

Hyponatraemic Dehydration in Neonates and Children: A Prospective Study

Ashutosh Kumar Verma

Senior Resident, Department of Pediatrics, Chacha Nehru Bal Chikitsalaya, Lady Hardinge Medical College, Delhi, India.

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Corresponding author: Dr. Ashutosh Kumar Verma

Conflict of interest: Nil

Abstract

Aim: To estimate the incidence of hyponatraemic dehydration in neonates and children.

Material & Methods: The study was done in Department of Pediatrics, Chacha Nehru Bal Chikitsalaya, Lady Hardinge Medical College, Delhi, India which provides tertiary level clinical care. A total of 100 Children including neonates are enrolled in the study.

Results: It was found that 65% of the males were having acute gastroenteritis while it was 35% in female subjects. The data also reveals that higher incidence of acute gastroenteritis was noted between 6 to 24 months of age while the lower incidence was found in the subjects above 36 months of age. The number of episodes of loose stools were correlating with the extent of dehydration. Higher the episodes the severe were the dehydration.

Conclusion: The clinical impression of the type of dehydration and electrolyte disturbances was fairly consistent with serum electrolytes values. This suggest that routine estimation of serum electrolytes is not necessary however it is necessary whenever electrolyte imbalance is suspected on clinical grounds and in cases which do not respond satisfactorily with routine fluid electrolyte therapy.

Keywords: Hyponatremia, Gastroenteritis, Dehydration, Vomiting, Diarrhea.

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Introduction

Acute gastroenteritis (AGE) is one of the most frequent medical pathologies in the first years of life and it can lead to dehydration that requires the child's hospitalisation and the subsequent use of parenteral rehydration solutions. An imbalance between the intake and loss of free water or serum sodium can occur in AGE which can cause hyponatraemia, in other words, a serum sodium level <135 mEq/l [1]. Ever since Holliday and Segar initiated a parenteral rehydration standard in 1957 that continues today, it is frequent to use hypotonic fluid in the intravenous

correction of water deficit in children with AGE [2]. Furthermore, in 1957, Schwartz published the first case of a metabolic disorder in which the anti-diuretic hormone (ADH) was released by non-physiological stimuli, which would cause the retention of electrolyte-free water followed by a high sodium concentration in the urine with resulting hyponatraemia [3].

Both oral and IVR can cause or exacerbate electrolyte disturbances related to sodium homeostasis. The risk for hypernatremia

associated with oral rehydration solutions (ORSs) containing excessive amounts of salt and carbohydrates was dramatically reduced by the introduction of reduced total osmolality ORS containing equimolar concentrations of sodium and glucose [4-6]. While the risk of hyponatremia exists with the use of ORT, it is exceedingly minimal in children with none to minimal dehydration, as reflected in a recent study that allowed children to drink preferred alternatives to standard ORS [7]. However, hospitalized children have a greater risk of developing hyponatremia due to the presence of excessive antidiuretic hormone (ADH) that limits the body's ability to excrete water. This potential may be exacerbated when hypotonic saline solutions are administered intravenously to maintain hydration [8]. While the use of isotonic saline solutions may mitigate the risk of hyponatremia in children with excessive ADH secretion [9-10], concerns related to sodium and fluid overload exist. These concerns provide the basis for the current debate regarding the optimal IVR solution composition in children [11-12].

Most noticeable among the clinical signs of both of these electrolyte variations from the norm are focal sensory system symptomatology as well as scatters of sensorium. Not inconsistently, such patients have other related ailments, which may alter the clinical picture exhibited by the anomalies of salt and water balance [13]. Intense hyponatremia is characterized by beginning of side effects <48hrs. Patients with intense hyponatremia create neurologic manifestations coming about because of cerebral edema incited by water development into the mind. These may incorporate seizures, debilitated mental status or trance like state and death. While chronic hyponatremia creating over >48hrs should be considered "chronic." Most patients have chronic hyponatremia. The serum sodium focus is more often than not above 120meq/L [14].

Thus, we aim to estimate the incidence of hyponatraemic dehydration in neonates and children.

Material & Methods:

The study was done in Department of Pediatrics, Chacha Nehru Bal Chikitsalaya, Lady Hardinge Medical College, Delhi, India, which provides tertiary level clinical care. Study population consisted of Infants to children aged till 12 years attending the pediatric Department both OPD and IPD care for acute gastroenteritis are enrolled in the study who is satisfying the criteria for Moderate to severe dehydration. A total of 100 Children including neonates are enrolled in the study.

After obtaining informed consent from the parents of cases, they are subjected to detailed history and clinical examination and the findings are entered in the Performa. Blood samples are collected, and measures of serum electrolytes & Sr Calcium are measured and compared with that of the clinical aspects of the patient i.e. diarrhea, vomiting, thirst, fever, abdominal distention and convulsions followed by urine analysis.

Inclusion criteria:

1. Watery diarrhoea of 4 or more episodes per day.
2. Age group less than 12 years
3. Signs and symptoms suggestive of mild dehydration.
4. Without any other severe complications.

Exclusion criteria:

1. Diarrhoea of 12 or more episodes per day.
2. Haematological disorders, chronic illness.
3. Signs suggestive of mild or no dehydration

Statistical analysis was done with Epi Info, SPSS and Microsoft Excel. Ethical Approval from institutional review board

was obtained before the study was initiated.

Results:

100 cases were studied and analyzed to detect Gastroenteritis associated dehydration and its clinical features as a possible risk factor for hyponatremia.

It was found that 65% of the males were having acute gastroenteritis while it was 35% in female subjects. The data also reveals that higher incidence of acute gastroenteritis was noted between 6 to 24 months of age while the lower incidence was found in the subjects above 36 months of age. (Table 1)

Table 1: Age and gender distribution of the subjects in study

Age distribution	Male	Female	Total
6m – 24m	48	30	78
25m-36m	9	2	11
Above 36m	8	3	11
Total	65	35	100

Hyponatremia was occurred in 32 subjects with high incidence in lower age group in both the genders. Males 68% were more effected than females 32%. (Table 2). Lowest sodium level was 127mmol.

Table-2: Incidence of hyponatremia with respect to age and gender

Age	Male			Females		
	Hyponatremic	Normal	Total	Hyponatremic	Normal	Total
6m – 24m	21	42	63	8	22	30
25m-36m	2	1	3	1	0	1
Above 36m	1	1	2	0	1	1
Total	23	44	68	9	23	32

Among 100 individuals, 22 were severely dehydrated and rest of them were moderately dehydrated (78). The number of episodes of loose stools were correlating with the extent of dehydration. Higher the episodes the severe was the dehydration. (Table 3)

Table-3: Incidence of severity of dehydration with respect to age and gender

Age	Male			Females		
	Severe	Moderate	Total	Severe	Moderate	Total
6m – 24m	10	54	64	10	18	28
25m-36m	0	2	2	2	0	2
Above 36m	0	2	2	0	2	2
Total	10	58	68	12	20	32

Discussion:

Despite the recommendation and acceptance of solutions taken orally to

rehydrate children with mild or moderate dehydration caused by AGE, it was observed that intravenous fluids were

frequently used in developed countries [15-16].

Suitable tonicity of the solutions is a subject of controversy, without which a consensus on the type of solution for the most convenient maintenance in hospitalised children would be reached. At the time of assessing and discussing the results of the consulted literature, the studied paediatric pathologies should have been considered [17], since the baseline hydrosaline situation of the case of a child with AGE differs to that of a critical patient or that of a child who undergoes surgery. Hydro electrolytic management in the infant has to be performed cautiously due to the immaturity of the renal function. Newborns have a high percentage of total body water, with a higher percentage of extracellular water and lower intracellular water percentage than adults. This situation changes progressively with age and the percentages of total, intracellular and extracellular water normalise around 6-12 months of life [18].

The “maintenance fluids” paradigm, coined by Holliday and Segar in the 1950s, was based on the emulation of physiologic daily requirements for water and electrolytes that need to be administered intravenously, to replace oral intake when it is not possible [19]. This approach led to the conception of formulas for calculation of electrolyte quantities and water volumes, that need to be added to calculated deficits and ongoing losses, and are to be administered over 24 h, aiming at meeting requirements, without risk for water or sodium overload. In most cases, such calculations demonstrate that the volume of fluid and quantity of electrolytes needed are approximated best by hypotonic saline solutions containing 0.3–0.45% saline [20]. However, despite its sensibility, this approach does not take into consideration non-osmotically induced and occasionally inappropriate excretion of ADH triggered by stress,

hypovolemia, and other factors directly related to the AGE itself [21].

Diarrhoea is the most concerning cause of dehydration in children as most of the fluids during gastroenteritis are lost. Our study reveals that prolong patient stay in the hospital is due to increase in the frequency of diarrhoea and so the risk of hyponatremia. Furthermore, emesis is also an important factor contributing to the fluid loss from the body resulting in electrolyte imbalance. As shown in our study, emesis and diarrhoea leads to hypokalemia as well in few subjects [22]. To tackle this, we need to monitor potassium levels in conjunction with sodium levels. To treat dehydration in children, calculated amount of fluids need to be infused as warranted by a study which shows that the maintenance fluid need for ongoing losses and deficit needs have to be fulfilled by providing adequate fluids till normo-volemia is achieved [23].

As stated by Jacob in his study that incidence of diarrhoea is high in children particularly in developing countries, but very low proportion of the effected children visits to the clinic. Our study also supports this results that children effected with diarrhoea is less frequently hospitalized than gastroenteritis [24,25].

Conclusion:

The clinical impression of the type of dehydration and electrolyte disturbances was fairly consistent with serum electrolytes values. This suggest that routine estimation of serum electrolytes is not necessary however it is necessary whenever electrolyte imbalance is suspected on clinical grounds and in cases which do not respond satisfactorily with routine fluid electrolyte therapy.

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