

Prevalence of Rotavirus Group A in Children Under Five Years Presenting with Acute Gastroenteritis in Eastern Nepal: A Cross-sectional Study

Randhir Kumar Singh,¹ Kapilesh Jadav,² Gopal Nath,³ Hem Sagar Rimal⁴

¹Department of Microbiology, Birat Medical College Teaching Hospital, Budhiganga-2, Tankisinuwari, Morang, Nepal, ²Department of Biotechnology, School of Engineering and Technology Jaipur National University, Jaipur, India, ³Department of Microbiology, IMS, Banaras Hindu University, Varanasi, India, ⁴Department of Pediatrics, Birat Medical College Teaching Hospital, Budhiganga-2, Tankisinuwari, Morang, Nepal.

ABSTRACT

Introduction: Acute gastroenteritis remains a major cause of illness and death among children under five years, especially in low- and middle-income countries. Rotavirus Group A is the leading viral cause of severe pediatric diarrhea and is commonly associated with dehydration and electrolyte disturbances. Data on its prevalence and biochemical abnormalities in eastern Nepal are limited. This study primarily aimed to determine the prevalence of Rotavirus Group A among children under five years presenting with AGE and secondarily to evaluate electrolyte abnormalities in these children, including those who were Rotavirus-positive.

Methods: A hospital-based cross-sectional study was conducted among 223 children under five years presenting with acute gastroenteritis. Stool samples were tested for Rotavirus Group A using enzyme-linked immunosorbent assay (ELISA). Data were analyzed using IBM SPSS Statistics version 25.0. Categorical variables were presented as frequencies and percentages. The prevalence of rotavirus infection was calculated as a percentage.

Results: The prevalence of Rotavirus Group A was 14.35%. Additionally, 15 (6.73%) children had rotavirus–adenovirus co-infection. A seasonal peak occurred during winter (December–February), including 65.47% of cases. Among 223 AGE patients, electrolyte abnormalities were present in 156 (69.96%). Among 32 rotavirus-positive cases, 21 (65.62%) had electrolyte abnormalities, with hyponatremia being most common (28.13%), followed by hypokalemia (15.63%).

Conclusions: Rotavirus is a leading cause of acute gastroenteritis among children under five years, particularly during winter, and is frequently associated with electrolyte disturbances. Early diagnosis, prompt electrolyte correction, and strengthened vaccination and surveillance programs are crucial to reducing morbidity and disease burden.

Keywords: acute gastroenteritis; child; diarrhea, viral; electrolytes; rotavirus infections.



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Correspondence:

Name: Mr. Randhir Kumar Singh

Affiliation: Department of Microbiology
Birat Medical College Teaching Hospital
Budhiganga-2, Tankisinuwari, Morang,
Nepal

Email: randhirinbmc@gmail.com

Phone number: +977- 9844035509



INTRODUCTION

Acute gastroenteritis (AGE) is a major cause of morbidity and mortality among children under five years of age, particularly in low- and middle-income countries.^{1,2}

Rotavirus Group A is the leading viral cause of severe acute gastroenteritis in infants and young children transmitted predominantly through the faeco-oral route.^{3,4} Rotavirus vaccination has substantially reduced rotavirus-associated hospitalization and mortality; however, rotavirus remains an important cause of childhood diarrhoea in Nepal.^{4,5}

Epidemiological data from eastern Nepal remain limited.⁶ Acute diarrhoeal illnesses, are frequently associated with electrolyte abnormalities particularly hyponatremia and hypokalemia,

requiring timely recognition and management.⁷ Therefore, the primary objective of this study was to determine the prevalence of Rotavirus Group A among children less than five years presenting with AGE at a tertiary care hospital in eastern Nepal. The secondary objective was to evaluate electrolyte abnormalities among all children with AGE, irrespective of rotavirus status.

METHODS

This hospital-based cross-sectional study was conducted in the Department of Microbiology at Birat Medical College Teaching Hospital, Morang, Nepal from June 2022 to March 2023. The

study population included children who attended outpatient and inpatient services for acute gastroenteritis during the study period. A consecutive sampling technique was used. All eligible children meeting the inclusion criteria during the study period were enrolled. The sample size was calculated using the formula:

$$n = Z^2 \times p \times q / d^2$$

Where:

$Z = 1.96$ at 95% confidence interval

$p = 17.6\%$

$q = 1 - p = 0.85$

$d = 0.05$, $d^2 = 0.0025$

A northern Indian study reported rotavirus positivity rate of 17.6% ($p = 0.176$) among children under five years with acute watery diarrhoea.⁸ A total of 223 children were ultimately enrolled in the study.

Children aged 0–59 months presenting with acute gastroenteritis (AGE), defined as acute-onset diarrhoea with or without vomiting, were included in the study. Diarrhoea was defined as the passage of ≥ 3 unusually loose or watery stools per day, or more frequent stools than usual for the individual, with an episode lasting < 14 days.⁹ Children with bloody diarrhoea, chronic diarrhoea lasting more than 14 days, hospital-acquired diarrhoea, or those who were immunocompromised were excluded.

Approximately 15–20 mL of fresh stool was collected in sterile wide-mouthed containers within three days of the onset of illness. In infants and toilet-untrained children, a clean plastic sheet was placed in the diaper or beneath the child to collect the stool, which was then transferred to a sterile container while avoiding urine contamination. The samples were transported in an ice box maintained at 2–8°C and stored at –20°C to –70°C until laboratory processing. Approximately 2 mL of venous blood was collected in a plain vacutainer tube. The blood sample was centrifuged to separate the serum, which was subsequently analyzed for electrolyte levels using the Sensa Core ST-200 aQua Electrolyte Analyzer.

Stool samples were initially screened for Rotavirus Group A antigen using an immunochromatographic test (ICT) kit manufactured by Bio footprints Health Care Pvt. Ltd., India. The presence of Rotavirus Group A VP6 antigen was further confirmed using an enzyme-linked immunosorbent assay (ELISA) kit (Rota clone, Meridian Bioscience Inc., USA). For quality assurance, stool samples were collected and processed according to the manufacturers' instructions for the respective diagnostic kits. Appropriate precautions were taken during sample collection, transportation, storage, and laboratory processing to minimize contamination and preserve sample integrity. Serum electrolyte measurements were performed using the specified electrolyte analyzer according to standard operating procedures. Laboratory findings were recorded along with relevant demographic and clinical information for subsequent statistical analysis.

Data were entered and analyzed using IBM SPSS Statistics version 25.0. Categorical variables were presented as frequencies and percentages. The prevalence of rotavirus infection was

calculated as a percentage.

Ethical approval was obtained from the Institutional Review Committee (IRC) of the Nepal Health Research Council (NHRC) [Reference number 178/2022]. Written informed consent was obtained from the parents or legal guardians of all participating children before enrolment, and the confidentiality of participants' information was maintained throughout the study.

RESULTS

Table 1. Distribution of rotavirus Group A infection among children with acute gastroenteritis (n = 223).

Viral infection status	n(%)
Rotavirus Group A positive	32(14.35)
Rotavirus mono-infection	17(53.13)
Rotavirus–adenovirus co-infection	15(46.88)
No viral infection detected	191(85.65)

Footnote: Percentages for mono-infection and co-infection are calculated among children positive for rotavirus Group A (n = 32); all other percentages are calculated using the total study population (n = 223).

A total of 223 children with acute gastroenteritis were included in the study. Male children comprised 148 (66.4%) of the study population. The highest proportion of children was in the 25–36-month age group 88(39.5%), followed by the 13–24-month age group 69(30.9%). The prevalence of Rotavirus Group A infection was 14.35%. Among the rotavirus-positive cases, 17(53.13%) had rotavirus mono-infection and 15(46.88%) had rotavirus–adenovirus co-infection. No viral infection was detected in 191(85.65%) children (Table 1).

Table 2. Distribution of children with acute gastroenteritis during the study period (n=223).

Study period	n(%)
Jun–Aug 2022	20(8.97)
Sep–Nov 2022	17(7.62)
Dec 2022–Feb 2023	146(65.47)
Mar-23	40(17.94)

The number of children presenting with acute gastroenteritis varied across the study period. The highest number was recorded during December 2022–February 2023, with 146 (65.47%) cases, followed by March 2023, with 40 (17.94%) cases. The lowest numbers were recorded during June–August 2022, with 20 (8.97%) cases, and September–November 2022, with 17 (7.62%) cases (Table 2).

Table 3. Electrolyte abnormalities among children with acute gastroenteritis (n=156).

Electrolyte finding	n(%)
Single electrolyte abnormality	96 (61.54)
Multiple electrolyte abnormalities	60 (38.46)

Among the 156 children with electrolyte abnormalities, 96 (61.54%) had a single electrolyte abnormality, whereas 60 (38.46%) had multiple electrolyte abnormalities (Table 3).

Among the 32 Rotavirus Group A-positive children, 21

(65.63%) had at least one electrolyte abnormality. Hyponatremia was the most common abnormality, present in 9 (28.13%) children, followed by hypokalemia in 5 (15.63%). No cases of hyperchloremia were identified (Table 4).

Table 4. Electrolyte abnormalities among the Rotavirus Group A-positive children (n=32).

Electrolyte abnormality	n(%)
No electrolyte abnormality	11(34.38)
Any electrolyte abnormality	21(65.63)
Hyponatremia	9(28.13)
Hypernatremia	2(6.25)
Hypokalemia	5(15.63)
Hyperkalemia	3(9.38)
Hypochloremia	2(6.25)
Hyperchloremia	0(0.00)

DISCUSSION

Globally, Rotavirus Group A remains one of the leading causes of acute gastroenteritis (AGE) among children under five years and continues to contribute substantially to childhood morbidity in low- and middle-income countries.¹⁰ In the present study, Rotavirus Group A was detected in 14.35% of children with acute gastroenteritis, comprising 7.62% with rotavirus mono-infection and 6.73% with rotavirus–adenovirus co-infection. These findings demonstrate that rotavirus remains an important etiological agent of pediatric diarrhoeal disease in eastern Nepal. The detection of both mono-infection and mixed viral infection indicates that different viral pathogens may contribute to the clinical presentation of AGE in this age group. The findings therefore reinforce the importance of laboratory-based surveillance for understanding the changing pattern of viral gastroenteritis and its contribution to pediatric morbidity.

The prevalence observed in this study is slightly lower than that reported in previous Nepalese studies, where rotavirus positivity ranged from 17% to 39% among hospitalized children with diarrhoea.^{11,12} Dhital et al. reported a prevalence of 22.9% among children under five years of age in Nepal¹¹ while Sherchand et al. reported a high burden of rotavirus diarrhoea, with a prevalence of 24.7% among hospitalized children.¹² The relatively lower prevalence observed in the present study may be due to regional variation, differences in seasonal sampling, improved hygiene practices, increasing vaccine uptake, or variation in healthcare-seeking behavior. Differences in study setting, study period, diagnostic approaches, and characteristics of the enrolled children may also contribute to differences in reported prevalence. Such variations make direct comparison between studies difficult, particularly when surveillance is conducted in different geographical and healthcare settings. Nevertheless, the detection of rotavirus in the present study confirms its continuing relevance as a cause of AGE among children presenting to healthcare facilities in eastern Nepal. Male children were more common in both the overall study group and among rotavirus-positive cases. Similar findings

have been reported in Nepalese hospital-based studies, in which males were more frequently affected by diarrhoeal disease.¹³ This difference may partly reflect sociocultural healthcare-seeking patterns rather than true biological susceptibility. The largest proportion of study participants was in the 25–36 months age group. Previous Nepalese studies have shown that Rotavirus infection is most common in younger children, particularly under two years of age.^{11,12} Although this differs from reports describing a predominance of rotavirus infection among children younger than two years, the finding may reflect differences in study population, healthcare-seeking behavior, and vaccination coverage. The distribution observed in the present study also suggests that rotavirus infection should not be considered exclusively a disease of infancy, as children in the second and third years of life may continue to present with clinically significant diarrhoeal illness. Differences in exposure patterns, immunity following previous infection, and vaccination status may also influence the age distribution of infection.

The distribution of children presenting with acute gastroenteritis showed marked seasonal variation, with the highest proportion enrolled during the winter months (December–February), accounting for 65.47% of the study population. This finding is consistent with recent surveillance studies from India, which have demonstrated a persistent winter peak in rotavirus infections even after vaccine introduction. Also, multicenter hospital-based surveillance from Maharashtra and Gujarat (2020–2023) showed the highest rotavirus positivity during colder months with a marked decline in summer, confirming persistent winter seasonality.^{14,15} This pattern is also supported by earlier regional and global evidence, which demonstrates that rotavirus transmission is strongly influenced by climatic factors, with increased circulation during cooler and drier seasons due to improved viral stability and enhanced indoor transmission.¹⁶ The pronounced winter concentration observed in the present study may have practical implications for pediatric healthcare services, as increased patient attendance during this period may place additional demands on emergency and pediatric services. Awareness of seasonal patterns may also support timely preparedness, particularly with regard to hydration management, diagnostic testing, and infection prevention measures. Electrolyte disturbances were common in the study population, occurring in 69.96% of children with acute gastroenteritis. Hyponatremia was the most frequent abnormality, followed by hypokalemia. A similar pattern has been reported by Shah et al., who identified hyponatremia and hypokalemia as common electrolyte disturbances among children with acute diarrhoeal illness and dehydration.⁷ The high frequency of electrolyte abnormalities observed in the present study highlights the importance of assessing electrolyte status, particularly in children with frequent diarrhoea and vomiting. These abnormalities may arise from gastrointestinal fluid and electrolyte losses, inadequate oral intake, and varying degrees of dehydration. Early recognition is therefore important because untreated electrolyte disturbances may contribute to clinical deterioration and prolong recovery. Particular attention should be given to children with repeated

vomiting, frequent watery stools, poor oral intake, or signs of dehydration. The findings also emphasize that management of AGE should extend beyond identification of the infectious cause and should include appropriate assessment and correction of fluid and electrolyte abnormalities.

Rotavirus–adenovirus co-infection was observed in 6.73% of cases. Similar rotavirus–adenovirus co-infections have been reported among Nepalese children with acute gastroenteritis.¹² The clinical significance of these co-infections warrants further investigation. The presence of co-infection may reflect simultaneous exposure to multiple enteric viruses and may have implications for the clinical severity or duration of illness. However, the present study was not designed to determine whether co-infection resulted in more severe disease than rotavirus mono-infection. Further studies involving larger numbers of patients could help clarify the clinical characteristics and outcomes associated with mixed viral infections.

The present study has limitations. As this was a single-center hospital-based study, the findings may not represent the community prevalence of rotavirus infection. The small sample size and number of rotavirus-positive cases may have affected subgroup analysis and generalizability. Molecular genotyping, vaccination status, and season-specific rotavirus positivity were not evaluated. In addition, bacterial and parasitic causes of acute gastroenteritis were not included. Screening for Rotavirus infection and monitoring of serum electrolytes should be encouraged in children presenting with acute gastroenteritis to ensure diagnosis and management. Strengthening Rotavirus vaccination coverage and promoting hygiene and sanitation practices may help reduce the burden of diarrhoeal disease. Multicentric studies with molecular genotyping and assessment of seasonal variation and vaccination status are recommended to better understand the epidemiology of Rotavirus infection in Nepal.

CONCLUSION

Rotavirus Group A remains an important cause of acute gastroenteritis among children under five years in eastern Nepal, accounting 14.35% of cases in the present study. Electrolyte disturbances, particularly hyponatremia and hypokalemia, were common among children with acute gastroenteritis and were also observed in Rotavirus-positive cases. Rotavirus–adenovirus co-infection was identified in a subset of patients, highlighting the presence of mixed viral infections in pediatric diarrhoeal disease.

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Conflict of Interest: The authors declare that there is no conflict of interest.

Data Availability Statement: The data supporting the findings of this study are available from the corresponding author upon request.

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