Pattern of Infections and Infestations in Severe PEM

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1 INTRODUCTION

INTRODUCTION

Primary malnutrition is seen in the dependent, who rely on others for nourishment; infants, children, elderly, prisoners; disabled and mentally ill are most vulnerable. Secondary malnutrition accompanies any disease which disturbs appetite, digestion, absorption or utilization of nutrients.

Malnutrition and infection pose a serious threat to the health of the population, especially young children in developing countries. Among several nutritional disorders of public health importance, PEM is one of the most widespread. The highest prevalence is among children under 5 years. PEM is not a single disease entity, but covers a wide spectrum of deficiency states ranging from severe cases of kwashiorkor and marasmus to milder forms, which manifests as varying degrees of growth retardation.

FACTORS CONTRIBUTING TO MALNUTRITION:

PEM is the result of a complex interplay of factors in the individual, family and community.[1] Inadequate dietary intake and infectious diseases are immediate determinants of PEM.[1]

ROLE OF INFECTION:

Infectious diseases may cause, accelerate or exacerbate PEM; conversely PEM may increase the susceptibility to and severity of infections. There are several mechanisms by which infection can adversely affect the nutritional status. During acute infection, appetite is impaired and food intake is reduced. Apart from this, dietary restriction is often imposed by the mother and health workers, as it is generally believed that food intake may aggravate the disease. Malabsorption of nutrients and metabolic losses during infection can also aggravate malnutrition.

Fig: 1. Disease- Malnutrition cycle*[1]

Therefore, control of infection should be an essential component of treatment and prevention of PEM.[2]

ROLE OF FEEDING PRACTICES:

In India, a majority of infants are breastfed and show satisfactory weight gain during the first 4 to 6 months. But thereafter, growth faltering occurs due to delayed introduction of supplementary foods. Improper weaning practices are fraught with dangers of: i). diarrhea due to infection from unhygienic preparations.[3,4] and ii) poor nutrition related to inadequate caloric intake due to low frequency of feeding and poor nutritional quality of the weaning diet.[4,5,6,7]

DIETARY INTAKE:

Community surveys in different parts of India have revealed that the primary defect in the diets of preschool children is energy.[8] If the food intake is raised to fill the energy deficit, the protein needs will be automatically met.

CLINICAL FORMS OF MALNUTRITION:

Most sensitive indicator of malnutrition is failure to achieve normal growth. PEM is a comprehensive term; in its advanced form the condition includes marasmus and kwashiorkor. The intermediate type is called marasmic kwashiorkor.

MARASMUS: deficiency of proteins as well as calories with severe growth retardation and well preserved metabolic processors.[9] It is characterized

by loss of subcutaneous fat and severe muscle wasting. The body weight is very low and edema is absent.

KWASHIORKOR occurs with deficient protein but relatively adequate caloric supply.[9] The breakdown of hormonal adaptive processes in kwashiorkor results in characteristic biochemical and clinical picture.[9] The main features of kwashiorkor are growth retardation, edema and mental apathy. In addition there may be dermatosis and hair changes. The causes of kwashiorkor include insufficient intake of protein or intake of poor quality of protein, impaired digestion or absorption; GI loss; increased protein requirement due to growth, tissue injury and infection.

MARASMIC KWASHIORKOR; in many areas where PEM is a problem, malnourished children exhibit the features of both marasmus and kwashiorkor. They have varying degrees of muscle wasting, edema as well as hair and skin changes. A transition from one form of malnutrition to the other form is not uncommon.

MANAGEMENT OF MALNUTRITION:

It depends on severity of the disease and the facilities available. Severely ill require intensive care and can be better managed in a hospital setup, while less severe can be treated on OPD basis or even at home. Treatment of associated complications is important for reduction of mortality, while proper dietary management is crucial for complete recovery.

In acute phase management of malnutrition, immediate complication should be managed like treatment of hypoglycemia, hypothermia, septicemia etc.

In the intermediate phase, energy and nutrients are given in amounts marginally above the patient's maintenance requirement to correct the metabolic abnormalities. Here appetite is used as an indicator.

In the rehabilitation phase, the patient's body is ready to make more tissue and the patient is fed according to appetite. Towards the end of this phase and upto discharge and following discharge, there should be education of parents and care takers with regard to continuing the rehabilitation and preventing recurrence.

The basic principle of dietary management is to improve the nutritional level of the patient as quickly as possible by providing a diet sufficient in protein and energy. Initially there may be a refusal of feeds due to poor appetite. This can be overcome by spoon feeding or tube feeding for the first few days. It is better to start with a liquid formula as it is easy to feed and measure the intake. As the appetite improves and the patient is able to take feeds, solid supplements can be introduced. Special supplement providing both high quality protein and calories would help in the recovery of the patient. As both protein and energy are required in large quantities, the recommended intake of protein 4 to 6 gm/kg/day and 150 to 220 kcal/kg/day. About 30 to 40% of the total calories can be provided safely through dietary fat.

Diets of children suffering from PEM are not only inadequate in protein and calories, but are also deficient in micronutrients. Vitamin A deficiency and anemia are the most common nutritional disorders. It is therefore essential to ensure the adequate intake of these nutrients. As many children with PEM have associated vitamin and mineral deficiencies, multivitamin and mineral preparations in adequate quantities are required along with the diet. Iron deficiency is the main cause of anemia in malnourished children. Folate deficiency is also seen. Mild to moderate anemia can be treated with oral iron and severe anemia (Hb <5 gm %) with blood transfusion.

Change from hospital diet to the traditional diet usually consumed by the family is important.

This study was undertaken to know the interplay of factors like infection (diarrhea, ARI, tuberculosis), infestation (giardiasis, helminthiasis), feeding practices and immunization status among malnourished children admitted to pediatric medical ward, KIMS Hospital Hubli.

2 AIMS AND OBJECTIVES

PEM is the common cause of morbidity and mortality in children. There are multiple factors responsible for malnutrition among children. Following were the aims and objectives of our study.

1. To study morbidity and mortality of children with infection and infestation among protein energy malnutrition cases admitted in pediatric medical ward in KIMS Hospital, Hubli.
2. To know the influence of feeding practices in the study group.
3. To study the extent of immunization coverage in the study group.

3 REVIEW OF LITERATURE

Maria Imaculada, et al.[10] evaluated relationship between PEM, vitamin A and parasitic infections in 124 children in Brazilia in 2002. 75% of children were infected with intestinal parasites. An association was found between PEM and Giardia lamblia, but not with Ascaris lumbricoides or Hymenolepis nana infection. Hypovitaminosis A was a major nutritional problem, but no relationship between this deficiency and parasitic infection was found.

Amadi B, et al.[11] evaluated 200 children aged between 6 to 24 months old with persistent diarrhea and malnutrition in Lusaka, Zambia in 2001. Antibodies to HIV were found in 108(54%) of the children. The common intestinal infections [cryptosporidium parvum (26%) and nontyphoid salmonella spp. (18%)], septicemia (17%) and pulmonary tuberculosis confirmed by gastric lavage (13.5%) were not significantly more common in HIV seropositive than in HIV seronegative children. HIV seropositive children were more likely to have marasmus whereas HIV seronegative children were more likely to have kawashiorkor. Of the 200 children 39(19.5%) died within 28 days; cryptosporidiosis and marasmus were the only independent predictors of death.

Tshikuka JG, et al.[12] studied relationship of childhood PEM and parasitic infection in 558 children aged 4 months to 10 years in Montreal, Canada in 1997. The risk of stunting was significantly higher in children with Ascaris lumbricoides. The risk of wasting was higher in children with Ascaris lumbricoides and Trichuris trichiura, whereas risk of kwashiorkor was high with T. trichiura but very reduced in those with Ascaris lumbricoides. Plasmodium infection was not related to nutritional indicators.

Renaudin P, et al.[13] studied 1050 hospitalized children ranging in age from 1 to 59 months in Moundou, Tchad in 1997. Diarrhea, dehydration, malaria, anemia, acute respiratory infection and meningitis accounted for 85.5% of

underlying disease and for 76% of deaths. Prevalence of malnutrition was highest in children with acute respiratory infections (61.3%) or diarrhea (89.8%). Mortality was higher in severely malnourished children and malnourished children with respiratory infection especially at ages under 1 year. Death was attributed to malnutrition in 30% of cases.

Mutombo, et al.[14] evaluated 183 undernourished children in Dabou in 1995. Malnutrition was noted in 18% of children admitted to pediatric department of Dabou including 70.5% with marasmus. Serologic tests were positive for HIV in 46 of the 183 children i.e., 25.1%. The type of malnutrition was not significantly different in seropositive children. Breast feeding was more common in the seropositive than seronegative group (59% vs. 39%).

In a study done by Udani PM,[15] at Bombay in 1994, malnourished children developed serious and often fatal types of tuberculosis such as miliary, meningitis and disseminated tuberculosis, in spite of BCG vaccination. The tuberculin anergy in malnourished children is mainly responsible for high morbidity and mortality.

Shimeless D, et al.[16] studied clinical profile and pattern of infection in 90 Ethiopian children with severe PEM in the year 1994. The study group consisted of 44 (49%) with marasmus, 29 (32%) with marasmic kwashiorkor and 17 (19%) with kwashiorkor, ranging in age from 4 to 60 months. Over 80% of the patients were infected and the lungs were the common sites. Bacterial pathogens, predominantly gram negative enteric organisms were isolated from 36% of blood and 37% of urine specimens. Rickets and overt vitamin A deficiency were seen in 37% and 17% of the patients respectively. Septicemia, gastroenteritis, pneumonia and disseminated tuberculosis accounted for an overall case fatality rate of 32%.

Christie CD, et al.[17] in his five year prospective study done at Kingston, Jamaica in 1992, documented bacteremia in sixteen percent of 336 severely malnourished children, 2 to 34 months of age . The 53 children had 60 episodes of nosocomial and community acquired bacteremia with 69 blood isolates. Community acquired bacteremia accounted for 72 %(43/60) of bacteremic episodes. 35% (24/69) of the strains were coagulase negative staphylococci, 19%(13/69) were staphylococcus aureus and 11%(8/69) were streptococcus group D. These patients were more likely to have

pneumonic consolidation than children with all other bacteremia combined. The bacteremia related case fatality rate was 8 %(5/60).

In study done by Issack H, et al.[18] at Dares Salaam, Tanzania in 1992, the incidence of hospital acquired acute bacterial infection among 164 severely malnourished children admitted to pediatric wards were included. On admission 92% of the patients had at least one form of bacterial infection. During subsequent 2 weeks hospital stay, 49% of patients acquired new infection. Septicemia and UTI were commonest infections. Pathogens similar to those found from patients were cultured from random samples taken from the floor, beds, towels, sinks and antiseptic containers in the wards.

Reed RP, et al.[19] identified campylobacter bacteremia in 19 children at South Africa in the year 1996; all isolates were C jejuni. 16 (84%) had malnutrition; 13 of these were severely malnourished.

Reed RP et al.[20] in his study at Johannesburg, South Africa in 1996, noted 9.6% incidence of bacteremia in malnourished children, 11.8% in those were severely malnourished. The predominant organisms retrieved were gram negative enteric bacilli (48.5%). The case fatality rate of severely malnourished bacteremic children was 20.8%.

Wolf BH, et al.[21] in his study at Bulawayo, Zimbabwe from July 1992 to May 1993, noted bacteremia in particular with gram negative bacteria, is an important cause of death in malnourished children irrespective of their HIV-1 antibody status.

Fridland IR[22] reported 36% of deaths in children with kwashiorkor related to bacteremia in a study done at Johannesburg, South Africa.

Berkowitz FE[23] prospectively studied infections occurring in 68 black children with marasmus, marasmic kwashiorkor and kwashiorkor. 15 episodes of bacteremia, most commonly due to gram negative enteric bacilli, occurred in 13 children (19%), 6 of these episodes being nosocomial. UTI, diagnosed on suprapubic urine specimens and all due to E coli, occurred in 5 out of 16 cases (31%). Of all the 14 deaths, 8 were associated with bacteremia.

Bagga A et al.[24] prospectively examined the incidence of bacteriuria in malnourished patients between 6 months and 5 years of age, at AIIMS New Delhi. Of 112 patients (65 boys), 55 had moderate and 57 had severe malnutrition; 43 had diarrhea and 35 had fever. Significant bacteriuria was found in 17 (15.2%) malnourished children. The risk of bacteriuria increased significantly with the severity of malnutrition and in patients with diarrhea. Bacteriuria was associated with symptoms in 70.6% of cases.

Rabasa AI, et al.[25] reported 11.3% prevalence of UTI among severely malnourished children at Maiduguri, Nigeria in 2002. There was no difference either between the sexes or the different categories of malnutrition. The commonest isolates were gram negative organisms predominantly E coli.

Caksel H, et al.[26] isolated E coli from urine in 54.8% of malnourished children with UTI at Van, Turkey 2000. Most strains of E coli were resistant to Co-trimoxazole (82.3%), ceftriaxone (17.6%), cefotaxime (17.6%) and ciprofloxacin (17.6%), but none of them were resistant to gentamicin.

V. S. Dani et al.[27] studied 194 children with severe protein energy malnutrition at Rural Yavatmal Dist. of Maharashtra from Jan to Jun 1994. 97.42% were from poor socioeconomic group. 36.06% of cases had vitamin A deficiency. Associated illness was found in 77.27% of cases. History of passing worms was found in 57.95%of cases. Among the associated illness URI was seen in 27.31% of cases and severe anemia in 17.01% of cases. He reported delayed initiation of breast feeding i.e., after 24 hours of birth in 89% of cases and after 48 hours in 54% of cases. He also found that 65% of children of severe PEM received breastfeeding alone without weaning food upto the age of 2 years.

Kala UK, et al.[28] evaluated 75 children with malnutrition at Johannesburg, South Africa in 1992, for UTI by culture of urine obtained suprapubically prior to antibiotic therapy. UTI was diagnosed in 26 (34.7%) of whom 21(81%) were boys. The overall prevalence of UTI in those with kwashiorkor/ marasmic kwashiorkor was 42%. E coli was the organism most commonly cultured. No anatomic abnormalities were identified in patients with UTI.

Brown KH, et al.[29] compared severe malnourished children with and without eye signs of vitamin A deficiency. Children with more severe eye lesions were more retarded in growth than those with minimal ocular

signs. All patients had high rates of bacterial infections regardless of their vitamin A status. However xerophthalmic children had a highly significant increase in the rate of positive urine culture. Mortality rates were similar in all study groups.

4 MATERIALS AND METHODS

The study was conducted in the Department of Pediatrics KIMS, Hubli from October 2002 to December 2003 (15 months).
The study included 62 cases of malnutrition that fulfilled the inclusion criteria.

INCLUSION CRITERIA:
All children fulfilling criteria of WELLCOME TRUST CLASSIFICATION for PEM except undernutrition ranging from 1 month to 59 months i.e.,

Weight between 60-80% of expected
With edemakwashiorkor
Without edema undernutrition

Weight below 60% of expected
With edemamarasmic kwashiorkor
Without edema nutritional marasmus

EXCLUSION CRITERIA:
All the patients who come under any of the following categories

- Children <1month.
- Children >59 months
- Children with cardiac disease
- Children with mental retardation, cerebral palsy
- Children with major congenital anomalies
- Children with LBW
- Children with weight/age 60-80%(i.e., undernutrition)

METHOD OF COLLECTION OF DATA:

- Informed consent from parents/guardians/ appropriate attender of malnourished children was taken.

- Information was collected in structured proforma for each case.
- All cases which were eligible, were included in the study(time bound)
- Routine and specific investigations are done to confirm respective infection/infestation

5 OBSERVATIONS

Table No. 1: AGE AND SEX DISTRIBUTION OF MALNOURISHED CHILDREN.

Age group (months)	Male	Female	Total	Percentage (%)
1-12	14	7	21	33.87
13-24	10	14	24	38.70
25-36	4	6	10	16.13
37-48	5	1	6	9.68
49-59	1	-	1	1.61
Total	34	28	62	100
Percentage	54.84	45.16	100	

In the present study, majority of cases were from 1-24 months.

Table No.2: RESIDENCE AMONG MALNOURISHED CHILDREN.

Area	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
Urban	13	3	-	16	25.80
Uuban slum	6	3	-	9	14.52
Rural	28	8	1	37	59.68
Total	47	14	1	62	100
Percentage (%)	75.8	22.58	1.62	100	

Majority were from rural area (59.68%) and next highest was urban area

Table N0. 3: RELIGION AMONG MALNOURISHED CHILDREN.

Religion	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
Hindu	35	13	1	49	79.04
Muslim	12	1	-	13	20.96
Total	47	14	1	62	100
Percentage	75.80	22.58	1.62	100	

Majority were Hindus (79.04%), followed by Muslims (20.96).

Table No.4.SOCIOECONOMIC STATUS* AMONG MALNOURISHED CHILDREN

Class	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
I	1	-	-	1	1.61
II	-	-	-	-	-
III	13	4	-	17	27.42
IV	32	9	1	42	67.75
V	1	1	-	2	3.22
Total	47	14	1	62	100
Percentage	75.80	22.58	1.62	100	

*Based on Modified Kuppuswamy classification

Malnutrition is more prevalent in poorer section of the society (98.39%).

Table No. 5: PRESENTING SYMPTOMS AMONG MALNOURISHED CHILDREN.

Presenting symptoms	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
Fever (A)	37	10	1	48	77.42
Cough (B)	26	9	-	35	56.45
Loose stool (C)	17	5	-	22	35.49
Vomiting (D)	13	2	-	15	24.2

Ear discharge (E)	7	4	-	11	17.75
Refusal of feeds (F)	5	1	-	6	9.67
Failure to thrive (G)	4	1	-	5	8.06
Skin manifestations (H)	4	2	-	6	9.67
Swelling of limbs (I)	-	3	1	4	6.45
Altered sensorium (J)	2	-	-	2	3.22
Tremors (K)	-	1	-	1	1.61

Fever was the commonest among presenting symptoms. It was present in 77.42% of cases. The other common symptoms observed were cough (56.45), loose stool (35.49%) and vomiting (24.20%). Many of the patients had more than one symptom.

Table No 6. XEROPHTHALMIA AMONG MALNOURISHED CHILDREN.

Eye Signs	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
Conjuctival xerosis	8	-	1	9	14.52
Bitot spots	3	1	-	4	6.45
Corneal xerosis	1	-	-	1	1.61
Corneal ulcer <1/3	-	3	-	3	4.84
Keratomalacia	-	1	-	1	1.61
No eye signs	35	9	-	44	70.97
Total	47	14	1	62	100

Xerophthalmia was seen in 29.03% cases. Severe signs were present in marasmic kwashiorkor.

Table No. 7: CONTACT WITH TUBERCULOSIS AMONG MALNOURISHED CHILDREN

History of contact	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
Present	6	3	-	9	14.52
Absent	41	11	1	53	85.48
Total	47	14	1	62	100

History of contact with tuberculosis was present in 14.52% of cases.

Table No. 8: SOURCE OF CONTACT WITH TUBERCULOSIS AMONG MALNOURISHED CHILDREN.

Source	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
Mother	3	-	-	3	33.33
Father	2	2	-	4	44.45
Grand father	1	-	-	1	11.11
Neighbor	-	1	-	1	11.11
Total	6	3	-	9	100
Percentage (%)	66.66	33.34	-	100	

Source of contact was parents in 7 children (77.78%) out of 9 children.

Table No.9: HISTORY OF PAST ILLNESS AMONG MALNOURISHED CHILDREN.

Illness	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
Diarrhea	8	1	-	9	14.52
Ear discharge	5	2	-	7	11.29
Measles	11	3	-	14	22.58
Tuberculosis	-	1	-	1	1.61

History of measles within past 12 months was elicited in 22.58% cases. History of tuberculosis in the past was present in only one case.

Table No. 10: TIME OF INITIATION OF BREAST FEEDING AMONG MALNOURISHED CHILDERN

Time of initiation of breast feeding (hours)	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
<1	4	1	-	5	8.06
1-4	11	4	1	16	25.8
4-24	6	1	-	7	11.29
24-48	1	4	-	5	8.06
>48	23	2	-	25	40.33
No breast milk	2	2	-	4	6.46
Total	47	14	1	62	100

Initiation of breast feeding within one hour was noticed in 8.06% of cases, whereas initiation between 1-24 hours, 24-48 hours and >48 hours was seen in 37.09%, 8.06% and 40.33% respectively. No breast feeding was given in 6.46% of cases.

Table No. 11: DURATION OF EXCLUSIVE BREAST FEEDING AMONG MALNOURISHED CHILDREN.

Duration of EBF (months)	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
<4	10	1	-	11	17.74
4-6	15	3	-	18	29.03
7-12	18	6	1	25	40.33
>12	2	2	-	4	6.45
No breast feeding	2	2	-	4	6.45

Early introduction of complementary foods was seen in 17.74% cases. Delayed initiation on complementary foods was seen in 46.78% cases. No breast feeding was given in 4 cases (6.45%).

Table No. 12: TOP FEEDING PRACTICES AMONG MALNOURISHED CHILDREN.

Feeding practice	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
Cup and spoon feeding	4	1	-	5	8.06
Bottle feeding	4	2	-	6	9.68
Total	8	3	-	11	17.74
Percentage (%)	12.9	4.84	-	17.74	

Top feeding practice was seen in 17.74% of cases.

Table No. 13: COMPLEMENTARY FEEDING AMONG MALNOURISHED CHILDREN.

Supplementation	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
Breast feeding alone without supplementation for >1year	2	2	-	4	6.45
Breast feeding with inadequate supplementary food	15	3	-	18	29.03
No breast milk but diluted milk and inadequate feeds	2	2	-	4	6.45

Table No. 14: FEEDING PRACTICES AMONG HIV SEROPOSITIVE MALNOURISHED CHILDREN.

Type of feeding	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
Breast feeding	5	1	-	6	85.72
Top feeding	-	1	-	1	14.28
Total	5	2	-	7	100

In the present study, breast feeding was seen in 6 (85.72%) HIV seropositive children. Top feeding was seen in only one seropositive case.

Table No. 15: IMMUNIZATION STATUS* AMONG MALNOURISHED CHILDREN.

Immunization status	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
Completely immunized	4	1	1	6	9.68
Partially immunized	38	12	-	50	80.64
Unimmunized	5	1	-	6	9.68
Total	47	14	1	62	100

* According to UIP schedule

Completely immunized till date were only 9.68% of children. 90.32% were partially immunized/unimmunized.

Table No. 16: TYPE OF ANEMIA AMONG MALNOURISHED CHILDREN

Type of anemia	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
Normocytic normochromic	6	2	1	9	14.52
Microcytic hypochromic	15	2	-	17	27.42
Macrocytic hypochromic	3	1	-	4	6.45
Dimorphic	14	5	-	19	30.64
Normocytic hypochromic	9	4	-	13	20.97
Total	47	14	1	62	100

Dimorphic anemia was predominant type (30.64%) followed by microcytic hypochromic anemia which was seen in 27.42% of children.

Table No. 17: SEVERITY OF ANEMIA* AMONG MALNOURISHED CHILDREN.

Severity of anemia	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
Mild	9	2	-	11	17.74
Moderate	25	9	1	35	56.45
Severe	12	3	-	15	24.20
No anemia	1	-	-	1	1.61
Total	47	14	1	62	100

*WHO classification of anemia.

In the present study 24.2 % of cases had severe anemia and 56.45% had a moderate anemia and 17.74% had mild anemia. No anemia was seen in one child.

Table No. 18; PATTERN OF INFECTION AND INFESTATION AMONG MALNOURISHED CHILDREN.

Pattern	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
GI infections	12	4	1	17	27.42
Ascariasis	3	1	-	4	6.44
Giardiasis	-	1	-	1	1.61
Meningitis	4	-	-	4	6.44
Otitis	14	3	-	17	27.42
URTI	1	1	-	2	3.22
Bronchopneumonia	12	2	1	15	24.19
Lobar pneumonia	3	2	-	5	8.06
Empyema	2	-	-	2	3.22
Tuberculosis	12	5	-	17	27.42
UTI	23	4	1	28	71.8 (28/39)
Measles	1	1	-	2	3.22
Septicemia	8	1	-	9	16.67 (9/54)
HIV	5	2	-	7	17.5 (7/40)

Table No. 19: PATTERN OF TUBERCULOSIS AMONG MALNOURSHED CHILDREN. (N=17)

Type	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
Pulmonary	7	4	-	11	64.70
Disseminated	-	1	-	1	5.89
Lymph node	2	-	-	2	11.76
Meningeal + miliary	3	-	-	3	17.65
Total	12	5	-	17	100

Diagnosis of tuberculosis was done in these cases either clinically, radiologically, histopathologically, or bacteriologically. 2 cases were positive for AFB by gastric lavage.

Table No.20. ORGANISMS ISOLATED FROM STOOL AMONG MALNOURISHED CHILDREN. (N = 37).

ORGANISMS	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
E .coli	7	-	-	7	18.92
Klebsiella spp	1	-	-	1	2.70
V .cholera	1	-	-	1	2.70
Normal commensals	19	8	1	28	75.68
Total	28	8	1	37	100

Gram negative organisms were isolated in 24.32 %(9/37) cases, whereas normal commensals in 75.68%(28/37) cases.

Table No.21.ISOLATION OF ORGANISMS FROM BLOOD* AMONG MALNOURISHED CHILDREN. (N=56)

ORGANISM	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	TOTAL	Percentage (%)
E.coli	1	-	-	1	1.78
H influenza	1	-	-	1	1.78
Pseudomonas	1	1	-	2	3.58
Providentia spp	2	-	-	2	3.58
S aureus	1	-	-	1	1.78
NFGNB	1	-	-	1	1.78
MRSA	1	-	-	1	1.78
CONS	1	-	-	1	1.78
Contamination	1	3	1	5	8.93
No growth	32	9	-	41	73.23
Total	42	13	1	56	100

*Based on blood culture report

Blood culture was positive in 17.86% (10/56) of cases. Gram negative organisms were isolated in 12.72% (7/56) of cases.

Table. No.22. ISOLATION OF ORGANISMS FROM URINE AMONG MALNOURISHED CHILDREN. (N = 39).

Organisms	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
E .coli	8	4	1	13	33.33
Klebsiella	4	-	-	4	10.25
Citrobacter	4	-	-	4	10.25
Enterobacter	3	-	-	3	7.69
Providentia spp	1	-	-	1	2.57
Proteus	1	-	-	1	2.57
Pseudomonas	1	-	-	1	2.57
Candida	1	-	-	1	2.57
Contaminant	1	1	-	2	5.13
No growth	8	1	-	9	23.07
Total	32	6	1	39	100

Gram negative organisms were isolated in 69.24% of cases.

Candida was isolated in one case (2.57%).

Table No.23. EAR INFECTION AMONG MALNOURISHED CHILDREN. (N=17)

Type of ear infection	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
ASOM	4	3	-	7	11.29
CSOM	7	-	-	7	11.29
Otitis Externa	3	-	-	3	4.84

Ear infection was present in 27.42 %(17/62) children.

Table no. 24. NEUROINFECTION AMONG MALNOURISHED CHILDREN. (N=10).

Type	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
Pyogenic meningitis	1	-	-	1	1.61
Tubercular meningitis	3	-	-	3	4.84
No infection	4	2	-	6	9.68
Total	8	2	-	10	16.13

LP was done in 10 cases. One patient had pyogenic meningitis and three had tubercular meningitis. Neuroinfection was observed in 6.45 %(4/62) of children.

Table no.25 .HIV SEROPOSITIVITY AMONG MALNOURISHED CHILDREN. (N=40).

Seropositivity	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
Positive	5	2	-	7	17.5
Negative	25	7	1	33	82.5
Total	30	9	1	40	100
Percentage	75	22.5	2.5	100	

Among 40 cases tested, 7 (17.5%) were found to be positive for HIV.

Table No. 26: GASTROINTESTINAL INFESTATION AMONG MALNOURISHED CHILDREN. (N=60).

GI Infestations	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
Ascariasis	3	1	-	4	6.67
Giardiasis	-	1	-	1	1.67
Total	3	2	-	5	8.34

Stool microscopic examination was done in 60 patients of whom 4 (6.67%) had ascariasis and 1(1.67%) had giardiasis.

Table No. 27: FNAC OF LYMPH NODE AMONG MALNOURISHED CHILDREN. (N=10).

FNAC Report	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
Reactive lymphadenitis	6	1	1	8	12.9
Tubercular lymphadenitis	2	-	-	2	3.22
Total	8	1	1	10	16.2

16.12% (10/62) of children had lymphadenitis among which 3.22 % (2/62) had tubercular lymphadenitis.

Table No. 28: CHEST X-RAY FINDINGS AMONG MALNOURISHED CHILDREN. (N=57).

CXR Findings	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total (57)	Percentage (%)
PPC	1	-	-	1	1.75
PPD	2	2	-	4	7
Miliary	3	-	-	3	5.26
Pleural effusion	2	-	-	2	3.5
Bronchopneumonia	13	6	1	20	35.08
Lobar pneumonia	7	4	-	11	19.30
Normal	14	2	-	16	28.07

Table No. 29: CAUSES OF DEATH AMONG MALNOURISHED CHILDREN. (N=10).

Causes of death	Marasmus	Marasmic Kwashiorkor	Kwashiorkor	Total	Percentage (%)
Septicemic shock	3	-	-	3	30
Aspiration pneumonia	-	3	-	3	30
Hypothermia	1	-	-	1	10
Disseminated TB	-	1	-	1	10
Pyogenic meningitis	1	-	-	1	10
Tubercular meningitis	1	-	-	1	10
Total	6	4	-	10	100

Mortality rate seen in our study was 16.13%. Aspiration pneumonia, septicemia and tuberculosis contributed 80% to the total cause of death.

6 DISCUSSION

PEM is still a major nutritional disorder among preschool children of the developing countries and often coexists with infectious illness. High morbidity due to acute and chronic infections and infestations and increased mortality resulting from illness caused by opportunistic organisms and intracellular pathogens are reported from severely malnourished children. These adverse interactions between severe malnutrition and infection have been shown to be the result of immunosuppression. The interaction is complex and it is not easy to separate the effect of infection on nutrition from the effect of nutrition on infection.

In India, about 65% i.e., nearly 80 million children under five years of age suffer from varying degrees of malnutrition .Prevalence of severe PEM has been found to be 0.7/1000 children below the age of 6 years.[27]

Age and sex distribution (table no. 1):
In the present study, majority of cases (77.57%) were from 1 month to 24 months.

Renaudin P[13] observed that prevalence of malnutrition is more in children less than 2 years than more than 2 years (80%v/s42.7%)

Shanti Ghosh, et al.[32] found maximum malnutrition between 6 months to 2 years when the child is dependent on someone to feed him/her.

Socioeconomic status (table no. 4):
In the present study 98.39% were from poor socioeconomic class.

V.S. Dani et al.[27] noticed that malnutrition prevalence was more common among poor socioeconomic group (97.42%)

Presenting symptoms. (Table no. 5):
In the present study, it was noticed that fever was the commonest presenting symptom, found in 77.42% of cases. The other common symptoms observed were cough (56.45%), loose stool (35.49%) and vomiting (24.2%). Many of the patients had more than one symptom.

G.P.Mathur et al.[31] reported that 54.7% of malnourished cases presented with respiratory tract infection and 50% with diarrhea.

Xerophthalmia (table no. 6):
In the present study, xerophthalmia was seen in 29.03% cases. V. S. Dani et al.[27] reported xerophthalmia in 36.06% of severe malnourished cases. Shimeles D. et al.[16] reported vitamin A deficiency in 17% cases of severe PEM.

Contact with tuberculosis (table no. 7 &8):
History of contact with tuberculosis was present in 14.52% of cases. Most of the contacts were parents, grandparent and neighbour.

History of past illness (table no. 9):
In spite of implementation of universal immunization program, history of measles within past 12 months was elicited in 22.58% cases. History of tuberculosis in the past was present in only one case. Past history of diarrhea was present in 14.52% of cases.

Breast feeding initiation (table no. 10):
In the present study, only 8.06% children were given breast feeding within one hour of birth. And delayed initiation of breast feeding was seen in 86% of cases.

V.S.Dani et al.[27] reported delayed initiation of breast feeding after 24 hours of birth in 89% of cases and after 48 hours in 54% of cases .

Duration of exclusive breast feeding (table no. 11):
In the present study, early initiation of complementary food was seen in 17.74% cases and delayed initiation of complementary food was seen in 46.78% cases.

Top feeding practices (table no. 12):
In the present study, top feeding practice was seen in 17.74% cases.

Feeding practices among HIV seropositive children (table no. 14):

In the present study, breast feeding practice was seen in 85.72 %(6/7) of HIV seropositive malnourished children.

Kessler L, et al.[30] reported that breast fed children presenting with severe malnutrition were significantly more likely to be HIV seropositive.

Immunization status (table no. 15):
Overall immunization status in the present study was very poor. Completely immunized till date. (According to UIP schedule) were only 9.68% of cases. 90.32% had partial/no immunization.

Type of anemia (table no. 16):
In the present study, dimorphic anemia was the commonest type (30.64%) followed by microcytic hypochromic anemia (27.42%).

Severity of anemia (table no. 17):
In the present study, hemoglobin (Hb) <7 gm/dl was noted in 24.2 %(15/62) of cases and in 56.45 %(35/62) of cases, Hb was between 7-10gm/dl and in 17.74 %(11/62) cases Hb >10gm/dl but below cut off range of normal was seen. No anemia was noted in one case.

Maria Imaculada, et al.[10] reported Hb between 10-11gm/dl in 12.4 %(15/121) of cases and 7-10gm/dl in 4.1% (5/121) cases.

High incidence of moderate and severe anemia noted in our study could be due to prolonged exclusive breast feeding and inadequate complementary feeds and infections (tuberculosis).

Pattern of infection and infestation (table no. 18):
The cases were presented with respiratory infection and diarrhea in 38.69% and 27.42 respectively. Parasitic infestation was found in 8.06% of cases. Tuberculosis was seen in 27.42% cases. Measles was seen in 3.22% of cases. Urinary tract infection in 71.8 %(28/39) cases. HIV seropositivity in 17.5 % (7/40) and septicemia in 17.86 %(10/56) of cases.

Mathur GP et al[31] reported respiratory tract infection, diarrhea and parasitic infestations in 54.7%, 50% and 4% respectively.

Pattern of tuberculosis (table no. 19):
Diagnosis of tuberculosis was done either clinically/ radiologically / histopathologically / bacteriologically. Severe forms of tuberculosis like miliary, meningeal and disseminated tuberculosis were seen in 6.45% of cases, whereas pulmonary and lymph node tuberculosis was seen in 17.75% and 3.22% of cases respectively.

Organisms isolated from stool (table no. 20):
In the present study, gram negative organisms were isolated from stool in 24.32% (9/37) of cases. Normal commensals were isolated from stool in 75.68 %(28/37) cases.

In our study, one case of V. cholera was reported.

Organisms isolated from blood (table No. 21):
In the present study, bacteremia was seen in 17.86% (10/56) of cases. Gram negative organisms were isolated in 12.72 %(7/56) cases.

Berkowitz FE[23] reported bacteremia, most commonly due to gram negative enteric bacilli in 19 %(13/68) of severely malnourished children.

Organisms isolated from urine (table no. 22):
In the present study, gram negative organisms were isolated in 69.24 % (27/39) of cases. Candida was isolated in one case.

BerkowitzFE[23] reported UTI in 31 %(5/16) of severely malnourished children, all were due to E. coli.

Kala UK, et al[28] reported UTI in 42% of children with marasmus and marasmic kwashiorkor. E coli was the organism most commonly cultured (84.6%).

High incidence of UTI noted in our study than the literature data, might be related to the method of urine collection, because we used sterile vials but not suprapubic aspiration and also may be related to high incidence of hypovitaminosis A.[29]

Ear infection (Otitis) (table no. 23):
Ear infection was seen in 27.42% (17/62) of children among which 11.29% had ASOM and 11.29% had CSOM.

Neuroinfection (table no. 24):
In the present study, neuroinfection was detected in 6.45% (4/62) of children, among which one (1.61%) patient had pyogenic meningitis and 3(4.84%) had tubercular meningitis.

HIV seropositivity (table no. 25):
In the present study, HIV seropositivity was seen in 17.5 %(7/40) of children. No significant difference in type of malnutrition among seropositive children was noted when compared with seronegative children (P>0.7).

Mutombo et al.[14] reported HIV seropositivity in 25.1 %(46/183) of undernourished children and also noted no significant difference in type of malnutrition among HIV seropositive children.

Gastrointestinal infestation (table no. 26):
In the present study, parasitic infestation of GI tract was seen in 8.34% (5/60) of children.

Maria Imaculada et al.[10] reported GI infestation in 75% of PEM children.

GP Mathur et al[31] reported parasitic infestation of GI tract in 2.67% (4/150) of malnourished children.

Low incidence (8.34%) of intestinal worm infestation noted in our study may be due to improved sanitation, periodic deworming by practitioners and geographical variations.

FNAC of lymph node (table 27):
16.12 %(10/62) of children had lymphadenitis among which 3.22% (2/62) had tuberculous lymphadenitis.

Chest x-ray findings (table no. 28):
In the present study pneumonia was seen in 54.38% (31/57) of cases. Pleural effusion was seen in 2 cases.

Case fatality rate (table no. 29):
In the present study, case fatality rate was 16.13 % (10/62). Aspiration pneumonia (30%), septicemia (30%), tuberculosis (20%) contributed 80% to the total case fatality rate.

Shimeless D, et al.[16] reported 32 % case fatality rate due to septicemia, gastroenteritis, pneumonia and disseminated tuberculosis.

Reed RP et al.[20] reported 20.8% case fatality rate in severe malnourished children.

Low case fatality rate noted in our study may be due to reduction in mortality due to diarrhea.

7 SUMMARY

Most of the cases were marasmus (75.8%) followed by marasmic kwashiorkor (22.58%) and kwashiorkor (1.62%).

Majority of the cases were from 1 month to 24 months (77.57%) and from rural area (59.68%). 98.39% of cases belonged to poor socioeconomic class.

Common presenting symptoms noted were fever (77.42%), cough (56.45%), loose stool (35.49%) and vomiting (24.2%).

History of contact with tuberculosis was present in 14.52% of cases. In 7 cases, source of contact was parents. History of measles in the past was present in 22.58% and diarrhea in 14.52% of cases. Fully immunized till date were only 6(9.68%) cases. 90.32% had partial /no immunization.

Initiation of breast feeding within one hour was seen in 8.06% of cases and in 40.33% of cases breast feeding was started after 48 hours. Early introduction of complementary food was seen in 17.74% of cases and delayed supplementation in 46.78% of cases. Top feeding practice was seen in 17.74% of cases.

Dimorphic anemia was the predominant type (30.64%) and 24.2% of cases had severe anemia. Xerophthalmia was seen in 29.03% of cases..

Pattern of infection and infestation
GI infections----24.32%
Ascariasis------- 6.45%
Giardiasis------- 1.61%
Neuroinfections-6.45%
URTI---------- 3.22%
Otitis ----------27.42%

Pneumonia----- 35.47%
Tuberculosis----27.42%
UTI----------45.16%
Septicemia------17.86%
HIV---------- 17.5%
Measles----------3.22%

Severe forms of tuberculosis like miliary, meningeal and disseminated tuberculosis were seen in 6.45% f cases, whereas pulmonary and lymph node tuberculosis was seen in 17.75% and 3.22% of cases respectively.

Normal commensals were isolated from stool in 75.68% (28/37) of cases, whereas gram negative organisms were isolated in 24.32 %(9/37) of cases. Bacteremia was seen in 17.86% of cases; gram negative organisms were isolated in 12.72% (7/56) of cases. Pneumonia was seen in 35.47% of cases. Bacteriuria was seen in 27/39 of cases; gram negative organisms were isolated in 69.24% of cases.

Otitis was seen in 27.42 %(17/62) children. Neuroinfection was noticed in 6.45 %(4/62) children.

HIV seropositivity was seen in 17.5 %(7/40) of cases.

Parasitic infestation of GIT was present in 8.34% of children; ascariasis in 6.67% and giardiasis in 1.67%.

Case fatality rate was 16.13%; aspiration pneumonia, septicemia, tuberculosis contributed 80% to the total cause of death.

8 CONCLUSION

Malnourished children are more likely to have anemia, xerophthalmia, bacteremia, bacteriuria, pneumonia, GI infection and tuberculosis.

In cases with severe malnutrition, screening for HIV infection must be done.

Education regarding early initiation of breast feeding within one hour of birth, exclusive breast feeding for 4 to 6 months and continued breast feeding for 2 years or beyond with adequate supplementation must be emphasized.

9 ANNEXURE-VI

LIST OF ABBREVIATIONS

ASOM – Acute Suppurative Otitis Media.
CSF – Cerebrospinal Fluid.
CSOM – Chronic Suppurative Otitis Media.
EBF – Exclusive Breast Feeding.
FNAC –Fine Needle Aspiration Cytology
GIT – Gastrointestinal Tract.
HIV – Human Immunodeficiency Virus.
LFT – Liver Function Tests
LP – Lumbar Puncture.
PEM – Protein Energy Malnutrition.
TB – Tuberculosis.
UIP – Universal Immunization Programme
UTI – Urinary Tract Infection.
WHO – World Health Organization.

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