



Prevalence of Breastfeeding-associated Hyponatremia among Hospitalized Hyperbilirubinemic Neonates

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ABSTRACT

Introduction: This study aimed to assess the incidence of breastfeeding-associated hyponatremia and related risk factors among hospitalized hyperbilirubinemic neonates.

Methods: This prospective study was conducted at Nemazee Hospital affiliated to Shiraz University of Medical Sciences during one year to determine the association between hyponatremia (serum sodium concentration of >150 mEq/L) and exclusive breastfeeding of the neonates. During the study period, 122 neonates were recruited and the patients' history was taken through using the medical records (regarding child delivery) and asking the mother. Laboratory data including total and direct bilirubin levels, serum sodium level and blood urea nitrogen (BUN) were recorded. P -value <0.05 was considered statistically significant.

Results: The study was carried out on 86 exclusively breastfed neonates (EBFN) and 36 neonates with mixed type of feeding. The incidence of hyponatremia among the EBFN and non-exclusively breastfed neonates (non-EBFN) was 9.3% and 2.7%, respectively. Moreover, 55% of the neonates with hyponatremia had a significant weight loss ($>10\%$ cumulative weight loss). A significant correlation was observed between hyponatremia and weight loss ($P=0.008$). Also, in spring and autumn, no hyponatremia was observed among 53 cases, and during summer and winter, 9 out of 69 neonates (13%) presented with hyponatremia ($P=0.042$).

Conclusion: Hyponatremic dehydration is relatively common among EBFN. Regular weight monitoring, proper breastfeeding and environmental temperature control should be encouraged for preventing breastfeeding-associated hyponatremia.

Keywords: Dehydration, Exclusively breast-fed, Hyperbilirubinemia, Hyponatremia, Neonate

Introduction

There is no doubt that breastfeeding is the best way to nourish the infant. It can protect the neonate against various health problems such as infectious diseases, neurodevelopmental disorders, and adulthood chronic conditions (1, 2).

One of the potentially fatal complications related to inadequate breastfeeding is hyponatremia. Hyponatremia is defined as serum sodium concentration ≥ 150 mEq/L and is usually induced by increased insensible water loss and/or excessive sodium intake.

The low sodium content of breast milk can protect the neonates from hyponatremia. Therefore, the most common causes of hyponatremia in newborns are hyponatremic dehydration due to increased insensible water

loss, and/or inadequate breast milk ingestion.

Neonates with hyponatremic dehydration have better preservation of intravascular volume, and therefore they are protected against hypotension and oliguria; in this case, the neonates are initially less symptomatic and therefore medical diagnosis might be delayed. Hyponatremic dehydration is usually associated with hyperglycemia and hypocalcemia which can increase the risk of central nervous system complications (3).

Newborns are especially susceptible to hyponatremia, and the disease can lead to negative consequences such as cerebral hemorrhage, vascular thrombosis, convulsion, and coma. Hyponatremia is more frequently observed

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in icteric infants, since it can lead to the disruption of blood-brain barrier and increase the risk of bilirubin encephalopathy (4-7). In the past, hypernatremia was considered as a complication in infants who were fed with concentrated milk (8); however, recent reports indicate that breastfeeding-associated hypernatremia (BFAH) is not a rare complication (9-14).

The aim of this study was to determine the prevalence of hypernatremia and associated risk factors among exclusively breast-fed neonates (EBFN) in order to encourage physicians to perform careful breastfeeding assessments, so that breast-fed neonates at risk of dehydration can be identified.

Materials and Methods

This was a prospective study conducted over a one-year period, from the beginning of spring to the end of winter 2011-2012; the study was carried out during all seasons to meet the purpose of the study. A total number of 160 neonates with hyperbilirubinemia were evaluated, and 122 healthy term neonates less than 30 days of age with exaggerated hyperbilirubinemia were included in the study; the patients referred to the nursery center of Nemazee Hospital, Shiraz, Iran.

In the present study, only neonates with hyperbilirubinemia were enrolled and the remainder who had the following pathological problems were excluded from the study: sepsis, prematurity, hemolysis, prolonged jaundice, low birth weight, and congenital malformations. The study was approved by the local ethics committee, and the informed consents were obtained from the parents.

Past medical history was obtained by using the medical records (related to child delivery) and asking the mothers. It included the time of yellow discoloration of the skin, neonate's age, gestational age, type of feeding and delivery, and parity. Laboratory data including total and direct bilirubin levels, serum sodium level and blood urea nitrogen (BUN) were recorded. Abnormal laboratory data was defined as serum sodium level >150 mmol/L and BUN >20 mg/dl. The neonates' weights were recorded using an electronic weighing balance with a sensitivity of 10 gr. Significant weight loss was defined as >10% cumulative weight loss.

The cases were allocated to two groups of EBFN and non-EBFN. These two groups were similar regarding the age, gender, and the severity of hyperbilirubinemia; the non-EBFN group was fed by infant-formula.

Nominal data were analyzed using Chi-square test and SPSS Version 12. P -value < 0.05 was considered statistically significant.

Results

During the one-year period of this study, the incidence of hypernatremia among 122 hospitalized hyperbilirubinemic neonates was 7.4% (9 neonates). Of the total of subjects, 86 neonates were exclusively breastfed and 36 were fed using infant-formula. Mean total bilirubin was 17.25 ± 3.92 and 16.94 ± 4.25 mg/dl in the EBFN and non-EBFN groups, respectively; hence, these two groups were similar regarding the bilirubin level. Moreover, the two groups were similar in terms of age, gender, and body weight (mean age was estimated as 6.68 ± 2.50 and 7.57 ± 2.35 days, and mean weight as 2.89 ± 0.46 and 2.99 ± 0.58 kg, respectively). The incidence of hypernatremia was 8 cases in the EBFN (9.3%), and one case in the non-EBFN group (2.7%) (9.3% vs. 2.7%; $P = 0.2$).

A high level of BUN (>20 mmol/L) was detected in 14 cases of the EBFN group (16.3%) and one case of the non-EBFN group ($P = 0.058$). Regarding the seasons of the year, the prevalence of hypernatremia was 0% in spring (0 out of 31 cases), 10.5% in summer (4 out of 38 cases), 0% in autumn (0 out of 22 cases) and 16.1% in winter (5 out of 31 cases) (Figure 1).

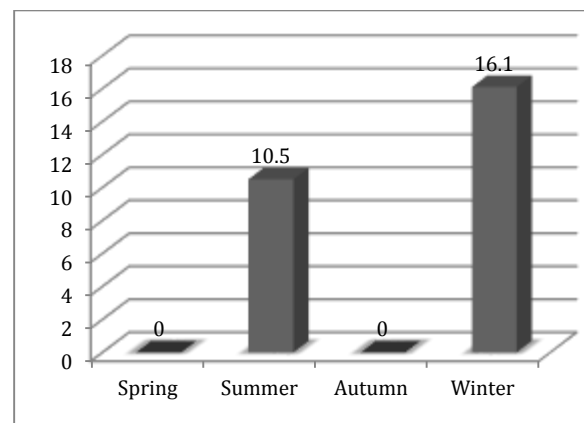


Figure 1. The incidence of hypernatremia according to the seasons

The prevalence of weight loss in the study group was 3.2% in spring (1 case), 13.1% in summer (5 cases), 18% in autumn (4 cases), and 29% in winter (9 cases). Also, the prevalence of high-level BUN in four seasons was reported as 9.7% (3 cases), 18.4% (7 cases), 4.5% (one case) and 12.9% (4 cases), respectively. There was a significant difference between the prevalence of hypernatremia and the season of delivery,

especially summer and winter versus spring and autumn ($P=0.04$).

Seventy five neonates were born through normal vaginal delivery (NVD) and 47 by cesarean section. The prevalence of hypernatremia was similar in both groups, and there was no relationship between hypernatremia and parity. Nineteen neonates experienced significant weight loss and 16 infants were EBFN (Figure 2). Fifty five percent of hypernatremic neonates presented with significant pathologic weight loss ($P=0.008$).

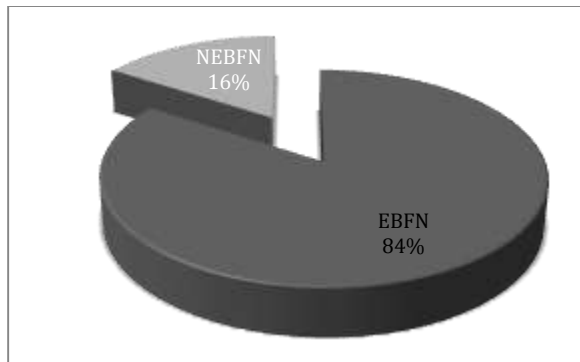


Figure 2. The distribution of Weight loss in newborns with respect to the mode of feeding

Discussion

The present study clearly demonstrated that breastfeeding-associated hypernatremia is not a rare condition. The prevalence of BFAH in the present study was 7.4% which is similar to the findings of other studies (15, 16). Uras *et al* showed that among 1,150 neonates in the neonatology department, 64 (5.6%) had hypernatremia (15); this indicated the possible breastfeeding problems and the need for more intensive evaluation of breastfeeding.

Tarcan *et al* revealed that among 86 EBFNs, 10 infants (12%) had severe weight loss combined with hypernatremia (16). There are several mechanisms for BFAH, and it occurs in infants with excessive crying and lethargy, leading to inadequate transfer of milk to the neonate. Moreover, impaired lactation and the consequent poor drainage of the breast can lead to high sodium content of breast milk, potentiating the neonatal hypernatremia (17).

In the present study, the sodium content of breast milk was not measured, therefore we could not investigate the impact of milk sodium concentration on neonatal hypernatremia; however, it seems that poor fluid intake and increased insensible water loss are the most probable causes of BFAH.

According to our findings, a significant weight loss is observed in neonates with hypernatremia. Considering the high prevalence of hypernatremia in newborns with significant weight loss, prevention and early detection of hypernatremic dehydration can be achieved by the early weighing of the neonate after being discharged from the hospital.

Among 9 cases with hypernatremia, 8 were EBFNs and only one case was non-EBFN ($P=0.2$). This insignificant correlation might be attributed to the small sample size of our study population.

Although there was no significant correlation regarding high BUN and weight loss between EBFN and non-EBFN groups ($P=0.065$ and $P=0.182$, respectively), high BUN and significant weight loss were more prevalent among the EBFN group (14 vs. 1, and 16 vs. 3). Similar to other studies, the present statistics highlight the association between hypernatremic dehydration in otherwise normal infants who are exclusively breastfed (16, 18).

Our study revealed a significant relationship between the prevalence of hypernatremia and non-temperate seasons of the year (summer and winter), which shows the effect of temperature on the development of dehydration. Probably in summer, due to warm weather and in winter due to extra usage of the heaters, infants lose more body water; therefore, it leads to a higher percentage of hypernatremia. Increased insensible water loss might be partly attributed to cultural issues, since families dress their infants with more clothes to protect them from respiratory tract infection.

There are conflicting results with respect to the route of delivery and co-morbidities related to breastfeeding. Our study demonstrated that the prevalence of hypernatremia, weight loss, and high BUN was not different regarding the mode of delivery (caesarian section vs. normal vaginal delivery). This was compatible with the study by Unal *et al* (19) which showed that delivery route has no influence on causing breastfeeding-related morbidities. Such results might be attributed to the efforts to encourage mothers to breastfeed their infants as soon as possible after delivery. Conversely, Caglar *et al* (18) and Yaseen *et al* (20) reported that caesarian section is a risk factor for excess weight loss and hypernatremia in exclusively breastfed infants; this is due to the significant delay in the first feeding of the neonate, especially for infants delivered by caesarian section, therefore, unnecessary delay should be avoided.

The current study showed that neonates born from primiparous and multiparous mothers were similar with respect to sodium and BUN levels ($P=0.9$ and $P=0.8$, respectively). The results of the present study are in contrast with other reports stating that most of the mothers of the neonates with hyponatremia were primiparous (5, 21); though, it is consistent with the results of Uras *et al* (15). The similar rate of hyponatremia in both groups shows that vulnerable primiparous and multiparous mothers didn't have successful lactation and did not receive adequate psychosocial support and practical advice on breastfeeding techniques.

Conclusion

In conclusion, the present study indicates that breastfeeding-associated hyponatremia is a rather common condition, especially in EBFN and during non-temperate seasons of the year. Regarding the significant weight loss in a high percentage of hyponatremic neonates, regular weight monitoring, and training about breastfeeding skills during and prior to lactation are highly suggested; also additional support should be provided for the mothers to ensure successful breastfeeding and to avoid further complications related to insufficient lactation. In order to prevent and treat dehydration and hyponatremia, taking a comprehensive approach should be part of any breastfeeding promotion campaign by health policy makers.

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