

## Patient information from the BMJ Group

# Lung cancer

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## Lung cancer

If you're diagnosed with lung cancer, you'll need to make some important decisions about your treatment.

We've brought together the best research about lung cancer and weighed up the evidence about how to treat it. You can use our information to talk to your doctor and decide which treatments are best for you.

### What is lung cancer?

It can be devastating to find out that you or someone close to you has lung cancer. It's a serious illness. It means some of the cells in your lungs have started to grow out of control, invading and destroying other cells. In the weeks and months to follow, you will probably have many different emotions, including anxiety about what lies ahead.

Almost before you have had time to take in what the doctors have told you, you will be offered a range of tests and treatments that aim to get rid of your cancer or relieve your symptoms, or both. The treatments you're offered will depend on the type of lung cancer you have, how large it is, and whether it has spread. A lot will also depend on how you feel about your illness and how you would like it to be treated.

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If you are diagnosed with lung cancer, you will need to make some important decisions about your treatment.

We hope our information will answer your questions about lung cancer. It may also help you talk to your doctor about the best treatments for you.

Some people want to know more about their cancer than others. Some will choose to have treatments that may help them live longer but which could have unpleasant, sometimes harmful, side effects. Other people prefer to enjoy as much of life as they can. <sup>[1]</sup>

There's no right or wrong way for you to deal with your cancer. The most important thing is for you to feel comfortable with the decisions you make. It's also essential that your medical team and those who care about you listen to what you say and respect your wishes.

## Key points for people with lung cancer

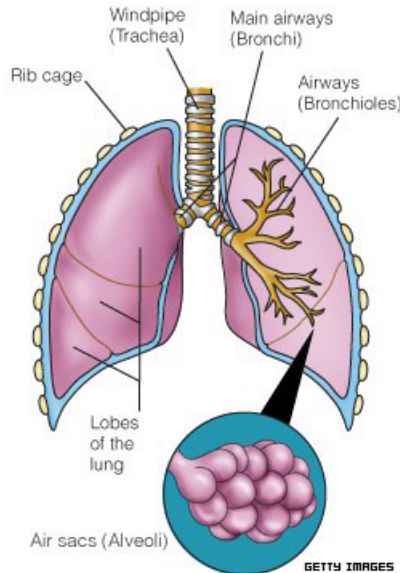
- Lung cancer is the second most common type of cancer in men and the third most common in women (not counting skin cancer). It's the leading cause of death from cancer in the UK.
- By the time most people are diagnosed, their lung cancer has spread outside their lungs.
- You will be offered a range of treatments that aim to get rid of the cancer and improve your symptoms.
- Most treatments have side effects. You need to weigh these against the benefits.

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- Cigarette smoking is the most common cause of lung cancer. The best way to prevent lung cancer is not to smoke.

## Your lungs and what they do

You have two lungs. They sit in your chest, inside your rib cage, one on each side of your heart. They are covered by a layer of moist tissue called the **pleura**.



Oxygen passes into your blood through tiny air sacs in your lungs.

Your lungs are a little like two spongy, elastic bags that fill up with air as you breathe in. They empty as you breathe out. The right lung is divided into three sections. These sections are called lobes. The left lung has two sections (or lobes).

Keeping your lungs healthy is important. They take oxygen from the air you breathe. Your blood carries this oxygen around your body. When you breathe out, your lungs get rid of carbon dioxide, which is a waste product made by your body.

Here's how air travels into your lungs.

Your windpipe (also called your **trachea**) is the air passage that leads from your throat into your chest. In your chest, your windpipe divides into two smaller airways (called **bronchi**). Each airway leads into a lung.

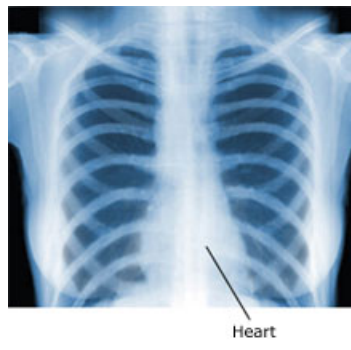
Inside your lungs, the airways divide into even smaller airways (called **bronchioles**). At the end of each of these smaller airways are little air sacs (called **alveoli**).

When you breathe in, air travels down your windpipe, through the airways, into your lungs and then into the smaller airways and the air sacs.

The air sacs in your lungs are connected to the network of blood vessels that surrounds your lungs. Oxygen from the air you breathe in passes through the thin walls of the air sacs and into these blood vessels. Then, the oxygen is carried back to your heart and

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pumped around your body. At the same time, carbon dioxide (which is made as a by-product of breathing) passes from your blood into the air sacs. The carbon dioxide leaves your body when you breathe out.



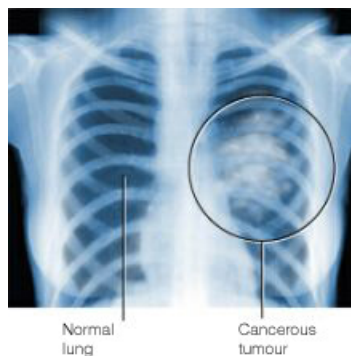
This is an x-ray picture of normal lungs. You can see the heart in the middle.

Also inside your chest, lying between your lungs are:

- Your heart
- The main blood vessels that carry blood to and from your heart and the rest of your body
- The tube that carries food from your mouth to your stomach. This tube is called the oesophagus.

### What goes wrong in lung cancer?

When your body's cells are healthy, they divide, grow old, then die and are replaced with new cells in an orderly way. But when you get cancer, your cells grow and multiply too quickly.



In lung cancer, abnormal cells group together to form a lump called a tumour.

This means your cells don't have time to develop into normal, healthy cells. They may be the wrong shape and may not work properly. And they tend to lie on top of one another instead of in neat rows. Lung cancer can start almost anywhere in your lungs, but it

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usually starts in the walls of your larger airways. Abnormal cells tend to group together and form a lump called a **tumour**. This slowly gets bigger.

Nearly all types of lung cancer can spread to other parts of your body and form more tumours. These are called secondary tumours. You may hear doctors talk about **metastasis**. This is the word doctors use to describe the way cancer spreads.

To find out more, see [How lung cancer spreads](#) .

### Types of lung cancer

Doctors divide lung cancer into two main kinds, based on what the cancer cells look like when examined in the laboratory.

The main types of lung cancer are:

**Non-small-cell lung cancer (NSCLC)**. This is the most common kind. About 80 in 100 cases of lung cancer are this type. It can start in different parts of the lung. There are three different types of non-small-cell cancer.

- **Adenocarcinoma**: This kind of cancer grows in certain glands that produce mucus. It usually starts in the airways at the outer edges of the lungs. It is the most common type of non-small-cell lung cancer, making up about 40 in 100 of all cases of lung cancer. <sup>[2]</sup>
- **Squamous cell carcinoma**: This is a slow-growing cancer that affects the airways. It makes up about 30 in 100 of all cases of lung cancer.
- **Large cell carcinoma**: This type of cancer is made up of larger cells than other forms of lung cancer. About 10 in 100 cases of lung cancers are this type.

**Small-cell lung cancer (SCLC)**. About 20 in 100 cases of lung cancer are this type. Doctors also call this sort of lung cancer **oat cell cancer** because it's made up of small cells that look like oats. These cells grow and spread more quickly than the cells in non-small-cell lung cancer. <sup>[3]</sup>

### Lung cancer: why me?

Some things increase your chances of getting lung cancer. Doctors call these things risk factors. Having a risk factor doesn't mean you'll definitely get lung cancer. It just means you're more likely to get it than someone who doesn't have the risk factor.

We've listed the main risk factors for lung cancer below. The most important is smoking. But sometimes people who have never smoked still get lung cancer.

If you think you have a high risk of getting lung cancer, you may wonder if there is some way of being tested that would catch lung cancer early, before it grows. This kind of test is called **screening**, but so far it hasn't been very successful for finding lung cancer. To find out more, see [Can I be screened for lung cancer?](#)

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## Smoking

Smoking is responsible for 9 in 10 deaths from lung cancer. <sup>[4]</sup> <sup>[5]</sup> Men who smoke are 22 times more likely to die from lung cancer than those who don't smoke. Women who smoke are 12 times more likely to die from lung cancer.

Smoking leads to cancer because cells in the lung are damaged by poisonous chemicals in cigarette smoke. Over time, these cells become cancerous.

How much you smoke is important too. If you smoke less than half a pack a day, you're 15 times more likely to die from lung cancer than a non-smoker. If you smoke one or two packs daily, you have a 42 times greater chance of dying from lung cancer than someone who doesn't smoke. <sup>[6]</sup>

Switching to a different brand with less tar or less nicotine doesn't make any difference to your risk of getting lung cancer. <sup>[7]</sup> There's no such thing as a safer cigarette. You'll also inhale poisonous chemicals that can cause lung cancer if you smoke cannabis.

Smoking cigars or a pipe also gives you a higher chance of getting lung cancer than non-smokers, even if you don't inhale.

Living or working in a smoky atmosphere makes it more likely you'll get lung cancer, even if you don't smoke. This is called **passive smoking**. Living with a smoker increases your risk of lung cancer by 20 percent to 30 percent. <sup>[4]</sup>

If you smoke or used to smoke, you may feel that this has caused your lung cancer and you may feel guilty. You may think other people blame you for getting lung cancer. You may even think that your doctor doesn't have much sympathy. But you shouldn't blame yourself for smoking. Nicotine is a highly addictive drug. And most people start smoking when they are teenagers and get addicted when they're too young to know any better. Also, some people with lung cancer have never smoked at all.

## Being older

Lung cancer is more common in older people, probably because they've been smoking longer. In the UK, only around 1 in 100 people who have lung cancer are under 45 when they get the disease. <sup>[8]</sup>

Young people who get lung cancer tend to be heavy smokers who started smoking at a young age. They also tend to have a family history of the disease. <sup>[6]</sup>

## Working in certain industries

Some materials used in industry can give you a greater chance of getting lung cancer. <sup>[8]</sup> About 10 percent to 15 percent of lung cancer cases are probably due to working with cancer-causing substances. The most common of these is asbestos. <sup>[6]</sup>

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All types of asbestos fibres cause lung cancer, but long-term exposure to types of asbestos called crocidolite or amosite carries the highest risk. It can take many years for the cancer to develop. The dangers of asbestos are now well-known, and there are laws about how it's used. So there should be fewer lung cancers due to asbestos in the future.

Other chemicals that can cause lung cancer include arsenic and chromium. Nickel and vinyl chloride also carry a small risk.<sup>[8]</sup> These substances are used in several industries, but there are laws about how they are used.

### Living with radon

Radon is an invisible, odourless and tasteless gas that is found naturally in soil and rocks. High levels of radon are found in buildings built on land that contains a lot of radon. If you live or work in one of these areas, you may have an increased chance of getting lung cancer.<sup>[9]</sup>

In the UK, these areas are Devon, Cornwall, Somerset, Northamptonshire, and Derbyshire.

The average concentration of radon in the home is 20 becquerels per cubic metre (Bq/m<sup>3</sup>).<sup>[9]</sup> If the level is higher than this, the UK government recommends steps to reduce it. Although radon gas is thought to cause lung cancer, researchers haven't proved whether there is a link.<sup>[6]</sup>

### Living with air pollution

Some studies have suggested there might be a link between air pollution and lung cancer. Researchers are trying to find out how this might happen. It could be that breathing in particles from the air damages the cells in your lungs. These damaged cells may become cancerous.

The main air pollutants are from motor vehicles, and include carbon monoxide, hydrocarbons, sulphur oxide and nitrogen oxide. However, if pollution does cause cancer, the risk is tiny compared with the risk from smoking. Studies have shown that air pollution may cause fewer than 1 in 100 cases of lung cancer.<sup>[6]</sup>

### Having another lung disease

If you have a lung disease such as tuberculosis, asthma, emphysema, or chronic bronchitis, you are slightly more likely to get lung cancer than other people.

If you smoke, you may have a condition called chronic obstructive pulmonary disease (COPD). If you have COPD, you are more likely to get lung cancer.<sup>[6]</sup> In COPD, not enough air flows into or out of the lungs. COPD is nearly always caused by smoking.

### Having lung cancer in the family

There's some evidence from the United States that if your parents, brothers or sisters have had lung cancer, you are slightly more likely to get the disease than people with no family history.<sup>[10]</sup>

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## What stage is your lung cancer?

The TNM system is used to classify your lung cancer. It looks at three factors:

- T is for tumour
- N is for (lymph) nodes
- M is for metastasis (when the cancer spreads to other parts of your body, such as your bones).

Each factor is given a number. Generally, lower numbers mean your cancer is smaller and hasn't spread far (if at all).

- For T: The number tells you how big your cancer is and whether the cancer has spread outside the lung.
- For N: The number tells you whether your lung cancer has spread to your lymph nodes. Cancer cells can grow in the nodes and then travel from there to other parts of the body.
- For M: The number tells you whether your lung cancer has spread to other parts of your body.

The numbers are then sometimes followed by letters. These tell the doctor how the cancer was found and they give more detail about how far it has spread.

Here is an explanation of what each letter and number says about your cancer. [\[18\]](#) [\[19\]](#)

	TNM score	What it means
T (tumour)	TX	Cancer cells have been found but your doctor cannot find a lump (tumour).
	T0	There is no sign of lung cancer.
	Tis	Your tumour is only in the lining of the airway (in the bronchus or bronchiole). Doctors call this carcinoma in situ.
	T1	The diameter of your tumour is 3 centimetres (cm) (1.2 inches) or smaller.
	T2	Your tumour is more than 3 cm in size and it has started to affect the covering around your lungs (pleura), but it is at least 2 cm (0.8 inches) from the point at which your windpipe (trachea) divides into the left and right airways (bronchi).



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	T3	Your tumour has spread into the covering round the lungs (pleura) or chest wall and is less than 2 cm (0.8 inches) from the point at which the windpipe (trachea) divides into the left and right airways (bronchi).
	T4	Your tumour has spread to other tissues in the chest, such as the heart, main blood vessels, windpipe (trachea) or the tube that carries food to the stomach (oesophagus). Or it is growing on the covering around the lung (pleura), causing fluid containing cancer cells to build up around the lung.
N (nodes)	NX	Regional lymph nodes cannot be assessed (you may not have been able to have the necessary tests).
	N0	Your lung cancer has not spread to the lymph nodes.
	N1	Your lung cancer has spread to lymph nodes near to the affected lung.
	N2	Your lung cancer has spread to lymph nodes in the middle of the chest.
	N3	Your lung cancer has spread to lymph nodes near the other lung or to lymph nodes above your collarbone.
M (metastasis)	MX	The spread of your cancer cannot be assessed (you may not have been able to have the necessary tests).
	M0	Your lung cancer has not spread to another part of your body.
	M1	Your lung cancer has spread to another lobe of your lung or to another part of your body.

For example, if your lung cancer is described as T1N1M0, it means that the lump (tumour) is 3 centimetres (1.2 inches) or smaller in size, has spread only to **lymph nodes** nearby and has not spread to other parts of your body. To learn more, see [How lung cancer spreads](#).

### Staging non-small-cell lung cancer

If you have non-small-cell lung cancer, doctors use the TNM system to **stage** your cancer on a scale of 0 to 4. Stage 0 is the least advanced stage of lung cancer (doctors call it **carcinoma in situ**) and stage 4 is the most advanced. Doctors call stage 1 and stage 2 lung cancer **early disease**. Stage 3A is called **locally advanced** disease, and stages 3B and 4 are **advanced disease**. Most people with lung cancer have advanced disease by the time they are diagnosed. <sup>[20]</sup>

Here is an explanation of what stages 1 to 4 mean. <sup>[21]</sup>

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- **Stage 1:** The cancer is only in the lung.
- **Stage 2:** The cancer is small but has spread to the lymph nodes closest to the affected lung (**Stage 2A**) or into the chest wall, the outer covering of the lung, the diaphragm or the outer covering of the heart (**stage 2B**).
- **Stage 3:** The cancer has spread to the lymph nodes further away from the affected lung but is still on the same side of the chest (**stage 3A**) or to the lymph nodes on the other side of the chest or collar bone, or to other places in the chest (**stage 3B**). Stage 3B can also mean that there is more than one tumour in the lung or that fluid around the lung (also known as pleural fluid) contains cancer cells.
- **Stage 4:** The cancer has spread to another lobe of the lung from where it started, or to other parts of the body, for example, the liver or brain.

By the time they are diagnosed:

- A quarter of non-small-cell lung cancer patients have cancer that has not spread
- A fifth have cancer that has spread to nearby lymph nodes
- More than half have cancer that has spread to other distant parts of the body. <sup>[22]</sup>

### Staging small-cell lung cancer

If you have small-cell lung cancer, your doctors won't describe the stage in such a complicated way as for non-small-cell lung cancer. <sup>[23]</sup> They will describe the cancer as one of two types.

- **Limited stage disease:** The cancer is on one side of the chest.
- **Extensive stage disease:** The cancer has spread beyond one side of the chest.

About two-thirds of people with small-cell lung cancer have extensive disease when they are diagnosed, and about one-third have limited stage disease. <sup>[23]</sup>

### What are the symptoms of lung cancer?

The most common symptoms of lung cancer are breathing problems and coughing. But you also get other illnesses that affect your lungs, such as [colds](#) , [flu](#) , [asthma](#) , and [bronchitis](#) .

Although your symptoms may start off seeming like a cold or flu, if you have lung cancer they won't get better. They won't be cured by remedies you can buy at a pharmacy or get from your doctor. You may also get much more worrying symptoms, such as coughing up blood.

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You shouldn't ignore minor symptoms like coughing and breathlessness, especially if they go on longer than you would usually expect with a cold or chest infection. And remember: people who've never smoked can get lung cancer too. So it's important to get these symptoms checked out, even if you're a life-long non-smoker.

These symptoms, like coughing and breathlessness, are caused by the cancer in your lung. And if the cancer has spread, you may get symptoms caused by its effects on your chest outside of your lungs or in other parts of your body. Many people get both types of symptoms, although usually they get symptoms in the lung first. <sup>[18]</sup>

### Symptoms from the cancer in your lung

- **Coughing:** If you have lung cancer, you may get a cough that doesn't go away and gets worse over time. The cancer stops you getting enough air into your lungs.
- **Shortness of breath or wheezing:** This may be due to a cold or flu. Or it may happen if you are getting more exercise than you're used to. But it may be a symptom of lung cancer. Again, the cancer is preventing you from getting enough air into your lungs.
- **Coughing up blood:** This could be just a few spots on a tissue. Or there could be larger amounts. It may be caused by the tumour damaging your lung tissue. If you cough up blood you should see a doctor straight away.
- **Airway infections:** Repeated chest infections, such as bronchitis and pneumonia, can happen when a tumour starts to block your airways. Fluid in your lungs becomes trapped and infected.
- **Fever:** Lung cancer can cause a rise in body temperature.

### Symptoms from cancer spreading into the lining of your lung

- **Pain in the chest:** You may also get this with other conditions, such as indigestion or angina (chest pain caused by narrowing of blood vessels near your heart). But with lung cancer, the pain doesn't go away.

### Symptoms from cancer spreading to other parts of your chest

- **Hoarseness when you speak:** A tumour in your left lung could spread into the middle of your chest. When this happens, the nerve that goes to your voice box may be damaged. This can cause hoarseness.
- **Swallowing problems:** This can happen if a tumour grows near the tube that carries food from your mouth to your stomach (oesophagus).

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## Symptoms from cancer spreading to other parts of your body

- Pain in your arms, legs, or back: As well as spreading to other parts of your chest, lung cancer can spread to your bones. This may cause stiffness, aching, or tingling in your arms, legs or back.
- Confusion, forgetfulness and other problems: Cancer that has spread to your brain may cause physical or emotional symptoms. The symptoms you get depend on which part of the brain is affected.

Do bear in mind that everyone gets aches and pains from time to time, whether or not they have lung cancer. It's natural to worry that a new pain means your cancer is spreading, but it may be because of something completely different. If you're anxious, be sure to tell your doctor or nurse, so that you can have tests to check it out.

## Symptoms you can get at any time

- Losing your appetite
- Losing weight
- Feeling weak
- Feeling tired.

These symptoms happen because cancer cells divide and grow much faster than normal cells. They 'steal' more than their fair share of the nourishment you get from your food, leaving your normal cells without enough. It's a vicious circle because the more tired you get, the less you feel like eating, and the weaker you feel.

## How do doctors diagnose lung cancer?

Doctors will ask you questions and do some tests to diagnose lung cancer.

## Seeing your doctor

If you have [symptoms](#) that are worrying you, you should go to your doctor. Your doctor is likely to:

- Ask you about your symptoms
- Listen to your breathing through a stethoscope
- Refer you to your local hospital for a chest x-ray
- Refer you to a hospital specialist.

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## Having a chest x-ray

A chest x-ray takes pictures of your lungs to see if there are any signs of lung cancer or another illness.

Your doctor will refer you for an urgent x-ray if you are coughing up blood. You'll also be referred for an urgent x-ray if you have any of the following symptoms without a clear reason for more than three weeks: <sup>[24]</sup>

- Coughing
- Pain in your chest, shoulder, or both
- Shortness of breath
- Unexpected weight loss
- Chest sounds that aren't normal
- A hoarse voice
- A change in shape of the ends of your fingers (called clubbing)
- Symptoms that could be explained by cancer that has spread to other parts of your body (for example, pain in your bones)
- Swellings in your neck or above your collar bone. This might mean you have cancer in your lymph nodes.

When your doctor gets the results of the x-ray, he or she can decide whether you need to see a specialist.

## Seeing a specialist

If your chest x-ray shows signs of lung cancer, you should be offered an urgent appointment with a specialist. You may also be offered an urgent appointment if your chest x-ray looks normal but your doctor still thinks you might have lung cancer.

If you have one the following symptoms, your doctor may send you straight to hospital to see a specialist as soon as possible, without awaiting the results of your chest x-ray. <sup>[24]</sup>

- You've been coughing up blood for more than three weeks and you're over 40 and a smoker or an ex-smoker
- You have a swelling on your face and neck because of a blockage in one the main veins that run down the sides of your neck (called the jugular veins).

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- You make a harsh, high pitched sound when you breathe (called **stridor**).

The specialist will ask you about your symptoms and listen to your breathing through a stethoscope. He or she will look at your chest x-rays if you've had some done, or arrange for them to be carried out if you haven't. Your specialist may also arrange for some other tests.

### Other tests

#### A computed tomography (CT) scan

If you have an abnormal chest x-ray, your doctor will probably order a CT scan of your chest for a closer look. CT stands for computer tomography.

A CT scan is a special type of x-ray that uses a computer to get a more detailed picture of your lungs. X-rays and CT scans can show if there is anything abnormal about your lungs. But they can't tell the difference between harmless (or benign) lumps and cancerous (malignant) lumps. In order to find out for certain whether you have cancer, you need to have a **biopsy** of any abnormal-looking lumps seen on the x-ray or CT scan.

#### A PET-CT scan

If your CT scan suggests you have cancer that's at an early stage and you are fit enough to have treatment, you should be offered a PET-CT scan. This combines a CT scan with a positron emission tomography (PET) scan. <sup>[27]</sup>

A PET scan uses injections of radioactive chemicals to show what's happening in your tissues, organs, and blood vessels. Cancers show up as very active because there are lots of cells in cancers that are busy dividing.

If the PET-CT scan shows that your cancer has not spread, you will probably be offered surgery or radiotherapy to cure the cancer. If the PET-CT scans shows that the cancer has spread to lymph nodes in your chest, you should be offered a biopsy of the nodes. This will help doctors work out the stage of the cancer and decide which treatments to offer.

#### A bronchoscopy

If you have a bronchoscopy, a flexible tube with a tiny camera on the end (bronchoscope) is passed down through your nose or mouth into your lungs. This lets your doctor look inside. You'll probably be given a medicine called a sedative to help you relax, or a medicine called an anaesthetic so you won't feel any discomfort.

Your doctor can also use the tube to remove small samples of cells from inside your lungs. These samples are called **biopsies**.

The samples are then looked at in a laboratory to find out whether you have cancer. If the cells are cancerous, it's possible to see what type of cancer you have.

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## More tests

If you can't or don't want to have a bronchoscopy and biopsy, you may be offered a test called a **sputum cytology**. You'll provide a sample of phlegm (sputum), which will then be tested in a laboratory for cancer cells. However, this is a less accurate way to detect lung cancer. <sup>[24]</sup>

If your CT scan suggests that cancer has spread to the lymph nodes in your chest or neck, you'll probably be offered an **ultrasound scan** of the area with a **biopsy**. <sup>[24]</sup>

If you are diagnosed with lung cancer, you'll need more tests to see how advanced your cancer is and if it has spread to other parts of your body. This is called [staging your cancer](#). One kind of test is a **bone scan**, an x-ray that shows whether the cancer has spread to your bones. Another test you'll need is a CT scan of your brain or abdomen (the part of your body below your chest).

Your doctor will also grade your cancer. This means finding out what your cancer looks like under a microscope, and giving it a grade from 1 to 4. The less the cancer cells look like normal cells, the higher their grade. Cancers with a high grade are more likely to be fast-growing. To find out more, see [What grade is your lung cancer?](#)

Knowing the stage and grade will help you and your doctor decide what treatment is best for you.

## Is there a blood test for lung cancer?

Researchers are trying to develop a blood test that could check for early lung cancer. <sup>[16]</sup> But the research is at a fairly early stage, and these tests are still experimental.

## How common is lung cancer?

In the UK, lung cancer is the second most common cancer in men (after prostate cancer) and the third most common in women (after breast cancer and bowel cancer). Lung cancer is also the leading cause of death from cancer in the UK.

Around 41,400 new cases of lung cancer are diagnosed each year in the UK ( <http://info.cancerresearchuk.org/cancerstats/types/lung/incidence> ) and more than 35,000 people die from it. <sup>[24]</sup> More British people die from lung cancer each year than from breast and bowel cancers combined. <sup>[25]</sup>

The good news is that lung cancer is becoming less common in men, since a peak in the early 1980s. <sup>[25]</sup> And figures in women are levelling off, though they aren't going down yet. <sup>[25]</sup> This is probably because fewer people are smoking.

However, a study of people born since 1950 shows just how quickly such trends may change. <sup>[26]</sup> Researchers found that among people in their 20s and 30s, there were small increases in the number dying from lung cancer. They suggest this may be due to the rise in teenage smoking.

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## What treatments work for lung cancer?

Doctors use three types of treatment for lung cancer: surgery, radiotherapy and chemotherapy. They may offer you a combination of these treatments.

## Key points about treating lung cancer

How you and your doctor decide to treat your lung cancer will depend on:

- What type of cancer you have (non-small-cell lung cancer or small-cell lung cancer)
- Where the cancer is in your lung
- Whether it has spread to other parts of your chest or to other parts of your body (what [stage](#) your cancer is)
- How well you are. For example, if you have other medical conditions, this might affect whether you're fit enough for surgery or chemotherapy
- How you feel about the treatments.

To learn more, see [What is lung cancer?](#) and [How lung cancer is treated](#) .

## How lung cancer is treated

Doctors have been given guidelines about how to treat people who they think may have lung cancer.<sup>[24]</sup> We can't say exactly what will happen to you. But we can give you some idea about what to expect.

- If your doctor thinks you may have lung cancer you'll probably have an [x-ray](#) . You may also have a [CT scan](#) .
- If these tests suggest you may have lung cancer, your GP will refer you urgently to a doctor in hospital. This will usually be a specialist who is used to treating lung cancer.
- In hospital you'll have more tests to find out for certain if you have lung cancer, what kind of cancer it is and how far this has spread. To learn more, see [How do doctors diagnose lung cancer?](#)
- Doctors and nurses will explain what each test involves and why you need it.
- If a doctor decides you need treatment for your lung cancer, it should start within 31 days.



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### If you have non-small-cell lung cancer

If you have early (stage 1 or 2) non-small-cell lung cancer and are fit enough, you will probably have surgery to remove the cancer. (To learn more, see [What stage is your lung cancer?](#) )

- The most common type of operation is called a **lobectomy**. This is when surgeons remove one lobe of your lungs. To learn more, see [Surgery](#) .
- Or you may have the whole of one lung removed. This is called a **pneumonectomy**. To learn more, see [Surgery](#) .
- You might have chemotherapy after surgery to get rid of any cancer cells that remain in your body. To learn more, see [Chemotherapy after surgery](#) .
- You probably won't have chemotherapy before surgery, unless you are taking part in a clinical trial. To learn more, see [Chemotherapy before surgery](#) .

If surgery isn't an option (for example, if the cancer has spread beyond your chest, or if you are not healthy enough to have surgery), you may be offered radiotherapy, chemotherapy, or both.

- If you have a small tumour that has not spread (stage 1) or has spread only to the lymph nodes nearby (stage 2), you may be offered **radiotherapy** to try to cure the cancer. You may also have this treatment if the cancer has spread to other lymph nodes in your chest and to areas near your lungs (stage 3), as long as the treatment area isn't too big.
- Your doctor might also suggest **intensive radiotherapy** . One type of intensive radiotherapy is **CHART**, which stands for continuous, hyperfractionated, accelerated radiotherapy. To learn more, see [Intensive radiotherapy](#) .
- If the cancer has spread to lymph nodes in your chest, you may be offered chemotherapy as well as radiotherapy. This is sometimes called **chemoradiotherapy**. To learn more, see [Radiotherapy plus chemotherapy](#) .
- If your cancer is large or has spread to more distant lymph nodes or other parts of your body (stage 3 or 4), you will probably be offered **chemotherapy**. The aim is not to cure your cancer but to help you live longer, to stop your cancer spreading and help you feel better. To learn more, see [Chemotherapy](#) .

### If you have small-cell lung cancer

You should be offered chemotherapy with a kind of drug called a **platinum drug**, plus other drugs.

- You'll probably have four to six cycles of **chemotherapy**.

## Lung cancer

- You may also be offered **radiotherapy**. You might have this at the same time as you have chemotherapy (usually during the first and second cycles) or afterwards. To learn more, see [Chemotherapy plus radiotherapy](#) .
- If these treatments have worked, you'll probably also have **radiotherapy to the head**. To learn more, see [Radiotherapy to the head](#) .

### Treatments for lung cancer

Which treatments work best? We've looked at the best research and given a rating for each treatment according to how well it works. We've looked separately at treatments for different kinds of lung cancer.

- [Treatments for non-small-cell lung cancer that can be operated on](#)
- [Treatments for non-small-cell lung cancer that can't be operated on](#)
- [Treatments for small-cell lung cancer](#)

For help in deciding which treatment is best for you, see [How to make the best decisions about treatment](#).

### Treatment Group 1

#### What treatments work for non-small-cell lung cancer that can be operated on?

If you have non-small-cell lung cancer and are suitable for surgery, surgery can help you live longer. Chemotherapy or radiotherapy can also be useful.

#### Key points about treating non-small-cell lung cancer that can be operated on

- Surgery can help you live longer. Surgery isn't usually a cure for lung cancer, although people who are treated at an early stage often do very well after surgery. (To read about the different stages of cancer, see [What stage is your lung cancer?](#) )
- Your doctors may also offer you chemotherapy after your surgery. People who have this are more likely to live longer.
- Drugs and surgery have harmful effects as well as good effects. You'll need to weigh the advantages of different treatments against their disadvantages.

# Lung cancer

## Treatments for non-small-cell lung cancer that can be operated on

### Usual treatment

- [Surgery](#) : If you have a small tumour that hasn't spread, you'll probably have surgery to remove it. There hasn't been much research on surgery for lung cancer. But if your tumour is small enough to be removed, most doctors think you should have it cut out. [More...](#)

### Treatments that are likely to work

- [Chemotherapy after surgery](#) : This is treatment with anti-cancer drugs after an operation. Doctors may offer you this if you have early cancer (stage 1 or stage 2) or if your cancer hasn't spread beyond your chest (stage 3). [More...](#)

### Treatments that work, but whose harms may outweigh benefits

- [Chemotherapy before surgery](#) : This involves using anti-cancer drugs to shrink the tumour before surgeons operate to remove it. In the UK, you'll only be offered chemotherapy before surgery if you are taking part in a clinical trial. [More...](#)

## Treatment Group 2

### What treatments work for non-small-cell lung cancer that can't be operated on?

If you have non-small-cell lung cancer and aren't suitable for surgery, your doctor may suggest chemotherapy, radiotherapy, or both.

### Key points about treating non-small-cell lung cancer that can't be operated on

- If doctors can't operate on your cancer, they may offer you chemotherapy, or chemotherapy plus radiotherapy to your chest.
- These treatments can help you live a longer.
- Drugs and radiotherapy have harmful effects as well as good effects. You'll need to weigh the advantages of different treatments against their disadvantages.
- If you're under 70, having chemotherapy plus radiotherapy can help you live longer than just having radiotherapy. But if you're over 70, this combination can do more harm than good.

### Treatments for non-small-cell lung cancer that can't be operated on

#### Treatments that work

- [Chemotherapy](#) : Your doctors may offer you treatment with anti-cancer drugs if you have advanced cancer that has spread to other parts of your body (stage 4 lung cancer). The aim is to relieve your symptoms and prolong your life rather than cure the cancer. [More...](#)
- [Radiotherapy plus chemotherapy](#) : If you have stage 3 lung cancer that hasn't spread beyond your chest but can't be operated on, you may be treated with a combination of anti-cancer drugs (chemotherapy) and high-energy x-rays (radiotherapy) to your chest. [More...](#)

#### Treatments that need further study

- [Intensive radiotherapy](#) : This is when you have treatment with high-energy x-rays twice a day for more than seven weeks. This is more often than with standard radiotherapy. Doctors may offer you this treatment if you have stage 1, 2, or 3 lung cancer that hasn't spread beyond your chest but can't be operated on. [More...](#)
- [Gefitinib and erlotinib](#) : These are two new drugs that work in a different way from other types of chemotherapy. [More...](#)

### Treatment Group 3

#### What treatments work for small-cell lung cancer?

Chemotherapy is the main treatment for small-cell lung cancer, although surgery is suitable for some very small tumours. You may also be offered radiotherapy.

#### Key points about treating small-cell lung cancer

- Surgery isn't an option for most people with small-cell lung cancer. However, a few patients have a very small tumour on the outer edge of the lung. These patients may have surgery followed by chemotherapy. To learn more, see [Surgery](#) .
- Chemotherapy is the main treatment for small-cell lung cancer. This treatment shrinks the tumour in at least three-quarters of all lung cancers.
- If the cancer is only on one side of your chest (this is called limited stage disease), you'll probably have chemotherapy combined with radiotherapy.
- If you don't have any signs of cancer after treatment, radiotherapy to your head may stop the cancer spreading to your brain.

## Lung cancer

- We don't know if having higher doses of chemotherapy (or having it more often) will help you live longer. But we do know that it can be harmful.

### Treatments for small-cell lung cancer

#### Treatments that work

- [Chemotherapy with or without radiotherapy](#) : Most people with small-cell lung cancer are offered anti-cancer drugs (chemotherapy). If your cancer is only on one side of your chest (limited stage disease), you may have chemotherapy combined with high-energy x-rays (radiotherapy). This treatment can stop the cancer growing in your lung. [More...](#)

#### Treatments that are likely to work

- [Radiotherapy to the head](#) : This therapy is given to people who have already had treatment and no longer have any signs of cancer. (Doctors call this being in **remission** .) The aim is to stop the cancer spreading to your brain. [More...](#)

#### Treatments that need further study

- [Intensive chemotherapy](#) : This means taking anti-cancer drugs more often or at higher doses than usual. [More...](#)

### What will happen to me?

The outlook for people with lung cancer is improving. The type of lung cancer you have and how early it was found will affect what happens to you. The kind of treatment you have and the way you decide to live with your cancer will also make a difference.

Most people with lung cancer are only diagnosed when the disease is advanced. It has already spread either to tissues nearby or to more distant parts of the body. And for many people with lung cancer, treatments don't work as well as they do for other types of cancer. There are striking success stories, and some people do live for many years after they discover they have lung cancer, but most don't.

Everyone has different priorities in their life. Research has shown that for most people, how we feel and the enjoyment we get out of life are at least as important as how long we live. When researchers have asked people with lung cancer what is important to them, they say that their general health, their family life, their social and leisure activities, and their overall enjoyment of life come before living longer. <sup>[1]</sup>

Wherever possible, your treatment should be designed to help you get what you want out of life. You may wish to spend time with friends or family, or you may want to stay as active or independent as possible. Some people want to think more about the spiritual side of life. And many find benefit from talking to a counsellor about their disease and how to best live with their illness.

## Lung cancer

Cancer specialists don't talk about treatments curing you because it's difficult to say when there has been a cure. Doctors may see no sign of cancer, but they can't be certain that it won't come back. Instead, they look at the number of people who live two, three, five or 10 years after their treatment. Doctors call these numbers **survival rates**.

You may hear your doctors use other words that measure the success of treatments for lung cancer. Here's what they mean.

- **Response:** A complete response means there is no sign of any cancer cells after treatment. A partial response means treatment has made the cancer smaller.
- **Remission:** This means you no longer have any sign of cancer and are in good health.
- **Time to relapse (or time to recurrence):** This is the amount of time before the cancer comes back after it has responded completely to treatment.
- **Disease-free survival:** This is a measure of how long people live after treatment without any signs of the cancer coming back.

If you have lung cancer, you may want to know more about what will happen to you. Some people want to read this information, others don't. If you read these figures, remember that they are based on the results seen with large groups of people. You are not a statistic, and no one can predict what will happen to you individually. Things such as your overall health when your lung cancer was diagnosed will affect what happens to you.

To find out the survival rates for different types and stages of the disease, see [Lung cancer survival rates](#) .

### Questions to ask your doctor

If you've been diagnosed with lung cancer, you may want to talk to your doctor to find out more.

Here are some questions that you might want to ask. We have included some questions to ask early on, and some further questions that you might want to ask if you have been advised to have surgery, radiotherapy or chemotherapy.

For more information, see [What treatments work for lung cancer?](#)

#### Questions to ask early on

- What type of lung cancer do I have?
- How far has it spread?

## Lung cancer

- Do I need more investigations? What about a **CT scan**? (This is a special type of **x-ray** that can pick up cancer cells in the brain.)
- What are my treatment options?
- What treatment do you recommend?
- What does the treatment aim to do?
- Will it help my symptoms?
- Will it try to get rid of my cancer?
- What side effects does the treatment have?
- What will happen if I decide not to have treatment?
- Are there any **clinical trials** that I might benefit from? (Clinical trials are studies carried out with patients in hospitals. They are designed to test whether a treatment works.)
- Would you mind if I get a second opinion? If your doctor isn't happy for you to do this, you could consider getting another doctor.

### Questions to ask if you're advised to have surgery

- Why do you want to operate?
- What will you do during the operation?
- Will it help my symptoms?
- How will I feel after the surgery?
- How long will I be in hospital, and what treatment will I need after surgery?
- What could go wrong, and how likely is that?
- What happens if the surgery doesn't work?
- How many operations like mine have you performed?
- Would you mind if I get a second opinion?

## Lung cancer

### Questions to ask if you're advised to have radiotherapy

- Why are you recommending radiotherapy ?
- What does it aim to do?
- Will it help my symptoms?
- How will I feel during the treatment?
- What side effects can I expect in the weeks after my treatment?
- What can you do to prevent or relieve side effects?
- What side effects can I expect months or years after my treatment, and will any of them be permanent?
- What happens if radiotherapy doesn't work?
- Would you mind if I get a second opinion?

### Questions to ask if you're advised to have chemotherapy

- Why do you recommend chemotherapy ?
- What does it aim to do?
- Will it help my symptoms?
- How will I feel during and after treatment?
- What are the side effects of treatment?
- What can you do to prevent or relieve side effects?
- If a side effect is nausea and vomiting, can you prescribe me something for this beforehand?
- What do I need to do if my white cell blood count is low? (Chemotherapy can lower your white cell count in your blood. This makes you more prone to infections.) Should I avoid crowded places? What should I do if a family member is ill?
- Will any of the side effects be permanent?
- What happens if the chemotherapy doesn't work?



## Lung cancer

- Would you mind if I get a second opinion?

### Lung cancer survival rates

This information tells you how long, on average, people live with lung cancer. As you read it, bear in mind that you are not a statistic. Lots of things affect how long you'll live, and no one can predict what will happen to you.

#### Non-small-cell lung cancer

This table shows how many people typically are still alive five years after being diagnosed with lung cancer.<sup>[28]</sup> Stage 4 is advanced cancer. To learn more about classifications of lung cancer, see [What stage is your lung cancer?](#)

Stage	TNM	Percentage of people who will be alive five years after being diagnosed
1	T1N0M0 or T1N1M0	57% to 67%
2	T1N1M0 or T2N1M0	39% to 55%
3A	T3N0M0, T3N1M0, T1N2M0, T2N2M0 or T3N2M0	23%
3B or 4	T4 (any N, any M); M1 (any N, any T); N3 (any T, any M)	5% or less

#### Small-cell lung cancer

This table shows how likely it is that someone will be alive after five years with different kinds of small-cell lung cancer.<sup>[29]</sup>

Stage	Definition	Typical survival
Limited stage disease	Tumour only in one side of the chest, or in the lymph nodes above the collarbone on the same side, or both of these	18 months
Extensive stage disease	Anything beyond limited stage	9 months

## Treatments:

### Surgery

In this section

This information is for people with lung cancer. It tells you about surgery, a treatment used mainly for people with non-small-cell lung cancer.

Some people with lung cancer may be suitable for surgery. The aim is to take out all the cancer cells so that the cancer doesn't come back or spread to other part of the body.

## Lung cancer

Whether you're suitable for surgery will depend on: <sup>[30]</sup>

- The type of lung cancer you have
- Where the cancer is
- The size of your tumour
- Whether the cancer has spread
- Your general health and fitness.

Doctors in the UK have been given guidelines about how to treat people with lung cancer. These say that if you have stage 1 or stage 2 non-small-cell lung cancer and you are healthy enough, you'll probably have surgery to remove the cancer. <sup>[24]</sup> <sup>[31]</sup> To learn more about the guidelines, see [How lung cancer is treated](#) .

For more information on the stages of lung cancer, see [What stage is your lung cancer?](#)

In general, surgery is the most suitable treatment if you have a small tumour that hasn't spread. This usually means non-small-cell lung cancer at stage 1 or stage 2. <sup>[30]</sup> These kinds of lung cancer haven't spread outside the lungs, although some of the lymph nodes near to the lung may be affected (stage 2). If the cancer is close to your heart, an important blood vessel or your windpipe, your surgeon may decide that an operation is too dangerous and may recommend another type of treatment.

Some doctors also recommend surgery for people with more advanced disease, called stage 3A. This stage of lung cancer has spread outside the lungs but is still fairly close to them and contained within the chest wall.

Doctors tend not to use surgery for small-cell lung cancer. By the time this type of cancer is diagnosed the cancer has usually spread to other parts of the body. Once this has happened, an operation to remove the lung cancer won't stop the cancer growing somewhere else in your body. However, a few people with small-cell lung cancer have a very small tumour on the outer edge of the lung. These people may have surgery followed by chemotherapy. <sup>[30]</sup>

### Types of surgery

The type of operation you have will depend on where in the lung your cancer is and how big it is. There are three main types of operation that can be used to remove a tumour from the lungs.

- One lobe of the lung is removed. This is called a **lobectomy**. When two lobes are removed it's called a **bi lobectomy**.

## Lung cancer

- The whole lung is removed. This is called a **pneumonectomy**. This is done if your doctor thinks that some cancer cells have spread to another part of the lung.
- A small part of the lung is removed. This is a **wedge resection** or **segmentectomy**. This type of operation isn't done very often.

### Before the operation

Surgery for lung cancer is a major operation, and your doctor will want to check that this treatment is right for you. You'll probably have some tests to check how well your lungs work. This is to make sure that you can still breathe comfortably after some or all of one of your lungs has been removed. Your heart also needs to be in good shape.

If your general health isn't good, your doctor may recommend another type of treatment or a different, less serious, operation. You'll probably need five to 10 days in hospital after your operation.

### Will I be able to breathe normally afterwards?

You may be concerned that you won't be able to breathe properly after some or all of one of your lungs is removed. But the part of your lung that was diseased was probably not working very well anyway. So removing it won't make a big difference to how you breathe. Provided your lungs are in good shape (apart from the cancer), it's possible to lead a full and active life, even with just one lung.

Before you have surgery for lung cancer, your doctors will test how well your lungs are working. They want to make sure you'll have enough good lung tissue left after your operation. But surgery for lung cancer isn't a cure for all breathing problems. For example, if you had chronic bronchitis or chronic obstructive pulmonary disease (COPD) before surgery, you'll still have these problems afterwards. But having another illness doesn't mean you won't be able to have surgery on the cancer. It all depends on how much good lung tissue you have.

### Can surgery for lung cancer be harmful?

Surgery for lung cancer used to be quite dangerous. But, because patients are being chosen more carefully and being given better care after surgery, results from this operation are getting better.<sup>[2]</sup> Few people today get serious complications after this type of surgery. It's important to ask your doctor about what could go wrong.

How quickly you recover will depend on your age, the type of operation you've had, how your lungs are working and the stage of your disease. You'll probably be in a lot of pain right after your operation, but painkillers can make you more comfortable. Don't be afraid to ask for more medicine if you're still in pain. Being in pain can delay your recovery.

You should try to move about as soon as possible, even if it's just walking to the end of the room and back or stretching your legs in bed. This will help keep your blood moving and reduce the chances of a clot forming in one of your blood vessels.

## Lung cancer

Don't expect to be able to do too much too soon. You'll probably feel some pain around your chest for about a month after your operation. You should be able to live your normal life after about eight weeks. You'll probably be given some breathing exercises to practise at home. These will help your recovery.

### Will I be cured?

It's hard to say if surgery will cure your lung cancer. Most doctors assume it's better to remove a cancer if at all possible than to leave it where it is. <sup>[32]</sup>

The benefit of a particular treatment is judged by how many people live for five years after having the treatment. Doctors call this **five-year survival**.

Several studies have compared people who just had surgery with people who had chemotherapy and then surgery. <sup>[33]</sup> Below, is a summary of how people did when they just had surgery.

As you read these numbers, remember that surgery is often combined with other treatments. And some of the studies were started in the 1980s, so treatments may have improved since then. So, the real outlook for people who have surgery for lung cancer may be better than these numbers suggest.

- Of the people with very early stage lung cancer (stage 1a) , who just had surgery, 75 in 100 were alive five years later.
- Of the people with stage 1b cancer, 55 in 100 were alive five years later
- Of the people with stage 2a cancer, 50 in 100 were alive five years later
- Of the people with stage 2b cancer, 40 in 100 were alive five years later
- Of the people with stage 3a cancer, between 15 in 100 and 35 in 100 were alive after five years
- People with stage 3b cancer had between a 5 in 100 and 10 in 100 chance of living for five years.

Here's what some other studies of surgery for non-small-cell lung cancer have found.

- About three-quarters of people who have surgery for stage 1 lung cancer are alive five years later. Only about one-fifth of people who have just radiotherapy for the same kind of disease are alive five years later. <sup>[34]</sup>
- More than two-thirds of people who have surgery for stage 1 lung cancer are alive 10 years later. <sup>[35]</sup>

## Lung cancer

- About half the people who have surgery for stage 2 lung cancer are alive five years later. <sup>[36]</sup>
- Surgery works better for people with stage 3 disease when their cancer has not affected their lymph nodes. Half the people with stage 3 lung cancer with no nodes affected who have surgery are alive five years later. Of the people with stage 3 lung cancer whose nodes are affected, only 7 percent to 21 percent are alive five years later. <sup>[37] [38] [39]</sup>

For a list of questions that you may wish to ask your doctor about surgery for lung cancer, see [Questions to ask your doctor](#).

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## Chemotherapy after surgery for non-small-cell lung cancer

In this section

[Does it work?](#)

[What is it?](#)

[How can it help?](#)

[How does it work?](#)

[Can it be harmful?](#)

[How good is the research on chemotherapy after surgery for non-small-cell lung cancer?](#)

This information is for people who have non-small-cell lung cancer that hasn't spread beyond their chest and can be operated on. It tells you about having chemotherapy after surgery. It is based on the best and most up-to-date research.

### Does it work?

Probably. Having chemotherapy after you've had [surgery](#) to remove your tumour can help you live longer if you have non-small-cell lung cancer that hasn't spread beyond your chest and can be operated on ( [stage 1, 2, or 3](#) ). But this treatment has many side effects.

### What is it?

Chemotherapy uses anti-cancer drugs to kill cancer cells in the lung and all over the body. There are lots of different drugs used in chemotherapy for lung cancer, and lots of different combinations of drugs.

Doctors in the UK have been given guidelines about how to treat people with lung cancer. These say that you may be offered chemotherapy after surgery. <sup>[24] [31] [40]</sup> For more on these guidelines, see [How lung cancer is treated](#).

### What drugs are used?

There are lots of drugs used in chemotherapy for lung cancer. Some of the newer drugs (with their brand names) are:

- gemcitabine (Gemzar)

## Lung cancer

- irinotecan (Campto)
- paclitaxel (Taxol)
- vinorelbine (Navelbine).

There are also older drugs, called alkylating agents.

- Cisplatin and carboplatin are alkylating agents. They also belong to a class of drugs called platinum drugs.
- Other alkylating agents that are sometimes used include cyclophosphamide (brand name Endoxana) and ifosfamide (Mitoxana).

### How is chemotherapy given?

Chemotherapy drugs are usually given as injections into your vein or as a drip (also called an IV or an intravenous infusion). Some come as tablets. You usually have to go to hospital to have injections and drips, but you should be able to go home afterwards. You'll only have to stay in hospital overnight if your treatment takes longer than usual or you have a bad reaction to the drugs.

You'll usually have some tablets to take at home after chemotherapy. These will help with some of the side effects you can get. For example, you may be given tablets to stop you feeling sick and vomiting. You might also be given an injection while you are in hospital to prevent vomiting.

### How long does treatment last?

Chemotherapy is usually given as a course of several cycles of treatment. One cycle of chemotherapy is usually given over a few days. Afterwards, you'll have a few weeks' rest to give your body a chance to recover from the harmful effects of the treatment. Most people have four to six cycles. A full course of treatment may take up to six months.

How many cycles you have will depend on the type of cancer you have and how well chemotherapy works for you. Some treatments are more intensive than others. You may be given more drugs to help prevent side effects such as damage to your blood cells.

### How can it help?

Having chemotherapy after surgery to get rid of non-small-cell lung cancer can help you live longer. <sup>[41]</sup> <sup>[42]</sup> <sup>[43]</sup> <sup>[44]</sup>

In one study among people with early ( [stage 1 or 2](#) ) non-small-cell lung cancer, nearly 7 in 10 of those given chemotherapy after their operation lived for at least five years compared with just over 5 in 10 of those given surgery alone. <sup>[45]</sup>

## Lung cancer

More recent studies have found that the newer chemotherapy drugs are more likely to help patients live longer than the older drugs. <sup>[46]</sup>

### How does it work?

Researchers think that chemotherapy after surgery might help to reduce the chance that cancer cells left behind will spread to other parts of the body. In other types of cancer, chemotherapy is often used successfully in this way.

### Can it be harmful?

All anti-cancer drugs have some harmful effects. This is because they don't just affect cancer cells. They also damage normal, healthy cells, and especially those that multiply rapidly. These include:

- Skin and hair
- **Bone marrow** , the soft tissue inside your bones that makes red and white blood cells
- The lining of the mouth and digestive system (this includes all the parts of your body involved in digesting your food such as your throat, gullet and stomach)
- The ovaries (the female sex organs where eggs are made) or the testicles (the male sex organs where sperm are produced).

Whether you get harmful effects will depend on:

- The drug or drugs you are having
- The dose of each drug
- How well you are
- What steps you and your medical team take to prevent or relieve any harmful effects.

The problems you're most likely to get soon after chemotherapy are nausea and vomiting, infections, tiredness and **diarrhoea** . <sup>[43]</sup> However, new drugs given with chemotherapy can cut the chances of nausea and vomiting. In the years after chemotherapy, there's a chance that you could become infertile, get another type of cancer or have heart problems.

In one study we looked at: <sup>[47]</sup>

- About 1 in 3 people had some damage to their **immune system**
- About 1 in 100 people lost their appetite

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- About 1 in 10 had very bad nausea or vomiting.

The side effects from chemotherapy can be very serious. In one study we looked at, out of nearly 60 people given chemotherapy after a lung cancer operation, two died from the side effects. <sup>[48]</sup>

To learn more, see [Side effects of chemotherapy](#) .

### How good is the research on chemotherapy after surgery for non-small-cell lung cancer?

There's been a lot of research on whether chemotherapy after surgery is helpful for non-small-cell lung cancer. We found three big summaries of the research ( [systematic reviews](#) ). They all found that having chemotherapy after surgery to get rid of non-small-cell lung cancer can help you live longer. <sup>[43]</sup> <sup>[49]</sup> <sup>[50]</sup>

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## Chemotherapy before surgery for non-small-cell lung cancer

In this section

[Does it work?](#)

[What is it?](#)

[How can it help?](#)

[How does it work?](#)

[Can it be harmful?](#)

[How good is the research on chemotherapy before surgery for non-small-cell lung cancer?](#)

This information is for people who have non-small-cell lung cancer that hasn't spread beyond their chest and can be operated on. It tells you about having chemotherapy before surgery. It is based on the best and most up-to-date research.

### Does it work?

It may work for some people. Some people who have chemotherapy before surgery to remove their lung cancer live longer than people who don't. But it's not clear whether the benefits outweigh the risk of side effects. This treatment is for people who have non-small-cell lung cancer that hasn't spread beyond their chest and can be operated on ( [stage 1, 2, or 3](#) ).

### What is it?

You have chemotherapy to shrink your cancer. You then have an operation to remove the cancer in your lung. To learn more about the operation, see [Surgery](#) .

Doctors in the UK have been given guidelines about how to treat people with lung cancer. These say that you'll only be offered chemotherapy before surgery if you are taking part in a clinical trial. <sup>[24]</sup> <sup>[31]</sup> <sup>[51]</sup> To learn more, see [How lung cancer is treated](#) .

Chemotherapy uses anti-cancer drugs to kill cancer cells in the lung and all over the body. There are lots of different drugs used in chemotherapy for lung cancer, and lots of different combinations of drugs.



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## What drugs are used?

Some of these drugs (with their brand names) are:

- gemcitabine (Gemzar)
- irinotecan (Campto)
- paclitaxel (Taxol)
- vinorelbine (Navelbine).

There are also other drugs, called alkylating agents.

- Cisplatin and carboplatin are alkylating agents. They also belong to a class of drugs called platinum drugs.
- Other alkylating agents that are sometimes used include cyclophosphamide (brand name Endoxana) and ifosfamide (Mitoxana).

## How is chemotherapy given?

Chemotherapy drugs are usually given as injections into your vein or as a drip (also called an IV or an **intravenous infusion** ). Some come as tablets. You usually have to go to hospital to have injections and drips, but you should be able to go home afterwards. You'll only have to stay in hospital overnight if your treatment takes longer than usual or you have a bad reaction to the drugs.

You'll usually have some tablets to take at home after chemotherapy. These will help with some of the side effects you can get. For example, you may be given tablets to stop you feeling sick and vomiting. You might also be given an injection while you are in hospital to prevent vomiting.

## How long does treatment last?

Chemotherapy is usually given as a course of several cycles of treatment. One cycle of chemotherapy is usually given over a few days. Afterwards, you'll have a few weeks' rest to give your body a chance to recover from the harmful effects of the treatment.

Some treatments are more intensive than others. You may be given more drugs to help prevent side effects such as damage to your blood cells.

## How can it help?

Some big, good-quality summaries of the research ( **systematic reviews** ) say that people are more likely to be alive five years later if they have chemotherapy before surgery. <sup>[52]</sup>

<sup>[53]</sup> <sup>[50]</sup> But other studies disagree and say there isn't any difference. <sup>[54]</sup> <sup>[55]</sup>

## Lung cancer

It's difficult when the studies don't agree. When we looked more closely, we found there is more evidence that chemotherapy before surgery is helpful for people with early (stage 1 or 2) non-small-cell lung cancer. People with stage 3 cancer (where the cancer has spread around the chest) may not get any benefit. To find out more about the stages of lung cancer, see [What stage is your lung cancer?](#)

### How does it work?

Having chemotherapy before surgery may shrink your tumour and make it easier to remove. It may also kill cancer cells that have started to spread. Most anti-cancer drugs work by damaging the DNA inside cancer cells.

DNA is a chemical that cells need to survive, grow, and divide. Damaging the DNA in cancer cells means they can't grow and replace each other. Some anti-cancer drugs work by damaging other substances that cells need to keep multiplying.

### Can it be harmful?

All anti-cancer drugs have some harmful effects. This is because they don't just affect cancer cells. They also damage normal, healthy cells, and especially those that multiply rapidly. These include:

- Skin and hair
- **Bone marrow**, the soft tissue inside your bones that makes red and white blood cells
- The lining of the mouth and digestive system (this includes all the parts of your body involved in digesting your food such as your throat, gullet and stomach)
- The ovaries (the female sex organs where eggs are made) or the testicles (the male sex organs where sperm are produced).

Whether you get harmful effects will depend on:

- The drug or drugs you are having
- The dose of each drug
- How well you are
- What steps you and your medical team take to prevent or relieve any harmful effects.

The problems you're most likely to get soon after chemotherapy are nausea and vomiting, infections, tiredness, and diarrhoea. In the years after chemotherapy, there's a chance that you could become infertile, get another type of cancer or have heart problems.

## Lung cancer

Research shows that 8 in 10 people having chemotherapy before surgery had serious problems after their first course of chemotherapy. About 7 in 10 needed to have their dose reduced for the second course. <sup>[52]</sup> <sup>[54]</sup>

To learn more see [Side effects of chemotherapy](#) .

### How good is the research on chemotherapy before surgery for non-small-cell lung cancer?

There's been quite a lot of good-quality research now looking at chemotherapy before surgery for non-small-cell lung cancer. We found five summaries of the evidence and one other good-quality study. <sup>[52]</sup> <sup>[53]</sup> <sup>[54]</sup> <sup>[55]</sup> <sup>[56]</sup> <sup>[50]</sup>

The trouble is, the research results are mixed. We still don't know whether it will help you live longer. It may be that it works better for some people more than others.

You'll need to talk to your doctor, to decide whether the chances of it helping you outweigh the chances of having serious side effects.

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## Chemotherapy for metastatic non-small-cell lung cancer

In this section

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[What is it?](#)

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[How does it work?](#)

[Can it be harmful?](#)

[How good is the research on chemotherapy for metastatic non-small-cell cancer?](#)

This information is for people who have non-small-cell lung cancer that has spread to other parts of the body (called stage 4 or metastatic disease). It tells you about having chemotherapy. It is based on the best and most up-to-date research.

### Does it work?

Yes. If you have non-small-cell lung cancer that has spread to other parts of your body (called stage 4 or metastatic disease), you are likely to live about six weeks to 10 weeks longer if you have chemotherapy. Having one of the newer chemotherapy drugs (gemcitabine, paclitaxel, or vinorelbine) by itself may help you feel more comfortable, but it may not help you live longer. You need a combination of drugs (usually a kind of drug called a platinum drug plus one of the newer drugs) to extend your life.

Chemotherapy with another newer drug called docetaxel (Taxotere) may help you live longer if you've had a platinum drug in the past and it isn't working anymore.

### What is it?

Chemotherapy uses anti-cancer drugs to kill cancer cells in the lung and all over the body. There are lots of different drugs used in chemotherapy for lung cancer, and lots of different combinations of drugs. Most people have two different drugs.

## Lung cancer

You'll probably be offered chemotherapy if you have stage 3 or 4 non-small-cell lung cancer.<sup>[24]</sup> <sup>[31]</sup> <sup>[57]</sup> To learn more, see [How lung cancer is treated](#) .

For more on the stages of lung cancer, see [What stage is your lung cancer?](#)

### What drugs are used?

There are lots of drugs used in chemotherapy for lung cancer. Some of the newer drugs (with their brand names) are:

- gemcitabine (Gemzar)
- irinotecan (Campto)
- paclitaxel (Taxol)
- vinorelbine (Navelbine)
- docetaxel (Taxotere)
- pemetrexed (Alimate).

There are also older drugs, called alkylating agents.

- Cisplatin and carboplatin are alkylating agents. They also belong to a class of drugs called platinum drugs.
- Other alkylating agents that are sometimes used include cyclophosphamide (brand name Endoxana) and ifosfamide (Mitoxana).

The National Institute for Health and Care Excellence (NICE) is the government body that decides which treatments should be available on the NHS. NICE recommends that people with advanced non-small-cell lung cancer should be offered treatment with one of these newer drugs in combination with a platinum drug.<sup>[24]</sup> <sup>[31]</sup> For example, you may be given cisplatin with gemcitabine, or cisplatin with vinorelbine. Or you may have carboplatin with paclitaxel or gemcitabine.

You might also have cisplatin with pemetrexed, but only if you have a specific type of non-small-cell lung cancer ( [adenocarcinoma or large-cell carcinoma](#) ) and you haven't yet had any treatment for your cancer.<sup>[58]</sup>

There's another chemotherapy drug called bevacizumab (brand name Avastin). It can be used to treat people with non-small-cell lung cancer that isn't the squamous cell type (this is a slow-growing cancer that affects the airways). Bevacizumab is used along with platinum chemotherapy drugs. It's not officially recommended for use in the NHS, but local NHS organisations can decide for themselves whether to use it or not.<sup>[59]</sup>

## Lung cancer

If you've been treated with chemotherapy, but it no longer seems to be helping you, you may be given treatment with a newer drug called docetaxel (Taxotere).<sup>[24]</sup>

### How is chemotherapy given?

Chemotherapy drugs are usually given as injections into your vein or as a drip (also called an IV or an intravenous infusion). Some come as tablets. You usually have to go to hospital to have injections and drips, but you should be able to go home later the same day. You'll only have to stay in hospital overnight if your treatment takes longer than usual or you have a bad reaction to the drugs.

You'll usually have some tablets to take at home after chemotherapy. These will help with some of the side effects you can get. For example, you may be given tablets to stop you feeling sick and vomiting. You might also be given an injection while you are in hospital to prevent vomiting.

### How long does treatment last?

Chemotherapy is usually given as a course of several cycles of treatment. One cycle of chemotherapy is usually given over a few days. Afterwards, you'll have a few weeks' rest to give your body a chance to recover from the harmful effects of the treatment. Most people have four to six cycles. A full course of treatment may take up to six months.

How many cycles you have will depend on the type of cancer you have and how well chemotherapy works for you. Some treatments are more intensive than others. You may be given more drugs to help prevent side effects such as damage to your blood cells.

### How can it help?

If your lung cancer has spread from your lung to other parts of your body, you'll be given treatment to relieve your symptoms and make you comfortable. If you're in pain, you should be given treatments that control your pain as much as possible. Doctors call this palliative or supportive care. You may also be offered chemotherapy to control your cancer.

Chemotherapy may help some people live a little longer.<sup>[60]</sup> Some people value the extra time that this treatment may give them. They may wish to spend time with their family or to make arrangements for what will happen after they are gone. But before deciding whether to have chemotherapy, you may want to discuss the side effects as well as the benefits of the treatment.

### Chemotherapy that includes a platinum drug

Cisplatin and carboplatin both belong to a group of drugs called platinum drugs. If you're being treated for advanced lung cancer, you'll probably have a combination of drugs. Including a platinum drug in the combination might work slightly better than using another type of drug instead.<sup>[61]</sup>

## Lung cancer

In one study, people taking a combination of drugs including cisplatin lived for just over 13 months on average. People taking a combination without cisplatin lived for an average of nearly 10 months.

But you are more likely to have unpleasant side effects with platinum drugs.

### **Chemotherapy with one newer drug (gemcitabine, paclitaxel, or vinorelbine)**

Having chemotherapy with one of the newer drugs on its own probably won't help you live any longer. But it may improve your quality of life. <sup>[62]</sup>

You may have less pain and fewer breathing problems than you would if you didn't take this treatment. You may also be able to get around more easily (to do your shopping and housework, for instance), and feel better emotionally. And because the newer drugs have fewer side effects, you should get fewer problems from one of these drugs than from older types of chemotherapy.

### **Chemotherapy with more than one drug**

Chemotherapy with two drugs can help you live longer. <sup>[63]</sup> The combination works better than one drug on its own, but also means you're more likely to get side effects. A combination of three chemotherapy drugs means even more side effects, and doesn't seem to work any better than two drugs.

### **Chemotherapy with docetaxel (Taxotere) by itself if you've already had chemotherapy**

If you've already had chemotherapy with a platinum drug but this treatment isn't helping to control your cancer any more, having chemotherapy with the drug docetaxel can help you live longer.

- In one study, about 4 in 10 people who had docetaxel lived for at least a year, compared with about 1 in 10 of those who didn't. <sup>[64]</sup>
- In another study, about 1 in 3 people treated with docetaxel lived for at least a year, compared with 1 in 5 people who were treated with ifosfamide or vinorelbine. <sup>[65]</sup>
- Another study found that docetaxel helped patients cope with pain better. <sup>[66]</sup>

## **How does it work?**

Cisplatin and the other drugs used in chemotherapy interfere with the way cancer cells multiply. This may slow the growth of the cancer in your lung and in other parts of your body. The damaging effects that your cancer is having on important parts of your body are delayed, helping you to live longer.

# Lung cancer

## Can it be harmful?

All anti-cancer drugs have some harmful effects. This is because they don't just affect cancer cells. They also damage normal, healthy cells, and especially those that multiply rapidly. These include:

- Skin and hair
- Bone marrow , the soft tissue inside your bones that makes red and white blood cells
- The lining of the mouth and digestive system (this includes all the parts of your body involved in digesting your food such as your throat, gullet and stomach)
- The ovaries (the female sex organs where eggs are made) or the testicles (the male sex organs where sperm are produced).

Whether you get harmful effects will depend on:

- The drug or drugs you are having
- The dose of each drug
- How well you are
- What steps you and your medical team take to prevent or relieve any harmful effects.

The problems you're most likely to get soon after chemotherapy are nausea and vomiting, infections, tiredness and diarrhoea . Later on, there's a chance that you could become infertile, get another type of cancer or have heart problems. To learn more see [Side effects of chemotherapy](#) .

In general, platinum drugs (cisplatin and carboplatin) are more likely to cause side effects than the newer drugs (gemcitabine, paclitaxel, vinorelbine, and docetaxel). Also, treatments with two drugs cause more side effects than treatment with just one drug.<sup>[67]</sup>

We've put together a summary of the side effects of many of the drugs used in chemotherapy for advanced lung cancer. See [Side effects of chemotherapy for advanced non-small-cell lung cancer](#) .

## How good is the research on chemotherapy for metastatic non-small-cell cancer?

Lots of research has been done on chemotherapy for people with non-small-cell lung cancer that has spread to other parts of the body (stage 4 or metastatic disease). (To read more, see [What stage is your lung cancer?](#) ) Most people are treated with a

## Lung cancer

combination of drugs. But researchers aren't sure which combination of drugs works best.

What we do know is that, overall, if you have chemotherapy you will probably live longer and have a better quality of life.<sup>[60]</sup>

### **Is chemotherapy with a platinum drug plus one or more other drugs better than no chemotherapy?**

One big summary of research (known as a **systematic review**) involving more than 1,000 people compared chemotherapy containing cisplatin (usually in combination with some other older drugs) with no chemotherapy.<sup>[80]</sup> Cisplatin is a platinum drug. The people given the chemotherapy typically lived for five-and-a-half months, while those who didn't have chemotherapy typically lived for four months. However, we don't know for certain if it was the cisplatin that was helping people to live longer or the other drugs used in the chemotherapy. Also, we don't know how well or ill people felt during and after their treatment.

### **Is chemotherapy with one newer drug better than no chemotherapy?**

We found four studies that looked at the effects of taking just one of the newer kinds of chemotherapy drug (paclitaxel, gemcitabine, or vinorelbine).<sup>[67] [71] [81]</sup> Having one of these drugs helped to improve people's quality of life. People felt better emotionally and were able to do more. They also had less pain, nausea and vomiting, and were less breathless.

### **Is a combination of drugs better than one drug?**

Having two chemotherapy drugs seem to work better than having just one.<sup>[63]</sup> You're more likely to be alive a year later if you have two drugs, but you're also more likely to get side effects.

Three drugs don't seem to be any better than two. And adding a third drug means you might get even more side effects.

### **Is chemotherapy with docetaxel helpful if a platinum drug no longer helps control your cancer?**

We found several studies that looked at this question. Two studies found that docetaxel can help people live longer when platinum drugs no longer help them.<sup>[82] [83]</sup> About 3 to 4 in 10 people who had docetaxel lived for at least a year. Of those who didn't get docetaxel, between 1 and 2 out of 10 lived for at least a year. One other study found that docetaxel helped patients cope with pain better.<sup>[66]</sup>

Another study compared docetaxel on its own with docetaxel combined with irinotecan and found no difference.<sup>[84]</sup> The final study compared two different doses of docetaxel and found no difference.<sup>[85]</sup>



# Radiotherapy plus chemotherapy for non-small-cell lung cancer

In this section

[Does it work?](#)

[What is it?](#)

[How can it help?](#)

[How does it work?](#)

[Can it be harmful?](#)

[How good is the research on radiotherapy plus chemotherapy for non-small-cell lung cancer?](#)

This information is for people who have stage 3 non-small-cell lung cancer that has not spread beyond their chest but can't be operated on. It tells you about having radiation plus chemotherapy. It is based on the best and most up-to-date research.

## Does it work?

Yes. If you have both chemotherapy and radiotherapy, you're likely to live longer than if you have only radiotherapy for [stage 3](#) cancer that hasn't spread beyond your chest but can't be operated on. But if you're over 70, this combination of treatments may be harmful. The treatment may be too much for your body to handle.

Also, researchers don't know how this combination of treatments affects your symptoms and the way you feel.

## What is it?

Radiotherapy and chemotherapy are used to kill cancer cells. You'll usually be offered these two treatments if you have stage 3 lung cancer but you can't have surgery. <sup>[24]</sup> <sup>[86]</sup> To learn more, see [How lung cancer is treated](#) .

For more on the stages of lung cancer, see [What stage is your lung cancer?](#)

Sometimes radiotherapy is given after a course of chemotherapy. A course of chemotherapy can take several weeks. However, recent research has looked at radiotherapy given during the course of chemotherapy. This is called 'concurrent' chemoradiotherapy. This way of giving the combined treatment is more effective. <sup>[87]</sup> <sup>[88]</sup>

## Radiotherapy

Radiotherapy uses high-energy x-rays to kill lung cancer cells and to shrink tumours. For people with lung cancer, radiotherapy is given to the chest area.

You'll be asked to lie inside a radiotherapy machine and keep very still while you have the treatment. It only takes a few minutes, and doesn't hurt. You may feel a bit isolated, and it's natural to feel anxious about the treatment. But your medical team will be able to reassure you.

Your doctors will have worked out exactly where your cancer is and how much energy they need to direct at it, and for how long. They want to destroy your cancer but cause as little damage as possible to the normal, healthy cells around it. So they target the

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x-ray beam very carefully. They do this by sending the x-rays towards your cancer from different directions. It's like sending an army of tanks on an exercise, using different routes to get to the same place. If they all went the same way, they'd tear up the road. But, by going different routes, they cause smaller amounts of damage that are easier to repair.

There are several other methods doctors use to give radiotherapy. These include giving the radiation in lots of small amounts over a shorter period of time (hyperfractionation), using a special machine that matches the x-rays to the shape of the cancer (conformal radiotherapy) and putting a radioactive pellet directly into the cancer or near the cancer (brachytherapy). For more details, see [Other ways doctors give radiotherapy](#) .

### Chemotherapy

Chemotherapy uses anti-cancer drugs to kill cancer cells in the lung and all over the body. There are lots of drugs used in chemotherapy for lung cancer.

Some of the newer drugs (with their brand names) are:

- gemcitabine (Gemzar)
- irinotecan (Campto)
- paclitaxel (Taxol)
- vinorelbine (Navelbine).

There are also older drugs, called alkylating agents.

- Cisplatin and carboplatin are alkylating agents. They also belong to a class of drugs called platinum drugs.
- Other alkylating agents that are sometimes used include cyclophosphamide (brand name Endoxana) and ifosfamide (Mitoxana).

The National Institute for Health and Care Excellence (NICE) is the government body that recommends which treatments should be used by the NHS. NICE says that people with advanced non-small-cell lung cancer should be offered one of these newer drugs in combination with a platinum drug.<sup>[80]</sup> For example, you may be given cisplatin with gemcitabine, or cisplatin with vinorelbine. Or you may have carboplatin with paclitaxel or gemcitabine.

There's another chemotherapy drug called bevacizumab (brand name Avastin). It can be used to treat people with non-small-cell lung cancer that isn't the squamous cell type (this is a slow-growing cancer that affects the airways). Bevacizumab is used along with platinum chemotherapy drugs. But we haven't looked at the research on this drug yet.

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If you've been treated with chemotherapy, but it no longer seems to be helping you, you may be given treatment with a newer drug called docetaxel (Taxotere).<sup>[24]</sup>

### How is chemotherapy given?

Chemotherapy drugs are usually given as injections into your vein or as a drip (also called an IV or an intravenous infusion). Some come as tablets. You usually have to go to hospital to have injections and drips, but you should be able to go home later the same day. You'll only have to stay in hospital overnight if your treatment takes longer than usual or you have a bad reaction to the drugs.

You'll usually have some tablets to take at home after chemotherapy. These will help with some of the side effects you can get. For example, you may be given tablets to stop you feeling sick and vomiting. You might also be given an injection while you are in hospital to prevent vomiting.

### How long does treatment last?

Chemotherapy is usually given as a course of several cycles of treatment. One cycle of chemotherapy is usually given over a few days. Afterwards, you'll have a few weeks' rest to give your body a chance to recover from the harmful effects of the treatment. Most people have four to six cycles. A full course of treatment may take up to six months.

How many cycles you have will depend on the type of cancer you have and how well chemotherapy works for you. Some treatments are more intensive than others. You may be given more drugs to help prevent side effects such as damage to your blood cells.

### How can it help?

People with this type of lung cancer who have radiotherapy as well as chemotherapy have a slightly higher chance of living longer than people who have only radiotherapy.

<sup>[89]</sup> <sup>[90]</sup> <sup>[91]</sup> One study found that 10 in 100 people who had both treatments were alive three years after treatment. Out of those who had just radiotherapy, only 2 in 100 were alive three years later.<sup>[92]</sup>

Sometimes radiotherapy is given while you are having a course of chemotherapy. This is called 'concurrent' chemoradiotherapy. Having the treatments together seems to work better than having them separately. Reviews of studies have found that people were less likely to have their lung cancer come back if they had both treatments at the same time,

<sup>[87]</sup> and they were also more likely to still be alive after three years and after five years.

<sup>[87]</sup> <sup>[88]</sup>

However, if you're over 70, combining chemotherapy and radiotherapy seems to shorten your life compared with just having radiotherapy alone. Studies have found that:<sup>[93]</sup>

- People over 70 who had both treatments lived for an average of about 11 months.
- But people over 70 who had just radiotherapy lived for about 13 months.

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There's not much information on whether these treatments help people to feel better. So, before you decide which treatment to have, you may want to ask your doctor about how you are likely to feel during and after treatment. You may find it helpful to talk to someone who has had the same treatment.

## How does it work?

Radiotherapy and many forms of chemotherapy work by damaging the DNA in cancer cells. DNA is a chemical that is vital for the body's cells to survive, grow and divide. Damaging it with radiotherapy or chemotherapy means cells can't grow and replace each other. These treatments can shrink cancers and slow down their growth. Some anti-cancer drugs work by damaging other substances that cells need to keep multiplying.

## Can it be harmful?

Yes, both radiotherapy and chemotherapy damage healthy cells in the body as well as cancer cells. But the damage to healthy tissues should be less than the damage to the cancer.

We know a lot about the side effects of radiotherapy and chemotherapy but studies don't tell us much about the side effects you're likely to get when having these two treatments together. However, some studies have found that having radiotherapy and chemotherapy together doesn't cause more side effects than just having radiotherapy.<sup>[92]</sup> <sup>[94]</sup>

Here's what we know about the side effects of each of these treatments.

### Side effects of radiotherapy

The most serious problem after radiotherapy to the lung is swelling (inflammation) around your lungs. This can make it harder to breathe and give you chest pain. It usually gets better on its own, but if it doesn't it can be treated with **steroids** .

You may also feel very tired.

Your throat may swell. This can cause problems swallowing and eating, although these will go away after a while. And if the tube that leads from your throat to your stomach gets narrower, you may get indigestion and **heartburn** . To learn more, see [Side effects of radiotherapy](#) .

### Side effects of chemotherapy

All anti-cancer drugs have some harmful effects. This is because they don't just affect cancer cells. They also damage normal, healthy cells, and especially those that multiply rapidly. These include:

- Skin and hair
- **Bone marrow** , the soft tissue inside your bones that makes red and white blood cells

## Lung cancer

- The lining of the mouth and digestive system (this includes all the parts of your body involved in digesting your food such as your throat, gullet and stomach)
- The ovaries (the female sex organs where eggs are made) or the testicles (the male sex organs where sperm are produced).

Whether you get harmful effects will depend on:

- The drug or drugs you are having
- The dose of each drug
- How well you are
- What steps you and your medical team take to prevent or relieve any harmful effects.

The problems you're most likely to get soon after chemotherapy are nausea and vomiting, infections, tiredness and diarrhoea . In the years after chemotherapy, there's a chance that you could become infertile, get another type of cancer or have heart problems.

### How good is the research on radiotherapy plus chemotherapy for non-small-cell lung cancer?

There's a lot of evidence from good-quality studies that this combination of treatments helps people live a little longer if they have non-small-cell lung cancer that hasn't spread beyond their chest (stage 3) but can't be operated on.

Much of the evidence is summarised in one big review of the research (called a [systematic review](#) ).<sup>[89]</sup> It includes 47 good-quality studies (called [randomised controlled trials](#) ) and also the results of six other systematic reviews.

However, the studies vary quite a lot. In some studies people had the treatments together. In others, they had one treatment first and then the other. That makes it harder to compare the results.

Overall, the research shows that people are more likely to live longer if they have both treatments (radiotherapy and chemotherapy) than if they just have radiotherapy. But they are also more likely to get side effects, which can be serious.

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## Intensive radiotherapy for non-small-cell lung cancer

In this section

[Does it work?](#)

[What is it?](#)

[How can it help?](#)

[How does it work?](#)

[Can it be harmful?](#)

[How good is the research on intensive radiotherapy for non-small-cell lung cancer?](#)

# Lung cancer

This information is for people who have non-small-cell lung cancer that hasn't spread beyond their chest but can't be operated on (stage 1, 2, or 3). It tells you about having intensive treatment with radiotherapy. It is based on the best and most up-to-date research.

## Does it work?

We don't know whether intensive radiotherapy works better than standard methods for treating lung cancer that hasn't spread beyond the chest but can't be operated on (stage 1, 2, or 3). More research is under way that compares intensive radiotherapy with standard radiotherapy, and with a combination of radiotherapy and chemotherapy.

## What is it?

Radiotherapy uses high-energy x-rays to kill lung cancer cells and shrink tumours (lumps of cancer cells). A large machine usually produces these rays. You will be asked to lie inside the radiotherapy machine and to keep very still while you have the treatment. It only takes a few minutes and does not hurt. You may feel rather isolated, and it's natural to feel anxious about it. But your medical team will be able to reassure you.

Your doctors will have worked out exactly where your cancer is, and they will target the x-ray beam very carefully. They will work out how much energy to direct at the tumour, and for how long. The aim is to destroy your cancer cells, while causing as little damage as possible to the normal, healthy cells around them.

Standard radiotherapy is usually given once a day, Monday to Friday, for about seven or eight weeks. Over the years, this practice has developed partly because it works and partly for practical reasons (it's easier to treat people during the working week).

More recently, doctors have looked at giving radiotherapy more often, over a shorter period of time. Intensive radiotherapy is called **hyperfractionation**. In hyperfractionated radiotherapy, the total dose of radiation is increased by giving smaller doses, more often, over a shorter amount of time. For non-small-cell lung cancer, hyperfractionated treatment is often given twice a day for more than seven weeks.

Another way of giving intensive radiotherapy is known as **CHART** (continuous, hyperfractionated, accelerated radiotherapy). CHART uses smaller doses of radiation than standard radiotherapy, but therapy is carried out three times a day over two weeks. This means that the total dose is the same or slightly less than what you get with standard radiotherapy.

The National Institute for Health and Care Excellence (NICE) says that people with non-small-cell lung cancer who need radiotherapy should be treated with CHART whenever possible.<sup>[24]</sup> (NICE is the government body that decides which treatments should be used by the NHS.)

# Lung cancer

## How can it help?

CHART is the only technique for giving intensive radiotherapy that may be better than standard treatment.<sup>[95]</sup> Other types of intensive radiotherapy don't work better than standard treatment.<sup>[95]</sup>

There is some evidence that CHART can help you live longer.<sup>[95]</sup> In one study, 3 in 10 people who had CHART lived for at least two years.<sup>[95]</sup> Among people who had standard radiotherapy, 2 in 10 people lived for at least two years.

## How does it work?

Radiotherapy works by damaging the DNA in cancer cells. DNA is a chemical that is vital for the body's cells to survive, grow and divide. When radiation damages the DNA in cancer cells, the cells can't grow and replace each other. This is why radiotherapy can shrink cancers and slow down their growth.

## Can it be harmful?

The most serious problem after radiotherapy to the lung is swelling (inflammation) around your lungs. This can make it harder to breathe and give you chest pain. It usually gets better on its own, but if it doesn't it can be treated with steroids. You may also feel very tired.

Your throat may swell which can cause problems swallowing and eating, although these will go away after a while. And if the tube that leads from your throat to your stomach gets narrower, you may get indigestion and heartburn.

You're more likely to get side effects after intensive radiotherapy than after standard radiotherapy. About half the people who have intensive radiotherapy get inflammation in the lung.<sup>[95]</sup> Among people who have standard chemotherapy, it's about 1 in 10. And you're more likely to get scarring in the lung. About 16 in 100 people who have CHART get scarring in the lung. For people who have standard chemotherapy it's only 4 in 100.<sup>[95]</sup>

Problems with swallowing and eating can also be worse after intensive radiotherapy.

To learn more, see [Side effects of radiotherapy](#) .

## How good is the research on intensive radiotherapy for non-small-cell lung cancer?

There isn't a lot of evidence about the effects of intensive radiotherapy for people with non-small-cell lung cancer that hasn't spread beyond their chest but can't be operated on ( [stage 1, 2, or 3](#) ). The biggest study we found was a summary of research (called a [systematic review](#) ) that looked at seven studies involving 1,369 people.<sup>[95]</sup>

## Gefitinib and erlotinib for non-small-cell lung cancer

In this section

[Do they work?](#)

[What are they?](#)

[How can they help?](#)

[How do they work?](#)

[Can they be harmful?](#)

[How good is the research on gefitinib and erlotinib for non-small-cell lung cancer?](#)

This information is for people with non-small-cell lung cancer that can't be operated on. It tells you about two newer drugs called gefitinib and erlotinib. It is based on the best and most up-to-date research.

### Do they work?

We don't know. Gefitinib and erlotinib are two newer drugs that work in a different way from other chemotherapy drugs. You might be offered one of these drugs if you have non-small-cell lung cancer and you can't have an operation. But there hasn't been much research to show whether they can be helpful.

### What are they?

Gefitinib and erlotinib are newer drugs that work against cancer in a different way from the usual types of chemotherapy.

Gefitinib and erlotinib come as tablets, and you will probably take them once a day.

The National Institute for Health and Care Excellence (NICE), which is the organisation that decides which treatments should be available on the NHS, has put together guidance for doctors on these drugs. <sup>[96]</sup>

According to NICE, you should be able to have gefitinib on the NHS if both the following are true:

- Your cancer has spread to tissues nearby or more distant parts of your body (locally advanced or metastatic cancer) and tests show it is a type of cancer that responds to gefitinib.
- You have not had drug treatment for non-small-cell lung cancer before.

You should be able to have erlotinib on the NHS if you have tried another type of chemotherapy and it hasn't worked. However, there are some restrictions. This treatment isn't recommended for:

- People with cancer that is locally advanced or metastatic and who cannot take another chemotherapy drug called [docetaxel](#)
- People who have already tried two types of chemotherapy, including docetaxel, and they haven't worked.



## How can they help?

We don't know if these drugs can help because there hasn't been much research on them.

In most studies, adding gefitinib or erlotinib to people's first round of chemotherapy didn't help them live any longer. <sup>[97]</sup> <sup>[98]</sup> Adding erlotinib to people's second or third round of chemotherapy doesn't appear to help them live any longer either. <sup>[99]</sup> <sup>[100]</sup>

However, a study in Japan found that having gefitinib as a first treatment helped people live longer if their cancer had gene mutations making it more sensitive to the drug. <sup>[101]</sup> And a separate study found that having erlotinib and standard chemotherapy helped people live longer compared with people who just had standard chemotherapy alone. But the benefit was mainly in those people whose cancer had gene mutations making it more sensitive to erlotinib. <sup>[102]</sup>

Studies also suggest that these drugs might have benefits for people who haven't been helped by other kinds of chemotherapy. <sup>[98]</sup> <sup>[103]</sup> People taking them may live a little longer.

## How do they work?

Erlotinib and gefitinib belong to a group of drugs called epidermal growth factor receptor inhibitors. They slow the growth of cancer cells by attaching to an enzyme involved in cancer cell growth.

Erlotinib and gefitinib may work better in some groups of people than others. These drugs seem to work better if: <sup>[104]</sup>

- You have an Asian background
- You are a woman
- You've never smoked.

## Can they be harmful?

Yes, both erlotinib and gefitinib can cause side effects. In studies, between 3 in 100 and 6 in 100 people taking either drug had bad **diarrhoea** or rash. Some people died because of the treatment. <sup>[104]</sup> <sup>[105]</sup>

Erlotinib can cause liver damage, especially in people who already have problems with their liver. <sup>[106]</sup> In severe cases, the damage can be bad enough to kill you. If you have liver problems and you're taking erlotinib, you should have regular checks to see how well your liver is working.

Erlotinib also increases your chances of three rare complications:

## Lung cancer

- Getting a hole in your intestine (gut)
- Bad blistering of the skin
- Ulcers in part of the eye (the cornea).

Doctors have been warned to be alert for any signs of these conditions developing. <sup>[107]</sup>

You're less likely to get side effects with lower doses of erlotinib or gefitinib. <sup>[108]</sup> <sup>[109]</sup>

### How good is the research on gefitinib and erlotinib for non-small-cell lung cancer?

There hasn't been much good research about erlotinib and gefitinib, which are sometimes used to treat people with non-small-cell lung cancer that can't be operated on.

We found two summaries of the research ( [systematic reviews](#) ) that looked at how well these drugs worked for people after standard chemotherapy. <sup>[103]</sup> <sup>[98]</sup> The summaries looked at the results of two studies.

One study found that erlotinib helped people live a little longer (on average, two months longer). <sup>[110]</sup> The other study found that gefitinib didn't help most people. <sup>[105]</sup>

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## Chemotherapy plus radiotherapy for small-cell lung cancer

In this section

[Does it work?](#)

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[How can it help?](#)

[How does it work?](#)

[Can it be harmful?](#)

[How good is the research on chemotherapy plus radiotherapy for small-cell lung cancer?](#)

This information is for people with small-cell lung cancer that is only on one side of the chest. It tells you about having chemotherapy plus radiotherapy. It is based on the best and most up-to-date research.

### Does it work?

Yes. If you have small-cell lung cancer that is only on one side of your chest, you'll probably have chemotherapy. Having radiotherapy to your chest as well can help you live longer. But doctors still aren't certain when it's best to give radiotherapy, and what the best dose is. They're also unsure whether treatment should be given every day for two to three weeks, or less often for a longer time.

### What is it?

Doctors in the UK have been given guidelines about how to treat people with lung cancer. These say that you may be offered radiotherapy combined with chemotherapy if your

## Lung cancer

cancer has not spread outside of your lung and nearby lymph nodes.<sup>[24]</sup> <sup>[111]</sup> For more on these guidelines, see [How lung cancer is treated](#) .

### Radiotherapy

Radiotherapy uses high-energy **x-rays** to kill lung cancer cells and shrink tumours. For people with lung cancer, it's given to the chest area.

If you have this treatment, you will be asked to lie inside a radiotherapy machine and to keep very still while you have the treatment. It takes only a few minutes and doesn't hurt. You may feel rather isolated, and it's natural to feel anxious about it. But your medical team will be able to reassure you.

Your doctors will have worked out exactly where your cancer is. They will also work out how much energy to direct at it, and for how long. They want to destroy your cancer, but they also want to cause as little damage as possible to the normal, healthy cells around it. So they target the x-ray beam very carefully.

They do this by sending the x-rays towards your cancer from different directions. It's like sending an army of tanks on an exercise, using different routes to get to the same place. If they all went the same way, they'd tear up the road. But, by going different routes, they cause smaller amounts of damage that are easier to repair.

There are several other types of radiotherapy doctors use to treat lung cancer. These include giving the radiation in lots of small amounts over a shorter period of time (hyperfractionation), using a special machine that matches the x-rays to the shape of the cancer (conformal radiotherapy) and putting a radioactive pellet directly into the cancer or near the cancer (brachytherapy). To find out more, see [Other ways doctors give radiotherapy](#) .

### Chemotherapy

Chemotherapy uses anti-cancer drugs to kill cancer cells in the lung and all over the body. Most anti-cancer drugs are injected directly into a vein, though some are taken as tablets or injected into a muscle or under the skin. The drugs can be given alone or as combinations of two, three or more drugs.

Chemotherapy is usually given as a course of several cycles of treatment. One cycle of chemotherapy is usually given over a few days. Afterwards you will have a few weeks' rest to give your body a chance to recover from the harmful effects of the treatment. How many cycles you have will depend on your type of cancer and how well it responds to the chemotherapy. Some treatments are more intensive than others. You may be given additional drugs to help prevent or relieve harmful effects, such as damage to your blood cells.

### How can it help?

Having radiotherapy to the chest at some time during your chemotherapy can improve your chances of living for at least three years by about 50 percent.<sup>[112]</sup> About 15 percent

## Lung cancer

of people who have both treatments live for at least three years.<sup>[112]</sup> Of the people who just have chemotherapy, about 10 percent live for at least three years. The cancer in your lung should also grow more slowly if you have the radiotherapy.<sup>[113]</sup>

We don't know if it's better to have a bigger dose of radiation or to start treatment earlier rather than later in the course of your chemotherapy.<sup>[114] [115]</sup> Some research suggests that, if you're having chemotherapy that includes a platinum drug such as cisplatin, earlier treatment may be slightly better.<sup>[116]</sup>

Doctors aren't sure whether to use [intensive radiotherapy](#) (called hyperfractionation) or standard radiotherapy. Studies have had mixed results.

### How does it work?

Radiotherapy and many forms of chemotherapy work by damaging the DNA in cancer cells. DNA is a chemical that is vital for the body's cells to survive, grow and divide.

Damaging the DNA of cancer cells with radiotherapy or chemotherapy means the cells can't grow and replace each other. These treatments can shrink cancers and slow down their growth. Some anti-cancer drugs work by damaging other substances that cells need to keep multiplying.

### Can it be harmful?

Although most people do better with the combination of radiotherapy and chemotherapy, some don't. With chemotherapy alone, between 1 in 100 and 2 in 100 people die as a result of the side effects of their treatment. But this almost doubles to between 3 in 100 and 4 in 100 who have the additional radiotherapy.<sup>[113]</sup>

Deaths from these treatments are usually the result of serious infections such as [pneumonia](#). These infections happen because one side effect of chemotherapy is a low white blood cell count. White blood cells help protect you against infections.

### Side effects of radiotherapy

The most serious problem after radiotherapy to the lung is swelling (inflammation) around your lungs. This can make it harder to breathe and give you chest pain. It usually gets better on its own, but if it doesn't it can be treated with steroids. You may also feel very tired.

Your throat may swell, which can cause problems swallowing and eating, although this will go away after a while. And if the tube that leads from your throat to your stomach gets narrower, you may get indigestion and heartburn. To learn more, see [Side effects of radiotherapy](#).

# Lung cancer

## Side effects of chemotherapy

All anti-cancer drugs have some harmful effects. This is because they don't just affect cancer cells. They also damage normal, healthy cells, and especially those that multiply rapidly. These include:

- Skin and hair
- **Bone marrow** , the soft tissue inside your bones that makes red and white blood cells
- The lining of the mouth and digestive system (this includes all the parts of your body involved in digesting your food such as your throat, gullet and stomach)
- The ovaries (the female sex organs where eggs are made) or the testicles (the male sex organs where sperm are produced).

Whether you get harmful effects will depend on:

- The drug or drugs you are having
- The dose of each drug
- How well you are
- What steps you and your medical team take to prevent or relieve any harmful effects.

The problems you're most likely to get soon after chemotherapy are nausea and vomiting, infections, tiredness and **diarrhoea** . In the years after chemotherapy, there's a chance that you could become infertile, get another type of cancer or have heart problems. To learn more, see [Side effects of chemotherapy](#) .

## How good is the research on chemotherapy plus radiotherapy for small-cell lung cancer?

There's fairly good evidence from two summaries of the research (called **systematic reviews** ) that this treatment helps people live longer if they have small-cell lung cancer on only one side of their chest. The studies in the summaries included more than 2,500 people.

Two systematic reviews looked at whether it's better to have radiation earlier or later during chemotherapy treatment. <sup>[115]</sup> <sup>[116]</sup> Overall, they said it made little difference. But having radiotherapy sooner might be best. <sup>[116]</sup>

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## Radiotherapy to the head for small-cell lung cancer

# Lung cancer

In this section

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[Can it be harmful?](#)

[How good is the research on radiotherapy to the head for small-cell lung cancer?](#)

This information is for people with small-cell lung cancer who have had previous treatment and no longer have any signs of cancer. It tells you about having radiotherapy to the head, which is a treatment to prevent the cancer from spreading to the brain. It is based on the best and most up-to-date research.

## Does it work?

Yes. If you've had treatment and no longer have any signs of cancer, radiotherapy to your head can help you live longer. Your cancer is less likely to spread to your brain than if you don't have radiotherapy. But there are risks with this treatment. Radiotherapy to the head may cause some brain damage, though no one knows for certain.

## What is it?

This treatment is for people who are in complete remission from small-cell lung cancer after they've been successfully treated with chemotherapy and radiotherapy to their chest.

Doctors in the UK have been given guidelines about how to treat people with lung cancer. These say that you may be offered radiotherapy to the head if treatment to your chest has been successful. <sup>[24]</sup> <sup>[117]</sup> To learn more about these guidelines, see [How lung cancer is treated](#) .

High-energy x-rays are given to the head. It's done to stop the cancer spreading to the brain.

Radiotherapy uses high-energy x-rays to kill lung cancer cells and shrink tumours. A large machine called a linear accelerator usually produces these rays. You will be asked to lie with your head inside the radiotherapy machine and keep very still while you have the treatment. It only takes a few minutes and doesn't hurt. You may feel rather isolated, and it's natural to feel anxious. But your medical team will be able to reassure you.

It's usual to have a daily dose of treatment for five days to 10 days.

## How can it help?

Having radiotherapy to your head can help you live longer. <sup>[118]</sup> Out of people who had this treatment, 21 out of 100 were alive three years later. Out of those who did not have this treatment 15 in 100 were alive three years later. <sup>[118]</sup> Radiotherapy also reduces the chance of the cancer spreading to the brain by half. <sup>[118]</sup> It seems that this treatment doesn't just delay brain tumours, but it actually prevents them appearing.

People who are given larger-than-average doses of radiation may have even less risk of their cancer spreading to their brain, although not all studies have found this. <sup>[119]</sup>

## Lung cancer

However, people having higher doses don't seem to live any longer.<sup>[120]</sup> Higher doses also are more likely to cause long-term side effects.<sup>[119]</sup>

### How does it work?

Doctors know from experience that when patients are diagnosed with small-cell lung cancer, in most cases it will have already started to spread out of the lung. They may not be able to see the cancer cells on x-rays and scans, and the cells may not be causing any symptoms. But they are probably on their way to causing more tumours (metastases) in other parts of the body.

The chemotherapy that is usually given to treat small-cell lung cancer, especially in the early stages, will travel around most parts of the body in the bloodstream. So, it will kill a lot of cancer cells, whether doctors can see them or not.

But chemotherapy can't get into the brain. Radiotherapy is therefore given to the head to kill any cancer cells that may have got into the brain, and which won't be killed by chemotherapy.

### Can it be harmful?

Radiotherapy can damage healthy cells as well as cancer cells. But most healthy cells grow and multiply more slowly than cancer cells. Radiotherapy causes more damage to cells that grow and multiply quickly, so the damage to healthy tissues should be less than the damage to the cancer.

Radiotherapy to the head can cause:<sup>[121]</sup>

- Harmful effects that start within 90 days of finishing the course of therapy
- Harmful effects that start 90 days or more after the course is finished.

### Harmful effects that start early on (within 90 days of treatment)

**Fatigue:** Many people feel tired during a course of radiotherapy, and you shouldn't expect to be able to do as much as usual while you are having treatment. You may need to rest during the day, and family and friends may need to help out with shopping, cooking, and other everyday tasks.

In one study, around 5 in 10 of people who had radiotherapy reported fatigue, compared with between 2 and 3 in 10 who did not have the treatment.<sup>[122]</sup>

**Hair loss:** Radiotherapy doesn't cause hair loss when given to other parts of the body. But when it's given to the head, the x-rays damage the follicles, which hold the hair. This makes hair fall out, and it doesn't grow back after treatment. If you would like to try a wig or hairpiece, someone at your hospital should be able to advise you.

## Lung cancer

One study found that around 2 in 10 of people who had radiotherapy had hair loss, compared with 1 in 10 of those who did not have the treatment. <sup>[122]</sup>

### Long-term harmful effects (after 90 days of treatment)

Researchers have been concerned that radiotherapy to the head might cause brain damage. In the 1980s, several studies reported that people showed symptoms such as forgetfulness and confusion, and showed signs of nerve damage on brain scans after they had radiotherapy. But it was hard to know whether these effects were due to the radiotherapy or to the cancer. More recent research has shown that up to 3 out of 5 people with lung cancer may show signs of mental problems even before radiotherapy. <sup>[118]</sup>

We need more research before we can be sure whether radiotherapy affects mental ability.

### How good is the research on radiotherapy to the head for small-cell lung cancer?

There's fairly good evidence from one summary of the research (called a [systematic review](#)) involving nearly 1,000 people that radiotherapy to the head can help some people with small-cell lung cancer. <sup>[118]</sup>

Another summary of the research had similar findings. <sup>[123]</sup>

Researchers have also looked at whether radiotherapy to the head can harm the brain. However, because many people with lung cancer may have brain and nerve problems before they are treated, doctors can't be certain if there is any link between radiotherapy to the head and brain and nerve damage. <sup>[118]</sup>

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## Intensive chemotherapy for small-cell lung cancer

In this section

[Does it work?](#)

[What is it?](#)

[How can it help?](#)

[How does it work?](#)

[Can it be harmful?](#)

[How good is the research on intensive chemotherapy for small-cell lung cancer?](#)

This information is for people with small-cell lung cancer. It tells you about having intensive chemotherapy. It is based on the best and most up-to-date research.

### Does it work?

We're not sure. We know that chemotherapy shrinks at least three-quarters of all small-cell lung tumours. But we don't know if intensive chemotherapy (using bigger doses of drugs or the same doses over a shorter time) works any better than standard chemotherapy. Intensive chemotherapy can be harmful. More people die from its effects than from standard chemotherapy.



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## What is it?

Chemotherapy uses anti-cancer drugs to kill cancer cells in the lung and all over the body. Most anti-cancer drugs are injected directly into a vein, though some are taken as tablets or injected into a muscle or under the skin. They can be given alone or as combinations of two, three or more drugs.

Chemotherapy is usually given as a course of several cycles of treatment. One cycle of chemotherapy is usually given over a few days. Afterwards you will have a few weeks' rest. This gives your body a chance to recover from the harmful effects of the treatment. How many cycles you have will depend on your type of cancer and how well your cancer responds to the chemotherapy. You may be given additional drugs to help prevent or relieve harmful effects, such as damage to your blood cells.

The doses and timing of chemotherapy drugs that doctors usually give to patients with cancer are called **standard chemotherapy**. Here are the standard cycles of anti-cancer drugs (followed by their brand names) that doctors prescribe for small-cell lung cancer:

- Four, five or six cycles of etoposide (Vepesid, Etopophos) plus either cisplatin or carboplatin.

But sometimes more intensive chemotherapy is given for small-cell lung cancer. This involves using higher doses of drugs, or the same doses over a shorter period of time. However, this kind of treatment isn't so common.

## How can it help?

We're not sure it can. There's no clear evidence that intensive chemotherapy helps people live longer or prevents their cancer from spreading. Different studies show different results. <sup>[124]</sup> <sup>[125]</sup> <sup>[126]</sup> <sup>[127]</sup> <sup>[128]</sup> <sup>[129]</sup> <sup>[130]</sup> <sup>[131]</sup> And intensive chemotherapy can cause side effects that are so bad they can kill you.

## How does it work?

Chemotherapy works by interfering with the way cancer cells grow and multiply. The different anti-cancer drugs do this in different ways. Some target DNA, a chemical that all cells need to survive and multiply. Other drugs affect other important chemicals or structures within cells.

By using two or more anti-cancer drugs that work in slightly different ways, doctors hope to kill more cancer cells. By giving higher doses of the drugs or giving standard doses in a shorter period of time than usual (dose intensification), doctors also hope to make treatment work better and kill off more cancer cells.

## Can it be harmful?

All anti-cancer drugs have some harmful effects. This is because they damage not only cancer cells, but also normal, healthy cells. Cells that multiply rapidly like cancer cells are affected most. These include cells found in:

## Lung cancer

- Skin and hair
- **Bone marrow** (the soft tissue inside bones, where red and white blood cells are made)
- The lining of the mouth and digestive system (this includes all the parts of your body involved in digesting your food such as your throat and stomach)
- The ovaries (the female sex organs where eggs are made) or the testicles (the male sex organs where sperm are produced).

Whether you get harmful effects will depend on:

- The drug or drugs you are having
- The dose of each drug
- How well you are
- What steps you and your medical team take to prevent or relieve any harmful effects.

Intensive chemotherapy seems to have more harmful side effects than standard chemotherapy. In one study, 8 in 100 people who had intensive chemotherapy died because of side effects, compared with only 1 in 100 people who had standard chemotherapy.<sup>[132]</sup> In another study, there were eight deaths among 62 patients who had intensive chemotherapy, compared with no deaths among 71 patients given standard chemotherapy.<sup>[133]</sup>

You will probably want to weigh the benefits of treatment against these risks. To learn more about the side effects of anti-cancer drugs, see [Harmful effects of common chemotherapy drugs for small-cell lung cancer](#) .

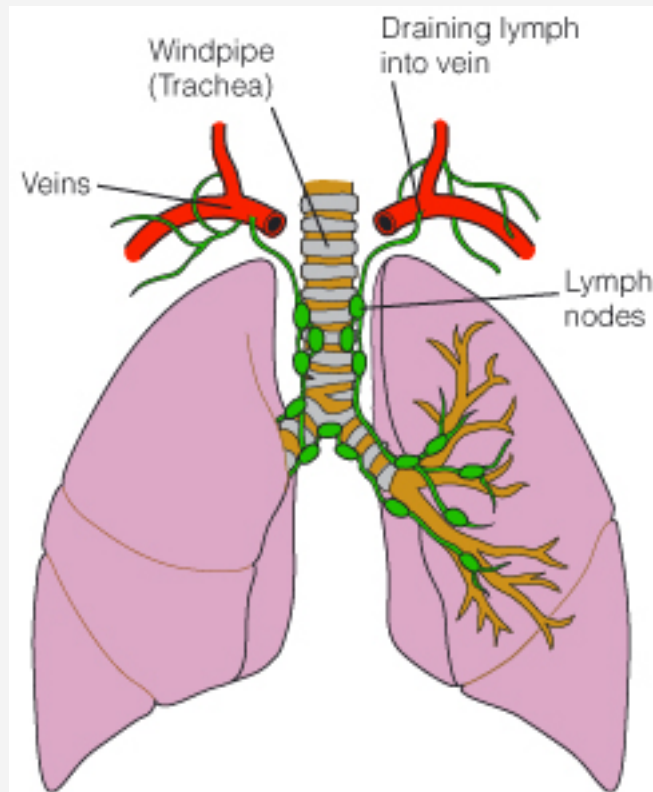
### **How good is the research on intensive chemotherapy for small-cell lung cancer?**

There is quite a lot of research comparing intensive chemotherapy with standard chemotherapy for small cell lung cancer. But the results are mixed and there's no clear evidence that intensive chemotherapy is any better than standard chemotherapy.

## Further informations:

### How lung cancer spreads

Lung cancer spreads around the body when cells break away from the original lump (tumour).



Cancer cells can be carried in the lymphatic system to other parts of the body.

The cells then travel to other parts of your body and start growing there. This spread is called **metastasis**. This is a more advanced and serious form of cancer.

Your cancer may spread to parts of your body near your lungs. It may spread to:

- The lining between your lungs and your chest wall (this lining is called the pleura)
- Your chest wall
- The large muscle below your chest (diaphragm)
- Your other lung.

## Lung cancer

It may also spread to more distant parts of your body, such as your bones, brain, liver or adrenal glands. The cancer cells are carried to other parts of your body either in your bloodstream or in a network called the lymphatic vessels.

These lymphatic vessels contain small swellings called lymph nodes. These nodes normally trap germs. To see if your cancer has spread, your doctors will look at lymph nodes near your lungs. These are found in three places:

- Close to the surface of the lungs
- In the centre of the chest, between the lungs
- Above the collarbone.

You may have a CT scan to show whether the lymph nodes have got bigger. However, this does not show whether there are cancer cells there. A sample of cells may be taken from the lymph nodes by putting a small tube into the tissue near the nodes. This is called a **biopsy**. The cells in the sample are examined under a microscope in the laboratory. It's possible to see whether the cells are cancerous (malignant) or not.

### Can I be screened for lung cancer?

When lung cancer has spread, it's very difficult to treat successfully. Yet people often only notice the symptoms, such as a persistent cough, later on in the disease.

Most cases of lung cancer are advanced by the time they are diagnosed.<sup>[11]</sup> This is why there has been so much interest in **screening** for lung cancer. This is where doctors try to pick up the disease early, before symptoms appear. It's done by testing large numbers of apparently healthy people, to find out who has the disease.

Several studies have been carried out to see if screening can detect lung cancer earlier and improve people's chances of surviving the disease. The studies have used different methods of testing, such as x-rays of your chest, or tests on the fluid (also called phlegm or sputum) that you cough up. More recently, a new way of screening called a **CT scan** has been used to screen people who smoke and others who have a high chance of getting lung cancer. CT scans use a special type of x-ray that produces pictures of 'slices' (cross sections) of your body.

Most studies have found that screening doesn't work, and some studies have found that it could be harmful. Having chest x-rays twice a year may do more harm than good. People with lung cancer who have frequent x-rays are more likely to die from the disease than people who are not screened.<sup>[12]</sup>

## Lung cancer

An annual x-ray combined with a sputum test every four months does have benefits. A sputum test is when a sample of phlegm you cough up is looked at under a microscope. Studies have shown that:<sup>[13]</sup>

- People with lung cancer who had this combination of tests were more likely to be diagnosed earlier, and more were treated successfully.
- Most importantly, people who had this screening lived for an average of five years longer than people who were not screened.
- But the number of advanced cancers didn't reduce, nor did the screening reduce the total number of deaths from the disease.
- Overall, screening didn't help doctors save lives.

Another recent large study looked at 154,901 people, half of whom were offered a chest x-ray every year for four years, and half of whom weren't a chest x-ray every year. This study confirmed that the screening didn't reduce people's risk of dying from lung cancer. In the group of people who had x-rays, 1,213 people died of lung cancer, and 1,230 people died in the group who didn't have x-rays. But this is such a small difference that it is probably due to chance.<sup>[14]</sup>

Other recent screening trials have shown that low-dose CT scans are better than x-rays at finding early signs of lung cancer. This means that more cancers are treated successfully.<sup>[13]</sup> However, low-dose CT scans sometimes wrongly show that people have signs of cancer. One study found that 21 in 100 people had false results after one test and 33 in 100 people had false results after two.<sup>[15]</sup>

Researchers are also worried that finding lung cancer when it is small may not necessarily help people to live longer.<sup>[13]</sup> Small, fast-growing tumours may be just as dangerous as larger ones. Research suggests that lung cancer may start to spread very early. This means that tests can't find them soon enough to make screening worthwhile.<sup>[13]</sup>

Until research shows that screening can reduce the number of people who die from lung cancer, specialists don't recommend that screening programmes be set up.<sup>[12] [13]</sup>

### Is there a blood test for lung cancer?

Researchers are trying to develop a blood test that could check for early lung cancer.<sup>[16]</sup><sup>[17]</sup> But the research is at a fairly early stage, and these tests are still experimental. At the moment, doctors can't use blood tests to screen for lung cancer.

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## What grade is your lung cancer?

Doctors may examine a sample of your lung cancer under the microscope. This helps them grade the cells according to how they look.

Healthy lung cells are described by doctors as **well differentiated**. This means they look like other healthy lung cells and have all the parts they need to work normally. Lung cancer cells don't look and work like healthy lung cells. They are called **less well differentiated**.

Lung cancers are graded as shown in the table below. The grade of your cancer indicates how fast it is likely to grow. G1 is the slowest. G4 is the fastest.

GX	Grade has not been assessed.
G1	Lung cancer cells are well differentiated.
G2	Lung cancer cells are moderately differentiated.
G3	Lung cancer cells are poorly differentiated.
G4	Lung cancer cells are undifferentiated.

## Side effects of chemotherapy

Chemotherapy for lung cancer can cause side effects that happen soon after treatment. It can also cause long-term side effects. You'll probably want to weigh the benefits of treatment against the side effects.

### Side effects that happen soon after treatment

**Nausea and vomiting:** How severe it is depends on the type of chemotherapy you have. But sickness can be reduced by taking drugs such as ondansetron (brand name Zofran). Lorazepam, a type of tranquilliser, can also help.

**Higher risk of infection:** Chemotherapy can reduce the number of white cells in your blood. White blood cells fight infections, so if the number of white cells in your blood (known as your white cell count) falls too low, you are at risk of getting an infection. Some people take a drug called G-CSF (filgrastim or lenograstim) to help boost their white blood cell count and help fight infections. If you think you have an infection, you should speak to your doctor as soon as you can. It's best to treat infections as early as possible.

**Bleeding:** Some drugs can reduce the number of platelets in your blood. Platelets help your blood clot when you cut yourself. If you have fewer platelets than normal, you might bleed and bruise more easily. You might get nosebleeds and find that your gums bleed. Some people can get serious bleeding problems, so if you notice any unusual bleeding or bruising, you should tell your doctor.

## Lung cancer

**Feeling tired:** You may feel very tired, even after you stop treatment. There are a few reasons why you feel so tired when you have chemotherapy. It may be that chemotherapy makes you **anaemic**. This means there is less of an oxygen-carrying substance in your blood called haemoglobin. Also, the drugs used in chemotherapy may interfere with your sleep. Treatment for anaemia may help reduce your tiredness.

**Hair loss:** Drugs used in chemotherapy kill hair cells. This is because hair cells divide rapidly like cancer cells. How much hair you lose depends on the type of chemotherapy you have. Losing your hair can be upsetting and some people who have chemotherapy find hair loss one of the most distressing side effects. Your hair stylist may be able to re-style your hair to cover the loss. You may also want to stock up with a range of hats and caps. If you would like to try a wig or hairpiece, someone at your hospital should be able to advise you.

**Mouth ulcers, diarrhoea and other problems:** Some types of chemotherapy cause problems in the parts of the body that help you digest food (your digestive system). It's worth asking your medical team about how you can relieve these problems.

### Long-term side effects

**Loss of fertility:** Many of the drugs used as chemotherapy in lung cancer can cause problems with fertility. If having children is important to you, it's worth asking your doctor if your eggs or sperm can be collected and stored before you have treatment.

**Risk of a second cancer:** This may be increased following some types of chemotherapy used to treat lung cancer, such as cyclophosphamide. These drugs increase the risk of other types of cancer such as **leukaemia**.

**Damage to the heart:** An anti-cancer drug called doxorubicin can make the heart flabby and less able to pump blood properly. The chance of getting heart failure is less than 1 in 100, as long as the dose of doxorubicin (brand names Caelyx, Myocet) is not more than 300 mg/m<sup>2</sup> to 350 mg/m<sup>2</sup>, where mg stands for milligrams and m<sup>2</sup> stands for metres squared. The number of milligrams per metres squared refers to how much of the drug is given for the size of your body.

### Other ways doctors give radiotherapy

Radiotherapy involves using **x-rays** to attack cancer cells. There are several different ways of giving radiotherapy to people with lung cancer.

- Some hospitals have radiotherapy machines that match the x-rays to the shape of the cancer. This is called **conformal radiotherapy** and it aims to damage the cancer cells more and the healthy cells less.
- Another way to give radiotherapy is to use **hyperfractionation**. This means giving the radiotherapy in lots of small amounts over a shorter period of time. One example

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is **CHART** (continuous, hyperfractionated, accelerated radiotherapy), where you have radiotherapy three times a day over 12 days.

- Internal radiotherapy (also known as **brachytherapy**) is a way of ensuring that radiation is released very close to the cancer. A radioactive pellet is put directly into the cancer or into the airway next to the cancer. Doctors use a special flexible tube with a camera attached. They put this into the lungs through the mouth or nose.

### Side effects of radiotherapy

There are several side effects you may get if you have radiotherapy for lung cancer.

**Inflammation in the lung:** This is the most common serious side effect of radiotherapy. It usually happens one month to four months after treatment, though it occasionally happens during particularly intensive radiotherapy, especially when it's combined with chemotherapy. If you have an inflamed lung you can get:

- Breathing problems
- A cough
- A fever
- Chest pain.

If you have mild inflammation, it will probably go away on its own. If you have more severe inflammation, you may need treatment with drugs called steroids. About 5 percent to 15 percent of people get serious inflammation, and it's most likely if:

- The lower lobe of your lung is treated
- Large areas of your lung are treated
- Large amounts of radiation are given in each dose
- Your radiotherapy is combined with chemotherapy
- You had symptoms such as a cough and breathing problems before treatment started.

**Fatigue:** You may feel tired during a course of radiotherapy. You shouldn't expect to be able to do very much while you are having treatment. You may need to rest during the day, and family or friends may need to help out with shopping, cooking and other everyday tasks.



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Inflammation of the tube that carries food from the mouth to the stomach (oesophagus): This is a common side effect of radiotherapy. It can make eating painful. With standard doses of radiotherapy, the problem is usually easy to treat with painkillers and drugs called [antacids](#) . These drugs make the problems go away within a few weeks. But if this problem happens after a high dose of radiotherapy, or radiotherapy combined with chemotherapy, it can be harder to treat. In these situations, the problems may go on for several months.

Narrowing or tightening of your oesophagus: This can happen if the area gets scarred by high doses of radiation, especially if it's combined with chemotherapy. The narrowing can make it difficult for food to get down into the stomach. This can result in indigestion and [heartburn](#) . It can be treated by using a special tube to stretch the oesophagus.

Scarring of lung tissue: You're likely to have this problem if you have high doses of radiation. It usually happens several months after treatment. You may find breathing difficult, although this isn't usually a severe problem. The scarring won't go away, but there are treatments that can help your breathing. Your doctors will need to make sure that any breathing problems are caused by scarring, not the cancer coming back.

Inflammation of the layer of tissue around your heart: This may start several months or years after radiotherapy. It can cause your heartbeat to become irregular. Mostly it goes away on its own, but you may need painkillers, drugs to reduce any fever and, occasionally, a drug to control your heartbeat.

### Side effects of chemotherapy for advanced non-small-cell lung cancer

Here's a summary of the side effects of many of the chemotherapy drugs used for advanced non-small-cell lung cancer. <sup>[57]</sup> <sup>[58]</sup> <sup>[64]</sup> <sup>[68]</sup> <sup>[69]</sup> <sup>[70]</sup> <sup>[71]</sup> <sup>[72]</sup> <sup>[73]</sup> <sup>[74]</sup> <sup>[75]</sup> <sup>[76]</sup>

#### Bevacizumab

Bevacizumab can cause a hole in your bowel (bowel perforation). <sup>[77]</sup> This is serious, and people who have this problem need emergency surgery. Studies have looked at people with bowel cancer or breast cancer who had treatment with this drug. In these studies between 1 in 100 and 2 in 100 people who took bevacizumab got a hole in their bowel. There's also a risk of serious bleeding in your lungs if you take this drug. This can be dangerous. In studies, about 2 in 100 people who took bevacizumab had serious bleeding. <sup>[77]</sup>

Bevacizumab may increase your risk of getting a blood clot inside a vein. <sup>[78]</sup> Combined results from several studies found that around 6 in 100 people taking bevacizumab got a blood clot that needed treatment. This compared with 4 in 100 people who weren't taking bevacizumab. To read more about blood clots, see [Deep vein thrombosis](#) .

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More common side effects of taking bevacizumab are high blood pressure, headaches, nosebleeds, and dry skin. <sup>[77]</sup>

### **Carboplatin**

You might get fewer side effects with carboplatin than with cisplatin. One study found that about 1 in 3 people who were being treated with cisplatin stopped treatment because the side effects were so bad. Only 1 in 6 people stopped taking carboplatin because of side effects.

### **Cisplatin**

You're more likely to get a low white blood cell count, nausea, vomiting, and diarrhoea than if you're treated with one of the newer chemotherapy drugs (such as docetaxel or gemcitabine). About a third of people stop taking cisplatin because the side effects are so bad.

### **Docetaxel (Taxotere)**

In studies, nearly a third of people had serious side effects, such as infections, diarrhoea, and fever. About a fifth stopped treatment, mainly because of nerve damage and allergic reactions.

### **Gemcitabine (Gemzar)**

Side effects tend to be milder and less common than with platinum drugs (such as cisplatin). Only a few people (about 3 in 100) lose their hair when they take gemcitabine. Nausea and vomiting affect about half the people who take gemcitabine. Nearly everyone who takes a platinum drug gets these side effects.

### **Paclitaxel (Taxol)**

Three-quarters of people taking this drug had hair loss. A quarter had joint and muscle pains. About 1 in 10 got infections, and about 14 percent felt weak. More than half the people needed treatment in hospital, compared with about 40 percent of people who didn't take anti-cancer drugs, although this may have been because they lived longer.

### **Pemetrexed (Alimate)**

Common side effects include nausea, vomiting, fatigue, and a low number of white blood cells (these cells help the body fight infections). Less common side effects include a skin rash, sores in your mouth or elsewhere along your digestive tract (mucositis), and liver problems.

### **Vinorelbine (Navelbine)**

You'll probably get more constipation, nausea, hair loss, and nerve damage than someone who isn't taking anti-cancer drugs. But you'll get fewer side effects than you would taking carboplatin or cisplatin.

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### Docetaxel and gemcitabine

In one study, 1 in 10 people taking docetaxel and gemcitabine together got damage to their lungs.<sup>[79]</sup> So, doctors are likely to be careful about using this combination for people with advanced lung cancer.

### Harmful effects of common chemotherapy drugs for small-cell lung cancer

Etoposide (Vepesid, Etopophos) can:

- Cause nausea, vomiting, mouth ulcers, and hair loss. Nausea and vomiting are less severe than with some other anti-cancer drugs, and can usually be helped by eating frequent, small meals. You may also get some diarrhoea. You can prevent or relieve mouth ulcers by using mouthwashes and soft toothbrushes or cotton swabs. You may lose some or all of your hair, but it will grow back
- Damage the cells in your bone marrow that make red and white blood cells and platelets. As red cells carry oxygen around your body, a fall in their numbers may make you feel tired. A drop in white blood cells may reduce your ability to fight infections, so you may feel feverish and require antibiotics and other drugs to fight infections. You may be given drugs to help boost your immune system, and you should avoid crowds and people with coughs or colds while your immunity is low. A fall in your platelet count may affect your ability to form blood clots, your skin may bruise easily and you may get nosebleeds
- Make you sterile
- Cause birth defects. So you should be sure that you can't get pregnant during your treatment.

Cisplatin can:

- Cause nausea and vomiting. These are common and severe with cisplatin treatment, though they may not start for up to 48 hours after treatment. Be sure to talk to your doctor about drugs you can take to relieve or prevent sickness
- Cause hair loss. This is common, but your hair will grow back
- Damage the cells in your bone marrow that make red and white blood cells and platelets. As red cells carry oxygen around your body, a fall in their numbers may make you feel tired. A drop in white blood cells may reduce your ability to fight infections, so you may feel feverish and require antibiotics and other drugs to fight infections. You may be given drugs to help boost your immune system, and you

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should avoid crowds and people with coughs or colds while your immunity is low. A fall in your platelet count may affect your ability to form blood clots, your skin may bruise easily and you may get nosebleeds

- Damage your kidneys . You'll be advised to drink plenty of fluids to reduce the risk
- Cause birth defects. So be sure that you can't get pregnant during your treatment.

Carboplatin is a platinum drug like cisplatin. It is less likely to cause nausea and vomiting or kidney damage, and more likely to cause damage to your bone marrow.<sup>[134]</sup>

Vincristine (Oncovin) is less harmful to the bone marrow than some other anti-cancer drugs, but it can cause:

- Serious nerve damage, especially at higher doses. This may result in muscle weakness, numbness, and digestive problems such as constipation, mild abdominal pain, and difficulty passing urine.<sup>[135]</sup> Constipation can be relieved with laxatives
- Nausea and vomiting. These can be relieved with drugs.

### Glossary:

#### gland

A gland is any group of cells in the body that makes and releases something for use by another part of the body. For example, the thyroid gland makes a hormone called thyroxine. This acts on receptors within cells. By acting on the receptors it gives the cells a message to speed up their metabolism and work harder.

#### liver

Your liver is on the right side of your body, just below your ribcage. Your liver does several things in your body, including processing and storing nutrients from food, and breaking down chemicals, such as alcohol.

#### adrenal glands

You have two adrenal glands. They are on top of your kidneys. Your adrenal glands make hormones that help control your blood pressure, how fast your heart beats and the way your body uses food.

#### lymphatic system

The lymphatic system is your body's way of clearing unwanted materials from your blood and tissues. It includes a network of lymph nodes that filter these materials to detect if there is an infection that needs to be dealt with by your immune system.

#### lymph nodes

Lymph nodes (also called lymph glands) are small, bean-shaped lumps that you can't usually see or feel easily. You have them in various parts of your body, such as your neck, armpits, and groin. Lymph nodes filter lymph and remove unwanted things from your body, such as bacteria and cancer cells.

#### CT scan

A CT scan is a type of X-ray. It takes several detailed pictures of the inside of your body from different angles. CT stands for computed tomography. It is also called a CAT scan (computed axial tomography).

#### tuberculosis

Tuberculosis (also known as TB) is an infection caused by certain bacteria. The most common type of tuberculosis affects your lungs. This can give cause chest pain, tiredness and a severe cough.

#### asthma

Asthma is a disease of the lungs. It makes you wheeze, cough and feel short of breath. Asthma attacks are caused by inflammation and narrowing of your airways, which makes it hard for air to pass in and out of your lungs.

#### emphysema

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Emphysema is a long-term disease of the lungs. The walls of the air sacs (alveoli) in the lungs become thin and less elastic. This makes it harder for oxygen to get in your blood and carbon dioxide to get out of your body. It makes you cough and feel short of breath. Smoking is the most common cause of emphysema.

## **bronchitis**

Bronchitis is inflammation of one or both of the major airways (called bronchi) that lead in and out of your lungs.

## **chronic obstructive pulmonary disease (COPD)**

Chronic obstructive pulmonary disease (COPD) is an illness that causes coughing and difficulty breathing. Most of the people who get it have smoked for a long time. COPD can include both emphysema, which is the breakdown of air sacs (alveoli) in your lungs, and chronic bronchitis, which is a recurrent, long-lasting cough that brings up phlegm.

## **pneumonia**

Pneumonia is an infection in your lungs. Anything that causes infections (bacteria, viruses or fungi, for example) can give you pneumonia.

## **body temperature**

Your body temperature is a measure of how warm you are. If you have a higher temperature than normal, it can mean that your body has an infection or you have a fever. Women also have a higher temperature at the time of month when their ovaries release an egg (ovulation).

## **veins**

Veins are blood vessels that carry blood back to your heart after your blood has delivered oxygen and food to the tissues.

## **biopsy**

Biopsy is when doctors remove some tissue from a part of your body, so that it can be examined under a microscope.

## **X-ray**

X-rays are pictures taken of the inside of your body. They are made by passing small amounts of radiation through your body and then onto film.

## **clinical trials**

Clinical trials are studies that are done to see if a treatment works. They generally involve comparisons between groups of patients who do receive the treatment and those who do not receive the treatment, to see if those receiving the treatment do better.

## **radiotherapy**

This is also called radiation therapy. It is a treatment that uses high-energy X-rays to kill cancer cells. It's most often used for tumours that are hard to treat with surgery alone. You won't feel any pain during this treatment, but you may get some side effects afterwards.

## **chemotherapy**

The use of chemicals or drugs to treat or prevent disease, usually cancer.

## **white cell count**

The white cell count is an estimate of how many white blood cells are in your blood. As white blood cells are involved in fighting infection, a rising white cell count can be a sign that your body is infected or inflamed.

## **tranquilliser**

A tranquilliser is a drug that can help you relax and feel less anxious.

## **platelets**

Platelets are small disc-shaped particles found in your blood (along with red blood cells and white blood cells). Platelets form the clots that stop the bleeding when you've been cut. People who don't have enough platelets have problems with bleeding too much.

## **anaemia**

Anaemia is when you have too few red blood cells. Anaemia can make you get tired and breathless easily. It can also make you look pale. Anaemia can be caused by a number of different things, including problems with your diet, blood loss and some diseases.

## **leukaemia**

Leukaemia is a type of cancer that affects your body's production of white blood cells. White blood cells are important for fighting infections. So, if you have leukaemia, you are more likely to catch an infectious disease.

## **inflammation**

Inflammation is when your skin or some other part of your body becomes red, swollen, hot, and sore. Inflammation happens because your body is trying to protect you from germs, from something that's in your body and could harm you (like a splinter) or from things that cause allergies (these things are called allergens). Inflammation is one of the ways in which your body heals an infection or an injury.

## **antacids**

Antacids are medicines you can buy over the counter. They counteract the acid in your stomach. Antacids can make you feel better if you have heartburn.

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## **heartburn**

Heartburn is a painful, burning sensation in the chest. It happens, often after meals, when the contents of the stomach pass back up into the oesophagus. The oesophagus is the tube that runs from the mouth to the stomach.

## **remission**

Remission is when the symptoms of an illness get better, or go away completely for a period of time.

## **blood clot**

A blood clot forms when the cells in blood clump together. Sometimes this happens to stop you from bleeding if you've had an injury. But it can also happen on the inside of your blood vessels, even when you haven't had an injury. A blood clot inside a blood vessel is called a thrombus.

## **intravenous infusion**

When a medicine or a fluid, such as blood, is fed directly into a vein, it's called an intravenous infusion (or IV). To give you an intravenous infusion, a nurse, technician or a doctor places a narrow plastic tube into a vein (usually in your arm) using a needle. The needle is then removed and the fluid is infused (or dripped) through the tube into the vein.

## **bone marrow**

Your bone marrow is the soft material inside your bones. Bone marrow makes and stores blood cells.

## **diarrhoea**

Diarrhoea is when you have loose, watery stools and you need to go to the toilet far more often than usual. Doctors say you have diarrhoea if you need to go to the toilet more than three times a day.

## **immune system**

Your immune system is made up of the parts of your body that fight infection. When bacteria or viruses get into your body, it's your immune system that kills them. Antibodies and white blood cells are part of your immune system. They travel in your blood and attack bacteria, viruses and other things that could damage your body.

## **systematic reviews**

A systematic review is a thorough look through published research on a particular topic. Only studies that have been carried out to a high standard are included. A systematic review may or may not include a meta-analysis, which is when the results from individual studies are put together.

## **high blood pressure**

Your blood pressure is considered to be high when it is above the accepted normal range. The usual limit for normal blood pressure is 140/90. If either the first (systolic) number is above 140 or the lower (diastolic) number is above 90, a person is considered to have high blood pressure. Doctors sometimes call high blood pressure 'hypertension'.

## **steroids**

Steroids are a type of chemical. Your body naturally produces steroids, which play a part in many of its processes. For example, steroids are involved in how your immune system, reproductive system and metabolism work. Steroids can also be given as medicines and are used for a number of different conditions: including asthma, rheumatoid arthritis and eczema. Corticosteroids are not the same as the steroids used by some body builders and athletes. Those steroids are called 'anabolic steroids'.

## **randomised controlled trials**

Randomised controlled trials are medical studies designed to test whether a treatment works. Patients are split into groups. One group is given the treatment being tested (for example, an antidepressant drug) while another group (called the comparison or control group) is given an alternative treatment. This could be a different type of drug or a dummy treatment (a placebo). Researchers then compare the effects of the different treatments.

## **Chemotherapy**

Treatment with cytotoxic drugs (see also non-taxane and taxane based combination chemotherapy regimens below).

## **antibiotics**

These medicines are used to help your immune system fight infection. There are a number of different types of antibiotics that work in different ways to get rid of bacteria, parasites, and other infectious agents. Antibiotics do not work against viruses.

## **kidney**

Your kidneys are organs that filter your blood to make urine. You have two kidneys, on either side of your body. They are underneath your ribcage, near your back.

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