Journal of Cardiovascular Disease Research

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 05, 2023

Original research article

Study of neonatal seizures in a tertiary newborn care unit: Clinical and biochemical profile

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Abstract

Aim and Objectives: The purpose of this study is to determine the prevalence of metabolic anomalies associated with neonatal convulsions. It was chosen to study the relationship between the early clinical symptoms and neonatal seizures.

Methods: Hospital-based, prospective study of newborns admitted to a department of paediatric DR VRK, Women's Medical College, Aziz Nagar, Hyderabad, Telangana, India, within the first 28 days of life. 50 infants participated in the trial, which ran from March 2022 to February 2023. The most common type of infant metabolic abnormalities was observed in this investigation.

Results: From day 1 to day 17, the median age at first seizure start was 3.26 (95% CI 2.40 to 2.72). Thirty-three of the seizures (33%) in our study began during the first 24 hours, while others began between 24 and 72 hours (days 1-3), 4 to 7 days (days 4-7), and beyond 7 days (9%). Nearly nine in ten cases of convulsions occur on day one. 14 (56%) premature infants had mild seizures, 7 (28%) of which were tonic and 4 (16%) were clonic.

Conclusion: Newborns frequently experience convulsions. The numerous causes of newborn seizures affect the course of the condition and its long-term neurological prognosis, mortality, and morbidity.

Keywords: Convulsions, hyponatremia, hypocalcaemia, neonates

Introduction

Paroxysmal electrical discharges from the brain are what constitute a seizure [1], and these discharges can cause motor, sensory, behavioural, or autonomic dysfunctions. Newborn convulsions have several potential causes, including but not limited to hypoxia ischemic encephalopathy, cerebral infarction and stroke intra cranial haemorrhage, intra cranial infections, metabolic abnormalities, and the unknown. Infants with hypoxic ischemic encephalopathy and intracranial haemorrhage frequently exhibited tonic and myoclonic seizures, both of which were associated with a poor prognosis. Hypocalcemia, hypoglycemia, hypomagnesemia, hyponatremia, and hypogiycaemia are the most common biochemical abnormalities linked with infant convulsion [2].

Knowing what caused an issue can improve prognosis and therapy options. Clinical practise at neonatal intensive care unit (NICU) in developing countries where synchronised video-EEG monitoring is practically non-existent, makes clinical observation the key to the diagnosis [3]. Studies suggest that neonatal seizures and their aetiology have a significant impact on developing brain.

Deaths and major issues with the child's physical and cognitive abilities are common results of newborn seizures, which are a non-specific response to the infant's underdeveloped nervous system [4]. Despite the fact that early diagnosis could always yield a superior treatment outcome, a major problem in the management of this neurological illness is the general lack of suitable diagnostic procedures, such as synchronised video-EEG monitoring, in most developing nations [5]. Clinical circumstances in addition to numerous biochemical features could be exploited for the correct identification of these seizures [6], particularly in areas where EEG monitoring for early detection of newborn seizures is practically impossible. Because of immaturity of cortical organization and poor myelination, typical generalized tonic clonic and absence seizures donot occur in neonates.

Subtle seizures

Sick neonates have repetitive stereotyped behavior like motor automatism such as cycling movements, Oro buccal- lingual movements like sucking, chewing movements and eye signs like random roving eye movements and nystagmus and when they occur in insulation, they are non-epileptic with no EEG changes. Apnea and bradycardia occur in preterm due to immaturity of respiratory centre. In term babies, subtle seizures manifest as apnea attacks with heart rate. Normal or increased with EEG abnormalities.

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 05, 2023

Materials and Methods

Hospitalised neonates who met the inclusion and exclusion criteria were observed prospectively in the Neonatal Intensive Care Unit of the Department of Paediatrics, DR VRK, Women's Medical College, Aziz Nagar, Hyderabad, Telangana, India. Fifty people took part in the study that lasted from March 2022 to February 2023.

Inclusion Criteria

1. All term and preterm infants who presented with seizures, including neonates who were inborn infants and referred infants

Exclusion criteria

1. Babies who were already receiving anticonvulsant therapy.
2. Mothers or caregivers who refused to give their consent.

Results

Fifty infants were admitted to the neonatal ward of the Department of Paediatrics for treatment of seizures.

Table 1: Presents a descriptive statistical analysis

Mode of delivery	Number	Percentages
Forceps	06	12%
LSCS	22	44%
NVD	22	44%

Only 12% of the population in the sample group had FORCEPS, while 44% had LSCS or NVD.

Table 2: IM/EM descriptive analysis in the study population

IM/EM	Number	Percentage
Intramural	40	80%
Extramural	10	20%

Forty infants born at the hospital and ten more referred from elsewhere made up the research population.

Table 3: Presents a descriptive analysis of gender data from the study population

Gender	Number	Percentage
Male	30	60%
Female	20	40%

Sixty-nine percent of the people surveyed were male, while just forty-one percent were female.

Table 4: Descriptive analysis of the study

Term/Pre Term/Post Term	Number	Percentage
Preterm	12	14%
Term	38	76%
Post term	0	0%

Twelve of the research group's births were premature, while all 38 babies were full-term.

Table 5: Descriptive analysis of the study population

AGA/SGA/LGA	Number	Percentages
SGA	31	62%
AGA	15	30%
LGA	4	8%

In the population under research, 31% were classified as having SGA, 15% as having AGA, and 4% as having LGA.

Table 6: Descriptive analysis of the research population's birth weight

Parameter	Mean ± STD	Median	Min	Max	95% C.I. for EXP(B)	
					Lower	Upper
Birth weight	2.45 ± 0.78	2.14	0.98	4.24	2.78	2.96

Birth weights in the study population ranged from 0.98 to 4.24 kilogrammes, with a mean of 2.45

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 05, 2023

kilogrammes.

Table 7: Descriptive analysis of the category of birth weight in the study population

Birth weight cat (kg)	Number	Percentage
Low birth weight (<2.5kg)	30	60%
Normal Birth weight (•2.5kg)	20	40%

There were 30 babies who were born with a low birth weight and 20 babies who were born at a normal weight.

Table 8: Descriptive analysis for the research populations

Parameter	Mean ±STD	Median	Min	Max	95% C.I. for EXP(B)	
					Lower	Upper
Day of onset of Seizures	3.15 ± 3.24	2.41	1.07	17.14	2.25	3.87

The average first day of seizures in the population under study was Day 3.15, ranging from Day 1.07 to Day 17.14.

Table 9: Presents a descriptive analysis of the Day of Onset Category in the population

Day of onset category	Number	Percentage
Within 24 hours	16	32%
24 to 72 Hours (day 1 to 3)	19	38%
4th day to 1 week (day 4 to 7)	10	20.00%
More than 1 week (More than 7 days)	5	10%

The incidence of different types of seizures in term and preterm infants was not significantly different. The majority of infants with moderate seizures were born prematurely or shortly after birth, according to my research. Tonic-clonic convulsions were more common in premature babies than in full-term babies. Clonic seizures are a leading cause of both premature and full-term babies.

Discussion

Preterm neonates are more likely to experience seizures than mature neonates, which are the most common neurological disorder affecting newborns. 50 neonates with seizures who were admitted to the neonatal intensive care unit of a government medical college and met the inclusion and exclusion criteria for our study were included. 50 newborns were well developed, compared to 25 preterm infants [7-9]. There were no post-term newborns in our study. 49 of the 50 neonates were underweight for their gestational age, 39 were within acceptable ranges, and 0 were overweight for their gestational age. In our study, full-term, healthy newborns made up the majority of the neonates who had seizures [10, 11]. Preterm infants make up 35% of the population, term neonates make up 65%, and AGA, SGA, and LGA make up 68%, 26%, and 6% of the population, respectively, according to the study by Aziz *et al*. Term babies also exhibited a much higher incidence of the disease than preterm neonates, according to studies by Park Weon *et al*. and Dinesh Das *et al*. 91.3% of term infants, 7.8% of preterm infants, and 0.9% of postnatal infants experienced seizures, according to Dinesh das *et al*. [11,12].

With a male to female ratio of roughly 1.25:1, male infants made up about 59% of the neonatal seizures in our sample, while female newborns made up about 41%. Studies by Aziz *et al*. (male 60%, female 40%) and Dinesh Das *et al*. Similarly revealed a male predominance [13-15]. The male:female ratio in another study by Tekgul *et al*. was 1.15:1, while Sudia *et al*. found a male:female ratio of 1.73:1, supporting our finding that seizures are more common in male. In my study, 12 babies were delivered with forceps, 44 babies were delivered vaginally naturally, and 44 babies received Caesarean sections. In their study, Aziz *et al*. discovered that newborns with convulsions were born in 48% of normal vaginal deliveries, 28% of lower segment caesarian procedures, and 24% of vaginal operations [15-17]. 49 neonates and 51 infants in my study, respectively, had birth weights under 2.5 kg and over 2.5 kg. Similar results were reported by Dinesh Das *et al*., who discovered that babies >2.5 kg made up 65% of the population and 2.5 kg made up 35%.

From the group of 50 neonates analysed here, 33 experienced seizures in the first 24 hours of life, 38% did so between 24 and 72 hours, 20% did so between days 4 and 7, and 9% did so after 7 days. The bulk of seizures in our study population happened within the first three days of life. Almost identical results were found by Dinesh Das *et al*. and Nawab *et al*. [17, 18].

Sixty-three percent of the neonates in our study experienced mild seizures, followed by twenty-five percent experiencing tonic seizures and twelve percent experiencing clonic seizures. Sudia *et al*. reported comparable numbers, reporting that 63 percent of babies experienced focal seizures, 25 percent experienced generalized tonic seizures, and 12 percent experienced multifocal clonic seizures. Dinesh

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 05, 2023

Das *et al*. observed that mild seizures were the most common type of infant seizure. The majority of infants experienced tonic-clonic seizures, while 15.7% experienced clonic seizures. Studies by Yadav *et al*., Park Weon *et al*., and Nawab *et al*. [18, 19] corroborated my findings that mild seizures were the most common type.

50 infants in our research who developed seizures were found to have biochemical abnormalities. Comparable research by Sood *et al*. also indicated that biochemical abnormalities were present in around half of the patients. Nawab *et al*. also revealed similar results from their studies, reporting that 41.8 percent, or 46 out of 110 neonates, had some sort of biochemical anomaly. Kumar *et al*. found overall biochemical abnormalities in 62.8% of neonates, while Madhusudan *et al*. found them in 43.33 percent [19, 20].

Table 10: Metabolic Problems

Sr. No.	Metabolic Problem	Number of patients
1.	Hypoglycemia	27
2.	Hypocalcemia	24
3.	Hyponatremia	08
4.	Hypomagnesemia	08
5.	Hypernatremia	05

In my study of newborns with metabolic problems, 27 were diagnosed with hypoglycemia. Twenty-four of the neonates had hypocalcemia, making up 24% of the total; eight had hyponatremia, making up 8%; eight had hypomagnesemia, making up 8%; and five had hypernatremia, making up 5%. Our research also found that preterm infants are disproportionately affected by hypoglycemia and hypocalcemia, with 7 instances and 6 cases, respectively. Comparable to my own findings, a research by Sood *et al*. found that 48.27%, 48.27%, 17.25%, and 17.24% of 59 neonates, respectively, had hypoglycemia, hypocalcemia, hyponatremia, or hypomagnesemia. The incidence of hyponatremia was found to be 45.5%, hypoglycemia to be 50%, hypocalcemia to be 31.8%, and hypomagnesemia to be 13.63% in the study by Kumar *et al*. 13.63% of patients also had hyperphosphatemia, and 4.54% had hypermagnesemia, both of which he documented [20, 21].

Our research showed that preterm infants are disproportionately affected by two metabolic abnormalities: hypoglycemia and hypocalcemia. Babies born prematurely were more likely to experience hypoglycemia. The prevalence of hypocalcemia was 36% in premature infants compared to 20% in full-term infants. Suganthi *et al*. reported similar results in their investigation, concluding that 89 of 150 cases exhibited metabolic abnormalities. Most common were low blood sugar, and low calcium levels. Consistent with my findings, Sameer Kumar Jain *et al*., Shah *et al*., and Iype Maya Prasad *et al*. found that hypoglycemia was the most common metabolic disturbance. On the other hand, hypoglycemia and hypocalcemia were found to be the most common biochemical abnormalities by Yadav *et al*. and Sarkar *et al*. Furthermore, our data supports a finding by Dinesh Das *et al*. that hypoglycemia is more common in preterm neonates. All of these studies support the idea that a biochemical work up is important in neonatal convulsions. Improving the prognosis and outcome is connected to treating these transient biochemical abnormalities [21-23].

Our research revealed three cases of concomitant hypoglycemia and hypocalcemia, two cases of concomitant hypocalcemia and hypomagnesemia, and one case of concomitant hypocalcemia and hypomagnesemia. Sudia *et al*. found that 9% of patients had hypoglycemia and hypocalcemia, while 7.9% of patients had hypocalcemia and hypomagnesemia. Similar pairings were also highlighted by Nawab *et al*. in their research [22, 23]. Pyridoxine dependent seizures are suppressed by giving pyridoxine as therapeutic trial. Seizures subside within minute if Pyridoxine dependency or dependency is causing them.

Conclusion

Neonate-onset seizures are one of the most common neurological disorders in infants. The aetiology of neonatal seizures is important because it influences not only the course of the condition but also its mortality rate, severity of neurological complications, and morbidity. These problems can be avoided with a thorough examination, a speedy diagnosis, and aggressive treatment targeted at the underlying cause. Metabolic disorders may also be secondary issues or have other causes. Seizures like these require immediate medical attention, so it's best to employ continuous video EEG monitoring whenever possible to determine the extent of the problem and act accordingly.

Funding: None

Conflict of Interest: None

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ISSN:0975 -3583,0976-2833 VOL14, ISSUE 05, 2023

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