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"Electrolyte Imbalance and Immediate Outcome in Asphyxiated Neonates: A study in a tertiary care hospital, Dhaka, Bangladesh"

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Abstract **Original Research Article**

Introduction: Perinatal asphyxia is the most common cause of neonatal morbidity and mortality in the world. Electrolyte imbalance is very common in the immediate post asphyxiated period and it effects on neonatal outcome. In Bangladesh like other developing countries, perinatal asphyxia is considered as one of the major cause of death and disability of newborn. ***Aim of the study:*** The aim of this study was to evaluate the serum sodium, potassium and calcium levels in postnatal period of asphyxiated newborns and the immediate outcome. ***Methods:*** This prospective observational study which was conducted in the Department Paediatric Medicine of Dr. MR Khan Shishu Hospital & Institute of Child Health, Dhaka, Bangladesh during the period from July 2018 to December 2018. In total 72 asphyxiated babies attended in selected hospital were finalized as study population. For collecting data MS-Excel and for analyzing data SPSS version were used. ***Result:*** In analyzing the serum sodium levels of the participants we found, 47 patients were with normal serum sodium level which was 69.9% and rest 25 patients which were 30.1% had hyponatremia. Not a single patient was found with hypernatremia. On the other hand in analyzing the serum potassium levels of the participants we found, the highest number of patients were with normal potassium level which was 73.61% (n=53) among all the participants. Then 14 (19.44%) patients had hyperkalemia and 5 (6.94%) patients had hypokalemia. ***Conclusion:*** The early identification and time-based intervention of electrolyte imbalance in the early post asphyxiated period can significantly reduce the morbidity and mortality. For getting more specific findings we would like to recommend for conducting more studies regarding the same issue with larger sized sample.

Keywords: Electrolyte imbalance, Asphyxiated, hyponatremia, Perinatal.

INTRODUCTION

Perinatal asphyxia is a threat to fetus or newborns due to lack of oxygen and/or perfusion to brain and other organs. It is often associated with multiple pathophysiological consequences, which lead to multi-organ dysfunction [1]. Perinatal asphyxia can lead to myocardial dysfunction, rhythm abnormalities, acute renal failure, and respiratory failure, necrotizing enterocolitis in preterm neonates, coagulation abnormalities, and metabolic abnormalities, such as hypoglycemia, hyperglycemia, and hypocalcemia [2]. Bangladesh is a developing country where about 85% of the deliveries are taking place at home without any proper supervision [3]. A high proportion of mother in rural area never seeks or gets any antenatal care (ANC) [4]. Every year approximately 3.8 million babies are born; of whom approximately 15,000 die in the first 28 days of life [4, 5]. In other words one new born dies in every 3.5 minutes. As antenatal care is unsatisfactory so the risk of asphyxia is present in every pregnancy [6]. And neonatal mortality contributes 74% of the infant mortality [7]. Perinatal asphyxia is the second major cause of neonatal mortality in our country. Perinatal asphyxia is the commonest illness associated with abnormal electrolytes among sick neonates [8]. In neonate, specific symptoms of electrolyte abnormalities often merge with features of underlying HIE, and inappropriate use of fluid and electrolytes in such situation perpetuates morbidity and mortality [9]. A variety of metabolic problems are present in asphyxiated infants including hyponatremia, hypoglycemia, hypocalcemia and hypomagnesemia [10]. As far we know, a few studies have been conducted in this context in Bangladesh. There is little information on this topic in our literature despite the

fact that birth asphyxia is a leading cause of neonatal mortality. With this vision the present study has been conducted to find out pattern of electrolyte abnormalities in asphyxiated neonates. The aim of this study was to evaluate the serum sodium, potassium and calcium levels in postnatal period of asphyxiated newborns. Another objective of this study was to compare the serum sodium, potassium and calcium level in different grading of HIE of perinatal asphyxia and immediate outcome. All the procedure of this study had been carried out to fulfill those aim an objectives.

OBJECTIVES

a) General objective

- To evaluate the serum sodium, potassium and calcium levels in immediate postnatal period of asphyxiated newborns.

b) Specific Objectives

- To compare the serum sodium, potassium and calcium level in different grading of HIE of perinatal asphyxia and immediate outcome.

METHODOLOGY & MATERIALS

This prospective observational study which was conducted in the Department Paediatric Medicine of Dr. MR Khan Shishu Hospital & Institute of Child Health, Dhaka, Bangladesh during the period from July 2018 to December 2018. The approval of the ethical committee of respective hospital and the proper written consents of all the respondents in favor of the study people had been obtained before starting the intervention. In total 72 asphyxiated babies attended MR Khan Shishu Hospital & Institute of Child Health, Dhaka, Bangladesh were finalized as study population for this study. According to the inclusion criteria live born babies with perinatal asphyxia who had delay to establish first breath within sixty seconds, delayed cry after birth. APGAR score <7 at 5 min, and early neonatal seizures were included in this study. On the other hand according to the exclusion criteria, baby of diabetic mother, septicemic babies, babies with inborn error of metabolism and baby having lethal congenital deformity were excluded from the study. Beside the patients attended the Department Paediatric Medicine clinically detected cases of perinatal asphyxia were included from inpatient department of pediatric and obstetrics ward according to inclusion criteria. After taking verbal consent a detailed history from the mother or other caregiver who attending the baby was recorded according to a predesigned data collection sheet. With all aseptic precaution small amount (2.0 ml) of venous blood was collected after taking informed consent from the person attending the baby. Easy Lyte PLUS auto analyzer was used for detection of sodium, potassium and chloride level. For collecting MS-Excel and for analyzing data SPSS version was used. On the other hand for disseminating the findings several tables were used.

RESULT

In our study among 72 participants 37 (51.39%) were male and 35 (48.61%) were female. In analyzing the serum sodium levels of the participants we found, 47 patients were with normal serum sodium level which was 65.28% and rest 25 patients which were 34.72% had hyponatremia. Not a single patient was found with hypernatremia. On the other hand in analyzing the serum potassium levels of the participants we found, the highest number of patients were with normal potassium level which was 73.61% (n=53) among all the participants. Then 14 (19.44%) patients had hyperkalemia and 5 (6.94%) patients had hypokalemia. According to the grading of asphyxiated babies we found the highest 44.44% (n=32) patients were in moderate condition followed by 33.33% (n=24) in mild and 22.22% (n=16) in severe condition. According to the serum sodium level among 24 mild asphyxiated babies 29.17% were with hyponatremia whereas 70.83% were normal in condition. Again, among 32 moderate asphyxiated babies 25% were with hyponatremia whereas 75% were normal in condition and among 16 severe asphyxiated babies 62.5% were with hyponatremia whereas 37.5% were normal in condition. In analyzing final outcome we found, among total population 52 (72.22%) patients survived whereas 20 (27.78) died. The highest 45% babies died with hyponatremic whereas normal sodium level 23.40% was died. On the other hand, according to the grading of asphyxiated babies and their potassium level we found the highest 28 patients were in moderate condition followed by 25 in severe and 19 in mild condition. According to the serum potassium level among 19 mild asphyxiated babies 5.26% were with hypokalemia, 78.95% were normal in condition and 15.79% were with Hyperkalemia. Again, among 28 moderate asphyxiated babies 3.57% were with hypokalemia, 75% were normal in condition and 21.43% were with hyperkalemia. On the other hand among 25 severe asphyxiated babies 12% were with hyponatremia, 68% were normal in condition and 20% were with hyperkalemia. The highest 60% babies died with hypokalemia potassium level whereas the lowest 22.64% were with normal potassium level.

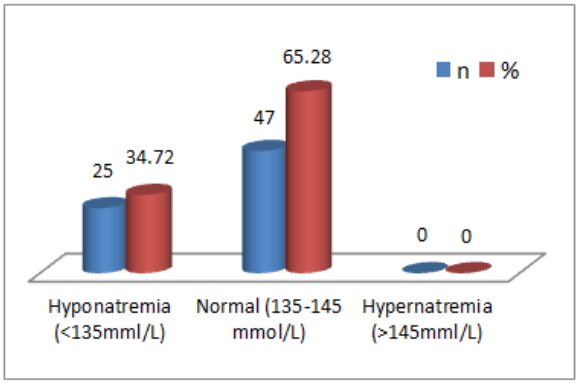

Fig-I: Serum sodium levels of participants (n=72)

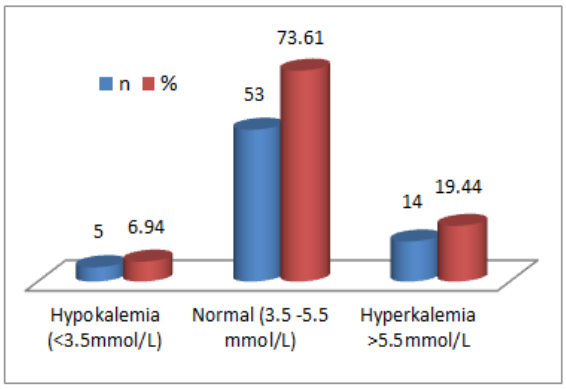

Fig-II: Serum potassium levels of participants (n=72)

Table-I: Grading of asphyxiated babies and final outcome regarding serum sodium level (n=72)

Serum sodium level	Grading of asphyxiated babies						Outcome of babies				Total (n=72)	
	Mild (n=24)		Moderate (n=32)		Severe (n=16)		Survived (n=52)		Died (n=20)			
	n	%	n	%	n	%	n	%	n	%	n	%
Hyponatremia	7	29.17	8	25	10	62.5	16	30.77	9	45	25	34.72
Normal	17	70.83	24	75	6	37.5	36	69.23	11	23.40	47	65.28
Total	24	100	32	100	16	100	52	100	20		72	100

Table-II: Grading of asphyxiated babies and final outcome regarding serum potassium level (n=72)

Serum sodium level	Grading of asphyxiated babies						Outcome of babies				Total	
	Mild (n=19)		Moderate (n=28)		Severe (n=25)		Survived (n=52)		Died (n=20)			
	n	%	n	%	n	%	n	%	n	%	n	%
Hypokalemia	1	5.26	1	3.57	3	12	2	3.85	3	60	5	6.94
Normal	15	78.95	21	75.00	17	68	41	78.85	12	22.64	53	73.61
Hyperkalemia	3	15.79	6	21.43	5	20	9	17.31	5	35.71	14	19.44
Total	19	100	28	100	25	100	52	100	20		72	100

DISCUSSION

In this study out of among all the participants 25 (34.72%) were hyponatremic. Hyponatremia was the predominant electrolyte abnormality in the present study. This finding is consistent with finding of Singhi [11] and Prasad [12], *et al.* where hyponatraemia found in 30% and 29.8% respectively. Presence of SIADH in perinatal asphyxia explain high incidence of hyponatremia in these neonates. But these findings were in contrast with findings of Hossain, *et al.* [l] where hyponatremia was reported in 26.7% neonates and they also found hypernatremia in 23.8% of asphyxiated neonates which was not found in the present study. They found out of 40 babies 17 (42.5%) of severely asphyxiated, 11 (27.5%) of moderately asphyxiated and 12 (30.0%) of mildly asphyxiated babies were hyponatremic. The positive association between serum sodium and grading of asphyxia was found to be statistically highly significant (P<0.001). Hypokalemia observed in 5 (6.94%) asphyxiated babies was the least common electrolyte abnormalities in this study. This finding is consistent with Hossian, *et al.*[8] (8.6%). Marudhkar[13] found 43 (14.8%) cases of hypokalemia. Hypokalemia was found in 28 (21.1%) asphyxiated neonates in this study. In another study, Yuan *et al.* found hypokalaemia in 44% of sick premature infants. Singhi [14] found hyperkalemia in 5.4% and 14.4% respectively of ICU admissions, which included asphyxiated as well as other sick neonates. Out of 25 (34.72%) hyponatremic babies 9 (45%) died, significantly higher mortality observed in present study and consistent another study [12]. Rao, *et al.*[15] reported 3 (60%) mortality in hypokalamic and 5 (35.71%) mortality in hyperkalemic neonates. Impaired serum calcium level in perinatal asphyxia also affects outcome. Our findings regarding hyponatremia were similar to many of the studies of the world. The finding was consistent with findings of Basu, *et al.* Prasad, *et al.* [11]. Of the asphyxiated babies (n=72) hyperkalemia was found in 6.94% neonate and hyperkalemia was found in 19.44% neonates. This result was significant (P<0.001) and consistent with Basu, *et al.* and Gupta, *et al.* [16]. In our study we found, 22.64% babies died with normal sodium level whereas 45% were hyponatremic. On the other hand, according to the grading of asphyxiated babies and their potassium level we found the highest 28 patients were in moderate condition followed by 25 in severe and 19 in mild condition. So patients of a big ratio can

die with normal level of serum sodium and serum potassium which demand more research and more consciousness in this treatment arena.

LIMITATIONS OF THE STUDY

This was a single centered study with a small sized of sample. So the findings of this may not reflect the exact scenario of the whole country.

CONCLUSION AND RECOMMENDATIONS

Hypokalamia and hyponatremia are the most common electrolyte abnormality among Asphyxiated Neonates followed by hyperkalemia. Mortality was found high among neonates having electrolyte abnormality and the highest among hypokalamic neonates. So, early identification and time based intervention can reduce the mortality.

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