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The Pattern of Infections in Children with Severe Protein Energy Malnutrition

G A OYEDEJI*

SUMMARY

Oyedeji GA. The Pattern of Infection in Children with Severe Protein Energy Malnutrition. *Nigerian Journal of Paediatrics,* 1989; **15:0.** Seventy three severely malnourished children admitted to the Wesley Guild Hospital, Ilesa, between January 1985 and December 1986 were studied prospectively for infections. Positive blood cultures were obtained in 13 (17.8%). Urinary tract infection due to coliforms was present in 8 (11%) cases and chest radiographic pneumonic changes in 30 (41.1%) children, half of whom were not clinically diagnosed as having pneumonia. Four (5.5%) patients had tuberculosis; all the 40 mantoux tests done were however, negative. Gastroenteritis and oral thrus were present in 18 (24.7%) and ten (13.7%) patients respectively, while parastic infestations were diagnosed from stool examination in 4 cases. Ear and throat infections were found in 17 (23.3%) whilst skin and superficial infections were present in 28 (38.4%) children. There were 16 (21.9%) deaths in all. A greater but non-significant percentage of bacteraemic patients (38.5%) deaths in all. A non-significant percentage of bacteraemic patients (38.5%) than of non-bacteraemic patients (18.3%), died.

Introduction

RECENT studies have shown that 24% and 16% of the total population of under five Nigerian children suffered from mild/moderate and severe malnutrition respectively during the years 1973 to 1983[1] thus making protein energy malnutrition (PEM) a common clinical condition. The interaction between PEM and infection has been well established.[2–4] Protein energy malnutrition probably contributes to the prevalence of illnesses and deaths from other diseases in pre-school age children in the developing countries. Both the immunological defects[4–7] and the organisms causing infections[8–12] in children with severe PEM have been studied. However, most of the studies on infections have concentrated on those due to bacterial agents and on subjects in other countries.

The present prospective study was carried out to define the types of infections

Obafemi Awolowo University, Ile-Ife

Department of Paediatrics and Child Health

*Reader

seen in severely malnourished children in Ijesa area. The study was carried out in the paediatrics unit of the Wesley Guild Hospital, Ilesa, a hospital serving the semi-urban Ijesa population of Western Nigeria and the surrounding towns in Oyo and Ondo State. It is hoped that knowlege of the agents causing infections in malnourished children will provide a guide for the choice of anti-microbial agents which can be used to treat such patients when culture and sensitivity tests cannot be done or before results of such tests become available.

Subjects and Methods

Seventy three children admitted to the main children's ward of the Wesley Guild Hospital, Ilesa, with the diagnosis of severe protein energy malnutrition between January 1985 and December 1986 were studied prospectively. Forty-four of these were studied in 1985 and 29 in 1986. The diagnosis of severe PEM was based on the fulfilment of the Wellcome classification[13] criteria plus at least, one feature of the disease which compelled hospitalisation, such as severe dermatoses with extensive wet areas, severe oedema , intractable diarrhoea, unsatisfactory tolerance of orral fluids and feeds, hypothermia and severe mental apatthy. Only the patients in whom the initial clinical assessment as detailed in the protocol and a minimum of investigations could be done before their deaths or discharge from hospital, were recruited. The 73 children studied constituted 61.9% of the 118 patients adminitted into the ward with the diagnosis of severe PEM during the two years. Other patients with PEM admitted primarily because of infectious diseases (eg measles, typhoid) and managed on our isolation children's ward were excluded from the study.

On the day of admission or a soon afterwards as possible, each patient was examined with particular attention being paid to evidence of any microbial or parasitic infections in the child. A record of the findings in each child was made on a predesigned proforma. Also recorded were the weight, head and mid-upper arm circumferences of each patient. The particular type of PEM in each child was categorised according to the Wellcome classification.[13]

As soon after admission as possible, as many as possible of the following investigations were carried out on each patient: haematocrit, white blood cell count-total and differential, blood films for malaria parasites, total serum protein and albumin blood culture and sensitivity, urinalysis, microscopy, culture and sensitivity of urine specimens obtained predominantly by a clean catch of mid steam urine or in a few, by suprapubic puncture, stool microscopy, culture and sensitivity, chest radiograph, mantoux test and culture of swabs from septic lesions. In addition, other investigations for infections and other conditions eg lumbar puncture, serum electrolytes and urea, were performed as indicated. Viral studies were not done.

Each child was managed as indicated by the clinical features of his/her illness.

Results

Forty-nine (31 males and 18 females) of the 73 children studied had kwashiorkor whilst 24 (12 males and 12 females) and marasmic-kwashiorkor.

The ages of the patients with kwashiorkor ranged from 12 months to 96 months (mean 23.7 months) whilst those of the patients

with maramic kwashiorkor ranged from 8 months to 54 months (mean 20.4 months).

The anthropometric and serum protein profiles of the patients are shown in Table I, while Table II contains the results of investigations carried out. The mean weights and mid upper-arm circumferences were more severely depressed in marasmic-kwashiorkor than in kwashiorkor whilst the mean serum total proteins and albumins were more severely depressed in kwashiorkor than in marasmic-kwashiorkor (Table I). The investigations with the greatest yields of positive results were the chest Xrays, urinalysis for albumin, blood and urine cultures. (Table II).

Infections diagnosed

The main infections diagnosed are shown in Table III; the most common were pyogenic pneumonia, skin an superficial tissue sepsis, gastroenteristic, bacteraemia and candidiasis. There were 136 infections in all — 65 of which were confirmed by positive ancillary investigation results. There were many instances of multiple diagnoses of infections in the same individuals.

TABLE I
Antropometric and Biochemical Values in Children with Protein Energy Malnutrition

	Kwashiorkor (n = 49)			Marasmic — Kwashiorkor (n = 24)		
	Mean	Range	Standard Deviation	Mean	Range	Standard Deviation
Weight (Kg)	8.2	4.5–17.0	2.2	6.5	3.0–9.9	2.3
Mid upper arm circumference (CM)	12.0	10.2–15.0	1.1	10.4	8.5–13.6	1.2
Serum total proteins (g/dl)	4.2	2.8–7.3	1.0	4.7	3.2–7.0	1.1
Serum albumin (g/dl)	2.0	1.2–3.7	0.6	2.3	1.6–3.5	0.6

TABLE III
Infections Diagnosed Children with Protein Energy Malnutirition

Investigations	No in whom performed	No in whom positive results obtained	% in whom positive results obtained
Chest Xray	49	30	61.2
Mantoux test	40	0	0
Urine culture	39	8	20.5
Urinalysis for albumin	39	14	35.9
Blood culture	34	13	38.2
Stood miscorscopy for oval and parasites	29	4	13.8
Stool culture	29	0	0
Blood film for malaria parasites	25	2	8

TABLE II
Investigations Performed in Children with Protein Energy Malnutrition

Infection	No in whom	% of 73
Pneumonia	26	35.6
Skin and superficial tisue sepsis	24	32.9
Gastroenteritis	18	24.7
Bacteraemia	13	17.8
Candidiasis	11	15.1
Otitis media	10	13.7
Urinary tract infection	8	11
Tonsillitis	7	9.6
Upper respiratory tract infection	6	8.2
Tuberculosis	4	5.5
Intestinal parasitic infestation	4	5.5
Tinea	3	4.1
Malaria	2	2.7

Respiratory infections

Twenty seven patients were diagnosed clinically as suffereing from pneumonia but only 20 of these had chest radiographs. Fifteen of the 20 had radiological evidence of pneumonic infiltrations. Fifteen other patients not diagnosed clinically as having pneumonia also had radiological evidence of pneumonic infiltrations. Thus, 30 (61.2%) out of 49 patients who had chest radiographic examination showed evidence of pneumonia. Nineteen of the positive chest x-rays showed bronchopneumonic and 7, lobar infiltrations. Four of the later had pneumatocoeles and 1, pneumothorax. The remaining four postive chest films were diagnostic of tuberculosis; pulmonary tuberculosis in 3 of these had previously been diagnosed clinically including one with abdominal tuberculosis in whom the ascitic fluid was positive for acid fast bacilli.

All the 40 Mantoux tests done were negative; in 38, there was no reaction while the reactions in the remaining two were each 8mm in diameter and were in patients previously diagnosed as having tubeculosis.

Ten (13.7%) of the 73 children had otitis media, 7(9.6%) tonsillitis while six others had upper respiratory tract infection (nasopharyngitis).

Gastrointestinal infections

Gastroenteritis and oral candidiasis were diagnosed in 18(24.7%) and 10(13.7%) children respectively. No bacteriological isolate was obtained from any of the 29 stool specimens examined. However, one patient each, passed stools containing ova of trichuris, ova of *Ascaris lumbricoides*, trophozoites of *Balantidium coli* and larve of *Strongyloides strecoralis*.

Urinary tract infections

Eight (20.5%) of the 39 urine specimens cultured yielded significant bacterial growths in association with significant pyuria. The bacterial isolated were *Escherichia coli* in 2 cases and Klebsiella species in 6 cases.

Blood Stream infections

Bacteria were recovered from 13 (38.2%) of 34 in whom blood cultures were done (Table II). It is interesting to note that a clinical diagnosis of septicaemia was not made in 8 of these cases. Eight (61.5%) of the 13 postive blood cultures grew gram positive cocci and 4 (30.8%) gram negative bacilli. The individual organisms cultured were *Staphylococcus aureus* (5 cases) *Staphylococcus epidermidis* (2 cases) *Escherichia coli* (2 cases) Klebsiella species (2 cases) *Non-haemolytic*

streptococcus (1 case) and Corynebacterium species (1 case).

Skin and subcutaneous tissue infections

Skin and surface septic lesions with purulent discharges were found in 24 patients (4 cases of conjunctivitis, 19 septic spots, boils, carbuncles, pustules at various sites and 1 of otitis externa). There was also one case of celulitis, one of perineal abscess and one of Funnier's gangrene.

Three children had tinea infection (head, groin and body respectively). One had heavy monilial infection of the external genitalia and adjacent skin folds.

Swabs from septic spots and aspirates from abscesses grew *Staphylococcus aureus* in 4 cases, *Pseudomonos aeruginosa* in 2 cases Proteus species in 1 case and *Staphylococcus epidermidis*, 1 case.

Malaria

Malaria parasitaemia was found in only 2 children out of 25 blood films reported on.

Length of Hospital stay and Outcome of Illness

Twelve (16.4%) patients stayed for 1 – 7 days in hospital, 34 (46.6%) for 8 – 14 days, 18(24.7%) 15 – 21 days, 3(4.1%) 22 – 28 days and 6(8.2%) for over 28 days before discharge or death.

Twelve (16.4%) patients were discharged against medical advice. Of the remaining 61 patients, sixteen (26.2%) died. The overall mortality was however, 21.9% of 73 patients. Ten of the deaths were from among the 49 patients with kwashiorkor (20.4% mortality) and 6 from the 24 with marasmic-kwashiorkor (25% morality). There were 9 female and 7 male deaths. Five (38.5%) of the 13 bacteraemic patients died compared with 11 (18.3%) of the 60 non-bacteraemic patients ($X^2 = 2.5295, p > 0.1$).

Other conditons diagnosed in the patients who died were gastroenteritis (7 cases), pneumonia (7 cases), discharging septic foci (5 cases), otitis media (4 cases), severe anaemia (3 cases), malaria (2 cases), tonsillitics (2 cases), oral thrush (2 cases), conjuctivitis (1 case), and hypothermia (1 case). Thus sepsis at multiple sites was diagnosed in most of the deaths.

Discussion

Bacteraemia seen in 17.8% of the patients in this study has been reported in 2% to 31% of patients with PEM in other studies.[8–11] The commonest organisms involved in most of the studies have been gram-negative bacilli. Conversely, 61.5% of the cases in the present study were due to gram-positive cocci. Five (38.5%) were due to *Staphylococcus aureus* which is also the commonest organism causing bacteraemia in children in our hospital (unpublished data). It would thus appear that organisms causing bacteraemia in malnourished and well-nourished patients are the same. However, mortality due to these infections seems higher in the malnourished. Two patients had bacteraemia due to *Staphylococcus epidermidis* and one to Corynebacterium species. Although these organisms are recognised skin commensals or laboratory contaminants, they have been known to cause cerebrospinal fluid shunt infections and intravascular catheter and prosthesis — associated bacteraemia and have also been reported to cause serious and even fatal deep organ infections in immuno compromised patients.[14–16] In the present study, one bacteraemic patient with corynebac-

terium species and one with *Staphylococcus epidermidis* died.

The overall incidence of urinary tract infections in this study was 11%. Figures ranging from 8.4% to 31% have been quoted as rates of urinary tract infections in malnourished children in other studies.[8,9,17–19]

None of the four children diagnosed as suffering from tuberculosis had a positive mantoux reaction. Yet, acid fast bacilli were obtained from the ascitic fluid of one of the children with an 8mm reaction. The phenomenon of depressed response of malnourished children to tuberculin is now well established.[5–7,20–21] Thus, any tuberculin reaction of what ever size in a malnourished child should be viewed carefully and the patient subjected to other investigations before a decision regarding the need or otherwise, for antituberculous therapy is made.

Pneumonia was the commonest systemic infection seen, being present in 41.1% of the patients. It is interesting that half of the radiologically proven cases were not diagnosed by physical examination. Similarly, 61.5% of the cases of bacteraemia occurred in children who had not been clinically suspected as such. These observations emphasize the need to perform full screening investigations for infections in malnourished children irrespective of whether signs referable to particular systems or organs are present or not. As soon as this has been done, such children should be commenced on suitable wide coverage antibiotics. The likelihood of this becoming necessary eventually, is further suggested by the high incidence of different types of infections in these children. Good as the recommendation to screen and treat early for infections may be, poverty often limits the ability of the parents to provide money for the purposes of procuring investigation and treatment materials. As a result, the management of these patients tends to be worse than ideal.

Although gastroenteritis was found in 24.7% of the patients, it cannot be claimed that these are due to infections since no bacterial agents were isolated and no viral agents were tested for. Also, diarrhoea in protein energy malnourished children may be due to disaccharide intolerance. The finding of gastro-intestinal candidiasis in 13.7% of the patients is consistent with the findings in earlier studies.[8,22] When taken together with the one other case of external genitalia candidiasis and three cases of tinea, a high incidence of fungal disease in the patients recorded can be explained on the basis of reduced resistance to candida and other infections due to immunosuppression. Hendrickse has suggested that this immunosupression may be due to the metabolic effects of aflatoxins which have been implicated in the pathogenisis to protein energy malnutrition.[23]

Infections constitute only one of the problems of a malnourished child. Yet they are very costly to investigate and manage. In such a common clinical condition, the challenge should be how to prevent PEM altogether. Oral rehydration therapy to reduce the metabolic affects of gastroenteritis, breast feeding, improvement of sanitation levels, supply of cheap, nutritious foods and provision of clean water, health education and raising of existing socio-economic levels are the best strategies for tackling the problem of malnutrition and infections.

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