

## The Pulmonary Complications of Scleroderma

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### Definition

- Scleroderma lung disease is categorized as an Interstitial Lung Disease (ILD).
- ILD refers to a broad category of lung diseases, of which scleroderma is one among nearly 150 conditions, marked by fibrosis or scarring of the lungs.
- The net result of the fibrosis is ineffective respiration or difficulty breathing .

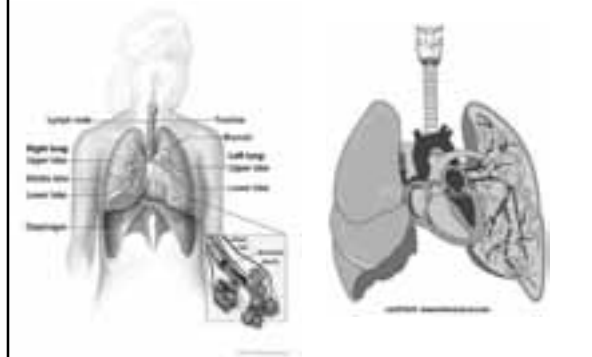
### Lung Disease in Scleroderma

- **Interstitial Lung disease (lung fibrosis)**
- Pulmonary Arterial Hypertension
- Aspiration Pneumonia
- Pleural disease
- Restrictive lung disease
- Bronchiolitis

### Lung Disease in Scleroderma

- Cough
- Breathlessness
- Fatigue

### Lung Disease in Scleroderma



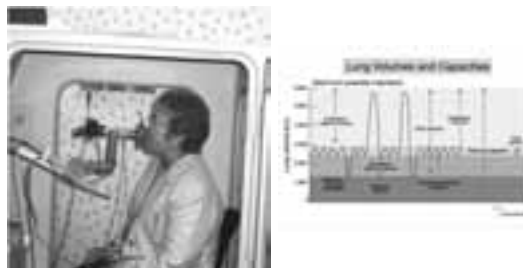
### Other Causes of the Symptoms

- Reflux
- Deconditioning
- Anxiety
- Allergies
- Anemia
- Smoking related lung disease
- Heart disease

### Interstitial Lung Disease (lung fibrosis) in Scleroderma

- 80% of patents with systemic sclerosis
- Maybe mild –extensive
- Patients with positive Scl-70
- Usually occurs within 5 years of diagnosis
- Severe lung scarring is seen more frequently in men and in African-American scleroderma patients.

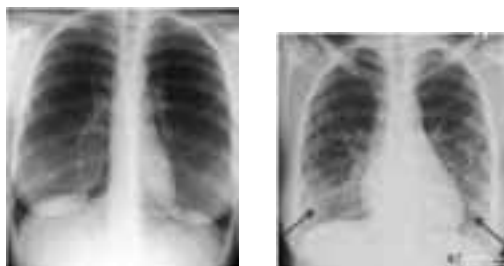
### Pulmonary Function Tests



### Diagnosis

- Cough
- Breathlessness
- Exercise impairment
- Abnormal breath sounds

### Chest X-Ray



A painless imaging test that shows the physician the general size, shape, and structure of the heart and lungs

### Workup

Suspect pulmonary fibrosis

Chest x-ray

Pulmonary function test, cardiopulmonary exercise test, blood tests, CT chest

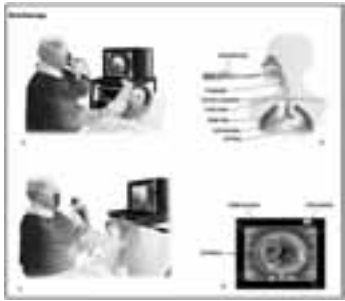
Bronchoscopy / Biopsy

### CT Scan of the Chest



This noninvasive scan provides images of multiple slices through the lung from top (apex) to bottom (base) and can even detect subclinical ILD, i.e. inflammation or fibrosis that occurs before the development of shortness of breath

### Bronchoscopy

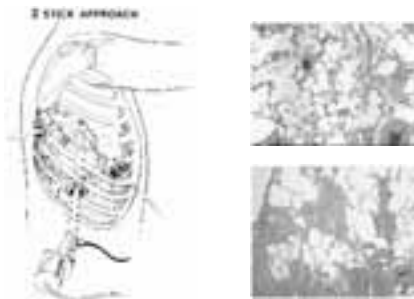


Bronchoscopy with broncho-alveolar lavage (BAL) is a more invasive test that also may provide information about the degree of inflammation in the lungs. Inflammation or alveolitis is believed to occur before lung fibrosis.

### Goals for treatment

- Suppress the inflammation
- Prevent fibrosis
- Maintain the lung function

### Lung Biopsy



Lung biopsy is often recommended to help diagnose various types of ILD

### Treatment

- Low dose Prednisone
  - Less than 20 mg a day
  - Avoid high dose Prednisone
- Control reflux

### Bronchiolitis

- Cough
- Shortness of Breath
- Breathing test shows obstruction

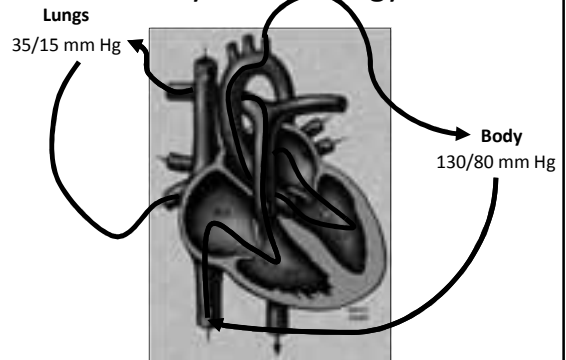
### Treatment

- Cyclophosphamide (cytoxan)
- Mycophenolate mofetil (cellcept)

### Treatment

- Endothelin receptor blockers
  - Bosentan
  - Ambrisentan

### Anatomy & Physiology 101



### Lung disease in Scleroderma

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### Diagnostic Classification

<b>Pulmonary Arterial Hypertension (PAH)</b>	Includes idiopathic pulmonary arterial hypertension (IPAH), familial PAH, congenital heart disease, collagen vascular disease, portal hypertension, HIV, drugs and toxins, and misc others
<b>Pulmonary Venous Hypertension</b>	Left heart disease
<b>Pulmonary Hypertension Associated with Hypoxemia</b>	Includes chronic obstructive pulmonary disease (COPD), interstitial lung disease (ILD), sleep apnea, altitude sickness, and developmental abnormalities
<b>Pulmonary Hypertension due to Chronic Thromboembolic Disease</b>	
<b>Miscellaneous</b>	Includes sarcoidosis, histiocytosis X, lymphangiomatosis, compression syndromes

### Definition

- Pulmonary hypertension (PH) is continuous high blood pressure in vessels of lungs
  - Most often affects the pulmonary arteries
- Increased pressure causes vascular walls to tighten/constrict
  - Vascular muscles can thicken leading to arterial narrowing
- High blood pressure and narrower arteries cause right side of heart to work harder to pump enough blood into lungs
  - Right side of the heart can dilate and muscles thicken (hypertrophy)

### Symptoms Are Nonspecific


- Shortness of breath with exertion
- Fatigue
- Chest pain
- Cough
- Fainting/near-fainting
- Edema
- Hoarseness
- Seizures

### Physical Examination

- Loud second heart sound
- Right ventricular heave
- Heart murmur
- Pale or bluish-colored skin
- Distended neck veins
- Enlarged liver
- Swollen feet, legs, abdomen

### Electrocardiogram (ECG)

An ECG shows the doctor the heart rate and rhythm and it can also show whether the heart is under any strain.



### Workup


Suspect pulmonary hypertension

Chest x-ray (CXR), electrocardiogram (ECG),  
echocardiogram (ECHO)

Pulmonary function test, cardiopulmonary exercise  
test, blood tests, lung ventilation perfusion scan


Right heart catheterization with acute  
vasodilator testing

### Echocardiogram (ECHO)



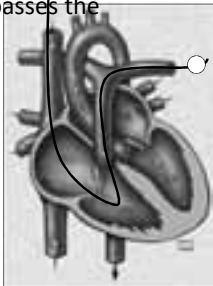
### Chest X-ray

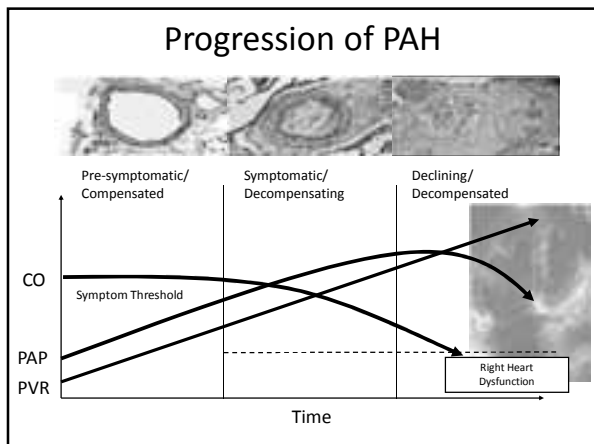
A painless imaging test that shows the physician the general size, shape, and structure of the heart and lungs.



### Cardiac Catheterization

- A more invasive test in which the physician inserts a small tube called a “catheter” into a patient’s blood vessel and passes the tube toward the heart
- Measures important pressures in the heart and lungs





### Endothelin Receptor Blocker

- Selective ET<sub>A</sub> blocker : Ambrisentan  
sitexsentan
- Dual endothelin receptor blocker: Bosantan
- Newer agent in phase III trials

### PAH Treatment: Goals

- Improved pressures
- Improved exercise capacity
- Improved function
- Prevention of clinical worsening
- Improved survival


### Phosphodiesterase Inhibitors

- Sildenafil
- Tadalafil

### PAH Conventional Therapy

- Digoxin (Lanoxin<sup>®</sup>)
- Furosemide (Lasix<sup>®</sup>)
- Spironolactone (Aldactone<sup>®</sup>)
- Warfarin (Coumadin<sup>®</sup>)

\*Recent data suggest that these drugs benefit approximately 6% of patients.



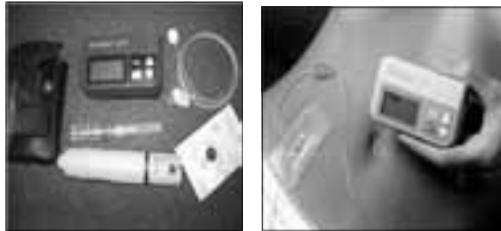
### Epoprostenol

#### Side Effects

- Jaw pain
- Headache
- Diarrhea
- Nausea /emesis
- Rash
- Leg and foot pain
- Weight loss
- Thrombocytopenia

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## Treprostinil Delivery System



## Goals for treatment

- Improve walk test
- Be able to resume usual activities
- Signs of heart failure improved

## Device Options

Infusion Devices



Inhaler Device



## Restrictive Lung disease

- Lungs are healthy
- Skin and the chest is tight

## Inhaled Treprostinil

- **Daily-use ampules** provide a full day's supply of medication
- **Treatment takes 2-3 minutes** q.i.d.
- **Dosage delivery** of 6 µg per breath .
- Start at 3 breaths QID to up to 9 breaths QID
- **Lightweight (10 oz) device** is easy to transport and comes with carrying case
- **Once-daily cleaning**
- **Rechargeable long-life battery** lasts for 7 to 10 days before recharging is required
- **Replacement accessory parts delivered monthly** with each TYVASO prescription refill, for patient convenience



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## Aspiration Pneumonia

- Swallowing problems and reflux common
- Aspiration of stomach contents in the lung can lead to irritation and infection
- Treatment
  - Control reflux
  - Swallowing study
  - Antibiotics as needed

### Approach to Lung Disease

- Detailed information of respiratory symptoms
- Pulmonary function test
- Chest X-Ray
- Echocardiogram

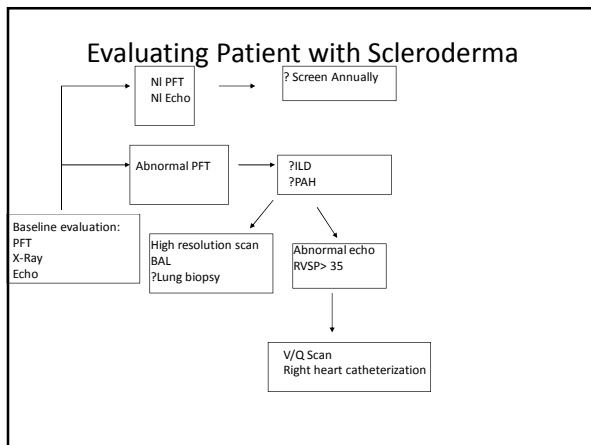
### What Every Patient Should Know (cont'd)

**Air Travel**

- Oxygen
- Wheelchair

**Vaccinations**

- Pediatrics: (respiratory syncytial virus (RSV), Prevnar®, influenza)
- Adults: (influenza, Pneumovax®)



### What Every Patient Should Know (cont'd)

**Communication**

- Take medications only after consultation with your physician
- Tell your physician if you are having any type of surgery (major or minor)
- Discuss new American Heart Association (AHA) recommendations for antibiotic preventative treatment with your physician

### What Every Patient Should Know

**Upper Respiratory Tract Infections**

- Early treatment
- Antibiotics
- Oxygen
- Antipyretics
- Cough medicine
- Medications to avoid
- Hospitalization
- Warfarin interactions with antibiotics

### What Every Patient Should Know (cont'd)

**What to Avoid**

<ul style="list-style-type: none"> <li>• Constipation</li> <li>• Excessive humidity/hot weather</li> <li>• High altitude</li> <li>• Oral contraceptives</li> <li>• Pregnancy</li> <li>• Anorexic agents</li> </ul>	<ul style="list-style-type: none"> <li>• Excessive alcohol</li> <li>• Illicit drugs</li> <li>• Over-the-counter decongestants</li> <li>• Smoking (1<sup>st</sup>- or 2<sup>nd</sup>-hand exposure)</li> <li>• Dehydration</li> <li>• Excessive physical activity</li> </ul>
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## What Every Patient Should Know (cont'd)

### *A Healthy Lifestyle*

- Maintain balanced diet
- Maintain ideal body weight
- Maintain modest exercise and activity level
- Get adequate sleep
- Optimally manage any anxiety, stress, or depression
- Control Blood Pressure

## Conclusion

- Lung complications remain a serious concern
- Current Tests to enable earlier diagnosis.
- Potential new therapies
- More effective and safer medications will become available to treat scleroderma lung disease

To find out more about  
clinical trials, centers,  
contact information:  
[www.clinicaltrials.gov](http://www.clinicaltrials.gov)