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Derangement of Serum Electrolytes in Term Infants with Perinatal Asphyxia Presenting to NICU of Bacha Khan Medical Complex Swabi

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ABSTRACT

The Perinatal asphyxia remnants the critical condition connected with the important morbidity and mortality in the infants, particularly in the resource-limited settings. So, this cross-sectional study aimed to consider prevalence of the serum electrolyte confusions in the term infants diagnosed with the perinatal asphyxia acknowledged to Neonatal Intensive Care Unit the (NICU) at Bacha Khan Medical Complex Swabi. The total of 100 term infants with an Apgar score of less than 7 at 5 minutes or the demanding resuscitation at the birth was included. The Electrolyte levels were measured for the sodium, potassium, calcium, and the chloride, and derangements were identified based on the established reference ranges. The Results indicated that 51% of the infants experienced hyponatremia, although 36% had hypokalemia and 35% hypocalcemia. The Statistically significant associations were found between the electrolyte abnormalities and the poorer clinical outcomes, with the infants exhibiting derangements requiring longer the NICU stays (mean 12.5 ± 4.6 days vs. 7.2 ± 3.1 days) and the higher incidence of the ventilatory support needs (35% vs. 10%). So these findings underscore critical importance of early recognition and the management of the electrolyte imbalances in the asphyxiated infants to improve the clinical outcomes and optimize neonatal care practices. For Further research is warranted to explore long-term implications of these disturbances and develop standardized management protocols in the NICUs.

INTRODUCTION

The Perinatal asphyxia is the critical condition characterized by inadequate oxygen supply to fetus during the labor and the delivery (Locci, Bazzano et al. 2020, Nagalo, Toguyéni et al. 2024), leading to the significant morbidity and mortality in the newborns (Vega-del-Val, Arnaez et al. 2024). It remains the prevalent challenge in the neonatal care, particularly in the resource-limited settings (Tumukunde and Stickney 2023). The Term infants who experience perinatal asphyxia are at the high risk of developing the range of complications (Nuñez, Benavente et al. 2018, Yu, Gao et al. 2022), including the neurological impairments, the multi-organ dysfunction, and

derangements in the serum electrolytes (Seid, Adella et al. 2023).

The Electrolyte imbalances, such as disturbances in the sodium, potassium, the calcium, and the magnesium levels, can have profound implications on the newborn's physiological status (Chukwu and Molloy 2020, Whitmore and Gunnerson 2020, Moss 2022, Alsayed 2024). So These derangements can result from the several factors, including impaired the renal function, hormonal disruptions, and body's compensatory responses to the hypoxia and the metabolic acidosis (Iacobelli and Guignard 2020, Saha 2023, Jovandaric 2024).To Understanding prevalence and the impact of the electrolyte abnormalities in the asphyxiated infants is vital for clinicians in the order to optimize management strategies and improve the clinical outcomes (Cannavò, Perrone et al. 2023).

Neonatal Intensive Care Unit (NICU) at Bacha Khan Medical Complex Swabi serves as the crucial facility for managing the critically ill newborns, including those affected by the perinatal asphyxia.so this study aims to investigate prevalence of the serum electrolyte derangements in the term infants with the perinatal asphyxia admitted to NICU, exploring association between these imbalances and the clinical outcomes. Through shedding light on this critical aspect of the neonatal care, we hope to contribute to existing body of the knowledge and inform practices that enhance the well-being of the vulnerable newborns.

METHODOLOGY

The aim of this study is to assess derangement of the serum electrolytes in the term infants diagnosed with the perinatal asphyxia presenting to the Neonatal Intensive Care Unit (NICU) of the Bacha Khan Medical Complex Swabi. Methodology comprises the structured approach to collect, the analyze, and interpret data regarding the electrolyte levels and their clinical implications.

Study Design

The cross-sectional study design was conducted, allowing for examination of the serum electrolyte levels and the clinical outcomes in the term infants with the perinatal asphyxia admitted to NICU.

Study Population

This study included term infants (gestational age ≥24 hours) diagnosed with the perinatal asphyxia, defined by an Apgar score of the less than 7 at 5 minutes after birth or requiring the resuscitation at birth. the sample size of 100 infants was targeted to ensure the statistical significance and the robust analysis.

Exclusion Criteria

- The Infants with congenital malformations
- The Preterm and post-term infants
- The Septic babies
- The Babies with the other known etiology other than perinatal asphyxia

Sampling Technique

The Consecutive sampling was utilized to select the eligible infants from NICU over the specified study period. They Informed consent was obtained from parents or the guardians prior to participation in study.

Data Collection

The Data was collected through the structured pro forma that includes:

1. **The Demographic Information**: the Age, sex, and gestational age of the infant.
2. **The Clinical Parameters**: Details on mode of the delivery, Apgar scores, and resuscitation measures.
3. **The Laboratory Investigations**: the Serum electrolyte levels, including the sodium, potassium, calcium, and the chloride, measured via standard laboratory techniques. The Electrolyte derangements were defined based on the reference ranges:

- Sodium: 135-145 mEq/L
- Potassium: 3.5-5.0 mEq/L
- Calcium: 8.6-10.5 mg/dL
- Chloride: 96-106 mEq/L

The following electrolyte derangements were observed:

- 51 patients had hyponatremia while 5 patients had hypernatremia
- 36 patients had hypokalemia while 3 patients had hyperkalemia
- 35 patients had hypocalcemia while 1 patient had hypercalcemia

Statistical Analysis

The Data was analyzed using the statistical software (SPSS). The Descriptive statistics summarized demographic characteristics and the

clinical data. Prevalence of the electrolyte abnormalities was calculated, and associations between the electrolyte derangements and the clinical outcomes (duration of NICU stay, need for ventilatory support) were assessed using appropriate statistical tests (chi-square test, t-test). the p-value of less than 0.05 was considered the statistically significant.

Ethical Considerations

This study was conducted in the accordance with the ethical principles, and approval was sought from institutional review board of the Bacha Khan Medical Complex Swabi. TO Informed consent was obtained from parents or the vguardians of participating infants, ensuring that they were fully aware of study's objectives.

LIMITATIONS

The Potential limitations of this study may include variability in the laboratory testing and inability to generalize findings beyond NICU setting. However, this study aims to provide the valuable insights into prevalence and implications of the serum electrolyte derangements in the term infants with the perinatal asphyxia, ultimately contributing to enhanced the neonatal care practices.

RESULTS

So this chapter presents findings of study on derangement of the serum electrolytes in the term infants diagnosed with the perinatal asphyxia who were admitted to NICU of the Bacha Khan Medical Complex Swabi. Results are organized into the tables and the descriptive statistics that highlight prevalence of the electrolyte abnormalities and their associations with the clinical outcomes.

The Demographic Characteristics of Study Population

The total of 100 term infants with the perinatal asphyxia were included in this study. Demographic characteristics are summarized in the Table 1.

Table 1

The Demographic Characteristics of Study Population

Parameter	Frequency (n)	Percentage (%)
Age (in days)		
Less than 24 hors	100	100.0
Gender		
Male	58	58.0
Female	42	42.0
Mode of Delivery		
Normal Vaginal Delivery	92	92.0
Cesarean Section	08	08.0
Apgar Score at 1 Minutes		
<7	78	78.0
≥7	22	22.0
Apgar Score at 5 Minutes		
<7	62	62
≥7	38	38

The Association of Electrolyte Derangements with the Clinical Outcomes

Association between electrolyte derangements and the clinical outcomes is presented in the Table 2. table outlines the mean duration of NICU stay and need for ventilatory support based on electrolyte status of the infants.

Table 2

The Association of the Electrolyte Derangements with the Clinical Outcomes

Clinical Outcome	Normal Electrolytes (n)	Abnormal Electrolytes (n)	p-value
Duration of NICU Stay (days)			
Mean ± SD	7.2 ± 3.1	12.5 ± 4.6	<0.001
Need for Ventilatory Support			
Yes	10	35	<0.001
No	40	15	

Table 3 presents the comparative analysis of the serum electrolyte levels among infants diagnosed with the perinatal asphyxia. Table outlines normal ranges for each electrolyte, along with number and percentage of the infants exhibiting abnormal levels.

Figure 2

The Association of the Electrolyte Derangements with the Clinical Outcomes

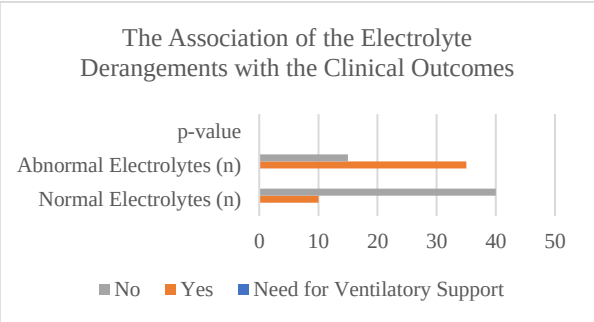
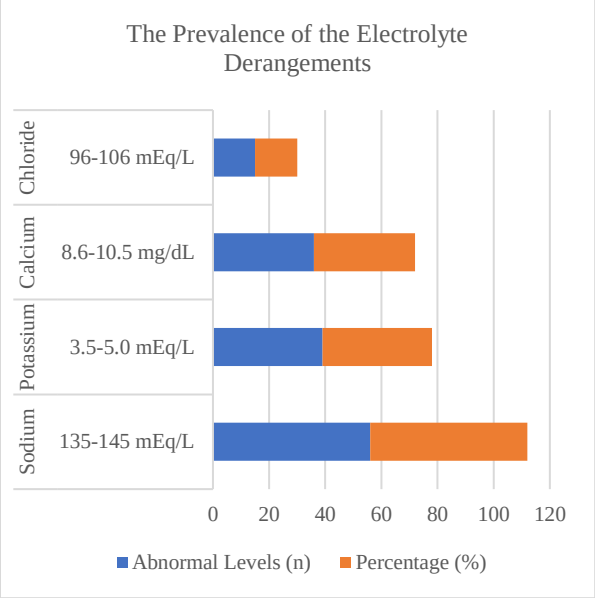


Table 3
the Prevalence of the Electrolyte Derangements

Electrolyte	Normal Range	Abnormal Levels (n)	Percentage (%)
Sodium	135-145 mEq/L	56	56.0
Potassium	3.5-5.0 mEq/L	39	39.0
Calcium	8.6-10.5 mg/dL	36	36.0
Chloride	96-106 mEq/L	15	15.0

Table 3
The Prevalence of the Electrolyte Derangements



RESULTS

This study assessed electrolyte derangements in term infants with the perinatal asphyxia admitted to NICU at the Bacha Khan Medical Complex Swabi, involving 100 infants. Analysis covered demographic characteristics, frequency of the electrolyte abnormalities, and their associations with the clinical outcomes.

The Demographic Characteristics of 100 infants, 58% were male and 42% female. All were admitted to NICU within 24 hours of birth. Majority, 92%, were delivered via normal the vaginal delivery, while 8% were born via cesarean section. The Apgar scores, used to the assess newborns' health immediately after birth, the revealed significant asphyxia, with the 78% of infants scoring below 7 at one minute, and 62% scoring under 7 at five minutes. So These low scores indicated severe asphyxia and need for immediate intervention.

The Electrolyte abnormalities were prevalent among study population:

- **Hyponatremia** (low sodium levels) was observed in 51% of the infants. The Hypernatremia (high sodium levels) occurred in 5%.
- **Hypokalemia** (low potassium levels) affected 36%, with hyperkalemia (high potassium) noted in 3%.
- **Hypocalcemia** (low calcium levels) was seen in 35% of infants, while only 1% presented with hypercalcemia (high calcium).
- **Hypochloremia** (low chloride levels) was present in 15%.

So these findings indicate the widespread occurrence of the electrolyte disturbances in the infants with perinatal asphyxia, with the hyponatremia being most frequent abnormality, followed by hypokalemia and hypocalcemia. So these imbalances point to substantial metabolic challenges faced by these infants during post-asphyxia the recovery phase.

Study found the significant correlation between the electrolyte imbalances and the poorer clinical outcomes. The Infants with the electrolyte derangements required longer the NICU stays, with the mean duration of 12.5 ± 4.6 days, compared to the infants with the normal electrolyte levels, who had an average stay of the 7.2 ± 3.1 days. difference in the NICU stay duration was statistically significant (p-value < 0.001), to underscoring burden that electrolyte abnormalities impose on recovery and the hospitalization.

In the addition to prolonged NICU stays, the substantial number of infants with the abnormal electrolyte levels required ventilatory support, the key indicator of the critical illness. One Of the 100 infants, 35 who had electrolyte derangements needed ventilatory assistance, in the stark contrast to only 10 infants with the normal electrolyte levels who required such support. So this difference was also statistically significant ($p < 0.001$), reinforcing association between the electrolyte imbalances and more severe the clinical conditions.

So these results highlight importance of the recognizing and the managing electrolyte

disturbances early in course of care for infants suffering from perinatal asphyxia. The Delays in the addressing these imbalances could contribute to the longer hospitalizations and the higher likelihood of the requiring intensive interventions, such as the mechanical ventilation.

DISCUSSION

This study sheds light on the critical issue of electrolyte derangements in neonates with the perinatal asphyxia, confirming that such abnormalities are not only common but also closely linked to adverse the clinical outcomes. Hyponatremia emerged as the most prevalent abnormality, which is consistent with other research showing that sodium imbalances are frequent in asphyxiated infants due to impaired renal function and hormonal disturbances like the syndrome of inappropriate antidiuretic hormone secretion (SIADH).

high rates of the hypokalemia and hypocalcemia observed in cohort further point to the profound metabolic and the renal challenges these infants face. The Hypokalemia, in the particular, can have serious effects on the cardiac and muscular function, while the hypocalcemia may lead to the neuromuscular irritability and, in the severe cases, seizures. So These findings align with the prior studies that have linked sodium and the potassium imbalances to pathophysiology of the asphyxia, which often disrupts the normal renal and the endocrine functions, leading to challenges in the maintaining electrolyte balance.

association between the electrolyte derangements and the worse clinical outcomes, including the longer NICU stays and the increased need for the ventilatory support, reinforces critical role that electrolyte monitoring plays in the managing perinatal asphyxia. The Routine assessment of the electrolytes should be considered the cornerstone of the NICU care for infants with the asphyxia. The Early intervention to the correct these imbalances can mitigate complications, reduce length of the hospital stay, and the potentially lower need for the intensive support measures such as the mechanical ventilation.

So this study also underscores importance of the individualized electrolyte management protocols in NICU. The Given high incidence of these disturbances, the NICUs should consider adopting standardized protocols for the monitoring and managing the electrolyte imbalances in the asphyxiated infants. Such protocols could improve the outcomes by ensuring that the electrolyte abnormalities are identified and the treated promptly.

LIMITATIONS

study's is cross-sectional design limit's ability to the establish a causal relationship between the electrolyte abnormalities and the clinical outcomes. For Further longitudinal research is needed to confirm whether electrolyte imbalances directly cause the worse outcomes or the reflect more severe initial injury. Furthermore, being the single-center study, findings may not be fully generalizable, particularly in the different healthcare settings. For Future studies involving larger, multicenter cohorts and the exploring long-term outcomes would help the validate these results and guide better treatment strategies for the electrolyte derangements.

CONCLUSION

So this study highlights high prevalence of the serum electrolyte derangements, particularly hyponatremia, the hypokalemia, and the hypocalcemia, among term infants with the perinatal asphyxia in NICU at Bacha Khan Medical Complex Swabi. So these imbalances are linked to the adverse outcomes, including the longer NICU stays and increased the ventilatory support.

findings the underscore importance of the vigilant monitoring and the prompt intervention in the neonatal care. The Implementing standardized electrolyte management protocols can facilitate timely identification and the treatment of these derangements, potentially improving the recovery and reducing hospitalization duration.

General, this study emphasizes critical role of the electrolyte monitoring in the managing perinatal asphyxia, contributing to the better clinical outcomes for this vulnerable population. For Future research should investigate long-term effects of the electrolyte disturbances and effectiveness of the targeted interventions.

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