Anthropometric Assessment of Children with Malignant Disease

Chinceşan Mihaela[1], Baghiu Despina[1], Grama Alina[1], Urtila Patricia[2], Răduţ Ioana[3]

[1] Pediatric Clinic No. I, University of Medicine and Pharmacy, Tîrgu Mureş, Romania
[2] Louis Ţurcanu Pediatric Clinic No. III, Victor Babeş University of Medicine and Pharmacy, Timişoara, Romania
[3] Student, University of Medicine and Pharmacy, Tîrgu Mureş, Romania

Introduction: The nutritional evaluation of the children with cancer includes medical history, physical examination, anthropometric measurement and laboratory data.
Objective: To assess the anthropometric parameters in children with malignant disease compared to children with a non-oncologic disease.
Material and method: A prospective study was performed on 73 children hospitalized in the Pediatric Clinic I Tg. Mures, between November 2009 – January 2011. The children were divided into two groups: group 1, children with malignant disease (27 children) and group 2-control group, children with different pediatric disease (46 children). Anthropometric measurements: weight, height, body mass index, middle upper arm circumference, tricipital skin fold thickness were performed. The values of parameters were converted in Z score for age and sex using Switzerland Growth Chart 1989. We studied the anthropometric parameters compared to the two groups and performed statistical correlations.
Results: We observed a low weight at group I (-0.86 SD), but not in group II (0.2 SD), with a statistically significant difference p=0.002. The height of children in group I was much lower (-0.74 SD) from group II (0.4 SD) with p=0.0019. We also found a statistically significant difference among the anthropometric parameters of the arm: middle upper arm circumference (-1.5 SD versus -0.55 SD) with p=0.0311 and tricipital skin fold thickness (-1.22 SD versus -0.32 SD) with p=0.0093.
Conclusions: Weight, height, MUAC and TSF are significantly lower at children with cancer compared to children with nononcological diseases. The arms anthropometry better identify malnutrition in children with cancer than simply assessing weight or height measurements.

Keywords: children, cancer, anthropometric parameters

Introduction

Children with a malignant disease frequently show signs of malnutrition at the time of diagnosis. Malnutrition at onset may be an unfavorable prognostic element, because it compromises the answer to chemotherapy, may reduce survival and increase the incidence of infectious complications [1]. The prevalence of malnutrition in these children depends on the criteria used to identify malnutrition and there are still controversies regarding the criteria used to acclaim malnutrition in children with cancer [2]. Anthropometric measurements, correlated with hematological and biochemical parameters, can define the nutritional status in these patients. Anthropometry is a useful and easy to use tool in the assessment of nutritional status [3].

In the present study we intend to evaluate the anthropometric parameters of children with a malignant disease compared to children with non-malignant diseases, and to evaluate the prevalence of malnutrition among children newly diagnosed with a malignant disease, based on these anthropometric parameters.

Material and method

A prospective study was performed on 73 children aged between 1–18 years, hospitalized in the Pediatric Clinic I Tîrgu Mureş, between November 2009 – January 2011. Children were divided into two groups. Group I contained the children newly diagnosed with a malignant disease (27 children – 38.02%) and group II – control group, children with different pediatric diseases: respiratory, digestive and hematological (46 children – 61.98%).

Children with other chronic diseases and secondary malnutrition were excluded from the study. We watched as demographic data: name, gender, date of birth, date of diagnosis, type of diagnosis. Somatic development was evaluated based on clinical examination and anthropometric measurements, respectively: weight, height, body mass index, middle upper arm circumference, tricipital skin fold thickness. The values of this parameters were converted in Z score for age, sex using the growth curves Switzerland Growth Chart 1989; were considered normal values between -2.5 and +2.5 SD.

Weight was measured with electronic scales, after fasting the night, with the child naked. Using electronic scales accurate measurement was greater, error being 0.1 kg. Height/length were measured with pediometer, in children younger than 2 years and in children older than 2 years were measured with stadiometer.

Height measurement error margin was 0.1 cm. Body mass index was calculated using the ratio of weight in kilograms and the square of height expressed in meters (kg/m^2).

MUAC (Mid-upper arm circumference) was measured as relaxed forearm resting on the trunk, has scored a point midway between the olecran process of ulna and acromial process of scapula. A strip of measuring paper was passed around the arm to the right marked point. The value was expressed in cm.

Correspondence to Mihaela Chinceşan
Email: mchincesan@yahoo.com

Table I. Oncological diagnosis of the children in group I

Diagnosis	Number of patients	Percentage
Leukemia	14	51.85%
Lymphoma	6	22.22%
Solid tumors	7	25.93%
TOTAL	27	100%

Tricipital, skin folds thickness (TSF) were measured using digital caliper. TSF was measured at the midpoint of the back of the arm, between the olecran and the acromial process ends, parallel to the longitudinal axis of the arm. The value was expressed in mm.

MUAC measure muscular mass and TSF the fat mass. For greater accuracy, the anthropometric measurements were performed in duplicate and we calculated the average.

We studied anthropometric parameters compared to the two groups and performed statistical correlations.

Results

Of the 73 evaluated children, 46 (64.78%) were male and 27 (35.22%) female. Age of children was between 1-18 years with an average age of 6.85 years.

Group I, consisting of 27 children, was represented by patients hospitalized in the Hemato-oncology Department of Pediatric Clinic I, and diagnosed with malignant disease. Of this, 14 children were diagnosed with leukemia, 6 with lymphoma and 7 with solid tumors (Table I).

Group II, consisting of 46 children, was represented by patients hospitalized in the Pediatric Clinic I with different diseases: respiratory, digestive and hematological.

Following the two groups compared to the average anthropometric measurements, we found these (Table II).

In group I we observed the average low weight for age (-0.86 SD), compared to the average weight at group II (0.2 SD), with a statistically significant difference p=0.002.

The height of children in group I was much lower (-0.74 SD), compared with group II (0.4 SD) with p=0.0019.

We also found a statistically significant differences among the anthropometric measurements of the arms: middle upper arm circumference – MUAC (-1.5 SD in group I and -0.55 SD in group II) with p=0.311 and tricipital skin fold thickness – TSF (-1.22 SD in group I and -0.32 SD in group II) with p=0.093.

Table II. Average anthropometric parameters in the two study groups

Anthropometric parameter	MEAN SD-SCORE		P value
	GROUP I	GROUP II	
W	-0.86	0.2	0.002
H	-0.74	0.4	0.0019
BMI	-0.77	0.3	0.1241
MUAC	-1.5	-0.55	0.0311
TSF	-1.22	-0.32	0.0093

In terms of body mass index, its average was not significantly different in the two groups of children (-0.77 SD in group I and 0.3 SD in group II) with p=0.12.

In group I, represented by children with cancer we watched as compared to the three types of malignant disease each anthropometric parameter, but we have not observed significant differences (Table III).

By simply measuring the height or weight, the percentage of malnourished children was not large; so two of the 27 children (7.40%) had weight and height for age <-2.5 SD, denoting severe malnutrition. But using arm anthropometry, we noticed a much higher percentage of malnourished children; so 11 of the 27 children (40.47%) presented the MUAC <-2.5 SD and 9 of the 27 children (33.33%) presented the TSF <-2.5 SD (Table IV). Therefore, it can be noticed that in children with cancer, using the anthropometric parameters of the arms (MUAC and TSF) we identified a greater number of malnourished children than by simply measuring the weight and height.

Discussion

Malnutrition has a negative impact on the evolution of malignant disease; its incidence being associated with higher morbidity and mortality in case of children with cancer. The prevalence of malnutrition depends on the criteria used to define children with malignant symptoms. Anthropometric measurements are a noninvasive and easily applicable method for assessing nutritional status [4].

Our study followed comparative the anthropometric parameters in children with cancer compared to children with different pediatric diseases. We found that weight, height, MUAC and TSF were significantly lower in children with malignant disease compared to children with nononcological diseases.

Table III. Anthropometric parameters in the three types of malignant disease

Anthropometric parameter (Mean SD-Score)	Type of malignant disease			P value
	Leukemia	Lymphoma	Solid tumors	
W	-0.69	-1.44	-0.28	0.6626
H	-0.56	-0.96	-0.92	0.78
BMI	-0.85	-1.12	-0.30	0.6292
MUAC	-1.98	-1.54	-0.51	0.3098
TSF	-1.57	-1.25	-0.52	0.4131

Table IV. Percentage of malnourished children with malignant disease (group I) according to anthropometric parameters

Anthropometric parameter	Z-scores <-2.5DS number (% of total)
	GROUP I
W	2/27 (7.40%)
H	2/27 (7.40%)
BMI	3/27 (11.11%)
MUAC	11/27 (40.74%)
TSF	9/27 (33.33%)

Although there are many methods for assessing body composition, most are too expensive and impractical. Tricipital skin fold thicknes and mid upper arm circumference are good nutritional indicators for pediatric patient with cancer [5]. Arm anthropometry is more useful in assessing nutritional status, especially in children with tumor masses, which may mask the weight loss. TSF reflects body fat, MUAC reflects the muscular mass [6].

We also aimed to assess the prevalence of malnutrition based on anthropometric measurements at onset in children with cancer.

According to growth curves for age and sex, anthropometric parameters values should normally be between -2.5 SD and +2.5 SD. Values under -2.5 SD are below the permissible, showing severe malnutrition, while values over +2.5 SD show overweight, obesity. Between -2.5 SD and +2.5 SD the values of anthropometric parameters are qvasinormal; with the mention that 0 should represent the majority of SD cases, with incidence gradually decreasing towards the two opposite poles of the curve (Gauss distribution curve).

In our study, within the group of children with malignant disease, we found that by measuring the weight, height and calculating the body mass index, the percentage of children with values of these parameters <-2.5 SD was small; so 7.4% of the children had their weight and height <-2.5 SD and 11.11% had their BMI <-2.5 SD. Instead, the anthropometric parameters of the arms have shown that the percentage of children with malnutrition was much higher; 40.74% of the children had their mid upper arm circumference <-2.5 SD and 33.33% had their tricipital skin fold thickness <-2.5 SD. As a result, it can be concluded that these parameters reflect more accurately the nutritional status of cancer than just measuring the weight and height.

Similar studies show that arm anthropometry offers greater accuracy in assessing malnutrition in children with cancer towards the weight and height [7,8,9].

Conclusions

1. In our study, we observed that weight, height, MUAC and TSF were significantly lower in children with malignant disease compared to children with nononcological disease.
2. The prevalence of malnutrition among children with cancer at the onset of disease is high.
3. The arms anthropometry identifies malnutrition better in children with cancer, than by simply measuring the weight or height.

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