

DIARRHEAL DISEASES AMONG HOSPITALIZED CHILDREN OF LESS THAN TWO YEARS OF AGE

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ABSTRACT

This study was done in Basrah Maternity and Child hospital from January 2002 till the end of December 2002 to determine the proportion of children less than two years of age with diarrheal diseases among hospitalized children and to study the morbidity and mortality of these patients. A child less than two years of age with diarrhea represents the leading cause of hospitalization and constituted (35%) of the total admission during the study period. Infants less than one year of age represent (64.9%) of all cases of diarrhea and the remaining were above one year of age. About (74.9%) of these cases were acute diarrhea and (25.1%) were chronic cases. Age of less than one year and associated malnutrition were the two most important predictors of development of chronic diarrhea. Sex of patients did not influence the occurrence of acute and chronic diarrhea. The duration of diarrhea and the age of patient determined the outcome of cases. Acute cases among infants less than one year of age have higher mortality than those children above one year of age. No death reported for acute cases above one year. The case fatality for chronic diarrhea was (49 % for under 1 year and 7.15 % for those above 1 year) and it is about 8 times more than that of acute cases. This mortality rate is more than the reported rate in the literatures by about two times, reflecting the need for improving the management of these of children.

INTRODUCTION

Worldwide, diarrheal diseases are responsible for a significant proportion of morbidity in children under five years of age and remain as a leading cause of childhood death. The greatest burden of diarrhea occurs in poor children of developing countries.^[1] Although the advent and wide use of oral rehydration therapy has reduced mortality rates from acute diarrhea in underdeveloped countries,^[2] diarrheal morbidity remains unchanged and accounts for as much as 30% of hospitalizations.^[1] On the other hand, persistent diarrhea is still a major problem and associated with strong negative impact on nutritional status. Persistent diarrhea and dysentery are now a major cause of infants and young child deaths.^[2] The interaction between diarrheal diseases and nutritional status are complex and synergistic. These are serious issues globally because they affect hundreds of millions of young children and annually cause more than three million deaths in children aged under five years.^[2] Any attempt to assess the severity of diarrhea in children should include attention to its acute and long-term effects such as dehydration, malabsorption, malnutrition and failure to thrive.^[3] An infant of less than one year old is defined as having protracted diarrhea of infancy if he has four or more loose stools per day, lasting for longer than 2 weeks, and

either loses or fail to gain body weight during this period.^[4] Such infant often presents a major problem in diagnosis and management, particularly if the patient's general condition precludes intensive investigation.^[4] Earlier reports have shown a mortality rate of (45%-70%), and this reflects the difficulties in management which these infants pose and the non-responsiveness to dietary treatment especially in patients in whom a specific diagnosis can not be established.^[4] The improved management and earlier intervention have improved outcome, and mortality rate is reduced to (5%). The treatment of protracted diarrhea of infancy includes supportive treatment (correction of dehydration, treatment of vitamins and trace minerals deficiency and, treatment of specific infectious agent) and dietary treatment. This study was done to determine the proportion of hospital admission due to acute and chronic diarrhea and age group at risk of chronic diarrhea in the first two years of life. Also, to evaluate prospectively the outcome of acute and chronic diarrhea in infancy and possible associated risk factors.

PATIENTS AND METHODS

This study was carried out in Basrah Maternity and Child hospital from January 2002 till the end of December 2002. All under 2 years children who were admitted to the hospital

with diarrhea during this period were included in the study. The total number of children who were admitted to hospital during this period was obtained from the Statistical Department of the hospital. Chronic diarrhea was defined as diarrhea with four or more loose bowel motions per day and with total diarrhea duration of 14 days or more and these include those patients who were presented at first with acute diarrhea.^[5] All other patients included whose total illness duration was less than this, were assumed as acute diarrhea. For all patients with diarrhea, the following data were obtained: *name, age, sex, address, duration of diarrhea, method of feeding, previous hospitalization for diarrhea, weight of the patient on admission, state of hydration*. The assessment of nutritional status was based on weight for age charts of National Center for Health Statistics/WHO. The patient was regarded as malnourished if his/her weight by using these charts was less than (-2SD) below the mean weight for age and sex. Laboratory data for those with chronic diarrhea where ever available were included in the study like: assessment of hemoglobin level, stool examination for parasite, leukocytes, red blood cells, pH and reducing substances, and urine samples for bacterial culture. All patients were followed during their days of hospital admission to determine outcome (*regarding improvement in diarrhea, weight loss, hydration status and total duration of diarrhea*) and accordingly patients either were discharged improved, discharged on family responsibility or, were died. For infants with chronic diarrhea, the total days of hospital stay were calculated from time of admission (either less than or more than 5 days). Data about different therapeutic interventions for patients with chronic diarrhea were obtained. The initial treatment for the included patients was directed at correction of dehydration and electrolytes imbalance, blood transfusion for severe anemia (if hemoglobin level was less than 3 g/ dl) and treatment of any systemic infection. The data were collected and analyzed by statistical method using chi-square test (P-value). P-value of less than 0.05 was regarded as significant.

RESULTS

During the months of the study, children under two years with diarrheal diseases represent about (35%) of total hospitalization of children to Basrah Maternity and Child hospital (493 case of diarrhea out of 1408 patient admitted to the hospital). Overall, infants less than one year of age represents (64.9%) of all those less than 2 years of age children admitted to the hospital with diarrhea compared to (35.1%) in those above of age (P:0.003). About (74.9%) of all cases of diarrhea were acute and the remaining were chronic. About (30%) of those less than 1 year of age infants have chronic diarrhea compared to (16.2%) in those above 1 year of age with ratio of (1.9:1) (*as shown in Table-1*).

Table 1. Acute and chronic diarrhea among hospitalized children of less than two years of age

Diarrheal State	Above one year of age No. %	Less than one year of age No. %	Total No. %
Acute Diarrhea	145 (83.8)	224 (70)	369(74.9)
Chronic Diarrhea	28 (16.2)	96 (30)	124 (25.1)
Total	173 (35.1)	320 (64.9)	493

P= 0.003 (P: HS)

There was no statistically significance difference between boys and girls in proportions affected with acute diarrhea (76.3% vs. 73.1%) and chronic diarrhea (23.7% vs. 26.9%) respectively (P>0.05) (*as shown in Table-2*).

Table 2. Sex distribution of children of less than two years of age with acute and chronic diarrhea.

Diarrheal state	Sex			
	Boys	%	Girls	%
Acute Diarrhea	203	76.3	166	73.1
Chronic Diarrhea	63	23.7	61	26.9
Total	266	100	227	100

P = 0.82511 (P: NS)

The highest incidence of diarrhea was among infants less than 6 months representing (49%) of total cases of diarrhea, in comparison to (15.8%) in those 7-12 months and (35.2%) for those above 12 months respectively (P: 0.003). For the three age groups, acute diarrhea predominate over chronic diarrhea and chronic diarrhea occurrence decrease with increasing age (30.6% at 1-6 months, 28.3% at 7-12 months and 16.2% for those above one year) (as shown in Table-3).

Table 3. *Age-related incidence rate of acute and chronic diarrhea among children of less than two years of age.*

Age distribution (months)	Acute Diarrhea No. %	Chronic Diarrhea No. %	Total No. %
1-6	168 (69.4)	74 (30.6)	242 (49)
7-12	56 (71.7)	22 (28.3)	78 (15.8)
Above 12	145 (83.8)	28 (16.2)	173(35.2)
Total	369 (100)	124(100)	493(100)

P = 0.003 P (HS)

Malnutrition was present in (70.8%) of infants less than 1 year of age with chronic diarrhea compared to (57.1%) in those above 1 year of age. Overall malnutrition is more common at both ages in chronic diarrhea than acute diarrhea (P: HS) (as shown in Table-4).

Table 4. *Nutritional status among hospitalized children of less than two years with acute and chronic diarrhea.*

Nutritional status of children	Acute diarrhea		Chronic diarrhea	
	>1year* No. %	<1year** No. %	>1year No. %	<1year No. %
Malnourished (Bwt < - 2SD)	20(13.8)	24(10.7)	16(57.1)	68(70.8)
Well-nourished	125(86.2)	200(89.3)	12(42.9)	28(29.2)
Total	145(100)	224(100)	28(100)	96(100)

*> 1 year P < 0.00001, (P: HS)

**< 1 year P < 0.00001, (P: HS)

Nearly three quarters of patients with diarrhea whether acute or chronic have received bottle feeding alone or with breast feeding. About (58.1%) and (64.6%) of infants less than 1 year of age with acute and chronic diarrhea respectively were bottle fed compared to (28.5%) and (23.9%) who were breast fed (P>0.05) (as shown in Table-5).

Table 5. *Feeding methods among infants of less than one year of age with acute and chronic diarrhea.*

Feeding Method	Acute Diarrhea	Chronic Diarrhea	Total
Breast feeding	64(28.5%)	23(23.9%)	87(27.2%)
Bottle feeding	130(58.1%)	62(64.6%)	192(60%)
Mixed feeding	30(13.4%)	11(11.5%)	41(12.8%)
Total	224(100%)	96(100%)	320

P = 0.548 (P: NS)

About (58.5%) of patients with chronic diarrhea have had urinary tract infections. Other significant manifestations include anemia (51.5%), vomiting (46%) and dehydration (37.5%) (as shown in Table-6).

Table 6. *Distribution of clinical manifestations among children less than two years of age with chronic diarrhea.*

Clinical Manifestation	No.	%
Diarrhea	128	100
Malnutrition	84	65.6
Anemia	66	51.5
Vomiting	59	46
Dehydration	48	37.5
Fever	42	32.8
Urinary tract infection	75	58.5
Dysentery	42	32.8
Napkin rash	36	28.12
Edema	13	10.1
Rectal prolepses	4	3.12

All infants (100%) with chronic diarrhea have received antimicrobial agents, and (66%) of them received lactose free formula. Hospitalization for more than 5 days was observed in 66.6% of infants and (55.2%) of them have previous hospitalizations for diarrhea (as shown in Table-7).

Table 7. Therapeutic interventions for cases of chronic diarrhea of infants less than one year of age.

Intervention	No. of cases	%
Antibiotics usage	96	100
Lactose free formula	64	66.6
Metronidazole usage	38	39.5
Intravenous fluids	57	59.5
Previous hospitalization for diarrhea	53	55.2
Average days of hospitalization		
Less than 5 days	32	33.4
More than 5 days	64	66.6

For patients with acute diarrhea in our study, (79.9%) of those under 1 year of age, and (91.7%) of those above 1 year were discharged from hospital improved. No death has occurred in those above 1 year of age with acute diarrhea compared to (1.3%, 3 deaths out of 224) for those less than 1 year of age. For chronic diarrhea, (55.2%) among infants below 1 year of age and (75%) of above 1 year of age were discharged with improvement. Nine infants of less than 1 year of age (9.4%) were died compared to 2 patients above 1 year of age (7.15%). About (33.3%) and (14.3%) of patients less than 1 year of age and above 1 year of age respectively with chronic diarrhea were discharged on family responsibility (as shown in Table-8).

Table 8. Outcome of hospitalized patients with diarrheal diseases.

Outcome Measure	Children above 1 year of age		Infants less than 1 year of age	
	Acute Diarrhea No. %	Chronic Diarrhea No. %	Acute Diarrhea No. %	Chronic Diarrhea No. %
Discharged Improved	133(91.7)	21(75)	179(79.9)	53(55.2)
Discharged on family responsibility	11(7.6)	4(14.3)	41(18.3)	32(33.3)
Death	-	2(7.15)	3(1.3)	9(9.4)
Others	1(0.7)	1(3.55)	1(0.4)	2(2.1)
Total	145(100)	28(100)	224(100)	96(100)

DISCUSSION

This study has further illustrated the importance of acute and chronic diarrhea as a leading cause of morbidity and mortality among hospitalized children of less than 2 years of age. It remains as a leading cause of hospitalization in developing countries.^[5-7] The 2 most important predictors of chronic diarrhea in our study were the age of less than 1 year especially those below 6 months of age, and poor nutritional status and these observations are comparable to data from other studies^[1,8,9]. In our study, more than ¾ of patients with chronic diarrhea were less than 1 year of age and of them about 76% were of less than 6 months of age. This is also observed in acute diarrhea patients but in a slightly lower proportion. These age-related findings regarding chronic diarrhea were also shown in other studies but the predominant age group affected was 7 to 12 months.^[10] The association of age of less than 6 months with chronic diarrhea may be due to less capability of responding to infection because of age-related immunologic deficiencies. Also, longer lasting episodes of chronic diarrhea in this group may be explained by the differences in the diarrheal pathogens between younger and older children.^[1] Younger infants are more susceptible to infections with bacterial and parasitic pathogens that are responsible for majority of prolonged episodes of diarrhea.^[11] Accurate morphological studies of the small bowel mucosa detected more severe

abnormalities in infants with enteropathogenic *Escherichia coli* (EPEC, the most common etiological agent of diarrhea at this age) infection with persistent diarrhea.^[12] Longer and recurrent episodes of diarrhea with its attendant treatment by dietary management (starvation, use of prolonged ORS, use of diluted formula, dietary manipulation) and these added to the catabolic state lead to malnutrition which in turn leads to more risk of diarrhea because of its effect on immunological system.^[2,11,13] The other possible mechanisms by which poor nutritional status predispose to greater diarrheal frequency include decreased gastric acidity and nutritional deficiencies^[8], especially individual micronutrients such as zinc which are known to affect immune function and to increase subsequent risk of childhood diarrhea.^[11] We can add to this, the already present social factors that contribute to occurrence of diarrheal diseases which include factors like lack of proper water sterilization, lack of breast feeding, improper technique of bottle-feeding and uneducated family.^[1,3,11,13] So, a vicious cycle may be started consisting of chronic diarrhea and malnutrition among these infants causing more malnutrition and prolongation of diarrhea. The interruption of this cycle by early effective treatment of specific cause if identified, and proper dietary manipulation with or without use of parenteral nutrition is mandatory for successful management and reduction of subsequent morbidity and mortality.^[3,4,14,15] Among possible factors in our patients for prolongation of episodes of diarrhea is the lack of proper choices for dietary manipulation like the availability of particular formulas as protein hydrolysate formula and also no firm nutritional rehabilitation strategy for the treatment of these patients. This study also shows that three quarters of infants receive some bottle-feeding. Giving bottle-feeding alone or with breast milk increases the risk of having acute and chronic diarrhea and this is shown in other studies.^[16] Protective effects of breast-feeding against infection and malnutrition can explain the lower incidence of diarrheal diseases among breast fed infants. Despite this, about ¼ of diarrhea patients were breast fed and this may be explained by that actually most of these patients are not exclusively breast fed, and they may receive some additional water and rice water

which acts as a vehicle for transmission of infection and this may explain the lack of complete protection of breast feeding against acute and chronic diarrhea in our patients. William et al found that exclusive breast-feeding was present only for 1.5 months, therefore, breast-feeding is continued but other liquids or semisolids diet were introduced.^[1] More than half of patients with chronic diarrhea had previous hospitalization for the same illness and this would indicate the severity and chronicity of illness. These findings are comparable to another study which shows that (33%) of patients with chronic diarrhea have previous episodes of diarrhea.^[14,16] Various therapeutic interventions were tried in these patients and are comparable to other studies^[14], but the use of intravenous fluids was more than reported. This may indicate that the presentation of our patients was more with severe dehydration or with repeated vomiting or inability of enteral feeding. Similar to other studies, there was a wide use of antimicrobial agents.^[13] This approach should be discouraged to avoid development of drug resistance and bacterial overgrowth due to alteration in the microflora of the gut.^[17-19] This may also contribute to more prolongation of diarrhea or even antibiotics-induced diarrhea. Thus antibiotics should be used after obtaining a sample for bacterial isolation and in appropriately selected patients. For patients with chronic diarrhea, lactose free Soya based formula was administered as an empiric treatment; coexisting intolerance to Soya based formula may explain why patients did not respond to this approach. This is why now in protracted diarrhea some use protein hydrolysate formula initially.^[15] In our study, chronic diarrhea was associated with prolonged hospitalization. This may indicate poor response, difficulties in treatment, and more severe illness at presentation to the hospital. This may also explain why there was a higher proportion of self-discharge from hospital than in acute diarrhea. In contrast, there was a good improvement rate for acute diarrhea. This is mostly due to successful rehydration therapy of these patients.^[8] The outcome of acute diarrhea differs greatly from chronic one particularly among those infants less than one year of age. Reported deaths from acute diarrhea were

mostly under one year of age as seen also by others.^[20,21] The mortality of chronic diarrhea exceeds that of acute one many times as shown by Mitra AK et al.^[22] In acute diarrhea cases, proper management with the use of oral rehydration solution (ORS) and in cases with dehydration hospital management have reduced death much. Earlier studies showed high mortality rate from chronic diarrhea of (45%) and (70%)^[4,19,23]. Improved understanding of the disease nature have led to implantation of effective and early treatment and led to great reduction in mortality rate in developed countries (5%) which is mainly due to sepsis.^[4] In a study done in Pakistan, the reported mortality was (4%) mostly resulting from bacteremia.^[24] However in our study mortality rate was higher (9.4%) than reported, the reason for this may be multifactorial. In addition to the difficulties encountered in the management of protracted diarrhea, proper facilities for the care of such children are lacking Among the other factors that might explain the higher mortality in our patients is the higher proportion of associated malnutrition.^[24] Differences in the etiology may explain the age of onset of chronic diarrhea and terminology between developed and developing countries. In developing countries it is mainly post infectious syndrome, cow's milk protein intolerance and associated malnutrition and occurs during the first year of life.^[25,26] In developed countries were now it is named severe and protracted diarrhea (SPD) , it is earlier in onset (mean age was 40 days) and associated with rare and inherited causes.^[27] Systemic approach to management and diagnosis of these patients to exclude specific etiology and early therapeutic intervention is essential to reduce morbidity and mortality of chronic diarrhea. From this study we can conclude that: Exclusive breast-feeding is protective against development of diarrheal disease including chronic diarrhea especially during the first six months of life. Bottle-feeding is a risk factor for development of diarrhea in infancy. Malnutrition is more common among infants with chronic diarrhea and perpetuates it. Therapeutic options in treatment of chronic diarrhea should include proper selection of dietary formula and systemic approach in diagnosis and treatment. Initiation of Paediatric Gastroenterology Unit may

provide help for proper diagnosis and treatment of chronic diarrhea.

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