Risk factors for hospitalization of children with diarrhea in Shahrekord, Iran

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ABSTRACT

Background: Diarrheal infections are responsible for over a quarter of all childhood mortality worldwide. The present study was performed to establish risk factors for hospitalization of children with diarrhea in Shahrekord, Iran.

Materials and methods: For this case-control study, cases were selected through children hospitalized due to acute diarrhea lasting less than 14 days and controls were compromised of children with a clinical diagnosis of acute diarrhea lasting for less than 14 days who did not require hospitalization. Controls were selected from out-patient department (OPD) or 3 primary health care centers.

Results: The study population included 259 hospitalized children (cases), 245 OPD and 245 primary health centres controls. In total, bloody diarrhea, dehydration, breastfeeding for ≤6 months, history of hospitalization in the previous year, lack of access to safe water, keeping animals at home and the presence of watery stool were associated with an increased risk of hospitalization during univariate analysis. However, multivariate analysis revealed that bloody diarrhea, watery stool, vomiting, use of unsafe water, prior hospitalization, and the presence of rotavirus or salmonella in the stool were independent factors increasing the risk of hospitalization.

Conclusion: Our results indicate that improving environmental sanitation, socio-economic status and establishing training programs for parents can reduce risk of hospitalization due to diarrhea in children.

Keywords: *Children, Diarrhea, Hospitalization, Risk factors, Iran.*
(Iranian Journal of Clinical Infectious Diseases 2006;1(3):131-136).

INTRODUCTION

Diarrheal infections are the second most common causes of disease resulting in one-third of all hospitalizations and over a quarter of deaths in children worldwide (1,2). More than one billion diarrhea episodes occur every year making diarrhea one of the most important health and economic problems in less developed countries, especially for children less than 2 years of age (2).

Hospital-based studies in industrialized countries have established that low birth weight, age<6 months, the presence of vomiting before admission, a history of previous hospitalization or having other concomitant illness, lack of exclusive breast feeding, young maternal age and smoking, and the presence of rotavirus in the stools are risk factors for hospitalization due to diarrhea (3,4). In

addition to these factors, in developing countries the presence of malnutrition, diarrhea lasting more than 7 days, low socio-economic status, inadequate sanitation at home, parents with poor education and high multiparity and the presence of Escherichia coli in the stool have also been found to increase the risk of hospitalization due to diarrhea (5,6).

There are, however, few studies addressing the factors increasing the risk of hospitalization in children with acute diarrhea in Iran or other Middle East countries. These societies are categorized under middle-income countries which have an epidemiological transition, with a decrease of infectious diseases and relative increase of non–communicable illnesses. Therefore, there is a need to investigate the factors that are associated with an increased risk of childhood hospitalization in Iran. This study describes the risk factors for hospitalization of children with acute diarrhea in Shahrekord, located in the middle part of Iran.

PATIENTS and METHODS

During October 2001 and August 2002, under 5-year old children admitted to Hajar hospital in Shahrekord, with a clinical diagnosis of acute diarrhea lasting less than 14 days were included systematically. Every third child with acute diarrhea and presence of three or more liquid or semi-liquid stools or a single watery stool per day was invited to the study after informed parental consent. For children less than 6 months old, their parents should have stated that the child had diarrhea and that the number of stools was different from the usual defecation pattern. Children with persistent diarrhea (i.e. diarrhea for >14 days duration) were excluded.

The control group was selected systematically through the children attending the outpatient department (OPD) of the hospital and those attending 3 primary health care centres with a clinical diagnosis of acute diarrhea lasting for less than 14 days who did not require hospitalization.

Cases and controls were visited during working days, from Saturday to Thursday, of the same months of the year. We have included two control groups (hospital- and health care centre-based) in order to clarify confounding factors more efficiently.

All the parents were interviewed using a standard questionnaire to obtain their socio-economic background, family characteristics and medical history. A total of 41 variables identified as risk factors for hospitalization in previous studies or considered to be potential risk factors within the local context, were explored.

The characteristics of the cases and controls were compared using univariate analysis to calculate odd's ratios (OR) and 95% confidence intervals (95%CI). ORs were obtained by comparing cases with hospital and health care centres controls. As the OR obtained with each control group were different, we maintained the comparisons for each control group independently of each other. A conservative approach was used to select variables for the multivariate analysis. Variables with p values <0.20 were selected and entered into the multiple logistic regression program of Epi 2002 (7). Variables selected for each control group were entered into separate logistic regressions to obtain adjusted odd's ratios (AOR).

RESULTS

A total of 259 hospitalized children (cases), 245 OPD and 245 primary health centres controls were enrolled among whom 143(55%), 133(54%) and 123(50%) were male, respectively. The mean age (±standard deviation) of the case and control groups was 15.2±12.1, 15.6±12.6 and 17.2±12.8 months, respectively, while the mean duration of the acute diarrhea episodes was 4.3±3.3, 3.7±2.7, and 4.3±2.9 days, respectively.

Table 1. *Risk factors associated with increased risk of hospitalization among hospitalized children versus out-patient and health care centers controls*

	Hospitalized	Out-patient	P-value	Health care centre	P-value
Family background					
Father					
Illiterate	29	14	0.04	10	<0.01
Mother					
Unhealthy	17	5	0.02	5	0.02
Age <20	20	10	0.12	9	0.07
Illiterate	38	11	<0.01	13	<0.01
Relative with diarrhea	18	23	0.40	28	0.11
> 9 persons/home	34	17	0.03	18	0.04
Lack of piped water	10	1	0.01	2	0.05
Use river/spring water	17	1	<0.01	2	< 0.01
Keeping animals at home	69	45	0.03	44	0.02
Medical history					
Beast fed ≤ 6 months	41	18	<0.01	15	<0.01
On solid food	220	185	0.01	192	0.07
Recently taking medications	174	131	<0.01	147	0.11
Presence of rotavirus	91	45	<0.01	NT	
Illness	141	86	<0.01	99	0.01
Pneumonia	49	17	<0.01	20	<0.01
Vomiting	14	6	0.14	4	0.04
Diarrhea	113	67	<0.01	76	0.01
Other infectious disease	15	4	0.02	3	0.01
Non infectious disease	13	6	0.20	5	0.44
Previous hospitalisation	88	35	<0.0 1	39	<0.01
Clinical signs on consultation					
Stools					
Watery	249	225	0.06	215	<0.01
Bloody	28	7	<0.01	8	0.01
Semi-liquid	128	170	<0.01	198	<0.01
> 8 (24 hours)	74	34	<0.01	42	0.01
Vomiting					
During the previous 24 hours	165	66	<0.01	59	<0.01
During the previous week	174	63	<0.01	88	<0.01
Lack of ORS use	175	150	0.27	109	<0.01
Fever (previous 5 days)	201	127	<0.01	133	<0.01
Presence of pathogen					
Rotavirus	91	45	<0.01	NT	-
Coronavirus	4	10	0.03	NT	-
Salmonella	13	6	0.20	NT	-
E.coli spp	38	20	1.93	NT	-

NT: not tested

The mean number of stools per day (prior to enrolment) was higher in hospitalized children when compared with OPD and primary health centres controls (7.1±3.8 vs. 5.7±2.8 and 6.2±3.1, respectively). Vomiting and fever were the most frequent concomitant complications in hospitalized children.

Table 1 presents risk factors associated with increased risk of hospitalization among hospitalized versus OPD and primary health care centres children. Considering the family background, lack of piped water, drinking river and spring water and having contact with animals were significantly more frequent in hospitalized cases

than in controls. Meanwhile, parents of hospitalized children were more often illiterate, while their mothers were more commonly lived in overcrowded families.

Having a history of hospitalization and concomitant illnesses such as pneumonia and other infectious diseases during the recent year was significantly more frequent in hospitalized children. Although nearly all children were breast-fed, hospitalized children were breast-fed for a shorter period when compared with controls (p<0.01).

Cases were more likely to have been introduced to solid foods and to receive medications before consultation, but less likely to receive ORS. The proportion of children who had watery stools was similar between the groups, but vomiting before consultations was reported more often among the cases. Hospitalized children had more frequently fever and bloody diarrhea and were more likely to be dehydrated (p<0.05). One hundred and thirty eight (53%) hospitalized children had mild to moderate dehydration, however, 20(8%) had severe dehydration. These figures were 84(34%) and 6(2%) for OPD and 59(24%) and 6(2%) for primary health care centres controls, respectively.

After multivariate analysis, the presence of blood in the stool, a history of vomiting and having non semi-liquid stools were independent risk factors associated with increased risk of hospitalization (table 2).

The use of spring water, having an illiterate mother, a history of previous hospitalization and the presence of rotavirus or Salmonella in stools were only identified when comparing the cases with OPD controls and the presence of watery stools, not using ORS and the presence of fever in the past 5 days prior to consultation were only identified when comparing cases with primary health care centres controls.

Table 2. *Independent risk factors for hospitalization in children and their related adjusted odd's ratio (AOR) following the multivariate analysis*

Risk factors	AOR (95%CI)	
	Health care centers	Out-patient department
Illiterate mother	NS	3(1.4-6.9)
Presence of fever during the past 5 days	2.2 (1.3-3.5)	NS
Use spring/river water	NS	12.3(1.3-113.4)
Hospitalized during the previous year	NS	2.3(1.3-3.9)
Vomiting during the week before enrolment	1.9(1.2-3.1)	3.7(2.3 –5.9)
Vomiting during the day before enrolment	3.4(2.2-5.6)	2.8(1.7-4.5)
Lack of ORS use	3.2 (2- 5.1)	NS
Bloody diarrhea	21.2(4.6-97.4)	6.9(2.6-18)
Watery stools	14.8(3.9-56.8)	NS
Non-semi-liquid stools	3.2(2-5.1)	1.9(1.2-3)
Presence of Rotavirus	NS	2.1(1.2 –3.5)
Presence of Salmonella	NS	5.1(1.4-18.4)

NS: not significant

DISCUSSION

Diarrhea is one of the most important causes of death in children and is still a considerable public health in developing countries (8). A large proportion of diarrhea episodes end up in hospitalization. There are few studies investigated the impact of diarrhea on hospitalization, however it is suggested that among causative pathogens, rotavirus alone causes approximately 111 million episodes of gastroenteritis require home care, 25 million consultations, 2 million hospitalization and 325,000 to 870,000 death in children <5 years of age (9). Despite many studies related to diarrhea, there is a little mention of factors increasing risk of hospitalization in diarrhea in developing countries and Iran.

This study revealed that having a history of vomiting in the week before consultation, a history

of previous hospitalization and the presence of blood in the stools were independent factors when comparing hospitalized children with OPD and primary health care centre controls. The presence of blood in the stool, however, was not a frequent finding since only 11% of the hospitalized children had blood in their stools. This suggests that although this is an important factor that should alert the health staff, it is rarely seen in clinical practice and would not be very useful to identify the majority of children who will end up in hospitalization.

OPD children were more likely to have slightly more severe diarrhea than children attending health care centres. As noted in prior studies, hospital-based controls are more likely to have other associated pathologies or medical problems when compared with other society-based controls. In agreement with our findings, epidemiological studies in the region (e.g. Pakistan) and other parts of the world have reported a higher frequency of blood in the stools (3–11%) of hospitalized children with acute diarrhea (10) and is likely that many of these diarrhea were bacteria in origin.

The presence of vomiting was an independent risk factor for the severity of diarrhea. This is in agreement with previous studies indicating that the majority of children with severe diarrhea had vomiting and fever before consultation (11). A large proportion (33%) of hospitalized children had a history of previous hospitalizations due to diarrhea or other diseases, probably reflecting a higher susceptibility of these children to infectious diseases. Thus, hospitalization is a risk factors for further hospitalization (6).

The presence of watery stools was an independent significant risk factor when comparing cases with health care centres controls. This is in consistent with studies conducted in developing countries.

Health care centres controls are more likely to receive ORS, possibly because they have milder episodes, while OPD controls are likely to have more severe courses. Indeed, lack of awareness of the ORS benefits for dehydrated children increases the risk of hospitalization. The majority of deaths, hospitalization and visits to emergency departments due to diarrhea could be prevented by appropriate promotion and use of ORS (12).

This study revealed that hospitalized children had been breast-fed for shorter periods. Similarly, prior studies revealed that breast feeding could decrease infectious diseases (13,14).

One hundred and fifty eight children admitted to the hospital had moderate to severe dehydration on admission, which was statistically higher than controls. These findings are in agreement with prior studies demonstrating that dehydration is present in the majority of hospitalized children with acute diarrhea. However, multivariate analysis failed to show dehydration as a risk factor. This could be in part explained by the approach used to control the confounding effect of the variables, as variables were subtracted from the equation on the basis of their statistical value. Additionally, dehydration was strongly associated with watery diarrhea, lack of ORS and vomiting, thus, it is an important clinical criterion (15).

Like many other studies, we have demonstrated that failure of access to safe water is a risk factor for hospitalization due to diarrhea (16,17).

On the other hand, maternal illiteracy and unhealthy conditions were significant independent risk factors of hospitalization. This is in agreement with studies denoting that parent's education, especially illiteracy, is a very important factor in the management of childhood diarrhea (18,19).

In conclusion, the risk factors for hospitalization due to acute diarrhea were the presence of bloody or watery stools, lack of ORS use, having non-semi liquid stools, use of unsafe (spring/river) water, vomiting during the past day or week prior to consultation, hospitalization during the previous year, the presence of rotavirus, Salmonella or E.coli in the stool, shorter duration of breast feeding and illiteracy of mother.

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