Needle Biopsy of the Lung

Needle biopsy of the lung uses imaging guidance to help locate a nodule or abnormality and remove a tissue sample for examination under a microscope. A biopsy may be necessary when imaging tests cannot confirm that a nodule is benign, or a nodule cannot be reached by bronchoscopy or other methods. Needle biopsy is less invasive than surgical biopsy and may not require general anesthesia.

Tell your doctor about any recent illnesses or medical conditions and whether you have any allergies, especially to anesthesia. Discuss any medications you're taking, including herbal supplements and aspirin. You may be instructed not to eat or drink for eight hours prior to your procedure, and you will be advised to stop taking aspirin or blood thinner three days beforehand. Leave jewelry at home and wear loose, comfortable clothing. You may be asked to wear a gown.

What is Needle Biopsy of the Lung?

A lung nodule is a relatively round lesion, or area of abnormal tissue located within the lung. Lung nodules are most often detected on a chest x-ray (http://www.radiologyinfo.org) and do not typically cause pain or other symptoms.

Imaging exams often detect nodules or abnormalities within the body. However, these imaging tests cannot always tell whether a nodule (http://www.radiologyinfo.org) is benign (http://www.radiologyinfo.org) (non-cancerous) or cancerous.

A needle biopsy (needle aspiration (http://www.radiologyinfo.org)) uses a hollow needle to remove a tissue sample from a suspicious area for lab analysis.

In a needle biopsy of lung nodules, imaging techniques such as computed tomography (CT), fluoroscopy, and sometimes ultrasound or MRI are often used to help guide the interventional radiologist's instruments to the site of the abnormal growth.

In a pleural biopsy, the pleural membrane, the layer of tissue that lines the pleural space between the lungs and the chest wall, is sampled.

What are some common uses of the procedure?

Although more than half of single (called solitary) nodules within the chest are determined to be benign, these lesions are considered potentially malignant until proven otherwise, usually through a needle biopsy. In general, solitary lung nodules in children who have no history of cancer are much less likely to be malignant.

When your doctor finds a nodule, they may order imaging tests to help determine if it is benign (http://www.radiologyinfo.org) (non-cancerous) or malignant (http://www.radiologyinfo.org) (cancerous). If imaging exams cannot clearly define the abnormality, a biopsy may be necessary.

When a physician orders a needle biopsy, the nodule is usually believed to be unreachable by other diagnostic techniques, such as bronchoscopy (http://www.radiologyinfo.org) .

A pleural biopsy is performed when the cause for excess fluid in the pleural space cannot be determined by thoracentesis (https://www.radiologyinfo.org/en/info/thoracentesis) . The tissue sample removed from the pleural membrane during a biopsy is further analyzed for evidence of:

- tuberculosis

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- cancer cells
- the presence of viral, fungal or a parasitic disease

How should I prepare?

Your doctor may tell you not to eat or drink for eight hours before your biopsy. However, you may take your routine medications with sips of water. If you are diabetic and take insulin, ask your doctor if you need to adjust your usual insulin dose.

Prior to a needle biopsy, tell your doctor about all the medications you take, including herbal supplements. List any allergies, especially to anesthesia. Your doctor may tell you to stop taking aspirin or a blood thinner for a time before your procedure.

Also, tell your doctor about recent illnesses and other medical conditions.

You may need to change into a gown for the procedure.

Women should always tell their doctor if there is any possibility that they are pregnant. Doctors do not perform some procedures that use image-guidance during pregnancy because radiation can be harmful to the fetus. *See the Radiation Safety (https://www.radiologyinfo.org/en/info/safety-radiation) page for more information about pregnancy and x-rays.*

You may want to have someone accompany you and drive you home afterward. This will be necessary if you receive sedation.

What does the equipment look like?

A biopsy needle is generally several inches long. The barrel is about as wide as a large paper clip. The needle is hollow so it can capture the tissue specimen.

A biopsy may use one of several types of needles. Common ones include:

- A fine needle attached to a syringe, smaller than needles typically used to draw blood.
- A core needle, also called an automatic, spring-loaded needle, which consists of an inner needle connected to a trough, or shallow receptacle, covered by a sheath and attached to a spring-loaded mechanism.
- A vacuum-assisted device (VAD), which uses a vacuum to aid in obtaining larger pieces of tissue.

Doctors perform needle biopsies with the guidance of computed tomography (CT) (http://www.radiologyinfo.org) , fluoroscopy (http://www.radiologyinfo.org) , ultrasound (http://www.radiologyinfo.org) , or MRI (http://www.radiologyinfo.org) .

CT

The CT scanner is typically a large, donut-shaped machine with a short tunnel in the center. You will lie on a narrow table that slides in and out of this short tunnel. Rotating around you, the x-ray tube and electronic x-ray detectors are located opposite each other in a ring, called a gantry. The computer workstation that processes the imaging information is in a separate control room. This is where the technologist operates the scanner and monitors your exam in direct visual contact. The technologist will be able to hear and talk to you using a speaker and microphone.

Fluoroscopy

This exam typically uses a radiographic table, one or two x-ray tubes, and a video monitor. Fluoroscopy converts x-rays into video images. Doctors use it to watch and guide procedures. The x-ray machine and a detector suspended over the exam table produce the video.

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Ultrasound

Ultrasound machines consist of a computer console, video monitor and an attached transducer (http://www.radiologyinfo.org) . The transducer is a small hand-held device that resembles a microphone. Some exams may use different transducers (with different capabilities) during a single exam. The transducer sends out inaudible, high-frequency sound waves into the body and listens for the returning echoes. The same principles apply to sonar used by boats and submarines.

The technologist applies a small amount of gel to the area under examination and places the transducer there. The gel allows sound waves to travel back and forth between the transducer and the area under examination. The ultrasound image is immediately visible on a video monitor. The computer creates the image based on the loudness (amplitude), pitch (frequency), and time it takes for the ultrasound signal to return to the transducer. It also considers what type of body structure and/or tissue the sound is traveling through.

How does the procedure work?

Using imaging guidance, the doctor inserts the needle through the skin and advances it into the lesion.

They will remove tissue samples using one of several methods.

- In a fine needle aspiration, a fine gauge needle and a syringe withdraw fluid or clusters of cells.
- In a core needle biopsy (http://www.radiologyinfo.org) , the automated mechanism moves the needle forward and fills the needle trough, or shallow receptacle, with “cores” of tissue. The outer sheath instantly moves forward to cut the tissue and keep it in the trough. This process is repeated several times.
- In a vacuum-assisted biopsy, the doctor inserts the needle into the site of abnormality. They activate the vacuum device, which pulls the tissue into the needle trough, cuts it with the sheath, and retracts it through the hollow core of the needle. The doctor may repeat this procedure several times.

How is the procedure performed?

Imaging-guided, minimally invasive procedures such as needle biopsy of lung nodules are most often performed by a specially trained interventional radiologist (http://www.radiologyinfo.org) .

Doctors usually perform needle biopsies on an outpatient basis.

A nurse or technologist (http://www.radiologyinfo.org) may insert an intravenous (http://www.radiologyinfo.org) (IV) line into a vein in your hand or arm. This will allow them to provide sedation or relaxation medication intravenously during the procedure. You may also receive a mild sedative prior to the biopsy.

The doctor will use a local anesthetic to numb the path of the needle.

If the doctor is using fluoroscopy guidance, you will lie down or stand for the procedure.

If the doctor is using CT (http://www.radiologyinfo.org) or MRI (http://www.radiologyinfo.org) guidance, you will lie down during the procedure. They will use a limited CT or MRI scan to confirm the location of the nodule and the safest approach for the targeted area. Once they confirm the nodule’s location, they will mark the entry site on the skin. The doctor will clean and disinfect the skin around the insertion site and cover it with a clean and sterile drape.

For nodules that are small and deep within the lung, or located near blood vessels, airways or nerves, CT allows better planning of the needle path for a safe biopsy.

CT-guided biopsies require patients to be able to hold still on the CT table for up to 30 minutes. Fluoroscopy and ultrasound allow real-time monitoring of the needle and are often easier for patients who have difficulty holding their breath.

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Some imaging facilities may use general anesthesia or conscious sedation in young children who are unable to hold still. In this case the parent may be permitted to stay in the exam room until their child has fallen asleep. There may be a somewhat longer wait after the exam to be sure that the child is reasonably alert.

The doctor will make a very small nick in the skin at the site where the biopsy needle will be inserted.

Using imaging guidance, the doctor will insert the needle through the skin, advance it to the site of the nodule (http://www.radiologyinfo.org) , and remove samples of tissue. They may need to collect several specimens for complete analysis.

After the sampling, the doctor will remove the needle.

Once the biopsy is complete, the doctor will apply pressure to stop any bleeding and cover the opening in the skin with a dressing. No sutures are needed.

You may be taken to an observation area for several hours. The doctor may use X-ray (http://www.radiologyinfo.org) (s) or other imaging tests to monitor for complications.

This procedure is usually completed within one hour.

For a pleural biopsy, a hollow needle is placed through the skin on your back and into the chest cavity. When the needle reaches the chest wall, up to three samples of tissue are removed.

Tissue samples will then be removed using one of two methods:

- In a fine needle aspiration, a fine gauge needle and a syringe withdraw fluid or clusters of cells.
- In a core needle biopsy, the automated mechanism is activated, moving the needle forward and filling the needle trough, or shallow receptacle, with 'cores' of pleural tissue. The outer sheath instantly moves forward to cut the tissue and keep it in the trough. This process is repeated three to six times.

A pleural biopsy is usually completed within 30 to 60 minutes.

At the end of the procedure, the needle will be removed and pressure will be applied to stop any bleeding. The opening in the skin is then covered with a dressing. No sutures are needed.

A chest x-ray (https://www.radiologyinfo.org/en/info/chestrad) may be performed after the pleural biopsy to detect any complications.

What will I experience during the procedure?

When you receive the local anesthetic to numb the skin, you will feel a slight pin prick from the needle. You may feel some pressure when the biopsy needle is inserted. The area will become numb within a short time.

You may receive a mild sedative prior to the biopsy. If needed, you may receive sedation or relaxation medication intravenously during the procedure.

You will need to remain still and not cough during the procedure. You also will need to hold your breath multiple times during the biopsy. It is important to maintain the same breath-hold each time to insure proper needle placement.

Aftercare instructions vary. However, you generally may remove your bandage one day after the procedure, and you may bathe or shower as normal.

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You should not exert yourself physically (such as heavy lifting, extensive stair climbing, sports, etc.) the night of and for one full day following your biopsy. On the second day, if you feel up to it, you may return to your normal activities. If you are considering air travel soon after the biopsy, consult your radiologist.

You may experience some soreness at the biopsy site as the local anesthesia (http://www.radiologyinfo.org) fades, but this should improve. You may also cough up a little blood, but this should be minimal. These symptoms will gradually fade over the 12 to 48 hours following the procedure.

Signs of a collapsed lung, which sometimes occurs following a needle biopsy of the chest, include shortness of breath, difficulty in catching your breath, rapid pulse (heart rate), sharp chest or shoulder pain with breathing, and/or blueness of the skin. If you experience any of these symptoms, go to the nearest Emergency Room and contact your physician as soon as possible.

Who interprets the results and how do I get them?

A pathologist (http://www.radiologyinfo.org) examines the removed specimen and makes a final diagnosis so that treatment planning can begin. Depending on the facility, the radiologist or your referring physician will disclose the results to you.

Your interventional radiologist may recommend a follow-up visit.

This visit may include a physical check-up, imaging exam(s), and blood tests. During your follow-up visit, tell your doctor if you have noticed any side effects or changes.

What are the benefits vs. risks?

Benefits

- Needle biopsy is a reliable way to obtain tissue samples that can help diagnose whether a nodule is benign (http://www.radiologyinfo.org) (non-cancerous) or malignant (http://www.radiologyinfo.org) .
- A needle biopsy is less invasive than open and closed surgical biopsies, both of which involve a larger incision in the skin and local or general anesthesia (http://www.radiologyinfo.org) .
- Generally, the procedure is not painful. Results are as accurate as when a tissue sample is removed surgically.
- Recovery time is brief, and patients can soon resume their usual activities.

Risks

- Any procedure that penetrates the skin carries a risk of infection. The chance of infection requiring antibiotic treatment appears to be less than one in 1,000.
- Bleeding.
- Coughing up blood (hemoptysis).
- An air leak from the punctured lung into the chest cavity that causes the lung to collapse (pneumothorax). If a collapsed lung should occur and is large enough to be considered harmful, a small tube may be inserted into the chest cavity to drain away the air. This tube is generally removed the next day. *See the Chest Tube Placement page (https://www.radiologyinfo.org/en/info/thoracostomy) for more information.*
- Women should always tell their doctor and x-ray technologist if they are pregnant. *See the Radiation Safety (https://www.radiologyinfo.org/en/info/safety-radiation) page for more information about pregnancy and x-rays.*
- This procedure may involve exposure to x-rays. However, radiation risk is not a major concern when compared to the benefits of the procedure. *See the Radiation Safety (https://www.radiologyinfo.org/en/info/safety-radiation) page for more information about radiation dose from interventional procedures.*

What are the limitations of Needle Biopsy of Lung Nodules?

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In a small number of cases, the tissue obtained during a biopsy may not be adequate for diagnosis.

Needle biopsy is not cost-effective for small lesions one to two millimeters in diameter. Nodules this small cannot provide enough tissue for an accurate diagnosis and are also too difficult to target.

For patients with certain conditions associated with emphysema (http://www.radiologyinfo.org) , lung cysts (http://www.radiologyinfo.org) , blood coagulation (http://www.radiologyinfo.org) disorder of any type, insufficient blood oxygenation, pulmonary hypertension (http://www.radiologyinfo.org) , and certain heart failure conditions, a needle biopsy may not be recommended. In these situations, your physician and the physician performing the biopsy will work together to help decide the best course of treatment.

Alternatives to lung biopsy usually include continued follow-up with imaging and surgical removal of the abnormality.

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