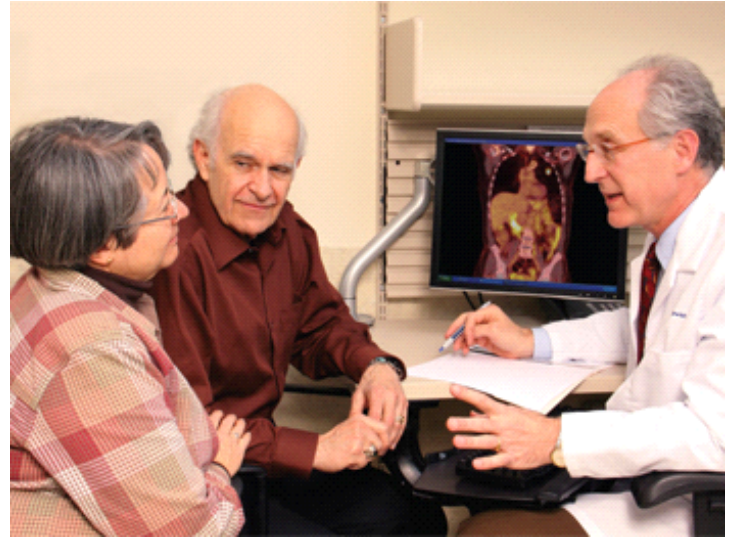


Non-Small Cell Lung Cancer

What Is Lung Cancer?

Your lungs are made up of millions of individual cells. These cells have a life cycle of growth, duplication and death. New duplicated cells replace older dying or damaged cells. This is a fine-tuned mechanism throughout your life. This mechanism can break down, causing lung cancer. New lung cells can be made when they aren't needed, or older lung cells don't die when they should, leading to unregulated growth of lung cells. This out-of-control growth is lung cancer.



What Causes Lung Cancer?

Lung cancer is caused by a variety of exposures to things in your environment over time, as well as the genetics of your family. Ongoing exposure to these environmental factors increases your risk of developing lung cancer. Exposures that are associated with developing lung cancer include:

- **Smoking** is the most common cause of lung cancer. The longer people smoke and the more often they smoke, the higher the chance they will develop lung cancer. Your doctor quantifies your smoking exposure by calculating the number of years you have smoked multiplied by the average number of packs of cigarettes you smoked per day to come up with "pack-years." The risk of developing lung cancer is lowered after giving up smoking, but never completely goes away.
- **Secondhand smoke:** Secondhand exposure to smoke or being around smoke increases the risk of lung cancer.
- **Radon gas**, often in the home or mining work: Radon is a radioactive, colorless, odorless gas that comes from uranium found in granite rock. Radon is more common in certain parts of the country.
- **Asbestos** is a fiber that occurs naturally. It is mined and milled and in the past was used in many applications and industries including in construction, ship building, and the automotive industry
- **Family history** of lung cancer in your immediate family, which suggests a genetic cause.

- **Personal history** of a previous lung cancer.
- **Radiation therapy** for another type of cancer, especially if the radiation therapy is in the chest area.
- **Age** over 65 years old.

Being exposed to, or having, several of these factors further increases your chance of developing lung cancer. If a person who smokes is also exposed to asbestos, then the risk of developing lung cancer is increased further than if that person had only been exposed to one lung cancer risk factor.

Not everyone exposed to these agents develops lung cancer. It is a complex interplay that we don't completely understand, but it depends on the type of exposure, how long you were exposed and your body's response to these agents.

What Are Signs and Symptoms of Lung Cancer?

Signs and symptoms of lung cancer are few, but may include those similar to a chest cold or a mild flu. Early during the development of a lung cancer, there may be no symptoms, as the cancer is small and does not interfere with lung function.

If symptoms of lung cancer are present, they may include:

- Coughing that doesn't go away or gets worse — Lung cancers can irritate the lung and bronchi (main airways in the lungs), leading to coughing.
- Shortness of breath or dyspnea — This can be caused by a variety of problems due to lung cancer. Lung cancers growing in a bronchus (airway in the lungs) may block breathing to a part of the lung. Lung cancers growing in the lung may get large enough compress the lung and cause breathing problems. Fluid leaking from the tumor may collect around the lung, compress it and decrease lung capacity.
- Coughing up blood — Lung cancers have a lot of blood vessels. Irritation of these blood vessels may cause them to bleed, leading to coughing up blood.
- Chest pain — Lung cancers that grow out to the edge of the lung and rub against the inside of the chest wall may cause pain.
- Fatigue
- Weight loss

These are common signs and symptoms of a variety of lung diseases. With symptoms, testing is done to make a diagnosis of lung cancer and determine the best treatment plan.

How Is Lung Cancer Diagnosed?

The evaluation and diagnosis of lung cancer often includes:

- A complete history and physical exam
- A chest X-ray
- A chest CT scan (a specialized X-ray, which produces detailed pictures of the lungs)

- Breathing tests, called pulmonary function tests. These detect emphysema and asthma as well as their impact on airflow out of the lungs.
- A lung biopsy. A biopsy is important to obtain a sample to view under a microscope. A pathologist can determine if the cells are normal, abnormal or lung cancer cells.
- A PET scan and brain scan may be needed to examine the entire body and determine the extent of a lung cancer or its stage.
- Brain imaging with either MRI or CT

Lung Biopsy

If the chest X-ray or chest CT scan identifies an abnormality in the lung that is suspicious for lung cancer, the next step is often a biopsy. The abnormality found on the X-rays may be referred to as a spot or nodule. Nodules in the lung are common. They can be seen in one out of every four lung CT scans. Most lung nodules (more than nine out of 10) are not cancerous. Benign or noncancerous nodules can be caused by previous infections or old surgery scars. A lung nodule may be considered suspicious for lung cancer based on its size, shape and appearance on a chest X-ray or CT scan, as well as any risk factors you may have for lung cancer, such as your age, smoking history, family history of lung cancer, etc. The lung nodule will need to be biopsied to determine if it is a lung cancer. A biopsy is a procedure to get a sample from the lung nodule to view under a microscope. A biopsy of the lung nodule can be done by bronchoscopy, by placing a needle through the chest wall and into the nodule under radiographic guidance (CT-Guided Fine Needle Aspirate), or through a small operation (Video Assisted Thoracoscopic Surgery or VATS).

- **Bronchoscopy:** Getting a biopsy using bronchoscopy is an outpatient procedure. It is not an operation and is done without any cutting, sutures or needles. During a bronchoscopy, you will be sedated, and your nose, mouth and throat will be numbed. A small tube (bronchoscope) with an even smaller video camera on the end will be placed through the nose and into the lungs. The bronchoscope will be guided to the lung abnormality based on its location on the chest X-ray or CT and, often, using a computer-assisted guidance system, by the doctor operating the instrument. A biopsy of the lung nodule is taken and examined by a pathologist (a doctor who identifies diseases by studying cells and tissue under a microscope), using special techniques to be certain of the diagnosis.
- **CT-Guided Fine Needle Aspirate:** Getting a biopsy using a fine needle aspirate is also an outpatient procedure, and not an operation. During a fine needle aspirate you may be sedated. You will be placed in a chest CT machine, and a thin needle will be inserted into the skin, which is numbed. The doctor guides the needle to the lung nodule by observing repeated CT scans during the procedure. The needle is advanced into the lung nodule, and then an aspirate or biopsy is taken. The sample is examined by the pathologist as described above.
- **VATS:** Occasionally a surgical biopsy of the lung nodule must be performed. This is typically done using Video Assisted Thoracoscopic Surgery (VATS). This is an operation performed in an operating room as an inpatient (staying overnight) in the hospital. A small incision is made between the ribs; the lung is deflated; and a small camera is inserted into the chest cavity. When the area or nodule to be biopsied is identified, small surgical instruments are inserted through two to three other small incisions (less than an inch) between the ribs, and the nodule is biopsied or removed. The instruments are removed; the lung is reinflated; and any incisions are sutured shut.

If you receive a diagnosis of lung cancer, you will be referred to a cancer specialist, called an

oncologist. The oncologist will recommend a combination of treatments, based on the type and stage of your lung cancer.

Are There Different Lung Cancer Types?

There are several types of lung cancer. The major groups are non-small cell lung cancers, small cell lung cancers and carcinoid lung tumors.

- **Non-small Cell Lung Cancer:** Non-small cell lung cancer is the most common type of lung cancer. There are three main subtypes that make up the non-small cell cancer group: squamous cell carcinomas, adenocarcinomas and large cell undifferentiated carcinomas. What the cancer looks like under the microscope allows the pathologist to assign the lung cancer to a particular type. Knowing these subtypes of cancer is becoming more important as treatment is becoming more targeted toward specific tumor types.
- **Small Cell Lung Cancer:** Small cell lung cancer makes up about 15 percent of all lung cancers. It is a faster growing type of lung cancer and treated differently than non-small cell lung cancers.
- **Carcinoid Lung Tumors:** Carcinoid lung tumors are a rare, slow-growing form of lung cancer.

Your doctor will discuss with you the type of lung cancer found. This is important because lung cancer treatment is based on the type and possibly the subtype of lung cancer you have.

This Med Facts will focus on non-small cell lung cancer.

Once Diagnosed, How Is Lung Cancer Treated?

Lung cancer treatment is guided by the lung cancer's location and size, and if it has spread anywhere.

Combining all this information provides what is called the lung cancer stage. Staging is different between non-small cell lung cancer and small cell lung cancer.

Non-Small Cell Lung Cancer Staging

Non-Small Cell Lung Cancer stages are numbered from 0 to IV. In general, the lower the number, the smaller the cancer and the less it has spread. The higher the number, the larger the cancer and the more it has spread. The table below describes the lung cancer stages for non-small cell cancer.

Stages of Non-Small Cell Cancer (Simplified Version)	
Stage 0	Cancer cells are identified, but do not invade the lung. These cells may invade the lung in the future.
Stage IA 1-3	A tumor is in the lung only and less than 1 ¼ inches in size
Stage IB	A tumor is in the lung and is more than 1 ¼ inches but no more than 2 inches. OR
	The tumor is less than 2 inches, but affects the main airway, causes partial lung collapse or involves the lung lining.
	The tumor is between 1 ¼ and 2 inches.

Stage IIA	OR The tumor is any size up to 2 inches and affects the main airway, causes partial lung collapse or involves the lung lining.
Stage IIB	Cancer has spread to the lymph nodes in the lung on the same side of the chest as the tumor, and the tumor is less than 2 inches in size. OR The tumor is greater than 2 inches but no more than 3 inches and invades the chest wall, heart, spine or diaphragm.
Stage IIIA	The tumor is up to 2 inches in size and has spread to the lymph nodes between the lungs in the center of the chest. OR The tumor is up to 3 inches in size and invades the chest wall, heart, diaphragm, spine and lymph nodes in the lung. OR A metastasis has developed separately from the main cancer, in the same part of the lung, with or without lymph node involvement in the lung.
Stage IIIB	The tumor up to 2 inches in size and has spread to the lymph nodes above the collarbone or is on the opposite side of the chest. OR The tumor is any size and invades the chest wall, heart, spine or diaphragm, and involves lymph nodes between the lungs. OR A metastasis has developed in the lung separately from the main cancer, and involves lymph nodes between the lungs.
Stage IIIC	The tumor is over 2 inches in size and has spread to the lymph nodes above the collarbone or is on the opposite side of the chest. OR The tumor is any size and invades the chest wall, heart, spine or diaphragm, and has spread to the lymph nodes above the collarbone or is on the opposite side of the chest OR A metastasis has developed in the lung separately from the main cancer, and has spread to the lymph nodes above the collarbone or is on the opposite side of the chest
Stage IV	Cancer has spread to the other lung or other organs.

Modified from National Cancer Institute Non-Small Cell Cancer Treatment, 3/2010

How is lung cancer treated?

Treatment

The Lung Cancer team, which consists of oncologists, pulmonologists, radiation oncologists, lung surgeons, nurses and radiologists will work closely to determine the best treatment plan for you, and bring in other specialist as needed to get you optimal care. Other specialists may include a dietician, physical therapist, social worker and/or psychologist.

Lung cancer treatment options may include surgery, radiation, chemotherapy, immunotherapy or combinations of these approaches. In treating lung cancer, three regions of cancer treatment or

cancer control are considered: local (in one spot), regional (in a wider region defined by anatomy) and systemic (or whole body).

- **Local treatment** is considered when the lung cancer is in the chest cavity and can be controlled with very localized therapy such, as surgery or radiation therapy.
- **Regional control** is considered when the lung cancer has spread outside of the lung to lymph nodes or other places within the chest. The cancer can no longer be controlled with just local therapy, and regional treatment is used, which may include radiation therapy, chemotherapy and occasionally surgery.
- **Systemic control** is considered when the lung cancer has spread to other parts of the body outside the chest, and therapy that goes throughout the entire body is needed. Chemotherapy and/or immunotherapy is often the treatment of choice for systemic control. Occasionally, radiation therapy is also used as treatment of selected areas such as the brain.

Surgery

There are different types of surgery used in the treatment of lung cancer. Your doctor may recommend one of the following procedures in the treatment of your lung cancer.

- Segmentectomy is the removal of the tumor and a small part of the lung.
- Lobectomy is the removal of the tumor and a larger part of the lung, called a lobe.
- Pneumonectomy is removal of the tumor and an entire lung.

This surgery may be done by video-assisted thoracoscopic surgery (VATS). Using this procedure, several small incisions are made to remove a portion of a lung. Occasionally the operation cannot be done by VATS, and a larger incision has to be made in the chest to remove the tumor and lung. This is called a thoracotomy.

Radiation Therapy

Radiation therapy is used to kill lung cancer cells and keep lung cancer cells from growing where the radiation is provided. Radiation therapy is aimed from a machine outside the body at the tumor. This is performed by a radiation oncologist. The radiation therapy dose is calculated so you receive radiation aimed at the tumor while sparing normal tissue. Radiation therapy can also be provided internally with a radiation device placed inside the body next to the tumor. This is not used often for lung cancer.

Radiation therapy may also affect normal cells near the radiation area. This may lead to side effects. Side effects of radiation for lung cancer may include:

- Skin redness like a sunburn
- Dryness and irritation of the skin where the radiation is given
- General fatigue
- Trouble swallowing (if the radiation is given near the esophagus)
- Damage to normal lung tissue, resulting in scarring

Talk with your radiation oncologist about helpful techniques to treat the side effects.

Chemotherapy

Chemotherapy is the use of medications to kill the cancer cells.

Chemotherapy is typically given through a vein in an IV (intravenous) catheter, through a large catheter, called a port, which is implanted in the chest. This will prevent having a needle inserted in a vein each time medicine is needed. Chemotherapy is less irritating when it is placed in a large vein through a port. Some chemotherapy can be given in pill form. Chemotherapy moves throughout the body to kill cancer cells. This is systemic treatment.

Cycles

Lung cancer chemotherapy is often given in “cycles” that last approximately three weeks, although this may vary, depending on the type of chemotherapy used. Chemotherapy is often given several times during a cycle. Then your body is given a chance to rest before another cycle is started. The number of cycles may vary, but often four to six cycles of chemotherapy are given.

Chemotherapy medications may be given together to treat lung cancer. The best combination of medications is selected by your oncologist to treat your lung cancer.

Chemotherapy also can affect normal cells. Normal cells that duplicate quickly are most often affected, and this is often the cause of side effects.

Side effects of chemotherapy for lung cancer may include:

- Hair loss (alopecia)
- Sores in the mouth (mucositis)
- Loss of appetite
- Nausea and vomiting
- Increased chance of infection
- Bruising easily
- Bleeding
- Anemia/low blood count (cytopenia)
- General fatigue
- Shortness of breath (dyspnea)

Talk with your health care provider about helpful techniques to treat the side effects. Your lung cancer chemotherapy may need to be adjusted based on your side effects and your response to the chemotherapy.

Targeted Therapy

Advances in chemotherapy include targeted therapy. Mutations in certain genes have been found to cause certain lung cancers. Medication targeted toward these mutations affect only the cancer cells that have the mutations, without harming normal cells that don't have the mutated genes. This is an exciting new area of lung cancer treatment, but it cannot be used in everyone — only in particular types of lung cancer. Targeted therapy may be used alone. In order to determine if your cancer might respond to this targeted therapy, a specimen of your lung cancer may be sent for genetic analysis, or mutational profiling. The specimen will be analyzed to determine whether your cancer has any of the mutant genes that might respond to targeted therapy.

Immunotherapy

A new form of lung cancer treatment is called immunotherapy. These are drugs given

intravenously every two to three weeks to stimulate your own white blood cells to attack the tumor.

The current immunotherapy drugs are called immune checkpoint inhibitors. Immune checkpoints are pathways in the immune system that help the immune system tell the difference between healthy and abnormal cells (such as cancer cells). Sometimes cancer cells can imitate healthy cells and avoid being recognized and killed by the immune system. Immune checkpoint inhibitors stimulate your immune system to kill cancer cells. These medications act very differently from chemotherapy. While chemotherapy attacks and kills cancer cells, immunotherapy activates your own white blood cells (lymphocytes) to find and kill the cancer.

These medicines are given IV (intravenously) over 30-60 minutes. During an immune checkpoint Inhibitor infusion, you will be monitored for any reaction to the medication that might cause wheezing, itching, rash, dizziness, increased shortness of breath, fever, chills or shaking.

Due to the increase in immune cell function, these drugs can cause side effects that are different from those seen with chemotherapy, and could be:

- Fatigue
- Diarrhea
- Shortness of breath
- Itching, rash
- Nausea

Less common side effects could include:

- Decreased appetite
- Constipation
- Increased serum creatinine
- Increased liver enzymes
- Electrolyte imbalances
- Joint pain, muscle pain, pain in extremities, back pain
- Vomiting
- Weakness
- Fever, chills
- Swelling

When the immune system is stimulated to attack cancer cells, healthy cells of different organ systems can also be attacked. This is known as an immune mediated adverse reaction. You will be monitored by your oncologist for any such event. Symptoms related to the area of the body that can be affected will be assessed.

The following are symptoms of which you **NEED** to notify your oncologist:

- Diarrhea
- Nausea (interfering with the ability to eat and unrelieved by medication)
- Vomiting (more than four to five times in a 24-hour period)
- Inability to eat or drink for 24 hours or signs of dehydration (thirst, tiredness, dry mouth, dizziness, decrease in the amount of urine, dark urine)
- Sudden changes in eyesight

- Urine that turns dark or tea-colored or has blood in it
- Blistering rash
- Stools that are light colored, bloody, dark or tarry/sticky
- Inability to pass urine or a change in the amount of urine passed
- Sudden onset of shortness of breath, accompanied by cough and/or fever
- Skin or the whites of your eyes turning yellow
- Stomach pain or upset stomach
- Very bad muscle pain, joint pain or weakness
- Big weight gain or swelling in your arms or legs.

The following are symptoms of which you need to notify your oncologist at you next clinic visit:

- Sores in the mouth
- Decreased appetite
- Itching, rash
- Bleeding or bruising more easily than normal
- Cough with or without fever
- Signs of trouble with your thyroid or pituitary gland (change in mood, change in weight, constipation, dizziness, deeper voice, feeling cold, hair loss, fainting, headache or loss of sex drive).

Your oncologist will consider many factors to determine the best lung cancer treatment plan for you. These factors include your age, the specific type of cancer you have, the stage of cancer, perhaps a tumor genetic analysis, your general health and your history of any past treatments given for cancer. In addition to considering your lung cancer treatment options, supportive care of symptoms is also important.

Treatment summary

Your oncologist will consider many factors to determine the best treatment plan for you. These factors include your age, the specific type of cancer you have, the stage of cancer, your general health and your history of any past treatments given for cancer. In addition to your cancer treatment supportive care of symptoms is also important. Members of your treatment team will be involved in aspects of supportive care.

Living with lung cancer - Supportive care

Living with lung cancer is a unique and special challenge that you and your family must deal with on a daily basis. But the more you know about lung cancer, the better suited you are in managing your disease. As you take control, your quality of life will improve. Be sure to talk with your health care provider if you have questions or concerns about your plan. Write down any questions you have and ask your health care provider at your next appointment. People often have concerns about a number of common symptoms; pain and shortness of breath or dyspnea.

Managing pain

Pain can occur with lung cancer, but pain can be relieved and controlled. Pain can occur from the cancer, procedures, surgery and the general muscle aches, headaches, soreness everyone can get. If you are experiencing pain it is important to discuss your pain with your health care provider. When you talk with him or her describe what the pain feels like, what makes the pain worse and what seems to

help the pain. This is very helpful in determining the best treatment or combination of treatments for your pain. Medications may be prescribed to control the pain. Medication may be prescribed on a regular basis to control the pain or as needed with the first feeling of pain. Medication tends to be more effective when given at the first sign of pain, rather than waiting until the pain is worse. In addition to medications, other treatments may be helpful. Relaxation techniques, biofeedback, physical therapy, hot and/or cold packs, exercise and massage can all be helpful. In addition support from family, friends and a support group can be helpful.

Managing shortness of breath

Shortness of breath is a common symptom of lung cancer and lung disease. Breathing techniques and oxygen therapy can be helpful.

Breathing techniques – Breathing techniques can help you move air in and out of your lungs more easily. This will help your shortness of breath. It will also help you think of your breathing and relax. Pursed lip breathing is one breathing technique. To do pursed lip breathing:

- Breathe in slowly through your nose with your mouth closed. Try to breathe in a normal amount of air.
- Purse your lips lightly, like you are going to whistle.
- Exhale slowly through your mouth. Breathe out for twice as long as your breathe in.

Oxygen therapy - If your lungs can not transfer enough oxygen into the blood, oxygen therapy may be needed. Oxygen therapy is used to assure that there is enough oxygen in the blood to provide for the body's needs during sleep, rest and activity. Oxygen therapy can also help you feel less short of breath and you will be able to be more active. If you need oxygen therapy your health care provider will prescribe oxygen therapy. You will be instructed in how to use oxygen therapy correctly.

Managing fluid around the lungs -Fluid may collect between the chest wall and the lung (pleural space). This can cause shortness of breath or trouble breathing. This fluid can be drained to relieve shortness of breath using a needle placed through the chest wall and into the fluid collection. Sometimes for large fluid collections, or if the fluid returns, a catheter is placed to drain the fluid, and it may be left in place to remove fluid as it collects in the pleural space.

What about a healthy lifestyle?

A healthy lifestyle is important for everyone. Here are some tips to consider:

- Exercise regularly as directed by your health care provider. You may feel general fatigue due to the lung cancer and treatment. Your exercise program can be modified based on how you are feeling. Ask your health care provider about being seen in the pulmonary rehabilitation program at National Jewish Health. A physical therapist can be very helpful when planning an exercise program, learning breathing techniques and addressing non-medication pain management strategies.
- Eat a well-balanced diet and drink plenty of fluid. Ask your health care provider about being seen by a registered dietician at National Jewish Health. A registered dietician can be helpful when thinking of strategies to address the nutrition issues related to lung cancer and treatment.
- Give up smoking and avoid exposure to passive smoke. Ask your health care provider for

techniques to help you give up smoking.

- Get a flu shot every year in the fall. Get a pneumococcal vaccine every 5 to 6 years as recommended by your health care provider.
- Visit our website for more information about support groups, clinical trials and lifestyle information.

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