Insights is an educational program designed exclusively for individuals with pulmonary arterial hypertension and those who care for them—brought to you by Gilead Sciences, Inc.

www.InsightsOnPAH.com
The link between connective tissue disease and PAH

Those living with a connective tissue disease (CTD) have an increased risk of developing pulmonary arterial hypertension (PAH). This brochure is designed to help you learn more about PAH and how it is related to CTD. It also discusses the importance of annual screening for PAH and describes how PAH is diagnosed and treated.

PAH is a disease that affects men and women of all ages and backgrounds. In the United States, at least 1,000 new cases of PAH are diagnosed each year.
CTD and PAH

What is connective tissue?
The soft tissues of your body (such as your skin and internal organs) require a strong yet flexible material to give them shape and support. This material is known as connective tissue. Connective tissue, which is made mostly of a protein called collagen, can also be found surrounding fat cells beneath the skin and in cartilage, bone, tendons, and ligaments.

What is CTD?
CTD (sometimes called collagen vascular disease) is a collection of diseases that attack the connective tissue or disrupt its normal function. There are many different disorders that affect connective tissue, and people with these diseases can have a wide variety of symptoms. In fact, the symptoms of two people with the same CTD may differ greatly.

CTDs include rheumatoid arthritis, Sjögren’s syndrome, systemic lupus erythematosus, systemic sclerosis (scleroderma), dermatomyositis/polymyositis, mixed connective tissue disease, and others.

What is systemic sclerosis (scleroderma)?
Although not the most common of the CTDs, scleroderma is the one that is most frequently associated with PAH. People with the type of scleroderma called limited cutaneous scleroderma have the highest risk of developing PAH. Limited cutaneous scleroderma was known until recently as CREST syndrome, a name that described its typical symptoms: calcinosis (calcium deposits), Raynaud’s phenomenon (painful discoloration of the fingers), esophageal dysfunction (swallowing difficulties and heartburn), sclerodactyly (hardening of the skin of the fingers), and telangiectasias (enlarged blood vessels under the skin).

What is PAH?
PAH is a disease characterized by high blood pressure in the arteries of the lungs (the pulmonary arteries). The pulmonary arteries transport blood from the right side of the heart to the lungs, where the blood picks up oxygen needed for physical activity.

In PAH, the pulmonary arteries become much narrower than usual, and blood cannot pass easily through the lungs. To pump enough blood through these narrowed arteries, the heart must work harder, which can weaken the heart over time and lead to serious complications.

Healthy pulmonary arteries become narrowed over time with PAH

(Magnified view of pulmonary arteries)
The relationship between CTD and PAH

Why do some people with CTD develop PAH?
Collagen is a normal part of most blood vessels. In people with CTD, too much collagen may be produced in and around the walls of the pulmonary arteries, making the arteries thicker and stiffer than usual. The immune systems of people with CTD can also trigger cells of the artery walls to grow out of control and crowd out the space inside the arteries where blood normally flows. Exactly what sets off these changes in people with CTD is unknown, and the process may vary according to the type of CTD they have.

How common is PAH in people with scleroderma?
Between 8% and 13% of all people with scleroderma are affected by PAH. For this reason, annual PAH screening is recommended for everyone with scleroderma. Although PAH can occur with any of the CTDs, it is most common with scleroderma, according to published reports. In fact, among all PAH patients with an underlying CTD, about three-quarters have scleroderma.

PAH is a very rare disease; however, for individuals with CTD, it is best to be alert. Familiarize yourself with the symptoms of PAH (listed on the next page) and talk to your doctor about being screened for PAH at a center that specializes in PAH care.
Recognizing PAH

What are the symptoms of PAH?
Symptoms of PAH may include:
• Shortness of breath, especially with physical activity
• Feeling tired
• Chest discomfort or pain
• Dizziness
• Light-headedness or fainting
• Swelling of the arms and legs

Unfortunately, by the time symptoms are felt, PAH is usually advanced. For this reason, regular screening for PAH is recommended for people at high risk.

Who should be screened for PAH?
People with scleroderma should be tested for PAH once a year by having an echocardiogram, or “echo,” which can pick up early signs of PAH, before symptoms develop. An echo is a quick procedure that is used to assess the structure and function of the heart and to estimate blood pressure in the pulmonary arteries. An echo can be done in your doctor’s office but may also be done in a hospital or outpatient testing center.

Some experts also recommend yearly pulmonary function testing to monitor the health of their patients with CTD. Included in pulmonary function testing is a special test called the Dlco that measures how oxygen moves from your lungs to the blood. This test can also screen for PAH.

There is no firm recommendation that people with CTDs other than scleroderma be tested regularly because they are not as likely to develop PAH. If you have a CTD other than scleroderma, your doctor can help you decide whether regular screening is a good idea for you.

Is there additional testing for PAH?
If you develop symptoms of PAH or have an echocardiogram that suggests you may have PAH, your doctor will ask you to undergo additional testing, as you may not, in fact, have PAH. Additional testing can help distinguish between PAH and other medical conditions that may have similar symptoms but different causes and different treatments.

Other tests your doctor may ask you to have include:
• Electrocardiogram
• Chest x-ray
• Pulmonary function test
• Ventilation/perfusion scan
• Chest CT or MRI
• Oximetry/sleep study
• Right heart catheterization

Right heart catheterization is a test that directly measures blood pressure in the pulmonary arteries and is required to confirm a diagnosis of PAH.

The tests listed here do not necessarily represent all of the tests your doctor may wish to perform or the order in which they may occur.

If you are experiencing any of the symptoms associated with PAH, speak with your healthcare professional. Although these symptoms can occur with many medical conditions other than PAH, people who have a CTD should pay special attention to their symptoms because their risk of developing PAH is higher than average.
Treating PAH

At this time, there is no cure for PAH. However, a number of medications are available to treat the disease. The goal of PAH treatment is to relieve PAH symptoms, improve quality of life, and help slow the progression of the disease.

What PAH treatment options are available?

- **Oral therapy**—medications that are taken by mouth
- **Inhaled therapy**—medications that are inhaled
- **Continuous intravenous (into a vein) or subcutaneous (under the skin) infusion**—medications that are delivered continuously to your bloodstream through a vein or a needle placed under the skin
- **Surgery**—including lung or heart-lung transplantation; considered for the most severe cases of PAH for which medication is not successful

Treatment may also include:

- **Anticoagulants ("blood thinners")** to prevent blood clots
- **Diuretics ("water pills")** to reduce swelling
- **Supplemental oxygen** to make sure the body has enough oxygen

Talk to your healthcare professional

If you have additional questions or concerns about PAH and CTD, speak with your healthcare professional.

Useful resources

Find more information about PAH and scleroderma from the following sources:

- **Insights**—an educational program designed exclusively for individuals with pulmonary arterial hypertension and those who care for them
  
  [www.InsightsOnPAH.com](http://www.InsightsOnPAH.com)

- **Pulmonary Hypertension Association**—education, support, advocacy, and awareness for the PAH community
  
  [www.phassociation.org](http://www.phassociation.org)
  
  301-565-3004
  
  **Look for a PAH support group near you at:**
  
  [www.phassociation.org](http://www.phassociation.org)

- **PHCentral**—information and support for people with PAH and their healthcare professionals
  
  [www.phcentral.org](http://www.phcentral.org)

- **Scleroderma Foundation**—mutual support, medical and public education, and research relating to scleroderma
  
  [www.scleroderma.org](http://www.scleroderma.org)
  
  800-722-HOPE (4673)
  
  **Look for a scleroderma support group near you at:**
  
  [www.scleroderma.org/support.shtm](http://www.scleroderma.org/support.shtm)

- **National Institutes of Health**—a medical research agency of the US government that maintains an online library you can use to research health topics, including CTD, scleroderma, and PAH
  
  [www.nih.gov](http://www.nih.gov)
  
  301-496-4000
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a closer look
at connective tissue disease and PAH