#### LUNG CANCER TREATMENTS



What you need to know about...

# chemotherapy















## foreword

### **About LUNGevity**

LUNGevity is the largest national lung cancer-focused nonprofit, changing outcomes for people with lung cancer through research, education, and support.

## About the LUNGevity PATIENT EDUCATION SERIES

LUNGevity has developed a comprehensive series of materials for patients/survivors and their caregivers, focused on understanding how lung cancer develops, how it can be diagnosed, and treatment options. Whether you or someone you care about has been diagnosed with lung cancer, or you are concerned about your lung cancer risk, we have resources to help you.

The medical experts and lung cancer survivors who provided their valuable expertise and experience in developing these materials all share the belief that well-informed patients make their own best advocates.

In addition to this and other booklets in the LUNGevity patient education series, information and resources can be found on LUNGevity's website at www.LUNGevity.org, under "For Patients & Caregivers" and "For Supporters & Advocates."

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# table of contents

01 About Chemotherapy	5
What is chemotherapy?	5
How does chemotherapy work?	6
How chemotherapy drugs differ from	8
How is chemotherapy administered?	9
Preparing for chemotherapy treatment	12
02 Chemotherapy and Lung Cancer1	3
Goals of lung cancer chemotherapy1	13
Commonly used chemotherapy drugs1	4
When is chemotherapy given for lung cancer?1	15
Treatment options for non-small cell lung cancer (NSCLC), by stage1	16
Treatment options for small cell lung cancer (SCLC), by stage1	19
Lung cancer chemotherapy side effects	0
Why there are side effects from lung cancer chemotherapy2	0
Common side effects of lung cancer chemotherapy	21
Managing the side effects of lung cancer chemotherapy2	22
Finding a clinical trial that might be right for you2	23
Questions to ask your healthcare team about chemotherapy2	26
03 Glossary2	27
04 Notes	3

## introduction

Chemotherapy is a type of treatment that uses drugs to attack cancer cells, including lung cancer cells. These drugs work by preventing the growth and division of the cancer cells. Chemotherapy has been used as a treatment for lung cancer for many years, and it remains an important treatment option despite the addition in recent years of new types of treatment. Chemotherapy drugs may be used alone or in combination with other chemotherapy drugs or other types of lung cancer treatments (such as immunotherapy and targeted therapy). Chemotherapy may also be used at all stages of both non-small cell lung cancer and small cell lung cancer.

This booklet will help you:

- Understand how chemotherapy works
- Learn what chemotherapy options are currently available
- Learn ways that chemotherapy side effects can be managed
- Understand whether chemotherapy might be a good treatment option for you

YOU'LL FIND A GLOSSARY TOWARD THE END OF THIS BOOKLET. Words included in the glossary appear **blue** the first time that they are used in the text.

## 01 about chemotherapy

### What is chemotherapy?

This booklet discusses traditional, or standard, **chemotherapy**. Chemotherapy is a treatment that uses drugs to stop the growth and division of lung cancer **tumor** cells. While each patient responds differently to chemotherapy drugs, chemotherapy treatment can shrink lung cancer tumors, alleviate lung cancer symptoms, and extend life. Chemotherapy may be used at all **stages** of lung cancer and for both **non-small cell lung cancer (NSCLC)** and **small cell lung cancer (SCLC)**.

Chemotherapy has been used as a cancer treatment for many years and remains important despite the addition in recent years of newer types of drug treatment—**targeted therapies**, **angiogenesis inhibitors**, and **immunotherapy**—that attack cancer in a different way. Chemotherapy may be used as a single drug or in combination with other chemotherapy drugs, in combination with some of the newer treatments, and with surgery and **radiation therapy** to make them more effective. Your healthcare team will help to select the best treatment based on your medical history, your overall health and any other medical problems, the stage of your lung cancer, and your preferences.

5

### How does chemotherapy work?

Our bodies are composed of trillions of individual cells, the "building blocks" of life. These cells—of which there are many types serving different functions in the body—have a natural life cycle. Cells that die or are old or damaged are replaced by new cells, through a process by which a living cell duplicates its contents and then divides to form two identical cells. Specifically, within each cell is the **nucleus**, which is comparable to the "brain" of the cell. The nucleus contains **chromosomes**, which are made up of **genes**. Genes, in turn, are made up of **DNA**, the instructions within a cell that control how the cell grows in a systematic and precise way. Once a cell copies its genes, it divides, forming two new cells, each with its own complete set of genes.

Healthy, normal cells in the body grow and divide in an orderly manner, per the instructions encoded in the genes, to replace dead, old, or damaged cells.



#### HOW NORMAL CELLS GROW AND DIVIDE

When a gene has an alteration in its DNA code of instructions, it is said to be "mutated." **Mutations** occur often, and normally the body can correct them. The correction method is similar to a "spell check" function on a computer or cell phone. However, sometimes, the "spell check" function does not work as it should, and the DNA mutation may become part of the cell's blueprint. Over time, an accumulation of mutations can cause cells to lose the capacity to grow and divide in an orderly manner. Out-of-control growth may occur instead, which can lead to the formation of a tumor.



#### HOW CANCER CELLS GROW AND DIVIDE

Chemotherapy drugs work by damaging the DNA inside the nucleus of rapidly growing cells or by keeping the cells from dividing and growing. This may happen either when a cancer cell is making copies of its genes or when the cancer cell is about to divide.

7

#### HOW CHEMOTHERAPY WORKS



### How chemotherapy drugs differ from targeted therapy and immunotherapy drugs

Chemotherapy drugs are most often used systemically; that is, they travel throughout the whole body (the system) via the bloodstream to reach and attack cancer cells wherever they may be. However, chemotherapy attacks not just fast-growing cancer cells but also fast-growing healthy cells. Targeted therapy drugs, each of which is intended to treat cancer that has a particular mutation, are aimed at specific **signaling pathways** that cancer cells use to thrive, blocking them in the same way that blocking a car's fuel line would keep it from running properly. Targeted therapies are more precise than chemotherapy drugs, which may make them more effective. However, not all cancers have a mutation that has a matching targeted therapy.

Immunotherapy drugs do not attack cancer cells directly; they work by strengthening the body's own immune system's ability to recognize cancer cells and selectively target and kill them.

## How is chemotherapy administered?

Chemotherapy can be administered systemically in many ways, including orally (by mouth), intravenously (through a vein), subcutaneously (injected under the skin), and intramuscularly (injected into a muscle). To treat lung cancer, chemotherapy drugs are usually given intravenously—through a needle or tube inserted into a vein.

#### INTRAVENOUS DRUG ADMINISTRATION THROUGH A VEIN IN THE HAND



Sometimes, a **chemoport** may be placed under the skin. The chemoport may stay for a few weeks to months and helps in the administration of the chemotherapy drug while avoiding multiple needle pricks.



#### INTRAVENOUS DRUG ADMINISTRATION THROUGH A CHEMOPORT

The way the chemotherapy is given depends on the type and stage of the cancer being treated. Most often, chemotherapy is given systemically; this process is described here. Chemotherapy may be given one drug at a time or as a combination of different drugs at the same time. Usually chemotherapy is given in "cycles." A typical cycle consists of a period of treatment of 1 to 3 days, followed by a break before the next treatment is given so that a patient can rest and allow the body time to recover. A chemotherapy cycle generally lasts 3 to 4 weeks and continues over a period of months. Sometimes chemotherapies are planned for a specific number of cycles, typically, 4–6 cycles. In other situations, chemotherapy is planned to be continual—given on an ongoing basis as long as it is tolerated and controlling the cancer.

The number of treatments within a cycle, the length of a cycle, and the number of cycles to be given may vary based on the type and stage of lung cancer and the drug(s) being given. It is always a good idea for you to check with your healthcare team to understand your treatment plans, including:

- What drugs are being used
- The drug schedule
- The length of a cycle
- How many cycles are planned
- What to expect between cycles

### Preparing for chemotherapy treatment

There are a number of things you can do to help prepare for chemotherapy treatment. Your healthcare team will advise you on these. They may include:

- Having a surgical procedure to insert a device, such as a chemoport, into a vein if your chemotherapy will be administered intravenously. The advantage of this is that a vein will not need to be found at each chemotherapy session
- Going to your dentist to make certain that there is no existing infection that could complicate your treatment and having any necessary dental work done prior to starting treatment
- Planning ahead for possible side effects. Side effects and how to alleviate them will be discussed in the next chapter
- Arranging for transportation and help around the house. You may or may not need the help, but it is not possible to predict before your treatment begins
- Getting a checklist from your healthcare team about what to expect before, during, and after chemotherapy

# 02 chemotherapy and lung cancer

### Goals of lung cancer chemotherapy

The goals of lung cancer chemotherapy depend on the type of lung cancer being treated, the stage of the lung cancer, and whether other types of treatment will be given. Some possible goals of chemotherapy are:

- To eliminate all of the cancer cells and to prevent recurrence after surgery or some other type of treatment
- To decrease the size of tumors for easier and safer removal by surgery
- To control the lung cancer by stopping it from growing and spreading
- To help make other cancer-killing treatments, such as radiation therapy, more effective
- To relieve symptoms caused by the cancer and to slow its growth when the lung cancer is at an advanced stage. This type of treatment is called **palliative care**

02 chemotherapy and lung cancer LUNGEVITY FOUNDATION 13

## Commonly used chemotherapy drugs

Generic (chemical) name	Brand name (sold as)
Carboplatin	Paraplatin®
Cisplatin	Platinol-AQ®
Docetaxel	Taxotere®
Etoposide	Etopophos®
Gemcitabine	Gemzar®
Paclitaxel	Taxol®, Onxol®
Paclitaxel (albumin-bound)	Abraxane®
Pemetrexed	Alimta®
Vinorelbine	Navelbine®

Commonly used chemotherapy drugs to treat NSCLC include:

When combination chemotherapy is used (because the drugs work in different ways and may be more effective together), usually it is the drugs made with platinum—carboplatin (Paraplatin®) and cisplatin (Platinol-AQ®)—that are used with another drug.

Commonly used chemotherapy drugs to treat SCLC include:

Generic (chemical) name	Brand name (sold as)
Carboplatin	Paraplatin®
Cisplatin	Platinol-AQ®
Docetaxel	Taxotere®
Etoposide	Etopophos®
Gemcitabine	Gemzar®
Paclitaxel	Taxol®, Onxol®
Paclitaxel (albumin-bound)	Abraxane®
Pemetrexed	Alimta®

02 chemotherapy and lung cancer LUNGEVITY FOUNDATION 14

Combination chemotherapy is usually the main treatment for patients with SCLC as the first round of chemotherapy. As with NSCLC, the combinations are most often a platinum-based drug (carboplatin [Paraplatin<sup>®</sup>] or cisplatin [Platinol-AQ<sup>®</sup>]) that is combined with another drug; cisplatin (Platinol-AQ<sup>®</sup>) and etoposide (Etopophos<sup>®</sup>) is most often the first combination chemotherapy used.

### When is chemotherapy given for lung cancer?

Chemotherapy is among the treatment options, but never the only option, at all stages of both NSCLC and SCLC. Note that treatment options develop over time; your healthcare team may suggest options that are not outlined below.

When given along with other treatments, the chemotherapy is referred to as adjuvant, neoadjuvant, or concurrent.

- Adjuvant chemotherapy: After surgery or radiation therapy, there may still be some microscopic cancer cells left behind that cannot be seen on regular computed tomography (CT) scans. When chemotherapy is given to kill those microscopic cancer cells, it is called adjuvant chemotherapy.
- Neoadjuvant chemotherapy: Chemotherapy may be given before surgery to shrink the cancer and make it easier to remove with surgery, in addition to killing cancer cells that cannot be seen on regular CT scans. This is called neoadjuvant chemotherapy.
  Sometimes neoadjuvant chemotherapy is given along with radiation therapy.
- **Concurrent chemotherapy:** When chemotherapy is given at the same time as radiation therapy, it is called concurrent chemotherapy, or sometimes concurrent chemoradiotherapy. Concurrent treatment may be given as the only planned therapy or it may be given in the neoadjuvant setting before a planned surgery.

## Treatment options for non-small cell lung cancer (NSCLC), by stage

In non-small cell lung cancer (NSCLC), chemotherapy may be used as the main treatment, but it is also frequently given along with other treatments.

**Stage I and stage II NSCLC:** Your healthcare team may recommend adding chemotherapy to your surgical treatment plan. Chemotherapy may be given as neoadjuvant chemotherapy to reduce the size of the tumor or as adjuvant chemotherapy to reduce the risk of the cancer coming back.

**Stage III NSCLC:** Chemotherapy is almost always used in stage III treatment, either alone or in combination with external beam radiation therapy (EBRT), a type of radiation therapy. The immunotherapy drug durvalumab (Imfinzi<sup>®</sup>) may also be administered to those stage III patients whose cancer cannot be removed by surgery and has not progressed following concurrent platinum-based chemotherapy and radiation therapy.

**Stage IV NSCLC:** Treatment of stage IV NSCLC patients depends on the performance status of a patient and whether their cancer has a **driver mutation** (as determined by **biomarker testing**). Your healthcare team will use one of several scales, such as the Eastern Cooperative Oncology Group (ECOG) Performance Scale, to measure your general health to help determine treatments that may be the best for you.

02 chemotherapy and lung cancer LUNGEVITY FOUNDATION 16

ECOG Performance Score	Definition of ECOG Performance Score
0	Patient is fully active and able to carry on all pre-disease performance without restriction
1	Patient is restricted in physically strenuous activity but ambulatory (able to walk and not confined to bed) and able to carry out work of a light or sedentary nature, e.g., light housework or office work
2	Patient is ambulatory and capable of all self-care but unable to carry out any work activities; the patient is up and about more than 50% of waking hours
3	Patient is capable of only limited self-care. The patient is confined to bed or chair more than 50% of waking hours
4	Patient is completely disabled, cannot carry on any self-care, and is totally confined to bed or chair

Some patients' performance scores improve after treatment, making them eligible for additional treatments.

Treatment options for patients with stage IV **adenocarcinoma** as determined by performance status include:

- For patients whose cancers do not have a biomarker for which a targeted therapy exists and who have the best performance scores, 0 or 1, platinum-based chemotherapy alone (e.g., cisplatin [Platinol-AQ<sup>®</sup>] or carboplatin [Paraplatin<sup>®</sup>]); chemotherapy in combination with bevacizumab (Avastin<sup>®</sup>), an anti-angiogenic treatment; pembrolizumab (Keytruda<sup>®</sup>), an immunotherapy drug, in combination with chemotherapy (specifically pemetrexed [Alimta<sup>®</sup>] and carboplatin [Paraplatin<sup>®</sup>]); or atezolizumab (Tecentriq<sup>®</sup>), an immunotherapy drug, in combination with chemotherapy and bevacizumab (Avastin<sup>®</sup>) may be recommended.
- For patients with a performance score of 2, chemotherapy may be recommended.
- For patients with a performance score of 3 or 4, palliative care may be recommended.

02 chemotherapy and lung cancer LUNGEVITY FOUNDATION

Depending on your health and response, your healthcare team will make recommendations for **maintenance** or **second-line** or further therapy.

Maintenance treatments may include the same or other chemotherapies or simply a "watch and wait" approach. The goal of maintenance therapy is to help keep the cancer from growing again. Generally, a patient is kept on maintenance therapy as long as the cancer stays controlled.



#### MAINTENANCE THERAPY TO TREAT LUNG CANCER

Second-line or further treatments may include immunotherapy drugs and other chemotherapies (including a combination of ramucirumab [Cyramza<sup>®</sup>], a **vascular endothelial growth factor receptor 2 [VEGFR2] inhibitor**, with docetaxel [Taxotere<sup>®</sup>]) for patients with performance scores of 2 or lower, and palliative care for patients with performance scores of 3 or 4.

Treatment options for patients with stage IV NSCLC whose tumors have high **PD-L1** expression (**tumor proportion score [TPS]**  $\geq$  50%) with no **EGFR** or **ALK** mutations may include the immunotherapy drug pembrolizumab (Keytruda<sup>®</sup>) for **first-line treatment**. For patients who cannot receive pembrolizumab (Keytruda<sup>®</sup>), platinum-based chemotherapy may be an alternative. Treatment options for patients with stage IV **squamous cell lung cancer** as determined by performance status include:

- For patients whose performance score is 0 or 1, platinum-based chemotherapy alone or in combination with pembrolizumab (Keytruda®), an immunotherapy drug, is an option.
- For patients whose performance score is 2, chemotherapy is an option.
- For patients whose performance score is 3 or 4, palliative care is an option.
- For maintenance therapy, chemotherapy is an option, as is a "watch and wait" approach.

## Treatment options for small cell lung cancer (SCLC), by stage

In small cell lung cancer (SCLC), for which there are fewer treatment options than in NSCLC, chemotherapy is usually the main treatment, for two reasons:

- SCLC responds initially very well to chemotherapy.
- SCLC may spread quickly beyond the lungs. Chemotherapy is the best option to initially treat cancer that has spread, so it is given in almost all SCLC cases, even if there is no sign of spread on CT scans.

If you have **limited-stage small cell lung cancer**, your healthcare team may recommend 4 to 6 cycles of a platinum compound (such as carboplatin [Paraplatin<sup>®</sup>] or cisplatin [Platinol-AQ<sup>®</sup>]) and etoposide (Etopophos<sup>®</sup>), along with **prophylactic cranial irradiation** and concurrent radiation.

The current standard of care for first-line treatment of **extensive-stage small cell lung cancer** includes a platinum compound (such as carboplatin [Paraplatin<sup>®</sup>] or cisplatin [Platinol-AQ<sup>®</sup>]) and etoposide (Etopophos<sup>®</sup>). A recent **clinical trial** has shown that the addition of an immunotherapy drug, atezolizumab (Tecentriq<sup>®</sup>), may be more effective than chemotherapy alone. Your healthcare team may decide to add an immunotherapy drug depending on your health status.

SCLC patients tend to have a good initial response to chemotherapy, but the disease inevitably recurs (comes back) because resistance to the treatment develops. When it recurs, a single chemotherapy, such as topotecan (Hycamtin<sup>®</sup>) or paclitaxel (Taxol<sup>®</sup> or Onxol<sup>®</sup>), is often used. Another option is the immunotherapy drug nivolumab (Opdivo<sup>®</sup>), which is approved for patients with extensive-stage SCLC whose cancer has progressed after treatment with a platinum-based chemotherapy and at least one other line of therapy.

### Lung cancer chemotherapy side effects

## Why there are side effects from lung cancer chemotherapy

Chemotherapy drugs kill rapidly dividing cells but cannot tell the difference between rapidly growing cancer cells and healthy, normal cells that also divide rapidly. Most healthy, normal cells do not divide rapidly. Those that do include hair cells, blood cells (**red blood cells**, **platelets**, and **white blood cells**), and the cells lining the mouth and intestines. When chemotherapy attacks these healthy, normal cells, it can cause side effects. However, normal cells can repair the damage or be replaced by other healthy cells, which is why side effects are usually temporary.

### Common side effects of lung cancer chemotherapy

**Note:** Each chemotherapy drug has a different set of most common side effects. Likewise, each person differs in their response to chemotherapy. Just because a side effect is possible does not mean that you will experience it.

The most common side effects of chemotherapy in both NSCLC and SCLC are:

- Constipation
- Diarrhea
- Easy bruising or bleeding
- Fatigue
- Hair loss
- Increased risk of infection
- Loss of appetite or change in taste buds
- Mouth and throat sores
- Nausea, vomiting
- **Peripheral neuropathy**: Pain, burning or tingling sensations, sensitivity to cold or heat, or weakness, mainly in hands and feet

While most of the side effects of chemotherapy stop after treatment, some side effects may continue, recur, or develop later. Among the serious long-term effects may be heart disease, another type of cancer, low levels of thyroid hormones, fertility issues, and **cognitive** problems. These can occur even years after treatment is completed. For that reason, it is essential if you receive chemotherapy that you are followed up throughout your life by a healthcare team that is aware of the potential effects of treatment.

## Managing the side effects of lung cancer chemotherapy

It is important for you to discuss each chemotherapy drug with your healthcare team to be prepared for potential side effects and to understand what can be done to prevent and/or treat them. Your healthcare team can often prescribe drugs or make recommendations about other ways to help relieve many of these side effects. Be sure to communicate with your healthcare team if and when new side effects begin, as treating them early on is often more effective than trying to treat them once they become severe. Sometimes the doses of the chemotherapy drugs may need to be lowered or treatment may need to be delayed to prevent the side effects from becoming worse.

Some specific ways in which the common side effects of chemotherapy drugs are sometimes managed are listed below; the list is by no means comprehensive. Again, discuss your side effects with your healthcare team to determine the best approaches to managing them given your particular situation.

- Constipation: Stool softeners; laxatives
- Diarrhea: Anti-diarrheal medications
- Easy bruising or bleeding: Lower chemotherapy dose; longer time between chemotherapy cycles; drug that prevents lower platelet counts
- **Fatigue:** If fatigue is related to depression, antidepressant medications; lower chemotherapy dose; longer time between chemotherapy cycles
- Hair loss: Cold cap therapy; medications; emotional support; cranial prosthesis
- Increased risk of infection: Preventive antibiotics; washing hands well; using lotion to keep skin from cracking; avoiding people with contagious illness; take filgrastim (Neupogen®), a medication that increases the number of infection-fighting cells in the body

- Loss of appetite or change in taste buds: Appetite stimulants; nutritional supplements
- Mouth and throat sores: Rinsing/gargling with a solution of salt water and baking soda; avoidance of foods that are spicy, salty, or acidic
- **Nausea, vomiting:** Medications, including both preventive and therapeutic; IV fluids; behavioral therapy
- Peripheral neuropathy: Physical therapy or complementary therapies (such as massage and acupuncture); medications (for neuropathic pain), including anticonvulsants and antidepressants; over-the-counter pain medications for mild pain; prescription non-steroidal anti-inflammatory drugs for severe pain; diet rich in B1 and B12, folic acid, and antioxidants

# Finding a clinical trial that might be right for you

If you are considering participating in a clinical trial, start by asking your healthcare team whether there is one that might be a good match for you in your geographic area. Note that if your lung cancer tests positive for a driver mutation for which a U.S. Food and Drug Administration (FDA)-approved therapy exists, you may be eligible to enroll in a trial with specific targeted therapies.

02 chemotherapy and lung cancer LUNGEVITY FOUNDATION 23

Below are several resources in addition to your healthcare team to help you find a clinical trial that may be a good match.

## RESOURCES TO HELP YOU NAVIGATE YOUR CLINICAL TRIALS SEARCH:

- LUNGevity Clinical Trial Finder: https://clinicaltrials.LUNGevity.org/
  - Find available clinical trials by type of lung cancer and geographic location
  - Also find information and links to the medical centers at which these clinical trials are taking place
- EmergingMed: https://app.emergingmed.com/lcctal/home
  - LUNGevity partners with this free clinical trials matching service to help you with the decision of whether to participate in a clinical trial; EmergingMed helps you identify lung cancer clinical trials for which you may be eligible
  - Clinical trial navigators are available Monday through Friday from 9:00am to 5:00pm ET at 877-769-4834
- National Cancer Institute (NCI): www.clinicaltrials.gov
- My Cancer Genome: www.mycancergenome.org/
  - My Cancer Genome gives up-to-date information on what mutations make cancers grow and related treatment options, including available clinical trials

#### (CONTINUED)

#### RESOURCES TO HELP YOU NAVIGATE YOUR CLINICAL TRIALS SEARCH (CONTINUED):

- Lung Cancer Mutation Consortium (LCMC): www.golcmc.com/
  - Composed of 16 leading cancer centers across the country, LCMC's goal is to examine the tumors of patients who have advanced stage non-small cell lung cancer adenocarcinoma (stage IIIB or IV), and match those patients to the best possible therapies, including clinical trials
- Lung Cancer Master Protocol (LUNG-MAP): www.lung-map.org/
  - For patients with squamous cell lung cancer, LUNG-MAP is a collaboration of many research sites across the country. They use a unique approach to match patients to one of several drugs being developed

In addition, if you are interested in a specific drug or other treatment that is being developed, you can often find information about studies for that drug on the website of the company developing it.

## QUESTIONS TO ASK YOUR HEALTHCARE TEAM ABOUT CHEMOTHERAPY:

- Why do I need chemotherapy?
- What are the advantages and disadvantages of chemotherapy for me?
- How successful is chemotherapy for my type of cancer?
- Are there any other treatments I can have instead?
- How much does treatment cost?
- What drugs will I be receiving? How will they be given?
- How often will I receive this treatment? How long will each treatment last?
- For how long will I be having chemotherapy treatments?
- Where will I have the chemotherapy? Can I have it close to where I live?
- What are the possible side effects of this treatment, and what can I do to control them?
- Will I need to eat a special diet while having chemotherapy?
- Are there any complementary therapies that will help?
- How will I know if the treatment is working?
- Will chemotherapy affect my sex life and/or fertility?
- After treatment has finished, will I need check-ups?
- Whom should I contact for information or if I have a problem during treatment? Who is my after-hours contact?
- Should I change my normal activities during chemotherapy? If yes, how?

02 chemotherapy and lung cancer LUNGEVITY FOUNDATION 26

## 03 glossary

Adenocarcinoma—One type of non-small cell lung cancer (NSCLC) that usually develops in the cells lining the lungs. It is the most common type of lung cancer seen in nonsmokers

ALK—See anaplastic lymphoma kinase

**Anaplastic lymphoma kinase (ALK)**—A gene that the body normally produces but, when it fuses with another gene, produces an abnormal protein that leads to cancer cell growth

**Angiogenesis inhibitor**—Drug given during cancer treatment to prevent the growth of new blood vessels that tumors need to grow

Antioxidant—A substance that protects cells from the damage caused by free radicals (unstable molecules made by the process of oxidation during normal metabolism). Antioxidants include beta-carotene, lycopene, vitamins A, C, and E, and other natural and manufactured substances

**Biomarker testing**—Analyzing DNA to look for a gene mutation that may indicate an increased risk for developing a specific disease or disorder **Chemoport**—A port is a device used to draw blood and give treatments, including intravenous fluids, drugs, or blood transfusions; a chemoport delivers the chemotherapy drug. The port is placed under the skin, usually in the chest. It is attached to a catheter (a thin, flexible tube) that is guided (threaded) into a large vein above the right side of the heart—the superior vena cava. A port may stay in place for many weeks or months. A needle is inserted through the skin into the port to draw blood or give fluids

**Chemotherapy**—Treatment that uses drugs to stop the growth of cancer cells, either by killing the cells or by stopping them from dividing

Chromosome—Part of a cell that contains genetic information (DNA)

**Clinical trial**—A type of research study that tests how well new medical approaches work in people. These studies test new methods of screening, prevention, diagnosis, or treatment of a disease. Also called clinical research trial or study

**Cognitive**—Of, or relating to, being, or involving conscious intellectual activity (such as thinking, reasoning, or remembering)

**Cold cap therapy**—Wearing a cap or head covering with cold packs before, during, or after chemotherapy to help prevent hair loss. The cold narrows the blood vessels in the skin on the head, which means that less of the drug reaches the hair follicles, the small openings on the scalp through which hair grows

**Cranial prosthesis**—A wig custom-made after hair loss from a condition or a treatment, such as chemotherapy

**CT scan**—A procedure that uses a computer linked to an X-ray machine to make a series of detailed pictures of areas inside the body. The pictures are taken from different angles and are used to create three-dimensional (3D) views of tissues and organs. A dye may be injected in a vein or swallowed to help the tissues and organs show up more clearly. Also called CAT scan and computed tomography scan

**DNA**—The molecules inside cells that carry genetic information and pass it from one generation to the next. Also called deoxyribonucleic acid

**Driver mutation**—A change in the DNA of a gene that leads to the development or progression of a tumor

EGFR—See epidermal growth factor receptor

**Epidermal growth factor receptor (EGFR)**—The protein found on the surface of some cells and to which epidermal growth factor binds, causing the cells to divide. It is found at abnormally high levels on the surface of many types of cancer cells, so these cells may divide excessively in the presence of epidermal growth factor

**Extensive-stage small cell lung cancer**—Small cell lung cancer (SCLC) that has spread outside the lung in which it began or to other parts of the body

**First-line treatment**—The first therapy given for a disease. It is often part of a standard set of treatments, such as surgery followed by chemotherapy and radiation. When used by itself, first-line therapy is the one accepted as the best treatment. If it doesn't cure the disease or it causes severe side effects, other treatments may be added or used instead

**Gene**—Coded instructions within a cell that control how the cell grows in a systematic and precise way. Genes contain DNA

**Immunotherapy**—A type of therapy that uses substances to stimulate or suppress the immune system to help the body fight cancer, infection, and other diseases. Some types of immunotherapy only target certain cells of the immune system. Others affect the immune system in a general way

Limited-stage small cell lung cancer—Small cell lung cancer (SCLC) found in one lung, the tissues between the lungs, and nearby lymph nodes only **Maintenance therapy**—Treatment that is given to help keep cancer from coming back after it has disappeared following the initial therapy. It may include treatment with drugs, vaccines, or antibodies that kill cancer cells, and it may be given for a long time

**Mutation**—Any change in the DNA or gene sequence of a cell. Mutations may be caused by mistakes during cell division, or they may be caused by exposure to gene-damaging agents in the environment. Certain mutations may lead to cancer or other disease

**Neuropathic pain**—Pain resulting from damage, disease, or dysfunction of one or more nerves of the peripheral nervous system

**Non-small cell lung cancer (NSCLC)**—A group of lung cancers that are named for the kinds of cells found in the cancer and how the cells look under a microscope. The three main types of NSCLC are adenocarcinoma, squamous cell lung cancer, and large cell lung cancer. NSCLC is the most common kind of lung cancer

**Non-steroidal anti-inflammatory drugs**—A class of drugs that reduce pain, fever, and inflammation

NSCLC—See non-small cell lung cancer

**Nucleus**—The central part of most cells that contains genetic material (DNA, genes, chromosomes) and is enclosed in a membrane

**Palliative care**—Care given to improve the quality of life of patients who have a serious or life-threatening disease. The goal of palliative care is to prevent or treat as early as possible the symptoms of a disease, side effects caused by treatment of a disease, and psychological, social, and spiritual problems related to a disease or its treatment. Also called comfort care, supportive care, and symptom management

**PD-L1 (programmed death ligand 1)**—Part of the immune system mechanism that keeps T cells from functioning

**Peripheral neuropathy**—A nerve problem that causes pain, numbness, tingling, swelling, or muscle weakness in different parts of the body. It usually begins in the hands or feet and gets worse over time

**Platelet**—Tiny piece of cells that are found in the blood and that help the blood clot

**Prophylactic cranial irradiation**—Radiation therapy to the head to reduce the risk that cancer will spread to the brain

**Radiation therapy**—The use of high-energy radiation from X-rays, gamma rays, neutrons, protons, and other sources to kill cancer cells and shrink tumors. Radiation may come from a machine outside the body (external-beam radiation therapy) or it may come from radioactive materials placed in the body near cancer cells (internal radiation therapy). Also called irradiation and radiotherapy

**Red blood cells**—Cells that carry oxygen to the tissues

SCLC—See small cell lung cancer

**Second-line treatment or therapy**—Treatment that is given when initial treatment (first-line therapy) doesn't work or stops working

**Signaling pathway**—Describes a group of molecules in a cell that work together to control one or more cell functions, such as cell division or cell death. After the first molecule in a pathway receives a signal, it activates another molecule. This process is repeated until the last molecule is activated and the cell function is carried out. Abnormal activation of signaling pathways can lead to cancer, and drugs are being developed to block these pathways. These drugs may help block cancer cell growth and kill cancer cells

**Small cell lung cancer (SCLC)**—An aggressive (fast-growing) cancer that forms in tissues of the lung and can spread to other parts of the body. The cancer cells look small and oval-shaped when looked at under a microscope

**Squamous cell lung cancer**—A type of non-small cell lung cancer (NSCLC) that usually starts near a central bronchus. It begins in squamous cells, which are thin, flat cells that look like fish scales. Also called squamous cell carcinoma

**Stage**—The extent of cancer in the body. In non-small cell lung cancer (NSCLC), stages range from 0 to IV, where IV is the most advanced stage, in which the cancer has spread to other parts of the body from where it started. In small cell lung cancer (SCLC), the two stages are limited-stage disease and extensive-stage disease

**Targeted therapy**—A type of treatment that uses drugs to identify and attack specific types of cancer cells with less harm to normal cells. Some targeted therapies block the action of certain enzymes, proteins, or other molecules involved in the growth and spread of cancer cells

**Tumor**—An abnormal group of tissue that results when cells divide more than they should or do not die when they should

**Tumor proportion score (TPS)**—The percentage of cancer cells that produce the PD-L1 proteins. The lung cancer tissue is stained with special dyes that mark PD-L1 positive tumor cells. A pathologist counts the number of cells that stain positive and determines the TPS

Vascular endothelial growth factor receptor 2 (VEGFR2) inhibitor— A substance that blocks an enzyme needed to form blood vessels. Also called VEGFR tyrosine kinase inhibitor

White blood cells—A type of blood cell that is made in the bone marrow and found in the blood and lymph tissue. White blood cells are part of the body's immune system. They help the body fight infection and other diseases

04 notes	
	04 notes LUNGEVITY FOUNDATION

04 notes LUNGEVITY FOUNDATION	34

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04 notes LUNGEVITY FOUNDATION	35



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