

Diagnosis for Lung Cancer

Summary

Diagnosing lung cancer involves a step-wise process rather than a single test, as medical professionals monitor various aspects to confirm the presence of cancerous cells, determine its stage, and guide treatment. The process begins with basic checks, including symptom reviews, evaluation of risk factors like smoking or family history, and initial tests like physical exams, blood tests, or chest X-rays. If results remain inconclusive, the next step involves detailed imaging tests such as CT, MRI, PET, or bone scans—to gather precise information about any abnormal growth and assess whether the cancer has spread. When imaging suggests cancer, tissue samples are collected for confirmation through biopsies, such as bronchoscopy (inserting a thin tube into the lungs), mediastinoscopy (examining the area between the lungs), or surgical methods like wedge resections. These steps collectively confirm the diagnosis and help determine how far the disease has spread, such as to lymph nodes or bones. This systematic approach enables doctors to design tailored treatment plans, ensuring effective management and improving outcomes for patients.

Diagnostic Journey: Steps and Methods

Now let's see an overview of how diagnosis happens for Lung Cancer.

Generally, the diagnosis of lung cancer will happen in a four-step process.

- **Initial visit to the doctor**
 1. If you have any lung-related symptoms, you visit a healthcare provider.[1]
 2. The healthcare provider after listening to your symptoms will ask for more details such as health history, do you smoke, etc.[2]
 3. Generally, the questions will revolve around the [risk factors](#) of lung cancer such as the direct and indirect consumption of tobacco, and your working conditions (do you work in places with radioactive gases, and chemicals).[3]
- **Physical Examination and Initial Tests**
 1. Then the healthcare provider will conduct a physical examination on you like listening to your heart and lungs.[2]
 2. The healthcare provider will get your blood tests and chest X-ray for further diagnosis.[2]
 3. [Know more about Physical Examination](#)
- **Imaging tests**

Healthcare providers often use imaging tests to get a clearer picture of the lungs and surrounding areas. These tests utilize advanced technologies to detect any abnormalities or changes in the lungs. Common imaging tests include:

1. Chest X-rays(Figure 3): This is often the first imaging test performed. It uses low doses of radiation to produce images of the lungs and chest cavity, helping identify unusual patterns or masses.[3]
2. CT (Computed Tomography) Scan: CT scans provide more detailed cross-sectional images of the lungs and chest. They can reveal finer details about the size, shape, and location of any irregularities.[3] ([Youtube Video Link](#))
3. MRI (Magnetic Resonance Imaging): Using magnetic fields and radio waves, MRIs create highly detailed images. These are especially useful for examining soft tissues and blood vessels.[3] ([Youtube Video Link](#))
4. PET (Positron Emission Tomography) Scan: Often combined with a CT scan, PET scans involve a small amount of radioactive material to detect active processes in the body, such as unusual metabolic activity.[3]([Youtube Video](#))

These imaging tests are vital for understanding the structure and function of the lungs and guiding the next steps, if needed.

- **Biopsy**

To gain more detailed information about the lung tissue, healthcare providers may perform a biopsy. This involves collecting a small sample of lung tissue, which is then examined under a microscope to study its cellular structure [2]. Biopsies provide essential insights into the health of the lung tissue and can guide further care decisions.

Several techniques may be used to perform a lung biopsy, depending on the specific situation:

1. Needle Biopsy: Guided by imaging techniques such as CT or ultrasound, a thin needle is inserted through the chest wall to collect a tissue sample.[2]
2. Bronchoscopy: A flexible tube with a camera and tools is passed through the airways to reach the lungs. This allows for sampling tissue from inside the airways.[5]
3. Mediastinoscopy: Used to collect tissue from lymph nodes in the space between the lungs (mediastinum), this procedure involves a small incision near the collarbone and the use of a specialized instrument.[5]

Each of these methods uses advanced tools and techniques to ensure accuracy and minimize discomfort. The information obtained from the biopsy helps providers make informed decisions about the most effective care options tailored to the individual's needs.

Imaging Techniques

- **CT (Computed Tomography) scan: -**

- Have you ever heard of a regular X-ray scan? Think of a CT (Computed Tomography) scan as a more advanced version of it.[3]
- While an X-ray typically captures one or two images, a CT scan takes multiple detailed images from different angles. These images are then combined to create a cross-sectional “slice” of the area being examined.[3]
- So, why is a CT scan used? In the context of lung health, it can provide much more information than a standard X-ray. For example, it can help identify tumors in the lungs with greater accuracy, showing their size, shape, and exact location. This level of detail is invaluable for healthcare providers in understanding what’s happening inside your lungs.[3]
- One of the great things about a CT scan is that it’s a painless procedure. It usually takes about 10 to 30 minutes to complete.[7]

- **MRI (Magnetic Resonance Imaging) scans: -**

- MRI scans can also be used to view detailed tumor images, just like CT scans. However, unlike CT scans, MRI scans use radio waves and strong magnets instead of X-rays to create highly detailed images.[3]
- When it comes to lung cancer, MRI is particularly useful for detecting whether the disease has spread to other areas of the body, such as the brain, spinal cord, or liver.[3]
- These images are extremely precise and allow healthcare providers to see soft tissues, nerves, and blood vessels in great detail. This level of detail helps in identifying even small changes or abnormalities that might not be visible with other imaging methods.
- Although MRI scans may take a bit longer than other imaging tests, typically lasting 30 to 60 minutes, they are non-invasive and do not involve exposure to radiation. For lung cancer patients, the information gained from an MRI can help in planning treatment, such as surgery, radiation, or systemic therapies, by providing a clear picture of how far the cancer has spread.

- **PET (Positron emission tomography) scan: -**

- The PET (Positron Emission Tomography) scan is a unique type of imaging test that helps healthcare providers understand what’s happening inside your body at a cellular level. For this scan, a slightly radioactive form of sugar called Fluoro-deoxy-glucose (FDG) is used.[3]
- Here’s how it works: FDG is injected into your bloodstream. Since cancer cells tend to absorb more sugar (glucose) than normal cells to fuel their rapid growth, the FDG is naturally drawn to areas where cancer might be present.[3]
- PET scans are particularly helpful in identifying whether lung cancer has spread to other parts of the body.

- By revealing how the body is functioning, a PET scan offers insights that go beyond just looking at the structure of tissues and organs. This makes it a vital step in planning and personalizing your care.
 - (Youtube Video)
 - https://www.youtube.com/watch?v=oySvkmezdo0&ab_channel=ANSTO
- **PET/CT scan: -**
 - As the name suggests the PET/CT scan is a way in which with the help of a special machine both PET and CT scan is carried out simultaneously.[5]
 - This lets the doctor compare areas of higher radioactivity on the PET scan with a more detailed picture on the CT scan.[3]
 - PET/CT scan are generally used to see the cancer staging and to see if the cancer has spread.[3]
 - While the PET/CT scan can be used to look at most organs in the body, however, they are not helpful to observe the brain or spinal cord.[3]
 - This scan is painless and takes 30 to 60 minutes.[7]
 - (Youtube Video)
 - https://www.youtube.com/watch?v=Bgkta3D1TfA&ab_channel=SiemensHealthineers
- **Bone Scan: -**
 - It can help us detect if cancer has spread to the bone. This technique is often used to identify areas of abnormal bone activity, such as damage or changes caused by cancer, even before they become visible on other imaging tests.
 - Procedure:
 - A small amount of low-level radioactive material is injected into your bloodstream.[3]
 - The material travels through the body and accumulates in areas with abnormal bone activity.
 - A special camera detects the radiation emitted by the material and creates detailed images of the bones.
 - (Youtube Video)
 - https://www.youtube.com/watch?v=w4XRWLy8Z5Y&ab_channel=CancerResearchUK

Once a doctor determines that there is a reason to suspect that there may be cancer (or some other condition) he or she will order further testing, which may include one or more of the following procedures [5]

- Needle Biopsy
- Bronchoscopy
- Endobronchial ultrasound(EBUS)
- Mediastinoscopy
- Video-assisted thoracoscopy(VAT)
- Wedge resection
- Percutaneous needle biopsy

These procedures help by providing more detailed information about the lungs and surrounding tissues. For instance, biopsies and needle biopsies allow for the examination of tissue under a microscope to confirm the presence of cancer cells.

Let's review each procedure one by one: -

Key Biopsy Procedures for Lung Cancer Diagnosis:

Needle Biopsy (Figure 4)

- Allows doctors to sample suspicious lung nodules detected in imaging scans.
- Provides a small tissue sample that can be examined under a microscope to determine if cells are cancerous, and if so, what type of lung cancer is present.[3]

Bronchoscopy

- Specifically useful for cancers located in the central parts of the lungs.
- Enables direct visualization of airways and allows doctors to take tissue samples from suspicious areas, helping to confirm cancer's presence and location.[5]
- (Youtube Video)
- <https://youtu.be/4WyoOXukotM?si=zQIPwm-dUjW1p94L>

Endobronchial Ultrasound (EBUS) (Figure 5)

- Helps identify cancer spread to lymph nodes in the chest.
- Allows precise sampling of lymph nodes to determine if cancer has spread beyond the original tumor site, which is crucial for accurate staging.[5]
- (Youtube Video)
- https://www.youtube.com/watch?v=ztU7kH284V4&ab_channel=YashodaHospitals-Hyderabad

Mediastinoscopy (Figure 6)

- Examines the area between the lungs where lymph nodes are located.
- Provides a comprehensive view of potential cancer spread, helping determine the extent of the disease.[5]

Video-Assisted Thoracoscopy (VAT)

- Allows direct visualization and sampling of lung nodules.
- Enables real-time examination and immediate sampling of suspicious tissue, with the ability to remove the nodule if found to be cancerous.[5]
- (Youtube Video)
- https://www.youtube.com/watch?v=KoBw_-xj68E&pp=ygU1VmlkZW8tYXNzaXN0ZWQgdGhvcmFjb3Njb3B5IGZvciBsdW5nIGNhbmNlciBhbmltYXRpb24%3D

Wedge Resection (Figure 7)

- Used when other biopsy methods are inconclusive.
- Removes a small, triangular section of suspicious tissue for definitive cancer diagnosis and potential early-stage treatment.[5]
- (Youtube Video)
- https://www.youtube.com/watch?v=hFW2Pbzy4YA&ab_channel=YouandLungCancer

Percutaneous Needle Biopsy (Figure 8)

- Obtains tissue samples from tumors that are difficult to reach by other methods.
- Provides a minimally invasive way to confirm the presence of cancer and determine its characteristics.[7]

References: -

- [1]. <https://www.mayoclinic.org/diseases-conditions/lung-cancer/diagnosis-treatment/drc-20374627>
- [2]. <https://my.clevelandclinic.org/health/diseases/4375-lung-cancer>
- [3]. <https://www.cancer.org/cancer/types/lung-cancer/detection-diagnosis-staging/how-diagnosed.html>
- [4]. <https://www.lung.org/lung-health-diseases/lung-disease-lookup/lung-cancer/symptoms-diagnosis/how-is-lung-cancer-diagnosed>
- [5]. <https://www.hopkinsmedicine.org/health/conditions-and-diseases/lung-cancer/lung-cancer-diagnosis>
- [6]. <https://pmc.ncbi.nlm.nih.gov/articles/PMC8395394/#sec6-ijms-22-08661>
- [7]. <https://www.nhs.uk/conditions/lung-cancer/diagnosis/>

Illustrations

Figure 1. **Mediastinum**

<https://my.clevelandclinic.org/health/diseases/13792-mediastinal-tumor>

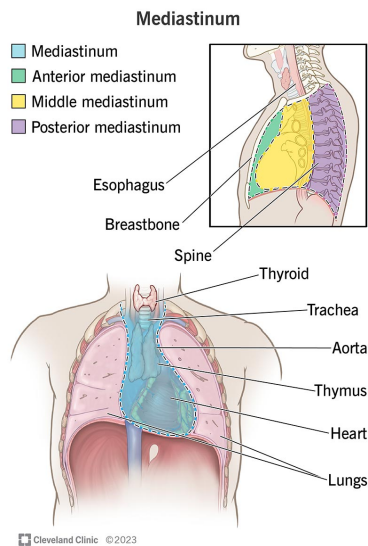


Figure 2. **Bronchoscopy**

<https://www.mayoclinic.org/diseases-conditions/lung-cancer/diagnosis-treatment/drc-20374627>

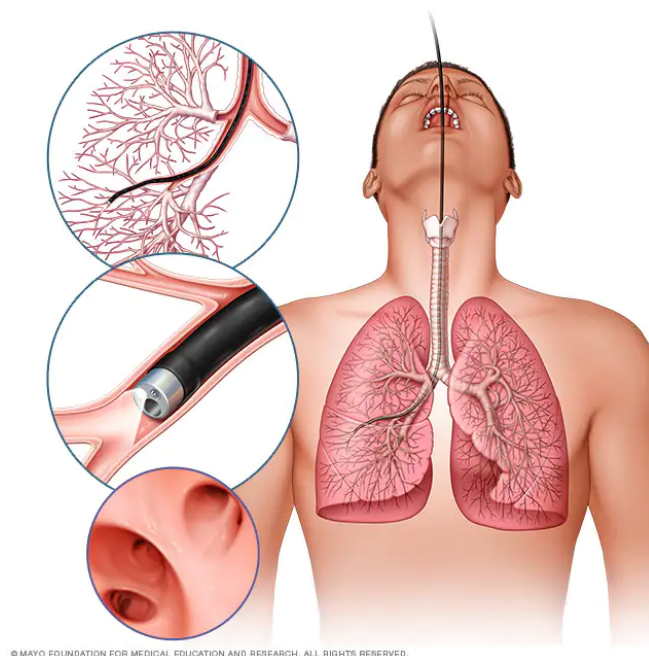


Figure 3. Chest X-ray

<https://my.clevelandclinic.org/health/diagnostics/10228-chest-x-ray>

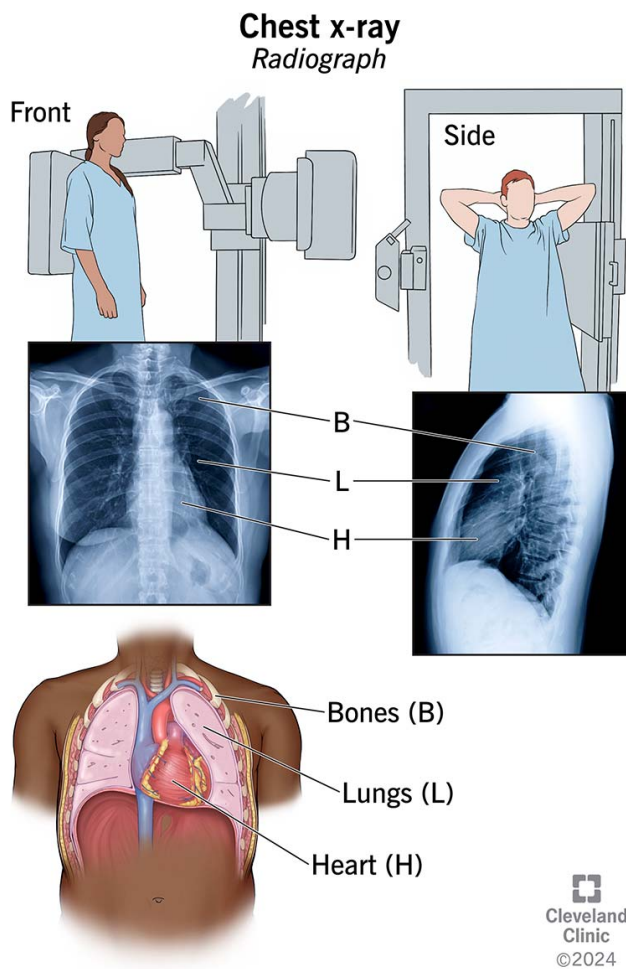


Figure 4. Needle Biopsy

<https://www.saintlukeskc.org/health-library/ct-guided-lung-biopsy>

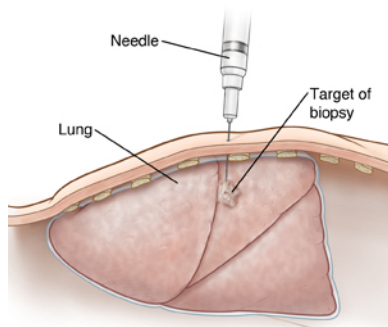


Figure 5. EBUS

<https://www.yashodahealthcare.com/blogs/ebus-bronchoscopy/>

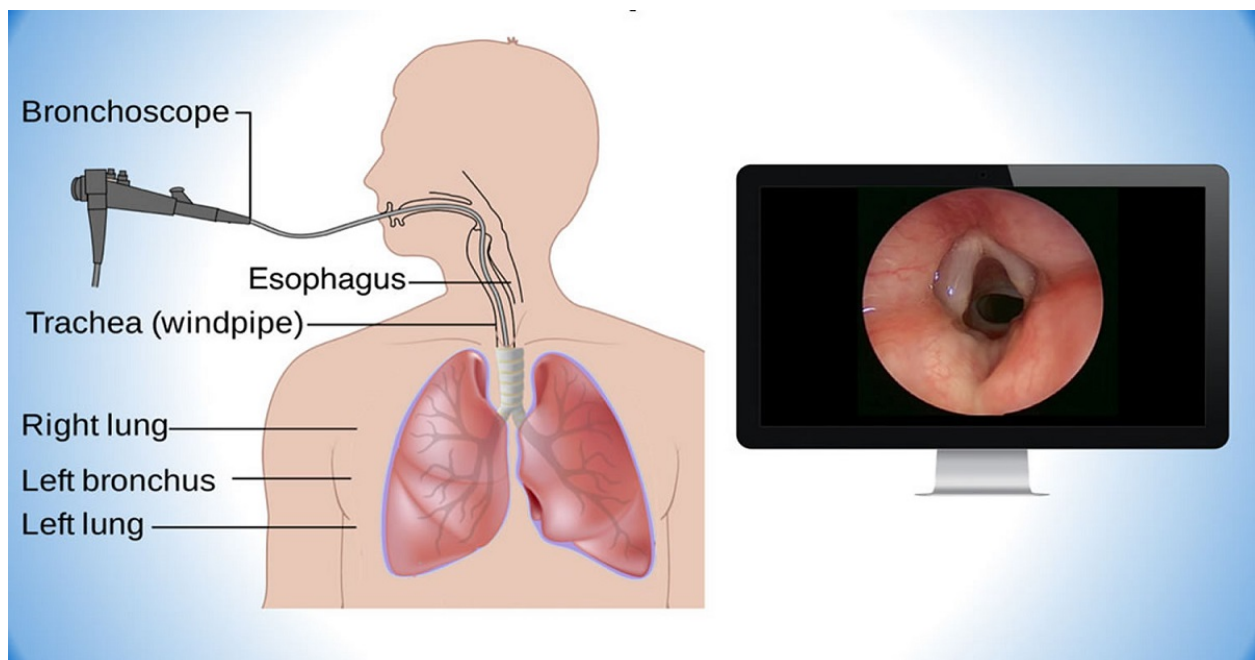


Figure 6. Mediastinoscopy

<https://visualsonline.cancer.gov/details.cfm?imageid=7242>

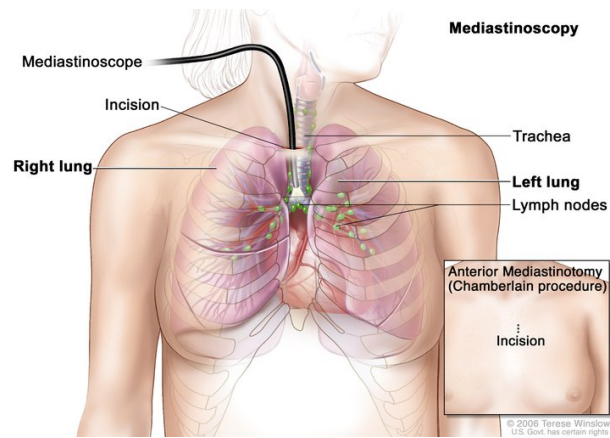


Figure 7. Wedge Resection

<https://visualsonline.cancer.gov/details.cfm?imageid=7243>

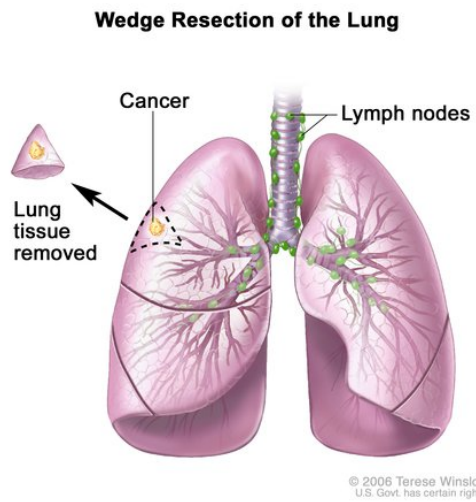


Figure 8.

<https://www.asbestos.com/mesothelioma/biopsy/>

Percutaneous Needle Core Biopsy Lung

