

## **Renal functions in term neonates admitted with dehydration in a tertiary care centre in Southern Rajasthan.**

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### **Abstract**

**Background:** Dehydration in neonates is common and many neonates undergo renal impairment due to its late diagnosis. The objective of the study is to assess the renal functions in neonates admitted with dehydration.

**Methodology:** A prospective study on term neonates with clinical features of dehydration and weight loss of >10% after birth, admitted in OUTBORN NICU of Balchikitsalaya, R.N.T. Medical college, Udaipur for a period of 24 months from July 2015 to June 2017. Sick neonates with congenital abnormalities, birth asphyxia, sepsis were excluded. Ethical clearance and consent were taken.

**Results:** The study population constituted 272 neonates with dehydration. Most neonates with dehydration 250 (91.9%) were admitted between day three to fourteen after birth. Mean weight loss after birth was 14.92%. Hyponatremia was observed in 156 (57.4%) neonates; 86 (31.6%) had hyperkalemia; 242 (88.9%) had high blood urea levels; 202 (74.3%) had high creatinine levels at admission; 23.5% neonates with dehydration had oliguria. Most of the neonates 262 (96.3%) were discharged. Ten neonates died due to various complications of dehydration and mortality was 3.67%.

**Conclusion:** Dehydration in neonates is potentially lethal condition which can impair renal perfusion and so the renal functions. Early diagnosis of dehydration by regular follow up of neonates and daily weighing may help in reducing the morbidity and mortality.

**Keywords:** Acute kidney injury, Breast feeding, Hyponatremic Dehydration.

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### **Introduction**

Exclusive breastfeeding is the universal recommendation till 6 months of life and undoubtedly provides health advantages to both infant and mother. Normally neonates lose 5-7% of its birth weight in first week of life due to transition of fluids in body compartments. Most neonates start gaining their weight by the tenth day of life if adequately breast fed [1,2]. Many mothers continue exclusive breast feeding without a watch on its adequacy and weight gain in the baby. Many underlying factors can interfere with lactation and breastfeeding, and thus contribute to inadequate breastfeeding and complications like dehydration [2]. Dehydration in neonates is lethal condition and may be associated with acute kidney injury, cerebral oedema, vascular thrombosis, intracranial haemorrhage, seizures, disseminated intravascular coagulation and death [3,4]. Most of the neonates with dehydration present with deranged renal functions which

leads to morbidity and financial burden on health institutes. This study was conducted to find out the renal functions among term neonates admitted with dehydration in NICU.

### **Material and Method**

A hospital based prospective study conducted on term neonates with clinical manifestations of dehydration, admitted in the OUTBORN NICU of Balchikitsalaya, RNT Medical College, Udaipur, India for period of 24 months from July 2015 to June 2017.

All neonates with birth weight >2 kg and gestational age >37 weeks with clinical features of dehydration and weight loss after birth of more than 10% were included in the study. These neonates were admitted in OUTBORN NICU of Balchikitsalaya, R.N.T. Medical College, Udaipur.

Sick neonates with congenital abnormalities, birth asphyxia, and sepsis were excluded. Ethical clearance

was taken from Institutional Ethics Committee of R.N.T Medical College & Controller & Attached group of Hospital. Informed consent was taken.

Those neonates who were born elsewhere and admitted were kept in separate NICU termed as OUTBORN NICU for sepsis control.

Dehydration was diagnosed if weight loss after birth was more than 10% in term neonates and also if these neonates had clinical signs of dehydration like hyperthermia, dry mucosa, sunken eyes, decreased skin turgor, depressed anterior fontanel, decreased frequency of urination.

Each and every neonate went through detailed examination. Weight was recorded using electronic weighing scale at admission. Gestational age was calculated by LMP. Rectal temperature recording was done using electronic probe of advanced monitors.

Hypernatremia was defined as serum sodium >145 mEq/L. Hyponatremia was defined as serum sodium < 130 mEq/L. Hyperkalemia was defined as serum Potassium >6.5 mEq/L. Acute Kidney Injury (AKI) was defined as creatinine >1.5 mg/dL irrespective of day of life. Oliguria was defined as urine output <1 mL/Kg/h [5-9]. A thorough clinical examination to see for urethral, meatal abnormalities, palpable bladder and kidneys was done. None of the neonates included in the study had any gross congenital anomaly of the kidney or urinary tract on clinical examination.

Sepsis ruled out by clinical evaluation and sepsis screening and if sepsis was found, neonate was excluded from the study. Details of neonate like age, sex, birth weight, gestational age and APGAR were noted. Blood investigations were done to rule out sepsis. Serum electrolytes (sodium/potassium), blood urea and serum creatinine were routinely done to aid in management. Each neonate was treated as per standard protocol. Data analysis was done using SPSS v21.

## Results

Two seventy two (272) neonates with dehydration were enrolled in the study. Among them, 160 (58.8%) were male and 112 (41.2%) were female; 182 (66.39%) neonates were admitted between day 3-7 after birth, 68(25%) neonates were admitted between day 7-14 after birth and 22 (8.1%) neonates were admitted after 14 days of life. Most of the neonates 250 (91.9%) were admitted between 3-14 days of life. Mean birth weight and mean admission weight was 2558.45 g and 2182.86 g respectively; 170 (62.5%) had weight loss 10-15% after birth and remaining 102(37.5%) had weight loss of more than 15%. Mean weight loss after birth due to dehydration was 14.92%. Most common presentations in these neonates were excessive cry 212 (77.9%), jaundice 150 (55.1%) and fever 142 (52.2%). Decreased frequency of micturation was found in 66 (24.2%). Some other presentation were refusal to feed 60 (22.1%), lethargy 60 (22.1%), breathlessness 42 (15.4%) and seizures 18 (6.6%). 156 (57.4%) neonates had hypernatremic dehydration (serum sodium >145 mEq/L) at admission. Hyperkalemia was present in 86(31.6%) neonates at admission. Out of the 272 neonates with dehydration, 242 (88.9%) had higher blood urea levels (>40 mg/dL) at admission. 202 (74.3%) neonates had high serum creatinine levels (>1.5 mg/dL) i.e 74.3% neonates had acute kidney injury due to dehydration at admission. Among the study population, 64 (23.5%) neonates with dehydration had oliguria. In other words, 31.6 % neonates had oliguric AKI. Maximum Serum Creatinine level of 7.2 mg/dL was recorded in one neonate. Most of the neonates 262 (96.3%) were discharged and 10 (3.67%) neonates died due to complications of dehydration. Mean hospital was 4.64 days. Other findings have been summarised in Tables 1 and 2.

## Discussion

A total of 272 term neonates with dehydration were enrolled in the study. Among the study population, 91.9% neonates were admitted between 3-14 days of life. Most literatures have described dehydration in neonates within first 2 weeks of life [10-12]. Clinical signs of dehydration

**Table 1.** Clinical profile of study population

Total number of neonates with dehydration	272
Mean Age at admission (days ± s.d)	6.04 ± 2.49
Mean Birth Weight (grams ± s.d)	2558.45 ± 302.68
Mean weight at admission (grams ± s.d)	2182.86 ± 291.66
Mean weight loss after birth (% ± s.d)	14.92% ± 4.33
Mean Stay at hospital (days ± s.d)	4.64 ± 1.39
Discharged/mortality	262/10

**Table 2.** Renal profile of the study population

Mean(sd) blood urea levels at admission in mg/dL	101.66 (64.32)
Mean(sd) serum creatinine levels at admission in mg/dL	1.95 (1.14)
Mean(sd) serum Sodium levels at admission in mEq/L	157.66 (13.29)
Mean(sd) serum Potassium levels at admission in mEq/L	4.98 (0.87)
Neonates with AKI	202 (74.3%)
Neonates with Oliguric dehydration	64 (23.5%)

get more evident in first week of life and more serious complications can occur beyond this period. During this period, dehydration is either because of decreased intake due to inadequate breast feeding or sometimes due to excessive insensible losses through lungs and skin during summers. Out of these 272 neonates, 37.5% lost more than 15% of birth weight at admission. This may be due to the fact that these neonates were discharged early after birth without being given proper breast feeding training. Also these neonates had poor follow up after discharge. These neonates only presented later when dehydration was severe and the caregiver/mothers could not assess the excessive weight loss in neonates. Most neonates presented with excessive cry 212 (77.9%), jaundice 150 (55.1%) and fever 142 (52.2%). These were early symptoms in most of the neonates with dehydration but some of the neonates presented late and had severe symptoms like seizures, coma and acidosis. Only 66 (24.3%) neonates came with complaints of decreased frequency of urination which suggest that neonates tends to maintain urine output even in dehydration because of immature kidney functions and thus urine output is not a great indicator for neonatal dehydration [9].

The 156 (57.4%) neonates had hypernatremic dehydration (serum sodium >145mEq/L) at admission. Hypernatremia occurs in neonatal dehydration and that has been discussed in other studies [1,10-13]. Primary cause of hypernatremia in neonates is water deprivation which is secondary to inadequate breast feeding and sometimes due to excess of water loss through skin and lungs when ambient temperature is high [14]. Previously it was thought that high content of sodium in breast milk is the cause of hypernatremia in neonates but since most of the neonates are inadequately breast fed and thus such low quantity of breast milk would not affect and increase serum sodium levels to levels found in dehydrated neonates.

Neonatal renal functions are affected because of the neonatal dehydration and this is evident from the biochemical changes. Out of the 272 neonates with dehydration, 88.9% had high urea levels, and more importantly 74.3% neonates had AKI. AKI associated with dehydration is not rare but is a relatively less recognized condition. Bhat et al. [10] and Boskabadi et al. [1] had not mention about the AKI in their research articles [1,10]. Oddie et al. [15] and Livingstone et al. [2] also failed to mention about AKI in their series even if there series had babies with weight loss up to 27% and 30% and serum sodium up to 175 and 207 respectively [2,15]. Few case reports have emphasized the incidence and concern regarding hypernatremia, but AKI and impaired renal functions were not highlighted.

Among the study population, only 23.5% neonates had oliguria and rest 76.5% had normal urine output. It is well known fact that neonates have immature renal functions and the concentrating ability of kidney is poor. Neonates tend to pass diluted urine irrespective of the state of hydration. In the early phase of dehydration, the

renal functions are affected due to pre renal cause of low intravascular volume, but as the severity of dehydration increases, there is acute kidney injury and thus leads to deranged renal functions and sometimes neonates land into acute renal failure and some of them may require dialysis too [9]. In our study, 3 neonates (1.4%) required peritoneal dialysis too for highly deranged renal functions.

Most of the neonates were successfully treated and discharged but only after mean stay of 4.64 days at hospital and required intensive care. Impaired renal functions in neonates with dehydration can be corrected with judicious use of fluids and careful watch on renal functions.

The 10 neonates expired due to fatal complications of dehydration like renal failure, cerebral edema, DIC, IVH etc. Dehydration in neonates is unsafe and if not looked upon and diagnosed in its early stage it may be lead to complications like cerebral oedema, cerebral vessel thrombosis, ICH, seizures, and DIC prior to death [3,4].

Limitations: The study unfortunately was not initially designed to assess the cause of dehydration in neonates and hence we could not differentiate if the dehydration was due to inadequate breast feeding or insensible water losses. We plan to emphasize on this aspect of neonatal dehydration in future studies.

## Conclusion

R.N.T medical college, Udaipur is a tertiary care centre in Southern Rajasthan, India which receives neonates from nearby places and often these neonates are referred to us in dehydration with impaired renal functions. Dehydration is frequently seen in exclusively breast fed healthy term neonates in outborn NICU due to early discharge after birth and poor follow up. Early discharge may lead to inadequate breast feeding in neonates as the mothers may not be appropriately counselled regarding breast feeding. These neonates continue to lose weight and later present with dehydration and its complications. Some of these neonates are severely dehydrated with impaired renal functions. High index of suspicion is required during early neonatal period for diagnosis of dehydration. Daily weight recording during initial days after birth and clinical evaluation will help us in diagnosing dehydration in neonates at early stages before serious complications develop.

## References

1. Boskabadi H, Maamouri G, Ebrahimi M, et al. Neonatal hypernatremia and dehydration in infants receiving inadequate breastfeeding. *Asia Pac J Clin Nutr* 2010;19: 301-307.
2. Livingstone VH, Willis CE, Abdel-Wareth LO, et al. Neonatal hypernatremic dehydration associated with breast-feeding malnutrition: a retrospective survey. *CMAJ* 2000; 162: 647-652.
3. Iyer NP, Srinivasan R, Evans K, et al. Impact of an early weighing policy on neonatal hypernatremic

- dehydration and breastfeeding. *Arch Dis Child* 2008; 93: 297-299.
4. Laing IA, Wong CM. Hyponatraemia in the first few days: is the incidence rising? *Arch Dis Child Fetal Neonatal* 2002; 87: F158-62.
  5. Vogt BA, Avner ED. The kidney and urinary tract. In: Fanaro FF, Avroy A, Martin Richard J, editors. *Neonatal-Perinatal Medicine: Disease of Fetus and New Born Infant*. 8th ed. St. Louis: Mosby; 2006; 2: 1666-1670.
  6. Avery GB, Fletcher MA, MacDonald MG. *Neonatology: Pathophysiology and Management of Newborn*. 6th ed. Philadelphia: Lippincott Williams and Wilkins; 2005; 2:1009.
  7. Gouyon JB, Guignard JP. Management of acute renal failure in newborns. *Pediatr Nephrol*. 2000; 14: 1037-1044.
  8. Greenbaum LA. Electrolyte and acid base disorders. In (eds) Kliegman RM, Stanton BF, St Geme JW, Schor NF *Nelson Textbook of Pediatrics*, 20<sup>th</sup> ed, Elsevier 2016. 346-384.
  9. Wright CJ, Posencheg MA, Seri I, et al. Fluid, electrolyte and Acid-Base Balance. In (eds) Gleason CA, Juul SE. *Avery's diseases of the newborn*, 10<sup>th</sup> ed, Elsevier 2018: 368-389.
  10. Bhat SR, Lewis P, Dinakar C. Hyponatremic dehydration in a neonate. *Indian Pediatr* 2001; 38: 1174-1177.
  11. Jain S, Basu S. Hyponatremic dehydration in term and near term neonates. *Indian J Pediatr* 2010; 77: 461.
  12. Yaseen H, Salem M, Darwich M. Clinical presentation of hyponatremic dehydration in exclusively breast fed neonates. *Indian J Pediatr* 2004; 71; 1059-106.
  13. Rand SE, Kolberg A. Neonatal hyponatremic dehydration secondary to lactation failure. *Journal of the American Board of Family Practice* 2001; 14: 155-158.
  14. Caglar MK, Altugan FS, Ozer I. Exclusive breast feeding and hyponatremic dehydration. *Iranian J Publ Health* 2005; 34: 1-11.
  15. Oddie S, Richmond S, Coulthard M. Hyponatremic dehydration and breast feeding: A population study. *Arch Dis Child* 2001; 85: 318-320.

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