sciendo
ПРИЛОЗИ. Одд. за мед. науки, XLVI 2, 2025 МАНУ
CONTRIBUTIONS. Sec. of Med. Sci., XLVI 2, 2025 MASA
10.2478/prilozi-2025-0013 ISSN 1857-9345

LYMPHOCYTE SUBSETS CHANGES IN CHILDREN WITH ACUTE LYMPHOBLASTIC LEUKEMIA DURING CHEMOTHERAPY

Arijeta Hasani[1], Aleksandar Petlickovski[2], Irina Panovska[3], Teodora Brnjarcevska[2], Nevenka Ridova[3], Svetlana Kocheva[1]

[1] University Clinic for Children's Disease, Faculty of Medicine, University Ss. Cyril and Methodius in Skopje, RN Macedonia
[2] Institute of Immunology and Human Genetics, Faculty of Medicine, University Ss. Cyril and Methodius in Skopje, RN Macedonia
[3] University Clinic for Hematology, Faculty of Medicine, University Ss. Cyril and Methodius in Skopje, RN Macedonia

Corresponding author: Arijeta Hasani MD, UL Kjemal Sejfula BR. 49/3-28, 1000 Skopje, Phone: +38975425111, email: arjetae@yahoo.com

ABSTRACT

Background: Acute lymphoblastic leukemia (ALL) is the most common childhood malignancy, with chemotherapy significantly impacting immune cell populations. This study evaluates changes in lymphocyte subsets in children with ALL during treatment.

Methods: A retrospective-prospective study analyzed 17 pediatric patients (aged 2–12 years) treated at the University Clinic for Children's Disease– Skopje following the BFM ALL-IC 2002 protocol. Lymphocyte subsets (CD3, CD4, CD19, CD45) were assessed before chemotherapy, after induction, and after reinduction using flow cytometry.

Results: Children with ALL exhibited reduced cellular immunity at the end of therapy. Lymphocyte depletion was observed in all patients following the induction phase. A statistically significant difference in CD19+ cell values across the three time points was confirmed (p=0.017). Post-hoc analysis revealed significantly lower CD19+ cell values after induction compared to baseline (1.22 vs. 15.3, p=0.008) and significantly lower values at the end of therapy compared to pre-therapy levels (2.5 vs. 15.3, p=0.021).

Conclusion: Intensive chemotherapy induces profound immunosuppression in pediatric ALL patients, primarily affecting B cells. These findings highlight the necessity for immune function assessment and consideration of supportive immunotherapy.

Keywords: ALL, SID, chemotherapy, lymphocyte subsets

INTRODUCTION

Malignant hematological disorders account for more than 40% of childhood malignancies. These are malignant diseases of the hematopoietic system, characterized by the clonal proliferation of lymphoid cells that are blocked in the early stages of differentiation [1, 2].

Acute lymphoblastic leukemia (ALL) is the most common childhood malignancy, accounting for 25% of all malignancies in children up to 15 years. The annual incidence of childhood leukemia is about 4.5 cases per 100,000 children up to 15 years of age (3). of age or approximately 60% of all cases of malignant disease in children and adolescents younger than 20 years of age [3–5].

In the last 5 decades, the 5-year total survival rate for children with ALL has made impressive progress and today exceeds 90% in highly developed countries (4–7). The 5-year overall survival rate for ALL in children up to 15 years of age ranges from 20 to 90%, depending on the subtype of the disease [9, 10].

During the initiation of treatment, children experience significant neutropenia [11]. However, lymphopenia, with low levels of B and T cells is common and is reported to persist for up to 6 months after treatment [12]. B cells have been reported to be more profoundly affected than T cells, with naive B-cell numbers falling proportionately more than memory B-cell populations [13, 14].

The reported effects of chemotherapy on T-cell populations are less consistent but with more significant effects reported on CD4+ T cells and relatively modest effects on CD8+ T-cell numbers [13]. Reports on the effects on natural killer (NK) cells are limited and inconsistent [15].

There are only a few publications on humans with CD45 deficiency or minimal CD45 surface expression, a condition leading to severe combined immunodeficiency (SCID).

Current therapeutic protocols include intensive chemotherapy protocols, biological agents, and radiotherapy, which often have a detrimental effect on immune system cells and are the cause of secondary immunodeficiency (SID) [16, 17].

Secondary immunodeficiency (SID) is mainly a consequence of the nature of the malignant disease or is an undesirable consequence of a series of medical treatments associated with specific immune defects and dysregulation of the immune system.

During chemotherapy for acute lymphoblastic leukemia (ALL), the risk for infection has been proposed to be associated with decreased numbers of T helper lymphocytes (CD4+ T cells) [12].

Infections remain a major cause of morbidity and mortality in patients with malignant diseases. They prolong the course of treatment in these patients and often pose a serious life-threatening risk. The interest in analyzing the immune status of children with malignant disease has been the subject of research in recent years.

This study aims to evaluate quantitative changes in lymphocyte subsets in children with ALL before initiation of chemotherapy, after completion of the induction phase of therapy (protocol I), and after the reinduction phase (protocol II).

MATERIAL AND METHODS

The study is an analytical, retrospective-prospective study. The study included 17 children with acute leukemia (15 children with B-cell ALL, 2 of them with T-cell ALL) aged 2–12 years, who were diagnosed and treated at the Department of Oncology -University Clinic for Children's Disease in Skopje over 1 year. A total of 17 patients were analyzed, for 7 of them, data were taken retrospectively from medical history at 2 points, with no possibility of taking analysis after the reinduction phase because the children were already on maintenance therapy. 10 of the children were prospectively monitored during the three examination points. 11 (64.7%) were female and 6 (35.3%) male. The children had a median age of 5.3 ± 2.8 years. All patients were treated according to the BFM ALL-IC 2002 (Berlin-Frankfurt-Munich) therapeutic protocol.

Among the children involved in the study, the following parameters were analyzed:

– Complete blood count with total leukocyte count, lymphocyte count, and neutrophil leukocytes were analyzed using fluorescence flow cytometry in Sysmex XS800i and Sysmex 1000 hematologic analyzers,

– Quantitative evaluation of the lymphocyte subpopulations CD3, CD4, CD19 and CD45, using10 color flow cytometry BD FASCLyrics. (Table 1)

Table 1. *Immunophenotyping markers used to quantify numbers of peripheral blood lymphocyte subsets*

Lymphocyte population	Phenotype
T-cell	CD3+, CD4+
B-cells	CD19+
Activate T-cells	CD45+

Immunological parameters were analyzed and monitored at 3 time points:

1. at the diagnosis of the disease, before initiation of chemotherapy,

2. after completion of the induction phase (protocol I),

3. after completion of the reinduction phase (protocol II).

The data obtained from the survey were analyzed statistically in the statistical program SPSS 23.0. Shapiro Wilk's test was used to test the normality of the data distribution. Statistical significance was defined at the level of $p<0.05$.

Categorical (attributive) variables are represented by absolute and relative numbers. Numerical variables are represented by mean, standard deviation, minimum and maximum values, medial value, and interquartile rank.

To compare the values of the analyzed parameters before therapy, after the induction phase, and after therapy, the non-parametric Friedman Chi-square dependent sample assay was used. Post-hoc analysis of total statistical significance was performed with the Wilcoxon matched pairs test, with correction with the Bonferroni test.

RESULTS

The study included 17 children with acute leukemia, of whom 11 (64.7%) were female and 6 (35.3%) were male. The children range in age from 2 to 12 years, with a median age of 5.3 ± 2.8 years.

Table 2 shows the values of the analyzed hematological parameters at the analyzed time points, i.e. before the starting of therapy, after the end of the induction phase, and after the end of therapy (reinduction).

Total leukocytes at diagnosis of disease, after induction therapy, and after reinduction averaged 16.51 ± 25.8, 3.12, ± 1.8, and 3.56 ± 1.3, respectively, at the three-time points, medial values of 4.39, 3.1, and 3.33, at the three-time points. A total statistically significant difference was recorded over the analyzed period concerning total leukocyte values (p=0.017). Post-hoc analysis showed that this total significance was due to significantly lower total leukocyte values after completion of the induction phase relative to pre-treatment values (3.1 vs 4.39, p=0.013).

Mean and medial neutrophil values were 2.34 ± 3.8, and 0.92, respectively, before therapy; 1.37 ± 1.02 and 1.48, respectively, after the induction phase; 1.97 ± 1.03 and 1.78, respectively, after completion of therapy. No statistically significant difference was found in neutrophil values during the analyzed period (p=0.53).

An overall statistically significant difference in lymphocyte values between the three time points was confirmed, with p=0.045. Post-hoc analysis of intertemporal differences as statistically significant confirmed the difference between T1 and T0 (p=0.003), and was due to significantly reduced lymphocytes after the induction phase (0.92 vs 2.52).

On average, lymphocytes had values of 11.27 ± 18.3 in T0, 1.27 ± 0.86 in T1, and 2.43 ± 4.2 in T2.

Quantitative evaluation of the lymphocyte subpopulations CD3, CD4, CD19, and CD45 are presented on Table 3.

The CD3 cells had averages of 57.56 ± 23.7, 57.56 ± 23.7, and 86.37 ± 7.7, respectively, at the three time points; and medial values of 63.8, 87, and 89.3, respectively, at the three time points. An overall statistically significant difference in CD3 values between the three-time points was confirmed, with p=0.035, which according to the results of the post-hoc analysis was due to significantly higher values after the induction phase compared to the initial values (87 vs 63.8, p=0.0065) and to significantly higher end-of-therapy values compared to pre-therapy values (89.3 vs 63.8, p=0.011).

The average CD4 cell values were 38.09 ± 19.1, 38.85 ± 11.3, and 42.62 ± 5.9, respectively, in T0, T1, and T2; at the three-time points, the medial CD4 values were 42, 39, and 40, respectively. The difference in CD4 cell values between the analyzed time points was statistically non-distinguishable (p=0.57).

CD19 cells had average values of 21.71 ± 19.9, 3.38 ± 7.5, and 3.56 ± 3.6, respectively, at the three time points; and medial values of 15.3, 1.22, and 2.5, respectively, at the three time points. For p=0.017, an overall statistically significant difference in CD19 values between the three-time points was confirmed. Post-hoc analysis of inter-time intervals showed significantly lower values after the induction phase compared to baseline (1.22 vs 15.3, p=0.008) and significantly lower values at the end of therapy compared to pre-therapy values (2.5 vs 15.3, p=0.021).

No statistically significant difference was found in CD45 cell values between the analyzed time points (74 vs 38.8 vs 32.p=0.29). Mean CD45 cell values were 64.06 ± 28.41, 43.34 ± 19.7, and 38.0 ± 15.24, respectively in T0, T1, and T2.

Table 2. *Total number of leukocytes, neutrophils, and lymphocytes – descriptive values*

Time	n	mean ± SD	min – max	median (IQR)	p-level
Total leucocytes number					
T0	17	16.51 ± 25.8	1.68 – 103.73	4.39 (3.23 – 18.81)	Friedman X^2=3.5 *p=0.017 T0 vs T1 Z=2.45 *p=0.013
T1	17	3.12 ± 1.8	0.73 – 6	3.1 (1.65 – 4.1)	
T2	10	3.56 ± 1.3	1.39 – 5.59	3.33 (2.64 – 4.86)	
Neutrophils x"3/uL					
T0	17	2.34 ± 3.8	0.26 – 12.4	0.92 (0.37 – 1.66)	Friedman X^2=1.3 p=0.53
T1	17	1.37 ± 1.02	0.03 – 3.19	1.48 (0.39 – 1.9)	
T2	10	1.97 ± 1.03	0.52 – 3.66	1.78 (1.22 – 2.46)	
Lymphocytes x"3/uL					
T0	17	11.27 ± 18.3	0.77 – 63.13	2.52 (1.83 – 15.12)	Friedman X^2=1.6*p=0.045 T0 vs T1 Z=3.0 **p=0.003
T1	17	1.27 ± 0.86	0.57 – 3.84	0.92 (0.7 – 1.44)	
T2	10	2.43 ± 4.2	0.47 – 14.4	0.97 (0.66 – 2.01)	

T0 (Pre-Therapy Start) Z (Wilcoxon Matched Pairs Test), customized with Bonferroni
T1 (after induction phase) *p<0.05, **p<0.01
T2 (after reinduction phase)

Table 3. *CD3, CD4, CD19 and CD45 – descriptive values*

Time	n	mean ± SD	min – max	median (IQR))	p-level
CD3(%)					
T0	17	57.56 ± 23.7	19.4 –92.77	63.8 (38.31 – 72.5)	Friedman X^2=6.7 *p=0.035 T0 vs T1 Z=2.7 **p=0.0065 T0 vs T2 Z=2.55 *p=0.011
T1	17	82.23 ± 12.6	61.43 – 98.5	87 (72.62 – 91.24)	
T2	9	86.37 ± 7.7	69.6 – 93.6	89.3 (82.4 – 91.2)	
CD4(%)					
T0	17	38.09 ± 19.1	2.54 – 68	42 (21.08 – 49.92)	Friedman X^2=1.1 p=0.57
T1	17	38.85 ± 11.3	20.42– 59.3	39 (29.43 – 47.4)	
T2	9	42.62 ± 5.9	36 – 52.5	40 (38.2 – 47.4)	
CD19(%)					
T0	17	21.71 ± 19.9	0 – 71.3	15.3 (9.55 – 21.7)	Friedman X^2=8.2 *p=0.017 T0 vs T1 Z=3.35 **p=0.008 T0 vs T2 Z=2.31 *p=0.021
T1	16	3.38 ± 7.5	0 – 31.18	1.22 (1 – 2.415)	
T2	9	3.56 ± 3.6	0 – 11.5	2.5 (1.2 – 4.94)	
CD45(%)					
T0	17	64.06 ± 28.41	12.53 – 94	74 (35.48 – 88.7)	Friedman X^2=2.5 p=0.29
T1	17	43.34 ± 19.7	12 – 85.1	38.8 (34.4 – 58)	
T2	9	38.0 ± 15.24	20 – 67	32 (26 – 48)	

T0 (Pre-Start of Th.) Z (Wilcoxon Matched Pairs Test), customized with Bonferroni
T1(by induction phase) *p<0.05,**p<0.01
T2 (after reinduction phase)

DISCUSSION

After completion of intensive care, all patients had some degree of immune dysfunction as measured by cytopenia and lymphocyte dysfunction.

The results of our study showed that lymphocytic depletion was observed in all children after completion of induction therapy. At p=0.017, an overall statistically significant difference in CD19 values between the three-time points was confirmed. Post-hoc analysis of the inter-time intervals showed significantly lower values after the induction phase compared to the initial (1.22 vs 15.3, p=0.008) and significantly lower end-of-therapy values compared to pre-therapy values (2.5 vs 15.3, p=0.021).

Studies such as Mackall et al. and others have shown that chemotherapy, especially corticosteroids and antimetabolites used in induction, leads to prolonged B-cell lymphopenia and impaired humoral immunity. This depletion extends beyond the clearance of malignant cells and involves delayed recovery of normal B cell precursors from the bone marrow [29]. Thus, while we recognize that the reduction in CD19+ cells immediately post-induction is confounded by the presence of leukemic blasts, sustained suppression of B cells beyond this period is clinically relevant and well-documented.

Although there is no significant decrease in CD45+ T lymphocytes, their decrease is still observed, which has an important prognostic effect in terms of relapses [18].

Studies have shown that children at the time of their ALL diagnosis have both higher proportions and absolute cell numbers of both CD4+ and CD8+ T cells in peripheral blood as well as increased proportions of T regs compared to age-matched controls [19, 20]. The use of more intense chemotherapy protocols has led to a dramatic improvement in prognosis, unfortunately accompanied by both acute- and long-term toxicity that causes significant treatment-related morbidity. The general understanding is that T cells remain more resistant to chemotherapy than B cells [21]. There is also evidence of a lower proportion of T cells in peripheral blood during chemotherapy, with a pronounced effect on naïve compared to memory T cells, the latter remaining overrepresented during a 3-year period of chemotherapy [22].

CD45 is a central player of immune cell activation. Loss of CD45 expression was also detected in childhood acute lymphocytic leukemia (ALL). Studies on adult ALL patients revealed that compared to CD45-low patients, CD45-high ALL patients had a lower event-free survival rate due to a higher cumulative relapse incidence [23].

The underlying mechanisms of SID in patients with hematologic malignancies are different and correlated with malignancy and specific treatments. The clinical effect of SID can lead from moderate susceptibility to infection to a more serious condition characterized by recurrent lung infections, and viral or fungal opportunistic infections that have a severe impact on the course of the disease [24-26].

A retrospective study analyzing infections in children diagnosed with ALL during

treatment was published from data taken from 17 hematology centers in Poland. 53.2% of children reported having a bacterial infection during treatment, 18.4% had viral infections, and 20.4% of children had a fungal infection. The rate of death was 2.4%, mainly due to fungal infection [27].

Changes in immune response in pediatric patients with malignant hematological disorders have not yet been investigated in our country. Research published so far indicates a mismatch between daily practice, clinical practice, recommendations, and currently approved immunoglobulin therapy (IgT) indications. This underscores the medical need for more evidence from clinical trials, particularly in hematologic malignancies other than chronic lymphoblastic leukemia (CLL) and multiple myeloma MM, to optimize risk stratification for patients and identify those patients who are likely to benefit from IgT. The consensus that has been reached among SID specialists, expert immunologists, and hemato-oncologists in European pediatric centers makes clear recommendations for the inclusion of IgT in treatment during the therapeutic protocol [28]. Despite differences in regional indications, IgT use is generally comparable across countries.

CONCLUSION

The results of this study suggest that modern multiagent chemotherapy in the immune system of children with ALL leads to secondary immunodeficiency. Detection of secondary immune deficiency is important for successful and much easier treatment. These initial results suggest the need for additional evaluation of immunological function, emphasizing the risk of infection in children with ALL, and consideration of supportive immunotherapy during the therapy to reduce morbidity and mortality in these children.

REFERENCES

1. Aster JC, DeAngelo DJ. (2011): Chapter 21: Acute Leukemias. In: Pathophysiology of blood disorders, eds Bunn H, Aster J, The McGraw-Hill Companies, Inc., New York, pp. 244–259.
2. Rytting ME, ed. (2013): Acute leukemia. Merck Manual Professional. Merck Sharp & Dohme Corp., Whitehouse Station.
3. National Cancer Institute Age-Adjusted and Age-Specific SEER Cancer Incidence Rates, 2014–2018. [(accessed on 18 April 2021)]; Available online
4. Pui CH, Robison LL, Look AT: Acute lymphoblastic leukaemia. Lancet 371, 1030–1043 (2008).
5. Pui CH, Carroll WL, Meshinchi S, Arceci RJ: Biology, risk stratification, and therapy of pediatric acute leukemias: An update. J Clin Oncol 29, 551–565 (2011).
6. Inaba H., Greaves M., Mullighan C.G. Acute lymphoblastic leukaemia. Lancet. 2013;381:1943–1955. doi: 10.1016/S0140-6736(12)62187-4.
7. Malard F., Mohty M. Acute lymphoblasti leukaemia. Lancet. 2020; 395: 1146–1162. doi: 10.1016/S0140-6736(19)33018-1
8. Hunger S.P., Mullighan C.G. Acute Lymphoblastic Leukemia in Children. N. Engl. J. Med. 2015;373:1541–1552. doi: 10.1056/NEJMra1400972.
9. Abrahamsson J, Forestier E, Heldrup J, Jahnukainen K, Jonsson OG, Lausen B, et al. Response-guided induction therapy in pediatric acute myeloid leukemia with excellent remission rate. J Clin Oncol. 2011; 29: 310–5. doi: 10.1200/JCO.2010.30.6829
10. Pession A, Masetti R, Rizzari C, Putti MC, Casale F, Fagioli F, et al. Results of the AIEOP AML 2002/01 multicenter prospective trial for the treatment of children with acute myeloid leukemia. Blood. 2013;122:170–8. doi: 10.1182/blood-2013-03-491621.
11. Kosmidis S, Baka M, Bouhoutsou D, et al. Longitudinal assessment of immunological status and rate of immune recovery following treatment in children with ALL. Pediatr Blood Cancer.2008; 50(3): 528–32.
12. Alanko S, Salmi TT, Pelliniemi TT. Recovery of blood T-cell subsets after chemotherapy for childhood acute lymphoblastic leukemia. Pedi atr HematolOncol.1994;11(3): 281–92.
13. Eyrich M, Wiegering V, Lim A, Schrauder A, Winkler B, Schlegel PG. Immune function in children under chemotherapy for standard risk acute lymphoblastic leukaemia: a prospective study of 20 paediatric patients. Br J Haematol.2009; 147(3): 360–70.
14. van Tilburg CM, van der Velden VH, Sanders EA, et al. Reduced versus intensive chemotherapy for childhood acute lymphoblastic leukemia: impact on lymphocyte compartment composition. LeukRes. 2011; 35(4): 484–91.
15. Pietras W, Chaber R, Pela H, Trybucka K, Chybicka A. The recovery of immune system parameters in children following lymphoblastic leukemia therapy: preliminary report. Adv Clin Exp Med.2014; 23(1): 97–102.
16. Rudant J, Lightfoot T, Urayama K, Petridou E, Dockerty J, Magnani C, Milne E, Spector LG, Ashton LJ, Dessypris N, Kang AY, Miller M, Rondelli R, Simpson J, Stiakaki E, Orsi L, Roman E, Metayer C, Infante-Rivard C, Clavel J: Childhood acute lymphoblastic leukemia and indicators of early immune stimulation: A childhood leukemia international consortium study. Am J Epidemiol 181, 549–562 (2015).
17. Jolles S, Chapel H, Litzman J. When to initiate immunoglobulin replacement therapy (IGRT) in antibody deficiency: a practical ap- proach. Clin Exp Immunol. 2017; 188: 333–341.
18. Cario G, Rhein P, Mitlöhner R, Zimmermann M, Bandapalli OR, Romey R, Moericke A, Ludwig WD, Ratei R, Muckenthaler MU, Kulozik AE, Schrappe M, Stanulla M, Karawajew L. High CD45 surface expression determines relapse risk in children with precursor B-cell and T-cell acute lymphoblastic leukemia treated according to the ALL-BFM 2000 protocol. Haematologica. 2014 Jan;99(1):103-10. doi: 10.3324/haematol.2013.090225. Epub 2013 Aug 2. PMID: 23911702; PMCID: PMC4007934.
19. WuCP,QingX,WuCY,ZhuH,ZhouHY.Immunophenotypeandincreased presence of CD4(+) CD25(+) regulatory T cells in patients with acute lymphoblastic leukemia. Oncol Lett. (2012) 3: 421–4. doi: 10.3892/ol.2011.499

20. Salem ML, El-Shanshory MR, Abdou SH, Attia MS, Sobhy SM, Zidan MF, et al. Chemotherapy alters the increased numbers of myeloid derived suppressor and regulatory T cells in children with acute lymphoblastic leukemia. ImmunopharmacolImmunotoxicol. (2018) 40: 158–67. doi: 10.1080/08923973.2018.1424897
21. van Tilburg CM, van der Velden VH, Sanders EA, Wolfs TF, Gaiser JF, de Haas V, et al. Reduced versus intensive chemotherapy for childhood acute lymphoblastic leukemia: impact on lymphocyte compartment composition. Leuk Res. (2011) 35: 484–91. doi: 10.1016/j.leukres.2010. 10.005
22. Das RK, Vernau L, Grupp SA, Barrett DM. Naive T-cell deficits at diagnosis and after chemotherapy impair cell therapy potential in pediatric cancers. Cancer Discov. (2019) 9: 492–9. doi: 10.1158/2159-8290.CD-18-1314
23. Rheinländer A, Schraven B, Bommhardt U. CD45 in human physiology and clinical medicine. Immunol Lett. 2018 Apr; 196: 22–32. doi: 10.1016/j.imlet.2018.01.009. Epub 2018 Jan 31. PMID: 29366662.
24. Ballo O, Tarazzit I, Stratmann J, Reinheimer C, Hogardt M, Wichelhaus TA, et al. Colonization With Multidrug Resistant Organisms Determines the Clinical Course of Patients With Acute Myeloid Leukemia Undergoing Intensive Induction Chemotherapy. PloS One (2019) 14(1): e0210991. doi: 10.1371/journal.pone.0210991
25. Chinen J, Shearer WT. Secondary Immunodeficiencies, Including HIV Infection. J Allergy Clin Immunol (2010) 125(2 Suppl.):S195–203. doi: 10.1016/j.jaci.2009.08.040
26. Na IK, Buckland M, Agostini C, et al. Current clinical practice and challenges in the management of secondary immunodeficiency in hematological malignancies. Eur J Haematol. 2019; 102(6): 447–456.
27. Joanna Zawitkowska , Katarzyna Drabko , Anna Szmydki-Baran , Agnieszka Zaucha-Prażmo , Monika Lejman , Krzysztof Czyżewski , Infectious profile in children with ALL during chemotherapy: A report of study group for infections, J Infect Chemother. 2019 Oct;25(10): 774–779. doi: 10.1016/j.jiac.2019.04.005. Epub 2019 May 14.
28. Stephen Jolles, Mauricette Michallet,Carlo Agostini, Michael Albert,David Edgar,Roberto Ria,Livio Trentin,Elisabeth Clodi,Vincent Lévy. AN INTERNATIONAL DELPHI CONSENSUS BUILDING APPROACH TO PATIENT ASSESSMENT AND USE OF IMMUNOGLOBULIN TREATMENT FOR SECONDARY IMMUNE DEFICIENCIES IN HEMATOLOGICAL MALIGNANCY. EHA Library. Albert M. 06/12/20; 297829; PB1913
29. C L Mackall, T A Fleisher et al. Lymphocyte depletion during treatment with intensive chemotherapy for cancer, Blood. 1994 Oct 1; 84(7): 2221–8.

Резиме

ПРОМЕНИ НА ПОДГРУПИТЕ НА ЛИМФОЦИТИТЕ КАЈ ДЕЦА СО АКУТНА ЛИМФОБЛАСТИЧНА ЛЕУКЕМИЈА ЗА ВРЕМЕ НА ХЕМОТЕРАПИЈА

Аријета Хасани[1], Александар Петличковски[2], Ирина Пановска[3], Теодора Брњарчевска[2], Невенка Ридова[3], Светлана Кочева[1]

[1] Универзитетска клиника за детски болести, Медицински факултет, Универзитет „Св. Кирил и Методиј“ во Скопје, РС Македонија

[2] Институт за имунологија и хумана генетика, Медицински факултет, Универзитет „Св. Кирил и Методиј“ во Скопје, РС Македонија

[3] Универзитетска клиника за хематологија, Медицински факултет, Универзитет „Св. Кирил и Методиј“ во Скопје, РС Македонија

Вовед: Акутната лимфобластна леукемија (АЛЛ) е најчестата малигна болест во детската возраст. Хемотерапија има значително влијание врз клетките на имунолошкиот систем. Оваа студија ги анализира промените во лимфоцитните подгрупи кај децата со АЛЛ за време на третманот.

Методи: Ретроспективно-проспективната студија анализира 17 педијатриски пациенти (на возраст од 2 до 12 години) третирани на Клиниката за детски болести – Скопје, според протоколот БФМ АЛЛ-ИЦ 2002. Лимфоцитните подгрупи (CD3, CD4, CD19, CD45) биле оценети пред хемотерапијата, по индукција и по реиндукција со користење на проточна цитометрија.

Резултати: Децата со АЛЛ покажале намален клеточен имунитет на крајот од терапијата. Деплеција на лимфоцитите било забележано кај сите пациенти по фазата на индукција. Потврдена е статистички значајна разлика во вредностите на CD19+ клетките во трите временски точки ($p = 0,017$). Постхок анализата откри значително пониски вредности на клетките CD19+ по индукцијата во споредба со основната линија (1,22 наспроти 15,3, $p = 0,008$)

Заклучок: Интензивната хемотерапија предизвикува длабока имуносупресија кај педијатриските пациенти, со првично дејство на Б-клетките. Овие наоди ја нагласуваат потребата од процена на имунолошката функција и разгледување на поддржувачка имунотерапија.

Клучни зборови: АЛЛ, СИД, хемотерапија, лимфоцитни подгрупи