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Investigation of neonatal seizure activity of clinical and biochemical profile survey at tertiary care center

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Abstract

Background: Neonatal seizures are a common and easily identifiable clinical manifestation of a malfunctioning brain system. The objective of the study is to utilize clinical criteria to diagnose neonatal convulsions and ascertain the presence of biochemical abnormalities.

Methods: An innovative study methodology focusing on neonates admitted to hospitals. This study identified the prevailing metabolic anomaly in neonates. The study was carried out at the pediatrics department of Madha Medical College, located in Chennai, Tamilnadu, India. The study was conducted from September 2018 to August 2019. Neonates who satisfied the specified criteria for inclusion and exclusion and were subsequently admitted to the Neonatal Intensive Care Unit.

Results: In my study, male babies accounted for roughly 59% of the cases of neonatal seizures, while female newborns accounted for approximately 41%. The male to female ratio was around 1.25:1. Another study conducted by Tekgul *et al.* demonstrated a male to female ratio of 1.15:1, while Sudia *et al.* reported a male to female ratio of 1.73:1. These findings support my study's conclusion that seizures are more prevalent in males. My study involved the delivery of 44 babies through vaginal birth, 44 kids through Caesarean sections, and 12 babies with the use of forceps.

Conclusion: Based on this investigation, it may be inferred that biochemical abnormalities may be the main or secondary problem. Temporary anomalies have a favorable prognosis and can be easily treated. Early treatment of metabolic problems improves the prognosis and outcome of the newborn, preventing neurological ramifications.

Keywords: Seizures, newborns, hyponatremia, and hypocalcemia

Introduction

Neonatal seizures are a common and distinctive clinical manifestation of an imbalance in the neurological system. Newborn seizures result in substantial newborn death and lasting health problems, such as motor and cognitive impairments during infancy. These are nonspecific reactions of the growing nervous system to various stresses. Seizures are more prevalent during the newborn period compared to any other stage of life, indicating that the immature brain is more susceptible to them^[1-3].

This phenomenon could be attributed to the precocious development of excitatory synapses compared to inhibitory synapses during the initial phases of growth. Neonatal seizures often suggest a hazardous neurological condition, most commonly hypoxia-ischemia. Neonatal seizures are commonly caused by stroke, intraventricular hemorrhage, intraparenchymal haemorrhage, meningitis, sepsis, and metabolic disorders^[2-4].

Gaining insight into the underlying cause is often advantageous for predicting the outcome and administering appropriate medical care. Nevertheless, in the context of newborn critical care units in impoverished nations where synchronized video-EEG monitoring is unavailable, clinical observation assumes paramount importance for making a diagnosis. Research indicates that newborn seizures and their underlying causes have a substantial impact on the developing brain. Neonatal seizures can be difficult to identify because of a phenomenon called electroclinical dissociation, which often lacks clinical correlates with the electrographic seizures^[3-5].

The convulsions only present modest symptoms due to incomplete development of regional interconnectivity, such as interhemispheric and corticospinal tracts, caused by insufficient myelination of white matter pathways. The objective of the study is to detect neonatal seizures based on clinical criteria and investigate the biochemical anomalies associated with these convulsions^[4-6]. The study was conducted at our center, which does not have access to continuous video-EEG monitoring.

Materials and Methods

A novel research methodology that specifically targets newborn infants who are admitted to hospitals. This study identified the predominant metabolic abnormality in newborns. The research was conducted at the paediatrics department of Madha Medical College, situated in Chennai, Tamilnadu, India. The research was carried out between September 2018 and August 2019. Infants who met the specific requirements for inclusion and exclusion and were later referred to the Neonatal Intensive Care Unit.

Inclusion criteria

All newborns, whether born intramural or extramural, whether they were born full-term or prematurely, who exhibited seizure activity

Exclusion criteria

- Infants who were already on anticonvulsant medication.
- Mothers or other caretakers who declined to grant permission.

Results

A total of 100 newborns experiencing seizures were hospitalized to the neonatal unit of the Department of Pediatrics at Madha Medical College in Chennai, Tamilnadu. This study comprised participants from September 2018 to October 2019.

Table 1: Delivery mode

Mode of delivery	Number	Percentages
Forceps	10	10%
LSCS	45	45%
NVD	45	45%

In the sample group, FORCEPS made up 10% of the population, whereas LSCS and NVD made up 45%.

Table 2: IM/EM descriptive analysis

IM/EM	Number	Percentage
Intramural	80	80%
Extramural	20	20%

In the study population, 80 babies were born inside the institution, while 20 were referred from outside.

Table 3: Gender data

Gender	Number	Percentage
Male	60	60%
Female	40	40%

Males made up 60 percent of the study population while females made up 40 percent.

Table 4: Descriptive analysis

Term/Pre Term/Post term	Number	Percentage
Preterm	24	24%
Term	76	76%
Post term	0	0%

Preterm births made up 24 (24%) of the study group while term births made up 76 (76%) and there were no preterm.

Table 5: Study population's AGA/SGA/LGA

AGA/SGA/LGA	Number	Percentages
SGA	60	60%
AGA	30	30%
LGA	10	10%

The SGA, AGA, and LGA among the study population were 60 (60%), 30 (30.00%), and 10 (10%) correspondingly.

Table 6: Birth weight

Parameter	Mean ± STD	Median	Min	Max	95% C.I. for EXP(B)	
					Lower	Upper
Birth weight	2.65±0.12	2.65	0.98	4.33	2.49	2.68

The average birth weight of the research population was 2.65 kg, ranging from 0.98 kg to 4.33 kg.

Table 7: Birth weight

Birth weight cat (kg)	Number	Percentage
Low birth weight	60	60%
Normal Birth weight	40	40%

Infants classified as having Low Birth Weight accounted for 60% of the total, while infants classified as having Normal Birth Weight accounted for 40%. There was no statistically significant disparity in the proportion of various seizure types between neonates delivered at full term and those born prematurely. Within my research, the prevalence of mild seizures was found to be 56% in preterm newborns and 56% in neonates. Tonic seizures were observed in 28.8% of preterm newborns compared to 29.3% of term infants. Chronic seizures account for around 16% of preterm babies and 14.6% of term births.

Discussion

Seizures are the most common neurological ailment that infants experience, with preterm neonates being affected more often than term neonates. For my research, I included 100 neonates who experienced seizures and met the specific criteria for inclusion and exclusion. These newborns were admitted to the neonatal critical care unit of a government medical college. Out of the total of 100 neonates, 25 were born prematurely, while the remaining 75 were born at full term. None of the children in my study were born after the expected due date [5-7]. Among a sample of 100 neonates, 61 were classified as having a normal gestational age, 39 were categorized as being underweight for their gestational age, and none were considered overweight for their gestational age. Most of the newborns in my study who had seizures were born at full term and were of appropriate size. The study conducted by Aziz *et al.* found that term newborns accounted for 65% of the population, whereas preterm babies accounted for 35%. Among the population, 68% were classified as AGA, 26% as SGA, and 6% as LGA. Research conducted by Park Weon *et al.* and Dinesh Das *et al.* found that term newborns had a higher occurrence of the disease compared to preterm neonates. Dinesh das *et al.* observed that seizures occurred in 91.3% of full-term infants, 7.8% of premature infants, and 0.9% of infants after birth [8-10].

In my study, male babies accounted for roughly 59% of the cases of neonatal seizures, while female newborns accounted for approximately 41%. The ratio of male to

female cases was around 1.25:1. Another study conducted by Tekgul *et al.* found a male to female ratio of 1.15:1, while Sudia *et al.* reported a male to female ratio of 1.73:1. These findings support my study's conclusion that seizures are more prevalent in males. My study involved the delivery of 44 babies through vaginal birth, 44 kids through Caesarean sections, and 12 babies with the use of forceps. Aziz *et al.* discovered that convulsions occurred in 48% of normal vaginal deliveries, 28% of lower segment caesarian sections, and 24% of vaginal operations in newborns [9-11]. According to my study, 51 babies and 49 neonates had birth weights below 2.5 kg and above 2.5 kg, respectively. Dinesh Das *et al.* observed similar results, stating that babies weighing more than 2.5 kg accounted for 65% of the population, while those weighing less than 2.5 kg accounted for 35%. Among the 100 neonates in my study, 33 experienced seizures during the first 24 hours, 38 had seizures between 24 and 72 hours, 20 had seizures between day 4 and 7, and 9 had seizures after 7 days. Within the initial three days of life, the majority of seizures were observed in 71% of neonates in my study. Dinesh Das *et al.* and Nawab *et al.* also reported similar results to my study, with 71.3% and 73.6% of seizures occurring within 3 days, respectively [10-12].

Our investigation revealed that subtle seizures were the predominant type of seizures observed in newborns, constituting around 63% of cases in approximately 63 neonates. Tonic seizures were the second most common, occurring in approximately 25% of neonates, followed by clonic seizures in approximately 12%. Sudia *et al.* discovered comparable findings, with mild seizures observed in 63% of neonates, generalized tonic seizures in 25%, and multifocal clonic seizures in 12% [11-13]. Dinesh Das *et al.* discovered that mild seizures were the most prevalent type of seizures in newborns, representing 42.6% of all occurrences. Tonic seizures constituted 33.9% of the cases, whereas clonic seizures accounted for 15.7% of the infants. Several investigations conducted by Yadav *et al.*, Park Weon *et al.*, and Nawab *et al.* have shown that mild seizures are the most commonly observed type, similar to my own research [12-14].

Out of the 100 babies in my study who had seizures, 72 of them had one or more biochemical abnormalities, which explains the occurrence of these cases. In a study conducted by Sood *et al.*, which was comparable to mine, it was discovered that there were a total of 29 instances, or around 49.15% of the cases, where biochemical anomalies were seen. Nawab *et al.* conducted examinations and revealed similar results. They observed that out of 110 neonates, 46 babies had biochemical anomalies, which accounted for 41.8% of the cases. Kumar *et al.* discovered general biochemical abnormalities in 62.8% of neonates, which is higher than the 43.33% reported by Madhusudan *et al.* [13-15]. During my investigation on metabolic abnormalities in babies, I discovered that 27 infants experienced hypoglycemia, which represents around 27% of the overall population. Among the newborns, 24 were diagnosed with hypocalcemia, 8 with hyponatremia, 8 with hypomagnesemia, and 5 with hypernatremia. Each of these conditions accounted for around 4% of the total cases. Within my study, there were 7 instances where hypoglycemia and hypocalcemia occurred simultaneously, as well as 6 cases where hypocalcemia and hypomagnesemia were present together [14-16]. These

combinations were predominantly observed in premature neonates. In a study conducted by Sood *et al.*, it was found that 48.27% of 59 neonates had hypoglycemia, 48.27% had hypocalcemia, 17.25% had hyponatremia, and 17.24% had hypomagnesemia. These findings align with the data I have collected. Kumar *et al.* discovered that the occurrence of hyponatremia was 45.5%, hypoglycemia was 50%, hypocalcemia was 31.8%, and hypomagnesemia was 13.63% in their research. In addition, he observed hyperphosphatemia in 13.63% of cases and hypermagnesemia in 4.54% of cases [15-17].

The prevalence of hypoglycemia was higher in preterm newborns, with 36% of them experiencing it, compared to 25% in term infants. The incidence of hypocalcemia in preterm infants was 36%, which was greater compared to the rate of 20% in term infants. Suganthi *et al.* conducted a study that yielded similar results, revealing that 89 out of 150 cases exhibited metabolic abnormalities. The most common occurrences were hypoglycemia and hypocalcemia, with 39 and 28 incidences, respectively. The investigations conducted by Sameer Kumar Jain *et al.*, Shah *et al.*, and Iype Maya Prasad *et al.* found that hypoglycemia, followed by hypocalcemia, was the most common metabolic disturbance [18-20]. These findings support my own research. In contrast, Yadav *et al.* and Sarkar *et al.* found that the predominant biochemical irregularities observed in their research were low blood sugar levels and low calcium levels (Hypocalcemia). In addition, according to my research, Dinesh Das *et al.* reported in their study that preterm newborns had a greater occurrence of hypoglycaemia [19-21]. Therefore, all of these studies emphasize the importance of doing a biochemical investigation in neonatal convulsions, especially in instances where blood glucose and calcium levels are elevated. Rectifying these transient biochemical anomalies is associated with a positive prognosis and result. In my investigation, I observed two instances of concurrent hypoglycemia and hypocalcemia, as well as one case of simultaneous hypocalcemia and hypomagnesemia. These conditions predominantly afflicted premature neonates. Sudia *et al.* found that 9% of individuals exhibited hypoglycemia and hypocalcemia, while 7.9% of cases showed hypocalcemia and hypomagnesemia. Nawab *et al.* also examined the presence of similar combinations in their investigation [20-22].

Conclusion

Among the most prevalent neurological conditions in newborns is neonatal seizures. Neonatal seizures can have a variety of origins, which affects not only how the disease develops but also its long-term neurological consequences, mortality, and morbidity. To avoid these issues, quick examination, prompt diagnosis, and vigorous care in accordance with the aetiology are required. Additionally, metabolic abnormalities may be a secondary issue or they may be linked to other etiologies. When detected early, these transitory anomalies are easily treated and have a favourable prognosis. Therefore, a biochemical workup should be performed on all infants who have seizures and should be the first line of inquiry in every situation. Early treatment of these biochemical anomalies helps to stop seizures from happening again and also helps to avoid overusing anticonvulsants, which may occasionally be unneeded. The prognosis and outcome of the newborn are improved by further early repair of these metabolic

abnormalities, which also helps to avoid the accompanying long-term neurological sequelae. To accurately assess the severity of the issue and administer prompt treatment for these seizures, continuous video EEG monitoring should be used whenever it is practical.

Funding

None

Conflict of Interest

None

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