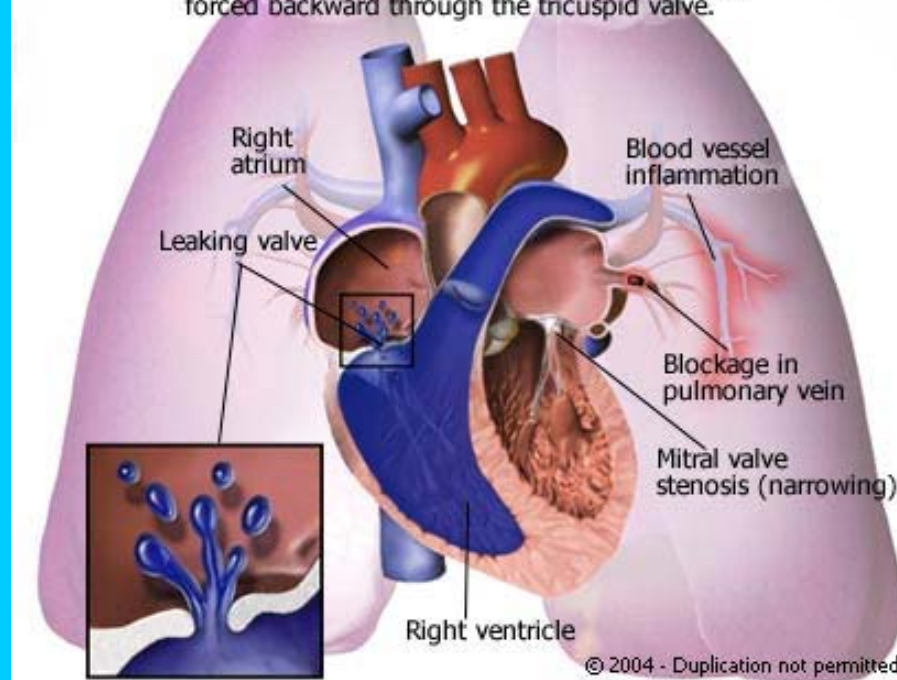
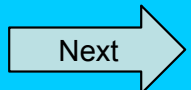


## Pulmonary Hypertension

Can be caused by a number of factors, all of which force the heart's right side to work harder to pump blood to the lungs. The right chambers may enlarge as they struggle to function, and blood is often forced backward through the tricuspid valve.



Debby Thompson, Amanda Georgiades and Patti Del Tufo



# Pulmonary Hypertension



Ref

## Normal Circulation from the Heart to the Lungs:

The right ventricle pumps blood through the pulmonary arteries to the lungs. While the blood is in the lungs it releases carbon dioxide and collects oxygen. The pulmonary veins send the oxygen-enriched blood to the left side of the heart and the left ventricle pumps the blood, by way of the aorta, to the rest of the body.

Normally, there is less blood flow resistance in the lungs than the rest of the body.

## What is Pulmonary Hypertension?

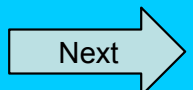
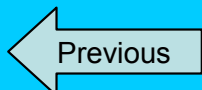
Pulmonary hypertension is when the blood pressure rises within the pulmonary arteries (which supply the lungs) becomes higher than 25mm Hg at rest and 30mm Hg during exercise. These higher pressures put the right side of the heart under strain. The end result of the elevated pressure is changes in the thickness of the endothelial cell lining of the lungs' arteries. This formation of extra tissue and the scarring (fibrosis) causes the arteries of the lungs to become narrow and stiff, reducing the flow of blood to the left side of the heart and ultimately to the rest of the body.

Pulmonary Hypertension is divided into two types:-

**PPH (Primary Pulmonary Hypertension)** - is when an underlying cause for high blood pressure in the lungs cannot be found. Although the exact cause is unknown, scientists believe that most people who develop the disorder are sensitive to substances that cause the blood vessels to constrict. This group includes Cocaine and the diet drug fenfluramine (fen-phen). In addition, a small percentage of people inherit a predisposition for PPH. Cirrhosis, AIDS, sickle cell anemia and connective tissue diseases such as scleroderma and lupus can trigger PPH

**SPH (Secondary Pulmonary Hypertension)** - is the most common form of pulmonary hypertension and is the result of another medical condition. Medical conditions that lead to SPH are:-

- Blood Clots in the lungs
- Chronic obstructive pulmonary diseases, such as emphysema
- Connective tissue disorders, such as scleroderma
- Sleep apnea
- Congenital heart disease
- Lung diseases such as pulmonary fibrosis
- Left heart failure



# Pulmonary Hypertension



Ref

## Signs and Symptoms:

Often pulmonary hypertension has nonspecific symptoms. This is because it is hard to dissociate from the patient's known pulmonary or cardiac disorder.

jugular vein distention	dyspnea on exertion
prominent right ventricular impulse	fatigue
accentuated pulmonic valve component	syncope
right-sided third heart sound (S3)	anginal chest pain

## Diagnosis and Screening:

Pulmonary Hypertension affects both genders equally; but, after puberty, it is more common in women with a ratio of 1.7:1. It is more prevalent in the age group of 20-40 years old. There is no racial bias.

In an otherwise healthy young person, shortness of breath may be the first symptom seen. Because shortness of breath is a subtle condition and its onset is slow; proper diagnosis may not be obtained for years.

In advanced pulmonary hypertension, the physician may begin his diagnostic evaluation by starting with a thorough patient history and careful physical examination. This examination would be followed by further tests such as:- echocardiography, pulmonary function test, perfusion lung scan, right heart catheterization, Computerized Tomography (CT) and Magnetic Resonance Imaging (MRI).

Patients with suspected pulmonary hypertension should have the diagnosis confirmed by the identification of tricuspid regurgitation. Late findings are right ventricular dilation and hypertrophy.

## Classifications:

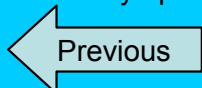
New York Heart Association has classified Pulmonary Hypertension in four classifications.

Class 1 - Diagnosed with pulmonary hypertension; but, without symptoms,

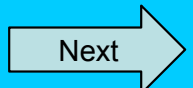
Class 2 - No symptoms at rest. But, with normal activity the patient experiences fatigue shortness of breath or chest pain.

Class 3 - No symptoms at rest. But, with slight activity, the patient experiences symptoms.

Class 4 - Symptoms at rest.



[1](#) [2](#) [3](#) [4](#) [5](#) [Test](#)



# Pulmonary Hypertension



## Treatment:

The possible treatments for Pulmonary Hypertension are complex and dangerous.

Correcting the underlying cause for pulmonary hypertension may be one of the first effective treatments. Such intervention includes: surgical repair of mitral stenosis, left to right shunt or accessible chronic thromboemboli.

Other possible treatments to consider are reducing afterload with meds like digoxin and diuretics for the treatment of left ventricular dysfunction. The effective treatment and prevention of respiratory infections and avoidance of anorectic agents can help with the patient's treatment.

To control pulmonary vasoconstriction calcium channel blockers may be introduced such as cardizem, norvasc or procardia. If the patient responds to long term use of these meds, they can produce a sustained hemodynamic response and increase the patient's survival rate. Oxygen, prostacyclin epoprostenol, also known as 'Flolan' or prostacyclin analogs, investigational meds such as Nitric Oxide, and anticoagulants like coumadin are also used for primary pulmonary hypertension and chronic thromboembolism.

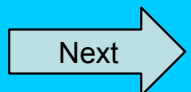
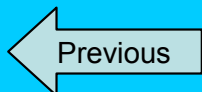
To increase cardiac output Digoxin is used as a short-term parenteral inotropes. To reduce volume overload, low-salt diets and diuretics are introduced to reduce the hearts work by eliminating excess fluid from the body.

Investigational atrial septosotomy or possible lung or heart-lung transplantation may be considered with younger patients with PPH.

After confirming the diagnosis of PPH through heart catheterization, Tracleer, may be introduced, This drug blocks a substance called endothelin from binding to its receptors. Endothelin is one of the most powerful vasoconstrictor substances made by the body and has been found in increased amounts in patients with pulmonary hypertension.

Tracleer is given in an oral form and does not need to be started in a hospital setting.

In the treatment of advanced pulmonary hypertension Flolan™ (Epoprostenol) or prostacycline has shown improvement in patients with class III or IV pulmonary hypertension. With continuous Flolan™ infusion there was improvement in exercise capacity, quality of life, and long-term survival rates.



# Pulmonary Hypertension



Ref

## Flolan™ considerations:

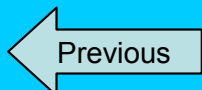
Flolan™ is administered for the treatment of Primary Pulmonary Hypertension (PPH). Flolan™ is a potent, short acting vasodilator and platelet aggregation inhibitor. It may also be used as a bridge for transplantation or as an end point to improve the quality of life.

Initially, the Flolan™ therapy test dose must be administered only in the ICU/CIC or Catheterization Laboratory prior to starting the continuous infusion.

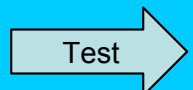
Once Flolan™ is started, most patients must continue to receive the drug without interruption for the remainder of the patient's life. Infusion must be maintained on micro-infusion pump and neither the med or the IV line is to be flushed.

Special consideration must be observed when infusing Flolan:

- Medication must be protected from light
- Stable for 8 hours at room temperature after reconstitution
- Stable for 24 hours in the mini-infusion pump if bag is wrapped in ice packs
- After reconstitution is stable for 48 hours if refrigerated
- No portion of the Flolan™ delivery system (catheter, catheter port, tubing, pump) is to be flushed



1 2 3 4 **5** Test



# Pulmonary Hypertension



Ref

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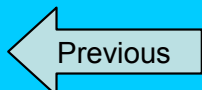
The next two slides show the Test Questions.

Please review them carefully, click on a Gold colored button on one of the Test Slides to print out the two pages of the test.

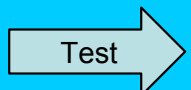
Circle the correct answers; 'True' or 'False' or the appropriate selections

Don't forget to add your name to the top of the first page and pass it to Lisa Baumgardner.

Thank you.



1 2 3 4 **5** Test



Click Here to  
Print the Test

# Pulmonary Hypertension



Ref

## Post Test (Page 1)

April, 2005

Name: \_\_\_\_\_

1) Pulmonary hypertension occurs when the pressure in the pulmonary arteries exceeds 25 mm Hg at rest and 30 mm Hg during exercise.

**True or False**

2) A diagnosis of Primary Pulmonary Hypertension is made when:

- a) another medical condition causes the hypertension
- b) the underlying cause for the high blood pressure cannot be found
- c) when the patient has pneumonia
- d) when the patient has a negative chest x-ray.

3) The most common form of pulmonary hypertension is:

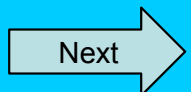
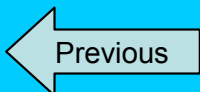
- a) primary pulmonary hypertension
- b) de-oxygenated pulmonary hypertension
- c) opium induced pulmonary hypertension
- d) secondary pulmonary hypertension

4) Medical conditions that lead to Secondary Pulmonary Hypertension include:

- a) blood clots in the lungs
- b) COPD
- c) connective tissue diseases
- d) pulmonary fibrosis
- e) atrial fibrillation

5) Pulmonary Hypertension is more common in women than men with a ratio of 1.7:1.

**True or False**





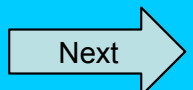
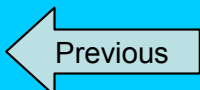
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# Pulmonary Hypertension

## Post Test (Page 2)

- 6) After the patient history and physical exam, the physician would most likely order many of the following diagnostic tests except:
- a) echocardiogram
  - b) pulmonary function test
  - c) perfusion lung scan
  - d) exercise stress test.
- 7) Correcting the underlying causes for pulmonary hypertension may be one of the first effective treatments.  
**True or False**
- 8) To control pulmonary vasoconstriction which of the following medications may be used?
- a) calcium channel blockers such as cardizem, norvasc or procardia
  - b) beta blockers such as lopressor
  - c) antibiotics such as penicillin
  - d) Insulin
- 9) Patients with Class III or IV advanced pulmonary hypertension have shown improvement with continuous infusion of:
- a) digoxin
  - b) cardizem
  - c) Flolan
  - d) grape juice
- 10) Once Flolan is started, most patients must continue to receive the drug without interruption for the rest of their lives.  
**True or False**



# **Pulmonary Hypertension Presentation**

Thank you for taking part in this exercise.

You will be advised of your results as soon as possible.

Debby Thompson, Amanda Georgiades and Patti Del Tufo

Press the 'Esc' key to end the presentation

# Pulmonary Hypertension

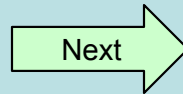


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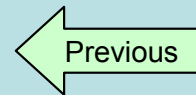
## Help and Information

Use the mouse or cursor keys to move between screens of information.

Each page has a navigation bar at the bottom of the page.  
Pressing the 'Next' arrow



or right cursor key will advance to the next page and pressing "Previous" arrow:-



Or left cursor key will go back to the preceding page. A particular page may be selected by pressing the appropriate page number.  
The white number signifies the screen number of the current slide.

Clicking on the "Ref" button above will bring up the References used for the Presentation.

To complete the Test at the end of the Presentation - Click 'Test'.

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# Pulmonary Hypertension

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## References

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Pulmonary Hypertension, April 2, 2004 , "Reliable Information for a Healthier Life". By Mayo Clinic staff. [www.MayoClinic.com](http://www.MayoClinic.com)

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