Severe Protein-Energy Malnutrition in Urban Dhaka, and their response to treatment

Sultana Khanum; H. Diamond;
H. Rahman and I. Kabir
Save the Children Fund
G. P. O. Box 55, Dhaka, Bangladesh.

Introduction

Malnutrition in preschool children is a serious problem in developing countries. In these countries 25%—50% of children die before their 5th birthday and more than 50% of these deaths are related directly or indirectly to malnutrition(1). In Bangladesh a Nutrition Survey (2) has shown that 25% of children suffer from severe mainutrition and 66% found to be stunted (chronic undernutrition). Apart from this survey very little information is documented as regards severe protein energy malnutrition (PEM). Children's Nutrition Unit (CNU) of the Save the Children Fund is an urban nutrition rehabilitation centre which deals with severe protein energy malnutritlon (PEM) in greater detail in its 60 bedded inpatient and takes care of other paediatric problems in its outpatient department (OPD).

This paper describes some characteristics of PEM children, their response to treatment, and mortality trends and is based on the analysis of 2143 cases admitted to CNU during a period of six years.

Background

Ninety nine per cent of children attending OPD clinics come from the urban slums of Dhaka City. The total population of the main catchment area is estimated to be 4-5 million. These children come from the very poor families. Majority of the fathers are rickshaw pullers and day labourers. The poor mothers are domestic servants. Both parents earn less than 600 taka per month. The heads of many households have low unsteady income. Five per cent of the children had only one parent. Only 27% of fathers and 12% of mothers are literate. On an average each family consisted of 5 members. There was definite seasonal trend in admission. highest in April through October. Forty five per cent were either the first or second born. The majority were females. Despite fairly high prevalence of breast feeding, bottle feeding was common having being practised in 42% of cases. A significantly greater number of marasmics were first born, details have been discribed elsewhere (3).

Methods

A total of 2143 severe cases of PEM admitted between 1977-1982, constituted the study subjects. They were admitted on the basis of being 50% or less weight for age for less than 1 year and 60% or less weight for height for over 1 year and all children with oedema irrespective

of wt/age or wt/ht percentage. They were further classified into marasmus (M) Kwashiorkor (K) and marasmic kwashiorkor (MK). Vitamin A deficiency and B-2 deficiency was identified clinically. Anaemia was diagnosed if haematocrit was below 25%. Rectal temperature greater than100° was considered fever and less than 96°F as hypothermia. Laboratory studies at the time of admission included total plasma protein, haematocrit, urinalysis and stool microscopy. Other routine examinations included throat swabs, blood and urine for bacteriology. Mantoux test (PPD) was done during admission and repeated in negative cases before discharge. Pulmonary tuberculosis was tentatively diagnosed when radiograph was consisted with clinical findings. Pneumonia was diagnosed on the basis of clinical and radiological findings. Septicaemia was diagnosed on the basis of positive blood culture and severe diarrhoea was based on the findings of 4 or more loose/watery stool per day.

Treatment

During the first week the treatment consisted essentially of the control of infection with appropriate antibiotics. Immediate correction of dehydration and electrolyte imbalance with oral/intravenous glucose and electrolyte. Packed cells were transfused for severe anaemia where indicated. The volume of feed was adjusted to provide approximately 120-150 kcal/kg/day and 3 gms of protein/kg/day for all patients on admission. Dried skimmed milk fortified with oil and sugar 100 ml/kg for kwashiorkor and marasmic-kwashiorkor and 120-150 ml/kg for marasmus was given 2 hourly round the clock during the first week and was supplemented with potassium (5-6 meq/kg/day), magnesium (meq/kg/day), Loguls Iodine, high potency vitamin A capsules as prophylaxis and Aquasol A injection or vitamin A capsules (if injection was not available) in xerophthalmia. Folic acid and multivitamin syrup were also given. In case of food refusal nasogastric feeding was given. When patient could tolerate additional solid foods locally available, acceptable and affordable which would also meet the nutrient requirement of the age group in question, like-rice pulses, meat, vegetables and rice pudding were offered on an adlibitum basis. Foods for MK and K were cooked salt free.

During the second, third, fourth and subsequent weeks younger patients were given four solid meals and four milk feeds and older children 6 solid feeds (no milk daily. During these 3-4 weeks, aim was to achieve energy intakes of 150-200 kcal/kg/day and 3·5-4 gm of protein/kg/day. From the second week feeds were supplemented with oral iron. All dietary intakes, left overs and vomitus were measured as diligently and accurately as possible. They were noted on the diet chart for each individual child. The weight of the children were measured daily (without clothes) durig the first week, then weekly before the mid morning food with a beam balance scale by the same person.

Discharge criteria

The children were considered to have recovered when the following criteria were fulfilled:

(1) they reached 80% of their expected weight for height, (2) became free of oedema and infection. They were discharged with advice to attend the follow-up clinic regularly for growth monitoring, immunisation, continuous education to mothers on nutrition, health and acceptance of family planning methods.

Analysis was done by SPSS Computer system. Results are expressed in proportions, Mean and ± standard deviation. Chisquare (X^2) test used for significance.

Results

Results reveal that 18% of the children were marasmic (M), 61% Marasmic-Kwashiorkor (MK) and 20% Kwashiorkor (K) using Welcome classification (Table 1). The mean age for M was 17 months and for MK and K 29 months. Weight-for age as percentage of the 50th of Harvard Standard was very low in all 3 categories that is 39% in M, and 45% in MK and 52% in K, weight-for-height similarly was very low indicating acute malnutrition 62% in M, 66% in MK and 73% in K. Height-for-age M 80%, K and MK 88%. Total plasma protein was low 5 and 4 gm% in MK and K for M was 5 gms%. They were both stunted and wasted. Seperate PEM was associated with nutrient deficiencies (fig. 1) like, Vitamin A deficiency seemed to be more frequent in Kwasiorkor (68.7%) and MK (64.2%) than in marasmus (53.0%) ($P<0.001$). Severe Anaemia was present for K (60%) MK (57.2%)M 42%. There was significant difference between Marasmus and oedematous malnutrition ($P<0.001$). Angular Stomatitis for M (20%) MK and K (30 & 40%).

The most common and frequent infections encountered (table 2) were Bronchepneumonia (56%), upper respiratory infections (46%) past history of measles (33.6%). Incidence of measles differs significantly with Marasmus from MK and K ($P<0.05$). Urinary tract infections was found in 20.9% severe diarrhoea with dehydration 15% (Chronic diarrhoea 80%) and pulmonary tuberculosis in 11.4% (Marasmus 19.3%, in K 5.4%, MK 11.2%). T. B. was significantly higher in M ($P<0.001$) Ottitis media in 20.6% and Septicaemia in 11.9%. Parasitic infections like Ascaries lumbricoides (40.7%) Trichuris Trichuria (40.2%) Entamoeba histolytica (38.3%) Giardia lamblia 20.7% Anchyclostoma duodenles (16.8%) were present at stool microscope (table 3). These infections were less common in marasmic cases probably because they tended to be younger and may have been duly present in older marasmics.

Higher energy intake were observed in M than in MK and K (table 4). The average kcal/kg/day being 190 and the corresponding weight gain 8-10 gm/kg/day. There was gradual decrease in hospital mortality with time from 25% in 1976. to 5.2% in 1982. Those with dehydration (see Table 5) were at greater mortality risk ($P<0.01$). Average length of hospitalisation had a marked decline from 38 days in 1977 to 28 days in 1979 and 19 days in 1982 (Table 6).

Discussion

The experience gathered in this urban rehabilitation centre in Dhaka, Bangladesh showed clearly that severe PEM mainly affects the poor section of this urban community. The children admitted were chronically malnourished as well as wasted. The higher weight for age and weight for height in kwashiorkor and marasmic-kwashiorkor children compared to marasmus may reflect the presence of oedema fluid in the former group of children. The total plasma protein concentration of 4 and 5 gm/100 ml in kwashiorkor and mararsic kwashiorkor children were significantly lower in the marasmic group (6 gm/100 ml). Our findings are consistant with findings in other studis (4). The mean age of marasmic children were 17 months compared to 29 months for children with K and MK occured approximately a year and a half later and may be the result of repeated bouts of infection especially diarrhoea and or an attack of measles. Vitamin and mineral deficiencies were also present in PEM cases. These cases of multiple deficiencies are prevalent all over Bangladesh. Among these deficiencies vitamin A is potentially dangerous as it causes keratomalacia and blindness. Brown et al(6) reported that vitamin A deficient children tended to be older and had greater prevalence for the oedematous type of malnutrition who had a lower plasma protein.

Bacterial infection in PEM children are well documented by various authors (7, 8, 9). Parasitic infection were also common more so, among K and MK. Most of these infections were successfully treated. However severely dehydrated diarrhoeal cases, cases with septicaemia, severe T. B. and younger patients with very low weight for height hold greater mortality risk. Fatality occured mostly during the first 48 hours of the admission. The over all case fatality rate during hospitalization was approximately 6% and there was no significant difference in the case fatality rate between various types of PEM. This low rate of mortality is possibly due to improved medical care of associated complications especially infection. Moreover from mid '78 broad spectrum antibiotic was given to all the children at the Unit before infection was confirmed. Another contributing factor may be improved rehabilitation which includes good nursing care and intensive feeding. It must be noted that PEM children at their end stage become complicated with numerous medical problems.

Recovery from malnutrition had been shown to include a period of very rapid weight gain. Energy intake of 225 kcal/kg/day were not infrequent in Jamaica, Ashworth et al (10) found that rapid recovery could be achieved if the caloric intake is sufficiently high. Majority of their recovering infants grew at a rate of 4-6 times as great as that of normal infants. They found a significant correlation between calorie intake and weight gain. When weight gain was plotted against calorie intake for 3 clinical types separately, marasmics gained more weight than those with K. However, it was not clear whether these children were complicated with infections.

Although our children had very high mean energy intake the mean weight gain was 8 gm/kg/day during the 3 weeks as shown in the result (Table 4). There was no correlation between energy intake and weight gain, nevertheless children achieved 80% of their expected weight for height by

the 4th week with above mentioned rate of growth. Talukdar et al (11) found similar weight gain rate and calorie intake like ours in a recent study. Possible reasons for our comparatively lower rate of weight gain than in Jamaica are, some malabsorption may have been present, although infections were treated but undiagnosed chronic infaction like T. B. or infectious fever increased metabolic rate and less energy was available for growth Moreover a very large standard deviation indicates a great deal of individual variation in the rate of growth.

On the whole considering the severe stage the children are brought in, the progress was of considerable success by the fact that all children had to attain a minimum of 80% expected weight for height before they were eligible for discharge Keeping this in mind it may be noticed that there was a sustained decrease in the duration of hospitalization between 1977-1982. The over all reduction in the number of days required to attain the minimum criteria for discharge was almost halved. This was due to better medical, nursing and nutritional care of these patients. The duration of hospital stay in all 3 types of PEM were similar.

Mc Laren (12) calculated that in Jordan it took on an average 4 months to rehabilitate 1 marasmic child at a cost of $1000. Pretorious and Novis (13) reported that the average stay in hospital was 3 months for marasmic children in South Africa compared with one month for these with Kwashiorkor. But in our cases duration of hospital stay for marasmic cases were 28 days That marasmus requires more prolonged feeding than kwashirokor was found to be not true.

The Children's Nutrition Unit has been successful in reducing the mortality rate of severely malnourished patients during hospitalization from 25% in the Ist year (1976) to 5.2% in 1982. Major factors that contributed to this success is posssibly timely treatment of infections and above all the meticulous nursing care which was undoubtedly most important.

Table 1 NUTRITIONAL STATUS OF PEM CHILDREN ON ADMISSION
(MEAN ± STANDARD DEVIATION)
COMPARED WITH 50TH CENTILE HARVARD STANDARD

	Marasmus (18%) N=330	Marasmic Kwashiorkor (61%) N=1313	Kwashiorkor (20%) N=443
Age (Months)	17 ±15	29 ±17	29 ±17
Wt/Age (%)	39 ± 6	46 ± 9	52 ± 9
Wt/Ht (%)	62 ± 6	66 ± 8	73 ± 9
Ht/Age (%)	80 ± 6	80 ± 6	88 ± 4
Total Plasma Protein (gm%)	6.1± 1.1	5.0± 0.9	4.1± 0.7

Table 2 TYPES OF INFECTION PRESENT (Percent of total of each type of PEM)

Infections	Marasmus		Kwashiorkor		Marashmic Kwashiorkor		All Cases	
	%	n	%	n	%	n	%	n
Bronchopneumonia	56.0	(64/380)	52.4	(232/443)	57.8	(755/1306)	56.3	(1200/2133)
Upper respiratory tract Infection (U.R.T.I.)	41.0	(156/380)	43.0	(190/443)	48.8	(642/1313)	46.2	(988/2136)
* *Past history of measles	28.0	(105/367	35.0	(155/443)	35.0	(448/1291)	33.6	(708/2101)
Urinary tract infection	16.7	(63/377)	20.9	(92/439)	22.1	(287/1293)	20.9	(442/2109)
*Severe diarrhoea	16.1	(64/380)	13.0	(58/443)	15.5	(203/1313)	15.2	(325/2136)
Pulmonary tuberculosis	19.3	(71/367)	5.4	(24/440)	11.2	(143/272)	11.4	(238/2077)
Septicaemia	11.7	(36/309)	11.3	(20/177)	12.0	(153/1266)	11.9	(209/1751)
Otitis Media	18.4	(70/380)	22.6	(100/443)	20.5	(270/1313)	20.6	(440/2136)

*More than 6 loose/watery stools per day
(**1-6 months prior to admission)

Table 3 INFESTATIONS WITH INTESTINAL PARASITES, PERCENTAGE OF TOTAL OF EACH CATEGORY OF P. E. M.

Infestiations	Marasmus		Kwashiorkor		Marasmic-Kwashiorkor		All Cases	
	%	n	%	n	%	n	%	n
Ascaris lumbricoides	27.0	(100/370)	42.4	(185/436)	44.1	(572/1296)	40.7	(857/2102)
Trichuris trichiura	28.9	(107/370)	45.5	(198/436)	46.6	(605/1296)	43.2	(910/2102)
Entamoeba histolytica	37.5	(139/370)	42.9	(187/436)	37.8	(490/1296)	38.8	(816/2102)
Giardia lamblia	16.0	(61/370)	24.3	(106/436)	20.8	(270/1296)	20.7	(437/2102)
Hookworm	5.9	(22/370)	21.3	(93/436)	18.4	(239/1296)	16.84	(354/2102)

Table 4 WEIGHT GAIN (WG) AND ENERGY INTAKE (EI) OF ALL 3 CATEGORIES OF PEM, COMPARISON TO WEEKLY MEAN (MEAN ± STANDARD DEVIATION)

	Marasmus			Kwashiorkor			Marasmic Kwashiorkor		
	Total No.	WG	EI	Total No.	WG.	EI	Total No.	WG	EI
WeeK 2	(214)	8±8	194±41	(314)	4±9	144±28	(827)	8±7	160±35
Week 3	(319)	6±9	214±48	(233)	6±8	153±30	(584)	5±7	171±44
Week 4	(885)	5±9	219±50	(119)	6±6	162±35	(342)	7±7	182±31

Table 5 MORTALITY RISK OF DEHYDRATION, T. B. AND SEPTICAEMIA

Condition	Present N/N (%)	Absent N/N (%)
Dehydration	83/448 (18.5) * *	76/1468 (5.2) * *
T. B.	37/320 (11.6) *	118/1655 (7.1) *
Septicaemia	18/204 (8. 8) *	52/1448 (3.5) *

* ($P<0.05$)
** ($P<0.01$)

Table 6 MEAN DURATION OF HOSPITALIZATION BY YEAR ACCORDING TO TYPES OF PEM
(Excluding fatal cases and these with antitubercular treatment)
(mean±Standard deviation)

Year	Marasmus n—256		Kwashiorkor n—354		Marasmic-Kwashiorkor n—966		All Cases n—1577	
1977	42.3±21.3	(29)	36.0±20.7	(9)	36.2±16	(54)	38.6±5.8	(92)
1978	33.8±22.0	(25)	37.2±16.3	(36)	35.7±15	(152)	35.5±1.7	(213)
1979	28.0±14.3	(56)	27.9±10.1	(78)	29.0± 1	(179)	28.3±0.6	(313)
1780	37.4±13.8	(65)	27.8± 9.5	(99)	26 5± 9	(223)	27.2±0 6	(387)
1981	23.3± 9.3	(51)	28.1± 9	(95)	26.8±11	(231)	26.0±2.4	(377)
1982	18.9±10.4	(31)	20.3± 6	(37)	18.0± 7	(127)	19.0±1.1	(195)
Total Mean	28.9±8.2	(257)	29.5± 6.2	(354)	28.6± 6.7	(966)	29.0±0.4	(1577)

Summary

Results are reported from analysis of in a patient hospital records of 2136 cases of severe protein-energy-malnutrition (PEM) which showed that 18% were marasmic, 20% had kwakhiorkor and 62% had marasmic-kwashiorkor according to Welcome classification. Marasmus presented at a younger age than K and M. K, They had evidence of other nutrient deficiencies, had evidence of both stunting and wasting and were complicated with 1 or more infections. They were treated for infections and were given high energy feeds for maximum catch up growth.

The mean energy intake was 200 kcal/kg/day and the corresponding weight gain was 8 to 10 gm per/kg/day. They achieved 80% of their expected weight for height by 3 to 4 weeks. There was a gradual decrease in the case fatality rate with time from 25% in 1976 to 5.2% in 1982. The average hospital stay declined from 38 days in 1977 to 19 days in 1982. It is encouraging that Children's Nutrition Unit has been successful in reducing mortality and duration of hospitalisation of severely malnourished children.

References

1) Puffer R. R. & Serrane C. U. Patterns of mortality in childhood, Washington D. D, Pan American Health Organisation, Pan American Sanitary Bureau, 1973.

2) Nutrition Survey of Rural Bangladesh (1975-76). Institute of Nutrition and Food Science, University of Dhaka.

3) Khanum S. Factors contributing to Protein Energy Malnutrition in Urban Dhaka, Bangladesh J. of Child Health Vol. 9(2) 80-89,1985.

4) Mc Laren D. S. Pellet P. I. and Reed W. W. C. A simple scoring system for classifying the severe forms of protein calorie-malnutrition of early childhood, Lancet 1,533, 1967.

5) Morely D. Paediatric priorities in the Developing World Post Graduate Paediatric Series 124-147. 1979.

6) Brown K. H. Gaffar A, and Alamgir S. M. Xerophthalmia-Protein- Calorie Malnutrition and infections in childhood. The Journal of Paediatrics, 95: 651-656, 1979.

7) Morehead C. D. Morehead M, Allen D. M. & Olson R. E. Bacterial infection in malnourished children. Environmental Child Health (June'74), 141-147, 1974.

8) Scrimshaw N. S., Taylor C.E. & Gerdon J.E. Interaction of Infection and Nutrition, WHO Monograph, No, 57, Geneva, 1968.

9) Brown K.H., Gaffar A., Alamgir S.M., Gilman R. & Strifs J. (1976-1977), Bacterial infection associated with severe protein calorie malnutrition, JHU-ICME Annual Report, 38.

10) Ashworth A., Bell Ruth W. P. I., James & Waterlow J. C. Calorie requirement of children recovering from Protein-Calorie Malnutrition, Lancet 2,600, 1968.

11) Talukdar M. Q. K., Kabir A. R., Kawsar C. A. Feeding, Socio-Economic Spectrum and Recovery of Severe Protein-Energy Malnutrition. Fourth Bangladesh Nutrition Conference. Abstract, 1986

12) Mc Laren D. B. A freesh look at Protein-Calorie Malnturition, Lancet ii. 485, 1966.

13) Preborious P. J. & Novis H. Nutritional marasmus in Bontu infants in the Pretoria Area, South African Medical Journal, 39,237. 1985.