Issues on Malnutrition in Children with Cancer

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Introduction: Malnutrition is present in a high percentage in children with cancer. It can be evaluated by anthropometric measurements and laboratory data.
Aims: 1. To determine the prevalence and severity of malnutrition at diagnosis in children with cancer. 2. To define the best modalities to assess nutritional status.
Material and methods: A prospective study was performed on 27 children hospitalized and diagnosed with various type of cancer in the Pediatric Clinic No.I Targu-Mures, between November 2009–January 2011. We evaluated anthropometric and biochemical parameters: weight, height, body mass index (BMI), middle-upper arm circumference (MUAC), triceps skin fold thickness (TSF), total protein, albumin, Insulin-like growth factor-1 (IGF-1). We divided patients into three categories depending on nutritional parameters: severely malnourished, risk of malnourished and adequately nourished. We correlated anthropometric parameters with biochemical parameters.
Results: Our group consisted of 20 males (74.04%) and 7 females (25.96%). Of the 27 children with cancer, 14 children were severely malnourished, 8 children were with risk of malnourished and only 5 children with normal nutritional status.
At the onset of malignant disease, 16 patients (59.25%) had low serum protein values and 10 patients (37.03%) had low levels of serum albumin. IGF-1 was decreased in 18 children (66.66%). We found a good correlation, statistically significant between TSF and serum proteins ($r = 0.41$; $p = 0.02$), between TSF and IGF-1 ($r = 0.44$; $p = 0.02$), and between MUAC and IGF-1 ($r = 0.39$; $p = 0.04$).
Conclusions: 1. The prevalence of malnutrition in children with cancer is high. 2. Arm anthropometry in conjunction with serum protein and IGF-1 most accurately characterizing the nutritional status.

Keywords: child, cancer, malnutrition

Introduction

Malnutrition at diagnosis in pediatric cancer patients is related to the type of tumor and the extent of disease [1]. Malnutrition may be a poor prognostic factor because it adversely affects the evolution of malignant disease and survival prospects [2,3]. Assessment of nutritional status is difficult because there is not a "gold standard" [1]. Anthropometric measurements correlated with biochemical parameters, can define nutritional status in patients with cancer [4].

Aim

Our study aims to determine the prevalence and severity of malnutrition at diagnosis in children with cancer and to define the best modalities to assess nutritional status.

Material and Methods

We have done a prospective study by a lot of 27 children hospitalized and diagnosed with various type of cancer in the Pediatric Clinic No. I Targu-Mures Hematooncology Department, between November 2009–January 2011. At admission we documented age, sex, birth date, date of diagnosis and oncology diagnosis. Anthropometric parameters evaluated were: weight, height, body mass index, middle-uper arm circumference (MUAC), triceps skin fold thickness (TSF). The values of these parameters were converted to Z score for age and sex using growth curves Switzerland Growth Chart 1989 and were considered normal values between -2.5 and +2.5 SD.

Biochemical parameters evaluated were: total serum protein, serum albumin and insulin-like growth factor-1 (IGF-1). Serum proteins were considered normal values above 6.4 g/dl and serum albumin values above 3.5 g/dl. Concentration of Insulin-like growth factor I (IGF-I) was determined by immunochemical method with detection by chemi luminescence. Plasma levels of IGF-1 is barely detectable at birth, increases gradually during childhood, reaching a peak during puberty. The value is expressed in ng/Ml [5].

Results

Our group consisted of 20 males (74.04%) and 7 females (25.96%). The age of children was between 1-18 years, with an average age of 7.65 years. The lot consisting of 27 patients were represented by patients newly diagnosed with

Table I. Classification of Childhood Cancer According to the ICCC [6]

Diagnosis	N	%
Leukemias	14	51.85
Acute lymphoblastic leukemia	10	
Acute myeloblastic leukemia	3	
Chronic myeloblastic leukemia	1	
Lymphomas	6	22.22
Hodgkin lymphoma	2	
Non-Hodgkin lymphoma	4	
Solid tumors	7	25.93
Total	27	

Table II. Z-score of anthropometric parameters

	Z-score < -2.5 (number)	% of total
Weight	2	7.4
Height	2	7.4
Body Mass Index	3	11.1
MUAC	11	40.74
TSF	9	30.36

Table III. Nutritional status at diagnosis

Diagnosis	A	D	S	Total
Leukemia	0	5	9	14
Lymphoma	2	1	3	6
Solid tumor	3	2	2	7
Total	5	8	14	27

A: Adequately Nourished; D: Depleted; S: Severely Depleted

malignant disease. They were classified according to ICCC [6], and then divided into the following groups: leukemia, lymphomas and solid tumors (Table I).

We evaluated the anthropometric parameters and found that two children had Z-score Weight < -2.5 and Z-score Height < -2.5. Eleven children had Z-score MUAC < -2.5 and 9 children Z-score TSF < -2.5 (Table II).

Analyzing the biochemical parameters, we found that at the onset of malignant disease, 16 patients (59.25%) had low serum protein values and 10 patients (37.03%) had low values of serum albumin. IGF-1 was decreased in 18 children (66.66%).

Based on anthropometric and biochemical parameters we have divided the patients into three categories: severely malnourished, risk of malnourished and adequately nourished.

Adequately nourished (A) (all these criteria must be fulfilled):

1. Weight: 0-2.5 SD;
2. MUAC and TSF: 0 -2.5 SD;
3. Serum proteins: > 6.4 g/dl;
4. Serum albumin: > 3.5 g/dl.

Risk of malnourished (D) (at least one of these criteria must be fulfilled) :

1. Weight: -2.5 – 0 SD;
2. 2. MUAC and TSF: -2.5 – 0 SD;
3. Serum proteins: 6.4–6.0 g/dl;
4. Serum albumin: 3.2–3.5 g/dl.

Severely malnourished (S) (at least one of these criteria must be fulfilled):

1. Weight: < -2.5 SD;
2. MUAC and TSF < -2.5 SD;
3. Serum proteins:< 6 g/dl;
4. Serum albumin: < 3.2 g/dl.

On the 27 children with cancer, 14 children were severely malnourished, 8 children were with risk of malnourished and only 5 children with normal nutritional status (Table III).

We correlated anthropometric parameters with biochemical parameters. We found a good correlation, statistically significant between TSF and serum proteins (r = 0.41; p = 0.02). Both MUAC and TSF positively correlated with IGF-1 (r = 0.39; p = 0.04 , respectively r = 0.44; p = 0.02). We didn't find a correlation between other anthropometric parameters (weight, height and BMI) and biochemical parameters.

In our study, we can say that the arms anthropometry in conjunction with total serum proteins and IGF-1 well characterized nutritional status.

Discussions

Our study showed that over half of children with cancer (51.85%) showed severe malnutrition at diagnosis and only 18.53% had normal nutritional status.

Our results confirmed similar studies that in children with cancer arm anthropometry is a more sensitive measurement of malnutrition [7, 8]. If we measure weight and height , the proportion of malnourished children is low (7.4%), but if we measure MUAC and TSF, the percentage is higher. Therefore, we can say that these parameters reflect more accurately the nutritional status of cancer than just measuring weight and height. Furthermore, these anthropometric parameters are correlated with biochemical parameters; in our study total serum proteins and IGF-1 reflects very good nutritional status.

Insulin-like growth factor I (IGF-I) (Somatomedin C) is a polypeptide hormone; it is predominantly synthesized in liver ,but also in other tissues under the influence of growth hormone (hGH). Protein-energy malnutrition cause low levels of IGF-1, in the presence of normal concentrations of circulating growth hormone [9]. In our study, children had decreased IGF-1 in 66.66% of cases and it was positively correlated with both MUAC and TSF. Brennan et al. assessed in 38 children with malignant disease the serum levels of IGF-1 and found a low concentration of malnourished children and more than that IGF-1 correlated with arm anthropometry but didn't correlate with weight, height or BMI [10].

Conclusions

1. The prevalence of malnutrition in children with cancer is high; 51.85% of patients were severely malnourished at diagnosis and 29.62% had risk of malnourished.
2. In our study, arm anthropometry in conjunction with serum protein levels and IGF-1 most accurately characterizing the nutritional status.

References

3. Sala A, Pencharz P, Barr RD – Children, cancer and nutrition – a dynamic triangle in review. Cancer 2004; 100(4): 677-687.
4. Viana MB, Murao M, Ramos G et al. – Malnutrition as a prognostic factor in lymphoblastic leukemia: a multivariante analysis; Arch Dis Child 1994; 71: 304-310

5. Lange BJ, Gerbing RB, Feusner J et al. – Mortality in Overweight and Underweight Children with Acute Myeloid Leukemia; JAMA, 2005, 293:203-211
6. Duggan C, Watkins JB, Walker WA – Nutrition in pediatrics 4, Fourth Edition , BC Decker Inc Hamilton, 2008, 610-611
7. Enberg HKG, Ritzen M et al. – Somatomedin A levels in serum from healthy children and from children with growth hormone deficiency or delayed puberty. Acta Endocrinology 1980; 94:155-65
8. Steliarova-Foucher E, Stiller C, Lacour B et al. – International classification of childhood cancer, Third edition. Cancer 2005, 103:1457-1467
9. Garofolo A, Lopez FA, Petrilli AS – High prevalence of malnutrition among patients with solid non-hematological tumors found by using skinfold and circumference measurements. Sao Paulo Medical Journal, 2005; 123 (6): 277-281
10. Tolar MT et al. – Nutritional Assessment of children with cancer. Journal of Pediatric Oncology Nursing, July-August 2009, 26(4):186-197
11. Houston S, Holly J, Feldman E – IGF and Nutrition In Health and Disease, Humana Press, 2005, Totowa, New Jersey, 25-41
12. Brennan B, Gill M, Pennells L et al. – Insulin-like growth factor I, IGF binding protein 3, and IGFBP protease activity: relation to anthropometric indices in solid tumours or leukaemia, Arch Dis Child, 1999, 80: 226-230