

Hypernatremic Dehydration Due to Faulty Formula Milk Preparation is Not a history, A Case Report

Mahmoud Abu Zahra¹, Montaha Al-Iede², Enas Al-Zayadneh², Manar Al-lawama^{3*}

¹*Pediatric Residency Program, Department of Pediatrics, The University of Jordan, Jordan*

²*Division of Pediatric Pulmonology, Department of Pediatrics, The University of Jordan, Jordan*

³*Division of Neonatology, Department of Pediatrics, The University of Jordan, Jordan*

***Corresponding Author:** Manar Al-lawama, Division of Neonatology, Department of Pediatrics, The University of Jordan, Amman, Jordan.

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Abstract

Hypernatremic dehydration is a rare life threatening condition in neonates. It has been associated with seizures, intraventricular hemorrhage, cerebral venous sinus thrombosis, acute kidney injury and even death [1-3]. It is usually caused by diarrhea, inadequate exclusive breast feeding and wrong preparations of infant formula [4-7]. We report a case of a seven-day-old male neonate who presented with hypoactivity, fever and hypernatremic dehydration with sodium of 184 mmol/L due to wrong formula preparation. The baby's condition improved with correction of sodium over sixty-six hours, there was no adverse neurological complications and the baby was doing well four months post discharge.

Keywords: *Hypernatremia; Dehydration; Formula Preparation; Acute Kidney Injury; Sodium*

Introduction

Hypernatremic dehydration is uncommon but a life-threatening condition in neonates. In this type of dehydration fluids shift from the intracellular into the extracellular space leading to difficulty in estimating the degree of dehydration and a delayed presentation of infants. We discuss a case of a seven-day-old baby who presented with severe hypernatremic dehydration due to wrong formula preparation.

Case Report

A seven-day old male neonate presented to our hospital with hypoactivity of one day duration, associated with two spikes of fever in the previous 2 days. The baby was reported to have good feeding, adequate urine output and normal stool consistency. Prenatal and birth history were insignificant except that he was born to a COVID-19 positive mother who was isolated from the baby after birth and his grandmother was taking care of him in her house.

On physical examination, the baby was ill looking and hypoactive, heart rate was 210 beat/minute, body temperature 37 Celsius degrees, respiratory rate 40 breath/minute, O₂ saturation 88% and blood pressure was 75/50 mmHg. The anterior fontanelle was slightly

depressed measuring 2 x 1cm, symmetrical equal breath sounds bilaterally, normal heart sounds, without murmurs, soft abdomen, no palpable masses, active bowel sounds and normal other physical findings.

The management in the emergency room consisted of oxygen support by nasal cannula with a flow rate of 2 liters/min, after which his saturation improved to 97%. Intravenous access was obtained and a bolus of 10 ml/Kg normal saline 0.9% was given. Serum glucose was measured, showed normal level of 72 mg/dL. Blood and urine cultures were taken and the baby was started on ampicillin and cefotaxime as a case of presumed sepsis. COVID-19 PCR test was done, and the baby was admitted to intermediate care unit.

The baby was attached to a continuous cardiopulmonary monitor. ECG showed sinus tachycardia. The lab work came back showing the following: metabolic acidosis with pH of 7.22, PaCO₂ 39 mmHg, bicarbonate 16 mmol/L and base excess -11. Normal complete blood count with peripheral leukocyte count of 9,9750/μL, with 34% neutrophils. Hemoglobin concentration was 15.5 g/dL. Platelet count was 449,000/μL and C-reactive protein level was 1.7 mg/dL (negative). Blood biochemistry and electrolytes revealed sodium 184 mmol/L, potassium 6.5 mmol/L, chloride 147 mmol/L, Calcium 12.6 mmol/L, magnesium 3.28 mmol/L, blood urea nitrogen 100 mg/dL, creatinine 0.77 mg/dL and alanine aminotransferase (ALT) was 81 IU/L.

Fluid management for hypernatremic dehydration started with dextrose saline 0.18% at a rate of maintenance plus one third of the deficit (estimated at 10%) per day. After six hours, the sodium dropped to 172 mmol/L. The type of fluid was changed to dextrose saline 0.3%. Levels were followed every 3 hours and the rate of infusion was adjusted several times to prevent any further rapid drop. A normal serum sodium level was achieved after 66 hours of treatment. On further meeting with the grandmother she revealed using two or more spoonful of formula powder per 60 ml of water instead of using one per 60 ml as she did not know how to properly prepare infant formula.

Bacterial cultures were negative. COVID-19 PCR test was negative. The baby was transferred to the pediatric floor for further monitoring and caregiver education.

During his hospital stay brain ultrasound was done, there was no evidence of intraventricular hemorrhage. The baby had normal level of consciousness, and he did not develop abnormal movement.

The baby was discharged home after 10 days and continued to be followed up in the outpatient clinic two weeks after the discharge and at the age of four months, he was asymptomatic thriving well and his developmental milestones were all appropriate for age, no neurological deficits attributable to hypernatremia have been identified.

Discussion

Hypernatremia is caused by water loss in excess of sodium, sodium intake that exceeds sodium losses and when both occur together. This will increase the osmolality in the extracellular space and lead to a fluid shift from the intracellular to the extracellular compartment.

The fluid shift along with the high extracellular fluid osmolality could have a negative impact on the central nervous system and an increase risk of thrombosis, both may manifest as seizures, intraventricular hemorrhage, cerebral venous sinus thrombosis and even death in severe cases [1-3].

The impact on the renal system has been reported too as hypernatremic dehydration was associated with several cases of acute kidney injury that might even lead to dialysis [1,8,9].

Causes of hypernatremic dehydration in neonates include diarrhea [10], exclusive breastfeeding [5,9] and faulty preparations of infant formulas [6,7] as in our case.

The formula used by the caregiver was supposed to be prepared with 1 spoonful powder of formula per 60 ml of water, although these instructions were printed on the milk can, she mentioned that she did not read them and decided to estimate the amount of powder by herself using two or more spoons per 60 ml. This improper preparation led to an increase in sodium intake in excess of water for several days manifesting as severe hypernatremia on day seven of life. Careful and detailed history taking in this case was the key for diagnosis.

Regarding the treatment of hypernatremia in neonates, and because of the rarity of this morbidity; neonatal management guidelines are lacking. However, based on pediatrics literature, a correction that leads to a decline of 0.5 - 1 mmol/hour is usually suggested to decrease the risk of brain edema [7,11]. In our case, Dextrose saline 0.18% was used in the beginning, to be changed quickly after 6 hours to dextrose 0.3% due to rapid decline in serum sodium.

Conclusion

Hypernatremic dehydration caused by improper formula preparation is a rare entity that has been reported in literature three times according to our knowledge [6,7,12]. It requires high index of suspicion and careful history taking to reach the diagnosis. Treatment and fluid management should follow a strict plan with frequent monitoring of serum sodium level to prevent rapid correction and decrease the risk of neurological complications. Long term follow up is needed. In our case the separation of the baby from his mother, a practice that was done at the beginning of COVID-19 pandemic contributed to this unfortunate, potential lethal event.

Conflict of Interest

Authors have no conflict of interest to disclose.

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