Original Research Article

"Outcome of Neonates with Septicaemia with Different Types of Electrolyte Abnormality"

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Abstract: *Introduction:* Electrolyte abnormalities are frequently encountered in sick neonates. They occur in a variety of conditions including neonatal sepsis and may remain unrecognized leading to morbidity and mortality irrespective of the primary disease. So, timely recognition, a high index of suspicion and a thorough understanding of common electrolyte abnormalities are necessary to ensure their correction. *Objective:* To assess the *Outcome of Neonates with Septicaemia with Different Types of Electrolyte Abnormality.* **Methods:** All neonates who were suffering from septicaemia and admitted in BSMMU from 1st January 2011 to 15th September 2011 and fulfilled the inclusion criteria were evaluated. **Results:** During the study period total 120 neonates were admitted with the diagnosis of septicaemia in the Department of Neonatology, BSMMU, and Dhaka, Bangladesh. Among the neonates mean age were 9.26±4.58 days, mean weight 2282.68±580.40 gm, mean gestational age was 35.68±2.40 weeks. Among the neonates with septicaemia males were 66 (55%) and females were 54 (45%) and male to female ratio was 1.2:1. Among 120 cases of septicaemia 57 (47.5%) were early onset and 63 (52.5%) were diagnosed as late onset neonatal sepsis. Among the 120 neonates with septicaemia 37 (30.83%) died and 83 (69.17%) survived. Neonates with dyselectrolytemia were found significantly associated with prolonged hospital stay in comparison to those with normal electrolytes level (p<0.05). Hyponatremia, Hypokalemia, Hypernatremia and mixed electrolyte abnormalities were significantly associated with prolonged hospital stay (P< 0.05) but hyperkalemia was not found significantly associated with prolonged hospital stay (p>0.05). Hyponatremia, hypokalemia and mixed electrolyte abnormalities were significantly associated with higher mortality (P<0.05). Hypernatremia and Hyperkalemia were not found significantly associated with higher mortality (P>0.05). *Conclusion:* Electrolyte abnormalities are common in neonates with septicaemia. We found electrolyte abnormalities in 35% cases. Hyponatremia (20%) was the commonest abnormality followed by hyperkalemia (15.8%). Hyponatremia, hypokalemia and mixed electrolyte abnormalities were found to be significantly associated with higher mortality in this study.

Keywords: Neonates, Septicaemia, Electrolyte Abnormality, Outcome.

INTRODUCTION

Electrolyte abnormalities are frequently encountered in sick neonates. They occur in a variety of conditions including neonatal sepsis and may remain unrecognized leading to morbidity and mortality irrespective of the primary disease. So, timely recognition, a high index of suspicion and a thorough understanding of common electrolyte abnormalities are necessary to ensure their correction. Disorders of electrolytes are one of the commonest derangements encountered in critically ill neonates. They may remain unrecognized leading to morbidity and mortality irrespective of the primary problem [1]. Electrolytes abnormalities were observed by Rao *et al*. [2] in 32.45% of children getting admitted in PICU. They found hyperkalemia is the commonest electrolyte abnormality which was found in 14.4% [2]

cases and hyponatremia was the second commonest electrolyte abnormality noted in this study which was found in 9.5% [2] cases and mixed electrolyte imbalance was found in 7.9% cases [2]. Though Bangladesh has achieved a significant reduction in childhood mortality from 173 per thousand in the early 80s to 65 per thousand in 2006, the country still ranks seventh among the 42 countries contributing to 90% of childhood deaths worldwide [3]. In contrast, Hossain MM *et al.* [1] observed electrolytes abnormalities in 65.6% of neonates getting admitted to ICU of Dhaka Shishu Hospital. They also found hyperkalemia is the commonest electrolyte abnormality which was found in 34.4% cases. These findings are in contrast to those by Singhi *et al.* [4] and Rao *et al.* [2] who found hyperkalemia in 5.4% and 14.4% of ICU admissions respectively. Hyponatremia was the second most common electrolyte abnormality (16.6%) noted in this study [1]. In a study conducted in a pediatrics ICU, 9.5% of total admissions had hyponatremia [2]. In extracellular fluid sodium is the major cation contributing to the osmolality of plasma. The quantity of sodium in the body is therefore of vital importance in regulating blood volume. Abnormalities of sodium homeostasis are common in neonates who need intensive care and case fatality is also very high in hyponatremic neonates [1, 2]. Hyponatremia was the second most common electrolyte abnormality observed by Rao *et al.* [2] and Hossain MM *et al.* [1]. They found hyponatremia in 9.5%[2] and 16.6% [1] cases respectively. Rao *et al.* [2] found that the risk of mortality is increased by 3-3.5 times in patient with hyponatremia when compared to those with normal serum sodium. In contrast Hossain MM *et al.* [1] found that case fatality in hyponatremia is 59.6%. In their study hyponatremia was found to have a significantly higher mortality rate which is consistent with other studies [5-7]. Syndrome of inappropriate ADH secretion is the most common form of dilutional hyponatremia in neonate [8]. In very sick neonates especially with perinatal asphyxia and neonatal sepsis, SIADH is a common problem where severe hyponatremia can occur [1]. Among the critically ill neonates hyponatremia was found in 16.6% cases with high case fatality rate (59.6%) in a study conducted in ICU of Dhaka Shishu Hospital [1]. Prasad *et al.* [5] observed that the overall mortality rate showed an increase with lowering of serum sodium (Fig- 1) when compared to the children with normal serum sodium ($\geq$131 mEq/L), the relative risk of mortality in children with a serum sodium $\leq$125 mEq/L was 3.2 (95% confidence interval 1.6-6.7) while in those with serum sodium between of 126-130 mEq/L it was 1.8 (95% confidence interval 1.1-3.7). The type of hyponatremia did not show any association with mortality rate. Prasad *et al.* [5] also observed that the mean duration of hospital stay in children with serum sodium <125 mEq/L was significantly longer than those with serum sodium between 126-130 mEq/L and $\geq$131 mEq/L, while it was similar among children with serum sodium concentration above 125 mEq/L. A significantly prolonged hospital stay was also observed by Hossain MM *et al.* [1] in neonates with hyponatremia when compared to neonates with normal serum sodium level which is consistent with other studies [5, 7]. Therefore this study had been undertaken to determine the frequency and pattern of electrolyte imbalance in neonates with septicaemia, their impact on morbidity and mortality in neonates and help in the management issue.

MATERIALS AND METHODS
Study design: Cross sectional study.

Place of study: Department of Neonatology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Shahbag, Dhaka, Bangladesh.

Period of study: 1st January 2011 to 15th September 2011.

Sample size: 120 patients.

Inclusion criteria:
All neonates who were suffering from septicaemia and admitted in the Department of Neonatology, BSMMU during the study period. Definite septicaemia of the newborn was diagnosed by positive blood culture and probable septicaemia was diagnosed by a scoring system [9] developed by Tollner U and positive CRP.

Exclusion criteria:
Neonates with gross congenital anomalies. Any neonate sufferings from disease other than septicaemia such as perinatal asphyxia, meconium aspiration syndrome, transient tachypnea of the newborn, respiratory distress syndrome etc.

Study procedure and data collection:
For each baby, a detailed history was obtained from the mother or other caregiver and recorded in a questionnaire form. Maternal history included antenatal care, duration of labour, prolonged rupture of the membrane, mode of delivery, place of delivery, and maternal illness during pregnancy. Admission weight of the baby was recorded. Gestational age was determined from maternal records and by using Modified Ballard Scoring System. Time of first cry or breathing after birth, apnoea, cyanosis, convulsion, respiratory distress, prelacteal feeding, breast feeding, reluctance to feed and bleeding manifestations were also recorded. Each case was thoroughly examined and followed up. Heart rate, respiratory rate, temperature, colour, activity, abnormalities in head, fontanelles, any congenital anomalies, primitive

reflexes, level of consciousness, muscle tone were recorded. Venous blood sample was sent from neonates with septicaemia for estimation of serum electrolytes (Sodium and Potassium). Blood was drawn by researcher himself (sometimes by duty doctors) on admission of patients with septicaemia or during hospital stay in case of nosocomial infection.

Other investigations:

Other relevant investigations for the diagnosis and follow up of the patients included- complete blood count, peripheral blood film, blood culture, CRP, blood urea, serum creatinine, random blood sugar, blood grouping, chest x-ray, serum bilirubin, arterial blood gas analysis.

DATA ANALYSIS

The collected data were analyzed thoroughly by SPSS program, version- 12. In addition to descriptive statistics such as frequency tabulation, mean and standard deviation, statistical tests such as chi-square test and t test were applied accordingly to determine statistically significant differences and or to adjust for pertinent variables as necessary.

RESULTS

During the study period total 120 neonates were admitted with the diagnosis of septicaemia in the Department of Neonatology, BSMMU, and Dhaka, Bangladesh. Among the neonates mean age were 9.26 ± 4.58 days, mean weight 2282.68 ± 580.40 gm, mean gestational age was 35.68 ± 2.40 weeks. Among the neonates with septicaemia males were 66 (55%) and females were 54 (45%) and male to female ratio was 1.2:1. Among 120 cases of septicaemia 57 (47.5%) were early onset and 63 (52.5%) were diagnosed as late onset neonatal sepsis (Table- I). Among the 120 neonates with septicaemia 37 (30.83%) died and 83 (69.17%) survived. Neonates with dyselectrolytemia were found significantly associated with prolonged hospital stay in comparison to those with normal electrolytes level ($p<0.05$). Hyponatremia, Hypokalemia, Hypernatremia and mixed electrolyte abnormalities were significantly associated with prolonged hospital stay ($P<0.05$) but hyperkalemia was not found significantly associated with prolonged hospital stay ($p>0.05$). Hyponatremia, hypokalemia and mixed electrolyte abnormalities were significantly associated with higher mortality ($P<0.05$). Hypernatremia and Hyperkalemia were not found significantly associated with higher mortality ($P>0.05$) (Table-II).

Table-I: Distribution of baseline characteristics among the neonates with septicaemia (n= 120)

Baseline characteristics	Mean	±SD
Age (days)	9.26	4.58
Weight (gm)	2282.68	580.4
Gestation (weeks)	35.68	2.4
Early onset sepsis	57	47.5
Late onset sepsis	63	52.5

Table-II: Outcome of neonates with septicaemia with different types of electrolyte abnormality (n=120)

Type of dyslectrolytemia		Mean±SD	Survived	Died	P
Dyselectrolytemia	Present (n= 42)	10.86±5.14	23 (54.76%)	19 (45.24%)	0.01
	Absent (n= 78)	8.37±3.74	60 (76.92%)	18 (23.08%)	
Hyponatremia	Present (n= 24)	12.38±4.74	12 (50%)	12 (50%)	0.02
	Absent (n= 96)	8.46±4.00	71 (74%)	25 (26%)	
Hypernatremia	Present (n= 12)	11.92±4.96	10 (83.33%)	2 (16.66%)	0.21
	Absent (n= 108)	8.94±4.23	73 (67.60%)	35 (32.40%)	
Hypokalemia	Present (n= 17)	12.71±3.68	8 (47%)	9 (53%)	0.03
	Absent (n= 103)	8.68±4.29	75 (72.80%)	28 (27.2%)	
Hyperkalemia	Present (n= 19)	9.00±5.01	11 (57.89%)	8 (42.11%)	0.16
	Absent (n= 101)	9.29±4.33	72 (71.28%)	29 (28.72%)	
Mixed	Present (n= 18)	13.56±3.98	8 (44.44%)	10 (55.56%)	0.01
	Absent (n= 102)	8.93±4.37	75 (73.53%)	27 (26.47%)	

X^2 test was done

DISCUSSION

In this study an attempt was made to find out the frequency and pattern of electrolyte abnormalities in neonates with septicaemia and their impact on morbidity and mortality of neonates. Electrolytes abnormality is a common complication in critically ill neonates. In the present study among the 120 neonates with septicaemia electrolytes abnormalities were observed in 42 (35%) of neonates which correlated with the findings of Rao *et al.* (32.45%) [2]. But Hossain MM *et al.* [1] observed electrolyte abnormalities in 65.6% of neonates. This difference was probably due to

inclusion of asphyxiated neonates in that study [1]. Hyponatremia was the commonest electrolyte abnormality found in present study. It is found in 24 (20%) patients. These findings are in contrast to those by Hossain MM *et al*. [1] and Rao *et al*. [7] who found hyponatremia in 16.6% and 9.5% cases respectively. They found that hyponatremia was the second most common electrolyte abnormality. Among the 17 patients with hypokalemia, 9 patients died and 8 patients survived. Death rate was 53%. In contrast, among the 103 patients with normal potassium level, 28 patients died. Death rate is 27.2%. Hossain MM *et al*. [1] also found that the risk of mortality is significantly higher in patients with hypokalemia in comparison to those with normal electrolyte values. The case fatality was 75%. Singhi *et al*. [4] and Marudkar *et al*. [10] also observed the similar results. The mortality rate was 15% and 25.6% respectively. Hypokalemia was also associated with prolonged hospital stay when compared to those with normal electrolytes level. Hossain MM *et al*. [1], Rao *et al*. [2], Singhi *et al*. [4] and Marudkar *et al*. [10] also observed the similar results. Hypernatremia was the least common electrolyte abnormality observed in the present study. It is found in 12 (10%) patients. Hossain MM *et al*. [1] observed in their study that 15.2% cases were hypernatremic which was the 3rd most common electrolyte abnormality. Rao *et al*. [2] observed hypernatremia in 4.9% of patient which was 3rd most common electrolyte abnormality. Hypernatremia was not found significantly associated with higher mortality in the present study ($p>0.05$). But Rao *et al*. [2] observed that hypernatremia is significantly associated with higher mortality and mortality rate was 33.33% with $P<0.008$. Mandal *et al*. [11] also observed the similar results. Hypernatremia was found significantly associated with prolonged hospital stay in the present study. Hossain MM *et al*. [1], Rao *et al*. [2] and Mandal *et al*. [11] also observed the similar results. Mixed electrolytes abnormalities were also commonly found in the present study. It is found in 18 (15%) patients. Rao *et al*. [2] observed 7.9% and Hossain MM *et al*. [1] observed 9.9% cases were mixed electrolyte abnormalities. The present study observed that mortality rates in patients with mixed electrolyte abnormalities were significantly higher when compared to those with single electrolyte abnormality or normal electrolyte values. Among the 18 patients with mixed electrolyte abnormality, 10 patients died and 8 patients survived. Death rate was 55.55%. Hossain MM *et al*. [1] observed that case fatality was 50% in mixed dyselectrolytemia. The present study also observed that the mean duration of hospital stay was also prolonging in patient with mixed dyselectrolytemia when compared to those with single abnormality or normal electrolytes value. Similar observations were also made by Hossain MM *et al*. [1], Rao *et al*. [2] and Prasad *et al*. [5]. In the present study, among the 120 neonates with septicaemia, electrolytes abnormalities were observed in 42 (35%) cases. Among the electrolytes abnormalities hyponatremia was seen in 24 (20%) cases, hypernatremia in 12 (10%), hypokalemia in 17 (14.2%), hyperkalemia in 19 (15.8%) and mixed abnormality in 18 (15%) cases. Of these 42 patients with electrolyte imbalance 19 (45.23%) expired. Hossain MM *et al*. [1] observed in their study that among the 225 patients with electrolyte imbalance 105 (46.7%) died.

CONCLUSION

Electrolyte abnormalities are common in neonates with septicaemia. We found electrolyte abnormalities in 35% cases. Hyponatremia (20%) was the commonest abnormality followed by hyperkalemia (15.8%). Hyponatremia, hypokalemia and mixed electrolyte abnormalities were found to be significantly associated with higher mortality in this study.

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