

# Complications of Acute Diarrhoea in Malnourished Children

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In a developing country like Pakistan malnutrition is a serious health problem. Diarrheal diseases and malnutrition are inter-related. Hence it is worth studying not only diarrhea itself but also the incidence of acute diarrheal complications in malnourished children. A total of 150 malnourished children with acute diarrhea, 50 patients in each 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> degree of malnutrition were included in the study to see the frequency of complications. Their ages ranged from 1 month to 4 years. Majority of the patients (44.68%) were between 6 months and 1 year. The incidence of complications was highest in the youngest age group (1 month to 1 year). The majority of the complications like acidosis, shock and septicemia were seen in children with 3<sup>rd</sup> degree malnutrition. Metabolic and electrolyte derangements were seen again in majority of the patients with 3<sup>rd</sup> degree malnutrition. The duration of hospital stay was directly related to the degree of malnutrition.

**Key words:** Acute diarrhoea, complications, malnutrition

Diarrheal diseases are one of the leading causes of morbidity and mortality in children worldwide, causing 1 billion episodes of illness and 3-5 million deaths annually. In the United States, 20-35 million episodes of diarrhoea occur each year among the 16.5 million children younger than 5 yr, reaching 2.1-3.7 million physician visits, 220,000 hospitalizations, 924,000 hospital days, and 300-400 deaths<sup>1</sup>. The situation is even more grave in developing countries where during infancy and early childhood acute diarrheal diseases are one of major cause of increased morbidity, mortality and malnutrition<sup>2</sup>. Four million of these die every year with 80% of them being less than two years of age<sup>3</sup>. In Pakistan, the incidence of acute diarrhea is 3-4 episodes per child per year. Each episodes may last for 5-7 days with a mortality rate of 19 per 1000<sup>4</sup>. The high incidence of diarrhea in Pakistan is due to low socio-economic status, poor hygiene, and lack of sanitation and inadequate supply of potable water<sup>5</sup>. Recurrent diarrheal episodes lead to malnutrition which is caused by anorexia, increased catabolism from infection, lack of adequate caloric and protein intake and decreased nutrient absorption usually associated with diarrhea. This malnutrition, in turn, again contributes to diarrhea when illness is more severe, prolonged and more frequent. This gives rise to the well known vicious cycle of diarrhea ⇒ malnutrition ⇒ diarrhea. Malnutrition itself is a common clinical problem in Pakistan where the incidence of malnutrition is 63% in periurban slums, 54% in villages and 26% in urban areas<sup>6</sup>. A malnourished child grows as unhealthy adult who may not be able to perform upto an optimal level. In a developing country like Pakistan, malnutrition is a serious health problem because not only the quality of life is poor but also there is lack of awareness regarding nutritional needs amongst the general population. Diarrheal diseases and malnutrition are interrelated as each springs from and gives rise to the complication of the other. Hence it was considered worth to study not only diarrhea itself but also the incidence of acute diarrheal complications in malnourished children.

## Materials and Methods:

This study was carried out in the department of paediatrics at Jinnah Hospital Lahore affiliated with Allama Iqbal Medical College. Selection criteria was: 1) age between one month and four years; 2) Presenting with acute diarrhea having moderate to severe dehydration; 3) Falling in the category of malnutrition according to modified Gomez's classification which is: a) Weight greater than 80% as normal, b) weight 70-80% as first degree malnutrition, c) weight 60-70% as second degree malnutrition, d) weight less than 60% as third degree malnutrition. A total of 150 patients were selected under the above mentioned criteria, with 50 patients in each degree of malnutrition. All the patients were assessed and evaluated through a detailed history and thorough physical examination for the degree of dehydration and presence of complications. Blood samples were taken from all patients for Hb, TLC, DLC, serum electrolytes, blood sugar, blood urea creatinine and ABG's. Wherever indicated, special investigations such as blood culture, PT, APTT, chest X-ray and abdominal X-ray in erect posture were done. Lumbar puncture was done in selected cases.

## Results:

During the study period of six months from April 1998 to September 1998, a total of 1278 patients were admitted, out of which 48.8% (n=624) suffered from diarrhea. A total of 150 malnourished children with acute diarrhea, 50 patients in each 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup>, were included in this study to see the frequency of complications. Age group was 1 month to 4 years. Majority of the patients (44.66%) were between 6 months and 1 year, and the second major group was between 1 and 2 years (26.66%). The incidence of complications was highest in the youngest age group (1 month to 1 year) (Table 1).

Acidosis was present in 30% of the patients. Other complications were sepsis 16.30%, post diarrheal distension 14.13%, convulsions 7.60%, acute renal failure

3.26%. Death due to complications of acute diarrhea in malnourished children was seen in 6% of children (Table 2). The data was analyzed to see the incidence of complications in relations to different degrees of malnutrition. The majority of the complications were seen in children with 3<sup>rd</sup> degree malnutrition (Table 3). Acidosis seen in 30% of children was present in 40% of 3<sup>rd</sup> degree malnourished children. Shock was the presentation in 34% of 3<sup>rd</sup> degree malnourished and 18% of 2<sup>nd</sup> degree malnourished. 24% of children with 3<sup>rd</sup> degree malnutrition had septicemia as compared to 10% in 2<sup>nd</sup> degree and 4% of children with 1<sup>st</sup> degree malnutrition. The review of other associated complications of acute diarrhea with malnutrition revealed hypothermia in 6.66%, oral thrush in 23.3%, perianal rash in 14.66%. Meningitis was seen 1.33%, while encephalitis was documented in only 1 patient (Table 4). Metabolic and electrolyte derangements were again seen in majority of the patients with 3<sup>rd</sup> degree malnutrition except hyponatremia which was relatively more common in children with 2<sup>nd</sup> degree malnutrition (Table 5). The duration of hospital stay was found to be directly proportional to the degree of malnutrition (Table 6), minimum stay in case of 1<sup>st</sup> degree malnutrition as compared to a maximum stay in 3<sup>rd</sup> degree malnutrition with acute diarrhea. Twenty four percent with acute diarrhea and 3<sup>rd</sup> degree malnutrition had a hospital stay of more than 7 days as compared 10% with diarrhea and 1<sup>st</sup> degree malnutrition.

Table 1: Age distribution

Age group	%age	=n
1-6 mo	16.6	25
6-1 yr	44.66%	67
1-2 yr	26.66%	40
2-4 yr	12.01%	18

Table 2: Complications in different age groups (n=150)

Complications	Age group i	Age group ii	Age group	Total
	1mo- 1yr	1-2yr	iii 2-4 yr	
Shock	21.73	17.50	22.20	20.66
Acidosis	35.86	25.00	11.11	30.00
PDD	14.13	7.50	5.50	11.30
PDI	8.70	--	--	5.30
Sepsis	16.30	10.00	--	12.66
Convulsion	7.60	12.50	--	8.00
ARF	3.26	2.50	--	2.60
Deaths	7.60	5.00	--	6.00

Table 3: Percentage of complications in different degrees of malnutrition

Complications	1 <sup>st</sup> Degree	2 <sup>nd</sup> Degree	3 <sup>rd</sup> Degree	Total
	Malnutrition	Malnutrition	Malnutrition	
Shock	10.00	18.00	34.00	20.66
Acidosis	14.00	36.00	40.00	30.00
PDD	04.00	12.00	18.00	11.33
PDI	---	06.00	10.00	05.30
Sepsis	04.00	10.00	24.00	12.60
Convulsion	02.00	14.00	08.00	08.00
ARF	02.00	04.00	02.00	02.60
Deaths	02.00	06.00	10.00	06.00

Table 4: Other associated complications

Complication	%age	No.
Fever	58.00	87
Hypothermia	06.66	10
Oral thrush	23.30	35
Pneumonia	08.66	13
Meningitis	01.33	02
Encephalitis	00.66	01
Peri-anal-rash	14.66	22

Table: Metabolic and electrolyte complications in different degrees of malnutrition

Complication	1 <sup>st</sup> Degree Malnutrition	2 <sup>nd</sup> Degree Malnutrition	3 <sup>rd</sup> Degree Malnutrition	Total
Hypokalemia	12.00	30.00	54.00	32.00
Hypoglycemia	12.00	16.00	24.00	17.30
Hyponatremia	08.00	22.00	14.00	14.66
Hypocalcemia	04.00	06.00	06.00	05.33
Hypertremia	---	04.00	02.00	02.00

Table 6: Duration of hospital stay versus degree of malnutrition

No. of Days	1 <sup>st</sup> Degree Malnutrition	2 <sup>nd</sup> Degree Malnutrition	3 <sup>rd</sup> Degree Malnutrition
< 3 days	58.00% (n=29)	30.00 (No.=15)	16.00% (No.=8)
3-7 days	32.00% (No.=16)	48.00 (No.=24)	60.00% (No.=30)
> 7 days	10.00 (No.=5)	22.00 (No.=11)	24.00 (No.=12)

## Discussion:

Diarrhea is a major cause of short term growth failure in children of developing world. The inadequate dietary intake or repeated bouts of diarrhea result in delayed catch up weight gain which in turn leads to progressive growth failure. The negative nutritional effects of diarrhea such as reduced food consumption, reduced absorption, metabolic alterations and severe protein energy malnutrition sets in the vicious cycle of repeated episodes of diarrhea causing malnutrition and leading to severe infection which further aggravates the diarrhea.

Of 1278 patients admitted from April 1998 to September 1998, 48.8% presented with acute diarrhea. Similar figure i.e. 51.2% has been reported from Mayo Hospital Lahore<sup>7</sup>. The Main objective of the study was to see the different types of complications in malnourished children who presented with acute diarrhea. The highest incidence of diarrhea was in children between 6 months to 1 year of age and majority of the patients (88%) were younger than 2 years. This age group is most vulnerable for diarrhea and its complications and similar age incidence has been reported by Mahmud A<sup>6</sup> and Suwartano<sup>8</sup>. In this study 45.33% of the patients were males whereas 54.66% were females with a male to female ratio of 1:1.2. Female preponderance in this study may be attributed to preferential attention to boys for foods as described by Rehman MM et al 1982<sup>9</sup> or it may be just coincidence. Dehydration was seen in all admitted cases which was due to increased vomiting, high purging rate, withdrawal of feeding and inadequate use of ORS. Shock

was most common in patients with 3<sup>rd</sup> degree malnutrition (34%) as compared to the 1<sup>st</sup> degree (10%). Results are comparable to other studies<sup>10</sup>. This is suggestive of the fact that malnutrition is one of the risk factor for the development of severe dehydration in young children with acute diarrhoea. Acidosis often occurs in diarrheal dehydration, particularly in poorly nourished children with acute diarrhoea because of loss of excessive amount of bicarbonate in intestinal secretions. In this study acidosis was three times higher in 3<sup>rd</sup> degree malnutrition (40%) as compared to 1<sup>st</sup> degree malnutrition (14%). Moreover acidosis was more common in younger age group, 35.86% in age group 1 month to 1 year as compared to 11.11% in age group 2-4 year. PDD and PDI were seen in 11.33% and 5.3% with maximum incidence in 3<sup>rd</sup> degree malnutrition, 18% and 10%. The higher incidence of post diarrheal distension and ileus was due to the fact that malnourished children are more prone to have this complication because of hypokalemia and septicemia<sup>11</sup>. Hypokalemia was the most common electrolyte disturbance seen in this study, affecting 32% of patients with maximum incidence in 3<sup>rd</sup> degree malnutrition (54%). This was suggestive that total losses of potassium increase with increasing degree of malnutrition. Moreover malnourished children are already potassium depleted before the onset of acute diarrhea<sup>12</sup>. Hypoglycemia was the second most common metabolic complication. It was observed in 17% of the total cases and incidence was two times higher (24%) in 3<sup>rd</sup> degree malnourished children as compared to 12% in 1<sup>st</sup> degree. Similar incidence of hypoglycemia associated with marked increase in the risk of death has been described by Bennish et al<sup>13</sup>. The higher incidence in malnourished children can be due to depletion of hepatic glycogen stores<sup>14</sup>. Hyperglycemia reported as stress response to hypovolemia<sup>15</sup> was not seen in any of our patients. Malnutrition is known to increase the risk of prolonging acute diarrhea as it was found in our study in which duration of stay in the hospital was less than 3 days in 58% of 1<sup>st</sup> degree malnutrition as compared to 16% of the 3<sup>rd</sup> degree malnutrition. The duration was prolonged up to one week in 30% of 1<sup>st</sup> degree malnutrition and 60% of 3<sup>rd</sup> degree malnutrition, so duration of stay in hospital was directly proportional to the degree of malnutrition. These observations are consistent with WHO statement and other studies<sup>16</sup> that in malnourished children diarrhea is more severe and prolonged. Overall mortality in our study was 6% and majority of the children (90%) were having 2<sup>nd</sup> and 3<sup>rd</sup> degree malnutrition. Bhandari et al<sup>17</sup> reported a mortality rate of 7% in diarrhea and malnourished children as compared to 0.31% in normally nourished children.

#### Conclusion:

Acute diarrheal episodes are usually self-limiting but young and malnourished children develop complications of acute diarrhea, which are associated with high morbidity and mortality. Complications could be due to the disease

itself, dehydration resulting from diarrhea or sometimes as a consequence of the treatment given.

Malnutrition, a global problem, primarily targets the developing countries where malnourished children constitute approximately one third of the total population of the world. Pakistan, an agricultural state-albeit a developing one, has a very high incidence of malnutrition\*. Although the low socio-economic group is the worst to be affected by malnutrition, the middle class also falls victim to it due to ignorance regarding adequate infant feeding, weaning, and preventive measures against infections. Hence vigorous and early feeding should be the mainstay of management in malnourished children suffering from acute diarrhea in developing countries because it might prove to be as important as the control of diarrhea in the prevention of malnutrition and growth failure. So there is barely any doubt that prevention of malnutrition by providing a better standard of living to the general population can lead to a reduced incidence of acute diarrhea, its complications and the morbidity and mortality caused by them.

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