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Study of Clinical and Biochemical Profile in Neonatal Seizures in a Tertiary Care Centre

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Abstract: ***Background**: Neonatal seizures are among the most common neurological emergencies during the neonatal period and often indicate underlying neurological or metabolic disturbances. The immature neonatal brain has a lower seizure threshold due to an imbalance between excitatory and inhibitory neurotransmission. Neonatal seizures may arise from various etiologies such as hypoxic–ischemic encephalopathy, infections, intracranial hemorrhage and metabolic abnormalities and electrolyte disturbances. Early identification of the clinical features and associated biochemical abnormalities is essential for timely management and prevention of long-term neurological complications. **Objectives**: The objectives of the study were to evaluate the clinical presentation of neonatal seizures, to assess the biochemical abnormalities associated with neonatal seizures and to determine the relationship between various etiological factors and the time of onset of seizures. **Methods**: This prospective observational study was conducted in the Department of Pediatrics at Saraswati Institute of Medical Sciences, Hapur, over a period of two years from April 2024 to May 2026 after obtaining approval from the Institutional **Ethics Committee**: A total of 150 neonates presenting with seizures, including both term and preterm babies, were enrolled after obtaining written informed consent from parents or caregivers. Detailed antenatal, natal and perinatal histories were recorded and thorough clinical examinations were performed. Seizures were classified according to Volpe's classification into subtle, focal clonic, multifocal clonic, tonic and myoclonic types. Laboratory investigations including blood glucose, serum calcium, serum sodium and serum potassium levels were carried out before initiation of treatment. Data were analyzed using SPSS version 25.0 and a p-value of **Results**: The majority of neonatal seizures occurred within the first three days of life. Subtle seizures were the most common clinical presentation followed by tonic and clonic seizures. Hypoxic–ischemic encephalopathy emerged as the most common etiological factor associated with neonatal seizures. Among biochemical abnormalities, hypoglycemia, hypocalcemia and hyponatremia were the most frequently observed disturbances. A significant association was noted between metabolic abnormalities and the occurrence and severity of seizures. Early onset seizures were more commonly associated with birth asphyxia, whereas metabolic disturbances were observed in seizures occurring later in the neonatal period. **Conclusion**: Neonatal seizures are frequently associated with significant clinical and biochemical abnormalities. Early recognition of seizure manifestations along with prompt biochemical evaluation is crucial for identifying underlying etiologies and initiating appropriate treatment. Systematic clinical assessment combined with metabolic screening can improve early diagnosis, guide management and help reduce morbidity and long-term neurological complications in affected neonates.*

Keywords: Neonatal seizures, biochemical abnormalities, hypoglycemia, hypocalcemia, hypoxic-ischemic encephalopathy, neonatal neurology

1. Introduction

Neonatal seizures are one of the most common neurological emergencies encountered in the neonatal period and are considered an important indicator of underlying neurological dysfunction. The neonatal brain is uniquely susceptible to seizures due to its developmental immaturity, excitatory neurotransmitter predominance and lower seizure threshold compared to older children and adults. Early identification and management of neonatal seizures are crucial, as they are associated with significant short- and long-term morbidity, including developmental delay, cerebral palsy and in severe cases, mortality.[1] The etiology of neonatal seizures is diverse and can be broadly categorized into hypoxic-ischemic encephalopathy, intracranial hemorrhage, central nervous system infections, metabolic disturbances and genetic or structural brain abnormalities. Among these, metabolic disturbances like hypoglycemia, hypocalcemia, hypomagnesemia and electrolyte imbalances, are potentially reversible causes, showing the need for prompt biochemical evaluation. Additionally, neonatal seizures may present with subtle or atypical clinical manifestations like lip smacking, eye deviation, or apnea, which can be easily overlooked, making early diagnosis challenging.[2]

2. Methodology

The present study was conducted after receiving approval from the Institutional Ethics Committee of Saraswati Institute of Medical Sciences, Anwarpur, Hapur, Uttar Pradesh. Written informed consent was received from the parents or caregivers of all eligible neonates prior to enrolment.

Inclusion Criteria

- All term and preterm neonates presenting with seizures.
- Both intramural and extramural babies were included.

Exclusion Criteria

- Neonates who were already on anticonvulsant therapy prior to admission

Statistical Analysis

The collected data were entered into Microsoft Excel and exported to IBM SPSS Version 29.0 for statistical analysis.

Descriptive statistics such as mean ± standard deviation (SD), frequency and percentage distribution were used. Chi-square test, paired t-test and correlation analysis were applied where appropriate. a p-value of <0.05 was statistically significant

3. Results

In this study of 150 neonates presenting with seizures, a higher proportion were male (52.7%) compared to female (47.3%). The mean gestational age was 36.5 ± 3.4 weeks with the majority of neonates being full-term (61.3%) and 38.7% being preterm. The mean birth weight was 2.5 ± 0.8 kg. Nearly half of the neonates had normal birth weight (47.3%) while a significant proportion were low birth weight (34.0%),

very low birth weight (11.3%), or extremely low birth weight (7.3%

In this study, the majority of neonatal seizures (52.0%) occurred between 24 and 72 hours of life. Seizures within the first 24 hours were seen in 34.0% of neonates while late-onset seizures occurring at or after 72 hours were noted in 14.0% of cases. This pattern shows that the first three days after birth are the most critical for the onset of neonatal seizures, showing the importance of close monitoring during this early neonatal period.

Among the 150 neonates with seizures, subtle seizures were the most frequently observed type, occurring in 56.0% of cases. Tonic seizures accounted for 29.3% while clonic seizures were the least common, seen in 14.7% of neonates. The predominance of subtle seizures shows the importance of careful clinical observation, as these seizures may be easily overlooked, potentially delaying diagnosis and management.

The type of neonatal seizure was significantly associated with gestational age (P = 0.022). Subtle seizures were almost equally distributed between preterm (47.6%) and term (52.4%) neonates. Tonic and clonic seizures, however, were more common in term neonates with 68.2% and 81.8% respectively. These findings show that while subtle seizures can occur across all gestational ages, more pronounced motor seizures like tonic and clonic types, are more likely to occur in term neonates. This shows the need for careful seizure type assessment in relation to gestational age for accurate diagnosis and management.

The etiology of neonatal seizures was significantly associated with birth weight (P = 0.000). Acute metabolic abnormalities were most common in low birth weight (LBW, 42.2%) and very low birth weight (VLBW, 15.6%) neonates. HIE occurred predominantly in normal weight neonates (75.4%) while sepsis was more frequent in LBW (50.0%) and VLBW (31.8%) infants. Developmental defects of the CNS were seen in normal weight neonates and kernicterus occurred in an LBW infant. These findings show that lower birth weight neonates are more prone to metabolic and infectious causes of seizures, whereas term or normal weight neonates are more susceptible to hypoxicischemic and structural causes. Early identification of high-risk birth weight groups can guide timely intervention and management

The distribution of seizure types according to onset time showed that the majority of seizures in all categories occurred between 24 and 72 hours after birth. Subtle and tonic seizures were most common during this period, accounting for 50.0% and 52.3% respectively while clonic seizures occurred in 59.1% of cases during the same window. Early-onset seizures

The presence of acute metabolic abnormalities was associated with significant differences in mean biochemical parameters. Neonates with metabolic abnormalities had significantly lower mean glucose (49.0 mg/dL) and calcium levels (7.47 mg/dL) compared to those without abnormalities (glucose 55.59 mg/dL, calcium 8.02 mg/dL; P = 0.000 for both). Sodium levels were higher in neonates with metabolic abnormalities (135.96 mEq/L vs. 134.68 mEq/L, P = 0.046), whereas potassium levels were similar significantly (P = 0.409). These findings show the critical role of early detection and correction of glucose and calcium disturbances in neonates with metabolic abnormalities to prevent seizures and associated complications.

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