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A Cross-Sectional Observational Study On Serum Electrolyte Abnormalities During An Episode Of Neonatal Seizure At A Tertiary Care Centre In Kolar

Dr.Deepak Melasangam[1], Dr. Shashidhar. K.N [2] , Dr .Krishnappa.J[3]

[1]Junior resident, Department of Paediatrics, Sri Devaraj Urs Medical College, Sri Devaraj Urs Academy of Higher Education and Research, Kolar-563103.

Email ID :deepak.m549@gmail.com

[2]Professor in Department of Biochemistry, Sri Devaraj Urs Medical College, Sri Devaraj Urs Academy of Higher Education and Research, Kolar-563103.

[3]Professor in Department of Paediatrics, Sri Devaraj Urs Medical College, Sri Devaraj Urs Academy of Higher Education and Research, Kolar-563103.

Email ID : drjkgowda@gmail.com

[*]**Corresponding author:**

Dr.Krishnappa.J

Sri Devaraj Urs Medical College, Sri Devaraj Urs Academy of Higher Education and Research, Kolar – 563103

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ABSTRACT

Background: Neonatal seizures signal neurological dysfunction, affecting 1.5–14 per 1,000 live births. They often result from brain injury, with causes like HIE, stroke, bleeds, infections, and metabolic issues. Biochemical imbalances such as hypoglycemia, hypocalcemia are key contributors or consequences. This study explores the range and impact of such abnormalities in neonatal seizures. Objectives: This study aims to assess the abnormalities of electrolytes noted during an episode of neonatal seizure and determine the association between electrolyte abnormalities and occurrence of seizures in neonates.

Methods: This cross-sectional study was conducted on neonates presenting with seizures at a tertiary care centre in Kolar between May 2023 and October 2024.Relevant clinical data and laboratory data was collected. The collected data underwent statistical analysis.

Results: In this study of 62 neonates with seizures, females were slightly predominant (58.1%), with most being term (72.6%) and delivered via cesarean section (53.2%). Seizures commonly occurred within the first three days, peaking on day two (37%). Subtle seizures were most frequent (50%), followed by generalized tonic (29%) and multifocal clonic (11.3%). Electrolyte abnormalities were present in 66.1%, mainly hypocalcemia (37.9%) and hypernatremia (31%). Nearly half (46.8%) of seizures were clearly linked to electrolyte disturbances, underscoring the importance of routine biochemical screening in neonatal seizures.

Conclusion: In this study, nearly half of neonates with seizures had electrolyte imbalances, predominantly hypocalcemia and hypernatremia. No significant association was found between seizure type and specific electrolyte abnormalities. Routine serum electrolyte evaluation is recommended for all neonatal seizures. Early detection and correction may improve outcomes and reduce recurrence.

Keywords: Seizures, biochemical abnormalities, metabolic disturbances, hypocalcemia, hypernatremia.

1. INTRODUCTION

Seizures represent one of the commonest, easily identifiable indication of dysfunction in the neurological system in newborns.1Hypoxic-ischemic injury is the primary cause behind neonatal seizures, with infarction of cerebrum and stroke being the next frequent causes, especially among otherwise healthy full-term infants without previous risk factors.2 Infections of the central nervous system, whether occurring during birth or afterward, can also trigger seizures.3 Biochemical imbalances frequently play a role, either as a primary cause or a secondary factor.4 Neonatal seizures have diverse causes, including neurological conditions (e.g., HIE, infections, haemorrhage) and metabolic disturbances. Some cases remain cryptogenic, with no identifiable underlying cause.5 Prompt detection and correction of metabolic disturbances are vital for

seizure control and better neurodevelopmental outcomes. This study aimed to assess the range and clinical significance of biochemical abnormalities associated with neonatal seizures

2. MATERIAL AND METHODS:

This cross-sectional observational study was conducted over 1.5 years in R.L. Jalappa Hospital, affiliated with Sri Devaraj Urs Medical College. Ethical clearance was obtained and informed consent was secured from parents.

Data from neonates presenting with neonatal seizures admitted to our hospital was collected. Antenatal, perinatal and postnatal history was collected and recorded in a predetermined proforma. Neonates admitted with seizures were studied for electrolyte abnormalities. Neonates who had previously been treated with anticonvulsant medication or on ongoing anticonvulsant therapy and

neonates with jitteriness were not included in the study.From the present study, primary outcomes of interest were electrolyte abnormalities such as hyponatremia/hypernatremia, hypomagnesemia/hypermagnesemia, hypocalcemia/hypercalcemia in isolation or in combination in a neonate with seizures.

Serum sodium levels were measured on venous blood sample and analysed using potentiometric method.[6,7] Hyponatremia is sodium value < 133 mmol/L in serum and hypernatremia is sodium value > 146 mmol/L in serum.[8,9]

Serum magnesium levels were measured on venous blood sample and analysed using the Formazan dye method.[10] Hypomagnesemia is magnesium level in serum < 1.6 mg/dl and hypermagnesemia is magnesium level in serum > 3.1 mg/dl.[11]

Serum calcium levels were measured on venous blood sample and analysed using the ARSENAZO-3 method.[12] Hypocalcemia is calcium level in serum < 7 mg/dl and hypercalcemia is calcium level in serum > 11 mg/dl.[13]

If any electrolyte abnormalities were detected, then that neonate was considered as case of neonatal seizure due to electrolyte abnormalities and managed immediately according to institutional protocol.

Sample size was estimated based on proportion of hypocalcemia (20%) observed in neonates with seizures, as reported in a study by Abdul Rahim et al.[14] At 95% confidence level, sample size of 62 subjects with neonatal seizures were included in this study.

Data was analysed using SPSS version 22. Categorical variables were expressed as frequencies and percentages, with the Chi-square test applied to determine statistical significance. Continuous variables were presented as means with standard deviation and the independent t-test was used for assessing differences between means. A p-value less than 0.05 was regarded as statistically significant.

3. RESULTS:

Table 1: Gestational Age among the study cases

Gestational Age	No. of cases	Percentage
Term	45	72.60%
Preterm	17	27.40%
Total	62	100.00%

Table 2: Types of seizure

Types of seizure	No. of cases	Percentage
Focal clonic	4	6.50%
Generalized tonic	18	29.00%
Multifocal conic	7	11.30%
Subtle	31	50.00%
Mixed	2	3.20%
Total	62	100.00%

Table 3: Electrolyte abnormalities among the study cases

Electrolyte abnormalities	No. of cases	Percentage
Yes	29	46.8%
No	33	53.2%
Total	62	100.00%

Table 4: Types of electrolyte abnormalities among the study cases

Electrolyte abnormalities	No. of cases (n=29)	Percentage
Hypocalcaemia	11	37.9%
Hypernatremia	9	31.0%
Hyponatremia	3	10.4%
Hypermagnesemia	2	6.9%
Hypercalcemia	3	10.4%
Hypomagnesaemia	1	3.4%

Table 5: Electrolyte Abnormalities among seizure cases

Seizure cases	No. of cases	Percentage
Electrolyte Abnormalities among seizure cases	29	46.8%
Without Electrolyte Abnormalities among seizure cases	33	53.2%
Total cases	62	100.00%

Table 6: Types of seizure and Electrolyte Abnormalities

Types of seizure	Electrolyte Abnormalities		Total
	Yes	No	
Focal clonic	1	3	4
Generalized tonic	9	9	18
Multifocal conic	3	4	7
Subtle	14	17	31
Mixed	2	0	2
Total	29	33	62

p=0.527 (p>0.05 not significant)

Among the 62 neonates with seizures, **29 cases (46.8%)** were associated with **electrolyte abnormalities**, while **33 cases (53.2%)** had **normal electrolyte levels**. **Subtle seizures** were the most common type overall (31 cases), with **14 of these (45.2%)** showing electrolyte disturbances. **Generalized tonic seizures** were the next most frequent (18 cases), equally distributed between those with and without abnormalities (9 each). **Multifocal clonic seizures** showed electrolyte disturbances in **3 out of 7 cases (42.9%)**, while **focal clonic seizures** had only **1 out of 4 cases (25%)** with an abnormality. Interestingly, **both cases of mixed seizures (100%)** were associated with electrolyte imbalances. These findings indicate that **electrolyte abnormalities occur across all seizure types**, with a relatively higher proportion in generalized, subtle, and mixed forms, highlighting the importance of electrolyte assessment regardless of seizure presentation.

4. DISCUSSION:

In present study involving 62 neonates presenting with complaints of seizures, electrolyte abnormalities were identified in 29 cases (46.8%), while 33 cases (53.2%) had no detectable electrolyte disturbances. This suggests that electrolyte imbalance is a significant contributing factor in nearly half of all neonatal seizure episodes. Among the abnormalities, disturbances in calcium, sodium, and magnesium levels were most frequently noted. Similar findings were observed in a study by Kyasa S et al., which reported a highly prevalent biochemical abnormalities among neonates with seizures, along with hypoglycemia affecting 39 infants (43.8%) and hypocalcemia observed in 28 infants (35.4%) as the leading contributors.[15]

Although electrolyte abnormalities were present across all seizure types, statistical analysis revealed no significance in association between the seizure type and the presence or absence of electrolyte disturbances (p = 0.527). This suggests that electrolyte imbalances occur irrespective of seizure classification. Additional findings were - Calcium abnormalities were more common in generalized tonic and subtle seizures, sodium imbalances (hypernatremia and hyponatremia) were frequently noted in subtle seizures, Magnesium abnormalities were rare and not significantly associated with any seizure type.

5. CONCLUSION:

In this study of neonates with seizures, almost half exhibited electrolyte imbalances, with hypocalcemia and hypernatremia being the most prevalent. While these disturbances are commonly linked to neonatal seizures, no significance in relationship was found between the type of seizure and electrolyte abnormalities. This highlights the importance of routine evaluation of serum electrolytes in all neonates with seizures, regardless of seizure classification. Prompt identification and correction of electrolyte disturbances is essential in improving clinical outcome and bring the risk of seizure recurrence down in this vulnerable population

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