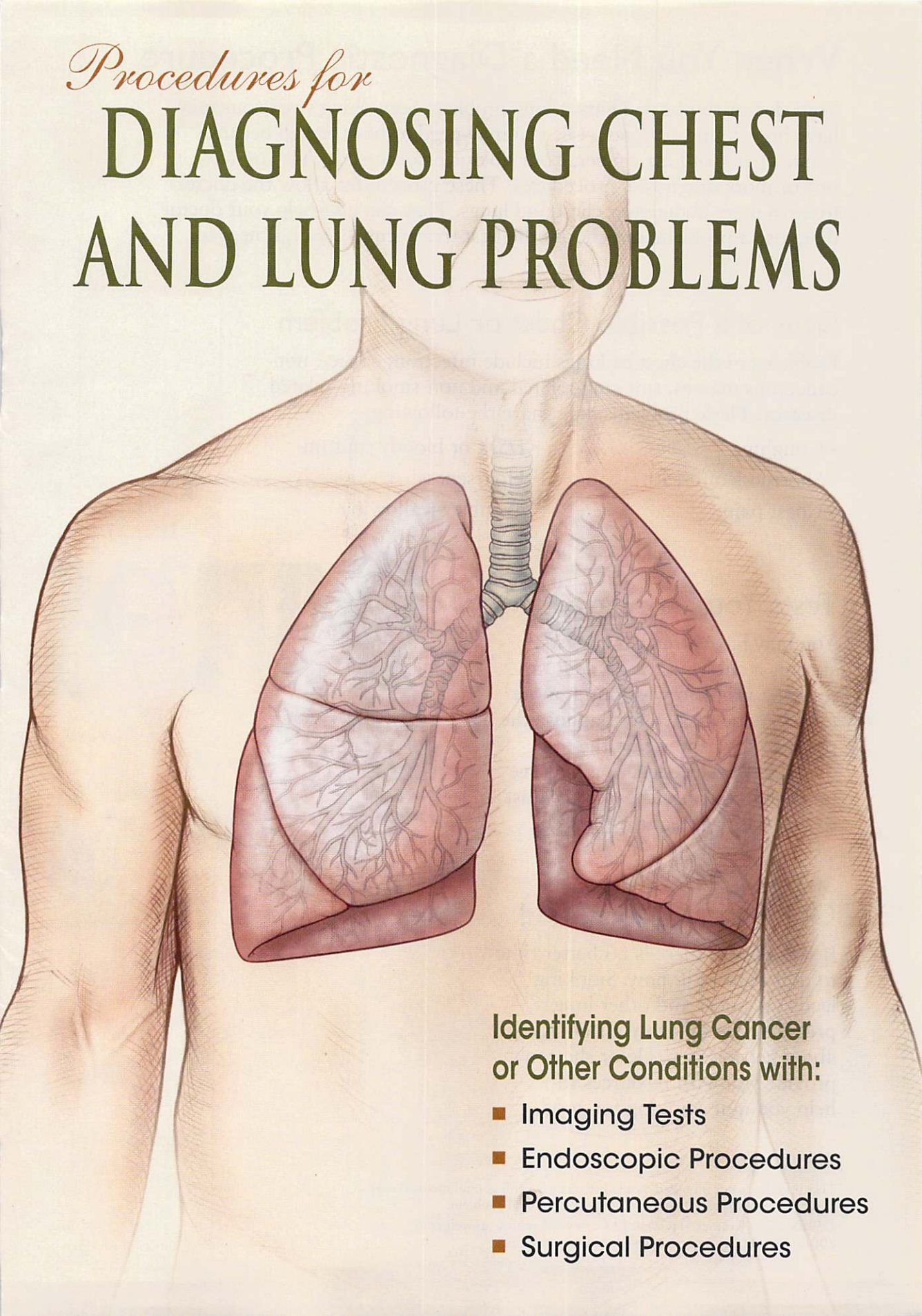
Procedures for

DIAGNOSING CHEST AND LUNG PROBLEMS



Identifying Lung Cancer or Other Conditions with:

- Imaging Tests
- Endoscopic Procedures
- Percutaneous Procedures
- Surgical Procedures

When You Need a Diagnostic Procedure

Your doctor thinks you have a lung problem. Something suspicious may have been found on a test. Or, you may need to be screened because you're at risk of lung cancer. Your doctor recommends that you have one or more diagnostic procedures. These procedures allow the doctor to learn more about your chest and lungs. They can also help your doctor diagnose a problem and choose the best treatment for you, if needed.

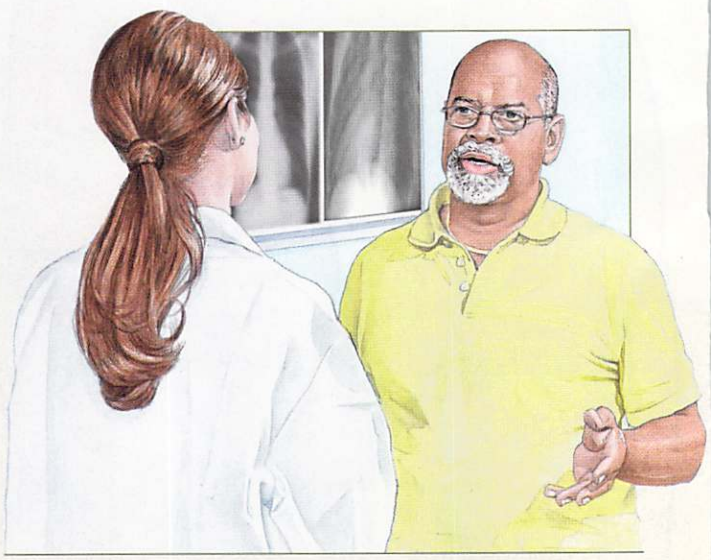
Signs of a Possible Chest or Lung Problem

Problems in the chest or lungs include infection, cancer, non-cancerous masses, smoking-related and non-smoking-related diseases. These problems may share the following:

- Coughing
- Shortness of breath
- Chest pain
- Dark or bloody sputum
- Hoarseness
- Trouble swallowing

Tests You May Have Had

You may have already had tests, such as a chest x-ray or a sputum test. If a problem was found, more tests may be needed to diagnose the problem. Depending on the tests or procedures needed, you may see more than one healthcare specialist to diagnose or treat the problem.



Quit Smoking for Good

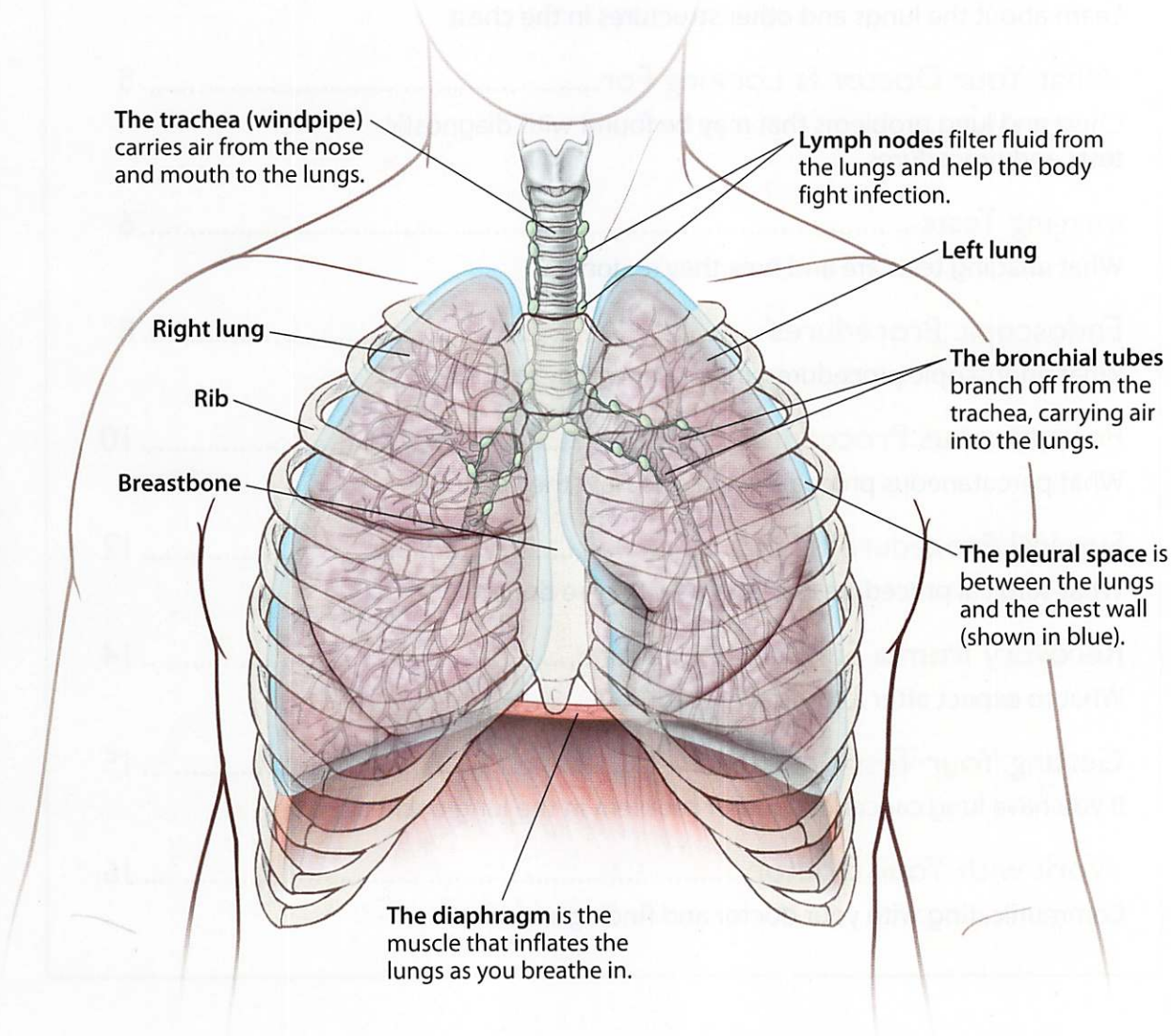
If you smoke, there is no better time to quit than right now. Smoking leads to cancer and other lung problems. So talk to your doctor about getting help. He or she can provide you with resources to help you quit smoking for good.

What You Will Learn

This booklet will help you understand the diagnostic procedures you may need. An overview of each procedure is included. If you still have questions after reading this booklet, be sure to talk to your doctor. He or she can address any concerns you have.

Anatomy of the Chest and Lungs

The space inside the chest where the lungs are found is called the **chest cavity.** The lungs take up most of the chest cavity. They are protected by the **chest wall,** which is made up of the ribs, breastbone, and muscles. The lungs are divided into sections called **lobes** (three in the right lung, two in the left). The lungs are separated from the abdomen by the **diaphragm** (breathing muscle). Air flows into and out of the lungs through **bronchial tubes** (breathing passages).



The Mediastinum

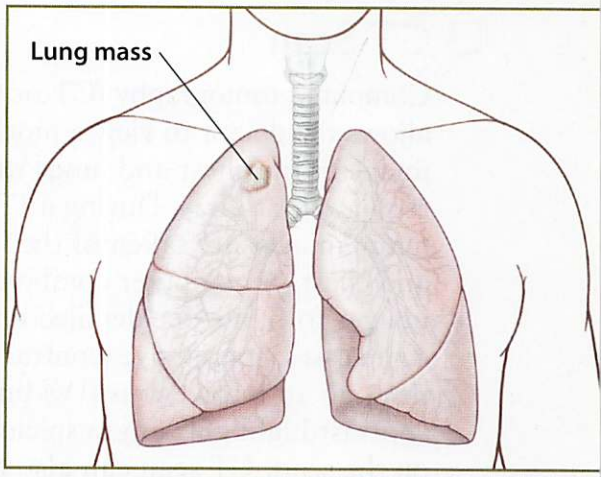
The mediastinum is the area between the two lungs. The heart, trachea, esophagus, bronchial tubes, and lymph nodes are in the mediastinum. The spine is at the back of the mediastinum and the breastbone is at the front.

What Your Doctor Is Looking For

A number of problems can affect the lungs and chest. These include masses, infections, and other diseases. The procedures mentioned in this booklet help the doctor determine what the problem is and how serious it may be. Common types of chest and lung problems are listed below.

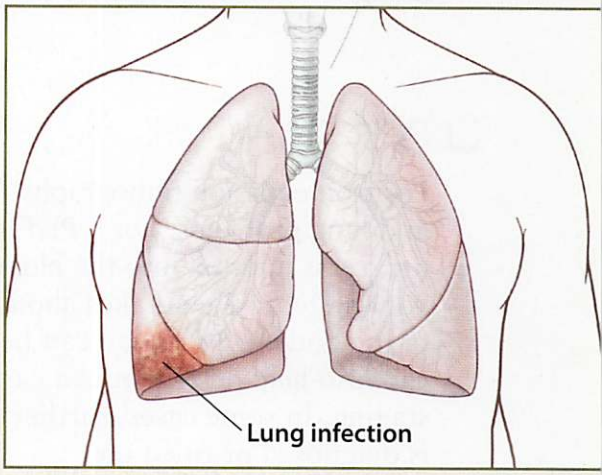
Masses

A mass is a lump of abnormal tissue. It can be **benign** (not cancerous) or **malignant** (cancerous). If a mass is found in the lung or chest, the doctor will want to take a **biopsy** (tissue sample) of it. This tissue sample helps the doctor determine if the mass is cancerous. Depending on the mass, it may need to be removed.



Infections

Infections are illnesses caused by bacteria, viruses, or fungi. Examples of lung infections include tuberculosis and pneumonia. Lung infections can irritate the airways. They can also cause fluid to build up in the lungs or chest. Some lung infections are contagious. This means they can travel from an infected person through the air to infect another person. Most lung infections can be treated with antibiotics or other medications.



Diseases

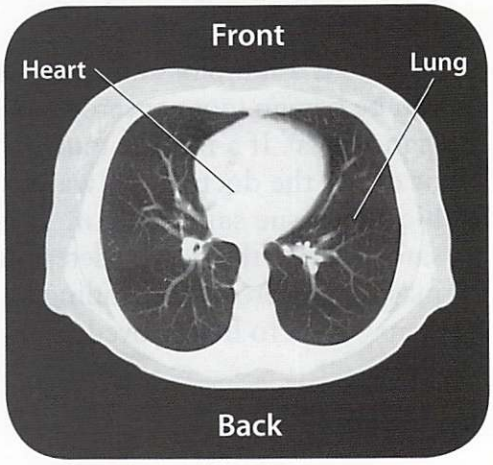
Smoking is often the cause of lung diseases. For example, smoking can lead to chronic obstructive pulmonary disease (COPD). COPD refers to a group of diseases that destroy the lungs and make it hard to breathe. COPD can include emphysema, chronic bronchitis, and chronic asthma. Certain non-smoke-related factors, such as exposure to asbestos, can also cause lung disease. Other conditions called interstitial lung diseases can lead to scarring of the lungs.

Imaging Tests

Imaging tests are often done to diagnose problems inside the body. These images (scans) help the doctor locate the problem and determine if it affects other structures. You will likely need more than one imaging test. This is so your doctor can learn more about the problem. If a mass has been found, imaging tests can also help determine if it has spread.

❑ CT Scan

Computed tomography (CT or CAT) allows the doctor to view a more detailed image of the chest and lungs than a regular chest x-ray. During a CT scan, many images are taken of the lungs and chest. A computer combines the images to create one detailed image. In some cases, special dye (contrast) is given through an intravenous (IV) line. The contrast highlights any suspicious area on the scan. CT scan can also be used along with other diagnostic procedures.



A CT scan allows the doctor to view an image of inside the chest and lungs.

❑ PET Scan

Positron emission tomography (PET) is used to diagnose chest and lung problems. For a PET scan, a safe radioactive liquid (tracer) is injected into the bloodstream. Once the tracer is in your system (which takes about 45 minutes), a scan is taken of the body. A PET scan can be helpful for detecting cancer. It can also help determine if a cancer has spread. This is called **staging.** In some cases, further testing is needed before cancer is diagnosed or ruled out.

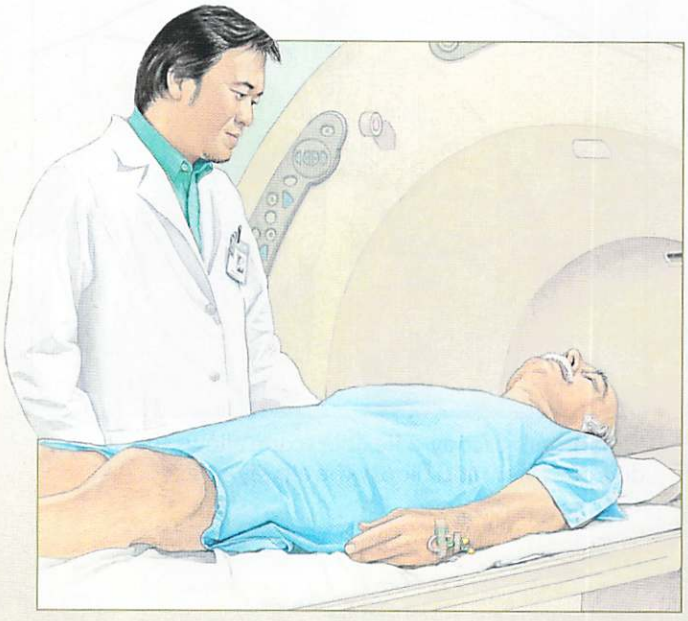
❑ MRI

Like the CT scan, magnetic resonance imaging (MRI) takes many images of the chest and lungs. Contrast may be given through an intravenous (IV) line. A scan is taken. MRI helps the doctor determine if a mass is affecting other structures in the chest, such as blood vessels.

Preparing for the Test

Before your imaging test, do the following:

- Follow your doctor's instructions about eating and drinking.
- Tell your doctor about the medications you take. You may need to stop taking certain medications before the test.
- Discuss any allergies and health problems with your doctor. Be sure to tell him or her if you are allergic to iodine or contrast or if you have kidney problems.
- Mention if you have any metal in your body. This includes loose pieces of metal or metal devices such as an aneurysm clip, a pacemaker, a prosthesis, or an intraocular lens.
- Tell your doctor if you are pregnant.



During the Test

For the test, you lie on your back inside a tubelike machine (scanner). You hear loud clicking sounds as images are taken. To ensure clear images, you must lie still. Straps may be used to help with this. Imaging tests (especially MRI) are done in a confined space. Talk to your doctor before the day of your test if you are afraid of confined spaces. You may be given medication (sedation) to help you relax during the test. If sedation is given, an adult family member or friend will need to drive you home after the test.

Risks and Complications

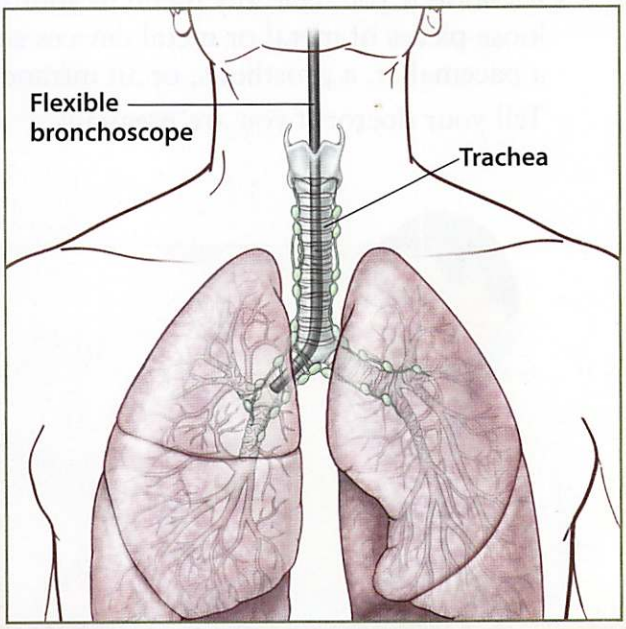
- Swelling, infection, or other problems at the IV site
- Contrast or tracer-related problems, such as allergic reaction or kidney damage
- Damage to metal devices or prostheses from large magnet in MRI scanner

Endoscopic Procedures

With endoscopic procedures, the doctor can view the airway and take a biopsy if needed. A tiny hollow tube with a light or camera (endoscope) is entered into the body through the nose or mouth. If a biopsy is needed, small instruments may be passed through the scope. These may be used to remove a small tissue sample. Small brushes may also be used to get a sample. The area may be washed in saline (saltwater) and the fluid tested for problems. Endoscopic procedures can also be used to diagnose and stage cancer.

Bronchoscopy

A bronchoscopy allows the doctor to look directly into breathing passages. This is done using a bronchoscope (a thin, flexible, hollow, lighted tube that lets the doctor see inside the lung). Biopsy instruments are passed down the middle of the scope. The sample is taken and tested for cancer and other problems.



With bronchoscopy, a flexible scope allows the doctor to view and biopsy the airway.

❑ Transbronchial Biopsy

Transbronchial biopsy (TBB) is a procedure used mainly to biopsy tissue near the airway. This is done using a bronchoscope and tiny forceps. The forceps are passed through the scope into the airway, and a sample is taken. The forceps are pulled back up through the scope. X-rays are often taken after the procedure.

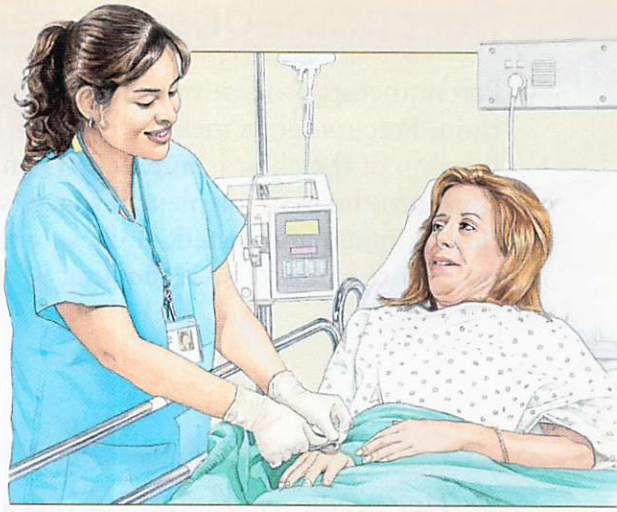
❑ Endobronchial Ultrasound

Endobronchial ultrasound (EBUS) is a type of bronchoscopy. With EBUS, the lungs and mediastinum are looked at using a flexible bronchoscope and ultrasound (images created using sound waves). Ultrasound guides the doctor and allows him or her to see through the airway walls. If a biopsy is needed, a thin needle is passed through the scope and a sample is taken. Masses both inside and outside the airway can also be biopsied with EBUS.

Preparing for the Procedure

Before your procedure, do the following:

- Follow your doctor's instructions about eating and drinking.
- Tell your doctor about the medications you take. You may need to stop taking certain medications before the procedure, especially aspirin, Coumadin, or other blood thinners.
- Discuss any allergies and health problems with your doctor.
- Tell your doctor if you are pregnant.



Before the procedure, medication to help you relax is given through an intravenous (IV) line.

During the Procedure

You receive sedation (medication to help you relax) through an intravenous (IV) line. You may also receive **local anesthesia** (numbing medication) with a needle. If so, you will feel some stinging as the needle enters the skin. Then a special spray is used to numb your throat and nose or mouth. This is to help keep you comfortable and prevent coughing during the procedure. It is important to stay calm and try to relax during the procedure.

After the Procedure

You are sent to the recovery room until the sedation wears off. This takes about 1 to 2 hours. Once you are fully awake, you can be sent home. Plan for an adult family member or friend to drive you home from the facility. Your throat will be sore for a day or two. At first, there may be a small amount of blood in your sputum. This is normal. But this should go away after the second day. Acetaminophen can help relieve pain you may have. Talk to your doctor about using it or other medications for pain.

Risks and Complications

- Bleeding
- Infection
- Injury to vocal cords
- Pneumothorax (collapsed lung)

When to Call the Doctor

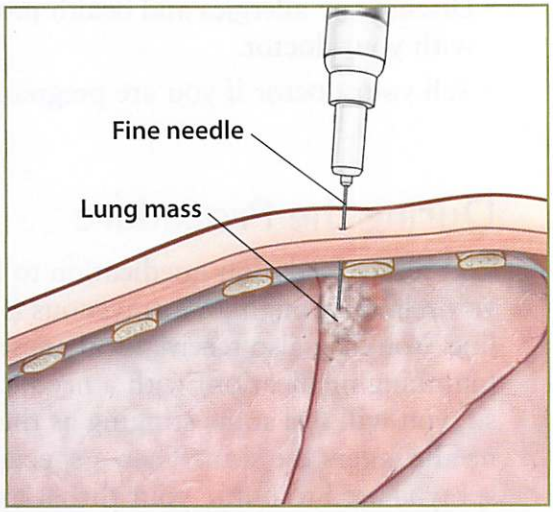
- Large amounts of blood in sputum
- Blood in sputum after two days
- Shortness of breath
- Chest pain
- Fever of 100.4°F (38°C) or higher
- Hoarseness that won't go away

Percutaneous Procedures

Percutaneous procedures allow the doctor to biopsy lung tissue or fluid. Percutaneous means "through the skin." For these procedures, the skin of the chest is numbed. Then a needle is passed through the skin into the mass or pleural space (see page 4). The sample tissue or fluid is taken and tested. A chest x-ray will likely be done after the procedure to make sure the lung is okay.

❑ Fine Needle Aspiration

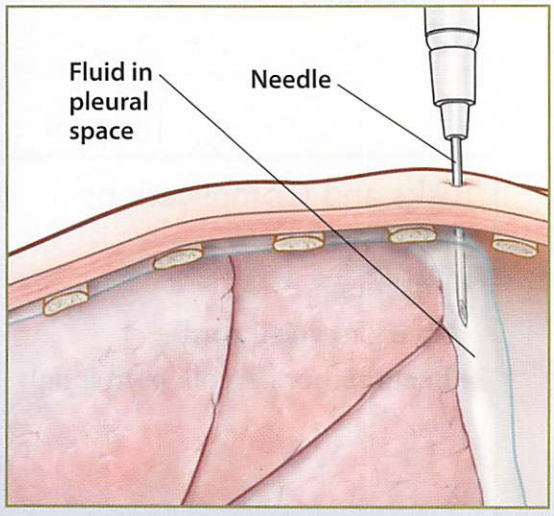
Fine needle aspiration (FNA) is a procedure used for taking a tissue sample from a mass. First, a CT scan is done. This helps the doctor locate the mass and determine where to place the needle. Then, a thin needle is inserted through the skin of the chest into the mass. Another CT scan is taken to ensure the needle is placed properly. Once the needle is in place, a small amount of tissue is drawn (aspirated) into the needle. The tissue sample is then sent for testing.



With FNA, a thin needle is used to take a tissue sample from a mass.

❑ Thoracentesis

Thoracentesis is used to drain abnormal buildup of fluid in the pleural space. Because the pleural space does not normally hold much fluid, extra fluid can make breathing difficult. For the procedure, a needle is put through the skin of the chest into the pleural space. Once inside the space, fluid is drained. Fluid is drawn into the needle and later tested for cancer and other problems.



Thoracentesis is used to remove fluid in the pleural space.

Preparing for the Procedure

Before your procedure, do the following:

- Follow your doctor's instructions about eating and drinking.
- Tell your doctor about the medications you take. You may need to stop taking certain medications before the procedure, especially aspirin, Coumadin, or other blood thinners.
- Discuss any allergies and health problems with your doctor.
- Tell your doctor if you are pregnant.

During the Procedure

You receive **local anesthesia** (numbing medication) to keep you from feeling pain. The area where the needle goes in is numbed. But you will feel some stinging as the anesthesia needle enters the skin. Medication to help you relax (sedation) may also be given through an intravenous (IV) line.

After the Procedure

You may have some pain after the procedure. You will be given medication to help ease any pain. The area where the needle was inserted is covered with an adhesive bandage. You can go home after you recover from anesthesia, usually the same day as the procedure. If you received sedation, an adult family member or friend will need to drive you home from the facility. If a tube was placed in your chest to drain fluid, you will likely stay at least 1 day in the hospital. Your doctor will tell you more.

Discharge instructions will be given to you before you go home. Follow these instructions carefully.

Risks and Complications

- Bleeding
- Infection
- Injury to other structures in the chest
- Pneumothorax (collapsed lung)

When to Call the Doctor

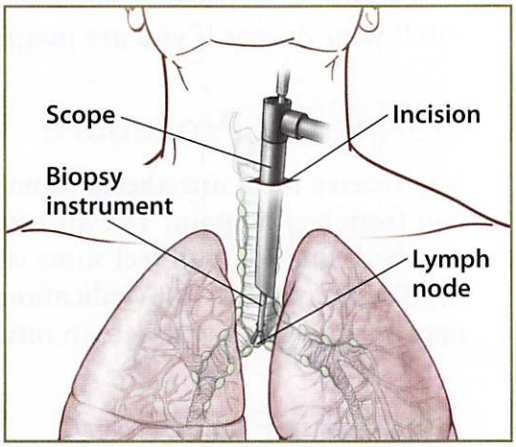
- Coughing up blood
- Shortness of breath
- Chest pain
- Fever of 100.4°F (38°C) or higher

Surgical Procedures

Surgical procedures are used to get large samples of tissue or lymph nodes from the chest or lung. These samples allow for more complete testing. In some cases, a suspicious mass or part of the lung may be removed. Surgical procedures typically require incisions and may take some time to recover from.

❑ Mediastinoscopy

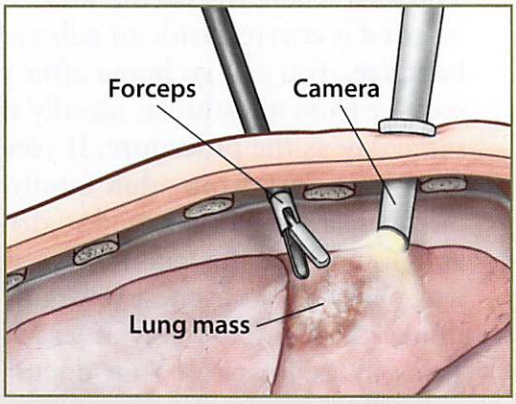
Mediastinoscopy allows the doctor to see inside the mediastinum (see page 4). Large lymph node samples can then be taken. First, an incision is made at the base of the neck. A scope is passed through the incision down into the mediastinum. Then a biopsy instrument is passed through the center of the scope. Once the lymph node sample is taken, the instrument is pulled up through the scope. The sample is then tested for cancer or other problems.



With mediastinoscopy, the scope enters the mediastinum through an incision in the neck.

❑ Video-Assisted Thoracic Surgery

Video-assisted thoracic surgery (VATS) allows the doctor to see inside the chest and take tissue samples. In some cases, a suspicious mass or area of lung is removed. VATS is done using a thoracoscope (instrument with a light, lens, and camera). First, an incision is made on the side of the chest. The scope is passed through the incision into the pleural space (see page 4). The tiny camera is passed down the scope. Images of inside the chest are sent to a monitor viewed by the doctor. Other small incisions are made for instruments to pass through and remove tissue. VATS can also help diagnose and stage cancer.



A sample of a mass can be taken using VATS. In some cases, a mass or a part of the lung is removed if cancer is found.

❑ Thoracotomy

In certain cases, open surgery is needed to diagnose and treat a lung or chest problem. If so, incisions are made and the chest is opened. This allows the doctor to see inside the chest and take a sample of lung tissue or a mass. Tissue, a mass, or part of the lung may be removed with thoracotomy.

Preparing for the Procedure

Before your procedure, do the following:

- Follow your doctor's instructions about eating and drinking.
- Tell your doctor about the medications you take. You may need to stop taking certain medications before the procedure, especially aspirin, Coumadin, or other blood thinners.
- Discuss any allergies and health problems with your doctor.
- Tell your doctor if you are pregnant.

During the Procedure

You receive **general anesthesia** (medication to make you sleep) during the procedure. Once you are asleep, incisions are made in the neck, chest, side, or back to allow the doctor to view the area or take a biopsy if needed. A tube placed in the chest during surgery drains fluid.

During thoracotomy, the doctor sees directly inside the chest.

Risks and Complications

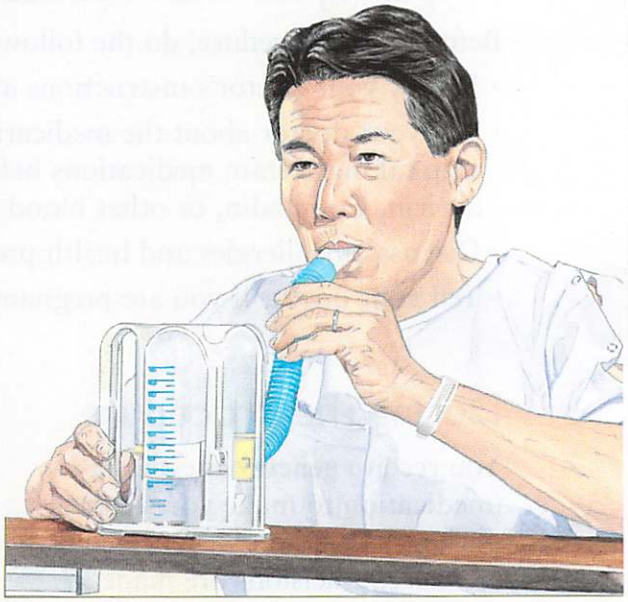
- Hoarseness
- Bleeding
- Infection
- Abnormal heart rate
- Pneumothorax (collapsed lung)
- Injury to other structures in the chest
- Respiratory failure (rare)
- Nerve damage
- Death (rare)

Recovery from a Surgical Procedure

You may feel groggy and sore after the procedure. You may need to stay in the hospital for 1 to 5 days. This is so staff can monitor your health and manage your pain. Once at home, slowly ease back into normal activities. Follow your doctor's instructions carefully. And be sure to make and keep all follow-up appointments.

In the Hospital

After your procedure, you are sent to a recovery room to recover from the anesthesia. Nurses continue to check on you. If you have pain, be sure to tell your nurses. They will give you pain medication when needed. In some cases, an IV line provides fluids and pain medication. To help keep your lungs clear, improve breathing, and prevent infection, a healthcare provider teaches you a breathing exercise called **incentive spirometry.** It should be done every hour or so. Also, depending on your condition, a nurse or other healthcare provider helps you get up and walk soon after the procedure. This is to keep your blood moving and help prevent infection.



Incentive spirometry should be done regularly to help inflate the lungs and prevent infection.

At Home

Once at home, be sure to:

- Avoid lifting more than 5 to 10 lbs.
- Limit strenuous activity.
- Take pain medication as directed.
- Return to work and drive a car only when your doctor says it's okay.
- Continue doing incentive spirometry.

When to Call the Doctor

- Redness or swelling of skin at incision sites
- Drainage at incision sites
- Uncontrolled or increased pain
- Shortness of breath
- Rapid heart rate
- Fever of 100.4°F (38°C) or higher

Getting Your Test Results

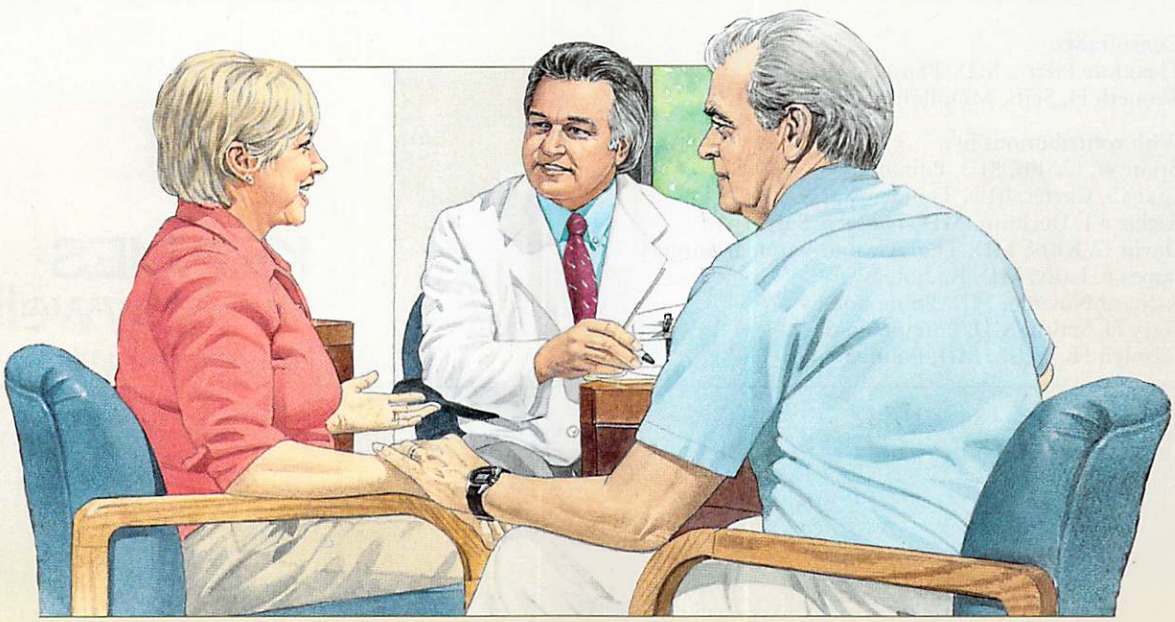
It will likely take a few days to get back your test results. During this time you may feel anxious. You're likely worried about cancer and what the next step is for your health. Your doctor will discuss the results with you in detail. He or she will explain any follow-up care or treatment you need. Be sure to share any concerns you have with your doctor.

If You Have Lung Cancer

You may be referred to one or more cancer specialists for further testing. Some of the procedures discussed in this booklet will likely be performed. They can help determine how far along the cancer is. This helps your doctor choose the best treatment plan for you. Your doctor will discuss treatment options with you.

If You Have Another Lung or Chest Problem

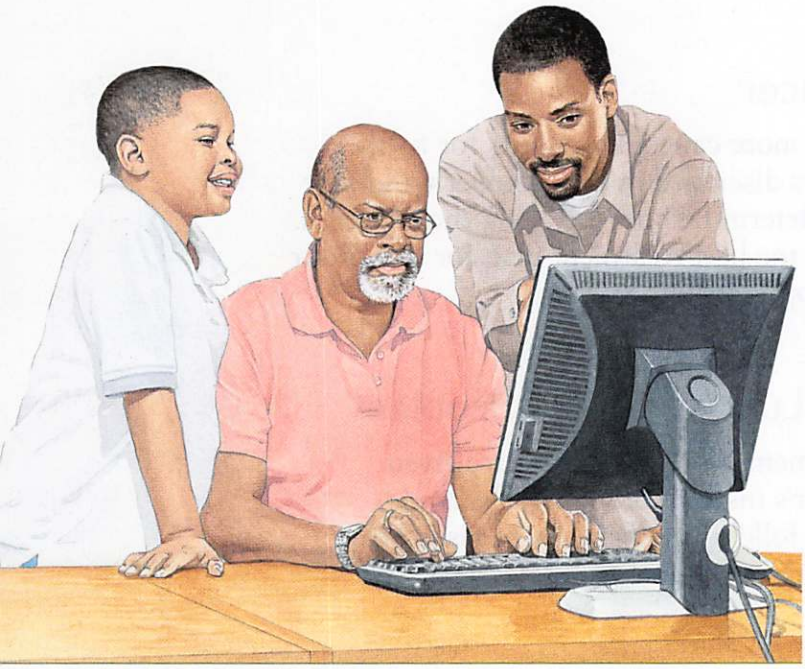
Your doctor will discuss treatment with you. If you are given medication, follow your doctor's instructions carefully. And continue to make and keep all follow-up visits. These visits help your doctor monitor your health.



Your doctor will discuss treatment options with you. Be sure to share any concerns you have with him or her.

Work with Your Doctor

If you've been diagnosed with cancer or another serious lung or chest problem, work closely with your doctor. Understand what treatment can and can't do for you. Be sure to ask any questions you may have. The resources below can offer support to you and your family.



Resources

- **American Lung Association**
  800-548-8252
  lung.org
- **National Jewish Health**
  800-222-5864
  www.nationaljewish.org
- **American Cancer Society**
  800-227-2345
  www.cancer.org
- **Lung Cancer Alliance**
  800-298-2436
  www.lungcanceralliance.org
- **CancerCare**
  800-813-4673
  www.cancercare.org

Consultants:
Theodore Pierre, MD, Thoracic Surgery
Kenneth H. Seiff, MD, Pulmonology

With contributions by:
Brian W. Carlin, MD, Pulmonology
Craig S. Carter, MD, Thoracic Surgery
Richard J. Declusin, MD, Thoracic Surgery
David G. Kitts, MD, Thoracic and Vascular Surgery
James F. Lally, MD, Radiology
Richard Novitch, MD, Pulmonology
Gary D. Smith, MD, Pulmonology
Carolyn H. Welsh, MD, Pulmonology

KRAMES staywell
www.kramesstaywell.com 800.333.3032