Evaluation of Bacteriological Profiles and Antibiotic Sensitivity Patterns in Children Under Age 5 Years with Acute Gastroenteritis

Arul B.[1], Prathiba M.[2], Vaishnav V.[1], Vinitha M. and Kothai R.[1]*
[1]Department of Pharmacy Practice, Vinayaka Mission's College of Pharmacy,
Vinayaka Mission's Research Foundation, (Deemed to be University), Salem (Tamilnadu), India.
[2]Department of Community Medicine, Vinayaka Mission's Kirupanandha Variyar Medical College & Hospitals,
Vinayaka Mission's Research Foundation, (Deemed to be University), Salem (Tamilnadu), India.

(Corresponding author: Kothai R.*)

ABSTRACT: Acute Gastroenteritis is an inflammation of the gastrointestinal tract's mucous membranes that causes vomiting and/or diarrhoea. The main aim of this study is to evaluate the bacteriological profiles and antibiotic sensitivity patterns in children under the age of 5 years with acute gastroenteritis. This retrospective study was carried out for 6 months from November 2020 to April 2021 in which 150 patients were selected for the study by considering the inclusion and exclusion criteria. A total of 150 children were analyzed in positive culture reports of acute gastroenteritis. Out of the total number of patients analyzed males (65.3%) children were more affected by acute gastroenteritis than females (34.7%). Patients in the age group of 25-36 months were mostly found to have gastroenteritis. Fever was the most common presenting symptom in our study along with diarrhoea (52%). The study shows that the prevalence of acute gastroenteritis was mostly present in patients with positive culture reports for *E. coli* (34%) organisms. Among 150 patients most of them were prescribed Metronidazole (25.3%) and third generation cephalosporin was the most frequently prescribed antibiotic in the ranges of 1 to 2 antibiotics (69.3%). The European Society for pediatric infectious disease guidelines make stronger recommendations for the use of probiotics for the management of acute gastroenteritis based on the option of "Doing the Least": oral rehydration therapy, early refeeding, and no unnecessary drugs.

Keywords: Acute gastroenteritis, Children, bacteriological profile, Antibiotics.

INTRODUCTION

Gastroenteritis (GE) is an inflammation of the gastrointestinal tract's mucous membranes that causes vomiting and/or diarrhoea (Koletzko & Osterrieder, 2009). Acute gastroenteritis (AGE), which is defined as the beginning of diarrhoea with or without vomiting, is still a leading cause of mortality and morbidity in children, particularly in resource-poor countries (Pieścik-Lech et al., 2013). Diarrhoea is defined as a change in the consistency and frequency of stools (Paul & Bagga, 1982). Acute diarrhoea is defined as a rise in stool fluid content over the normal amount of 10 mL/kg/day that occurs suddenly (Koletzko & Osterrieder, 2009). Diarrhoea affects 68 percent of children under the age of five worldwide(Bartram, 2003). Diarrhoea is the sixth-highest cause of death in children, accounting for around 2.5 million fatalities annually (Morris et al., 2003; UN, 2010). Some bacteria directly infiltrate the intestinal mucosa, eliciting an inflammatory response in the host, while others cause harm by producing toxins (Guarino et al., 2008).

The primary non-pathogenic facultative anaerobe of human colonic flora, *Escherichia coli*, is normally harmlessly restricted to the gut lumen. Some *E.coli* strains have evolved the ability to cause a wide range of human diseases and different types of enteric infections are divided into five groups based on their virulence qualities. This study focuses on acute gastroenteritis in children in developed countries, where viruses cause 75 to 90 % of acute infectious of gastroenteritis in children. Bacteria are responsible for about 20% of cases (King et al., 2003). Bacteria are the cause of roughly 15% of infections in children, with *Escherichia Coli, Salmonella, Shigella,* and *Campylobacter* species being the most prevalent. Some bacterial causes of gastroenteritis (such as *Salmonella* and some *E. coli* strains) can occasionally result in hemorrhagic or bloody diarrhoea. Stool culture tests are the most common diagnostic tests performed to identify the pathogen that has caused gastroenteritis. A sample of stool would be cultured in a specific nutrient media which allows the selective growth of the pathogen. Culture tests help in detecting the most common intestinal infections such as *Salmonella, Campylobacter,* and *Shigella*. Specific stool tests for detecting the toxins produced by organisms such as Clostridium difficile and *E. coli*. Antibiotic sensitivity

refers to bacteria's vulnerability to antibiotics. Because susceptibility varies even between species. The pattern of antibiotic sensitivity might differ regionally and even amongst hospitals within the same community.

Antibiotics are most frequently prescribed to treat infections. Antibiotic prophylaxis is still a problem in some hospitals. Antibiotics are provided inappropriately and without evidence for complaints that do not require antibiotics or for which culture and sensitivity testing could be safely delayed.

Table. 1: Age wise distribution of children affected with AGE.

Age range	Number of patients	Percentage of patients
0-12 months	14	9.3%
13-24 months	23	15.3%
25-36 months	88	58.7%
37-48 months	25	16.7%
Total	150	100%

MATERIAL AND METHODS

The study was conducted retrospectively and the patients were selected based on the inclusion and exclusion criteria. The patients who were diagnosed with AGE were identified and their medical records containing prescriptions were examined. The study was conducted by selecting patients who were admitted from November 2020 to April 2021 by random selection method. All the patients included in the study had undergone a culture test. The case records were collected from the tertiary care hospitals, and the pediatrics department of various hospitals, in Salem, Tamil Nadu. All the relevant and necessary data is collected from patient case sheets. The data collected include demographic details, past medical and medication history, symptoms, number of antibiotics per prescription, and presence of organisms. A sample of 150 cases was randomly selected from the list of patients who underwent positive culture reports. Those patients whose medical records were unavailable were excluded. The patients who were diagnosed with AGE under age 5 were included in the study. Then later antibiotic sensitivity patterns were examined with simultaneous preparations of charts. They were categorized according to organism present, number of antibiotics prescribed, and sensitivity of pathogens against antibiotics.

RESULTS AND DISCUSSION

This retrospective study was conducted in 150 patients of a teaching hospital and selected paediatric hospitals of Salem, Tamilnadu. In this study, it was found that boys (65.3%) were mostly affected by AGE than girls (34.7%). According to the age-wise distribution, it was observed that children between the ages of 25-36 months (58.7%), were most affected with AGE followed by 37-48 months (16.7%), 13-24 months (15.3%), 0-12 months (9.3%). The results are shown in Table 1. Based on presenting symptoms most patients presented with fever along with diarrhoea 78 (52%),

followed by diarrhoea alone 24 (16%), fever without diarrhoea 20 (13.3%), Fever along with diarrhoea and vomiting 15 (10%), diarrhoea along with vomiting 13 (8.7%). The patients with the symptoms are shown in Table 2.

Table 2: Distribution according to presenting symptoms.

Presenting symptoms	Number of patients	Percentage of patients
Fever with diarrhoea	78	52%
Fever with diarrhoea, vomiting	15	10%
Fever without diarrhoea	20	13.3%
Diarrhoea, vomiting	13	8.7%
Diarrhoea	24	16%
Total	150	100

The predominant organism that causes AGE is *E. coli* (34%), the most common organism isolated from the study. The other isolated organisms were *Campylobacter* 46 (30.7%), *shigella* 25 (16.7%), *Salmonella* spp 16 (10.7%), Yersinia 8 (5.3%) and *Clostridium difficile* 4 (2.6%). The results are shown in Table 3.

Table 3: Distribution according to the isolated organism.

Isolated organism	Number of patients	Percentage
E. coli	51	34%
Yersinia	8	5.3%
Salmonella	16	10.7%
Shigella	25	16.7%
Campylobacter	46	30.7%
Clostridium difficile	4	2.6%
Total	150	100

Table 4: Prescribed antibiotics for AGE.

Antibiotic	Number of patients	Percentage
Amikacin	38	25.3%
Ceftriaxone	23	15.3%
Ceftriaxone+ Amikacin	4	2.6%
Metronidazole	27	18%
Ciprofloxacin	6	4%
Azithromycin	15	10%
Cotrimoxazole	13	8.6%
Metronidazole+ Norfloxacin + Simethicone	10	6.7%
Vancomycin	4	2.7%
Trimethoprim Sulfamethozaxone	10	6.7%
Total	150	100

Table 4 shows the details of antibiotics prescribed for the study population. Antibiotics are the commonly

prescribed drugs for AGE Aminoglycoside antibiotics like Amikacin 38 (25.3%) followed by metronidazole 27 (18%), ceftriaxone 23(15.3%), azithromycin 15(10%), cotrimoxazole 13(8.6%), Trimethoprim-sulfamethoxazole 10(6.7%), metronidazole with norfloxacin and simethicone 10 (6.7%), ciprofloxacin 6(4%), ceftriaxone with amikacin 4 (2.6%), vancomycin 4(2.6%), and third generation cephalosporins such as ceftriaxone are the commonly prescribed antibiotics.

Table 5: Dosage form of the prescribed drugs.

Dosage form	No. of Patients	Percentage of Patients
IM	7	4.6%
IV	63	42%
IV, IM	4	2.7%
IV, Syrup	36	24%
IV, Tablet	21	14%
Syrup	10	6.7%
Tablet	9	6%
Total	150	100

The least prescribed drugs were vancomycin 4 (2.6%). The number of antibiotics per prescription was in the range of 1-2 (69.3%), 0-1 (20%), and 2-3 (10.7%). Table 5 shows the list of dosage forms prescribed for the study population. The results indicates that the antibiotics were mostly prescribed in the parenteral form i.e. intravenous (IV) (42%), and intramuscular (IM) (4.6%). The other forms of dosage were syrup (6.7%), and tablets (6%).

Most of the patients were hospitalized in the ranges of 4-6 days (70.7%), followed by 0-4 days (17.3%) and 6-8 days (12%).

In this present study of 150 patients, *E. coli* was found to be a high rate of resistance to vancomycin, and ciprofloxacin and was highly sensitive to amikacin followed by ceftriaxone. Whereas *shigella* was found to be highly sensitive to ceftriaxone followed by azithromycin and resistant to trimethoprim-sulfamethoxazole. *Salmonella* showed high sensitivity to third generation cephalosporin followed by azithromycin. *Yersinia* showed high sensitivities to aminoglycosides and was highly sensitive and resistant to vancomycin.

Table 6: Frequency and Sensitivity Pattern of Uropathogens against Antibiotics.

Antibiotics	*E. coli*	*Shigella*	*Salmonella*	*Yersinia*	*Campylobacter*	*Clostridium difficile*
Amikacin	83	38	14	2	26	1
Ceftriaxone	52	45	25	4	21	1
Metronidazole	49	12	7	1	18	2
Ciprofloxacin	9	3	11	0	56	0
Ofloxacin	15	1	9	0	4	0
Azithromycin	32	44	22	1	58	1
Cotrimoxazole	31	7	13	1	13	0
Vancomycin	2	0	1	0	35	2
Trimethoprim-Sulfamethoxazole	23	13	7	4	12	0

CONCLUSIONS

Acute Gastroenteritis is the most common viral or bacterial infection affecting children. It is more common in males than in females. The most common organism that causes AGE is *E. coli,* Rotavirus/Norviruses followed by *Campylobacter coli/jejuni, Shigella, salmonella* spp, etc. The risk of AGE occurring before 5 years is around 6-8% in boys and 2-4% in girls. Diarrhoea is one of the most common symptoms of AGE. AGE should be suspected in any infant or child with diarrhoea without focus beyond three days. The clinical features depend upon the age and severity of AGE. Neonates show features of vomiting, diarrhoea, fever, and abdominal pain. A retrospective study of 150 patients was done to evaluate bacteria-causing AGE and antibiotic sensitivity patterns in the tertiary care hospital and some padiatric departments of other hospitals in Salem. Pathogenic *Escherichia coli* is the most common cause of Acute Gastroenteritis in children. *Salmonella, Shigella, Yersinia, Campylobacter,* and *Clostridium difficile* are the other organisms identified.

FUTURE SCOPE

The promising results identified in this study can be carried out in other parts of the country to find out most susceptible organism for the acute gastroenteritis.

REFERENCES

Bartram, J. (2003). New water forum will repeat old message. In *Bulletin of the World Health Organization* (Vol. 81, Issue 3, p. 158).

Guarino, A., Albano, F., Ashkenazi, S., Gendrel, D., Hoekstra, J. H., Shamir, R., & Szajewska, H. (2008). European Society for Paediatric Gastroenterology, Hepatology, and Nutrition/European Society for Paediatric Infectious Diseases evidence-based guidelines for the management of acute gastroenteritis in children in Europe: executive summary. *Journal of Pediatric Gastroenterology and Nutrition*, *46*(5), 619–621.

King, C. K., Glass, R., Bresee, J. S., & Duggan, C. (2003).

Managing acute gastroenteritis among children: oral rehydration, maintenance, and nutritional therapy. *MMWR. Recommendations and Reports: Morbidity and Mortality Weekly Report. Recommendations and Reports*, *52*(RR-16), 1–16.

Koletzko, S., & Osterrieder, S. (2009). Acute infectious diarrhoea in children. *Deutsches Arzteblatt International*, *106*(33), 539–547.

Morris, S. S., Black, R. E., & Tomaskovic, L. (2003). Predicting the distribution of under-five deaths by cause in countries without adequate vital registration systems. *International Journal of Epidemiology*, *32*(6), 1041–1051.

Paul, V. K. & Bagga, A. (1982). *Ghai Essential Pediatrics* (Nineth). CBS Publishers. 15-23.

Pieścik-Lech, M., Shamir, R., Guarino, A. & Szajewska, H. (2013). Review article: the management of acute gastroenteritis in children. *Alimentary Pharmacology & Therapeutics*, *37*(3), 289–303.

UN. (2010). *Goal 4: Reduce child mortality*. 26-28.