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Nutritional Status at Diagnosis of Children with Malignancies in Casablanca

Illias Tazi, MD¹, Zakia Hidane, MD¹, Saadia Zafad, MD, PhD¹, Mhamed Harif, MD, PhD¹, Said Benchekroun, MD, PhD¹, and Raul Ribeiro, MD, PhD²

¹Hematology and Pediatric Oncology Department, Hopital, 20 Aout 1953, Casablanca Morocco

²Department of Oncology, and International Outreach Program St Jude Children's Research Hospital, Memphis, Tennessee, USA

Abstract

Introduction—Nutritional assessment is an essential component of the initial assessment of children with cancer. Malnutrition may be present at diagnosis due to the effects of the malignancy or, in low income countries (LIC), due to poverty and an inadequate diet.

Purpose—The aim of this study is to evaluate the prevalence of malnutrition at diagnosis in children with cancer in Morocco.

Procedure—Nutritional status of 100 children aged less than 18 years with newly diagnosed malignancy between January 2005 and January 2006 was evaluated by anthropometric and biochemical parameters before initiating therapy. We measured weight, height, weight-for-height using z-scores index for children and body mass index for adolescents, triceps skinfold thickness and mid-upper arm circumference, and serum albumin.

Results—A total of 100 patients were included. The mean age was 7 years (range 1 to 18 years). Sixty percent were boys. The diagnosis was: Burkitt lymphoma (n=19), acute myeloblastic leukaemia (n=18), acute lymphoblastic leukaemia (n=14), rhabdomyosarcoma (n=13), Ewing sarcoma (n=7), nephroblastoma (n=6), Hodgkin disease (n=5), osteosarcoma (n=5), retinoblastoma (n=4), neuroblastoma (n=3), germ cell tumor (n=3), orbital lymphoma (n=1), cerebral lymphoma (n=1), ependymoma (n=1). Incidence of malnutrition ranged from 20–50%, depending upon the measurement used.

Conclusion—The prevalence of malnutrition in this study was high, so interventions are being implemented to improve the nutritional status of these patients.

Keywords

cancer; nutritional status; nutritional assessment; anthropometry

Introduction

Malnutrition is a major problem in children with cancer. The reported incidence varies from 6% to 50%, depending upon the nature of the malignancy, the size, location and stage of the disease, the population being evaluated and the means used to evaluate malnutrition [1,2,3,4]. Malnutrition is closely related to late stage of malignancy and is a poor prognostic sign. In fact, it is a frequent cause of death in children with cancer. Compared with adults, children are at a greater risk for nutritional depletion since they have a more rapid metabolic rate and greater caloric needs for growth and development [5]. Malnutrition in children with cancer has been considered part of the symptom complex of progressive and active cancer. Only recently has it been recognized as an isolated problem, quite apart from cancer, which must be identified and managed like other complications, such as infection and cytopenias.

Various factors have been involved in the origin and progression of malnutrition in children with cancer [6]. Malnutrition is one of the main problems in children with cancer and has been seen in some studies to adversely affect the tolerance to chemotherapy, performance status, immune status, disease free duration and survival [1,7].

Nutritional assessment is an essential component of the history and physical examination of children with cancer. Protein-energy malnutrition frequently complicates the clinical course of malignant disease in childhood.

Nutritional status is an important factor in treatment response and chemotherapy tolerance. Thus, the present study was carried out with the objective of evaluating the prevalence of malnutrition at diagnosis in children newly diagnosed with cancer presenting in a pediatric oncology ward in Casablanca, Morocco.

Patients and Methods

Patients

Between January 2005 and January 2006, a comprehensive nutritional assessment was performed on 100 new paediatric cancer patients at the Department of Haematology and Paediatric Oncology in Casablanca. Children with a diagnosis of malignant disease who were less than 18 years of age were included. The study sample has been chosen of consecutive patients independently of their age, sex and disease. The initial assessment of nutritional status was done by the same person in order to avoid measurement bias. Patients with associated disease that could be affected by nutritional status (i.e cardiopathy, nephropathy and gastrointestinal diseases) and patients at relapse were excluded.

Nutritional assessment

Children with newly diagnosed malignancy were evaluated by anthropometric and biochemical parameters before initiating therapy. The weight for age (WFA) and height for age (HFA) values were compared with the NCHS (National Center for Health Statistics) standards for that age and sex [8]. The weight for height (WFH) z-score was classified in accordance with the World Health Organization (WHO) 1999 criteria for malnutrition in children [9], and the body mass index (BMI) percentiles in accordance with the WHO 1995

criteria for malnutrition in adolescents [10]. Triceps skinfold thickness (TSFT), mid-upper arm circumference (MUAC) and arm muscle circumference (AMC) were measured at the same time.

TSFT was determined by grasping the skin and adjacent subcutaneous tissue between the thumb and forefinger, shaking it gently to exclude underlying muscle, and pulling it away from the body just far enough to allow the jaws of the caliper (Harpender) to impinge on the skin. Duplicate readings were made at this site to improve the accuracy and reproducibility of the measurements. MUAC was determined at the midpoint between the acromion and olecranon. From these two measurements, AMC was calculated as follows: $AMC = MUAC - (TSFT \times 0.314)$. These variables were interpreted in accordance with the Frisancho (1993) percentiles charts [11] and their percentages of adequacy were demonstrated, which were obtained as follows: $\text{Percentage adequacy} = (\text{Observed value} / \text{Ideal value}) \times 100$. Serum albumin was measured by a standard dye binding technique with bromo-cresol green. A child is considered to have first, second or third degree malnutrition if serum albumin is less than 33mg/dl, 27mg/dl or 21mg/dl respectively [12].

Definition of nutritional status [7]

Adequately Nourished (A), all these criteria must be fulfilled. Ideal body weight (IBW) 90th percentile; albumin >3.5 g/dl; weight loss <5%; TSFT and MUAC both above the 10th percentile; **Inadequately nourished; Depleted (D), at least one of these criteria must be fulfilled.** IBW 60–90th percentiles; albumin 3.2–3.5 g/dl; weight loss 5–10%; TSFT and MUAC between the 5–10th percentile or (TSFT <5th percentile and MUAC >10th percentile) or (MUAC <5th percentile and TSFT >10th percentile); **Severely Depleted (S), at least one of these criteria must be fulfilled.** IBW <60th percentile; albumin <3.2 g/dl; weight loss >10%; TSFT and MUAC less than 5th percentile.

Results

One hundred paediatric patients with newly diagnosed cancer had a complete nutritional evaluation prior to the therapy. Distribution and numbers of each tumour type are given in Table I. There were 58 haematological malignancies, 38 solid tumors and 4 CNS tumors. Sixty percent were male and the mean age was 7 years (range 1 to 18 years).

A high prevalence of malnutrition was found by anthropometric criteria (Table II). Malnutrition was seen in 37% of children by weight for age (WFA <2z) and in 20% of children by height for age (HFA <2z). The analysis showed higher percentages of deficits using TSFT (50%) and MUAC (39%) than when using W/H z-scores or BMI (33%). The overall prevalence of malnutrition by conventional measurements parameters was found to be lower as compared to arm anthropometry. Patients with solid tumors and CNS tumors presented greater deficits than did those with hematological malignant diseases.

According to serum albumin level we found 28 cases of malnutrition (3 cases of severe malnutrition, 8 cases of moderate malnutrition and 17 cases of mild malnutrition). Prevalence of malnutrition by biochemical parameters was observed to be higher in children with hematological malignancies as compared to non hematological malignancies.

Biochemical parameters detected a much lower prevalence of malnutrition as compared to anthropometric parameters.

Discussion

Malnutrition is a significant pediatric health problem in developing countries. Few studies on the nutritional state of children have been performed in Morocco. A national survey was completed in 1997, included 3750 children younger than 5 years and used anthropometric parameters recommended by the WHO. A prevalence of malnutrition in normal child of 24,1% was shown [13].

Malnutrition in patients with cancer is related to factors associated with the treatment and with the disease itself and sometimes economic and social conditions. Food intake, energy expenditure and nutrient absorption and metabolism, as well as complications such as oral and gastrointestinal toxicity and nephrotoxicity caused by drugs used to treat neoplasias and infections, play an important role in the etiology of malnutrition in cancer [14]. The acceptance of foods is influenced by emotional and psychological factors, in addition to those associated with the treatment and the disease itself [15]. Metabolic disturbance is another problem among cancer patients, and this is often represented by catabolic status. It has been shown that the weight losses that occur in cachexia lead to reductions in lean body tissue [16,17]. Among children and adolescents, the treatment itself, and particularly chemotherapy and radiotherapy, seems to be an important nutritional risk factor. Their treatment is associated with nausea and vomiting, oral mucositis, constipation, xerostomia, dysgeusia and food aversion, and it thus plays an important role in decreased food intake, nutrient loss, energy expenditure alterations and weight loss, particularly lean body mass [18]. These conditions predispose such patients towards malnutrition, especially when there are frequent periods of chemotherapy treatment [19]. Although the association of malnutrition with malignancy has been well known, it has not been generally recognized that the nutritional status of a child with malignancy has a bearing on the treatment and survival.

In the present study, the prevalence of malnutrition at the time of diagnosis in children with malignancies was studied using anthropometric, hematological and biochemical parameters. The overall prevalence of malnutrition was found to be high in the present study. VanEys [20] found a 28.2% prevalence of malnutrition by weight for height at the time of diagnosis of cancer in children. Smith [21] in a similar study found that HFA and WFA were unaffected, but 20% of patients were malnourished by MUAC and 23% by TSFT. In another study WFH was unaffected but 27% patients were mal-nourished by MUAC and TSFT [22]. Delbecque-Boussard et al. [23] in a French longitudinal study about nutritional status of children with ALL found a prevalence of 21.2% by WFA and 17.4% by HFA.

Mukhopadhyay et al. [24] in a retrospective study of ALL patients, found a prevalence of 16.9% by WFA and 10.3% by HFA. In a similar study of ALL patients [25], the prevalence of malnutrition at the time of diagnosis was found to be 52% by WFA which rose to 88% when arm anthropometric parameters were also evaluated.

The present study revealed that arm anthropometry detected a higher prevalence of malnutrition in all type of malignancies than the conventional weight and height based parameters. Similar findings have been reported in other studies [21,22,25]. This can be explained by the fact that the presence of a large tumor mass, ascites or edema can mask the effect of nutritional depletion on body weight and secondly, when faced with nutritional restrictions, the body first utilizes its nutritional reserves stored in the form of skeletal muscle protein and fat reflected by an early decline in MUAC and TSFT values [21]. In this study we observe also a higher prevalence of malnutrition using a BMI in children with hematological malignancies as compared to non hematological malignancies. The same conclusion was observed using albumin value probably due to the nature of the disease. The prevalence of malnutrition according to MUAC, AMC and TSFT value in children with solid tumors is higher than children with hematological malignancies. The analysis showed higher percentages of deficits using TSFT (50%) and MUAC (39%) than when using W/H z-scores or BMI (33%). The overall prevalence of malnutrition by conventional measurements parameters was found to be lower as compared to arm anthropometry. Patients with solid tumors and CNS tumors presented greater deficits than did those with hematological malignant diseases. Therefore, catabolism of lean body mass is a common effect of the disease, thereby making the evaluation of body composition an essential part of the assessment of such patients. Furthermore, children and adolescents with cancer present problems with their weight measurements because of tumor size, amputation and sometimes edema. Thus, measurement of body composition is an important procedure in evaluating patients in several situations, especially with regard to catabolic diseases [26].

Dual energy x-ray absorptiometry or metabolic studies using radioisotopes is the gold standard for measurement of body composition in clinical practice and should not be dismissed. The prevalence of malnutrition by biochemical parameters was seen to be much lower in comparison to that detected by anthropometry. Similar observations were made by other authors as well [1,20,22,27]. Elhasid et al. evaluated biochemical indices rather than anthropometric indices among 50 children with solid tumors [28].

The prevalence of malnutrition at diagnosis in children with cancer in Casablanca is high compared to other studies [1,2,21,22]. Incidence of malnutrition ranged from 20–50%, depending upon the measurement used. This study may reflect conditions common to other developing countries. Programs to evaluate and treat malnutrition should be put in place to minimize cancer-associated morbidity and enhance quality of life.

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Table I

Diagnoses of 100 children and adolescents with cancer studied in Casablanca

Diagnosis	N=	Male	Female
Hematological malignancies	58	34	24
Burkitt lymphoma	19	11	8
Acute myeloblastic leukemia	18	12	6
Acute lymphoid leukaemia	14	6	8
Hodgkin disease	5	3	2
Orbital lymphoma	1	1	–
Cerebral lymphoma	1	1	–
Solid tumors	38	24	14
Rhabdomyosarcoma	13	9	4
Ewing sarcoma	7	5	2
Nephroblastoma	6	3	3
Osteosarcoma	5	3	2
Retinoblastoma	4	2	2
Neuroblastoma	3	2	1
CNS tumors	4	3	1
Germinal tumors	3	2	1
Ependymoma	1	1	–
Total	100	60	40

Table II

Prevalence of malnutrition by anthropometric and biochemical criteria

Malignancy	Number of patients	WFA <-2z N(%)	HFA <-2z N(%)	z-score/BMI <-2z N(%)	TSFT <5 th P N(%)	MUAC <5 th P N(%)	AMC <5 th P N(%)	Albumin <33mg/dl N(%)
Hematological malignancies	58	23	12	21	27	19	22	17
		39.6%	20.7%	36.2%	46.5%	32.7%	37.9%	29.3%
Solid tumors	38	12	7	11	20	17	17	10
		31.5%	18.4%	28.9%	52.6%	44%	44%	26.3%
SNC tumors	4	2	1	1	3	3	3	1
		50%	25%	25%	75%	75%	75%	25%
Total	100	37	20	33	50	39	42	28
		37%	20%	33%	50%	39%	42%	28%

WFA (weight for age) – HFA (height for age) – BMI (body mass index) – TSFT (triceps skinfold thickness) – MUAC (mid-upper arm circumference) – AMC (arm muscle circumference)