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ORIGINAL ARTICLE

Comparative study on electrolyte in asphyxiated neonates as compared to normal

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ABSTRACT:

Aim: The aim of the study was to assess the immediate post-natal electrolyte values in asphyxiated new-borns and their comparison between same age group of healthy neonates. **Material and Method:** A total number of 100 neonates of both sex 50 asphyxiated babies and 50 healthy neonates admitted into pediatrics and Gynecology has been taken for the present study. The blood sample for electrolyte examination was collected in red capped plain sterile vacutainer within 3 hours of birth. Statistical analysis of collected data has been determined by using SPSS (16.0). Chi square (chi-square) analyses were done to compare the test values between cases and control. P value < 0.05 was considered as statistically significant. **Result:** This study shows hyponatremia, hyperkalemia, hypomagnesaemia and normal calcium level between two groups, i.e. Cases and Controls. **Conclusion:** From this study it can be concluded that electrolyte abnormalities are common asphyxia, which has a great impact on mortality and morbidity. If inappropriate fluid and electrolytes are given, serious morbidity can result from fluid and electrolyte imbalance.

Key words: Asphyxia, hyponatremia, hyperkalemia, hypomagnesaemia

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INTRODUCTION

In basic term birth asphyxia is delay in establishing spontaneous respiration upon delivery of a newborn[1]. More precisely, birth asphyxia is defined as the presence of hypoxia, hypercapnia, and acidosis leading to systemic disturbances in the newborn[2]. The fluid and electrolyte shift can occur after birth asphyxia[3]. Perinatal asphyxia may result in adverse effects on all major body systems. In a term infant with perinatal asphyxia renal, neurologic, and cardiac and lung dysfunction occurs in 50%, 28%, 25% and 23% cases respectively[4]. Fluid, electrolyte and metabolic abnormalities are the commonest derangements encountered in critically ill asphyxiated neonate. Serum sodium, potassium and calcium are major electrolytes in the body and any deviation from their normal level leading to convulsions, shock, and major metabolic abnormalities[5]. Syndrome of inappropriate secretion of antidiuretic hormone (SIADH) is a common problem in these neonates accounting for hyponatremia, hyperkalaemia results from ischaemic insult with eventual renal insufficiency. According to the WHO 2005 data, birth asphyxia is one of the leading causes of death in first week of life[6]. It is strongly associated with 1.1 million stillbirths and development of 3About 30-50% of infants with HIE-II and III suffer from some form of mental and physical disabilities every year in our country. Despite the increasing understanding of the mechanisms leading to and resulting from neonatal asphyxia, early determination of brain damage following hypoxic-ischemic events still remains thehardest problems in neonatal care,[7] according to WHO, 4 million deaths per year occur causes related to birth asphyxia which is the largest cause of deaths under 5 mortality (8.5%) after neonatal infections and other complications after birth[8]. In least developed countries perinatal asphyxia remains a major cause of death and disability[9]. Calcium is an important second messenger in our body and act as a cofactor for muscle function and several enzyme activities[10,11] hypocalcemia triggers seizure activity and deleterious cardio vascular sequences in asphyxiated new-borns. It is difficult to differentiate the seizure activity due to hypocalcimia and asphyxia [12,13]. Therefore, monitoring of serum calcium levels assumes the importance in birth asphyxia. Not only the serum calcium level, monitoring of serum sodium and potassium levels also required to the manage deleterious effects of birth asphyxia. This study has been done to monitor the electrolytes derangements correlating with the severity of birth asphyxia.

To the best of our knowledge, 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.

MATERIAL AND METHOD

A total number of 100 neonates of both sex 50 asphyxiated babies and 50 healthy neonates admitted into pediatrics and Gynecology has been taken for the present study. The blood sample for electrolyte examination was collected in red capped plain sterile vacutainer within 3 hours of birth. Blood sample after clot formation were centrifuged at 3500 rpm for 10 minutes to obtain serum. Serum electrolyte was estimated by direct ISE method within 2 hours of sample collection. The aim of the study was to assess the immediate post-natal electrolyte values in asphyxiated new-borns and their comparison between same age group of healthy neonates.

Statistical analysis of collected data has been determined by using SPSS (16.0). Chi square (chi-square) analyses were done to compare the test values between cases and control. P value < 0.05 was considered as statistically significant.

INCLUSION CRITERIA

1) Delay to establish first breath within sixty seconds.
2) Delayed cry over 90 seconds.
3) Heart Rate <100 beats/minute at birth.
4) If the newborn remains hypotonic or floppy over hours.
5) Early neonatal seizures.

EXCLUSION CRITERIA

1) Baby of diabetic mother.
2) Septicemic babies.
3) Babies with inborn error of metabolism.
4) Baby having lethal congenital deformity.
5) Babies born to mothers with abnormal electrolyte values, hypertension, diabetes, fever within 2 weeks.

RESULT

Comparison of serum Sodium level between controls and asphyxiated neonates by Student's t-test

Parameter	Control group (n=50) Mean ± SD	Children with asphyxia (n=50) Mean ± SD	p- value
Serum Sodium level (mmol/L)	142± **5.1**	127± **3.1**	0.003

Statistically significant differences were observed in the mean serum sodium level of controls (142± 5.1 mmol/L) and neonates with asphyxia (127± 3.1 mmol/L) (p = 0.003). This result suggests asphyxiated neonates may suffer from hyponatremia.

Comparison of potassium level between controls and asphyxiated neonates by Student's t-test

Parameter	Control group (n=50) Mean ± SD	Children with asphyxia (n=50) Mean ± SD	p- value
Serum potassium level (mmol/L)	4.1± 1.4	5.3 ± 0.5	0.002

Statistically significant differences were observed in the mean serum potassium level of controls (4.1 ± 1.4 mmol/L) and neonates suffering from asphyxia (5.3 ± 0.5 mmol/L). (p= 0.002). This result strongly suggests asphyxiated neonates may suffer from hyperkalemia.

Comparison of total Calcium level between controls and asphyxiated neonates by Student's t-test

Parameter	Control group (n=50) Mean ± SD	Children with asphyxia (n=50) Mean ± SD	p- value
Serum Total Calcium level (mg/dl)	9.1± **5.3**	8.9 ± **6.1**	0.09

Statistically significant differences were not observed in the mean serum total calcium level of controls (9.1±5.3 mg/dl) and neonates suffering from asphyxia (8.9 ± 6.1mg/L) (p= 0.09). This result suggests there may not be any changes in total calcium level in asphyxia condition in neonates.

Comparison of Magnesium level between controls and asphyxiated neonates by Student's t-test

Parameter	Control group (n=50) Mean ± SD	Children with asphyxia (n=50) Mean ± SD	p- value
Serum Magnesium level (mmol/L)	2.3 ± 1.0	1.7 ± 1.2	0.01

Statistically significant differences were observed in the mean serum magnesium level of controls (2.3 ± 1.0 mmol/L) and Children suffering from asphyxia (1.7 ± 1.2mmol/L). (p= 0.01). This result shows a significant difference in the test value of magnesium in control group as compare to asphyxiated neonates which suggest hypomagnesaemia.

Tabular representation showing Pearson correlation coefficient (r) and p-value Between sodium and potassium

Parameters	r- value	p-value
Sodium– Potassium (in Cases)	0.36	0.04
Sodium– potassium (in Control)	0.21	0.07

After applying Pearson's correlation coefficient it was found that there is a positive correlation between serum sodium level and serum potassium (r = 0.36) in cases. Whereas, in control it do not shows any significant correlation.

Between Calcium and Magnesium

Parameters	r- value	p-value
Calcium - Magnesium (in Cases)	-0.27	0.03
Calcium - Magnesium (in Control)	0.19	0.09

After applying Pearson's correlation coefficient it was found that there is a negative correlation between serum calcium and magnesium (r = -0.27) in cases. Whereas, in control it do not shows any significant correlation.

DISCUSSION

Asphyxia is an insult to the fetus or newborn due to lack of oxygen or lack of perfusion to various organs. Immediate morbidity and mortality of perinatal asphyxia is due to multi-organ dysfunction resulting from hypoxic-ischaemic insult. It was observed that babies with asphyxia had higher incidence of abnormal electrolyte imbalance. This imbalance will be the major risk factor for brain injury and can result in multi-organ failure. Careful correction of the above electrolyte abnormalities will surely improve the outcome of new-borns. This study interprets the association of electrolyte abnormalities with the different electrolytes which are major concern during neonates. In this study, statistically significant differences were observed in the mean serum potassium level of controls (4.1 ± 1.4 mmol/L) and neonates suffering from asphyxia (5.3 ± 0.5 mmol/L). (p= 0.002). Which is similar to the study of Basu P *et al.*[3], Similarly in another case control study done by Varndana V et al.[14], they also found the similar result. On the other hand in this study statistically significant differences were observed in the mean serum sodium level of controls (142± 5.1 mmol/L) and neonates with asphyxia (127± 3.1 mmol/L) (p = 0.003). This result suggests asphyxiated neonates may suffer from hyponatremia. Which is also similar to the study of Bansal P et al.[15], and Varma V et al.,. Whereas in this study level of calcium statistically significant differences were not observed in the mean serum total calcium level of controls (9.1±5.3 mg/dl) and neonates suffering from asphyxia (8.9 ± 6.1mg/L) (p= 0.09). This result suggests there may not be any changes in total calcium level in asphyxia condition in neonates. In contradictory to our study, Jajoo et al,[10] observed significant low calcium levels at birth and other periods also. While statistically significant differences were observed in the mean serum magnesium level of controls (2.3 ± 1.0 mmol/L) and children suffering from asphyxia (1.7 ± 1.2mmol/L). (p= 0.01). This result shows a significant difference in the test value of magnesium in control group as compare to asphyxiated neonates which suggest hypomagnesaemia. On the other hand after applying Pearson's correlation coefficient it was found that there is a positive correlation between serum sodium level and serum potassium (r = 0.36) in cases. Whereas, in control it do not shows any significant correlation. Similarly, this study also shows a negative correlation between serum calcium and magnesium (r = -0.27) in cases. Whereas, in control it do not shows any significant correlation. This study was limited as only one sample were drawn from patient within 3 hours of birth and sample size need to be increase to make further interpretation.

CONCLUSION

From this study it can be concluded that electrolyte abnormalities are common asphyxia, which has a great impact on mortality and morbidity. In this study it is proved that babies with asphyxia develop hyponatremia, which is associated with the severity of asphyxia. The asphyxiated babies also develop hyperkalemia and hypomagnesaemia but to reach to definite conclusion further studies are required. If inappropriate fluid and electrolytes are given, serious morbidity can result from fluid and electrolyte imbalance. So measurement of serum electrolyte is the best way to measure the baby's electrolyte status and the adequacy or excess of electrolyte intake.

Specific symptoms of electrolyte abnormality often merge with the underlying disease. Close monitoring and correction of electrolyte abnormalities are important to reduce morbidity and mortality in asphyxia. More severe hyponatremia should be suspected if there is severe birth asphyxia and vice versa. Hence its level should be more regularly monitored to prevent the problems associated with it. Severe hyperkalemia is also associated with severe birth asphyxia and vice versa; so regular potassium monitoring and ECG monitoring is required to detect cardiac changes which can play a significant role in decreasing mortality of neonates.

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