Section: Paediatrics

Original Research Article

STUDY OF ETIOLOGICAL FACTORS AND IMMEDIATE OUTCOMES OF NEONATAL SEIZURE AMONG PRETERM ANS TERM NEONATE IN A TERTIARY CARE CENTRE OF NORTHERN INDIA

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Abstract

Background: A seizure is defined clinically as a paroxysmal alteration in neurologic function, i.e. motor, behavior and/or autonomic function. The fundamental mechanisms of neonatal seizures are generally unknown, disturbance in energy production can result in a failure of Na+/ K+ pump. In addition to these cellular factors, differential development of neural systems may enhance the excitatory state of the immature brain and predispose to seizures. Other suggested mechanisms of injury include effects of nitric oxide synthase inhibition on cerebral circulation, which then contributes to ischemic injury. **Materials and Methods:** This prospective observational study was conducted at the department of pediatrics, over the course of one year, from November 2022 to October 2023. All neonates delivered in our hospital and admitted to the Neonatal Intensive Care Unit (NICU) with clinically identified seizures up to 28 days of postnatal age are included. Excluding preterm neonates less than 28 weeks of gestational age, neonates with obvious congenital malformations, and those whose parents did not give consent. A detailed history of the seizure episode including its onset, duration, type, number, and antenatal, natal, and postnatal risk factors were obtained for each case, followed by detailed clinical examination. Essential laboratory investigations were conducted, such as blood gas, blood glucose, serum calcium, sodium, magnesium, sepsis screen, serum bilirubin levels, serum urea and creatinine, blood culture, and CSF examination were done as required. **Result:** Out of 5554 live births during the study period, 150 developed neonatal seizures. The incidence of neonatal seizures was found to be 2.71% in our hospital. However, the incidence in preterms was 5 times more (8.70%) than term (1.66%) and incidence in early preterms was 7 times more (12.05%) than term (1.66%) as shown in table 1. **Conclusion:** Persistently high incidence of neonatal seizures requires further strengthening of antenatal, natal, and post-natal health services. Early identification of neonatal seizures and timely intervention are very important for better outcomes.

INTRODUCTION

Seizures are more common in the neonatal period than in any other stage and affects approximately 1% of all neonates. Amongst neurological disorders, seizures are the most common in the neonates.[1]

A seizure is defined clinically as a paroxysmal alteration in neurologic function, i.e. motor, behavior and/or autonomic function. The fundamental mechanisms of neonatal seizures are generally unknown, disturbance in energy production can result in a failure of Na+/ K+ pump. In addition to these cellular factors, differential development of neural systems may enhance the excitatory state of the immature brain and predispose to seizures. Other suggested mechanisms of injury include effects of nitric oxide synthase inhibition on cerebral circulation, which then contributes to ischemic injury.[2]

The International League Against Epilepsy classification adopted by WHO, still considers neonatal seizures within an unclassified category. Historically seizures were divided in following clinical categories viz focal clonic, multifocal clonic, tonic, myoclonic, and subtle seizures.[3]

Diverse medical conditions in the newborn can be associated with neonatal seizures. Hypoxia-ischemia is nonetheless traditionally considered the most common cause of neonatal seizures. Cerebral infarction and stroke are the second most common cause of neonatal seizures occurring in otherwise well term infants, without previous risk factors.

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Hypoglycemia is a well-known cause of neonatal seizures. Infants with sepsis and meningitis frequently have hypoglycemia which can be attributed to inadequate intake, increased metabolic rate and impaired ability to metabolize glucose.[4]
Electroencephalograph (EEG) is an important tool and can be used for detection as well as diagnosis of neonatal seizures, also it gives an estimate of perinatal brain damage. The variability of normal maturation of brain can influence its interpretation, also the restricted availability of equipment are its limitations. The risk of mortality and associated morbidities like developmental delay, focal neurological deficits, and cognitive impairment, makes this clinical entity a matter of concern for clinicians.[5] Early detection and timely intervention can reduce the morbidity profile. This study was conducted to determine the incidence rate, etiology, and short-term outcome of clinically recognizable neonatal seizures.

MATERIALS AND METHODS

This prospective observational study was conducted at the department of pediatrics, over the course of one year, from November 2022 to October 2023.

Inclusion Criteria

All neonates delivered in our hospital and admitted to the Neonatal Intensive Care Unit (NICU) with clinically identified seizures up to 28 days of postnatal age.

Exclusion Criteria

Excluding preterm neonates less than 28 weeks of gestational age, neonates with obvious congenital malformations, and those whose parents did not give consent.

A detailed history of the seizure episode including its onset, duration, type, number, and antenatal, natal, and postnatal risk factors were obtained for each case, followed by detailed clinical examination. Essential laboratory investigations were conducted, such as blood gas, blood glucose, serum calcium, sodium, magnesium, sepsis screen, serum bilirubin levels, serum urea and creatinine, blood culture, and CSF examination were done as required. Additional investigations included TORCH serology, serum parathyroid hormone, and metabolic profile for inborn errors of metabolism. Radiological investigations (chest X-ray, cranial ultrasonography, computed tomography, and magnetic resonance imaging of the brain) and EEG were performed if necessary. All the neonates were managed as per the standard treatment protocols.

Statistical Analysis: Statistical analysis was conducted using SPSS 20.0 system version. The qualitative parameters were compared using the chi-square test/ Fisher's exact test, whichever is applicable, p value less than 0.05 was considered significant.

RESULTS

Out of 5554 live births during the study period, 150 developed neonatal seizures. The incidence of neonatal seizures was found to be 2.71% in our hospital. However, the incidence in preterms was 5 times more (8.70%) than term (1.66%) and incidence in early preterms was 7 times more (12.05%) than term (1.66%) as shown in [Table 1].

Table 1: Incidence of neonatal seizures according to gestational age

Gestational age (weeks)		No. of Neonates Delivered	No of Neonatal Developed Seizures (NDS)	Incidence of NDS (%)
Term (≥ 37)		4721	78	1.66%
Preterm (≤ 37)		833	72	8.70%
Preterm	<34 (Early preterm)	278	33	12.05%
	34-36.6 (Late preterm)	555	39	7.02%
Total		5554	150	2.71%

Table 2: Neonatal characteristics (n=150)

Neonatal characteristics		N	Percentage
Gender	Male	86	57.0
	Female	65	43.0
Birth Weight (Grams)	<1.5	32	21.5
	1.5-2.499	53	34.8
	>2.5	66	43.7
Ante natal registration	Booked	20	13.6
	Un-booked	130	86.4
Mode of Delivery	LSCS	63	42.05
	NVD	87	57.9
Onset of Seizures according to age (Hrs)	0-24	104	68.9
	25-48	21	13.9
	49-72	12	8.3
	>72	13	8.9
Type of seizure	Subtle	129	52.3
	Clonic	52	34.3
	Tonic	19	12.6
	Myoclonic	1	0.7
Maternal risk factors	PIH	30	19.8

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	PROM	25	16.5
	Placenta previa	7	4.63
	Multiple pregnancy	6	3.97
	Oligo-hydramnios	3	1.98
	Chronic maternal diseases	3	1.98
	GDM	2	1.32

Table 3: Distribution of neonates as per etiology (n=150)

Etiology	N	Percentage
HIE (Hypoxic ischaemic encephalopathy)	86	57
Sepsis	15	9.6
Meningitis	13	8.9
Hypoglycemia	13	8.6
Hypocalcemia	9	6.3
ICH (Intra-cranial haemorrhage)	9	6.3
Kernicterus	2	1.3
Unknown	3	2
Total	150	100

Table 4: Relationship of outcome of neonatal seizures with GA, birth weight, age at onset of seizures and type of seizures

Variable		Outcome N (%)		Total	P Value
		Discharge	Expired		
GA (weeks)	28-33.6	17 (50.7)	16 (49.3)	33	0.001
	34-36.6	30 (76.9)	18 (23.1)	48	
	>37	63 (80.9)	15 (19.1)	78	
Birth weight	<1.5	15 (47.7)	17 (52.3)	32	0.001
	1.5-2.499	40 (75.2)	13 (24.8)	52	
	>2.5	55 (84.1)	10 (15.9)	65	
Onset of Seizure	0-24	72 (69.2)	32 (30.8)	104	0.001
	25-48	16 (78.6)	04 (21.4)	20	
	49-72	10 (80)	02 (20.0)	12	
	>72	12 (88.9)	02 (11.1)	14	
Type of Seizure	Clonic	38 (73.1)	14 (26.9)	52	0.001
	Myoclonic	01 (100)	00 (0.0)	01	
	Subtle	56 (70.9)	23 (29.1)	129	
	Tonic	15 (81.6)	03 (18.4)	18	

The association of gestational age (GA), birth weight and outcome with etiology came out to be statistically significant with p value of 0.001. Comparison of mortality with other parameters showed that mortality was highest in early preterms (49.3%) and very low birth weight babies (52.3%). Also, mortality was more in babies in whom 1st seizure developed within 24 hrs of age (30.8%) and in neonates with subtle seizures than clonic, tonic, and myoclonic seizures as shown in [Table 3].

DISCUSSION

Seizure is defined as a paroxysmal involuntary disturbance of brain function. The various presentations of neonatal seizures are impairment in consciousness, abnormal motor, or behavioural activity, and sensory or autonomic disturbances. Neonatal seizures can adversely affect neurodevelopment and may result in cognitive, behavioural, and epileptic complications in later life. As this could be the sole presentation of underlying CNS disorder, early recognition is very important.[6]

In our study the overall incidence of neonatal seizures was 2.7% which is lower than the studies done by Sabzehei et aland Sahanaet al while higher than the study done by Venkatesh et al which can be due to tertiary care status of our hospital where high risk and complicated deliveries are referred and most of them are un-booked deliveries (86.4%). The incidence of neonatal seizures was 1.6 % in term neonates and 8.70% in preterm, among preterm neonates early preterm had 12.05% and late preterm had 7.02%. So total preterm (early and late) had a higher (5 times) incidence than term and among preterm early preterm had a higher incidence.[7]

These findings are consistent with other studies done by Tekgul et al and Kumar et al. The overall incidence of prematurity in the current study was 15%. Preterm babies may have multifactorial etiology for neonatal seizures. Low birth weight, maternal illnesses, and metabolic causes could be the contributing factors. We found male predominance in our study which is consistent with other studies, we do not have any plausible mechanism behind that.[8]

Neonatal seizures were more common in low birth weight babies (56.30%) as compared to normal birth weight babies (43.70%) which is comparable with the study conducted by Shah et al. Low birth weight has many predisposing common factors for neonatal seizures namely maternal illnesses, neonatal infections, decreased metabolic stores, etc.[9]

We found seizures were more common in vaginally delivered babies. It may be assumed that vaginal delivery if difficult may cause asphyxia and subsequent complications and asphyxia remained the leading cause of seizures in our study. Most of the cases i.e., 82.8% had seizures during the first 48 hrs

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of life which is like the previous studies. The most common seizure type was subtle (52.3%), this is consistence with the Chesti et al study. Many underlying maternal risk factors have been described as important predisposing factors for neonatal seizures.[10]

CONCLUSION

There is still a deficiency of sufficient perinatal care that is available to all communities, despite notable improvements in neonatal care and delivery services. This lack of comprehensive care has led to a persistently high rate of preterm and its associated consequences, including infections and ICH. Furthermore, unmonitored prenatal care can result in unanticipated, difficult deliveries, especially in term neonates, which raises the risk of perinatal hypoxia, early and late neonatal sepsis, and intrauterine growth retardation. As a result, there is a significant prevalence of seizures in newborns. newborn morbidity and death can be reduced by promptly identifying and treating newborn seizures and their underlying causes. To secure a brighter future, prenatal, perinatal, and neonatal health facilities must be strengthened even further.

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