light weight in your hands. Start with 1 pound, then slowly progress to more weight as tolerated, but no more than 5 pounds in each hand. Many objects around the house can be used as weights: a can of soup, tools, a plastic bottle filled with rice or pennies, etc.

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