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ASSESSMENT OF SERUM ELECTROLYTE PROFILE IN NEONATES AND ITS CLINICAL SIGNIFICANCE

Paediatrics

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ABSTRACT

Perinatal asphyxia is a common neonatal problem and contributes significantly to neonatal mortality and long-term morbidity. The incidence of perinatal asphyxia is 1-6 % in most developed countries and is inversely related to gestational age and birth weight. Birth asphyxia is a prevalent neonatal condition that can lead to systemic organ dysfunction, including renal, neurological, cardiac, and pulmonary complications. Hypoxic-Ischemic Encephalopathy (HIE) is a major concern due to its potential long-term neuromotor sequelae of perinatal asphyxia. This study aimed to compare serum electrolyte levels (sodium and potassium) in asphyxiated and non-asphyxiated newborns. The study also analyses the correlation between electrolyte disturbances and the severity of birth asphyxia. The findings highlight the importance of early detection and management of electrolyte imbalances to improve neonatal outcomes.

KEYWORDS

Neonates, Perinatal Asphyxia, Hyponatremia, Hyperkalaemia.

INTRODUCTION

Perinatal asphyxia refers to a condition during first and second stage of labour in which impaired gas exchange leads to foetal hypoxemia and hypercarbia.[1] It is identified by foetal acidosis as measured in umbilical arterial blood. Although the most widely accepted definition of foetal acidosis is a pH of < 7, even with this degree of acidosis, the likelihood of brain injury is low.[2] According to National Neonatal Perinatal Database (NNPD) 2003 data collected from 17 tertiary neonatal intensive care units in India, Apgar scores < 7 at 1 minute (includes moderate and severe asphyxia) was 8.4% of all live births[3]. Oxygen was the most used resuscitative measures in 9.5%. Bag and mask ventilation was used in 6.3% infants and 0.8% infants needed cardiac compressions and use of medications in 0.5% for resuscitation at birth.[4] Perinatal asphyxia is a significant neonatal issue that contributes to high rates of mortality and long-term health complications. While vital organs like the brain, heart, and adrenal glands receive prioritized blood flow, other systems such as the kidneys, gastrointestinal tract, and skin may suffer from reduced perfusion, resulting in multi-organ dysfunction.[5] Hypoxic ischaemic encephalopathy is particularly concerning due to its potential for long-term brain damage. Electrolyte imbalances, such as hyponatremia and hyperkalaemia are common in asphyxiated newborns and can result in convulsions, shock, and metabolic abnormalities. Understanding these disturbances is crucial for effective neonatal care.[6] The study aims to summarize the findings of a study conducted to evaluate electrolyte abnormalities in neonates with perinatal asphyxia and their correlation with the severity of the condition.

MATERIALS AND METHODS

This study was conducted on term, appropriate for gestational age newborns with birth asphyxia admitted to the NICU of Nalanda Medical College Hospital between December 2017 and November 2019. The aim was to analyse serum electrolytes (sodium and potassium) in neonates and their correlation with the severity of perinatal asphyxia. The inclusion criteria consisted of term newborns with birth asphyxia. Exclusion criteria included congenital abnormalities of the kidneys or urinary tract, septicaemia, respiratory distress syndrome, preterm babies with birth asphyxia. The study included 50 newborns with birth asphyxia and 50 normal newborns, with informed written consent obtained from parents. Perinatal history and clinical examinations were conducted, and birth asphyxia was diagnosed using APGAR scores. Serum electrolytes were monitored at 24, 48, and 72 hours post-birth. The collected data was analysed using statistical methods such as Unpaired and Paired 't' tests, Karl Pearson correlation coefficient, and chi-square test.

RESULTS

Serum Electrolyte Disturbances

Serum Sodium Level

The present study reported that the serum sodium was low among the study population as compared to the control group and the difference between the two groups was statistically significant. Hyponatremia is seen among cases and is directly proportional to the severity of birth asphyxia. Hyponatremia is more in severe birth asphyxia whereas it is less marked in mild asphyxia.

Table 1: Serum Sodium Among Cases and Controls

Serum Sodium	Group	N	Mean (mEq/L)	Standard Deviation	T
< 24 Hrs	Cases	50	133.11	3.8	4.088
	Controls	50	137.33	1.84	p < 0.001
48 Hrs	Cases	50	133.46	3.68	4.88
	Controls	50	138.26	1.44	p < 0.001
72 Hrs	Cases	50	133.17	4.47	4.22
	Controls	50	138.33	2.29	p < 0.001

Table 2: Serum Sodium Levels with Severity of Birth Asphyxia

Serum Sodium	Birth asphyxia	N	Mean (mEq/L)	Standard Deviation	F	P
< 24 Hrs	Severe	10	129.71	2.43	11.19	< 0.001
	Moderate	20	132.07	3.41		
	Mild	20	135.86	2.79		
48 Hrs	Severe	10	130.86	1.57	2.97	0.066
	Moderate	20	133.43	4.52		
	Mild	20	134.78	2.89		
72 Hrs	Severe	10	130.14	3.39	4.49	0.019
	Moderate	20	132.36	5.33		
	Mild	20	135.50	2.68		

Serum Potassium Levels

In the present study, the serum potassium was found to be higher in the study group as compared to control and the difference between both the groups was statistically significant. We found that although the cases had higher potassium levels than controls, there was no significant difference between the severity of birth asphyxia.

Table 3: Serum Potassium Among Cases and Controls

Serum Potassium	Group	N	Mean (mEq/L)	Standard Deviation	T
< 24 Hrs	Cases	50	5.12	0.64	2.86
	Controls	50	4.57	1.84	p = 0.006
48 Hrs	Cases	50	5.14	0.61	2.92
	Controls	50	4.64	0.35	p = 0.005
72 Hrs	Cases	50	5.26	0.63	3.82
	Controls	50	4.60	0.30	p < 0.001

Table 4: Serum Potassium Levels with Severity of Birth Asphyxia

Serum potassium	Birth asphyxia	N	Mean (mEq/L)	Standard Deviation	F	P
< 24 Hrs	Severe	10	5.24	0.73	0.83	0.446
	Moderate	20	5.23	0.51		
	Mild	20	4.95	0.72		
48 Hrs	Severe	10	5.11	0.76	0.92	0.408
	Moderate	20	5.30	0.60		
	Mild	20	4.98	0.55		
72 Hrs	Severe	10	5.24	0.76	1.17	0.323
	Moderate	20	5.44	0.67		
	Mild	20	5.08	0.51		

DISCUSSION

Serum Sodium Levels

The mean serum sodium value was133.25+3.98 mEq/L among the cases as compared to controls had 137.97+1.86 mEq/L in the present study. B D Gupta[7] with his colleagues found that babies with asphyxia had higher incidence of hyponatremia and the mean serum sodium levels in study group was 132.82+ 5.73 mEq/L which was lower than that observed in control group of 135.82 + mEq/L with p value of < 0.001. This data almost corresponds to the present study.

P K Misra[8] and colleagues also found that decreased serum sodium levels in cases (128.28 + 0.45 mEq/L) as compared to controls (135.7 + 0.68 mEq/L). Pallab Basu[9] and coworkers studied the electrolyte status in asphyxiated neonates and found that mean serum sodium levels were significantly lower in asphyxiated babies (122 + 6.0 mEq/L) as compared to controls (138.8 + 2.7 mEq/L) with p value of <0.001. In the present study the mean serum sodium concentration was lower among the cases as compared to controls which was comparable with other studies which was statistically significant. The serum sodium levels were lower in neonates with severe birth asphyxia. Pallab Basu et al.'s study does not mention the distribution of cases in with different severity of asphyxia.

Serum Potassium Levels

The mean serum potassium value was 5.17+0.63 mEq/L among the cases as compared to controls had 4.60+0.41 mEq/L in the present study. A study done by Gupta et al[7] found that the serum potassium levels were comparable in both cases and controls. PK Misra[8] with his coworkers found that serum potassium levels were increased in asphyxiated neonates as compared to controls. Similar study was done by Pallab Basu[9] and colleagues. They found that mean serum potassium levels were higher in asphyxiated babies as compared to controls with p value of <0.001. In the present study the mean serum potassium level was higher than the controls which is comparable with the other studies. In Misra et al[8] study the mean serum potassium level was higher than the other studies in which only 7 neonates have been studied and majority had stage II or stage III Hypoxic ischaemic encephalopathy.

CONCLUSION

Electrolyte abnormalities, including hyponatremia and hyperkalemia, are prevalent among neonates with perinatal asphyxia and are closely associated with the severity of the condition. Early detection and management of these imbalances are essential to improving neonatal outcomes and reducing mortality rates. Addressing risk factors such as inadequate antenatal care and untrained personnel during childbirth is crucial in preventing perinatal asphyxia and its associated complications.

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