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Original Research Article

Assessment of the Clinico-Etiologic Profile of Hospital-Acquired Diarrhea in Subjects of Age Less than 15 Years: A Clinical Study

Vaibhav Gode[1], Sunil Bule[2], Tushar Liladhar Sonawane[3]

[1]Assistant Professor, Department of Paediatrics, SMBT Institute of Medical College and Research Center, Nasik, Maharashtra

[2]Assistant Professor, Department of Paediatrics, SMBT Institute of Medical College and Research Centre, Nasik, Maharashtra

[3]Associate Professor, Maharashtra Post Graduate Institute of Medical Education and Research, Maharashtra University of Health Sciences, Nasik, Maharashtra

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Corresponding author: Dr Tushar Liladhar Sonawane

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Abstract

Introduction: HAD (hospital-acquired diarrhea) is seen in nearly 2-32% of children admitted to hospital which increases the increased stay, cost, increased mortality, and mortality. Each HAD episode deprives the children of nutrients necessary for growth by their loss. More risk is seen in pediatric subjects in hospitals owing to their exposure to subjects having communicable diseases, healthcare workers, and contaminated surfaces with a higher risk in low-income hospitals due to poor infection control.

Aim: The present clinical study was conducted to assess the prevalence and etiology of hospital-acquired diarrhea in pediatric subjects.

Methods: The present study included 120 subjects admitted to the hospital and in the age range of 1-15 years with hospital stay duration of more than 3 days and admission was for reasons other than diarrhea. In all the study subjects, stool samples were collected and assessed for the presence of fungal, parasitic, bacterial, or viral agents. Latex agglutination test was done to detect human rotavirus antigen and ELISA for Clostridium difficile.

Results: In 108 subjects with hospital-acquired diarrhea, Enteropathogenic Escherichia coli was seen in the majority of subjects with 19.16% (n=23) subjects followed by rotavirus in 14.16% (n=17) subjects, C. difficile in 11.66% (n=14) subjects, E. histolytica in 10% (n=12) subjects, Pseudomonas aeruginosa in 6.66% (n=8) subjects, Shigella flexneri in 5% (n=6) study subjects, C. Albicans, Giardia lambia, Cryptosporidium parvum, Proteus mirabilis, and Salmonella enteritidis in 5 subjects each, and Klebsiella oxytoca was seen in the least (n=3) study subjects.

Conclusions: The present study concludes that hospital-acquired diarrhea is highly prevalent in pediatric subjects and the infectious etiology was more common in these subjects compared to the non-infectious etiology. Most commonly associated was a bacterial infection.

Keywords: Bacterial infections, Children, Escherichia coli, Enteropathogenic, Hospital-acquired diarrhea

Introduction

HAD (hospital-acquired diarrhea) is is seen in nearly 2-32% of children admitted to hospital which increases the increased stay, cost, increased mortality, and mortality. Each HAD episode deprives the children of nutrients necessary for growth by their loss.

More risk is seen in pediatric subjects in hospitals owing to their exposure to subjects having communicable diseases, healthcare workers, and contaminated surfaces with a higher risk in low-income hospitals due to poor infection control. As per WHO data, nearly 5.25 lakh pediatric subjects under the age of 5 years die due to hospital-acquired diarrhea every year globally among 1.7 billion subjects developing HAD [1].

Prevalence of diarrhea is three times more common in subjects of age under 3 years compared to older subjects every year globally. At each diarrhea episode, the child loses various nutrients vital for growth and development. Normal colonic flora is disturbed after the prolonged use of broad-spectrum antibiotics which result in the colonization of Clostridium difficile, further increasing the risk of developing hospital-acquired diarrhea. The risk is much higher in subjects admitted to low-income hospitals owing to the contact with health care workers, contaminated surfaces, and infected subjects due to poor infection control followed by them [2].

Previous literature data from various developing and developed countries shows that risk factors associated with hospital-acquired diarrhea are host-related factors, nasogastric intubation, endoscopies like gastrointestinal procedures, nutritional status, immune system, hospital stay duration, and age. In nursing homes and hospitals, the main reason for concern is food contamination for the spread and control of hospital-acquired diarrhea [3]. With the untrained staff in the hospital performing malpractices for handling, preparation, and food storage constitute the primary reason for hospital-acquired diarrhea in the child subjects. In addition, drinking water is usually unsafe in the hospitals due to compromised quality and limited storage which continue the problem and lead to waterborne infectious outbreaks and hospital-acquired diarrhea [4]. The present clinical study was conducted to assess the prevalence and etiology of hospital-acquired diarrhea in pediatric subjects.

Materials and Methods

The present cross-sectional clinical study was conducted to assess the prevalence and etiology of hospital-acquired diarrhea in pediatric subjects. The study population was comprised of the subjects admitted to the Department of Paediatrics, SMBT Institute of Medical College and Research Center, Nasik, Maharashtra.

The study included a total of 120 subjects admitted to the Department of Pediatrics with the age range of 1 year to 15 years and the mean age of 6.82±3.46 years. The inclusion criteria for the study were subjects admitted to the Department of Pediatrics of the Institute, for reasons other than diarrhea, within the age of 1-15 years, subjects admitted for more than 3 days, and who had consented to participate. To diagnose hospital-acquired diarrhea in the study subjects, CDC (center for disease control and prevention) definition [5] was used wherein a hospitalized subject, had acute diarrhea onset with a minimum of 3 days of hospitalization before diarrhea onset. After the final inclusion of the study subjects, detailed history was recorded for all the study subjects followed by the general examination. This was followed by the examination of stools in all the study subjects. This was followed by laboratory investigations. In each subject, stool samples were collected in clean,

sterilized, and disposable containers which were then transported to the laboratory for assessment and processing. Various laboratory tests were conducted to assess the fungal, parasitic, bacterial, and virus

detection. ELISA (Enzyme-linked immunosorbent assay) was done for assessment of toxins of Clostridium difficile and rotavirus antigen were detected using the latex agglutination test. The collected data were subjected to the statistical evaluation using SPSS software version 21 (Chicago, IL, USA) and one-way ANOVA and t-test for results formulation.

The data were expressed in percentage and number, and mean and standard deviation. The level of significance was kept at $p<0.05$.

Results

The present cross-sectional clinical study was conducted to assess the prevalence and etiology of hospital-acquired diarrhea in pediatric subjects. The study included a total of 120 subjects admitted to the Department of Pediatrics with the age range of 1 year to 15 years and the mean age of 6.82±3.46 years. The demographic characteristics of the study subjects are described in Table 1. The majority of the study subjects were within the age range of 1-4 years with 35.83% (n=43) subjects followed by 31.66% (n=38) subjects in the age of 5-8 years, 16.66% (n=20) subjects in age of 9-12 years, and 15.83% (n=19) subjects in the age range of 13-15 years. There were 60.83% (n=73) males and 39.16% (n=47) females in the present study. In the study subjects assessed, hospital-acquired diarrhea was seen in 90% (n=108) of study subjects.

In 108 study subjects who had hospital-acquired diarrhea in the present study, rotavirus was seen most commonly in 1-4 years age group with 7 subjects followed by 5 subjects in 5-8 years where rotavirus was isolated, 4 subjects in 9-12 years, and 1 subject in 13-15 years. In 1-4 years, age, after rotavirus, entamoeba histolytica and enteropathogenic E. coli were commonly isolated in 6 subjects each, clostridium difficile in 5 subjects, C. Albicans and pseudomonas aeruginosa in 3 subjects each, and cryptosporidium parvum, Shigella flexneri, Proteus mirabilis, and Klebsiella oxytoca in 2 subjects each. In 5-8 years Enteropathogenic Escherichia coli was isolated from 6 subjects, followed by rotavirus in 5, Pseudomonas aeruginosa and C.difficile 4 each, Entamoeba histolytica in 3, and the rest others in 2 subjects each. In 9-12 years, Enteropathogenic Escherichia coli was seen in 5 subjects followed by rotavirus in 4, C. difficile in 3, and rest in either 2 or 1 subject only. In the 13-15 years, age group, Enteropathogenic Escherichia coli was seen in 3 subjects and was the main isolate, whereas, all others were seen in either 2, 1, or no subject (Table 2).

On assessing the total number of isolates in the study subjects, it was seen that in 108 subjects with hospital-acquired diarrhea, Enteropathogenic Escherichia coli was seen in the majority of subjects with 19.16% (n=23) subjects followed by rotavirus in 14.16% (n=17) subjects, C. difficile in 11.66% (n=14) subjects, E. histolytica in 10% (n=12) subjects, Pseudomonas aeruginosa in 6.66% (n=8) subjects, Shigella flexneri in 5% (n=6) study subjects, C. Albicans, giardia lambia, Cryptosporidium parvum, Proteus mirabilis, and Salmonella enteritidis in 5 subjects each, and Klebsiella oxytoca was seen in the least (n=3) study subjects as shown in Table 2**.**

Table 1: Demographic characteristics of the study subjects

Characteristics	%	N=120
Mean age (years)	6.82±3.46	
Age range (years)	1-15	
1-4	35.83	43
5-8	31.66	38
9-12	16.66	20
13-15	15.83	19
Gender		
Males	60.83	73
Females	39.16	47

Table 2: Infectious agents based on the age group in subjects with hospital-acquired diarrhea in the study.

Infectious agents	Isolates based on the age group (years)				N=120	%
	1-4 (n=48)	5-8 (n=38)	9-12 (n=20)	13-15 (n=19)		
Rotavirus	7	5	4	1	17	14.16
Candida albicans	3	2	0	0	5	4.16
Giardia lambia	0	2	2	1	5	4.16
Cryptosporidium parvum	2	2	1	0	5	4.16
Entamoeba histolytica	6	3	2	1	12	10
Shigella flexneri	2	2	0	2	6	5
Proteus mirabilis	2	2	1	0	5	4.16
Pseudomonas aeruginosa	3	4	1	0	8	6.66
Klebsiella oxytoca	2	0	1	0	3	2.5
Salmonella enteritidis	0	1	2	2	5	4.16
Clostridium difficile	5	4	3	2	14	11.66
Enteropathogenic Escherichia coli	6	9	5	3	23	19.16
Total	38	36	22	12	108	100

Discussion

The present cross-sectional clinical study was conducted to assess the prevalence and etiology of hospital-acquired diarrhea in pediatric subjects. The study included a total of 120 subjects admitted to the Department of Pediatrics with the age range of 1 year to 15 years and the mean age of 6.82±3.46 years. The majority of the study subjects were within the age range of 1-4 years with 35.83% (n=43) subjects followed by 31.66% (n=38) subjects in the age of 5-8 years, 16.66% (n=20) subjects in age of 9-12 years, and 15.83% (n=19) subjects in the age range of 13-15 years. There were 60.83% (n=73) males and 39.16% (n=47) females in the present study. In the study subjects assessed, hospital-acquired diarrhea was seen in 90% (n=108) of study subjects. These demographics were comparable to the studies by Chikere CB *et al* [6]. in 2008 and Horan TC *et al* [7]. in 2008 where authors assessed subjects with comparable demographics as in the present study. In subjects with hospital-acquired diarrhea in the present study,

rotavirus was seen most commonly in 1-4 years age group with 7 subjects followed by 5 subjects in 5-8 years where rotavirus was isolated, 4 subjects in 9-12 years, and 1 subject in 13-15 years. In 1-4 years, age, after rotavirus, entamoeba histolytica and enteropathogenic E. coli were commonly isolated in 6 subjects each, clostridium difficile in 5 subjects, C. Albicans and pseudomonas aeruginosa in 3 subjects each, and cryptosporidium parvum, Shigella flexneri, Proteus mirabilis, and Klebsiella oxytoca in 2 subjects each.

In 5-8 years Enteropathogenic Escherichia coli was isolated from 6 subjects, followed by rotavirus in 5, Pseudomonas aeruginosa and C.difficile 4 each, Entamoeba histolytica in 3, and the rest others in 2 subjects each. In 9-12 years, Enteropathogenic Escherichia coli was seen in 5 subjects followed by rotavirus in 4, C. difficile in 3, and rest in either 2 or 1 subject only. In the 13-15 years, age group, Enteropathogenic Escherichia coli was seen in 3 subjects and was the main isolate, whereas all others were seen in either 2, 1, or no subject.

These results were consistent with the findings of Pittet D *et al* in 2008 and Szajewska H *et al* in 2016 where authors reported a similar prevalence of different infectious agents as a present study in their studies.

Concerning the assessment of the total number of isolates in the study subjects, it was seen that in 108 subjects with hospital-acquired diarrhea, Enteropathogenic Escherichia coli was seen in the majority of subjects with 19.16% (n=23) subjects followed by rotavirus in 14.16% (n=17) subjects, C. difficile in 11.66% (n=14) subjects, E. histolytica in 10% (n=12) subjects, Pseudomonas aeruginosa in 6.66% (n=8) subjects, Shigella flexneri in 5% (n=6) study subjects, C. Albicans, giardia lambia, Cryptosporidium parvum, Proteus mirabilis, and Salmonella enteritidis in 5 subjects each, and Klebsiella oxytoca was seen in the least (n=3) study subjects. These findings were in agreement with the studies of Rutledge-Taylor K *et al* in2012 and Wanke M *et al* in 2014 where authors have also reported results similar to the present study concerning the infectious agents associated with hospital-acquired infections.

Conclusion

Within its limitations, the present study concludes that hospital-acquired diarrhea is highly prevalent in the pediatric subjects and the infectious etiology was more common in these subjects compared to the non-infectious etiology. Most commonly associated was a bacterial infection. Hence, assessing stools on regular basis in children admitted to hospitals is vital for early detection of infections allowing early management.

Also, proper disinfection protocols should be followed to reduce the cases of diarrhea. The present study had a few limitations including small sample size, shorter monitoring period, and geographical area biases. Hence, more longitudinal studies with a larger sample size and longer monitoring period will help reach a definitive conclusion.

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