

Nutritional Parameters in Children with Acute Leukemia

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Background: Nutritional problems with children suffering from cancer varies from extreme malnutrition to complex nutritional problems due to both disease and treatment.

Aim: In this study we intend to assess the nutritional status of the children with acute leukemia and the malnutrition effect on the evolution of the disease.

Material and method: We have performed a retrospective study on a group of 53 children suffering from acute leukemia who were diagnosed and treated in The Pediatric Clinic No. 1 Targu-Mures, The Department of Hematooncology within the period of 2001–2009. The nutritional status is assessed through anthropometric, hemathological and biochemical parameters before the initiation of chemotherapy.

Results: The group of study included 32 males and 21 females, with an average age of 7.2 years at the beginning of the malignant disease; out of 53 patients, 46 were diagnosed with acute lymphoblastic leukemia and 7 with acute myeloblastic leukemia.

At the beginning of the malignant disease, 10 patients (18.9%) had the weight under percentage 5. The height corresponding to the age was, at the beginning of the disease under percentage 5 with 6 patients (11.32%), showing a chronic state of malnutrition. The hemoglobin is diminished to 88.67% of the patients. Sideremia was lowered to 3.77% of the patients and increased to 45.28%. 35.85% of the children had the serum proteins decreased, from which 28.30% had hypoalbuminemia.

We had in view a period of 6 months since the initiation of chemotherapy the response to the treatment by: realising the remission, an occurrence of relapse, infectious episodes, those of febrile neutropenia and the rate of death. In our study we have found that along with the children with a proper nutritional status, the malnourished children show a higher amount of infectious episodes (9.66 versus 7.32 infectious episodes/child); the number of the febrile neutropenia episodes was higher (3.8 versus 2.01 episodes/child). The remission at 6 months was slightly inferior in malnourished children, yet, the rate of mortality has not been influenced.

Conclusions: 1. The prevalence of the assessed severe malnutrition based on the anthropometric indicators was 18.9% at the beginning of the malignant disease. 2. The children's smaller height at the beginning of the tumoral disease is given by the chronic protein-caloric malnutrition, existing before the disease. 3. Among the malnourished patients, the frequency of the infectious episodes is higher and the remission at 6 months is inferior to those with a normal nutritional status, however the rate of death is not different.

Keywords: child, malnutrition, acute leukemia

Introduction

Malnutrition represents a major problem in children suffering from cancer. Its incidence varies according to the nature of the malignant disease, size, location and the phase of the disease [1]. Malnutrition represents an unfavourable prognosis element with children suffering from malignant diseases, it compromises the response to chemotherapy, affects the muscular function, reduces the survival rate and increases the incidence of infections [2]. The assessment of the state of nutrition, itself, is difficult, because nowadays, there are no „gold standards” [3,4,5].

In this study, we intend to assess the nutritional status of children with acute leukemia and the relation between the state of nutrition and the evolution of the malignant disease.

Material and method

We have done a retrospective study on a group of 53 children suffering from acute leukemia who were diagnosed and cured in the Pediatric Clinic No. 1 Tîrgu-Mureș, The Department of Hematooncology in the period of 2001–2009. The nutritional status has been assessed through

anthropometric, hematological and biochemical parameters repeatedly, which is prior and after the chemotherapy initiation, at 3 and 6 months respectively, since initiating the treatment. The group of study included 32 males and 21 females, with an average 7.2 years of age at the beginning of the malignant disease.

The somatic development has been assessed based on a clinical exam and the anthropometric measurements, respectively weight and height.

The value of the weight for age and height are compared with CDC Growth Charts 2000 values for age and gender [6].

The hemathological and biochemical parameters which we have in view are: the hemoglobin, sideremia, the serum proteins, the serum albumin, the transaminases – Alanin-aminotransferases (TGO), Glutamapiruvatransaminases (TGP).

The level of the hemoglobin below 11 g/dl in children under 5 and below 12 g/dl in children elder than 5, is considered decreased. Sideremia was considered normal for the values between 7–20 ug/dl. The whole serum proteins are considered decreased for values below 6.4 g/dl, the serum

Table I. The characteristics of the studied patients

The characteristics	The frequency (number)	The percentage (%)
Gender		
Male	32	60.37%
Female	21	39.63%
The age group		
0-4 years	15	28.30%
4-8 years	17	30.07%
8-18 years	21	41.63%
Environment		
Rural	35	66%
Urban	18	34%
Diagnosis		
LAL	46	86.80%
LAM	7	13.20%

LAL = Acute lymphoblastic leukemia; LAM = Acute myeloblastic leukemia

albumin for values below 3.2 g/dl. The serum transaminases were interpreted as being decreased for values higher than 45 U/dl.

All the cases have been in our view for a period of 6 months, and during all this period, the response to the treatment has been assessed through: the achievement of the remission, a recurrence within 6 months period, complication during the treatment, infectious episodes as well as febrile neutropenia and mortality during the period of assessment.

Results

The group of study included 53 patients out of which 32 males and 21 females, aged between 3 months and 17 years, with an average age of 7.2 years. The distribution of the cases, depending on the place where the patients lived showed a predominance in the rural area (66%). Out of the 53 patients, 46 were diagnosed with acute lympho-

blastic leukemia and 7 with acute myeloblastic leukemia (Table I).

At the beginning of the malignant disease, 23 patients (43.4%) had the right weight for their age underpercentage 25, from which 10 patients (18.86%) had an underpercentage 5. The right height for the age at the beginning of the disease is underpercentage 25 in 21 patients (39.62%), and underpercentage 5 with 6 patients, (11.32%), resulting severe chronic malnutrition.

The value of the hemoglobin decreased in the case of 47 patients (88.67%); the sideremia decreased with 2 patients, within normal limits for 27 patients and increased with 24 patients. The increase of the serum iron at the beginning of leukemia is due to the inefficient erythropoiesis because of the infiltration of the marrow with blasts, the serum iron remaining unused. The total serum proteins are decreased at the beginning of the disease for 35.78% patients and the plasmatic albumins for 28.29% (Table II).

Having in view the anthropometric parameters on a period of 6 months of evolution, we have found that at 3 months since the initiation chemotherapy the proportion of children with weight underpercentage 5 (13.04%) decreases, but those with underpercentage height 5 (17.39%) it increases. After 6 months, since the initiation of chemotherapy, the weight is slowly modified – underpercentage weight 5 in 14.28% patients, but increases progressively the percentage of the children with underpercentage height 5 (21.42%) (Table III).

Within the 6 months of evolution, under cytostatic treatment, the increase of hemoglobin has been observed as compared to the beginning of the disease, but decreased the medium value of the serum albumins (Table IV).

We have considered those transaminases to be enlarged which had a 45 U/l serum value to be increased. The TGO rises at the beginning of the disease with 18 children, and

Table II. The prevalence of malnutrition at the debut of the disease based on anthropometric, biochemical and hemathological parameters

Type of leukemia	Number of patients	W < P5	H < P5	P < 6.4 g/dl	A < 3.2 g/dl	S < 7 ug/dl	Hgb < 11 g/dl under 5 years, < 12 g/dl below 5 years
LAL	46	10	6	18	13	2	40
The percentage		18.86%	11.32%	33.90%	24.52%	3.77%	75.47%
LAM	7	0	0	1	2	0	7
The percentage		0	0	1.88%	3.77%	0.00%	13.20%
TOTAL	53	18.86%	11.32%	35.78%	28.29%	3.77%	88.67%

W = weight for the age; H = height for the age; P = total serum proteins; A = serum albumins; Fe = sideremia; Hgb = hemoglobine;

Table III. The weight and height in different stages of the disease

WEIGHT	< P5 %	P5-25 %	P25-75 %	P75-95 %	> P95 %
At the beginning	18.86	24.52	39.62	11.32	5.66
3 months	13.04	28.26	32.6	19.56	4.34
6 months	14.28	23.8	45.23	11.9	4.76
HEIGHT	<P5 %	P5-25 %	P25-75 %	P75-95 %	> P95 %
At the beginning	11.32	28.3	37.73	11.32	11.32
3 months	17.39	26.08	34.78	15.21	4.34
6 months	21.42	23.8	38.09	11.9	1.88

Table IV. The medium value of the hemathologic and biochemical parameters at the beginning, within 3 and 6 months after chemotherapy

Parameters	Debut of the disease	3 months after chemotherapy	6 months after chemotherapy
Hemoglobin g/dl	8.21	10.82	11.88
Sideremy $\mu\text{g/dl}$	22.25	20.51	20.16
Serum protein g/dl	6.61	6.72	6.61
Serum albumin g/dl	4.37	3.89	3.78

the TGP with 9 children. A number of diseased patients showed a rise in transaminases on long periods, in different stages of the disease and its treatment (Table V).

We have in view the response to the treatment on a period of 6 months since the initiation of chemotherapy by: realizing the remission, the occurrence of relapse, infectious episodes, those of febrile neutropenia and death rate. Within our study, we have found that the incidence of the infectuous episodes was slightly more increased in the case of the patients with chronic malnutrition (the height for the age < P5) compared to the children without malnutrition symptoms (9.66 versus 7.32 infectious/child episodes); the number of the febrile neutropenia episodes was also higher (3.8 versus 2.01 episodes/child). Seeing the remission at 6 months , it was found that in the group of the children with hypoproteinemia at the beginning of the disease, the remission at 6 months was 68.42% compared to the group of those with normal serum level of proteins (73.52%). Six months since the beginning of the disease, we also have in view the death rate; which is 15%; but no differences in survival among malnourished children have been noticed and those with a normal nutritional status.

Discussions

For the past years, the survival of the children suffering from cancer has improved a great deal. Therefore, the emphasis is not solely on survival but also on the quality of the children's lives [7]. The link between malnutrition and cancer is well-known, yet, recent studies show that the nutritional status with a child with malignant disease influences the treatment and the rate of survival [8].

In our study, the prevalence of malnutrition is studied, using anthropometric, hemathological and biochemical parameters. Using anthropometric parameters at the beginning of disease, we have found a prevalence of 18.86% in children with a percentage weight under 5, from which 11.32% had the percentage height under 5, showing a severe chronic malnutrition. Under an intensive cytostatic treatment, after 3 respectively 6 months of chemotherapy, the children's weight has slightly improved, explicable by a long term corticotherapy which determines a weight increase because of the water retention and NaCl. On the other hand, the study of the patients'height stagnates, the percentage of the children with under percentage weight 3 increases noticeably. The stagnation of the height and, in some cases, the height decrease under intensive treatment

Table V. The patients with high values of the transaminases in different stages of the disease

Parameters	At the beginning of the disease	3 months after chemotherapy	6 months after chemotherapy
GOT	18 (34%)	23 (43.4%)	11 (20.75%)
GPT	9 (17%)	14 (26.4%)	18 (34%)

occurs due to a long term therapy, respectively the osteoporosis subsequent to corticotherapy. At the beginning of the malignant disease, some studies show a higher prevalence of the children with under percentage weight 5, therefore Atta-ur-Rehman Khan et al [9] in a prospective study on patients with ALL has found a prevalence of 63% in malnourished children with under percentage weight for their age 5. Based on the biochemical parameters, the prevalence of malnutrition was higher, so that 35.78% of the children showed hypoproteinemia at the beginning of the disease, a percent which does not improve under a chemotherapy treatment, as a result a higher percent of malnourished children is maintained.

88.67% of the patients had a decreased hemoglobin when they are diagnosed. The increased prevalence is explained by the infiltration of the marrow with blasts [10].

At the beginning of the malignant disease, we have found a growth of the serum transaminases in 18 patients; a frequent affectation of the hepatic function, revealed by the serum transaminases modifications, which can be explained by the leukemic infiltration of the liver in the acute leukemia. Similarly, under chemotherapy treatment a high percent of children developed increased transaminases which shows the hepatotoxic nature of the chemotherapeutical agents used in leukemia treatments.

Among the malnourished patients, we have noticed a higher prevalence of the infectuous episodes, respectively those of febrile neutropenia compared to the children who were not malnourished. Similar studies have shown a more increased frequency of the infectuous episodes in children with malignant diseases who were malnourished [11,12]. In our study the remission at 6 months was inferior in children with hipoproteinemia as compared to those with normal values for the serum proteins ; on the other hand the decreased anthropometric indicators (under percentage weight and height 5) have not influenced the remission. Atta-ur-Rehman Khan et al. demonstrates in a prospective study on a group of 220 children with ALL how hypoproteinemia influences the evolution of the disease and the response to the treatment in a negative way, being a more faithful indicator in contrast with the anthropometric indicators [13].

In our study the rate of death at 6 months was 15%, but malnutrition has not influenced the mortality.

Conclusions

The prevalence of malnutrition proves to be high in our study with children suffering from acute leukemia representing a decisive factor in the evolution of malnutrition

diseases because it increases the frequency of the infections and influences negatively the recurrence of the disease . That is why we consider that it is very important to prevent, respectively, to alter, as early as possible, the protein-calorific malnutrition in children suffering with cancer .

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