DOI: https://doi.org/10.53350/pjmhs2115123222

ORIGINAL ARTICLE

Nutritional Status of Children with Pediatric Acute Lymphoblastic Leukemia

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ABSTRACT

Aim: To analyze the nutritional status of children with pediatric Acute Lymphoblastic Leukemia (ALL) at presentation.
Study design: Descriptive prospective study
Place and duration of study: Department of Paediatric Haematology Oncology, Children Hospital, Lahore from March 2018 to April 2019.
Methodology: A total of 195 children diagnosed as acute lymphoblastic leukemia on bone marrow biopsy were included. Anthropometric measurements were taken for each patient.
Results: Out of 195 diagnosed patients with ALL, majority were having B-cell ALL 165(84.6%) and 30(15.4%) T-cell ALL. There was almost equal number of both standard and high risk patients (49% vs 51%) respectively. Mean age of children was 6.79±3.78 years and there was male predominance 120(61.5%). The percentage of children having weight for age <5th centile was 91(47), only 8(4%) were overweight or obese. Children under the age of five years had a slightly higher propensity of weight <5th centile i.e. 47(51.6%) as compared to older age group 5-10 years 26(28.7%) and >10 years 18(19.7%) (p=0.295).Similarly height for age was <5th centile in 50(26%) children in total, and in under 5 year age group 26(13.3%) but there was no statistically significant difference related to age above 5 years (p=0.547).
Conclusion: Pediatric ALL has overall high prevalence of under nutrition and both weight for age and height for age is lower in under-five children as compared to older age group.
Keywords: Children, cancer, nutrition, malnutrition, Acute Lymphoblastic leukemia

INTRODUCTION

Acute Lymphoblastic Leukemia is considered as the most common childhood cancer. Over last 50 years there is a dramatic change in the treatment of ALL. Now with advancement in treatment almost 90% of children are cured of this deadly disease which was once fatal before the invent of latest chemotherapeutic medicines[1].The identification of various factors on presentation like age, white cell count and cancer immune-phenotype which influence outcome and survival are crucial before starting the treatment .In addition to these factors, nutritional status of the child plays a decisive role and under-nourished children are more prone to develop treatment related toxicity and poor outcome.[2,3].In the resource limited countries as compared to the rich countries, the survival of children with ALL is dismal and contributing factors include under nutrition, higher risk of infection in these immunocompromised children, insufficient supportive care and poor adherence to treatment[4].Worldwide malnutrition in children is a major public health concerns and it is more prevalent in poorly resourced countries. The children suffering from cancer have severe weight loss and also have multiple nutritional deficiencies. These are due to inadequate intake of energy and proteins which often leads to increased toxicity of chemotherapy[5].

It has been seen that children with various cancers develop signs and symptoms of malnutrition during the course of disease and the frequency varies according to the type of malignancy. The relationship between childhood ALL and nutritional status has not been extensively studied in our country. As nutritional status of children with cancer on presentation has great impact on the disease course and ultimate response to the chemotherapy[6].

The aim of our study was to analyze the nutritional status of newly diagnosed ALL on presentation.

METHODOLOGY

The target population was children diagnosed as ALL and admitted in the Oncology ward of The Children's Hospital & the Institute of Child Health (ICH) Lahore from March 2018 to April 2019 with permission from Ethical Review Board. Sample size of 195 was calculated by using Open Epi statistical calculator and taking the prevalence of ALL in children as 15% with 95% confidence interval and 5% margin of error. The data was collected after taking approval from the Institutional Review Board of ICH and verbal informed consent from the care taker of the child. The data included age, gender and anthropometric measurements of the child. Weight-for-age (underweight) and height-for-age (stunting) was calculated using WHO charts. SPSS-22 was used for data analysis. The quantitative variables like age was presented as mean and SD. Qualitative variables like gender, risk stratification and type of leukemia was presented as frequency and percentages. The association between ALL, child's nutritional status with age and gender of children was sought by using chi-square test and p-value of < 0.05 is considered as significant.

Received on 13-06-2021
Accepted on 27-11-2021

Operational definitions:

Malnutrition: defined according to WHO is the cellular imbalance between the supply of nutrients and the body's demand for them to ensure growth, maintenance, and specific functions. This pathological state may result from inadequate nutrition causing under nutrition (<5thcentile), or over nutrition resulting in obesity (95th centile). It is classified according to Gomez classification as follows:

-Median Weight for Age (WFA %): Mild 75-90% WFA; Moderate 60-74%; Severe <60%

-Median Height for Age (HFA %): Mild 90-94%HFA; Moderate 85-90%; Severe < 85%

Risk Stratification: According to NCI UKALL Criteria, children with ALL at diagnosis are categorized into Standard or High Risk, based on Age, ALL subtype, initial TLC count.

Standard Risk: Pre-B ALL, age between 1-10 years and TLC less than 50,000

High Risk: Pre- T ALL, age less than 1 year or more than 10 years, TLC more than 50,000

RESULTS

One hundred and ninety-five children were diagnosed with pediatric acute lymphoblastic leukemia between March 2018 and April 2019. The mean age of children was 6.79±3.78 years and there was male predominance 120(61.5%). Majority were having B-cell ALL 165(84.6%) and almost equal distribution of both standard and high risk groups (49% vs 51%) respectively (Table 1). Relationship of age groups and the risk stratification with the

nutritional status of children is shown in (Table 2). Number of children having weight for age <5th centile was 91 (47%) and only 8 (4%) were overweight or obese (Fig-1). Children under the age of five years had a little higher frequency of weight <5th centile i.e. 47 (51.6%) as compared to older age group 5-10 years were 26(28.7%) and >10 years=18 (19.7%), (p=0.295) (Fig-2). Similarly height for age was <5th centile in 50 (26%) (Fig-3) but there was no statistically significant difference based on age (p=0.547). There was no significant difference in nutritional status (weight for age and height for age) based on gender (p=0.239) and (p=0.175) respectively shown in (Table 3).

Table 1: Demographics of study participants

Category	Number (%)
Age	
Mean age in years	6.79±3.78 years
1 year - 5 years	86 (44)
5.1 years-10 years	62 (32)
10.1 years-15 years	47 (24)
Gender	
Male	120 (61.5)
Female	75 (38.5)
Type of leukemia	
B-cell ALL	165 (84.6)
T-cell ALL	30 (15.4)
Risk stratification	
Standard risk	95 (49)
High risk	100 (51)

Figure- 1: Weight for age

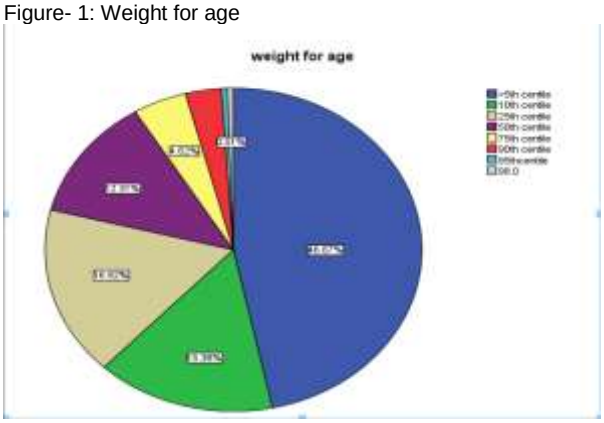

Figure-2: Weight for age with reference to age distribution

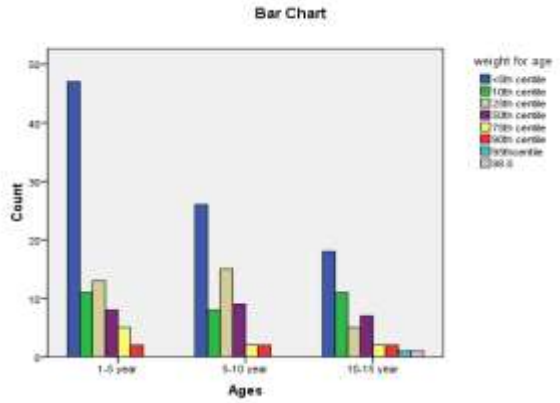

Figure-3: Height for age with reference to age distribution

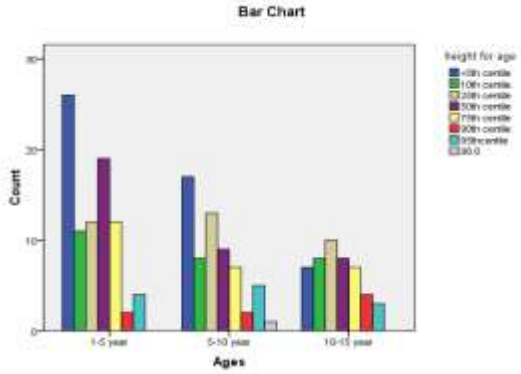

Table-2: Relationship of age group and risk stratification with reference to wt for age

Category (n=195)	<5th centile	10th centile	25th centile	50th centile	75th centile	90thcentile	95th centile	p-value
Age groups								0.295
1-5 years (n=86)	47 (51.6%)	11 (13)	13 (15)	08 (9)	05 (6)	02 (2)	0 (0)	
5-10 years (n=62)	26 (28.7%)	08 (13)	15 (24)	09 (15)	02 (3)	02 (3)	0 (0)	
>10 years (n=47)	18(19%)	11 (24)	05(11)	07 (15)	02 (4)	2 (4)	2 (4)	
Risk stratification								0.229
Standard risk n=95)	52 (55)	11 (12)	16 (17)	10 (10)	05 (5)	01 (1)	0 (0)	
High risk (n=100)	39 (39)	19 (19)	17 (17)	14 (14)	04 (4)	05 (5)	02 (2)	

Table-3: Weight and Height status of children with acute lymphoblastic leukemia based on Gender

Category(n=195)	<5th centile	10th centile	25th centile	50th centile	75th centile	90th centile	95th centile	p-value
Weight for age								0.239
Male (n=120)	49 (40.8)	20 (16.7)	26 (21.7)	15 (12.5)	05 (4.2)	04 (3.3)	01 (0.8)	
Female(n=75)	42 (56)	10 (13.3)	07 (9.3)	09 (12)	04 (5.3)	02 (2.7)	01 (1.3)	
Height for age								0.175
Male (n=120)	28 (23.3)	13 (10.8)	26 (21.7)	23 (19.2	17 (14.2)	07 (5.8)	06 (05)	
Female(n=75)	22 (29.3)	14 (18.7)	09 (12)	13 (17.3)	09 (12)	01 (1.3)	07 (9.3)	

DISCUSSION

Under nutrition is relatively common in children with newly diagnosed acute lymphoblastic leukemia especially in resource poor countries and it is a major concern for pediatric oncologist as it can affect the treatment tolerance, disease prognosis and ultimate survival. Nutritional status assessment should be done for every child diagnosed with ALL[7].

Mean age of children in our study was 6.79±3.78 years and that is similar to a study conducted in Guatemala in which median age was 7.7 years. In their study 58.9% of the children belonged to high risk group and we had 51% in high risk group[7]. Similarly majority of patients were between 01-10 years of age in a study

from Pakistan.[12] On the contrary, a study from Iraq showed >60% of patients belonged to the age group of 1-5 years.[11] These results from all over the world signify that commonest age group of ALL having compromised nutritional status is 2-10 years. Male gender predominates in our study i.e. 61% males comparable with a study by Al-Momenin which showed 58% males[10].Similar results of predominance of male gender is shown in a research from Indonesia and Malaysia.[8,9]

We evaluated the frequency of under nutrition among children suffering from acute lymphoblastic leukemia. Our results showed that almost half of the children 91 (47%) had weight for age less than 5th centile for their age and 50 (26%) had low height for age of <5th centile. Moreover under nutrition was highest among young children in the age group of 01-05 years 47 (51.6%) as compared to older age range of 10-15 years, 18(19.7%). This is in line with a recent a study from Guatemala which showed> 50% of newly diagnosed children with ALL were moderately nutritionally depleted[7].A study from Morocco on the nutritional status of children with different malignancies showed similar results of 20-50% of malnutrition in children. In their study 37% of children had low weight for age (<-2SD)) and 20% had low height for age[13].Almost half of our children had low weight for age of <5th centile and quarter had low height for age. The reason of such high rates of malnutrition is probably related to factors associated with the disease itself and sometimes socio-economic conditions. In our country like other resource poor countries etiology of malnutrition in cancer is multifactorial including poor socioeconomic conditions, dietary habits and disease related factors. Limited resources is one main reason for high rates of child under nutrition, stunting and wasting.[14] A major problem among children with cancer is metabolic and it is represented by catabolic status resulting in weight losses leading to decrease in lean body mass which is more serious in already malnourished children. Contradicting results were narrated in a study by Tan showing high prevalence of being overweight and obesity despite lower energy intake compared to controls with acute ALL[9].Differences in the prevalence of under nutrition could be due to varied criteria of patient inclusion and secondly due to special nutritional support program for these patient in the study from Malaysia[9].Stratification of the data by age and gender revealed results consistent with most studies.

A prospective cohort study from Scotland also showed much lesser number (13%) of children having under nutrition in newly diagnosed patients with ALL. Moreover they showed that under nutrition decreased over time and at the end of the study no patient was undernourished[15]. Likewise, a study from Malaysia showed similar results[9]. On the other hand, our study revealed a high prevalence of under nutrition in newly diagnosed children with ALL which is in contrast to the study from Scotland and Malaysia but in agreement with findings from Morocco[13], which may be due to the resource rich country of Scotland and nutritional interventional programs in Malaysia which is lacking in our set up.

A research by Hafiz MG showed that under nutrition in children at presentation and later during induction phase had twice more chance of infection proven by culture positivity. Moreover these children had prolonged hospital stay and required significantly longer duration of induction therapy[16].In contrast, a study by Athifah, depicted that in newly diagnosed children with ALL, there was no correlation between nutritional status and remission outcome[8]. However, we did not look at the outcome in our study population and its correlation with the nutritional status. Similarly a research article published by Khan from Pakistan showed that pre-existing malnutrition adversely effects the treatment outcome in children with ALL[17]. Knowledge gaps still remain despite recognition of the crucial role of nutritional status on outcomes in children with leukemia[18].

Limitation: This was a single centered study and we did not look into the relation of nutritional status with the remission and outcome of disease. Moreover socioeconomic condition was not explored.

CONCLUSION

Pediatric ALL has overall high prevalence of under nutrition on presentation which is more common in under-five age group in our population. We will plan to study the impact of undernutrition on further course of treatment and outcome. We also recommend having a routine assessment of initial nutritional status along with nutritional rehabilitation program to overcome this problem and to improve survival of ALL at our centre.

Conflict of interest: Nil

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