Case Report

Severe hypernatremic dehydration in a breast-fed neonate

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Although it is a rare condition, breast-feeding may result in hypernatremic dehydration. However, incidences might be increasing with more mothers breast-feeding. Although the early detection and management of hypernatremic dehydration from breast-feeding is important, its prevention is even more important on account of its serious complications. In order to prevent hypernatremic dehydration secondary to breast-feeding, it is essential to educate mothers in successful breast-feeding methods. An early follow-up after discharge is recommended. We report a case of hypernatremic dehydration secondary to breast-feeding in a full-term newborn that was corrected without any complications. **(Korean J Pediatr 2007;50:85-88)**

Key Words : Hypernatremic dehydration, Breast-feeding, Newborn

Introduction

Hypernatremic dehydration in newborns is rare, but can be dangerous. In particular, it can lead to frequent brain damage including cerebral edema and intracranial hemorrhage in the neonatal period[1].

During the last 10 years the number of publications reporting an increase in the incidence of hypernatremia in infants who are breast-fed exclusively has increased[2-5]. It is believed that hypernatremia due to breast-feeding is a consequence of inadequate breast-feeding technique in inexperienced mothers[5]. In Korea, the number of mothers breast-feeding has increased during previous several years because it is considered to be the most appropriate source of nutrition for infants. However, to the best of our knowledge only one case of hypernatremic dehydration associated with breast-feeding has been reported until now[6].

We present a case of uncommon case of hypernatremic dehydration associated with breast-feeding with a review of the literature.

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Case Report

A 14-day-old male infant was admitted to the emergency center of Inha University Hospital due to poor oral intake, irritability and decreased urine output for the previous day. The patient was born to a 29-year-old, primigravida, healthy, mother via normal spontaneous vaginal delivery at 42 weeks' gestation. There was no evidence of mastitis or medication in his mother. The baby was exclusively breast-fed ten to twelve times a day. The mother considered him to be a quiet baby who was easily satisfied. The patient's mother did not fully comprehend the severity of the patient's dehydration or cachexia. At admission, he had no fever, chills, dyspnea or tachypnea. He had no cyanosis or jaundice. There had been no vomiting or diarrhea. He had a shrill cry, irritability, poor oral intake, and decreased urine output.

The patient's vital signs were a body temperature of 36.0℃, heart rate 120 beats/min, respiratory rate 40 breaths/min, and blood pressure 83/57 mmHg. Oxygen saturation was 99% by pulse oximetry. Examination revealed a sick baby who was irritable and lethargic and had signs of severe dehydration. His weight at admission was 2,700 g, which is 24% weight loss in compare with his birth weight (3,560 g). Significant sunken anterior fontanelle and eyeballs, dry mucous membranes, and decreased skin turgor were

found. The skin was doughy and capillary refill was greater than 2 seconds. Findings on heart and lung examination were unremarkable. On neurologic examination, intermittently lethargic appearance without focal neurologic findings was shown. His primitive reflexes, including Moro reflex, traction reflex, and sucking reflex were normal. Laboratory findings at admission were as follows: pH 7.57, pCO_2 22 mmHg, pO_2 84 mmHg, sodium 195 mEq/L, potassium 4.1 mEq/L, chloride 154 mEq/L, bicarbonate 20 mmol/L, blood urea nitrogen 140 mg/dL, creatinine 2.52 mg/dL, blood glucose 122 mg/dL, and serum osmolality 463 mOsm/kg. The leukocyte count was 8,900/mm^3, hemoglobin 14.9 g/dL, hematocrit 47.9 %, and platelets 85,000/mm^3. A urinalysis disclosed the following values: pH 5.0, specific gravity 1.025, and urine osmolarity 786 mOsm/kg.

He was diagnosed as severe hypernatremic dehydration and pre-renal azotemia: Fractional excretion of Na 0.9%, renal failure index 1.766%, urine osmolarity 786 mOsm/kg, urine Na 68 mEq/L, and Ucr/Pcr 38.

Following initial fluid bolus with 5% dextrose saline, the level of serum sodium was 191 mEq/L and he began to void urine. Free water deficit and sodium excess was managed by gradual and slow correction over 72 hours to prevent cerebral edema and neurologic sequelae. The calculation used to correct the severe hypernatremic dehydration is illustrated to Table 1. The serum sodium levels returned to normal by day 4 of admission (Fig. 1). Blood urea nitrogen and creatinine reached the normal range by day 6 of admission, and their value were 10.3 mg/dL and 0.65 mg/dL, respectively. The baby could be fed completely orally by day 5 of admission.

In view of his sick appearance and abnormal platelets count, sepsis and disseminated intravascular coagulopathy were considered. Therefore, antibiotics were administered until the blood and urine culture reports were obtained, which were negative. Bradycardia was observed intermittently in cardiopulmonary monitoring, during therapy. However, the electrocardiography revealed sinus bradycardia without any other cardiac rhythmic abnormalities. The result of the echocardiography was normal.

There appeared to be no clear cause for the patient's disease, so the mother's breast milk was examined. The milk was found to have a higher concentration of sodium than those of several control mothers' breast milk. The sodium concentration in our case was 68 mEq/L, whereas it was 51 mEq/L, 28 mEq/L, 13 mEq/L, and 24 mEq/L in four control mothers, respectively.

Table. 1. Fluid Deficit Calculation

Birth weight 3.56 kg, Admission weight 2.70 kg
Weight loss 860 g
Percent dehydration = 860/3,560=0.241≒24%
Free water deficit = Weight loss=860 mL

Fluid Therapy
Step 1: Emergency phase
Restore vascular volume with bolus of 20 mL/kg of 5% dextrose/0.9% normal saline.
→ 20 mL/kg×3.56 kg≒70 mL over 1hr
Step 2: Rehydration phase
Aim to correct water deficit and sodium excess within 48-72 hours.
maintenance during 3 days: 100 mL/kg/d×3.56 kg×3 days=1,068 mL
→ Maintenance+deficit=1068 mL+860 mL=1,928 mL, and take initial hydration fluid out of this.
→ 1,928 mL-70 mL=1,858 mL
→ 1,858 mL/71 hr≒26 mL/hr of 5% dextrose/0.45% normal saline.

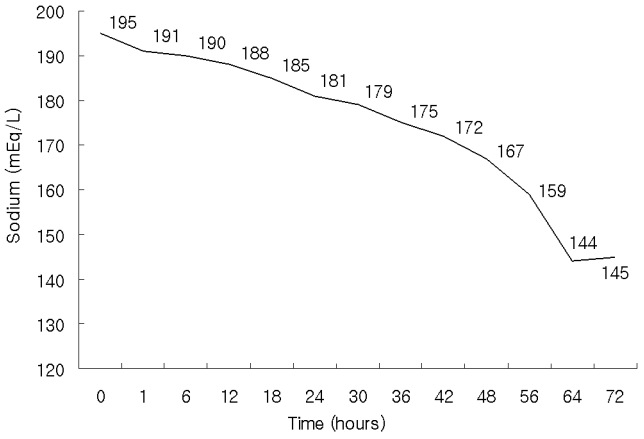


Fig. 1. The change in serum sodium concentrations during fluid therapy.

The baby was discharged on day 12 after admission, and has been fed both breast milk and formula milk without complications. His weight at discharge was 3,460 grams. Currently, he is 27-months-old and is growing well without any problems.

Discussion

Hypernatremic dehydration was previously believed to be unusual in breast fed babies. In the 1990s, however, there was an increase in the number of reports of hypernatremic

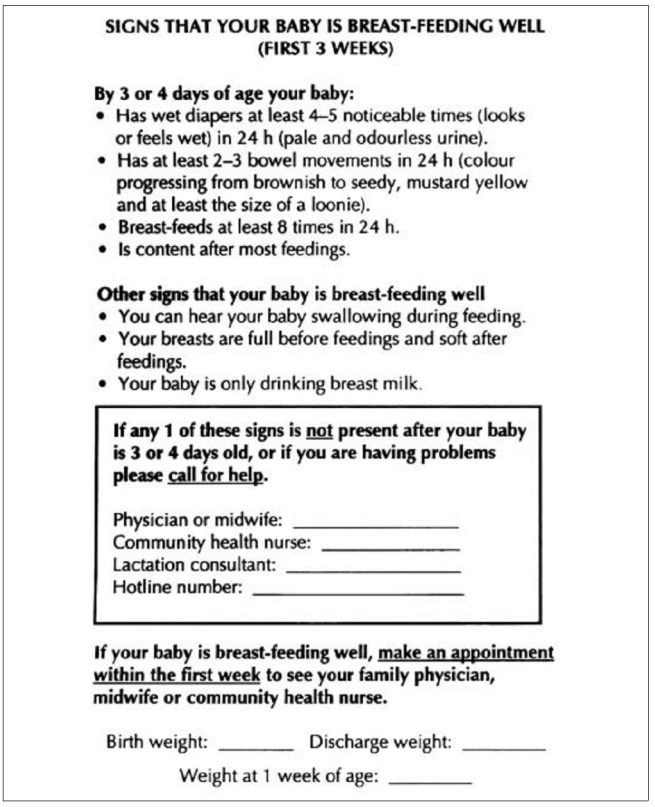
dehydration in exclusively breast-fed infants[7-11]. Cooper et al[3] reported five cases born between 1991 and 1994 in Ohio. Oddie et al[8] encountered eight cases of hypernatremic dehydration in exclusively breast-fed infants in England in 1998, and reported that the incidence of hypernatremic dehydration secondary to breast feeding difficulty may be as high as 7.1 per 10,000 breast-fed newborns. They considered that it might be associated with an increase in the number of breast-feeding mothers, inadequete breast-feeding methods causing lactation failure, early postpartum discharge and late follow-up.

Hypernatremic dehydration due to breast milk feeding usually presents between the first and third weeks of life. The infants are often lethargic, irritable, malnourished, and dehydrated. The mother is often primigravid, intelligent, and well motivated to breast-feeding. The infant is often described as a sleepy or quiet baby who does not appear hungry, and usually thrives with adequate nutritional support[12]. For these reasons, the condition can be late to recognize. This case had the same above conditions, including primigravida and a motivated breast-feeding mother, who considered her baby a quiet baby.

Breast-feeding induced hypernatremia has been attributed to dehydration and malnutrition due to low breast milk production and inadequate breast-feeding. In addition, this might be related to high concentration of sodium in the breast milk. Previous studies of the electrolyte composition of breast milk have shown a mean sodium value of 64.8±4.4 mEq/L after delivery, reducing to a mean of 21.4±2.3 mEq/L by the third postpartum day (colostrum), and leveling off to a value of 7±2 mEq/L by 2 weeks (mature milk)[13]. In our case, the sodium concentration in the breast milk was higher than those from the control mothers. High levels of sodium in breast milk may be a contributing factor to hypernatremia.

On the other hand, it is important that mothers should learn adequate breast-feeding techniques. In order to prevent nipple confusion, it is known that breast-fed babies should not be given artificial nipples during the first three to four weeks, when they are learning their breast-feeding skills. For this reason, even though the baby might be fed breast milk insufficiently, most mothers adhere to breast-feeding without any supplementary artificial formula. Moreover, most mothers cannot be sure of the amount of breast milk the baby takes. These factors may aggravate hypernatremic dehydration in breast-fed infants. However, it has been suggested that theoretical nipple confusion does not become the problem clinically. Therefore, in oder to prevent dehydration, it may be wise to supplement the insufficient breast-feeding intake by feeding water to her baby during the course of breast milk feeding[6].

In addition, the physician should educate the mother about adequate breast-feeding methods and to search for the early signs of dehydration in infants. Livingstone et al[14] recommended that physicians give every mother educational materials including a brochure, as shown in Fig. 2, to prevent dehydration due to breast-feeding. To achieve successful breast feeding and prevent dehydration, we believe that a similar educational brochure should be available in Korea. Early postpartum hospital discharge might contribute to the increased dehydration due to breast-feeding. In most institutes, the baby usually re-visit physician's office two to three weeks after discharge. This follow-up interval might be too long to identify the infant's problems early. We suggest that earlier follow-up visits should be done within the first week of life after discharge. An earlier follow-up visit will allows the clinician to reinforce the signs of breast-



SIGNS THAT YOUR BABY IS BREAST-FEEDING WELL
(FIRST 3 WEEKS)

By 3 or 4 days of age your baby:
- Has wet diapers at least 4–5 noticeable times (looks or feels wet) in 24 h (pale and odourless urine).
- Has at least 2–3 bowel movements in 24 h (colour progressing from brownish to seedy, mustard yellow and at least the size of a loonie).
- Breast-feeds at least 8 times in 24 h.
- Is content after most feedings.

Other signs that your baby is breast-feeding well
- You can hear your baby swallowing during feeding.
- Your breasts are full before feedings and soft after feedings.
- Your baby is only drinking breast milk.

If any 1 of these signs is not present after your baby is 3 or 4 days old, or if you are having problems please call for help.

Physician or midwife: _____
Community health nurse: _____
Lactation consultant: _____
Hotline number: _____

If your baby is breast-feeding well, make an appointment within the first week to see your family physician, midwife or community health nurse.

Birth weight: _____ Discharge weight: _____
Weight at 1 week of age: _____

Fig. 2. Brochure given to new mothers at the time of hospital discharge explain the signs that indicate breast-feeding is going. Reprinted from Livingstone et al[5].

feeding success as well as detect any problems the baby might have earlier.

Therefore, adequate education of breast-feeding including providing mothers with information such as brochures and early follow-ups after discharge are necessary to prevent breast-feeding induced hypernatremic dehydration.

한 글 요 약

모유 수유 환아에서 발생한 심한 고나트륨혈성 탈수

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모유 수유로 인한 고나트륨혈성 탈수는 흔하지는 않으나, 최근 모유 수유가 증가하면서 그 빈도가 증가할 수 있다. 고나트륨혈증은 여러 심각한 합병증을 초래할 수 있으므로 조기에 발견하여 치료해야 하며, 무엇보다 예방이 중요하다. 모유 수유로 인한 고나트륨혈성 탈수의 예방을 위해서는 모유 수유에 대한 올바른 교육과 퇴원 후 조기 추적 관찰이 중요하다. 저자들은 정상 신생아에서 아무런 합병증 없이 치료된 모유 수유로 인한 고나트륨혈성 탈수를 경험하였기에 이를 보고하는 바이다.

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