

ORIGINAL ARTICLE / PRACA ORYGINALNA

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**ASSESSMENT OF MALNUTRITION IN CHILDREN WITH CANCER
DURING ONCOLOGICAL TREATMENT**

STAN ODŻYWIENIA U DZIECI LECZONYCH ONKOLOGICZNIE

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S u m m a r y

Aim of the study. Assessment of malnutrition status in children with cancer during oncological treatment.

Material and methods. 62 children aged from 0 to 18 years were included. Anthropometric and biochemical parameters were measured: weight (W), height(H), middle arm circumference (MAC), triceps skinfold thickness (TSFT), serum albumin. Middle arm muscle circumference (MAMC) was calculated. These variables were interpreted in accordance with Polish population percentiles charts and analyzed according AHOPCA 2004 Report. Adequately nourished- all criteria must be fulfilled: ideal body weight (IBW)≥90th percentile(ile), albumin>3,5 g/dL, weight loss <5%;TSFT and MAC both above the 10th ile. Inadequately nourished: at least one of these criteria must be fulfilled without isolated hypoalbuminemia; Depleted: IBW 60-89%, albumin 3,2-

3,5g/dL, weight loss 5-10%,TSFT and/or MAC between the 5-10th ile; Severely depleted: IBW < 60%, albumin<3,2g/dL, weight loss>10%, TSFT and/or MAC less than 5th ile.

Results. The prevalence of malnutrition at diagnosis ranged from several to nearly 50% children, depending upon the measurement used - in 22.6% of children by W, in 17.7% by H, in 19.4% by W/H ratio, in 21.0% by TSFT, in 32,3% by MAC, in 46,8% by MAMC. Hypoalbuminemia was noted in 29,0% of children. Weight loss >5% was detected in 29% of children, in 11% it was higher than 10%. At diagnosis about 37% of children were adequately nourished, 39% were depleted and 24% severely depleted. Finally, 66% of children were adequately nourished, but 14.5% had severe malnutrition in the final examination.

Conclusions. Arm anthropometry is very useful for malnutrition detection and nutritional intervention.

S t r e s z c z e n i e

Cel pracy. Ocena stanu odżywienia u dzieci leczonych onkologicznie z powodu choroby nowotworowej.

Materiał i metody. do badania włączono 62 dzieci w wieku od 0 do 18 lat. Oceniano parametry antropometryczne: waga (W), wysokość (H), obwód środkowej części ramienia (MAC), grubości fałdu skórno-mięśniowego nad mięśniami trójgłowym ramienia (TSFT) oraz oznaczono stężenie albuminy w surowicy. Obliczano wskaźnik MAMC. Uzyskane wyniki były interpretowane zgodnie z polskimi tabelami percentylowymi ludności i analizowane zgodnie z raportem AHOPCA 2004. Prawidłowe odżywienie-spełnione wszystkie kryteria: idealna waga ciała (IBW) ≥90th percentyla (ile), albumina > 3,5 g/dl, utrata masy ciała <5%; TSFT oraz MAC obu powyżej 10. Ile. Niedostateczne odżywienie: co najmniej jedno z tych kryteriów musi być

spełnione bez jednoczesnej hypoalbuminemii; niedożywienie: IBW 60-89%, albumina 3,2-3,5 g/dl, utrata masy ciała o 5-10%, TSFT i/lub MAC pomiędzy 5-10th Ile; ciężkie niedożywienie: ICC <60%, stężenie albumin <3,2 g/dl, utrata masy ciała > 10%, TSFT i / lub MAC mniej niż 5th Ile.

Wyniki. Częstość niedożywienia podczas diagnostyki wahała się w zakresie od kilku do prawie 50% dzieci, w zależności od zastosowanej metody- 22,6% dzieci ocena W, w 17,7% w H w 19,4% stosunek W / H , w 21,0% wg TSFT, w 32,3% wg MAC, w 46,8% wg MAMC. Hypoalbuminemię stwierdzono u 29,0% dzieci. Utrata masy ciała >5% stwierdzono u 29% dzieci, w 11% był wyższy niż 10%. Podczas diagnostyki ok 37% dzieci było odpowiednio odżywione, niedożywienie stwierdzono u 39%, a ciężkie niedożywienie u 24%. Ostatecznie 66% dzieci było

odpowiednio odżywione, a u 14,5% występowało poważne niedożywienie w ostatnim badaniu.

Key words: nutritional assessment, cancer in children

Słowa kluczowe: badanie stanu odżywienia, choroba nowotworowa u dzieci

Wnioski. Badanie antropometryczne jest bardzo przydatne do wykrywania niedożywienia i umożliwia szybką i adekwatną interwencję żywieniową.

INTRODUCTION

Malnutrition in cancer disease is a complex problem caused by the prolonged, lower dietary intakes, chronic disease and side effects of oncological treatment. The occurrence and the increase of nutrition disorders depend on the type, location and stage of cancer and on the applied therapy. According to the Polish data, malnutrition appears in 8-32 % of children with newly diagnosed cancer, and in 40% of children in progression cachexia is observed [1].

A lot of authors write about the correlation between the nutrition status and the results of oncological treatment, which depend on the infectious complications and number of recurrences. Clinical researches show less frequent delays in treatment and doses reduction, also better therapy results in case of proper nutrition [2-9]. That is why one of the priorities in oncological treatment is not to allow the malnutrition happen, especially protein deficiency.

A great deal of clinical trials was done on children in the developing countries, where the problem of malnutrition is observed not only in chronically ill children. In 2005 AHOPCA (Asociacion de Hemato-Oncologia Pediatrica de Centro America) published their guidelines for the assessment of nutritional status in children with cancer. To estimate the nutritional status they took into account the data such as weight loss, some simple anthropometric measures, like triceps skinfold thickness (TSFT) and middle arm circumference (MAC), and albumins level, which is the most popular biochemical marker of malnutrition. An actual body weight was shown as % Ideal Body Weight (%IBW) plotted on the same centile for age, gender and height [10]. It is essential for the practical reason to combine the results of these measurements with nutrition support guidelines [11].

The criteria shown above are consistent with the European Society of Pediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN) guidelines from 2012, which also takes into consideration the weight loss and triceps skinfold thickness in the assessment of the nutrition status and nutrition support [6].

AIM OF STUDY

The aim of the study was the assessment of nutritional status in children with cancer during oncological treatment with especially malnutrition cases diagnosed in terms of wide range of anthropological indexes and albumins level, and their utility in classification for nutrition support.

MATERIAL AND METHODS

62 children with newly diagnosed cancer disease were included in the study, 31 girls and 31 boys, aged from 0 to 18, treated in 2008-2010. In this group, 23 children underwent treatment for acute lymphoblastic leukemia, 14 due to lymphoma, and 25 due to solid tumors.

In order to make the assessment of the nutritional status there were anthropometric parameters measured, such as body weight and height, middle arm circumference, triceps skinfold thickness. On the basis of the last two parameters there was the middle arm muscles circumference calculated, which shows indirectly lean body mass, as follows: MAMC= MAC-(TSFT x 0.314). Albumin level was measured as the biochemical marker of malnutrition. These parameters were measured three times: at diagnosis, in the middle of the treatment and after the intensive chemotherapy. The results were interpreted according to the criteria of Nutritional Status in Children with Cancer: A Report From the AHOPCA 2004 [10].

Table I. *Criteria of nutritional status in children with cancer according to: A Report From the AHOPCA 2004*

parameter	adequately nourished	inadequately nourished-depleted	inadequately nourished-severely depleted
% ideal body mass	≥ 90	60-89	<60
albumin [g/dl]	>3.5	3.2-3.5	<3.2
weight loss [%]	<5	5-10	>10
triceps skinfold thickness (percentile)	>10	5-10	<5
middle arm circumference (percentile)	>10	5-10	<5

The patients were diagnosed as adequately nourished or inadequately nourished within two groups: depleted or severe depleted. A patient had to fulfilled all the criteria to be defined as adequately nourished. Inadequately nourished group consisted of patients with at least one of the criteria except isolated hypoalbuminemia. Classification of a patient to the severely malnourished group should be connected with the nutrition intervention.

RESULTS

The number of patients with anthropometric and biochemical criteria under 10 percentile or below normal range at diagnosis, during and after the oncological treatment are presented in table II.

Table II. The number of patients with anthropometric and biochemical criteria under 10 centile or below normal range

number of patients	order of assessment	weight for age N (%)	height for age N (%)	weight for height N (%)	middle arm circumference N (%)	triceps skinfold thickness N (%)	middle arm muscle circumference N (%)	albumin <3,5g/dL N (%)
62	at diagnosis	14 22.6%	11 17.7%	12 19.4%	20 32.3%	13 20.9%	29 46.8%	18 29.0 %
62	during treatment	12 19.4%	14 22.6%	16 25.8%	17 27.4%	11 17.7%	27 43.6%	7 11.3%
62	after treatment	11 17.7%	15 24.2%	12 19.4%	9 14.5%	8 12.9%	24 38.7%	7 11.3%

At diagnosis, depending on the index used there were from 17.7% to 46.7% children under 10 percentile. Body weight deficiency was observed in 22.6 % of children, 17.7 % of patients were below the body height normal range. Weight for height ratio was <10 percentiles in 19.3% of children. Additional anthropometric measurements showed the decreased values of triceps skinfold thickness in 20,9 %, middle arm circumference in 32.3%, middle arm muscles circumference in 46.8% of the children. The decreased level of albumins was seen in 29% of children. 29 % of children showed the body mass loss more than 5 % in the last month, among them 11% showed over 10% body mass loss.

At diagnosis 37 % of children were classified as adequately nourished according to these criteria, 39% of children were depleted and 24 % were severely depleted. During the treatment the number of adequately nourished children increased and in the group of depleted and severely depleted it decreased. The assessment after the intensive chemotherapy showed that the number of adequately nourished children increased again up to 66%. Our survey found that during the oncological treatment 48.4% of children improved their nutrition status, in 14.5% cases we

observed the deterioration of nutrition and 37% of our patients did not change the nutrition status, according to the criteria used.

Table III. Classification of nutritional status in children with cancer according to: A Report From the AHOPCA 2004

number of patients	order of assessment	adequately nourished N(%)	inadequately nourished-depleted N(%)	inadequately nourished-severely depleted N(%)
62	at diagnosis	37.1	38.7	24.2
62	during treatment	43.5	35.5	21.0
62	after treatment	66.1	19.4	14.5

The assessment of the nutritional status according to AHOPCA 2004 Report based on history taking about body weight loss and on anthropometric and biochemical measurements showed severe malnutrition in 24.2% of children before the treatment and in 14.5% in the final one.

DISCUSSION

Basing our study on the criteria from Meeting Report AHOPCA 2004 we found the improvement of nutritional status in children with cancer during oncological therapy. In the examination after the intensive chemotherapy the number of children adequately nourished increased, and the number of malnourished children decreased, however it was still 33.8%. When comparing this qualification method to the single anthropometric and biochemical rates, the most similar was the middle arm muscles circumference (MAMC) value, which in the assessment after the treatment was below the normal rate in 38.7 % of the children [5].

The highest percentage of children with malnutrition was detected by such additional anthropometric measurement as middle arm muscles circumference (MAMC)- 46.7% at the diagnosis. The

number of children with arm circumference and fat skinfolds below 10 percentile decreased during the oncological treatment with the lowest percentage at the assessment after the intensive chemotherapy.

Weight loss is the important sign of malnutrition. It is common in clinical studies and oncological diagnosis. In the ESPGHAN report from 2005 the inhibition of body weight increasing followed by weight loss was acknowledged the earliest malnutrition symptom [12]. Weight loss is also important criteria for nutrition intervention. According to the MEETING REPORT AHOPCA 2004 weight loss of over 5% during the previous month is the criteria for malnutrition even if the anthropometric measures are within norm. In our own study weight loss was observed in 29% of children at diagnosis, which means one third of children were inadequately nourished before the oncological treatment [6, 12].

CONCLUSIONS

1. The results of the study confirm that normal body weight does not mean the correct body composition and cannot be the only criteria for adequate nutrition.
2. Weight and height measurements underestimate the protein-energy malnutrition in children with cancer disease. In our study the analysis of the correlation of different methods showed the usefulness of additional anthropometric measurements, such as middle arm circumference, triceps skinfold thickness, middle arm muscles circumference. They are more efficient in early malnutrition detection than body weight and height indices. Serum protein measurements (albumin) are less sensitive than muscles protein estimation by anthropometric measurements in protein malnutrition detection.
3. The combined estimation of nutritional status undertaking weight loss, fat and lean body mass measurements and albumin level help in early detection of nutrition disorders and qualifying patients for nutrition support. The oncological therapy may temporarily influence the nutrition status, growing the risk of malnutrition, but when the remission is achieved, the nutrition status is improved.

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