

Factors affecting morbidity of diarrhea in children

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Abstract

Objectives: To know the clinical variables and nutritional status associated with morbidity of diarrhea in children under the age of 5 years. **Setting:** Department of pediatrics in a medical college hospital over a period of one year. **Type of study:** This was a prospective and observational study. **Methodology:** 200 randomly selected children in the age group of 6 month to 5 years admitted in indoor and attending Pediatric department OPD were included for study. A detailed medical, dietary, socio economic and immunization history was taken after informed consent along with Physical examination including anthropometry, general physical examination and systemic examination. **Results:** social class has a significant effect on severity of diarrhea ($p < 0.0003$) but it does not have any significant effect on duration or prolongation of diarrhea. Stunting has no significant effect on severity and duration of diarrhea but children who are wasted and severely wasted have significantly high number of severe dehydration ($p = 0.0016$) and prolong duration of diarrhea ($p = 0.0019$). Higher frequency of stool have significant ($p < 0.0008$) effect on morbidity of diarrhea. Whereas vomiting has no significant effect on duration but has significant effect on severity of diarrhea. Children having diarrhea along with fever end's up with longer duration of diarrhea ($P = 0.0411$). Only 8% of Exclusively breast fed children had diarrhea for more than 14 days as compared to 22% of those who did not had exclusive breast feeding ($p < 0.0005$). **Conclusion:** Poor nutritional status, high purge rate, fever, lack of exclusive breast feeding increase the possibility of persistent diarrhea.

Keywords: Prolonged diarrhea, Wasting, Dehydration, Vomiting.

Introduction

Diarrheal diseases are a major cause of hospitalization & child's death globally. Together they account for approximately one in six deaths among children younger than five year's (WHO). In India more than 2.3 million annual deaths among children are attributable to diarrheal diseases [1]. Rotavirus is the leading cause of severe diarrhea in children in developing and developed countries. Major risk for diarrhea includes environment contamination & increased exposure to enter pathogens. Additional risk include young age, malnutrition, lower socioeconomic status and lack of exclusive or predominant feeding [2, 3, 4, 5]. Mortality from diarrhea has declined over the past two decades from an estimated 5 million deaths among children under five to 1.5 million deaths in 2004, which parallels downward trends in overall under-five mortality during this period.

Despite these declines, diarrhea remains the second most common cause of death among children under five globally, following closely behind pneumonia, the leading killer of young children. Together, pneumonia and diarrhea account for an estimated 40 per cent of all child deaths around the world each year. [1]

Among children aged 1–4 years, acute watery diarrhea accounted for 31–69% of diarrheal deaths, acute bloody diarrhea for 12–28%, and persistent diarrhea for 12–56%. Among infants aged 1–11 months, persistent diarrhea accounted for over 30% of diarrheal deaths in Ethiopia, India, Pakistan, Uganda and the United Republic of Tanzania Persistently high rates of diarrhea among young children despite intensive efforts are of particular concern. There is very little information on the long term consequence of diarrheal diseases especially persistent or prolong diarrhea and subsequent malnutrition which can affect growth of children [6].

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Material and Method

This was a prospective and observational study conducted in the department of pediatrics at a medical college hospital with due approval from the ethical committee for a period of one year. Out of total no of children admitted in the department of pediatrics nearly 10% of children had diarrhea and those attending OPD almost 20% had diarrhea.

Out of these children we randomly enrolled 200 children between 6 months to 5 years age having diarrhea without any associate severe illness and excluded those cases whose parents were not willing and having diarrhea due to non infectious cause for e.g. celiac disease, HIV and lactose intolerance etc.

Informed written consent of parent or guardian was taken before enrolment of the children. A detailed medical, dietary, socioeconomic and immunization history was taken. These details were entered in a predesigned proforma.

Clinical examination included anthropometry (weight, length/height, weight for height, mid upper arm circumference, chest circumference, and head circumference), general physical examination and systemic examination. Nutritional status was classified according to WHO classification. Low height for age was classified as stunting and severe stunting and low weight for height as wasting and severe wasting if values were below 2SD or 3SD of mean respectively. Detailed data including age, sex, environment, education level, Immunization history, history of breast

feeding and complementary feeding was taken in detail. Social class was assessed by modified Kuppu swami scale. [12]

Detail history of source and treatment of water use for drinking was also taken to assess the degree of contamination of water and their effect on morbidity of diarrhea, also hand washing practice of enrolled children before eating was also observed as poor hygiene may be a significant cause of diarrhea.

Detail history of diarrhea and clinical presentation at the time of enrolment was taken, factors like fever associated with diarrhea, a question about presence of cough and cold along with diarrhea was recorded.

Premedication history was also taken whether the enrolled child has taken any antimicrobial before enrolment, have they used ORS or Zinc before enrolment and correlation of their use on morbidity of diarrhea was studied in this study.

Duration of diarrhea before enrolment was also noted down and its correlation with morbidity of diarrhea was analyzed.

After taking detail history correlation of social class, immunization, nutritional status, breast feeding and complimentary feeding, use of premedication with severity and duration of diarrhea was assessed.

The statistical analysis was performed by chi-squared test by using Epi Info software 3.5.4. version 2012. Differences were regarded as significant when $P < 0.05$.

Results

Age-wise distribution of the subjects (Table-1) reveals that majority of the children were in the age group below two years. Only 4% children were above 4 years.

Evaluation of parental education shows that out of 200 mothers 75% were either illiterate or educated up to primary school, this figure was 55% in case of fathers.

Social class of these children was also taken in consideration & as per modified KUPPU SWAMI Scale they were divided into five classes. Majority of the children belonged to lower middle class followed by upper lower and lower class (26% each). Only 5% children come into upper class.

Relation of socioeconomic status with diarrhea morbidity (Table-2) shows that social class has a significant effect on severity of diarrhea (P -value=0.0003) but it does not have any significant effect on duration or prolongation of diarrhea.

Table-3 shows correlation between children having complete immunization as per their age & duration of diarrhea. This study shows significantly lower duration of diarrhea in children who were immunized (P -value=0.0132) as compared to those who were not completely immunized. Only 7 children have rotavirus immunization.

Nutritional status of enrolled children is also taken under consideration (table-4) it shows stunting has no significant effect on severity and duration of diarrhea but children who are wasted and severely wasted have significantly high number of severe dehydration (P-value=0.0016) and prolong duration of diarrhea (P-value=0.0019) hence shows significant effect on morbidity of diarrhea.

The analysis of clinical presentation (Table-5) revealed that higher frequency of stool have significant (P-value=0.0008) effect on morbidity of diarrhea. Whereas vomiting has no significant effect on duration but have significant effect on severity of diarrhea. Duration of diarrhea before enrolment shows significant effect on severity and total duration of diarrhea. Cough and cold has no significant effect on duration and severity of diarrhea. There is no difference in morbidity of children in spite of having cough and cold in comparison to children having no associated complaint of cough and cold. Association of fever with diarrhea shows significant effect on duration of diarrhea i.e. child's having diarrhea along with fever end's up with longer duration of diarrhea. (P-value=0.0411).

Statistically significant association was observed between diarrheal morbidity and exclusive breast feeding (Table-6). only 8% of Exclusive breast fed children had diarrhea for more than 14 days and those who did not had exclusive breast feeding show that almost 22% children were having diarrhea for more than 14 days, (p<0.0005).

There was also significant association between complimentary feeding and morbidity of diarrhea. Study show that 16 children had complimentary feeding after 12 months and out of these almost 40% were having diarrhea for more than 14 days (p= <0.0005).

Furthermore there was strong association between use of antimicrobial and duration. Those who have used anti microbial before enrolment shows Lower duration of diarrhea (P-value=0.0030) wise versa those who have used ors had significantly less severity of diarrhea but there is no significant (P-value=0.0493) effect of ors on duration of diarrhea. zinc supplementation has shown no significant effect on morbidity of diarrhea (Table-07).

Table No.1: Age Wise Distribution

Age	Total		Male		Female	
	No	%	No	%	No.	%
<1YR	44	22%	20	10%	24	12%
1-2 YR	82	41%	43	21.5%	39	19.5%
2.1-3 YR	42	21%	19	9.5%	23	11.5%
3.1-4 YR	24	12%	12	6%	12	6%
4.1-5 YR	8	4%	4	2%	4	2%
Total	200	100%	98	49%	102	51%

Table No 2: Relation of socioeconomic status on diarrhea morbidity

Social Class	Total (200)	Type of dehydration		P value	Total duration of diarrhea episode (days)			P value
		Severe (N=58)	No And Some (n=142)		P value	<7 Days N=117	7-14 Days N=52	
1. Upper	10(5%)	02(20%)	08(80%)	0.0003	05(50%)	04(40%)	1(10%)	0.2693
2. Upper middle	23(11.5%)	04(17.3%)	19(82.6%)		12(52.1%)	09(39.1%)	2(8.6%)	
3. Lower middle	62(31%)	12(19.3%)	50(88.6%)		41(66.1%)	16(25.8%)	5(8.6%)	
4. Upper lower	52(26%)	22(42.3%)	40(76.9%)		29(55.7%)	11(21.1%)	12(23.0%)	
5. Lower	53(26.5%)	18(33.9%)	35(16.0%)		30(56.6%)	12(22.6%)	11(20.7%)	

Table No 3: Correlation of immunization status with diarrhea morbidity

Immunization Status	Total (200)	Type of Dehydration		P value	Total Duration of Diarrhea Episode			P value
		Severe (N=58)	No And Some (n=142)		<7 Days N=117	7-14 Days N=52	>14 Days N=31	
Immunization								
1.Complete	83(41.5%)	19(22.8%)	64(77.1%)	0.436	50(60.2%)	27(32.5%)	06(7.2%)	0.0132
2.Incomple	117(58.5%)	39(33.3%)	78(66.6%)		67(57.2%)	25(21.3%)	25(21.3%)	
Rota Virus vaccine								
1.Given	07(3.5%)	01(14.2%)	06(85.7%)	0.0781	06(85.7%)	01(14.2%)	00(0%)	0.6052
2.Not Given	193(96.5%)	57(29.5%)	136(70.4%)		111(57.5%)	51(26.4%)	31(16.0%)	

Table No 4 : Correlation of nutritional status with diarrhea morbidity

Nutritional Status	Total (200)	Type of Dehydration		P value	Total Duration of Diarrhea Episode			P value
		Severe (N=58)	No and Some n=142)		<7 Days N=117	7-14 days N=52	>14 days N=31	
1.Normal	92(46%)	26(28.2%)	66(71.7%)	0.2529	55(59.7%)	27(29.3%)	110(119.5%)	0.6431
2.Stunted	80(40%)	23(28.7%)	57(71.2%)		44(55%)	18(22.5%)	18(22.5%)	
3.Severe Stunted	28(14%)	09(32.1%)	19(67.8%)		18(22.5%)	07(25%)	03(10.7%)	
1.Normal	153(76.5%)	28(18.3%)	125(81.6%)	0.0016	107(69.9%)	40(26.1%)	6(3.92%)	0.0003
2.Wasted/ Severe wasted	47(23.5%)	30(63.8%)	17(36.1%)		10(21.2%)	12(25.3%)	25(53.1%)	

Table No.5: Correlation of clinical presentation on diarrhea morbidity

Clinical Presentation	Total (200)	Type Of Dehydration		P value	Total Duration of Diarrhea Episode			P value
		Severe (N=58)	No and Some (n=142)		<7 days N=117	7-14 days N=52	>14 days N=31	
Vomitting								
None	42(21%)	10(23.8%)	32(76.1%)	0.0111	27(64.2%)	9(21.4%)	6(14.2%)	0.2090
<3	39(19.5%)	11(28.2%)	28(71.7%)		22(56.4%)	12(30.7%)	5(12.8%)	
3-5	78(39%)	19(24.3%)	59(75.6%)		52(66.6%)	19(24.3%)	7(8.9%)	
>5	41(20.5%)	18(43.9%)	23(56.1%)		16(39%)	12(29.2%)	13(31.7%)	
No. of Stool at presentation								
3 (n=32)	32(16%)	05(15.6%)	27(84.3%)	0.001	22(68.7%)	9(28.1%)	01(3.1%)	0.0008
4-10 (n=131)	131(65.5%)	31(23.6%)	100(76.3%)		79(60.3)	36(27.4%)	16(12.2%)	
>10 (n=37)	37(18.5%)	22(59.4%)	15(40.5%)		16(43.2%)	7(18.9%)	14(37.8%)	
Duration at presentation								
1 DAY (N=61)	60(30%)	21(35%)	40(66.6%)	0.0316	56(93.3%)	05(8.3%)	00(0%)	0.0106
1-7 DAYS (N=102)	105(52.5%)	35(33.3%)	67(63.8%)		61(58.0%)	35(33.3%)	06(10%)	
>7DAYS (N=37)	35(17.5%)	02(5.7%)	35(100%)		00(0%)	12(34.2%)	25(71.4%)	
Cold and cough								
YES	45(22.5%)	07(15.5%)	38(84.4%)	0.0727	26(57.7%)	12(26.6%)	07(15.5%)	0.9921
NO	155(77.5%)	51(32.9%)	104(67.0%)		91(58.7%)	40(25.8%)	24(15.4%)	
H/O fever								
PRESENT	102(51%)	29(28.4%)	73(71.5%)	0.082	51(50.2%)	31(30.3%)	20(19.6%)	0.0411
ABSENT	98(49%)	29(29.5%)	69(70.4%)		66(67.3%)	21(21.4%)	11(11.2%)	

Table No.6: Effect of feeding practices on diarrhea morbidity

Feeding Practices	Total (200)	Type of Dehydration		P value	Total Duration of Diarrhea episode			P value
		Severe (N=58)	No and some (n=142)		<7 days N=117	7-14 days N=52	>14 days N=31	
EBF								
Yes	103(51.5%)	14(13.5%)	89(86.4%)	<0.0005	77(74.7%)	18(17.4%)	08(7.7%)	<0.0005
No	97(48.5%)	44(45.3%)	43(44.3%)		40(41.2%)	34(35.0%)	23(23.7%)	
COMPL								
before 6 month	56(28%)	5(8.9%)	41(73.2%)	0.0005	39(69.6%)	13(23.2%)	04(7.1%)	<0.0005
AT 6 MNTH	70(35%)	30(42.8%)	40(57.1%)		41(58.5%)	18(25.7%)	11(15.7%)	
AT 7-12 MNTHS	58(29%)	17(29.3%)	41(70.6%)		32(55.1%)	16(27.5%)	10(17.2%)	
>12 months	16(8%)	6(37.5%)	10(62.5%)		05(31.2%)	05(31.2%)	06(37.5%)	

EBF- exclusive breast feeding up to 6 month, COPL- complimentary food

Table No 07: Effect of premedication on diarrhea morbidity

Premedication	Total (200)	type of dehydration		P value	Total duration of diarrhea episode			P value
		severe (N=58)	No And Some (n=142)		<7 days N=117	7-14 days N=52	>14 days N=31	
Medication Received								
ANTIMICROB (48)	48(24%)	15(31.2%)	33(68.7%)	0.3004	28(58.3%)	13(27.0%)	07(14.5%)	0.6446
ORS (52)	52(26%)	06(11.5%)	46(88.4%)	0.0493	28(53.8%)	19(36.5%)	05(9.6%)	0.0931
ZINC(15)	15(7.5%)	04(26.6%)	11(73.3%)	0.6053	10(66.6%)	04(26.6%)	01(6.6%)	0.6053

Discussion

It is widely recognized that diarrhea is a major cause of morbidity and mortality among children, especially children in developing countries. India is a low-income country, where diarrhea is the second leading cause of deaths among children less than five years of age.

Low socio-economic status, limited education, poor environmental sanitation and low hygienic practices poses a serious threat to people's health, especially children's health.

In the present study we did not find any significant sex difference. Similar results were observed by Monica Couto et al (2012), Yilgwan CS, Okolo S N. (2012) although Higher rate of diarrhea has been observed in boys than girls in other studies [2, 3].

Archna B Patel et al found insignificantly higher number of male children in their study [4].

A number of studies have reported higher incidence of diarrhea in malnourished children similar to present study. Sachdev HP et al (1991) in a study on risk factors for fatal diarrhea in hospitalized children in India found significant association of death with severe wasting ($\leq 50\%$ weight for age) and severe stunting ($\leq 85\%$ height for age) [5].

Wences Arvelo et al.(2010) in his study to determine risk factors for diarrhea reported acute malnutrition was present in 12 (48%) of 25 case-children [6]. Archna B Patel et al in their study found 52.7% children to be ≤ 2 Z score and it had an Adjusted odd ratio of 4.32 with a p value of <0.001 . Risk of continuation of diarrhea was

25% more in this population as compared to children with no malnutrition [4].

Our study finds that more than half of the children were having fever at the time of enrolment and 26% were having cough & cold whereas 21% were having blood in stool at the time of enrolment. Cough and cold has no significant effect on duration and severity of diarrhea.

There is no difference in morbidity of children in spite of having cough and cold in comparison to children having no associated complaint of cough and cold.

Association of fever with diarrhea shows significant effect on duration of diarrhea i.e child's having diarrhea along with fever ends up with longer duration of diarrhea (P-value=0.0411).

Uma maheswari B et al (2010) in their study on Persistent diarrhea: risk factors and outcome shows that LRI was significantly associated with persistent diarrhea [7].

Archna B Patel et al found mean temperature of children was 98.8^oF and fever was associated with diarrhea > 7 days with an odd ratio of 1.25. [4]

Statistically significant association was observed between diarrheal morbidity and exclusive breast feeding (<0.0005). Study show that 16 children had complimentary feeding after 12 months and out of these almost 40% were having diarrhea for more than 14 days (p= <0.0005).

Archna B Patel et al found that 56% children had exclusive breast feeding and timely complementary feeding [4].

Alfredo guarino et al (1995) in their study on risk factors for severe and protracted diarrhea in 38 cases found that 71% of cases were not receiving breast feed against 35% of controls (p=0.0007) [8].

Strand TA, Sharma PR et al (2012) in their study to determine Risk Factors for Extended Duration of Acute Diarrhea in Young Nepalese Children found that not breast children had a 9.3 folds higher odds as compared to breast fed children [9].

Muluken Dessalegn et al (2011) in a study on under five children in Ethiopia for having diarrhea in partial breast fed was 2.43 folds more common [10].

Present study shows only 41.5% children were completely immunized as per their age. Only 7 children had received Rota virus immunization.

This study shows significantly lower duration of diarrhea in children who were immunized (P-value=0.0132) as compared to those who were not completely immunized.

This figure is similar to that found by NFHS-3 which reports that only 43.5% in India and 40.3% in M.P. were fully immunised.

Muluken Dessalegn et al (2011) in a study on under five children in Ethiopia found diarrhea to be more prevalent in children unimmunized for measles (crude OR=1.53) [10] similarly Archna B Patel et al (2010) found Incompletely immunised children were more likely to have severe dehydration (odd ratio =3.3) [4].

As far as the frequency of stool is concerned 16% children were having 3 stools at the time of enrolment, 66% between 3-5 and rest 18.5% were having more than 10 stools/day at the time of enrolment Higher the purge rate more severe is the dehydration is a well known fact but it affects the duration of diarrhea as seen in many of the studies.

Archna B Patel et al (2010) in their study to know risk factors for predicting diarrhea duration and morbidity in children with acute diarrhea mean number of stools was 8.5. odd ratio for continuation of diarrhea was 1.01 [4].

Strand TA, Sharma PR in their study to determine Risk Factors for Extended Duration of Acute Diarrhea in Nepalese Young Children found that stool frequency up to 9/day had 1 fold, 9-16/day had 2-3 fold and > 16/day had a 8.5 fold increase in the odds for continuation of diarrhea beyond 7 days[9].

Zodpey SP, Deshpande SG et al (1998) in a study on diarrhea children at Nagpur shows significant effect of frequency of stool > 8/day on severity of dehydration [11].

History of medication of these children before enrolment were also taken, out of these 200 children 26% children had received antimicrobial, 26% had taken ORS and only 7.5% had taken zinc before enrolment.

Those who have used anti microbial before enrolment shows Longer duration of diarrhea (P-value=0.0030) and wise versa.

This finding is in confirmation to those reported in NFHS-3 where 16 percent were treated with antibiotics. Similarly Archana B Patel et al (2010) and Uma maheswari B et al (2010) in their study in Indian children on Persistent diarrhea: risk factors and outcome shows that prior antibiotic use was significantly associated with PD.

Conclusion

Poor nutritional statuses, high purge rate, fever, lack of exclusive breast feeding are important risk factors of persistent diarrhea.

Higher the purge rate more severe is the dehydration is a well known fact but it also affects the duration of diarrhea as seen in many of the studies. A combination of these factors predisposes the children for prolonged and persistent diarrhea.

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