



# About Non-Hodgkin Lymphoma

## Overview and Types

If you have been diagnosed with non-Hodgkin lymphoma or are worried about it, you likely have a lot of questions. Learning some basics is a good place to start.

- [What Is Non-Hodgkin Lymphoma?](#)
- [Types of Non-Hodgkin Lymphoma](#)

## Research and Statistics

See the latest estimates for new cases of non-Hodgkin lymphoma and deaths in the US and what research is currently being done.

- [Key Statistics for Non-Hodgkin Lymphoma](#)
- [What's New in Non-Hodgkin Lymphoma Research and Treatment?](#)

# What Is Non-Hodgkin Lymphoma?

Cancer starts when cells in the body begin to grow out of control. Cells in nearly any part of the body can become cancer, and can spread to other areas of the body. To learn more about how cancers start and spread, see [What Is Cancer?](#)

Non-Hodgkin lymphoma (also known as non-Hodgkin's lymphoma, NHL, or sometimes just lymphoma) is a cancer that starts in white blood cells called *lymphocytes*, which are part of the body's immune system.

There are two types of lymphoma. They are treated differently, so it's important to know which one you have. The information here focuses on non-Hodgkin lymphoma in adults.

For information on the other type of lymphoma, see [Hodgkin Lymphoma](#). We also have

separate information about [non-Hodgkin lymphoma in children](#) and [lymphoma of the skin](#).

## The lymph system

To understand what lymphoma is, it helps to know about the body's lymph system (also known as the *lymphatic system*). The lymph system is part of the immune system, which helps fight infections and some other diseases. The lymph system also helps fluids move through the body.

### Lymphocytes

The lymph system is made up mainly of immune system cells that help the body fight infections. Most of these cells are **lymphocytes**, a type of white blood cell. There are 2 main types of lymphocytes:

**B lymphocytes (B cells):** B cells normally help protect the body against germs (bacteria or viruses) by making proteins called antibodies. The antibodies attach to the germs, marking them for destruction by other parts of the immune system.

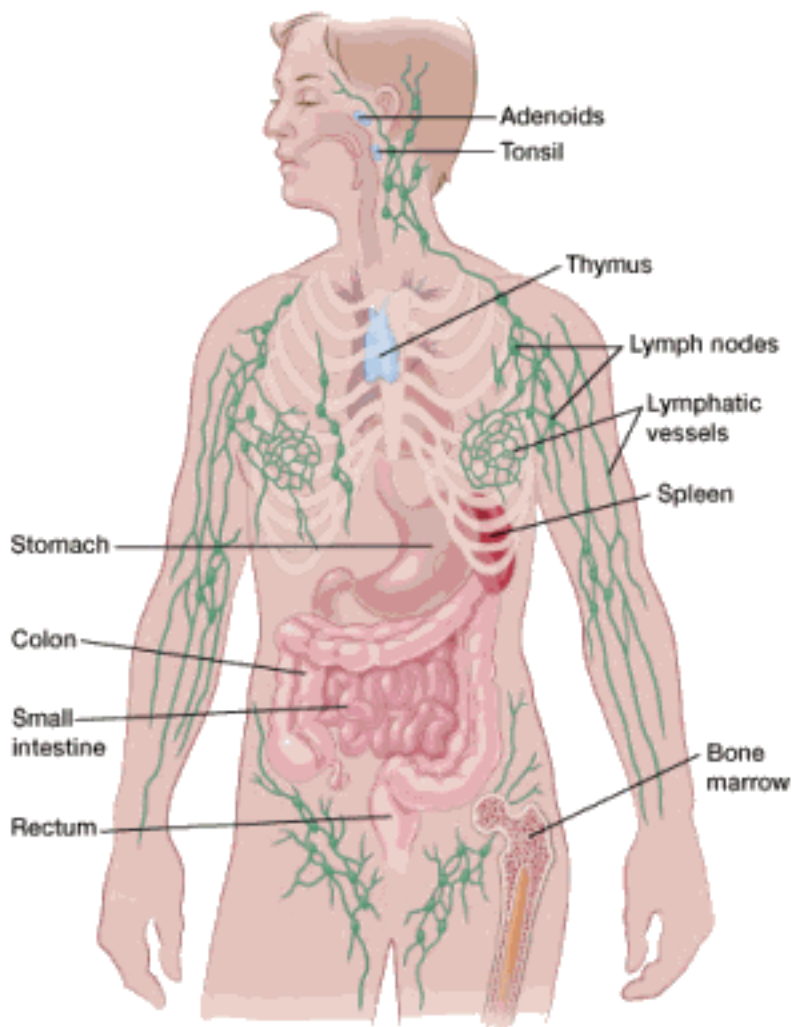
**T lymphocytes (T cells):** There are several types of T cells. Some T cells destroy germs or abnormal cells in the body. Other T cells help boost or slow the activity of other immune system cells.

Non-Hodgkin lymphoma can develop from either type of lymphocyte, but B-cell lymphomas are much more common in the United States than T-cell lymphomas. Different types of lymphoma can develop from each type of lymphocyte, based on how mature the cells are when they become cancerous and other factors.

Treatment for non-Hodgkin lymphoma depends on which type it is, so it's important for doctors to find out the exact [type of lymphoma](#) you have.

### How non-Hodgkin lymphoma starts and spreads

Lymph tissue is found in many places throughout the body, so lymphomas can start almost anywhere.



The major sites of lymph tissue are:

- **Lymph nodes:** Lymph nodes are bean-sized collections of lymphocytes and other immune system cells throughout the body, including inside the chest, abdomen, and pelvis. They are connected by a system of lymphatic vessels.
- **Spleen:** The spleen is an organ under the lower ribs on the left side of the body. The spleen makes lymphocytes and other immune system cells. It also stores healthy blood cells and filters out damaged blood cells, bacteria, and cell waste.
- **Bone marrow:** The bone marrow is the spongy tissue inside certain bones. This is where new blood cells (including some lymphocytes) are made.
- **Thymus:** The thymus is a small organ behind the upper part of the breastbone and in front of the heart. It's important in the development of T lymphocytes.

- **Adenoids and tonsils:** These are collections of lymph tissue in the back of the throat. They help make antibodies against germs that are breathed in or swallowed.
- **Digestive tract:** The stomach, intestines, and many other organs also have lymph tissue.

There are many [different types of non-Hodgkin lymphoma](#), which can start in different parts of the body. This can affect which symptoms a person has.

Non-Hodgkin lymphoma can also grow and spread at different rates, depending on which type it is:

- Some types of lymphoma tend to grow and spread slowly. These are known as **indolent lymphomas**. Some indolent lymphomas might not need to be treated right away, but can be watched closely instead. The most common type of indolent lymphoma in the United States is follicular lymphoma.
- Some types of lymphoma tend to grow and spread quickly. These are known as **aggressive lymphomas**, and they usually need to be treated right away. The most common type of aggressive lymphoma in the United States is diffuse large B cell lymphoma (DLBCL).
- Some types of lymphoma don't fit neatly into either of these categories.

Regardless of how quickly they grow, all non-Hodgkin lymphomas can spread to other parts of the lymph system if not treated. Eventually, they can also spread to other parts of the body, such as the liver, brain, or bone marrow.

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# Types of Non-Hodgkin Lymphoma

There are many different types of non-Hodgkin lymphoma (NHL), so classifying it can be quite confusing (even for doctors). Several different systems have been used, but the most recent system is the **World Health Organization (WHO) classification**. The WHO system groups lymphomas based on:

- The type of lymphocyte the lymphoma starts in
- How the lymphoma looks under a microscope
- The chromosome features of the lymphoma cells
- The presence of certain proteins on the surface of the cells

The more common types of lymphoma are listed below according to whether they start in B lymphocytes (B cells) or T lymphocytes (T cells). Some rarer forms of non-Hodgkin lymphoma are not listed here.

## B-cell lymphomas

B-cell lymphomas make up most (about 85%) of NHL in the United States.

### Diffuse large B-cell lymphoma (DLBCL)

This is the most common type of NHL in the United States, accounting for about 1 out of every 3 lymphomas. The lymphoma cells look fairly large when seen with a microscope.

DLBCL can affect people of any age, but it occurs mostly in older people. (The average age at the time of diagnosis is mid-60s.) It usually starts as a quickly growing mass in a lymph node deep inside the body, such as in the chest or abdomen, or in a lymph node you can feel, such as in the neck or armpit. It can also start in other areas such as the intestines, bones, or even the brain or spinal cord.

DLBCL tends to be a fast-growing (aggressive) lymphoma, but it often responds well to treatment. Overall, about 3 out of 4 people will have no signs of disease after the initial treatment, and many are cured.

A common subtype of DLBCL is **primary mediastinal B-cell lymphoma**. This type of

lymphoma occurs mostly in young women. It starts in the mediastinum (the area in the middle of the chest behind the breastbone). It can grow quite large and can cause trouble breathing because it often presses on the windpipe (trachea) leading into the lungs. It can also block the superior vena cava (the large vein that returns blood to the heart from the arms and head), which can make the arms and face swell. This is a fast-growing lymphoma, but it usually responds well to treatment.

There are several other subtypes of DLBCL, but these are rare.

## **Follicular lymphoma**

About 1 out of 5 lymphomas in the United States is a follicular lymphoma. This is usually a slow-growing (indolent) lymphoma, although some follicular lymphomas can grow quickly.

The average age for people with this lymphoma is about 60. It's rare in very young people. Usually, this lymphoma occurs in many lymph node sites throughout the body, as well as in the bone marrow.

Follicular lymphomas often respond well to treatment, but they are hard to cure. These lymphomas may not need to be treated when they are first diagnosed. Instead, treatment may be delayed until the lymphoma starts causing problems. Over time, some follicular lymphomas turn into a fast-growing diffuse large B-cell lymphoma.

## **Chronic lymphocytic leukemia (CLL) /small lymphocytic lymphoma (SLL)**

CLL and SLL are closely related diseases. In fact, many doctors consider them different versions of the same disease. The same type of cancer cell (known as a *small lymphocyte*) is seen in both CLL and SLL. The only difference is where the cancer cells are found. In CLL, most of the cancer cells are in the blood and bone marrow. In SLL, the cancer cells are mainly in the lymph nodes and spleen.

Both CLL and SLL are usually slow-growing (indolent) diseases, although CLL, which is much more common, tends to grow more slowly. Treatment is the same for CLL and SLL. They are usually not curable with standard treatments, but many people can live a long time (even decades) with them. Sometimes, these can turn into a more aggressive (fast-growing) type of lymphoma over time.

For more information, see [Chronic Lymphocytic Leukemia](#).

## Mantle cell lymphoma (MCL)

About 5% of lymphomas are mantle cell lymphomas. MCL is much more common in men than in women, and it most often appears in people older than 60. When MCL is diagnosed, it is usually widespread in the lymph nodes, bone marrow, and often the spleen.

MCL can be challenging to treat. It tends to grow faster than indolent (slow-growing) lymphomas, but it doesn't usually respond to treatment as well as aggressive (fast-growing) lymphomas. But newer treatments might offer a better chance for long-term survival for patients now being diagnosed.

## Marginal zone lymphomas

Marginal zone lymphomas account for about 5% to 10% of lymphomas. They tend to be slow-growing (indolent). The cells in these lymphomas look small under the microscope. There are 3 main types of marginal zone lymphomas:

**Extranodal marginal zone B-cell lymphoma, also known as mucosa-associated lymphoid tissue (MALT) lymphoma:** This is the most common type of marginal zone lymphoma. It starts in places other than the lymph nodes (extranodal). Most MALT lymphomas start in the stomach and are linked to infection by *Helicobacter pylori* (the bacteria that causes many stomach ulcers). MALT lymphoma might also start in the lung, skin, thyroid, salivary glands, or tissues surrounding the eye. Usually the lymphoma stays in the area where it begins and is not widespread. Many of these other MALT lymphomas have also been linked to infections with bacteria or viruses.

The average age of people with MALT lymphoma at the time of diagnosis is about 60. This lymphoma tends to grow slowly and is often curable if found early. Doctors often use antibiotics as the first treatment for MALT lymphoma of the stomach, because treating the *Helicobacter pylori* infection often cures the lymphoma.

**Nodal marginal zone B-cell lymphoma:** This is a rare disease, found mainly in older women. It starts and usually stays in the lymph nodes, although lymphoma cells can also sometimes be found in the bone marrow.

This lymphoma tends to be slow-growing (although not usually as slow as MALT lymphoma), and is often curable if found early.

**Splenic marginal zone B-cell lymphoma:** This is a rare lymphoma. Most often the lymphoma is found only in the spleen and bone marrow.

It is most common in older men, and often causes fatigue and discomfort due to an enlarged spleen. Because the disease is slow-growing, it might not need to be treated unless the symptoms become troublesome. This type of lymphoma has been linked to infection with the hepatitis C virus.

## **Burkitt lymphoma**

This fast-growing lymphoma is named after the doctor who first described this disease in African children and young adults. It makes up about 1% to 2% of all lymphomas. It is rare in adults, but is more common in children. It's also much more common in males than in females.

The cells in Burkitt lymphoma are medium-sized. A similar kind of lymphoma, **Burkitt-like lymphoma**, has slightly larger cells. Because it is hard to tell these lymphomas apart, the WHO classification combines them.

Different varieties of this lymphoma are seen in different parts of the world:

- In the African (or *endemic*) variety, Burkitt lymphoma often starts as a tumor of the jaw or other facial bones. It is often linked to infection with the Epstein-Barr virus (EBV, which can also cause infectious mononucleosis or “mono”). This type of Burkitt lymphoma is rare in the United States.
- In the type seen more often in the United States, the lymphoma usually starts in the abdomen (belly), where it forms a large tumor. It can also start in the ovaries, testicles, or other organs, and can spread to the brain and spinal fluid. It is not usually linked to EBV infection.

Burkitt lymphoma grows very quickly, so it needs to be treated right away. But more than half of patients can be cured by intensive chemotherapy.

## **Lymphoplasmacytic lymphoma (Waldenstrom macroglobulinemia)**

This slow-growing lymphoma is not common, accounting for only 1% to 2% of lymphomas. The lymphoma cells are small and found mainly in the bone marrow, lymph nodes, and spleen. This lymphoma is discussed in detail in [Waldenstrom Macroglobulinemia](#).

## **Hairy cell leukemia**

Despite the name, hairy cell leukemia (HCL) is sometimes considered to be a type of



lymphoma. It is rare – about 700 people in the United States are diagnosed with it each year. Men are much more likely to get HCL than women, and the average age at diagnosis is around 50.

The cells are small B lymphocytes with projections coming off them that give them a “hairy” appearance. They are typically found in the bone marrow and spleen and in the blood.

Hairy cell leukemia is slow-growing, and some people may never need treatment. An enlarging spleen or low blood cell counts (due to cancer cells invading the bone marrow) are the usual reasons to begin treatment. If treatment is needed, it’s usually very effective.

Hairy cell leukemia is also talked about in [Chronic Lymphocytic Leukemia](#).

## **Primary central nervous system (CNS) lymphoma**

This lymphoma involves the brain or spinal cord (the central nervous system, or CNS). The lymphoma is also sometimes found in tissues around the spinal cord or the eye. Over time, it tends to become widespread in the central nervous system.

Primary CNS lymphoma is rare overall, but it’s more common in older people and in people with immune system problems, such as those who have had an organ transplant or who have AIDS. Most people develop headaches and confusion. They can also have vision problems; weakness or altered sensation in the face, arms, or legs; and in some cases, seizures.

Historically, the outlook for patients with primary CNS lymphoma has not been as good as for many other lymphomas, but this is at least partly because people with CNS lymphoma tend to be older or have other serious health problems. Still, some people do well with treatment.

For information about lymphoma of the eye (primary intraocular lymphoma), which is related to primary CNS lymphoma, see [Eye Cancer \(Melanoma and Lymphoma\)](#).

## **T-cell lymphomas**

T-cell lymphomas make up less than 15% of non-Hodgkin lymphomas in the United States. There are many types of T-cell lymphoma, but they are all fairly rare.

## Precursor T-lymphoblastic lymphoma/leukemia

This disease accounts for about 1% of all lymphomas. It can be considered either a lymphoma or a type of acute lymphoblastic leukemia (ALL), depending on how much of the bone marrow is involved (leukemias have more bone marrow involvement). The cancer cells are very early forms of T cells.

This lymphoma often starts in the thymus (a small organ behind the breastbone and in front of the heart, which is where many T cells are made), and can grow into a large tumor in the mediastinum (the area between the lungs). This can cause trouble breathing and swelling in the arms and face.

This lymphoma is most common in teens or young adults, with males being affected more often than females.

This lymphoma is fast-growing, but if it hasn't spread to the bone marrow when it is first diagnosed, the chance of cure with chemotherapy is quite good.

Often, the lymphoma form of this disease is treated in the same way as the leukemia form. For more information, see [Acute Lymphocytic Leukemia \(Adults\)](#).

## Peripheral T-cell lymphomas

These uncommon types of lymphomas develop from more mature forms of T cells.

### **Cutaneous T-cell lymphomas (mycosis fungoides, Sezary syndrome, and others):**

These lymphomas start in the skin. Skin lymphomas account for about 5% of all lymphomas. They are described in [Lymphoma of the Skin](#).

**Adult T-cell leukemia/lymphoma:** This lymphoma is caused by infection with a virus called *HTLV-1*. It is rare in the United States, and much more common in Japan, the Caribbean, and parts of Africa – where infection with HTLV-1 is more common. It can affect the bone marrow (where new blood cells are made), lymph nodes, spleen, liver, skin, and other organs. There are 4 subtypes:

- The **smoldering** subtype tends to grow slowly and has a good prognosis.
- The **chronic** subtype also grows slowly and has a good prognosis.
- The **acute** subtype is the most common. It grows quickly like acute leukemia, so it needs to be treated right away.
- The **lymphoma** subtype grows more quickly than the chronic and smoldering types,

but not as fast as the acute type.

**Angioimmunoblastic T-cell lymphoma:** This lymphoma accounts for about 4% of all lymphomas. It is more common in older adults. It tends to involve the lymph nodes as well as the spleen or liver, which can become enlarged. People with this lymphoma usually have fever, weight loss, and skin rashes and often develop infections. This lymphoma often progresses quickly. Treatment is often effective at first, but the lymphoma tends to come back (recur).

**Extranodal natural killer/T-cell lymphoma, nasal type:** This rare type often involves the upper airway passages, such as the nose and upper throat, but it can also invade the skin, digestive tract, and other organs. It is much more common in parts of Asia and South America. Cells of this lymphoma are similar in some ways to natural killer (NK) cells, another type of lymphocyte.

**Enteropathy-associated intestinal T-cell lymphoma (EATL):** EATL is a lymphoma that occurs in the lining of the intestine. This lymphoma is most common in the small intestine, but can also occur in the colon. Symptoms can include severe abdominal (belly) pain, nausea, and vomiting. There are 2 subtypes of this lymphoma:

- **Type I EATL** occurs in some people with celiac disease (also called *gluten-sensitive enteropathy*). Celiac disease is an autoimmune disease in which eating gluten, a protein found mainly in wheat and barley, causes the immune system to attack the lining of the intestine and other parts of the body. Type I EATL is rare among people who have had celiac disease since childhood, and is more common in people diagnosed as older adults. This lymphoma is more common in men than women.
- **Type II EATL** is not linked to celiac disease and is less common than type I.

**Anaplastic large cell lymphoma (ALCL):** About 2% of lymphomas are of this type. It is more common in young people (including children), but it can also affect older adults. This type of lymphoma tends to be fast-growing, but many people with this lymphoma can be cured.

There are different forms of ALCL:

- **Primary cutaneous ALCL** only affects the skin. This is discussed in more detail in [Lymphoma of the Skin](#).
- **Systemic ALCL** can affect the lymph nodes and other organs, including the skin. Systemic ALCL is divided into 2 types based on whether the lymphoma cells have a change in the ALK gene. ALK-positive ALCL is more common in younger people and tends to have a better prognosis (outlook) than the ALK-negative type.

- **Breast implant-associated ALCL** is a rare type of ALCL that can develop in the breasts of women who have had implants. It seems to be more likely to occur if the implant surfaces are textured (as opposed to smooth).

**Peripheral T-cell lymphoma, not otherwise specified (PTCL, NOS):** This name is given to T-cell lymphomas that don't readily fit into any of the groups above. Most people diagnosed with these lymphomas are in their 60s. These lymphomas often involve the lymph nodes, but they can affect the skin, bone marrow, spleen, liver, and digestive tract, as well. As a group, these lymphomas tend to be widespread and grow quickly. Some patients respond well to chemotherapy, but over time these lymphomas tend to become harder to treat.

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## Key Statistics for Non-Hodgkin Lymphoma

Non-Hodgkin lymphoma (NHL) is one of the most common cancers in the United States, accounting for about 4% of all cancers. The American Cancer Society's most recent estimates for non-Hodgkin's lymphoma are for 2018:

- About 74,680 people (41,730 males and 32,950 females) will be diagnosed with

NHL. This includes both adults and children.

- About 19,910 people will die from this cancer (11,510 males and 8,400 females).

The average American's risk of developing NHL during his or her lifetime is about 1 in 47. But each person's risk can be affected by a number of [risk factors](#).

NHL can occur at any age. In fact, it is one of the more common cancers among [children](#), [teens](#), and [young adults](#). Still, the risk of developing NHL increases throughout life, and more than half of patients are 65 or older at the time of diagnosis. The aging of the American population is likely to lead to an increase in NHL cases during the coming years.

Visit the [American Cancer Society's Cancer Statistics Center](#) for more key statistics.

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# What's New in Non-Hodgkin Lymphoma Research and Treatment?

Research into the [causes](#), [prevention](#), and [treatment](#) of non-Hodgkin lymphoma (NHL) is being done in many medical centers throughout the world.

## Genetics

Scientists are making a lot of progress in understanding how changes in the DNA inside normal lymphocytes can cause them to develop into lymphoma cells. Once this is understood, drugs may be developed that block these processes.

Progress in understanding DNA changes in lymphoma cells has already led to improved and highly sensitive tests for detecting this disease. Some of these tests are already in use, and others are being developed. They may be used to:

- Detect lymphoma cells in a biopsy sample
- Determine what [type](#) of lymphoma a person has
- Help determine if a lymphoma is likely to grow and spread, even within a certain subtype of lymphoma
- Help figure out if a certain [treatment](#) is likely to be helpful
- Help determine if a lymphoma has been destroyed by treatment or if a relapse is likely

For example, in recent years, genetic tests have shown that there are different subtypes of diffuse large B-cell lymphoma (DLBCL), even though they look the same under the microscope. These subtypes seem to have different outcomes (prognoses) and responses to treatment. The hope is that such tests can be used to help guide treatment decisions.

## Treatment

Much of the research being done on NHL is focused on looking at new and better ways to treat this disease.

## Chemotherapy

Many new chemotherapy drugs are being studied in [clinical trials](#). In recent years, these studies have led to the approval of drugs such as bendamustine (Treanda) and pralatrexate (Folotyn) for use against certain types of lymphoma. Other studies are looking at new ways to combine drugs using different doses or different sequences of drugs.

## Stem cell transplants

Researchers continue to improve [stem cell transplant](#) methods, including new ways to collect the stem cells before the transplant.

Autologous transplants (which use stem cells from the patient rather than from another person) have the risk of reintroducing lymphoma cells back into the patient after treatment. Researchers are testing new and improved ways to separate out the last traces of lymphoma cells from the stem cells before they are returned to the patient. Some of the new monoclonal antibodies developed for treating lymphoma may help remove these remaining cells.

Researchers are also studying the effectiveness of non-myeloablative (reduced-intensity) stem cell transplants in people with lymphoma. This approach may allow more people to benefit from stem cell transplants, especially those who are older or otherwise in poor health.

## Targeted therapies

As researchers have learned more about lymphoma cells, they have developed newer drugs that target specific parts of these cells. These targeted drugs are different from standard chemotherapy drugs, which work by attacking rapidly growing cells. Targeted drugs may work in some cases where chemotherapy doesn't, and they often have different side effects.

Some targeted drugs, such as ibrutinib (Imbruvica) and idelalisib (Zydelig), are already being used to treat some types of NHL, and are being studied for use against other types.

Some other targeted drugs that have shown promise against lymphoma in early studies include:

- **Phosphatidylinositol 3 kinase (PI3K) inhibitors**, such as duvelisib and

copanlisib

- **BCL-2 inhibitors**, such as venetoclax (Venclexta)
- **Janus kinase (JAK) inhibitors**, such as ruxolitinib
- **Tyrosine kinase inhibitors**, such as crizotinib, for lymphomas that express the ALK protein.

These and many other targeted drugs are now being studied in [clinical trials](#).

## Immunotherapy

Doctors have known for some time that people's immune systems may help fight their cancer. Scientists are now trying to develop ways to encourage this immune reaction. Some types of immunotherapy are already being used to treat lymphoma, as discussed in [Immunotherapy for Non-Hodgkin Lymphoma](#).

**Monoclonal antibodies:** Lymphoma cells have certain proteins on their surface. Monoclonal antibodies can be made to target these proteins and destroy the lymphoma cells while causing little damage to normal body tissues. This treatment strategy has already proven effective. Several such drugs, including rituximab (Rituxan), are already used to treat lymphoma.

Many new monoclonal antibodies are being developed as well. One example is epratuzumab, which targets the CD22 antigen on certain lymphoma cells.

Some newer antibodies are attached to substances that can poison cancer cells, and are known as *antibody-drug conjugates* (ADCs) or immunotoxins. They act as homing devices to deliver the toxins directly to the cancer cells. For example:

- **Brentuximab vedotin (Adcetris)** is made up of an antibody to CD30 that is attached to a cell poison. It has been shown to help treat patients with anaplastic large cell lymphoma (ALCL), and is now being studied for use against other types of lymphoma.
- **CAT-8015 (moxetumomab pasudotox)** targets the CD22 antigen on certain lymphoma cells, bringing along a toxin known as PE38. An earlier version of this drug showed a great deal of promise in treating hairy cell leukemia (HCL) in early clinical trials.

Several other ADCs are now being studied as well, including pinatuzumab vedotin and IMG529.

**Immune checkpoint inhibitors:** Immune system cells normally have substances that act as checkpoints to keep them from attacking other healthy cells in the body. Cancer



cells sometimes take advantage of these checkpoints to avoid being attacked by the immune system. Some newer drugs, such as pembrolizumab (Keytruda) and nivolumab (Opdivo), work by blocking these checkpoints, which can boost the immune response against cancer cells. These drugs have shown promise in treating several types of cancer, and are now being studied for use against some types of lymphoma.

**Chimeric antigen receptor (CAR) T-cell therapy:** In this treatment, immune cells called T cells are removed from the patient's blood and altered in the lab to have specific receptors (called *chimeric antigen receptors*, or CARs) on their surface. These receptors can attach to proteins on the surface of lymphoma cells. The T cells are then multiplied in the lab and given back into the patient's blood, where they can seek out the lymphoma cells and launch a precise immune attack against them.

This technique has shown encouraging results in early clinical trials against some hard-to-treat lymphomas. Doctors are still improving how they make the T cells and are learning the best ways to use them. CAR T-cell therapy is only available in clinical trials at this time.

**Lymphoma vaccines:** Unlike vaccines against infections like measles or mumps, these vaccines are designed to help treat, not prevent, lymphomas. The goal is to create an immune reaction against lymphoma cells in patients who have very early disease or in patients whose disease is in remission. One possible advantage of these types of treatments is that they seem to have very limited side effects. So far, there have been a few successes with this approach, and it's a major area of research in lymphoma treatment. At this time, lymphoma vaccines are only available in [clinical trials](#).

## Antibiotics

Some types of lymphoma are strongly linked to infections. Researchers are finding that in some cases, treating the infection actually helps treat the lymphoma. For example, gastric MALT lymphoma, which is linked to infection by the bacteria *Helicobacter pylori*, can often be treated with antibiotics. MALT lymphoma of the tissues around the eye (called ocular adnexal marginal zone lymphoma) has been linked to infection with the bacterium *Chlamydomphila psittaci*. Some research has shown that treating this infection with an antibiotic (doxycycline) might make this lymphoma get better or even go away. More studies may be needed before antibiotics become part of the standard treatment for this type of lymphoma.

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