

Original Article

Association of Serum Electrolyte Abnormalities in Preterm Low Birth Weight Neonates

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Abstract:

Despite decline in under five mortality in the last few decades, neonatal mortality rate has not changed substantially. A large number of these newborn are premature or low birth weight. Premature infants are at increased risk of developing dehydration or overhydration. Therefore, high index of suspicion, prompt recognition and thorough understanding of common electrolyte abnormalities are necessary to improve neonatal outcome. It seems to be essential for immediate management for planning appropriate fluid and electrolyte therapy and thereby for improved outcome. To study the electrolytes abnormalities in preterm low birth weight neonates information were collected who gave consent and participated in the study willingly. Duration of data collection was approximately 6 (Six) months. Patients admitted to the Dhaka Medical College Hospital and after meeting the inclusion and exclusion criteria a simple random sampling technique was applied for selecting the sample patients. Total 50 preterm LBW neonates fulfilling the inclusion criteria were studied during this study period. Abnormal electrolytes were documented in 20(40%) preterm LBW neonates of which hyperkalemia was the predominant electrolyte abnormality found in 8(16.0%) neonates, hyponatremia was found in 7 (14.0%), hypokalemia in 3 (6.0%) and hypernatremia in 2 (4.0%). It was observed that electrolyte abnormalities are common in preterm LBW neonates. So, identification of associated electrolyte abnormalities and proper management of fluid and electrolytes and close monitoring are important.

Key words: Preterm, Low birth weight, Serum electrolytes, Neonate.

Introduction:

Preterm is defined as gestational age less than 37 completed weeks at birth and low birth weight (LBW), as weight less than 2,500 gram¹. Being born

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prematurely is a threat to survival, a significant proportion develop disabilities and impairments². According to Bangladesh demographic and health survey 2014, under five mortality rate is 46, infant mortality is 38 and neonatal mortality rate is 28. Despite decline in mortality in children in this age group in the last few decades, neonatal mortality rate has not changed substantially. ICDDR, B Health and Science Bulletin published in March 2006 reported that prematurity and low birth weight contributes to 27.8% of neonatal deaths in rural areas of Bangladesh³. In Bangladesh, preterm delivery is a common condition demanding hospital admission. Hospital admissions represent an underestimate of the true community incidence of prematurity. In a study conducted at Dhaka Shishu Hospital ICU from July 2001 to December 2003 showed that out of 92 preterm low birth weight infants admitted in ICU, 53 had some form of electrolytes abnormalities⁴.

Fluid, electrolyte and metabolic abnormalities are the commonest derangements encountered in preterm infants due to their renal immaturity and relatively immature skin. They are at increased risk of developing dehydration or overhydration⁵. Clinical parameters such as altered skin turgor, dry mucous membrane,

depressed anterior fontanelles are not sensitive indicators of dehydration in premature infants⁶. Premature infants require excess fluid to compensate for their larger insensible water losses and to avoid hypernatremia, hyperkalemia, hypovolemia and hypotension. Inadequate hydration leads to hyperosmolarity and may be a risk factor for intraventricular hemorrhage.

A loss of >20% birth weight during first week of life is extreme and suggests uncompensated insensible water loss. If weight loss is <2% per day for the 4-5 days, fluid administration is probably excessive⁶.

A few studies have been conducted on assessment of electrolytes in the context of prematurity in Bangladesh. But it seems to be essential for immediate management for planning appropriate fluid and electrolyte therapy and thereby for improved outcome. With this objective, the present study has been conducted to find out the association of electrolyte abnormalities with morbidity and mortality of the preterm low birth weight neonates.

Materials and methods:

The study was conducted in Special care baby unit (SCBU), Department of Paediatrics, Dhaka Medical College Hospital during 1st July 2014 to 30th January, 2015. It was a cross-sectional study. Neonates having gestational age <37 completed weeks, birth weight <2500 grams and normal BP (mean BP 40-60 mm of Hg) were included in this study. Neonates with gross congenital abnormalities, severe perinatal asphyxia, sepsis, maternal peripartum fever and presence of signs of infection were excluded.

A total 50 neonates meeting the inclusion criteria were selected by simple random sampling technique and were taken as sample. Data were recorded in questionnaire. All collected questionnaire were checked very carefully to identify the error in the data. Data processing work consisted of registration schedules, editing computerization, preparation of dummy table, analyzing and matching of data. Working definitions^{4,5} are: Hyperkalemia: Defined as serum potassium level greater than 6.5 mmol/l in a conventionally collected hemolysed blood specimen. Hypokalemia: Defined as serum potassium level less than 4.6 mmol/l. Hypernatremia: Defined as serum sodium level greater than 146 mmol/l. Hyponatremia defined as serum sodium level less than 133 mmol/l.

Results:

A total 50 preterm LBW neonates fulfilling the inclusion criteria were studied during this study period. Sex distribution of preterm LBW neonates were 25(50%) male and 25(50%) female babies and male female ratio was 1:1. There were 26 (52.0%) LBW and 24(48.0%) VLBW babies, 26(52.0%) babies had gestational age 28-33 weeks and 24 (48.0%) had gestational age 34-36 weeks and 36(72.0%) were AGA and 14(28.0%) babies were SGA with AGA: SGA was 18:7 (Table I).

Table I: Distribution of preterm newborns by intrauterine growth and gestational age

Classification	No of babies	Percent (%)
AGA	36	72.0
SGA	14	28.0
Total	50	100.0

AGA: Appropriate Gestational Age, SGA: Small for Gestational Age

Abnormal electrolytes were documented in 20(40%) out of 50 preterm LBW neonates and electrolyte status was normal in 30(60.0%) cases.

Hyperkalemia was the predominant electrolyte abnormality found in 8(16.0%) neonates, hyponatremia was found in 7(14.0%), hypokalemia in 3(6.0%) and hypernatremia in 2(4.0%). None of them had mixed electrolyte abnormalities. (Chart 1)

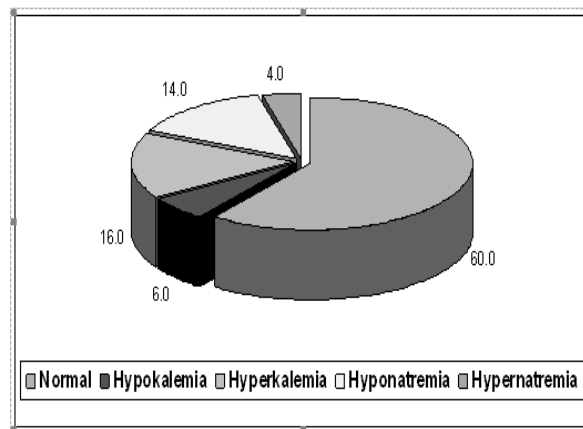


Chart 1: Type of electrolyte abnormalities

Table-II: Serum Sodium Level Analysis

Serum Sodium Level	Frequency
Normal(133-146mmol/l)	41
Hyponatremia (<133mmol/l)	7
Hypernatremia (>146mmol/l)	2
Mean	137.98
Median	138.00
Std. Deviation	5.30
Minimum	130.00
Maximum	156.00

Table II shows serum sodium level analysis. Sodium level was normal in 41(82%) and abnormal in 9(18.0%). Hyponatremia was found in 7(14.0%) and hypernatremia was found in 2(4.0%). Mean sodium level was 137.98 mmol/l, range was 130-156 mmol/l.

Table -III: Serum Potassium Level Analysis

Serum Potassium Level	Frequency
Normal (3.60-6.5mmol/L)	39
Hyperkalemia (> 6.5mmol/L)	8
Hypokalemia (< 3.60 mmol/L)	3
Mean	5.27 ± 1.13 SD

Table III shows serum potassium level normal in 39(78.0%), hyperkalemia in 8(16.0%) and hypokalemia in 3(6.0%) neonates. Mean potassium level was 5.27 ± 1.13 SD.

Discussion:

The study found electrolyte abnormalities in significant number (20) of preterm LBW babies. Hyperkalemia (8) was the commonest abnormality detected. Hyponatremia (7), hypokalemia (3) and hypernatremia (2) were also found.

Hyperkalemia was found in 8(16.0%) babies in this study. These findings are in contrast to those by Yuan et al⁷ who found hyperkalemia in 44% of sick premature neonates. One fact relevant to this difference in findings might be that the present study included healthy preterm neonates. Hossain MM et al⁴ have found hyperkalemia in 58.5% (31) neonates out of 53 preterm LBW admitted in ICU. The difference revealed in this study may be due to most of the neonates are healthy and mean gestational age 33 weeks at which age nephrogenesis is almost complete although maturation is still going on. Another important factor is that most of the studies were conducted in ICU patients, by definition their prematurity was not in a stable condition. We used working definition of hyperkalemia more than 6.5 mmol/l for preterm infant, but cut off value in other studies is more than 6 mmol/l⁷.

In this study hyponatremia was found in 7(14.0%) babies, gestational age was between 30-32 weeks. Al-Dahhan et al⁸ found negative sodium balance in 100% of neonates <30 weeks gestation, in 70% of neonates at 30-32 weeks, in 46% at 33-35 weeks and in none greater than 36 weeks.

Hypokalemia was found in 3(6.0%) neonates with no significant abnormalities, who had gestational age ≥ 34 weeks. In a search for the causes of hypokalemia, we found that baby could not be put to the mother's breast frequently for suckling due to maternal illness and primi parity. Inadequate feeding in early days of life may cause hypokalemia⁹ which is within tolerable limits and this might be the possible explanation of hypokalemia in this healthy preterm baby. Hypernatremia was found in 2(4.0%) neonates in this study. Hossain MM et al⁴ have found hypernatremia in 37.5% (31) neonates out of 53 preterm LBW admitted in ICU. It may be due to excessive insensible water loss and it responded to fluid challenge and measures were taken to reduce insensible water loss.

Conclusion:

From this study it was observed that electrolyte abnormalities are common in preterm LBW neonates. So identification of associated electrolyte abnormalities and proper management of fluid and electrolytes and close monitoring are necessary to reduce the neonatal mortality rate.

References :

- Da Silva O.P. Prevention of low birth weight/preterm birth. In: Canadian Task Force on the Periodic Health Examination. Canadian Guide to Clinical Preventive Health Care. Ottawa: 1994. p. 38-50. Last updated 2003.
- Marlow N. Outcome following preterm birth. In: Robertson NRC. Text book of neonatology, 5th edn. London: Churchill Livingstone; 2004. p. 63-79.
- ICDDR, B Health and Science Bulletin, 4, No 1, March 2006. P. 23-28.
- Hossain MM, Shirin M, Mamun AA, Chowdhury NA, Hasan MQ, Afroza S. Electrolyte abnormalities in neonates admitted in intensive care unit. Bangladesh J Child Health 2004;28:13-17.
- Gomella TL, Cunninham MD, Eyal F G, Zenk KE. Neonatology: Management, Procedures, On-Call Problems, Diseases, and Drugs. 4th ed. Connecticut: Appleton and Lange; 1999. p. 68-74.
- Ambalavanan N. Fluid, Electrolyte, and Nutrition Management of the Newborn. www. eMedicine Specialties /Pediatrics /Neonatology. Last visited: May 17, 2006.
- Yuan HC, Jeng MJ, Soong WJ, Chon HJ, Hwang BT. Hyperkalemia during early postnatal days in premature infants. Acta Pediatr. Taiwan 2003; 44:208-14.
- Al Dahhan J, Haycock GB, Chanter C, Stimmler L. Sodium homeostasis in term and preterm neonates. I Renal aspects. Arch Dis Child 1983; 58:335-42.
- Haycock G B, Aperia A. Salt and newborn kidney. Pediatric Nephrology 1991; 5:65-70.