Non-Small Cell Lung Cancer Treatment

Treatment Option Overview
There are different types of treatment for patients with non-small cell lung cancer.

Nine types of standard treatment are used:

- Surgery
- Radiation therapy
- Chemotherapy
- Targeted therapy
- Laser therapy
- Photodynamic therapy (PDT)
- Cryosurgery
- Electrocautery
- Watchful waiting

New types of treatment are being tested in clinical trials.

- Chemoprevention
- Radiosensitizers
- New combinations

Patients may want to think about taking part in a clinical trial.

Patients can enter clinical trials before, during, or after starting their cancer treatment.

Follow-up tests may be needed.

There are different types of treatment for patients with non-small cell lung cancer.

Different types of treatments are available for patients with non-small cell lung cancer. Some treatments are standard (the currently used treatment), and some are being tested in clinical trials. A treatment clinical trial is a research study meant to help improve current treatments or obtain information on new

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Source: NIH National Cancer Institute
treatments for patients with cancer. When clinical trials show that a new treatment is better than the standard treatment, the new treatment may become the standard treatment. Patients may want to think about taking part in a clinical trial. Some clinical trials are open only to patients who have not started treatment.

Nine types of standard treatment are used:

**Surgery**

Four types of surgery are used to treat lung cancer:

- **Wedge resection:** Surgery to remove a tumor and some of the normal tissue around it. When a slightly larger amount of tissue is taken, it is called a segmental resection.
- **Lobectomy:** Surgery to remove a whole lobe (section) of the lung.
- **Pneumonectomy:** Surgery to remove one whole lung.
- **Sleeve resection:** Surgery to remove part of the bronchus.

Even if the doctor removes all the cancer that can be seen at the time of the surgery, some patients may be given chemotherapy or radiation therapy after surgery to kill any cancer cells that are left. Treatment given after the surgery, to lower the risk that the cancer will come back, is called adjuvant therapy.

**Radiation Therapy**

Radiation therapy is a cancer treatment that uses high-energy x-rays or other types of radiation to kill cancer cells or keep them from growing. There are two types of radiation therapy:

- **External radiation therapy** uses a machine outside the body to send radiation toward the cancer.
- **Internal radiation therapy** uses a radioactive substance sealed in needles, seeds, wires, or catheters that are placed directly into or near the cancer.

Stereotactic body radiation therapy is a type of external radiation therapy. Special equipment is used to place the patient in the same position for each radiation treatment. Once a day for several days, a radiation machine aims a larger than usual dose of radiation directly at the tumor. By having the patient in the same position for each treatment, there is less damage to nearby
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healthy tissue. This procedure is also called stereotactic external-beam radiation therapy and stereotaxic radiation therapy.

Stereotactic radiosurgery is a type of external radiation therapy used to treat lung cancer that has spread to the brain. A rigid head frame is attached to the skull to keep the head still during the radiation treatment. A machine aims a single large dose of radiation directly at the tumor in the brain. This procedure does not involve surgery. It is also called stereotaxic radiosurgery, radiosurgery, and radiation surgery.

For tumors in the airways, radiation is given directly to the tumor through an endoscope.

The way the radiation therapy is given depends on the type and stage of the cancer being treated. It also depends on where the cancer is found. External and internal radiation therapy are used to treat non-small cell lung cancer.

Chemotherapy

Chemotherapy is a cancer treatment that uses drugs to stop the growth of cancer cells, either by killing the cells or by stopping them from dividing. When chemotherapy is taken by mouth or injected into a vein or muscle, the drugs enter the bloodstream and can reach cancer cells throughout the body (systemic chemotherapy). When chemotherapy is placed directly into the cerebrospinal fluid, an organ, or a body cavity such as the abdomen, the drugs mainly affect cancer cells in those areas (regional chemotherapy).

The way the chemotherapy is given depends on the type and stage of the cancer being treated.

Targeted Therapy

Targeted therapy is a type of treatment that uses drugs or other substances to attack specific cancer cells. Targeted therapies usually cause less harm to normal cells than chemotherapy or radiation therapy do. Monoclonal antibodies and tyrosine kinase inhibitors are the two main types of targeted therapy being used to treat advanced, metastatic, or recurrent non-small cell lung cancer.

Monoclonal Antibodies

Monoclonal antibody therapy is a cancer treatment that uses antibodies made in the laboratory from a single type of immune system cell. These antibodies can identify substances on cancer cells or normal substances in the blood or tissues that may help cancer cells grow. The antibodies

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Source: NIH National Cancer Institute
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attach to the substances and kill the cancer cells, block their growth, or keep them from spreading. Monoclonal antibodies are given by infusion. They may be used alone or to carry drugs, toxins, or radioactive material directly to cancer cells.

There are different types of monoclonal antibody therapy:

- Vascular endothelial growth factor (VEGF) inhibitor therapy: Cancer cells make a substance called VEGF, which causes new blood vessels to form (angiogenesis) and helps the cancer grow. VEGF inhibitors block VEGF and stop new blood vessels from forming. This may kill cancer cells because they need new blood vessels to grow. Bevacizumab and ramucirumab are VEGF inhibitors and angiogenesis inhibitors.

- Epidermal growth factor receptor (EGFR) inhibitor therapy: EGFRs are proteins found on the surface of certain cells, including cancer cells. Epidermal growth factor attaches to the EGFR on the surface of the cell and causes the cells to grow and divide. EGFR inhibitors block the receptor and stop the epidermal growth factor from attaching to the cancer cell. This stops the cancer cell from growing and dividing. Cetuximab and necitumumab are EGFR inhibitors.

- Immune checkpoint inhibitor therapy: PD-1 is a protein on the surface of T cells that helps keep the body's immune responses in check. When PD-1 attaches to another protein called PDL-1 on a cancer cell, it stops the T cell from killing the cancer cell.

- PD-1 inhibitors attach to PDL-1 and allow the T cells to kill cancer cells. Nivolumab and pembrolizumab are types of immune checkpoint inhibitors.

Tyrosine Kinase Inhibitors

Tyrosine kinase inhibitors are small-molecule drugs that go through the cell membrane and work inside cancer cells to block signals that cancer cells need to grow and divide. Some tyrosine kinase inhibitors also have angiogenesis inhibitor effects.

There are different types of tyrosine kinase inhibitors:

- Epidermal growth factor receptor (EGFR) tyrosine kinase inhibitors: EGFRs are proteins found on the surface and inside certain cells, including cancer cells. Epidermal growth factor attaches to the EGFR inside the cell and sends signals to the tyrosine kinase area of the cell, which tells the cell to grow and divide. EGFR tyrosine kinase inhibitors stop these signals and stop the cancer cell from growing and dividing. Erlotinib, gefitinib, and afatinib are types of EGFR tyrosine kinase inhibitors. Some of these drugs work better when there is also a mutation (change) in the EGFR gene.

- Kinase inhibitors that affect cells with certain gene changes: Certain changes in the

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Source: NIH National Cancer Institute
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*ALK* and *ROS1* genes cause too much protein to be made. Blocking these proteins may stop the cancer from growing and spreading. Crizotinib is used to stop proteins from being made by the *ALK* and *ROS1* gene. Ceritinib is used to stop proteins from being made by the *ALK* gene.

**Laser Therapy**

Laser therapy is a cancer treatment that uses a laser beam (a narrow beam of intense light) to kill cancer cells.

**Photodynamic Therapy (PDT)**

Photodynamic therapy (PDT) is a cancer treatment that uses a drug and a certain type of laser light to kill cancer cells. A drug that is not active until it is exposed to light is injected into a vein. The drug collects more in cancer cells than in normal cells. Fiberoptic tubes are then used to carry the laser light to the cancer cells, where the drug becomes active and kills the cells. Photodynamic therapy causes little damage to healthy tissue. It is used mainly to treat tumors on or just under the skin or in the lining of internal organs. When the tumor is in the airways, PDT is given directly to the tumor through an endoscope.

**Cryosurgery**

Cryosurgery is a treatment that uses an instrument to freeze and destroy abnormal tissue, such as carcinoma in situ. This type of treatment is also called cryotherapy. For tumors in the airways, cryosurgery is done through an endoscope.

**Electrocautery**

Electrocautery is a treatment that uses a probe or needle heated by an electric current to destroy abnormal tissue. For tumors in the airways, electrocautery is done through an endoscope.

**Watchful Waiting**

Watchful waiting is closely monitoring a patient’s condition without giving any treatment until signs or symptoms appear or change. This may be done in certain rare cases of non-small cell lung cancer.

**New types of treatment are being tested in clinical trials.**

This summary section describes treatments that are being studied in clinical trials. It may not mention every new treatment being studied.

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Chemoprevention

Chemoprevention is the use of drugs, vitamins, or other substances to reduce the risk of cancer or to reduce the risk cancer will recur (come back). For lung cancer, chemoprevention is used to lessen the chance that a new tumor will form in the lung.

Radiosensitizers

Radiosensitizers are substances that make tumor cells easier to kill with radiation therapy. The combination of chemotherapy and radiation therapy given with a radiosensitizer is being studied in the treatment of non-small cell lung cancer.

New combinations

New combinations of treatments are being studied in clinical trials.

Patients may want to think about taking part in a clinical trial.

For some patients, taking part in a clinical trial may be the best treatment choice. Clinical trials are part of the cancer research process. Clinical trials are done to find out if new cancer treatments are safe and effective or better than the standard treatment.

Many of today's standard treatments for cancer are based on earlier clinical trials. Patients who take part in a clinical trial may receive the standard treatment or be among the first to receive a new treatment.

Patients who take part in clinical trials also help improve the way cancer will be treated in the future. Even when clinical trials do not lead to effective new treatments, they often answer important questions and help move research forward.

Patients can enter clinical trials before, during, or after starting their cancer treatment.

Some clinical trials only include patients who have not yet received treatment. Other trials test treatments for patients whose cancer has not gotten better. There are also clinical trials that test new ways to stop cancer from recurring (coming back) or reduce the side effects of cancer treatment.

Clinical trials are taking place in many parts of the country. See the Treatment Options section that follows for links to current treatment clinical trials. These have been retrieved from NCI's listing of clinical trials.

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Source: NIH National Cancer Institute
Follow-up tests may be needed.

Some of the tests that were done to diagnose the cancer or to find out the stage of the cancer may be repeated. Some tests will be repeated in order to see how well the treatment is working. Decisions about whether to continue, change, or stop treatment may be based on the results of these tests.

Some of the tests will continue to be done from time to time after treatment has ended. The results of these tests can show if your condition has changed or if the cancer has recurred (come back). These tests are sometimes called follow-up tests or check-ups.