

# Significance of the Application of Oral Rehydration Solution to Maintain Water and Electrolyte Balance in Infants with Ileostomy

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## SUMMARY

**Introduction** Ileostomy represents a necessary procedure to solve various surgical diseases in children. As the result of increased fluid loss and colonic exclusion in its regulation, it is often followed, particularly during the first months after birth, by chronic dehydration and failure to thrive.

**Objective** The aim of the paper was to present our experience related to the application of oral rehydration solution (ORS) to compensate the intestinal loss of water and electrolytes in infants with ileostomy.

**Methods** Treatment was performed with ORS containing 65 mmol/L of sodium in five infants aged 1.5-8 months ( $3.8 \pm 2.46$  months) with dehydration and undernutrition after ileostomy performed in the first five days after birth.

**Results** After rehydration, the continual application of ORS in the daily dosage of  $63.90 \pm 25.03$  ml/kg, i.e. approximately matching the volume of intestinal content elimination ( $57.00 \pm 19.23$  ml/kg), resulted in all infants in optimal water and electrolyte homeostasis, and in further course also in the improvement of their nutritional status ( $p=0.023$ ).

**Conclusion** Our experience indicates that continual application of reduced sodium content of ORS in the approximate equal quantity of intestinal content loss represents the method of choice in water and electrolyte homeostasis maintenance in infants with ileostomy.

**Keywords:** ileostomy; infants; oral rehydration

## INTRODUCTION

Functional colonic exclusion represents a significant problem for patients related, not only to a non-physiological mode of bowel emptying, but also to problems in water and electrolyte homeostasis [1, 2, 3], absence of the immunoregulatory and nutritive role of intestinal bacterial flora and other [4, 5, 6]. Due to a high degree of immaturity and vulnerability of the mechanism of hydroelectrolytic, acid-base and immune regulation in the first months after birth, the lack of colonic physiological role is especially expressed at this stage of life [7]. There are numerous congenital and acquired pathological conditions followed by a complete or partial, i.e. temporary or permanent lack of colonic function. They primarily refer to ileostomy, colostomy and colectomy as a necessary procedure in resolving various colorectal anomalies and diseases [8, 9, 10].

## OBJECTIVE

The aim of the study was to present our experience on the therapeutic effect of oral rehydration solution (ORS) in maintaining water and electrolyte homeostasis in infants with ileostomy.

## METHODS

The study is based on a sample of five infants, three female and two male, age range 1.5 to 8 ( $3.8 \pm 2.46$ ) months, rehospitalized because of dehydration and failure to thrive as a complication of ileostomy performed between 1-5 days ( $2.4 \pm 1.67$  days) after birth. Indications for ileostomy surgery were small intestine atresia in three cases, Hirschsprung's disease in one and volvulus with small intestine perforation in one. A partial resection in the length of 22 cm of the distal ileum was also necessary in three neonates and in one a 10 cm of the proximal colon as we well. Beside the aforementioned, none of the patients had additional anomalies. After eventless postoperative course, all neonates were discharged and continued with standard home treatment. On regular out-patients' surgical and pediatric follow-ups, except for slightly poorer meals intake, increased regurgitation, failure to thrive, evident lethargy and signs of milder dehydration 3-4 weeks before rehospitalization, no other problems were noted. Since birth all infants were bottle-fed, at this, in order to prevent/correct malnutrition, four were on extensive protein hydrolysate-based milk formula and one on free amino-acid based formula. An 8-months old infant, after completed age six months, was also included into complementary feeding.

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**Table 1.** Basic clinical and laboratory data of patients on admission

Patient	Age (months)	Degree of dehydration	Blood laboratory results					Body weight (%)*
			Na+ (mmol/L)	K+ (mmol/L)	Cl- (mmol/L)	pH	Creatinine (μmol/L)	
I	8	Severe	120	4	90	7.51	36	-23
II	1.5	Severe	128	4.3	99	7.13	64	-9
III	3	Severe	121	2.5	87	7.54	49	-12
IV	3.5	Severe	124	5.1	92	7.47	28	-14
V	3	Moderate	130	4.7	97	7.48	26	-18

\* difference related to ideal

**Table 2.** Basis of patients' treatment, and clinical and laboratory results

Patient	Daily loss of ileal content (ml/kg)*	Daily intake of ORS (ml/kg)*	Blood laboratory results				Body weight (%)**
			Na+ (mmol/L)	K+ (mmol/L)	Cl- (mmol/L)	pH	
I	50	45	138	5.3	93	7.49	-6.5
II	50	53	136	5.3	99	7.45	-2.4
III	40	46.5	135	5.3	100	7.39	-10
IV	55	70	136	5.4	105	7.40	0
V	90	105	132	4.7	97	7.43	+2

\* average; \*\* difference related to ideal

Immediately after hospital admission body weight (BW) and body length (BL) were determined, and a complete clinical examination was performed. The obtained BL and BW values were compared with age and gender matched reference values, with BL expressed in percentiles (P) and deviation of BW from the ideal in percentages [11]. The assessment of the presence and severity of dehydration was done based on standard clinical parameters, and type according to the level of serum sodium [12]. With the aim to exclude intestinal and/or extraintestinal infections as the additional cause of a high loss of intestinal fluids and dehydration, beside the standard indicators of inflammation and complete urine analysis, the culture of ileal content to pathogenic bacteria, latex agglutination test to *Rotavirus* and *Adenovirus* was done in all patients.

During hospitalization at least twice-a-day rounds on all the patients were made, with a special attention paid to water and electrolyte balance, i.e. the level of intake and quantity of fluid loss through the stoma, as well as the clinical evaluation of hydration, then the quantity of food intake, increase in BW and assessment of the general condition. The mode of rehydration and a 24-hour quantity of fluids and electrolytes were determined based on BW and the degree of present dehydration. Indications for intravenous rehydration were severe dehydration [12]. After rehydration, maintenance of the achieved water and electrolyte balance was done by using Orosal 65<sup>®</sup> (Galenika), ORS produced in Serbia that contains 65 mmol of sodium, 20 mmol of potassium, 60 mmol of chloride and 25 mmol bicarbonate per one liter. Daily fluid losses through the ileostoma and its compensation with ORS 65 were expressed in ml/kg/BW.

The patients were under follow-up for 19-150 (58±52.33) days, while the difference in BW deviation related to the ideal one at the beginning and at the end of the treatment was tested by the Paired Samples t- test.

## RESULTS

The degree of dehydration and nutritive status on admission, as well as the mode of dehydration are presented on Table 1. After rehydration, administered intravenously in four and orally in one patient, normal water and electrolyte balance was maintained with ORS (Table 2). The optimal daily intake of ORS was based on the quantity of intestinal content eliminated through the ileostoma, and its therapeutic effect on the follow-up of the relevant clinical and laboratory indicators of hydroelectrolytic and acid-base homeostasis. As seen on Table 2, ORS administered in the approximate quantity matching the quantity loss through the ileostoma (63.90±25.03 vs. 57.00±19.23 ml/kg) achieved a complete compensation of water and electrolyte loss in all five patients. Further continuation of the compensation of intestinal fluids loss using ORS, with a corresponding nutritive intake, resulted in the stabilization of general condition in all patients and significant improvement of their nutritional status (p=0.023) (Figure 1a,b).

## DISCUSSION

Maintenance of normal water and electrolyte balance belongs to the basic physiological processes of the body. Compared to adults and older children, the infant is characterized by more specificities related to body fluids homeostasis [12]. First, a relative representation of body fluids is considerably higher, while its relation between the intra- and extracellular sectors is lower. Second, water and electrolyte physiological losses are relatively higher, and therefore, the needs as well. Third, in accordance with growth rate, the child retains daily specific quantity water and electrolytes. And fourth, renal function, the key organ in hydroelectrolytic and acid-base homeostasis, is insufficiently mature. All these facts make the homeostasis of



**Figure 1.** A patient on admission (a) and 1.5 months later (b)

water and electrolytes in infants, particularly during the first six months after birth, highly vulnerable, and accordingly their marked tendency to dehydration [12].

Within the frame of multiorgan and highly complex system responsible for water and electrolyte homeostasis in the body, the ileum and colon occupy a significant position. At the level of ileum and colon epithelium, similarly to the renal distal tubule, by the mechanism of electroneutral transport “conservation” is carried out, i.e. resorption of sodium, chloride and water [12, 13]. This process is of exceptional physiological significance, because sodium and chloride are the carriers of 80-85% of the extracellular fluids sector in the body.

Having in mind nutrition regime, which at this age implies a low sodium-chloride intake, a 3-4 times higher loss of intestinal content through the ileostoma and the limited compensatory mechanism of water and electrolyte homeostasis, it is clear why all our patients developed chronic dehydration, as well as negative consequences that accompanies it. Except for the infant with serum sodium concentration of 130 mmol/L, dehydration was of the hyponatremic type in all patients. By understanding ileostomy as the condition equivalent to diarrheal disorder, after intravenous correction of dehydration, the maintenance of water and electrolyte balance was achieved with Orosol 65. Such a therapeutic approach, based on the mechanism of the active co-transport of sodium and glucose primarily

present in the small intestine proximal part, has been successfully applied for over four decades in the compensation of fluids loss by vomiting and/or diarrhea [13-17]. The application of ORS in the compensation of excessive intestinal loss of water and electrolytes has also proved to be justified and successful on the example of our patients. The achieved homeostasis of water and electrolytes, with a corresponding nutrition, was of key significance in the normalization of the general condition, nutritional status and growth and development of the patients, as well as their adequate preparation for a definite surgical intervention.

## CONCLUSION

High loss of intestinal content through the ileostoma, particularly if combined with a partial resection of the ileum, essentially endangers the physiologically vulnerable water and electrolyte homeostasis of the infant, and consequently the patient's general condition and development. Bearing in mind these facts, as well as our experience, covering intestinal loss by an approximately a matching quantity of standard ORS in infants with ileostoma represents the solution of choice in the prevention of these complications, as well as one of the preconditions for their complete recovery and adequate preparation for a definite surgical intervention.

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## Значај примене оралног рехидратационог раствора у одржавању баланса воде и електролита код одојчади с илеостомом

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### КРАТАК САДРЖАЈ

**Увод** Илеостомија је нужна процедура у решавању различитих хируршких обољења код деце. Као последица појачаног губитка течности и искључења колоне у њеној регулацији, често је, посебно у првим месецима по рођењу, праћена хроничном дехидратацијом и поремећајем напредовања детета.

**Циљ рада** Циљ рада је био да се опише наше искуство у вези с применом оралног рехидратационог раствора у компензацији цревног губитка воде и електролита код одојчади с илеостомом.

**Методе рада** Истраживањем је обухваћено петоро одојчади узраста од месец и по дана до осам месеци (просечно 3,8±2,46 месеци) с илеостомијом која је урађена током првих пет дана по рођењу детета. Надокнада губитка воде

и електролита илеостомом је обављана раствором с натријумом од 65 mmol/l.

**Резултати** Након корекције дехидратације, континуирана примена оралног рехидратационог раствора у дневној количини од 63,90±25,03 ml/kg, тј. приближној обиму елиминације цревног садржаја (57,00±19,23 ml/kg), код свих је болесника довела до нормализације хомеостазе воде и електролита, а у даљем току и до побољшања њихове исхрањености ( $p=0,023$ ).

**Закључак** Наше искуство показује да је континуирана примена оралног рехидратационог раствора у количини сличној обиму губитка цревног садржаја метода избора у одржавању хомеостазе воде и електролита код одојчади с илеостомом.

**Кључне речи:** илеостомија; одојчад; орална рехидратација