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Outcome of severely malnourished children treated according to UNICEF 2004 guidelines: a one-year experience in a zone hospital in rural Ethiopia

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Summary Malnutrition still has a dramatic impact on childhood mortality in sub-Saharan African countries. Very few studies have tried to evaluate the outcome of severely malnourished children treated according to the UNICEF 2004 guidelines and reported fatality rates are still very high. During 2006, 1635 children were admitted to the paediatric ward of St. Luke Catholic Hospital in Wolisso, South West Shewa, Ethiopia. Four hundred and ninety-three (30.15%) were severely malnourished and were enrolled in the study. We reviewed the registration books and inpatient charts to analyze their outcome. A mortality rate of 7.1% was found, which is significantly lower than reported in the literature. 28.6% of deaths occurred within 48 h of admission; the recovery rate was 88.4%; the drop-out rate was 4.5%. Early deaths were due to the poor condition of the children on admission, leading to failure of treatment. Late mortality was considered to be related to electrolyte imbalances, which we were unable to measure. The clinical skills of nursing and medical staff were considered an important factor in improving the outcome of malnourished patients. We found that proper implementation of WHO guidelines for the hospital treatment of severely malnourished children can lead to a relatively low mortality rate, especially when good clinical monitoring is assured.

1. Introduction

Since 1960, Ethiopian domestic food production has declined and failed to meet the minimum food requirement (EPHA, 1997). The annual population growth rate is about 2.7%, with a total fertility rate of about 5.4 children per woman

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(UNICEF, 2007a). Agricultural production has not kept up with population growth and there is an increasing gap between food availability and the population's food needs.

Estimates show that about 12 million children less than 5 years of age die every year in developing countries and malnutrition seems to be associated with more than 60% of these deaths (Umeta et al., 2003). In Ethiopia, 52% of children <5 years of age are moderately or severely stunted, 38% are underweight and 8—10% are considered wasted (weight-to-height (W/H) ratio <70% according to WHO/National Center for Health Statistics [NCHS] reference) (Central Statistical Agency Ethiopia, 2005; De Stefano, 2004; Lawrence et al., 1994). Recent data from UNICEF appear quite similar (UNICEF, 2007b).

In 2004, UNICEF in collaboration with the Ethiopian Ministry of Health (MOH) developed technical guidelines (UNICEF and Ethiopian Federal Ministry of Health, 2004) for the treatment of severely malnourished children. The guidelines include treatments both for children admitted to hospital and for those who can be managed as outpatients. Poor hospital care is thought to be an additional factor contributing to case-fatality rates in severely malnourished children admitted to hospital. To our knowledge, few research studies trying to evaluate the outcome of these children have been published recently. One of these (Amsalu, 2006), was carried out in Ethiopia, in Gondar University Hospital, over a period of 4 years and showed an overall case-fatality rate of 18.4%, with a high rate of dropout from treatment of 9.1%.

The main aim of the present study was to evaluate the outcome of malnourished children admitted in 2006 to the paediatric ward of St. Luke Hospital, Ethiopia and treated according to the above-mentioned guidelines. The secondary purpose was to try to evaluate factors associated with early and late mortality.

2. Patients and methods

Our study was carried out in St. Luke Catholic Hospital, Wolisso, South West Shewa, Ethiopia, which provides services for an area of about 2637 km^2 with a population of more than 1 080 000 and an estimated proportion of children under 5 years of around 18%. Accessibility is enhanced by the flat-fee system; patients are charged only on admission and the fee does not increase according to the number of procedures or the duration of the hospital stay. Free care is assured in case of need and is commonly provided to the poorest families.

Between 1 January and 31 December 2006, 1635 children aged 0—5 years were admitted to the paediatric ward of the hospital. Four hundred and ninety-three (30.15%) presented severe malnutrition, alone or as a complication of other diseases. A retrospective study of these cases was made, based on the data reported in the inpatient charts and registration books.

2.1. Admission criteria

All children were weighed with a suspension scale after removing all clothing. Under 85 cm, we considered length, while over 85 cm height was measured with a standard altimeter. The WHO/NCHS growth reference was used. Children older than 6 months were admitted as severely malnourished if they had a W/H ratio <70% without oedema or if they had bilateral oedema. For children taller than 75 cm, a mid upper arm circumference <11 cm was also considered a criterion for admission (De Stefano, 2004; Lawrence et al., 1994; UNICEF, 2004; WHO and UNICEF, 2000).

UNICEF 2004 guidelines state specific admission criteria for infants below 6 months of age. They state that this group of children can be admitted according to anthropometrical parameters [weight-to-length (W/L) <70% or presence of bilateral oedema] (De Stefano, 2004; Lawrence et al., 1994; UNICEF, 2004; WHO and UNICEF, 2000), and additionally in case of insufficient growth at home or if they are too weak to suck, regardless of W/L ratio. In our study, we did not consider weakness as a criterion for malnutrition independently of weight and length. Children with mild malnutrition (W/L 75—80%) were admitted in case of concomitant pathological conditions such as dehydration, acute diarrhoea, hypoglycaemia, lower respiratory tract infection, tuberculosis (TB), acute febrile illness and HIV positivity.

All children were admitted together with a relative, and infants below 6 months of age were always admitted with their mothers so as to provide breastfeeding. Orphans were present but there was always somebody (a relative or a neighbour) to look after them during their hospital stay. Informed verbal consent was obtained from the caretakers of the children.

2.2. Treatment for children over 6 months of age

Phase 1 (P_1) of treatment according to UNICEF and MOH guidelines started with the administration of F75 fortified milk, which provides 75 kcal/100 ml. The daily amount was established according to the child's weight and was divided into eight feeds per day (UNICEF, 2004). A nasogastric tube was inserted when the oral intake was less than 75% of the prescribed diet or in case of any condition that made it difficult to feed by mouth, such as dyspnoea, cleft palate or disturbances of consciousness.

The Transition Phase (T) started when decrease of oedema was observed in children with kwashiorkor or after 3—4 days of proper feeding in those with marasmus. In this phase the patients were moved from F75 to F100 milk (100 kcal/100 ml), still given eight times a day (UNICEF, 2004). Breastfed children were allowed breast milk before F100 and on demand.

Progress to Phase 2 (P2) was based on good appetite and a minimum of 2 days in the transition phase for marasmus patients or 2 days after the complete disappearance of oedema for kwashiorkor patients. In Phase 2, F100 was administered 4—6 times per day and additional food was restarted.

All children received vitamin A according to weight: 50 000 U (<5 kg), 100 000 U (6—10 kg), 200 000 U (>10 kg) on the day of admission. Vitamin A was then repeated on day 2 and 14 after admission. Folic acid was given in a single dose of 5 mg orally on admission, with the exception of children with proven malarial infection. Zinc acetate solution was given by mouth at 3 mg/kg/day once daily for at least 2 weeks.

All malnourished children without signs of a serious systemic infection received first-line treatment with oral amoxicillin 25 mg/kg twice daily or oral co-trimoxazole 25 mg/kg twice daily, both for 7 days. All children received antiparasitic treatment with mebendazole 100 mg orally twice daily for 3 days or tinidazole 50 mg orally once daily for 3 days. Children with clear signs of infection received specific antibiotic treatment, if available according to the WHO essential drugs list. We administered chloramphenicol 25 mg/kg three times daily orally for 7—10 days in case of pneumonia; oral cloxacillin 25—50 mg/kg four times daily was given for 10 days to children with skin infections; metronidazole 7.5 mg three times daily was administered to patients with amoebiasis. Intravenous therapies were limited to septic children: we used ceftriaxone 80—100 mg/kg i.v. once daily and, in some cases, chloramphenicol 25 mg i.v. three to four times daily for 10 days. Measles vaccine was given to all unvaccinated children older than 9 months.

2.3. Treatment for children below 6 months of age

These infants continued to breastfeed often in order to stimulate proper breast milk production. They received F100 diluted, prepared by adding one packet of F100 to 2.7 l of water, while infants <6 months with oedema received F75 instead of F100 diluted (UNICEF, 2004). 100 kcal/kg/day were given divided into eight feeds a day during the P_1 and T phases, and six times daily in the P_2 phase. F100 diluted is more suitable for small children (especially <3 kg) as it gives a lower load of solutes for the still immature kidneys of these infants. Other supplements and antibiotics were given according to the same criteria as for the older children, with the exception of chloramphenicol, which was not administrated to this group of children.

2.4. Co-morbidities and complications

All complications and conditions associated with malnutrition, including hypothermia, hypoglycaemia, dehydration, sepsis, shock, heart failure and anaemia were treated according to the Integrated Management of Childhood Illnesses (IMCI) clinical principles (WHO and UNICEF, 2000) and to UNICEF/MOH guidelines (UNICEF, 2004). For children with signs of congestive heart failure, treatment with furosemide was available at a dosage of 1—2 mg/kg orally once or twice daily. Oral digoxin was given to those patients with signs of reduced contractility or reduced ejection fraction on echocardiographic examination. Antiretroviral therapy was started in HIV-positive subjects once improvement of severe malnutrition occurred. In severely anaemic children with haemoglobin <4 g/dl, a blood transfusion of 10 ml/kg was performed.

2.5. Surveillance and monitoring

On admission, weight, height, W/H ratio and the degree of oedema were recorded; oedema score ranged from 0 (no oedema) to 3+ (diffuse bilateral oedema of face, upper and lower limbs). The target weight (W/H ratio of 85%) was calculated for all children on admission. Children were weighed every morning, after removing all clothing. Weight was always measured with the same suspension scale on the ward, which was calibrated once a week. Oedema score was re-assessed every morning. These data were entered in a multi-chart and plotted each day. Body temperature and vital signs were measured three times daily. Height was re-evaluated every 21 days. All the malnourished children in our hospital were routinely examined at least once daily by a doctor. In case of clinical signs of anaemia, haemoglobin or haematocrit were measured. If oedema was not responding to nutritional treatment, urine analysis was done. Stool examination was performed in case of dysentery or any diarrhoeal disease unresponsive to first-line treatment. A chest X-ray was taken in the presence of cough, unexplained fever or any sign of respiratory distress (respiratory rate >40/min, dyspnoea or chest indrawing, reduced air entry, rales or crackles). Echocardiography was performed in case of signs of cardiac impairment. Anti-tubercolar therapy was also started in children with any clinical sign of tuberculosis. All malnourished children were tested for HIV infection.

2.6. Discharge criteria

For children over 6 months of age, discharge was based on anthropometric criteria: W/H ratio >85% in at least two consecutive determinations and absence of oedema for more than 8—10 days. Immunization was updated before discharge. For infants younger than 6 months, the main criterion for discharge was significant weight gain on breast milk alone. All concomitant acute pathologies had to be resolved and treatment for chronic conditions was started at discharge. Follow-up visits were prescribed 15 and 30 days after discharge.

2.7. Data collection

Data were collected from the registration books of the paediatric ward and, in some cases, directly from the inpatient charts. For each patient, age, gender, place of residence, main diagnosis, co-morbidities, therapies, duration of hospital stay and outcome were considered. Patients' place of residence was considered at the level of the woreda (district) and kebele (group of villages) where they declared to live. The registration books in Wolisso hospital appeared to be quite complete, although secondary diagnosis and details about therapies had to be taken from the inpatient charts. The data regarding how much food the child consumed for each meal during treatment were taken from the multi-charts that were completed every day during the hospital stay. These were archived together with the inpatient charts after discharge.

Outcomes were classified as improved, unchanged, referred, dead or self-discharged. Malnourished children were considered improved if their W/H ratio exceeded 85% in the absence of any acute illness or with a good response to TB treatment or to the treatment for any other chronic condition by the time of discharge.

3. Results

In 2006, 1635 children aged 0—5 years were admitted to the paediatric ward, of whom 493 (30.15%) were severely malnourished and of these, 59% were male. Re-admissions were counted twice as they were registered with a new inpatient number. The average age of malnourished children was 20.27 months. 20.3% of the admitted malnourished children were from Wolisso woreda, the rest from other woredas in the same zone and, in some cases, from another region of Ethiopia (Southern Nations, Nationalities, and People's Region). About 50—60% came from rural areas. Marasmus was diagnosed in 178 children (36%) and kwashiorkor in 315 (64%) (Table 1). A secondary diagnosis of pneumonia was made in 10%; TB in 6.6% according to clinical and radiological criteria and 4.6% were HIV positive. Severe anaemia requiring transfusion was seen in 4.6%. Severe systemic infection (sepsis) was found in about 8.5% of cases. These results show a relatively low prevalence of severe infectious complications in these children.

The average hospital stay for a malnourished child was 12.5 days, the overall average in the paediatric ward being 8 days. The mortality rate was 7.1% (35 children) for deaths directly related to malnutrition only, while the overall fatality rate in the paediatric ward in 2006 was 8.2%. Ten deaths (28.6%) occurred in the first 48 h of admission (early mortality); all these patients were in critical condition when they came to our attention. Eight of them had severe marasmus with a W/H ratio much lower than 60% and two had severe kwashiorkor with bilateral diffuse oedema. All of them had symptoms and signs of concomitant systemic infection and respiratory distress. One child developed congestive heart failure. Three children had severe rickets aggravating the respiratory distress. Two cases were HIV positive, while three had underlying TB. For these children, aggressive antibiotic therapy and specific treatment for suspected TB were started, together with supportive and nutritional therapy. However, all of them died without any improvement, four of them within 3 h of admission.

Twenty-five patients (71.4%) died more than 48 h after admission (late mortality) and, in some cases, more than 1 week after the beginning of nutritional treatment (Table 2). Four hundred and thirty-six children were discharged improved, giving a recovery rate of 88.4%. Twenty-two self-discharges were recorded (4.5%) before their improvement could be determined. The main reasons for self-discharge included low parental compliance, family problems and harvesting time. Nevertheless, the overall dropout rate was lower than that previously reported (Amsalu, 2006).

4. Discussion

Since WHO guidelines for the inpatient treatment of malnourished children have been introduced in African countries, including Ethiopia, very few studies have tried to evaluate the real benefit of these measures according to the outcome of the patients. One study (Ashworth et al., 2004) was carried out in two rural South African hospitals between April 2000 and April 2001. Case-fatality rates fell from 45% to 21% and from 25% to 18%, respectively, in the two examined sites after the implementation of the WHO guidelines. The study concluded that, despite the improvement in the quality of care resulting from the implementation of these guidelines, too many deaths were still related to medical and nursing errors. Another outcome study based on retrospective analysis over a period of 4 years was carried out in Gondar University Hospital, North West Ethiopia (Amsalu, 2006). In this study, the overall case-fatality rate was 18.4%, with a dropout rate of 9.1%. More recently Maitland and colleagues retrospectively reviewed data from Kifili District Hospital, Kenya for severe malnutrition between 1 September 2000 and 30 June 2002 (Maitland et al., 2006). The mortality rate was 19%, with one-third of deaths occurring within 48 h of admission and a close relationship between mortality and the presence of WHO-recommended danger signs (WHO and UNICEF, 2000).

In our study, severely malnourished children were treated according to the same WHO guidelines but the fatality rate was only 7.1%. This result is surprising and might be related to population, social or hospital factors. We did not statistically compare our mortality rate to those reported in previous studies because we do not know the characteristics of those samples and they might not be homogeneous with our population. In our population, a relatively low prevalence of co-morbidities was seen, suggesting malnutrition was generally secondary to uncomplicated lack of food, rather than to chronic illnesses or acquired disabilities. HIV prevalence in our malnourished children was not as high as in other countries (4.6%). Moreover, Wolisso is an area where malaria is not endemic. TB was detected in 6.6% of cases, but the great majority of them had uncomplicated pulmonary TB, responsive to treatment.

Early deaths were probably due to the very wasted and critical condition of those children on admission, leading to failure of any treatment. The specific underlying cause responsible for late mortality was often difficult to define, but these children showed poor responses to treatment: the kwashiorkor patients had oedema which did not decrease after 3—4 days of F75 feeding, while those with marasmus showed failure to gain weight and poor reactivity due to

Table 1 Characteristics of the study population according to type of malnutrition

	n (%)	Average age (months)	Average W/H ratio (NCHS)	Early death[a]	Late death[b]
Marasmus	178 (36)	24	60%	8	7
Kwashiorkor	315 (64)	18	75%	2	18

W/H: weight-to-height; NCHS: National Center for Health Statistics.
[a] ≤48 h after admission.
[b] >48 h after admission.

Table 2 Co-morbidities according to outcome in malnourished children

	n (%)	Average age (months)	Blood transfusion	HIV positivity	Confirmed TB	Pneumonia	Sepsis
Improved	436 (88.4)	20	4.6%	4.0%	5.2%	8.7%	7.1%
Dead	35 (7.1)	34	8.6%	11.4%	14.3%	25.7%	31.4%
Self-discharged	22 (4.5)	19	0%	4.5%	18.0%	13.6%	0%

neurological impairment. In our setting, about two-thirds of malnourished children presented kwashiorkor. These children seem to be susceptible to late mortality, which is considered likely to be related to electrolyte imbalance. In our hospital, which is in a rural area, no electrolyte monitoring was possible. This could have been useful to identify high-risk children with electrolyte imbalance, renal failure or metabolic acidosis, as suggested by Maitland et al. (2006). Where electrolyte monitoring and haemogas analysis are possible, the assessment and treatment of metabolic changes will certainly promote a more favourable outcome in these patients (Heikens, 2007).

In our setting, critically ill patients were often identified on the basis of clinical criteria and only basic routine examinations. Our results suggest that clinical findings based on an accurate physical examination are reliable parameters to identify high-risk patients who need special monitoring or more aggressive antibiotic and supportive treatment.

A nurse/patient ratio of 1:14.6 was possible in our hospital, a positive situation not present in most sub-Saharan hospitals, where the ratio is often much lower. This good nurse/patient ratio in our opinion was essential in assuring good surveillance and in helping the parents to provide frequent feeding, even at night, as the UNICEF protocol suggests. On the basis of these data we can conclude that, if properly implemented, the WHO guidelines offer good tools for the effective treatment of severe malnutrition. The area to strengthen could be the clinical skills of medical and nursing staff; the importance of accurate clinical monitoring both by doctors and nurses in the daily management of malnourished children has also been highlighted in a recent work (Karaolis et al., 2007). We believe that our low mortality rate could be directly related to the strict monitoring of our patients by the nursing staff, to their capacity to detect the early signs of incipient complications and to their positive attitude to ensuring good adherence and compliance to therapies and feeding. Unfortunately we could not collect reliable data regarding post-discharge controls and compliance to follow-up visits, mostly because there is a different registration system for post-discharge visits.

The high rate of estimated wasted and underweight children (Central Statistical Agency Ethiopia, 2005; De Stefano, 2004; Lawrence et al., 1994) clearly shows that hospitalization to treat severe malnutrition is not enough and a proper educational programme for mothers is urgently needed. Although the hospitalization period is often long enough to teach strategies for the proper use of local products to prepare a nutritionally balanced diet, according to demographic data (Central Statistical Agency Ethiopia, 2005), less than 1% of children aged 0–5 years has access to a hospital, so delivery of health education at a community level is needed in order to reduce the impact of malnutrition and related syndromes. There is evidence of the effectiveness of community-based approaches to treat mild-to-moderate malnutrition with ready-to-use therapeutic food (Jackson et al., 2006; Oruamabo, 2007). Education about breastfeeding, weaning food, child spacing, HIV prevention and many other important matters could also be more effective when given at community and household level in the context of a public health programme in the district (Oruamabo, 2007).

In conclusion, our results show that correct implementation of WHO guidelines for the inpatient treatment of severely malnourished children can lead to a relatively low mortality rate. Identification of the most critically ill patients by clinical criteria and treatment with drugs commonly included in the WHO essential drugs list seems reliable. Clinical monitoring of these children is essential to recognize any sign of worsening or to detect complications as soon as possible, so as to treat them more effectively. The clinical skills of nursing and medical staff are thus a very important factor in improving the outcome of these patients. On the basis of our data, we could not identify any specific pathophysiological factor that may be associated with a high mortality risk. We could not monitor electrolyte balance or metabolic status; it is likely that the outcome of severely wasted children treated according to WHO guidelines could be improved with knowledge of electrolyte and metabolic disturbances. This is especially true for late mortality as, in these cases, death is more likely to be related to metabolic imbalances. Early mortality, on the other hand, seems to be related to a very wasted and critical condition on admission, rather than the treatment performed.

Authors' contributions: All authors were directly involved in the clinical management of these children. AB, CP and FM designed the study protocol; AB and CP were directly involved in the clinical management of the patients and ERB and FM were consulted when needed; AB and FM carried out the data collection; AB, FM and ERB carried out the analysis and interpretation of the data; AB and ERB drafted the article. All authors read and approved the final manuscript. AB and ERB are guarantors of the paper.

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Conflicts of interest: None declared.

Ethical approval: Not required; all children were assessed and treated according to the protocol approved by the Ethiopian Ministry of Health and in accordance with standard clinical procedures at St. Luke Catholic Hospital, Wolisso, South West Shewa, Ethiopia.

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