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Diffuse Large B-cell Lymphoma

NCCN NON-HODGKIN'S LYMPHOMA SERIES

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LEARNING that you have cancer can be overwhelming.

The goal of this book is to help you get the best cancer treatment. It explains which cancer tests and treatments are recommended by experts of diffuse large B-cell lymphoma.

The National Comprehensive Cancer Network® (NCCN®) is a not-for-profit alliance of 27 leading cancer centers. Experts from NCCN have written treatment guidelines for doctors who treat diffuse large B-cell lymphoma. These treatment guidelines suggest what the best practice is for cancer care. The information in this patient book is based on the guidelines written for doctors.

This book focuses on the treatment of diffuse large B-cell lymphoma. Key points of the book are summarized in the [NCCN Quick Guide™](#). NCCN also offers patient books on multiple myeloma, chronic lymphocytic leukemia, chronic myelogenous leukemia, acute lymphoblastic leukemia, and many other cancer types. Visit NCCN.org/patients for the full library of patient books, summaries, and other resources.

About



These patient guidelines for cancer care are produced by the National Comprehensive Cancer Network® (NCCN®).

The mission of NCCN is to improve cancer care so people can live better lives. At the core of NCCN are the NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines®). NCCN Guidelines® contain information to help health care workers plan the best cancer care. They list options for cancer care that are most likely to have the best results. The NCCN Guidelines for Patients® present the information from the NCCN Guidelines in an easy-to-learn format.

Panels of experts create the NCCN Guidelines. Most of the experts are from NCCN Member Institutions. Their areas of expertise are diverse. Many panels also include a patient advocate. Recommendations in the NCCN Guidelines are based on clinical trials and the experience of the panelists. The NCCN Guidelines are updated at least once a year. When funded, the patient books are updated to reflect the most recent version of the NCCN Guidelines for doctors.

For more information about the NCCN Guidelines, visit NCCN.org/clinical.asp.

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NCCN Foundation was founded by NCCN to raise funds for patient education based on the NCCN Guidelines. NCCN Foundation offers guidance to people with cancer and their caregivers at every step of their cancer journey. This is done by sharing key information from leading cancer experts. This information can be found in a library of NCCN Guidelines for Patients® and other patient education resources. NCCN Foundation is also committed to advancing cancer treatment by funding the nation's promising doctors at the center of cancer research, education, and progress of cancer therapies.

For more information about NCCN Foundation, visit NCCNFoundation.org.

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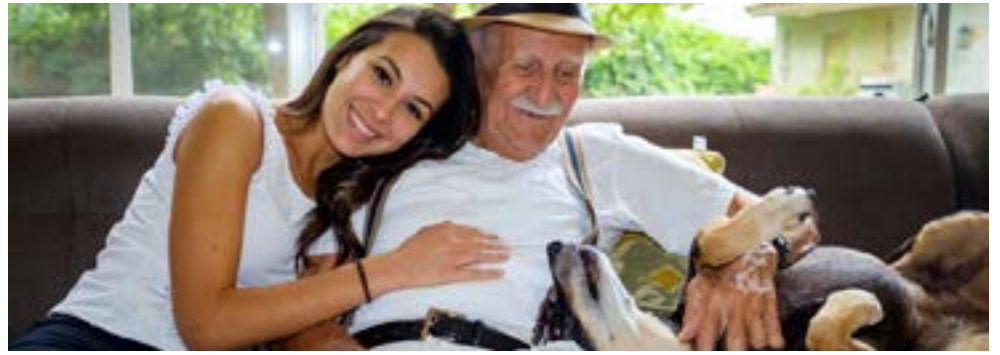
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The Leukemia & Lymphoma Society (LLS)

LLS is dedicated to developing better outcomes for blood cancer patients through research, education and patient services and is happy to have this comprehensive resource available to patients. [LLS.org/information-specialists](https://www.lls.org/information-specialists).



Contents

- 6 How to use this book
- 7 Part 1
DLBCL basics
Explains how and where this lymphoma starts.
- 14 Part 2
Treatment planning
Describes how doctors plan your treatment.
- 24 Part 3
Overview of cancer treatments
Describes the treatments used to cure or control diffuse large B-cell lymphoma.
- 37 Part 4
Treatment guide
Presents treatment options for first- and second-line treatment.
- 46 Part 5
Making treatment decisions
Offers tips for choosing the best treatment.
- 54 Glossary
Dictionary
Acronyms
- 62 NCCN Panel Members
- 63 NCCN Member Institutions
- 64 Index

Who should read this book?

Diffuse large B-cell lymphoma is the focus of this book. It is also known as DLBCL, for short. It is the most common type of non-Hodgkin's lymphoma.

This lymphoma has many subtypes. Subtypes covered in this book include DLBCL with follicular lymphoma (or transformed lymphoma); DLBCL with gastric MALT lymphoma; DLBCL with nongastric MALT lymphoma; DLBCL NOS; follicular lymphoma grade 3; intravascular large B-cell lymphoma; DLBCL associated with chronic inflammation; ALK-positive DLBCL; EBV-positive DLBCL of the elderly; double- or triple-hit DLBCL, and T-cell-/histiocyte-rich large B-cell lymphoma.

People with the subtypes listed above and those who support them—caregivers, family, and friends—may find this book helpful. It is a good starting point to learn what your options may be.

This book does not include information on primary cutaneous B-cell lymphoma; primary DLBCL of the CNS; primary mediastinal large B-cell lymphoma; grey zone lymphoma; and primary cutaneous B-cell lymphoma, leg type.

Are the book chapters in a certain order?

Early chapters explain concepts that are repeated in later chapters. **Part 1** explains what DLBCL is. Knowing more about this lymphoma may help you better understand its treatment.

Parts 2 through 5 address issues related to treatment. **Part 2** lists which health tests and other steps of care are needed before treatment. **Part 3**

briefly describes all the types of treatments so you can understand your options that are listed in **Part 4**. Tips for making treatment decisions are presented in **Part 5**.

Does this book include all options?

This book includes information for many people. Your treatment team can point out what applies to you. They can also give you more information. While reading, make a list of questions to ask your doctors.

The treatment options are based on science and the experience of NCCN experts. However, their recommendations may not be right for you. Your doctors may suggest other options based on your health and other factors. If other options are given, ask your treatment team questions.

Help! What do the words mean?

In this book, many medical words are included. These are words that your treatment team may say to you. Most of these words may be new to you. It may be a lot to learn.

Don't be discouraged as you read. Keep reading and review the information. Ask your treatment team to explain a word or phrase that you do not understand.

Words that you may not know are defined in the text or in the *Dictionary*. Acronyms are also defined when first used and in the *Glossary*. Acronyms are short words formed from the first letters of several words. One example is DNA for **d**eoxyribonucleic acid.

1

DLBCL basics

8 Lymphatic system

8 A disease of cells

10 Diagnosis

13 Review



You've learned that you have or may have lymphoma. It's common to feel shocked and confused. Part 1 reviews some basics that may help you learn about DLBCL.

Lymphatic system

Before learning about DLBCL (diffuse large B-cell lymphoma), it is helpful to know about the lymphatic system. It is one of 13 systems of the human body. It transports fluids to the bloodstream and fights germs. As such, it supports your blood-flowing (cardiovascular) and disease-fighting (immune) systems.

Lymph

Cells are the building blocks of tissue in the body. The spaces between cells are filled with fluid. This fluid is called interstitial or tissue fluid. Most tissue fluid comes from parts of blood plasma that have passed out of blood vessels. Cells also release waste and other products into tissue fluid.

When tissue fluid increases, it drains into vessels. Almost all of tissue fluid drains back into blood vessels. The rest of it drains into lymph vessels. Once inside of lymph vessels, tissue fluid is called lymph. Lymph travels in lymph vessels back to the bloodstream.

The lymphatic system also collects fat and some vitamins from your gut. After you eat, your stomach turns food into a liquid. Then, the liquid drains into your small intestine. Within your small intestine, fat and some vitamins are absorbed into lymph vessels. This fatty lymph, called chyle, travels in lymph vessels to the bloodstream.

Lymphoid tissues

As lymph travels, it will pass through and be filtered by lymph nodes. Lymph nodes are organized masses of lymphoid tissue. There are hundreds of lymph nodes throughout your body. **See Figure 1.** High numbers of lymph nodes exist in the middle of your chest, neck, armpit, groin, pelvis, and along your gut.

Lymph nodes and other lymphoid tissue are defined by high numbers of lymphocytes. Lymph also has lymphocytes. Lymphocytes are a type of white blood cell. They help fight germs. The three types of lymphocytes are NK (natural killer) cells, B-cells, and T-cells. Lymphocytes are made in bone marrow then are moved by blood to the lymphatic system.

Other parts of your body that have many lymphocytes are included in the lymphatic system. In children, the thymus stores T-cells until they are able to fight germs. Germs in blood are filtered and destroyed by lymphocytes within your spleen. Your tonsils kill germs in lymph that enter through your mouth and nose. There are also small clumps of lymphatic tissue in your gut, thyroid, breasts, lungs, eyes, and skin.

A disease of cells

Your body is made of trillions of cells. Cancer is a disease of cells. Each type of cancer is named after the cell from which it derived.

Lymphoma

Lymphomas are cancers of lymphocytes within the lymphatic system. There are two main types of lymphomas. Hodgkin lymphoma is defined by the presence of Reed-Sternberg or related cells. Non-Hodgkin's lymphomas include all the other types of lymphomas.

In the United States most non-Hodgkin's lymphomas—85 out of every 100—are B-cell lymphomas. About 10 out of 100 are T-cell lymphomas. A few have unknown cell origin. It is now known that most Hodgkin lymphomas are also from B-cells. Thus, Hodgkin and non-Hodgkin's lymphomas are more related than first thought.

Diffuse large B-cell lymphoma

DLBCL is a type of non-Hodgkin's lymphoma. It is a cancer of B-cells. There are many types of B-cells and, thus, many B-cell cancers. B-cells differ from one another based on the cell's stage of development. As B-cells “mature” they change in their ability to make antibodies.

Antibodies are Y-shaped proteins that are made in response to the presence of antigens. Some antigens enter your body from outside. Such

antigens include viruses, bacteria, chemicals, and pollen. Some antigens are formed inside your body like those found on tissue cells. Antibodies attach to antigens, which triggers a response from your immune system.

Cell of origin

DLBCL is a cancer of B-cells that have been exposed to antigens. Some DLBCLs start from B-cells that are within the “factories” of your lymphatic organs. These factories are called germinal centers. Germinal centers are short-lived structures that are formed in response to an outside antigen. B-cells undergo changes within the germinal centers to prepare them for making antibodies. Other DLBCLs start from B-cells that have been released from germinal centers.

Figure 1 Lymphatic system

The lymphatic system kills germs in the body and collects and transports lymph to the bloodstream.

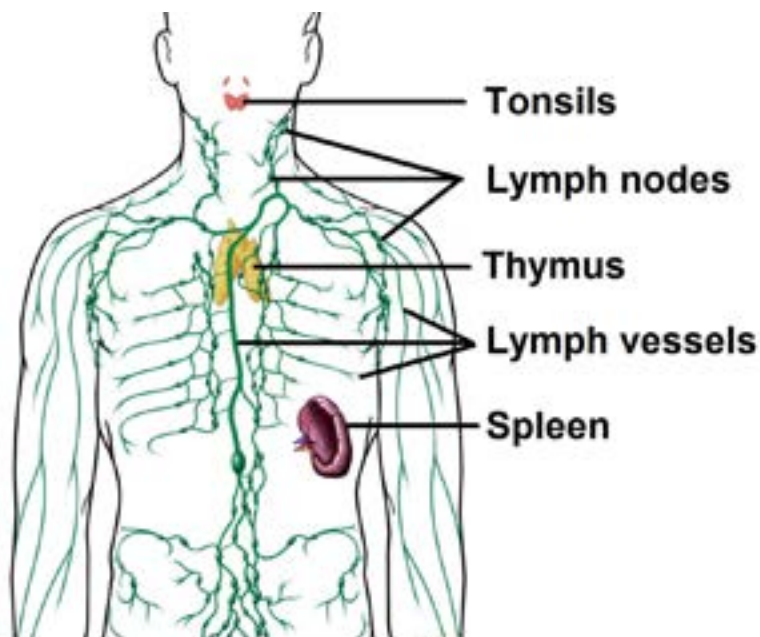


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Mutations

Cells have a control center called the nucleus. The nucleus contains chromosomes, which are long strands of DNA (**deoxyribonucleic acid**) tightly wrapped around proteins. **See Figure 2.** Within DNA are coded instructions for building new cells and controlling how cells behave. These instructions are called genes.

There can be abnormal changes in genes called mutations. Some types of mutations that are linked to cancer are present in all cells. Other mutations are present only in cancer cells. Mutations cause cancer cells to not behave like normal cells and, sometimes, to look very different from normal cells. Researchers are still trying to learn what causes genes to mutate and cause cancer.

Cancer's threat

Cancer cells don't behave like normal cells. First, the mutations cause cancer cells to grow more quickly and live longer than normal cells. Normal cells grow and then divide to form new cells when needed. They also die when old or damaged as shown in **Figure 3.** In contrast, cancer cells make new cells that aren't needed and don't die quickly when old or damaged. Over time, the lymphoma cells may build up in tissues and may travel in blood or lymph to other sites. Without treatment, the cancer may cause organs not to work.

Diagnosis

DLBCL is often a fast-growing tumor. The tumor often occurs in lymph nodes within the neck, armpit, or groin area but may appear elsewhere. Other common sites are the stomach and gut. When your doctor suspects cancer, testing is needed. The tests that are needed to confirm (diagnose) DLBCL are described next.

Biopsy

The only way to know if you have cancer is to test tissue or fluid. A biopsy is a procedure that removes samples of fluid or tissue for testing. There are many types of biopsy.

For DLBCL, an incisional or excisional biopsy is advised. An incisional biopsy removes only a part of the tumor through a cut made into your body. An excisional biopsy removes the whole tumor. The methods used to do either biopsy depend on where the tumor is in your body.

FNA (**f**ine-**n**eedle **a**spiration) and a core needle biopsy remove very small samples with a needle. Neither should be used alone to diagnose DLBCL. You may have cancer even if these biopsies find no cancer.

Hematopathology review

The biopsy samples will be sent to a special type of pathologist. A pathologist is a doctor who's an expert in testing cells to find disease. For DLBCL, the pathologist should be a specialist in hematopathology.

Hematopathologists spend all of their time looking at blood, bone marrow, and lymph nodes. They become very good with diagnosing blood cancers. The hematopathologist will first examine the samples using a microscope.

Figure 2 Genetic material in cells

Most human cells contain the “blueprint of life”—the plan by which our bodies are made and work. The plan is found inside of chromosomes, which are long strands of DNA that are tightly wrapped around proteins. Genes are small pieces of DNA that contain instructions for building new cells and controlling how cells behave. Humans have an estimated 20,000 to 25,000 genes.

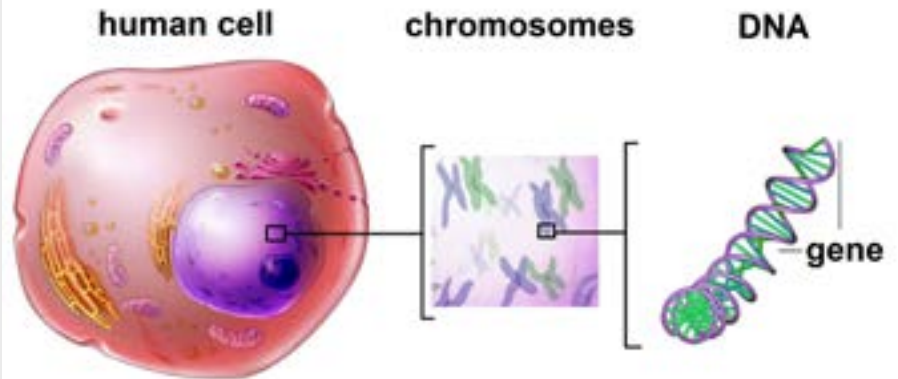


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Figure 3 Normal cell growth vs. cancer cell growth

Normal cells increase in number when they are needed and die when old or damaged. In contrast, cancer cells quickly make new cells and live longer because of abnormal changes in genes.

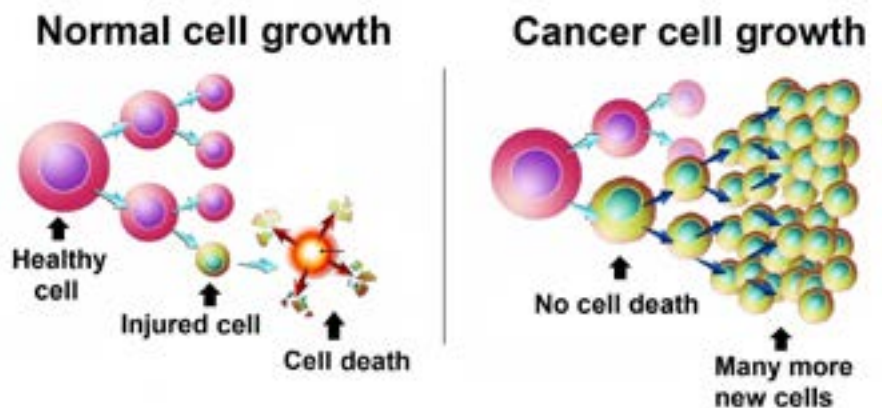


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The way cancer cells look may help to identify which type of cancer it is. DLBCL gets its name from the way it looks. The cancer cells are large and grow throughout tissue rather than in clusters.

Protein tests

For diagnosis, the hematopathologist needs to study the proteins in the cells' surface (membrane). This is called immunophenotyping. DLBCL has a common pattern or "signature" of proteins. **See Figure 4.** These proteins are also studied to learn if the cancer is a GCB (germinal center B-cell) or non-GCB subtype.

IHC panel

An IHC (immunohistochemistry) panel is a test for these proteins. It involves applying a chemical marker to cells and then looking at them with a microscope. The IHC panel should test for BCL2,

BCL6, CD3, CD5, CD10, CD20, CD45, IRF4/MUM1, Ki-67, and MYC. DLBCL cells often have CD20 and CD45 and no CD3.

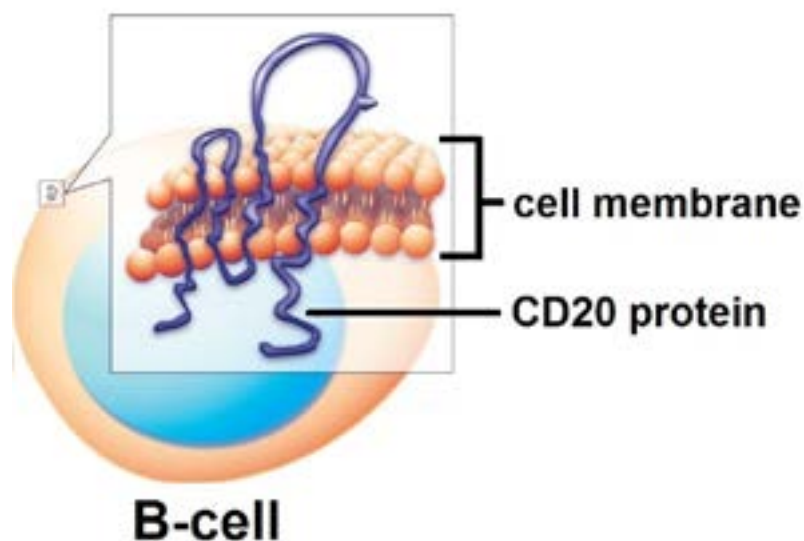
In some cases, it is helpful to learn the lymphoma subtype. To do so, the panel should also include ALK, CD30, CD138, cyclin D1, EBER-ISH, HHV8, SOX11, and kappa and lambda light chain proteins. Light chain proteins are part of antibodies.

Flow cytometry

Flow cytometry is a newer method that can also be used to assess the surface proteins on lymphoma cells. This method involves first adding a marker—a light-sensitive dye—to cells. Then, your blood will be passed through a flow cytometry machine. The machine measures surface proteins on thousands of cells.

Figure 4 CD20 protein

DLBCLs have a common pattern of proteins in their membrane. This pattern includes the presence of CD20 and CD45 and no CD3. Immunophenotyping is the process of identifying the proteins in cells' membranes.



Derivative work of Rituximab Binding to CD20 on a B Cell Surface by NIAID available at commons. [wikimedia.org/wiki/File:Rituximab_Binding_to_CD20_on_a_B_Cell_Surface_\(6830897205\).jpg](https://commons.wikimedia.org/wiki/File:Rituximab_Binding_to_CD20_on_a_B_Cell_Surface_(6830897205).jpg) under a Creative Commons Attribution 2.0 Generic license

Flow cytometry may be done in addition to an IHC panel. If done, it should test for CD45, CD3, CD5, CD10, CD19, CD20, and kappa and lambda light chain proteins.

Genetic tests

Genetic testing is advised if the IHC test finds GCB-like DLBCL with 1) *MYC*, and 2) *BCL2* or *BCL6*. Genetic testing will be used to assess for *MYC*, *BCL2*, and *BCL6* gene rearrangements. A gene rearrangement is the fusion of one gene with another gene to create a new gene. Tests that detect gene rearrangements are a karyotype and FISH (fluorescence in situ hybridization).

DLBCL that has a *MYC* rearrangement and either a *BCL2* or *BCL6* rearrangement is called a “double-hit” lymphoma. If all three rearrangements are present, the cancer is a “triple-hit” lymphoma. These DLBCLs grow faster than others. Double-hit lymphomas occur between 2 and 11 out of every 100 people with DLBCL (ie, 2%–11%).

Pathology report

All lab results are recorded in a pathology report. A report will be written each time tissue is removed from your body and tested. These reports are vital to diagnosis and planning treatment.

Review your pathology report(s) with your doctor. Ask questions if you don't understand. This information can be complex. It's also a good idea to get a copy of your pathology report(s) and take notes.

Review

- ▶ The lymphatic system consists of lymph and a network of vessels and organs. It helps kill germs in the body and transports fluids to the bloodstream.
- ▶ Lymphomas are cancers that start in lymphocytes within the lymphatic system. DLBCL is a lymphoma of B-cells that are within or have been released by germinal centers of lymphatic organs.
- ▶ DLBCL is a fast-growing cancer. It will spread from one group of lymph tissue to the next and to sites outside the lymphatic system.
- ▶ Incisional or excisional biopsy is needed to diagnose DLBCL.
- ▶ The biopsy tissue should be tested by a hematopathologist. The hematopathologist will perform a number of tests that assess for cell type, surface proteins, and maybe genetics.

2

Treatment planning

15 Medical history

16 Physical exam

16 Blood tests

18 Imaging tests

19 Bone marrow exam

20 Spinal fluid tests

21 Prognostic scores

22 Heart tests

22 Fertility and pregnancy

23 Review



Doctors plan treatment with many sources of information. One of these sources is tests of your health and the cancer. Part 2 describes who should receive which tests before treatment. Some of these tests are repeated during and after treatment. Besides tests, Part 2 describes other types of care that are important to receive before cancer treatment.

Medical history

Your medical history includes any health events and medicines you've taken in your life. You will be asked about illnesses, injuries, health conditions, and more. It may help to make a list of old and new medications while at home to bring to your doctor's office.

Symptoms are a part of your medical history. Some symptoms of DLBCL are tiredness and a feeling of fullness in your belly. This cancer may also cause "B symptoms." It's important that your doctor knows if you have them. These symptoms include fevers, chills, night sweats, and weight loss without dieting.

Some cancers and other health conditions can run in families. Thus, your doctor will ask about the medical history of your blood relatives. Your doctor may ask about the health of your siblings, your parents and their siblings, and your grandparents and their siblings. Be prepared to tell who in your family has had what diseases and at what ages.

A medical history is one of the tests needed for treatment planning. See [Guide 1](#) for a complete list of care that is recommended prior to treatment. Some types of care are for anyone with DLBCL while others may be useful for some people.

Guide 1. Health care before cancer treatment

Must haves	Sometimes useful
Medical history	Beta-2 microglobulin
Physical exam	HIV testing
CBC with differential	Head and neck CT or MRI
Comprehensive metabolic panel	Endoscopy or colonoscopy
Lactate dehydrogenase	Lumbar puncture in some cases
Uric acid	Fertility support
Hepatitis B testing	
Whole-body PET/CT ± diagnostic CT	
Bone marrow biopsy ± aspiration	
Echocardiogram or MUGA if you will receive certain types of chemotherapy	
Pregnancy test if you can have babies	

Physical exam

Doctors should perform a physical exam along with taking a medical history. A physical exam is a study of your body for signs of disease. To start, your basic body functions will be measured. These functions include your temperature, blood pressure, and pulse and breathing (respiration) rate. Your weight will also be checked.

During the exam, your doctor will listen to your lungs, heart, and gut. Your doctor will also look at and feel parts of your body. This is done to see if organs are of normal size, are soft or hard, or cause pain when touched. Cancer and other health conditions can cause organs to become enlarged and hard.

Enlarged structures

For DLBCL, there are certain parts of your body that should be checked. DLBCL is often found in lymph nodes. Thus, areas with lots of lymph nodes should be examined. High numbers of lymph nodes exist in the middle of your chest, neck, throat, armpit, groin, pelvis, and along your gut. The size of your spleen and liver should also be assessed.

Performance status

Results of your medical history and physical exam will be used to rate your performance status. Performance status is your ability to do daily activities. It is used by doctors to assess if you can undergo certain treatments.

Blood tests

Blood tests are used to learn if cancer treatment might be needed now. They are also used to find unknown diseases including those related to lymphoma. It's important to treat all illnesses.

Blood tests require a sample of your blood. Samples of blood can be removed with a blood draw. Before a blood draw, you might need to stop drinking and eating for several hours. A needle will be inserted into your vein to remove blood. Your blood sample will be sent to a lab for testing.

Complete blood count with differential

A CBC (complete blood count) measures parts of the blood. It is often done with a machine. Test results include counts of white blood cells, red blood cells, and platelets. Your blood counts may be low or high because of cancer or another health problem. It is an essential test that gives a picture of your overall health.

There are several types of white blood cells. A differential counts the number of each type of cell. It also checks if the counts are in balance with each other. Your doctor can determine the cause of an abnormal white blood count from this test.

Comprehensive metabolic panel

Chemicals in your blood come from your liver, bone, and other organs. A comprehensive metabolic panel often includes tests for up to 14 chemicals. The tests show if the levels of chemicals are too low or high. Abnormal levels can be caused by cancer or other health problems.

LDH

LDH (lactate dehydrogenase) is a protein that is in most cells. It gets into your blood when a cell is damaged. Thus, a high level of LDH is a sign of cell damage. High levels can be caused by cancer or other health problems. If related to lymphoma, high

levels may be a sign that treatment may be needed now or soon.

Beta-2 microglobulin

Beta-2 microglobulin is a small protein made by many types of cells, including lymphoma cells. It is measured with a blood chemistry test. If related to lymphoma, high levels may be a sign that treatment may be needed now or soon. This test may be useful to gauge the extent of the cancer. This test is not often used for DLBCL but may be useful at times.

Hepatitis testing

Hepatitis B can be an important factor in the treatment of DLBCL. Hepatitis B can become active again due to the cancer or some of its treatments. Thus, tell your treatment team if you've ever been infected with hepatitis. If you're unsure, ask your treatment team if you should get tested. Testing may be needed if you will be treated with a drug called rituximab.

Uric acid

Some people with DLBCL are at risk for TLS (tumor lysis syndrome). This syndrome can be life threatening. It occurs when the waste released by dead cells is not quickly cleared out of your body. This results in kidney damage and severe blood electrolyte disturbances.

TLS can occur among people with DLBCL who are undergoing strong cancer treatments. The cancer treatment kills many cancer cells. In turn, too much tumor cell waste is released within in a short period of time.

Your doctors may want to know your uric acid level before starting treatment. You may be given certain medications that can help prevent TLS. Also, drinking plenty of water throughout chemotherapy can help. Ask your treatment team for more information.

HIV testing

If you have HIV, treating it is an important part of treating DLBCL. HIV treatment will improve how well cancer treatment works. In addition, your DLBCL may be managed differently. Thus, tell your treatment team if you have HIV and about your treatment. If you are unsure, ask your treatment team if you should get tested.



My diagnosis was sudden, unexpected and life shattering. I am a non-smoker and runner, and had just completed a ½ marathon before diagnosis. My only symptom was a persistent cough. My tumor was 10 cm by 14 cm and causing fluid to back up in my heart and lungs.

– Angie

Survivor, Age 52 at diagnosis

Imaging tests

Imaging tests make pictures (images) of the insides of your body. They can show which sites have cancer. This information helps your doctors stage the cancer. More information on cancer staging is on page 21.

Your treatment team will tell you how to prepare for the test. You may need to stop taking some medicines and stop eating and drinking for a few hours before the scan. Tell your doctors if you get nervous when in small spaces. You may be given a sedative to help you relax.

Imaging machines are large. You will likely be lying down during testing. At least part of your body will be in the machine. **Figure 5** shows one type of imaging machine.

After the test, you will likely be able to resume your activities right away. If you took a sedative, you will have a waiting period. You may not learn of the results for a few days since a radiologist needs to see the pictures. A radiologist is a doctor who's an expert in reading the images.

Whole-body PET/CT

PET (positron emission tomography) and CT (computed tomography) are two types of imaging tests. When used together, they are called a PET/CT scan. PET/CT may be done with one or two machines depending on the cancer center. Whole-body PET/CT is a test that is needed to plan treatment for DLBCL.

For PET, a sugar radiotracer will first be injected into your body. The radiotracer is detected with a special camera during the scan. Cancer cells appear brighter than normal cells because they use sugar more quickly. PET can show even small amounts of cancer because the images are based on the use of sugar (cell metabolism).

CT takes many pictures of a body part from different angles using x-rays. A computer combines the x-rays to make detailed pictures. CT can show structural features of the cancer such as shape and size. The picture is saved for later viewing by the radiologist.

Figure 5 Imaging machine

Pictures of the insides of your body can be made with an imaging test. During the scan, you will lie on a table that will move into the tunnel of the imaging machine. The pictures will be viewed by a doctor who will look for signs of cancer.



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Diagnostic CT

In addition to PET/CT, you may receive a diagnostic CT scan. Images of your chest, abdomen (belly area), and pelvis (between your hip bones) are advised. A contrast dye is used for diagnostic CT. It makes the pictures clearer.

The dye will be injected into a vein in your hand or arm. You will also be given a liquid contrast to drink. The contrast may cause you to feel flushed or get hives. Rarely, serious allergic reactions occur. Tell your doctor and the technicians if you have had bad reactions to contrast.

Bone marrow exam

The PET scan may suggest there's cancer inside your bones. If so, a bone marrow exam is needed to confirm the PET results. If the PET scan doesn't show cancer, a bone marrow exam is only needed if your doctor thinks you may have another type of lymphoma.

The bone marrow exam may consist of two procedures. A bone marrow biopsy removes a sample of bone and soft bone marrow. A bone marrow aspiration also may be done. A bone marrow aspiration removes a small amount of liquid bone marrow.

If needed, these procedures are often done at the same time. They are performed on the back of hip bone. You may receive a light sedative beforehand.

You will likely lie on your side as shown in **Figure 6**. Some people lie on their belly. Your doctor will first clean and numb your skin.

For aspiration, a hollow needle will be inserted into your skin and pushed into the bone. Liquid bone marrow will then be drawn into a syringe. For the

biopsy, a wider needle will be inserted into your bone and rotated to remove a core sample.

The samples will be sent to a lab for testing. You may feel bone pain during and after the procedures for a few days. Your skin may bruise.

Figure 6
Bone marrow exam

A bone marrow exam removes a sample of bone and marrow for testing. The procedure is often done on the back of the hip.

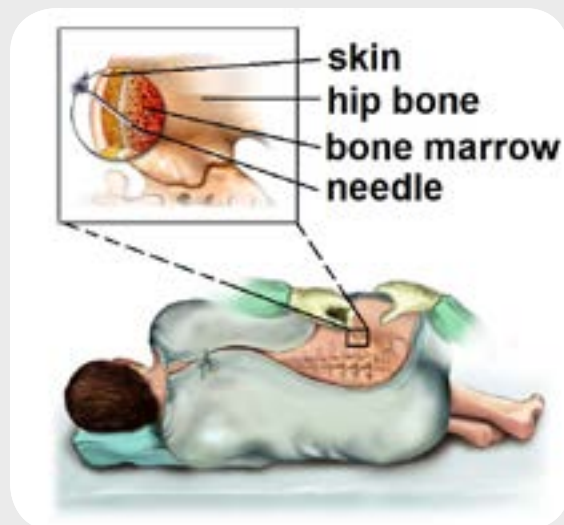


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Spinal fluid tests

DLBCL can spread into the fluid around the brain and spinal cord. This fluid is called cerebrospinal fluid or spinal fluid. Cancer is very likely in your spinal fluid if 4 to 6 of the following factors describe you:

- Older than 60 years of age,
- Your level of lactate dehydrogenase is high,
- Your performance status score is 2 or greater,
- The cancer is stage III or IV (see page 21),
- The cancer has spread to more than 1 site beyond your lymph nodes,
- The cancer has spread to your kidneys or adrenal glands.

To confirm that cancer is in spinal fluid, a sample must be removed and tested. A lumbar puncture is a procedure that removes spinal fluid. It is also called a spinal tap. A lumbar puncture may also be used to inject cancer drugs into spinal fluid.

During a spinal tap, you will be lying down or sitting on an exam table. If lying down, your knees must be tucked up near your chest. If sitting, you must lean slightly forward and down toward your knees as shown in **Figure 7**.

The lower part of your back over your spine will be numbed with a local anesthetic. Next, a thin needle will be inserted between the bones of your spine and into the space around your spinal cord. You may feel some pressure during the procedure. The fluid sample will then be sent to a lab for testing.

Figure 7 Lumbar puncture

A lumbar puncture is used to remove a sample of spinal fluid so it can be tested for cancer. A lumbar puncture may also be used to inject cancer drugs into spinal fluid.

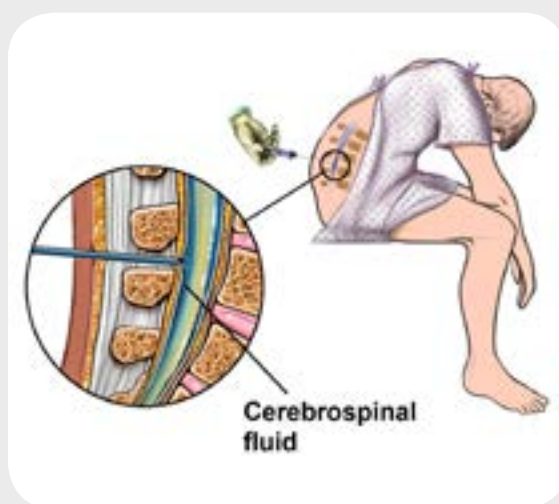


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Prognostic scores

A prognosis is a prediction of the pattern and outcome of a disease. For treatment planning, your doctors will assess the cancer prognosis. The cancer stage and IPI score are the two methods used.

Cancer stage

A cancer stage is a rating by your doctors of how far the cancer has grown and spread. The Ann Arbor staging system is used to stage DLBCL. In this system, there are four cancer stages.

- **Stage I** is cancer that is in only one cluster of lymph nodes.
- **Stage II** is cancer that is in 2 or more clusters either above or below your diaphragm.
- **Stage III** is cancer that is in lymph tissue on both sides of your diaphragm.
- **Stage IV** is cancer that has widely spread outside the lymphatic system.

When the cancer is staged, other letters are also assigned. The letters “A” and “B” indicate whether B symptoms have been present in the past 6 months. No symptoms is rated A, and if symptoms are present, B. The letter “E” stands for extranodal disease, which is cancer in sites other than the lymph nodes. The letter “X” means the cancer is large (>10 cm).

In general, earlier cancer stages have better outcomes. However, doctors define cancer stages with information from thousands of patients, so a cancer stage gives an average outcome. It may not tell the outcome for one person. Some people will do better than expected. Others will do worse. Other factors not used for staging cancer are also very important. Such factors include your general health and the features of the cancer.

International Prognostic Index

The IPI (International Prognostic Index) is a scoring system that uses risk factors to assess prognosis. A risk factor is anything that increases your chances of an event or outcome. The first IPI was created over 20 years ago.

In the standard version, 1 point is given for every risk factor that describes you. The five risk factors are: 1) older than 60 years of age; 2) lactate dehydrogenase level above normal; 3) performance status score of 2 or greater; 4) stage III or IV; and 5) more than one extranodal site. The total number of points is used to assign you to one of four risk groups, which are:

- **Low risk** includes scores of 0 and 1.
- **Low-intermediate risk** includes a score of 2.
- **High-intermediate risk** includes a score of 3.
- **High risk** includes scores of 4 or more.

There is now more than one version of the IPI. There is an age-adjusted version for people 60 years of age and younger. One point is given for: 1) stage III or IV; 2) lactate dehydrogenase level above normal; and 3) performance status score of 2 or greater. A score of 0 is low risk, a score of 1 is low-intermediate risk, a score of 2 is high-intermediate risk, and a score of 3 is high risk.

NCCN-IPI

The NCCN-IPI is a newer version that works better than the standard version. One point is given for: 1) ages 41 to 60; 2) lactate dehydrogenase level between 1 and 3; 3) stage III or IV; 4) extranodal disease; and 5) performance status score of 2 or greater. Two points are given for: 1) ages 61 to 74; and 2) lactate dehydrogenase level greater than 3. Three points are given for age 75 and older.

The total number of points is used to assign you to one of four risk groups, which are:

- Low risk includes scores of 0 or 1.
- Low-intermediate risk includes scores of 2 or 3.
- High-intermediate risk includes scores of 4 or 5.
- High risk includes scores of 6 or higher.

Heart tests

Some cancer treatments can damage your heart. Thus, your doctor may test how well your heart is pumping blood throughout your body. You may receive one of the two tests described next. If your heart isn't working well, you may receive other treatment.

Echocardiogram

An echocardiogram uses sound waves (ultrasound) to make pictures. During this test, you will be lying down. Small patches will be placed on your chest to track your heartbeat. Next, a probe with gel on its tip will be slid across part of your bare chest. A picture of your beating heart will be seen at once on a screen. The pictures will be recorded for future viewing.

MUGA

For a MUGA (**multi-gated acquisition**) scan, patches will be placed on your chest to track your heartbeat. Also, a radiotracer will be injected into your vein. Pictures of your heart will be taken with a special camera that can detect the radiation released by the tracer.

Fertility and pregnancy

Some cancer treatments can limit your ability to have a baby. If you want the choice of having babies after treatment or are unsure, tell your doctors. It may also help to talk with a fertility specialist before you begin cancer treatment.

A fertility specialist is an expert in helping people have babies. The fertility specialist can discuss with you how to have a baby after treatment. Some methods of fertility preservation are discussed next. If you are a woman of childbearing age, important information on pregnancy is also addressed.

Sperm banking

Men who want to father children after cancer treatment can use sperm banking. Sperm banking stores semen for later use. This is done by freezing semen with sperm in liquid nitrogen. Talk to your treatment team about the costs of and how well sperm banking works.

Egg freezing and more

Like sperm banking, a woman's eggs can be removed, frozen, and stored for later use. Your frozen eggs can be fertilized with sperm beforehand. Also, a part of your ovary that contains eggs can be frozen and stored.

Pregnancy test

Some cancer treatments can harm an unborn baby. Get a pregnancy test before treatment if you may be pregnant now. Your treatment options will depend on the results. During treatment, take steps to avoid getting pregnant. Your doctors can tell you which birth control methods are best to use.

Review

- ▶ Tell your doctor if you have recently had fevers, night sweats, and weight loss without dieting. These can be symptoms of DLBCL.
- ▶ Your doctor will examine your body for signs of disease. He or she will check if your lymph nodes, liver, or spleen are large. Your doctor will also rate your ability to do everyday activities.
- ▶ Blood tests can be done to assess if cancer treatment is needed and for other health conditions.
- ▶ Imaging tests allow your doctors to see inside your body without cutting into it. PET/CT with or without diagnostic CT is needed. Head and neck CT or MRI may be received.
- ▶ A bone marrow biopsy removes a piece of bone and marrow to test for cancer cells. An aspirate removes liquid marrow. These tests may be helpful before starting treatment.
- ▶ A lumbar puncture may be needed to confirm if the cancer has spread into your spinal fluid.
- ▶ You may undergo heart tests to see if you are healthy enough to have certain cancer treatments.
- ▶ Talk to a fertility specialist to learn about ways to have babies after cancer treatment. If you may be pregnant now, get a pregnancy test since some cancer treatments can harm unborn babies.

3

Overview of cancer treatments

25	Immunotherapy
26	Immunomodulators
27	Chemotherapy
30	Steroids
30	Targeted therapy
31	Radiation therapy
33	Blood stem cell transplant
35	Clinical trials
36	Review



In Part 3, the main treatment types for DLBCL are briefly described. Knowing what a treatment is will help you understand your treatment options listed in Part 4. There is more than one treatment for DLBCL. Not every person will receive every treatment described in this chapter.

Immunotherapy

The immune system is your body's natural defense against disease. Immunotherapy increases the activity of this system. As a result, it improves your body's ability to find and destroy cancer cells. Immunotherapy is a common treatment for DLBCL.

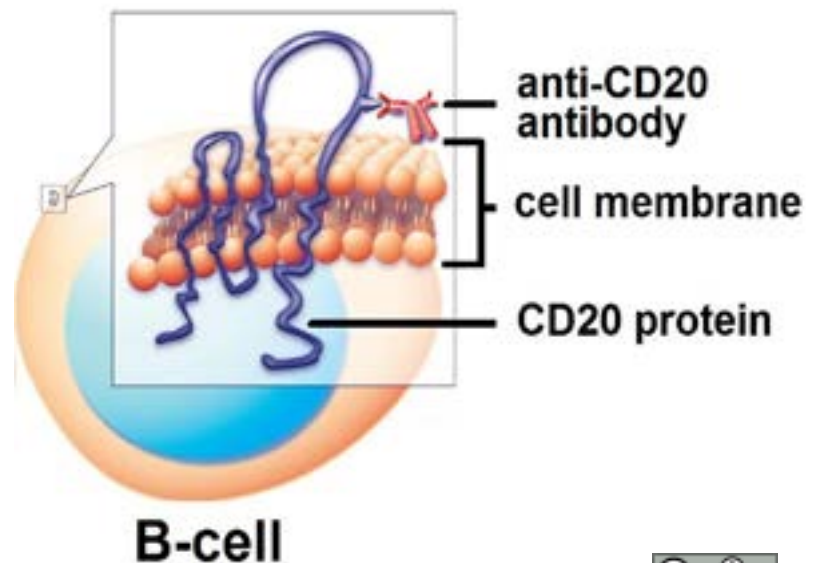
Immunotherapy for DLBCL uses rituximab. It is an anti-CD20 monoclonal antibody. This human-made antibody attaches to CD20 on the surface of lymphoma cells. **See Figure 8.** It works by marking the cells for destruction. It may directly kill cells, too.

Rituximab is sold as Rituxan[®]. It is a liquid that will be slowly injected into your vein (infusion). It often takes a few hours to receive the full dose. How often rituximab is received differs among people. Ask your doctor for more information.

Rituximab is also sold as Rituxan Hycela[™]. This medicine is injected under the skin for treatment of certain lymphomas. Injections may be received after the first dose of rituximab by infusion. Also, injections may be an option as long as rituximab isn't being used with ibrutinomab tiuxetan. Injections last between 5 and 7 minutes.

Figure 8 Anti-CD20 monoclonal antibody

Anti-CD20 monoclonal antibodies attach to lymphoma cells to mark them for destruction by your immune system.



Derivative work of Rituximab Binding to CD20 on a B Cell Surface by NIAID available at commons. [wikimedia.org/wiki/File:Rituxima_Binding_to_CD20_on_a_B_Cell_Surface_\(6830897205\).jpg](https://commons.wikimedia.org/wiki/File:Rituxima_Binding_to_CD20_on_a_B_Cell_Surface_(6830897205).jpg) under a Creative Commons Attribution 2.0 Generic license

Side effects are unhealthy or unpleasant physical or emotional responses to treatment. Ask your treatment team for a full list of common and rare side effects.

You may have an allergic reaction while receiving rituximab. Other common side effects are chills, infections, body aches, tiredness, and low blood cell counts. Rituximab also increases your chances for TLS, heart problems, and blockage and tears in your gut.



I am a giver and participant, however during treatment, it was time for me to receive. I had an AMAZING support team. My family, church, running club, golf group, book club, nurses, and doctors (oncologist, pulmonologist, cardiologist) all took GREAT care of me.

– Angie
Survivor

Immunomodulators

Immunomodulators are drugs that modify different parts of the immune system. Lenalidomide (Revlimid®) is an immunomodulator. It may be used to treat non-GCB DLBCL if first-time treatment fails..

Lenalidomide treats lymphoma in more than one way. As an immunomodulator, it boosts the immune system. It also helps stop cancer cells from increasing in number. Third, it also works like a type of targeted therapy called an angiogenesis inhibitor. Angiogenesis inhibitors stop the growth of new blood vessels that would provide food (nutrients) to the cancer.

Lenalidomide is made in pill form. It is given in cycles of treatment days followed by days of rest. A cycle may consist of 3 weeks of treatment and 1 week of rest. It may also be given for 4 straight weeks. Cycles may repeat until the cancer grows or side effects become severe.

Common side effects include low blood counts, diarrhea, itching, rash, and fatigue. Serious but less common side effects include blood clots, bleeding disorders, loss of vision, and skin cancer. Ask your treatment team for a full list of side effects.

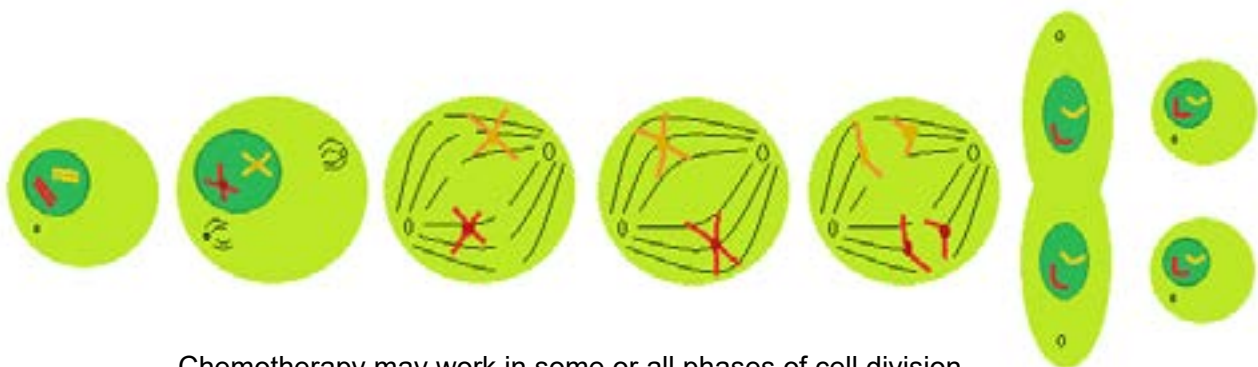
Chemotherapy

Chemotherapy, or “chemo,” includes drugs that disrupt the life cycle of cancer cells. The types of chemotherapy differ in the way they work. Some kill cancer cells by damaging their DNA or by disrupting the making of DNA. Others interfere with cell parts that are needed for making new cells. Thus, no new cells are made to replace dying cells. Chemotherapy can affect both cancer and normal cells.

Some chemotherapy drugs work when cells are in an active growth phase. **See Figure 9.** During the active growth phase, cells grow and divide to form a new cell. Chemotherapy that disrupts the growth phase works well for cancer cells that are growing and dividing quickly. Other chemotherapy drugs work in any growth or resting phase.

Figure 9 Chemotherapy and the cell cycle

A cell goes through many changes to divide into two cells. Science has grouped these changes into 7 main phases. There may be another phase of rest, too. Some chemotherapy drugs work in any phase. Other chemotherapy drugs work in one or two growth phases. In growth phases, DNA is copied and two full sets of chromosomes are made. A full set of chromosomes is pulled into each end of the cell. The cell then divides into two cells each with their own set of chromosomes.



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What to expect

Chemotherapy used to treat DLBCL is listed in [Guide 2](#). Most are liquids that are slowly injected into a vein. Some are a pill that is swallowed. By any method, the drugs travel in your bloodstream to treat cancer throughout your body. Doctors use the term “systemic” when talking about a cancer treatment for the whole body.

Chemotherapy is given in cycles of treatment days followed by days of rest. This allows your body to recover before the next cycle. Cycles vary in length depending on which drugs are used. Often, a cycle is 2 to 4 weeks long. If you will have chemotherapy, ask

your doctor how many cycles will be given. Also ask how many days of treatment there are within a cycle.

Chemotherapy may consist of one or more drugs. When only one drug is used, it is called a single agent. However, not all drugs work the same way, so often more than one drug is used. A combination regimen is the use of two or more chemotherapy drugs. A steroid, immunotherapy, or both are often added to chemotherapy.

Side effects of chemotherapy

Side effects are unhealthy or unpleasant physical or emotional responses to treatment. They differ among

Guide 2. Chemotherapy

Generic (chemical) name	Brand name (sold as)
Bendamustine hydrochloride	Treanda [®] , Bendeka [™]
Carboplatin	–
Cisplatin	Platinol [®]
Cyclophosphamide	–
Cytarabine	Cytosar-U [®]
Doxorubicin hydrochloride	–
Doxorubicin hydrochloride, Liposome injection	Doxil [®]
Etoposide; Etoposide phosphate	Etopophos [®] Preservative Free
Gemcitabine hydrochloride	Gemzar [®]
Ifosfamide	–
Methotrexate	–
Mitoxantrone hydrochloride	Novantrone [®]
Oxaliplatin	Eloxatin [®]
Procarbazine hydrochloride	Matulane [®]
Vincristine sulfate	–
Vinorelbine	Navelbine [®]

people. Some people have many side effects. Other people have few. Some side effects can be very serious. Others can be unpleasant but not serious.

Side effects of chemotherapy depend on multiple factors. These factors include the drug type, amount taken, length of treatment, and the person. In general, side effects are caused by the death of fast-growing cells.

Fast-growing cells are found in the hair follicles, gut, mouth, and blood. Death of these cells can cause low blood cell counts, not feeling hungry, nausea, vomiting, diarrhea, hair loss, and mouth sores. Lung damage may also occur at the time of treatment.

Most side effects appear shortly after treatment starts and will stop after treatment. However, other side effects are long-term or may appear years later. Late side effects include another type of cancer, heart disease, low levels of thyroid hormones (hypothyroidism), and problems having babies (infertility).

Not all side effects of chemotherapy are listed here. Please ask your treatment team for a complete list of common and rare side effects. If a side effect bothers you, tell your treatment team. There may be ways to help you feel better. There are also ways to prevent some side effects.

Supportive care

Supportive care doesn't aim to treat cancer but aims to improve quality of life. It is also called palliative care. It can address many needs. One example is treatment for physical and emotional symptoms.

Supportive care can also help with treatment decisions as you may have more than one option. It can also help with coordination of care between health providers. Talk with your treatment team to plan the best supportive care for you.

Steroids

Steroid is the short name for corticosteroid. It is a type of drug that is often used to relieve inflammation. Steroids also are toxic to lymphoma cells. They have strong anti-cancer effects. The steroids used to treat DLBCL are listed in [Guide 3](#).

Steroids are a part of some chemotherapy regimens. They are often given on the same days as chemotherapy but only for a few days or a week. Prednisone is made in pill form but dexamethasone and methylprednisolone are made both as a liquid to be injected or a pill to be swallowed.

Most side effects of steroids fade away once the drugs are stopped. Common side effects include feeling hungry, upset stomach, and mood changes. You may have trouble sleeping. Wounds may be slow to heal. Swelling of ankles, feet, or hands is also common.

Guide 3. Steroids

Generic (chemical) name	Brand name (sold as)
Dexamethasone	–
Methylprednisolone; Methylprednisolone acetate; Methylprednisolone sodium succinate	A-Methapred Depo-Medrol® Medrol® Solu-Medrol®
Prednisone	–

Targeted therapy

Targeted therapy is a class of drugs. These drugs work on molecules that help cancer cells grow. They are less likely to harm normal cells than chemotherapy. Targeted therapy for DLBCL is called brentuximab vedotin.

On the surface of some DLBCL cells are proteins called CD30. Brentuximab consists of a human-made monoclonal antibody, which attaches to CD30. After attaching, it enters the cells. Then, it releases chemotherapy. By targeting only cells with CD30, fewer normal cells are harmed.

Brentuximab vedotin is a treatment option for refractory or relapsed DLBCL that is 1) CD30 positive and 2) won't be treated with a blood stem cell transplant. Read Part 4 for more information.

Brentuximab vedotin is sold as Adcetris®. It is slowly injected into a vein for about 30 minutes. It is often given every 3 weeks.

The most common side effects include tingling in hands and feet, fatigue, nausea, diarrhea, fever, rash, and lung infections. Blood cell counts may decrease. Rare but severe effects include brain infection, serious disorder of skin and mucous membranes, and kidney problems.

Not all side effects of brentuximab vedotin are listed here. Please ask your treatment team for a complete list. If a side effect bothers you, tell your treatment team. There may be ways to help you feel better. There are also ways to prevent some side effects.

Radiation therapy

Radiation therapy uses high-energy x-rays to treat DLBCL. The x-rays damage DNA in cancer cells. This either kills the cancer cells or stops new cancer cells from being made. Radiation therapy may be received after drug regimens to treat stages I and II. It is used less often to treat stages III and IV.

A radiation oncologist will oversee your radiation treatment. A radiation oncologist is a doctor who's an expert in treating cancer with radiation. He or she will tailor treatment to you.

Involved-site radiation therapy

ISRT (involved-site radiation therapy) is sometimes used to treat DLBCL. It can treat lymph nodes in which the cancer first started. It may also treat cancer near to these nodes.

It is given with a method called EBRT (external beam radiation therapy). A large machine makes high-energy x-rays used for treatment. This machine is called a LINAC (linear accelerator). **See Figure 10.**

Planning and setup sessions

A planning session is needed to map out your treatment. The planning process is called simulation. It involves obtaining a scan of your body in the position that is needed for treatment. The scan is only used for treatment planning.

A CT scan with contrast is used. PET/CT and MRI (magnetic resonance imaging) often enhance treatment planning for ISRT. For tumors near the breastbone, 4D-CT (four-dimensional computed tomography) or fluoroscopy can account for tumor movement from breathing. If your breathing causes large movements, motion control methods during the scans may be used.

After simulation, your radiation team will further plan your treatment. Plans are made by viewing

your scans on the treatment planning computer. Your radiation oncologist will work closely with a dosimetrist. They will plan the best dose, number and shape of radiation beams, and number of treatments. Your plan will be designed to treat the cancer while sparing normal tissue.

Once your treatment plan is made, a setup session is needed. This session is sometimes called "port film" day or dress rehearsal. The setup session occurs in the treatment room.

Figure 10 External beam radiation therapy

Radiation therapy is often delivered from a large machine called a linear accelerator. The rays pass through skin and travel to the tumor. Healthy tissue is protected using modern types of treatment.



Treatment sessions

During treatment, you will lie on a table in the same position as done for simulation. Devices may be used to keep you from moving. You will be alone while the therapists operate the machine from the nearby control room.

The therapists will be able to see, hear, and speak with you. As treatment is given, you may hear noises. One session takes less than 10 minutes. The types of EBRT include:

- **3D-CRT (three-dimensional conformal radiation therapy)** delivers, from different angles, a photon beam that matches the shape of the target.
- **IMRT (intensity-modulated radiation therapy)** is a form of 3D-CRT. It further modifies the beam's intensity during treatment.
- **Proton therapy** uses proton beams that deliver radiation mostly within the tumor.

IGRT (image-guided radiation therapy) can improve how well the radiation beam targets some tumors. IGRT uses the machine that delivers the radiation to also take images of the tumor and normal body structures. This can be done right before or during treatment. These images are compared to the ones taken during simulation. If needed, changes will be made to your body position or the radiation beams.

Side effects

Side effects from radiation therapy differ among people. Factors like treatment site, radiation dose, and length of treatment play a role. Side effects are cumulative. This means they build up slowly and are worse at the end of treatment. Your doctor will check on you every week during treatment. He or she will review skin care, medicines, and other options to help you feel better.

Acute effects

Acute effects are those that happen during treatment or shortly after the last session. Many people feel fatigue. Changes in skin are also common right after treatment. Your treated skin may look and feel as if it has a mild sunburn. It may also become dry, sore, and feel painful when touched. You may also have short-term hair loss, but only where treated.

Treatment to the head and neck can cause mouth sores, dry mouth, changes in taste, and a sore throat. Chest radiation can cause a dry cough or a sensation of a lump when you swallow. Radiation near your belly can cause nausea and maybe vomiting, and when given between your hip bones, diarrhea and cramps.

Late effects

Late effects are those that happen after treatment. Some do not go away. The effects depend on the treatment site. Examples include dry mouth, dental cavities, hypothyroidism, lung scarring, heart disease, infertility, and second cancers.

Not all side effects of radiation are listed here. Please ask your treatment team for a complete list of common and rare side effects. If a side effect bothers you, tell your treatment team. There may be ways to help you feel better. There are also ways to prevent some side effects.

Blood stem cell transplant

Blood (hematopoietic) stem cells are cells from which all blood cells are formed. They mainly exist in bone marrow. Cancer or its treatment can damage or destroy blood stem cells.

A blood stem cell transplant replaces damaged or destroyed stem cells with healthy stem cells. The healthy stem cells form new marrow and blood cells. There are two types of blood stem cell transplants.

Autologous blood stem cell transplant

Autologous blood stem cell transplant uses your healthy stem cells to repair bone marrow. This treatment is also called HDT/ASCR (**high-dose therapy with autologous stem cell rescue**). Your healthy stem cells will be collected when imaging tests show that cancer treatment is working. You will then receive intense chemotherapy and maybe radiation to destroy any remaining cancer cells. This intense treatment will also destroy bone marrow. Your healthy stem cells will be put back into your body to “rescue” your marrow.

Allogeneic blood stem cell transplant

Allogeneic blood stem cell transplant uses healthy stem cells from a donor. HLA (**human leukocyte antigen**) typing is the test used to check if the donor and your tissue type are a good fit. Chemotherapy will be given to destroy cancer cells and suppress your immune system from attacking the donor cells.

The transplanted stem cells will form new marrow and attack remaining cancer cells. This attack is known as the GVT (**graft-versus-tumor**) effect. On the other hand, there is a serious risk of GVHD (**graft-versus-host disease**). GVHD is when the donated cells see the cells in your body as foreign and attack them.

What to expect

A blood stem cell transplant is not an option for everyone. It can have severe side effects. Thus, it is not given to people who are frail or quite sick.

Autologous blood stem cell transplant is more commonly used for DLBCL. Sometimes it is used if initial treatment doesn't work or the cancer reappears on tests. More details on this transplant are given next.

Collecting your blood stem cells

The first step of an autologous blood stem cell transplant is to collect your blood stem cells. Blood stem cells are found in the bone marrow and in the bloodstream. The methods to harvest differ based on collecting from marrow or blood.

If stem cells are collected from blood, a process called apheresis will be done. First, medicine is given to increase the number of stem cells in blood. Then, some blood will be removed from a large vein most likely in your arm. The blood will flow through a tube and into a machine that removes stem cells. The rest of the blood will be returned through the other arm.

Apheresis typically takes 4 to 6 hours and does not require anesthesia. It may take two or more sessions to obtain enough stem cells. During the procedure, you may have lightheadedness, chills, numbness around the lips, and cramping in the hands.

Bone marrow aspiration is used to remove bone marrow. For this procedure, either regional anesthesia or general anesthesia is given. Next, a needle will be inserted through the skin into the hip bone to draw out the bone marrow. The needle must be inserted many times into one or more spots to collect enough marrow. The marrow will then be processed to collect the stem cells.

Collection of the bone marrow takes about 1 hour. The entire hospital stay will likely be 6 to 8 hours,

which includes recovery time. The aspiration will likely cause some pain and soreness for a few days. Anesthesia may cause nausea, headache, and tiredness.

After apheresis or aspiration, the harvested cells will be combined with a preservative. Then, they will be frozen and stored to keep them alive until the transplant. This process is called cryopreservation.

High-dose chemotherapy

Before the autologous transplant, you will likely receive high doses of chemotherapy. High doses are given to kill any cancer cells that may remain after prior treatment. Chemotherapy is often received for several days. The transplant will occur 1 or 2 days later to allow the chemotherapy to clear from your body. Otherwise, the chemotherapy could damage the healthy stem cells.

Transplanting your blood stem cells

After chemotherapy, you will receive your healthy stem cells through a transfusion. A transfusion is a slow injection of blood products through a central line into a large vein. A central line (or central venous catheter) is a thin tube. The tube will be inserted into your skin through one cut and into your vein through a second cut. Local anesthesia is used. This process can take several hours to complete.

The transplanted stem cells will travel to your bone marrow and grow. New, healthy blood cells will form. This is called engraftment. It usually takes about 2 to 4 weeks.

Until then, you will have little or no immune defense. You will need to stay in a very clean room at the hospital. You may be given an antibiotic to prevent or treat infection. You may also be given a blood platelet transfusion to prevent bleeding and blood transfusion to treat low red blood counts (anemia). While waiting for the cells to engraft, you will likely feel tired and weak.

Complementary and alternative medicine

CAM (complementary and alternative medicine) is a group of treatments that aren't often given by doctors. There is much interest today in CAM for cancer. Many CAMs are being studied to see if they are truly helpful.

Complementary medicines are treatments given along with usual medical treatments. While CAMs aren't known to kill cancer cells, they may improve your comfort and well-being. Two examples are acupuncture for pain management and yoga for relaxation.

Alternative medicine is used in place of usual medicine. Some alternative medicines are sold as cures even though they haven't been proven to work in clinical trials. If there was good proof that CAMs or other treatments cured cancer, they would be included in this book.

It is important to tell your treatment team if you are using any CAMs. They can tell you which CAMs may be helpful and which CAMs may limit how well medical treatments work.

Clinical trials

One of your treatment choices may be to join a clinical trial. Joining a clinical trial is strongly supported. NCCN believes that you will receive the best management in a clinical trial.

New tests and treatments aren't offered to the public as soon as they're made. They first need to be studied. A clinical trial is a type of research that studies a test or treatment in people.

Clinical trials study how safe and helpful tests and treatments are for people. When found to be safe and helpful, they may become tomorrow's standard treatment. Because of clinical trials, the tests and treatments in this book are now widely used to help people with lymphoma. Future tests and treatments that may have better results will depend on clinical trials.

New tests and treatments go through a series of clinical trials. These trials aim to ensure they're safe and work. Without clinical trials, there is no way to know if a test or treatment is safe or helpful. Clinical trials have four phases. Some examples of the four phases for treatment are:

- ▶ **Phase I trials** aim to find the safest and best dose of a new drug. Another aim is to find the best way to give the drug with the fewest side effects. These trials often involve about 20 people.
- ▶ **Phase II trials** assess if a drug works for a specific type of cancer. These trials often involve 20 to 100 people.
- ▶ **Phase III trials** compare a new drug to a standard treatment head-to-head. These trials often involve hundreds or thousands of people.

- ▶ **Phase IV trials** test drugs approved by the U.S. FDA (**F**ood and **D**rug **A**dministration) to learn more about side effects with long-term use.

Joining a clinical trial has benefits. First, you'll have access to the most current cancer care. However, please note that it is unknown how well new treatments work if at all. Second, you will receive the best management of care. Third, the results of your treatment—both good and bad—will be carefully tracked. Fourth, you may help other people who will have cancer in the future.

Clinical trials have risks, too. Like any test or treatment, there may be side effects. Also, new tests or treatments may or may not improve your health. In fact, your health may worsen during a trial. Other downsides may include more hospital trips, paperwork, and extra costs for you.

To join a clinical trial, you must meet the conditions of the study. Patients in a clinical trial are often alike in terms of their cancer and general health. Thus, if patients improve, it's because of the treatment and not because of differences between them.

To join, you'll need to review and sign an informed consent form. This form describes the study in detail. The study's risks and benefits should be described and may include others than those described above.

Ask your treatment team if there is an open clinical trial that you can join. There may be clinical trials where you're getting treatment or at other treatment centers nearby. You can also find clinical trials through the websites listed in Part 5.

Review

- Immunotherapy helps your immune system to attack and destroy cancer cells.
- Lenalidomide is an immunomodulator. It treats DLBCL by modifying your immune system and by other means.
- Chemotherapy stops the life cycle of cancer cells so they can't increase in number.
- Some steroids have anti-cancer effects and may be used with chemotherapy.
- Brentuximab vedotin is a targeted therapy. It attaches to cells with CD30 proteins then releases chemotherapy inside.
- Involved-site radiation therapy kills cancer within lymph nodes and nearby cells by damaging DNA.
- A blood stem cell transplant treats lymphoma by giving a person healthy blood stem cells.
- Clinical trials give people access to new tests and treatments that otherwise can't usually be received. These new tests and treatments may in time be approved by the FDA.



During chemo, I made sure I ate (even when not hungry) and drank plenty of water. After chemo, I had 18 radiation treatments. I would walk my steps until I could do 8 times up & down (to rebuild my lung capacity). Then I walked a 5k during treatment. It was hard but my sister was with me.

– Angie
Survivor

4

Treatment guide

38 First-line treatment

42 Follow-up care

44 Second-line treatment

44 Review



Part 4 is a guide to the treatment options for DLBCL. It starts with explaining the first treatments received by cancer stage. If treatment works, the health care for after treatment is listed. The last section lists options for second-line treatment. Your doctor may suggest other options based on your health and wishes. Fully discuss your options with your doctor.

First-line treatment

Treatment options are partly based on cancer stage. Treatment for stages I and II are discussed next. Treatment for stages III and IV are discussed starting on page 42.

Stages I & II

Guide 4 lists options for initial treatment of stages I and II. These lymphomas are either above or below the diaphragm. The lymphoma may be in more than one cluster of lymph nodes. If so, it is confined to a small area.

Treatment options are based on the size of the lymphoma. Large (bulky) lymphomas are 7.5 cm or larger. Small (non-bulky) lymphomas are smaller than 7.5 cm. Options 1 and 2 are for lymphomas of any size. Option 3 is for small lymphomas.

Option 1

The lymphoma will be treated with rituximab-based chemotherapy then by radiation. Chemotherapy will be given for 6 cycles. If you are unable to receive chemotherapy, involved-site radiation therapy alone may be received.

Some chemotherapy may harm your health. Thus, your current health and age will affect which chemotherapy you will receive. Start treatment

with RCHOP if you are healthy. If you have heart problems or are frail, your options include RCEPP, RCDOP, DA-EPOCH with rituximab, RCEOP, and RGCVP. RGCVP and R-mini-CHOP can be received if you are older than 80 years of age and have multiple health conditions.

When chemotherapy is finished, treatment results will be checked. Imaging tests are used. PET/CT has been found to be very useful for checking results. Imaging should occur at least 8 weeks after treatment. Results are used to advise the next steps in treatment.

If there are no signs of cancer, there is no need to change your treatment plan. Radiation therapy may be received.

If the cancer looks smaller, a biopsy may be done to confirm there's cancer. If no cancer is found, radiation therapy may be received. If cancer is found or a biopsy isn't done, you have three options. These options are high-dose radiation therapy, a blood stem cell transplant with or without radiation therapy, and joining a clinical trial.

Imaging tests may suggest that the cancer is the same or larger. In this case, read **Guide 8** for treatment options. Radiation therapy may also be an option if you can't receive chemotherapy.

Option 2

Option 2 includes treating the cancer with only chemotherapy and rituximab. No radiation will be used. Chemotherapy will be given for 6 cycles.

Some chemotherapy may harm your health. Thus, your current health and age will affect which chemotherapy you will receive. Start treatment with RCHOP if you are healthy. If you have heart problems or are frail, your options include RCEPP, RCDOP, DA-EPOCH with rituximab, RCEOP, and RGCVP. RGCVP and R-mini-CHOP can be received

Guide 4. First-line treatment for stages I & II

Option 1

Immunochemotherapy	Results	Treatment
6 cycles of: • RCHOP or • RCEPP • RCDOP • DA-EPOCH + rituximab • RCEOP • RGCVP • R-mini-CHOP	No signs of cancer	• Radiation therapy
	Cancer looks smaller on scans and no cancer is found with biopsy	• Radiation therapy
	Cancer looks smaller on scans; Cancer is found with biopsy or biopsy is not done	• Higher-dose radiation therapy • Blood stem cell transplant ± radiation therapy • Clinical trial
	Cancer looks the same or larger	• Second-line treatment (Guide 8) • Radiation therapy in some cases.

Option 2

Immunochemotherapy	Results	Treatment
3–4 cycles out of 6 planned cycles of: • RCHOP or • RCEPP • RCDOP • R-DA-EPOCH + rituximab • RCEOP • RGCVP • R-mini-CHOP	No signs of cancer	• Complete treatment
	Cancer looks smaller	• Complete treatment
	Cancer looks the same or larger; No cancer is found with biopsy	• Complete treatment
	Cancer looks the same or larger; Cancer is found with biopsy or biopsy is not done	• Second-line treatment (Guide 8) • Radiation therapy in some cases

if you are older than 80 years of age and have multiple health conditions.

After 3 to 4 chemotherapy cycles, treatment results will be assessed. Testing should occur at least 8 weeks after treatment. Imaging tests are used. PET/CT has been found to be very useful for

checking results. Tests results are used to advise the next steps in treatment.

If the cancer appears to be gone or smaller, there is no need to change your treatment plan. Complete the 6 cycles of chemotherapy. If the cancer looks the same or larger, a biopsy may be done to confirm

Guide 4 continued

Option 3 for small cancers

Immunochemotherapy	Results	Treatment
3 cycles of: • RCHOP or • RCEPP • RCDOP • DA-EPOCH + rituximab • RCEOP • RGCVP • R-mini-CHOP	No signs of cancer	• Radiation therapy
	Cancer looks smaller on scans and no cancer is found with biopsy	• Radiation therapy
	Cancer looks smaller on scans; Cancer is found with biopsy or biopsy is not done	• Higher-dose radiation therapy • Clinical trial
	Cancer looks the same or larger	• Second-line treatment (Guide 8) • Radiation therapy in some cases.

there's cancer. If no cancer is found, complete the 6 cycles of chemotherapy.

If cancer is found or a biopsy isn't done, read [Guide 8](#) for treatment options. Radiation therapy may be an option if you can't receive chemotherapy.

Option 3

Option 3 maps a third treatment option for small stage I and II cancers. It includes treating the cancer with rituximab-based chemotherapy then by radiation. Chemotherapy will be given for 3 cycles. Some chemotherapy may harm your health. Thus, your current health and age will affect which chemotherapy you will receive.

Start treatment with RCHOP if you are healthy. If you have heart problems or are frail, your options include RCEPP, RCDOP, DA-EPOCH with rituximab, RCEOP, and RGCVP. RGCVP and R-mini-CHOP can be received if you are older than 80 years of age and have multiple health conditions.

When chemotherapy is finished, treatment results will be assessed. Imaging tests are used. PET/CT has been found to be very useful for checking results. Imaging should occur at least 8 weeks after treatment.

Test results are used to advise the next steps in treatment. If there are no signs of cancer, there is no need to change your treatment plan. Radiation therapy may be received.

If the cancer looks smaller, a biopsy may be done to confirm there's cancer. If no cancer is found, radiation therapy may be received. If cancer is found or a biopsy isn't done, you have two options. These options are high-dose radiation therapy and joining a clinical trial.

Imaging tests may suggest that the cancer is the same or larger. In this case, read [Guide 8](#) for treatment options. Radiation therapy may also be an option if you can't receive chemotherapy.

Drug regimens

Combinations of drugs are almost always used to treat DLBCL. These combinations can be complex. Throughout Part 4, the short names for the regimens are listed. Below, the name of each drug for every regimen is provided.

- **CEOP** (cyclophosphamide, etoposide, vincristine, prednisone)
- **CEPP** (cyclophosphamide, etoposide, prednisone, procarbazine)
- **DHAP** (dexamethasone, cisplatin, cytarabine)
- **Dose-adjusted EPOCH** (etoposide, prednisone, vincristine, cyclophosphamide, doxorubicin)
- **ESHAP** (etoposide, methylprednisolone, cytarabine, cisplatin)
- **GDP** [gemcitabine, dexamethasone, (cisplatin or carboplatin)]
- **GemOx** (gemcitabine, oxaliplatin)
- **ICE** (ifosfamide, carboplatin, etoposide)
- **MINE** (mesna, ifosfamide, mitoxantrone, etoposide)
- **RCHOP** (rituximab, cyclophosphamide, doxorubicin, vincristine, prednisone)
- **RCEOP** (rituximab, cyclophosphamide, etoposide, vincristine, prednisone)
- **RCEPP** (rituximab, cyclophosphamide, etoposide, prednisone, procarbazine)
- **RCDOP** (rituximab, cyclophosphamide, liposomal doxorubicin, vincristine, prednisone)
- **RGCVP** (rituximab, gemcitabine, cyclophosphamide, vincristine, prednisolone)

During and after cancer treatment, you may be treated to prevent or control other health conditions. Such actions are a part of supportive care. Health conditions that are a concern for some people include TLS, reactivated viruses, and other infections. Talk to your doctor about which health conditions you may develop as a result of cancer treatment.

Stages III & IV

Guide 5 maps the initial treatment of stages III and IV. These lymphomas are on both sides of your diaphragm. Otherwise, they have widely spread outside the lymphatic system.

Rituximab-based chemotherapy

One option includes 6 cycles of rituximab-based chemotherapy. For select people, radiation to bulky sites may be received beforehand. A second option is to join a clinical trial.

Some chemotherapy may harm your health. Thus, your current health and age will affect which chemotherapy you will receive. Start treatment with RCHOP if you are healthy. If you have heart problems or are frail, your options include RCEPP, RCDOP, DA-EPOCH with rituximab, RCEOP, and RGCVP. RGCVP and R-mini-CHOP can be received if you are older than 80 years of age and have multiple health conditions.

Sometimes DLBCL spreads into the CNS (central nervous system). This system includes your brain and spinal cord. If this is the case, other cancer drugs will be added to the treatment described above. Most CNS disease can be treated with methotrexate. The two innermost layers of your brain's membrane are called the leptomeninges. If the cancer has spread to this site, treatment includes both methotrexate and cytarabine.

Treatment results

After 2 to 4 chemotherapy cycles, treatment results will be assessed. Imaging tests are used. PET/CT has been found to be very useful for checking results. Imaging should occur at least 8 weeks after treatment.

Test results are used to advise the next steps in treatment. If the cancer appears to be gone or smaller, complete the 6 cycles of chemotherapy. Another option is to join a clinical trial.

If the cancer looks the same or larger, a biopsy may be done to confirm there's cancer. If no cancer is found, complete the 6 cycles of chemotherapy. Another option is to join a clinical trial.

If cancer is found or a biopsy isn't done, read **Guide 8** for treatment options. Radiation therapy may also be an option.

Guide 6 lists options if first-time treatment worked. If treatment worked, the signs of cancer will be gone or greatly reduced on tests. One option is to start observation. Observation or "watch-and-wait" is a period of testing to see if cancer grows.

A second option is radiation therapy. It may be given to sites where the cancer had grown large. It may also be used to treat lymphoma that has spread to small areas of the bone.

A third option is maintenance treatment. The goal of maintenance is to prevent the cancer from returning. Lenalidomide maintenance has been studied among older people who received RCHOP.

A fourth option is consolidation treatment with an autologous blood stem cell transplant. The chance of the cancer coming back may be high for some people. The goal of consolidation treatment is to kill any cancer cells that may remain.

Follow-up care

Guide 7 provides follow-up care options for when there are no signs of cancer after treatment. This care may include a medical history, physical exam, imaging, and blood tests. Imaging will involve a CT scan of your chest, abdomen, and pelvis. Contrast should be used. A biopsy is often needed to confirm there's cancer. If the cancer returns (relapses), read **Guide 8** for options.

Guide 5. First-line treatment for stages III & IV

Immunochemotherapy	Results	Treatment
2–4 cycles out of 6 planned cycles of: <ul style="list-style-type: none"> • RCHOP or • RCEPP • RCDOP • DA-EPOCH + rituximab • RCEOP • RGCVP • R-mini-CHOP 	No signs of cancer or cancer looks smaller on scans	<ul style="list-style-type: none"> • Complete treatment • Clinical trial
	Cancer looks the same or larger; No cancer is found with biopsy	<ul style="list-style-type: none"> • Complete treatment • Clinical trial
	Cancer looks the same or larger; Cancer is found with biopsy or biopsy is not done	<ul style="list-style-type: none"> • Second-line treatment (Guide 8) • Radiation therapy in some cases

Guide 6. Extra treatment

What are the options?
• Wait and watch
• Consider radiation therapy
• Consider lenalidomide maintenance
• Consider blood stem cell transplant if likely to relapse

Guide 7. Follow-up care

Type of care	How often is this care needed?
Medical history and physical exam	<ul style="list-style-type: none"> • Every 3–6 months for 5 years <ul style="list-style-type: none"> ◦ If normal, then repeat every year or when needed
Lab tests	<ul style="list-style-type: none"> • Every 3–6 months for 5 years <ul style="list-style-type: none"> ◦ If normal, then repeat every year or when needed
CT scan	<ul style="list-style-type: none"> • As needed for stages I & II • No more often than every 6 months for 2 years or as needed for stages III and IV

Second-line treatment

Guide 8 lists options for second-line treatment. These options are used if first-treatment didn't work. They are also used if the lymphoma reappears on tests. Your treatment options are based on whether you plan to have a blood stem cell transplant.

Transplant planned

Chemotherapy is first received. Rituximab may be added. There is no preferred regimen among those listed in the Guide.

For CNS disease, other drugs will be added to the regimen you will receive. Most CNS disease can be treated with methotrexate. Sometimes rituximab or cytosine arabinoside are also used. The two innermost layers of your brain's membrane are called the leptomeninges. If the cancer has spread to this site, treatment includes both methotrexate and cytarabine.

After chemotherapy, treatment results will be assessed. Imaging tests are used. PET/CT has been found to be very useful. Imaging should occur at least 8 weeks after treatment. Results are used to advise the next steps in treatment.

If the cancer appears to be gone or smaller, there are 3 treatment options. The first option is consolidation treatment with an autologous blood stem cell transplant. The goal of consolidation treatment is to kill any cancer cells that may remain. The second and third options are clinical trials and, for some people, an allogeneic blood stem cell transplant. Ask your doctor if you can have an allogeneic transplant.

Radiation therapy may improve the results of a transplant. Involved-site radiation therapy before the transplant may be received. In addition, sites that had cancer may be treated with more radiation before or after the transplant.

If the cancer looks the same or larger, there are four options. The first option is to join a clinical trial. The second option is treatment with one of the regimens listed in *Guide 8 Blood stem cell transplant is not planned*. The third option is radiation therapy to cancer sites to relieve symptoms. Relief of symptoms is part of supportive care. The fourth option is supportive care other than radiation therapy.

Transplant not planned

Join a clinical trial if you can. If you can't, the drug regimens that are listed in the Guide are advised. For CNS disease, other drugs such as methotrexate will be added to the regimen you accept. A third option is radiation therapy to cancer sites to relieve symptoms. Relief of symptoms is part of supportive care. The fourth option is supportive care other than radiation therapy.

Review

- Options for initial treatment of DLBCL are based on the stage of the cancer.
- Stage I and II cancers are often treated with 6 cycles of immunochemotherapy followed by radiation therapy. Small cancers may be fully treated with only 3 cycles. Another option is treating the cancer with only chemotherapy and rituximab.
- Stage III and IV cancers are often treated with 6 cycles of immunochemotherapy. A second option is to join a clinical trial. If 6 cycles of treatment works, you may be further treated with radiation therapy, lenalidomide, or a blood stem cell transplant.
- Second-line treatment is based on whether a blood stem cell transplant is planned.

Guide 8. Second-line treatment

Blood stem cell transplant is planned

Immunochemotherapy	Results	Treatment
<ul style="list-style-type: none"> • DHAP ± rituximab • ESHAP ± rituximab • GDP ± rituximab • GemOx ± rituximab • ICE ± rituximab • MINE ± rituximab <p>Other cancer drugs to treat CNS disease may also be received</p>	No signs of cancer or cancer looks smaller	<ul style="list-style-type: none"> • Autologous blood stem cell transplant ± involved-site radiation therapy • Clinical trial • Allogeneic blood stem cell transplant in some cases
	Cancer looks the same or larger	<ul style="list-style-type: none"> • Clinical trial • Drug treatment • Radiation therapy • Best supportive care

Blood stem cell transplant is not planned

What are the options?
• Clinical trial
• Drug treatment
◦ Bendamustine ± rituximab
◦ Brentuximab vedotin for CD30+ disease
◦ CEPP ± rituximab
◦ CEOP ± rituximab
◦ DA-EPOCH ± rituximab
◦ GDP ± rituximab
◦ GemOx ± rituximab
◦ Lenalidomide ± rituximab
◦ Rituximab
◦ Other cancer drugs to treat CNS disease may also be received
• Radiation therapy
• Best supportive care

5

Making treatment decisions

47 It's your choice

47 Questions to ask your doctors

52 Deciding between options

53 Websites

53 Review



Having cancer is very stressful. While absorbing the fact that you have cancer, you have to learn about tests and treatments. In addition, the time you have to accept a treatment plan feels short. Parts 1 through 4 described the cancer and treatment options. Part 5 aims to help you make decisions that are in line with your beliefs, wishes, and values.

It's your choice

The role each person wants in choosing his or her treatment differs. You may feel uneasy about making treatment decisions. This may be due to a high level of stress. It may be hard to hear or know what others are saying. Stress, pain, and drugs can limit your ability to make good decisions. You may feel uneasy because you don't know much about cancer. You've never heard the words used to describe cancer, tests, or treatments. Likewise, you may think that your judgment isn't any better than your doctors'.

Letting others decide which option is best may make you feel more at ease. But, whom do you want to make the decisions? You may rely on your doctors alone to make the right decisions. However, your doctors may not tell you which option to choose if you have multiple good options. You can also have loved ones help. They can gather information, speak on your behalf, and share in decision-making with your doctors. Even if others decide which treatment you will receive, you still have to agree by signing a consent form.

On the other hand, you may want to take the lead or share in decision-making. Most patients do. In shared decision-making, you and your doctors share information, weigh the options, and agree on a treatment plan. Your doctors know the science

behind your plan but you know your concerns and goals. By working together, you are likely to get a higher quality of care and be more satisfied. You'll likely get the treatment you want, at the place you want, and by the doctors you want.

Questions to ask your doctors

You may meet with experts from different fields of medicine. Strive to have helpful talks with each person. Prepare questions before your visit and ask questions if the person isn't clear. You can also take notes and get copies of your medical records.

It may be helpful to have your spouse, partner, family member, or a friend with you at these visits. A patient advocate or navigator might also be able to come. They can help to ask questions and remember what was said. Suggested questions to ask are listed on the following pages.

What's my diagnosis and prognosis?

It's important to know that there are different types of cancer. Cancer can greatly differ even when people have a tumor in the same organ. Based on your test results, your doctor can tell you which type of cancer you have. He or she can also give a prognosis. A prognosis is a prediction of the pattern and outcome of a disease. Knowing the prognosis may affect what you decide about treatment.

1. Where did the cancer start? In what type of cell? Is this cancer common?
2. What is the cancer stage? Does this stage mean the cancer is advanced?
3. Is this a fast- or slow-growing lymphoma?
4. What tests do you recommend for me?
5. Where will the tests take place? How long will the tests take and will any test hurt?
6. What if I am pregnant?
7. How do I prepare for testing?
8. Should I bring a list of my medications?
9. Should I bring someone with me?
10. How often are these tests wrong?
11. Would you give me a copy of the pathology report and other test results?
12. Who will talk with me about the next steps? When?

What are my options?

There is no single treatment practice that is best for all people. There is often more than one treatment option along with clinical trial options. Your doctor will review your test results and recommend treatment options.

1. What will happen if I do nothing?
2. Can I just carefully monitor the cancer?
3. Do you consult NCCN recommendations when considering options?
4. Are you suggesting options other than what NCCN recommends? If yes, why?
5. Do your suggested options include clinical trials? Please explain why.
6. How do my age, health, and other factors affect my options? What if I am pregnant?
7. Which option is proven to work best?
8. Which options lack scientific proof?
9. What are the benefits of each option? Does any option offer a cure or long-term cancer control? Are my chances any better for one option than another? Less time-consuming? Less expensive?
10. What are the risks of each option? What are possible complications? What are the rare and common side effects? Short-lived and long-lasting side effects? Serious or mild side effects? Other risks?
11. How do you know if treatment is working?
12. What are my options if my treatment stops working?
13. What can be done to prevent or relieve the side effects of treatment?

What does each option require of me?

Many patients consider how each option will practically affect their lives. This information may be important because you have family, jobs, and other duties to take care of. You also may be concerned about getting the help you need. If you have more than one option, choosing the option that is the least taxing may be important to you:

1. Will I have to go to the hospital or elsewhere? How often? How long is each visit?
2. What do I need to think about if I will travel for treatment?
3. Do I have a choice of when to begin treatment? Can I choose the days and times of treatment?
4. How do I prepare for treatment? Do I have to stop taking any of my medicines? Are there foods I will have to avoid?
5. Should I bring someone with me when I get treated?
6. Will the treatment hurt?
7. How much will the treatment cost me? What does my insurance cover?
8. Will I miss work or school? Will I be able to drive?
9. Is home care after treatment needed? If yes, what type?
10. How soon will I be able to manage my own health?
11. When will I be able to return to my normal activities?

Deciding between options

Deciding which option is best can be hard. Doctors from different fields of medicine may have different opinions on which option is best for you. This can be very confusing. Your spouse or partner may disagree with which option you want. This can be stressful. In some cases, one option hasn't been shown to work better than another. Some ways to decide on treatment are discussed next.

2nd opinion

The time around deciding a treatment is very stressful. People with cancer often want to get treated as soon as possible. They want to make their cancer go away before it spreads farther. While cancer can't be ignored, usually there is time to think about and choose which option is best for you.

You may wish to have another doctor review your test results and suggest a treatment plan. This is called getting a 2nd opinion. You may completely trust your doctor, but a 2nd opinion about which option is best can help.

Copies of the pathology report, a DVD of the imaging tests, and other test results need to be sent to the doctor giving the 2nd opinion. Some people feel uneasy asking for copies from their doctors. However, a 2nd opinion is a normal part of cancer care.

When doctors have cancer, most will talk with more than one doctor before choosing their treatment. What's more, some health plans require a 2nd opinion. If your health plan doesn't cover the cost of a 2nd opinion, you have the choice of paying for it yourself.

If the two opinions are the same, you may feel more at peace about the treatment you accept to have. If the two opinions differ, think about getting a 3rd opinion. A 3rd opinion may help you decide between

your options. Choosing your cancer treatment is a very important decision. It can affect your length and quality of life.

Support groups

Besides talking to health experts, it may help to talk to other people who have walked in your shoes. At support groups, you can ask questions and hear about the experiences of other people with lymphoma. Find a support group at the websites listed on page 53.

Compare benefits and downsides

Every option has benefits and downsides. Consider these when deciding which option is best for you. Talking to others can help identify benefits and downsides you haven't thought of. Scoring each factor from 0 to 10 can also help since some factors may be more important to you than others.

Websites

American Cancer Society

cancer.org/cancer/non-hodgkin-lymphoma

Leukemia & Lymphoma Society

[LLS.org/information-specialists](https://lls.org/information-specialists)

National Cancer Institute (NCI)

cancer.gov/types/lymphoma

National Coalition for Cancer Survivorship

canceradvocacy.org/toolbox

NCCN for Patients®

nccn.org/patients



My goal was to run another ½ marathon. I had to have a goal. This kept depression and despair away. I took one day at a time. One year after treatment, I ran and completed the Niagara's women's half marathon.

– Angie

Survivor

Review

- ▶ Shared decision-making is a process in which you and your doctors plan treatment together.
- ▶ Asking your doctors questions is vital to getting the information you need to make informed decisions.
- ▶ Getting a 2nd opinion, attending support groups, and comparing benefits and downsides may help you decide which treatment is best for you.

Glossary

55 Dictionary

59 Acronyms

Dictionary

adrenal gland

A small organ on top of each kidney that makes hormones.

allogeneic blood stem cell transplant

A cancer treatment that destroys bone marrow then replaces it by adding healthy blood stem cells from a donor.

anesthesia

Loss of feeling with or without loss of wakefulness that is caused by drugs.

antibody

A protein made by white blood cells that helps fight off infection. Also called an immunoglobulin.

antigen

Any substance that activates the immune system.

autologous blood stem cell transplant

A cancer treatment that destroys bone marrow then replaces it by adding healthy blood stem cells from the patient. Also called an HDT/ASCR (high-dose therapy with autologous stem cell rescue).

B symptoms

Fevers, heavy night sweats, and weight loss without dieting caused by B-cell cancers.

B-cell

One of three types of a white blood cell called a lymphocyte.

beta-2 microglobulin

A small protein made by many types of cells.

biopsy

Removal of small amounts of tissue or fluid to be tested for disease.

bone marrow

Soft, sponge-like tissue in the center of most bones where blood cells are made.

bone marrow aspiration

Removal of a small amount of bone marrow that is liquid to test for disease.

bone marrow biopsy

Removal of a small amount of solid bone and bone marrow to test for disease.

cancer stage

A rating of tumors that suggest the outlook of the disease.

chemotherapy

Drugs that stop the life cycle of cells so they don't increase in number.

chromosome

Strands of genetic material inside of cells.

chyle

A fatty liquid absorbed from the gut into the lymphatic system.

clinical trial

Research on a test or treatment to assess its safety or how well it works.

complete blood count (CBC)

A test of the number of blood cells in a sample.

comprehensive metabolic panel

Tests of up to 14 chemicals in your blood.

computed tomography (CT)

A test that uses x-rays to view body parts.

consolidation treatment

Extra treatment given to kill any remaining cancer cells.

contrast

A dye put into your body to make clearer pictures during imaging tests.

deoxyribonucleic acid (DNA)

A chain of chemicals inside cells that contains coded instructions for making and controlling cells.

diagnose

To identify a disease.

diaphragm

A sheet of muscles below the ribs that helps a person to breathe.

differential

Measurement of the different types of white blood cells present in a blood sample.

double-hit lymphoma

The presence of a *MYC* gene rearrangement with either a *BCL2* or *BCL6* gene rearrangement.

echocardiogram

A test that uses sound waves to make pictures of the heart.

external beam radiation therapy (EBRT)

Treatment with radiation that is delivered by a machine into the body.

fatigue

Severe tiredness despite getting enough sleep that limits one's ability to function.

fertility specialist

An expert who helps men and women have babies.

flow cytometry

A test that looks at certain substances on the surface of cells to identify the type of cells present.

fluorescence in situ hybridization (FISH)

A lab test that uses special dyes to look for abnormal chromosomes.

four-dimensional computed tomography (4D-CT)

A CT scan that can show the movement of organs.

gene

Instructions in cells for making and controlling cells.

gene rearrangement

The fusion of parts from two genes that creates a new gene.

general anesthesia

A controlled loss of wakefulness from drugs.

germinal center

A short-lived structure that forms within an lymphatic organ in response to germs.

germinal center B-cell (GCB)

A type of lymphocyte found within short-lived structures, called germinal centers, within lymphatic organs.

human leukocyte antigen (HLA) typing

A blood test that finds a person's unique set of proteins on cells.

image-guided radiation therapy (IGRT)

Radiation therapy that uses imaging tests during treatment to better target the tumor.

imaging test

A test that makes pictures (images) of the inside of the body.

immune system

The body's natural defense against illness.

immunohistochemistry (IHC)

A test of cancer cells to find specific cell traits involved in abnormal cell growth.

immunomodulator

A type of drug that modifies some parts of the body's disease-fighting system.

intensity-modulated radiation therapy (IMRT)

Radiation therapy that uses small beams of different strengths based on the thickness of the tissue.

International Prognostic Index (IPI)

A scoring system used to predict the outcome of diffuse large B-cell lymphoma.

involved-site radiation therapy (ISRT)

Treatment with high-energy rays (radiation) that is delivered to lymph nodes and nearby sites with cancer.

karyotype

A test that uses a microscope to examine a cell's chromosomes.

kidney

One of a pair of organs that removes waste from blood, helps control blood pressure, and helps to make red blood cells.

lactate dehydrogenase

A protein that helps to make energy in cells.

liver

Organ that removes waste from the blood and helps to digest food.

local anesthesia

A controlled loss of feeling in a small area of the body caused by drugs.

lumbar puncture

A procedure in which a thin needle is inserted between the bones of the spine to remove a sample of spinal fluid or give drugs into the spinal fluid.

lymph

A clear fluid containing white blood cells.

lymph node

Small groups of special disease-fighting cells located throughout the body.

lymph vessel

Tube-shaped ducts that carry lymph throughout the body.

lymphatic system

Network in the body that collects and transports a fluid (lymph) and fights germs.

lymphocyte

A type of white blood cell that helps protect the body from illness.

lymphoma

Cancer that begins in white blood cells called lymphocytes that are within the lymphatic system.

magnetic resonance imaging (MRI)

A test that uses a magnetic field and radio waves to make pictures of the insides of the body.

medical history

All health events and medications taken to date.

monoclonal antibody

Man-made antibodies that attach proteins on cancer cells.

multi-gated acquisition (MUGA) scan

A test of the heart that uses radiation to make pictures.

natural killer (NK) cell

One of three types of a white blood cell called a lymphocyte.

observation

A period of testing for cancer growth.

pathologist

A doctor who's an expert in testing cells to find disease.

performance status

A rating of one's ability to do daily activities.

physical exam

A review of the body by a health expert for signs of disease.

positron emission tomography (PET)

A test that uses radioactive material to see the shape and function of body parts.

positron emission tomography/computed tomography (PET/CT)

A test that uses radioactive material and x-rays to view the shape and function of organs and tissues.

proton therapy

Radiation therapy that uses protons to treat a disease. Also called hadron therapy.

radiation therapy

The use of radiation to treat cancer.

regional anesthesia

A type of drug used for short-term loss of feeling or awareness in a part of the body without loss of wakefulness.

sedative

A drug that helps a person to relax or go to sleep.

side effect

An unplanned physical or emotional response to treatment.

spleen

An organ to the left of the stomach that helps protect the body from disease.

steroid

A drug used to reduce redness, swelling, and pain, but also to kill cancer cells.

supportive care

Treatment for the symptoms or health conditions caused by cancer or cancer treatment.

targeted therapy

Drugs that stop the growth process that is specific to cancer cells.

T-cell

One of three types of a white blood cell called a lymphocyte.

three-dimensional conformal radiation therapy (3D-CRT)

Radiation therapy that uses beams that match the shape of the tumor.

thymus

A gland located behind the breastbone.

tonsil

A group of tissue within the throat that contains many white blood cells called lymphocytes and fights germs that enter the mouth and nose.

triple-hit lymphoma

The presence of a *MYC*, *BCL2*, and *BCL6* gene rearrangement.

tumor lysis syndrome (TLS)

A condition that occurs when many cancer cells die very quickly and release their contents into the blood, which can damage the kidneys and other organs.

ultrasound

A test that uses sound waves to take pictures of the inside of the body.

uric acid

A chemical that is made and released into the blood when cells and other substances in the body break down.

Acronyms

3D-CRT

three-dimensional conformal radiation therapy

4D-CT

four-dimensional computed tomography

CAM

complementary and alternative medicine

CBC

complete blood count

CNS

central nervous system

CT

computed tomography

DLBCL

diffuse large B-cell lymphoma

DNA

deoxyribonucleic acid

EBRT

external beam radiation therapy

FDA

Food and Drug Administration

FISH

fluorescence in situ hybridization

FNA

fine-needle aspiration

GCB

germinal center B-cell

GVHD

graft-versus-host disease

GVT

graft versus tumor

HDT/ASCR

high-dose therapy with autologous stem cell rescue

HLA

human leukocyte antigen

IGRT

image-guided radiation therapy

IHC

immunohistochemistry

IMRT

intensity-modulated radiation therapy

IPI

International Prognostic Index

ISRT

involved-site radiation therapy

LDH

lactate dehydrogenase

LINAC

linear accelerator

MRI

magnetic resonance imaging

MUGA

multi-gated acquisition

NCCN

National Comprehensive Cancer Network

NK cells

natural killer cells

PET

positron emission tomography

TLS

tumor lysis syndrome



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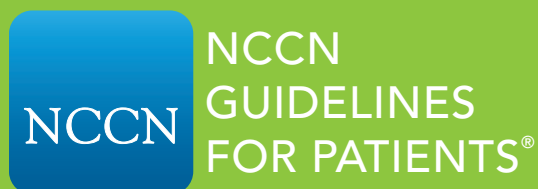
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Index

- 2nd opinion** 52
- biopsy** 10, 38–40, 42
- blood stem cell transplant** 33–34, 38–39, 42–43, 44–45
- blood tests** 16–17, 42
- bone marrow exam** 19
- cancer stage** 20, 21, 38
- chemotherapy** 27–29, 38–40, 42, 44
- clinical trial** 35, 38–40, 42–43, 44–45
- complementary and alternative medicine (CAM)** 34
- complete blood count (CBC)** 16
- comprehensive metabolic panel** 16
- computed tomography (CT)** 19, 42
- diagnosis** 10–13
- double-hit lymphoma** 13
- fertility** 22
- immunohistochemistry (IHC)** 12
- immunomodulators** 26
- immunotherapy** 25–26
- involved-site radiation therapy (ISRT)** 31, 44
- lumbar puncture** 20
- lymphatic system** 8
- lymphocyte** 8
- lymphoma** 8–10
- medical history** 15, 42
- NCCN Member Institutions** 63
- NCCN panel members** 62
- observation** 42
- pathology report** 13
- physical exam** 16, 42
- positron emission tomography/computed tomography (PET/CT)** 18, 38–40, 42, 44
- radiation therapy** 31–32, 38–40, 42–43, 44–45
- shared decision-making** 47
- steroids** 30
- supportive care** 29, 41, 44–45
- targeted therapy** 30





Diffuse Large B-cell Lymphoma

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