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MEDfacts

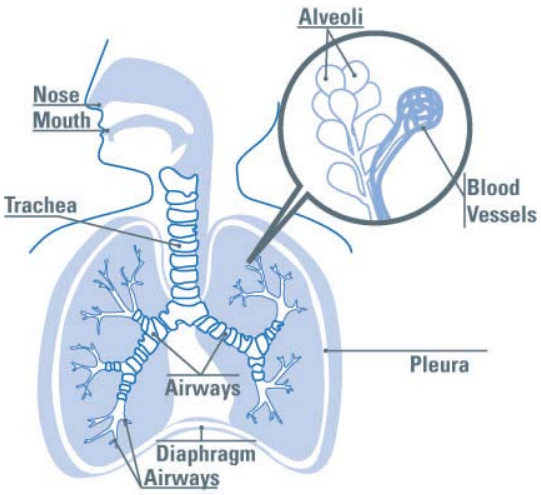
An Educational Health Series From National Jewish Health®

Non-Small Cell Lung Cancer

About Your Lungs and Lung Cancer

How do your lungs work?

To understand lung cancer it is helpful to understand your lungs. Your lungs put oxygen into the blood, which the heart then pumps throughout the body. When blood returns to the lungs, they remove carbon dioxide, a gas your body does not need, from the blood, put oxygen back into the blood, and the process starts over again.



When you inhale, fresh air enters through the nose and mouth and travels to the lungs via the trachea (windpipe) as shown in the figure. The trachea splits into a right and left main bronchi in the chest allowing the air to travel to the right and left lung. Once in the lungs, the air moves through a series of smaller and smaller tubes called airways. These smaller airways are also call bronchioles. At the end of the airways are grape-like sacs, called alveoli. It is here, at the alveoli, where oxygen moves from the alveoli into the blood and carbon dioxide moves form the blood to the alveoli. The blood is pumped out delivering oxygen to all the cells of the body, and the carbon dioxide is exhaled.

Each lung is surrounded by a thin lubricating layer, called the pleura. The pleura is surrounded by the chest wall. The pleura and chest wall are important in protecting the lungs. The dome-shaped muscle under the lungs is called the diaphragm. As the diaphragm contracts and relaxes with each breath, it causes air to move in and out of the lungs.

What is cancer?

Your body's tissues, organs and all the parts of your body 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. New cells can be made when they aren't needed. This out of control duplication can result in a tumor. A tumor may be benign or cancerous.

What is a lung nodule?

A lung nodule or pulmonary nodule typically is found as a "spot" on your lung. It is usually round or oval in shape. A lung nodule may be easy to find but can be hard to find out exactly what it is.

Nodules can be present in your body years before they are discovered by a doctor. Doctors find lung nodules on one out of every 500 chest x-rays. Most nodules (more than 60 percent) are benign or not cancerous. They are usually discovered on a chest X-ray or a CT scan.

Benign or non-cancerous nodules can be caused by previous infections or old surgery scars.

Nodules need to be examined and watched closely. Even though most are benign, some are lung cancers. Eighty percent of people who have small lung cancer nodules (1/3 of an inch or less in size and not spread outside the lung) removed live at least five years after the diagnosis. People with larger lung cancer nodules or have lung cancer nodules that have spread outside the lung have a lower survival rate, so early detection is important.

What are the types of lung cancer?

Lung cancers start in the lung. There are several types of lung cancer. They include non-small cell lung cancer, small cell lung cancer and carcinoid lung tumors.

- Non-small cell lung cancer - Non-small cell lung cancer is the most common type of lung cancer. This is a slower growing form of cancer. There are three sub-types of non-small cell cancer; squamous cell carcinoma, adenocarcinoma and large cell undifferentiated carcinoma. 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 research is becoming more targeted toward specific tumor types.
- Small cell lung cancer – Small cell lung cancer is less common and a faster growing type of lung cancer.
- Carcinoid lung tumors – Carcinoid lung tumors are a rare, slow growing form of lung cancer.

Your doctor will discuss the type of lung cancer found with you. This is important because the treatment is based on the type and possibly the sub-type of lung cancer you have. This Med Facts will focus on non-small cell lung cancer.

Who is at risk for developing lung cancer?

A risk factor for developing lung cancer is something that increases your chance of developing lung cancer. You have an increased risk of developing lung cancer if:

- You currently smoke – Smoking is the most common risk factor for developing lung cancer. The longer a person smokes and the more often they smoke the higher the risk of developing lung cancer. You r 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.
- You are exposed to second hand exposure – Second hand exposure to smoke or being around smoke increases the risk of lung cancer.
- You are exposed to 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.
- You are exposed to asbestos and other substances, often at work.
- There is a history of lung cancer in your immediate family.
- There is a personal history of a previous lung cancer.
- You had radiation therapy for another type of cancer, especially if the radiation therapy is in the chest area.
- You are over 65 years of age.

Having several risk factors further increases your risk of developing lung cancer. If a person who smokes is exposed to asbestos the risk of developing lung cancer is increased further than one risk factor alone.

What are the symptoms of lung cancer?

Nearly 90 percent of all lung nodules are discovered incidentally and may not cause any symptoms. Usually they are seen on chest X-rays or CT scans that are performed for other reasons. As the nodule gets larger it may cause symptoms. Symptoms are few, but may include those similar to a chest cold or a mild flu. Symptoms may include:

- Coughing that doesn't go away or gets worse,
- Shortness of breath,
- Frequent lung infections,
- Coughing up blood,
- Fatigue
- Weight loss.

These are common symptoms of a variety of lung diseases. Testing is done to make a diagnosis and determine the best treatment plan.

How is lung cancer diagnosed?

The evaluation of lung nodules and 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)
- Other imaging studies. Imaging studies may be needed to determine the lung

cancer stage.

- Breathing tests, called pulmonary function tests. These detect emphysema and asthma as well as their impact on airflow out of the lungs.
- A biopsy of the lung nodule. A biopsy of the lung nodule is important to obtain a sample of the lung nodule to view under a microscope. A pathologist (type of Doctor) can determine if the cells are normal, abnormal or cancer cells.

Biopsy of the lung nodule

If a lung nodule is considered highly suspicious based on its size, shape and appearance on chest x-ray or CT scan, as well as any risk factors you may have for lung cancer, such as your age, or smoking history, it will need to be biopsied to determine if it is cancerous. The biopsy is a simple procedure of getting 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 thru the chest wall and into the nodule under radiographic guidance, or through a small operation.

Using Bronchoscopy to obtain a biopsy – Getting a biopsy using bronchoscopy is done as an outpatient procedure without any cutting, sutures or needles. During a bronchoscope you will be sedated and your 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 nodule by the doctor operating the instrument based on the location on the chest X-ray or CT, and often at National Jewish Health using a computer assisted guidance system. A biopsy of the lung nodule is taken and examined twice by a pathologist (a doctor who identifies diseases by studying cells and tissue under a microscope). The biopsy is immediately examined to determine if the nodule is cancerous, and is again examined by the pathologist over 48 hours using special techniques to be certain of the diagnosis.

Using CT guided fine needle biopsy to obtain a biopsy. Getting a biopsy using a fine needle biopsy is also done as an outpatient procedure. During a fine needle biopsy you will be sedated. A fine 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 guided into the lung nodule, and then the biopsy is taken. The biopsy is examined as described above.

Using a VATS procedure to obtain a biopsy. A biopsy may need to be taken from the lymph nodes that are in the area between the lungs (mediastinum). This procedure is a small operation and you will be sedated deeply. During a mediastinoscopy a small incision will be made above the sternum. A small tube with an even smaller video camera on the end will be placed through the incision. This will be guided to the lymph nodes by the doctor operating the instrument based on the location on the chest X-ray or CT. During a mediastinotomy a different approach to get a lymph node biopsy is taken through a larger incision between the ribs, and then the tube is inserted.

Occasionally a surgical biopsy of the lung and lung nodule must be performed. This is typically done using Video Assisted Thoracoscopic Surgery (VATS). This is an operation and will be performed in an operating room. 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 2-3 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 it is not cancerous, your doctor will ask you to come back to re-examine the spot so he/she can watch it for any changes and be certain it is not cancerous. If the lung nodule is cancerous, a few more studies will be performed to determine if the cancer has spread. This may include specialized radiographic scans of our body and brain, and potentially biopsies of other areas. If lung cancer is diagnosed, you will be referred to a cancer specialist, called an oncologist. The oncologist will recommend a combination of treatment based on your stage of cancer and the sub-type of cancer you have.

What are the stages of lung cancer?

The stage of lung cancer guides the best treatment option. When lung cancer is diagnosed, the next step is to determine the stage of your lung cancer. The stages are numbered from 0 to IV. In general, the lower the number, the less the cancer has spread. The higher the number the more the cancer has spread. The table below describes the Stages for Non-Small Cell Cancer.

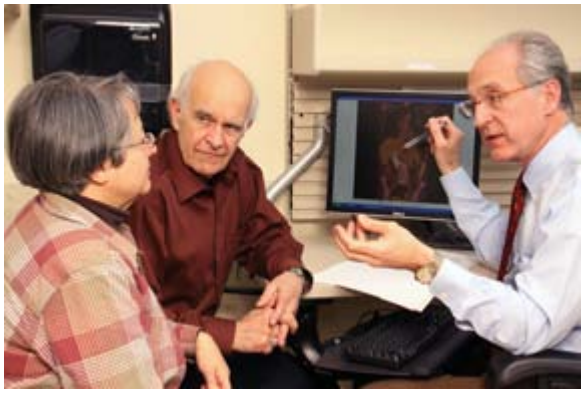
Stages of Non-Small Cell Cancer Simplified Version	
Occult stage	Cancer cells are seen in the sputum. Sputum is mucus that is coughed up from the lungs. A tumor is not seen using diagnostic testing.
Stage 0	Abnormal cells are seen in the lining of the lung. These abnormal cells may become cancer cells. A tumor is not seen using diagnostic testing.
Stage IA	A tumor is in the lung only. The tumor is 1 ¼ inches or less
Stage IB	A tumor is in the lung and is more than 1 ¼ inches. OR The tumor is less than 1 ¼ inches, but may affect the airways or pleura.
Stage IIA	The tumor is 1 ¼ inches or less and has spread to the lymph nodes on the same side of the chest as the tumor.
Stage IIB	Cancer has spread to the lymph nodes on the same side of the chest as the tumor and is more than 1 ¼ inches. OR The tumor is more than 1 inch and affects the airways or pleura.
Stage IIIA	Cancer has spread to the lymph nodes in the center of the chest between the

	lungs and affects the airways, pleura, chest wall or diaphragm.
Stage IIIB	The tumor is any size and has spread to the lymph nodes above the collar bone or on the opposite side of the chest as the tumor and/or other organs/structures within the chest cavity.
Stage IV	Cancer has spread to the lymph nodes, to another lobe of the lung or to other parts of the body.

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 often includes surgery, radiation, chemotherapy or a combination. There are three levels in the body that are considered in controlling lung cancer: local, regional and systemic, or whole body control. Local control is considered when the lung cancer is in the chest cavity and can be achieved with surgery and/or radiation therapy. Regional control is considered when the lung cancer has spread outside of the lung to lymph nodes within the chest. Regional control 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. Chemotherapy is often the treatment of choice for systemic control. Occasionally radiation therapy is also used for control of selected areas outside of the chest

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.

Tumor Resection

Tumor Resection refers to a type of surgery where the lung cancer is removed with a lung or a portion of lung.

- Segmentoctomy is the removal of the tumor and a small part of the lung.
- Lobectomy is the removal of the tumor and up to a third or half of the lung, a lobe.
- Pneumonectomy is removal of the tumor and an entire lung.

This surgery may be done by video assisted thoracotomy (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. Since National Jewish Health does not have a surgical unit, the operation will be performed at another hospital. You will return to National Jewish Health for follow-up care.

Radiation Therapy (Radiotherapy)

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

Advances in radiation therapy are able to provide higher doses of radiation and avoid normal tissue. Radiation therapy can also affect normal cells. Radiation may affect normal cells that duplicate quickly and are near the radiation area. This may lead to side effects. Side effects of radiation for lung cancer may include: redness, dryness and irritation to the skin where the radiation is given, general fatigue and trouble swallowing if the radiation is given near the esophagus, damage to normal lung resulting in scarring. Talk with your radiation oncologist about helpful techniques to treat the side effects. Since National Jewish Health does not have a radiation oncology center, and radiation treatment will be performed at another hospital or radiation center. You will return to National Jewish Health for follow-up care.

Chemotherapy

Chemotherapy is the use of medications to kill the cancer cells and stop them from duplicating. Chemotherapy is often given through a vein in an IV (intravenous) catheter, or through a large catheter, called a port, that is implanted in the chest. This will prevent you from having a needle inserted in a vein each time you need medicine. Chemotherapy is less irritating when it is placed in a large vein through a port. The chemotherapy then moves throughout the body to kill cancer cells. This is systemic treatment. Some newer chemotherapy medications may be given as a pill.

In addition to systemic treatment, regional chemotherapy may be used. Regional chemotherapy for lung cancer may involve placing a catheter into the space between the chest wall and the lung (pleural space) for a period of time. Chemotherapy can be given directly into the pleural space if this treatment is recommended. This catheter can also be used to drain fluid that may collect in the pleural space.

Chemotherapy is often given in cycles. These cycles last approximately 3 weeks, although this may vary depending on the chemotherapy used. . The chemotherapy is often given several times during this 3 week period. Then your body is given a chance to rest before another cycle is started. The number of cycles may vary, but often 4-6 cycles of chemotherapy are given.

Two to three chemotherapy medications are often given together to treat lung cancer. The combination of medication is selected by your oncologist to best control your lung cancer.

Chemotherapy can also affect normal cells. Normal cells that duplicate quickly are most often affected and this is often related to side effects. Side effects of chemotherapy for lung cancer may include: hair loss, sores in the mouth, loss of appetite, nausea and vomiting, increased chance of infection, bruising easily, bleeding, anemia/low blood count, and general fatigue. Talk with your health care provider about helpful techniques to treat the side effects. Your 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. Medication is targeted toward the cancer cells without harming normal cells. 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 at the same time chemotherapy is given or may be used after chemotherapy.

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.

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 or 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 you 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.

What is the role of National Jewish Health?

What do we do? The Oncology Division is dedicated to the diagnosis, treatment and long-term follow-up and surveillance of individuals with known or suspected lung or thoracic cancers. We are pleased to participate in your evaluation at any point; evaluation of an abnormal x-ray, state-of-the art therapy if a cancer diagnosis has been made, or providing a second opinion regarding a diagnosis or recommendation.

Why National Jewish Health? We achieve optimal care through a multidisciplinary team combining lung specialists, medical oncology experts, pathologists specifically trained in cancers of the lung, expert radiologist capable of interpreting all types of radiologic images, radiation oncologists to deliver needed radiation therapy, surgeons that focus exclusively on lung surgery, and dedicated nurses to guide you through the process from diagnosis to therapy to ongoing evaluation. This expert group, through frequent meetings to review patient progress, ensures that state-of-the art care is provided to everyone.