MEDWIN PUBLISHERS
Committed to Create Value for Researchers

Clinical Pathology & Research Journal
ISSN: 2642-6145

Comparative Analysis between Absolute Neutrophil Count and Absolute Monocyte Count as a Predictor of Haematopoietic Recovery in Patients with Acute Lymphoblastic Leukaemia

Yesmin MS*[1], Zohra F[2], Badiuzzaman S[1], Sultana T[1] and Ahmed ANN[1]

[1]Department of Laboratory Medicine, Bangabandhu Sheikh Mujib Medical University (BSMMU), Bangladesh

[2]Department of Psychiatry, Bangabandhu Sheikh Mujib Medical University (BSMMU), Bangladesh

***Corresponding author:** Yesmin MS, Department of Laboratory Medicine, Bangabandhu Sheikh Mujib Medical University, Bangladesh, Email: shailarini@gmail.com

Research Article

Volume 7 Issue 1

Received Date: April 08, 2023

Published Date: April 24, 2023

DOI: 10.23880/cprj-16000159

Abstract

Objectives: This study was aimed to find out the comparison between absolute neutrophil count and absolute monocyte count for haematopoietic recovery in acute lymphoblastic leukaemia (ALL) patients.

Methods: In this study, a total of 50 patients of acute lymphoblastic leukaemia, aged between 8 months to 15 years were studied prospectively.

Results: In the initial treatment phase (induction of remission phase), regularly increasing trends were seen in absolute neutrophil counts (ANC) prior to recovery of absolute monocyte counts (AMC). Of all the parameters, ANC recovered 1 day (≥0.5 x 10^9/l) prior to recovery of AMC above (≥0.1 x 10^9/l).

Conclusion: ANC can be considered as an early predictor of haematopoietic recovery over AMC. These parameters can be used in conjunction with clinical conditions to decide about early discharge of leukaemia patients especially in developing countries where prolonged stay can result in hospital acquired infections.

Keywords: Lymphoblastic Leukaemia; Lymphoblastic; Myelosuppression; Monocytopenia

Abbreviations: ALL: Acute Lymphoblastic Leukaemia; ANC: Absolute Neutrophil Counts; AMC: Absolute Monocyte Counts.

Introduction

Acute lymphoblastic leukaemia (ALL) is a highly curable disease due to chemotherapy responsiveness. Chemotherapy is the mainstay of treatment in acute lymphoblastic leukaemia (ALL) in the children aged 2-5 years, representing nearly one third of all paediatric cancers [1]. The cure rate in western countries lies between 70-80% [2]. Chemotherapy uses anticancer drugs to destroy the leukaemic cells. Myelosuppression occurs in the patients after chemotherapy [3]. Blood counts fall within a week of treatment and take some time to recover [4-6]. It is decreased due to myelosuppression. Neutropenia occurs as a result of myelosuppression. There is an increased chance of infection. It has been shown that ANC of 0.5x10^9/l or less significantly increases the risk of infection and is associated

with anaemia, thrombocytopenia and also monocytopenia [7-9]. Absolute neutrophil count ≥0.5x10^9/l defines successful myeloid recovery after chemotherapy [10]. The severity of myelosuppression can be evaluated by absolute monocyte count [11]. Recovery of AMC above (> 0.1 x 10^9/l) is defined as haematopoietic recovery [12]. So, among the various haematological tests complete blood count, absolute neutrophil count, absolute monocyte count, peripheral blood film examination is used for diagnosis of hematopoietic recovery [7]. But early evidence of marrow recovery is not a clearly defined end point. So, the aim of the study was to predict the haematological predictors in remission phase and its recovery in ALL children and to determine early predictors, if any, of bone marrow recovery.

Materials and Methods

This study was carried out in the Department of Laboratory Medicine and Department of Paediatric Haematology and Oncology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka. Fifty (50) Children upto 18 years of age irrespective of sex with acute lymphoblastic leukaemia attended in Paediatric Haemato-Oncology outpatients and inpatients department were included in this study on the basis of inclusion and exclusion criteria. Blood sample (2 ml) was collected in an EDTA tube for complete blood count (CBC), ANC, AMC, total platelet counts and peripheral blood film (PBF) examination. Count was done preferably within 2 hours of collection. During the phase, the children were carefully observed daily for clinical examination and CBC were done 4 days apart until 32 days. ANC ≥0.5x10^9/l and AMC (≥ 0.1 x 10^9/l) were taken as haematopoietic recovery [13-19]. On the day of recovery, the ANC, AMC counts were recorded and their comparisons were studied. Statistical analyses were done by SPSS 16. All reported tests were statistically significant at a p value >0.05. The results and observations of recovery were done by the Mean, Median and ANOVA test.

Results

Age Group years	Number of Patients	Percentage (n=50)
≤5	29	58
06-Oct	18	36
Nov-15	3	6
Mean ±SD	5.5	±3.2
Range (min – max)	(8 mo -15 years)	

Table 1: Age distribution of the patients (n=50).

Sex	Number of patients	Percentage
Male	30	60
Female	20	40

Table 2: Sex distribution of the studied patients (n=50).

	Early recovery (n=26)	Late (n=11)	Same (n=13)	P value
ANC				
Mean± SD	23.3±5.7	13.5 ±4.9	22.9 ±5.6	0.001s
Median	23	14	24	
Mode	20	10	20	
Range	10-32	4-20	14-32	
AMC				
Mean± SD	23.2 ±7.6	18 ±10.4	24.5± 5.7	0.113^{ns}
Median	24	18	26	
Mode	24	8	28	
RangeMin-Max	6-32	4-32	12-32	
LAG Period				
Mean± SD	8.5 ±5.2	8.7 ±6.1	0.3 ±1.1	0.001^{s}
Median	8	8	0	
Mode	4	4	0	
Range	(4-24)	(4-24)	(0-4)	

Table 3: Comparison of ANC, AMC and LAG Period with recovery in days (n=50).
P value done by ANOVA test S = significant, NS = Not significant.

In this study the age limit was between 8 months to 15 years of age and mean age of the patients was 5.5±3.2 years (Table 1). Maximum patients were male. Male and female ratio was 1.5:1 (Table 2). Table 3 shows the mean distribution of ANC and AMC and LAG according to recovery of the study patients and the mean (±SD) ANC was 23.3:15.7 days in early recovery, 13.5±4.9 days in late recovery and 22.915.6 days' same recovery. The mean (±SD) AMC was 23.2±7.6 days in early recovery, 18±10.4 days in late recovery and 24.5+5.7 days in the same recovery. The mean (±SD) Lad period was 8.5+5,2 days in early recovery, 8.7±6.1 days in late recovery and 0.3±1.1 days in the same recovery. The ANC and Lag period were statistically significant (statistically significant at a p value >0.05) in different recovery status.

Discussion

Acute lymphoblastic leukaemia is one of the disseminated malignancies that respond well to chemotherapy. The age limit was between 8 months to 15 years of age in this study. The mean age of the patients was 5.5±3.2 years (Table 1). Maximum patients were male. Male and female ratio was 1.5:1 (Table 2). A study found patients were between 1.5 to 13 years of age with a male and female ratio was 1.73:1 [14]. Another study found similar results [15]. The neutropenia in these patients can be due to the disease or to the use of myelotoxic chemotherapeutic agents and the variety of infections causing bone marrow suppression [16]. In this study, the duration of neutropenic episodes was prolonged in patients during the initial phase of treatment. The use of more myelotoxic drugs in rapid succession before the recovery. When the haematological parameters were studied from the fifth preceding day to the day of recovery, it was found that a regular and consistent decrease of total leucocyte count occurred from day 8 to the last follow up. Parameters such as Hb and AMC showed fluctuant changes. The children were profoundly neutropenic between 12 to 16 days. ANC recovery occurred 10-32 days at a median of 23 days. Das et al. in 2006 found dropping of ANC <500/ml on 7 days' post chemotherapy and ANC recovery was between 10-35 days (median day 19). The AMC declined up to 12 to 20 days, recovery occurred at a median of 24 days and last of all to recover. So, ANC recovery occurred 1 day prior to recovery of AMC. Bhatnagar et al. (2002) found that AMC recovered 1 day prior to recovery of ANC [20-21].

Conclusion

This study concluded that bone marrow recovery after remission infection was earlier by ANC than AMC in children with ALL. This early laboratory indicator will guide the clinicians to make important therapeutic decisions, which will be economic savings as well as live saving. Nowadays, these parameters are offered in most of the third generation haematology analyzers. Moreover, this test is simple, quick, cost effective, reproducible and reliable tool on the automated haematology analyzer. Thus its potential use as a routine test to see bone marrow recovery is important.

Acknowledgement

I would like to thank all the faculties, consultants, doctors and staff of the Department of Laboratory Medicine, BSMMU, Dhaka for their sincere help in conducting this study.

References

1. Satake N, Yoon JM (2009) Acute Lymphoblastic Leukaemia. E Medicine Pediatric: medscape.com 12: 1-26.

2. Veerman AJP (2003) Acute lymphoblastic leukaemia in children: Experiences in West and East, Bangladesh. J Child Health 27: 16-17.

3. Torres A, Sanchez J, Lakomsky D, Serrano J, Alvarez AM et al. (2001) Assessment of hematologic progenitor engraftment by complete reticulocyte maturation parameters after autologous and allogenic hematopoietic stem cell transplantation. Haematologica 86: 24-29.

4. Kuse R (1993) The appearance of reticulocytes with medium or high RNA content is a sensitive indicator of beginning granulocyte recovery after aplasiogenic cytostatic drug therapy in patients with AML. Ann Hematol 66: 213-214.

5. Davis BH (1996) Immature reticulocyte fraction (IFR): by any name, a useful clinical parameter of erythropoietic activity. Lab Hematol 2: 2-8.

6. Remacha (1994) Flow cytometric reticulocyte quantification in the evaluation of hematologic recovery. Spanish Multicentric Study Group for Hematopoietic Recovery. Eur J Haematol 53: 293-297.

7. Greinix HT, Linkesch W, Keil F, Kalhs P, Schwarzinger I et al. (1994) Early detection of hematopoietic engraftment after bone marrow and peripheral blood stem cell transplantation by highly fluorescent reticulocyte counts. Bone Marrow Transplant 14: 307-313.

8. Hellgriel K (1993) The clinical significance of reticulocyte determination, In: Basting T, (ed.), The Emerging Importance of Accurate Reticulocyte Counting. Miles, Inc. Diagnostic Division, Tarrytown, pp: 7-10.

9. Davis BH, Bigelow NC (1989) Flow cytometric reticulocyte quantification using thiazole orange provides clinically useful reticulocyte maturity index.

Arch Pathol Lab Med 113: 684-689.

10. Riley S, Jonathon M, Ezra B, Goel R, Tidwell A, et al. (2001) Reticulocytes and Reticulocyte Enumeration. Journal of Clinical Laboratory Analysis 15: 267-294.

11. Racko WR, Gonin R, Robinson C, Kreissman SG, Breitfeld PB, et al, (1996) Predicting the risk of bacteremia in children with fever and neutropenia. Clin Oncol 14: 919-924.

12. Bhatnagor S, Chandra J, Naayanb S (2002) Hematological Changes and Predictors of Bone Marrow Recovery in Patients with Neutropenic Episodes in Acute Lymphoblastic Leukaemia. Journal of Tropical Pediatrics 48(4): 200-203.

13. Klassen RJ, Goodman R, Pham B, Doyle JJ (2000) Low risk prediction rule for paediatric oncology patients presenting with fever and neutropenia. J Clin Oncol 18: 1012-1019.

14. Hossain T (2015) Effectiveness of dexamethasone compared with prednisolone in induction therapy of childhood acute lymphoblastic leukaemia J. Paediatr. Surg. Bangladesh 6(1): 3-9.

15. Sather HN (1986) Age at diagnosis in childhood acute lymphoblastic leukaemia. Med Pediatr Oncol 14: 166-172.

16. Khalil F, Cauling H, Cogburn J, Miles L (2007) The criteria for Bone Marrow Recovery Post Myelosuppressive Therapy or Acute Myelogenous Leukaemia: A Quantitative Study. Archives of Pathology and Laboratory Medicine 131(8): 1281-1289.

17. Bain BJ, Lewis SM, Bates I (2008) Basic haematological techniques, In: Lewis SM, Bain Bf.; Bates I, Dacie and Lewis Practical Haematology, 10 eds. Philadelphia: Churchill Livingstone pp: 25-57.

18. Dekoninck A, Brusselmans C, Goossens W (2002) Indicators for hematopoietic recovery in patients after bone marrow transplantation or intensive chemotherapy, Department of laboratory Medicine, University Hospital Leuven, Leuven, Belgium, pp; 39.

19. Praful B, Godkar G, Darshan D, Godkar P (2003) routine haematological tests, 'Textbook of Medical Technology, 2nd (Edn.), pp: 750-751.

20. Das R, Dip NB, Garewal G, Marwaha RK, Vohra H, et al. (2006) Automated Reticulocyte response is a good predictor of bone marrow recovery in paediatric malignancies Pediatric Hematology and Oncology 23: 299-305.

21. Hughes WT, Armstrong D, Bodey GP, Bow E, Arthur E, et al. (2002) Guidelines for use of the antimicrobial agents in neutropenic patients with cancer. Clin Inect Dis 34: 730-751.