Balloon Pulmonary Angioplasty (BPA)

Information for patients with Chronic Thromboembolic Pulmonary Hypertension (CTEPH) and their caregivers

My BPA procedure has been scheduled for:

Date: _____________________
Time: _____________________

Come to the Toronto General Hospital on:

Date: _____________________
Time: _____________________

Toronto Chronic Thromboembolic Pulmonary Hypertension (CTEPH) Program
“To optimize the care of patients with CTEPH in Canada”
What is Balloon Pulmonary Angioplasty (BPA)?

Chronic thromboembolic pulmonary hypertension (CTEPH) happens when blood vessels in the lungs become narrow or blocked due to blood clots.

Pulmonary endarterectomy (PEA) surgery is the best treatment for patients with CTEPH. Your doctor will let you know if PEA surgery is right for you.

If PEA surgery is not right for you, the CTEPH team will assess you to find other treatment options that may include:

1. Pulmonary hypertension medication called Riociguat®
2. Balloon Pulmonary Angioplasty (BPA)

How does my CTEPH team decide if BPA is right for me?

BPA may be a treatment option for you if:

1. The clots or scar tissue that are blocking the blood vessels in your lungs are deep in the outer areas of your lungs and cannot be removed by PEA surgery.
2. You have other medical conditions and you cannot have PEA surgery.
3. You had PEA surgery and now have pulmonary hypertension. In this case, you will have a CT pulmonary angiogram. If this test shows leftover scar tissue in the lungs, and you are having shortness of breath, then the CTEPH team will talk with you about having a BPA procedure.
How will a BPA procedure help me?

A BPA procedure will do 2 things:

1. Prevent the right side of your heart from getting weaker.
   - BPA stretches out the blood clots in your blood vessels and widens the vessels.
   - Lower pressure in your lungs means the right side of your heart does not have to work as hard.

2. Improve the blood flow in your lungs and help with your shortness of breath.
   - If you use oxygen, you may be able to use less over many weeks or months after the procedure.
   - You may be able to return to your normal activities and become more active. This will improve your quality of life.

How is a BPA procedure done?

A BPA is done by an interventional radiologist. First you will have an x-ray called a pulmonary angiogram. The radiologist injects you with a contrast dye to show the blood flowing in your lungs. People with CTEPH have blood vessels in the lungs with webs of scar tissue. An angiogram helps the interventional radiologist find which blood vessels are blocked.

The picture below shows a normal blood vessel and a blood vessel blocked by scar tissue.
• Your interventional radiologist then passes a catheter or small tube into these webbed blood vessels.
• There is a balloon at the end of the catheter.
• This balloon is inflated, pushing the webs of scar tissue to the side of the blood vessel.
• The inflated balloon opens up the blood vessel and helps the blood flow better. The blood vessel stays open with the webs of scar tissue moved to the side.
• The picture below shows a balloon pushing the webs to the side of the blood vessel.

**Balloon Pulmonary Angioplasty Procedure**

1. The catheter is pushed through the scar tissue
2. The balloon is inflated to push the scar tissue to the side
3. Blood can flow through the opened vessel
How many times will I need a BPA?

Depending on the pressure inside the blood vessels of your lungs, you may need **4 to 8 BPA sessions**. The higher the pressure in the blood vessels, the more sessions you will need.

Sometimes, a condition called pulmonary edema (fluid in the lung tissue) happens after BPA. When vessels that used to be blocked are opened, the blood can rush inside causing the fluid to leak into the lung.

Your interventional radiologist may need to do 4 to 8 BPA sessions over time and dilate or widen blood vessels during each session. This will reduce your chance of having pulmonary edema.

Who will I see about my BPA procedure?

**Thoracic surgeon**
- Talks with you in the Toronto CTEPH Clinic at the Toronto General Hospital
- Finds out if a BPA is right for you
- Talks with you about the risks and benefits of the procedure and how it is done
- Calls you to arrange your BPA

**CTEPH coordinator**
- Gives you a detailed care schedule with clear instructions when you are admitted to the hospital

**Interventional radiologist**
- Does the BPA on the day of your procedure
How do I get ready for my BPA?

1. Do not eat or drink from midnight (12:00 am) the night before your BPA procedure. If you have diabetes, talk to your CTEPH coordinator.

2. Take all your medications including your anticoagulation medications, for example, Warfarin®, Xeralto®, Apixaban®, Tinzaparin®) and Adempas (Riociguat®) with small sips of water the morning of your BPA procedure.

3. If you feel sick (for example, you have a cold or the flu) before the procedure, call your CTEPH coordinator 416 340 4800, extension 5274 right away.

Remember:
- Nothing to eat or drink from midnight (12:00 am)
- Take all your medications (including anticoagulation and pulmonary hypertension medications), even on the day of the procedure

How long will I need to stay in the hospital?

You will need to stay in the hospital for 4 to 5 days for your BPA procedure. During one hospital stay, 2 BPA sessions will be done.

My hospital stay

Day 1

Blood tests and admission

You will get a detailed care schedule with printed instructions from your CTEPH coordinator several days before your admission at the Toronto General Hospital.
One hour before your admission time, do blood tests at the Toronto General Hospital Diagnostic Test Centre, Ground Floor – Eaton Building, Phone: 416 340 3968

Go to the Admitting Department, Ground Floor, Eaton Building, Phone: 416 340 3917 or 416 340 3921

Take the Eaton elevators to the Thoracic Surgery Unit, 10th floor Eaton South. Stop at the nursing station to be admitted.

A member of thoracic surgery team will take your history and order your home medications.

Getting ready for my BPA procedure

- On the Thoracic surgery unit (10 Eaton South), a nurse helps you to get ready for your BPA procedure by:
  - Giving you a hospital gown to change into
  - Inserting an intravenous (IV) line into your arm
- A porter takes you on a stretcher to the Radiology Department.

Starting my BPA procedure

- The interventional radiologist explains the procedure to you first. Then you are asked to sign a consent form. **At this time, please ask any questions you may have.**
- The BPA may take up to 2 hours.
During my BPA procedure

For your comfort, your BPA is done under local anesthesia and conscious sedation.

- This means you are awake but feel relaxed and slightly sleepy.
- Your groin area where the BPA catheter is inserted will feel frozen or numbed.
- You will not feel any pain because the procedure is done inside your blood vessels.

Equipment used during my BPA

**Fluoroscope:** This is an x-ray machine placed above you and connected to a TV monitor.

**Heart monitor, blood pressure cuff and oxygen monitoring probe:** These 3 pieces of equipment are attached to you during the procedure.

The BPA procedure

1. The interventional radiologist finds the femoral vein in your groin area using an ultrasound machine.
   
   You can help by finding a comfortable position to lie very still in for the entire procedure. You will be given a small amount of sedation during the procedure. Let your nurse know if you need help.

2. Your groin area is cleaned with an antiseptic and then draped with sterile towels.

3. The interventional radiologist uses a needle to give you a local anesthetic in your groin. The medicine numbs the area. The anesthetic stings or burns a bit before it starts to work.
4. A long thin tube called a **catheter** is placed into the femoral vein in your groin. The interventional radiologist then moves the catheter forward in the following direction:

   - inferior vena cava → to right atrium → to right ventricle → to main pulmonary artery → to smaller pulmonary artery

The picture below shows the direction that the interventional radiologist moves the catheter forward.

As the catheter moves inside you, you may notice pressure in the groin, but you will not feel pain. You may feel heart palpitations (racing heart beat) during the procedure.
5. When the catheter is in place, the contrast dye is injected through the catheter into the blood vessels of your lungs. Then x-rays are taken.

6. The interventional radiologist is now be able to see how well blood is moving through the vessels of your lungs and where the scar tissue is blocking the blood flow. At the same time, the interventional radiologist uses the catheter in your pulmonary artery to measure your pulmonary artery pressure.

7. Next, the interventional radiologist inflates the balloon at the end of the catheter. The inflated balloon widens the blood vessel by pushing scar tissue to the side of the vessel wall. This helps blood flow in the vessel and lowers your pulmonary artery pressure.

8. At the end of the procedure, the interventional radiologist removes the catheter and puts pressure on your groin area for 10 minutes to stop any bleeding. The BPA procedure usually takes 2 hours.
What happens after my BPA procedure?

• You return to 10 Eaton South Thoracic Surgery unit and rest in bed for 2 hours.

• You are given intravenous (IV) fluids until the next morning. This helps to clear the x-ray contrast dye from your body.

• You are given a diuretic medication (water pill) to prevent pulmonary edema. This medication causes you to need to urinate or pee. Ask your nurse for help while you are in bed.

• You are not be able to eat or drink for 2 hours. After that, you can return to your normal diet.

• You have a chest x-ray to look at your lungs.

Day 2

On day 2 of your hospital stay, you will be recovering after your first BPA procedure and will be closely monitored by the thoracic surgery team.

• The intravenous fluids are stopped.

• You get another chest x-ray. Depending on the results of the chest x-ray, you may need to go for a CT scan of your chest.

• Your nurse does some blood tests.

• To get ready for your second BPA procedure, you cannot eat or drink from midnight (12:00 am).

Day 3

This is the day when you have your second BPA procedure.

• A porter takes you on a stretcher to the Radiology Department.

• The procedure is the same as described on Hospital Day 1.
What happens after my second BPA procedure?

- You return to 10 Eaton South Thoracic Surgery unit and rest in bed for 2 hours.
- You are given intravenous fluids until the next morning. This helps to clear the x-ray contrast dye from your body.
- You are given a diuretic medication (water pill) to prevent pulmonary edema. This medication causes you to need to urinate or pee. Ask your nurse for help while you are in bed.
- You are not able to eat or drink for 2 hours. After that, you can return to your normal diet.
- You have a chest x-ray to look at your lungs.

Day 4

On day 4 of your hospital stay, you will be recovering from your second BPA procedure.

- The intravenous fluids are stopped.
- You get another chest x-ray.
- Your nurse does some blood tests.

If the results of the chest x-ray and blood work are normal, you will go home on this day.

Your nurse will remove the intravenous line.

You must have someone take you home from the hospital.

At the time of discharge, you will not be given a follow up appointment with your thoracic surgeon or interventional radiologist.
Questions for my BPA team to prepare me for home:

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What should I expect after my discharge home?

Your CTEPH coordinator will call you after you leave the hospital to let you know about your follow-up plan.

Depending on the results of the BPA procedure, you will have either:

1. Another hospital admission for more BPA sessions.

2. A follow-up visit with your thoracic surgeon.
Emergency instructions while at home

Call your thoracic surgeon right away if:

1. You are having new or worsening shortness of breath
2. You have fainted (loss consciousness)
3. You are having new chest pain

If you can’t reach your thoracic surgeon:

• Go to the Toronto General Hospital emergency department or to your nearest hospital emergency department right away.

Who are the members of my BPA team?

• Dr. Marc de Perrot (Thoracic surgeon)
• Dr. Laura Donahoe (Thoracic surgeon)
• Dr. KT Tan (Interventional radiologist)
• Anastasia Bykova (Thoracic surgery nurse practitioner)
• Susan Beaudoin (CTEPH coordinator)
• A surgical resident, a surgical fellow or both (doctors doing extra training)
• Members of the UHN Interventional Radiology team
• Members of the thoracic surgery team

Who can I call if I have any questions?

If you have questions about your BPA procedure, call:

Toronto CTEPH Program
Division of Thoracic Surgery
Phone: 416 340 4800 ext. 5274
Fax: 416 340 3853
Pager: 416 714 0840
Address: Toronto General Hospital, 9N - 927
200 Elizabeth Street
Toronto, ON M5G 2C4

If needed, you can also call:
Dr. KT Tan
Head, Interventional Radiology
University Health Network
Phone: 416 340 4800 ext. 6166