NATIONAL MARROW DONOR PROGRAM®

Acute Lymphoblastic Leukemia (ALL)

Acute lymphoblastic leukemia (ALL) is a fast-growing cancer of the white blood cells. Lymphocytes are a type of white blood cell that the body uses to fight infections. In ALL, the bone marrow makes lots of unformed cells called blasts that normally would develop into lymphocytes. However the blasts are abnormal. They do not develop and cannot fight infections. The number of abnormal cells (or leukemia cells) grows quickly. They crowd out the normal red blood cells, white blood cells and platelets the body needs.

Symptoms and Diagnosis

There are about 4,000 new cases of ALL in the United States each year. It appears most often in children younger than age 10. ALL is the most common leukemia in children. However, it can appear in people of any age – about one-third of cases are adults. Acute lymphoblastic leukemia may also be called acute lymphocytic leukemia or acute lymphoid leukemia.

Signs and Symptoms

The symptoms a person with ALL has depend on how many normal blood cells he or she has. Symptoms also depend on how many leukemia cells there are and where they collect in the body.

- Red blood cells carry oxygen throughout the body. Low numbers of red blood cells can lead to anemia – feeling tired or weak, being short of breath and looking pale.
- White blood cells fight infections. Low numbers of white blood cells can lead to fever and frequent infections that are hard to treat.
- Platelets control bleeding. Low numbers of platelets can lead to cuts that heal slowly, easy bruising or bleeding and tiny red spots under the skin (petechiae).
- High numbers of leukemia cells can cause pain in the bones or joints, lack of appetite, headache or vomiting. These symptoms are less common.

Diagnosis

ALL is diagnosed when blood and bone marrow samples show a large number of abnormal lymphocyte blasts. To find out the type of ALL and how well it might respond to treatment, doctors test samples taken from the blood and bone marrow to learn:

- The size and number of leukemia cells.
- The type of lymphocyte affected – the leukemia cells can begin from one of two types of lymphocytes, B cells or T cells.
- What changes appear in the chromosomes of the leukemia cells. This is called cytogenetics.

Doctors also use a test called a lumbar puncture (or spinal tap) to find out whether there are leukemia cells in the fluid around the brain and spinal cord.

Based on these tests, doctors may categorize ALL into one of the following types: (1) Early pre-B ALL; (2) Common ALL; (3) Pre-B-cell ALL; (3) Mature B-cell ALL (Burkitt leukemia); (4) Pre-T-cell ALL; (4) Mature T-cell ALL

The type of ALL is one of several factors doctors use to plan treatment.

Treatment Options

ALL can get worse quickly, so doctors usually begin treatment right away. To plan the treatment, doctors look at a patient's risk factors (also called prognostic factors). Risk factors are patient and disease traits that clinical research studies have linked to better or poorer outcomes from treatment. Examples of risk factors are a patient's age and the type of ALL he or she has.

For a patient with ALL, the treatment plan may include:

- Chemotherapy – drugs that destroy cancer cells or stop them from growing (discussed further below). Some form of chemotherapy will be part of the treatment plan for all patients with ALL.
- Radiation therapy – most patients do not receive radiation therapy. However, children who have signs of disease in the central nervous system (brain and spinal cord) or have a high risk of the disease spreading to this area may receive radiation therapy to the brain.
- Bone marrow or cord blood transplant (also called a BMT) – a transplant (discussed further below) offers some patients the best chance for a long-term remission of their disease. Because transplants can have serious risks, this treatment is used for patients who are less likely to reach a long-term remission with chemotherapy alone.

Chemotherapy for Acute Lymphoblastic Leukemia

There are three phases of chemotherapy treatment for ALL: induction, consolidation and maintenance. Many patients also receive treatment called intrathecal chemotherapy to prevent leukemia from spreading to the central nervous system.

Induction Chemotherapy

Most patients with ALL are given induction chemotherapy. The goal of induction therapy is to bring the disease into remission. Remission is when the patient's blood counts return to normal and bone marrow samples show no sign of disease. Induction therapy achieves a remission in more than 95% of children and in about 75% to 89% of adults. [1, 2] Induction therapy is usually very intense and lasts about 1 month. After induction chemotherapy, the next step may be a transplant or consolidation chemotherapy, depending on the treatment plan.

Consolidation Therapy

Consolidation therapy, the second phase of chemotherapy, is also intense. It lasts about 4 to 8 months. The goal of consolidation therapy is to reduce the number of disease cells left in the body. The drugs and doses used during consolidation therapy depend on the patient's risk factors.

Maintenance Therapy

If a patient stays in remission after induction and consolidation therapy, maintenance therapy begins. The goal is to destroy any disease cells that remain so that the leukemia is completely gone. Maintenance therapy is less intense than the other two phases. It may last 2 to 3 years.

Intrathecal Chemotherapy

During all three phases of chemotherapy treatment, many patients receive extra chemotherapy to destroy leukemia cells that may have spread to the central nervous system (the brain and spinal cord). This chemotherapy is injected right into the spinal fluid using a lumbar puncture (spinal tap) or an Omaya reservoir (a device placed under the scalp). It is called intrathecal chemotherapy.

Children with ALL who have a high risk of the disease spreading to the central nervous system may receive higher or more frequent doses of intrathecal chemotherapy. Some of these children may also be given radiation therapy to the brain. However, radiation to the brain can cause problems with growth and mental development in children, so doctors try to avoid this treatment.

Chemotherapy Success Rates for ALL

One way to measure the success of a treatment is tracking how many patients survive 5 years or more after treatment.

For children, the overall survival rate after chemotherapy is nearly 80%. [3] This includes children with all levels of risk factors. Survival rates are much lower for children with high-risk disease, while children with low-risk disease have even higher rates of survival.

For adults, the overall survival rate after chemotherapy is about 40%. [3] This includes adults with all levels of risk factors. For adults with high-risk disease, survival rates are much lower, while survival rates are higher for some adults with low-risk disease.

Relapse

Induction therapy brings about a remission in most patients, but over time some patients relapse. A relapse is when the disease returns after a remission. Patients who relapse after chemotherapy may be treated with different chemotherapy drugs and/or more intense doses. Patients who relapse soon after remission or while they are receiving chemotherapy have high-risk disease. For these patients, chemotherapy is less likely to achieve a long-term remission, but a bone marrow or cord blood transplant may be effective.

Bone Marrow or Cord Blood Transplants

For some patients, a marrow or cord blood transplant may offer the best chance for a long-term remission. A transplant is a strong treatment with risks of serious side effects, so it is not used for all patients with ALL. Transplants are used when chemotherapy alone is unlikely to provide a long-term remission.

Allogeneic Transplants for ALL

Most transplants for ALL are allogeneic. An allogeneic transplant replaces the abnormal cells in the patient's bone marrow with healthy blood-forming cells from a family member, unrelated donor or cord blood unit.

Patients may receive an allogeneic transplant at a first remission, in second or third remission after a relapse, or while the disease is active if they do not reach remission. The state of the patient's disease at the time of the transplant can affect the likelihood of a good outcome. In general, transplants in first remission have a better chance of a good outcome than transplants received later or when the disease is not in remission. In addition, the closeness of the donor match can affect the likelihood of a good transplant outcome.

Autologous Transplants for ALL

Another option for some patients may be an autologous transplant, which uses the patient's own blood-forming cells. Autologous transplants have risks of serious side effects, but these risks are lower than for allogeneic transplants. However, patients have a higher risk of relapse of their leukemia after autologous transplants. This is because leukemia cells may be returned to the patient along with his or her blood-forming cells.

Transplant Success Rates

Transplants have risks of serious complications, but a transplant offers some patients the best chance for a cure of their disease. If transplant is an option for you, your doctor can talk with you about your risks and your chances of a cure with transplant.

Making Treatment Decisions

ALL is an acute disease that can get worse quickly. If transplant may be a treatment option for you or your child, talk with your doctor about a consultation with a transplant doctor soon after diagnosis. Getting a transplant at the right time in the course of your disease may offer the best chance of a cure. In general, getting a transplant at first remission gives better outcomes than transplants after one or more relapses. However, the possible benefits need to be weighed against the risks of transplant and the possible risks and benefits of chemotherapy.

For patients with high-risk ALL, an allogeneic transplant may be an option as soon as the patient reaches remission. For patients with standard-risk ALL in first remission, the choice between allogeneic transplant, autologous transplant and continued chemotherapy is less clear. It is important to talk about your treatment options with a doctor who is experienced in treating ALL. Your doctor can discuss your specific risk factors and options with you.

References

1. Margolin JF, Steuber CP, Poplack DG. Acute lymphoblastic leukemia. In: Pizzo PA, Poplack DG, eds. Principles and Practice of Pediatric Oncology. 4th ed. Philadelphia: Lippincott Williams & Wilkins; 2002: 489-544.

2. Gokbuget N, Hoelzer D. Recent approaches in acute lymphoblastic leukemia in adults. Rev Clin Exp Hematol. 2002; 6(2):114-141. Pui C-H, Relling MV, Downing JR. Acute Lymphoblastic Leukemia. N Engl J Med. 2004; 350(15):1535-1548.

The NMDP's Office of Patient Advocacy (OPA) continually develops resources and materials to help patients, family members and doctors with questions about marrow or cord blood transplantation. In addition to print, audio and visual materials, OPA has bilingual (Spanish/English) case managers and LanguageLine interpreter services available for callers. All OPA materials and services are free and confidential. Call the OPA toll-free at 1 (888) 999-6743. Outside the United States call (612) 627-8140, or visit marrow.org/patient