PULMONARY THROMBOENDARTERECTOMY GUIDE
Evaluation and Treatment of Chronic Thromboembolic Pulmonary Hypertension

INTRODUCTION

Our goal for the PTE program is to provide the highest quality of medical and surgical care of CTEPH both in western Pennsylvania and the eastern United States. In recognition of our quality care, we have recently become western Pennsylvania’s only accredited pulmonary hypertension center from the Pulmonary Hypertension Association (PHA).

Patients referred to our program for CTEPH undergo a thorough evaluation to identify the anatomic, hemodynamic and functional burden of the disease. Each patient is then discussed in a multidisciplinary meeting along with the referring physician to ensure that an appropriate, evidence-based and congruent treatment care plan is developed. Once the diagnosis of CTEPH has been established, our team discusses with you and your family, appropriate evidence-based treatment options in order to develop a congruent care plan. Besides pulmonary endarterectomy (PTE) surgery, we also offer balloon pulmonary angioplasty (BPA) and medical therapy for those ineligible for surgery. Please refer to our brochure for further details.

WHAT IS A PULMONARY THROMBOENDARTERECTOMY?

PTE is a surgical procedure, which involves removing old blood clots from the pulmonary arteries using specialized techniques. Since the clots are stuck to the arterial wall thereby narrowing the blood vessel, meticulous and sometimes lengthy dissection is required. To remove the clots, the surgeon must open these arteries while no blood is flowing through them. In fact, your blood will go through the heart-lung machine (bypass pump) during the surgery. The heart-lung machine will oxygenate the blood and pump it through your body. The surgeon will enter your chest through an incision made in the sternum (breast bone). You will also be made very cold during the surgery. When your body is cold, your oxygen requirements are reduced. Since you will be asleep, you won't be aware of the cold.

General anesthesia is required for PTE surgery. The day before your surgery, the anesthesiologist who will put you to sleep will come and talk with you about what to expect. A member of the surgical team will ask you to sign permission for surgery and to get permission for a possible blood transfusion if this becomes necessary and you will also meet your surgeon. The nurses will give you a kit and ask you to soap up with the Chlorhexadine (a disinfectant). You will not be allowed to eat or drink after midnight the night before surgery.
Early on the morning of your surgery, you will be taken to a preoperative area where an intravenous (IV) infusion will be started. More disinfectant will be applied and the hair on your chest and body will be shaved. In the operating room, you will be given more medication to put you to sleep. After you are asleep, the doctor will place an endotracheal tube (small plastic tube) through your mouth and into your trachea (windpipe). This will be connected to a ventilator that will breathe for you while you are in a deep sleep. This procedure is the same for anyone receiving general anesthesia. An infusion and monitoring catheter in your neck, a blood pressure monitoring line in your groin, and a catheter to drain urine will also be put into place.

Recovery:
After the operation you will be brought directly to the ICU. We will keep you asleep until the next morning. When you wake up, the endotracheal tube will still be in place to help you breathe. You will not be able to talk because the tube passes through your vocal cords. There is a balloon at the lower end of the tube to help hold it in place. It will also be secured in place at your mouth by placing tape around the tube and securing it to your cheeks. The ventilator will be breathing for you but it will feel like your own normal breathing.

Your time in the ICU after surgery is typically short and you will be kept reasonably comfortable. The average stay is 3 or 4 days during which you will have many tubes and equipment. They are necessary to monitor your heart and lung function and your progress after surgery. They are only temporary. Most of them will be removed after 2 or 3 days. You will have several monitoring lines in place. The one in your wrist will be an arterial line. We will monitor your blood pressure with this and can be used to take blood samples to determine your oxygen level. Another monitoring line called a Swan-Ganz catheter will enter the chambers of your heart through a large vein in your neck (similar to that used during the catheterization). Through the Swan-Ganz catheter, we can measure the pressure in your pulmonary artery and the amount of blood being pumped through the heart (cardiac output).

The incision in your sternum is closed by wiring the sternum together. The wires stay there permanently. Under the skin, there are sutures, which dissolve. And on the outside there are no sutures; there is a protective “bioglue” that is applied that simply peels off as your incision heals. Eventually it will heal to a straight line.

After your surgery, when they close the sternum (breast bone), there is air and fluid that remains in the chest. Two to three tubes will need to be left in your chest to drain out the remainder of this air and fluid. They are called chest tubes and may be removed several days after your surgery. You will have two small (1/4 inch) scars on your front lower chest from these tubes.

Post-ICU care:
The average time for recovery on the floor is 7 to 10 days. You will be on supplemental oxygen with a nasal cannula continually until you are ready for discharge. You will be started on a gradual ambulation program that consists of walking. First you will be asked to walk in your room with assistance. Then you will be able to walk in the halls, first with assistance and later, when you are stronger, on your own. If you need more assistance, physical
therapy may be ordered. Patients do have some incisional and chest discomfort after PTE surgery. However, as previously mentioned, it is usually not severe and occurs mostly with coughing. If you are uncomfortable, ask the nurse for medication.

**Discharge and rehabilitation:**
You will likely need to use supplemental oxygen either continuously or when you exercise for a short period of time after you leave the hospital (70% of patients). This is because the pulmonary circulation needs time to re-establish itself. Your local physician can check your oxygen needs in 2-4 weeks after you’ve returned home, to see if it is still required. Most patients are on oxygen for 6-8 weeks. When you get home, you should make an appointment with your doctor 2-3 days after your arrival in order to have your Protime/INR checked, and to have your incision and chest examined. If your doctor has any questions about your care, we would be pleased to answer them. You should continue to take a walk on level ground 3-4 times daily at home (using your oxygen if it is prescribed). Until the incision in your breast bone (sternum) heals, you should not lift anything that weighs over 5-10 pounds. We also recommend that you do not drive a car for at least one month. The sternum usually takes two full months to heal completely.

**WHO IS A CANDIDATE FOR PTE?**

In general, patients with significantly increased pulmonary vascular resistance secondary to chronic clot obstruction of major pulmonary vessels who wish to accept the risks of a thromboendarterectomy are considered candidates. The precise location of the obstructing thrombi remains the central issue in determining whether someone is a surgical candidate. Other consideration includes the patient's functional disabilities, desires, acceptance of risks, and test results. This risk is individually assessed after the evaluation is complete. An example of a high risk patient would be someone with distal disease, underlying heart, kidney or lung disease, severe obesity etc. If a patient is not a candidate for PTE, we also offer the option of balloon pulmonary angioplasty.

**WHAT PREOPERATIVE TESTS ARE PERFORMED?**

To optimize selection and outcome, we have established the following studies/procedures as important in the decision making process:

1. Chest X-ray and EKG
2. Blood work
3. Echocardiogram (ultrasound of the heart)
4. Lung ventilation-perfusion scan (special scan of the lungs done in Nuclear Department)
5. Right heart catheterization and pulmonary angiography (to assess pressure in your lung and clot burden in the pulmonary artery)
6. CT angiogram of chest (requires IV dye)
7. If indicated, coronary angiography (to rule out blockages in heart arteries)
8. Pulmonary function studies (breathing test)
9. If indicated, carotid duplex (ultrasound of the arteries in the neck)
If these tests have been performed elsewhere, we tend not to repeat them unless clinically necessary.

**HOW YOU CAN PREPARE FOR YOUR EVALUATION**

1. Know your insurance benefits and eligibilities: If your primary care physician or referring physician needs to submit a referral to your insurance company, it is your responsibility to see that he/she takes care of it as soon as possible.

2. Determine what oxygen company you will use during your stay and know what paperwork your airline requires to arrange oxygen: We will be available to help you with arrangements, but anything you can do ahead of time will be extremely helpful. The majority of patients will require oxygen for several months following surgery, even if they did not require it prior to their operation. We will not know until the last day of your hospital stay, whether or not you will be required to remain on oxygen for a short time following your discharge from the hospital. For your flight to Pittsburgh you will need to work with your local physician to fill out any paperwork required in order to fly with oxygen. Most carriers do not provide oxygen and you will need to obtain a Personal Oxygen Concentrator (POC) from your oxygen company. For your flight home from Pittsburgh our team will provide you with the required paperwork for your airline.

3. Bring a supply of your medications with you: While you are hospitalized, we will provide your medication. However, if you need a prescription while you are an outpatient, or during your hotel stay, we will not be able to incorporate it into your hospital bill.

4. Have enough money to cover the following:
   - Your hotel bill
   - Oxygen during your hotel stay, flight, and/or to transport you to or from the airport
   - Transportation to and from the hospital and/or rental car (depending on where you stay)
   - Any unexpected travel expenses for you or your family members
   - Meals for when you are not hospitalized
   - Incidentally
   - Outpatient medications

5. If possible, please bring someone (family or friend) with you for any assistance you may need.

**WHAT IS THE LENGTH OF HOSPITAL STAY?**

The average duration of hospital stay is 2-3 weeks: 2-3 days of evaluative testing, 2-5 days in the cardiovascular center ICU, and 7-10 days on the telemetry ward. Of course, with complications, the post-operative course may be longer.

**WHAT IS THE COST OF PTE SURGERY?**

Most third party insurance companies pay but require prior authorization. Medicare offers reimbursement. Coverage from Medicaid varies from state to state and must be pre-approved. Our staff will work to get the necessary approval.