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"Hypernatremic Dehydration and Neonatal Hypernatremia in Exclusively Breastfed Term Neonates"

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Abstract
INTRODUCTION*: Hypernatremic dehydration and hypernatremia occurs in exclusively breastfed neonates in the first few days of life. Early detection and prompt treatment of this condition are necessary to prevent morbidity and mortality. Poor drainage of milk from breast results in breast milk hypernatremia which exaggerates neonatal hypernatremia. Hot environment further worsens dehydration because of increased loss of water from skin and lungs.*
AIMS AND OBJECTIVES*: The objective of this study is to evaluate the clinical features, causative factors, complication and outcome of hypernatremia in exclusively breastfed term neonates.*
MATERIALS AND METHODS*: A prospective study was carried out on 250 neonates from 1st FEBRUARY 2021 to 30th APRIL 2021 in C.U SHAH HOSPITAL on exclusively breastfed term neonates with hypernatremia (serum sodium >145 mg/dl). The presenting symptoms, birth and feeding history, clinical signs, and laboratory investigations of the subjects were noted and analyzed.*
RESULT: *Hypernatremia was noted in 28 neonates (11.2%) of the total term neonates out of which it is more common in babies delivered by cesarean section (17.8%), firstborn neonates and during summer months (67.8%).*
The most common findings are feeding problems (75%), reduced frequency of urination (60.7%), fever (53.5%) and weight loss. Serum sodium ranged from 145.5 to >169 meq/dl. Acute kidney injury (14.2%) was also noted. All the patients were discharged successfully and no mortality was there.
CONCLUSION: *Daily weighing of the neonates and monitoring and frequency of urine are important for early detection. Encouraging early breastfeeding with proper techniques helps to prevent this condition.*
Keyword: *HYPERNATREMIA, FULLTERM, DEHYDRATION, BREASTFED , WEIGHT LOSS, NEONATE*

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AIMS AND OBJECTIVES: -

- To recognize the feeding problems in exclusively breastfed babies in POSTNATAL WARD IN C.U SHAH HOSPITAL and providing them expressed breastmilk with spoon following direct breastfeeding, which can provide adequate fluid required to prevent dehydration.
- The objective of this study is to evaluate the clinical features, causative factors, complication and outcome of hypernatremia in exclusively breastfed term neonates.
- Early identification and prompt treatment to prevent potentially serious complications of hypernatremic dehydration.

MATERIALS AND METHODS: -

- The prospective study was carried out from 1st February 2021 to 30th April 2021 on 250 neonates in postnatal ward in C. U shah hospital.
- Patients presenting with fever, irritability, poor feeding, significant weight loss and decreased frequency of urination were admitted in NICU and treated.
- Information regarding age, gender, birth order, mode of delivery, birth weight, and gestational age (as per modified Ballard score) of the newborns were noted. Feeding pattern including adequacy of breast milk secretion, technique of breastfeeding, and breast problems in the mothers was recorded.

- The weight of the baby at presentation was measured on an electronic weighing scale.
- All the symptoms were noted and examination findings including status of hydration assessed.
- CBC, Sr CREATININE, SERUM ELECTROLYTES, BLOOD UREA, Sr BILIRUBIN (if icteric) AND SEPTIC SCREEN was done and analyzed.

INCLUSION CRITERIA:
- ✓ Full term neonate (gestational age > 37week)
- ✓ Intramural neonate of < 28 days of age on exclusive breast feeds
- ✓ Neonates having hypernatremia (serum sodium >145 mEq/dl)

EXCLUSION CRITERIA: -
- ✓ Extramural
- ✓ Preterm
- ✓ Cow, goat milk or Formula fed babies
- ✓ Patient having respiratory distress, sepsis, perinatal asphyxia are excluded from this study

I. Introduction:

Neonatal hypernatremia is a potentially lethal condition and is associated with **cerebral edema**, **intracranial hemorrhage**, **hydrocephalus** and **gangrene**. There has been increase in the number of breastfed infants having hypernatremia and hypernatremic dehydration.

Adequate breastmilk intake depends on several stages such as normal mammary development(mammogenesis), unimpeded initiation of lactation(lactogenesis), sustained ongoing milk synthesis(galactopoiesis) and effective milk removal[1]. Milk removal depends on proper maternal and infant breastfeeding techniques, with intact milk ejection reflex and total daily milk intake depends on frequency and duration of feeds.

Elevated BM Na is an important etiological factor in neonatal hypernatremia. BM of mothers of neonates with increased serum Na who were exclusively breast-fed and no risk factor for hypernatremia indicates that BM was the source of Na load [4].

The first sign of neonatal dehydration includes the failure to have bowel movements or the presence of urate crystals, with weight loss.[16]

Normally a newborn loses 7-10% of its birth weight in first few days of life and starts gaining weight by 10^{th} day of life. If there is weight loss of >3% per day or >10% of birth weight, feeding problem and dehydration should be suspected in all newborns[6].

Hot environment further worsens dehydration because of increased loss of water from the skin and lungs [3].

DANGER SIGNS OF DEHYDRATION: excessive thirst, irritability, poor feeding, lethargy and decreased frequency of urination.

These patients have raised level of **blood urea** and **serum creatinine**
suggestive of **prerenal ACUTE KIDNEY INJURY.** THESE PATIENTS RESPONDS WELL TO FLUID THERAPY.

High serum sodium noted in these patients are known risk factors for adverse outcome and mortality[4]

Hypernatremia may be associated with:

DEFINITION	***SERUM NA, mmol/l***
HYPONATREMIA	<135
NORMAL	135-145
MILD HYPERNATREMIA	146-150
MODERATE HYPERNATREMIA	151-169
SEVERE HYPERNATREMIA	>170

- Decreased fluid intake
- Excessive fluid loss or excessive Na intake[12]

CLINICAL MANIFESTATION IN HYPERNATREMIC DEHYDRATION
- Weight loss was considered significant if the loss was more than 7% of the birth weight or more than 5% in 24 hr.
- Decreased frequency of urination was defined as frequency <6 times in 24 h.
- Fever was considered as an axillary temperature >37.5°C measured by a digital thermometer.
- Hypernatremia was defined as serum sodium level 145 mEq/L, and

- serum creatinine level was considered elevated if it was >0.8mg/dl.
- Blood urea levels 1.5 mg/dl for at least 24–48 h (provided maternal serum creatinine level was normal), or
- rate of rise of serum creatinine >0.3 mg/dl in 48 hours[2]

Failure to diagnose the condition early might lead to complications. Plasma hyperosmolality due to hypernatremia leads to intracellular water loss. Shrinkage of the brain and tearing of the meningeal vessels can cause intracranial hemorrhage[7].

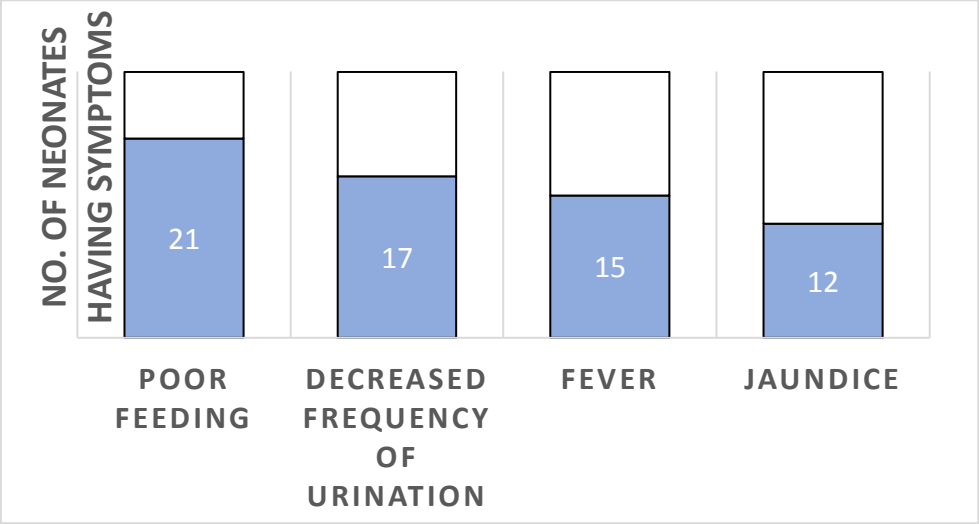
Insufficient perfusion of the kidneys could lead to acute kidney injury (AKI), vascular thrombosis and even death can occur.

Management of hypernatremic dehydration with intravenous fluids requires great care and monitoring as rapid correction of hypernatremia can lead to cerebral edema[5,9].

II. Result

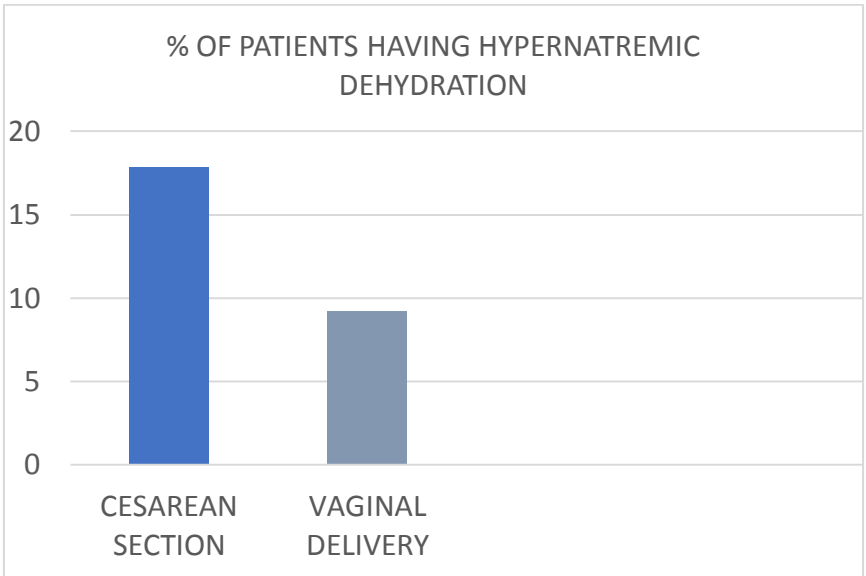
Out of 250 sample, 28 patients (11.2%) full term exclusively breastfed neonate were admitted in NICU with hypernatremia dehydration and weight loss (>10%) from birth weight.21 neonates presented with poor feeding (75%), 17 patients with decreased frequency of urination(60.7%), 15 patients had fever (53.5%) and 14 patients developed jaundice (42.8%).

Mothers of 7(25%) babies had breast related problems like cracked, inverted nipple or poor drainage. Out of 28 total admission, 19 patients(67.8%) were admitted during summer month (April)



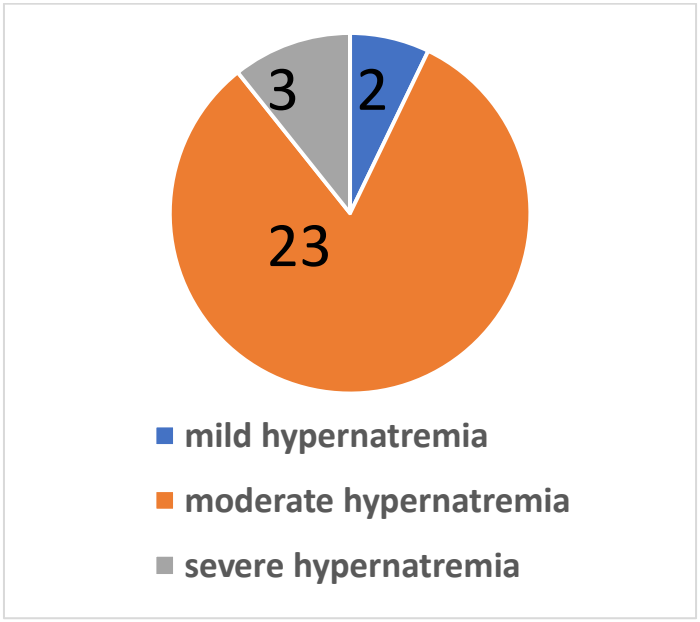
HYPERNATREMIA AND MODE OF DELIVERY

10 patients(17.8%) out of 56 cesarean section developed hypernatremic dehydration and 18 patients (9.2%) out of 194 vaginal deliveries developed hypernatremic dehydration in full term exclusively breastfed neonates.

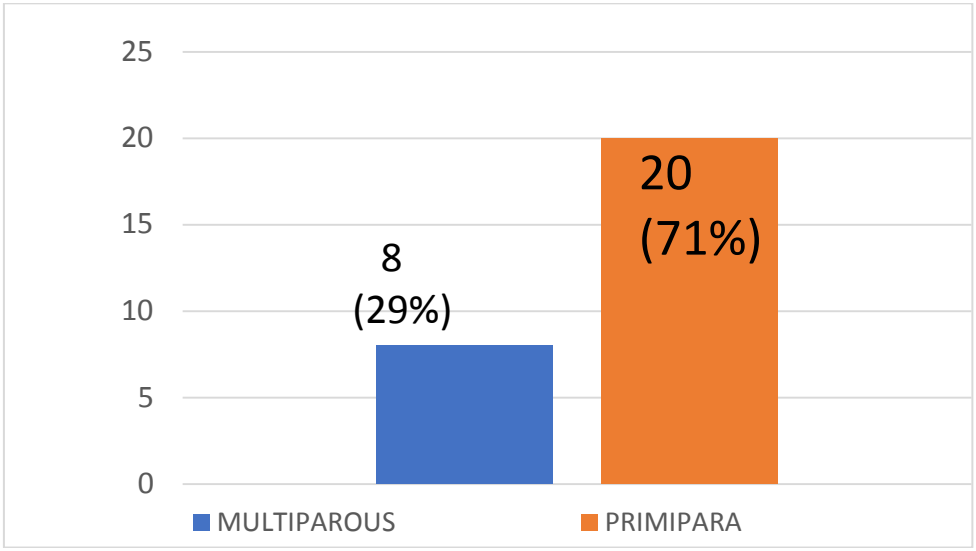


INCIDENCE OF HYPERNATREMIA

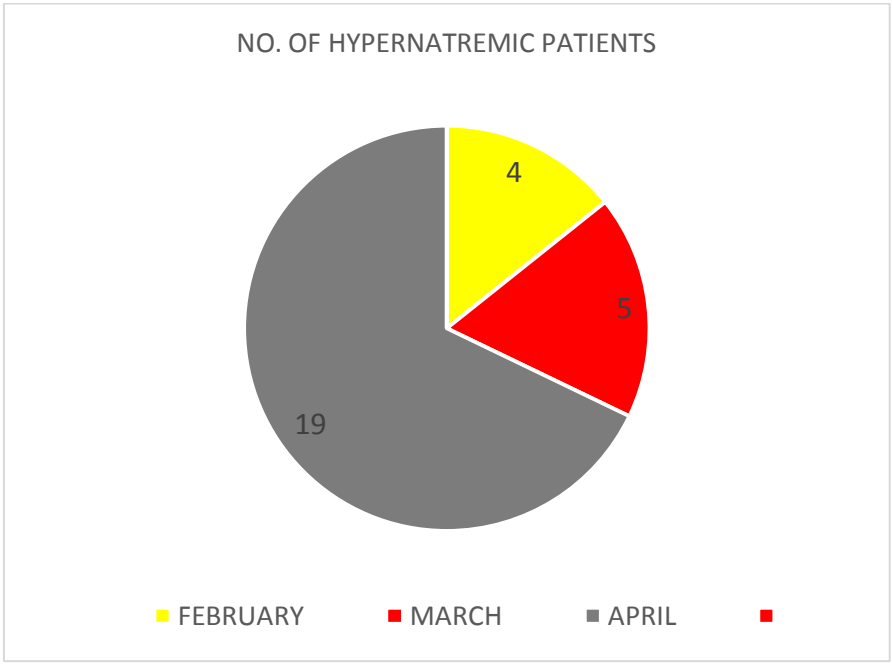
• Out of **28 neonates**, 2 neonates have mild hypernatremia (146-149 meq/dl), 23 neonates have moderate hypernatremia (150-169 meq/dl) and 3 neonates have severe hypernatremia (>170meq/dl)



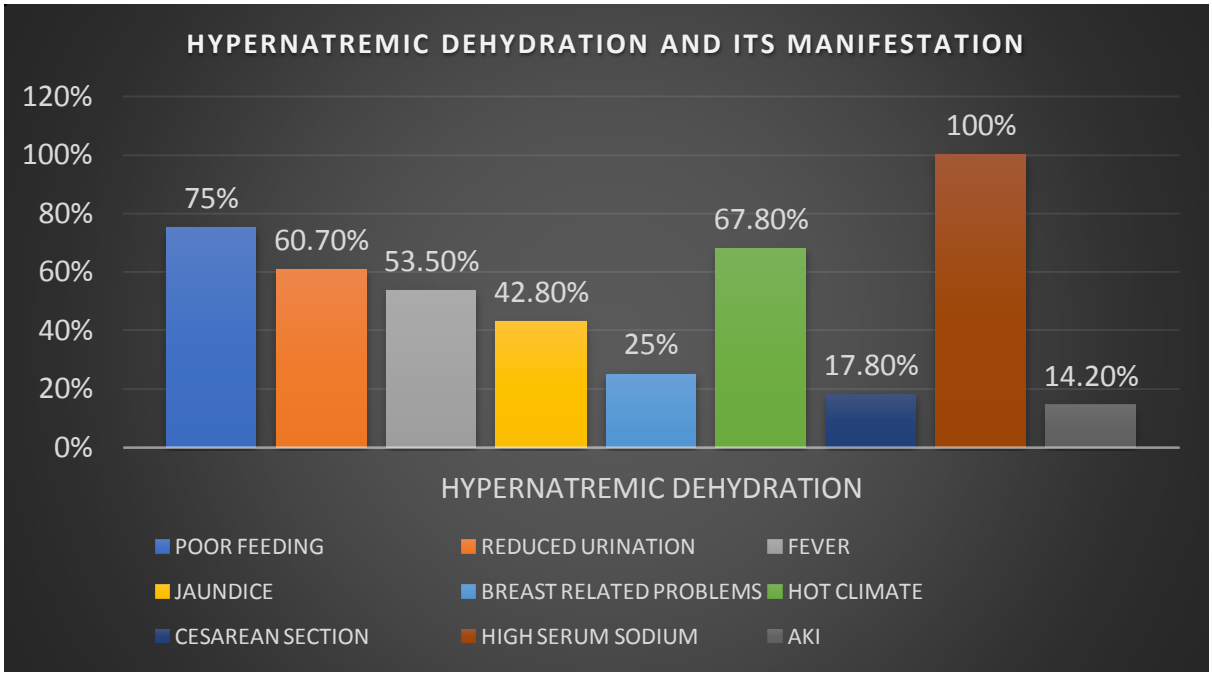
HYPERNATREMIA AND PARITY



HYPERNATREMIA AND HOT CLIMATE



OVERALL COMPARISON



CLINICAL FEATURES OF NEONATES

CLINICAL FEATURES	n(%)
Refusal to feed	21(75%)
Decreased frequency of urination	17(60.5%)
Jaundice	14(42.8%)
Fever	15(53.5%)
Lethargy	7(25%)

LABORATORY PARAMETERS AT THE TIME OF PRESENTATION

PARAMETERS	n(%)
Serum sodium	
146-149 meq/dl	2(7.14%)
150-169 meq/dl	23(82%)
>170 meq/dl	3(10.7%)
Serum creatinine	
<0.8mg/dl	12(43%)
0.8-1.5mg/dl	12(43%)
>1.5mg/dl	4(14%)

THERE WAS LOWER INCIDENCE OF COMPLICATION AND NO MORTALITY NOTED AS PATIENTS WERE CLOSELY MONITORED IN POSTNATA WARDS FOR FEEDING PROBLEMS AND WEIGHT LOSS.

III. Discussion

MATERNAL AND PERINATAL FACTORS

Early initiation of breast-feeding is important for successful lactation while delayed onset of lactation is a risk factor for suboptimal infant breastfeeding. Education of mothers on increased breastfeeding and breastfeeding support early neonatal life is important to reduce the incidence of hypernatremia in newborns.

Early lactation success is strongly influenced by parity, with primiparity as the strongest risk factor for delayed lactogenesis and early breastfeeding failure[12,13]. Cesarean section is a risk factor for excess weight loss and hypernatremia in exclusively breastfed infant. Delay in initial feeding of these neonates is the main contributing factor to hypernatremia.

In this study, infants born through cesarian section had a higher mean serum sodium concentration and more likely to be initiated on breastfeeding later than the recommended (within first hour post-delivery) compared to those delivered vaginally [13]. Separation of mother and baby in threat delays initiation of breastfeeding resulting in delayed lactogenesis and increased risk of hypernatremic dehydration.

Reduced post-delivery length of hospital stay in newborns is a risk for readmission with dehydration, jaundice, feeding problems and poor weight gain. WHO recommends postnatal care within the health facility for the first 24-72 hours after delivery.

NEONATAL FACTORS

Weight loss below 10% of birth weight during the first week of life, is acceptable physiologically, while ≥10% weight loss could be an early indicator of hypernatremic dehydration [8]. Several studies have reported an association between excessive weight loss and hypernatremic dehydration [10]. Iyer et al., found regular weight monitoring on day 3- 4 and then day7-10 of life, combined with a breastfeeding support strategy allows early detection of breastfeeding problems and intervention, thereby preventing hypernatremic dehydration and severe sequelae, compared to just weighing on the seventh to tenth day [11].

Exclusively breastfed healthy term infants in whom breastfeeding is not well established are also prone to hyperbilirubinemia [12]. In this study, jaundice was the third most common presenting symptom and the second commonest clinical examination finding in infants with hypernatremia whose TSB was in phototherapy range. Similar studies on neonates with hypernatremia showed findings consistent with our study.

The high incidence of significant hyperbilirubinemia may contribute to long-term neurologic sequelae in infants with hypernatremia. Measurement of serum sodium concentrations should be recommended as part of guidelines for the management of hyperbilirubinemia [15].

The WHO newborn health guidelines recommend early postnatal follow up of newborns on day 3 (48-72hrs) then between day 7-14 of life. Recommendation on early postnatal reviews on day 3 and day 7. In this study the mean age at presentation was 6.6 days reflecting a possible delay in the first postnatal visit, thereby missing that early identification of neonates at risk of breastfeeding failure.

Late presentation was more likely to be associated with severe dehydration and AKI, increasing the risk of mortality.

IV. Conclusion

Hypernatremic dehydration and hypernatremia is common condition in exclusively breastfed neonates in first week of life.

As per our study, neonates born to primigravida mother, improper feeding techniques, babies delivered by cesarean section are likely to develop hypernatremic dehydration, particularly in hot climates.

Poor feeding, decreased urinary frequency, fever, jaundice and weight loss>10% are the most common clinical findings noted.

Breastfeeding should be encouraged with proper feeding techniques and proper methods of attachment by counselling mothers and neonates should be closely monitored for weight loss in postnatal wards.

Expressed breastmilk should be given with spoon following direct breastfeeding to ensure adequate fluid intake every 2hourly with minimum intake of 30ml breastmilk/feed.

"**HENCE BREASTFEEDING IS CRUCIALLY BENEFICIAL TO BABY AND SHOULD BE STRONGLY ADVOCATED WITHIN 24HOURS OF LIFE"**

All the neonates with hypernatremia were admitted in the Neonatal Intensive Care Unit (NICU) and treated according to the standard protocol [10] with IV fluids (0.45% normal saline in 5% dextrose) as per the fluid deficit and requirement. The rate of sodium reduction was kept at 10–12 mEq/24 hr.

Breastfeeding was continued, and mother was counselled regarding the proper technique of breastfeeding and the advantages of breast milk and breastfeeding. The neonates were discharged after normal serum sodium levels were attained and breastfeeding was established.

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