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NUTRITIONAL STATUS IN PAEDIATRIC PATIENTS WITH ACUTE LEUKAEMIA DURING INDUCTION CHEMOTHERAPY: A RETROSPECTIVE ANALYSIS FROM A TERTIARY CARE CENTRE IN CENTRAL INDIA

Oncology/Radiotherapy

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ABSTRACT

Acute Leukemia in children is a potentially curable disease and its prognosis has been linked to several factors, such as nutritional status. Malnutrition is present in 44% patients at diagnosis, this increased to 46% in pediatric cancer patients post induction1. Under nutrition among pediatric acute leukemia patients is more in developing countries 60% as compared to 10% in developed countries 2,3. A retrospective cohort study of 41 children with a recent diagnosis of Lymphoid or myeloid malignancy was done to determine the frequency of malnutrition before and after induction chemotherapy and outcome of ALL postinduction. Children with malnutrition at the time of diagnosis are more prone to have frequent episodes of febrile neutropenia which makes them prone for having prolonged hospitalization and increased risk of mortality.

KEYWORDS

Malnutrition, Pediatric cancer, infections, mortality

INTRODUCTION

Acute Leukemias constitute the most common diagnostic group of childhood cancers worldwide, and in India.[4,5] Remarkable progress has been made in the treatment of acute lymphoblastic leukemia with 5-year overall survival rate reaching 90% in the high-income countries (HICs).[6] There are several factors associated with unfavourable outcomes and death in these patients, including: the type of cancer, a lack of information about the disease, poor access to health services, delayed diagnosis and initial treatment as well as a lack of resources for comprehensive treatment and nutritional status.[7]

Malnutrition in children with cancer, whether it be by overnutrition or undernutrition, has been linked to poor outcomes, greater rates of treatment discontinuation, hospital stays, treatment-related toxicity, infectious complications and mortality.[7] Hypotheses have been developed that suggest malnutrition impairs the ability of the immune response against infections due to cytokine hormone function alterations [8] and micronutrient deficiencies.[9,10]It also impairs the effectiveness of cancer treatments because of pharmacokinetic and pharmacodynamic changes that are explained by an altered metabolic state.[11] Likewise, it has also been associated with a poorer quality of life and poorer physical, social and emotional performances.[12]

As nutritional status is a factor that is subject to potential change, this study was conducted to determine the frequency of malnutrition in children with haematolymphoid malignancies at the time of diagnosis, as well as during treatment and to also investigate its relationship with the development of infectious complications and death. It thereby provides information that could lead to strategies that will impact the treatment of paediatric cancer.

METHODS

A Retrospective study was conducted at State cancer institute in central India, which reviewed the medical records of 41 patients of age group 2 to 14 years diagnosed with lymphoid and myeloid malignancies.

Those that started and finished treatment between march 2023 and October 2023 were included and those that discontinued treatment, relapsed, had comorbidities that affected the nutritional status like HIV, congenital or acquired immunodeficiencies, cardiopathy with haemodynamic compromise, and those who died within the first 72 hours of beginning treatment were excluded.

Age, gender, type of cancer and risk stratification was recorded. The anthropometric assessment was obtained from the medical records, without knowing the calibration status of the teams or the training of the staff that obtained it.

The nutritional classification was conducted by only considering anthropometric indicators associated with weight and size and were obtained using the World Health Organization (WHO).As for the outcomes, the time of death was recorded and the cause identified. The time the episodes of infection occurred was also recorded and were classified into categories of the most common and highest risk entities: febrile neutropenia (FN), serious infection (bacteraemia, catheter-associated infections, sepsis, pneumonia, pyelonephritis, meningitis, osteomyelitis, septic arthritis, serious soft tissue infections and neutropenic) amongst others.

The data were consolidated in an Excel database and analysed using the version 23 of SPSS software. Graphical representations and normality statistics were used for the descriptive statistics, using the Kolmogórov–Smirnov test. Variables with normal distribution were recorded using their standard deviation and mean and those that had asymmetrical distribution, with the median and percentiles 25 and 75. Qualitative nominal variables and categories were recorded as frequencies as well as their respective proportions.

RESULTS

Data for 41 patients were recorded upon selection of the records, as is explained in Table 1.

Table1– Characteristics of children admitted in Pediatric oncology ward

Age average	
Gender, n (%)	
Male	22 (54)
Female	19 (46)
Type of cancer, n (%)	
ALL	25 (60)
Hodgkin lymphoma	4 (9.7)
Non-Hodgkin lymphoma	6 (14.6)
Acute myeloid leukaemia (AML)	4 (9.7)
Acute Promyelocytic leukaemia (APML)	2 (4.8)
Nutritional status at onset n (%)	
Malnourished before induction Moderate Severe	8 (19.5) 7 (17)
Malnourished before induction Moderate Severe	8 (19.5) 8 (19.5)
Age, n (%)	
Under 5 years	16 (39)
Over 5 years	25 (61)

We found a greater number of males, an average age of 8 years, a greater proportion of patients had ALL and high nutritional risk.

Table2 – Outcome of patients

No of episodes of febrile neutropenia During induction		P Value
Children with malnutrition	32	<0.01
Children with adequate nutrition	18	
Mortality during induction, n (%) based on type of cancer		
ALL	2 (4.8)	

Non-Hodgkin lymphoma	1 (2.4)	
Acute Promyelocytic leukaemia (APML)	1 (2.4)	
Nutritional status in those who died		
Severe Malnutrition	3	P Value
Moderate Malnutrition	1	<0.01

Children with malnutrition had significantly more episodes of febrile neutropenia as compare to those with adequate nutrition. Four children died during induction period and cause of death was infectious illness. All the children who died had severe malnutrition.

DISCUSSION

It is widely recognised in the literature that the nutritional status of patients with cancer is affected by several intrinsic factors such as the type of cancer, location, the clinical stage or type of neoplastic therapy as well as extrinsic factors such as poverty, lack of education and poor access to health. The latter are of greater relevance in developing countries.[13]

It was found in this current study that most patients had poor nutritional status at the time of diagnosis (36%), with half of the patients had severe malnutrition.

When comparing these results with those obtained in studies from Central and South America, there are significant differences given that higher rates of undernourishment were reported at diagnosis. This includes the study conducted in Venezuela by Fuente *et al* [14] with malnutrition by undernutrition in 40.4% of children or that conducted in Colombia by Suarez *et al* [15] who reported acute undernourishment in 13.6%. The explanation for these differences may not only be attributed to socio-economic conditions. By using different strategies to assess the nutritional status, such as the triceps skinfold, the average arm circumference or biochemical markers like albumin; higher rates of undernourishment are recorded. This is evident in studies like that of Maia Lemos *et al* [16] in Brazil, where undernourishment was found at diagnosis in up to 27.3% of patients, that of Villanueva *et al* in Guatemala [17] that reported 47% or that of Peccatori *et al* [18] in Nicaragua that reported 65.4%. The latter coincides with the undernourishment percentages reported in low and low to middle-income countries, where it reaches up to 40%–90%.[19,20] It is thereby important to emphasise that in the definition of malnutrition heterogeneity is a determinant of the variability reported in different studies, the methodology used to assess the nutritional status (anthropometric or biochemical measures) and the criteria or cut-off points that vary from population to population, thus making it difficult to accurately estimate the prevalence of cancer-related malnutrition.[21] This may also be the reason for undernourishment rates being low in this study, when compared with those reported in countries in Latin America.

The nutritional status of paediatric patients with cancer is changeable. It has been shown that the development of alterations may not only occur at the time of diagnosis, but also during treatment.[22] However, it should be made clear that these percentages do not reflect a consistent number of patients at all times, given that those affected by lymphomas were followed-up for 6 or 12 months and those affected by leukaemia for up to 24 months. Combining this with those lost from death, changes the understanding of this trend. The results outlined are similar to those reported in other countries, like those of Revuelta Iniesta *et al*,[23] who followed patients for 36 months and found greater undernourishment at diagnosis than at any other time and an increase in malnutrition by overnutrition as time went by. This initial trend of further deterioration in the nutritional status, with subsequent recovery and an increase in the number of overweight patients, has also been reported in other investigations.[24,25]

Several publications have identified the potential adverse effects of nutritional problems during treatment, including a reduced tolerance of chemotherapy, drug-altered metabolism, impaired immunity and increased TRM. The latter is shown in a greater number of complications, infections, relapses or death.[26] However, the quality of the evidence supporting each of these effects is varied [27] and conflicting in some cases.[28,29]

With regard to the relationship between the nutritional status and infections, it was found in this study that 83.8% of patients had at least 1 infectious complication and 47.1% had ≥ 3 during the follow-up period. These results contrast with that reported by Loeffen *et al*,[30] who found a strong association between rapid weight loss in the first 3 months of treatment and a higher rate of FN episodes with bacteraemia in the first year after diagnosis (OR = 3.05, CI of 95% = 1.27–7.30, p = 0.012). However, when it comes to the impact of these episodes, the investigations concur that there are no statistically significant differences between patients who were adequately nourished at the time of diagnosis, and patients with malnutrition by undernutrition or overnutrition. Similar results have been reported in investigations like that of Pribnow *et al*.[31]

Nutritional status has also been unpredictably associated with the risk of relapse with this being considered as a factor of further decline itself in the nutritional status, this outcome was not assessed in the study since these patients are excluded.

There are many limitations to understanding the results obtained in this study. Amongst them are the fact this was a retrospective investigation, which affects the accuracy of the information collected, a lack of technique standardisation, non-calibrated tools to obtain anthropometric measures and the nutritional status classification being limited to the use of certain WHO anthropometric indicators (weight and size). Others such as measuring the skinfold or biochemical markers are not included, since they are not part of the routine assessment, nor are clinical signs or food history given the retrospective nature of this study. This may be related to the low number of patients found to be malnourished, which directly affects its association with the outcomes. It is essential that the classification criteria for risk and nutritional status in patients with cancer are consolidated for the correlation between these results to be more reliable.

CONCLUSION

The differences in results obtained in these investigations may be related to the varied nutritional status definitions and the ways of measuring it, which limits comparisons between them. Conducting a prospective and interdepartmental investigation would be ideal, in order to obtain a more representative sample with results that are applicable to the population.

Conflicts of interest

No conflicts of interest were declared by the authors.

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