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CLINICAL PATTERN OF INFECTIONS IN MALNOURISHED CHILDREN

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ABSTRACT

OBJECTIVE:*To determine the clinical pattern of infections in admitted malnourished children.*
METHODS:*It is a cross-sectional study conducted at department of Paediatrics Dow University of Health Sciences and Civil Hospital Karachi from April 2008 to December 2009. Patients between 3 to 60 months of age admitted in the nutritional rehabilitation ward were graded for nutritional status according to WHO guidelines as mild (weight for height ratio between -1SD to -2SD), moderate (-2SD to -3SD) and severe malnourished (weight for height ratio <-3SD of NCHS/WHO reference values). These patients were clinically examined for weight, height/ length, sign and symptoms of infections and micronutrient deficiencies. Relevant investigations including CBC, Urine D/R, and Blood culture were done to confirm the clinical diagnosis. The collected data was analyzed and presented as frequencies and percentages.*
RESULTS:*A total of 112 admitted malnourished children with various types of infections were included in the study. Majority of these patients (58%) were between 12 to 36 months of age, females were fifty nine and males were fifty three with male to female ratio of 1:1. There were hundred severely malnourished, eleven moderate and one case of mild malnutrition. Common infections found were acute gastroenteritis (44.6%), acute respiratory tract infections (24%), enteric protozoal and helminthic infections (23%) and sepsis (16%). Blood Culture was positive in 11.6% cases and common pathogens isolated were staphylococcus aureus (60.23%), gram negative organisms, including klebsiella pneumoniae (23%), E-coli (9.2%) and salmonella typhi in (7.6%) of cases whereas urine and stool culture revealed predominantly E-coli. Most of these organisms were sensitive to ciprofloxacin (100%), vancomycin (88.8%), co-amoxiclav (22.2%) and amikacin (33.3%) and showed resistant to most of the first line drugs including chloramphenicol ampicillin, gentamicin and co-trimaxazole. Co-existing micronutrient deficiencies were rickets (35.7%), vitamin A deficiency (18.7%) while (80%) children had iron deficiency anemia.*
CONCLUSION:
Common infections found in malnourished children were acute gastroenteritis, acute respiratory tract infections, protozoal, helminthic infections and sepsis. Staphylococcus aureus and gram negative organisms were common pathogens found in blood, urine and stool cultures of malnourished children. These pathogens were sensitive to ciprofloxacin, co-amoxiclav, amikacin and 3rd generation cephalosporins but resistant to all first line drugs recommended by WHO including co-trimaxazole, gentamicin, penicillin, chloramphenicol.

K**EY WORDS:** Clinical Pattern, Infections, Malnourished Children.

INTRODUCTION:

Health and nutritional problems of children in developing countries are related to various factors including inadequate food intake and repeated infections. Approximately 5.6 million children die annually due to malnutrition and almost 2.7 million deaths reported under five years of age are due to severe acute malnutrition [1].

Under nutrition impedes metabolic processes in the body and also decreases immunity which leads to severe infections [2]. In developing countries main causes of morbidity and mortality in malnourished children are diarrhea, pneumonia, measles, malaria and HIV infections and fifty percent of these children also have micro nutrient deficiencies [3].

Vitamin A, D, zinc, iron, and iodine deficiencies are major contributors for infections in under nourished children. Vitamin A and zinc deficiencies are responsible for 0.6 million and 0.4 million deaths respectively and 9% of global childhood DALYS in developing

TABLE-I
AGE V/S GRADE OF MALNUTRITION (n=112)

AGE	MILD MALNUTRITION (-1 TO -2 SD)	MODERATE MALNUTRITION (-2 TO -3 SD)	SEVERE MALNUTRITION (≤-3SD)	TOTAL
3 months upto 12 months	01	05	32	38 (33.9%)
12 months upto 36 months	-	05	60	65 (58%)
36 months to 60 months	-	01	08	09 (8%)
total	**01**	**11**	**100**	**112**

TABLE-II
INFECTIONS V/S GRADE OF MALNUTRITION (n=112)

INFECTIONS	MILD MALNUTRITION (-1 TO -2 SD)	MODERATE MALNUTRITION (-2 TO -3 SD)	SEVERE MALNUTRITION (<-3SD)	TOTAL	Percentage %
ACUTE GASTROENTERITIS	-	07	43	50	44.6%
ACUTE RESPIRATORY TRACT INFECTION	-	03	24	27	24%
PROTOZOAL & HELMINTHIC INFECTIONS	-	03	23	26	23%
SEPSIS	-	-	18	18	16%
URINARY TRACT INFECTION	01	-	14	15	13.5%
MENINGITIS	-	-	07	7	6.2%
MALARIA	-	-	03	4	3.5%
ENTERIC FEVER	-	01	03	3	2.6%
PULMONARY TUBERCULOSIS	-	-	03	3	2.6%
MEASLES	-	-	02	2	1.7%
SCABIES	-	-	02	2	1.7%

countries [4]. Almost fifty percent of Vitamin A deficiency cases are found in South Asia and its supplementation can prevent morbidity due to infections in this region [5]. Zinc is an important micronutrient used for treatment and prevention of diarrhea and respiratory diseases [6].

Other common co-morbidities reported in malnourished children are worm infestations and parasites infections like Ascaris lumbricoides, Giardia Lamblia and Entamoeba histolytica infections [7]. Severe malnutrition is also an important risk factor for tuberculosis in poor socio-economic countries. In South African countries tuberculosis was reported to be highly associated with HIV/AIDS infection in undernourished children [8]. Urinary tract infections are also very common in malnourished children, studies have shown a prevalence of 8-35% and risk of bacteremia increases with the severity of malnutrition [9]. Management of poorly nourished children having infections is very crucial. Although WHO has produced guidelines for the management of common illnesses in these children, lack of early diagnosis, inappropriate use of drugs and increasing resistance to commonly used antibiotics leads to adverse effects and causes long term decline in physical growth and cognitive abilities with high risk of chronic diseases. There is also paucity of recent local data regarding the clinical pattern of common infections in undernourished children. Keeping the scenario in view, present study

was done to determine the clinical pattern of infections in admitted malnourished children. This study will provide relevant information regarding present status of common infections, causative organisms and sensitivity pattern of antibiotics used in malnourished children and it will also contribute in planning and implementation of management strategies for these children in national child health and nutritional development programme.

METHODS:

It is a cross-sectional study conducted at Paediatric department of Dow University of Health Sciences and Civil Hospital Karachi from April 2008 to December 2009. This is a tertiary care centre and provides health facilities to a large population of urban and peri-urban areas of Sindh. Patients aged 3 to 60 months admitted in the nutritional rehabilitation ward were classified for the nutritional status according to the WHO guidelines for malnutrition [10]. They were classified as mild having weight for height ratio (between -1SD to -2SD), moderate (between -2SD to -3SD) and severe malnourished (less than -3SD or less than 70% of NCHS/WHO reference values). Children with severe malnutrition were further grouped as severe wasted or edematous malnutrition (based on the presence of symmetrical pedal, hands or generalized edema). These children were clinically examined for height/length, sign and symptoms of infections and micronutrient deficiencies. Standard deviation for weight for height ratio was calculated by plotting weight of patients on NCHS/WHO chart against their height/length on the corresponding gender site. Clinical features of infections including hyper/hypothermia, tachypnoea, reluctance to feed, lethargy, bleeding, dehydration, slow capillary refill, discharge from ears, skin lesions, rash, cough, wheeze, crepitation on chest examination, urinary complaints, jaundice, and throat inflammation were recorded. The clinical signs of micronutrient deficiencies like pallor (palmar, conjunctiva and oral mucosa), vitamin D deficiency signs including wide anterior fontanells, wrist widening, bowing of legs, eyes signs for vitamin A deficiency like photophobia, dry hazy conjunctiva and cornea, bitot spot, signs of other miscellaneous micronutrients like B- complex and zinc deficiencies such as chelosis, dermatitis were also recorded on pre-designed performa. Relevant investigations were done to confirm the diagnosis including blood CBC, Chest X-ray, Urine D/R, Stool D/R, Montaoux test, random blood sugar, serum urea/creatinine electrolytes and blood cultures were done in all cases whereas cultures from other sites such as urine, stool, CSF, throat, ears were also done where indicated. For micronutrient deficiencies Haemoglobin less than 11gm/dl was taken as anaemia according to WHO [11], iron profile including TIBC, Serm ferritin was done to confirm iron deficiency anaemia, radiological evidence of vitamin D deficiency including decrease mineralization on X-ray wrist joint and biochemical tests like serum calcium, alkaline phosphatase and phosphorus were also done. Patients with chronic illnesses including congenital malformations, inborn error of metabolism, inherited autosomal disorders like cystic fibrosis, chronic diarrhea including celiac diseases, congenital cardiac diseases and cardiomyopathies were excluded from the study. Patients included in the study were managed as per WHO guidelines [10]. The collected data was analyzed and presented as frequencies and percentages.

RESULTS:

In the present study 112 admitted malnourished children with various types of infections were enrolled. These children were between 3 to 60 months of age, majority of them (58%) were between 12 to 36 months of age. (Table-I). Females (59) were more affected than males (53) and male to female ratio was 1:1. Regarding nutritional status, there were hundred patients of severe malnutrition out of them 75% were severely wasted and 25% had edematous malnutrition, moderate malnutrition was present in eleven and there was only one case of mild malnutrition. (Table-I).

Common infections found were acute gastroenteritis (44.6%), acute respiratory tract infections (24%) followed by helminthic and protozoal infections (23%) and sepsis in (16%) cases. Malaria was present in 3.5% patients (Table-II).

Most frequent helminthic infections found were ascariasis (Ascaris lumbricoides) infection (57.6%) and Hymenolepis nana (2%). Entamoeba histolytica was the most common enteric protozoan observed in 23% cases followed by Giardia lamblia infection in 11% patients. Blood culture was positive in 11.6% cases, the organisms found were staphylococcus aureus in (60.23%), klebsiella pnemoniae (23%), E-coli (9.2%) and salmonella typhyi in (7.6%) of isolates. Urine culture showed growth in (26.6%) specimens, gram negative bacilli, Klebsiella pneumoniae and Ecoli were the two pathogens found in fifty percent each of the isolates. Stool cultures were positive in (6.9%) cases and showed gram negative organisms, Ecoli was the predominant organism, isolated in (66.6%) followed by Klebsiella pnemoniae in (33.3%) specimens. Streptococcus pnemoniae was cultured in CSF specimens in (14.28%) cases.

The antibiotic sensitivity reports showed that staphylococcus aureus was sensitive to vancomycin (88.8%), ciprofloxacin (100%), co-amoxiclav (22.2%) and amikacin (33.3%) whereas it was resistant to most of the first line drugs including penicillin, gentamicin, cloxacillin, cephradine, chloramphenicol and 3rd generation cephalosporins. Klebsiella pneuomiae was sensitive to cefotaxime and amikacin in (100%) of isolates, whereas Ecoli was highly sensitive (100%) to 3rd generation cephalosporins, nalidixic acid, ciprofloxacin, and imipinem whereas both organisms were resistant to all first line drugs including, penicillin, gentamicin, chloramphenicol and Co-trimaxazole. Co-existing micronutrient deficiencies found were iron deficiency anaemia (80%), rickets 40 (35.7%), vitamin A deficiency 21 (18.7%) and other miscellaneous deficiencies including zinc and B-complex deficiency were observed in 52 (46%) patients, most of these children were between 13-36 months of age. Only two patients expired during the study period, one with sepsis and disseminated intravascular coagulopathy (DIC) and other died due to acute gastroenteritis and shock, rest of the children were discharge after treatment and called for follow up in the nutritional rehabilitation clinic.

DISCUSSION:

Association of malnutrition and infections in children is an important health issue leading to increase fatal outcome. It is estimated that globally 50.6 million children under five years of age are malnourished and nearly 90% of these children are from developing countries [12]. Majority of undernourished children admitted in the hospital have various types of infections, although overt signs are difficult to detect compare to a well nourished child [10].

Prevalence of malnutrition and co-existing infections is high between 3 to 24 months of age with predominant female involvement [13]. Most of the local studies showed similar reports [14]. In the current study majority (58%) of children were between 12 to 36 months of age and females were more affected than males. In Pakistan 38% children under five years of age are underweight, 37% are stunted whereas 13% are wasted and are prone to develop recurrent illnesses leading to poor physical growth [15]. In our study majority of children were severely malnourished (89%) out of whom 75% were severe wasted and 25% had edematous malnutrition. Poor nutrition is associated

with fifty percent of deaths associated with pneumonia, persistent dirrhoea and dysentery [16]. Factors causing co-occurrence of diarrhoea and acute lower respiratory tract infections inundernourished children are acute micronutrient loss, stress on immune system and dehydration. A study has reported that there is high risk of acute lower respitaroty tract infections in malnourished children hospitalized for severe dirrohea [17]. In the present study also 44.6% patients had acute gastroenteritis whereas acute respiratory tract infections were present in 24% cases. The high percentage of these infections found in the current study is because of poor hygiene and sanitary conditions associated with inadequate immunization and lack of breast feeding practices. Sepsis is associated with shock and myocardial dysfunction especially in undernourished children [18]. It is reported that most of the deaths in poorly nourished children are due to sepsis [19]. In our study there were 16% cases of sepsis. Protozoaland helminthic infections were another frequent problems found in the current study, Ascariasis was the most common helminthic infection observed in (57.6%) followed by Hymenolepis nana (2%) whereas Entamoeba histolytica infection was the commonest protozoal infection seen in (23%) cases followed by Giardiasis in (11%) patients. A study from Africa reported Ascaris lumbricoides (17.8%), Giardia lamblia (9%) Hymenolepsis nana (4.7%) and Entamoeba histolytica in (2.1%) cases[20] whereas data from Bangladesh showed significantly high proportion of Entamoeba histolytica [21]. Malnutrition is a major contributor to malaria morbidity and mortality. It is reported in a study that under nutrition significantly lowers the antiplasmodium falciparum antibody response, leading to decrease response to antimalarial drugs and increase severity of illness [22]. In the present study malaria was found in (3.5%) cases. Urinary tract infection is also common in malnourished children, in the present study it was found in (13.5%) patients. Other infections observed were vaccine preventable diseases including measles, meningitis, enteric fever and tuberculosis, indicating lack of immunization, inadequate feeding, contaminated food, water and poor hygienic conditions in the community.

Blood culture is a gold standard for diagnosis of infections. An earlier data showed that blood culture was positive in 17% of isolates, gram negative organisms were found in 58%, staphylococcus aureus 26% and streptococococcus pneumoniae was observed in 13 % cases [23]. In our study blood culture was positive in 11.6% cases whereas most common organisms found were staphylococcus aureus (60.23)%, klebsiella pneumoniae (23%), E-coli (9.2%) and salmonella typhi in (7.6%) of isolates. Urine and stool cultures reports showed increase frequency of gram negative bacilli, Esherichia coli (Ecoli) and Klebsiella pneumoniae whereas CSF culture showed streptococcus pneumoniae. Sensitivity pattern of common pathogens causing infections in malnourished children has shown significant changes over the years. Previous reports revealed that 95.8% of all isolates were sensitive to combination of ampicillin and gentamicin [24], but recent data showed high susceptibility to ciprofloxacin, ceftriaxone and gentamicin and resistance to chloramphnicol, co-trimaxazole and ampicillin [23], similarly high sensitivity is reported for co-amoxiclav, nalidixic acid, gentamicin and third generation cephalosporins for gram-negative baclli from urine isolates [9], the current study also showed similar results.

Co-existing micronutrient deficiencies increases the severity of infections in malnourished children. A study showed that pneumonia was associated with rickets in 47% cases [25]. Vitamin A and zinc deficiency is also associated with dirroheal and respiratory diseases. In our study iron deficiency anaemia was the most frequent micronutrient deficiency found in (80%) followed by rickets (35.7%) and vitamin A was found in (18.7%) of cases. The association of under nutrition and micronutrient deficiency is one of the factors leading to increase frequency of infections in the present study. Hence early diagnosis and treatment of infections in malnourished children is essential for prevention of mortality.

Limitation of study: This is a hospital based study and conducted on a small sample size. Investigations like stool cultures and urine cultures were not obtained in all the cases because of financial constraints.

CONCLUSION:

Common infections found in malnourished children were acute gastroenteritis, acute respiratory tract infections, enteric protozoal, helminthic infections and sepsis. Staphylococcus aureus and gram negative organisms including klebsiella pneumoniae, E-coli and salmonella typhi were common pathogens found in blood, urine and stool cultures of malnourished children. These pathogens were sensitive to ciprofloxacin, third generation cephalosporins, amikacin, co-amoxiclav, but resistant to all first line drugs recommended by WHO including co-trimaxazole, gentamicin, penicillin and chloramphenicol. Co-existing micronutrient deficiency in undernourished children were iron deficiency anaemia 80%, rickets 35.7% and vitamin A deficiency in 18% cases.

RECOMMENDATIONS:

There is a need of implementing strategies for treatment and control of infections in malnourished children. The changing pattern of organisms sensitivity to antibiotics should be considered during preparation of management protocols. Counseling of mothers regarding breast feeding, complementary feeding and immunization should be further promoted in the health facilities and media to reduce the childhood morbidity and mortality in the community due to infections and malnutrition. Micronutrient supplementation and immunization should be emphasized in national nutritional and health programme.

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