Original Research Article

DOI: http://dx.doi.org/10.18203/2349-3291.ijcp20190227

Clinical profile of neonates admitted with hypernatremia in NICU at tertiary hospital in Vadodara, Gujarat, India

Nimisha Pandya*, Kedar G. Mehta

Department of Pediatrics, GMERS Medical College, Gotri, Vadodara, India

Received: 09 January 2019 Accepted: 16 January 2019

*Correspondence: Dr. Nimisha Pandya,

E-mail: nimisha.pandya@hotmail.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 hypernatremia is less common but significant metabolic problem with acute morbidity as well as long term consequences. Many causative factors have been identified such as inadequate breastfeeding, hot weather with high evaporative losses, infections etc. It is important to identify, anticipate and correct the condition before it leads to damaging consequences. The objective of the present study was evaluation of clinical profile, renal parameters and causative factors associated with hypernatremia in exclusively breast-fed infants.

Methods: A retrospective review of 30 new-borns less than 28 days of age admitted in GMERS General hospital for hypernatremia was conducted. The study group included inborn and out born admissions. Records were reviewed, feeding history, severity of hypernatremia and altered renal parameters were analysed. The study period was from April 2018to June2018i.e summer months.

Results: Total NICU admissions were 303 during these months out of which 30 were diagnosed with hypernatremia completely and discharged. Mean age of presentation was 8.4 days. Sodium levels ranged from 146-179 mmol/l. Mild hypernatremia was most common (56.7%), followed by moderate hypernatremia in 40%. All neonates were on exclusive breast feeding. Majority of the affected neonates were term SGA followed by term AGA and preterm AGA. Renal parameters were altered in quarter of affected infants. Most common clinical feature noted was lethargy(70%), followed by fever(53.3%), significant weight loss , jaundice and dehydration. 29 patients were successfully discharged on breast milk feeding.

Conclusions: Hypernatremia though rare, is common in young infants in summer months. It is preventable and treatable condition. It is important to anticipate, identify and treat such patients at the earliest. Treating physicians and nursing staff should be more vigilant for establishment of breast feeding in low birth weight infants. Exclusive breast feeding for first six months of life should always be promoted.

Keywords: Dehydration, Exclusive breast feeding, Hypernatremia, Low birth weight

INTRODUCTION

Neonatal hypernatremia is defined as a serum concentration of >145mEq/L.¹ Hypernatremia develops when water is lost, and excess of sodium is present (hypernatremic dehydration) or sodium intake exceeds sodium losses (salt poisoning) or both. Water loss and excess of sodium is most commonly caused by diarrhea, vomiting or high-grade fever. On the other hand, improper preparation of formula resulting in concentrated formula can cause solute overload.

Recent studies point towards inadequate feeding in early days of life in term babies as well as low birth weight babies as a cause of hypernatremic dehydration. It is normal for a term newborn to lose 1-3% of birth weight every day till 1 week through normal diuresis and regain birth weight by day 10 (physiological weight loss). Rapid

weight loss (>3%/day) or excessive weight loss (>10%) should attract attention to look for dehydration and feeding problems. A trend of increase in number of exclusively breast-fed babies with hypernatremia is being observed. The sodium content of breast milk at birth is high and shows a rapid decline from 22 mmol/l in colostrum to 13mEq/l in transitional milk and finally 7 mmol/l in mature milk.^{1,2} Inadequate breastfeeding, in the form of delayed first feed, improper attachment, and decreased frequency of feeds results in delayed physiological decrease in breast milk concentration. Evidence suggests that the most common cause of hypernatremic dehydration in neonates is due to decreased volume intake of breast milk due to inadequate breast emptying due to improper feeding technique. Infant becomes dehydrated as kidneys are mature to retain sodium while insensible losses occur through skin and lungs. Exclusive breast feeding associated with hypernatremia in study by Hassan was 3.1% which was higher than incidence of elevated sodium in older children.3 A study done by Dewey KG et al showed that neonates of mothers with delayed lactation had 7.1 times more increased weight loss than the neonates without risk factors. Weight loss observed was more in neonates with suboptimal breastfeeding on day 0.4

Neonatal dehydration develops over 3 to 21 days, mean age being 10 days. Infant presents with anaemia, oliguria, irritability, lethargy, poor feeding, seizures, spasticity, doughy skin texture and weight loss. Intracranial hemorrhage, acute renal failure due to tubular necrosis, cerebral edema and hydrocephalus are less common but major complications of hypernatremia. Since the clinical features are similar to other common medical conditions, sepsis, meningitis and intracranial pathology should be ruled out.⁵

Hypernatremia is often associated with renal profile alteration, presenting as additional lab findings like elevated BUN, increase in glucose, and decrease in calcium if potassium is low. The management of hypernatremia is different than treatment of pure hypovolemic shock. Hypernatremia leads to an efflux of fluid from intracellular to extracellular compartment leading to transient cell shrinkage and cerebral volume decrease. Prolonged hypernatremia can cause increased production of idiogenic osmoles that help in restoring brain volume. Rapid correction of hypernatremia or administration of excessively hypotonic fluids may lead to brain edema and pontine mylenolysis due to inability of brain to remove idiogenic osmoles. The fluid of choice for correction of hypernatremia is 0.9% normal saline followed by hypovolemic saline (0.3% to 0.45% of NS). Volume restoration is an emergency in severely dehydrated infants with 0.9% Normal Saline as bolus of 20ml/kg. This should be followed by 1.3 to 1.4 times 0.45 DNS calculated as per fluid deficit. Reestablishment of plasma tonicity may lead to deleterious consequences, if it is not done appropriately. It is recommended that Serum sodium drop should not be more than 0.5meg/l per

hour i.e. 10-12 mEq/day. Along with sodium levels, body weight, S. electrolytes, urine output and specific gravity must be monitored regularly. Extreme hypernatremia (Sodium >200 mEq/L) should be treated with peritoneal dialysis and managed over 2 to 3 days.⁶

METHODS

Study design

Retrospective cohort study, hospital based.

Study center NICU at GMERS Medical College and General Hospital, Gotri, Vadodara, Gujarat. Study period was between April 2018 to June 2018 (summer months). The study population-all newborns admitted in NICU age including inborn and outborn admissions.

Inclusion criteria

- Age <28 days old,
- Serum sodium >145mmol/l.

Exclusion criteria

• Not fulfilling inclusion criteria.

Methodology

Retrospective analysis 30 new-borns diagnosed with hypernatremia during the months of April to June 2018 was done. New-borns presenting with hypernatremia were those referred from postnatal ward on 3rd to 7th day of life or out born admissions. Complete blood count, sepsis screen, RBS, blood urea, serum creatinine, and serum electrolytes (Na, K, Ca) was reviewed from cases. Breast milk sodium levels could not be assessed due to lack of lab support. The symptoms and signs noted were oliguria, irritability, lethargy, poor feeding, seizures, spasticity, doughy skin texture and weight loss. Birth weight and detailed history was elicited. Dietary history regarding pre-lacteal feeds, type, mode, frequency and amount of feeding was elicited and recorded. Physical examination was done, and signs of hypernatremia were assessed. Severity of dehydration, weight loss, temperature and urine output was assessed. All patients were classified as mild, moderate and severe hypernatremia according to serum sodium levels as follows:

- S Na <135-Hyponatremia
- S Na 135-145-Normal
- S Na 146-149-Mild hypernatremia
- S Na 150-169 Moderate hypernatremia
- S Na >170-Severe hypernatremia

Breast feeding was ensured in all babies who recovered from morbidity. Breast milk feeding was initiated once patient recovered from acute morbidity. Term AGA were started on direct breast feeding while term SGA were given measured spoon feeds with expressed breast milk along with active breast feeding. Correct position and attachment was taught to mothers. All mothers were counselled regarding the advantages of breast feeding.

RESULTS

Mild hypernatremia was observed in majority of the cases followed by moderate hypernatremia, while severe hypernatremia was observed in 1 case. All neonates were exclusively breast fed which strongly suggests that exclusive breast feeding does not cause severe hypernatremia (Table 1).

Table 1: Severity of hypernatremia.

S. Sodium	No. of patients	(%)
Mild Hypernatremi (145-149)	17	56.7
Moderate Hypernatremia (150-169)	12	40
Severe Hypernatremia ≥170	01	3.3

The results show that hypernatremia is strongly correlated with small for gestattioal age newborns ,term and preterm. Primipara mothers also show strong association with hypernatremia in newborns (Table 2).

Table 2: Association of hypernatremia with gestational age, birth weight, and parity.

Gestational age	No. of patients	(%)
Term (37-42 weeks)	26	86.7
Preterm (<37 weeks)	04	13.3
Term AGA	08	30.8
Term SGA	18	69.2
Preterm AGA	03	75
Preterm SGA	01	25
Parity	N	(%)
Primiparous	23	76.7
Multipara	07	23.3

Altered renal profile was observed in 28% cases which was similar to the incidence in other studies. Altered Bl. Urea was observed more as compared to S. creatinine or Potassium elevation suggesting pre-renal failure (Table 3).

Table 3: Altered renal profile in neonates with hypernatremia.

Altered renal parameter	n	(%)
Bl. Urea	7	23.6
S. Creatinine	5	16.6
S. Potassium	5	16.6

The most common presenting complaint was lethargy or not feeding well and weight loss. Hyperthermia was also a significant complaint. Hyperthermia and not feeding well draws the attention of the caregiver to consult for medical care. Jaundice was observed in 40% of the cases and dehydration in 30% newborns (Table 4).

Table 4: Clinical features in patients with hypernatremia.

Signs and symptoms	No. of patients	(%)
Lethargy	21	70
Hyperthermia	16	53.3
Jaundice	12	40
Seizures	02	6.7
Weight loss (>15%)	18	60
Dehydration	09	30
Encephalopathy	01	3.3

DISCUSSION

Hypernatremia is a rare but known entity in neonates. It has been attributed to inadequate breast milk production as well as high breast milk sodium. Hypernatremia has been observed in exclusively breast-fed infants with no risk factors in many studies, thus suggesting a strong association between breast milk Na and occurrence of hypernatremia. Low birth weight babies, especially term SFD are prone to develop metabolic abnormalities due to inadequate feeding as they are weak to attach and suckle effectively.⁷

Present study included 30 neonates presenting with hypernatremia. All neonates were exclusively breast fed. The gender profile was(M:F) 1:1.2. Age at diagnosis ranged from 3-18 days of life with mean age 8.4 days. Mean age was similar to 10.5 days observed in study by Shah RH.⁸ Bolat F. reports similar age of presentation, 2 to 21 days in their study. Clinical presentation of these babies is usually between first to third week of life with severe dehydration and lethargy in studies by Sofer S and Kini N.^{10,11} Gestational age ranged from near term 36 weeks to 41 completed weeks. 86.7% neonates were term out of which 69.2% were small for gestational age (SFD). 4 near term newborns were also diagnosed with hypernatremia. Highest association of hypernatremia was found with term SGA. This can be explained by the problems in breast feeding like difficulty in latching and tiring on suckling in low birth weight infants. Failure to recognize breast feeding problems and not adding measured spoon feeding leads to development of hypernatremia in these young infants. Association of low birth weight, feeding difficulties and hypernatremia has been noted in studies on exclusively breast-fed infants by Kaplan JA et al and Chilton LA et al. 12,13

Another strong association found was development of hypernatremia in patients born to primiparous mothers, (76.7%) which points to feeding problems related to attachment and positioning as these mothers are anxious and not as adept at breastfeeding as a multiparous mother. The most common presenting clinical feature was lethargy or not feeding well (70 %),followed by significant weight loss (60%), fever (53.3%) and jaundice

(40%). Weight loss was noted in 60% neonates which was higher than observed in study by Shah RH (46.4%). 30% cases presented with dehydration. Seizures were observed in 6.7% newborns. Hypernatremia was observed in 9.9 % patients. Wang et al and Shah et al report an incidence of hypernatremia as 2.3/1000 and 6.45% respectively. 14 Prevalence of hypernatremia was 1.8% in study by Bolat F. The incidence is higher in Indian studies due to the hotter summer conditions in our 56.7% neonates presented with mild country. hypernatremia and 40% presented with moderate hypernatremia. Sodium elevation more than 170 was present in 1 patient only. Successful discharge was observed in 96%% patients. 1 patient presenting with severe hypernatremia and encephalopathy requiring peritoneal dialysis succumbed. Altered renal profile was noted in 28% patients compared to 35.7% and 22% in study by Shah RH and Bolat F et al respectively. The occurrence of altered renal profile was similar to the incidence of dehydration in present study. S. creatinine and potassium elevation was noted in 17% of patients but was reversed after dehydration was corrected.

CONCLUSION

Hypernatremia in neonates, though rare, is common in our country especially during summer months due to the higher temperature conditions. Exclusive breast feeding is strongly recommended to reduce neonatal morbidity and mortality in developing countries like India, Special attention to successful establishment of breast feeding, especially in low birth weight infants can prevent this condition. Excessive weight loss in a healthy child should also direct our attention to hypernatremia. Management of hypernatremia requires strict fluid monitoring. It is preventable and treatable if recognised early. Failure to recognise or treat can lead to sever acute morbidity and long-term sequel too.

Funding: No funding sources Conflict of interest: None declared

Ethical approval: The study was approved by the

Institutional Ethics Committee

REFERENCES

- Choukair MK.Fluids and electrolytes.In:Siberry GK,editor.The Harriet Lane Handbook. 15th ed. London; Mosby Publishers. 2000.pp 232-3
- 2. Koo WW, Gupta JM .Breast milk sodium. Arch Dis Child.1982;57(7):500-2.
- 3. Boskabadi H, Godarzi M, Zakerihamidi M. The study of the relationship between hypernatremia in neonates and mode of maternal breast feeding in

- hospitalized infants in Ghaem Hospital of Mashhad, Iran. Iran J Obstet, Gynecol, Infertil. 2014;16(90):1-9
- Dewey KG, Nommsen-Rivers LA, Heinig MJ, Cohen RJ, Risk factors for suboptimal infant breastfeeding behavior, delayed onset of lactation, and excess neonatal weight loss Pediatrics 2003 112(3):607-19.
- 5. Yassen H, Salem M, Darwich M. Clinical presentation of hypernatremic dehydration in exclusively breast-fed neonates. Indian J Pediatr.2004;71(12):1059-62
- 6. Bischoff AR, Dornelles AD, Carvalho CG. Treatment of Hypernatremia in Breastfeeding Neonates: A Systematic Review. Biomedicine Hub. 2017;2(1):3.
- 7. Das JC. Hypernatremic Dehydration in newborn infants. Ulutas Med J. 2015;1(2):22-5.
- 8. 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 Contemo Pediatr. 2018;5(3):761-3.
- 9. Bolat F, Oflaz MB, Güven AS, Özdemir G, Alaygut D, Dogan MT, Içagasoglu FD, Cevit Ö, Gültekin A. What Is the Safe Approach for Neonatal Hypernatremic Dehydration?: A Retrospective Study From a Neonatal Intensive Care Unit. Pediatric Emerg Care. 2013;29(7):808-13.
- 10. Sofer S, Ben-Ezer D, Dagan R. Early severe dehydration in young breast-fed newborn infants. Isr J Med Sci. 1993;29(2-3):85-9
- 11. Kini N, Zahn S, Werlin SL. Hypernatremic dehydration in breast fed infants. Wis Med J. 1995;94:143-14593;29(3):85-9.
- 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. ChiltonLA.Prevention and Management of hypernatremic dehydration in breast fed infants.West J Med.1995:163(1):74-6.
- 14. Wang AC, Chen SJ, Yuh YS, Hua YM, Lu TJ, Lee CM. Breast feeding associated neonatal hypernatremic dehydration in a medical center: a clinical investigation. Acta Paediatr Taiwan. 2007;48(4):186-90.

Cite this article as: Pandya N, Mehta KG. Clinical profile of neonates admitted with hypernatremia in NICU at tertiary hospital in Vadodara, Gujarat, India. Int J Contemp Pediatr 2019;6:436-9.