Acute Lymphoblastic Leukemia

There are 5 different types of white blood cells in the blood, one of which is the lymphocyte. A cell called lymphoblast in the bone marrow develops and transforms into a lymphocyte. Similar to the process of a child growing into an adult, this transformation also involves many changes in cell form and properties. Acute lymphoblastic leukemia (ALL) occurs when the transformation process is disrupted, and lymphoblasts multiply at an uncontrolled rate. Lymphoblasts first occupy the entire bone marrow. Just as crops die when a field is overgrown with weeds, healthy cells are destroyed when lymphoblasts overrun the bone marrow. Thus, anemia occurs due to the lack of production of red blood cells, infection and fever due to the lack of healthy white blood cells, and bleeding due to the lack of platelets. Cancer cells that multiply too fast can cause pain in the bones and knees as they put pressure on the bones.

Acute lymphoblastic leukemia usually occurs in young children, with 80% of all blood cancers in children being ALL. In adults, this proportion is only 20%.

It is not possible to determine the exact cause of ALL. However, a common finding in patients with ALL is a mutation in the genes of stem cells in the bone marrow. It is because of these mutations that cells acquire the ability to multiply in an uncontrolled manner.

There are two types of ALL, namely B-ALL and T-ALL. T-ALL is associated with a higher incidence of brain involvement and recurrence. Therefore, when treating T-ALL, special care is taken to ensure chemotherapy drugs reach the brain.

ALL originates in the bone marrow and gradually spreads to the blood, lymph nodes, and spleen. In many cases, the presence of this cancer is detected through a blood test. A bone marrow examination may also reveal cancer cells. Additionally, a bone marrow sample is sent for chromosomal analysis.

When examining blood or bone marrow under a microscope, blast cells can be seen. However, distinguishing between lymphoblasts and myeloblasts requires a special test called flow cytometry. This test not only confirms the presence of ALL but also determines whether it is B-ALL or T-ALL. Chromosome studies and PCR tests on specific genes help determine whether ALL can be treated with chemotherapy alone or requires a bone marrow transplant.

The watery fluid surrounding the brain, called cerebrospinal fluid (CSF), also needs to be tested. This helps identify whether the cancer has spread to the brain. This procedure allows the administration of chemotherapy drugs directly into the CSF fluid. This process is called intrathecal injection (IT).

After treatment, about 80% of children with ALL achieve complete cure, while the rate of cure in adults is lower, with only 40 to 50 percent of adult patients recovering completely.

Once the disease is confirmed, treatment details, possible side effects, and expenses are discussed with the parents of the child. If they agree to the treatment, some pre-treatment tests are performed, including an ECHO to assess heart function, chest and abdominal scanning to determine the extent of the disease spread, and blood tests related to liver and kidney function.

During treatment, frequent blood tests and several intravenous chemotherapy injections are administered. To minimize patient discomfort, a small device called PICC LINE is implanted in the patient, which provides a more accessible vessel for treatments and avoids repeated piercings. Proper care of the PICC line, including changing the dressing every week and flushing it with saline before each use, is crucial to prevent infection.

The treatment of ALL involves four main steps:

1. Induction
2. Consolidation
3. Reinduction
4. Maintenance

Induction phase of treatment consists of two parts, with the first part lasting for 35 days, out of which 28 days require hospitalization. During the initial seven days, only steroids are administered. During this phase there is death of billions of cancer cells, which poses the risk of kidney failure due to excessive waste production. To counteract this, high volumes of saline solutions are administered, and daily blood tests are conducted to monitor kidney function and the progress of cancer regression. Additionally, it is crucial to closely monitor the patient's water intake and urine output during this stage.

From the 8th day onwards, chemotherapy treatment is initiated. Injections of Daunorubicin and Vincristine are administered on the eighth day, and they are given weekly. In between, approximately 8 doses of L-Asparaginase are administered. On the 35th day, a bone marrow examination is performed again to confirm the extent of disease regression. This examination serves as a crucial indicator of the therapy's effectiveness.

In the second part of the induction phase, the drug cyclophosphamide is administered first, followed by cytosine for 4 days and G-CSF for 3 days. This treatment is given continuously for four weeks, with each week's treatment referred to as a "block." IT injections are given at the beginning of each block. After four blocks, cyclophosphamide is given again. Following the induction phase, there is a 15-day break in treatment.

The consolidation phase involves administration of high-dose methotrexate followed by rescue doses of Folinic Acid. This treatment is given four times in every fortnight, with the patient staying in the hospital for three to four days each time. After consolidation, another fortnight break occurs before the reinduction phase.

The reinduction phase is similar to the induction phase, with doxorubicin used instead of daunorubicin and dexamethasone instead of prednisolone. The second phase of reinduction involves only 2 cytosine blocks instead of four.

The final stage in the treatment of ALL is called maintenance. During this phase, chemotherapy drugs are administered in the form of tablets to prevent the disease from relapsing. The patient is prescribed daily 6-MP tablets and weekly Methotrexate tablets. It is essential

to take the 6-MP tablets around 5 pm and avoid eating anything two hours before and after consumption. Additionally, milk or milk products should not be consumed from 2 pm till the next morning. The Methotrexate tablets, given once a week, should not be taken daily under any circumstances. Throughout the maintenance phase, it is crucial for the patient to have monthly visits to the doctor and share the blood test reports with them. The dosage of the medicine may be adjusted based on the patient's WBC count. Additionally, IT (intrathecal) injections are administered every three months at this stage. During maintenance phase there are no restrictions on attending school.

After two and a half years of maintenance treatment, regular blood tests are required every three months for duration of two years. If the patient remains healthy five years after starting treatment, he/she is declared completely cured of ALL.

Some individuals with ALL may have adverse features, which makes the disease high risk. These features include:

- Having the Ph chromosome
- More than 1000 cancer cells per milliliter of blood on the eighth day of treatment
- Presence of more than 5% cancer cells in bone marrow examination on the day 35 of treatment
- Mutation of the MLL gene
- Relapse during treatment

For patients with any of these features, chemotherapy alone has a low cure rate, and bone marrow transplant treatment is recommended. During treatment, chemotherapy can lower the patient's immune system, increasing the risk of infections. If the patient experiences symptoms such as fever, chills, vomiting, stomach pain, diarrhea, sore throat, headache, pain at the PICC line site, or any other signs of infection, they should seek immediate medical attention and receive antibiotic injections.

To minimize infection risk, patients are advised to avoid crowds during treatment and should not come into contact with individuals experiencing cough, cold, or fever. Consuming well-cooked, hot food and filtered water is essential and regular hygiene practices like brushing teeth, bathing, and washing hands before meals should not be neglected. Additionally, a sitz bath should be taken once a day to prevent infections near the anus, and constipation should be avoided. If needed, a laxative called Lactulose can be consumed. During treatment, patients should not get pregnant due to the serious effects of the drugs on the developing fetus.

ALL disease is not a hereditary disease and cannot be transmitted from one person to another. New drugs, such as CAR-T CELLS, are now available for treating this disease. Many more drugs will be available in the future. These are being used in clinical trials. If there is an opportunity for a patient to participate in a clinical trial, it is better to participate in it.

If you have any doubts about acute lymphoblastic leukemia, other than the information given here, you can consult your treating doctor.

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