CASE REPORTS

Hypernatraemic Dehydration in Exclusively Breastfed Infants
A Potentially Fatal Complication

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ABSTRACT

There have been several reports in the literature about hypernatraemic dehydration and severe malnutrition in exclusively breastfed infants. The authors report a series of four such cases admitted to the Newborn Special Care Unit of the University Hospital of the West Indies over a seven-year period. All four were term infants who had weight loss of greater than 20% of their birthweight, serum sodium levels greater than 175 mmol/L, metabolic acidosis and pre-renal failure at presentation. Three of the infants had seizures shortly after presentation. One of the infants died soon after admission to hospital, the three others had normal neurological development clinically at the time of last review.

Deshidratación Hipernatrémica en Bebés Amamantados Exclusivamente al Pecho: una Complicación Potencialmente Fatal

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RESUMEN

*Ha habido varios reportes en la literatura sobre deshidratación hipernatrémica y malnutrición severa en bebés amamantados exclusivamente al pecho. Los autores reportan una serie de cuatro de estos casos, ingresados en la Unidad de Cuidados Especiales para Recién Nacidos del Hospital Universitario de West Indies, a lo largo de un período de siete años. En los cuatro casos se trataba de infantes a término que habían perdido más del 20% de su peso al nacer, tenían niveles de sodio en suero superiores a 175 mmol/l, acidosis metabólica, y presentaban fallo pre-renal al ser atendidos. Tres de los bebés presentaron convulsiones poco después de ser vistos por el médico. Uno de los bebés murió poco después del ingreso al hospital, en tanto que los otros tres presentaban un desarrollo ne*urológico normal al momento del último examen.

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INTRODUCTION

The benefits of breast milk are indisputable. Unfortunately, exclusive breastfeeding can have serious complications leading to significant morbidity and mortality (1–4). Although there have been several reports in the literature about hypernatraemic dehydration and severe malnutrition in exclusively breastfed infants, the authors are not aware of any reports from the English-speaking Caribbean. We report a series of four such cases admitted to the Newborn Special Care Unit at the University Hospital of the West Indies (UHWI), Jamaica.

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Case 1 B/O MG

This term infant presented on day nine of life with a two-hour history of fever, lethargy, poor feeding and vomiting. He had not passed stool or urine that day. He was exclusively breastfed but his mother felt that she was not producing enough breast milk, for although he breast fed continuously, he was reluctant to discontinue feeding and was irritable after feeding. Her breasts were always soft and she was unable to manually express any significant quantity of milk. Despite seeking medical attention on three occasions in the preceding

five days, she was reassured and advised to continue exclusive breastfeeding. Maternal and neonatal characteristics are shown in Tables 1 and 2.

Table 1: Maternal characteristics of four cases of infants with hypernatraemic dehydration

Characteristic	Case			
	B/O MG	B/O JM	G/O PH	B/O SH
Age	29	33	29	27
Parity	0	0^{+1}	1	0
No. of times medical attention sought prior to presentation	3	1	0	0
Identifiable problems with breast/nipple or technique	Yes	Yes	Yes	Yes

No. = Number

Table 2: Neonatal characteristics of four cases of hypernatraemic dehydration

Characteristics	Case			
	B/O MG	B/O JM	G/O PH	B/O SH
Gestational age	Term	Term	Term	Term
Sex	Male	Male	Female	Male
Birthweight (g)	3550	3120	3310	2620
Admission weight (g)	2561	2190	2440	2000
% Wt loss	29	30	20	24
Time from delivery to discharge from postnatal ward (hrs)	72	48	24	24
Age at admission to NSCU (days)	9	12	7	11
H/O decreased urine output	Yes	Yes	Yes	Yes
Complications	jaundice seizures ICH death	Nil	seizures	seizures DIC jaundice

NSCU = Newborn special care unit; ICH = Intracranial haemorrhage; DIC = Disseminated intravascular coagulopathy

On examination he was emaciated, his weight was 2561 g (birthweight, Bwt 3550g). He was lethargic, icteric and pale. His axillary temperature was 38.2°C, pulse rate 160/min with normal volume femoral pulses, blood pressure 65/48 mm Hg and respiratory rate 60/min. His mucous membranes were dry, his skin was doughy and his anterior fontanelle was sunken. The rest of his physical examination was normal. Laboratory findings are shown in Table 3.

He was initially managed with intravenous fluids (0.45% normal saline) and antibiotics. Water deficit was calculated to decrease serum sodium levels by 10mmol/L over a 24-hour period; in addition, three-quarters fluid maintenance was given. Eight hours after admission he exhibited opisthotonic posturing and his anterior fontanelle was bulging and tense. Shortly after, he had generalized clonic seizures that were resistant to phenobarbitone and required paraldehyde to abort them.

Table 3: Laboratory results in four cases of hypernatraemic dehydration

Results	Case			
	B/O MG	B/O JM	G/O PH	B/O SH
Sodium (mmol/L)	190	182	178	191
Potassium (mmol/L)	5.5	7	9.7	5.5
Chloride (mmol/L)	138	145	135	148
Bicarbonate (mmol/L)	10	5	10	9
Urea (mmol/L)	62.7	35.3	_	58.4
Creatinine (umol/L)	254	171	484	291
Bilirubin Ind (umol/L)	126	_	101	167
Haemoglobin (g/dl)	17	18	16	11.5
Platelets (10^9/L)	149	490	211	60
Cultures	Sterile	Sterile	Sterile	Sterile

Over the following 48 hours, serum sodium levels trended down to a low of 164 mmol/L. However, the infant's respiratory status deteriorated to the point where he required intubation and ventilatory support, which was not available at the time. The infant subsequently died. At autopsy, cerebral oedema and subarachnoid haemorrhage were noted.

Case 2 B/O JM

This term infant presented on day twelve of life with a history of weight loss and not passing stools for nine days. His mother had not observed any reduction in urinary frequency. Medical attention was sought at a general practitioner's office three days prior to presentation and a diagnosis of constipation was made, for which sodium picosulphate was prescribed. Persistence of symptoms prompted the visit to the newborn unit. Tables 1 and 2 describe maternal and neonatal characteristics.

On examination, he was lethargic, emaciated and weighed 2190 g (Bwt 3120 g). He was afebrile and had a pulse rate of 138/min with normal volume femoral pulses. His blood pressure measured 86/60 mmHg and respiratory rate was 46/min. His mucous membranes were dry, and decreased skin turgor was noted: however his anterior fontanelle was flat. The rest of his physical examination was normal. Laboratory features are shown in Table 3.

He was initially managed with intravenous fluids (5% dextrose water in 0.9% normal saline) and antibiotics. Water deficit was calculated to decrease serum sodium levels by 10 mmol/l over a 24-hour period; in addition three quarters fluid maintenance was given. Over the following five days serum sodium levels trended down to a low of 141 mmol/L, his prerenal failure and metabolic acidosis gradually resolved. Enteral feeds were commenced on day two of admission, initially via nasogastric tube and then orally when the infant was sufficiently alert to suck.

His mother received several lactation management consultations and breastfeeding was re-established one week after admission. The infant was discharged home on day 9 of admission being breastfed as well as supplemented with formula feeds; his discharge weight was 2720g. At his last review one month post discharge, he had normal neurological development clinically.

Case 3 G/O PH

This infant presented on day seven of life with a one day history of poor feeding, irritability and lethargy. She was exclusively breastfed and fed two hourly from each breast for approximately 45 minutes. She was always reluctant to discontinue breast feeds; she cried even after feeding and would often fall asleep during feeds. The infant had last passed stool five days prior to admission and her mother changed approximately 3–4 diapers with urine/day. The mother's nipples were flat and this hindered the baby from properly latching on to the breast, resulting in the mother having sore nipples.

On examination, the infant was lethargic, emaciated, hypotonic and centrally cyanosed. She weighed 2440g on admission (Bwt 3310g). Her temperature was 37.2°C and generalized hypotonia and central cyanosis were noted. Her heart rate was 200/min with undetectable peripheral pulses and unrecordable blood pressure. Her mucous membranes were dry, eyes were sunken, skin turgor was decreased and her anterior fontanelle was sunken. The rest of her physical examination was normal. Blood sugar measured by glucometer was 0mmol/L. Table 3 shows laboratory results. Cranial ultrasound and CT brain were normal.

Resuscitative efforts addressed restoring the infant's blood pressure and correcting hypoglycaemia and metabolic acidosis. In addition, a sepsis screen was performed and she received empiric antibiotic therapy. Three hours after admission, she developed seizures, which were controlled with phenobarbitone and phenytoin. Extreme cyanosis of the lower limbs persisted for 48 hours. Over the next four days blood chemistry normalized. Enteral feeds were commenced on day four of admission initially *via* nasogastric tube and then orally.

Her mother received lactation management consultations and breastfeeding was re-established by one week post admission. The infant was discharged home on day 11 of admission. Discharge weight was 3007g and mild truncal hypotonia was still noted. At follow-up visit two months post discharge, psychomotor development and neurological examination were normal.

Case 4 B/O SH

This term infant presented on day 11 of life with a history of poor feeding and lethargy. His mother expressed concern about markedly reduced urine output and stool frequency from birth.

On examination, he was lethargic, emaciated and weighed 2000g (Bwt 2620g). His temperature was 37.2°C, pulse rate134/ min with normal volume femoral pulses, blood pressure 71/42 mm Hg and respiratory rate was 48/ min. His mucous membranes were dry and his anterior fontanelle was sunken. His skin was dry with decreased skin turgor and was doughy in consistency. The rest of his physical examination was normal. Table 3 shows laboratory findings. Cranial ultrasound and abdominal ultrasound were normal.

The infant initially received a bolus of Ringer's Lactate solution 20cc/kg followed by an infusion of 5% dextrose water in 0.9% normal saline. Water deficit was calculated to decrease serum sodium levels by 10 mmol/L over a 24-hour period; in addition three quarter fluid maintenance was given. Eight hours post admission he had a generalized clonic seizure and was given a loading dose of phenobarbitone. Over the following five days, serum sodium levels trended down to a low of 144 mmol/l and his pre-renal failure and metabolic acidosis gradually resolved. Enteral feeds were commenced on day five of admission. His mother received several lactation management consultations. He was discharged home on day 18 of admission with a weight of 2620g. His mother was advised to supplement breastfeeding with formula feeds. Unfortunately she did not keep the follow-up clinic appointment.

All four were term infants who had weight loss of greater than 20% of their birthweight, serum sodium levels greater than 175 mmol/L, metabolic acidosis and pre-renal failure at presentation. Three of the infants had seizures shortly after presentation to hospital. One of the infants died and the other three, at last review, had normal neurological clinical examination.

DISCUSSION

Breastfeeding is undoubtedly the best nutritional choice for the otherwise well newborn and its numerous benefits are well described (5). Major health education initiatives have sought to promote this practice and several institutions worldwide have embraced the Baby-friendly Initiative. In Jamaica, several public awareness campaigns to promote exclusive breastfeeding in the first six months of life have been instituted. However, with the increased promotion of breastfeeding, there arises a need for healthcare workers to become aware of rare but important life-threatening complications of this desired practice.

Hypernatraemic dehydration is a potentially fatal complication of the failure of establishment of breastfeeding especially when recognition of risk factors, signs and symptoms is delayed. The unfortunate demise of B/O MG despite multiple medical visits emphasizes this.

The diagnosis of hypernatraemic dehydration is made when a predominantly breastfed neonate (little or no supplementation with infant formula or water) presents with clinical features of dehydration, at least 10% weight loss and an ele-

vated serum sodium level of greater than 150 mmol/L. Recognized complications of hypernatraemic dehydration include renal failure, jaundice, coagulopathy, dural thromboses, intraventricular haemorrhage, seizures, brain damage and death (2, 3, 6–8).

The characteristic maternal profile of the "at risk neonate" has been described in reports (2). These mothers are usually primigravid women who are highly motivated to breastfeed but have either decreased milk production or have nipple-related abnormalities that create feeding diffi-culty and result in inadequate fluid and caloric intake in their infants. Prior breast surgery, inverted nipples, very large nipples or incorrect latching technique have all been recognized as factors contributing to insufficient feed intake (9, 10). Occasionally, other factors that interfere with the baby's appetite or ability to suck such as neurological abnormalities or sepsis may predispose to failure in establishing breastfeeding (2). Three of the mothers in the present case series were primigravid, the other mother had a pregnancy six years previously. All the above cases had identifiable feeding problems related to breast anatomy or feeding technique.

Most infants with hypernatraemic dehydration are healthy term infants who are discharged home a few days after birth and hungrily suck at the breast for long periods but demonstrate failure to thrive. They usually fail to meet the minimum requirement of six wet diaper changes per day and may have infrequent stools. By the time they present to hospital, significant weight loss in excess of 10% of their birthweight has occurred. Jaundice, renal failure and seizures are recognized complications, however neurological complications may identify those infants at higher risk for mortality (2, 3, 6–8). The presence of seizures in the fatal case concurs with this finding. The age at presentation of the babies in this series, the presenting clinical features, the complications seen and the outcome are similar to those described in the literature.

Prevention of mortality and morbidity related to breastfeeding failure must begin with education and follow through with a targeted approach that identifies high-risk mothers and infants. Antenatal preparation of mothers should include an introduction to breastfeeding techniques and proper preparation of the breast. First-time mothers should not be discharged from hospital until proper breastfeeding technique is observed. Mothers with identifiable problems should be referred promptly to lactation management specialists and close follow-up should be maintained following discharge. In addition, all mothers should be educated about the features that may indicate inadequate intake and advised about the importance of seeking medical attention early.

This case series highlights an uncommon but easily preventable complication of breastfeeding that is associated with mortality and significant morbidity. It is important that physicians and nurses become aware of the risk factors and clinical features of breastfeeding failure so that prevention and early intervention can be maximized.

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