



16-Year-Old Boy with Pancytopenia Suspected of Hematoblastic Malignancy Acute Lymphoblastic Leukemia and Hyperleukocytosis

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KEYWORDS

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ABSTRACT

Lymphoblastic leukemia acute (ALL) is a cell malignancy that occurs in blood cells in the bone marrow, which grow and become abnormal quickly. According to RISKESDAS 2023, the prevalence of cancer in aged 0-14 years amounted to 16,291 cases, and the type of most cancers suffered by children in Indonesia were leukemia and retinoblastoma. This case report aimed to explain the paediatric case which is Acute Lymphoblastic Leukemia through descriptive studies by observation for one week in a paediatric ward. We reported a 16-year-old boy, with the chief complaint of difficulty of breathing. The complaint was accompanied by cough, vomiting, fluctuating fever, weakness, weight loss, and a sore throat. The diagnosis is based on clinical symptoms, laboratory and other evaluations. Given therapy in the form of IVFD D51/4 NS/ asering 120cc/hour for 24 hours, TC transfusion 4 units at 12-hour intervals, omeprazole 2x40 mg injection, cefotaxime 3x1 gr injection, furosemide 2x20 mg injection, ketorolac 3x1/2 amp injection, ca gluconate 3x10cc injection, dexamethasone 3x10 mg injection, allopurinol 3x1 tablet, bicnat 3x2 tablet, NGT entramix diet 8x100cc. After following treatment for a week, the patient got improvement and will continue the treatment.

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INTRODUCTION

Lymphoblastic Leukemia Acute (ALL) is a cell malignancy that occurs in blood cells in the marrow bones that grow and become heavy quickly (Liwang et al., 2020). According to the National Cancer Institute's Surveillance, Epidemiology, and End Results Program cancer statistics, the prevalence of leukemia is 13.7 per 100,000 population per year, and the number of deaths is 6.8 per 100,000 population per year (Noone et al., 2017). In 2017, it was estimated that as many as 62,130 cases of new leukemia and 24,500 people died because of leukemia. The prevalence of leukemia occurs in men more than women, which is 17.6%, and women, 10.7%. The incidence of leukemia in children (0-19 years), according to the CDC in 2014, is 8.4 per 100,000 found in the group ages 1-4 years, and incidence of death due to leukemia were 0.8 per 100,000 children found in the group aged 15-19 years (Group, 2014). According to 2013 Riset Kesehatan Dasar (RISKESDAS), the prevalence of cancer in aged 0-14 years amounted to 16,291 cases, and the types most cancers suffered by children in Indonesia were leukemia and retinoblastoma. On research conducted on patients' children in a cancer hospital, Dharmais, in the same year, states that leukemia is a disease with the most deaths, in cancer hospital Dharmais (Circulation, 2017). The aim for this case report is to explain a rare case, a 16-year-old boy with acute lymphoblastic leukemia starting from anamnesis, physical examination, additional evaluation until the treatment given.

A-16-year-old, came to the emergency department at Wongsosenegoro Regional Hospital with a complaint of mild shortness of breath since 1 day before hospital admission. The complaint accompanied by cough, dryness, no phlegm, vomiting twice a day, and fluctuating fever that has been felt for more than 1 month of before hospital admission. The patient also had dry cough and vomiting since two weeks ago. The patient also had a sore throat and weight loss. Patient also complained of colored stools and abdominal pain. The patient had a history of pulmonary tuberculosis and had done the treatment for a year.

On the physical examination we found compos mentis consciousness, blood pressure 125/70 mmHg, pulse 114x/ minute, respiratory rate 24x/minute, SpO₂ 98%, and temperature 36.8C, with underweight status based on the CDC curve. On the inspection, we found anemic on the conjunctiva (+/+), enlarged level II and III of lymph nodes in the neck; on abdominal examination, found Schaffner 2 (+), tenderness on the right upper quadrant (+), epigastric (+) and left upper quadrant (+).

On the further evaluation, form laboratory test, we found hemoglobin 8.0 g/dL, erythrocytes 2.73/ uL, hematocrit 24.00%, leukocytes 157.7/ uL, platelets 16/ uL CRP 16.10 mg/dL, sodium 130.0 mmol/L, urea 71.7 mg/dL, SGPT 77 U/L, SGOT 57 U/L, neutrophils 12.5%, absolute neutrophils 19.52 10³/ ul, lymphocytes 8.4%. During routine urine examination, bacteria +1 was found. AP chest x-ray found spotting consolidation in the right perihilar and right paracardial and on the left paracardial.



Figure 1: Manifestation of Pneumonia on Thorax X-ray

the abdominal ultrasound found the right kidney size got enlarged (\pm 13.18 cm), with visible enhancement echogenicity, and on the left kidney's, the size also enlarged (\pm 13.31 cm). The spleen is visibly enlarged (\pm 12.76 cm). Free fluid in the para vesica. The result from we got from the ultrasound was suspect Acute Kidney Injury, splenomegaly, and ascites.

The patient was diagnosed with Pancytopenia, suspected malignancy, with Hematology Acute Lymphoblastic Leukemia accompanied by Hyperleukocytosis. Given therapy in the form of IVFD D51/4 NS/ asering 120cc/hour for 24 hours, TC transfusion 4 units at 12-hour intervals, omeprazole injection 2x40 mg, Cefotaxime injection 3x1 gr, furosemide injection 2x20 mg, ketorolac injection 3x1/2 amp, ca gluconate injection 3x10cc, dexamethasone injection 3x10 mg, allopurinol 3x1 tablet, bicnat 3x2 tablet, NGT with entramix diet 8x100cc.

METHOD

We conducted this research on July 2022 in Wongsonegoro Public Hospital in Semarang, Indonesia. We got the sample from one paediatric patient which underwent a leukemia therapy. This case report describe a condition of the problem through descriptive studies starts with anamnesis, physical examination, further evaluation, and diagnosis and then interventions given to patients qualitatively.

RESULTS AND DISCUSSION

Lymphoblastic leukemia acute (ALL) is a cell malignancy that occurs in blood cells in the bone marrows, which grow and become heavy quickly. In ALL, malignancy started from leukocytes and young lymphoblasts (Liwang et al., 2020). LLA is a malignancy marked by B or T lymphoblasts with proliferation. (Roberts, 2018).

We found this Leukemia Lymphoblastic Acute (ALL) case in a 16-year-old boy, who had no history of familial cancer, no history of viral infections before, no history of smoking and radiation exposure. This patient had a history of lung tuberculosis when he was 1,5 year old. He finished the treatment for a year.

The incidence of ALL, usually occurs in ages over 5 years in children and linked with predominantly men and older age-old at the top incident (Behrman, 2015). This is linear with the case, which is occur in a 16-year-old-boy.

According to the National Cancer Institute's Surveillance, Epidemiology, and End Results Program cancer statistics, the prevalence of leukemia is 13.7 per 100,000 population per year, and the number of deaths is 6.8 per 100,000 population per year. In 2017, it was estimated that as many as 62,130 cases of new leukemia and 24,500 people died because of leukemia. The prevalence of leukemia could be seen from the sex, it usually occurs in men more than women, which is 17.6%, and women 10.7%. The incidence of leukemia in children (0-19 years), according to the CDC in 2014, was 8.4 per 100,000 found in the group ages 1-4 years, and death due to leukemia is 0.8 per 100,000 children found in the group aged 15-19 years.4 According to 2013 RISKESDAS, the prevalence of cancer in child aged 0-14 years were 16,291 cases, and the type of most cancers suffered by children in Indonesia, are leukemia and retinoblastoma. Research conducted on children in a Cancer Hospital Dharmais in the same year stated that leukemia is a disease with the most deaths in cancer hospitals in Dharmais (Indonesian Ministry of Health, 2016). Risk Factors LLA occurs in child age under 6 years (75%), age between mid and end of 30-year (0.2% of the population), genetic abnormalities (twins monozygous, trisomy 21, Klinefelter syndrome, Fanconi anemia, bloom syndrome, and ataxia telangiectasia), history LLA in family, history of malignancy especially with treatment chemotherapy, viral infections (Epstein-Barr virus and HIV), men (1.15 times higher), smoking, Caucasoid (2 times higher), history of radiation exposure (Liwang et al., 2020).

The etiology of acute leukemia is still unclear. Still, there is a hypothesis that acute leukemia is caused by the immune system's presence after viral infection (Deswita et al., 2023). In acute leukemia cases, lesions occur in hematopoietic progenitor cells' DNA. Acute Lymphoblastic Leukemia (ALL) is a suspected genetic disorder in the form of polymorphism on the X chromosome that changes characteristics of the glucose-6-phosphate enzyme; leukemic blast cells infiltrate the marrow bones and other organs and later bother the normal function of these organs. Other studies say ALL is related to gene translocation on chromosomes 9 and 22 (Liwang et al., 2020). Genome studies have noticed that the bodily and polymorphic characteristics of ARD5B, IKZF1, and CDKN2A were associated with the enhancement risk of ALL (odds ratio 1.3 to 1.9). Rare germline mutations, others on PAX5, ETV6, and especially p53, can also become a predisposition strong to the development of leukemia (Puckett & Chan, 2017). There might be mutations on this patient's cells, but we didn't do more research on the patient's gene. Splenomegaly and hepatomegaly happen due to the absorption of platelets and lymphocytes in the spleen and liver because of white blood cells. Typically, the spleen reacts by taking it out from the blood (DeRenzo et al., 2018) (Ramos et al., 2018). Along with the research by DeRenzo and Ramos et al, this patient also had splenomegaly, which is visibly enlarged (± 12.76 cm) by the ultrasound. We strongly believe this is due to the absorption of platelets and lymphocytes in spleen and made the enlargement of the spleen, but we still need to do more evaluation on this.

Signs and symptoms of acute leukemia relate to infiltration of leukemia cells to normal tissue, causing failure of marrow bones (anemia, neutropenia, thrombocytopenia) or infiltration network-specific (glandular sap lymph nodes, liver, spleen, brain, skin, gums, testicles) (Firani, 2018). Frequent symptoms arise are fever, pallor, petechiae, or joints. On the physical examination, often shows lymphadenopathy and hepatosplenomegaly. On this patient, we found frequent fever, splenomegaly, shortness of breath, cough and malaise as well. Patients with leukocytosis $>100.00/\mu\text{L}$ can experience leukostasis in the lungs that can manifest as tightness, crackles, and abnormal breath. Temporary leukostasis of the nerve center can cause a headache, vision blur, lost of consciousness, and stroke (Liwang et al., 2020) (Behrman, 2015). Based on the research by Liwang and Behrman et al, there are also manifestations of the lungs, due to the leucocytosis, this could be the reason why this patient having shortness of breath when he first came to the ER. The other symptoms that the patient had were also cough, vomiting, more than 1-month before hospital admission. Five days after the patient had its first treatment on the hospital, the patient suddenly had bloody stools and stomachache.

On the further evaluation, the results of complete blood count usually shows leukocytosis $>100,000/\mu\text{L}$, followed by normocytic anemia, normochrome, and or thrombocytopenia. The patient's leukocytes can be normal or low. On a blood smear could be found lymphoblasts and other blast cells, PT, aPTT, and D-dimer can be found abnormal, Disseminated Intravascular Coagulation (DIC). On

aspiration, marrow bone can be found in hypercellular, blast cells, and lymphoblasts (Widiaskara et al., 2016). We only did a complete blood count on this patient, and linear with the research by Widiaskara, we also found leucocytosis on this patient, which is 157.7/uL, it is quite high.

The gold standard for leukemia is biopsy on the bone marrow. Flow cytometry is used To determine the degree of acute leukemia, starting from minimal differentiation to megakaryoblastic (Murzalina, 2019). Unfortunately, we didn't do this evaluation and we need to do the biopsy for the further evaluation. Other examinations, such as electrolyte, calcium, phosphate, and acid veins, as well as kidney and liver function, must be monitored to evaluate complications (Liwang et al., 2020) (Behrman, 2015). In the case of, found pancytopenia and splenomegaly from the ultrasound. We also found pneumonia on the chest x-ray.

Patients with ALL generally get chemotherapy and transplantation when required. Chemotherapy induction with three or four-agent chemotherapy based on the group risk. Patients with low risk usually get vincristine, prednisone, and L-asparaginase for 4 weeks; high risk patients usually get anthracyclines (daunorubicin or doxorubicin). During induction, a combination of methotrexate, cytarabine, and hydrocortisone is administered intrarectally to treat existing CNS leukemia or prevent the expansion of CNS involvement.

Adequate hydration is also essential to prevent the impact to kidney (Scholz et al., 2021). This patient already showed the abnormality on the kidney from the ultrasound. We found enlargement on both kidneys (Dias et al., 2014).

Splenectomy is seldom required for lymphocytic leukemia. Splenectomy can help to increase platelets. Splenectomy can be done for serious symptoms that can not be treated with chemotherapy. Radiation can also be used in cases of enlarged spleen to try and reduce spleen size (Liwang et al., 2020) (Brown et al., 2017). We gave IVFD D5 1/4 NS/ asering 120cc/hour for 24 hours, TC transfusion 4 units at 12-hour intervals, omeprazole 2x40 mg injection, Cefotaxime 3x1 gr injection, furosemide 2x20 mg injection, ketorolac 3x1/2 amp injection, calcium gluconate 3x10cc injection, dexamethasone 3x10 mg injection, allopurinol 3x1 tablet, bicnat 3x2 tablet, NGT entramix diet 8x100cc. We haven't done the chemotherapy on this patient because the patient's haven't reached its stable state.

Patients can experience bleeding and significant anemia requiring platelet transfusion. Neutropenia with a neutrophil count below 500/mm³, especially below 100 neutrophils / mm³, is a predisposition to happen to bacteria infection. Immunosuppression increases the risk of *Pneumocystis jirovecii* (Carinii) pneumonia. Complications can also arise caused by therapy, for example, toxicity channel indigestion and alopecia (Liwang et al., 2020) (Behrman, 2015). In this patient, we found neutropenia and pancytopenia, linear with the research that has been done by Liwang and Behrman et al.

Leukemia Lymphoblastic Acute (ALL) prognosis is classified into four groups prognostic risk (low, standard, high, and very high) depends on age, leukocytes count, onset, genetic characteristics, and response to therapy. About 90% of ALL patients are < 30 years old and reach remission perfectly. Life expectancy in 3 years in the group reached 58%. Among children with ALL, about 98% will reach remission. About 85% of patients aged 1 to 18 years with a new diagnosis of ALL are treated with the existing regimen. (Möricke et al., 2016). 10,11

CONCLUSION

We reported a 16 year-old boy with the diagnosis of ALL. The patient then treated in the paediatric ward and being treated with IVFD D5 1/4 NS/ asering 120cc/hour for 24 hours, TC transfusion 4 units at 12-hour intervals, omeprazole 2x40 mg injection, Cefotaxime 3x1 gr injection, furosemide 2x20 mg injection, ketorolac 3x1/2 amp injection, ca gluconate 3x10cc injection, dexamethasone 3x10 mg injection, allopurinol 3x1 tablet, bicnat 3x2 tablet, NGT entramix diet 8x100cc. After the following treatment for a week, this patient got improvement and might be able to continue its treatment for the leukemia until he reaches stable state.

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