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A Clinical Study of Hypernatremic Dehydration in Neonates at a Tertiary Care Hospital

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ABSTRACT

Background: Hypernatremic dehydration is a serious condition occurring exclusively in neonates. The management is challenging because rapid correction can lead to serious complications. Certain factors like the average environmental temperature play an important role in the frequency of cases detected.

Aim: We in the present study tied to evaluate the frequency of hypernatremic dehydration in neonates presenting to our tertiary care hospital.

Methods: This Prospective case-control study was conducted in the Department of Neonatology, Aditya Hospital, Hyderabad, from January 2017 to December 2017. A total of n=115 cases>36wks 6 days of gestation age and or 2.499Kg of birth weight, discharged by 36 hours in case of normal vaginal delivery and 72 hrs to 96 hours in lower section cesarean section. With features quite like that of sepsis, neonatal hyperbilirubinemia, but on investigations finally diagnosed and managed as hypernatremic dehydration without sepsis. A total of n=31 cases of hypernatremic dehydration were found out of total n=115 cases in the study.

Results: Out of n=31 cases of hypernatremic dehydration, 61.29% were male and 38.7% were females. The average sodium levels throughout the year were estimated in cases with suspicion of dehydration. The sodium levels in the summer months were minimum 159.2 mEq/L and maximum values were 168.1 mEq/L and the average values were 160 mEq/L.

Conclusion: The frequency of hypernatremic dehydration is very high in summer seasons in neonates. The typical features of presentation were weight loss, lethargy, hunger, and dehydration. The weight loss was significantly greater in the summer months. Management was done by slow rehydration as per protocol (IV Fluids). Early recognition and prompt treatment will prove beneficial in reducing morbidity and mortality.

Key Words: Hypernatremic Dehydration, Neonates, Diagnosis, Management

INTRODUCTION

Hypernatremic dehydration in severe cases can be associated with cerebral oedema, intracranial haemorrhage, hydrocephalus, and gangrene and it has a high degree of mortality.[1]In cases of infants due to hypernatremia the plasma sodium concentration is raised mainly due to loss of extracellular water. Most of the time, infantile hypernatremia was the result of artificial feeds with a too high concentration of sodium which was given to babies.[2] Higher concentrations of sodium were found in powdered milk and the tendency of mothers adding extra scoops of powder and failure to provide enough water for the mixture. The resulting hypernatremia causes stimulation of the child's thirst and feeds high in sodium will exacerbate the problem. The incidence of hypernatremic dehydration varies depending on the geographical locations across the globe. In western countries, the prevalence is approximately 1.8% of breastfeeding newborn infants.[3] In Turkey 5.65 of neonates experience serum sodium concentrations of greater than mmol/L.[4] In India surprisingly there are fewer cases reported probably due to its decreased awareness and lack of reporting and sometimes wrongly diagnosed and treated.[5] In neonates hypernatremic dehydration is suspected when there is weight loss of >10% of birth weight at the end of the first week or if there are clinical findings of dehydration and hypernatremia.[6,7] The important factor is the signs may be non-specific including lethargy and irritability. Occasionally there could be acute deterioration that

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could lead to emergency admission in the hospital. Clinical examination can show the presence of lethargy, hunger, and dehydration.[8] Clinical features of jaundice, seizures, and excessive weight loss are generally observed.[9] In moderate to severe hypernatremic dehydration, skin turgor could be normal and there may be fever, tachycardia with poor perfusion, and hypotension with hypovolemia. The main aim of treatment is to rehydrate the child very slowly because sudden corrections with high sodium lead to cerebral oedema and potential brain damage.[10] The general line of treatment is in emergency phase restoration of vascular volume with 10 to 20ml/kg of isotonic intravenous [IV] like Ringer lactate with 130mmol/L of sodium or normal saline with 154 mmol/L of sodium. The rehydration phase is done with normal saline with 154 mmol/L of sodium. With this background, we in the present study tried to evaluate the cases of hypernatremic dehydration cases in our tertiary care hospital.

MATERIAL AND METHODS

This Prospective case-control study was conducted in the Department of Neonatology, Aditya Hospital, Hyderabad, from January 2017 to December 2017. Ethical Permission was obtained for the study from the Ethical Committee (Reference Number: IEC/AH/2017/06 Dated 15/01/2017). Written consent was obtained from the parents of the cases in the study. A total of n=115 cases >36wks 6 days of gestation age and or 2.499Kgs of birth weight, discharged by 36hours in case of normal vaginal delivery and 72 hrs to 96 hours in lower section cesarean section. With features quite like that of sepsis, neonatal hyperbilirubinemia, but on investigations finally diagnosed and managed as hypernatremic dehydration without sepsis. They were considered to have HD when presented with the following criteria;

1. Weight loss greater than 10% of the birth weight
2. >5% weight loss in 24 hours
3. Sodium concentrations >149 mEq/L at presentation.

Based on these criteria we found n=31 cases of hypernatremic dehydration out of total n=115 cases in the study. Excluded from the study were preterm babies, congenital malformations, perinatal asphyxia, low birth weight, sepsis +ve, respiratory distress, shock, congenital malformations, active medical treatment were not included. Sepsis was ruled out in all the babies with laboratory investigations. CBP, blood culture, CSF analysis, serum bilirubin, blood urea, serum creatinine, electrolytes, and blood sugar were estimated. Weight of the baby, temperature, urine output, and stool frequency and fluid requirements were monitored daily for the study cases. Rehydration was done with 0.45% NS with 5% dextrose or NS depending on the serum sodium levels. Breastfeeding was ensured in all babies who were recovered from morbidity. Counselling was done for all mothers and the advantages of breastfeeding were explained and increasing the frequency of breastfeeding in the summer season was advised.

Statistical Analysis: All the data was recorded on MS Excel spreadsheet and analyzed with IBM SPSS version 19 on windows format. All quantitative variables were analyzed using descriptive statistics such as mean, standard deviation, and percentage and results were entered in relevant tables.

RESULTS

A total of n=115 consecutive cases of dehydration were examined in the duration of the study period of one year. Out of the n=115 cases of dehydration n=71(61.74%) cases were admitted in the summer months from April to July. Hypernatremic dehydration was detected in n=31(26.95%) cases. Out of the total n=31 cases, n=26 (83.87%) cases of hypernatremic dehydration were seen in the summer months. The overall picture shows that the cases of dehydration admission are higher in summer months and Hypernatremic dehydrations almost exclusively are found in the summer months details in table 1.

A comparison of the average temperature of this area in summer months and the rate of admission for hypernatremic dehydrations was done in table 2. The average temperature of the summer months is 40^{o}C ± 2 ^{o}C. The cumulative cases of admission in summer months were n=26 and in non-summer months were only n=5. This shows that there is a profound effect of temperature on sodium concentration and dehydration and they are directly related.

In our study out of n=31 cases of hypernatremic dehydration, 61.29% were male and 38.7% were females. Birth weight was between 2.5 Kg to 4.0 Kgs in n=27 cases and n=4 cases were the birth weight of lesser than 2.5 Kgs. Mean weight loss was 14.54+2.072%. Mean day of presentation to the hospital was 4.90 + 3.13 days. Mean birth weight of these babies was 2.53 + 0.39 Kgs details shown in table 3.

The infants were examined at the time of admission for signs and symptoms. The most common presenting symptoms were oliguria in n=30(96.77%) cold hands and feet in n=25(80.66%) followed by dry mouth n=17(54.83%). the other findings were fever and poor feeding with weight loss in n=19(61.29%) of cases. Jaundice was found in n=11(35.48%) cases. One case presented with seizures shown in table 4.

The average sodium levels throughout the year were estimated in cases with suspicion of dehydration. The sodium levels in the summer months were minimum 159.2 mEq/L and maximum values were 168.1mEq/L and the mean Serum sodium values throughout the year 154.1 ± 10.6 mEq/L. The Mean serum sodium values were 160 mEq/L was found to be higher in summer months as compared to the non-summer months 139.5 mEq/L given in table 5.

Most of the cases were having pyrexia and the mean external body temperature in cases was 102.6°C ± 0.998 and similarly, the serum urea levels were found to be higher at 81.5 mg/dl and mean Na^+ 154.1 ± 10.6of mEq/L signs of hyperosmolarity and hypernatremia given in table 6.

N=28(90.32%) out of n=31 cases did not require ventilator support and they were managed adequately. N=3(9.68%) required ventilator support for management. N=30 cases had favourable prognosis and they were treated and discharged and n=1(3.23%) died during the treatment shown in table 7.

DISCUSSION

In the present study, we found the incidence of hypernatremic dehydration to be about 26.95% and almost all the cases of hypernatremic dehydration were found in summer months. There were no incidences of hypernatremic dehydration in winter months. Hence in summer months, the neonates need to be checked properly for this condition, and there is a need for monitoring the adequacy of breast milk during the summer season. Since breast milk is the best and safest feed for neonates' also human milk is low in sodium which can prevent the development of hypernatremia. A reduction of feeding frequency is also found to be associated with a marked rise in sodium concentration in milk. [9]Insufficient milk production is one of the causes of the induction of hypernatremia. Recent studies have shown that breastfeeding malnutrition is an important factor in pathophysiology however, failed to identify the causes of insufficient milk intake. [11,12,13]

Maternal factors like a low level of knowledge in lactation, cesarean section and insufficient postnatal follow up were associated with neonatal dehydration. The decrease in urine and stool frequency is one of the signs of the failure of lactation.[14] Laing IA et al. have found there is an increase in the incidence of hypernatremic dehydration in recent times.[15] The found that in breastfed infants hypernatremic dehydration has been a problem and it has been under-reported. They recommended that all the neonates with >10% loss of birth weight must be included as hypernatremic dehydration.[16] Moritz et al.[16] found that 1.9% of hospitalized term and near-term infants had hypernatremic dehydration with moderate severity median Na+ levels 153 meq/L; range: 150-177 mEq/L) and 13.7% mean weight loss. In this study, we found sodium levels in the summer months were minimum 159.2 mEq/L and maximum values were 168.1 mEq/L and the average values were 160 mEq/L. Koklu et al.[17] reported an incidence of 2.1% in breastfeeding neonates with hypernatremic dehydration in near term infants in Turkey. They found abnormalities in development at 12 months of age in more than half of the infants admitted with breastfeeding hypernatremia. A study by Samayam P et al.[18] found 7.87% of babies born to primiparahave excessive weight loss as compared to 4.08% of those born to multipara. This indicates the lower knowledge of new mothers regarding breastfeeding of babies. Similar findings were reported by Jain S et al.[19] where the exclusively breastfed term and near-term infants mean the day of presentation of neonatal hypernatremic dehydration was 5.30±2.33 with mean serum sodium of 153.50± 9.78 mEq/L and those born to primiparous mothers presented with more weight loss and hypernatremia. Hypernatremic dehydration in exclusive bread fed neonates is preventable. Primipara mothers must be given appropriate counselling and support for successful initiation of breastfeeding and maintenance of lactation. Early diagnosis and recognition of symptoms and adequate treatment will prove beneficial for overall prognosis.

CONCLUSION

Within the constraints of the present study, it can be concluded that neonatal hypernatremia is not a rare condition as believed previously. It is a potentially lethal condition that can be associated with cerebral oedema, intracerebral haemorrhage, hydrocephalus and gangrene. Successful establishment of breastfeeding practice is important in the first week of life because in an otherwise healthy baby poor feeding and weight loss could lead to suspicion of hypernatremia. We found the frequency of hypernatremic dehydration is very high in summer months in neonates. The typical features of presentation were weight loss, lethargy, hunger, and dehydration. The weight loss was significantly greater in the summer months. Management was done by slow rehydration as per protocol. Breastfeeding was promoted and continued during the fluid correction. Early recognition and prompt treatment will prove beneficial in reducing morbidity and mortality.

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Conflict of Interest: None

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Table 1: Showing the symptomatic admissions taken during the study

Month	Symptomatic Admissions	Hypernatremic Dehydration
January	9	0
February	3	0
March	9	3
April	20	9
May	23	9
June	15	5
July	13	3
August	14	2
September	4	0
October	5	0
November	0	0
December	0	0
Total	115	31

Table 2: Showing the Average temperatures and frequency of cases of hypernatremic dehydration

Month	Temperatures (Average) ° C	Frequency of Cases	Percentage (n=31)
January	30.2	00	00
February	33.5	00	00
March	36.4	03	9.68
April	40.2	09	29.03
May	41.2	09	29.03
June	37.6	05	16.13
July	33.6	03	9.68
August	31.1	02	6.45
September	31.9	00	00
October	33.1	00	00
November	30.3	00	00
December	28.5	00	00

Table 2: *(Continued)*

Table 3: Showing the profile of cases included in the study

Variable	Frequency	Percentage
Sex		
Male	19	61.29
Female	12	38.70
Total	31	100
Birth weight		
<2500 g	04	12.90
2500 – 3000 g	20	64.51
3001 – 4000 g	07	22.58
Total	31	100

Table 4: showing the signs and symptoms of cases at admission

Symptoms- Presented	Frequency of Cases	Percentage (n=31)
Fever and Poor Feeding	19	61.29
Icterus	11	35.48
Seizures	1	3.22

Table 4: *(Continued)*

Parched dry mouth	17	54.83
Shrunken eyes	7	22.58
Cold hand and feet	25	80.66
Wrinkled skin	22	70.96
Oliguria	30	96.77

Table 5: Average Sodium levels throughout the year

Month	Sodium Levels mEq/L
January	136.2
February	138.2
March	146.4
April	159.2
May	160.2
June	168.1
July	153.4
August	145.8
September	138.1
October	139.3
November	138.5
December	138.6

Table 6: Showing the mean values of parameters in cases

Parameters	Total	Mean	± SD
External body Temperature°C	31	102.6	0.998
Serum Urea (mg/dl)	31	81.5	15.9
Serum creatinine (mg/dl)	31	1.59	0.315
Na + mEq/L	31	154.1	10.6

Table 7: Ventilator support and prognosis of cases

	Frequency	Percentage
Ventilator support		
Not required	28	90.32
Required	03	9.68
Total	31	100
Prognosis		
Favourable	30	96.77
Unfavourable	01	3.23
Total	31	100