Children with brain tumors: a study of nutritional status on hospital admission

Crianças com tumores cerebrais: um estudo do estado nutricional na admissão hospitalar

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Abstract

Objective: to assess the nutritional status of children with brain tumors on hospital admission and to verify whether the nutritional status varies according to the type of tumor. **Methods**: anthropometric data of 30 children between 2 and 10 years old, of both sexes, with brain tumors and admitted to a hospital in the city of São Paulo, Brazil, were evaluated. Secondary data collection allowed to assess and classify the Z-scores of the body mass index, percentage of adequacy of the triceptal skinfold and the arm muscle circumference, carried out between the years 2004 and 2011. **Results**: the frequencies of brain tumors were: 33.3% astrocytic, 40% embryonal, 10% of the seal region and 16.6% ependimals. The median age and body mass index Z scores were 5.5 years (4.0 and 7.0) and 0.66 SD (- 1.41 and 0.87), respectively. The median percentage of adequacy of arm muscle circumference was 98% (88.9 and 103.2) and the triceptal skinfold was 83.2% (57.0 and 106.6). As for nutritional status, 21 (70%) of the children were eutrophic; 7 (23.3%) overweight and 2 (6.7%) with malnutrition/wasting showing no significant difference between groups of brain tumors (p = 0.721). The percentages of adequacy of the triceptal skinfold and of the arm muscle circumference also showed no significant difference between the different types of brain tumors (p = 0.865 and p = 0.860, respectively). **Conclusion**: at the time of hospital admission, the children were in good nutritional status, regardless of the type of brain tumor.

Keywords: Brain tumors. Pediatrics. Nutritional status.

Resumo

Objetivo: avaliar o estado nutricional de crianças com tumores cerebrais na admissão hospitalar e verificar se o estado nutricional varia de acordo com o tipo de tumor. **Métodos**: avaliou-se os dados antropométricos de 30 crianças entre 2 e 10 anos, de ambos os sexos, com tumores cerebrais e admitidas em um hospital na cidade de São Paulo, Brasil. A coleta secundária de dados permitiu avaliar e classificar os escores Z do índice de massa corporal, percentual de adequação da dobra cutânea triceptal e da circunferência muscular do braço, realizados entre os anos de 2004 e 2011. **Resultados**: as frequências dos tumores cerebrais foram: 33,3% astrocíticos, 40% embrionários, 10% da região selar e 16,6% ependimais. As medianas de idade e dos escores Z do índice de massa corporal

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foram, respectivamente, 5,5 anos (4,0 e 7,0) e 0,66 DP (- 1,41 e 0,87). A mediana do percentual de adequaçâo da circunferêncoa muscular do braço foi de 98% (88,9 e 103,2) e da dobra cutânea triceptal foi 83,2% (57,0 e 106,6). Quanto ao estado nutricional, 21 (70%) das crianças apresentaram-se eutróficas; 7 (23,3%) com excesso de peso e 2 (6,7%) com desnutrição/magreza, não mostrando diferença significante entre os grupos de tumores cerebrais (p=0,721). Os percentuais de adequação da dobra cutânea triceptal e da circunferência muscular do braço também não mostraram diferença significante entre os diferentes tipos de tumores cerebrais (p=0,865 e p=0,860, respectivamente). **Conclusão**: no momento da admissão hospitalar as crianças se encontravam em bom estado nutricional, independentemente do tipo de tumor cerebral.

Palavras-chave: Tumores cerebrais. Pediatria. Estado nutricional.

Introduction

Cancer is the name given to a set of more than 100 different types of diseases that have in common the disorderly and malignant growth of cells that invade tissues and can manifest themselves as metastases in other regions of the body.[1-2]

The etiology of many tumors in the adult population is well described in the literature,[3-4] however, most pediatric tumors are still classified as idiopathic due to the lack of their etiology. Considered to be a rare disease, pediatric cancer, also known as childhood and juvenile cancer (one that affects children and adolescents between 0 and 19 years old), corresponds to 1% and 3% of all malignant tumors in most populations, with brain tumors are the most common solid tumors in pediatrics.[1] As it is a multifactorial disease, its treatment is complex and involves several aspects.

Antineoplastic treatment consists of performing, together or separately, modalities such as radiation, chemotherapy and resection surgery. The combination of these modalities is performed according to the diagnosis and stage of the disease.[2,5-6] These therapies often cause damage to the quality of life[7] and, consequently, to the child's nutritional status. In the case of pediatric patients, this damage can be even more impacting.[7-8] Thus, nutritional therapy is essential to ensure that nutritional needs are met and to prevent protein energy malnutrition during antineoplastic treatment in pediatrics.[4,9-12] Malnutrition promotes increased hospitalization costs, reduced immune function, worsened quality of life indicators, decreased drug metabolism and, consequently, worsened overall prognosis.[7,13]

In addition to all the aspects mentioned, it is important to highlight that there is a lack of data in the literature about the etiological factors, as well as the consequences of malnutrition during the antineoplastic treatment of the different brain tumors.[14] The better the pediatric patient's nutritional status is at the start of treatment, the better the prognosis and the quicker they will be admitted to the hospital. Thus, in view of this panorama, the present study aimed to assess the nutritional status of children with brain tumors on admission to a reference hospital for the treatment of cancer in children and adolescents in the city of São Paulo, Brazil, in addition to verify whether the nutritional status varies according to the type of tumor. The study was approved by the Research Ethics Committee of the Universidade Federal de São Paulo, nº CAAE: 42442114.4.0000.5505.

Methods

This is an observational and cross-sectional study with anthropometric data of 30 children aged between 2 and 10 years, of both genders and with brain tumors, seen at the Clinical Nutrition outpatient clinic of a cancer reference hospital children and adolescents, in the city of São Paulo, state of São Paulo, Brazil, in the period between the years 2004 and 2010.

Through secondary data collection in the records of the Clinical Nutrition outpatient clinic, anthropometric measurements[15-16] were taken of the children. Weight and length/height were assessed based on weight/age Z scores; height/age and weight/height, with the aid of the computer

program Anthro version 3.2.2 for children up to 5 years old, and Anthro Plus for children aged 5 years and 1 day up to 10 years.[17] To classify the nutritional status the Z scores of the body mass index (BMI Z) were used according to the World Health Organization (WHO).[18]

The triceptal skinfold thickness and the arm muscle circumference were interpreted according to the percentage of adequacy in relation to the values found in percentiles 5, 25, 50, 75 and 95.[16] When the percentage of adequacy of TST and AMC were below 70%, the nutritional status was classified as severe malnutrition; between 70 and 80% moderate malnutrition; between 80 and 90% mild malnutrition; above 90 to 110% normal weight, between 110 and 120% overweight and, above 120% fitness, obesity.[19]

Descriptive statistics was based on absolute / relative and median frequency (p25 and p75). Anova was used to verify the variation of anthropometric indicators according to the type of tumor. Sigma Stat software was used and the level of rejection of the null hypothesis was fixed at ≤ 0.05 or 5%.

Results

Age varied between 2 and 10 years, with a median of 5.5 years (4.0 and 7.0). As for genders 56.6% (17) were male and 43.3% (13) female (Table 1).

Table 1 - Median (p25 and p75) of age, absolute and relative frequency of the genders of children with brain tumors on hospital admission.

	Admission (N = 30)
Age (years)	5.5
	(4.0 7.0)
Male	17 (56.6%)
Female	13 (43.3%)

Source: Authors

The frequencies of brain tumors showed that 10 children were carriers of astrocytic tumors (AT), 12 of embryonal tumors (EMT), 3 of tumors of the seal region (SRT) and, 5 of ependymal tumors (EPT), as highlighted in Table 2.

Table 2 - Absolute and relative frequency of children's with brain tumors on hospital admission.

	Admission (N = 30)
Astrocytic tumors	10 (33.3%)
Embryonal tumors	12 (40%)
Seal region tumors	3 (10%)
Ependymal tumors	5 (16.6%)

Source: Authors

The median of the BMI Z scores of all children at admission was - 0.66 (-1.41 and 0.87), while the percentage of adequacy of the triceptal skinfold thickness was 83.2% (57.0 and 106.6). As for the arm muscle circumference, the median percentage of adequacy was 98.0% (88.9 and 103.2) as shown in Table 3.

Table 3 - Medians (p25 and p75) of the BMI Z scores, the percentage of adequacy of the triceptal skinfold thickness and the arm muscle circumference of the children with brain tumors on hospital admission.

	Admission (N = 30)
BMI Z scores (SD)	- 0.66 (- 1.41 0.87)
% Triceps skinfold thickness adequacy	83.2 (57.0 106.6)
% Arm muscle circumference adequacy	98.0 (88.9 103.2)

Source: Authors

Table 4 shows the absolute and relative frequency of classification of children's nutritional status in relation to BMI. At the time of hospital admission, 21 (70%) of them were eutrophic; 7 (23.3%) were overweight and 2 (6.7%) were malnourished/wasting.

Table 4 - Absolute and relative frequency of eutrophy, malnutrition/underweight and overweight of children with admission brain tumors on hospital.

	Admission (N = 30)
Malnutrition/underweigth	2 (6.7%)
Eutrophy	21 (70%)
Overweight	7 (23.3%)

Source: Authors

The statistical analysis of the variation of the BMI Z scores and the percentages of adequacy of the triceptal skinfold and of the muscular circumference of the arm according to the types of brain tumors is presented in Table 5. Anova did not show statistically significant differences in the nutritional status according to the types of tumors, respectively $p = 0.721$; $p = 0.865$ and $p = 0.860$.

Table 5 - BMI Z scores and the percentages of adequacy of the triceptal skinfold and arm muscle circumference according to the types of brain tumors on hospital admission.

	Astrocytic tumors	Embryonic tumors	Seal region tumors	Ependymal tumors	p
BMI Z scores (SD)	-0.95 (-1.41 1.47)	-0.14 (-1.89 0.12)	-0.16 (-0.35 1.72)	-1.06 (-1.45 0.27)	0,721*
% Triceps skinfold thickness adequacy	82.2±38.9	80.1±18.9	96.2±23.9	83.6±30.1	0.865#
% Arm muscle circumference adequacy	99.8±19.3	96.6±12.3	97.6±8.1	92.7±14.5	0.860#

*Kruskal-Wallis. #One Way Analysis of Variance.
Source: Authors

Discussion

Anthropometric data allowed an overview of the children's nutritional status at the time of admission, as well as a previous analysis of the nutritional prognosis. Thus, this study highlights positive aspects of great relevance, as it contributes to the establishment of nutritional conducts appropriate to the type of tumor, in addition to warning that the presence of malnutrition or even overweight, in the initial moments of treatment, may interfere with the course of treatment, increasing hospitalization costs, decreasing immune function, interfering with the metabolization of drugs and negatively impacting quality of life indicators.[7,13]

Emphasis should also be given to the age of the children, which was important in the constitution of the study population, allowing the anthropometric variables of both genders to be assessed together, thus reducing the possibility of interference by puberty factors. However, the determination of the presence of brain tumors probably contributed to the small sample size of the studied population.

Still there are few studies that evaluated the nutritional status of children with cancer, and the literature highlights malnutrition as an important factor in the poor prognosis of the disease, increasing the risk of morbidity and mortality and negatively impacting the course of treatment.[20-23] A study carried out in Morocco showed a 33% prevalence of malnutrition in children and adolescents with solid tumors and hematological neoplasms 30. Brinksma et al.[24] and Tazi et al.[25] also found malnutrition in children and adolescents with cancer, however, the prevalence was around 10%. However, these results are different from those found in our study, considering that the presence of malnutrition / thinness showed a prevalence of less than 10%. However, it is important to note that in these studies the study population included children and adolescents with different types of neoplasms and, our sample included exclusively children with tumors of the central nervous system. It is possible to suggest that this aspect may justify the lower prevalence of malnutrition found by us when compared to other studies.

Regarding solid tumors Garófolo et al.[26] evaluated 44 children and found a 27% prevalence of malnutrition during the first month of treatment. In this study, the evaluated population also had brain tumor as well as our sample, however, the period of time elapsed from the moment of admission to treatment and the moment of nutritional assessment, as well as, the side effects of treatment may have negatively impacted the evolution of the nutritional status of that study population. Our study population was assessed using anthropometric parameters on hospital admission, when it was not yet under the antioneoplastic treatment protocol.

Another not less important aspect refers to the methodology used to measure anthropometric parameters, which is highlighted in the literature.[23,24-28] Some studies have used triceptal skinfold thickness, arm muscle circumference and body mass index (BMI) to assess the nutritional status of pediatric cancer patients, the latter being widely used. However, skin folds are more sensitive in detecting changes in body composition.[24,27,29] In this context, our results revealed that the triceptal skinfold thickness of children with brain tumors aged 2 to 10 years, showed a homogeneous percentage of adequacy, however, already indicating depletion of body fat stores.

Just as the thickness of the triceptal skinfold can reflect the composition of body fat, the arm muscle circumference reflects lean mass or the conditions of muscle mass. Our results on the percentage of adequacy of the arm muscle circumference showed medians compatible with the eutrophic standard, however, the values referring to the 25th percentile of the arm muscle circumference of the children, showed a reduction in muscle mass. However, the results of the analysis test of the variance of the BMI Z scores and the percentages of adequacy of the triceptal skinfold and arm muscle circumference, did not show any difference in relation to the type of brain tumor. This is possibly a limitation of our study, given the sample size.

Even so, our study showed results from a population that is usually quite adherent to the treatment as a whole, which could, among other factors, provide better maintenance of nutritional status. This aspect can also justify the presence of excess weight in almost ¼ of the evaluated population.

Thus, it can be concluded that according to the anthropometric parameters evaluated according to the types of brain tumors, at the time of hospital admission, children have good nutritional status, however, there is a need to monitor muscle and fat reserves in order to avoid malnutrition.

Conflict of interest

No conflict of interest.

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