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Nutritional Status of Pediatric Cancer Patients And Its Association With Repeated Hospitalizations

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ABSTRACT

Background: Malnutrition is known to be a poor prognostic factor affecting the outcome of pediatric cancers. The objective of this study was to assess the pre-existing malnutrition in newly diagnosed pediatric cancer patients presenting at the Pediatric Oncology Department, Children Hospital, PIMS and their number of hospital admissions due to causes other than chemotherapy.

Methodology: Data of 44 newly diagnosed children with cancer was analyzed to find out the association of nutritional status according to z-score for weight and height for age, body mass index (BMI) and mid-upper arm circumference (MUAC) with their number of hospital admissions for 6 months since their date of diagnosis.

Results: The mean age of the study subjects was 4.25 ± 2.85 years, out of which 33(75%) were males and 11(25%) females. Most of the patients were diagnosed with leukemia or lymphoma. Nutritional status evaluation of thirty patients who got admitted was mild to moderate wasting in 24(80%) assessed by weight for age, mild to moderate stunting in 21 (70%) according to height for age and mild to severe malnutrition in 10 (33%) based on body mass index and mid upper arm circumference (MUAC). There was significant association between nutritional status of patients at the time of diagnosis with additional hospitalization with p value less than 0.05

Conclusion: Malnutrition at the time of diagnosis is significantly associated with an increase in the number of hospital admissions in pediatric cancer patients.

Key words: Hospitalization, Malnutrition, Oncology, Pediatric

Authors' Contribution:
[1]Conception; Literature research; manuscript design and drafting; [2,3] Critical analysis and manuscript review; ,[4,5]Data analysis; Manuscript Editing.

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Introduction

Malnutrition is a major problem in children with cancer in developing countries and significantly affects their survival.[1,2] The cause of malnutrition can be primary or secondary due to malignancy itself or its aggressive multimodal treatment. It has been shown that both the relapse and mortality rates of undernourished children with malignancies are higher than the rest of the population. It is suggested that socioeconomic and nutritional factors should be considered in the prognostic evaluation of children with cancer in developing countries.[3] Malnutrition causes a decrease in cytokines, complement and immunoglobulin levels that leads to a deficient immune system.[4] This makes the child prone to infections, cytopenias and poor response to chemotherapy that initiates the cycle of repeated hospital admissions.

Nutritional assessment must be a vital component of the history and physical examination of children with cancer. Nutritional imbalance in children can be measured using various indicators such as Z-score, WHO recommended growth charts for weight-for-age, height-for-age, body mass index, mid-upper arm circumference and skin fold thickness.[5,6] Poor dietary intake is associated with an increased risk of infections and febrile neutropenia in pediatric cancer patients. Therefore, the chances of hospital admissions increase causing more treatment cost, poor quality of life and higher mortality compared to age and sex matched oncological children with good nutritional status.[7]

Methodology

This prospective observational study was conducted on 44 newly diagnosed cancer patients in Pediatric oncology unit, children hospital, PIMS from April 2021 to March 2022, after approval of institutional ethical review board. Inclusion criteria was pediatric patients with newly diagnosed malignancies, however pediatric oncology patients with pre-existing illnesses like nephropathy, an inborn error of metabolism, cardiac, neurological or gastrointestinal diseases were excluded from the study. After informed consent from parents/ guardian, the demographic and clinical data was collected on a pre designed proforma.

Patients were assessed for their nutritional status at the time of diagnosis by BMI, weight-for-age and height-for-age on standard WHO Z-score charts, appropriate for their age and gender. The mid-upper arm circumference was measured by standard MUAC measuring tape and plotted on the WHO standard Z-score chart. WHO classification for nutritional assessment according to Z-score was used as under;[7]

- well-nourished (Z score <-1 to 0)
- mildly malnourished (Z-score -2 to -1)
- moderately malnourished

(Z-score -3 to -2)

- severely malnourished (Z-score<-3)

The patients were started on chemotherapy protocols according to their oncological diagnoses. All cases were managed indoor or in daycare facilities according to their respective chemotherapy regimens.

The patients were hospitalized immediately in case of febrile neutropenia or any other infection like pneumonia, urinary tract infection, meningitis, acute gastroenteritis and managed according to standard treatment guidelines.

Data was analyzed by SPSS (version 20). Data of categorical variables was presented in frequencies and percentages, and continuous variables in mean ±SD. Chi-square test was used to determine association of nutritional status with hospitalization in addition to chemotherapy.

Results

The mean age of study subjects was 4.25 ± 2.85 years, out of which 33(75%) were males and 11(25%) females. Most of the patients were diagnosed cases of leukemia or lymphoma. Out of 44 patients, 29 (65.9%), had mild to severe wasting, 31 (70.45%) had

mild to moderate stunting and 11 (25%) had mild to severe malnutrition based on BMI (Table 1)

Table I: Diagnosis and Nutritional status at time of presentation	
Diagnosis	Frequency (%)
Acute B Lymphoblastic Leukemia (B-ALL)	23 (52.3)
Acute T Lymphoblastic Leukemia (T-ALL)	6 (13.6)
Hodgkin's lymphoma	6 (13.6)
Wilm's Tumor	6 (13.6)
Langerhans cell histiocytosis (LCH)	2 (4.5)
Burkitt's lymphoma	1 (2.3)
Nutritional status	Frequency (%)
Weight for age	
Normal	15 (34.1)
Mild wasting	19 ((43.2)
Moderate wasting	8 (18.2)
Severe wasting	2 (4.5)
Height for age	
Normal	13 (29.5)
Mild stunting	19 (43.2)
Moderate stunting	10 (22.7)
Severe stunting	2 (4.5)
Mid Upper arm Circumference	
Normal	33 (75)
Mild Malnutrition	11 (25)
BMI	
Normal	33 (75)
Mild	8 (18.2)
Severe	3 (6.52)

Out of forty-four patients, 30 (68.18%) needed hospitalization in addition to chemotherapy due to pneumonia (25%), UTI (13%), meningitis (19%), acute gastroenteritis (25%) and other causes (18%). Nutritional status evaluation of thirty patients who got admitted was mild to moderate wasting in 24(80%) assessed by weight for age, mild to moderate stunting in 21 (70%) according to height for age and mild to severe malnutrition in 10 (33%) based on BMI and MUAC. There was significant association between nutritional status of patients at the time of diagnosis with additional hospitalization at p value less than 0.05 (Table 2).

Table II: Association of nutritional status with hospitalization in addition to chemotherapy					
Nutritional status	No. of Hospitalization				
	0 N (%)	1 N (%)	2 N (%)	>2 N (%)	p-value
Weight for age					
Normal (15)	9 (60)	6 (40)	0 (0)	0(0)	0.00*
Mild wasting (19)	5 (26)	9(47)	5(26)	0(0)	
Moderate wasting (8)	0(0)	1(13)	4(50)	3 (37)	
Severe wasting (2)	0 (0)	0 (0)	0 (0)	2 (100)	
Height for age					
Normal (13)	8(61)	4(31)	0(0)	1(7)	0.01*
Mild stunting (19)	6(32)	10(53)	3(15)	0(0)	
Moderate stunting (10)	0(0)	2(20)	5(50)	3(30)	
Severe stunting (2)	0(0)	0(0)	1(50)	1(50)	
Mid Upper arm Circumference					
Normal (33)	13(39)	14(43)	4(12)	2(6)	0.03
Mild malnutrition (11)	1(9)	2(18)	5(45)	3(28)	
BMI z score					
Normal (33)	13(39)	13(39)	6(19)	1(3)	

Mild malnutrition (8)	1(12)	2(25)	3(38)	2(25)	0.05*
Severe malnutrition (3)	0(0)	1(33)	0(0)	2(66)	
Total	14	16	9	5	
Duration of Admission/ hospitalization (Mean ± SD)		8 ±5.4	9±5.1	6±3.9	

Discussion

Pediatric cancer is related to severe morbidity and mortality in children.[1] Malnutrition has been recognized as a poor prognostic indicator for pediatric oncology patients.[1,8] Moreover, there is a correlation of poorer survival outcomes and treatment-related toxicity both short and long term for those who are underweight at diagnosis.[9,10]

According to the 2018 Pakistan National Nutrition Survey (NNS), four out of ten children under five years of age are stunted and 17.7% suffer from wasting. NNS 2018 shows that almost one in eight adolescent girls is underweight. Adolescent boys are more affected with one in five being underweight. The associated factors of child malnutrition in Pakistan include poverty, maternal under nutrition, low income, poor health facilities, overcrowded houses, food taboos, lack of education and awareness.[11]

Cancer is a catabolic state and there is a continuous wasting of the body reservoirs. The treatment of cancer whether surgery, chemotherapy or radiotherapy is an important nutritional risk factor.[12] The treatment is accompanied with nausea and vomiting, oral mucositis, sepsis, diarrhea, constipation, dyspepsia and cachexia. All these factors play a fundamental role in decreased food intake, nutrient loss, alterations in energy expenditure and weight loss.[12]A child with malignancy undergoing treatment is therefore predisposed to malnutrition and its consequences.

This study shows that the children being treated at our center are 80% wasted and 83% stunted in different categories according to the WHO Z-score. The frequency of admissions in moderately and severely malnourished children was more than the mild group. These children were prone to having febrile neutropenia as a complication of disease and its management. Almost 43.2% of the patients admitted were in the induction phase of their chemotherapy. This is due to increase tumor burden initially, high dose of chemotherapeutic drugs, neutropenia, low immunity and thus high infection rate.

Adequate nourishment is important for maintaining energy levels, muscle mass and a healthy weight during cancer treatment. It then improves treatment tolerance and reduces the risk of chemotherapy side effects. Screening of nutritional status should be performed on all pediatric cancer patients before starting their therapy. Interventions must be made to identify, improve and prevent further malnutrition in these patients. We at our center thoroughly counsel parents regarding their child's nutritional needs during the course of treatment. They are given proper neutropenic diet plan, advised hygienic measures and their growth is monitored regularly during the hospital visits. Those children with severe malnutrition are fed via nasogastric tube and oral nutritional supplements. Parenteral nutrition due to its complications and lack of expertise is not routinely used at our center.

Nutrition is an essential factor in pediatric oncology that affects the development of the disease, symptoms, response to chemotherapy, cancer recovery and survival.[14, 15, 16] Therefore, it has a strong impact on the quality of life and prognosis of the disease. Poor nutritional status leads to wasting

of muscle mass, decreased functional capacity, higher incidence of infections, drug toxicity and increased hospitalization, as well as higher mortality.[11] This study focuses on the need of early detection and intervention to prevent nutritional deterioration and thus lessen the burden of cancer morbidity and mortality in the pediatric population.[17, 18] Since it is a single centered study, the results cannot be generalized.

Conclusion

Malnutrition is significantly associated with an increase in the number of hospital admissions in newly diagnosed pediatric cancer patients.

Recommendation

A timely intervention will not only prevent infection rate and hospitalization in pediatric cancer patients but also improve their survival and quality of life.

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