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ORIGINAL ARTICLE

Comparative Analysis of Oral and Intravenous Rehydration Therapy in Paediatric Acute Gastroenteritis

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ABSTRACT

Background: Acute gastroenteritis remains one of the leading causes of morbidity and mortality among children worldwide, particularly in developing countries.

Objective: To compare the clinical effectiveness, safety, and overall outcomes of oral rehydration therapy and intravenous rehydration therapy in pediatric patients with acute gastroenteritis.

Methodology: This comparative cross-sectional study was at Department of Pediatric Medicine, Continental Medical College, Hayat Memorial Hospital Lahore from 1st October 2022 to 31st March 2023. A total of 240 children aged 6 months to 10 years diagnosed with acute gastroenteritis and presenting with mild to moderate dehydration were enrolled. They were equally divided into two groups: Group A received oral rehydration therapy using WHO-formulated reduced-osmolarity oral rehydration solution, and Group B received intravenous rehydration with isotonic fluids.

Results: Both therapies achieved 100% rehydration success. The mean time to rehydration was significantly shorter in the IV group (5.8±1.7 hours) than in the oral group (7.4±2.2 hours, $p<0.001$). However, the oral rehydration group demonstrated a significantly shorter hospital stay (1.6±0.8 days vs. 2.8±1.2 days, $p<0.001$) and earlier resumption of feeding ($p = 0.04$). Complications such as vomiting occurred in 15% of the oral group, while IV site phlebitis (6.7%) and mild electrolyte imbalance (7.5%) were noted in the IV group.

Conclusion: Both oral and intravenous rehydration therapies are effective for managing dehydration in pediatric acute gastroenteritis. However, oral rehydration therapy offers comparable efficacy with fewer complications, lower costs, and shorter hospitalization, making it the preferred choice for mild to moderate dehydration.

Keywords: Dehydration, Patients, Acute gastroenteritis, Diagnosed, Effectiveness

INTRODUCTION

Acute gastroenteritis (AGE) is a leading cause of pediatric illness worldwide, particularly in developing countries where poor sanitation, limited access to safe drinking water, and inadequate healthcare infrastructure contribute significantly to its high prevalence.[1] Acute onset of diarrhea, vomiting, fever, abdominal pain, and varying degrees of dehydration are the primary symptoms of the condition.[2] In children, especially those under five years of age, the risk of dehydration is exceptionally high due to smaller body fluid reserves and a higher basal metabolic rate.[3] According to the World Health Organization (WHO), diarrheal diseases continue to account for nearly 10% of all deaths in children under five, amounting to approximately 480,000 deaths each year. Acute gastroenteritis continues to impose a significant clinical and financial burden worldwide, despite the fact that mortality rates have decreased over the past few decades as a result of improved management and public health measures.[4] Viruses like rotavirus and norovirus, bacteria like Escherichia coli, Salmonella, and Shigella, and less frequently protozoal infections like Giardia lamblia and Entamoeba histolytica are the primary causes of AGE in children. Regardless of etiology, the fundamental treatment goal remains the same restoration and maintenance of fluid and electrolyte balance.[5]

Dehydration, if left untreated, can lead to hypovolemic shock, metabolic acidosis, renal failure, and death. Therefore, the foundation of management is prompt and appropriate rehydration therapy.[6] Rehydration can be accomplished through either oral rehydration therapy (ORT) or intravenous rehydration therapy (IVRT). ORT involves administering an oral rehydration solution (ORS) a carefully balanced mixture of salts and glucose designed to optimize water and electrolyte absorption through the intestinal sodium-glucose cotransport mechanism.[7] This method is simple, inexpensive, and can be administered at home or in outpatient settings, making it particularly valuable in resource-limited environments. Numerous studies have demonstrated that ORT is highly effective in treating mild to moderate dehydration and significantly reduces mortality and hospital admissions.[8] Furthermore, the WHO and UNICEF have long endorsed ORT as a first-line therapy for pediatric diarrhea, given its accessibility and cost-effectiveness.[9] In contrast, intravenous rehydration therapy is typically reserved for children who suffer from persistent vomiting, altered sensorium, or paralytic ileus or who are severely dehydrated. IV therapy allows for rapid volume expansion, immediate electrolyte correction, and better control over fluid administration, making it the preferred option in emergency or inpatient care settings. However, IV therapy is not without drawbacks.[10] It requires medical supervision, sterile equipment, and skilled personnel.[11] Moreover, complications such as local infection, thrombophlebitis, electrolyte imbalance, and fluid overload can occur, particularly in fragile pediatric populations. The need for hospitalization and higher costs also make IV therapy less practical for widespread use in mild cases.[12]

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MATERIALS AND METHODS

This was a comparative cross-sectional study conducted at Department of Pediatric Medicine, Continental Medical College, Hayat Memorial Hospital Lahore from 1st October 2022 to 31st March 2023. A total of 240 pediatric patients were enrolled in the study. Non-probability consecutive sampling was employed. Children aged between 6 months and 10 years, diagnosed with acute gastroenteritis (diarrhea of ≤14 days' duration), presenting with mild to moderate dehydration (as classified by WHO criteria) and parents or guardians providing informed consent were included. Those children with severe dehydration requiring immediate resuscitation, presence of comorbidities such as malnutrition, congenital heart disease, renal impairment, or chronic diarrhea and cases with suspected surgical abdomen or other causes of vomiting unrelated to gastroenteritis were excluded. After obtaining ethical approval from the institutional review board,

all eligible patients were evaluated through detailed history and physical examination. The degree of dehydration was assessed based on WHO guidelines (mild, moderate, or severe). Baseline parameters, including age, gender, weight, vital signs, and laboratory values (serum electrolytes, urea, and creatinine), were recorded.

Group A (Oral Rehydration Therapy): The patients were given WHO-developed low-osmolarity ORS. The amount and frequency were calculated based on the weight of the body and the degree of dehydration. ORS was given in a slow manner using a spoon or cup to avoid vomiting.

Group B (Intravenous Rehydration Therapy): Intravenous fluids of isotonic type (Ringer's lactate or normal saline) were given to the patients according to the WHO rehydration guidelines, depending on the body weight and the level of dehydration. Under the constant medical control, IV fluids were used.

The major parameters that were evaluated were time to clinical rehydration, vomiting time and diarrhea time after the commencement of treatment, time taken to resume oral intake, total hospital stay and incidence of complications such as electrolyte imbalance, IV site infection or frequent relapse of dehydration. Rehydration was also judged when the vital signs, sufficient urine output, moist mucous membranes and an improvement in the skin Turgor were normal. Data were entered and analyzed using SPSS-26. The data was compared using an independent samples t-test and Chi-square test. A p-value of less than 0.05 was considered statistically significant.

RESULTS

The mean age between the two groups were 3.9±2.1 years in the oral rehydration group and 4.1±2.4 years in the intravenous groupindicating no significant difference in age distribution. Males predominated slightly in both groups (55.8% in the oral group and 53.3% in the intravenous group), while females accounted for 44.2% and 46.7%, respectively. The severity of dehydration at presentation was mostly mild to moderate, with 57.5% of children in the oral group and 50.8% in the intravenous group classified as mildly dehydrated, while 42.5% and 49.2%, respectively, had moderate dehydration. The mean body weight was nearly identical between the two groups (14.2±4.8 kg vs. 13.9±4.6 kg), and the mean duration of diarrhea before admission was also similar (18.7±6.9 hours vs. 19.1±7.3 hours) [Table 1].

The mean time to achieve clinical rehydration was significantly shorter among patients receiving intravenous therapy (5.8±1.7 hours) compared to those on oral rehydration (7.4±2.2 hours, p<0.001). Although IV therapy achieved faster rehydration, both groups had a 100% rehydration success rate. The duration of diarrhea and vomiting after treatment was statistically similar between the groups, indicating that both methods were equally effective in resolving gastrointestinal symptoms. Interestingly, children in the oral rehydration group resumed oral feeding earlier (9.3±2.7 hours) than those in the intravenous group (10.1±3.0 hours, p=0.04) [Table 2].

Mild vomiting during therapy occurred in 15% of children receiving ORT but was transient and self-limiting. Electrolyte imbalance occurred slightly more in the IV group (7.5%) compared to the oral group (3.3%), though the difference was not statistically significant (p = 0.09). IV site complications, including phlebitis and infiltration, were reported in 10.9% of patients receiving intravenous fluids. Recurrent dehydration was rare and comparable in both groups (1.7% vs. 2.5%, p = 0.65) [Table 3].

Both ORT and IV therapy resulted in marked improvement in serum sodium, potassium, bicarbonate, and urea levels, as well as urine output and capillary refill time, indicating successful restoration of fluid and electrolyte balance. The mean post-treatment serum sodium rose from 133.8±3.9 to 137.2±2.8 mEq/L in the ORT group and from 132.9±4.1 to 136.9±3.0 mEq/L in the IV group. Similar improvements were seen in potassium (3.6 → 3.9 mEq/L for ORT, 3.5 → 3.8 mEq/L for IV) and bicarbonate levels (17.5 → 20.3 mEq/L vs. 17.3 → 20.7 mEq/L). Blood urea levels decreased post-rehydration in both groups, confirming hydration adequacy (Table 4).

Table 1: Baseline demographic and clinical characteristics of study population (n = 240)

Variable	Oral Rehydration Therapy (n=120)	Intravenous Rehydration Therapy (n=120)
Age (years)	3.9±2.1	4.1±2.4
Gender		
Male	67 (55.8%)	64 (53.3%)
Female	53 (44.2%)	56 (46.7%)
Severity of dehydration		
Mild	69 (57.5%)	61 (50.8%)
Moderate	51 (42.5%)	59 (49.2%)
Body weight (kg)	14.2±4.8	13.9±4.6
Duration of diarrhea before admission (hours)	18.7±6.9	19.1±7.3

Table 2: Comparison of clinical outcomes between oral and intravenous rehydration groups

Outcome variable	Oral Rehydration	Intravenous Rehydration	P value
Time to clinical rehydration (hours)	7.4±2.2	5.8±1.7	<0.001*
Duration of diarrhea after treatment (hours)	26.4±6.3	25.2±7.1	0.28
Duration of vomiting (hours)	13.6±4.8	12.9±4.3	0.33
Time to resume oral feeding (hours)	9.3±2.7	10.1±3.0	0.04*
Length of hospital stay (days)	1.6±0.8	2.8±1.2	<0.001*
Successful rehydration	120 (100%)	120 (100%)	—

Table 3: Complications and tolerance among study groups

Parameter	Oral Rehydration (n = 120)	Intravenous Rehydration (n = 120)	P value
Vomiting During Therapy	18 (15.0%)	—	—
Electrolyte Imbalance,	4 (3.3%)	9 (7.5%)	0.09
IV Site Phlebitis/Infiltration,	—	13 (10.9%)	—
Recurrent Dehydration	2 (1.7%)	3 (2.5%)	0.65
Parental/Caregiver Satisfaction	110 (91.7%)	101 (84.2%)	0.08

Table 4: Laboratory and physiological parameters before and after rehydration therapy

Parameter	Oral Rehydration (n = 120)	Intravenous Rehydration (n = 120)	P value
Serum Sodium (mEq/L)	133.8±3.9 → 137.2±2.8	132.9±4.1 → 136.9±3.0	0.29
Serum Potassium (mEq/L)	3.6±0.4 → 3.9±0.3	3.5±0.5 → 3.8±0.4	0.21
Serum Bicarbonate (mEq/L)	17.5±2.6 → 20.3±2.1	17.3±2.8 → 20.7±1.9	0.38
Blood Urea (mg/dL)	32.8±8.5 → 24.2±6.1	33.1±7.9 → 23.8±5.8	0.61
Urine Output (mL/kg/hr)	0.7±0.3 → 1.6±0.4	0.8±0.3 → 1.7±0.5	0.12
Capillary Refill Time (seconds)	3.8±1.1 → 1.9±0.6	3.6±1.0 → 1.8±0.5	0.44

DISCUSSION

The current research study compared clinical efficacy, safety and general outcomes of oral and intravenous rehydration therapy in children with acute gastroenteritis. It was evident that both oral rehydration therapy (ORT) and intravenous (IV) rehydration methods were useful in full rehydration, but secondary outcomes like time to recovery, tolerance, complication rate, and hospital stay were significantly different. Such findings confirm the accumulating reports that the oral rehydration therapy continues to be the foundation of treatment of mild to moderate cases of dehydration in children as per the World Health Organization (WHO) guidelines. The demographic information of this research study demonstrated that there were no statistically significant differences, in terms of age, gender distribution and existing level of dehydration severity, in the two groups so that the results can be compared. The average age of respondents of about four years agrees with the epidemiology of the most prevalence of the acute gastroenteritis in the first years of childhood because of poorly developed immune systems and high exposure to infectious factors. Past records, also manifested that acute gastroenteritis mainly occurs in children younger than five years of age, which highlights the significance of proper and timely hydration in children.[13-15]

The period of time to attain clinical rehydration in this research was much less in intravenous group than in oral group, which depicts the speed at which circulatory volume is restored through the use of parenteral fluids. In addition, the two groups had a comparable average time to recover diarrhea and vomiting which emphasizes that oral therapy is equally effective in restoring normal gastrointestinal activity after hydration is restored. The notable observation in this research was that the number of hospitals stay of children who were administered oral rehydration was considerably reduced in comparison to their counterparts who were administered intravenous fluids. The average length of stay in the ORT group was almost one day less, and this fact has significant consequences in the context of the healthcare resource utilization and cost-effectiveness.[16] The early discharge also reduces the chances of nosocomial infections and reduces the psychological stress of both children and parents. The benefits of oral rehydration therapy are also further supported by the complication profile in this study. Although vomiting is a symptom in a small percentage of patients during the initial phases of ORS administration, it was readily controlled by temporary intake of fluid and slower fluid intake.[17] On the contrary, the IV rehydration group had few complications like phlebitis, local infiltration, and electrolyte imbalance that though not life-threatening are uncomfortable and demand medical intervention. The clinical observations were further confirmed by the laboratory parameters that occurred before and after treatment. There was a significant improvement in the treatment groups in terms of serum electrolytes, level of bicarbonate and urine output, which validated that there was sufficient correction of dehydration. No statistically significant differences were found between ORT and IV groups in post-treatment biochemical parameters, which is an indication that the two modalities are equally effective in the restoration of physiological balance.[18] The satisfaction of parents who are a significant, yet frequently neglected outcome measure, was significantly greater in the oral treatment group.[19]

This is due to the non-invasive nature of ORT, less time in hospital and the fact that children could be managed at the home after stabilization. Attitudes of caregivers are also influential in the implementation of treatment recommendations and a better sense of acceptance of ORT leads to a better outcome on the community level [20]. Investigations of similar socioeconomic have proved that improving parental education and confidence in ORT is a significant contributor to increasing the use of ORT and decreasing unnecessary hospitalizations. Although this study has some strong aspects, such as a clear sample size and thorough evaluation of the outcomes, one must admit some limitations. The research was carried out in one tertiary care environment, which might not be generalizable to any other community or primary care environment. Besides, there was no long-term follow-up on recurrence of dehydration or post discharge complications, as this would have given further information about the sustainability of the outcomes. It is advisable to conduct future multicenter studies using more populations and follow-up durations to enhance the evidence base.

CONCLUSION

Both oral and intravenous rehydration therapies are effective in restoring fluid and electrolyte balance in pediatric patients suffering from acute gastroenteritis. However, oral rehydration therapy (ORT) offers several practical and clinical advantages over intravenous (IV) therapy in children presenting with mild to moderate dehydration. Although IV therapy achieved faster initial rehydration, ORT provided comparable outcomes in overall recovery, with the added benefits of shorter hospital stay, fewer complications, greater tolerance, and higher caregiver satisfaction.

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