

FREQUENCY OF BACTERIAL AND NON-BACTERIAL ACUTE GASTROENTERITIS IN CHILDREN ADMITTED AT A TERTIARY CARE SETTING

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ABSTRACT

Introduction: Acute gastroenteritis is a life-threatening condition especially in children. It is caused by a wide array of pathogens, including bacteria, viruses, and parasites. This study was designed to find out the frequency of acute gastroenteritis in hospitalized children at a tertiary care hospital.

Material & Methods: A cross-sectional study was carried out in the pediatric department of Lady Reading Hospital, Peshawar from May 2019 to November 2019. Ethical approval was obtained from the institutional ethical committee and children were enrolled after informed consents were taken from their parents. Patients of age less than 15 years hospitalized due to acute gastroenteritis were included in the study. The demographic information, clinical features and laboratory findings were collected from all children. Stool samples were assessed at the hospital laboratory for bacterial pathogens using culture and microscopy.

Results: A total of 292 patients were enrolled in the study. Children in age range from one year to seven years were 61% and 39 % were in the age range from 8 to 15 years. Males were 57% and females were 43%. Out of all 292 children, 18% had bacterial diarrhea while the rest 82% had nonbacterial diarrhea.

Conclusion: In this study, the frequency of acute gastroenteritis was higher in children below age 7 years. Males were affected more compared to females. The bacterial causes of acute gastroenteritis may be due to the unavailability of basic life resources including pure drinking water, sanitation and awareness of hand hygiene. Moreover, the frequency of bacterial diarrhea was lower compared to non-bacterial which may be due the unavailability of vaccine against *Rotavirus*.

Key Words: acute gastroenteritis, bacterial diarrhea, children, non-bacterial diarrhea, Rotavirus

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INTRODUCTION

Acute gastroenteritis (AGE) is the leading cause of significant morbidity and mortality among children in both developed and underdeveloped countries.¹ Each child may

have experience as much as 1 to 5 episodes of AGE (diarrhea) per year.² Global health data exchange program in 2016 reported that diarrhea is the eighth leading cause of death in

all ages children while fifth in under five years of age children. The main contributing risk factors for diarrhea are overcrowding, malnutrition, use of unsafe water, and improper sanitation.^{3,4} However, the definite risk factors vary from country to country.⁵ WHO defines diarrhea as the passage of 3 or more time loose or liquid stool per day for > 3 days and < 14 days.⁶ The clinical symptoms associated with AGE included abdominal pain, tenesmus, nausea, vomiting, watery diarrhea, dehydration in case bacterial origin fever and bloody diarrhea may also occur.⁷ The etiological agents of AGE are a wide range of pathogens that may include bacteria, viruses, and protozoan. Viruses being the most common cause of AGE account for 70 to 80%, among which the rotavirus and norovirus consider the commonest.⁸ The incidence rate of virus infection is the same in both developed and developing countries after the availability of rotavirus vaccine⁹ however, in developing countries, due to poor sanitation and unhygienic condition, there is a higher incidence of bacterial and parasites infection, like cryptosporidium spp, Entamoeba histolytica, worm infestation, campylobacter spp, shigella, salmonella spp, and Escherichia coli spp.^{10,11} The major complication of diarrhea is dehydration, electrolytic imbalance, hypovolemic shock, and death. To restore hydration WHO defines 3 managements plan A, B, and C for a different level of dehydration in order to restore hydration and normal physiology of the body.^{6, 12} These guidelines mainly focus on the use of low osmolarity oral rehydration solution (ORS) and zinc. AGE is mostly self-limiting and having viral aetiology, therefore, the use of antibiotic is only recommended for bloody diarrhea or after culture sensitivity.¹³ Anti-diarrheal medication such as loperamide is contraindicated in diarrhea despite its effectiveness at reducing the duration of diarrhea by a mean of 0.8 days, due to the possible risk of side effects such as ileus, abdominal distension, lethargy, sleepiness, and retention of toxin in the gut which further deteriorate body function.¹¹ Furthermore, the use of rapid diagnostics molecular technique for evaluating the aetiology of AGE and prompt management of dehydration, treatment of causative organism of AGE, and use of the vaccine against common GIT pathogens significantly reduce

the mortality due to AGE.^{14, 15} However, AGE being a global health treat among children, the incident of AGE could be reduced by AGE preventive measure like implementing personal and food hygiene, proper sanitation, use of pure water, encouraging people to used vaccine against potential viruses, bacteria that causes AGE, and educating mother for breastfeeding and safe nutrition.^{16, 17} In order to enhance our knowledge regarding the incident of AGE in children of different age, gender, education of parents, socio-economic status, pathogens involved, duration of the disease, and correlation of the severity of the AGE with all these factors among hospitalized children in Peshawar, we performed this cross-sectional study in the department of paediatric Lady reading hospital Peshawar.

MATERIAL AND METHODS

A cross-sectional descriptive study was carried out at the department of paediatrics, Lady Reading Hospital Peshawar, Pakistan. A total of 292 patients with AGE were selected whose parents or guardians were willing to provide consent and participate in the study. The study was conducted during 6-month duration (May to November 2019), keeping the frequency of 5%¹⁸ proportion of bacterial infection among children with acute diarrhea, with 95% confidence interval and 2.5% margin of error using World Health Organization (WHO) sample size calculator.

Children visiting hospital OPD for the treatment of diarrhea and having duration of diarrhea ≤ 14 days or patients who were admitted in the paediatric ward for the treatment of diarrhea were included in the study through non-probability consecutive sampling technique. Patients with hospital acquired diarrhea (diarrhea was not initial diagnose at the time of admission) or with chronic diarrhea (that persist for more than 2 week) were excluded from the study.

Procedure of data collection

The study was conducted after approval from the hospital's Institutional Ethical Board. All the patients presenting with acute diarrhea and fulfilling the inclusion criteria were included in the study. The importance of the study was explained to the parents of the children and a written informed consent was obtained. A short history and physical examinations were performed for every patient. Stool samples of the patients were sent to the lab for

bacteriological examination. Samples culture were grown on different (selective and differential) bacteriological culture media including Sabouraud agar and MacConkey agar. This was followed by gram staining and sugar fermentation to find out the type of pathogen. All the above mention data including the patient's age, gender, and duration of diarrhea, resident, parent education, and socioeconomic status were documented on a pre-designed proforma. To avoid bias in the study a strict exclusion criterion was followed.

Analysis of Data

SPSS version 20 was used for the analysis of the collected data. Mean and stander deviation were calculated for quantitative variables like age, duration of diarrhea. Percentages and frequency were obtained of categorical variable like gender, residence, socioeconomic status, education level, and bacterial diarrhea. Bacterial diarrhea was stratified among age, gender, duration of diarrhea, residence, socioeconomic status, education level to comprehend the effects of modifications. Post-stratification chi-square test was applied in which a P-value \leq of 0.05 was considered a significant value. All results were presented in the form of tables and graphs.

RESULTS

A total of 292 stool samples were analysed for bacterial diarrhea using commonly available bacteriological culture media and gram staining procedure. Samples were considered positive for bacteria evolvment after growth on culture media and gram staining with the ratio of 53/292 (18%). Nonbacterial cases were reported 82%. The demographic parameters of the study population including age, gender, duration of diarrhea, socioeconomic status, and residence are summarized in the table-1. Low age children were found more susceptible to AGE being 61% on the other hand the frequency was decline to 39% in advanced age children (8-15years). A high percentage of AGE was observed in poor/middle class and illiterate /secondary education parent children while the cases were lower in economically sound and highly educated families' children. Due to poor sanitation and overcrowding urban area people was reported more than rural area. Stratification of bacterial gastroenteritis vs non-bacterial with respect to the age, gender, duration of diarrhea, residence, socioeconomic status, and education level is given in the table-

1. Children under the age of 7 years and rural are more affected as shown in the table-2.

DISCUSSION

This study was conducted during a period of six months, from 23rd May to 23rd November 2019, at the department of paediatrics LRH Peshawar. To the best of our knowledge, this is one among the few studies conducted in Peshawar Khyber Pakhtunkhwa to determine the different etiological agent of AGE particularly the bacterial origin, and also to address various demographic factors which are important contributing factors in the occurrence and severity of the AGE in children. For this, we selected 292 patients who have been diagnosed with AGE. In our study high prevalence of AGE was seen in children under 7 years of age 178 (61%) followed by 114 (39%) in children age 8 to 15 years old. among which male children were predominant 166 (57%) while the female was 126 (43%). A total of 193 (66%) children had a duration of diarrhea \leq 30 days while 99 (34%) children had a duration of diarrhea $>$ 30 days. Similar findings were reported in a study conducted in Colombia, South America in which high prevalence of AGE was found in under 5 years of age 89.8% and 10.2% in older children, male were 52% while female 48%, duration of diarrhea less than 14 days was reported in 95% children while only 5% have more than two-week duration of diarrhea.¹⁹ In the present study highly educated family children have a low frequency of AGE 41 compared to illiterate and secondary school level that are 114, and 137. AGE was found more prevalent in economically poor 123 (42%) and middle class 137 (47%) while lower in the children of rich families 32 (11%). A previous study conducted at Afgan border Peshawar also reported similar findings of high prevalence of AGE in illiterate and low socioeconomic status families' children. Also in a Colombian study, the findings were 91% in low-income family whose monthly income were up to 393\$ while only 9% of whose income range from 394 to 1100\$ 80% in elementary education while 20 % in graduate family children.^{19, 20} In the current study more cases were reported from urban 213 (73%) compared to rural area 79 (27%). Similar findings were reported in Colombia.¹⁹ In the present study nonbacterial AGE, 239 (82%) was found predominant than that of bacterial diarrhea 53 (18%). Concerning

the aetiology of AGE, similar results were observed in other studies like Johargy reported 106/270 (39%) positive cases in which 90 (33%) had viral aetiology while 13 (5%) had bacterial involvement. In viral rotavirus infection was found in most of the cases 22%. In bacteria, major organisms were salmonella 3%, shigella 2%, and 1% of parasitic origin *Giardia lamblia*.¹⁸ Farthing et al also reported a comparable result of bacterial infection, 8.8% in children diagnosed with AGE²¹, another study conducted by Qu et al in which his team recovered 20.2% bacteria out of 968 patients stool samples, the observed results of bacteria spp. were *Shigella* 5.9% predominant followed by *Vibrio* spp 5.2%, *Salmonella* 3.9%, and *Escherichia coli* 0.9%.⁷ Feldman et al also reported similar findings in which the frequency of AGE in male children was 65% while in the female it was 35%, and the prevalence of bacterial diarrhea was 12% in children presented with AGE, the frequency was specifically found higher in the summer and early autumn with the main sign and symptoms of bacterial AGE including, fever, nausea, vomiting, abdominal pain, tenesmus, and either watery or bloody diarrhea.²²

CONCLUSION

The study concluded that the frequency of bacterial acute gastroenteritis is lower than nonbacterial. A relatively high prevalence of gastroenteritis was seen in male children under 7 years of age with increasing frequency in illiterate and low socioeconomic families children. It may be because Peshawar is a highly populated city of the province where overcrowding, poor sanitation, lack of pure water supply, and vaccine unitability for the non-bacterial viral types of gastroenteritis to common peoples are big issues which further accelerates the incidence of the disease.

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Table 1. Demographics of the study population (n=292)

Age Distribution	Number	Percentage
1-7 years	178	(61%)
8-15 years	114	(39%)
Gender		
Male	166	(57%)
Female	126	(43%)
Duration of disease		
<30days	193	(66%)
>30 days	99	(34%)
Parent Education		
Illiterate	114	(39%)
Literate	198	(61%)
Socioeconomic status		
poor	123	(42%)
Middle class	137	(47%)
Rich	32	(11%)
Residence		
Rural	79	(27%)
Urban	213	(73%)
Cause of gastroenteritis		
Bacterial	53	(18%)
Nonbacterial	239	(82%)

Table 2. Stratification of bacterial diarrhea w.r.t various parameters

Bacterial Diarrhea	Age (1-7: 8 - 15)	Gender (Male: Female)	Duration (days (<30: >30))	Parent education (Illiterate: Literate)	Socioeconomic Status (Poor: middle: rich)	Residence (Rural: urban)
Yes	32/21	30: 23	35: 18	21: 32	22: 26: 5	15: 38
No	146/93	136: 103	158: 81	93: 146	101: 137: 32	64: 175
p-value	0.92	0.9681	0.99	0.9809	0.9020	0.8212