

UNDERSTANDING SERIES

Understanding
NON-
SMALL
CELL
LUNG
CANCER

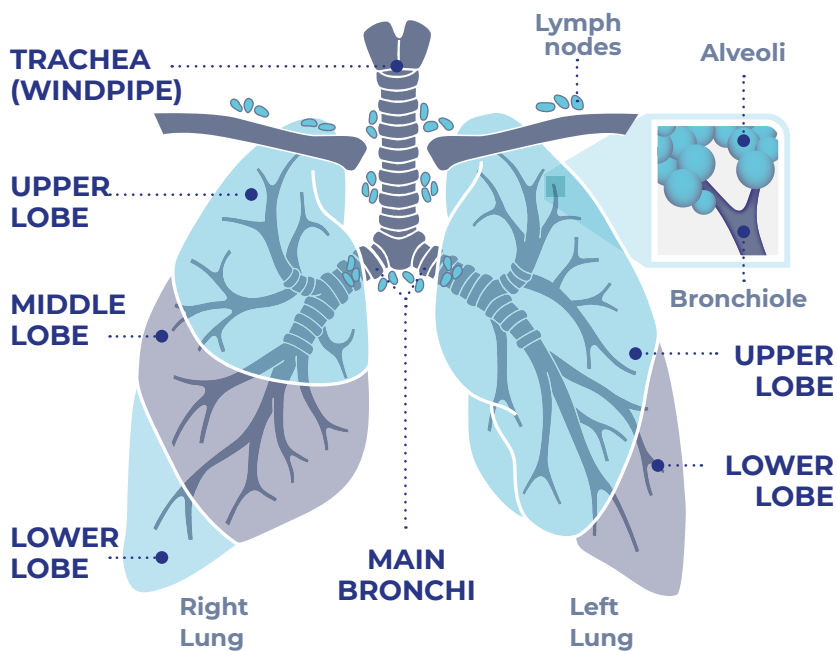
GO₂ FOUNDATION
FOR LUNG CANCER

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A GUIDE FOR THE PATIENT

ANATOMY OF THE LUNGS

The following image shows different parts that make up the lungs. Please use this picture to help guide you through the topics discussed in this brochure.



The content of this publication is for informational purposes only and is not intended to be a substitute for professional medical advice, diagnosis or treatment. Only your doctor can provide you with advice on what is safe and effective for you. Models used in the brochure are for illustrative purposes only.

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NON-SMALL CELL LUNG CANCER

Cancer is a group of diseases in which normal cells change, grow and divide out of control. Cancer that begins in the lungs – lung cancer – is one of the most commonly diagnosed cancers in the United States. There are two main types: non-small cell lung cancer (NSCLC) and small cell lung cancer (SCLC). NSCLC makes up about 85% of lung cancer diagnoses.



RISK FACTORS



A HISTORY OF SMOKING is the main risk factor for developing lung cancer. Cigarettes contain many carcinogens, which are substances that cause lung cancer.



EXPOSURE TO RADON (an invisible, odorless, tasteless radioactive gas that occurs naturally in soil and rocks).



FAMILY HISTORY of lung cancer.



RADIATION THERAPY to the chest area.



OTHER LUNG ILLNESSES (such as emphysema, chronic obstructive pulmonary disease [COPD] or tuberculosis).



EXPOSURE TO INDUSTRIAL CHEMICALS including arsenic, asbestos, beryllium and uranium.



EXPOSURE TO SECONDHAND SMOKE (or passive smoking).



DIAGNOSING NSCLC

IMAGING

A number of tests provide information on areas of the lungs that do not appear normal. Doctors sometimes refer to these areas as tumors, spots, lesions, nodules or masses. These imaging techniques can provide information beyond what can be seen with a chest X-ray. Imaging can help doctors learn if a suspicious area is cancerous (malignant) or not cancerous (benign). Some imaging tools include the following:

CT (computed tomography) or “CAT” scanning can show tumors that may not be visible on a normal chest X-ray.

LDCT (low-dose computed tomography) scanning is used to screen those who are at high risk every year to see if they have lung cancer.

PET (positron emission tomography) scanning shows how a tumor is using glucose (also known as sugar). Since tumors typically use more glucose than surrounding tissue, they appear as “hot spots” (bright areas) in these images.

MRI (magnetic resonance imaging) creates detailed images of the body and can help determine whether a tumor has spread beyond its original location. Used in NSCLC to check for spread of cancer to the brain.

BIOPSIES

A biopsy is a procedure in which tissue is removed from the body for testing. The tissue can help doctors diagnose cancer and provide specific information about the suspicious area.

There are several types of biopsy procedures:

NEEDLE BIOPSY OR NEEDLE

ASPIRATION: A hollow needle is inserted through the skin to draw out tissue for testing. The procedure is usually done with the aid of imaging tests such as CT scans, fluoroscopy, ultrasound or MRI to determine where to insert the needle. There are two types of this kind of biopsy:

- **Fine Needle Aspiration (FNA):** Tissue is removed using a thin hollow needle. Depending on the location of the tumor, FNA is done during a bronchoscopy procedure (in which a camera-equipped tube is used to view the windpipe and other airways) or through skin. This procedure may be guided by an ultrasound or a CT scan.
- **Core Needle Biopsy:** Tissue is removed using a wider needle. More tissue can be removed with this procedure than with fine needle aspiration.

THORACENTESIS: Fluid is removed from the space around the lungs (also called the pleural cavity) using a hollow needle inserted into the chest.

LIQUID BIOPSY: Blood or other fluid is removed for biomarker testing to help with planning treatment. Liquid biopsy is **NOT** used to diagnose lung cancer.

SURGICAL BIOPSY: Tissue is removed during surgery.

BRONCHOSCOPY: A thin, lighted tube (bronchoscope) is passed down the throat through the mouth or nose and into the center area of the lungs. A needle is then inserted down the tube and samples are removed for testing.

- **Endobronchial Ultrasound (EBUS):** Uses a bronchoscope and ultrasound (high frequency sound waves) and allows for better examination of the lymph nodes and other structures in the center of the chest to see if cancer has spread.
- **Electromagnetic Navigational Bronchoscopy (ENB):** Uses a bronchoscope to reach the lungs. Pictures from a CT scan and GPS like technology are used to create a map and navigate the lungs to nodules. This procedure allows doctors to get to the outer areas of the lung which may be difficult to reach using traditional bronchoscopy.
- **Autofluorescence:** Uses a bronchoscope with a special light and camera, which captures live color video viewed on a monitor. Under this light, abnormal/pre-cancerous tissue appears in a different color than normal tissue.

HISTOLOGY AND SUBTYPE

NSCLC is not the same in every person. “Histology” refers to the structure of the cancer when viewed under a microscope. There are many subtypes of NSCLC but the most commonly diagnosed are:

ADENOCARCINOMA

SQUAMOUS CELL CARCINOMA

LARGE CELL CARCINOMA

Knowing the subtype of NSCLC helps the healthcare team identify the best treatment options.

When cancer has spread to other areas of the body, it is still named after the type and histology of the primary tumor. So lung cancer that has spread to the brain is called lung cancer with brain metastasis, not brain cancer.



STAGING

STAGE



The tumor is only in one lung and is no more than 5cm with no spread to nearby lymph nodes.

STAGE



The tumor is only in one lung and may be larger than those in stage I. The cancer may have spread to nearby lymph nodes but not beyond.

NSCLC is divided into four stages, based on the TNM System. Stage is generally determined by the size of the cancer and whether or not it has spread from the place it started (including to lymph nodes).

- **T** stands for **TUMOR**: Where the tumor is and how big it is.
- **N** stands for **LYMPH NODES**: Whether the cancer has spread to lymph nodes and where the affected lymph nodes are located.
- **M** stands for **METASTASIS**: Whether the cancer has spread beyond the lung to the other lung, the pleura or other parts of the body.

STAGE III

The tumor or tumors are only in one lung and may have grown into other structures within the chest or spread to more lymph nodes.

STAGE IV

The tumor may be any size and the cancer has spread to the other lung, the lining of the lung or organs outside the lungs.

Your treatment team may tell you that your stage is an A or B, for example, IIIA or IIIB. A is a lower stage (smaller or less spread) than B.

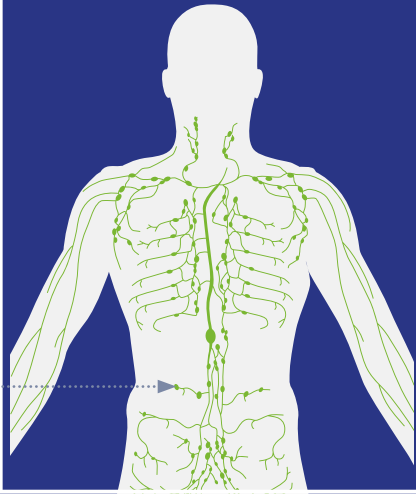
IT IS IMPORTANT TO KNOW THE STAGE OF THE CANCER.

Staging can help doctors create a treatment plan that is best for you.

The terms “early stage” or “locally advanced” are sometimes used to refer to stage I, stage II and some stage III tumors. The term “advanced” may be used to describe some stage III tumors and all stage IV tumors. Ask your healthcare team for more details about tumor staging and how it may affect your choices for treatment.

THE LYMPHATIC SYSTEM

Lymph Node



The lymphatic system is a collection of organs, vessels and nodes that are found throughout the body. It has two major functions: to collect excess fluid and return it to the blood, and to fight infection.

LYMPH VESSELS are similar to blood vessels and help to circulate lymph fluid throughout the body. Lymph fluid contains white blood cells, which help to fight infection.

LYMPH NODES are small, oval-shaped organs within the lymphatic system.

The purpose of lymph nodes is to trap and collect invading organisms that can be destroyed by white blood cells. Lymph nodes are found throughout the body, but major clusters can be found behind the knee and elbow joints and in the groin, armpits, chest and neck. A large group is found in the center of the chest (mediastinum) which drains lymph fluid from the lungs.

Cancer cells can break off from the main tumor and travel through the lymphatic system. Some of these cells can become trapped within a lymph node and start to grow. Determining whether there are cancer cells in lymph nodes can help a doctor estimate how far the cancer may have spread.

BIOMARKER TESTING

Tumor tissue removed during a biopsy can be tested for biomarkers. Biomarkers are features of the cancer that give the treatment team specific information about the cancer. These features may be specific proteins on the surface of the cell or genetic information inside the cell. Some biomarkers can help predict how the cancer will act while others indicate whether a specific treatment may be effective.

Ask your doctor if you have had biomarker testing. If not, we can help provide it. Learn more at lungmatch.org or call 1-800-298-2436.



MAKING TREATMENT DECISIONS

Treatment for NSCLC has become much more personalized and all lung cancers are not treated the same way. The stage, subtype and biomarker testing results for your cancer will direct your treatment team in determining what treatment options are best for you. Discuss this information with your treatment team and share your personal values and goals to determine the options best for you.

TREATMENT OPTIONS

TREATMENT FOR NSCLC include one or more of the following:

- Surgery
- Radiation
- Chemotherapy
- Targeted Therapy
- Immunotherapy
- Clinical Trials
- Palliative Care (Symptom Management)

TREATMENT DEPENDS ON THE FOLLOWING:

- Subtype and stage of NSCLC
- If certain biomarkers are present
- How well your lungs are working
- Other health problems which may increase the toxicity of therapy
- Your ability to perform activities of daily living without assistance like eating, bathing and dressing

SURGERY

Types of lung cancer surgery include:

- **SUB-LOBAR RESECTIONS:** Removal of the tumor and surrounding lung tissue without removing the whole lobe of the lung. Types include wedge resection and segmentectomy.
- **LOBECTOMY:** Removal of an entire lobe of the lung.
- **BI-LOBECTOMY:** Removal of two lobes of the lung.
- **PNEUMONECTOMY:** Removal of an entire lung.
- **COMPLEX RESECTIONS:** Removal of part or all of a lung and surrounding structures such as ribs, part of the chest wall or windpipe (bronchus) when the cancer has spread to those areas.

All surgeries should include testing of the lymph nodes associated with that part of the lung.

Types of surgical procedures:

- **THORACOTOMY:** An incision is made between the ribs to allow removal of the cancer.
- **MINIMALLY INVASIVE SURGERY:** A series of small incisions allows insertion of a video camera along with small instruments for removing cancerous tissue. Types include:
 - Video assisted thoracic surgery (VATS)
 - Robotic assisted thoracic surgery (RATS)

RADIATION THERAPY

Radiation therapy is a treatment that uses high energy x-rays or particles to kill or shrink cancer cells, to manage pain or to prevent the cancer from spreading. It can be used to get rid of tumors entirely, eradicate residual disease after surgery. At times it might be helpful to reduce the size of tumors before surgery.

Radiation therapy is also commonly used to treat brain metastases and may be used for this purpose with other treatments.

There are several types of radiation therapy:

- **EXTERNAL BEAM RADIATION:** Use of carefully aimed beams of radiation targeting the areas of cancer.
- **INTENSITY MODULATED RADIATION THERAPY (IMRT):** A type of radiation treatment that carefully shapes the beams of radiation around the areas of cancer.
- **STEREOTACTIC BODY RADIATION THERAPY (SBRT):**
A type of treatment that can target small lung cancers that cannot be removed by surgery. SBRT can be given either in a one-day session with a single dose of radiation or on a “fractionated” schedule in which smaller doses are given over time.
- **STEREOTACTIC RADIOSURGERY (SRS):** Despite its name, this type of radiation does not involve surgery. It delivers very high doses of targeted radiation to tumors.
- **BRACHYTHERAPY (INTERNAL OR IMPLANT RADIATION THERAPY):** Radioactive material is sealed in needles, seeds, wires or catheters and placed directly into or near a tumor. This technique allows very high doses of radiation to be more safely delivered while helping to reduce side effects.
- **PROTON THERAPY:** A type of radiation treatment that uses a beam of protons or positively charged particles at high energy to deliver radiation directly to cancer cells. This treatment is offered only at select centers in the US.
- **CONCURRENT CHEMORADIATION:** Sometimes chemotherapy and radiation may be used at the same time to treat the cancer.

CHEMOTHERAPY

Chemotherapy is a treatment that kills cancer's rapidly growing and dividing cells. In NSCLC, chemotherapy may be given as a single drug or as multiple drugs at the same time, depending on the overall health of the patient as well as stage and subtype of NSCLC.

Chemotherapy drugs most often used to treat NSCLC are:

- Paraplatin (Carboplatin)
- Alimta (Pemetrexed)
- Platinol (Cisplatin)
- Gemzar (Gemcitabine)
- Taxol (Paclitaxel)
- Navelbine (Vinorelbine)
- Taxotere (Docetaxel)
- Abraxane (Paclitaxel protein-bound)

TARGETED THERAPY

Targeted therapies are aimed at a particular “target” in a tumor cell with the goal of stopping the cancer from continuing to grow. Your biomarker testing results will tell the treatment team if you are a good candidate for targeted therapy. The most common “targets” in NSCLC are gene changes in EGFR, ALK, ROS1 and BRAF.

To learn more about Targeted Therapy, including the drugs currently in use, please refer to our “Targeted Therapy for Lung Cancer” brochure.

IMMUNOTHERAPY

Immunotherapy is a new type of treatment that helps the body's own immune system fight the cancer. A class of immunotherapy drugs called “checkpoint inhibitors” are approved for use in NSCLC .

To learn more about Immunotherapy, including the drugs currently in use, please refer to our “Immunotherapy for Lung Cancer” brochure.

COMBINATION THERAPY

Sometimes using more than one type of treatment may produce better results. For example, chemotherapy may be combined with Avastin (a targeted therapy) or with radiation; radiation and chemotherapy may be used before and/or after surgery. Your treatment team will let you know if a single treatment or combination therapy is best for your situation.

ADJUVANT THERAPY

A drug may be given as an “adjuvant” or additional therapy along with surgery or radiation. Following surgical removal of lung cancer, adjuvant therapy is sometimes recommended, depending on the risk of recurrence. The goal is to increase the cure rate compared to surgery alone.

NEO-ADJUVANT THERAPY

Sometimes a drug may be given prior to surgery, often to shrink the tumor. This is known as neo-adjuvant therapy.

MAINTENANCE THERAPY

Some drug therapies may be used after the initial therapy regimen has ended. Maintenance therapy may be used as long as it continues to work and is tolerable.

The two types of maintenance therapies are:

- “Continuation”: When a drug that has been used before is continued
- “Switch”: When a new drug is used under certain circumstances



CLINICAL TRIALS

Clinical trials are research studies to determine whether new approaches to therapy are safe and effective, as well as to determine how they compare to existing treatments. Clinical trials in lung cancer may involve new ways of giving radiation, new chemotherapy drugs or new drugs which target specific biomarker abnormalities in the cancer. Having biomarker testing may help your treatment team identify an appropriate clinical trial for you that is more precisely targeted to your cancer.

There are also new types of clinical trials including LUNG-MAP and NCI-MATCH (for all cancers) where you will undergo biomarker testing as part of the clinical trial to put you in a group testing a drug that is most likely to be effective for you.

Talk to your treatment team about whether a clinical trial is right for you. To see if you may qualify for a research study, call our HelpLine at 1-800-298-2436 or visit lungmatch.org.

SIDE EFFECTS

RADIATION THERAPY

Common side effects of radiation therapy include:

- Tiredness (fatigue)
- Skin irritation
 - Redness
 - Itching
 - Dryness
 - Infection
- Loss of appetite (anorexia)
- Inflammation of the esophagus (esophagitis)
- Inflammation of the lung(s) (pneumonitis)

Be sure to talk with your healthcare team about ways to manage any side effects you may experience.

DRUG THERAPY

The goal of treatment is to kill cancer cells, which are fast growing. Chemotherapy can't tell cancer cells from other fast growing cells so it can damage them, too and cause side effects. While side effects from targeted therapies and immunotherapies tend to be milder than chemotherapy, they can still result in challenging side effects.

COMMON SIDE EFFECTS OF MANY TREATMENTS:

- Tiredness (fatigue)
- Diarrhea
- Constipation
- Loss of appetite (anorexia)
- Nausea and vomiting
- Shortness of breath (dyspnea)

COMMON SIDE EFFECTS OF CHEMOTHERAPIES:

- Hair loss
- Numbness or tingling in the hands or feet (neuropathy)
- Low red/white blood cell counts

COMMON SIDE EFFECTS OF TARGETED THERAPIES:

(Note, these typically depend on the type of targeted therapy)

- Rash
- Eye irritation or vision problems
- Swelling of hands and feet
- Nosebleeds
- High blood pressure

COMMON SIDE EFFECTS OF IMMUNOTHERAPIES:

- Pain in muscles and joints
- Immune reactions which may lead to inflammation in various organs. These immune-related side effects are uncommon but can be serious and close monitoring is required.



A multidisciplinary team approach is when members of the healthcare team discuss your situation and work together to make treatment recommendations. It is thought that this team approach improves coordination of care and communication amongst the team.

YOUR TREATMENT TEAM MAY INCLUDE

THORACIC SURGEON: A doctor who performs surgeries in the chest region. Some thoracic surgeons specialize in lung cancer.

MEDICAL ONCOLOGIST: A doctor who specializes in diagnosing and treating cancer. Medical oncologists may use chemotherapy, hormonal, biologic or molecularly targeted therapies as well as supportive therapies to treat cancer.

PATHOLOGIST: A doctor who specializes in diagnosing and classifying cancer by studying tissue, fluid or blood samples.

RADIATION ONCOLOGIST: A doctor who specializes in treating cancer using various forms of radiation by focusing it on the tumor site in the body.

PULMONOLOGIST: A doctor who specializes in treating diseases and conditions involving the lungs.

PULMONARY REHABILITATION SPECIALIST: A specialist who works to reduce symptoms and side effects from diseases of the lung—including lung cancer—and their treatments.

ONCOLOGY NURSE: A nurse who specializes in helping people with cancer and who may further specialize in the surgical or medical management of a patient's care.

ONCOLOGY SOCIAL WORKER OR COUNSELOR: A social worker or counselor who specializes in helping patients and loved ones cope with the emotional impact of cancer and who may help identify other needed resources.

PATIENT NAVIGATOR: A nurse, social worker or trained lay person who assists patients and loved ones on their journey through the health care system.

GLOSSARY

BIOPSY: Removal of a small piece of tissue for examination and analysis.

CANCER: A group of diseases in which cells grow and divide uncontrollably, forming tumors. In some cases, the tumors can invade nearby tissues. Tumor cells may also travel through the bloodstream and lymphatic system to spread to more distant parts of the body.

CARCINOMA: Cancer that arises from epithelial cells, which are cells that cover or line internal and external body surfaces.

CHEMOTHERAPY: Treatment with a chemical or a combination of chemicals, to slow or kill rapidly dividing cells.

CLINICAL TRIAL: A research study conducted to determine whether investigational drugs or treatments are safe and effective in humans.

COMPUTED TOMOGRAPHY (CT): An imaging technique that uses a computer to create a series of precise X-ray images of internal organs. CT scans show much more detail than standard X-rays. Also known as “CAT” scanning.

HISTOLOGY: The microscopic structure of tumor cells that helps a doctor determine the subtype of a tumor.

LOBECTOMY: Surgery that removes the lobe (a portion) of the lung that contains a tumor. The right lung is divided into three lobes; the left lung has two lobes.

LYMPH NODES: Small, oval structures located throughout the body that together form part of the immune system.

MAGNETIC RESONANCE IMAGING (MRI): The use of magnetic fields to create images of internal organs.

METASTASIS: The spread of tumor cells to sites in the body beyond the location in which the tumor began.

PNEUMONECTOMY: Surgical removal of an entire lung.

POSITION EMISSION TOMOGRAPHY (PET) SCAN: An imaging technique that detects rapidly dividing cells. This may help find cancers that are difficult to detect by other means (e.g., X-ray, CT scan, MRI).

RADIATION THERAPY: The use of focused beams of radiation to kill cancer cells and reduce tumor size.

RESECTION: The surgical removal of part of a tissue or organ.

SIDE EFFECTS: Any undesired effects of a drug or treatment on a patient.

SPUTUM: A phlegm-like substance brought up from the lungs that contains mucus and cells and may contain microorganisms, blood and/or pus.

STAGING: Description of a tumor based on its size, location and extent of spread to other organs.

TNM SYSTEM: Staging of tumors according to three factors—size and location of tumor (“T”), spread to lymph nodes (“N”), and spread to other organs (also known as metastasis, “M”). In lung cancer, a tumor is considered metastatic if it spreads to the other lung or the pleura (the thin sac covering the lung).

TUMOR: Abnormal tissue that results from uncontrolled cell division. Tumors perform no useful bodily function and may be either benign (not cancerous) or malignant (cancerous).

WHERE CAN I GO FOR MORE INFORMATION?

For more information about lung cancer, treatments and clinical trials, to discuss support options or for referral to other resources, please contact us.

HELPLINE | 1-800-298-2436 or support@go2foundation.org

**BIOMARKER TESTING &
CLINICAL TRIAL MATCHING** | lungmatch.org

WEBSITE | go2foundation.org



Empower Everyone. Ignore No One.



GO₂ FOUNDATION FOR LUNG CANCER

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Founded by patients and survivors, GO₂ Foundation for Lung Cancer transforms survivorship as the world's leading organization dedicated to saving, extending, and improving the lives of those vulnerable, at risk, and diagnosed with lung cancer.

GO₂ Foundation works to change the reality of living with lung cancer by ending stigma, increasing public and private research funding, and ensuring access to care.

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