

Original Research Article

Clinical profile and outcome of neonates admitted in sick newborn care unit with hypernatremic dehydration and association with breastfeeding in a tertiary care hospital in Northern India

Mohit Bajaj¹, Chiranth R.^{2*}, Swati Mahajan¹, Pancham Chauhan³

¹Department of Pediatrics, Dr. RPGMC Tanda at Kangra, Himachal Pradesh, India

²Department of Pediatrics, BGS Global Institute of Medical Sciences, Bengaluru, Karnataka, India

³Department of Pediatrics, Indira Gandhi Medica College, Shimla, Himachal Pradesh, India

Received: 31 March 2021

Accepted: 07 May 2021

*Correspondence:

Dr. Chiranth R.,

E-mail: chiranthspc@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Neonatal hypernatremic dehydration is a very commonly seen potentially devastating condition. Inadequate breastfeeding, gastrointestinal losses, warm weather and improperly diluted mixed feeding are the main etiologies linked with neonatal hypernatremic dehydration. We conducted this study to evaluate the etiology, risk factors, clinical symptoms and outcomes of neonates admitted with hypernatremic dehydration and its association with breastfeeding from hilly region in northern India.

Methods: The authors retrospectively studied records from extramural sick newborn care unit (SNCU) from April 2018 to June 2019. Inclusion criteria for the study included admitted neonates with documented hypernatremia (serum sodium level >145 mmol/L).

Results: Nine hundred and twenty-two neonates were admitted in sick newborn care unit during this study period. One hundred and three (13.39%) newborns were admitted with hypernatremic dehydration at the time of admission. All newborns had deranged kidney function tests at time of admission. Most commonly found presenting complaints were poor feeding (85.71%), fever (45.71%), loose stools (42.8%) and decreased urine output (8%). The mean (SD) sodium on admission was 154.04 (7.41) meq/L. The mean (SD) time taken to correct hypernatremia was 35.6 (14.6) hours. Six of total admitted newborn developed neurological complications (2 had developed cerebral venous thrombosis and 4 had developed seizures). Mortality rate was 4.4%. Top fed neonates (50.41%) had higher percentage of mean sodium level and acute kidney injury at time of admission.

Conclusions: Hypernatremic dehydration is preventable and treatable condition. Looking in to and addressing etiology in a timely manner is main step in management. All mothers should be taught correct breastfeeding technique. More breast examination during prenatal and postnatal periods and careful neonatal weight record postnatally could decrease the incidence of neonatal hypernatremic dehydration. Top feeding should be discouraged and only exclusive breastfeeding for 6 months.

Keywords: Hypernatremia, Dehydration, Breastfeeding

INTRODUCTION

Hypernatremic dehydration is a commonly seen preventable lethal condition and is associated with

complications like seizures, intracranial hemorrhage, and thrombosis.¹ It is one of the most common causes of NICU admissions these days. Inadequate breastfeeding, gastrointestinal losses, warm weather, and improperly

diluted mixed feeding are the main etiologies for neonatal hypernatremic dehydration.¹ Hypernatremia was previously thought to be unusual in breast-fed babies but an increase in the number of breastfed infants reported to have hypernatremia and hypernatremic dehydration in the last two decades.¹ The condition carries acute morbidity and mortality.²

Initial contact between the mother and infant should take place in the delivery room, and opportunities for extended intimate contact and breastfeeding should be provided within 1st hour after birth. Breastfeeding is usually given on demand every 2 hourly. It is normal for a newborn in the first week of life to lose as much as 10% of its birth weight through normal diuresis.³ Neonates should start to gain weight thereafter and regain their birth weight by the 10 days of life. Rapid weight loss >10% of birth weight is a cause for concern. Decreased awareness regarding this clinical entity results in many cases that tend to be missed or wrongly diagnosed as sepsis due to common non-specific clinical features like lethargy, irritability, oliguria, fever associated with both conditions.^{4,5}

It has been seen that early postpartum hospital discharge does play a role in the establishment of breastfeeding and contributes to increased neonatal morbidity.⁶ Also, there is a belief in mothers that in the early days of the breastfeeding mother milk supply is inadequate which can lead to the baby not gaining weight, thus leading to the initiation of bottle feeding.⁷ In contrast, other mothers which have a good establishment of breastfeeds are aware of the unique benefits of breast milk and persist with exclusive breastfeeding, and are reluctant to give additional formula despite excessive neonatal weight loss. These babies are in danger of serious weight loss and hypernatremic dehydration, with the potential permanent neurological and vascular damage if their condition isn't recognized and treated early.⁸ one important hospital practice to encourage successful breastfeeding and in turn reducing the incidence of neonatal hypernatremia is rooming-in of newborns with their mothers. therefore, it should be encouraged that term, healthy infants remain continuously within the mother's room whenever possible.

The purpose of this study was to identify various possible causes of breastfeeding malnutrition that resulted in neonatal hypernatremic dehydration and to study the association of breastfeeding with dehydration.

METHODS

This was a retrospective study done over one year (April 2018 -June 2019) at a tertiary care institute Indira Gandhi medical college, Shimla in Northern India from the sub-Himalayan belt.

Inclusion criteria for the study includes all newborns (<28 days of life) admitted to SNCU and newborns with

documented hypernatremia at the time of admission. Newborns with blood culture-proven sepsis, newborn with birth weight (<1500 gram), newborn with perinatal asphyxia and newborn referred to institute having received I V fluids within 48 hours before the diagnosis of hypernatremia is made were excluded from the study.

Data regarding gender, maternal age, gestation age in weeks, mode of delivery, birth weight, the weight of the baby at admission, and feeding method were recorded in a structured case record Performa.

The total weight loss and weight loss per day were calculated as a percentage of the birth weight. Excess weight loss was defined as a total weight loss of more than 10%.

Axillary temperature >38°C was considered a fever. The rate of decline in serum sodium was calculated using the sodium before and after treatment and the time taken to achieve it. Acute kidney injury (AKI) was diagnosed as per guidelines.⁹ Jaundice treated with phototherapy was considered as significant. Hypernatremia is categorized into mild (145-160 meq/L), moderate (160-170 meq/L), and severe (>170 meq/L).⁷ At the time of discharge, babies were said to have improved if their serum sodium level was <150 meq/L and was taking feeds well.

Details regarding the duration of hospital stay, complications during the hospital stay, and neurological outcomes were also recorded.

The data were tabulated using an excel sheet and statistical work completed through SPSS software version 24.

RESULTS

Out of 922 admissions during one year period, 123 newborns were admitted with hypernatremia out of which 103/123 (83.70%) were full term newborns.

Table 1: Association of hypernatremia with gestational age, birth weight, parity and mode of delivery.

Gestational age (weeks)	No. of patients	Percentage (%)
Term (37-42)	103	83.70
Preterm	20	16.26
Term AGA	33	26.82
Term SGA	70	56.90
Preterm AGA	17	13.82
Preterm SGA	3	2.43
Primiparous	107	86.90
Multiparous	16	13.10
LSCS	29	23.57
Vaginal delivery	94	76.42

AGA-appropriate for age, SGA-small for gestational age, LSCS-lower segment caesarean section.

Out of the 103 term newborns, the number of term SGA newborns with hypernatremia was more than double of the number of term AGA newborns (57% versus 27%). Importantly, out of 20 preterm newborns, 17 (85%) of preterm SGA newborns presented with the hypernatremia.

Majority of newborns (87%) admitted were borne to primigravida mothers. Nearly three-fourths of newborns (76.42%) were delivered by vaginal route.

Table 2: Demographic and clinical features of newborns admitted.

Clinical features	Variables
Mean age of presentation (days)	10.5
Male/female	(78/55) 1.4: 1
Mean age of mother (year)	26.1
Rural/urban	1:1.3
Exclusively breastfeeding	61/123 (49.59%)
Mean weight loss (%)	15.6
Number of babies with more than 15% weight loss	71 (57.7)

The mean age on admission was approximately 10-11 days with male to female preponderance of 1.4:1. The mean age of the mother was 26 years.

The approximate weight loss of the baby from birth up to the time of admission was approximately 15%.

Table 3: Clinical features in newborns with hypernatremia.

Signs and symptoms	No. of newborns	Percentage (%)
Poor feeding	105	85.71
Fever	56	45.71
Jaundice	52	42.8
Decreased urine output	25	20.5
seizure	4	0.03

Table 4: Severity of hypernatremia in admitted newborns.

Parameters	No. of patients	Percentage (%)
Serum sodium (meq/l)		
Mild hypernatremia (145-149)	68	56
Moderate hypernatremia (150-169)	52	42.27
Severe hypernatremia (>170)	3	3.69

Baby not feeding well and hyperthermia made the attenders to seek medical care. Hence, the most common

presenting complaint was poor feeding (85.71%) followed by fever (45.71%).

Mean (SD) sodium on admission was 154.04 (7.41) mEq/L. However more than half of the newborns had mild hyponatremia (defined as serum sodium concentration of 145 to 149 mEq/L). Three out of the 123 newborns had severe hypernatremia at the time of admission.

Table 5: Comparison between mean sodium values and kidney function tests between exclusive breast-fed neonates and top fed neonates.

Parameter	Exclusively breast fed, (n=61)	Top fed (formula fed and cow's milk), (n=62)	P value between breastfed and top fed neonates
Serum sodium (mEq/l)	152.52	159.5	0.00001
Serum creatinine (mg/dl)	1.44	1.91	0.0002
Serum urea (mg/dl)	22.6	28.33	0.000015

All newborns had deranged kidney function tests at the time of admission but reversed after treatment of dehydration except three newborns who required peritoneal dialysis.

On performing, unpaired t test, newborns who were top-fed had significantly more severe hypernatremia and the deterioration of kidney functions was statistically significant when compared to newborns who were exclusively breast-fed.

Table 6: Neurological complications in neonates with hypernatremia.

Neurological complications	Number	Percentage (%)
Seizures	4/123	3.25
cerebral venous thrombosis	2/123	1.62

Six/123 (4.87%) of newborns developed neurological complications.

Table 7: Final outcome of neonates with hypernatremia.

Final outcome	Number	Percentage (%)
Improved	118	95.50
Death	5	4.40

Nearly 96% of newborns who were admitted and had hypernatremia improved with subsidence of symptoms. Mean (SD) time taken to correct hypernatremia was almost 35.6 (14.6) hours.

DISCUSSION

Breast feeding is considered to be the best and safest way to feed neonates. Human milk is low in sodium, which mitigates against the possible development of hypernatremia in breast fed neonates.³ Compared to cow's milk, human milk contains considerably less sodium, potassium and chloride.³ Low level of maternal knowledge in lactation, cesarean delivery and failure of early post-natal follow up was related to the neonatal dehydration. Decreased urine and stool frequency might be considered as a warning for failure of lactation.⁴⁻⁷

Present study included 123 newborns admitted with hypernatremia. The mean age of presentation was 10.5 days with minimum 3 days of life with and maximum 28 days which is in concordance with studies done by Livingstone et al (8 days) and Hassan Boskabadi et al (9 days).^{10,11}

There was a slight preponderance of males (63%) over females (37%), which is in agreement with study conducted by Boskabadi et al (44% females), Moritz et al (48% females).¹¹ This is due to lower number of males getting admitted during our study period. In addition, we studied the relationship of gender distribution in relation to sodium levels, but there was no statistically significant difference in the distribution ($p=0.620$).

Our study concluded that term SGA newborns had highest association with hypernatremia (56.9%) which can be explained by problems in breastfeeding in latching and suckling in low-birth-weight newborns. Association of low birth weight, feeding difficulties and hypernatremia has been noted in studies on exclusively breast-fed infants by Kaplan et al and Chilton et al.^{12,13}

86.9% of our admitted newborns were 1st born. These results were comparable with Moritz et al (66.9% first born).¹⁰ Strong association with primiparous mother (86.9%) further highlights the feeding problems due to improper attachment and positioning and need of breastfeeding counseling among primiparous mothers.

76.42% of newborns were borne by vaginal route which again points out importance of establishment of breastfeeding in hospital.¹⁰ Mostly in our set up due to high load of deliveries discharge is done by 24-48 hours whereas in caesarean section discharge is done on 5th day.

Most of our mothers admitted belonged to rural areas (1.3:1) which indicates late recognition of symptoms with hypernatremia. This could be due to the fact that hypernatremic dehydration shows mild signs of dehydration initially despite a huge water loss from body

because of preserved intravascular volume, secondary to shift from intravascular compartment. Our observation is similar to other studies.¹⁴

Mean weight loss was observed to be 15.6% and 57.7% of newborns had weight loss more than 15% which is in concordance with studies reporting that newborn presenting at a later age have more severe weight loss and hypernatremia.¹⁵

At admission poor feeding, fever, jaundice, and dehydration were common symptoms in 85% of newborns. About 15 % of newborns admitted were asymptomatic which is similar to study done by Uras et al (14%).¹⁶

68/123 (56%) neonates were admitted with mild hypernatremia. 52/123(52%) with moderate hypernatremia and only 3 newborns were admitted with serum sodium >170 meq/l. Mean (SD) sodium at admission was 154.04 meq/l.

Out of 123 newborns, 61(49.59%) were exclusively breast fed and 62 (50.41%) newborns were on top feeds. We found significantly more severe hypernatremia in top fed newborn as compared to breast fed newborn (159.5 meq/l vs 152.52 meq/l) ($p=0.00001$). Altered kidney function tests were more seen among top fed newborns as well ($p=0.0002$). These reports are similar to results seen in study by Shah et al.¹⁷

Fifty six percent neonates admitted with mild hypernatremia, 52% with moderate hypernatremia and only 3 newborns were admitted with serum sodium >170 meq/l. mean (SD) sodium at admission was 154.04 meq/l. out of 123 newborns, 61 (49.59%) were exclusively breast fed and 62 (50.41%) newborns were on top feeds. We found significantly severe hypernatremia and altered kidney function tests among top fed newborns compared to exclusively breast-fed newborns.

All newborns had deranged renal function tests at admission but only 3 newborns required peritoneal dialysis during hospital stay and rest improved once dehydration once corrected 0.95.5% newborns were discharged successfully after adequate weight gain. Two newborns who developed cerebral venous thrombosis and 3 newborns who required peritoneal dialysis succumbed.

Hypernatremia is a lethal condition results in cerebral edema, intracranial hemorrhage, seizures, disseminated intravascular coagulation and eventually death. However clinical presentation of hypernatremic dehydration is usually around ten days with range from 3 to 21 days. Major complications are central pontine myelinosis and hyperglycemia, hypocalcaemia, renal tubular injury and renal vein thrombosis. it is a medical emergency with high rates of mortality and morbidity.⁶ For survival and better prognosis of neonates with hypernatremic dehydration early diagnosis and treatment plays a very

crucial role. Mother should be educated about signs and symptoms of dehydration before discharge after delivery.

CONCLUSION

Hypernatremic dehydration is a preventable and treatable condition. Looking in to and addressing the etiology in a timely manner is the major step in the management. Regular weight monitoring and breast examination in the prenatal and postnatal periods could decrease the incidence of hypernatremic dehydration in neonates. Mother should be encouraged to exclusively breast feed the baby for first 6 months. All mothers should be taught correct feeding method like proper positioning and attachment. Limitations of the study include its retrospective design, lack of late neurodevelopmental outcomes.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Laing IA, Wong CM. Hypernatremia in the first few days is the incidence rising. Arch Dis Child Fetal Neonatal Ed. 2002;87:F158-62.
2. Salim N, Jaiswal AN. Hypernatremia in the neonate: neonatal hypernatremia and hypernatremic dehydration in neonates receiving exclusive breastfeeding. Indian J Crit Care Med. 2017;21(1):30-3.
3. Clarke TA, Markarian M, Griswold W, Mendoza S. Hypernatremic dehydration resulting from inadequate breastfeeding. Pediatr. 1979;63:931-2.
4. Rowland TW, Zori RT, Lafleur WR, Reiter EO. Malnutrition and hypernatremic dehydration in breast-fed infants. JAMA. 1982;247:1016-7.
5. Thullen JD. Management of hypernatremic dehydration due to insufficient lactation. Clin Pediatr. 1988;27:370-2.
6. Lock M, Ray JG. Higher neonatal morbidity after routine early hospital discharge: Are we sending newborns home too early? CMAJ. 1999;161(3):249-53.
7. Gussler JD, Briesemeister LH. The insufficient milk syndrome: A bicultural explanation. Med Anthropol. 1980;145-74.
8. Roddy OF, Martin ES, Swetenburg RL. Critical weight loss and malnutrition in breastfed infants. Am J Dis Child. 1981;135:597-9.
9. Subramanian S, Agarwal R, Deorari A, Paul V, Bagga A. Acute renal failure in neonates. Indian J Pediatr. 2008;75:385-91.
10. Michael LM, Mioara DM, Debra LB, Carlos Ayus J. Breastfeeding-associated hypernatremia: are we missing the diagnosis? Pediatrics. 2005;116(3):6:e343-7.
11. Mansour, Ghayour-Mobarhan M, Esmaeily H, Sahebkar, Amirhossein, Ferns, Gordon AA. Neonatal Hypernatremia and Dehydration in Infants Receiving Inadequate Breastfeeding. Asia Pacific J Clin Nutr. 2010;19:301-7.
12. Kaplan JA, Siegler RW, Schmunk GA. Fatal hypernatremic dehydration in exclusively breast-fed newborn infants due to maternal lactation failure. Am J Forensic Med Pathol. 1998;19(1):19-22.
13. Chilton LA. Prevention and Management of hypernatremic dehydration in breast fed infants. West J Med. 1995;163(1):74-6.
14. Ahmad Bhat S, Hassan ZS, Ahmad Tak S. Clinical profile and outcome of neonates with hypernatremic dehydration-a tertiary care hospital-based study. Int J Contemporary Med Res. 2019;6(2):B1-4.
15. Oddie SJ, Craven V, Deakin K, Westman J, Scally A. Severe neonatal hypernatremia: a population-based study. Arch Dis Childhood Fetal Neonatal Ed. 2013;98(5):F384-7.
16. Yang WC, Zhao LL, Li YC, Chen CH, Chang YJ, Fu YC et al. Bodyweight loss in predicting neonatal hyperbilirubinemia 72 hours after birth in term newborn infants. BMC Pediatr. 2013;13:145.
17. Shah RH, Javadekar BB. Clinical profile and outcome of neonates admitted during summer months with dehydration and hypernatremia in tertiary care hospital of central Gujarat, India. Int J Contempo Pediatr. 2018;5(3):761-3.

Cite this article as: Bajaj M, Chiranth R, Mahajan S, Chauhan P. Clinical profile and outcome of neonates admitted in sick newborn care unit with hypernatremic dehydration and association with breastfeeding in a tertiary care hospital in Northern India. Int J Contemp Pediatr 2021;8:1074-8.