

## Lymphoma in Children and Young Adults

Lymphoma is a cancer that develops in the white blood cells, which are part of our immune system. This type of cancer can present with symptoms such as unexplained weight loss, fatigue, night sweats, coughing or trouble breathing.

Your doctor will perform a physical exam and may be able to feel enlarged lymph nodes. If the doctor is concerned about a diagnosis of lymphoma, they may order blood tests and imaging exams such as ultrasound (US), MRI, or a CT scan. After diagnosis, follow-up tests may include lumbar puncture, biopsy of lymph nodes or bone marrow, and additional imaging exams such as a PET-CT. Imaging exams help to locate enlarged lymph nodes throughout the body to determine what parts of the body are involved. Treatment of lymphoma depends on the type and stage and the patient's age and overall health. Young patients may receive treatment as part of a clinical trial.



### What is pediatric lymphoma?

Lymphoma is a cancer that develops in the white blood cells (lymphocytes), which is part of the body's immune system.

There are two major types of lymphoma: Hodgkin (HL) and non-Hodgkin (NHL). Each of these types has several subtypes. Specific types of lymphoma differ in how they behave and how they respond to treatment. Your doctor will examine a tissue sample under a microscope to determine the type of lymphoma you have.

Lymphoma is more common in adults, but this cancer can also develop in children (under the age of 15) and young adults (between the ages of 15 and 24). Hodgkin lymphoma is more common in teens and young adults. Children are more likely to have Non-Hodgkin.

### Symptoms

Lymphoma can be difficult to diagnose. Many of the symptoms of lymphoma are also symptoms of other illnesses; symptoms also vary among patients. They include:

- swollen or enlarged lymph nodes in the neck, armpit, or groin that are not painful and don't go away
- upset or painful stomach, swollen belly, constipation, or diarrhea
- a persistent cough, wheezing, or shortness of breath
- fatigue
- night sweats
- high body temperature
- poor appetite
- losing weight without trying
- itching
- bruising and bleeding easily
- headaches, dizziness, or seizures.

## How is pediatric lymphoma diagnosed and evaluated?

Your doctor will ask about your medical history and perform a physical exam. They may order one or more of these tests:

- **Blood tests** to check on the number of white blood cells, platelets, and red blood cells in your body. These cell counts may become low when lymphoma spreads to the bone marrow. These tests also help determine how your liver and kidneys are functioning.
- **Bone marrow biopsy:** In this surgical procedure, the doctor inserts a needle into the hip bone to remove a small amount of bone marrow for examination. *See the Biopsy page (<https://www.radiologyinfo.org/en/info/biopen>) for more information.*
- **Biopsy:** In this procedure, the doctor surgically removes part of or an entire lymph node or other tissue for examination under a microscope. A needle biopsy may be sufficient to diagnose lymphoma. In some cases, your doctor may use CT or ultrasound imaging to guide insertion of the needle into a suspicious area.
- **Imaging**
  - **Chest x-ray** (<https://www.radiologyinfo.org/en/info/chestrad>) : Your doctor uses a chest x-ray to look at the lungs and to see the size of the lymph nodes in the chest.
  - **Body CT** (<https://www.radiologyinfo.org/en/info/bodyct>) : Your doctor uses CT of the body to detect enlarged lymph nodes or organs and abnormalities in the abdomen, pelvis, chest, head, and neck.
  - **PET scan** (<https://www.radiologyinfo.org/en/info/pet>) : (<https://www.radiologyinfo.org/en/info/pet>) A PET scan, which uses a small amount of radioactive material, can help detect abnormal lymph nodes throughout the body that may not be seen on a CT scan. Your doctor may use repeat PET scans to see if treatment is working. They may combine the PET scan with a CT or MRI scan to get detailed views of the body.
  - **Bone scan:** (<https://www.radiologyinfo.org/en/info/bone-scan>) In a bone scan, the doctor injects a radioactive isotope into a vein. The isotope travels to damaged areas of bone. The doctor will use this test if you are having bone pain or if other tests indicate lymphoma involves the bone.
  - **MRI** (<https://www.radiologyinfo.org/en/info/bodymr>) : An MRI scan is useful in detecting lymphoma that has spread to the brain or spinal cord. Doctors also use it to look at the head and neck or organs in the abdomen.
  - **Ultrasound** (<https://www.radiologyinfo.org/en/info/abdominus>) : (<https://www.radiologyinfo.org/en/info/abdominus>) Your doctor may use ultrasound to examine enlarged lymph nodes in the abdomen and other organs such as the kidneys or testes, to determine if lymphoma is present.
- **Lumbar puncture** (<https://www.radiologyinfo.org/en/info/spinaltap>) . In this test, the doctor removes a small amount of cerebrospinal fluid (CSF) and examines it under a microscope for lymphoma cells. Doctors only use this test for certain types of lymphoma or if your symptoms suggest the lymphoma has reached the brain.

## How is pediatric lymphoma treated?

Doctors treat children with HL similarly to adults. Treatment for NHL depends on the NHL sub-type. NHL in young people is more aggressive and fast-growing than NHL in adults.

Treatment depends on the patient's age, general health, and the type and stage of lymphoma. Researchers are studying current therapies for adults for possible use in children and young adults. Young people may receive treatment as part of a clinical trial.

Treatment options include:

- **Chemotherapy.** Patients will receive cancer-killing drugs by mouth or injection. Often, chemotherapy will use several drugs at the same time.
- **External beam therapy** (<https://www.radiologyinfo.org/en/info/ebr>) (**EBT**). This type of radiation therapy ([https://www.radiologyinfo.org/en/info/intro\\_onco](https://www.radiologyinfo.org/en/info/intro_onco)) directs beams of high-energy x-rays generated by a machine at a tumor and cancerous lymph nodes.
- **Monoclonal antibody therapy**(also called targeted therapy). This treatment uses laboratory-produced molecules

(monoclonal antibodies) that target cancer cells and deliver a drug to kill them.

- **Immunotherapy.** This treatment involves natural or laboratory-made substances that work with the body's natural defenses against cancer.
- **CAR T-cell therapy.** This targeted treatment takes T-cells from the body's immune system and modifies them in a laboratory to recognize and kill lymphoma. Doctors use this therapy to treat DLBCL or primary mediastinal B cell lymphoma types that do not respond to other therapies or return after treatment.
- **ALK inhibitors.** Drugs target the abnormal ALK gene in children with the anaplastic large cell type of lymphoma.
- **Stem cell transplant.** In this treatment, your doctor replaces diseased bone marrow with your own healthy stem cells (autologous) or donor stem cells (allogeneic). This allows new bone marrow to grow. A stem cell transplant may be an option if lymphoma returns after treatment. Before a stem cell transplant, you may first receive external beam radiation and high-dose chemotherapy to eliminate as many lymphoma cells as possible.

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