The Analysis of Risk Factors in Severe Protein Energy Malnutrition in Order to know their Significance for Outcome in Children from 2 Months to 5 Years of Age

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ABSTRACT

OBJECTIVES: To investigate risk factors in severe protein energy malnutrition and their significance for outcome in children from 2 months to 5 years of age.
STUDY DESIGN: Descriptive.
PLACE AND DURATION OF STUDY: This study was conducted in the Department of Pediatrics Unit II Liaquat University Hospital, Jamshoro from 01-08-2010 to 29-02-2012.
SUBJECTS AND METHOD: One hundred fifty two patients from 2 month to 5 years age who presented with severe protein energy malnutrition, defined according to WHO as presence of oedema of both feet and severe wasting (70% weight-for-height/length or <-3SD) or clinical sign of severe malnutrition, were included in study. The risk factors were evaluated and investigations were recorded on a proforma. Diagnosis was based on clinical signs and anthropometric measurement like height, weight, mid upper arm circumference were taken which was compared with WHO height /weight or height and length reference card. The risk factors were analysed to know their significance for outcome.
RESULTS: The study group comprised of 152 children ranging from 2 months to 5 years,51.3% (n=78) were male, 48.6% (n=74) were female, the mean age of presentation 24.6months. The 15.7% (n=24) out of 152 either died or left in serious condition against medical advise. The risk factors the mother 66% (ill working, in competent), father 48% (ill, unemployed), parental loss 7%, large family size 43%, mixed or bottle feed, improper dilution 47%, delayed feeding of solid food or inadequate weaning 69%, chronic recurrent diarrhea 61%, recurrent respiratory infections 51%, measles 31%, pneumonia 34%, incomplete vaccinations 66% are the statistically significant for severe protein energy malnutrition and mortality.
CONCLUSION: The risk factor in order of significance are the mother (ill working, in competent), father (ill, unemployed), parental loss, large family size, mixed or bottle feed, improper dilution, delayed feeding of solid food or inadequate weaning, chronic recurrent diarrhea, recurrent respiratory infections, measles, pneumonia, incomplete vaccinations are the statistically significant for severe protein energy malnutrition and mortality.

KEY WORDS: Malnutrition, risk factors, outcome.

INTRODUCTION

Protein-energy malnutrition (PEM) is one of the most serious health problems in Pakistan and other re-source-poor countries where PEM accounts for more than 35% of deaths of children aged less than five years (under-five mortality) and 11% of the total burden of disease [1]
Earlier reviews reported that severely-underweight children [weight for-age z-score (WAZ) <-3], aged 6-59 months, had more than eight-fold increase mortality[2,] and stunting, severe wasting, and intrauterine growth restriction together are responsible for 2·2 million deaths and 21% of disability-adjusted life-years (DALYs) for children aged less than five years (under-five children)[1]
Protein-energy malnutrition (PEM), first described in the 1920s, is observed most frequently in developing countries but has been described with increasing frequency in hospitalized and chronically ill children in the United States.[3]The effects of changing environmental conditions in increasing malnutrition is multifactorial. Poor environmental conditions may increase insect and protozoal infections and also contribute to environmental deficiencies in micronutrients. Bacterial infection is more common in severe and complicated malnutrition and thought to occur in part due to the immunosuppressive effects of malnutrition and in part due to the loss of the protective mucosal barrier in the gastrointestinal tract [4] Overpopulation, more commonly seen in developing countries, can reduce food production, leading to inadequate food intake or intake of foods of poor nutritional quality. Conversely, the

effects of malnutrition on individuals can create and maintain poverty, which can further hamper economic and social development.[2] The World Health Organization estimates that by the year 2015, the prevalence of malnutrition will have decreased to 17.6% globally, with 113.4 million children younger than 5 years affected as measured by low weight for age. The overwhelming majority of these children, 112.8 million, will live in developing countries with 70% of these children in Asia, particularly the southcentral region, and 26% in Africa. An additional 165 million (29.0%) children will have stunted length/height secondary to poor nutrition. Currently, more than half of young children in South Asia have PEM, which is 6.5 times the prevalence in the western hemisphere. In sub-Saharan Africa, 30% of children have PEM. Despite marked improvements globally in the prevalence of malnutrition, rates of undernutrition and stunting have continued to rise in Africa, where rates of undernutrition and stunting have risen from 24% to 26.8% and 47.3% to 48%, respectively, since 1990 to 98 with the worst increases occurring in the eastern region of Africa.[1] In Pakistan it is estimated that nearly 40% to 50% of children under 5 years are stunted, 12% severe underweight, 13% moderate to severely wasted [8] Malnutrition is directly responsible for 300,000 deaths per year in children younger than 5 years in developing countries and contributes indirectly to over half the deaths in childhood worldwide. The adverse effects of malnutrition include physical and developmental manifestations. Poor weight gain and slowing of linear growth occur. Impairment of immunologic functions in these children mimics those observed in children with AIDS, predisposing them to opportunistic and other typical childhood infections. In developing countries, poor perinatal conditions account for 23% of deaths in children younger than five. Malnourished women are at high risk of giving birth to low birth weight infants. Many low birth weight infants (23.% of all births) face severe short-term and long-term health consequences, such as growth failure in infancy and childhood, which increases risk of morbidity and early death.[2] Children who are chronically malnourished exhibit behavioral changes, including irritability, apathy and decreased social responsiveness, anxiety, and attention deficits. In addition, infants and young children who have malnutrition frequently demonstrate developmental delay achievement of motor skills, delayed mental development, and may have permanent cognitive deficits. The degree of delay and deficit depends on the severity and duration of nutritional compromise and the age at which malnutrition occurs. In general, nutritional insults at younger ages have worse outcomes. Dose-dependent relationships between impaired growth and poor school performance

and decreased intellectual achievement have been shown.[2, 5, 6, 7] Although death from malnutrition in the United States is rare, in developing countries, more than 50% of the 10 million deaths each year are either directly or indirectly secondary to malnutrition in children younger than 5 years.[1]

If risk factors in children with severe protein energy malnutrition are known mortality can be predicted among the children aged 2–59 months. The objective of the study was to investigate risk factors in severe protein energy malnutrition and their significance for outcome in children from 2 months to 5 years of age in our institution.

MATERIAL AND METHODS

This descriptive and observational study was conducted on 152 children from 2 months to five years of age in the Department of Pediatrics Unit II, Liaquat University of Medical and Health Sciences Jamshoro for the period of 18 months from 01-08-2010 to 29-02-2012. A proforma was designed and mothers were interviewed for variables, detailed examination, anthropometric measurements recorded patients managed according to WHO protocols and outcome recorded. Children age from 2 months to five years both male and female with WHO admission criteria i.e severe wasting , bipedal edema, mid upper arm, circumference less than 11.5c.m or weight for height below three standard deviation were included in the study. Patients with acute secondary problems like cerebral palsy, meningitis, infiltrative disorder were excluded.

After informed consent of parents or attendant of patients a total of 152 patients of severe malnutrition were enrolled, who fulfilled the inclusion criteria. A thorough history including, socioeconomic status, feeding pattern, including breast feeding and weaning practices, nutritional assessment of children, history of vaccination, chronic or recurrent diarrhea, worm infestation, recurrent respiratory tract infections including pneumonia and whooping cough, tuberculosis and measles infection. Severe malnutrition was labeled according to WHO definition criteria as presence of oedema of both feet, and severe wasting (<70% weightfor- height/length or <-3SDa), or clinical signs of severe malnutrition10,by checking height and weight of every case of hospitalized children. Special emphasis was given to measure weight, height or length, MUAC by uniform measuring tools. These were then plotted on standard WHO growth charts. All children were treated according to WHO, 10 steps standard management protocols. All the information was collected on a proforma and computerized. Patients were followed up until they were discharged well, with good appetite, edema subsides and weight gain upto-1

Ghulam Shabir Laghari, Muhammad Akbar, Abdul Hameed Radhan, Zahid Hussain

SDa, (Good outcome) or died or left against medical advice (Both summed as poor outcome) in precarious condition as they were not improving. Those with poor outcome had sepsis as the main secondary cause of death with or without persistent diarrhoea.

The permission to investigate and treat the children with malnutrition was taken from ethical committee; LUMHS and consent from the parents of patients were taken before including them in our study.

Statistical analysis:

The data was entered and analyzed in statistical program SPSS version 16.0. Frequencies and percentages of categorical variables such as age in months, gender and risk factors were calculated and chi square test was applied to compare the proportions. A p value $\leq$ 0.05 were considered as statistical significant level.

RESULTS

Age and sex distribution:

A total of 152 children raonging from 2 months to 5 years were identified as a severe malnutrition in 18 months study duration. Out of them 51.3% (n=78) were male and 48.6% (n=74) were female. Malnutrition was more common in male sex as compared to female. The mean age of presentation was 24.6 months. The mean age of presentation for female children was 26.01 months. While for male 23.23 months. Commonest age group was 33 months to 60 months in which 66% children were found. The outcome, 82.2% (n=128) improved, 62 were male, 66 were female & 15.7% (n=24) are either died or left in serious condition against medical advice, 16 were male 8 were female are shown in table 1 & 2.

TABLE I:
AGE DISTRIBUTION IN GROUPS (n = 152)

Age in months	No: of Children	%
2 - 12	10	6.57
13 – 36	43	28.28
37 – 60	99	65.13
Total	**152**	**100**

TABLE II: SEX & OUTCOME (n = 152)

Sex	No. of Children	Improve	Death/LAMA
Male	78	62	16
Female	74	66	8
Total	**152**	**128**	**24**

TABLE III: THE VARIABLES THAT WERE FOUND TO BE SIGNIFICANT RISK FACTORS FOR SEVERE PROTEIN ENERGY MALNUTRITION AND MORTALITY (n = 152)

Factors (Social)	Risk factors +ve	*P-value for risk factors	*P-value for mortality
Mother (ill, working, Incompetent)	66	0.000	0.000
Father (ill, unemployed)	48	0.000	0.000
Parental loss (death, Desertion, Divorce, Separation)	7	0.000	0.000
Inadequate child care for working mother	20	0.000	0.040
Drug addiction in family	17	0.000	0.847
More than 2 children under 5 years	62	0.016	0.000
Previous infant death	32	0.000	0.009
Large family siz (more than 5 children)	43	0.162	0.000
Factors (medical)	-----	----	----
Low birth weight	35	0.003	0.002
Twin	8	0.000	0.088
Lactation failure	23	0.000	0.162
Mixed or bottle feed, improper dilution	47	0.549	0.000
Delayed feeding of solid food or inadequate weaning	69	0.000	0.000
Chronic recurrent diarrhea	61	0.028	0.000
Recurrent respiratory infections	51	0.841	0.014
Measles	31	0.000	0.014
Tuberculosis	28	0.000	0.040
Whooping cough	5	0.000	0.016
Recurrent otitis media	10	0.000	0.221
Pneumonia	34	0.001	0.008
Incomplete vaccination	66	0.001	0.000

Significant p-value less than 0.05

DISCUSSION

It is estimated that severe malnutrition accounts for 2 million deaths annually [9]. Case-fatality rates in African hospitals for severe acute malnutrition (SAM) remain unacceptably high, especially in children complicated by HIV, invasive bacterial disease or underlying medical complications [10], [11, It is also high in our setup. It is important to know its magnitude in order to formulate solutions. Severe malnutrition in childhood presents a serious humanitarian and public health challenge[12]. Multiples social malpractices, poor socioeconomic status, poor nutritional believes and practices, infections and various congenital abnormalities of child can lead to malnutrition in child leading to poor growth and development of these children. Thus a nation provides ill and poorly developed generations. Thus we conducted this study for the analysis of risk factors of severe protein energy malnutrition in order to know their significance for outcome. . In our study out of 152 cases that belong to the age group 2 months to 5 years, 51.3% (n=78) of them were male while 48.6% (n=74) were female. Mean age of presentation was 24.62 months. The feeding and patterns of feeding also play a vital role in development of malnutrition [13]. Poor ways of feeding, lack of awareness and education of proper timing of feeding including weaning, social believes and malpractices reading food, poor concentration of mother towards children due to multiple reasons including frequent pregnancies can lead to poor nutrition of children and results in malnutrition in child [14]. Diarrhea is defined as 3 or more stools per days, often complicates SAM [15], some studies diarrhea has been shown to predict poor outcome, especially when complicated with other features of severity [16] [17], this may be due to infective including viral, bacterial and protozoal. Other important cause of childhood morbidity is recurrent respiratory tract infections including pneumonia, and tuberculosis In our study the variable that were found to be significant factors for severe protein energy malnutrition and mortality are show in (table 3). History of mother (ill, working, incompetent) were present in 66% out of 152 cases. The p value is 0.000 that is highly significant risk factor for severe protein energy malnutrition as well as for mortality, when it was compare with poor out come. Father (ill, unemployed) were present in 48% out of 152 cases, the p value is 0.000 that is highly significant risk factor for sever protein energy malnutrition as well as for mortality, when it was compare with poor out come in our study. Parental loss (death/desertion,, divorce / separation) were present in 7% out of 152 cases, the p value is 0.000 that is highly significant risk factor for severe protein energy malnutrition as well for mortality, when it was compare with poor out come in our study. Inadequate child care for working mother were present in 20% out of 152 cases, the p values is 0.000 that is highly significant risk factor for severe protein energy malnutrition, when it was compare with poor outcome the p value is 0.010 that is not significant risk factor for mortality.

Drug addiction in family were present in 17% out of 152 cases, the p value is 0.000 that is highly significant risk factor for severe protein energy malnutrition, when it was compare with poor outcome the p value is 0.847 that is not significant risk factor for mortality in our study.

The study conducted at E.P.I centre pediatrics outpatient department B.V Hospital Bahawalpur shows (52.9%) children were malnourished [18]. In our study more than 2 children under 5 years were present in 62% out of 152 cases, the p value is 0.016 that is not highly significant risk factor for severe protein energy malnutrition, when it was compare with poor outcome that p value is 0.000 that is highly significant risk factor for mortality previous infant death were present in 32% out for 152 cases, the p value is 0.000 that is highly significant risk factor for severe protein energy malnutrition when it was compare with poor outcome the p value is 0.009 that is not significant risk factor for mortality in our study.

Large family size sere present in 43% out for 152 cases, the p value is 0.162 that is not significant risk factor for severe protein energy malnutrition when it was compare with poor outcome that p value is 0.000 that is highly significant risk factor for mortality in our study.

Low birth weight were present in 35% out of 152 cases, the p value is 0.003 that is not significant risk factor for severe protein energy malnutrition as well as for mortality, when it was compare with poor outcome the p value is 0.002 in our study.

Twin were present in 8% out of 152 cases, the p value is 0.000 that is highly significant risk factor for severe protein energy malnutrition it was compare with poor outcome, the p value is 0.088 that is not significant risk factor for mortality in our study.

Location failure were present in 23% out of 152 cases, the p value is 0.000 that is highly significant risk factor for severe protein energy malnutrition when it was compare with poor outcome, the p value is 0.162 that is not significant risk factor for mortality in our study.

The feeding and patterns of feeding also play a vital role in development of malnutrition [19], Poor ways of feeing lack of awareness and education of proper timing of feeding including weaning, social believes and malpractices reading food, poor concentration of mother towards children due to multiple reason including frequent pregnancies can lead to poor nutrition of schildren and results in malnutrition in child [20], In our study out of 152 malnourished children 53% were on

exclusive breast feeding, 47% on partial breast feedings, bottle feeding / mixed feeding with improper dilution, the p value is 0.549 it is not significant risk factor for the severe protein energy malnutrition but when it is compared with poor outcome p value is 0.000 and is highly significant for mortality in our study.

Delayed feeding of solid food or inadequate weaning was asked which showed delayed weaning in majority of children i.e. 69% the p value is 0.000 that is highly significant risk factors for severe protein energy malnutrition as well as for mortality. On getting history of diarrhea we came to know that our of 152 malnourished cases 61% cases gave positive history of chronic persistent diarrhea, the p value 0.028 it is not highly significant risk factor for severe protein energy malnutrition, when it is compare with poor outcome the p value is 0.000 that is highly significant risk factor for mortality. Diarrhea is an important cause of childhood morbidity and death [21], Other important cause of childhood morbidity is recurrent respiratory tract infections including pneumonia, and tuberculosis. Recurrent RTI is common in this age group due to reduced immunity of children, poor nutrition, lack of good ventilation, overcrowding and incomplete treatment of such infections. The is the major cause of morbidity and mortality in this age group in our study 51% cases out of 152 had history of recurrent RTI, the p value is 0.841 that is not significant risk factor for severe protein energy malnutrition when it is compare with poor outcome, the p value is 0.000 that is highly significant risk factor for mortality. This favors the above observation. Measles is also a major cause of children's morbidity and growth failure. Its incidence is greatly reduced after use of vaccination. Even then it cause growth failure in our community either due to lack of immunization or ineffective vaccines. In our study our of 152 cases 39% had positive history for measles. The p value is 0.000 that is highly significant risk factor for severe protein energy malnutrition as well as for mortality. This draws our attention to wards the need of effective vaccination programmers and increasing education among community about this lethal health issue.

Same is the status of Tuberculosis 28% out of 152 cases had either positive history of tuberculosis of taken anti tuberculosis therapy. The p value is 0.000 that is highly significant risk factors for severe protein energy malnutrition, when it was compare with poor outcome the p value is 0.040 that is not significant factor for mortality in our study. However here there is need to conduct further studies in a large sample size regarding the effective use of ATT and the response of such long term treatment on overall status of children's health and specially on status of tuberculosis [22]. Here it is important that the use of ATT should be

justifiable. Because unfortunately in our setup. It is used very frequently even in cases which are not justified cases of tuberculosis.

Whooping cough were present in 5% of the cases out of 152. The p value is 0.000 that is highly significant risk factor for severe protein energy malnutrition when it was compare with poor outcome. The p value is 0.040 that is not significant risk factor for mortality in our study.

Recurrent otitis media were present in 10% out of 152 cases. The p value is 0.000 that is highly significant risk factor severe protein energy malnutrition, when it was compare with poor outcome. The p value is 0.001 that is highly significant risk factor for severe protein energy malnutrition. When it was compare with poor outcome, the p value is 0.008 that is not significant risk factor for mortality in my study.

History of vaccinations was asked form these children's, 66% were received in complete vaccination out for 152 cases, for six communicable diseases included in EPI. The p value is 0.001 that is highly significant risk factor for severe protein energy malnutrition. When it was compare with poor outcome the p value is 0.000 that is highly significant risk factor for mortality.

Vaccination is an important way of prevention from major communicable diseases of childhood, that is a major cause of morbidity, hospital stay and death in this age group.

CONCLUSION

The risk factors such as the mother (ill working, in competent), father (ill, unemployed), parental loss, large family size, mixed or bottle feed, improper dilution, delayed feeding of solid food or inadequate weaning, chronic recurrent diarrhea, recurrent respiratory infections, measles, pneumonia, incomplete vaccinations are the statistically significant for severe protein energy malnutrition and mortality.

REFERENCES

1. Black RE, Allen LH, Bhutta ZA, Caulfield LE, de Onis M, Ezzati M et al. Maternal and child undernutrition: global and regional exposures and health consequences. Lancet 2008;371:243-60.
2. Nahar B, Ahmed T, Brown KH, Hossain MI. Risk factors associated with severe underweight among young childrenreporting to a diarrhoea treatment facility in Bangladesh. J Health Popul Nutr. 2010 Oct;28(5):476-83.
3. Hendricks KM, Duggan C, Gallagher L, et al. Malnutrition in hospitalized pediatric patients. Current prevalence. *Arch Pediatr Adolesc Med*. Oct 1995;149(10):1118-22.
4. Aiken AM, Mturi N, Njuguna P, Mohammad S,

Berkely JA et all, Risk and causes of paediatric hospital-acquired bacteraemia in Kilifi District Hospital, Kenya: a prospective cohort study. Lancet. 2011 Dec 10;378(9808):2021-7.

5. Mendez MA, Adair LS. Severity and timing of stunting in the first two years of life affect performance on cognitive tests in late childhood. J Nutr. Aug 1999;129(8):1555-62.

6. Heywood AH, Marshall T, Heywood PF. Motor development and nutritional status of young children in Madang, Papua New Guinea. P N G Med J. Jun 1991;34(2):109-16.

7. Martorell R, Rivera J, Kaplowitz H, Pollitt E. Long-term consequences of growth retardation during early childhood. In: Hernandez M, Argente J. Human growth:basic and clinical aspects. Amsterdam: Elsevier Science Publishers; 1992:143-9.

8. Pelletier DL, Frongillo EA, Jr., Schroeder DG, Habicht JP. A methodology for estimating the contribution of malnutrition to child mortality in developing countries. J Nutr 1994;124(10 Suppl):2106S-22S.

9. Collins S. Treating severe acute malnutrition seriously. Arch Dis Child 2007;92: 453–61.

10. Brewster DR. Critical appraisal of the management of severe malnutrition: 1. Epidemiology and treatmentguidelines. J Paediatr Child Health. 2006 Oct;42(10):568-74.

11. Maitland K, Berkley JA, Shebbe M, Peshu N, English M, et al. Children with severe malnutrition: can those at highest risk of death be identified with the WHO protocol. PLoS Med. 2006 Dec;3(12):e500.

12. Malik FR, Tahir M, Kundi Z. Risk factors for malnutrition in an urban slum. Ann Pak Inst Med Sci 2006;2:265-8.

13. Rana MN, Kazi MY, Nasir A, Hussain A. Prevalence of risk factors of primary 3rd degree malnutrition in children under 5 year of age; admitted in Services Hspital Lahore. Anna Kind Edward Med

Coll Apr-Jan 2006: 12 (2) 208-9.

14. Tazi I, Hidane Z, Zafad S, Harif M, Benchekroun S, Ribeiro R. Nutritional status at diagnosis of children with malignancies in Casablanca. Pediatr Blood Cancer 2008;51:495-8.

15. Irena AH, Mwambazi M, Mulenga V. Diarrhea is a major killer of children with severe acute malnutrition admitted to inpatient set-up in Lusaka, Zambia. Nutr J. 2011 Oct 11;10:110.

16. Maitland K, Berkley JA, Shebbe M, Peshu N, English M, et al. Children with severe malnutrition: can those at highest risk of death be identified with the WHO protocol? PLoS Med 2006;3:e500.

17. Brewster DR. Critical appraisal of the management of severe malnutrition: 3. Complications. J Paediatr Child Health. 2006 Oct;42(10):583-93.

18. Abdul salam Malik, Prof. Attaullah Mazhar, Assessment of nutritional status of children under 48 months of age. Pak Paed J Mar 2006;30(1):38-47.

19. Rana MN, Kazi MY, Nasir A, Hussain A. Prevalence of risk factors of primary 3rd degree malnutrition in children under 5 years of age; admitted in Services Hospital Lahore. Anna Kind Edward Med Coll Apr-Jan 2006:12 (2) 208-9.

20. Tazi I, Hidane Z, Zafed S, Harif M, Benchekroun S, Ribeiro R. Nutritional status atg diagnosis of children with malignancies in Casablanca, Pediatr Blood Cancer 2008;51;495-8.

21. Ashraf H, Ahmed T, Hossain MI, Alam NH, Mahmud R, Kamal SM et al. Day-care Management of children with severe malnutrition in an Urab Health Clinic in Dhaka, Bangladesh, J Trop Pediatr, June 1, 2007;53 (3); 171-8

22. Rice Al, Sacco L. Hyder A, Black RE. Malnutrition as an underlying cause of childhood deaths associated with infectious diseases in developing countries, But World Health Organ 2000;78:1207-21.

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