

*Case report*

# High breast milk sodium concentration resulting in neonatal hypernatraemic dehydration

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## Introduction

Hypernatraemic dehydration is a serious condition. In neonates the consequences of its complications are life-threatening. In this case study, the causes for dehydration in an otherwise healthy baby were examined and found to be associated with a high concentration of sodium in the mother's breast milk and lactation failure. A previously affected baby in the family, who died at the age of 10 days, suggested a recurring factor causing the hypernatraemia.

## Case presentation

A 13-day-old Jordanian female baby presented to our hospital in March, 1998 with a 2-day history of reluctance to feed, irritability, repeated vomiting and not passing any urine for more than 12 hours. There was no history of diarrhoea. The birth history revealed that she was a full-term normal vaginal delivery following an uneventful pregnancy and birth. Her birth weight was 2.9 kg. The birth record showed that she had a normal routine neonatal examination and was on established breastfeeding before discharge from the postnatal ward. Her family history revealed a sister who had died 2 years previously,

aged 10 days. The causes of death were dehydration and acute renal failure.

The parents were first cousins. The father was a healthy 28-year-old and the mother a 22-year-old and also in good health. The patient had been on on-demand breastfeeding since birth. However, the mother complained that her baby was always hungry and her milk was never enough to satisfy the baby.

Physical examination revealed a rectal temperature of 38 °C, weight of 2.5 kg, bulging anterior fontanelle, cold peripheries, capillary filling of 3 seconds and doughy dry skin. She was not cyanosed. Neurologically, she was hypertonic, with exaggerated Moro reflex, but there was no focal neurological deficit.

An examination of the medical records of her older sister showed that the sister had been admitted at 10 days old with severe dehydration and shock, acute renal failure and repeated seizures. Her plasma sodium level had been 193 mmol/L, with a potassium level of 6.4 mmol/L and plasma creatinine of 3.5 mg/dL. She had died on the same day of admission.

Investigations on the current case, including a full septic screen, showed no evidence of infection. The rest of her investigations were as follows: haemoglo-

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bin 15.6 g/dL, white blood cell count  $28.6 \times 10^9/L$ , platelet count  $333 \times 10^9/L$ , urica 67 mg/dL, creatinine 2.1 mg/dL, sodium 189 mmol/L, potassium 5.2 mmol/L, calcium 9.9 mg/dL and bicarbonate 6.1 mmol/L. The urine had a sodium content of 63 mmol/L and a specific gravity of 1030. The fact that she had a sister who had died after similar presentation alerted the clinicians to search for an underlying cause for this dehydration. Diabetes insipidus, renal and adrenal disorders were excluded. Sodium in the mother's breast milk was 28 mmol/L, with plasma sodium of 137 mmol/L. Breast-milk sodium was measured in the same laboratory in five other mothers on their 7th–14th day of lactation. These measures were used as controls. All were found to have sodium of  $\leq 18$  mmol/L. The mother's breast milk was expressed for measurement and analysis. Over a 24-hour period, 175 mL of milk were expressed.

Our patient was treated as a case of severe hypernatraemic dehydration with renal shut down. She showed gradual improvement with normalization of her sodium and kidney function on day 5 of her hospital stay. Breastfeeding was discontinued and replaced with a formula feed. On follow-up until the age of 8 months, she continued to develop normally with no abnormalities in her kidney function or neurological system.

## Discussion

Our patient's mother had a sodium content of 28 mmol/L, much higher than expected. The volume of milk produced was much less than the baby's requirements. Morton et al. found a breast-milk sodium level of  $\leq 16$  mmol/L to be associated with adequate and sustained lactation [1]. In our case, it is not clear whether the hypernatraemia was due to the intake of high amounts of sodium present in the breast milk, or to the in-

adequate production of milk in the mother. The mother's milk production, when expressed, was much less than the maintenance requirements of the baby.

A previous study, which described six infants with severe dehydration and mothers with high breast-milk sodium and inadequate milk production, concluded that the hypernatraemia in these infants was secondary to poor fluid intake and increased insensible water loss, rather than to elevated milk sodium [2]. Another study in Canada found that breast-milk sodium concentration was a predictor of successful lactation [3]. It found that 75% of mothers with low breast-milk sodium sustained a high level of breastfeeding at 4 weeks postpartum, compared to only 22% of mothers with high sodium in their milk. A study by Peters, who followed a lactating mother with high sodium in her milk from 12 to 30 days of lactation and found it to remain high, suggests it is due to disturbances of the maturation of breast milk [4].

The mechanism of elevated concentration of breast-milk sodium is obscure. Anand et al. speculated that diminished breast-milk production or delayed maturation best explained abnormally high breast-milk sodium levels [5]. Nichols et al. found that the concentration of breast-milk sodium chloride and lactose concentration combine to maintain the osmolality of breast milk, similar to that of the blood [6]. Mercier et al. found an inverse relation between the concentration of lactose and that of sodium in breast milk, suggesting that it is part of a more complex disturbance of lactation [7]. Since the sodium concentration is reciprocally related to that of lactose, any fall in lactose will result in a rise in sodium level. Thus, the basic mechanism is that of inadequate lactose production. This failure of maturation of lactation has been suggested to be due to primary sucking or

appetite control deficiency in the infant [8,9]. It has been suggested that this is preventable by supportive counselling of these mothers on nursing techniques [8].

Hypernatraemic dehydration in the two siblings with similar presentation, but different outcome, suggested a similar etiology. The clear evidence in our patient is that the high sodium concentration in the mother's milk was the reason. The mother was a healthy woman with normal kidney function tests. Her adrenal function tests were also normal. The fact that the parents were first cousins and there was a recurrence in the same family may suggest a familial or inherited predisposition for this condition. However this has not been described in the literature.

Hypernatraemic dehydration has been described in babies whose mothers previously successfully breastfed [2]. It is not known whether the tendency to produce milk with high sodium content is recurrent.

In this case, we advised the parents that high breast-milk sodium must be looked for in all subsequent deliveries.

## Conclusion

We conclude that measurement of breast milk sodium is essential in any breastfed baby presenting with hypernatraemic dehydration. Mothers of these neonates tend to have inadequate lactation. The possibility of recurrence in subsequent babies should be considered. Mothers should be educated and warned about this possibility. Lactation and breast-milk sodium should be assessed and counselling on breastfeeding offered to all mothers. Other means of providing fluid to these babies should be used until lactation resumes adequately. Resumption of lactation has been shown to be heralded by a drop in the concentration of sodium in the breast milk.

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