

**Clinico-Etiological Profile of Hypernatremic Dehydration in Exclusively Breastfed Neonates: An Observational Study**Sridhar P V<sup>1</sup>, Ishrath Fathima T M<sup>2</sup>, Sandeep M<sup>3</sup><sup>1</sup>Associate Professor, Department of Paediatrics, Mandya Institute of Medical Sciences, Mandya<sup>2</sup>Senior Resident, Department of Paediatrics, Koppal Institute of Medical Sciences, Koppal<sup>3</sup>Assistant Professor, Department of Paediatrics, Mandya Institute of Medical Sciences, Mandya

Received: 25-01-2024 / Revised: 23-02-2024 / Accepted: 26-03-2024

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Conflict of interest: Nil

**Abstract:**

**Background:** Hypernatremic dehydration is defined as serum sodium >145 mEq/L with signs of dehydration like fever, weight loss, lethargy, depressed anterior fontanelle, increase skin turgor, dry mucus membrane. Risk factors are found to be due to inadequate breastfeeding, insufficient milk secretion often in primi-parous mother, post LSCS, summer season. Early diagnosis and proper fluid management is cornerstone of good outcome in hypernatremic dehydration.

**Methods:** A prospective observational study involving neonates with birth weight more than 2 kg and gestational age of > 34 weeks, on exclusive breastfeeding was conducted. Data was collected in a structured questionnaire, details of serum electrolytes, renal function test and serum bilirubin were collected. Regular weight monitoring and urine output monitoring of the babies were done. Data was entered into Microsoft Excel data sheet and was analyzed using SPSS 22 version software.

**Results:** Hypernatremic dehydration is more common in neonates born to primi mother and following caesarean delivery. The most common presenting features were weight loss >10%, fever, decreased urinary frequency, excessive cry, poor feeding and jaundice. There was a strong association between weight loss and hypernatremia though the correlation was not statistically significant. Fever and weight loss >10% in an otherwise healthy baby should alarm for the evaluation. Lactational failure due to inadequate milk secretion, nipple problems and poor technique were the major risk factors for hypernatremia. We observed that the frequency was very high in summer months compared to other months.

**Conclusion:** Monitoring the mother and baby in the first week of life for successful establishment of breastfeeding is essential with special concern on primi mothers and post LSCS. In an otherwise healthy baby, poor feeding and weight loss could be helpful to suspect hypernatremia.

**Keywords:** Neonatal Hypernatremia, Exclusively Breastfed, Dehydration, Weight loss, Primi mother.

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**Introduction**

Neonatal hypernatremia is defined as serum sodium >145 mEq/L. [1] Risk factors of are inadequate breastfeeding/ insufficient milk production and ineffective breastfeeding. [2] It is a potentially lethal condition and is associated with major complications affecting central nervous system, acute renal failure is also an important complication. [3,4,5] Hypernatremia was previously thought to be unusual in breastfed babies. Since 1990's there has been an increase in the number of breastfed infants reported to have hypernatremia and signs of dehydration in first week of life. [1,3]

Early diagnosis and proper fluid management is cornerstone of good outcome in hypernatremic dehydration. [2] A vicious cycle can ensue in which the infant sucks poorly, breast milk

production drops, sodium concentration rises, and the infant becomes increasingly dehydrated, hypernatremic, and lethargic. [7] Neonatal hypernatremia due to breast milk hypernatremia is now an established entity. There is no reason to stop breastfeeding even if breast milk sodium is high as breastfeeding still remains crucially beneficial to baby and should be strongly advocated. [3,7]

Several studies have showed the hypernatremic dehydration is primarily due to underlying lactation failure in an otherwise healthy neonate. Problems with maternal breast milk synthesis, difficulty with breast milk removal and low daily breast milk intake are attributed to be the main predisposing factors. [1,3] Excessive weight loss >10% is a most common association, but not a mandatory finding.

[6] The usual clinical presentation includes jaundice, hyperthermia, poor oral intake, low urine output, and lethargy, which are all unspecific signs for a great variety of diseases in the neonatal period. [2]

This study was conducted with an objective to determine risk factors, etiological profile and clinical manifestations of hypernatremic dehydration in exclusively breastfed neonates.

### Methodology

**Study design:** Prospective observational study

**Study period:** 1 year (April 2020 to March 2021)

**Sample Size:** 100 neonates with signs of dehydration (lethargy, weight loss >5% on day 1 and >10% at any time, dry skin and mucous membrane, depressed anterior fontanelle)

**Sampling Method:** Purposive sampling

**Study Population:** Early neonates who are exclusively breastfed presenting with signs of hypernatremia and dehydration to Neonatal Intensive Care unit of Mandya Institute of Medical Sciences

**Inclusion Criteria:** Term and late preterm (>34 weeks) neonates with

- Birth Weight more than 2 kg
- Exclusively Breastfed with normal neonatal adaptation
- Weight loss of >5% of birth weight on day 1 and >10% of birth weight at any day from day 2 onwards
- Serum sodium - > 145 mEq/L

**Exclusion Criteria:** Neonates with congenital malformation, Birth asphyxia and neonates born to mother with any obstetric complications

**Method of Collection of Data:** The present study was carried out in NICU, MIMS, and Mandya after obtaining approval from the Institutional Ethical Committee. Neonates who satisfy inclusion criteria and exclusion criteria were enrolled into study after obtaining consent from parents.

Data was collected in a structured questionnaire which included demographic, maternal & delivery

details, indication for admission, clinical findings, detailed examination and diagnosis. Serum electrolytes, renal function test and serum bilirubin level values were collected from the routine investigations sent as a part of treatment protocol. All study subjects were followed up till the time of discharge. Treatment was done as per standard treatment protocol.

A regular weight monitoring and urine output monitoring of the babies were done and counseling was given to the mother about exclusive breastfeeding, its benefits to mother, baby and also regarding the proper technique of breastfeeding.

- Weight loss percent = [(birth weight - present weight) / birth weight] × 100
- Urine output = (Volume of urine voided/time of voiding) / body weight in ml/kg/hr

**Statistical Analysis:** Data was entered into Microsoft Excel sheet and analyzed using SPSS 22 version software. Categorical data were expressed as frequencies and proportions; Continuous data as mean and standard deviation. Chi square/Fishers Exact test was used as test of significance for qualitative data. Independent t test /ANOVA test were used to identify the mean difference between two Quantitative variables. P value of <0.05 was considered as statistically significant.

### Results

A total of 100 neonates satisfying inclusion and exclusion criteria were enrolled in the study. 55 were male and 45 were female. Majority of neonates were admitted to NICU during day 3-4 (70) followed by day 5-7 (27) and day 1-2 (3). 78 were Term babies and 22 were Preterm. 81 were born to primi-parous mother and 19 were born to multi-parous mother. 72 were delivered by LSCS and 28 were delivered vaginally. 93 of the study subjects had Birth weight > 2.5 kg and 7 had Birth weight < 2.5 kg. Risk factor for hypernatremic dehydration among study subjects is summarized in Table 1.

The most common risk factor was primi parity followed by LSCS delivery, lactation failure, summer months, followed by male gender and preterm birth.

**Table 1: Frequency of risk factors for Hypernatremic dehydration among study subjects**

Risk factors	Number (n)	Percentage (%)
Preterm baby	22	22.0
Male baby	55	55.0
LSCS delivery	72	72.0
Primi-parous Mother	81	81.0
Summer Month	62	62.0
Lactation failure	62	62.0

Among the study subjects weight loss > 10% was the most common presentation at admission (92%) followed by fever (82%), decreased urinary frequency (47%), jaundice (46%) and excessive cry (44%). Involuntary movements (seizures) were present in 3 neonates (Table 2).

**Table 2: Frequency of Clinical Features among study subjects at admission**

Clinical Features	Number (n)	Percentage (%)
Fever	82	82.0
Weight loss > 10%	92	92.0
Poor feeding	24	24.0
Excessive cry	44	44.0
Jaundice	46	46.0
Involuntary movements	03	3.0
Decreased urinary frequency	47	47.0

Among the 100 study subjects 91 had moderate hypernatremia, 8 had mild hypernatremia, and only 1 had severe hypernatremia at admission. Highest number of admission were observed during March to June month (62%) which is considered as warm months, as compared to 145 cases admitted in cold months, difference in case distribution was significant statistically ( $P < 0.01$ ). Among 82 mothers with lactation failure 32 had inadequate milk secretion, 16 had short nipple followed by 11

with poor technique while feeding and 3 had cracked nipple. 41 neonates with hypernatremic dehydration had significant rise in CRP. Mean and standard deviation of weight loss, temperature and laboratory parameter between preterm and term neonates is summarized in table 3. Difference between two groups was not significant statistically except for temperature which was significant statistically ( $P = 0.029$ )

**Table 3: Mean and standard deviation of clinical and laboratory parameters among Term and Preterm neonates**

Parameters	Term(n=78)		Late Preterm (n=22)	
	Mean	Standard deviation	Mean	Standard deviation
Wt. loss in grams	516.79	±170.93	497.27	±153.6
Wt. loss in %	16.73	±5.21	17.42	±4.59
Temp ( $^{\circ}$ C)	38.09	±0.54	38.38	±0.51
B. Urea (mg/dL)	72.86	±25.22	74	±19.34
S.Creatinine(mg/dL)	1.12	±0.46	1.01	±0.25
B. Glucose(mg/dl)	88.26	±12.38	89.5	±11.04
S. Sodium(mEq/L)	155.73	±4.61	154.5	±4.54
*CRP (mg/dl)	0.45 (median)	0.05-1.25 (IQR)	0.36 (Median)	0.05-0.46 (IQR)

Among the 100 study subjects who were enrolled in the study there was no statistically significant association between gestational age and clinical Profile of subjects such as Age, Sex, Mode of delivery, H/o Fever, H/o Weight loss and Risk Factors, except for birth weight ( $P < 0.01$ ) (Table 4).

**Table 4: Association between gestational age and clinical profile of the study subject**

Characteristics		Late preterm	Term	Total	Chi square P Value
		Number (Percentage)	Number (Percentage)	Number	
Age	Day 1 – 2	0(0%)	3(3.85%)	3	0.535
	Day 3 – 4	17(77.27%)	53(67.95%)	70	0.701
	Day 5 – 7	5(22.73%)	22(28.21%)	27	
Sex	Male	16(72.73%)	39(50%)	55	3.581
	Female	6(27.27%)	39(50%)	45	0.088
Birth Weight	>2.5 Kg	5(22.73%)	1(1.28%)	6	< 0.01
	<2.5 Kg	17(77.27%)	77(98.72%)	94	<0.01
Mode of Delivery	LSCS	17(77.27%)	55(70.51%)	72	3.788
	Vaginally (NVD+VAD)	5(22.73%)	23(29.49%)	28	0.13
H/O Fever	Yes	2(9.09%)	16(20.51%)	18	1.517
	No	20(90.91%)	62(79.49%)	82	0.347
H/O Weight loss	> 10%	21(95.5%)	71(91%)	92	0.457
	< 10%	1(4.5%)	7(9%)	8	0.681
Risk Factors for Hypernatremic Dehydration	Preterm*	22 (100 %)	0 (0 %)	22	0
	Male	16(29.09%)	39(70.9%)	55	0.088
	LSCS	17(23.61%)	55(76.38%)	72	0.13

	<b>Primi-parous</b>	20(24.69%)	61(75.30%)	81	0.230
	<b>Summer</b>	15(24.19%)	47(75.8%)	62	0.539
	<b>Lactation failure</b>	11(17.74%)	51(82.25%)	62	0.45

## Discussion

Neonatal hypernatremic dehydration is an emerging complication even in exclusively breastfed neonates. Most common cause being lack of awareness, inadequate secretion of milk, poor technique and nipple issues in mothers. Several studies have shown it is more common in neonates of primi mother and following caesarean delivery.

A total of 100 neonates with features of hypernatremic dehydration were included in the study. In the Present study, neonates with hypernatremic dehydration were admitted to NICU from Day 2-7 of age, majority of the admissions were during Day 3-4 of age (70%) with mean age (SD) at admission being  $3.5 \pm 0.71$  days. In contrast study conducted by Shivanagouda J et al. [1] had maximum number of admissions during day 2-3. Studies conducted by Kadegaon B et al. [8] and Yaseen H et al. [4] had higher mean age at presentation compared to our study.

Prevalence of hypernatremic dehydration was found to be more in male infants than in female infants, with the ratio of 1.22:1. Male predominance was also observed in studies conducted by Shivanagouda J et al. and Ferrández-González M et al. [9] This male predominance may be due to the fact that male neonates have less organ maturity and as well as have higher oxidative stress when compared to female neonates. [10] In our study 81 neonates were born to primi-parous mother. Similar findings are documented in study done by Shivanagouda J et al. and Yaseen H et al.

72% of neonates were delivered by LSCS. Similar observations have been seen in study conducted by Jain S et al. [11], in contrast study conducted by Shivanagouda J et al. had higher number of neonates born through vaginal delivery than LSCS. 92% of neonates had weight loss > 10% which is higher than reported by Shivanagouda J et al (44.83%). Hypernatremic dehydration was more common during summer season (62%) which is similar to the observations in studies conducted by Kadegaon B et al. and SR Bhat et al.

The risk factors in the present study were primi-parous mother, LSCS delivery, lactation failure, and male gender, similar to observation by Shivanagouda J et al. Most common presenting feature was weight loss > 10%, followed by fever and decreased urinary frequency which is similar to observations of Nair S, et al. [2] and Sajad Ahmed Bhat et al. [12]

We observed lactation failure issue similar to those reported by Shivanagouda J et al. and Boskabadi H

et al. [13] most common lactation related issues noted were inadequate milk secretion followed by short nipple. 41% of study subjects had significant rise in CRP, of which only 2 were case of late onset sepsis (culture positive), rise in CRP may be attributed to the ongoing stress during the hypernatremic dehydration. Mean serum values of urea, creatinine and sodium observed in our study were identical to the observations of Shivanagouda J et al. and Sandeep S. [14]

3% of neonates had involuntary movements (seizures) as compared to 5.9% reported by Sajad Ahmed Bhat et al., 1% reported by Shivanagouda J et al. and Sandeep S.

## Conclusion

Within the constraints of the present study, it can be concluded that Neonatal Hypernatremic Dehydration is an emerging complication seen in exclusively breastfed neonates. It is more common in neonates born to primi mother and in those born by LSCS delivery. Fever and weight loss >10% in an otherwise healthy baby should alarm for the evaluation of neonatal hypernatremic dehydration. Clinical diagnosis is often difficult as the neonates show very subtle and nonspecific signs of dehydration. Early diagnosis with adequate, timely rehydration and sodium correction are the key for effective treatment.

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