

Risk factors for hospitalization in children with acute diarrhea: a case control study

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SUMMARY: Yalçın SS, Hızlı Ş, Yurdakök K, Özmert E. Risk factors for hospitalization in children with acute diarrhea: a case control study. Turk J Pediatr 2005; 47: 339-342.

To determine the risk factors for hospitalization in 0 to 24-month-old children with acute diarrhea, a retrospective case-control study was done at the Diarrheal Diseases Training and Treatment Center, where all the cases are managed according to World Health Organization (WHO) criteria. For each hospitalized patient, the next two consecutive admissions were enrolled as the control group. Clinical history and detailed physical examination results on admission were obtained from the standard file for all patients. The two groups were found to be similar for age, sex, height, blood in stool, and duration of diarrhea on admission. However, more children in the hospitalized group had high purging rate, frequent vomiting, malnutrition, dehydration and fever, and were not breast-fed on admission compared to the control group in univariate analysis. In multiple logistic regression analysis, only high purging rate, presence of dehydration and absence of breast-feeding on admission were the statistically significant factors. Mothers should be advised to seek early medical attention if the child has high purging rate (more than 8/day) and to continue breast-feeding up to 24 months of age. Multi-center studies with a large number of cases should be done to clarify the possible risk factors for hospitalization in cases with acute diarrhea.

Key words: acute diarrhea, children, hospitalization.

Oral rehydration therapy has decreased the morbidity and mortality of diarrheal diseases; however, some cases need to be hospitalized in both developing and developed countries^{1,2}. A reduction in diarrhea-related hospitalization may be possible by identifying high-risk patients on admission and targeting appropriate intervention for them. On the other hand, the reason that some children with diarrhea require hospitalization is still far from clear. Previous studies have established limited knowledge about the clinical characteristics of children with diarrhea who require hospital care^{1,2}. However, there have been studies to determine the risk factors for fatal diarrhea and development of dehydration³⁻⁷. Concomitant infection, severe wasting, severe stunting and persistent diarrhea were related with mortality. Withdrawal of breast-feeding during diarrhea, not giving oral rehydration solution, and frequent purging (>8/day) and vomiting

(>2/day) increased the risk of dehydration. Severe dehydration, intractable vomiting, anuria, abdominal distension, ileus and any coexisting disease causing difficulty with oral feeding are indications for intravenous fluid treatment and usually require hospitalization. However, to our knowledge, there has been no study about the risk factors for hospitalization of children with acute diarrhea⁸.

Recognizing the high-risk patients on admission will lead to timely and appropriate management of cases and facilitate arrangements for referral as well, if necessary. This study aimed to determine the risk factors for hospitalization in 0 to 24-month-old children with acute diarrhea.

Material and Methods

A retrospective case-control study was conducted between September 1992-December 1996 at Hacettepe University İhsan Doğramacı Children's Hospital Diarrheal Diseases Training

and Treatment Center, where all the cases were managed according to World Health Organization (WHO) criteria⁸. Children (0-24 months of age) with diarrhea of less than 14 days' duration were included into the trial. Cases with chronic diseases were not included in the study. The files of all patients hospitalized due to acute diarrhea were reviewed retrospectively. For each hospitalized patient, the next two consecutive admissions with acute diarrhea, matched for age and gender, were chosen to serve as the control group.

In all patients the clinical history and physical examination results were collected from the patient's file. Any coexisting diseases were

Results

A total of 167 children including 54 hospitalized cases and 113 controls were enrolled in the trial. The comparative results of the hospitalized and the control patients are displayed in Table I.

The hospitalized and control groups were similar regarding mean age and duration of diarrhea on admission. However, hospitalized children were weaker than the control group. There were no differences in the presence of blood in stool between groups. The mean frequency of diarrhea was significantly higher in the hospitalized group than in the control group (9.0 ± 5.2 versus 5.5 ± 2.5 /day; $p < 0.001$) (Table I). Overall, cases with stool frequency

Table I. Clinical Characteristics of Hospitalized and Control Cases

	Control (n=113)	Hospitalized (n=54)	P
Age (mo)*	6.66 ± 4.20	6.97 ± 4.81	NS
Weight (kg)*	7.08 ± 1.85	6.22 ± 2.08	0.007
Height (cm)*	66.5 ± 7.7	64.7 ± 8.1	NS
Duration of diarrhea (day)*	4.7 ± 3.1	5.1 ± 3.1	NS
Diarrhea frequency (/day)*	5.5 ± 2.5	9.0 ± 5.2	<0.001
Vomiting frequency (/day)*	1.2 ± 1.9	2.7 ± 2.5	<0.001
Blood in stool, n (%)	7 (6.2)	3 (5.6)	NS
Lactose-glucose intolerance**	1/11 (9)	10/25 (40)	NS

*values are mean ± SD.

**In children with high purging rate.

recorded. In children with dehydration, body weight after rehydration was used for analysis. Malnutrition was defined as being under the 90th percentile of the standards of weight for age according to the National Center of Health Statistics⁹. Axillary temperature recorded on admission as more than 38°C was accepted as fever. Children with high stool frequency (>8/day) were also examined for reducing substance. On routine stool cultures, only Salmonella and Shigella had been isolated.

All analyses were conducted using SPSS statistical software package (version 6.0 for Windows; SPSS Inc., Chicago, IL, USA). Student's t-test or χ^2 was used for statistical comparison where appropriate. Multiple logistic regression analysis was used to evaluate the association between hospitalization and some characteristics of children (gender, high purging rate, vomiting frequency >2/day, malnutrition, absence of breast-feeding, and presence of dehydration/fever).

of more than eight per day were 7.26 times as likely to be hospitalized ($p < 0.001$, Table II). Among cases with high purging rate (>8/day), there were six cases with lactose intolerance and four cases with glucose intolerance in the hospitalized group, whereas only one case with lactose intolerance was present in the control group. A total of 46.3% of hospitalized cases had vomiting frequency of more than two per day versus 24.8% among the control cases ($p = 0.007$).

Malnutrition and dehydration were more common among hospitalized patients than the controls (51.9% vs 26.5%; $p = 0.002$ for malnutrition and 88.9% vs 1.8%; $p < 0.001$ for dehydration, respectively, Table II). Two cases in the hospitalized group were severely dehydrated. Of hospitalized children, 48.1%, 37.1% and 14.8% had no, mild and moderate malnutrition, respectively, while these rates were 73.5%, 25.6%, and 0.9% in the control group ($p < 0.001$).

Table II. Univariate Analysis and Multivariate Logistic Regression Model for Hospitalization Among 0-24-Month-Old Children With Acute Diarrhea

	Control N (%)	Hospitalized N (%)	Univariate analysis		Multivariate analysis	
			OR (95% CI)	P	OR (95% CI)	P
Male infants	72 (63.7)	36 (66.7)	0.88 (0.44-1.74)	NS	4.45 (0.57-34.53)	NS
Diarrhea frequency >8/day	12 (10.6)	25 (46.3)	7.26 (3.25-16.19)	<0.001	9.94 (1.03-95.65)	0.047
Vomiting frequency >2/day	28 (24.8)	25 (46.3)	2.62 (1.32-5.19)	0.007	3.12 (0.51-19.32)	NS
Absence of breast-feeding	7/74 (9.5)	28/54 (51.9)	6.12 (2.92-12.82)	<0.001	11.52 (1.69-78.52)	0.013
Presence of dehydration	2 (1.8)	48 (88.9)	444 (86- 2279)	<0.001	325 (39-2738)	<0.001
Malnutrition	30 (26.5)	28 (51.9)	2.98 (1.51-5.87)	0.002	3.89 (0.69-22.02)	NS
Axillary temperature >38°C	9 (8.0)	12 (22.2)	3.30 (1.30-8.42)	0.013	1.28 (0.17-9.49)	NS
Constant						<0.001

OR : Odds ratio.

CI : Confidence intervals.

In patients with known breast-feeding status, the rate of children not being breast-fed was higher in the hospitalized cases than in the controls (51.9% vs 9.5%; $p < 0.001$).

Fever (axillary temperature $> 38^{\circ}\text{C}$) was more common among the hospitalized patients than in the control group (22.2% vs 8.0% respectively; $p = 0.013$).

Upper respiratory tract infections were detected in 7.4% of the hospitalized group and in 18.6% of the control group ($p = 0.096$). Children in the hospitalized group had lower respiratory tract infection at a rate slightly higher than that in the control group (5.6% vs 0.9%, respectively; $p = 0.099$). In the hospitalized group, 5.6% (3/54) had urinary tract infection, while this rate was 2.5% (2/80) in the control group ($p = 0.39$).

There were no differences between groups for pathogenic bacteria identified on routine stool cultures (2 *Shigella* in hospitalized cases and 1 *Shigella*, 3 *Salmonella* in controls).

Multiple logistic regression analysis was also used to evaluate the association between hospitalization and various characteristics of children (gender, breast-feeding status, malnutrition, fever, vomiting rate, purging rate, dehydration). Only presence of dehydration, lack of breast-feeding, and high purging rate were found as significant predictors of hospitalization (Table II).

Discussion

Although the majority of diarrheal episodes are self-limited, a small proportion of cases need hospitalization. The question is which of the cases will be hospitalized. Given the scarce medical resources available in less developed countries, clinical criteria for hospitalization on admission are necessary. For this reason, it is important to identify the risk factors leading to hospitalization as early as possible to decrease morbidity and mortality from diarrheal diseases.

In our center, an overall 2% of the patients with diarrhea are hospitalized (unpublished data). However, this rate increases to 18% among moderately dehydrated cases¹⁰. Similarly, in the present study, the major risk factor for hospitalization was found to be moderate to severe dehydration. Victoria et al.⁷ reported fever as a risk factor for fatal dehydration. In

addition, frequent passage of stool and vomiting had the highest risk for development of dehydration^{3,7}. Similarly, in the present study, hospitalized cases had fever more frequently than the controls. Purging rate was higher and vomiting observed more in hospitalized patients than in the control cases. Since it is well known that malnutrition is strongly associated with the risk of fatal diarrhea^{4,7}, malnutrition increased the rate of hospitalization in our study. Another observation was the substantial protective effect of breast-feeding against hospitalization. In a previous study, Sachdev et al.⁶ also showed the protective role of breast-feeding against death from diarrheal diseases. This study emphasizes the importance of continued breast-feeding (up to 24 months) to decrease hospitalization frequency in diarrhea cases. Evidence from this study might suggest that bloody diarrhea did not increase the risk for hospitalization in children younger than 24 months with acute diarrhea. The presence of fever, frequent vomiting, high frequency of diarrhea, malnutrition, absence of breast-feeding, and presence of dehydration were found to be early indicators for hospitalization in univariate analysis. In multivariate analysis, only high purging rate, absence of breast-feeding and presence of dehydration on admission were found to be the most important clinical risk factors in children with acute diarrhea.

In our study, seven hospitalized cases (13%) had coexisting disease such as pneumonia and urinary tract infection. Due to the limited number of cases with coexisting disease, multivariate analysis could not be done. To clarify the effect of any coexisting disease, further studies with a large number of cases are necessary.

In our population of 0-24-month-old children with acute diarrhea, high purging rate, absence of breast-feeding and presence of dehydration

on admission were the most important clinical risk factors and thus require careful evaluation. Mothers should be advised to seek early medical attention if the child has high purging rate (more than 8/day). Multi-center studies with a large number of cases should be done to score the possible risk factors for hospitalization in cases with acute diarrhea.

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