Aspects of the management of children with cancer in Malawi
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Chapter 3

Nutritional status at admission of children with cancer in Malawi

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Abstract

**Background:** Malnutrition at diagnosis is found in 10% - 50% of children with cancer in industrialized countries. In developing countries a large proportion of the normal paediatric population is undernourished and children with cancer often present late with advanced disease. Therefore it would be expected that many children with cancer are malnourished at admission. Malnutrition is associated with more severe chemotherapy toxicity and infectious complications.

**Methods:** All new paediatric oncology patients admitted in the Queen Elizabeth Central Hospital, Blantyre, Malawi between January 1st 2007 – January 1st 2008 were included. We documented age, clinical diagnosis, HIV status, weight, height, mid-upper-arm-circumference (MUAC) and triceps skinfold (TSF), and calculated arm muscle area (AMA). Nutritional data were compared with the 1978 NCHS growth curves.

**Results:** Of 128 children, 70 (55.1%) had an AMA for age < 5th percentile and 76 (59.3%) had a TSF and MUAC below the 5th percentile, both parameters indicating acute malnutrition. Fifty seven patients (44.5%) had a height for age < -2 SD (indicative of stunting), and 22 patients (17.2%) had a weight for height < -2 SD.

**Conclusion:** Arm anthropometry shows that more than half of Malawian children with cancer are severely acutely malnourished at diagnosis. Weight for height, in children with large tumor masses, is less sensitive than arm anthropometry in detecting acute malnutrition. Forty five percent of paediatric oncology patients in Malawi are stunted, making interpretation of weight for age very difficult.
Introduction

Malnutrition at diagnosis in paediatric cancer patients is related to the type of tumour and the extent of disease. In industrialized countries it ranges from < 10% in standard risk acute lymphoblastic leukaemia (ALL) to 50% in advanced neuroblastoma.(1;2) It is also common in children with solid intra-abdominal tumours such as Wilms stage II – IV and in Ewing sarcoma.(3) In Malawi, of all children < 5 years of age, 45% are stunted (height for age < -2 SD), 22% are underweight (weight for age < -2 SD) and 5% are wasted (weight for height < -2 SD).(4) Therefore, one would expect many children with cancer in Malawi to be malnourished at diagnosis. This is especially likely in those with solid intra abdominal masses and those who present late with advanced disease.

There are few data on the nutritional status of paediatric oncology patients at admission in developing countries.(1) Wessels et al in a retrospective study described 59 children with Wilms tumour treated in Tijgerberg Hospital, South Africa between 1983 and 1986.(5) Weight for age (WFA) below the third centile or weight for height (WFH) less than 90% of the expected value was defined as malnutrition. By these criteria 21 (of 59; 35%) were poorly nourished at diagnosis.(5) However, this figure may have underestimated the true incidence of malnutrition, as the weight of large tumours may have masked reduction of body weight. On the other hand, children may have been stunted, with low weights for age.

Figure 1. Acutely malnourished patient with abdominal Burkitt lymphoma.
Recently Sala et al published the results of a study on nutritional status at diagnosis in children with cancer in Guatemala.\(^{(6)}\) They defined severe malnutrition as MUAC and TSF < 5\(^{th}\) percentile and depleted as TSF and MUAC between the 5\(^{th}\) and 10\(^{th}\) percentile. They found 57\% of the patients to have some degree of malnutrition at diagnosis and 9\% of the patients to be severely malnourished.

There are different ways of evaluating nutritional status. Weight for height is potentially misleading in children with large abdominal tumours that weigh more than 10\% of their total body weight.\(^{(1)}\) (Figure 1) Arm anthropometry is valuable in these children because it is independent of tumour mass.\(^{(7)}\) The most essential information in evaluating nutritional status is the lean body mass. In this respect measuring mid upper arm circumference (MUAC) and triceps skin fold (TSF) are also useful and when determining the arm muscle area (AMA) both these parameters are used. The lean body mass is deduced by measuring the mid upper arm circumference (i.e. muscle + fat) and triceps skin fold (i.e. fat only).\(^{(8)}\)

The intuitive relationship between poor nutritional status and a poor prospect for survival in children with cancer has been confirmed in most studies, but not in all.\(^{(1;9)}\) Altered pharmacokinetics, more severe toxicity (neutropenia) and delay of chemotherapy have been reported in children with malnutrition.\(^{(10)}\) The interrelation of malnutrition, diminished immunity and increased risk of infection is well established.\(^{(1)}\) This is of great importance in developing countries where the intensity of chemotherapy given is often limited by the level of supportive care.

**Patients and methods**

Between January 1\(^{st}\) 2007 – January 1\(^{st}\) 2008 we assessed the nutritional status of all newly admitted paediatric oncology patients aged 1-16 years admitted to the Queen Elizabeth Central Hospital in Blantyre, Malawi. Patients with AIDS related Kaposi sarcoma and with retinoblastoma were excluded as, in our setting, these patients are usually seen and/or operated on by other specialists before referral to our team. Edematous (and obese) children were also excluded. Obesity was defined as a TSF > 90\(^{th}\) percentile.

At admission we documented age, clinical diagnosis, weight, height, mid-upper-arm-circumference (MUAC) and triceps skinfold (TSF). An ELISA antibody test (Determine™ HIV-1/2/VIH-1/2, Abbott Laboratories Japan) was done to determine HIV status. In some, but not all, patients clinical diagnosis was confirmed by cytology (fine needle aspirate). Weight was recorded (to the nearest 0.1 kg) on weighing scales (Beurer typ PS 07) and calibrated against scales used in the nutritional unit (Tanita Model 1502). Children were weighed without shoes. Height
was recorded on a locally made length board to the nearest 0.1 cm. Skin folds and MUAC were measured twice and the average taken. Skin fold readings were made to the nearest 0.1 mm approximately 3 seconds after application of the caliper (Harpenden skinfold caliper). Mid upper arm circumference was measured midway between the acromion and olecranon of the left upper arm with the arm hanging relaxed and extended.

Arm muscle area (AMA) was extrapolated from the mid upper arm circumference and the triceps skinfold, using the following equation: 
\[ AMA = \frac{(MUAC - \pi TS)^2}{4\pi} \]

(MUAC in mm, TS is triceps skinfold in mm) Z-scores for height for age (HAZ), weight for age (WAZ) and weight for height (WHZ) were derived in reference to the 1978 NCHS growth curve.(11) Results for triceps skinfold and arm muscle area were compared to the same data set.(8) These results were expressed as percentile values in absence of a standard deviation for this abnormally distributed reference data set.

Results

Three children below the age of one year were excluded. Three very sick (and clinically wasted) children died before measurements could be taken. No children were excluded for edema or obesity. 128 children were included in the study of whom 70 (54.7%) boys. The average age was 7 years (range 1 – 16, S.D. 3 years and 9 months). The clinical diagnoses of the patients are presented in Table I. Burkitt lymphoma is the most common diagnosis. In almost all patients a fine needle aspirate

<table>
<thead>
<tr>
<th>Clinical diagnosis:</th>
<th>Number</th>
<th>% of total</th>
<th>FNA confirmed (Number)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burkitt lymphoma</td>
<td>82</td>
<td>64.0</td>
<td>52</td>
</tr>
<tr>
<td>Lymphoma (not BL)</td>
<td>10</td>
<td>9.4</td>
<td>2</td>
</tr>
<tr>
<td>Wilms Tumour</td>
<td>11</td>
<td>8.6</td>
<td>6</td>
</tr>
<tr>
<td>Neuroblastoma</td>
<td>6</td>
<td>4.7</td>
<td>0*</td>
</tr>
<tr>
<td>Rhabdomyosarcoma</td>
<td>4</td>
<td>3.1</td>
<td>2</td>
</tr>
<tr>
<td>Germ cell tumour</td>
<td>2</td>
<td>0.8</td>
<td>1</td>
</tr>
<tr>
<td>Hepatocellular carcinoma</td>
<td>3</td>
<td>2.3</td>
<td>1</td>
</tr>
<tr>
<td>Osteosarcoma</td>
<td>2</td>
<td>1.6</td>
<td>2</td>
</tr>
<tr>
<td>Leukaemia</td>
<td>1</td>
<td>0.8</td>
<td>0</td>
</tr>
<tr>
<td>Other (or unknown)</td>
<td>7</td>
<td>5.5</td>
<td>3</td>
</tr>
</tbody>
</table>

* Two fine needle aspirates (FNAs) showed small blue round cells.
aspirate (FNA) is performed at admission aiming to confirm the clinical diagnosis. Unfortunately the result is often inconclusive. Nine children (7.0%) tested positive for HIV and all others tested negative.

The data on nutritional status are presented in Table II. Fifty seven (44.5%) children were stunted with a Z score height for age < -2, 51 (39.8%) were underweight with a Z score weight for age < -2 and 22 (17.2%) had a weight for height Z-score < -2. Seventy (55.1%) of patients had an AMA for age below the 5 th percentile, 76 (59.3%) of patients had both MUAC and TSF below the 5 th percentile.

<table>
<thead>
<tr>
<th></th>
<th>Z – score &lt; -2</th>
<th>&lt; 5th Percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number (% of total)</td>
<td>Number (% of total)</td>
</tr>
<tr>
<td>Height for age</td>
<td>57 (44.5)</td>
<td></td>
</tr>
<tr>
<td>Weight for age</td>
<td>51 (39.8)</td>
<td></td>
</tr>
<tr>
<td>Weight for height</td>
<td>22 (17.2)</td>
<td></td>
</tr>
<tr>
<td>Arm muscle area / age</td>
<td></td>
<td>70 (55.1)</td>
</tr>
<tr>
<td>TSF and MUAC</td>
<td></td>
<td>76 (59.3)</td>
</tr>
<tr>
<td>TSF and MUAC &gt; 10th percentile</td>
<td></td>
<td>6 (4.7)</td>
</tr>
</tbody>
</table>

Discussion

The results of this study show that in Malawi more than half of the children with cancer are severely acutely malnourished at admission. It is striking to see that the children with cancer in Malawi are so much more severely malnourished at diagnosis than similar patients in Guatemala. We found 59.3% of patients severely malnourished and 95.3% of patients having some degree of malnutrition according to their criteria. Sala et al. found 9% severe malnutrition and 57% some degree of malnutrition.(6) This can probably be explained by the higher prevalence of malnutrition among the normal paediatric population in Malawi and the presentation with more advanced disease. It has been shown that the incidence of acute malnutrition is higher in patients presenting with advanced disease.(1;2) Patients in Malawi often present with bulky tumours and widespread disease after a long delay in arrival at hospital for various reasons.

The high rate of stunting (45%) reflects the prevalence of chronic malnutrition in Malawi and is the same as in the general paediatric population (45%).(13) It is not increased in this patient population probably because most patients (about 60%) have Burkitt lymphoma, a rapidly growing tumour with a usually short pre admission history.
Our results also confirm previous findings that in stunted children with large tumour masses, arm anthropometry is a sensitive measure of malnutrition. Weight is an inappropriate measure since many children have large abdominal masses masking loss of body weight. Weight for height detected malnutrition in only 17.2% of patients whereas arm anthropometry showed acute malnutrition in 55.1% (using AMA) and 59.3% (using TSF and MUAC).

There is no golden standard for the evaluation of malnutrition. Weight for height, TSF, AMA is all used. Usually malnutrition is defined as less than the 5th percentile or <-2 SD (which is equivalent to a Z-score -2) of an appropriate reference population.

We used the HANES growth curves which are data from white children in the United Stated of America collected between 1971 and 1974. The advantage of these data is that they are used commonly in paediatric oncology literature and allow for comparison of data. The growth data (height) of affluent Malawi children are similar to these growth curves. Standard deviations are not available for the AMA and TSF reference data. Nor can it be derived at since it is not a normal distribution. Therefore malnutrition was defined as a value < 5th percentile. In a normal distribution, the 5th percentile would correspond to a S.D. of -1.65.

One of the limitations of this study is selection bias, since some patients (Kaposi sarcoma, retinoblastoma) were excluded because we do not see them at the time of diagnosis. Patients with leukaemia, a common diagnosis in the West and in whom malnutrition is not common (10% in standard risk) are rarely diagnosed in our setting. The three patients who died appeared very malnourished. If their nutritional status could have been assessed before they died, the percentage of malnutrition in this study population would have been higher.

We found an HIV positivity rate of 7%. This is slightly higher than the rate of 5.8% which Sinfield et al found in a retrospective study in Blantyre in paediatric cancer patients in 1998 – 2003 after excluding the patients with Kaposi Sarcoma, who are almost all HIV positive. Only 67% of patients were tested in that study, probably creating a bias towards raising the rate. On the other hand, anti retroviral therapy (ART) has become available since then and cotrimoxazole has become more widely available, both prolonging the survival of these patients and thus possibly raising the HIV positivity rate in paediatric cancer patients in our setting. Of the patients who we found positive three were on cotrimoxazole prophylaxis and one was on ART.

Arm anthropometry shows that more than half of the Malawian children with cancer are severely acutely malnourished at admission. It may be necessary to reduce the intensity of treatment in these patients. Nutritional therapy in these patients is of importance. Forty five percent of paediatric oncology patients in Malawi are stunted. This makes interpretation of weight for age as an assessment of acute malnutrition difficult to interpret. Weight for height is less sensitive than
TSF and AMA in detecting acute malnutrition, because large abdominal tumours mask body weight loss.

Reference List


(4) Unicef. The state of the world’s children. 2006.


(13) Unicef. The state of the world’s children. 2006.