What are lymph nodes?

Lymph nodes are small, grape-sized glands that exist throughout the body and make up part of the lymphatic fluid circulation system. Lymphatic fluid (or lymph) is a clear fluid that leaks out of blood vessels, and in order for the body to keep the blood volume constant, is collected and returned to the blood via the lymphatic circulation. Lymph nodes are connected to each other by lymph vessels that transfer the lymphatic fluid. Before returning the lymph to the blood, lymph nodes clean up the fluid, filtering out infection-causing germs (bacteria, viruses, etc.). Most people can remember having swollen "glands" under their neck when they had an infection. Those "glands" were swollen lymph nodes that were reacting to the infection.

Clusters of lymph nodes exist in particular parts of the body, like the neck, the underarm, and the groin. There are also specific organs in the body that are considered part of the lymphatic system, like the spleen and the tonsils. These organs and the lymph nodes are the major regions of the body where lymphatic tissue is found, but small amounts can also be found in many of the other organs in the body.

What is Hodgkin lymphoma?

Hodgkin lymphoma is a disease of lymph nodes and lymphatic tissues, called a lymphoma. There are other types of lymphomas besides Hodgkin lymphoma, but they will be discussed in a separate article. Hodgkin lymphoma occurs when cells in the lymph nodes begin to grow out of control and compress nearby tissues, or spread throughout the body via the lymphatic circulation. Hodgkin lymphoma is distinguished from the other types of lymphomas by the way it looks under a microscope and by the way it grows and spreads.

Who is at risk for Hodgkin lymphoma?

Hodgkin lymphoma is an uncommon cancer in children. It is more common during adolescence than in early childhood. In fact, Hodgkin lymphoma is extremely rare in children under the age of 5 years.

No one knows what causes Hodgkin lymphoma. No clear-cut associations have been found with exposures to toxins, chemicals, or environmental agents. First-degree relatives of patients with Hodgkin lymphoma have a higher chance of developing the lymphoma, but exactly how genetics control this lymphoma is poorly understood.

Hodgkin is more common in people who have underlying problems with their immune systems including certain viruses that affect the immune system, like HIV and EBV.

Because no one knows exactly what causes Hodgkin lymphoma, there are no specific steps to prevent developing it.

What screening tests are available?

Hodgkin lymphoma is rare enough that it is not screened for with any specific tests. The best way to pick up a diagnosis of Hodgkin lymphoma early is to see a doctor regularly for a thorough physical examination.

What are the signs of Hodgkin lymphoma?

Unfortunately, the early stages of Hodgkin lymphoma may not have any symptoms. The most common presenting symptom is a swelling in the neck. As the tumor grows in size, it can produce other symptoms including:

- swelling of nodes in the neck, groin or underarm
- fever
- night sweats
- weight loss
- generalized itching (pruritis)
- persistent cough
- pain in the lymph node regions associated with drinking alcohol

Many of these symptoms are non-specific, and could represent a variety of different conditions; however, a child with any of these symptoms should be seen by a physician.

**How is Hodgkin lymphoma diagnosed and staged?**

When a patient presents with symptoms suggestive of Hodgkin lymphoma, the healthcare provider will perform a thorough history and physical examination. If there is a lymph node that is enlarged, it will likely be surgically removed with what is called an "excisional biopsy" so that it can be evaluated under a microscope. This is the only way Hodgkin lymphoma can be diagnosed.

Other tests can help support the diagnosis and help to plan for treatment including blood tests and other imaging tests. A few different blood tests will probably be ordered. The physician will also get a CT scan and PET scan to stage the patient. Staging is important to guide the choice of treatment and offer information about prognosis. A simplified version of the staging system for Hodgkin lymphoma (called the Modified Ann Arbor Staging System) is offered below:

**Stage 1:** Single lymph node region involved with lymphoma

**Stage 2:** Two or more lymph node regions involved on the same side of the diaphragm (the muscle that controls breathing and that separates the chest from the abdomen)

**Stage 3:** Lymph node regions involved on both sides of the diaphragm

**Stage 4:** Diffuse involvement of an organ that is not considered part of the lymphatic system (like the lung or liver).

If a patient has certain symptoms, this can affect the stage risk classification. High fevers, night sweats, or weight loss (greater than 10% of original body weight) are all called "B" symptoms. If a patient has B symptoms, then his/her stage will include the letter "B" after the stage number. If a patient doesn't have any of these B symptoms, then his/her stage will include the letter "A" after the stage number. Additionally, any lymphoma that is found in regions other than lymph nodes (like other organs) is called extranodal lymphoma. Any patient with extranodal lymphoma will have the letter E included in their stage. Finally, patients with large (bulky) lymph nodes may have the letter X included in their stage. In addition, based on size and location of lymph nodes that are involved, patients will be classified as low, intermediate or high risk.

**What are the treatments for Hodgkin lymphoma?**

Over the years, the cure rates for pediatric Hodgkin lymphoma have increased dramatically. Given the excellent results achieved with older regimens, newer research efforts have focused on decreasing the toxicity of the available curative therapies in order to decrease long-term treatment-related side effects in survivors.

**Chemotherapy**

Chemotherapy is the use of anti-cancer drugs that go throughout the entire body. These drugs may be given through a vein or by mouth. Chemotherapy has become the mainstay of treatment for patients with Hodgkin lymphoma, and combinations of different chemotherapy drugs are used to kill the tumor cells.

There are many different chemotherapy regimens. Some of the more common pediatric regimens and the drugs used in them are listed below:

- **OPPA:** Vincristine, procarbazine, prednisone, and doxorubicin
- **OEPA:** Vincristine, etoposide, prednisone, and doxorubicin
- COPP: Cyclophosphamide, vincristine, procarbazine, and prednisone
- COPDAC: Cyclophosphamide, vincristine, prednisone and dacarbazine
- ABVD: Doxorubicin, bleomycin, vinblastine, and dacarbazine
- VBVP: Vinblastine, bleomycin, etoposide, and prednisone
- DBVE: Doxorubicin, bleomycin, vincristine, and etoposide
- ABVE-PC: Doxorubicin, bleomycin, vinblastine, prednisone, doxorubicin, bleomycin, and vinblastine
- BEACOPP: Bleomycin, etoposide, doxorubicin, cyclophosphamide, vincristine, procarbazine, and prednisone
- COPP/ABV: Cyclophosphamide, vincristine, procarbazine, prednisone, doxorubicin, bleomycin, and vinblastine
- VAMP: Vinblastine, doxorubicin, methotrexate, and prednisone
- CVP: Cyclophosphamide, vinblastine and prednisone

Newer agents used include: Gemcitabine, vinorelbine and brentuximab

Radiation Therapy

Pediatric Hodgkin lymphoma patients may be treated with radiation therapy after they receive chemotherapy. Many regimens use radiation therapy depending on the initial response to chemotherapy, so healthcare providers will make a decision about using radiation after some treatment with chemotherapy is complete and they reassess the lymphoma with pictures again. Radiation therapy uses high-energy particles or rays from an external source to kill cancer cells. Radiation may be directed at every area that initially contained lymphoma, or only at certain areas that showed a large amount of disease or disease that did not respond quickly to chemotherapy. The decision of which areas should be radiated depends both on the chemotherapy received, and on the patient's response to chemotherapy.

Stem Cell Transplantation

Sometimes patients receive chemotherapy and radiation therapy and their Hodgkin lymphoma isn't cured. When this happens, further chemotherapy and radiation, or stem cell transplantation may be recommended. Stem cells are cells in everyone's body that can develop into other types of cells when placed in certain environments. Stem cell transplantation is used along with high doses of chemotherapy. The high doses of chemotherapy are so intense that they destroy a patient's bone marrow. Without bone marrow, a person can't make the components of blood and the immune system that are necessary to survive. In order to replace the patient's bone marrow, stem cells are used. In the case of "autologous" stem cell transplants, a patient's own stem cells are harvested before the high dose chemotherapy is given, then stored, and finally returned to the patient after the chemotherapy is done. This way, the bone marrow can re-grow from the stem cells. This enables a patient to tolerate the super high doses of chemotherapy that work against Hodgkin lymphoma but have the unwanted side effect of wiping out healthy bone marrow. In allogeneic stem cell transplants, the stem cells of another person may be used to re-grow the bone marrow of a patient needing high-dose chemotherapy. Stem cell transplantation is a complex and intense treatment, so it is typically reserved for patients who aren't cured with the initial regimens of chemotherapy and radiation therapy.

Clinical Trials

Clinical trials are extremely important in furthering our knowledge of this lymphoma. It is through clinical trials that we know what we do today, and many exciting new therapies are currently being tested. Talk to your doctor about participating in clinical trials in your area. You can also explore currently open clinical trials using the OncoLink Clinical Trials Matching Service.

Follow-up care and Survivorship

Once a patient has been treated for Hodgkin lymphoma, he or she needs to be closely followed for a recurrence. At first, follow-up visits will occur fairly often. The longer a patient is free of lymphoma, the less often he or she will have to go for checkups. Your doctor will tell you when he or she wants follow-up CT scans or PET scans. Unfortunately, anyone who receives radiation or chemotherapy may be at higher risk for a second cancer later in life. This risk may be higher for children who receive radiation, and children who have had cancer treatment should be followed by a specialist who is able to screen for second cancers. The American Cancer Society and The Children's Oncology Group have identified an increased risk of breast cancer in females who receive radiation to the chest as part of Hodgkin lymphoma. For this reason, it is recommended that women who have had chest radiation in the past be screened for breast cancer with mammogram and MRI scans starting 8 years after their radiation treatment, or at age 25 (whichever is later). They also suggest a clinical breast exam performed by a healthcare provider at least once a year until age 25 and then every 6 months.
Survivors often wonder what steps they can take to live healthier after cancer. There is no supplement or specific food you can eat to assure good health, but there are things you can do to live healthier, prevent other lymphomas, detect any subsequent cancers early and work with the social and emotional issues, including insurance, employment, relationships, sexual functioning, and fertility, that a prior cancer diagnosis sometimes brings with it. Your oncology team is there to support you and can help you find support resources.

It is important to have a plan regarding who will provide your cancer-focused follow up care (an oncologist, survivorship doctor or primary care doctor). Talk with your oncology team about developing a survivorship care plan. If you would like to find a survivorship doctor to review your history and provide recommendations, you can contact cancer centers in your area to see if they have a survivor's clinic or search for a clinic on OncoLink's survivorship clinic list.

This article is meant to give you a better understanding of pediatric Hodgkin lymphoma. You may find this information useful when meeting with your physician, making treatment decisions, and continuing your search for information.

**Resources for More Information**

**Leukemia and Lymphoma Society**

Provides disease information and support resources.

[www.lls.org](http://www.lls.org)

**Lymphoma Research Foundation**

Offers education and patient services, information on research, co-pay assistance and stories of hope.

[www.lymphoma.org](http://www.lymphoma.org)

**Lymphomainfo.net**

Aims to bring people together around lymphoma-related issues by providing concise, up-to-date information and a meeting place for lymphoma patients and those who care about them.

[www.lymphomainfo.net](http://www.lymphomainfo.net)