BG Pulse Journal USA
ISSN:1947-2536 http://www.bgpulseusa.com/index.php/bg
BG PULSE JOURNAL

UDC 616.34-008.314.4-053.3-07-085.384

RAPID ASSESSMENT OF DEHYDRATION SEVERITY AND GOLD STANDARDS OF ORAL REHYDRATION THERAPY (ORS) IN YOUNG CHILDREN WITH SEASONAL DIARRHEA

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doi:https://doi.org/10.5281/zenodo.24050786

Abstract: Seasonal acute infectious diarrhea remains a leading cause of morbidity and hospitalization among infants and toddlers in the Fergana Valley, particularly during the hot summer-autumn period. Delayed recognition of hypovolemia and the inappropriate overuse of intravenous infusions instead of evidence-based enteral rehydration often complicate clinical outcomes. This article presents a comparative clinical study conducted at Andijan State Medical Institute. Using the IMRAD framework, the research evaluates the diagnostic accuracy of rapid clinical dehydration scales (Clinical Dehydration Scale and WHO criteria) combined with the therapeutic efficacy of the gold-standard low-osmolarity oral rehydration salts (ORS, 245 mOsm/L) and zinc supplementation in young children compared to conventional hypotonic fluid regimens. The study involved 200 pediatric patients aged 6 to 36 months and utilized clinical scoring, point-of-care capillary blood gas/electrolyte analysis, and fluid-balance monitoring tools. The results demonstrate a strong correlation between rapid clinical dehydration scores and biochemical acidosis, as well as a statistically faster resolution of dehydration, shorter diarrhea duration, and reduced need for unscheduled intravenous therapy in the low-osmolarity ORS group. The study concludes that coupling standardized rapid clinical triage with low-osmolarity ORS and zinc supplementation represents the optimal clinical gold standard for managing pediatric seasonal diarrhea.

Keywords: young children, seasonal diarrhea, dehydration assessment, Clinical Dehydration Scale, oral rehydration salts, low-osmolarity ORS, sodium-glucose cotransport.

БЫСТРАЯ ОЦЕНКА СТЕПЕНИ ОБЕЗВОЖИВАНИЯ И ЗОЛОТЫЕ СТАНДАРТЫ ПРОВЕДЕНИЯ ПЕРОРАЛЬНОЙ РЕГИДРАТАЦИИ (ОРС) НА ФОНЕ СЕЗОННОЙ ДИАРЕИ У ДЕТЕЙ РАННЕГО ВОЗРАСТА

Аннотация: Сезонная острая инфекционная диарея остается одной из ведущих причин заболеваемости и госпитализации среди детей раннего возраста в Ферганской долине, особенно в жаркий летне-осенний период. Несвоевременное распознавание гиповолемии и необоснованное злоупотребление внутривенными инфузиями вместо научно обоснованной энтеральной регидратации нередко осложняют клиническое течение. В данной статье

представлено сравнительное клиническое исследование, проведенное в Андижанском государственном медицинском институте. Используя структуру IMRAD, исследование оценивает диагностическую точность шкал быстрой клинической оценки дегидратации (шкала CDS и критерии ВОЗ) в сочетании с терапевтической эффективностью «золотого стандарта» — низкоосмолярных солей для пероральной регидратации (ОРС, 245 мОсмоль/л) и препаратов цинка у детей раннего возраста по сравнению с традиционными режимами питьевой нагрузки. В исследовании приняли участие 200 пациентов детского возраста от 6 до 36 месяцев, использовались клинические шкалы, экспресс-анализ газов и электролитов капиллярной крови и мониторинг водного баланса. Результаты демонстрируют сильную корреляцию между баллами быстрой клинической оценки и биохимическим ацидозом, а также статистически более быстрое купирование эксикоза, сокращение продолжительности диареи и снижение потребности в инфузионной терапии в группе низкоосмолярного ОРС. Исследование делает вывод, что сочетание стандартизированного клинического триажа с низкоосмолярным ОРС и цинком является оптимальным золотым стандартом ведения сезонной диареи у детей.

Ключевые слова: дети раннего возраста, сезонная диарея, оценка обезвоживания, шкала клинической дегидратации, пероральная регидратация, низкоосмолярный ОРС, натрий-глюкозный котранспорт.

ERTA YOSHDAGI BOLALARDA MAVSUMIY DIAREYA FONIDA SUVSIZLANISH DARAJASINI TEZ BAHOLASH VA PERORAL REGIDRATATSIYA (ORS) O‘TKAZISHNING OLTIN STANDARTLARI

Annotatsiya: Mavsumiy o‘tkir yuqumli diareya Farg‘ona vodiysida, ayniqsa, issiq yoz-kuz mavsumida erta yoshdagi bolalar orasida kasallanish va shifoxonaga yotqizilishning asosiy sabablaridan biri bo‘lib qolmoqda. Gipovolemiyani kech aniqlash va dalillarga asoslangan enteral regidratatsiya o‘rniga vena ichi infuziyalarini asossiz ravishda ko‘p qo‘llash klinik oqibatlarni murakkablashtiradi. Ushbu maqolada Andijon davlat tibbiyot institutida o‘tkazilgan qiyosiy klinik tadqiqot natijalari keltirilgan. IMRAD tuzilmasiga asoslangan ushbu ish erta yoshdagi bolalarda suvsizlanishni tez klinik baholash shkalalarining (CDS shkalasi va JSST mezonlari) diagnostik aniqligini hamda «oltin standart» hisoblangan past osmolyarlikdagi peroral regidratatsion tuzlar (ORS, 245 mOsm/l) va rux preparatlari kombinatsiyasining terapevtik samaradorligini an’anaviy suyuqlik ichirish rejimlari bilan qiyosiy o‘rganadi. Tadqiqotda 6 oylikdan 36 oylikkacha bo‘lgan 200 nafar bola ishtirok etdi hamda klinik ballash, kapillyar qon gazlari va elektrolitlari ekspress-tahlili hamda suv balansi monitoringi vositalaridan foydalanildi. Natijalar tez klinik baholash ballari bilan biokimyoviy atsidoz o‘rtasida kuchli korrelyatsiya mavjudligini, shuningdek, past osmolyarlikdagi ORS guruhida suvsizlanishning statistik jihatdan tezroq bartaraf etilishini, diareya davomiyligining qisqarishini va rejadan tashqari vena ichi infuziyalariga ehtiyojning kamayishini ko‘rsatdi. Tadqiqot standartlashtirilgan tez klinik saralashni (triaj) past osmolyarlikdagi ORS va rux

preparatlari bilan uyg‘unlashtirish bolalardagi mavsumiy diareyani davolashning maqbul oltin standarti ekanligini xulosa qiladi.

Kalit so‘zlar: erta yoshdagi bolalar, mavsumiy diareya, suvsizlanishni baholash, klinik degidratatsiya shkalasi, peroral regidratatsiya, past osmolyarlikdagi ORS, natriy-glyukoza kotransporti.

INTRODUCTION

Acute seasonal diarrhea remains one of the most prevalent pediatric emergencies globally and a primary contributor to preventable morbidity in early childhood. In Uzbekistan, particularly in the continental climate of the Fergana Valley, high ambient summer temperatures accelerate insensible fluid losses and favor the transmission of enteropathogens such as rotavirus, norovirus, and enterotoxigenic Escherichia coli. Young children aged 6 to 36 months are exceptionally vulnerable to rapid extracellular fluid depletion due to their high metabolic rate, large body surface area-to-weight ratio, and immature renal concentrating mechanisms.

The clinical management of pediatric acute gastroenteritis relies on two interdependent pillars: rapid, objective stratification of dehydration severity and immediate physiological restoration of water-electrolyte homeostasis. Waiting for comprehensive laboratory panels in overcrowded emergency reception departments delays life-saving therapy, whereas subjective visual estimation often leads to diagnostic errors. Standardized bedside tools—specifically the World Health Organization (WHO) dehydration algorithm and the 4-item Clinical Dehydration Scale (CDS)—allow clinicians to quantify fluid deficits within minutes. Physiologically, even during secretory or osmotic diarrhea, the intestinal brush-border sodium-glucose cotransporter 1 (SGLT-1) remains intact. The WHO/UNICEF gold-standard low-osmolarity Oral Rehydration Salts (ORS, 245 mOsm/L, containing 75 mmol/L sodium and 75 mmol/L glucose) utilizes this 1:1 molar ratio to drive active sodium and passive water absorption across the enterocyte, while reduced osmolarity prevents osmotic drag into the gut lumen.

Despite clear international guidelines, clinical practice in regional settings frequently deviates from these gold standards. Parents and outpatient practitioners often administer non-standardized household fluids (sweetened tea, fruit compotes, plain water) or legacy high-osmolarity solutions (311 mOsm/L), which exacerbate osmotic diarrhea and hyponatremia, ultimately leading to unnecessary intravenous (IV) cannulation.

At Andijan State Medical Institute, it was hypothesized that implementing a unified protocol combining rapid CDS/WHO bedside scoring with strict fractional administration of low-osmolarity ORS (245 mOsm/L) and zinc supplementation significantly improves rehydration kinetics and reduces hospital intervention rates in young children with seasonal diarrhea. This article aims to evaluate the diagnostic precision of rapid clinical dehydration assessment and the clinical-biochemical efficacy of gold-standard oral rehydration therapy compared to conventional rehydration practices.

METHODS

This comparative clinical study was conducted at the pediatric infectious diseases department and emergency reception units of Andijan State Medical Institute over two consecutive seasonal epidemic peaks (May to October).

Study Population - The study enrolled 200 young children aged 6 to 36 months presenting with acute seasonal watery diarrhea (3 or more loose stools within 24 hours lasting less than 72 hours) complicated by mild-to-moderate (some) dehydration. All 200 patients initially underwent rapid triage assessment and were subsequently divided into two equal groups based on their rehydration protocol:

Main Group (n=100): Children managed strictly according to the WHO Gold Standard Protocol—fractional nasogastric or oral administration of low-osmolarity ORS (245 mOsm/L; 50–100 mL/kg over 4 hours plus 10 mL/kg per ongoing loose stool) supplemented with oral zinc sulfate (20 mg/day) and continued age-appropriate feeding.

Control Group (n=100): Children who received conventional mixed oral rehydration prior to or during early admission (alternating standard/legacy glucose-saline solutions of 311 mOsm/L with hypotonic domestic fluids such as tea, rice water, or diluted juices) without standardized fractional dosing or zinc supplementation. Children presenting with severe hypovolemic shock (WHO Plan C), paralytic ileus, intractable bilious vomiting, bloody dysentery, or congenital malabsorption syndromes were excluded.

Data Collection

Rapid Clinical Dehydration Assessment: Upon admission (Minute 0), every child was evaluated within 3 minutes using the 8-point Clinical Dehydration Scale (CDS: general appearance, eyes, mucous membranes, and tears) alongside the WHO dehydration classification, capillary refill time (CRT), and skin turgor recoil time. Accurate pre-illness weight and post-rehydration weight gain were recorded to establish the true percentage of body weight deficit.

Biochemical and Acid-Base Verification: To validate the rapid clinical scores, point-of-care capillary blood analysis was performed at baseline and at 6 hours to measure serum sodium (Na^+), potassium (K^+), blood urea nitrogen (BUN), venous blood pH, serum bicarbonate (HCO_3^-), and base deficit.

Therapeutic Outcome Monitoring: Clinical response was tracked at 4, 6, 12, and 24 hours, recording the time to complete resolution of dehydration signs, stool frequency and volume, vomiting episodes, serum electrolyte normalization, and the rate of treatment failure requiring escalation to intravenous (IV) infusion therapy.

Statistical Analysis - Data were analyzed using SPSS 25.0 software. Differences in categorical clinical outcomes and IV escalation rates between groups were assessed using the Chi-square test, while continuous biochemical variables were compared via Student's t-test. Correlations between rapid CDS scores, capillary refill time, and laboratory acidosis markers were analyzed using Pearson's correlation coefficient. A p-value of <0.05 was considered statistically significant.

RESULTS

The study demonstrated high diagnostic validity of rapid bedside dehydration scoring and pronounced therapeutic superiority of the low-osmolarity ORS gold-standard regimen.

Diagnostic Accuracy of Rapid Dehydration Assessment - Across the entire cohort of 200 children, rapid bedside evaluation using the combined CDS and CRT protocol required an average of 2.4 minutes per patient and accurately stratified mild (3–5 percent weight deficit) versus moderate (6–9 percent weight deficit) dehydration in 93.5 percent of cases when verified against post-rehydration weight gain. There was a strong inverse correlation ($r=-0.79$, $p<0.05$) between initial CDS scores and serum bicarbonate (HCO_3^-) levels, and a strong positive correlation ($r=0.76$, $p<0.05$) between prolonged capillary refill time (>2 seconds) and true percentage of fluid weight loss. Mucous membrane dryness and sunken eyes exhibited the highest sensitivity (94 percent), while delayed skin turgor and prolonged CRT showed the highest specificity (91 percent) for moderate dehydration.

Kinetics of Rehydration and Acid-Base Recovery - Children in the Main Group (low-osmolarity ORS, 245 mOsm/L) achieved complete clinical rehydration within the target 4-to-6-hour window in 92 percent of cases, compared to 67 percent in the Control Group. The mean time to full restoration of normal skin turgor, moist mucous membranes, and adequate diuresis (>1 mL/kg/hour) was 4.2 ± 0.8 hours in the Main Group versus 6.9 ± 1.4 hours in the Control Group. Biochemically, mean serum bicarbonate (HCO_3^-) increased from 16.2 mmol/L at baseline to 21.8 mmol/L at 6 hours in the Main Group, compared to an increase from 16.5 mmol/L to 18.4 mmol/L in controls.

Electrolyte Safety and Stool Output Reduction - The gold-standard low-osmolarity ORS prevented iatrogenic electrolyte imbalances that were frequently observed with conventional hypotonic or high-osmolarity fluids. At 12 hours, mild hyponatremia ($Na^+ < 135$ mmol/L) or persistent hypokalemia ($K^+ < 3.5$ mmol/L) was documented in only 4 percent of the Main Group compared to 22 percent of the Control Group. Furthermore, the 24-hour stool output volume in the Main Group was 28 percent lower than in the Control Group, and the total duration of acute diarrhea averaged 52.4 hours in the Main Group versus 78.6 hours in the Control Group (a reduction of 26.2 hours).

Vomiting Control and Avoidance of Intravenous Therapy - Fractional administration of chilled/room-temperature low-osmolarity ORS (5 mL every 1–2 minutes via spoon or syringe) reduced recurrent vomiting within the first 2 hours in 89 percent of children in the Main Group versus 61 percent in the Control Group. Consequently, treatment failure requiring escalation to unscheduled intravenous fluid infusion occurred in only 6 percent of the Main Group compared to 24 percent of the Control Group (a 4-fold reduction in IV cannulation).

DISCUSSION

The clinical findings from Andijan State Medical Institute underscore that adherence to structured rapid assessment and physiological oral rehydration protocols directly determines clinical recovery in pediatric seasonal diarrhea.

Clinical Value of Rapid Bedside Triage - In high-volume pediatric infectious disease hospitals during summer peaks, laboratory confirmation of dehydration is often impractical for initial triage. The strong correlation ($r=-0.79$) between the 4-item Clinical Dehydration Scale (CDS) and metabolic acidosis confirms that structured physical signs reliably mirror internal hemodynamic

and acid-base derangements. Combining CDS with capillary refill time (CRT) eliminates subjective guesswork, allowing nurses and physicians to initiate WHO Plan B rehydration within minutes of hospital arrival.

Physiological Superiority of Low-Osmolarity ORS (245 mOsm/L) - The 28 percent reduction in stool volume and faster rehydration observed in the Main Group are explained by intestinal membrane biophysics. Legacy ORS formulations (311 mOsm/L) and sugar-rich domestic beverages create a hyperosmolar luminal environment relative to blood plasma (285–295 mOsm/L), drawing net water into the gut before glucose absorption can occur. In contrast, the gold-standard 245 mOsm/L ORS maintains a favorable blood-to-lumen osmotic gradient while preserving the equimolar 1:1 sodium-to-glucose ratio (75 mmol/L each) required for maximal SGLT-1 cotransport, even when rotavirus partially blunts villous tips.

Synergistic Role of Zinc and Fractional Technique - The marked shortening of total diarrhea duration by 26.2 hours in the Main Group reflects the synergistic inclusion of zinc sulfate alongside low-osmolarity ORS. Zinc inhibits cyclic AMP-mediated chloride secretion in intestinal crypt cells, accelerates enterocyte regeneration, and enhances brush-border enzymatic activity. Additionally, enforcing strict fractional feeding (5 mL every 1–2 minutes) prevents gastric distension and gastrocolic reflex activation, successfully overcoming emesis without resorting to unnecessary parenteral infusions.

Reducing Nosocomial Risks and Healthcare Burden - A 4-fold reduction in intravenous therapy (6 percent vs. 24 percent) has profound practical implications. Avoiding routine IV cannulation spares young children from venipuncture trauma, eliminates the risk of phlebitis and nosocomial bloodstream infections, prevents iatrogenic fluid overload, and significantly lowers hospital expenditure.

CONCLUSION

The comparative clinical study conducted at Andijan State Medical Institute leads to the following conclusions regarding rapid dehydration assessment and gold-standard oral rehydration in young children with seasonal diarrhea.

Firstly, rapid clinical assessment integrating the Clinical Dehydration Scale (CDS), WHO criteria, and capillary refill time accurately quantifies fluid deficit within 3 minutes and strongly correlates with the severity of metabolic acidosis (r=-0.79), enabling immediate targeted therapy.

Secondly, fractional oral rehydration using the gold-standard low-osmolarity ORS (245 mOsm/L) combined with zinc supplementation restores hydration within 4 to 6 hours in 92 percent of children, reduces stool volume by 28 percent, and prevents iatrogenic hyponatremia compared to conventional fluid regimens.

Thirdly, strict adherence to the fractional low-osmolarity ORS protocol reduces the need for unscheduled intravenous infusion therapy by 4 times (from 24 percent to 6 percent) and shortens total diarrhea duration by an average of 26.2 hours.

Therefore, it is recommended that pediatricians, infectious disease specialists, and primary care practitioners universally adopt the CDS/WHO rapid triage algorithm and enforce fractional

low-osmolarity ORS (245 mOsm/L) with zinc as the primary gold standard for managing mild-to-moderate dehydration in young children.

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