

## Patient information from the BMJ Group

# Breast cancer

In this section

[What is it?](#)

[What are the symptoms?](#)

[How is it diagnosed?](#)

[How common is it?](#)

[What treatments work?](#)

[What will happen?](#)

[Questions to ask](#)

## Breast cancer

Many women who get breast cancer say it changes their life. Most women cope better with their illness and have a better quality of life if they learn about their breast cancer and are involved in making decisions about their treatment.

We've brought together the best research about breast 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 breast cancer?

It can be devastating to be told that you have breast cancer. The condition is so common that you may already know at least one woman who has it. But you can still feel frightened and alone when you're the one who has been diagnosed with breast cancer.



Breast cancer is so common that you may already know at least one woman who has it.

## Breast cancer

Getting breast cancer will undoubtedly change your life. We know from women with breast cancer that, although you'll feel shocked, you'll probably want to learn about your condition. Many women with breast cancer also say that, once the shock fades, they often appreciate life more and feel more positive and optimistic.

### Key points for women with breast cancer

- More women live with breast cancer than die from it.
- Breast cancer is the most common cancer among women in the UK.
- Each generation of women has a better chance of surviving breast cancer than their mothers' generation.
- Different women will have different treatments, depending on what type of breast cancer they have and how they feel about the treatments.
- Early breast cancer can usually be cured.
- There are two main types of treatments for breast cancer: treatments that just affect your breast, such as surgery and radiotherapy, and whole-body treatments, such as chemotherapy and hormone treatment.
- Breast-conserving surgery (which removes only some of your breast) often works just as well as a mastectomy (which removes all of your breast).

Men can also get breast cancer, although this isn't common. Our information focuses on breast cancer in women.

### Your breasts



The parts of a healthy breast

To understand how breast cancer starts and how it is treated, it helps to know about your breasts.

In women, the breast is designed to make milk for babies. Milk is made in parts of your breast called **lobules**. Milk drains into the nipple through thin tubes, called **ducts**.

## Breast cancer

- The space between the lobules and milk ducts is filled with supporting tissue (called **connective tissue**).
- A layer of fat surrounds the connective tissue and lies between the milk-producing parts of the breast and the skin.
- This layer of fat contains **blood vessels** (which carry oxygen and food to the cells of the breast) and **lymph vessels** (which carry a fluid, known as lymph, back into the bloodstream). To read more, see [What are lymph vessels?](#)
- The part of the breast that is most likely to get a disease is the part that includes the lobule and the last drain duct (known as the **terminal duct lobular unit**).

### What happens in breast cancer?

Breast cancer starts in the cells lining the ends of the milk-producing glands (the lobules) and in the thin tubes that carry milk to the nipple (the ducts).

Normally, cells grow, divide, die and get replaced in an orderly way. For example, when cells are damaged, as they are by everyday wear and tear, they get replaced. In cancer, however, the cells grow in a disorderly way. Cells grow on top of each other and don't stop growing when they touch other cells.

Cancer cells also look different from normal cells. This is because they grow faster and start dividing before they look like their **parent** cells. Often they look like immature versions of their parent cells. This chaotic growth is the start of cancer, and, as it continues, the cancer spreads to nearby tissues.

If these cells enter the blood vessels or lymph vessels, they can travel to other parts of the body and start growing there. When a cancer spreads, this is called **metastasis**.

### Types of breast cancer

Doctors give breast cancers different names depending on how far they have spread. If the cancer cells are contained within the ducts of the breast, this is called **ductal carcinoma in situ** (DCIS), or **non-invasive breast cancer**. If the cancer cells have spread into the surrounding tissue, this is called **invasive breast cancer**.

There are different types of invasive breast cancer.

- The most common type is **early breast cancer**, which means the cancer is still fairly small and hasn't spread beyond the breast or nearby **lymph nodes**.
- If the cancer is bigger than 5 centimetres across or has spread to the skin, to the front of the chest, or to both the skin and chest, this is **locally advanced breast cancer**. The lymph nodes under the armpit might also have become matted together by the cancer.

## Breast cancer

- If the cancer has spread to another area in the body (such as the lungs or liver), this is **advanced (metastatic) cancer**. A cancer can also be advanced if it hasn't spread but has grown directly into tissues close to the breast and cannot be removed through surgery.

To learn more, see [Types of breast cancer](#) .



A mammogram

To work out what type of breast cancer you have, your doctor will need to know how advanced it is. Doctors call this **staging**.

Your doctor may also look at how much your cancer cells resemble normal breast cells when viewed under a microscope. Doctors call this **grading**.

Knowing the stage and grade of your cancer will help your doctor decide which treatments are best for you. To learn more, see [Staging and grading breast cancer](#) .

### Breast cancer: why me?

The first question many women ask is, "Why me?" There really is no answer to this question unless you are one of the very few women who get breast cancer because of inherited **genes** . (To learn more, see [Breast cancer in your family](#) .) All we can say is that your breast cancer is not your fault.

For most women, no cause for the cancer can be found. Doctors can tell you about risk factors rather than causes. Risk factors are things that increase your chance of getting a condition. The biggest risk factor for breast cancer is being older.

## Breast cancer

Some of the risk factors for breast cancer are listed below. When you read this list, please remember that just because you have one or more of these risk factors, it doesn't mean you will definitely get breast cancer.



Your age when you have your first baby can affect your risk of breast cancer.

### Risk factors you can't change

- **Being older:** This is the strongest risk factor. The older a woman is, the more likely she is to get breast cancer. The risk is very low when women are in their 20s, and then gradually increases. About 80 in 100 women diagnosed with breast cancer are older than 50.<sup>[1]</sup> To get an idea of your chance of getting cancer in the next 10 years, see [How common is breast cancer?](#)
- **Starting periods early (before age 11) or going through the menopause late (after age 54):** Either of these things increases your risk of breast cancer, perhaps because some breast cancers are encouraged to grow by **hormones**. If you start your periods early or go through the menopause late, then more of the female hormone **oestrogen** will be in your body for longer.<sup>[2] [3] [4]</sup>
- **Having certain genes:** Most breast cancers happen by chance. However, some women get breast cancer because they have inherited genes that make this more likely. Two of the most important genes are BRCA1 and BRCA2, which are estimated to cause between 3 in 100 and 7 in 100 breast cancers.<sup>[5]</sup> Studies show that women with a faulty BRCA1 gene have a 65 in 100 chance of getting breast cancer by age 70. Those with a faulty BRCA2 gene have a 45 in 100 chance.<sup>[6]</sup> Another study estimated that about 10 in 100 breast cancers in Western countries like the UK are due to inherited genes.<sup>[2]</sup>
- **Having breast cancer in your family:** Your risk of getting breast cancer may be higher if you have one or more close relatives with the disease, particularly if they got the disease before the age of 50. In one large review of studies, researchers estimated that around 8 in 100 women get breast cancer if they have no close

## Breast cancer

relatives with the disease. This compares with 13 in 100 women who have one close relative with breast cancer, and 21 in 100 women who have two close relatives with this cancer.<sup>[7]</sup> Your risk is also higher if you have relatives with both breast and ovarian cancer. To read more, see [Breast cancer in your family](#).

- **Having had breast cancer before:** If you've had cancer in one breast, you have an increased risk of getting a new cancer in the other breast or in another part of the same breast. However, you'll have regular checks to make sure that any new cancer is picked up early.
- **Having had radiotherapy:** Your risk of getting breast cancer is increased if you had radiotherapy to your chest as a child or young adult. Radiotherapy is often used to treat other cancers, such as Hodgkin's disease, non-Hodgkin's lymphoma, and leukaemia.<sup>[8]</sup> <sup>[9]</sup>

### Other risk factors

You may be able to influence some of these factors.

- **Being older when your first child is born:** This increases a woman's chance of getting breast cancer, although the reasons why aren't clear. Women who never have children also have an increased risk.<sup>[4]</sup> <sup>[10]</sup> <sup>[11]</sup>
- **Not breastfeeding, or not breastfeeding for very long:** Breastfeeding reduces the risk of breast cancer. And the longer you breastfeed, the greater the protection.<sup>[12]</sup> <sup>[13]</sup> <sup>[14]</sup> One study estimated that around 3 in 100 breast cancers in the UK would be prevented if women breastfed every child for six months or longer.<sup>[15]</sup>
- **Taking hormone replacement therapy (HRT):** Some women take HRT to help with the symptoms of the menopause. This increases their risk of breast cancer while they are taking it, and for up to five years after they stop.<sup>[16]</sup> <sup>[17]</sup> The risk is higher for women who are taking combined HRT (oestrogen and progestogen) than for those who are taking oestrogen alone. To read more, see our information on [HRT](#) in our section on the menopause.
- **Taking the pill:** Some studies have found that a woman's risk of getting breast cancer increases by a small amount while she is taking the pill.<sup>[18]</sup> But once she stops taking it, this extra risk goes away over the next 10 years. However, other studies have found that taking the pill doesn't seem to increase the risk of breast cancer.<sup>[19]</sup>
- **Being overweight or obese:** Being overweight or obese can slightly increase a woman's risk of getting breast cancer, once she is over the menopause.<sup>[20]</sup> This could be because fat helps the body make oestrogen, and oestrogen encourages

## Breast cancer

some breast cancers to grow. A way to find out whether you are overweight or obese is to work out your **body mass index** (BMI). This measurement looks at your weight in relation to your height. A BMI of 25 to 29.9 means you're overweight, and a BMI of 30 or more means you're obese. You can use our [calculator](#) to work out your BMI.

- **Eating a high-fat diet:** Eating a lot of high-fat foods seems to increase a woman's risk of breast cancer, particularly if she eats a lot of saturated fat.<sup>[21]</sup> In a study of nearly 320,000 European women, those who ate the most saturated fat were 13 percent more likely to develop breast cancer than those who ate the least. Saturated fat is found in foods such as red meat, butter, and cream.
- **Drinking alcohol:** Drinking alcohol can increase your risk of breast cancer.<sup>[22]</sup> The more a woman drinks on a regular basis, the greater her risk. One review of 53 studies found that women who had three or four drinks a day increased their risk of breast cancer by about a third, and women who drank around four or more drinks a day increased their risk by almost half.<sup>[23]</sup> Another study estimated that around 6 in 100 breast cancers in the UK in 2010 were linked to alcohol.<sup>[24]</sup>
- **Being inactive:** Doing little or no physical activity is linked to a raised risk of breast cancer. A review of 73 studies found that, overall, the least active women had a 25 percent higher risk of breast cancer, compared with the most active women.<sup>[25]</sup> A UK study estimated that, in 2010, more than 3 in 100 breast cancers among women after the menopause were linked to too little exercise (less than 150 minutes of moderate activity per week).<sup>[26]</sup>

## Staging and grading breast cancer

If you have breast cancer, your doctor will need to know how advanced it is (see [Types of breast cancer](#)). To do this, your doctor will work out the **stage** of your cancer and possibly the **grade** of your cancer. Knowing your stage and grade will help you and your doctor decide which treatments are best for you.

### Staging your cancer

#### TNM (tumour, node, metastasis)

When your breast cancer is staged, it is classified according to three things.

- How big your breast cancer (tumour) is, and whether it has spread from the breast tissue into the nearby skin or chest wall.
- Whether your breast cancer has spread to your **lymph nodes**, and if so, how many and which ones (lymph nodes are small collections of cells that are part of your **immune system**).

## Breast cancer

- Whether your breast cancer has spread to other parts of your body.

These three things are used together and called the **TNM classification**.<sup>[28]</sup>

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

Each factor is given a number.

- For T, the number tells you how big the tumour is.
- For N, the number shows which lymph nodes have cancer cells in them.
- For M, the number tells you whether your breast cancer has spread outside your breast and the nearest lymph nodes to other parts of your body.

Generally, lower numbers mean your cancer is less serious. For example, if your cancer was classified as T1N0M0, this would show that you had a small tumour that had not spread to the lymph nodes nearest to it or to other parts of your body.

Here's what the different classifications mean.

TNM		What it means
T (tumour)	Tis	Your breast cancer hasn't spread beyond the lining of the ducts. It's called carcinoma in situ.
	T1	Your breast cancer is 2 centimetres (0.8 inches) or less across.
	T2	Your breast cancer is more than 2 centimetres (0.8 inches) across but no bigger than 5 centimetres (2 inches) across.
	T3	Your breast cancer is bigger than 5 centimetres (2 inches) across.
	T4	Your tumour extends from the breast into the chest wall and/or the skin, and/or is inflammatory. (Inflammatory cancer is a rare, invasive cancer that can block the lymph vessels in the skin over the breast.)
N (nodes)	N0	Your breast cancer hasn't spread to the nearest (local) lymph nodes.
	N1mi	Your breast cancer has spread to one to three of the nearest lymph nodes,



## Breast cancer

		but these nodes have only very small areas of cancer, called micrometastases.
	N1	Your breast cancer has spread to the lymph nodes on the same side of your body as your breast cancer, and these can be moved around (they aren't matted together by the cancer).
	N2	Your breast cancer has spread to the lymph nodes on the same side of your body as your breast cancer, and these can't be moved around (they are matted together).
	N3	Your breast cancer has spread to lymph nodes towards the middle of your chest (the internal mammary nodes) on the same side as your breast cancer.
M (metastasis)	M0	Your breast cancer hasn't spread to another part of your body.
	M1	Your breast cancer has spread to another part of your body. (This may mean it has spread to lymph nodes above the collarbone on the same side of your body as your breast cancer.)

### Stages of breast cancer

Once your doctor has your TNM classification, he or she uses it to work out your cancer **stage**. Doctors divide cancer into five main stages. They use a system called the International Union Against Cancer staging system. <sup>[28]</sup> This helps them decide if your cancer is an early, locally advanced, or advanced cancer. (see [Types of breast cancer](#)).

#### Stage 0

This is the **earliest stage** of breast cancer. It is called a **non-invasive cancer**. Most stage 0 cancers are a type called **ductal carcinoma in situ (DCIS)**. Cancer cells have formed within the ducts of the breast, but they have not spread into (invaded) the surrounding tissue or lymph nodes. <sup>[29]</sup>

#### Stage 1

This is an **invasive cancer**. Stage 1 breast cancer has spread from where it started into the surrounding breast tissue. The tumour is small (2 centimetres or less across) and the cancer has not spread to the lymph nodes, or only small amounts of cancer cells are in the lymph nodes. <sup>[30]</sup>

Stage 1 cancers are **early breast cancers**.

#### Stage 2

## Breast cancer

This is an **invasive cancer**. Stage 2 breast cancers can be divided into three main categories:

- The tumour measures less than 2 centimetres across and has spread to lymph nodes under the armpit.
- The tumour is between 2 centimetres and 5 centimetres across and may or may not have spread to the lymph nodes under the armpit.
- The tumour is larger than 5 centimetres across but has not spread to any lymph nodes.

Many stage 2 cancers are **early breast cancers**. However, if the tumour is large, they can be **locally advanced breast cancers**.

### Stage 3

This is an **invasive cancer** that has spread further than stage 2 but still hasn't spread to other parts of the body. Some stage 3 breast cancers are larger than 5 centimetres across and have cancer cells in the nearby lymph nodes. They can also be any size if: [\[30\]](#)

- The cancer has spread to many lymph nodes in the armpit or matted together the lymph nodes under the armpit, or
- The cancer has spread into the chest wall or the skin, or
- The cancer has spread to lymph nodes above or below the collarbone or near the breastbone.

Most stage 3 cancers are **locally advanced breast cancers**. But they can also sometimes be **early breast cancers** or **advanced breast cancers**.

### Stage 4

This is any **invasive cancer** that has spread beyond the breast, lymph nodes, or nearby areas to other parts of the body. [\[30\]](#) The parts of the body most likely to be affected are the bones, lungs, liver, more distant lymph nodes, and brain. [\[31\]](#)

Stage 4 cancers are **advanced breast cancers**. You may also hear them called **metastatic** or **secondary breast cancers**.

### More about stages

Doctors also divide some of these stages further. For example, stage 2 is divided into 2A and 2B. If you'd like to read more about how doctors stage cancer using the TNM

## Breast cancer

system and International Union Against Cancer staging system, see [Cancer staging table](#) .

### Grading your cancer

Your doctor may also tell you about the **grade** of your cancer. The grade describes how much the cancer cells look like normal breast cells when viewed under a microscope.

Doctors usually grade cancers as **low grade**, **intermediate grade**, or **high grade**. Low-grade cancer cells look similar to normal breast cells. High-grade cancer cells look very different to normal cells. Higher-grade cancers tend to grow more rapidly and spread faster than lower-grade cancers. Cancer grade can also be described as a number between 1 and 3. A lower number means a lower grade. <sup>[31]</sup>

### What are the symptoms of breast cancer?

Many women learn that they have breast cancer before they get any symptoms. They usually find out after they have a mammogram. (A mammogram is an X-ray of the breast.) Mammograms can reveal lumps that are too small to feel. All women aged 50 to 70 in the UK are invited for a mammogram every three years. <sup>[39]</sup> Women outside these ages aren't invited for routine mammograms, but can ask their GP for screening if they think they need it (for example, if close family members have been diagnosed with breast cancer).

If you have breast cancer you may notice:

- A lump or thickening in your breast
- A change in how your breast feels or looks. For example, it may feel heavy, warm or uneven, or the skin may look pitted or dimpled. The size and shape of the breast may change.
- Changes in your nipple. For example, the nipple might be pulled back into the breast (known as an inverted nipple)
- Discharge from your nipple, such as blood or other fluid
- A rash that makes your nipple red and scaly. It may just be **eczema** , but it could be a sign of a rare type of cancer known as [Paget's disease of the breast](#) .
- A swelling or lump in the armpit.



# Breast cancer

Dimples in the skin (left) and changes in the shape of the breast (right) are symptoms of breast cancer.

## How do doctors diagnose breast cancer?

If you're worried about a lump or change in your breast, you should see your doctor.

He or she will probably ask you how long you've had your symptoms and ask other questions about your health. He or she may also ask whether any of your relatives have had breast cancer or [ovarian cancer](#) .

Your doctor will examine your breasts and feel under your arms and at the base of your neck for lumps or any [lymph nodes](#) that seem larger than normal. Your doctor will look for:

- Lumps in your breast
- Painful lumps
- Changes in your nipple
- Changes in the skin of your breast
- Discharge from your nipple.

If your doctor is concerned that there is a chance you could have breast cancer, he or she will refer you to see a specialist in your local breast cancer team. The team is made up of doctors and nurses with experience in looking after women and men with breast cancer. They may be based at a cancer unit or your local hospital.

You should be able to see a specialist within two weeks of your doctor asking for an appointment if : <sup>[41]</sup>

- You have a distinct, hard lump that doesn't move. Your skin may or may not be dimpled
- You are over 30 and have a distinct lump that is still present after your next period, or appears after the [menopause](#)
- You are under 30 and have a lump that is getting bigger or has other features that suggest it may be cancer. For example, the lump is fixed and hard or you have a history of breast cancer in your family
- You have had breast cancer before and have a new lump or other symptoms that suggest you might have cancer
- You have [eczema](#) on one breast or changes in your nipple that don't go away with treatment

## Breast cancer

- Your nipple has recently changed shape
- You have a bloody discharge from one nipple
- You're a man aged 50 or older with a firm lump in one breast. You may or may not have changes in your nipple or the skin of your breast.

Some women will be referred to the breast clinic for a non-urgent appointment.<sup>[41]</sup> This means you'll wait more than two weeks to see a specialist. But the time will vary depending on where you live and how busy your hospital is. You should also get this type of referral if:<sup>[41]</sup>

- You are under 30 and your GP is fairly sure that your lump is not cancer
- You've been treated for breast pain, but the treatment hasn't helped
- You've had breast symptoms for a while and your doctor is unsure what's causing them.

### Tests

When you see a member of your local breast cancer team, you'll probably be given what's called **triple assessment**.

Firstly, your doctor will **examine your breasts** to see if there's anything unusual.

Secondly, your doctor will **take images of your breast**. There are several tests that take pictures of the breast. The most common types are a mammogram, ultrasound and MRI (magnetic resonance imaging).

A mammogram is an **X-ray** of the breast. To get a good picture of your breast, the person doing the mammogram will place your breast on the bottom plate of the mammogram machine. A clear plastic plate will then be lowered onto your breast to flatten it slightly.

- Having a mammogram can be uncomfortable because your breast is squeezed between the two plates. Some women say it really hurts.
- But the test takes just a few minutes and any pain should pass quickly.
- It's useful for spotting changes in the breast that might be difficult to feel.
- A mammogram is a good test for breast cancer but, like all tests, it can give the wrong result. It's more common to miss cancer in younger women. This is because young women's breasts may be firmer with more dense tissue in them, which makes mammograms hard to read.

## Breast cancer

- There's also a small chance that you'll be told you may have breast cancer when you don't. <sup>[42]</sup> <sup>[43]</sup>

If your doctor finds a lump during the examination or mammogram, you may have an **ultrasound**.

- This uses sound waves to get a picture of the breast.
- It tends to be used for younger women who may not get a clear picture on a mammogram. If you're under 35, you may have an ultrasound.

Thirdly, your doctor will **take some breast tissue**.

- Your doctor may use a fine needle and syringe to collect some cells from your breast. This test is called **fine needle aspiration**.
- Or you may have a **core needle biopsy**. In this test the doctor uses a bigger needle to collect a small sample of tissue (a biopsy) from your breast. You'll be given a drug to numb the area (a **local anaesthetic**), so you shouldn't feel any pain. In the UK, core needle biopsies are now more common than fine needle aspirations. Both tests work, but it's easier for your doctor to get enough cells to test with a core needle biopsy. This means that you're less likely to need a second test to collect more cells. <sup>[44]</sup>
- In both tests, the doctor may guide the needle by feeling the lump in your breast. If it's not easy to feel a lump, the doctor might use ultrasound or mammogram to guide the needle to the right place. <sup>[42]</sup>
- The samples collected from these tests are sent to a laboratory where they are examined for signs of cancer.

Occasionally, after a triple assessment doctors still can't say for certain if a woman has breast cancer. <sup>[44]</sup> For example, the core needle biopsy may not have taken enough tissue to give a clear result. If this happens, you may need to have an **open biopsy**. This involves having an operation to remove one or more tissue samples through a small cut in the breast.

### Getting your results

You'll normally get your test results within the week, and within three days if possible. <sup>[44]</sup> However long you have to wait, this will be an anxious time. If you want someone to talk to, your doctor may be able to put you in touch with a counsellor or someone who has been through a similar experience.

## Breast cancer

When you get your results, you'll be told whether you have breast cancer or not. You may feel very anxious about getting your results. If you're told you have breast cancer you may feel devastated. But the treatment of breast cancer has improved dramatically in the last 10 years. This means that more women of all ages are now surviving breast cancer.

If you have breast cancer, your doctor may want to carry out some more tests to see how far your cancer has spread. You'll probably have blood tests and an X-ray.

After these tests, your doctor or nurse may be able to tell you what type of breast cancer you have and how advanced it is. To read more, see [Types of breast cancer](#) and [Staging and grading breast cancer](#) .

Your biopsy may show whether your cancer is more sensitive to oestrogen than other cancers (that is, whether it is **oestrogen-receptor positive** ). This means that oestrogen encourages your cancer grow. It's important to know if your cancer is oestrogen-receptor positive because you may be able to take a drug (such as tamoxifen) to block oestrogen and stop the cancer spreading.

But you may have to wait until you have surgery to find these things out. To read more, see [More about surgery for breast cancer](#) .

### How common is breast cancer?

Breast cancer is the most common cancer in women.

Here's what we know about the rates of breast cancer. <sup>[40]</sup>

- In 2010, more than 49,500 women in the UK were diagnosed with breast cancer. <sup>[40]</sup>
- The number of women diagnosed with very early breast cancer (carcinoma in situ) has increased over recent years because more women are having **mammograms** . <sup>[40]</sup> This kind of breast cancer is the easiest to treat.
- The risk of breast cancer is highest for older women. For example, for women under 30 the risk of getting breast cancer is 1 in 2,000. For women under the age of 70, the risk is 1 in 13.
- About 8 in 10 cases of breast cancer happen in women older than 50.
- More women are getting breast cancer now than before, especially those who are older. We don't know why.
- But more women of all ages and backgrounds are surviving the disease than ever before. In the 1970s, around 5 in 10 women with breast cancer survived beyond five years. Now more than 8 out of 10 survive. This may be because screening means women are being diagnosed with breast cancer earlier. Better treatments also may be helping.

## Breast cancer

Men can also get breast cancer. In the UK, about 300 to 400 men are diagnosed with the disease each year and around 70 to 80 die each year. <sup>[40]</sup>

### Do 1 in 8 women get breast cancer?

It's a commonly quoted statistic that 1 in 8 women will get breast cancer during their lifetime. But it doesn't mean that every woman has a 1 in 8 chance of getting breast cancer. Your risk is unique. It depends on lots of things.

A more useful way to think about the general risk of getting breast cancer may be by age. The table below can give you some idea of your chance of getting breast cancer over certain periods of your life. <sup>[40]</sup>

Age	Risk of breast cancer
By age 40	1 in 215
By age 50	1 in 50
By age 60	1 in 22
By age 70	1 in 13
Lifetime risk	1 in 8

### What treatments work for breast cancer?

Doctors use different treatments for women with different types of breast cancer. Here we talk about treatments for breast cancer that has not spread beyond the breast and the nearby lymph nodes (called non-metastatic breast cancer).



Your doctor will tailor your treatment to your disease.



## Breast cancer

The treatments that you will be offered depend on:

- The size of the cancer
- Where the cancer is in your breast
- What type of breast cancer you have
- Whether it has spread to other areas and, if so, where it has spread
- Your general health.

### Key points about treating breast cancer

- There are two main types of treatments. **Local treatments** treat your breast and the nearby lymph nodes. **Systemic treatments** treat your whole body.
- Local treatments are **surgery** and **radiotherapy**.
- Systemic treatments are **chemotherapy** (anti-cancer drugs) and **hormone therapy**. These reduce the chance that cancer will come back in the same place or anywhere else in your body.
- Your treatment should start within four weeks of your breast cancer being diagnosed.

The National Institute for Health and Care Excellence (NICE), which advises the government on health care, has published some guidelines on how women with breast cancer should be treated (to read more, see <http://www.nice.org.uk/Guidance/CG80> ).  
[36]

### Treatments for breast cancer

Which treatments work best? We've carefully weighed the research and looked at the treatments for ductal carcinoma in situ, early breast cancer and locally advanced breast cancer.

- [Treatments for ductal carcinoma in situ](#) : This is breast cancer that hasn't spread from the milk ducts in your breast. Treatments include surgery, radiotherapy and tamoxifen. [More...](#)
- [Treatments for early breast cancer](#) : This is cancer that has spread into your breast tissue from your milk ducts and possibly to your lymph nodes. Treatments include surgery, radiotherapy, chemotherapy, ovarian ablation (which involves removing your ovaries or stopping them making oestrogen) and hormone treatments (tamoxifen and aromatase inhibitors). [More...](#)

## Breast cancer

- [Treatments for locally advanced breast cancer](#) : This breast cancer is bigger than 5 centimetres (around 2 inches), or has spread to your skin or to the front of your chest, or to both your skin and chest. The **lymph nodes** under your armpit might also have become matted together by the cancer. Treatments include surgery, chemotherapy, radiotherapy, and hormone treatments (tamoxifen). [More...](#)

To read about the different kinds of breast cancer, see [Types of breast cancer](#) .

For help in deciding which treatment is best for you, see [How to use research to support your treatment decisions](#).

### Treatment Group 1

#### Treatments for ductal carcinoma in situ

Ductal carcinoma in situ (DCIS) is breast cancer that hasn't spread outside the milk ducts of your breast. To learn more, see [Types of breast cancer](#) .

#### Key points about treating ductal carcinoma in situ

- You'll have **surgery** to remove the cancer cells from your breast.
- You'll probably have a **lumpectomy**, which involves removing the cancer cells and some surrounding tissue (also called breast-conserving surgery).
- You may need **radiotherapy** after surgery if the cancer cells are aggressive or fast growing. (Your surgeon will send some cells to the laboratory to find out what they are like.) Radiotherapy reduces the chance that your cancer will come back.
- If your cancer cells are sensitive to a **hormone** called **oestrogen** (they are **oestrogen-receptor positive** ), taking **tamoxifen** may reduce the chance that your cancer will come back.

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

#### Treatments for ductal carcinoma in situ

##### Treatments that work

- [Surgery plus radiotherapy](#) : After your tumour is removed by surgery, you may have radiotherapy to your breast (and possibly to the nearby lymph nodes). Radiotherapy helps make sure that the cancer cells have been killed. [More...](#)

##### Treatments that need further study

- [Surgery plus radiotherapy and tamoxifen](#) : After surgery and radiotherapy, you may be treated with tamoxifen. Tamoxifen is a drug that blocks the action of the female

## Breast cancer

hormone oestrogen in the body. This can help prevent breast cancer coming back.  
[More...](#)

### Treatment Group 2

#### Treatments for early breast cancer

Early breast cancer is cancer that has spread to the breast tissues and possibly to the lymph nodes, and it can be operated on. This is also sometimes called **primary operable breast cancer**. To learn more, see [Types of breast cancer](#).

#### Key points about treating early breast cancer

- Most women with early breast cancer can have **breast-conserving surgery** (a lumpectomy) in which the tumour and some surrounding tissue are removed. This works just as well as having the whole breast removed (a mastectomy).
- But if you have more than one lump, if your tumour is large or large compared with the size of your breast, or if you've had radiotherapy before, you may need to have the whole breast removed (a mastectomy).
- If your tumour is large, having **chemotherapy before surgery** can help to shrink it and make surgery easier.
- Having **radiotherapy and chemotherapy after surgery** can reduce the chance of your cancer coming back.
- If your cancer cells are sensitive to **oestrogen** (they are what's called **oestrogen-receptor positive**), having treatment that stops your body making or responding to oestrogen can reduce the chance of your cancer coming back. You might be **treated with drugs** (tamoxifen, aromatase inhibitors) or have **ovarian ablation**, which involves using radiation or drugs to stop your ovaries make estrogen or having your ovaries removed.
- Trastuzumab (Herceptin) can reduce the chances of your cancer coming back if it's the type of breast cancer that makes a protein called HER-2. About 1 in 5 women with breast cancer have this type.

If you need to have your breast removed (a mastectomy), your doctor should discuss surgery to reconstruct your breast. You may be able to have the reconstruction done at the same time as the operation to remove the breast.<sup>[36]</sup> For more information, see [Breast reconstruction](#).

Which treatments work best for early breast cancer? We've looked at the best research and given a rating for each treatment according to how well it works.

### Treatments for early breast cancer

#### Treatments that work

- [Surgery](#) : In breast-conserving surgery, the cancer is removed along with some of the surrounding healthy tissue. A mastectomy removes the whole breast. [More...](#)
- [Breast-conserving surgery plus radiotherapy](#) : The cancer is removed along with some of the surrounding healthy tissue. You then have radiotherapy to your breast to destroy any cancer cells that are left behind. [More...](#)
- [A mastectomy plus radiotherapy](#) : After an operation to remove the breast, radiotherapy is sometimes used for women whose cancer is likely to come back. [More...](#)
- [Chemotherapy after surgery](#) : Anti-cancer drugs help to kill any cancer cells that remain after surgery. [More...](#)
- [Tamoxifen](#) : The drug tamoxifen is sometimes used after surgery for breast cancer. [More...](#)
- [Ovarian ablation](#) : This treatment stops the ovaries producing oestrogen in women who have not yet gone through the menopause . This can be done with drugs, radiation or by removing the ovaries with surgery. [More...](#)
- [Aromatase inhibitors](#) : These are a newer type of drug that stop the body making oestrogen, a hormone that can encourage some breast cancers to grow. Aromatase inhibitors include anastrozole (brand name Arimidex), exemestane (brand name Aromasin) and letrozole (brand name Femara). [More...](#)
- [Trastuzumab \(Herceptin\)](#) : This is a drug used with chemotherapy or by itself to stop some cancers growing. It works only on tumours that make a protein called HER-2. About 1 in 5 women with breast cancer have this type of tumour. [More...](#)

#### Treatments that are likely to work

- [Chemotherapy to shrink the tumour before surgery](#) : Having chemotherapy to make your tumour smaller before you have surgery may reduce the chances that you'll need to have your whole breast removed. [More...](#)
- [Radiotherapy to the lymph nodes in the armpit](#) : After surgery for breast cancer, radiotherapy can be used to treat the lymph nodes in the armpit. [More...](#)
- [Sentinel node biopsy](#) : This is a treatment that uses an injection of a blue dye, a radioactive material or both to find the closest lymph nodes that drain fluid from the

## Breast cancer

breast. These lymph nodes are tested. If no cancer is found, the other lymph nodes are likely to be free from cancer too. [More...](#)

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

- [Removing all the lymph nodes in the armpit](#) : This is surgery to remove all the lymph nodes from the armpit during breast surgery. [More...](#)

### Treatments that need further study

- [Radiotherapy to the lymph nodes under the breastbone](#) : After surgery for breast cancer, radiotherapy is sometimes used to treat the lymph nodes that run under the breastbone. [More...](#)
- [Radiotherapy to the lymph nodes above the collarbone](#) : After surgery for breast cancer, radiotherapy is sometimes used to treat the lymph nodes above the collarbone on the same side of the chest as the breast cancer. [More...](#)

### Treatments that are likely to be ineffective or harmful

- [High doses of chemotherapy plus a stem cell or bone marrow transplant](#) : This treatment uses high doses of anti-cancer drugs to kill cancer cells. Then a transplant of cells from the bone marrow or blood helps to make new blood. [More...](#)

## Treatment Group 3

### Treatments for locally advanced breast cancer

Locally advanced breast cancer is bigger than 5 centimetres (around 2 inches), or has spread to your skin or to the front of your chest, or to both your skin and chest. The lymph nodes under your armpit might also have become matted together by the cancer. But the cancer has not spread to other parts of your body (it has not metastasised). To learn more, see [Types of breast cancer](#) .

### Key points about treating locally advanced breast cancer

- You'll probably have **surgery to remove your breast** (a mastectomy).
- You'll probably have **chemotherapy**. This is the standard treatment. But the research on how well this works is not very good.
- Having **radiotherapy** after surgery can reduce the chance of your cancer coming back, and it can help you live longer.

## Breast cancer

- If your cancer cells are sensitive to a **hormone** called **oestrogen** (they are oestrogen-receptor positive ), taking a drug called **tamoxifen** to stop your body responding to oestrogen can reduce the chance of your cancer coming back.
- If your cancer cells make a lot of a protein called HER-2, you may also be offered a drug called **trastuzumab** (Herceptin) to reduce the chance of your cancer coming back.

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

### Treatments for locally advanced breast cancer

#### Treatments that work

- [Surgery](#) : If you have locally advanced breast cancer, you will probably have a mastectomy. [More...](#)
- [Radiotherapy after surgery](#) : After surgery, you might also have radiotherapy to make sure that any cancer cells that are left have been killed. The nearby lymph nodes may be treated as well. [More...](#)

#### Treatments that are likely to work

- [Hormone treatment plus radiotherapy](#) : Radiotherapy is used to kill cancer cells. Tamoxifen is used to block the action of oestrogen in the body. Some breast cancers are encouraged to grow by oestrogen. [More...](#)

#### Treatments that need further study

- [Chemotherapy](#) : Treatment with anti-cancer drugs attempts to kill cancer cells anywhere in the body. This is a standard treatment. But the research on how well this works is not very good. [More...](#)

#### Other treatments

We haven't looked at this treatment in as much detail as we use to assess other treatments that we cover. (To read more, see Our method.) But we wanted to cover this treatment because you may be interested in it.

- [Trastuzumab \(Herceptin\)](#) : This is a drug that is used with chemotherapy or by itself to stop some cancers growing. It works only on tumours that make a protein called HER-2. About 1 in 5 women with breast cancer have this type. [More...](#)

### What will happen to me?

It can be hard to look at a statistic that is supposed to tell you how long women with breast cancer tend to live. No one can say for certain what will happen to you. Breast cancer isn't always a predictable disease.

But it is important to know that:

- Doctors usually talk about the percentage of women who will be alive five years after being treated with breast cancer. This is because the risk that breast cancer will come back is highest in the first five years
- But being alive five years later doesn't necessarily mean that you have been completely cured. You will probably always need to be watchful and have regular check-ups, even after 20 years. Talk to your doctor about your follow-up care plan. You should have annual mammograms for at least five years and possibly longer, depending on your risk of cancer coming back. <sup>[36]</sup>
- Breast cancer is an unpredictable disease, and sometimes women who were told that they had very advanced breast cancer survive for many years.

If you want more information, see [Survival rates for breast cancer](#). But please remember that you are an individual. Statistics cannot tell you what will happen in your specific case.

Most women nowadays recover from breast cancer and lead long and healthy lives.

### Questions to ask your doctor

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

Here are some questions you might want to ask.

- Has my breast cancer spread outside my breast? What stage is it?
- How big is my tumour?
- Can I have surgery that removes only the lump (breast-conserving surgery) and not the whole breast (mastectomy)?
- Did my breast cancer happen because of **genes** I have inherited?
- What will you do to find out if my breast cancer has spread to the **lymph nodes** in my armpit?
- What treatment will I need after surgery?

## Breast cancer

- What side effects can I expect from surgery and other treatments?
- Is my breast cancer encouraged to grow by the hormone oestrogen (is it oestrogen-receptor positive )?
- Do I have HER-2 positive breast cancer (this means the cancer cells make too much of a protein called HER-2)?
- Will my surgery be done by a specialist breast surgeon who does more than 20 breast operations a year? (This can be a difficult question to ask, but the risk of your cancer coming back where it first started depends on whether your surgeon removes enough of the tissue around your cancer along with the cancer itself. Studies show that experienced surgeons are better at doing this.)
- Do any of my lymph nodes have cancer cells in them? If so, how many?
- How abnormal do the cancer cells look under a microscope? (This can tell you how likely it is that your tumour will spread and what kind of treatment you need.)
- Will I need chemotherapy after surgery? If so, what type and for how long?
- Will I need hormone therapy? If so, what type and for how long?
- If I have a mastectomy, should I have breast-reconstruction surgery? If so, when should it be done and what sort of surgeon should do it?
- Are the other women in my family more likely to get breast cancer? Should they have check-ups more often?

---

## Treatments:

### Surgery plus radiotherapy for ductal carcinoma in situ

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 surgery plus radiotherapy for ductal carcinoma in situ?](#)

This information is for people who have a type of breast cancer called ductal carcinoma in situ. It tells you about surgery plus radiotherapy, a treatment used to treat this type of breast cancer. It is based on the best and most up-to-date research.



# Breast cancer

## Does it work?



Breast-conserving surgery keeps as much healthy breast tissue as possible.

Yes. If you have ductal carcinoma in situ (DCIS), breast-conserving surgery followed by radiotherapy can reduce the risk of your breast cancer coming back.

## What is it?

If you have ductal carcinoma in situ (DCIS), the cancer cells are contained inside the milk ducts in your breast. They haven't spread to other parts of your breast or your body. But there is a risk that cancer cells will spread into your breast tissue. If this happens, it's called **invasive breast cancer**. This type of breast cancer is more serious than DCIS because cancer cells might spread to other parts of your body.

Treating DCIS reduces your risk of getting invasive breast cancer.

Most women with DCIS are treated with **breast-conserving surgery** to remove the cancer. Your doctor will probably recommend that you also have **radiotherapy** after surgery to kill any cancer cells left behind.

**Breast-conserving surgery** is an operation for breast cancer that lets you keep your breast. Your surgeon will remove only the DCIS and a tiny bit of healthy-looking breast. The aim is to get rid of your breast cancer while changing the appearance of your breast as little as possible. We've prepared some extra information for people thinking of having this operation. To read more, see [Breast-conserving surgery \(lumpectomy\)](#).

Your doctor might recommend that you have a **mastectomy** if the area of DCIS is large compared with the size of your breast, or if you have DCIS in more than one place. In a mastectomy, your whole breast is removed. To read more, see [More about surgery for breast cancer](#).

**Radiotherapy** is usually used after breast-conserving surgery to kill any cancer cells that may have been left behind. It uses **X-rays** to destroy cancer cells in your breast. You'll need to have radiotherapy five days a week for between three weeks and six weeks. Each session takes only a few minutes. Radiotherapy doesn't hurt, but it has side effects. To read more, see [How does radiotherapy work?](#)

If your doctor thinks that it's very unlikely that your DCIS will come back, he or she may discuss with you whether you need radiotherapy. Doctors say your risk is lower if the

## Breast cancer

area of DCIS in your breast is very small and the cells don't look aggressive or fast growing (doctors say they are **low-grade**).

### How can it help?

Most women treated with surgery and radiotherapy don't get DCIS again, and don't go on to get invasive breast cancer.

Having radiotherapy after breast-conserving surgery reduces the chance of cancer coming back in your breast from about 22 in 100 for women who just have surgery, to about 11 in 100 for women who have surgery and radiotherapy. <sup>[86]</sup>

But even though the chances of getting breast cancer again are lower, it may not make a difference to how long you live. In a summary of the research, doctors say that death rates are very low for women with DCIS, which may be why there is not a difference in death rates between the treatments. <sup>[86]</sup>

There aren't any good studies that directly compare women who've had breast-conserving surgery with women who've had a mastectomy for DCIS. <sup>[55]</sup> However, there are studies that look at women with invasive cancer that hasn't spread outside the breast or has spread only as far as the nearest lymph nodes. These show that women who have breast-conserving surgery live as long as women who have a mastectomy. <sup>[87]</sup>

### How does it work?

Surgery removes the cancer from the tumour in your breast.

Radiotherapy is like an insurance policy for the rest of your breast. Your surgeon may have removed all of the breast cancer that he or she could see, along with some healthy tissue around it. But cancer cells could have been left behind, and they could start growing in the future.

Radiotherapy kills any cancer cells left behind. It uses high-energy X-rays to kill cancer cells.

Because normal cells can also be damaged by these high-energy X-rays, radiotherapy is given very carefully to make sure that the right areas of the body are hit as accurately as possible.

The timing of the doses makes it more likely that the cells that grow and divide faster, such as cancer cells, are hit more often than other cells.

### Can it be harmful?

#### Side effects of surgery

Some of the side effects of breast-conserving surgery are given below.

**Feeling unhappy with how your breast looks:** When women were asked about how their breast looked after surgery, between 6 and 9 out of 10 rated their results as good

## Breast cancer

or excellent. So there's only a small chance that you'll be unhappy with how your breast looks after surgery.<sup>[52]</sup> You may find that your scar is bigger than you expected, your breast looks distorted or your breasts are uneven sizes. But if this happens, you can have more surgery to improve the way your breast looks.

**Needing another operation because not enough tissue was removed:** Sometimes, not enough tissue is removed from around the lump. This may happen if the cancer has spread further than your surgeon thought. The tissue that has been removed during the operation will be checked, and if your surgeon thinks some cancer could have been left behind, you may need a second operation. About 1 in 5 women need another operation, though the rate may vary depending on where you live.<sup>[56]</sup> You may either have more of your breast removed or have a mastectomy. Some women who need more surgery say they wish they had chosen to have a mastectomy in the first place.<sup>[52] [88]</sup>

**Infection:** All wounds can get infected. An infection can make your wound hurt, and the surrounding skin may be hot, red and throbbing. The risk of infection after breast-conserving surgery is around 1 in 50.<sup>[89]</sup> Occasionally, the infection causes pus to collect around the scar. You may need **antibiotics** for this.

**Fluid under the scar:** A clear fluid, called **serous fluid**, can collect under the scar. This is called a **seroma**. It is part of the normal healing process. About 1 in 5 women get a seroma after their breast cancer is removed.<sup>[65]</sup> The fluid can be drained with a needle by a doctor.

**Bleeding:** You may get bleeding under the cut in your skin after the operation. If the blood builds up and clots, you will get a big bruise called a **haematoma**. The area will be swollen and feel tender. If this happens, you may need surgery to remove the blood clot and stop any bleeding.

To read more, see [Side effects of surgery for breast cancer](#) .

### Side effects of radiotherapy

Radiotherapy does have side effects, and different women have different experiences. You may have heard some worrying stories about radiotherapy, but many women cope well with the side effects.

Generally the side effects of radiotherapy can be divided into two groups: side effects that happen early and side effects that happen later.

- **Early side effects:** Your skin may itch or change colour after radiotherapy, and your breast may feel tender. Some women feel more tired than usual. These problems are usually mild and go away after a few weeks.
- **Later side effects:** You may get nerve damage or **inflammation** in your lungs. These sound serious, but they are rare and can be treated.

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

### How good is the research on surgery plus radiotherapy for ductal carcinoma in situ?

There's good research to show that having radiotherapy after surgery reduces the risk that your ductal carcinoma in situ (DCIS) will come back in the same place.

We found one review of the research ( [systematic reviews](#) ) that looked at four good-quality studies ( [randomised controlled trials](#) ).<sup>[86]</sup> The researchers compared radiotherapy with no radiotherapy after surgery for DCIS. The studies followed women for up to 10 years after treatment.

The results showed that cancer came back for 22 in 100 women who did not have radiotherapy, but only 11 in 100 women who did have radiotherapy.<sup>[86]</sup>

---

### Surgery plus radiotherapy and tamoxifen for ductal carcinoma in situ

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 surgery plus radiotherapy and tamoxifen for ductal carcinoma in situ?](#)

This information is for people who have breast cancer. It tells you about surgery plus radiotherapy and tamoxifen, a treatment used for ductal carcinoma in situ. It is based on the best and most up-to-date research.

#### Does it work?

We're not sure. If you have ductal carcinoma in situ, breast-conserving surgery can remove the cancer cells and reduce the chance of your breast cancer coming back. Your chance of cancer returning will be even lower if you also have radiotherapy after surgery. Taking tamoxifen may cut the risk even more, but the research isn't clear.

We know that [tamoxifen can help women with early breast cancer](#) . And some research suggests it also works for women with the very earliest stage of breast cancer, called ductal carcinoma in situ (DCIS). However, other research suggests that women with DCIS may do just as well without taking tamoxifen.

Tamoxifen works best for women who have cancer that is sensitive to the hormone [oestrogen](#) .

#### What is it?

In ductal carcinoma in situ (DCIS), cancer cells are contained inside the milk ducts in your breast. They haven't spread to other parts of your breast or your body. If you have DCIS, there is a risk that cancer cells will spread into your breast tissue. If this happens,

## Breast cancer

it's called **invasive breast cancer**. This type of breast cancer is more serious than DCIS because cancer cells might spread to other parts of your body.

Doctors treat DCIS to reduce your risk of getting invasive breast cancer.

Most women with DCIS are first treated with **breast-conserving surgery** to remove the cancer. Some women decide to have **radiotherapy** to the breast after surgery to kill off any cancer cells that might have been left behind. Your doctor may also suggest that you take a drug called **tamoxifen** after these treatments.

The information on this page tells you how much extra benefit women get from taking tamoxifen after they've had surgery and radiotherapy.

Here's a brief overview of each of the treatments.

- **Breast-conserving surgery** is an operation for breast cancer that lets you keep your breast. Your surgeon will remove only the cancer and a tiny bit of healthy-looking breast. The aim is to get rid of your breast cancer while changing the appearance of your breast as little as possible. We've prepared some extra information for people thinking of having this operation. To read more, see [Breast-conserving surgery \(lumpectomy\)](#).

Your doctor might recommend that you have a mastectomy if the area of DCIS is large compared with the size of your breast, or if it's in more than one place. To read more, see [More about surgery for breast cancer](#) .

- **Radiotherapy** is usually used after surgery to kill any cancer cells that may have been left behind. It uses **X-rays** to destroy cancer cells in your breast. You'll need to have radiotherapy five days a week for between three weeks and six weeks. Each session takes only a few minutes. Radiotherapy doesn't hurt, but it has side effects. To read more, see [How does radiotherapy work?](#)
- **Tamoxifen** is a drug that treats the whole body. It stops the female hormone oestrogen working in the body. Some breast cancers are more sensitive to oestrogen than others (they are oestrogen-receptor positive). This means that oestrogen encourages them to grow. Your doctor will do tests on your tumour to find out if it is oestrogen-receptor positive. If it is, your doctor may prescribe tamoxifen for up to five years. Sometimes doctors also prescribe tamoxifen for women who don't have oestrogen-receptor positive breast cancer but whose cancer seems to be linked to **hormones** .

Tamoxifen comes as tablets. Its brand names include Nolvadex, Soltamox, and Tamofen.

## How can it help?

Taking tamoxifen after surgery and radiotherapy may reduce your risk of getting breast cancer again.<sup>[90]</sup> But not all studies have found that it helps with the earliest stage of breast cancer (DCIS).

In the study that found tamoxifen did help with DCIS:<sup>[90]</sup>

- About 14 in 100 women who had radiotherapy after breast-conserving surgery had their cancer come back after six years
- About 9 in 100 women who took tamoxifen after breast-conserving surgery and radiotherapy had their cancer come back after six years.

But one study didn't show any advantage to taking tamoxifen for women with DCIS.<sup>[91]</sup> This could be because women with DCIS already recover well after surgery and radiotherapy, so any extra benefits from tamoxifen aren't obvious.

Tamoxifen may help only if you have breast cancer that is encouraged to grow by oestrogen (oestrogen-receptor positive breast cancer).<sup>[92]</sup>

## How does it work?

Tamoxifen helps prevent some types of breast cancer developing further. Some breast cancers are encouraged to grow by oestrogen (a female hormone). Tamoxifen prevents this type of breast cancer developing by blocking the place on breast cells where oestrogen would normally attach. It affects both normal cells and cancer cells. (These types of cancers are called oestrogen-receptor positive because the place on the cell that oestrogen attaches to is known as a **binding site** or a **receptor site**.)

Tamoxifen stops oestrogen being able to tell the cell what to do, which in this case is to keep growing and dividing in an uncontrolled way.

## Can it be harmful?

### Side effects of surgery

Every woman's experience of breast surgery is different. Some women recover in a matter of weeks with no lasting problems. Others take much longer to get over the operation.

Problems after surgery for breast cancer can include pain, swelling in your arm, and infections. To read more, see [Side effects of surgery for breast cancer](#) .

### Side effects of radiotherapy

Radiotherapy does have side effects, and different women have different experiences. You might have heard some worrying stories about radiotherapy, but many women cope

## Breast cancer

well with the side effects. Generally the side effects of radiotherapy can be divided into two groups: side effects that happen early and side effects that happen later.

- **Early side effects:** Your skin may itch or change colour after radiotherapy, and your breast may feel tender. Some women feel more tired than usual. These problems are usually mild and go away after a few weeks.
- **Later side effects:** You may get nerve damage or inflammation in your lungs. These sound serious, but they are rare and can be treated.

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

### Side effects of tamoxifen

Tamoxifen stops the female hormone oestrogen working in your body. This can give you symptoms of the menopause , such as hot flushes (which can be severe), irregular periods and vaginal dryness. About half the women who take tamoxifen get these types of symptoms. This is more likely if you haven't been through the menopause. <sup>[70]</sup>

Tamoxifen may also cause indigestion or make you feel sick.

There are also some less common side effects of taking tamoxifen, including cataracts , deep vein thrombosis or cancer that affects the lining of your womb. <sup>[90]</sup>

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

### How good is the research on surgery plus radiotherapy and tamoxifen for ductal carcinoma in situ?

We found two well-designed studies ( randomised controlled trials ) that looked at the effects of taking tamoxifen after having surgery and radiotherapy for ductal carcinoma in situ. <sup>[90]</sup> <sup>[92]</sup> <sup>[91]</sup>

The first study looked at women who took tamoxifen or a dummy treatment (a placebo ) after being treated with breast-conserving surgery and radiotherapy. <sup>[90]</sup> After five years, the women who took tamoxifen were less likely to have any form of breast cancer and less likely to have got invasive cancer. (Invasive cancer is cancer that has spread into the fat and other tissue in the breast. It can then spread to other parts of the body.)

But the women who took tamoxifen were slightly more likely to have cancer of the lining of the womb (endometrial cancer). Tamoxifen only helped women with breast cancer that was encouraged to grow by oestrogen ( oestrogen-receptor positive breast cancer). <sup>[92]</sup>

The second study looked at women who had surgery for ductal carcinoma in situ and who received different types of additional treatments. <sup>[91]</sup> The results showed that adding tamoxifen to radiotherapy didn't help to reduce the risk of cancer coming back any more

than having radiotherapy on its own. The researchers concluded that radiotherapy is worthwhile for women who have had surgery for ductal carcinoma in situ, but that tamoxifen isn't, especially for women over 50.

---

### Surgery for early breast 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 surgery for early breast cancer?](#)

This information is for people who have early breast cancer. It tells you about surgery, a treatment used for early breast cancer. It is based on the best and most up-to-date research.

#### Does it work?

Yes. If you have early breast cancer, surgery can remove your cancer, stop it spreading and help you live longer.

Breast-conserving surgery (removing the part of the breast that has cancer) works just as well as a mastectomy (removing the whole breast). This is true for women of all ages. You are just as likely to be alive 10 years or 20 years after breast-conserving surgery as after a mastectomy.

#### What is it?

If you have early breast cancer, the cancer hasn't spread outside your breast, or has spread only as far as the nearest **lymph nodes**. There are two main types of breast surgery for early breast cancer:

- **Breast-conserving surgery** is an operation that lets you keep your breast. Your surgeon will remove only the part of your breast that has cancer. The aim is to get rid of your breast cancer while changing the appearance of your breast as little as possible. Doctors sometimes call this operation a **lumpectomy** or **wide local excision**. The size of your scar will depend on how much tissue is taken away
- **A mastectomy** is an operation that removes all of the breast tissue, including the skin and the nipple, from the side of the chest that has cancer. You will be left with a flat scar that goes across your chest. Most scars run diagonally or horizontally. This operation is sometimes called a **total mastectomy**. Doctors used to also remove some of the muscles under the breast. This is called a **radical mastectomy**. It isn't done very often now.

The information on this page can help you decide whether you want to have all or part of your breast removed.



## Breast cancer

Up to 80 in 100 women with early breast cancer are able to have breast-conserving surgery. You may be able to have breast-conserving surgery if: <sup>[89]</sup>

- **You have just one lump in your breast.** If you have more than one lump, or lots of small patches of cancer cells, it's hard to remove all the cancer cells without changing the way your breast looks
- **Your lump is small compared with the size of your breast.** If you have a small lump, you'll have only a small scar and maybe a small dent in your breast
- **You can have radiotherapy.** You may need radiotherapy after breast-conserving surgery. Doctors try to avoid giving radiotherapy to the same area twice, so you may not be able to have breast-conserving surgery if you've had radiotherapy before. To learn more about radiotherapy, see [Breast-conserving surgery plus radiotherapy](#) .

During surgery, you may also need to have some, or all, of the lymph nodes in your armpit removed. These will be tested to see if the cancer has spread here. For more information, see [More about surgery for breast cancer](#) .

We've prepared some extra information for people thinking about having breast-conserving surgery. To read more, see [Breast-conserving surgery \(lumpectomy\)](#).

If you are advised to have a **mastectomy** (the whole breast removed), your surgeon should discuss surgery to rebuild your breast (breast reconstruction). <sup>[36]</sup> Many women can have this done at the same time as the operation to remove the breast. For more information, see [Breast reconstruction](#) .

### How can it help?

If you have early breast cancer, surgery can **stop your cancer spreading** and **help you live longer**.

#### Breast-conserving surgery

Having breast-conserving surgery with radiotherapy works just as well as having your whole breast removed. This is true for women of all ages. You are just as likely to be alive 10 years or 20 years after breast-conserving surgery as after a mastectomy. <sup>[89]</sup>  
<sup>[93]</sup> <sup>[94]</sup>

In one big summary of the research, the difference between still being alive 20 years after breast conserving surgery, compared to being alive 20 years after mastectomy, was about 1 death for every 100 women. <sup>[94]</sup> This difference is so small that it is very likely to be down to chance. Some women are likely to have died of causes other than breast cancer, during the 20 years of follow-up.

The summary also showed very little difference in the chances of breast cancer coming back. After 10 years, 8 in 100 women who'd had a mastectomy had a return of breast

## Breast cancer

cancer, compared to 10 in 100 women who'd had breast-conserving surgery. But this difference between treatment results had disappeared by 15 years after treatment, when the same numbers of women had a return of breast cancer.

Breast-conserving surgery has some advantages over a mastectomy. You'll be able to keep your breast, your scar will be smaller and you won't need to wear a false breast or have surgery to reconstruct your breast. You're also likely to feel better about the way your body looks. <sup>[53]</sup> <sup>[54]</sup>

To read about the pros and cons of each operation, see [More about surgery for breast cancer](#).

### Mastectomy

If you have a mastectomy, removing the muscles from your breast (a radical mastectomy) won't help you live longer and can make your chest look worse. Doctors used to think that the more breast tissue and surrounding muscle they removed the less likely it was that breast cancer would come back. But we now know that this isn't true. <sup>[89]</sup>

### How does it work?

Doctors usually recommend removing your breast cancer because otherwise it may grow bigger and spread through your breast tissue into your chest wall, skin and the muscles below the breast. If your cancer is only in one part of your breast, removing just that part is enough to stop it spreading.

### Can it be harmful?

Some of the more common side effects of breast surgery are given below. To learn more, see [Side effects of surgery for breast cancer](#). To see how breast-conserving surgery compares with a mastectomy, see [More about surgery for breast cancer](#).

### Side effects of breast-conserving surgery

**Feeling unhappy with how your breast looks:** When women were asked about how their breast looked after surgery, between 6 and 9 out of 10 rated their results as good or excellent. So there's only a small chance that you'll be unhappy with how your breast looks after surgery. <sup>[52]</sup> You may find that your scar is bigger than you expected, your breast looks distorted or your breasts are uneven sizes. But if this happens, you can have more surgery to improve the way your breast looks.

**Needing another operation because not enough tissue was removed:** Sometimes, not enough tissue is removed from around the lump. This can happen if the cancer has spread further than your surgeon thought. The tissue that has been removed during the operation will be checked, and if your surgeon thinks some cancer could have been left behind, you may need a second operation. About 1 in 5 women need another operation although this rate varies in different parts of the UK. <sup>[56]</sup> You may either have more of

## Breast cancer

your breast removed or have a mastectomy. Some women who need more surgery say they wish they had chosen to have a mastectomy in the first place. <sup>[52]</sup> <sup>[88]</sup>

**Infection:** All wounds can get infected. An infection can make your wound hurt, and the surrounding skin may be hot, red and throbbing. The risk of infection after breast-conserving surgery is around 1 in 50. <sup>[89]</sup> Occasionally, the infection causes pus to collect around the scar. You may need **antibiotics** for this.

**Fluid under the scar:** A clear fluid, called **serous fluid**, can collect under the scar. This is called a **seroma**. It is part of the normal healing process. About 1 in 5 women get a seroma after their breast cancer is removed. <sup>[65]</sup> The fluid can be drained with a needle by a doctor.

**Bleeding:** You may get bleeding under the cut in your skin after the operation. If the blood builds up and clots, you will get a big bruise called a **haematoma**. The area will be swollen and feel tender. If this happens, you may need surgery to remove the blood clot and stop any bleeding.

### Side effects of a mastectomy

A mastectomy is a serious operation. Afterwards you may get some of the following side effects.

**Missing your breast:** Some women say they feel disfigured after losing a breast. You may find it hard to look at your scar. You may also find it difficult to be intimate and have sex. But breast reconstruction can help with all these feelings. And you may be able to have your breast removed and reconstructed during the same operation. <sup>[36]</sup> Ask your doctor about all your options.

**Needing more treatment because your cancer comes back:** There is a small risk that breast cancer will come back in your scar, so removing all the breast tissue cannot guarantee that your breast is free from cancer cells.

**Infection:** There is a chance that you'll get an infection. This risk is higher than if you had breast-conserving surgery. It can be treated, but you may need to spend a few extra days in hospital.

**Fluid under the scar:** Fluid may build up around the top of the scar on your chest and also in your upper arm. This is called a **seroma** and can be uncomfortable and make your arm stiff. You may need to have this fluid drained in hospital.

**Bleeding:** You may get bleeding under the cut in your skin after the operation. If the blood builds up and clots, you will get a big bruise (a **haematoma**). The area will be swollen and feel tender. If this happens, you may need surgery to remove the blood clot and stop any bleeding.

### How good is the research on surgery for early breast cancer?

#### Breast-conserving surgery compared with mastectomy

Three large reviews ( [systematic reviews](#) ) looked at more than 15 well-designed studies ( [randomised controlled trials](#) ) with around 8,000 women who had breast-conserving surgery or a mastectomy. <sup>[89] [93] [94]</sup>

These reviews found that women who had breast-conserving surgery were just as likely to be alive 10 or 20 years after being diagnosed with breast cancer as women who had a mastectomy. Most of the women in the studies were happy with the way their breast looked after breast-conserving surgery. <sup>[89]</sup>

#### Different types of mastectomies

There's good evidence that removing the muscles under the chest wall along with the breast (a radical mastectomy) won't help you live longer.

A review of five well-designed studies ( [randomised controlled trials](#) ) with more than 2,000 women compared different types of mastectomies, including radical mastectomy. This review found that having a radical mastectomy didn't reduce women's chances of dying within 10 years. <sup>[89]</sup>

---

### Breast-conserving surgery plus radiotherapy for early breast 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 breast-conserving surgery plus radiotherapy for early breast cancer?](#)

This information is for people who have early breast cancer. It tells you about breast-conserving surgery plus radiotherapy, a treatment used for early breast cancer. It is based on the best and most up-to-date research.

#### Does it work?

Yes. If you have early breast cancer, having radiotherapy after breast-conserving surgery reduces the chance of your cancer coming back, compared with having surgery alone.

#### What is it?

Early breast cancer means the cancer hasn't spread outside your breast, or has spread only as far as the nearest [lymph nodes](#) . Most women with this type of cancer are treated with breast-conserving surgery followed by radiotherapy. Radiotherapy is given to reduce the chance of the cancer coming back in the same place.

## Breast cancer

This information tells you how much extra benefit you may get from having radiotherapy as well as surgery.

- **Breast-conserving surgery** is an operation that lets you keep your breast. Your surgeon will remove only the part of your breast that has cancer. The aim is to get rid of your breast cancer while changing the appearance of your breast as little as possible. Doctors sometimes call this operation a **lumpectomy** or **wide local excision**. It is done instead of an operation to remove your whole breast (a **mastectomy**). Your doctor may also remove some of the lymph nodes from your armpit to see if the cancer has spread there. To read more, see [More about surgery for breast cancer](#).
- **Radiotherapy** is used to kill any cancer cells that might be left behind after surgery. It uses **X-rays** to destroy cancer cells in your breast. You'll need to have radiotherapy five days a week for between three weeks and six weeks. Each session takes only a few minutes. Radiotherapy doesn't hurt, but it has side effects. To read more, see [How does radiotherapy work?](#)

A drug called [tamoxifen](#) is also sometimes used after breast-conserving surgery for women with early breast cancer.

### How can it help?

Surgery removes the cancer from your breast.

Radiotherapy can help **stop your cancer coming back**.<sup>[95]</sup> Women who don't have radiotherapy are more likely to get their cancer back than women who do.

The research shows:

- About 19 in 100 women who have radiotherapy have cancer again within 10 years
- But 35 in 100 women who don't have radiotherapy have their cancer back within 10 years.

Radiotherapy after breast-conserving surgery may also help women live longer.<sup>[96]</sup>

Having radiotherapy (with or without tamoxifen) works better at preventing cancer coming back than using tamoxifen on its own.<sup>[66] [97] [98]</sup>

Researchers looked to see whether women with less aggressive cancers did as well without radiotherapy. But they found that even for these women, having radiotherapy cut their chances of breast cancer coming back by about half.<sup>[99]</sup>

Researchers are looking at whether having radiotherapy to the breast during surgery (called intraoperative radiotherapy) works as well as having radiotherapy after surgery.<sup>[100] [101]</sup> But more research is needed to know if radiotherapy around the part of your

## Breast cancer

breast being removed is better and safer than radiotherapy to a wider area.<sup>[102] [103] [104]</sup>  
To learn more, see [Radiotherapy during surgery](#) .

If the cancer does come back, you'll probably need to have the rest of your breast removed.

Having breast-conserving surgery with radiotherapy **works just as well as having your whole breast removed** (a mastectomy). This is true for women of all ages. You are just as likely to be alive 10 years or 20 years after breast-conserving surgery as after a mastectomy.<sup>[93] [94]</sup>

### How does it work?

Radiotherapy is like an insurance policy for the rest of your breast. Your surgeon may have removed all of the breast cancer that he or she could see, along with some healthy tissue around it to make sure that all the cancer was removed. But breast cancer cells may have been left behind, and they could start growing in the future.

Radiotherapy kills any cancer cells left behind by blasting high-energy X-rays at them.

Normal cells also can be affected by these high-energy X-rays. So radiotherapy is given very carefully to make sure that the right areas of the body are hit as accurately as possible.

The timing of the doses makes it more likely that the cells that grow and divide faster, such as cancer cells, are hit more often than other cells.

### Can it be harmful?

#### Side effects of surgery

Every woman's experience of breast surgery is different. Some women recover in a matter of weeks with no lasting problems. Others may take much longer to get over the operation.

Problems after surgery for breast cancer can include pain, swelling in your arm and infections. To read more, see [Side effects of surgery for breast cancer](#) .

#### Side effects of radiotherapy

There aren't many studies on the side effects of radiotherapy.<sup>[87]</sup> Different women have different experiences. You may have heard some worrying stories about radiotherapy, but many women cope well with the side effects.

Generally the side effects of radiotherapy can be divided into two groups: side effects that happen early and side effects that happen later.

- **Early side effects:** Your skin may itch after radiotherapy, and your breast may feel tender.<sup>[66]</sup> Some women feel more tired than usual. You may also get breast pain

## Breast cancer

and changes in the colour and look of the skin on your breast.<sup>[98]</sup> These problems are usually mild and go away after a few weeks.

- **Later side effects:** You may get nerve damage or inflammation in your lungs. These sound serious, but **they are rare** and can be treated. You may also find that hair stops growing in your armpit.

To read more, see [Side effects of radiotherapy](#) . Having radiotherapy as well as surgery seems to increase your chances of getting problems with swelling and stiffness in your upper arm.<sup>[105]</sup>

### How good is the research on breast-conserving surgery plus radiotherapy for early breast cancer?

There's good evidence that, for women with early breast cancer, having radiotherapy after breast-conserving surgery reduces the risk of cancer coming back in the place where it started. Surgery plus radiotherapy works better than surgery alone.

One big summary of the research (a systematic review ) looked at 17 studies involving 10,801 women with early breast cancer.<sup>[106]</sup> The summary showed that:

- About 19 in 100 women who have radiotherapy have cancer again within 10 years
- But 35 in 100 women who don't have radiotherapy have their cancer back within 10 years.

Radiotherapy after breast-conserving surgery may also help women live longer.<sup>[106]</sup>

---

## Mastectomy plus radiotherapy for early breast 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 a mastectomy plus radiotherapy for early breast cancer?](#)

This information is for people who have early breast cancer. It tells you about mastectomy plus radiotherapy, a treatment used for early breast cancer. It is based on the best and most up-to-date research.

### Does it work?

Yes. If you have a high risk that your cancer will come back after a mastectomy , radiotherapy can reduce this risk by about two-thirds.

## Breast cancer

But radiotherapy doesn't work as well in women whose tumour is very large or whose lymph nodes have become matted together with cancer. Also, if there's only a small chance of cancer coming back, radiotherapy may do more harm than good.

If you've had a mastectomy for your early breast cancer, this information can help you decide whether to have radiotherapy too.

### What is it?

If your breast cancer has spread to your breast tissue from your milk ducts and maybe to your lymph nodes, it's called invasive or early breast cancer. You may need a **mastectomy**. A mastectomy is an operation that removes all of the breast tissue, including skin and the nipple, from the side of the chest that has cancer.

You will be left with a flat scar that goes across your chest. Most scars run diagonally or horizontally.

If you are advised to have a mastectomy (the whole breast removed), your surgeon should discuss surgery to rebuild your breast (breast reconstruction).<sup>[36]</sup> Many women can have this done at the same time as the operation to remove the breast. For more information, see [Breast reconstruction](#) .

To read more, see [More about surgery for breast cancer](#) .

**Radiotherapy** to the chest is sometimes recommended after a mastectomy to kill any cancer cells that may have been left behind. It uses X-rays to destroy the cancer cells.

Most women don't need radiotherapy after their breast is removed. This is because surgery can remove all the cancer. But radiotherapy may be recommended for women who have a high risk of their breast cancer coming back.

You're thought to be at high risk if:<sup>[107]</sup> <sup>[108]</sup> <sup>[109]</sup>

- Your tumour is large (more than 5 centimetres across)
- Your cancer cells look aggressive and fast growing under a microscope (they are high-grade). This means that they may have already spread
- Cancer cells are found in more than three of your lymph nodes
- Cancer cells are in the edge (margin) of the breast tissue removed during your mastectomy.

Very occasionally, doctors recommend that women also have radiotherapy to all the lymph nodes around the breast area. This includes the lymph nodes in the armpit, along the sides of the breastbone and upper ribs, and in the hollows of the neck (around the collarbone). Doctors call this treatment **total nodal radiotherapy** or **total nodal irradiation**.



## Breast cancer

To learn more, see [How does radiotherapy work?](#)

### How can it help?

If there's a high risk that your cancer will come back after a mastectomy:<sup>[110]</sup>

- Having radiotherapy reduces the chance of cancer coming back in the same place by two-thirds. This is true for women of all ages
- But radiotherapy may not work as well if a lot of your lymph nodes have cancer and they have become matted together.

It's important to know that the side effects from radiotherapy can be serious. If there is **only a small chance** that your cancer will come back, radiotherapy may do more harm than good.

### How does it work?

Radiotherapy kills cancer cells by blasting high-energy X-rays at them.

Normal cells can also be affected by these high-energy X-rays. So radiotherapy is given very carefully to make sure that the right areas of the body are hit as accurately as possible.

The timing of the doses makes it more likely that the cells that grow and divide faster, such as cancer cells, are hit more often than other cells.

### Can it be harmful?

#### Side effects of surgery

Every woman's experience of breast surgery is different. Some women recover in a matter of weeks with no lasting problems. Others may take much longer to get over the operation.

Problems after surgery for breast cancer can include pain, swelling in your arm and infections. To read more, see [Side effects of surgery for breast cancer](#) .

#### Side effects of radiotherapy

There aren't many studies on the side effects of radiotherapy.<sup>[87]</sup> Different women have different experiences. You may have heard some worrying stories about radiotherapy, but many women cope well with the side effects. Generally the side effects of radiotherapy can be divided into two groups: side effects that happen early and side effects that happen later.

- **Early side effects:** Your skin may itch or change colour after radiotherapy, and your breast may feel tender.<sup>[66]</sup> Some women feel more tired than usual. These problems are usually mild and go away after a few weeks.

## Breast cancer

- **Later side effects:** You may get nerve damage or inflammation in your lungs. These side effects sound serious, but **they are rare** and can be treated. You may also find that hair stops growing in your armpit.

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

### How good is the research on a mastectomy plus radiotherapy for early breast cancer?

There's good evidence that if you have a high risk of your cancer coming back after a mastectomy, radiotherapy can reduce this risk.

We found one summary of the research (a systematic review ) that included 36 good studies ( randomised controlled trials ) of women with early breast cancer.<sup>[111]</sup> The women were treated with a mastectomy, and then they had radiotherapy or no other treatment. The summary found that those women who had radiotherapy were much less likely to get breast cancer in the same place again. Within five years of treatment:

- 1 in 10 women had their cancer back again if they had radiotherapy.
- 3 in 10 women had cancer again if they didn't have radiotherapy after a mastectomy.

Women who also had the lymph nodes removed from under their arm were less likely to die from breast cancer within 15 years if they had radiotherapy. But for women who just had a mastectomy (and didn't have their lymph nodes removed) radiotherapy didn't make a difference to how long they lived.

Radiotherapy may not work as well for women who have:<sup>[112] [107] [108] [109]</sup>

- A large tumour
- Cancer that has caused their lymph nodes to become matted together
- High-grade cancer cells (this means their cancer is fast growing and aggressive)
- Cancer in the edge (margin) of the breast tissue removed during their mastectomy.

---

## Chemotherapy after surgery for early breast 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 early breast cancer?](#)

## Breast cancer

This information is for people who have early breast cancer. It tells you about chemotherapy after surgery, a treatment used for early breast cancer. It is based on the best and most up-to-date research.

### Does it work?

Yes. If you have early breast cancer, having chemotherapy after surgery to remove your tumour reduces the chance that your cancer will come back in the same place. It can also help you live longer.

### What is it?

Most women with early breast cancer are treated with surgery to remove the cancer. Some are then given radiotherapy to their chest area to stop the cancer coming back in the place it started.

Your doctor may also suggest that you have chemotherapy. This treats your whole body and will affect both normal cells and cancer cells.

Chemotherapy can be used after breast surgery and radiotherapy to:

- Reduce the chance of breast cancer coming back in either breast
- Reduce the chance that breast cancer will spread somewhere else in your body
- Control breast cancer that has already spread to other parts of your body but can't yet be detected in tests.

Some women also have [chemotherapy before surgery](#) to reduce the size of their breast tumour. This can make it easier to remove. This could make the difference between removing a breast cancer lump (breast-conserving surgery) and the whole breast (mastectomy).

Not every woman with early breast cancer needs chemotherapy. It will probably be recommended only if:

- There's a high risk that your cancer has spread outside of your breast and armpit area. Your cancer may be more likely to spread if you have a large cancer or the cancer cells are high-grade (this means they look fast growing and aggressive under a microscope)
- You have cancer in lots of the nodes under your arm.

If your cancer cells are sensitive to **oestrogen** (they are **oestrogen-receptor positive**), you may be given hormone therapy, such as [tamoxifen](#), instead of chemotherapy. Some women have both chemotherapy and tamoxifen.

## Breast cancer

Chemotherapy drugs are most effective at killing cells that divide rapidly. Cancer cells divide into new cells faster than normal cells, so chemotherapy should kill more cancer cells than normal cells.

Unfortunately, the drugs used in chemotherapy also affect other cells in the body that divide rapidly. This can cause side effects (see below).

Chemotherapy drugs can be given as tablets or as a drip (also called an IV or an **intravenous infusion** ). You may get treatment at a clinic or hospital as an outpatient.

Just as **bacteria** can become resistant to the **antibiotics** used to fight them, cancer cells can become resistant to anti-cancer drugs. Cancer cells can change and adapt to avoid being damaged by chemotherapy drugs. Because of this, more than one drug is given at a time.

Common combinations of these drugs include: <sup>[113]</sup>

- doxorubicin and cyclophosphamide
- 5-fluorouracil, epirubicin, and cyclophosphamide (the combination is sometimes called CEF or FEC)
- cyclophosphamide, methotrexate, and 5-fluorouracil (this combination is also called CMF).

Doxorubicin and epirubicin are a type of drug called an **anthracycline**. Chemotherapy that includes an anthracycline may be more effective than other types, although more research is needed.

Chemotherapy drugs called **taxanes** can help women who have a high risk of their cancer coming back. Studies show they can help stop cancer coming back if it has spread to the **lymph nodes** in your armpit. <sup>[114]</sup> <sup>[115]</sup> They're used together with other chemotherapy drugs.

There are two taxane drugs available in the UK. They are:

- docetaxel (brand name Taxotere)
- paclitaxel (Taxol).

The National Institute for Health and Care Excellence (NICE), which recommends treatments for use in the NHS, has approved docetaxel to treat early breast cancer that's spread to the lymph nodes. <sup>[36]</sup> NICE hasn't approved paclitaxel for early breast cancer. <sup>[36]</sup>

### How can it help?

Having chemotherapy after surgery reduces the chance that your cancer will come back. It also increases the chance that you will live for at least 10 years after being diagnosed with breast cancer. <sup>[83]</sup>

If you'd like to see information about how long women live after chemotherapy for early breast cancer, see [Long-term results of chemotherapy](#) .

We also know that:

- Combination treatments involving chemotherapy drugs such as doxorubicin and epirubicin (which are called anthracyclines) can work slightly better than standard chemotherapy (with cyclophosphamide, methotrexate, and 5-fluorouracil, a combination known as CMF). <sup>[83]</sup> However, this might depend on the particular combination chosen: a combination of doxorubicin with cyclophosphamide has similar benefits to standard CMF, but a three-drug combination of 5-fluorouracil and cyclophosphamide with either epirubicin or doxorubicin seems to work better. <sup>[116]</sup>
- Chemotherapy that includes a taxane drug as well as an anthracycline drug increases your chances of living longer and reduces your chances of cancer coming back, more than standard anthracycline-based chemotherapy alone. <sup>[116] [117]</sup>
- Adding extra treatments with a drug other than a taxane to a combination with an anthracycline may also increase your chance of living longer. <sup>[116]</sup>
- Doubling the length of time you are treated with chemotherapy (from the usual four months or six months) doesn't help in itself. <sup>[83]</sup>
- Using much higher doses of chemotherapy doesn't offer any benefit. <sup>[84] [118]</sup>

### How does it work?

Surgeons can remove your breast cancer and radiotherapy specialists can give you radiotherapy, but these treatments treat only the area right around your tumour.

We know that breast cancer cells can get into the blood and into the lymph vessels . When this happens, they can be carried to other parts of the body. They may lie there for a while before growing or they may die.

You may benefit from chemotherapy unless you have a small tumour and there is no evidence that cancer cells have spread to your lymph nodes.

Most anti-cancer drugs attack the DNA of cells (the genetic code in cells that controls how they grow and divide to form new cells). All cells, whether they are normal cells or

## Breast cancer

cancer cells, grow and divide to form new cells. Normal cells are programmed to do this to replace damaged cells. Cancer cells grow quickly in an unregulated, chaotic way.

### Can it be harmful?

Side effects happen mainly because chemotherapy drugs kill some normal cells along with the cancer cells. In particular, they target cells that divide rapidly, including:

- Cells lining the digestive tract (this is the tube that takes food through your body as it is being digested)
- Red blood cells (which carry oxygen and food around the body)
- White blood cells (which fight infection)
- Hair cells
- Cells in the **ovaries** .

Because of the effects of chemotherapy drugs on these cells, you may feel sick and vomit during or after your treatment. You may also feel tired, lose your hair, put on weight and get symptoms of the **menopause** . To learn more, see [Side effects of chemotherapy](#)

### How good is the research on chemotherapy after surgery for early breast cancer?

A review of the research (a **systematic review** ) looked at 47 well-designed studies ( **randomised controlled trials** ) with 18,000 women. <sup>[83]</sup>

The research showed that chemotherapy helped reduce women's chance of their breast cancer coming back, whether or not the cancer had spread to their **lymph nodes** . <sup>[84]</sup> Women who had chemotherapy also lived longer, especially if they were under 50 and had cancer involving their lymph nodes, or if they were aged 50 to 69 and had cancer only in their breast. <sup>[118]</sup>

### Chemotherapy with anthracycline drugs

One review (a systematic review) looked at 11 well-designed studies (randomised controlled trials) with 5,942 women. <sup>[83]</sup> Women given anthracyclines were less likely to have their cancer come back than women given the regular anti-cancer drugs. Women given anthracyclines were also more likely to be alive five years later.

Another large analysis that compared results from 123 well-designed studies using different combinations of drugs found that the value of giving an anthracycline might depend on the particular treatment combination. A combination of doxorubicin with cyclophosphamide (known as AC) wasn't any more effective than standard

## Breast cancer

cyclophosphamide, methotrexate, and 5-fluorouracil (CMF). However, women treated with a three-drug combination, using either doxorubicin or epirubicin with cyclophosphamide and 5-fluorouracil, were more likely to be alive 10 years later than those given CMF or AC. <sup>[116]</sup>

### Larger doses or extra doses of chemotherapy

In a summary (systematic review) of 123 well-designed studies involving over 100,000 women, it seemed that women given extra cycles of treatment, either with a taxane or a non-taxane drug, and those given combinations including higher doses of an anthracycline drug, were more likely to be alive 10 years later than those given less intensive treatment. <sup>[116]</sup>

However, several well-designed studies (randomised controlled trials) have found that women didn't get any extra benefit from having larger doses of anti-cancer drugs. <sup>[84]</sup>

<sup>[118]</sup> Women who had larger doses of chemotherapy didn't seem to live any longer than women who had normal doses.

### Chemotherapy with taxane drugs

One summary (a systematic review) looked at 13 well-designed studies (randomised controlled trials) covering almost 23,000 women. Women who took taxanes as well as a chemotherapy regime including an anthracycline drug were more likely to be alive five years later, and to be free from cancer. <sup>[117]</sup> Another summary, involving 123 studies of different drug combinations in more than 100,000 women, also found that women given extra cycles of treatment with a taxane were more likely to be alive 10 years later, although this was also true if they had extra cycles of treatment with a non-taxane drug. <sup>[116]</sup>

---

## Tamoxifen for early breast cancer

In this section

[Does it work?](#)

[What is tamoxifen?](#)

[How can it help?](#)

[How does it work?](#)

[Can it be harmful?](#)

[How good is the research on tamoxifen for early breast cancer?](#)

This information is for people who have early breast cancer. It tells you about tamoxifen, a treatment used for early breast cancer. It is based on the best and most up-to-date research.

### Does it work?

Yes. If you have early breast cancer that is **oestrogen-receptor positive**, taking tamoxifen for up to five years after surgery reduces the chance that your cancer will come back. It also reduces the chance that you will die from breast cancer.

### What is tamoxifen?

Tamoxifen is a drug that you take as a tablet. It stops the female hormone **oestrogen** working in the body. Some breast cancers are more sensitive to oestrogen than others (they are oestrogen-receptor positive). This means that oestrogen encourages them grow.

Most women with early breast cancer are treated with [breast-conserving surgery](#) to remove the cancer, followed by [radiotherapy](#). Some women also take tamoxifen. This information tells you how much extra benefit you may get from taking tamoxifen compared with just having surgery and radiotherapy.

Your doctor will do tests on your tumour to find out if it is oestrogen-receptor positive. If it is, your doctor may prescribe tamoxifen for you for up to five years after your breast cancer has been removed with surgery. Sometimes doctors also prescribe tamoxifen for women whose cancers are not oestrogen-receptor positive but seem to be affected by hormones.

Tamoxifen works around the whole body, not just the breast. The aim of this treatment is to reduce the risk of new breast cancer growing in either breast.

There are many brand names for tamoxifen. They include Nolvadex, Soltamox, and Tamofen.

### How can it help?

- If you have early, oestrogen-receptor positive breast cancer, taking tamoxifen for up to five years halves the chance that your cancer will come back after surgery. <sup>[72]</sup>
- Tamoxifen also reduces the chance that you will die of breast cancer if your cancer is oestrogen-receptor positive.
- If your breast cancer isn't oestrogen-receptor positive, then tamoxifen may not help you very much.
- Tamoxifen may not work as well if you take it for less than five years. <sup>[72]</sup> Some research suggests that taking tamoxifen for 10 years rather than five may further reduce the chance that your cancer will come back or that you will die of breast cancer. But taking tamoxifen for longer can also increase the risk of [side effects](#). <sup>[119]</sup>

### How does it work?

Tamoxifen helps prevent some types of breast cancer developing further. Some breast cancers are encouraged to grow by oestrogen (a female hormone). Tamoxifen prevents this type of breast cancer developing by blocking the place on breast cells where oestrogen would normally attach. It affects both normal cells and cancer cells. (These



## Breast cancer

types of cancers are called oestrogen-receptor positive because the place on the cell that oestrogen attaches to is known as a **binding site** or a **receptor site**.)

Tamoxifen stops oestrogen being able to tell the cell what to do, which in this case is to keep growing and dividing in an uncontrolled way.

Tamoxifen slows the cell's growth. It can potentially slow down the growth of a cancer cell until it stops. Tamoxifen may also encourage cells to die early. <sup>[70]</sup>

### Can it be harmful?

When you take tamoxifen, the female hormone oestrogen stops working in your body. This can give you symptoms of the **menopause**, such as hot flushes (which can be severe), irregular periods, and vaginal dryness. About half the women who take tamoxifen get these types of symptoms. The symptoms are more likely if you haven't been through the menopause. <sup>[70]</sup>

Tamoxifen may also cause indigestion or make you feel sick. There are also some less common side effects of taking tamoxifen, including **cataracts** and **deep vein thrombosis**. <sup>[70]</sup> To learn more, see [Side effects of tamoxifen](#).

### How good is the research on tamoxifen for early breast cancer?

There's good evidence that tamoxifen can help women with early breast cancer. One review of the research combined information on nearly 21,500 women from 20 different studies. <sup>[72]</sup> They compared women who took tamoxifen after surgery with women who took a dummy treatment (a **placebo**).

Researchers found that taking tamoxifen can help if you have breast cancer that is encouraged to grow by oestrogen (it is **oestrogen-receptor positive**). The results suggest that taking tamoxifen for five years: <sup>[72]</sup>

- Reduces the risk that your cancer will come back by half
- Reduces the risk that you will die from breast cancer during the 15 years after starting tamoxifen by about a third.

Some research suggests that taking tamoxifen for 10 years rather than five years may be even more helpful. One large study looked at nearly 7,000 women with oestrogen-receptor positive breast cancer. The women were randomly assigned to take tamoxifen for either five years or 10 years. Women who took tamoxifen for longer were less likely to have their cancer come back or to die of breast cancer. <sup>[119]</sup> But they were also more likely to get a blood clot in their lungs and cancer in the lining of their womb (endometrial cancer). More studies are exploring whether taking tamoxifen for longer is worth the risks.

# Ovarian ablation for early breast 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 ovarian ablation for early breast cancer?](#)

This information is for people who have early breast cancer. It tells you about ovarian ablation, a treatment sometimes used for early breast cancer. It is based on the best and most up-to-date research.

## Does it work?

Yes. If you haven't been through the **menopause**, stopping your ovaries making oestrogen (**ovarian ablation**) may help you live longer.

## What is it?

Ovarian ablation stops the ovaries working in women who haven't gone through the menopause. Stopping the ovaries working reduces the amount of the **hormone** oestrogen that is produced by the body. This is important because oestrogen can help some breast cancers to grow.

Ovarian ablation is a type of hormone therapy. It's used to lower your risk of getting a new breast cancer.

Your doctor may suggest ovarian ablation if he or she thinks there's still a high risk that the cancer could come back after you've had other treatments. It is usually recommended only for women who haven't reached the menopause and whose breast cancer is sensitive to oestrogen (it is **oestrogen-receptor positive**).

Ovarian ablation can be done in a few ways.

You can have **surgery** to remove your ovaries while you're under a **general anaesthetic**.

Another option is to use **medicine, such as hormones**. For example, goserelin reduces the amount of a hormone that is released by the pituitary gland (a small gland in the brain). This hormone ordinarily increases the amount of oestrogen in the body. The brand name for goserelin is Zoladex.

Goserelin is given as an injection just under your skin. Within three weeks, it works as well as if you had your ovaries removed by surgery, but it has the advantage of being reversible. You may need to be treated with it for two years to five years. Once you stop using goserelin, it may take six months for your ovaries to start working again.

## Breast cancer

Ovarian ablation can also be done with **radiotherapy**. This can take a few months to work and can cause **diarrhoea**, stomach pain, and vomiting. There is a small chance that radiotherapy won't work.

### How can it help?

If you haven't yet gone through the menopause but have had surgery and radiotherapy, adding ovarian ablation may help you live longer and lower the chance that your cancer will come back or spread to other parts of your body. Several good studies have looked at ovarian ablation done through **radiation** or **surgery**. Here's what they've found: <sup>[120]</sup>

- Women's chances of being alive 15 years after surgery rose from 46 in 100 to 52 in 100 with ovarian ablation
- Women's chances of having their cancer come back within 15 years fell from 45 in 100 to 39 in 100 with ovarian ablation.

Ovarian ablation can help even if the cancer has spread to your **lymph nodes**.

Not as much good research has been done on using a medicine for ovarian ablation. But several studies have suggested that treatment with **goserelin** can help women live longer and reduce their risk of cancer coming back. <sup>[121]</sup>

Ovarian ablation doesn't help women who have already gone through the menopause. <sup>[120]</sup>

### How does it work?

If you have not yet gone through the menopause and you have a breast cancer that is encouraged to grow by oestrogen, then switching off the production of oestrogen is likely to improve your chances of living longer. If there is less oestrogen in your body, the cancer will not grow so quickly.

### Can it be harmful?

Side effects that happen soon after treatment are caused by the lack of oestrogen in the body. These include symptoms of the menopause, such as hot flushes (which can be severe), vaginal dryness, loss of sex drive, and sleep problems.

Longer-term side effects can include:

- Heart problems (oestrogen protects women against **heart disease** until they go through the menopause)
- Weakened bones that can break more easily (oestrogen helps **calcium** make bones stronger). Doctors are advised to check the density of women's bones with a special type of **X-ray** before they start ovarian ablation. <sup>[36]</sup>

## Breast cancer

Women having ovarian ablation should be offered bone scans before and after treatment, to check for weakened bones. <sup>[36]</sup>

### How good is the research on ovarian ablation for early breast cancer?

There's good evidence that ovarian ablation by radiotherapy or surgery is helpful for women with early breast cancer who haven't yet gone through the **menopause** .

One review of the research (a **systematic review** ) looked at 12 fairly high-quality studies ( **randomised controlled trials** ) that followed 2,102 women for at least 15 years after they were diagnosed. <sup>[120]</sup>

After 15 years, women who'd had ovarian ablation to stop their ovaries working were more likely to be alive and to not have had their cancer come back than those who did not have ovarian ablation.

Not as much good research has been done on using drugs for ovarian ablation. However, a review of studies did find that ovarian ablation with a drug called **goserelin** can help women live longer and reduce their risk of cancer coming back. <sup>[121]</sup>

---

## Aromatase inhibitors for early breast 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 aromatase inhibitors for early breast cancer?](#)

This information is for people who have early breast cancer. It tells you about aromatase inhibitors, a treatment used for early breast cancer. It is based on the best and most up-to-date research.

### Do they work?

Yes. If your cancer is helped to grow by **oestrogen** and you have gone through the **menopause** , taking an aromatase inhibitor can help reduce the risk that your cancer will come back. It can also reduce the chance that you will get cancer in your other breast. But we don't know if taking an aromatase inhibitor will help you live longer.

Aromatase inhibitors aren't used for women who haven't been through the menopause.

### What are they?

Aromatase inhibitors are drugs used to treat breast cancers that are sensitive to oestrogen (they are **oestrogen-receptor positive** ). Oestrogen is a hormone that encourages some cancers to grow. Your doctor will do tests on your tumour to find out if it is sensitive to oestrogen.

## Breast cancer

Aromatase inhibitors stop your body making oestrogen. The aim is to reduce the chance that your cancer will come back.

There are three aromatase inhibitors available in the UK. They are (with brand names):

- anastrozole (Arimidex)
- exemestane (Aromasin)
- letrozole (Femara).

Anastrozole, exemestane, and letrozole are all tablets you take once a day.

Aromatase inhibitors have been used for years to treat breast cancer that has spread to another part of the body (it has metastasised), but more recent research has tested these drugs in women with early breast cancer. Early breast cancer is cancer that is contained within the breast or has spread to the **lymph nodes** in the armpit.

This information is about aromatase inhibitors for **early breast cancer**.

### When are they used?

Most women with early breast cancer have [surgery to remove their cancer](#) . Many women also have **radiotherapy** after their surgery. But these two treatments treat only the breast. You may also need treatments that kill any stray cancer cells that are left in your body.

Aromatase inhibitors treat your whole body. They reduce the amount of oestrogen your body makes. So, if your cancer is sensitive to oestrogen, cutting the amount of oestrogen in your body stops it growing.

Aromatase inhibitors are given only to women who have been through the **menopause** . If you haven't been through the menopause, you may be offered a drug called [tamoxifen](#) instead.

Tamoxifen is another drug that affects your hormones. Women often take it for five years after they have surgery for breast cancer. If you've been through the menopause, aromatase inhibitors can be used instead of tamoxifen for some or all of the five years. Or your doctor may suggest that you start taking an aromatase inhibitor after you've finished a five-year course of tamoxifen. So: <sup>[122]</sup> <sup>[123]</sup>

- You might start treatment with an aromatase inhibitor straight after surgery, instead of tamoxifen
- You might change to an aromatase inhibitor after you've been taking tamoxifen for a while. You and your doctor may plan this from the start, so you switch from tamoxifen to an aromatase inhibitor after a certain time. Or you may decide to change as you go along. For example, if you get side effects from tamoxifen

## Breast cancer

- You might start taking an aromatase inhibitor after you've finished a five-year course of tamoxifen.

### How can they help?

Taking an aromatase inhibitor can reduce the chance of your cancer coming back, if you have oestrogen-sensitive breast cancer. <sup>[124]</sup> <sup>[125]</sup> <sup>[126]</sup> <sup>[127]</sup> <sup>[128]</sup> <sup>[129]</sup>

This is true whether you take it for five years immediately after surgery, or if you take it after taking tamoxifen for two or three years. Most of the research compares aromatase inhibitors to tamoxifen. One summary of the research (a **systematic review**) found that: <sup>[124]</sup>

- Women who took aromatase inhibitors for five years after surgery had a 10 in 100 chance of their cancer coming back. This compared to a 13 in 100 chance if they took tamoxifen for five years.
- Women who took aromatase inhibitors for three years, after taking tamoxifen for two to three years, had a 5 in 100 chance of their cancer coming back. This compared to an 8 in 100 chance if they continued taking tamoxifen for the full five years.

Other research looks at the different aromatase inhibitor drugs separately.

- One study looked at women who started taking letrozole after they'd taken tamoxifen for five years. <sup>[125]</sup> Women who took it were less likely to have their cancer come back. After four years, 93 in 100 women who took letrozole were still free of cancer. This compared with 87 in 100 women who took a dummy treatment (a **placebo**).
- One study found that anastrozole worked better than tamoxifen when women took it for five years after surgery. <sup>[126]</sup> <sup>[127]</sup> <sup>[128]</sup>
- One study found that switching to exemestane after taking tamoxifen for two or three years worked better than taking tamoxifen for the whole five years. <sup>[129]</sup> Women who took it were less likely to have their cancer come back.

Aromatase inhibitors also reduce your chance of getting cancer in your other breast. <sup>[128]</sup> <sup>[129]</sup>

Even though aromatase inhibitors seem to be better than tamoxifen at stopping your cancer coming back, most of the research shows that women who take them don't seem to live any longer than women who take tamoxifen. <sup>[123]</sup> However, one more recent study did find that aromatase inhibitors helped women live longer, compared with tamoxifen.

## Breast cancer

There isn't much research on the long-term benefits and side effects of aromatase inhibitors.<sup>[123]</sup> Most of the studies didn't follow women for very long after they stopped taking their treatment.<sup>[130]</sup>

### How do they work?

Aromatase inhibitors lower the amount of oestrogen in your body. Some breast cancers are oestrogen-receptor positive. This means they are encouraged to grow by oestrogen. Reducing the amount of oestrogen in your body helps stop this kind of cancer growing or spreading.

Tamoxifen is another drug that affects the way oestrogen works in your body. But aromatase inhibitors work differently from tamoxifen. Tamoxifen works by blocking the effects of oestrogen. But if you've gone through the menopause, your body makes less oestrogen anyway. After the menopause, your ovaries will have stopped making oestrogen, but your adrenal glands will still make small amounts. Aromatase inhibitors stop your adrenal glands making oestrogen.

### Can they be harmful?

Aromatase inhibitors have some side effects. You may get symptoms of the menopause. For example, you may get hot flushes (which can be severe) and vaginal bleeding. These symptoms are less common with aromatase inhibitors than with tamoxifen. You may also get aching joints and weak bones that can break (fracture) more easily. These symptoms seem more common with aromatase inhibitors than tamoxifen.<sup>[131]</sup> <sup>[132]</sup> <sup>[133]</sup>

Women taking aromatase inhibitors should be offered bone scans before and after treatment, to check for weakened bones.<sup>[36]</sup>

### How good is the research on aromatase inhibitors for early breast cancer?

There's good evidence that aromatase inhibitors can help women who have gone through the menopause and whose cancer is encouraged to grow by oestrogen.

We found a summary of the research (a systematic review) looking at about 18,000 women.<sup>[124]</sup> The research found that women were less likely to have their cancer return if they took an aromatase inhibitor, whether or not they had taken tamoxifen first.

#### Exemestane (brand name Aromasin)

In one study of 4,742 women (a randomised controlled trial), switching to exemestane after taking tamoxifen for two to three years reduced the chance of breast cancer coming back in the same place or in the other breast. It worked better than taking tamoxifen for the whole time.<sup>[129]</sup>

When doctors checked on the women after five years, women treated with exemestane were more likely to be alive than women taking tamoxifen.<sup>[130]</sup>

## Breast cancer

### Letrozole (brand name Femara)

A study of letrozole (a randomised controlled trial) included more than 5,000 women who had already been treated with tamoxifen for five years. Taking letrozole after five years of taking tamoxifen reduced women's risk of having their cancer come back and of dying from breast cancer.<sup>[134]</sup> But it didn't help women live longer overall.

### Anastrozole (brand name Arimidex)

One large study of 10,000 women (a randomised controlled trial) found that anastrozole worked better than tamoxifen for women with early breast cancer and caused fewer side effects.<sup>[128]</sup> <sup>[127]</sup> <sup>[126]</sup>

In the five years after surgery, women who took anastrozole were less likely to get their breast cancer back than women who took tamoxifen. Women who took anastrozole were also about half as likely to get cancer in their other breast or somewhere else in their body.

A follow-up study found that the benefits of taking anastrozole over tamoxifen continued after women stopped taking the drugs.<sup>[135]</sup>

Side effects for anastrozole included bone pain and weakened bones that could break (fracture) more easily.

---

## Trastuzumab (Herceptin)

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 trastuzumab \(Herceptin\) for early breast cancer?](#)

This information is for people who have early breast cancer. It tells you about trastuzumab, a treatment used for some types of early breast cancer. It is based on the best and most up-to-date research.

### Does it work?

Yes. Treatment with trastuzumab can reduce the chances of your cancer coming back. But trastuzumab will work only if you have a type of breast cancer in which the cancer cells make a protein called HER-2.

### What is it?

Trastuzumab is a type of drug called a **monoclonal antibody**. This means that it is made in a laboratory to attack specific cancer cells. The brand name for trastuzumab is Herceptin.



## Breast cancer

Trastuzumab is used to treat some types of breast cancer. It attacks cancer cells that make too much of a protein called HER-2. This protein is found on the surface of some cancer cells. Trastuzumab slows down or stops cells with too much HER-2 growing.

About 1 in 5 breast cancers make too much HER-2. <sup>[136]</sup> These tumours grow faster and are more likely to come back than those that don't make too much HER-2.

Your doctor can measure the amount of HER-2 protein in your tumour. This helps your doctor decide whether trastuzumab might be right for you.

Trastuzumab can be given on its own or with chemotherapy. It's given as a drip (also called an IV or an intravenous infusion). It takes between 30 minutes and 90 minutes to have one treatment. Most women are treated with trastuzumab every three weeks for a year. Or they might have a lower dose every week for a year. <sup>[136]</sup>

### Who can take it?

About half the women diagnosed with breast cancer each year in the UK are suitable for HER-2 testing. <sup>[137]</sup> That's about 20,000 women who can be tested to see if their tumour makes too much HER-2. About 1 in 4 of these women could benefit from treatment with trastuzumab. <sup>[137]</sup>

In the UK, trastuzumab is licensed to treat:

- Women with cancer that has spread to other parts of their body, such as their liver. This is called **advanced (metastatic) breast cancer**.
- Women with **early** or **locally advanced** breast cancer.

To learn more about these cancers, see [Types of breast cancer](#) .

Guidelines from the National Institute for Health and Care Excellence (NICE), the government body which advises the government on which treatments should be available on the NHS, say women with **early, locally advanced breast cancer**, or **advanced breast cancer**, who could benefit from trastuzumab should all be offered it through the NHS. <sup>[138]</sup> <sup>[139]</sup>

### How can it help?

Being treated with trastuzumab can reduce the risk that cancer will come back, compared with having chemotherapy on its own. It can also reduce the risk of dying from breast cancer. A summary of the research ( a systematic review ) that looked at 11 studies involving nearly 12,000 women found that trastuzumab reduced the risk of dying of breast cancer by about a third, and reduced the risk of the disease coming back by even more than this. Over two to three years this would mean that: <sup>[140]</sup>

- 93 out of 100 women who were given trastuzumab would be still be alive, and 74 of these would be free of cancer

## Breast cancer

- 90 out of 100 women who didn't get trastuzumab would still be alive, and 65 of them would be free of cancer.

### How does it work?

Trastuzumab attacks cancer cells that make too much of a protein called HER-2. About 1 in 5 breast cancers make too much HER-2.<sup>[136]</sup> These tumours grow faster and are more likely to come back than those that don't make too much HER-2. Trastuzumab slows down or stops cells with too much HER-2 growing.

### Can it be harmful?

You may get a high temperature and chills after treatment with trastuzumab. Other common side effects include pain, weakness, sickness, diarrhoea, headaches, breathing problems, and rashes. These side effects tend to be worst after the first treatment with trastuzumab.

Trastuzumab can also cause **heart problems**, especially when it's used with some types of chemotherapy.<sup>[141]</sup> In particular, it can lead to heart failure, which can cause breathing problems, shortness of breath, a fast or irregular heartbeat, a cough, and swollen feet or ankles. A review of the research (a **systematic review**) that looked at 11 studies with nearly 12,000 women found that about 26 women in 1,000 would develop serious heart problems (heart failure) if treated with trastuzumab for a year. This compared with about 5 in 1,000 women not treated with trastuzumab. The risk might be a bit lower if the trastuzumab was given for a shorter time (six months) but there isn't a lot of evidence to support this.<sup>[140]</sup>

Trastuzumab can also seriously affect the **lungs**. This can cause severe breathing problems as well as an **allergic reaction**. A serious allergy can lead to a drop in **blood pressure**, breathing problems, rashes and wheezing.

Because of these problems, women who have HER-2 positive breast cancer are carefully checked to see if they are healthy enough to be treated with trastuzumab. Women are also monitored throughout their treatment.

### How good is the research on trastuzumab (Herceptin) for early breast cancer?

A summary of the research (a **systematic review**) looked at 11 well-designed studies (**randomised controlled trials**) involving almost 12,000 women with early breast cancer of the type that makes HER-2. It found that over two to three years of follow-up:<sup>[140]</sup>

- 93 out of 100 women who were given trastuzumab were still alive, compared with 90 out of 100 who didn't get trastuzumab
- 74 out of 100 women given trastuzumab were free of cancer, compared with 65 of 100 not given trastuzumab.

# Chemotherapy to shrink the tumour before surgery for early breast 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 having chemotherapy to shrink the tumour before surgery for early breast cancer?](#)

This information is for people who have early breast cancer. It tells you about chemotherapy to shrink the tumour before surgery, a treatment sometimes used for early breast cancer. It is based on the best and most up-to-date research.

## Does it work?

Probably. Women who have chemotherapy before surgery are less likely to need surgery that removes their whole breast (a mastectomy). But it doesn't help them to live longer.

If you have chemotherapy before surgery, your doctor may call it **neoadjuvant chemotherapy**.

## What is it?

Chemotherapy drugs are used to kill breast cancer cells. They treat the whole body and will affect both normal cells and cancer cells.

Chemotherapy can be used:

- Before surgery, to reduce the size of your breast tumour. This makes it easier to remove. It could make the difference between removing a breast cancer lump (breast-conserving surgery) and the whole breast (mastectomy)
- After surgery, to reduce the chance of breast cancer coming back
- After surgery, to reduce the chance that breast cancer will grow somewhere else in your body
- After surgery, to control breast cancer that has spread to other parts of your body.

Chemotherapy drugs are most effective at killing cells that divide rapidly. Cancer cells divide into new cells faster than normal cells, so chemotherapy should kill more cancer cells than normal cells.

Unfortunately, the drugs used in chemotherapy also affect other cells in the body that divide rapidly. This can cause side effects (see below).

Chemotherapy drugs can be given as tablets or as a drip (also called an IV or an intravenous infusion). You may get treatment at a clinic or hospital as an outpatient.

## Breast cancer

Just as **bacteria** can become resistant to the **antibiotics** used to fight them, cancer cells can become resistant to anti-cancer drugs. Cancer cells can change and adapt to avoid being damaged by chemotherapy drugs. Because of this, more than one drug is given at a time.

Common combinations of these drugs include:

- doxorubicin and cyclophosphamide
- cyclophosphamide, methotrexate and 5-fluorouracil (this combination is also called CMF).

Doxorubicin is a type of drug called an anthracycline. Chemotherapy that includes an anthracycline may be more effective than other types, although more research is needed.

### How can it help?

If you have this treatment, you'll have chemotherapy before you have surgery. This should make your cancer smaller. This may make it possible for your surgeon to remove only part of your breast instead of your whole breast. <sup>[142]</sup>

Women who have chemotherapy before surgery may be slightly more likely to have their cancer return in their breast than those who have chemotherapy after. Even so, women seem to live just as long whether they have chemotherapy before or after surgery. <sup>[142]</sup>

### How does it work?

Chemotherapy helps shrink the size of your cancer before you have surgery to take it out.

It does this by killing cells that divide rapidly, such as cancer cells. This makes your cancer smaller. If your cancer is smaller, your surgeon may be able to remove less of your breast.

Many women with breast cancer who have chemotherapy before surgery don't need to have their whole breast removed.

### Can it be harmful?

The side effects of chemotherapy drugs happen mainly because they kill some normal cells along with the cancer cells. In particular, they target cells that divide rapidly, including:

- Cells lining the digestive tract (this is the tube that takes food through your body as it is being digested)
- Red blood cells (which carry oxygen and food around the body)
- White blood cells (which fight infection)

## Breast cancer

- Hair cells
- Cells in your ovaries .

Because of the effects of chemotherapy drugs on these cells, you may feel sick and vomit during or after your treatment. You may also feel tired, lose your hair, put on weight and get symptoms of the menopause . To read more, see [Side effects of chemotherapy](#)

### How good is the research on having chemotherapy to shrink the tumour before surgery for early breast cancer?

There's some good research on the effects of chemotherapy before surgery. We found a summary of the research (a systematic review ) that looked at 14 good-quality studies ( randomised controlled trials ) with a total of 5,500 women.<sup>[142]</sup> Some women had chemotherapy before surgery, and others had chemotherapy after.

Overall women were **less likely to have their entire breast removed** if they had chemotherapy before surgery. But women who had chemotherapy before surgery were slightly more likely to have their cancer return in their breast than those who had chemotherapy after. Even so, women lived just as long whether they had chemotherapy before or after surgery.<sup>[142]</sup>

Six studies have also compared different chemotherapy drugs used before surgery.<sup>[143]</sup>  
<sup>[144]</sup> <sup>[145]</sup> <sup>[146]</sup> <sup>[147]</sup> <sup>[148]</sup> There was no evidence that any one type of chemotherapy was better than another.

---

## Radiotherapy to the lymph nodes in the armpit for early breast 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 to the lymph nodes in the armpit for early breast cancer?](#)

This information is for people who have early breast cancer. It tells you about radiotherapy to the lymph nodes in the armpit, a treatment sometimes used for early breast cancer. It is based on the best and most up-to-date research.

### Does it work?

Probably. If you have early breast cancer, treating the lymph nodes in your armpit with radiotherapy works about as well as removing the lymph nodes affected by cancer. But it has side effects.

## What is it?

Radiotherapy uses X-rays to destroy cancer cells.

If you have early breast cancer you'll probably have surgery to remove the cancer. During this surgery, your surgeon may also remove some, or all, of the lymph nodes in your armpit. This is because these nodes are usually the first place breast cancer spreads to.

Some women also have radiotherapy to the remaining nodes in the armpit. Doctors usually recommend this only if there were lots of cancer cells in the lymph nodes removed.

Radiotherapy doesn't hurt, but it has side effects. To learn more about what happens in radiotherapy, see [How does radiotherapy work?](#)

## How can it help?

Treating the armpit with radiotherapy can reduce the chance that your cancer will come back in the place where it started. <sup>[149]</sup>

## How does it work?

If there are any cancer cells in your armpit, killing them with radiotherapy reduces the risk that they will spread to another part of your body.

## Can it be harmful?

There aren't many studies on the side effects of radiotherapy. <sup>[87]</sup> Different women have different experiences. You may have heard some worrying stories about radiotherapy, but many women cope well with the side effects. Generally the side effects of radiotherapy can be divided into two groups: side effects that happen early and side effects that happen later.

- **Early side effects:** Your skin may itch or change colour after radiotherapy, and your armpit may feel tender. <sup>[66]</sup> Some women feel more tired than usual. These problems are usually mild and go away after a few weeks.
- **Later side effects:** You may get nerve damage. This sounds serious, but **it is rare** and can be treated. You may also find that hair stops growing in your armpit.

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

## How good is the research on radiotherapy to the lymph nodes in the armpit for early breast cancer?

We found one summary of the research (a systematic review ) that looked at 26 studies ( randomised controlled trials ) involving women who had radiotherapy to their armpit.

<sup>[150]</sup> The summary found that having radiotherapy to the armpit reduced the chance of

## Breast cancer

cancer coming back whether or not women had cancer in the lymph nodes . But it was less clear whether this helped women live longer.

---

### Removing all the lymph nodes in the armpit for early breast 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 removing all the lymph nodes under the armpit for early breast cancer?](#)

This information is for people who have early breast cancer. It tells you about removing all the lymph nodes in the armpit, a treatment sometimes used for early breast cancer. It is based on the best and most up-to-date research.

#### Does it work?

Probably not. If you have early breast cancer, removing all of the lymph nodes from your armpit (axillary clearance) probably won't help you live longer than removing a small number (axillary sampling or sentinel node biopsy) and examining them for cancer cells. And you're more likely to get side effects if all your lymph nodes are removed than if just some are removed.

#### What is it?

If you have early breast cancer, your surgeon needs to find out if the cancer has spread to the lymph nodes under your armpit (the armpit is also called the axilla). This is because these nodes are usually the first place breast cancer spreads to. To read more, see [What are lymph vessels?](#)

Lymph nodes are usually removed from the armpit during surgery to remove the cancer in the breast.

- If you have breast-conserving surgery (where just the cancer is removed, not the whole breast) and your cancer is in the upper part of your breast near your armpit, your surgeon may be able to reach your lymph nodes through the same cut he or she made in your breast. But if your cancer is somewhere else, the surgeon will need to make a cut under your arm to reach the lymph nodes.
- If you have a mastectomy, the lymph nodes can be removed through the cut made to remove the breast.

By removing some of your lymph nodes and examining them to see if they contain any cancer cells, doctors can get a better idea of whether your cancer has spread.

If the lymph nodes in your armpit have cancer cells in them, then you need further treatment. This is because there may be other cancer cells in the remaining lymph nodes.

## Breast cancer

There are a few approaches to checking the lymph nodes for cancer cells.

- **Axillary clearance.** This involves having all 20 or so lymph nodes removed from your armpit. It is done to check whether any of the lymph nodes have cancer cells, and, if so, how many of them have cancer cells. This can influence your treatment because the more lymph nodes that have cancer cells, the more likely your tumour may be to spread. The aim is to remove all of the cancer by removing all of the lymph nodes.
- **Axillary sampling.** This involves removing between four and 10 lymph nodes to see if they contain cancer cells. If the nodes in the lowest part of your armpit are clear of cancer, it's unlikely that any of the nodes higher up will have cancer in them.
- **Sentinel node biopsy.** This is a newer treatment that doctors use to avoid removing lymph nodes unless absolutely necessary. An injection of a blue dye, a radioactive material or both is put into your breast (in the UK, doctors are advised to use both).<sup>[36]</sup> This shows up the lymph node (or nodes) that fluid from the breast drains into first.<sup>[51]</sup> These nodes, called the sentinel nodes, are then removed and tested for cancer. If there are no cancer cells in these nodes, it's likely that the other lymph nodes are free from cancer as well. To learn more, see [Sentinel node biopsy for early breast cancer](#).

The National Institute for Health and Care Excellence (NICE), which advises the government on health care, says most women should have a sentinel node biopsy, not axillary clearance.<sup>[36]</sup>

To decide which method to use, your doctor will first check the lymph nodes for signs of cancer with an **ultrasound**. If there are no signs of cancer in the nodes, a **sentinel node biopsy** is the preferred treatment, since it causes fewer side effects.<sup>[36]</sup>

If there are signs of cancer on the ultrasound, your doctors will remove a small amount of tissue from the node using a needle. If the tissue doesn't have cancer cells, then a sentinel node biopsy is still the preferred treatment. If cancer cells are in the node, then your doctor may recommend having them all removed (axillary clearance).<sup>[36]</sup>

### How can it help?

Removing all the lymph nodes from your armpit (axillary clearance) doesn't seem to help more than other treatments. And you're more likely to get problems afterwards if you have all your lymph nodes removed. Here's what the research tells us:

- You're just as likely to be alive two years later if you have all your lymph nodes removed or if you have just your sentinel nodes removed.<sup>[151]</sup>



## Breast cancer

- You're just as likely to be alive after five years if you have all your lymph nodes removed, or if you have four to 10 lymph nodes removed, and then have radiotherapy to your armpit, if cancer cells are found in the nodes. <sup>[152]</sup>
- You're just as likely to be alive after 10 years if you have all your nodes removed or if you have radiotherapy to your lymph nodes (whether there are cancer cells in them or not). <sup>[153]</sup>

### How does it work?

Your doctor needs to know if your breast cancer has spread to your lymph nodes. This will help your doctor decide whether you need more treatment where your tumour was (local treatment) and whether you need treatment in the rest of your body (systemic treatment). Examining your lymph nodes also helps your doctor find out how advanced your cancer is.

If your breast cancer has spread to your lymph nodes, then it might also have spread to somewhere else in your body. [Anti-cancer drugs](#) and hormonal treatments (such as [tamoxifen](#)) can stop these stray cancer cells growing and kill them. These are systemic treatments (they treat your whole body).

If there are cancer cells in your armpit, then you also need treatment there (local treatment). Radiotherapy can kill cancer cells in this area and may be less traumatic than having all your lymph nodes removed.

### Can it be harmful?

The most common side effects of removing some or all the lymph nodes from your armpit are listed below.

- The **pain and discomfort** under your arm can last for a few weeks. <sup>[50]</sup> Your arm may feel bruised and heavy.
- **Shoulder stiffness** can start because your upper arm is painful after surgery. In one study, about 1 in 4 women had this problem. <sup>[50]</sup> You need to take painkillers and do gentle arm exercises. <sup>[154]</sup> Don't let your shoulder stiffen up because it hurts to move it. Six months after surgery, stiffness is more common in women who have all, rather than a few, of their lymph nodes removed. <sup>[152]</sup>
- You may get **numbness or tingling** in your arm, shoulder or breast. This happens if the surgeon accidentally stretches or damages the nerves that run close to your lymph nodes. Women who get this problem after having a few of their lymph nodes removed tend to recover within a few months. About 2 to 4 out of 10 women who have all their nodes removed get this problem. <sup>[50]</sup>

## Breast cancer

- Swelling of the arm and armpit (**lymphoedema**) can start straight away or years later. It happens when **lymph fluid** can't drain properly because lymph nodes have been removed. It can be very unpleasant. Your arm may feel heavy and painful. Wearing a tight-fitting elastic sleeve can help prevent the swelling. Gentle massage may also help. The risk of getting lymphoedema is greater if you have all the lymph nodes in your armpit removed. It's hard to say how common the problem is because studies say different things. At least 1 out of 3 women get lymphoedema after all their lymph nodes are removed. Some studies show that there is no risk of lymphoedema if only a few nodes are removed. But other studies show that up to 2 in 10 women get this problem after a few nodes are removed.<sup>[64]</sup> Lymphoedema won't go away, but it can be treated so that the swelling goes down. If the swelling comes back, see your doctor as soon as you can.
- **Fluid** can collect under the scar in your armpit. This is part of the normal healing process. It happens to between a quarter and half of women who have all their lymph nodes removed.<sup>[152]</sup>

### How good is the research on removing all the lymph nodes under the armpit for early breast cancer?

There are no big summaries of research ( **systematic reviews** ) comparing removing all the **lymph nodes** under the armpit (axillary clearance) with removing a small number to examine for cancer (sentinel node biopsy or axillary sampling).

One study (a **randomised controlled trial** ) looked at 516 women who had a small breast cancer and received **radiotherapy** after surgery.<sup>[155]</sup> Some women had a sentinel node biopsy alone and others had a sentinel node biopsy plus some or all of their lymph nodes removed.

- Women who had only a sentinel node biopsy had less severe pain and could move their arm better.
- The women were just as likely to be alive two years later, whichever treatment they had.

Another study looked at almost 300 women.<sup>[156]</sup> It found that women who had a sentinel node biopsy had less loss of feeling and swelling in their arm than women who had other treatments to remove lymph nodes.

Another study (a **randomised controlled trial** ) looked at 466 women who'd had breast-conserving surgery . It compared the effects of removing all the lymph nodes (axillary clearance) with removing between four and 10 lymph nodes (axillary sampling) and then having **radiotherapy** if any cancer cells were found.<sup>[152]</sup> The results showed that women were just as likely to be alive after five years whichever treatment they had.

## Breast cancer

One big systematic review compared removing all the lymph nodes with treating the lymph nodes with radiotherapy whether or not they had cancer cells in them. <sup>[153]</sup> The review looked at eight good studies that involved more than 4,000 women. It found that women were just as likely to be alive 10 years later whichever treatment they had.

Another systematic review found that axillary clearance was more likely to cause lymphoedema than axillary sampling, regardless of whether women had radiotherapy. <sup>[64]</sup> (Lymphoedema is arm swelling that happens when lymph fluid can't drain properly.) However, the studies this review looked at were poor quality.

---

## Radiotherapy to the lymph nodes under the breastbone for early breast 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 to the lymph nodes under the breastbone for early breast cancer?](#)

This information is for people who have early breast cancer. It tells you about radiotherapy to the lymph nodes under the breastbone, a treatment sometimes used for early breast cancer. It is based on the best and most up-to-date research.

### Does it work?

We don't know. You can have radiotherapy to treat the lymph nodes that run under your breastbone. But there's not enough research to tell us whether this treatment can help.

### What is it?

Radiotherapy uses X-rays to destroy cancer cells. It's given to reduce the risk of cancer coming back in the place it started.

If you have early breast cancer you'll probably have surgery to remove the cancer, with or without radiotherapy. During this surgery, your surgeon may also remove some, or all, of the lymph nodes in your armpit. This is because these nodes are usually the first place breast cancer spreads to.

Very occasionally, doctors recommend that women also have radiotherapy to treat the lymph nodes that run under their ribcage near the breastbone. This area is called the **internal mammary chain**. It's possible for breast cancer cells to spread to the lymph nodes here, through the lymphatic system. To read more, see [What are lymph vessels?](#)

The aim of giving radiotherapy to the lymph nodes under your breastbone is to:

- Kill any stray cancer cells that may be in this area
- Reduce the risk of cancer coming back.

## Breast cancer

To read more, see [How does radiotherapy work?](#)

Not all doctors think that it's necessary to have radiation under the breastbone because **cancer very rarely comes back here**. About 2 in 100 women who have surgery to remove their breast (a mastectomy) get cancer back under their breastbone.<sup>[157]</sup> So having radiotherapy to the breast is usually enough.

However, your doctor may suggest this treatment if:

- Cancer cells were found in lots of the lymph nodes removed from your armpit. This means that there's a higher chance that the cancer has spread under your breastbone. About 1 in 3 women who have cancer in their lymph nodes have cancer under their breastbone<sup>[158]</sup> <sup>[159]</sup>
- Your cancer is large and in the middle of your chest (next to your breastbone).<sup>[158]</sup>  
<sup>[159]</sup>

### How can it help?

We don't know for certain that it can help. So far, studies suggest that having radiotherapy under your breastbone probably won't help you to live longer than having radiotherapy only to your breast.

However, there are new ways of doing radiotherapy that can pinpoint the lymph nodes under your breastbone more easily. This means that doctors can tell where these nodes are and how deep they are, and use computers to give radiotherapy more accurately. These techniques weren't available when some of the research was done.<sup>[89]</sup> <sup>[48]</sup> <sup>[160]</sup>

Some studies suggest that the new ways of doing radiotherapy may help some women.<sup>[161]</sup> <sup>[162]</sup> <sup>[163]</sup> But until there's more research, we can't say for certain whether this treatment works.

### How does it work?

If there are any cancer cells under your breastbone, treating them with radiotherapy might reduce the risk that cancer will spread to another part of your body.

### Can it be harmful?

Yes. Radiotherapy to the lymph nodes that run under the breastbone is more likely to affect your heart than radiotherapy given to other areas.<sup>[164]</sup> You might get a condition known as **pericarditis**. This happens when the sac covering the heart gets **inflamed**. It causes chest pain and fever.

Different women have different experiences with radiotherapy. Many women cope well with the side effects, but the more radiation you have, the more likely you are to get

## Breast cancer

problems. Generally the side effects of radiotherapy can be divided into two groups: side effects that happen early and side effects that happen later.

- **Early side effects:** Your skin may itch or change colour after radiotherapy, and the area around your breastbone may feel tender.<sup>[66]</sup> Some women feel more tired than usual. These problems are usually mild and go away after a few weeks.
- **Later side effects:** You may get nerve damage. This sounds serious, but **it is rare** and can be treated.

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

### How good is the research on radiotherapy to the lymph nodes under the breastbone for early breast cancer?

We found one study of 270 women who had breast-conserving surgery.<sup>[165]</sup> Some women then had radiotherapy to the lymph nodes under their breastbone, while others did not.

After two-and-a-half years, the researchers found that women were just as likely to have had their cancer come back whether they had radiotherapy or not. Radiotherapy also didn't seem to affect the women's chances of still being alive.

The researchers didn't provide specific numbers from the study, so this makes it difficult to judge how helpful this information is.

---

## Radiotherapy to the lymph nodes above the collarbone for early breast 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 to the lymph nodes above the collarbone for early breast cancer?](#)

This information is for people who have early breast cancer. It tells you about radiotherapy to the lymph nodes above the collarbone, a treatment sometimes used for early breast cancer. It is based on the best and most up-to-date research.

### Does it work?

We're not sure. We don't know whether having radiotherapy to the lymph nodes above your collarbone on the same side as your breast cancer will help you live longer. But this treatment may reduce the chance that cancer will come back in this area.

### What is it?

Radiotherapy uses X-rays to destroy cancer cells. It's given to reduce the risk of cancer coming back.

## Breast cancer

Most women with early breast cancer have surgery to remove the cancer, with or without radiotherapy. During breast surgery, surgeons may also remove some, or all, of the lymph nodes in the women's armpit. This is because these nodes are usually the first place breast cancer spreads to.

Very occasionally, doctors recommend that women also have radiotherapy to treat the lymph nodes in their neck, in the area above their collarbone on the same side as their breast cancer. Doctors call this area the **supraclavicular fossa**. It's possible for breast cancer cells to spread to the lymph nodes here through the **lymphatic system**. To read more, see [What are lymph vessels?](#)

The aim of giving radiotherapy to your neck is to:

- Kill any stray cancer cells that may be in this area
- Reduce the risk of cancer coming back.

To read more, see [How does radiotherapy work?](#)

Not all doctors think that it's necessary to have radiotherapy to your neck because **cancer rarely comes back here**. Just having radiotherapy to the breast tissue left behind after surgery is usually enough.

However, your doctor may suggest having radiotherapy to the lymph nodes in your neck if:

- Cancer cells were found in lots of the nodes removed from your armpit. This means that there's a higher chance that the cancer has spread to the nodes in your neck
- Your cancer is large and high-grade (this means it looks fast growing and aggressive under a microscope).

### How can it help?

The research shows that radiotherapy to the chest walls and lymph nodes can stop cancer coming back to the lymph nodes in your neck.<sup>[166]</sup> But we don't know for certain if radiotherapy to your neck can also help. There aren't enough studies to tell us. This treatment may mean that there's less risk of your cancer coming back in your neck, but the research doesn't give a clear answer about whether having radiotherapy to the lymph nodes will help you live longer.<sup>[167]</sup> <sup>[163]</sup>

### How does it work?

If there are any cancer cells in your neck, treating them with radiotherapy may reduce the risk that they will spread to another part of your body.

### Can it be harmful?

Yes. Radiotherapy to the lymph nodes in your neck is more likely to affect your oesophagus (the tube that carries food from your mouth to your stomach) than radiotherapy given to other areas. Most women will get symptoms. But these are likely to be mild and pass quickly.

Different women have different experiences with radiotherapy. Many women cope well with the side effects but the more radiation you have, the more likely you are to get problems. Generally the side effects of radiotherapy can be divided into two groups: side effects that happen early and side effects that happen later.

- **Early side effects:** Your skin may itch or change colour after radiotherapy. Some women feel more tired than usual. These problems are usually mild and go away after a few weeks. Most women who have radiation to the lymph nodes above their collarbone get **oesophagitis** (inflammation of the oesophagus), but this is temporary.
- **Later side effects:** Side effects that can happen awhile after your treatment can include nerve damage and inflammation in the lungs.<sup>[67]</sup> These may sound serious, but **they are rare** and can be treated. Radiation to the lymph nodes above the collarbone can affect the upper tip of the lung, called the apex. The apex often becomes scarred later on, but this doesn't do any harm. You may get damage to the nerves in your arm and shoulder which makes moving this part of your body difficult.<sup>[67]</sup> <sup>[168]</sup> There's a very small chance that the part of your **spinal cord** in your neck may be damaged.

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

### How good is the research on radiotherapy to the lymph nodes above the collarbone for early breast cancer?

We don't really know how effective it is to have radiotherapy to the **lymph nodes** above your collarbone.

There's one review of the research (a **systematic review** ). It found that if radiotherapy was directed at the area above the collarbone after surgery, it reduced the risk that breast cancer would come back in this area.<sup>[167]</sup>

One study (a **randomised controlled trial** ) looked at nearly 1,400 women. All the women had gone through the **menopause** , had a high risk that their breast cancer would come back in the area where it first appeared, and took [tamoxifen](#) after having a **mastectomy** .<sup>[163]</sup> Cancer was less likely to come back above the collarbone in women who had radiotherapy there.

---

## Sentinel node biopsy for early breast cancer

# Breast 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 sentinel node biopsy for early breast cancer?](#)

This information is for people who have early breast cancer. It tells you about sentinel node biopsy, a treatment used for early breast cancer. It is based on the best and most up-to-date research.

## Does it work?

Yes, it is likely to work.

Sentinel node biopsy is a newer treatment for finding out if cancer has spread to your lymph nodes. Studies show that you'll probably have less pain and be able to move your arm more easily if you have a sentinel node biopsy than if you have more lymph nodes removed.

Having fewer nodes removed probably won't affect how long you'll live, but we need more research to be sure.

## What is it?

When you have surgery for early breast cancer, your surgeon will remove some or all of the lymph nodes in your armpit. This is because these nodes are usually the first place breast cancer spreads to.

There are a few approaches to checking the lymph nodes for cancer cells.

- **Axillary clearance.** This involves having all 20 or so lymph nodes removed from your armpit. It is done to check whether any of the lymph nodes have cancer cells, and, if so, how many of them have cancer cells.
- **Axillary sampling.** This involves removing between four and 10 lymph nodes to see if they contain cancer cells. If the nodes in the lowest part of your armpit are clear of cancer, it's unlikely that any of the nodes higher up will have cancer in them.
- **Sentinel node biopsy.** Doctors use this treatment to avoid removing lymph nodes unless absolutely necessary. An injection of a blue dye, a radioactive material or both is put into your breast (in the UK, doctors are advised to use both).<sup>[36]</sup> This shows up the lymph node (or nodes) that fluid from the breast drains into first.<sup>[51]</sup> These nodes, called the sentinel nodes, are then removed and tested for cancer. If there are no cancer cells in these nodes, it's likely that the other lymph nodes are free from cancer as well.



## Breast cancer

To decide which method to use, your doctor will first check the lymph nodes for signs of cancer with an [ultrasound](#). If there are no signs of cancer in the nodes, a **sentinel node biopsy** is the preferred treatment, as it causes fewer side effects. <sup>[36]</sup>

If there are signs of cancer on the ultrasound, your doctor will remove a small amount of tissue from the node using a needle. If the tissue doesn't have cancer cells, then a sentinel node biopsy is still the preferred treatment. If cancer cells are in the node, then the doctor may recommend having them all removed (axillary clearance). <sup>[36]</sup>

The National Institute for Health and Care Excellence (NICE), which advises the government on health care, says sentinel node biopsy should be used instead of removing all the lymph nodes under your arm. <sup>[36]</sup>

### How can it help?

One study found that women who had a sentinel node biopsy were just as likely to be alive two years later as those who had other types of lymph node surgery (axillary clearance or axillary sampling). <sup>[155]</sup>

Sentinel node biopsies also caused fewer side effects than other treatments to remove lymph nodes. You're likely to have: <sup>[155]</sup> <sup>[169]</sup> <sup>[170]</sup>

- Less pain
- Less swelling and be able to move your arm more easily.

### How does it work?

The idea behind the sentinel node biopsy is to reduce the number of lymph nodes surgeons remove unnecessarily. It helps to detect the lymph node that is closest to where the breast cancer is. This is the node that cancer cells are most likely to reach first. If this node does not contain cancer cells, then it's unlikely that the others will. <sup>[155]</sup>

### Can it be harmful?

Yes. About 2 in 100 people get an allergic reaction to the dye used in sentinel node biopsies. They might get a rash, redness and itchy skin. Using a smaller amount of dye might reduce the risk of these reactions. <sup>[171]</sup>

You'll probably get less swelling in your arm and shoulder if you have a sentinel node biopsy than if you have lots of nodes removed. You'll probably also be able to move your arm more easily. <sup>[171]</sup>

### How good is the research on sentinel node biopsy for early breast cancer?

There's some evidence that sentinel node biopsy works as well as other treatments to remove the **lymph nodes** from the armpit, but it causes fewer side effects.

One study (a **randomised controlled trial**) looked at 516 women who had a small breast cancer and received **radiotherapy** after surgery.<sup>[155]</sup> Some women had a sentinel node biopsy alone and others had a sentinel node biopsy plus some or all of their lymph nodes removed.

- Women who had only a sentinel node biopsy had less severe pain and could move their arm better.
- The women were just as likely to be alive two years later, whichever treatment they had.

Another study looked at almost 300 women.<sup>[156]</sup> It found that women who had a sentinel node biopsy had less loss of feeling and swelling in their arm than women who had other treatments to remove lymph nodes.

Two other studies have published preliminary results.

The first study compared sentinel node biopsy with sentinel node biopsy plus removing some or all of the lymph nodes.<sup>[172]</sup> Researchers found no difference in how long women lived after having either treatment.

The second study compared having a sentinel node biopsy with having radiotherapy to the lymph nodes or having all the lymph nodes removed.<sup>[173]</sup> Women who had a sentinel node biopsy had less arm swelling (**lymphoedema**) and less nerve injury afterwards. But women were able to move their shoulder about the same amount whichever treatment they had.

---

### High doses of chemotherapy plus a stem cell or bone marrow transplant for early breast 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 high doses of chemotherapy plus a stem cell or bone marrow transplant for early breast cancer?](#)

This information is for people who have early breast cancer. It tells you about high doses of chemotherapy plus a stem cell or bone marrow transplant, a treatment sometimes used for early breast cancer. It is based on the best and most up-to-date research.

# Breast cancer

## Does it work?

No. High doses of chemotherapy followed by a transplant of stem cells or bone marrow cells will not help you live longer if you have early breast cancer that has a high risk of spreading or coming back. In fact, this treatment can be very harmful and has led to the deaths of some women.

Early breast cancer means that your cancer has spread to the breast tissues and possibly to the **lymph nodes**.

## What is it?

This treatment uses high doses of anti-cancer drugs (chemotherapy) to kill cancer cells. Before you have chemotherapy, doctors will collect from your body young cells (called stem cells) which can grow into any kind of blood cell. After chemotherapy, they'll put these cells back into your bloodstream. This is known as a transplant. If the stem cells came from your blood, it's called a **stem cell transplant**. If the stem cells came from your bone marrow, it's a **bone marrow transplant**. Stem cells help repair the damage that anti-cancer drugs do to your bone marrow.

Because this treatment is still experimental you'll probably be offered it only if other treatments haven't helped you. If a treatment is experimental it means that doctors aren't sure whether it is better than the standard treatment. It's best to have experimental treatments only if you are part of a study called a clinical trial. Your cancer specialist will be able to tell you if there are clinical trials in your area and answer any questions you might have.

There are several stages to having high doses of chemotherapy and a transplant.

- The first step is to get rid of as much cancer as possible with standard doses of chemotherapy.
- You then get daily injections of drugs called growth factors which tell your bone marrow to make extra stem cells. Stem cells are found in your blood.
- The stem cells are collected from your blood or bone marrow and frozen until you need them. Stem cells are usually collected from your blood through a needle in your arm. Getting bone marrow is more difficult. You may need a small operation and possibly a **general anaesthetic**.
- Then you have high doses of chemotherapy over a few days. Chemotherapy uses anti-cancer drugs to clear your body of the cancer. But it also wipes out your bone marrow (the tissue that makes blood cells).
- The frozen stem cells or healthy bone marrow are thawed and put back into your bloodstream.

## Breast cancer

- You then wait in hospital for a few weeks while the treatment repairs your bone marrow and you start making new blood cells.

This treatment can be stressful for you and your family. You can be in hospital for up to six weeks. You are also likely to get some serious side effects including exhaustion, infections, and damage to your bone marrow.

### How can it help?

The research shows that that having high doses of chemotherapy plus a transplant won't help you live any longer than having standard doses of chemotherapy. <sup>[174]</sup> <sup>[175]</sup> <sup>[176]</sup>

### How does it work?

The idea behind this treatment is to give extra-high doses of chemotherapy to kill all the cancer cells that have been left behind after surgery to remove a breast tumour. But because such large doses of anti-cancer drugs can damage the bone marrow (the tissue that makes blood cells), doctors save some of this tissue before chemotherapy.

After treatment with chemotherapy, doctors put the cells they have saved back into your bloodstream. They hope this will help your body to make new blood cells faster. This should help you recover more quickly.

### Can it be harmful?

Yes. This treatment can cause serious side effects, including death.

In some studies, women who had this treatment needed to spend an extra 18 days in hospital compared with women who had standard doses of anti-cancer drugs. <sup>[174]</sup> They were also more likely to say that their life was affected by their treatment, especially for the first three months afterwards. <sup>[174]</sup>

Women who have high doses of chemotherapy plus a transplant are also more likely to get the following side effects. <sup>[174]</sup>

- **Low levels of white blood cells.** These cells help to fight infections. The fewer you have, the more likely you are to get serious infections and blood poisoning.
- **Mouth sores ( ulcers ).**
- **Fatigue, vomiting and diarrhoea.** These side effects are common with all types of chemotherapy but are more likely to happen and be severe with higher doses of anti-cancer drugs.
- **Damage to the heart, lungs, kidneys, liver, bladder, skin, and nervous system.** Most of these problems will go away when the anti-cancer drugs are cleared from your body. But sometimes they may be permanent. For example, some women have damage to nerves in their hands and feet.

## Breast cancer

- **Death.** About 4 in 100 women treated with high doses of chemotherapy died as a result of their treatment. None of the women who had standard chemotherapy died from their treatment.
- **Dying of another cause.** Women who had high doses of chemotherapy were more likely to die during the study from something other than breast cancer. In the studies we looked at, 48 women out of 1,075 who had high doses of chemotherapy died of other causes. This compared with 4 women out of 1,087 who had standard doses. The kinds of things they died from included [heart failure](#) and other kinds of cancer.

### How good is the research on high doses of chemotherapy plus a stem cell or bone marrow transplant for early breast cancer?

We found one summary of the research (called a [systematic review](#)) on the effects of high doses of chemotherapy plus a transplant.<sup>[174]</sup> This summary included the results of nine good-quality studies (called [randomised controlled trials](#)) with a total of 3,525 women. High doses of chemotherapy and a transplant were used to treat 1,758 of the women. The other 1,767 were treated with standard doses of chemotherapy.

When the researchers put all the results of the studies together, they found that women who had high doses of chemotherapy plus a transplant were no more likely to be alive five years after their treatment than those who had standard chemotherapy. And high-dose treatment increased women's risk of dying from a condition other than their breast cancer or from the side effect of chemotherapy.

Two more studies published after the summary confirmed that this treatment does not help women to live longer.<sup>[175]</sup> <sup>[176]</sup>

---

## Surgery for locally advanced breast 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 surgery for locally advanced breast cancer?](#)

This information is for people who have locally advanced breast cancer. It tells you about surgery, a treatment used for this type of cancer. It is based on the best and most up-to-date research.

### Does it work?

Yes. If you have locally advanced breast cancer, having surgery to remove it (probably a mastectomy) should reduce the chance that it will come back or spread elsewhere in your body.

## Breast cancer

If your breast cancer is described as being locally advanced, it is bigger than 5 centimetres (2 inches), or it has spread to your skin, the front of your chest or to both your skin and chest. It may also mean that the **lymph nodes** in your armpit have become matted together by the cancer.

### What is it?

If you have locally advanced breast cancer you will probably need a mastectomy. A mastectomy is an operation that removes all of the breast tissue, including skin and the nipple, from the side of the chest that has cancer.

You'll be left with a flat scar that goes across your chest. Most scars run diagonally or horizontally.

There are two main types of mastectomy.

- **Total mastectomy:** All of the breast tissue is removed, along with some of the skin over the breast and the nipple. Some lymph nodes in the armpit are also removed.
- **Radical mastectomy:** With this type of surgery, you'll have some of the muscles under your breast removed as well as all of your breast tissue, some skin, the nipple and the lymph nodes in your armpit. Radical mastectomy was once a common operation for breast cancer. Doctors had hoped that women would be cured because anything that could have had cancer cells left in it was removed. It's now known this isn't the case, and the only reason this surgery is done is because the breast cancer has spread very far through the breast and into underlying tissues.

To read more, see [More about surgery for breast cancer](#) .

If your doctor thinks that there's a high risk that your cancer will come back in your chest wall after surgery, he or she may suggest you also have radiotherapy. To learn more, see [Radiotherapy after surgery for locally advanced breast cancer](#) .

If you have locally advanced breast cancer, you'll also need treatment such as [chemotherapy](#) to treat your whole body. Chemotherapy kills any stray cancer cells that may have spread to other parts of your body.

If you are advised to have a mastectomy (the whole breast removed), your surgeon should discuss surgery to rebuild your breast (breast reconstruction).<sup>[36]</sup> Many women can have this done at the same time as the operation to remove the breast. For more information, see [Breast reconstruction](#) .

### How can it help?

Most women with locally advanced breast cancer have surgery. It's hard to say for sure whether removing your breast helps you live longer, as studies don't compare women who have surgery with those who don't. But experts think that taking away the cancer reduces the chance that it will come back or spread elsewhere in your body.

### How does it work?

Removing all the cancer cells, or as many of them as possible, from the body means there is less chance that more cancer cells will grow. Stopping cancer growing can help you live longer.

### Can it be harmful?

A mastectomy is a serious operation. Afterwards you may get some of the following side effects.

- Fluid may build up around the top of the scar on your chest and also in your upper arm. This is called a **seroma** and it can be uncomfortable and make your arm stiff. You may need to have this fluid drained in hospital.
- There is always a small risk that breast cancer will come back in the scar, so removing all the breast tissue cannot guarantee that your breast is free from cancer cells.
- There is a chance that you'll get an **infection**. This risk is higher than if you had a smaller operation to remove the tumour from your breast. It can be treated, but you may need to spend a few extra days in hospital.
- You may miss your breast, and some women say they feel disfigured after losing a breast. You may find it hard to look at your scar. You may also find it difficult to be intimate and have sex. But breast reconstruction may help with all these feelings. And you may be able to have your breast removed and reconstructed during the same operation.<sup>[36]</sup> Ask your doctor about all your options. For more information, see [Breast reconstruction](#) .

To learn more, see [Side effects of surgery for breast cancer](#) .

### How good is the research on surgery for locally advanced breast cancer?

Surgery is the standard treatment for locally advanced breast cancer. This is because experts agree that taking away the cancer reduces the chance that it will come back or spread elsewhere in your body. However, there isn't good research on this, as it wouldn't be fair to offer some women surgery but not others.

---

## Radiotherapy after surgery for locally advanced breast 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 after surgery for locally advanced breast cancer?](#)

## Breast cancer

This information is for people who have locally advanced breast cancer. It tells you about radiotherapy after surgery, a treatment used for this type of cancer. It is based on the best and most up-to-date research.

### Does it work?

Yes. If you have locally advanced breast cancer, having radiotherapy after surgery may reduce the chance that your breast cancer will come back in the place where it started. Radiotherapy may also help you live longer.

Locally advanced breast cancer is cancer that is bigger than 5 centimetres (2 inches) across, or that has spread to your skin or to the front of your chest, or to both your skin and chest. It may also have caused the **lymph nodes** in your armpit to become matted together.

### What is it?

Radiotherapy is used to kill any cancer cells that may have been left behind after surgery. It uses **X-rays** to destroy cancer cells in your breast. You'll need to have radiotherapy five days a week for between four weeks and six weeks. Each session takes only a few minutes. Radiotherapy doesn't hurt, but it has side effects. To learn more, see [How does radiotherapy work?](#)

Most women with locally advanced breast cancer are treated with a **mastectomy**. A mastectomy is an operation that removes all of the breast tissue, including skin and the nipple, from the side of the chest that has cancer. You will be left with a flat scar that goes across your chest. Most scars run diagonally or horizontally. This operation is sometimes called a **total mastectomy**. Doctors used to also remove some of the muscles under the breast. This is called a **radical mastectomy**. It isn't done very often now.

If your doctor thinks that there's a high risk that your cancer will come back in the chest wall, he or she may suggest you have radiotherapy. You may be at higher risk of your cancer coming back if:

- You have a large cancer
- The cancer cells are high-grade (this means they look fast growing and aggressive under a microscope)
- You have cancer in lots of the lymph nodes under your arm
- Tests after your surgery found cancer cells very near the edge of the breast tissue you had removed
- Cancer cells have spread to the skin on your breast or into the muscle of your chest wall.



## Breast cancer

A mastectomy and radiotherapy treat only the breast area. If you have locally advanced cancer, you will also need [hormone treatment \(tamoxifen\)](#) or [chemotherapy](#) to stop cancer spreading further and growing in other parts of your body.

### How can it help?

If you have locally advanced breast cancer and have a mastectomy followed by chemotherapy, adding radiotherapy to these treatments:

- May reduce the risk of your cancer coming back in the same place.<sup>[163] [177]</sup> In one study cancer came back in the same place in 10 in 100 women who had radiotherapy, compared with 30 in 100 women who didn't<sup>[163]</sup>
- May increase the chance that you will live for at least 10 years after being diagnosed.<sup>[163]</sup> In one study 54 in 100 women who had both chemotherapy and radiotherapy were alive 10 years later. This compares with 45 in 100 women who didn't have radiotherapy.<sup>[163]</sup>

### How does it work?

Radiotherapy kills any cancer cells left behind by blasting high-energy X-rays at them.

Normal cells also can be affected by these high-energy X-rays. So radiotherapy is given very carefully to make sure that the right areas of the body are hit as accurately as possible.

The timing of the doses makes it more likely that the cells that grow and divide faster, such as cancer cells, are hit more often than other cells.

### Can it be harmful?

#### Side effects of surgery

Every woman's experience of breast surgery is different. Some women recover in a matter of weeks with no lasting problems. Others may take much longer to get over the operation.

Problems after surgery for breast cancer can include pain, swelling in your arm and infections. To read more, see [Side effects of surgery for breast cancer](#) .

#### Side effects of radiotherapy

Early side effects of radiotherapy include skin reactions, tiredness, and breast tenderness. These are usually mild and pass after a few weeks. However, you're more likely to get skin reactions from radiotherapy if your breast cancer has spread to your skin. This is because a bigger dose of radiation is used. Skin reactions can include peeling, changes in skin colour, and red patches.

## Breast cancer

Side effects that happen awhile after your treatment has finished include nerve damage, hair loss, and inflammation in the lungs. These may sound serious, but they are rare and can be treated. To learn more see [Side effects of radiotherapy](#) .

### How good is the research on radiotherapy after surgery for locally advanced breast cancer?

We found four studies ( randomised controlled trials ) that looked at the effects of radiotherapy after surgery for locally advanced breast cancer. <sup>[162]</sup> <sup>[177]</sup> <sup>[178]</sup> <sup>[179]</sup>

Three studies found that radiotherapy reduced the risk of cancer coming back in the same place, and two studies found that radiotherapy helped women live longer. <sup>[162]</sup> <sup>[177]</sup> <sup>[178]</sup> One study was not very good and the researchers could not draw any firm conclusions from it. <sup>[179]</sup>

Here are the results from the largest study: <sup>[162]</sup>

- Overall, 10 in 100 women who had radiotherapy got cancer back in the same place, compared with 30 in 100 women who didn't have radiotherapy
- Among women who had radiotherapy, 54 in 100 were alive 10 years after surgery, compared with 45 in 100 women who didn't have radiotherapy.

---

## Hormone treatment plus radiotherapy for locally advanced breast 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 hormone treatment plus radiotherapy for locally advanced breast cancer?](#)

This information is for people who have locally advanced breast cancer. It tells you about hormone treatment plus radiotherapy, a treatment used for this type of cancer. It is based on the best and most up-to-date research.

### Does it work?

Probably. If you have locally advanced breast cancer, taking a drug called tamoxifen and having radiotherapy will probably help you live longer than just having radiotherapy.

If you have locally advanced breast cancer, it means that your cancer is bigger than 5 centimetres (2 inches), or that it has spread to your skin or to the front of your chest, or to both your skin and chest. It may also mean that the lymph nodes under your armpit have been matted together by the cancer.

## What is it?

If you have locally advanced breast cancer you may be offered several different treatments. Most women have surgery to remove their breast (a **mastectomy**). You may also have radiotherapy alongside a hormone treatment such as tamoxifen.

**Radiotherapy** uses **X-rays** to kill cancer cells so that the cancer doesn't come back. It is used to kill cancer cells in the skin, breast tissue and the armpit.

Radiotherapy may be given five days a week for four weeks to six weeks. To read more, see [How does radiotherapy work?](#)

**Tamoxifen** is used to treat breast cancers that are more sensitive to the **hormone oestrogen** than other cancers (they are **oestrogen-receptor positive**). Oestrogen encourages these cancers to grow. Your doctor will do tests on your tumour to find out if it is oestrogen-receptor positive. If it is, your doctor may prescribe tamoxifen for you for up to five years.

Tamoxifen stops oestrogen working in the body. The aim is to reduce the chance that your cancer will come back.

You take tamoxifen as a tablet. There are several brand names for tamoxifen. They include Nolvadex, Soltamox and Tamofen.

## How can it help?

Having tamoxifen plus radiotherapy for locally advanced breast cancer may:

- Reduce the chance of your cancer coming back. In one study, cancer came back in 50 in 100 women treated with both tamoxifen and radiotherapy and in 60 in 100 women who had just radiotherapy<sup>[163]</sup>
- Help you live longer.<sup>[163]</sup> <sup>[180]</sup> In one study, 45 in 100 women who had tamoxifen and radiotherapy were alive 10 years after they were diagnosed.<sup>[163]</sup> Out of those who had just tamoxifen, 36 in 100 were alive 10 years later.<sup>[163]</sup> Another study found that having both tamoxifen and radiotherapy may give you about an extra year of life compared with just having radiotherapy.<sup>[180]</sup>

## How does it work?

If your cancer is encouraged to grow by oestrogen, **tamoxifen** can make it grow more slowly. It can sometimes slow the growth down so much that the tumour stops growing.

**Radiotherapy** is like an insurance policy for the tissues close to where your tumour was. It kills any cancer cells left behind by blasting high-energy X-rays at them.

Normal cells also can be blasted by these high-energy X-rays. Radiotherapy is given very carefully to make sure that the right areas of the body are hit as accurately as

## Breast cancer

possible. The timing of the doses makes it more likely that the cells that grow and divide faster, such as cancer cells, are hit more often than other cells.

### Can it be harmful?

When you take **tamoxifen**, the female hormone oestrogen stops working in your body. This can give you symptoms of the **menopause**, such as hot flushes (which can be severe), irregular periods and vaginal dryness. About half the women who take tamoxifen get these types of symptoms. The symptoms are more likely if you haven't been through the menopause. <sup>[70]</sup>

Tamoxifen can also cause indigestion or make you feel sick. There are also some less common side effects of taking tamoxifen, including **cataracts** and **deep vein thrombosis**. <sup>[180]</sup> <sup>[70]</sup> To learn more, see [Side effects of tamoxifen](#).

Early side effects of **radiotherapy** include skin reactions, tiredness and breast tenderness. These are usually mild and pass after a few weeks. However, you're more likely to get skin reactions from radiotherapy if your breast cancer has spread to your skin. This is because a bigger dose of radiation is used. Skin reactions may include peeling, changes in skin colour and red patches.

Side effects that happen awhile after your treatment has finished include nerve damage, hair loss and **inflammation** in the lungs. These may sound serious, but they are rare and can be treated. To learn more, see [Side effects of radiotherapy](#).

### How good is the research on hormone treatment plus radiotherapy for locally advanced breast cancer?

There's quite good evidence that having both tamoxifen and radiotherapy works better than having either treatment on its own. We found two studies.

One study (a **randomised controlled trial**) included 410 women with locally advanced breast cancer. It found that the women who had both treatments lived about a year longer than the women who just had radiotherapy. <sup>[180]</sup>

The other study (a randomised controlled trial) included nearly 1,400 women who'd had surgery. It found that cancer was less likely to come back in women who had both radiotherapy and tamoxifen than in those who had just tamoxifen. Women who had both treatments were also likely to live longer. <sup>[163]</sup> But it's important to note that some of the women in this study had **stage 2** breast cancer rather than **stage 3**, so their cancer hadn't spread as far and might have been easier to treat. So women with more advanced breast cancer may not get such good results.

---

## Chemotherapy for locally advanced breast cancer

In this section

[Does it work?](#)

[What is it?](#)

[How can it help?](#)

# Breast cancer

[How does it work?](#)

[Can it be harmful?](#)

[How good is the research on chemotherapy for locally advanced breast cancer?](#)

This information is for people who have locally advanced breast cancer. It tells you about chemotherapy, a treatment used for this type of cancer. It is based on the best and most up-to-date research.

## Does it work?

You'll probably be given chemotherapy if you have locally advanced breast cancer. It's the standard treatment. But we're not sure whether this will help you live longer. The research on this is not very good.

## What is it?

If you have locally advanced breast cancer, you have several treatment options. Most women have surgery to remove their breast (a [mastectomy](#)). Some women also have [radiotherapy to the chest](#) to kill any cancer cells left behind after the mastectomy. These treatments treat only the breast area.

Most women then have chemotherapy. Chemotherapy drugs can kill stray cancer cells left in the body. They treat the whole body and will affect both normal cells and cancer cells.

Chemotherapy can be used after breast surgery and radiotherapy to:

- Reduce the chance of breast cancer coming back
- Reduce the chance that breast cancer will spread further
- Control breast cancer that has spread to other parts of the body.

Some women also have chemotherapy before surgery to reduce the size of their tumour and make it easier to remove their breast.

Chemotherapy drugs are most effective at killing cells that divide rapidly. Cancer cells divide into new cells faster than normal cells, so chemotherapy should kill more cancer cells than normal cells.

Unfortunately, the drugs used in chemotherapy also affect other cells in the body that divide rapidly. This can cause side effects (see below).

Chemotherapy drugs can be given as tablets or as a drip (also called an IV or an [intravenous infusion](#)). You may get treatment at a clinic or hospital as an outpatient.

Just as [bacteria](#) can become resistant to the [antibiotics](#) used to fight them, cancer cells can become resistant to anti-cancer drugs. Cancer cells can change and adapt to avoid being damaged by chemotherapy drugs. Because of this, more than one drug is given at a time.

## Breast cancer

Common combinations of these drugs include:

- doxorubicin and cyclophosphamide
- 5-fluorouracil, epirubicin, and cyclophosphamide (the combination is sometimes called CEF or FEC)
- cyclophosphamide, methotrexate and 5-fluorouracil (this combination is also called CMF).

Doxorubicin and epirubicin are a type of drug called an **anthracycline**. Chemotherapy that includes an anthracycline may be more effective than other types, although more research is needed.

Chemotherapy drugs called **taxanes** are sometimes used if you can't take other chemotherapy drugs, or if other drugs haven't worked. You may be offered one called docetaxel (brand name Taxotere). Another taxane is called paclitaxel (Taxol). <sup>[36]</sup>

### How can it help?

We don't know if having chemotherapy after surgery can improve your chance of living longer if you have locally advanced disease. The studies are not good enough for us to be able to draw firm conclusions. <sup>[180] [181] [182]</sup>

One study found that having chemotherapy before and after a mastectomy doesn't help you live any longer than having chemotherapy only after surgery. <sup>[183]</sup>

### How does it work?

Chemotherapy drugs can kill stray cancer cells left in the body. Most anti-cancer drugs attack the DNA of cells (the genetic code in cells that controls how they grow and divide to form new cells). All cells, whether they are normal cells or cancer cells, grow and divide to form new cells. Normal cells are programmed to do this to replace damaged cells. Cancer cells grow quickly in an unregulated, chaotic way.

### Can it be harmful?

The side effects of chemotherapy drugs happen mainly because they kill some normal cells along with the cancer cells. In particular, they target cells that divide rapidly, including:

- Cells lining the digestive tract (this is the tube that takes food through your body as it is being digested)
- Red blood cells (which carry oxygen and food around the body)
- White blood cells (which fight infection)
- Hair cells

## Breast cancer

- Cells in the ovaries .

Because of the effects of chemotherapy drugs on these cells, you may feel sick and vomit during or after your treatment. You may also feel tired, lose your hair, put on weight and get symptoms of the menopause . To learn more, see [Side effects of chemotherapy](#) .

### How good is the research on chemotherapy for locally advanced breast cancer?

There are no good studies into chemotherapy for locally advanced breast cancer. The studies we did find seemed to include some women whose cancer was less locally advanced. <sup>[180]</sup> <sup>[181]</sup> <sup>[182]</sup> This makes their results less reliable.

There is no evidence that anti-cancer drugs work for locally advanced disease, but this treatment is still used. A lack of evidence doesn't always mean that a treatment doesn't work. It can just mean that the studies aren't good enough to say whether it works.

We found one study (a randomised controlled trial ) involving 101 women that looked at chemotherapy before and after surgery. It found that women who had chemotherapy before and after a mastectomy didn't live any longer than women who just had chemotherapy afterwards. <sup>[183]</sup>

---

## Trastuzumab (Herceptin) for locally advanced breast cancer

In this section

[Can it be harmful?](#)

This information is for people who have locally advanced breast cancer. It tells you about trastuzumab (Herceptin) a treatment sometimes used for this type of cancer.

We haven't looked at the evidence for trastuzumab for locally advanced breast cancer in as much detail as other treatments on our site (see Our method for more information). But we've included this information because you may find it helpful.

Trastuzumab is a type of drug called a **monoclonal antibody**. This means that it is made in a laboratory to attack specific cancer cells. The brand name for trastuzumab is Herceptin.

Trastuzumab is used to treat some types of breast cancer. It attacks cancer cells that make too much of a protein called HER-2. This protein is found on the surface of some cancer cells. Trastuzumab slows down or stops cells with too much HER-2 growing. This may cut the chances of your cancer coming back.

About 1 in 5 breast cancers make too much HER-2. <sup>[136]</sup> These tumours grow faster and are more likely to come back than those that don't make too much HER-2.

## Breast cancer

Your doctor can measure the amount of HER-2 protein in your tumour. This helps your doctor decide whether trastuzumab might be right for you.

Trastuzumab can be given on its own or with [chemotherapy](#) . It's given as a drip (also called an IV or an [intravenous infusion](#) ). It takes between 30 minutes and 90 minutes to have one treatment. Most women are treated with trastuzumab every three weeks for a year. Or they might have a lower dose every week for a year. <sup>[136]</sup>

### Who can take it?

About half the women diagnosed with breast cancer each year in the UK are suitable for HER-2 testing. <sup>[137]</sup> That's about 20,000 women who can be tested to see if their tumour makes too much HER-2. About 1 in 4 of these women could benefit from treatment with trastuzumab. <sup>[137]</sup>

In the UK, trastuzumab is licensed to treat:

- Women with cancer that has spread to other parts of their body, such as their liver. This is called advanced (metastatic) breast cancer
- Women with early or locally advanced breast cancer.

To learn more about these cancers, see [Types of breast cancer](#) .

Guidelines from the National Institute for Health and Care Excellence (NICE), the government body which advises the government on which treatments should be available on the NHS, say women with **early, locally advanced, or advanced breast cancer**, who could benefit from trastuzumab should all be offered it through the NHS. <sup>[139]</sup>

A study looking at women with locally-advanced, HER-2 positive breast cancer found that women were more likely to be alive and free from cancer after three years, if they'd taken trastuzumab. <sup>[184]</sup>

- 71 in 100 women who'd had trastuzumab were alive and free of cancer
- 56 in 100 women who'd not had trastuzumab were alive and free of cancer.

### Can it be harmful?

You may get a fever and chills after treatment with trastuzumab. Other common side effects include pain, weakness, sickness, [diarrhoea](#) , headaches, breathing problems, and rashes. These side effects tend to be worst after the first treatment with trastuzumab.

Trastuzumab can also cause **heart problems**, especially when it's used with some types of chemotherapy. <sup>[141]</sup> In particular it can lead to heart failure, which can cause breathing problems, shortness of breath, a fast or irregular heartbeat, a cough, and swollen feet or ankles. A review of the research (a [systematic review](#) ) that looked at 11 studies with



## Breast cancer

nearly 12,000 women found that about 26 women in 1,000 would develop serious heart problems (heart failure) if treated with trastuzumab for a year. This compared with about 5 in 1,000 women not treated with trastuzumab. The risk might be a bit lower if the trastuzumab were given for a shorter time (six months) but there isn't a lot of evidence to support this. <sup>[140]</sup>

Trastuzumab can also seriously affect the **lungs**. This can cause severe breathing problems as well as an **allergic reaction**. A serious allergy can lead to a drop in **blood pressure**, breathing problems, rashes and wheezing.

Because of these problems, women who have HER-2 positive breast cancer are carefully checked to see if they are healthy enough to be treated with trastuzumab. Women are also monitored throughout their treatment.

---

### Further informations:

#### What are lymph vessels?

Just as blood vessels carry blood, lymph vessels carry lymph. Lymph vessels are very thin. You can't usually see them.

Lymph is a fluid that surrounds tissues and organs. It is taken up by the lymph vessels and flows back into the bloodstream. This fluid:

- Carries waste products from around your body
- Carries cells that are part of the **immune system** and help fight infections
- Contains **protein**.

The lymph vessels take the fluid to your **lymph nodes**. These small collections of cells are part of your immune system. They are found all over your body, such as in your groin, the backs of your knees and under your chin. They are small, round or oval lumps that you can't usually feel unless you are thin or have an infection that has made them swollen.

Lymph fluid from the breast travels to your armpit (which doctors sometimes call the axilla). If there are cancer cells in your breast, they may be picked up by the lymph fluid and carried to the lymph nodes in your armpit. The cancer cells may continue growing in your armpit or travel on through your lymph vessels to other parts of your body. These cancer cells may die off or start growing.

About 5 percent of the lymph fluid from your breast goes to another group of lymph nodes called the **internal mammary chain**. These lymph nodes lie under your breastbone in the centre of your chest.

## Breast cancer

You can't tell if breast cancer has spread to the lymph nodes in your armpit unless at least one of them is removed by surgery and checked for cancer cells under a microscope.

Breast cancer cells can also be picked up by blood vessels in the breast and can travel around the body in your bloodstream. They may then grow somewhere else in the body. This is why women with breast cancer are sometimes given drugs that treat the whole body. This type of treatment (known as systemic treatment) reduces the chance that the cancer will appear somewhere else in your body.

### Breast cancer in your family

You should see your GP if you're worried that you may be at increased risk of getting breast cancer because one or more of your close relatives have had it. Your GP will take a detailed history of your family's health to work out your risk.

Here are some questions your GP may ask. <sup>[27]</sup>

#### What cancers have there been in your family?

To get a good family history, your doctor will need to know about any cancers in your mother's and father's sides of the family. You will need to tell your doctor about cancer in your father and mother, sons and daughters, brothers and sisters, aunts and uncles, nieces and nephews, and grandparents. For any relative who has had cancer, your doctor will need to know: <sup>[27]</sup>

- Their relationship to you
- What kind of cancer they had
- How old they were when they were diagnosed
- Whether the same family member had more than one type of cancer, including whether they had breast cancer in both breasts.

#### Has a faulty breast cancer gene been found in one of your relatives?

Breast cancer can be caused by faulty genes. The most important of these are called BRCA1, BRCA2, and TP53. If you have a fault on one of these genes, you have a high risk of developing breast cancer at some point in your life, but this does not mean you will definitely get it. For example, women with a faulty BRCA1 gene have about a 65 in 100 chance of getting breast cancer by age 70, and those with a faulty BRCA2 gene have around a 45 in 100 chance. <sup>[6]</sup>

## Breast cancer

The number of people with a fault in one of these genes is very small.<sup>[27]</sup> If someone in your family has been found to have a faulty gene, you can have genetic testing to see if you also have this gene.

### What is your ethnic background?

Some faulty breast cancer genes are 5 to 10 times more common among Ashkenazi Jewish women.<sup>[2]</sup>

### What happens next

From your answers, your GP will work out whether you may have a raised risk of breast cancer. If you do, your doctor will refer you to a specialist to take a closer look at your risk.<sup>[27]</sup>

When meeting with the specialist, you will again be asked for information about cancers in your family. This time, you may be asked about more distant relatives, such as your cousins. You'll also be asked about things that can raise your breast cancer risk, such as whether you drink alcohol or take hormone replacement therapy (HRT) for symptoms of the menopause. (To learn more about things that can increase your breast cancer risk, see [Breast cancer: why me?](#) ) The specialist may use a computer program or questionnaires to help estimate your risk of breast cancer.

If you do have a raised risk of breast cancer, you may hear it described as being either 'moderate' or 'high'.<sup>[27]</sup>

### If you have a moderate risk

- You have between a 17 in 100 and 30 in 100 chance of getting breast cancer at some time in your life. You will be offered support and information about what this risk means to you.<sup>[27]</sup>
- If you are aged between 40 and 49, you will be offered a **mammogram** every year.
- If you are aged 50 to 59, your doctor may recommend having an annual mammogram or the usual mammogram every three years.
- If you are aged 60 or older, you will be offered the usual mammogram every three years, instead of every year. This is because breast cancers are easier to see in older women and they tend to grow more slowly. Having a mammogram more often probably wouldn't help to diagnose breast cancer any earlier.
- If you are under 40, you will be offered support and counselling. Doctors don't yet know if having mammograms before the age of 40 helps to diagnose breast cancer. But you might be offered one as part of a study to see if they do.

## Breast cancer

### If you have a high risk

- Your risk of getting breast cancer is 30 in 100 or higher. <sup>[27]</sup>
- You'll have the chance to see a genetic counsellor to get a more accurate estimate of your risk. You will get the chance to ask questions, and the counsellor will explain what your risk means.
- If you don't yet know if you carry a faulty gene for breast cancer, you may be able to have genetic testing. If someone in your family with breast or ovarian cancer is alive, doctors can look for the faulty gene in a sample of their blood. If this test finds a faulty gene, then other members of your family can have a test to see if they too carry the gene. If a close relative with breast or ovarian cancer is not available for testing, you can still be tested if you have at least a 10 in 100 chance of having a faulty gene. <sup>[27]</sup>
- Many women at high risk of breast cancer will have a yearly mammogram, MRI scan, or both. However, women usually switch to having a mammogram every three years once they reach age 50 or 60, unless they have a faulty breast cancer gene. <sup>[27]</sup>
- Some women at high risk of breast cancer choose to have treatment to reduce their risk. They may take medicines called tamoxifen or raloxifene, or have surgery to remove their breasts and possibly their ovaries too. This will involve counselling with experts. <sup>[27]</sup>

### Cancer staging table

The table below shows how your doctor uses the TNM system to find out your cancer stage. <sup>[32]</sup>

To use the table, you find your TNM classification in each of the three columns and compare it with the stages on the left. Stages with lower numbers represent cancers that may not have spread as far and may need less treatment.

For example, if your TNM classification is **T1N1M0**, your cancer would be **stage 2A**.

You can find definitions for the medical terms used in the table at the bottom of the page.

Stage	T (tumour)	N (lymph nodes)	M (metastasis)
Stage 0	Tis: Ductal carcinoma in situ	N0: No tumour in the regional lymph nodes.	M0: No distant metastases

## Breast cancer

Stage 1A	T1: Tumour size is 2 centimetres (0.8 inches) or smaller.	N0: No tumour in the regional lymph nodes.	M0: No distant metastases
Stage 1B	T0 or T1: Tumour is not found or is 2 centimetres (0.8 inches) or smaller.	N1mi: 1 to 3 regional lymph nodes have very small areas of cancer, called micrometastases.	M0: No distant metastases
Stage 2A	T0: No evidence of primary tumour	N1: Cancer is in the regional lymph nodes. But the lymph nodes are still movable.	M0: No distant metastases
	T1: Tumour size is 2 centimetres (0.8 inches) or smaller.	N1: Cancer is in the regional lymph nodes. But the lymph nodes are still movable.	M0: No distant metastases
	T2: Tumour is bigger than 2 centimetres (0.8 inches) but smaller than 5 centimetres (2 inches).	N0: No tumour in the regional lymph nodes.	M0: No distant metastases
Stage 2B	T2: Tumour is bigger than 2 centimetres (0.8 inches) but smaller than 5 centimetres (2 inches)	N1: Cancer is in the regional lymph nodes. But the lymph nodes are still movable.	M0: No distant metastases
	T3: Tumour is bigger than 5 centimetres (2 inches).	N0: No cancer in the regional lymph nodes.	M0: No distant metastases
Stage 3A	T0: No evidence of primary tumour	N2: Cancer is in the regional lymph nodes, and the nodes are non-movable.	M0: No distant metastases
	T1: Tumour size is 2 centimetres (0.8 inches) or smaller.	N2: Cancer is in the regional lymph nodes, and the nodes are non-movable.	M0: No distant metastases
	T2: Tumour is bigger than 2 centimetres (0.8 inches) but smaller than 5 centimetres (2 inches).	N2: Cancer is in the regional lymph nodes, and the nodes are non-movable.	M0: No distant metastases
	T3: Tumour is bigger than 5 centimetres (2 inches).	N1 or N2: Cancer is in the regional lymph nodes. The nodes may be movable or non-movable.	M0: No distant metastases
Stage 3B	T4: Tumour extends to the front of the chest or the skin, or is inflammatory.	Any N: Cancer is in any of the lymph nodes, or none of the lymph nodes.	M0: No distant metastases
Stage 3C	Any T: The tumour is any size and extends to either the skin or front of the chest wall.	N3: Cancer is in the internal mammary lymph nodes.	M0: No distant metastases
Stage 4	Any T: The tumour is any size and extends to either the skin or front of the chest wall.	Any N: Cancer is in any of the lymph nodes, or none of the lymph nodes.	M1: Distant metastases

# Breast cancer

## Definitions

- **Ductal carcinoma in situ:** A non-invasive cancer that has stayed in the spot where it started growing and hasn't spread further.
- **Inflammatory breast cancer:** This is a rare, invasive cancer.
- **Internal mammary lymph nodes:** These lymph nodes are under the central part of the breastbone.
- **Metastases:** This is cancer that has spread to other parts of the body.
- **Movable lymph nodes:** This means that your nodes are not matted together by the cancer.
- **Non-movable lymph nodes:** This means that your nodes are matted together by the cancer.
- **Primary tumour:** This is the original lump or group of cancer cells in your breast.
- **Regional lymph nodes:** In breast cancer, this refers to lymph nodes under your armpit on the same side of your body as the breast cancer.

## Types of breast cancer

Breast cancer is usually described according to whether or not it has spread from where it started. When a cancer hasn't spread, it is called **non-invasive breast cancer**. When it has spread, it is called **invasive breast cancer**.

### Non-invasive breast cancer

Non-invasive breast cancer is contained within the ducts of the breast. This means it hasn't spread beyond the lining of the ducts, and into the surrounding fat or other breast tissue. This type of cancer is also called **ductal carcinoma in situ (DCIS)**. 'In situ' is a Latin phrase that means 'in position'.

The cancer may eventually spread (become invasive), or it may not. We don't know how many of these cancers would eventually spread if left untreated. This is because nearly all women diagnosed with DCIS (99 in every 100) have surgery to remove their cancer.

[33]

You might also hear about **lobular carcinoma in situ (LCIS)**. This means some of the cells in the lobules of the breast are abnormal (the lobules are where milk is made). **LCIS**

## Breast cancer

**is not usually thought of as cancer.** However, women with LCIS have a raised risk of getting cancer in either breast. <sup>[34]</sup>

Non-invasive breast cancers are so small that you can't feel them. So they are usually found during a mammogram. On a mammogram they look like little white specks. These specks are actually tiny spots of calcium. <sup>[35]</sup>

### Invasive breast cancer

Invasive breast cancer has spread from where it started, 'invading' the fatty tissue in the breast. From there it can get into the lymph vessels or blood vessels. It can then spread to other parts of your body.

Invasive breast cancer is classified according to how far it has spread. It may be called: <sup>[36]</sup>

- **Early breast cancer.** This means that the cancer is still fairly small and seems to be only in your breast or also in some of the lymph nodes under your arm.
- **Locally advanced breast cancer.** This means the cancer is bigger than 5 centimetres (around 2 inches), or has spread to your skin or to the front of your chest, or to both your skin and chest. The lymph nodes under your armpit might also have become matted together by the cancer.
- **Metastatic (or advanced) breast cancer.** This usually means the cancer has spread to other parts of the body, such as your bones, liver, or lungs. But it can also mean that the cancer hasn't spread but has grown directly into tissues close to the breast and cannot be removed through surgery.

Most women with invasive cancer have early breast cancer that hasn't spread beyond the breast or nearby lymph nodes.

Invasive cancer is also called **infiltrating breast cancer**.

### Rarer forms of breast cancer

You may also hear about rarer forms of breast cancer. These include:

- **Inflammatory breast cancer.** This is a less common type of cancer that blocks the lymph vessels in the skin of the breast. This makes the skin look pitted or dimpled, like orange peel. The skin may also feel warm and often looks red. This type of cancer can develop and spread quickly. <sup>[37]</sup>
- **Paget's disease of the breast.** This is a less common cancer that affects the skin on and around the nipple. Signs of Paget's disease can include itching, redness, and flaking of the skin. In its early stages, Paget's disease is often confused with

eczema and other skin conditions. Women with Paget's disease often have cancer within their breast as well. <sup>[38]</sup>

### More about surgery for breast cancer

Most women who are diagnosed with breast cancer will need some kind of surgery.

The type of surgery you have will depend on:

- The size of the cancer or lump
- Whether the cancer has spread to other parts of your body
- What type of surgery you prefer.

Before you have surgery, your surgeon or breast cancer nurse will talk to you in detail about the different options available to you. You'll be given time to think about what's best for you, and a chance to ask questions. You may find it helpful to learn as much as you can about the different types of surgery and how your breast will look after each type.

Here we describe the different types of surgery and tell you who they are most suitable for.

#### Breast-conserving surgery

Breast-conserving surgery is an operation for breast cancer that lets you keep your breast. Your surgeon will remove only the part of your breast that has cancer. The aim is to get rid of your breast cancer while changing the appearance of your breast as little as possible.

Doctors sometimes call this operation a **lumpectomy**. It's done instead of removing your whole breast (a mastectomy).

#### Is this operation suitable for me?

You may be able to have breast-conserving surgery if: <sup>[45]</sup>

- **You have ductal carcinoma in situ:** This means the cancer hasn't spread from the milk ducts in your breast
- **You have early breast cancer.** This means the cancer hasn't spread outside your breast, or has spread only as far as the nearest lymph nodes. Lymph nodes are small, round or oval lumps. They help fight infections in your body. Breast cancer usually spreads to the lymph nodes in the armpit before it spreads anywhere else



## Breast cancer

- **You have just one lump in your breast.** If you have more than one lump, or lots of small patches of cancer cells, breast-conserving surgery may not be suitable. It's hard to remove all the cancer cells without changing the way your breast looks. And if you have lots of small patches of cancer, the cancer is more likely to come back than if you have a single lump. Removing your breast can help stop this. <sup>[46]</sup> <sup>[47]</sup>
- **Your lump is small compared with the size of your breast.** If you have a small lump, you'll have only a small scar, and maybe a small dent in your breast
- **You can have radiotherapy.** You may need radiotherapy after breast-conserving surgery to destroy cancer cells left after surgery. Doctors try to avoid giving radiotherapy to the same area twice, so you may not be able to have breast-conserving surgery if you've had radiotherapy before. If you are pregnant, you may want to avoid radiotherapy as it can harm your baby.

Up to 8 in 10 women with early breast cancer are able to have breast-conserving surgery. And there's good evidence from lots of studies that women who have only their lump removed live just as long as women who have their entire breast removed. <sup>[48]</sup> <sup>[49]</sup>

But breast-conserving surgery isn't right for everyone. If you have a large lump and a small breast, or if you have cancer under your nipple, it can be difficult to remove the cancer without changing the way your breast looks. You may get a better result with a mastectomy and breast reconstruction. There are several kinds of breast reconstruction available, including surgery to put in breast implants.

If you have a family history of cancer or tests show you have a high risk of breast cancer, you have a bigger chance that the cancer will come back in the same place. <sup>[50]</sup> Some women choose to have a mastectomy rather than risk needing more surgery later.

### Mastectomy

A mastectomy is an operation that removes all of the breast tissue, including skin and the nipple, from the side of the chest that has cancer. A mastectomy is usually essential if you have breast cancer that is in more than one place in your breast.

You'll be left with a flat scar that goes across your chest. Most scars run diagonally or horizontally.

There are two main types of mastectomy.

- **Total mastectomy:** All of the breast tissue is removed along with some of the skin over the breast and the nipple. Some lymph nodes in the armpit also are removed.
- **Radical mastectomy:** It's rare to have this type of surgery nowadays. With this type of surgery, doctors remove some of the muscles under your breast as well as all of your breast tissue, some skin, the nipple and the lymph nodes in your armpit. Radical mastectomy was once a common operation for breast cancer. Doctors had hoped

## Breast cancer

that women would be cured because anything that could have had cancer cells left in it was removed. It's now known this isn't the case, and the only reason this surgery is done is because the breast cancer has spread very far through the breast and into underlying tissues.

A mastectomy is a more serious operation than breast-conserving surgery and it may take you longer to recover. Fluid can build up around the top of the scar on your chest and also in your upper arm. This can be uncomfortable and make your arm stiff. But there are exercises that can help.

You can have breast reconstruction after a mastectomy, or sometimes at the same time as the operation. This may include surgery to put in implants. To find out more, see our information on [breast reconstruction](#) .<sup>[36]</sup>

### Surgery on the lymph nodes

During breast surgery, your surgeon will probably remove some or all of the lymph nodes in your armpit. This is because these nodes are usually the first place breast cancer spreads to. If you have a type of early breast cancer called **ductal carcinoma in situ** (DCIS), you won't need to have any lymph nodes removed. This is because the cancer is only in the ducts of the breast and there's no risk that they've spread to the lymph nodes.

If you're having breast-conserving surgery and your breast cancer is in the upper part of your breast near your armpit, your surgeon may be able to reach your lymph nodes through the same cut he or she makes in your breast. But if your cancer is somewhere else, the surgeon will need to make another cut.

If you're having a mastectomy, your surgeon will be able to reach the lymph nodes through the same cut.

You and your doctor will need to decide how many nodes to remove. This will depend on how likely it is that your cancer has spread. Your doctor will consider the size of your tumour and how it looks under a microscope (this is called the **grade** of your cancer). Your doctor may also check for signs of cancer in your lymph nodes using an [ultrasound scan](#). You'll have fewer side effects if fewer nodes are removed.<sup>[50]</sup>

- You may have all 20 or so lymph nodes removed from your armpit. This is called an **axillary clearance**. The aim is to remove any cancer that might have spread there by removing all of the lymph nodes.
- Or your surgeon may remove between four and 10 lymph nodes to see if they contain cancer cells. This is called **axillary sampling**. If the nodes in the lowest part of your armpit are clear of cancer, it's unlikely that any of the nodes higher up will have cancer in them.

## Breast cancer

- Sentinel node biopsy** is a newer treatment doctors use to avoid removing lymph nodes unless absolutely necessary. You'll have fewer side effects if fewer nodes are removed. <sup>[50]</sup> An injection of a blue dye, a radioactive material or both is put into your breast. This shows up the lymph node (or nodes) that fluid from the breast drains into first. <sup>[51]</sup> These nodes, called the sentinel nodes, are then removed and tested for cancer. If there are no cancer cells in these nodes, it's likely that the other lymph nodes are free from cancer as well. If there are cancer cells in the sentinel node, you will need other nodes nearby removed. To learn more, see [Sentinel node biopsy for early breast cancer](#) .

If the lymph nodes in your armpit have cancer cells in them, then you may need radiotherapy or chemotherapy .

The sentinel node biopsy is the recommended treatment for women with **early breast cancer** whose lymph nodes don't show any signs of cancer on an ultrasound scan. It's also recommended for women whose ultrasound shows signs of cancer but no cancer cells are found in tissue taken from the lymph nodes with a needle. <sup>[36]</sup>

### Pros and cons of breast surgery

Breast-conserving surgery has some advantages over a mastectomy. <sup>[52] [53] [54] [55] [56]</sup>

	Breast-conserving surgery	Mastectomy
How well does it work?	You will probably live for as long as you would if you had a mastectomy.	You're not likely to live any longer than if you had breast-conserving surgery.
Will my breast cancer come back?	The chance of breast cancer coming back after breast-conserving surgery is the same as the chance of it coming back after a mastectomy.	There is always a small risk that breast cancer will come back in the scar, so removing all the breast tissue can't guarantee that your breast is totally free of cancer. The chance of your cancer coming back is the same with a mastectomy as with breast-conserving surgery.
What are the side effects of surgery?	You will probably have some pain after your operation and you may get an infection in your wound.	You're likely to get more serious side effects than you would from breast-conserving surgery. You may be in some pain and get swelling under your arm and in your wound. There's also a chance you may get some nerve pain. These problems will get better with time.
Will I need another operation?	About 1 in 5 women need a second operation to remove more tissue, though the rate may vary depending on where you live. This is usually done as an insurance policy to make sure that the cells on the border between the cancer and the healthy tissue don't turn into cancer later.	Not usually. Women who need further surgery after breast-conserving surgery often say they wish they had chosen to have a mastectomy in the first place.

## Breast cancer

	There is a risk that the tissue around the tumour in your breast will be abnormal and your surgeon will advise you to have a mastectomy.	
Will I need radiotherapy?	Most likely. You'll probably need radiotherapy to kill any clumps of breast cancer cells in your breast that are too small for your doctor to find. Radiotherapy reduces the chance of the cancer coming back in the same breast.	Not usually. Although you may need treatment in your armpit area if cancer cells are found in the lymph nodes there.
What about my lymph nodes?	You won't need to have your lymph nodes checked if you have ductal carcinoma in situ. But, otherwise, your surgeon will check your lymph nodes for cancer. This may be done through the same cut that your cancer was removed, or you may need to have another cut.	Your surgeon will remove some of your lymph nodes and check them for cancer. If they contain cancer, then your surgeon will may remove all of the nodes.
How will my breast look?	You'll be able to keep your breast, although it won't look the same as it did before. Your scar will be small compared with a mastectomy scar. The exact size of your scar will depend on how much tissue was taken away. Between 6 in 10 and 9 in 10 women rate their breast as looking 'good' to 'excellent' after breast-conserving surgery.	Your breast is completely removed. But you can have breast reconstruction, either at the same time as the mastectomy or at some time later.
How will it affect me afterwards?	You may feel better about having less of your breast removed. You'll be able to wear the same clothes, and you may find it easier to get back into your routine. You won't need to wear a false breast or have surgery to reconstruct your breast.	You may miss your breast, and some women say they feel disfigured by losing a breast. But breast reconstruction can help.

### Breast reconstruction

If you are having a mastectomy, your surgeon should discuss your options for having your breast reconstructed. In many cases, this can be done at the time that you have the breast removed.

The National Institute for Health and Care Excellence (NICE), which advises the government on health care, says you should be offered all types of breast reconstruction surgery, even if they're not available locally.

The main types of reconstruction surgery available are:

- Implants, where a bag of liquid saline or silicon is placed under the skin of the breast (or sometimes under the breast muscle)

## Breast cancer

- Tissue flaps, where your breast is reconstructed from skin and fat from behind your armpit area, or from your lower abdomen
- A combination of tissue flaps and implants.

All the operations have advantages and disadvantages. Implants may need two operations (to stretch the skin and then to put in the implant). Tissue flaps mean you'll have scars where the tissue is taken from elsewhere on your body. Talk to your surgeon or breast cancer nurse about what's right for you. Some operations are better for women with smaller breasts than larger breasts. <sup>[57]</sup>

Some people decide not to have the reconstruction surgery at the same time as the mastectomy, because they feel it's too much to take on at one time. And some people can't have reconstruction surgery until after they've had radiotherapy. In those cases, you should be offered the chance to talk about having your breast reconstructed at a later date. <sup>[36]</sup> It has been suggested that you might feel better mentally if you can have the reconstruction at the same time as the mastectomy, rather than waiting or not having reconstruction, but there isn't really any good evidence to support this. <sup>[58]</sup>

If you decide not to have your breast reconstructed, you may want to wear a prosthesis, which is an artificial breast you wear inside your bra. It may help if you're worried about looking 'lopsided' with only one breast. However, some people find them uncomfortable to wear.

It's a good idea to talk to your surgeon about how your breast is likely to look after reconstruction. It may look quite different from your existing breast. When you first have the reconstruction, your breast won't have a nipple, although an artificial nipple can be made or tattooed on afterwards. You can ask your surgeon to show you photographs of how reconstructed breasts look.

### Survival rates for breast cancer

The outlook for your breast cancer depends mainly on:

- The stage of your cancer (to learn more, see [Staging and grading breast cancer](#) )
- The size of your cancer
- Whether your lymph nodes are affected
- Whether your tumour is sensitive to oestrogen . This refers to whether it is oestrogen-receptor positive , which means that oestrogen helps it grow
- Whether the cancer cells in your tumour make a protein called HER-2

## Breast cancer

- What the tumour looks like under a microscope. This is called the grade of your cancer. It refers to how much the tumour cells look like normal breast cells. The more they look like normal cells, the better your outlook may be. Doctors usually say that a cancer is high grade or low grade. Some doctors use the numbers 1 to 3 to refer to grade. The lower the number, the lower the grade.

In general, if your cancer is diagnosed at an earlier stage and is low grade, you're more likely to live longer.

The good news is that more women are living longer after being diagnosed with breast cancer. Each generation of women can expect to have a better chance of surviving breast cancer than their mothers' generation. For example, among women diagnosed in the early 1990s, only 54 in every 100 survived 10 years or longer. Today, around 77 in every 100 women diagnosed with breast cancer survive at least 10 years. <sup>[59]</sup>

Breast cancer is a disease that can come back 20 years after you have first been diagnosed, so once you reach five years you are not 'cured', exactly. This is why women sometimes call themselves 'breast cancer survivors'. However, if breast cancer is going to come back, it's most likely to do so within the first two years.

This table provides an estimate of the number of women who live at least one, five, 10, or 20 years after being diagnosed with breast cancer. <sup>[60]</sup> These figures are for women whose breast cancer has spread outside the ducts. Women with cancer that has not spread outside the ducts (called ductal carcinoma in situ) are very unlikely to die of their cancer after treatment.

Time since breast cancer diagnosis	Percentage of women still alive
1 year	95 in 100
5 years	85 in 100
10 years	77 in 100
20 years	65 in 100

### How does radiotherapy work?

To understand how radiotherapy works, it is helpful to know about the phases that all cells in the body go through to grow and divide to form new cells.

- In the **resting phase**, the cell hasn't started to divide.
- Then, the cell is **stimulated to reproduce**, perhaps because other cells have been damaged or are worn out and need replacing.
- The cell **makes a copy of its genetic code** (its DNA) so that there will be one copy available for each new cell when the original cell divides.

## Breast cancer

- The cell **forms other essential proteins** that it needs to function.
- The cell **splits into two new cells**. This last phase takes only half an hour to an hour.

Radiation works best at killing cells that are dividing, particularly if they are dividing rapidly. It isn't as good at killing cells that are resting or that divide slowly.

To kill as many cancer cells as possible, doses of radiation may be given five days a week for four weeks to six weeks. The doses are given in this way because not all of the cancer cells will be dividing at the same time. So to destroy as many cancer cells as possible you need to be treated for several days at a time. Because normal cells rest for longer before dividing, they are less likely to be destroyed by radiation.

Doctors have also tried giving higher dose radiotherapy for a shorter period of 3 weeks. Studies suggest this works just as well. <sup>[61]</sup>

The dose of radiation that you need will be carefully worked out by your doctor.

When you have radiotherapy, you will probably be treated with a **linear accelerator machine** that focuses high-energy X-rays onto your breast. Your breast will be marked to show where the treatment should be focused, and you may have to lie still for a few minutes. You will probably be given radiotherapy eight weeks to 12 weeks after surgery.

### Side effects of surgery for breast cancer

Every woman's experience of breast surgery is different. Some women recover in a few weeks with no lasting problems. Others take much longer to get over the operation and adjust to their new body shape. Here we look at some of the physical and emotional problems you might go through after surgery.

Anaesthetics can have side effects. These are more likely with a **general anaesthetic** (which puts you to sleep for the operation) than a **local anaesthetic** (which numbs the area being operated on). You may have an **allergic reaction** to the general anaesthetic or get breathing or heart problems. These problems are serious but very rare. If you have any allergies, **tell your doctor**.

#### Pain

You'll probably have some pain after surgery. This can be severe, especially if you've had a **mastectomy** with surgery to your armpit.

You don't have to grin and bear it. Lots of painkillers are available, and specialist doctors and nurses are trained to help you. Make sure you tell someone if you are in pain.

## Breast cancer

You should be given painkillers regularly while you're in hospital, and you may be prescribed some to take at home. If one painkiller doesn't help, you may need a bigger dose or a stronger drug.

### Lack of movement in your arm

If you've had a mastectomy, or had lymph nodes removed from your armpit, you may find it hard to move your arm as easily as you used to. Exercises will help you get the full range of movement back. Your nurse or physiotherapist will start exercises with you while you're still in hospital. Exercises will help your arm feel less stiff. They should also help your wound heal more quickly.

You'll need to carry on doing your exercises at home.

### Swelling in the arm

You may get some swelling in the arm next to where you had surgery. But this usually settles down after a few weeks as you start to move your arm more. <sup>[62]</sup>

Some women get a more serious problem with swelling in their arm. This can happen months or even years after surgery. Doctors call it **lymphoedema**. It happens in up to a third of women who've had breast surgery. <sup>[62]</sup> When some of the lymph nodes in the armpit are removed, fluid from the tissues has nowhere to drain to. Instead, it collects in the arm, leading to lymphoedema.

One study suggests that having physiotherapy and doing exercises within a few weeks of surgery can cut your chances of getting lymphoedema. <sup>[63]</sup>

Lymphoedema is usually permanent. But there are treatments that can help control it. An elastic bandage around the affected arm can help the fluid to drain away. Gentle massage can also help.

If you have lymphoedema you may get the following symptoms: <sup>[62]</sup>

- Pain in your arm
- Your arm feels heavy
- You can't move your arm as much
- You find it harder to do some things, such as getting dressed.

It's important to see your doctor as soon as you can if you think you may be getting lymphoedema. This is because:

- Getting treatment early can stop your lymphoedema getting worse



## Breast cancer

- Lymphoedema can be a sign that your cancer has come back. And this needs to be diagnosed and treated as soon as possible.

The risk of getting lymphoedema is greater if you have radiotherapy to your armpit or if all the lymph nodes in your armpit are removed. About 2 or 3 out of 10 women get lymphoedema after all their lymph nodes are removed. Some studies show that there is no risk of lymphoedema if only a few nodes are removed. But other studies show that up to 2 in 10 women get this problem after a few nodes are removed. <sup>[64]</sup>

### Wound infection

All wounds can get infected. An infection can make your wound from surgery hurt, and the surrounding skin may be hot, red, and throbbing. The infection might also cause pus to collect around the scar. You may need antibiotics for this.

### Fluid pool in your arm (seroma)

A clear fluid, called **serous fluid**, can collect under the scar. <sup>[65]</sup> This is called a **seroma**. It's part of the normal healing process. The fluid can be drained with a needle by a doctor.

### Nerve damage

There is a small chance that some of the nerves in your upper arm could get damaged during surgery to remove some of the lymph nodes. Nerves could also get damaged during radiotherapy to the armpit. Nerve damage may make the inside of your upper arm feel numb, and you may find it difficult to move your arm in some ways. However, with modern radiotherapy equipment and better surgical techniques, this problem is now rare.

### Depression and anxiety

Up to a third of women with breast cancer get anxious or depressed within a year of being diagnosed. If you find yourself worrying a lot about your cancer coming back or you don't seem to be enjoying life the way you used to, talk to your doctor. You may find that all you need is some reassurance that these feelings are a normal part of recovering from a serious illness. But if your problem is more serious, then your doctor should be able to offer treatments to help.

### Adjusting to changes in your body

It can be hard adjusting to life after breast surgery. You might feel disfigured and worry that your partner may see you in a different way. You may not want to undress in front of your partner or other people, and you may find it difficult to look at your chest in a mirror. You may not want to have sex because you feel unattractive or think that your partner doesn't want to touch you.

You need to **give yourself time** to get used to the changes to your body. Having breast-reconstruction surgery makes some women feel better about the way their body looks.

## Breast cancer

Sometimes it can help to talk to someone about how you feel. There are support groups and cancer charities that can give you advice. Many have trained counsellors who may have been through a similar experience. Ask your doctor for the support groups in your area. The breast cancer nurse at the hospital where you were treated may also be able to help.

### Side effects of radiotherapy

The side effects of radiotherapy can happen soon after your treatment or awhile later.

#### Early side effects

- **Skin reactions** are less common now because of better, modern radiotherapy equipment. But your skin can get dry, red and itchy during the first two weeks to four weeks of treatment. You may get some blisters or red spots on your skin, and later it may get moist and weepy. Ask your radiotherapist about what you can put on your skin to soothe it. Avoid getting direct sunlight on your skin because it will be sensitive for some time. One study found that about 1 in 3 women who had radiotherapy had skin irritation three months later. This compared with 1 in 10 who had only breast-conserving surgery. <sup>[66]</sup>
- **Breast soreness and swelling** can happen, but this should get better when your treatment finishes. One study found that about 1 in 3 women who had radiotherapy after surgery had breast pain after six months. This compares with 1 in 5 women who had only surgery. <sup>[66]</sup>
- **Breast tissue changes** happen in some women. Your breast may feel more firm and solid than before radiotherapy. This may make your breasts look uneven. The skin on your breast may also get darker temporarily. You may also get a red, spidery rash over your breast, which may fade with time.
- **Overwhelming tiredness** happens in some women. Some women continue to go to work while having radiotherapy, but many more stay at home because they feel so worn out. Radiotherapy can be exhausting, and the effects can last for a while after you've finished your treatment. No one knows why. Try not to get depressed. You will get your energy back. But, in the meantime, take good care of yourself and don't expect to do too much too soon. Aim to do one enjoyable thing a day. Doing some light exercise, such as taking a short walk to shops, followed by a rest is a good way to start doing things again.

## Breast cancer

### Later side effects

- **Lung inflammation** affects between 1 in 100 and 7 in 100 women who have radiotherapy for breast cancer. The inflammation can make you cough and feel short of breath. <sup>[67]</sup>
- **Damage to the nerves in the armpit** affects some women. If radiotherapy is given to your armpit, you may feel tingling or weakness in your shoulder, arm and hand. Some women find this improves over time, but others find that their arm never entirely returns to normal. However, with new radiotherapy techniques, this is increasingly rare.
- **Hair loss** can happen in areas that were treated by radiotherapy. You may lose any hairs growing around your nipple. If your armpit had radiotherapy, then your hair there may fall out and not grow back.
- **Rib damage** used to happen because radiotherapy weakened people's bones. This side effect is now rare.
- **Increased risk of other cancers** is a possibility for women who've had radiotherapy. One study found that women who had radiotherapy for breast cancer had a slightly increased risk of getting cancer in the other breast. About 3 in 100 women who had radiotherapy got breast cancer in the other breast compared with 1 percent of those who didn't have radiotherapy. <sup>[35]</sup> Women who have breast cancer in one breast already have a slightly increased risk of getting it in their other breast.
- **Inflammation of the sac covering the heart** (pericarditis) affects about 3 in 1,000 women treated with radiotherapy. <sup>[67]</sup> It causes chest pain and fever. Women who have radiotherapy under their breastbone are most likely to get this problem. <sup>[68]</sup>
- **Fibrosis** is a problem that makes your breast feel hard and change shape. If your doctor thinks that there's a high risk of your breast cancer coming back, you may have an extra boost of radiotherapy to your breast. This can cause fibrosis. <sup>[69]</sup>

### Side effects of tamoxifen

Tamoxifen can cause a range of side effects. Some are quite common, while others are rare. <sup>[70]</sup>

Tamoxifen stops the female hormone oestrogen working in the body. This can make your body think you are going through the menopause .

## Breast cancer

- About 50 in 100 women who take tamoxifen have **symptoms of the menopause**, such as hot flushes (which can be severe) and irregular periods. This is more common among women who haven't been through the menopause yet. But tamoxifen may not be the only thing causing these symptoms. In studies, up to 40 in 100 women taking a dummy treatment (a placebo) also had symptoms of the menopause.
- Some women get **vaginal discharge or dryness**. This is common and can be difficult to cope with. You may not feel like having sex and you may feel uncomfortable. Ask your doctor for advice. There are creams that can make you more comfortable.
- About 10 in 100 women get **indigestion** or **feel sick** when they take tamoxifen.
- If you haven't been through the menopause, tamoxifen can make you more likely to become pregnant. But tamoxifen may also cause birth defects. You **should not get pregnant** while taking it, and you should wait a few months after you stop taking it before trying to get pregnant. Make sure you discuss birth control with your doctor.
- You may feel **restless, depressed, tired** and **have difficulty sleeping**. But these problems seem to also happen in women with breast cancer who don't take tamoxifen.
- **Cataracts** from tamoxifen are rare. And it may be that tamoxifen just makes cataracts worse rather than causing them.
- There is a small risk of getting a blood clot (a **deep vein thrombosis**, or **DVT**) while taking tamoxifen. Deep vein thrombosis happens when a blood clot forms in a large vein, usually in the leg, and it can cause pain and swelling. In studies, about 1 in 100 women taking tamoxifen get a blood clot. The risk is bigger at times when you can't move around, such as when you're recovering from surgery.<sup>[71]</sup> Blood clots that travel in your bloodstream to your lungs can be dangerous, so tell your doctor if you feel breathless. Pain in your leg can also be a sign of a DVT.
- Studies have found that tamoxifen slightly increases the risk of **cancer of the lining of the womb** (endometrial cancer). But the overall risk is small. One study looked at women who took tamoxifen for five years.<sup>[72]</sup> It found that, in the 10 years after starting tamoxifen, these women had a 2 in 1,000 chance of dying of endometrial cancer. Your doctor will only recommend tamoxifen if the benefits outweigh the risks.
- Tamoxifen can cause **weaker bones**, but only in women who haven't yet gone through the menopause. However, for women who've been through the menopause, tamoxifen improves bone density.<sup>[73]</sup>

### Beneficial side effects

Studies show that tamoxifen may also have some positive side effects. One study followed women for 10 years after they'd had surgery for early breast cancer. Within this time, women who had taken tamoxifen for five years were less likely to have died of **heart disease** than those who'd taken the drug for two years.<sup>[74]</sup> Other research has shown that tamoxifen may improve **bone density** for women who've been through the menopause and help lower **cholesterol**.<sup>[73] [75] [76] [77]</sup>

### Radiotherapy during surgery

This is a type of radiotherapy that's currently being looked at in studies. You're given radiotherapy at the same time as you have surgery to remove your cancer. After your surgeon has removed your tumour, he or she will place a probe (rod) with a ball at its end, the size of an orange, inside your chest.

Radiotherapy is given through this rod into the area where your tumour used to be. The idea is that using radiotherapy at this early stage, and right where the tumour was, could mean you won't need radiotherapy later. So you have just one treatment instead of four weeks of treatment.

You may have fewer side effects when you have radiotherapy during surgery than if you have radiotherapy after surgery. And your breast could look better after radiotherapy during surgery.<sup>[78] [79]</sup> Having radiotherapy at the same as surgery is also more convenient.

But we need more research to know if radiotherapy around the part of your breast being removed is better and safer than radiotherapy to a wider area.<sup>[80] [81] [82]</sup> This treatment is being tried in:

- Women with small tumours (less than 3 centimetres [1.2 inches])
- Women over 50 with lower-grade tumours.

The chances of cancer coming back in these women is less than in:

- Women who have larger tumours
- Younger women.

## Long-term results of chemotherapy

You are not a statistic, and no one can tell you exactly what will happen to you after treatment for breast cancer. But studies can give you some idea of how well women with early breast cancer live after chemotherapy.

The table below shows the benefit of having chemotherapy for breast cancer. <sup>[83]</sup> Women who have chemotherapy are more likely to be alive 10 years later than women who don't.

Because studies need to follow women for a long time to get these results, it means that the women who took part in these studies were all treated at least 10 years ago. Treatments have improved since then, so it's likely that women now live even longer after chemotherapy than these numbers suggest.

### Percentage of women alive 10 years after being diagnosed with breast cancer

Age	Lymph nodes involved?	No chemotherapy	Chemotherapy
Under 50	Yes	41 in 100	54 in 100
	No	72 in 100	78 in 100
50-69	Yes	46 in 100	49 in 100
	No	65 in 100	71 in 100

## Side effects of chemotherapy

Side effects of chemotherapy can happen soon after treatment or later on. You should weigh up the benefits of treatment against these side effects.

### Side effects that can happen soon after treatment

These are also called acute side effects. <sup>[83]</sup>

- **Nausea and vomiting:** You'll probably feel sick, but the feeling will probably be mild. Even so, it can be very difficult. About 1 in 20 women get bad nausea. It can be prevented by taking drugs such as ondansetron. Lorazepam, a type of tranquilliser, can also help you feel less sick.
- **Fewer white blood cells:** 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 count**) falls too low, you are at risk of getting an infection. Only about 2 in 100 women who have chemotherapy end up getting life-threatening infections, and most of these can be treated. To prevent this side effect, you can get injections to stimulate your white cells to grow.
- **Fatigue:** Your tiredness may be overwhelming, and it can continue after you stop treatment. About two-thirds of women say their tiredness is moderate or severe. No

## Breast cancer

one knows exactly why people feel so tired when they have chemotherapy. It may be that chemotherapy can make you anaemic, or that the drugs used in chemotherapy interfere with sleep. Three years after having chemotherapy, most women say their energy levels are back to normal, although many women feel better long before this.

- **Hair loss:** This happens because the drugs used in chemotherapy kill hair cells. If you are taking anthracyclines, you will probably lose all your hair. Many women find this very distressing, but it will grow back.
- **Problems with your digestive tract:** Fortunately, bad mouth sores (ulcers) and diarrhoea don't happen all that often, but they may be more severe if you are treated with a drug called 5-fluorouracil.

### Side effects that can happen later on

These side effects can happen after you stop treatment. <sup>[83]</sup> <sup>[84]</sup>

- **Weight gain:** Most women with breast cancer who are treated with cyclophosphamide, methotrexate, and 5-fluorouracil gain between 2 kilograms (4.5 pounds) and 5.5 kilograms (12 pounds). Women often gain weight after they are diagnosed with breast cancer. This weight gain may happen because they are exercising less, or because their metabolism slowed down after chemotherapy. Or it may be that their ovaries stopped working because of their treatment (the ovaries usually produce hormones that affect weight gain). Also, women are often given steroids as part of treatment and these can cause weight gain.
- **Loss of fertility:** Being treated with cyclophosphamide, methotrexate, and 5-fluorouracil for six months can stop the ovaries working permanently. This happens to 70 in 100 women over 40 and 40 in 100 younger women. When the ovaries stop working, this can cause symptoms of the menopause, including hot flushes (which can be severe), vaginal dryness, pain during sex, difficulty sleeping and depression. There's also a risk of long-term thinning of the bones (osteoporosis). To protect yourself, you should do weight-bearing exercise (such as walking briskly) and take vitamin D and calcium (found in milk and dairy products). You may need treatment for some of these problems. Your doctor will check the density of your bones with a special type of X-ray. <sup>[36]</sup>
- **Risk of a second cancer:** Some women who have chemotherapy also get leukaemia, sometimes many years after treatment. This side effect is very rare. It affects less than 1 in 100 women treated with chemotherapy. It may happen only after treatment with certain drug combinations, such as cyclophosphamide, methotrexate, and 5-fluorouracil given for six months. The risk of getting a second cancer may double if you have chemotherapy, but this is still a small risk that works out as five extra cases happening over 10 years in every 10,000 patients treated with chemotherapy.

## Breast cancer

- **Heart damage:** Doxorubicin can directly damage the heart muscle and make it flabby and less able to pump properly. The risk of getting heart failure is less than 1 in 100, as long as the dose of doxorubicin is not more than 300 milligrams/metre squared to 350 milligrams/metre squared. 'Metres squared' refers to how much of a drug is given for the size of your body. To learn more, see our articles on [Heart failure](#).
- **Memory problems and loss of concentration:** Women who have chemotherapy sometimes say that they have lapses in concentration and problems with their memory, even three years after treatment. But studies have had conflicting results, with some finding that chemotherapy may affect memory and concentration, and others finding that it does not. A review of studies suggested that women who have chemotherapy may have small declines in their ability to find and use the right word (their verbal ability) and in their performance on tests where they recreated a complex image or pattern. But the review found no decrease in the women's memory or level of attention. <sup>[85]</sup>

### Glossary:

#### metastasis

This happens when cancer cells spread to parts of the body that are far away from the original tumour. The cancer can travel through the bloodstream, lymphatic system or other fluids. New tumours may form in another area of the body as a result.

#### 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.

#### lymph fluid

Lymph is a clear or whitish liquid that flows throughout your body through the lymphatic vessels and lymph nodes (also called lymph glands). Lymph contains proteins and fats, some red blood cells and many white blood cells (especially lymphocytes). Lymphocytes help your body fight infection.

#### 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.

#### proteins

A lot of your body's tissues are made out of proteins. Proteins can be made in your cells. Proteins are also part of the food you eat, particularly meat and dairy products. Your body breaks down the protein you eat into amino acids. Your cells then use these amino acids to build new proteins, which make up muscles, joints, hair and other parts of your body.

#### genes

Your genes are the parts of your cells that contain instructions for how your body works. Genes are found on chromosomes, structures that sit in the nucleus at the middle of each of your cells. You have 23 pairs of chromosomes in your normal cells, each of which has thousands of genes. You get one set of chromosomes, and all of the genes that are on them, from each of your parents.

#### hormones

Hormones are chemicals that are made in certain parts of the body. They travel through the bloodstream and have an effect on other parts of the body. For example, the female sex hormone oestrogen is made in a woman's ovaries. Oestrogen has many different effects on a woman's body. It makes the breasts grow at puberty and helps control periods. It is also needed to get pregnant.

#### oestrogen

Oestrogen is the name given to three female sex hormones: oestradiol, oestrone and oestriol. Oestrogen causes women's sexual development during puberty: it is needed to develop breasts, have periods and get pregnant. Oestrogen is also thought to affect women's health in other ways. It may influence their mood, cholesterol levels and how their bones grow. Men have very low levels



# Breast cancer

of oestrogen in their bodies, but doctors aren't completely sure what it does. Oestrogen is an important ingredient in most types of contraceptive pill and hormone replacement therapy.

## 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.

## mammogram

A mammogram is a special kind of X-ray picture of the breast. It is used to screen women for breast cancer, as well as to investigate breast lumps.

## MRI scan

A magnetic resonance imaging (MRI) machine uses a magnetic field to create detailed pictures of the inside of your body.

## calcium

Calcium is an important mineral in your body. It helps to make your bones and teeth strong. It also keeps your heart, nerves, muscles and blood working properly.

## lymph vessels

Lymph vessels are part of your body's lymphatic system. The lymphatic system moves lymph fluid through your body. This fluid carries proteins, white blood cells and other substances. Lymph vessels carry fluid between your lymph nodes.

## 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.

## eczema

Eczema is a very itchy rash. It may be dark and bumpy and release fluid. Scratching makes it worse. You can get eczema anywhere on your body, but it is most common on the wrists, the insides of the elbows and the backs of the knees. If you have asthma or allergies you are more likely to get eczema than someone who doesn't have these conditions.

## menopause

When a woman stops having periods, it is called the menopause. This usually happens around the age of 50.

## local anaesthetic

A local anaesthetic is a painkiller that's used to numb one part of your body. You usually get local anaesthetics as injections.

## oestrogen-receptor positive

Oestrogen-receptor positive tumours are cancers that are encouraged to grow by the presence of the hormone oestrogen.

## mastectomy

A mastectomy is an operation for breast cancer. It removes all of your breast tissue, including the skin and the nipple, from the side of your chest that has cancer.

## ultrasound

Ultrasound is a tool doctors use to create images of the inside of your body. An ultrasound machine sends out high-frequency sound waves, which are directed at an area of your body. The waves reflect off parts of your body to create a picture. Ultrasound is often used to see a developing baby inside a woman's womb.

## chemotherapy

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

## general anaesthetic

You may have a type of medicine called a general anaesthetic when you have surgery. It is given to make you unconscious so you don't feel pain when you have surgery.

## allergic reaction

You have an allergic reaction when your immune system overreacts to a substance that is normally harmless. You can be allergic to particles in the air you are breathing, like pollen (which causes hay fever) or to chemicals on your skin, like detergents (which can cause a rash). People can also have an allergic reaction to drugs, like penicillin.

## physiotherapist

A physiotherapist is a health professional who is trained to use physical activity and exercises to help people's bodies heal.

## 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.

## inflammation

# Breast cancer

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.

## placebo

A placebo is a 'pretend' or dummy treatment that contains no active substances. A placebo is often given to half the people taking part in medical research trials, for comparison with the 'real' treatment. It is made to look and taste identical to the drug treatment being tested, so that people in the studies do not know if they are getting the placebo or the 'real' treatment. Researchers often talk about the 'placebo effect'. This is where patients feel better after having a placebo treatment because they expect to feel better. Tests may indicate that they actually are better. In the same way, people can also get side effects after having a placebo treatment. Drug treatments can also have a 'placebo effect'. This is why, to get a true picture of how well a drug works, it is important to compare it against a placebo treatment.

## cataract

A cataract is when your eye's lens, which is normally clear, gets cloudy. This makes your vision blurred or fuzzy, like trying to see through a fogged-up window.

## deep vein thrombosis

A deep vein thrombosis is a blood clot that has formed in the deep veins of your arms or legs. These clots can form if a person doesn't move their limbs often enough. This is because blood is pushed through your veins by the contraction of muscles that occurs when a limb is moved. Blood tends to clot when it is not kept flowing, so clots can form if a person is not moving. Deep vein thrombosis is also called deep venous thrombosis or DVT.

## 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.

## ulcer

An ulcer is an open sore. Ulcers can happen in many parts of your body, such as in your stomach, and the skin of your legs, mouth, or genitals.

## 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.

## ovaries

Women have two ovaries, one on each side of their womb. They are small glands that store eggs. Inside the ovaries are hundreds of thousands of pre-eggs, called follicles. Some of these grow into eggs.

## 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'.

## 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.

## haematoma

A haematoma is a collection of blood in any part of your body. The blood has usually clotted or dried.

## 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.

## 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.

## 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.

## bacteria

# Breast cancer

Bacteria are tiny organisms. There are lots of different types. Some are harmful and can cause disease. But some bacteria live in your body without causing any harm.

## heart disease

You get heart disease when your heart isn't able to pump blood as well as it should. This can happen for a variety of reasons.

## 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.

## blood pressure

Blood pressure is the amount of force that's exerted by your blood on to your blood vessels. You can think of it like the water pressure in your home: the more pressure you have, the faster and more forcefully the water flows out of the shower. Blood pressure is measured in millimetres of mercury (written as mm Hg). When your blood pressure is taken, the measurement is given as two numbers, for example 120/80 mm Hg. The first, higher, number is called the systolic pressure, and the second, lower, number is the diastolic pressure. The systolic number is the highest pressure that occurs while your heart is pushing blood into your arteries. The diastolic number is the lowest pressure that happens when your heart is relaxing and is not pushing your blood.

## 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.

## breast-conserving surgery

An operation to remove cancer from the breast, which aims not to take away any more tissue than is necessary to get rid of the cancer. It may be a lumpectomy (removal of just the lump and a little surrounding tissue), wide local excision (removal of the lump and more surrounding tissue), or segmented or quadrant resection (removal of the lump and up to a quarter of the breast).

## lymphoedema

Lymphoedema is when lymph nodes can't drain lymph properly. This causes swelling. It happens when lymph nodes are destroyed or damaged. If you have breast surgery or radiotherapy for breast cancer, you can get lymphoedema and swelling in your arm.

## 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.

## spinal cord

Your spinal cord is a thick bundle of nerves that runs down your backbone (spine). These nerves carry messages between your brain and the rest of your body. The bones (vertebrae) in your neck and back protect your spinal cord. If your spinal cord gets damaged, you may lose feeling in your legs or arms.

## heart failure

When the heart loses its ability to push enough blood through the blood vessels, it is called heart failure.

## Sources for the information on this leaflet:

1. Office for National Statistics. Breast cancer in England, 2009. September 2011. Available at <http://www.ons.gov.uk/ons/rel/cancer-unit/breast-cancer-in-england/2009/breast-cancer.html> (accessed on 5 November 2013).
2. McPherson K, Steel CM, Dixon JM. ABC of breast diseases. Breast cancer: epidemiology, risk factors and genetics. *BMJ*. 2000; 321: 624-628.
3. de Waard F, Thijssen JH. Hormonal aspects in the causation of human breast cancer: epidemiological hypotheses reviewed, with special reference to nutritional status and first pregnancy. *Journal of Steroid Biochemistry & Molecular Biology*. 2005; 97: 451-458.
4. Parsa P, Parsa B. Effects of reproductive factors on risk of breast cancer: a literature review. *Asian Pacific Journal of Cancer Prevention*. 2009; 10: 545-550.
5. Pasche B. Recent advances in breast cancer genetics. *Cancer Treatment and Research*. 2008; 141: 1-10.
6. Antoniou A, Pharoah PD, Narod S, et al. Average risks of breast and ovarian cancer associated with BRCA1 or BRCA2 mutations detected in case series unselected for family history: a combined analysis of 22 studies. *The American Journal of Human Genetics*. 2003; 72: 1117-1130.

## Breast cancer

7. Collaborative Group on Hormonal Factors in Breast Cancer. Familial breast cancer: collaborative reanalysis of individual data from 52 epidemiological studies including 58,209 women with breast cancer and 101,986 women without the disease. *Lancet*. 2001; 358: 1389-1399.
8. Ng AK, Travis LB. Radiation therapy and breast cancer risk. *Journal of the National Comprehensive Cancer Network*. 2009; 7: 1121-1128.
9. Henderson TO, Amsterdam A, Bhatia S, et al. Systematic review: surveillance for breast cancer in women treated with chest radiation for childhood, adolescent, or young adult cancer. *Annals of Internal Medicine*. 2010; 152: 444-455.
10. Lee SH, Akuete K, Fulton J, et al. An increased risk of breast cancer after delayed first parity. *American Journal of Surgery*. 2003; 186: 409-412.
11. Britt K, Ashworth A, Smalley M. Pregnancy and the risk of breast cancer. *Endocrine-Related Cancer*. 2007; 14: 907-933.
12. Furberg H, Newman B, Moorman P, et al. Lactation and breast cancer risk. *International Journal of Epidemiology*. 1999; 28: 396-402.
13. Collaborative Group on Hormonal Factors in Breast Cancer. Breast cancer and breastfeeding: collaborative reanalysis of individual data from 47 epidemiological studies in 30 countries, including 50302 women with breast cancer and 96973 women without the disease. *Lancet*. 2002; 360: 187-195.
14. Ip S, Chung M, Raman G, et al. Breastfeeding and maternal and infant health outcomes in developed countries. *Evidence Reports/Technology Assessments*. 2007; 153: 1-186.
15. Parkin DM. Cancers attributable to reproductive factors in the UK in 2010. *British Journal of Cancer*. 2011; 105 (supplement 2): S73-S76.
16. Nelson HD, Walker M, Zakher B, et al. Menopausal hormone therapy for the primary prevention of chronic conditions: a systematic review to update the U.S. Preventive Services Task Force recommendations. *Annals of Internal Medicine*. 2012; 157: 104-113.
17. Beral V; Million Women Study Collaborators. Breast cancer and hormone-replacement therapy in the Million Women Study. *Lancet*. 2003; 362: 419-427.
18. Collaborative Group on Hormonal Factors in Breast Cancer. Breast cancer and hormonal contraceptives: further results. *Contraception*. 1996; 54 (supplement): S1-S106.
19. Marchbanks PA, McDonald JA, Wilson HG, et al. Oral contraceptives and the risk of breast cancer. *New England Journal of Medicine*. 2002; 346: 2025-2032.
20. Rose DP, Vona-Davis L. Interaction between menopausal status and obesity in affecting breast cancer risk. *Maturitas*. 2010; 66: 33-38.
21. Boyd NF, Stone J, Vogt KN, et al. Dietary fat and breast cancer risk revisited: a meta-analysis of the published literature. *British Journal of Cancer*. 2003; 89: 1672-1685.
22. Baan R, Straif K, Grosse Y, et al; WHO International Agency for Research on Cancer Monograph Working Group. Carcinogenicity of alcoholic beverages. *Lancet Oncology*. 2007; 8: 292-293.
23. Hamajima N, Hirose K, Tajima K, et al. Alcohol, tobacco and breast cancer: collaborative reanalysis of individual data from 53 epidemiological studies, including 58,515 women with breast cancer and 95,067 women without the disease. *British Journal of Cancer*. 2002; 87: 1234-1245.
24. Parkin DM. Cancers attributable to consumption of alcohol in the UK in 2010. *British Journal of Cancer*. 2011; 105 (supplement 2): S14-S18.
25. Friedenreich CM. The role of physical activity in breast cancer etiology. *Seminars in Oncology*. 2010; 37: 297-302.

## Breast cancer

26. Parkin DM. Cancers attributable to inadequate physical exercise in the UK in 2010. *British Journal of Cancer*. 2011; 105 (supplement 2): S38-S41.
27. National Institute for Health and Care Excellence. Familial breast cancer (breast cancer in the family). June 2013. Available at <http://publications.nice.org.uk/ifp164> (accessed on 5 November 2013).
28. UICC International Union Against Cancer. TNM classification of malignant tumours. 5th edition. Sobin LH, Wittekind CH, eds. Wiley-Liss, New York, NY; 1997.
29. Allred DC. Ductal carcinoma in situ: terminology, classification, and natural history. *Journal of the National Cancer Institute (Monographs)*. 2010; 2010: 134-138.
30. Aebi S, Davidson T, Gruber G, et al; ESMO Guidelines Working Group. Primary breast cancer: ESMO clinical recommendations for diagnosis, treatment and follow-up. *Annals of Oncology*. 2011; 22 (supplement 6): v12-v24.
31. European Society for Medical Oncology. Breast cancer: a guide for patients. 2013. Available at <http://www.esmo.org/content/download/6593/114959/file/ESMO-RCT-Breast-Cancer-Guide-for-Patients.pdf> (accessed on 5 November 2013).
32. American Cancer Society. Detailed guide: breast cancer. How is breast cancer staged? October 2013. Available at <http://www.cancer.org/cancer/breastcancer/detailedguide/breast-cancer-staging> (accessed on 5 November 2013).
33. NHS Cancer Screening Programmes. NHS Breast Screening Programme: Annual Review 2011. 2011. Available at <http://www.cancerscreening.nhs.uk/breastscreen/publications/nhsbsp-annualreview2011.pdf> (accessed on 5 November 2013).
34. National Cancer Intelligence Network. The non-invasive breast cancer report. December 2011. Available at <http://www.cancerscreening.nhs.uk/breastscreen/non-invasive-breast-cancer-report.html> (accessed on 5 November 2013).
35. Julien JP, Bijker N, Fentiman IS, et al. Radiotherapy in breast-conserving treatment for ductal carcinoma in situ: first results of the EORTC randomised phase III trial 10853. *Lancet*. 2000; 355: 528-533.
36. National Institute for Health and Care Excellence. Early and locally advanced breast cancer: diagnosis and treatment. Clinical guideline 80. February 2009. Available at <http://www.nice.org.uk/cg80> (accessed on 5 November 2013).
37. Dushkin H, Cristofanilli M. Inflammatory breast cancer. *Journal of the National Comprehensive Cancer Network*. 2011; 9: 233-240.
38. Sakorafas GH, Blanchard K, Sarr MG, et al. Paget's disease of the breast. *Cancer Treatment Reviews*. 2001; 27: 9-18.
39. NHS Breast Screening Programme. What does the NHS Breast Screening Programme do? Available at <http://www.cancerscreening.nhs.uk/breastscreen/screening-programme.html> (accessed on 5 November 2013).
40. Cancer Research UK. UK breast cancer incidence statistics. Available at <http://info.cancerresearchuk.org/cancerstats> (accessed on 5 November 2013).
41. National Institute for Health and Care Excellence. Referral guidelines for suspected cancer. June 2005. Clinical guideline 27. Available at <http://www.nice.org.uk/cg27> (accessed on 20 October 2014).
42. National Cancer Institute. Breast cancer PDQ: screening. Health professional version. October 2013. Available at <http://www.cancer.gov/cancertopics/pdq/screening/breast/healthprofessional/page1> (accessed on 5 November 2013).
43. Gøtzsche PC, Nielsen M. Screening for breast cancer with mammography (Cochrane review). In: *The Cochrane Library*. Wiley, Chichester, UK.
44. National Institute for Health and Care Excellence. Improving outcomes in breast cancer. August 2002. Available at <http://www.nice.org.uk/cat.asp?c=36017> (accessed on 5 November 2013).
45. National Institute for Health and Care Excellence. Improving outcomes in breast cancer. August 2002. Available at <http://www.nice.org.uk/cat.asp?c=36017> (accessed on 5 November 2013).

## Breast cancer

46. Fisher ER, Sass R, Fisher B, et al. Pathologic findings from the National Surgical Adjuvant Breast Project (protocol 6). II. Relation of local breast recurrence to multicentricity. *Cancer*. 1986; 57: 1717-1724.
47. Kurtz JM, Jacquemier J, Amalric R, et al. Breast-conserving therapy for macroscopically multiple cancers. *Annals of Surgery*. 1990; 212: 38-44.
48. Early Breast Cancer Trialists' Collaborative Group. Favourable and unfavourable effects on long-term survival of radiotherapy for early breast cancer: an overview of the randomised trials. *Lancet*. 2000; 355: 1757-1770.
49. Fisher B, Anderson S, Bryant J, et al. Twenty-year follow-up of a randomized trial comparing total mastectomy, lumpectomy, and lumpectomy plus irradiation for the treatment of invasive breast cancer. *New England Journal of Medicine*. 2002; 347: 1233-1241.
50. Schijven MP, Vingerhoets AJ, Rutten HJ, et al. Comparison of morbidity between axillary lymph node dissection and sentinel node biopsy. *European Journal of Surgical Oncology*. 2003; 29: 341-350.
51. Goyal A, Newcombe RG, Mansel RE. Axillary Lymphatic Mapping Against Nodal Axillary Clearance (ALMANAC) Trialists Group: clinical relevance of multiple sentinel nodes in patients with breast cancer. *British Journal of Surgery*. 2005; 92: 438-442.
52. Al-Ghazal SK, Blamey RW. Cosmetic assessment of breast-conserving surgery for primary breast cancer. *Breast*. 1999; 8: 162-168.
53. Al-Ghazal SK, Fallowfield L, Blamey RW. Comparison of psychological aspects and patient satisfaction following breast conserving surgery, simple mastectomy and breast reconstruction. *European Journal of Cancer*. 2000; 36: 1938-1943.
54. Schain WS, d'Angelo TM, Dunn ME, et al. Mastectomy versus conservative surgery and radiation therapy: psychosocial consequences. *Cancer*. 1994; 73: 1221-1228.
55. Virnig BA, Shamlivan T, Tuttle TM, et al. Diagnosis and management of ductal carcinoma in situ (DCIS). Evidence Report Technology Assessment. 2009; 185: 1-549.
56. Jeevan R, Cromwell DA, Trivella T, et al. Reoperation rates after breast conserving surgery for breast cancer among women in England: retrospective study of hospital episode statistics. *BMJ*. 2012; 345: 4505.
57. Cancer Research UK. Types of breast reconstruction. October 2012. Available at <http://www.cancerhelp.org.uk/type/breast-cancer/treatment/surgery/reconstruction/types-of-breast-reconstruction> (accessed on 5 November 2013).
58. D'Souza N, Darmanin G, Fedorowicz Z. Immediate versus delayed reconstruction following surgery for breast cancer (Cochrane review). In: *The Cochrane Library*. Wiley, Chichester, UK.
59. Cancer Research UK. Predicted improvements in breast cancer survival. October 2012. Available at <http://www.cancerhelp.org.uk/about-cancer/cancer-questions/predicted-improvements-in-breast-cancer-survival> (accessed on 5 November 2013).
60. Cancer Research UK. Breast cancer survival statistics. Available at <http://info.cancerresearchuk.org/cancerstats/types/breast/mortality/uk-breast-cancer-mortality-statistics> (accessed on 5 November 2013).
61. Whelan TJ, Pignol JP, Levine MN, et al. Long-term results of hypofractionated radiation therapy for breast cancer. *New England Journal of Medicine*. 2010; 362: 513-520.
62. Pain SJ, Purushotham AD. Lymphoedema following surgery for breast cancer. *British Journal of Surgery*. 2000; 87: 1128-1141.
63. Torres Lacomba M, Yuste Sánchez MJ, Zapico Goñi A. Effectiveness of early physiotherapy to prevent lymphoedema after surgery for breast cancer: randomised, single blinded, clinical trial. *BMJ*. 2010; 340: b5396.
64. Browning CJ. Lymphoedema: prevalence risk factors and management: a review of research. 1997. NHMRC National Breast Cancer Centre resource. Available at

# Breast cancer

<http://canceraustralia.gov.au/publications-resources/cancer-australia-publications/lymphoedema-prevalence-risk-factors-management> (accessed on 5 November 2013).

65. Gonzalez EA, Saltzstein EC, Riedner CS, et al. Seroma formation following breast cancer surgery. *Breast Journal*. 2003; 9: 385-388.
66. Fisher B, Bryant J, Dignam JJ, et al. Tamoxifen, radiation therapy, or both for prevention of ipsilateral breast tumor recurrence after lumpectomy in women with invasive breast cancers of one centimeter or less. *Journal of Clinical Oncology*. 2002; 20: 4141-4149.
67. Steering Committee on Clinical Practice Guidelines for the Care and Treatment of Breast Cancer. A Canadian consensus document. *Canadian Medical Association Journal*. 1998; 158 (supplement 3): S1-S84.
68. Gyenes G, Rutqvist LE, Liedberg A, et al. Long-term cardiac morbidity and mortality in a randomized trial of pre- and postoperative radiation therapy versus surgery alone in primary breast cancer. *Radiotherapy and Oncology*. 1998; 48: 185-190.
69. Kurtz JM. Impact of radiotherapy on breast cosmesis. *Breast*. 1995; 3: 163-169.
70. Osborne CK. Tamoxifen in the treatment of breast cancer. *New England Journal of Medicine*. 1998; 339: 1609-1618.
71. British National Formulary. Tamoxifen. Section 6.7.2. British Medical Association and Royal Pharmaceutical Society of Great Britain. Also available at <http://bnf.org> (accessed on 5 November 2013).
72. Early Breast Cancer Trialists' Collaborative Group. Relevance of breast cancer hormone receptors and other factors to the efficacy of adjuvant tamoxifen: patient-level meta-analysis of randomised trials. *Lancet*. 2011; 378: 771-784.
73. Powles TJ, Hickish T, Kanis JA, et al. Effect of tamoxifen on bone mineral density measured by dual-energy x-ray absorptiometry in healthy premenopausal and postmenopausal women. *Journal of Clinical Oncology*. 1996; 14: 78-84.
74. Nordenskjöld B, Rosell J, Rutqvist LE, et al. Coronary heart disease mortality after 5 years of adjuvant tamoxifen therapy: results from a randomized trial. *Journal of the National Cancer Institute*. 2005; 97: 1609-1610.
75. Love RR, Wiebe DA, Feyzi JM, et al. Effects of tamoxifen on cardiovascular risk factors in postmenopausal women after 5 years of treatment. *Journal of the National Cancer Institute*. 1994; 86: 1534-1539.
76. Cushman M, Costantino JP, Tracy RP, et al. Tamoxifen and cardiac risk factors in healthy women: suggestion of an anti-inflammatory effect. *Arteriosclerosis, Thrombosis, and Vascular Biology*. 2001; 21: 255-261.
77. Grey AB, Stapleton JP, Evans MC, et al. The effect of the anti-estrogen tamoxifen on cardiovascular risk factors in normal postmenopausal women. *Journal of Clinical Endocrinology and Metabolism*. 1995; 80: 3191-3195.
78. Australian Safety and Efficacy Register of New Interventional Procedures - Surgical, and the Royal Australasian College of Surgeons. A systematic review of intraoperative radiotherapy in early stage breast cancer. October 2002. Available at <http://www.surgeons.org/media/291393/IORTreview1002.pdf> (accessed on 5 November 2013).
79. Coles CE, Moody AM, Wilson CB, et al. Reduction of radiotherapy-induced late complications of early breast cancer: the role of intensity-modulation radiation therapy and partial breast irradiation. Part II: radiotherapy strategies to reduce radiation-induced late effects. *Clinical Oncology*. 2005; 17: 98-110.
80. Ribeiro GG, Magee B, Swindell R, et al. The Christie Hospital breast conservation trial: an update at 8 years from inception. *Clinical Oncology*. 1993; 5: 278-283.
81. Magee B, Swindell R, Harris M, et al. Prognostic factors for breast recurrence after conservative breast surgery and radiotherapy: results from a randomised trial. *Radiotherapy and Oncology*. 1996; 39: 223-227.
82. Dodwell DJ, Dyker K, Brown J, et al. A randomised study of whole-breast vs tumour-bed irradiation after local excision and axillary dissection for early breast cancer. *Clinical Oncology*. 2005; 17: 618-622.
83. Early Breast Cancer Trialists' Collaborative Group. Polychemotherapy for early breast cancer: an overview of the randomised trials. *Lancet*. 1998; 352: 930-942.

## Breast cancer

84. Fisher B, Anderson S, Wickerham DL, et al. Increased intensification and total dose of cyclophosphamide in a doxorubicin-cyclophosphamide regimen for the treatment of primary breast cancer: findings from National Surgical Adjuvant Breast and Bowel Project B-22. *Journal of Clinical Oncology*. 1997; 15: 1858-1869.
85. Jim HS, Phillips KM, Chait S, et al. Meta-analysis of cognitive functioning in breast cancer survivors previously treated with standard-dose chemotherapy. *Journal of Clinical Oncology*. 2012; 30: 3578-3587.
86. Goodwin A, Parker S, Ghersi D, et al. Post-operative radiotherapy for ductal carcinoma in situ of the breast (Cochrane review). In: *The Cochrane Library*. Wiley, Chichester, UK.
87. Rutqvist LE, Rose C, Cavallin-Stahl E. A systematic overview of radiation therapy effects in breast cancer. *Acta Oncologica*. 2003; 42: 532-545.
88. Kurtz JM, Jacquemier J, Amalric R, et al. Is breast conservation after local recurrence feasible? *European Journal of Cancer*. 1991; 27: 240-244.
89. Early Breast Cancer Trialists' Collaborative Group. Effects of radiotherapy and surgery in early breast cancer: an overview of the randomized trials. *New England Journal of Medicine*. 1995; 333: 1444-1455.
90. Fisher B, Dignam J, Wolmark N, et al. Tamoxifen in treatment of intraductal breast cancer: National Surgical Adjuvant Breast and Bowel Project B-24 randomised controlled trial. *Lancet*. 1999; 353: 1993-2000.
91. Houghton J, George WD, Cuzick J, et al. Radiotherapy and tamoxifen in women with completely excised ductal carcinoma in situ of the breast in the UK, Australia, and New Zealand: randomised controlled trial. *Lancet*. 2003; 362: 95-102.
92. Allred D, Bryant J, Land S, et al. Estrogen receptor expression as a positive marker of the effectiveness of tamoxifen in the treatment of DCIS: findings from NSABP Protocol B-24 (conference abstract). *San Antonio Breast Cancer Symposium*, 2002.
93. Morris AD, Morris RD, Wilson JF, et al. Breast-conserving therapy vs. mastectomy in early-stage breast cancer: a meta-analysis of 10-year survival. *Cancer Journal from Scientific American*. 1997; 3: 6-12.
94. Yang SH, Yang KH, Li YP, et al. Breast conservation therapy for stage I or stage II breast cancer: a meta-analysis of randomized controlled trials. *Annals of Oncology*. 2008; 19: 1039-1044.
95. Early Breast Cancer Trialists' Collaborative Group. Effect of radiotherapy after breast-conserving surgery on 10-year recurrence and 15-year breast cancer death: meta-analysis of individual patient data for 10,801 women in 17 randomised trials. *Lancet*. 2011; 378: 1707-1716.
96. Early Breast Cancer Trialists' Collaborative Group. Effects of radiotherapy and of differences in the extent of surgery for early breast cancer on local recurrence and survival: an overview of the randomised trials. *Lancet*. 2005; 366: 2087-2106.
97. Fyles AW, McCreedy DR, Manchul LA, et al. Tamoxifen with or without breast irradiation in women 50 years of age or older with early breast cancer. *New England Journal of Medicine*. 2004; 351: 963-970.
98. Hughes KS, Schnaper LA, Berry D, et al. Cancer and Leukemia Group B; Radiation Therapy Oncology Group; Eastern Cooperative Oncology Group. Lumpectomy plus tamoxifen with or without irradiation in women 70 years of age or older with early breast cancer. *New England Journal of Medicine*. 2004; 351: 971-977.
99. Holli K, Hietanen P, Saaristo R, et al. Radiotherapy after segmental resection of breast cancer with favorable prognostic features: 12-year follow-up results of a randomized trial. *Journal of Clinical Oncology*. 2009; 27: 927-932.
100. Australian Safety and Efficacy Register of New Interventional Procedures - Surgical, and the Royal Australasian College of Surgeons. A systematic review of intraoperative radiotherapy in early stage breast cancer. ASERNIP-S Report No. 27. October 2002. Available at <http://www.surgeons.org/media/291393/IORTreview1002.pdf> (accessed on 5 November 2013).
101. Coles CE, Moody AM, Wilson CB, et al. Reduction of radiotherapy-induced late complications of early breast cancer: the role of intensity-modulation radiation therapy and partial breast irradiation. Part II: radiotherapy strategies to reduce radiation-induced late effects. *Clinical Oncology*. 2005; 17: 98-110.



## Breast cancer

102. Ribeiro GG, Magee B, Swindell R, et al. The Christie Hospital breast conservation trial: an update at 8 years from inception. *Clinical Oncology*. 1993; 5: 278-283.
103. Magee B, Swindell R, Harris M, et al. Prognostic factors for breast recurrence after conservative breast surgery and radiotherapy: results from a randomised trial. *Radiotherapy and Oncology*. 1996; 39: 223-227.
104. Dodwell DJ, Dyker K, Brown J, et al. A randomised study of whole-breast vs tumour-bed irradiation after local excision and axillary dissection for early breast cancer. *Clinical Oncology*. 2005; 17: 618-622.
105. Lee TS, Kilbreath SL, Refshauge KM, et al. Prognosis of the upper limb following surgery and radiation for breast cancer. *Breast Cancer Research & Treatment*. 2008; 110: 19-37.
106. Early Breast Cancer Trialists' Collaborative Group. Effects of radiotherapy and of differences in the extent of surgery for early breast cancer on local recurrence and survival: an overview of the randomised trials. *Lancet*. 2005; 366: 2087-2106.
107. O'Rourke S, Gaba MH, Morgan D, et al. Local recurrence after simple mastectomy. *British Journal of Surgery*. 1994; 81: 386-389.
108. Fowle B, Gray R, Gilchrist K, et al. Identification of a subset of patients with breast cancer and histologically positive nodes who may benefit from postoperative radiotherapy. *Journal of Clinical Oncology*. 1988; 6: 1107-1117.
109. Houghton J, Baum M, Haybittle JL. Role of radiotherapy following total mastectomy in patients with early breast cancer: the Closed Trials Working Party of the CRC Breast Cancer Trials Group. *World Journal of Surgery*. 1994; 18: 117-122.
110. Early Breast Cancer Trialists' Collaborative Group. Effects of radiotherapy and of differences in the extent of surgery for early breast cancer on local recurrence and survival: an overview of the randomised trials. *Lancet*. 2005; 366: 2087-2106.
111. Early Breast Cancer Trialists' Collaborative Group. Effects of radiotherapy and of differences in the extent of surgery for early breast cancer on local recurrence and survival: an overview of the randomised trials. *Lancet*. 2005; 366: 2087-2106.
112. Gherzi D, Simes J. Draft report of the effectiveness of postmastectomy radiotherapy and risk factors for local recurrence in early breast cancer. Report to the National Health and Medical Research Council. National Breast Cancer Centre, Sydney, Australia; 1998.
113. Macmillan Cancer Support. Chemotherapy for breast cancer. August 2011. Available at <http://www.macmillan.org.uk> (accessed on 5 November 2013).
114. Roche H, Fumoleau P, Spielmann M, et al. Sequential adjuvant epirubicin-based and docetaxel chemotherapy for node-positive breast cancer patients: the FNCLCC PACS 01 Trial. *Journal of Clinical Oncology*. 2006; 24: 5664-5671.
115. Martin M, Pienkowski T, Mackey J, et al. Adjuvant docetaxel for node-positive breast cancer. *New England Journal of Medicine*. 2005; 352: 2302-2313.
116. Early Breast Cancer Trialists' Collaborative Group. Comparisons between different polychemotherapy regimens for early breast cancer: meta-analyses of long-term outcome among 100,000 women in 123 randomised trials. *Lancet*. 2012; 379: 432-444.
117. De Laurentiis M, Cancellato G, D'Agostino D, et al. Taxane-based combinations as adjuvant chemotherapy of early breast cancer: a meta-analysis of randomized trials. *Journal of Clinical Oncology*. 2008; 26: 44-53.
118. Wood WC, Budman DR, Korzun AH, et al. Dose and dose intensity of adjuvant chemotherapy for stage II, node-positive breast carcinoma. *New England Journal of Medicine*. 1994; 330: 1253-1259.
119. Davies C, Pan H, Godwin J, et al. Long-term effects of continuing adjuvant tamoxifen to 10 years versus stopping at 5 years after diagnosis of oestrogen receptor-positive breast cancer: ATLAS, a randomised trial. *Lancet*. 2013; 381: 805-816.
120. Early Breast Cancer Trialists' Collaborative Group. Ovarian ablation in early breast cancer: overview of the randomised trials. *Lancet*. 1996; 348: 1189-1196.
121. Goel S, Sharma R, Hamilton A, et al. LHRH agonists for adjuvant therapy of early breast cancer in premenopausal women (Cochrane review). In: *The Cochrane Library*. Wiley, Chichester, UK.

## Breast cancer

122. National Institute for Health and Care Excellence. Hormonal therapies for the adjuvant treatment of early oestrogen-receptor-positive breast cancer. November 2006. Technology appraisal 112. Available at <http://www.nice.org.uk/ta112> (accessed on 5 November 2013).
123. Hind D, Ward S, De Nigris E, et al. Hormonal therapies for early breast cancer: systematic review and economic evaluation. *Health Technology Assessment*. 2007; 11: 26.
124. Dowsett M, Cuzick J, Ingle J et al. Meta-analysis of breast cancer outcomes in adjuvant trials of aromatase inhibitors versus tamoxifen. *Journal of Clinical Oncology*. 2010; 28: 509-518.
125. Goss PE, Ingle JN, Martino S, et al. A randomized trial of letrozole in postmenopausal women after five years of tamoxifen therapy for early-stage breast cancer. *New England Journal of Medicine*. 2003; 349: 1793-1802.
126. Baum M, Buzdar AU, Cuzick J, et al. Anastrozole alone or in combination with tamoxifen versus tamoxifen alone for adjuvant treatment of postmenopausal women with early breast cancer: first results of the ATAC randomised trial. *Lancet*. 2002; 359: 2131-2139.
127. Baum M, Buzdar A, Cuzick J, et al. Anastrozole alone or in combination with tamoxifen versus tamoxifen alone for adjuvant treatment of postmenopausal women with early-stage breast cancer: results of the ATAC (Arimidex, Tamoxifen Alone or in Combination) trial efficacy and safety update analyses. *Cancer*. 2003; 98: 1802-1810.
128. Howell A, Cuzick J, Baum M, et al. Results of the ATAC (Arimidex, Tamoxifen, Alone or in Combination) trial after completion of 5 years' adjuvant treatment for breast cancer. *Lancet*. 2005; 365: 60-62.
129. Coombes RC, Hall E, Gibson LJ, et al. A randomized trial of exemestane after two to three years of tamoxifen therapy in postmenopausal women with primary breast cancer. *New England Journal of Medicine*. 2004; 350: 1081-1092.
130. Coombes RC, Kilburn LS, Snowdon CF, et al. Survival and safety of exemestane versus tamoxifen after 2-3 year's tamoxifen treatment (Intergroup Exemestane Study): a randomised controlled trial. *Lancet*. 2007; 369: 559-570.
131. Coleman RE, Banks LM, Girgis SI, et al. Skeletal effects of exemestane on bone-mineral density, bone biomarkers, and fracture incidence in postmenopausal women with early breast cancer participating in the Intergroup Exemestane Study (IES): a randomised controlled study. *Lancet Oncology*. 2007; 8: 119-127.
132. Howell A. Effect of anastrozole on bone mineral density: 2-years results of the Arimidex (anastrozole), Tamoxifen, Alone or in Combination (ATAC) trial. *Breast Cancer Research and Treatment*. 2003; 82 (supplement 1): S27 (abstract 129).
133. Becker T, Lipscombe L, Narod S, et al. Systematic review of bone health in older women treated with aromatase inhibitors for early-stage breast cancer. *Journal of the American Geriatrics Society*. 2012; 60: 1761-1767.
134. Goss P, Ingle JN, Martino S, et al. A randomized trial of letrozole in postmenopausal women after five years of tamoxifen therapy for early-stage breast cancer. *New England Journal of Medicine*. 2003; 349: 1793-1802.
135. Forbes JF, Cuzick J, Buzdar A, et al. Effect of anastrozole and tamoxifen as adjuvant treatment for early-stage breast cancer: 100-month analysis of the ATAC trial. *Lancet Oncology*. 2008; 9: 45-53.
136. National Cancer Research Institute. UK clinical guidelines for the use of adjuvant trastuzumab (Herceptin) with or following chemotherapy in HER2-positive early breast cancer. December 2005. Available at <http://www.dh.gov.uk> (accessed on 5 November 2013).
137. Department of Health. Hewitt fast-tracks cancer drug to save 1000 lives. October 2005. Available at <http://www.medicalnewstoday.com/articles/31791.php> (accessed on 5 November 2013).
138. British National Formulary. Other antineoplastic drugs. Trastuzumab. Section 8.1.5. British Medical Association and Royal Pharmaceutical Society of Great Britain. Also available at <http://bnf.org> (accessed on 5 November 2013).
139. National Institute for Health and Care Excellence. Trastuzumab for the adjuvant treatment of early-stage HER2-positive breast cancer. August 2006. Technology appraisal 107. Available at <http://www.nice.org.uk/TA107> (accessed on 5 November 2013).

## Breast cancer

140. Moja L, Tagliabue L, Balduzzi S, et al. Trastuzumab containing regimens for early breast cancer (Cochrane review). In: The Cochrane Library. Wiley, Chichester, UK.
141. Genentech Biooncology. Important drug warning (dose modification guidelines for HERCEPTIN in Study NSABP B-31). August 2005. Available at <http://www.fda.gov> (accessed on 5 November 2013).
142. Mieog JS, van der Hage JA, van de Velde CJ. Preoperative chemotherapy for women with operable breast cancer (Cochrane review). In: The Cochrane Library. Wiley, Chichester, UK.
143. Therasse P, Mauriac L, Welnicka-Jaskiewicz M, et al. Final results of a randomized phase III trial comparing cyclophosphamide, epirubicin, and fluorouracil with a dose-intensified epirubicin and cyclophosphamide + filgrastim as neoadjuvant treatment in locally advanced breast cancer: an EORTC-NCIC-SAKK multicenter study. *Journal of Clinical Oncology*. 2003; 21: 843-850.
144. Smith IC, Heys SD, Hutcheon A, et al. Neoadjuvant chemotherapy in breast cancer: significantly enhanced response with docetaxel. *Journal of Clinical Oncology*. 2002; 20: 1456-1466.
145. D'Orazio AI, O'Shaughnessy J, Seidman AD. Neoadjuvant docetaxel augments the efficacy of preoperative docetaxel/cyclophosphamide in operable breast cancer: first results of NSABP B-27. *Clinical Breast Cancer*. 2002; 2: 266-268.
146. Buzdar AU, Singletary SE, Theriault RL, et al. Prospective evaluation of paclitaxel versus combination chemotherapy with fluorouracil, doxorubicin, and cyclophosphamide as neoadjuvant therapy in patients with operable breast cancer. *Journal of Clinical Oncology*. 1999; 17: 3412-3417.
147. Cocconi G, Bisagni G, Ceci G, et al. Three new active cisplatin-containing combinations in the neoadjuvant treatment of locally advanced and locally recurrent breast carcinoma: a randomized phase II trial. *Breast Cancer Research and Treatment*. 1999; 56: 125-132.
148. Takatsuka Y, Yayoi E, Kobayashi T, et al. Neoadjuvant intra-arterial chemotherapy in locally advanced breast cancer: a prospective randomized study. *Japanese Journal of Clinical Oncology*. 1994; 24: 20-25.
149. Early Breast Cancer Trialists' Collaborative Group. Effects of radiotherapy and of differences in the extent of surgery for early breast cancer on local recurrence and survival: an overview of the randomised trials. *Lancet*. 2005; 366: 2087-2106.
150. Early Breast Cancer Trialists' Collaborative Group. Effects of radiotherapy and of differences in the extent of surgery for early breast cancer on local recurrence and survival: an overview of the randomised trials. *Lancet*. 2005; 366: 2087-2106.
151. Veronesi U, Paganelli G, Viale G, et al. A randomized comparison of sentinel-node biopsy with routine axillary dissection in breast cancer. *New England Journal of Medicine*. 2003; 349: 546-553.
152. Chetty U, Jack W, Prescott RJ, et al. Management of the axilla in operable breast cancer treated by breast conservation: a randomized clinical trial. *British Journal of Surgery*. 2000; 87: 163-169.
153. Early Breast Cancer Trialists' Collaborative Group. Effects of radiotherapy and surgery in early breast cancer: an overview of the randomized trials. *New England Journal of Medicine*. 1995; 333: 1444-1455.
154. Browse DJ, Goble D, Jones PA. Axillary node clearance: who wants to immobilize the shoulder? *European Journal of Surgical Oncology*. 1996; 22: 569-570.
155. Veronesi U, Paganelli G, Viale G, et al. A randomized comparison of sentinel-node biopsy with routine axillary dissection in breast cancer. *New England Journal of Medicine*. 2003; 349: 546-553.
156. Purushotham AD, Upponi S, Klevesath MB, et al. Morbidity after sentinel lymph node biopsy in primary breast cancer: results from a randomized controlled trial. *Journal of Clinical Oncology*. 2005; 23: 4312-4321.
157. Veronesi U, Valagussa P. Inefficacy of internal mammary node dissection in breast cancer surgery. *Cancer*. 1981; 47: 170-175.
158. Handley R. Carcinoma of the breast. *Annals of The Royal College of Surgeons of England*. 1975; 57: 59-66.

## Breast cancer

159. Veronesi U, Cascinelli NM, Bufalino R, et al. Risk of internal mammary lymph node metastases and its relevance on prognosis in breast cancer patients. *Annals of Surgery*. 1983; 198: 681-684.
160. Cuzick J, Stewart H, Rutqvist L, et al. Cause-specific mortality in long term survivors of breast cancer who participated in trials of radiotherapy. *Journal of Clinical Oncology*. 1994; 12: 447-453.
161. Ragaz J, Jackson SM, Le N, et al. Adjuvant radiotherapy and chemotherapy in node-positive premenopausal women with breast cancer. *New England Journal of Medicine*. 1997; 337: 956-962.
162. Overgaard M, Hansen PS, Overgaard J, et al. Postoperative radiotherapy in high-risk premenopausal women with breast cancer who receive adjuvant chemotherapy. *New England Journal of Medicine*. 1997; 337: 949-955.
163. Overgaard M, Jensen MB, Overgaard J, et al. Postoperative radiotherapy in high-risk postmenopausal breast-cancer patients given adjuvant tamoxifen. *Lancet*. 1999; 353: 1641-1648.
164. Gyenes G, Rutqvist LE, Liedberg A, et al. Long-term cardiac morbidity and mortality in a randomized trial of pre- and postoperative radiotherapy versus surgery alone in primary breast cancer. *Radiotherapy and Oncology*. 1998; 48: 185-190.
165. Kaija H, Maunu P. Tangential breast irradiation with or without internal mammary chain irradiation; results of a randomized trial. *Radiotherapy and Oncology*. 1995; 3: 172-176.
166. Early Breast Cancer Trialists' Collaborative Group. Effects of radiotherapy and of differences in the extent of surgery for early breast cancer on local recurrence and survival: an overview of the randomised trials. *Lancet*. 2005; 366: 2087-2106.
167. Early Breast Cancer Trialists' Collaborative Group. Favourable and unfavourable effects on long-term survival of radiotherapy for early breast cancer: an overview of the randomised trials. *Lancet*. 2000; 355: 1757-1770.
168. Bates T, Evans RGB. Report of the independent review commissioned by The Royal College of Radiologists into brachial plexus neuropathy following radiotherapy for breast cancer. Royal College of Radiologists, London, UK; 1995.
169. Purushotham AD, Upponi S, Klevesath MB, et al. Morbidity after sentinel lymph node biopsy in primary breast cancer: results from a randomized controlled trial. *Journal of Clinical Oncology*. 2005; 23: 4312-4321.
170. Lucci A, McCall LM, Beitsch PD, et al. Surgical complications associated with sentinel lymph node dissection (SLND) plus axillary lymph node dissection compared with SLND alone in the American College of Surgeons Oncology Group Trial Z0011. *Journal of Clinical Oncology* : official journal of the American Society of Clinical Oncology 2007; 25: 3657-3663
171. King TA, Fey JV, Van Zee KJ, et al. A prospective analysis of the effect of blue-dye volume on sentinel lymph node mapping success and incidence of allergic reaction in patients with breast cancer. *Annals of Surgical Oncology*. 2004; 11: 535-541.
172. Julian TB, Krag D, Brown A, et al. Preliminary technical results of NSABP B-32, a randomized phase III clinical trial to compare sentinel node resection to conventional axillary dissection in clinically node-negative breast cancer patients. *Breast Cancer Research and Treatment*. 2004; 88 (supplement 1): S11-S12.
173. Mansel RE, Goyal A, Necombe RG, et al. Objective assessment of lymphedema, shoulder function and sensory deficit after sentinel node biopsy for invasive breast cancer: ALMANAC trial. *Breast Cancer Research and Treatment*. 2004; 88 (supplement 1): S12.
174. Farquhar C, Bassler R, Majoribanks J, et al. High dose chemotherapy and autologous bone marrow or stem cell transplantation versus conventional chemotherapy for women with early poor prognosis breast cancer (Cochrane review). In: *The Cochrane Library*. Wiley, Chichester, UK.
175. Zander AR, Schmoor C, Kroger N, et al. Randomized trial of high-dose adjuvant chemotherapy with autologous hematopoietic stem-cell support versus standard-dose chemotherapy in breast cancer patients with 10 or more positive lymph nodes: overall survival after 6 years of follow-up. *Annals of Oncology*. 2008; 19: 1082-1089.
176. Moore HC, Green SJ, Gralow JR, et al. Intensive dose-dense compared with high-dose adjuvant chemotherapy for high-risk operable breast cancer: Southwest Oncology Group/Intergroup study 9623. *Journal of Clinical Oncology*. 2007; 25: 1677-1682.

## Breast cancer

177. Olson JE, Neuberg D, Pandya KJ, et al. The role of radiotherapy in the management of operable locally advanced breast carcinoma: results of a randomized trial by the Eastern Cooperative Oncology Group. *Cancer*. 1997; 79: 1138-1149.
178. Overgaard M, Jensen MB, Overgaard J, et al. Postoperative radiotherapy in high-risk postmenopausal breast-cancer patients given adjuvant tamoxifen. *Lancet*. 1999; 353: 1641-1648.
179. Papaioannou A, Lissaios B, Vasilaros S, et al. Pre- and postoperative chemoendocrine treatment with or without postoperative radiotherapy for locally advanced breast cancer. *Cancer*. 1983; 51: 1284-1290.
180. Bartelink H, Rubens RD, van der Schueren E, et al. Hormonal therapy prolongs survival in irradiated locally advanced breast cancer: a European Organization for Research and Treatment of Cancer randomized phase III trial. *Journal of Clinical Oncology*. 1997; 15: 207-215.
181. Koning C, Hart G. Long-term follow-up of a randomized trial on adjuvant chemotherapy and hormonal therapy in locally advanced breast cancer. *International Journal of Radiation Oncology, Biology, Physics*. 1998; 41: 397-400.
182. Rodger A, Jack WJ, Hardman PD, et al. Locally advanced breast cancer: report of phase II study and subsequent phase III trial. *British Journal of Cancer*. 1992; 65: 761-765.
183. Deo SV, Bhutani M, Shukla NK, et al. Randomized trial comparing neo-adjuvant versus adjuvant chemotherapy in operable locally advanced breast cancer (T4b N0-2 M0). *Journal of Surgical Oncology*. 2003; 84: 192-197.
184. Gianni L, Eiermann W, Semiglazov V, et al. Neoadjuvant chemotherapy with trastuzumab followed by adjuvant trastuzumab versus neoadjuvant chemotherapy alone, in patients with HER2-positive locally advanced breast cancer (the NOAH trial): a randomised controlled superiority trial with a parallel HER2-negative cohort. *Lancet*. 2010; 375(9712): 377-384.

---

This information is aimed at a UK patient audience. This information however does not replace medical advice. If you have a medical problem please see your doctor. Please see our full [Conditions of Use](#) for this content. For more information about this condition and sources of the information contained in this leaflet please visit the Best Health website, <http://besthealth.bmj.com> . These leaflets are reviewed annually.

The logo for BMJ (British Medical Journal) is displayed in a bold, blue, sans-serif font. The letters 'B', 'M', and 'J' are connected, with the 'J' having a distinctive hook.