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Frequency of Neurological Complication in Patients Presenting with Birth Asphyxia at Tertiary Care Hospital, Hyderabad

Rabat Aslam[1], Muhammad Aslam Memon[1], Aisha Jawaid[1]

[1]Department of Paediatrics, Isra University Hospital, Hyderabad, Sindh, Pakistan.

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Correspondence to: Rabat Aslam, Postgraduate Resident, Department of Paediatrics, Isra University Hospital, Hyderabad, Sindh, Pakistan.
Email: khanrabaat@gmail.com

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ABSTRACT

Background: Birth asphyxia is a significant cause of neonatal illness and death, particularly in developing countries. One of the most serious consequences of asphyxia is neurological injury, which can lead to long-term complications. Despite its clinical importance, there is limited local data on the types and frequency of these complications in affected newborns. **Objective:** This study aimed to assess the frequency of neurological complications among neonates with birth asphyxia admitted to a tertiary care hospital in Hyderabad. **Methods:** This cross-sectional study over a six-month period from January 2025 to June 2025 at the Department of Pediatrics, Isra University Hospital. A total of 195 term neonates (≥ 37 weeks gestation) presented with birth asphyxia were included through consecutive sampling. Information was collected on seizures, tone abnormalities, feeding difficulties, and neonatal reflexes. Associations between neurological findings and demographic variables such as gender, gestational age, and residence were evaluated using chi-square tests, with p-values less than 0.05 considered significant. **Results:** Out of 195 neonates, 39 (20%) developed seizures, 32 (16.4%) showed changes in tone, 30 (15.4%) had feeding difficulties, and 38 (19.5%) exhibited abnormal neonatal reflexes at the time of discharge. Male infants were more likely to present with abnormal reflexes compared to females (p = 0.01). A significant association was also observed between urban residence and abnormal tone (p = 0.01). Other demographic variables did not show significant correlations. **Conclusion:** Neurological complications are commonly observed in neonates with birth asphyxia, with seizures and abnormal reflexes being particularly frequent. Male gender appears to be associated with increased vulnerability. These findings highlight the importance of early neurological evaluation and follow-up in asphyxiated infants to prevent long-term disability.

INTRODUCTION

Neonatal encephalopathy due to perinatal hypoxia-ischemia (birth asphyxia) is to date one of the most important causes of an adverse neurodevelopmental outcome and even death: 2 up to 26 neonates per 1,000 live births have an adverse long-term outcome such as cerebral palsy, epilepsy, cognitive impairment and learning difficulties. Moreover, birth asphyxia is responsible for 25% of the neonatal mortality rate in the world.[1]

In the majority of perinatal asphyxia there is an acute hypoxic-ischemic insult and in such situations the deeper brain structures such as brain stem, thalamus and basal ganglia are in particular affected, whereas subacute and chronic hypoxia-ischemia, which happens in about 10% to15% during perinatal asphyxia, induce damage at the borders of the vascular beds of the anterior, middle and posterior cerebral arteries, the so-called watershed damage. [2] Hypoxic-ischemic insults that lead to a global pattern of injury are relatively rare, probably because in most cases this will result in fetal or intrapartum death, and infants will not undergo MRI examinations[3-4]. When hypoxia–ischemia persists long enough, it will cause permanent neurologic injury, which may eventually develop into neurodevelopmental disorders such as developmental delay and cerebral palsy. [5]

Dyskinetic cerebral palsy and spastic quadriplegia are the most common subtypes with 80% of dyskinetic cerebral palsy attributable to perinatal hypoxia-ischaemia at term. Sensory disruption is also increased following hypoxic-ischaemic injuries. Rates of hearing loss are reported to be as high as 17.1% in those with other persistent neurological deficits. Up to 63.1% of infants diagnosed with asphyxia have an abnormality in some element of visual function in the first year of life. [6] This percentage rises significantly when associated with moderate to severe basal ganglia changes and severe white matter changes on MRI. [7]

In a study assessing the long-term neurodevelopmental outcomes of children who experienced perinatal asphyxia, found that 43.8% of the affected children exhibited minor neurological abnormalities, and 12.5% developed epilepsy. Additionally, 34% showed mild motor impairments. Health-related quality-of-life assessments indicated that 12.5% had mild vision disorders, 3.1% had hearing disorders, 6.3% had speech disorders, 9.4% experienced pain, 25% had ambulation disorders, 6.2% had dexterity disorders, and 31.3% had cognitive disorders. [8] A comprehensive meta-analysis has demonstrated that birth asphyxia significantly increases the risk of cerebral palsy (CP) in neonates. The study, which included 10 studies with a total of 1,665 infants, found that the pooled rate of CP among neonates with birth asphyxia was 20.3% (95% CI: 16.0-24.5) in randomized controlled trials. [9] A study done Siddiqui et al found the prevalence of neurological complication to be 46%. [10]

Birth asphyxia is a significant global health issue and a leading cause of neonatal morbidity and mortality, resulting when a newborn's brain and other organs do not receive adequate oxygen and nutrients before, during, or immediately after birth. Studying the frequency of these neurological complications in patients with birth asphyxia is crucial for several reasons. First, knowing how often these complications occur enables healthcare providers to identify high-risk infants early, allowing for timely interventions that may reduce the severity of outcomes or prevent complications from worsening. This research also guides healthcare systems and policymakers in resource allocation, ensuring that adequate support is available for neonatal intensive care, rehabilitation, and long-term follow-up services. Moreover, understanding the prevalence of neurological complications provides valuable insight for improving perinatal and neonatal care practices, such as resuscitation techniques and neuroprotective therapies. This knowledge is also vital for parental counseling, giving families clearer expectations and better access to necessary support services.

MATERIAL AND METHODS

A cross-sectional study was carried out in the Department of Pediatrics at Isra University Hospital, Hyderabad, over a six-month period from January 2025 to June 2025, following the approval of the research synopsis. The aim was to assess the frequency of neurological complications among neonates diagnosed with birth asphyxia. A total of 195 term neonates were enrolled using a non-probability, consecutive sampling technique. The sample size was determined using WHO sample size calculator based on a prevalence rate of 46%, a 7% margin of error, and a 95% confidence level.

Eligibility for participation included term neonates with a gestational age of 37 weeks or more, aged between birth and 14 days, and meeting the criteria for hypoxic-ischemic encephalopathy, defined by an Apgar score of less than 7 at five minutes and requiring NICU admission. Both male and female infants were included. Neonates were excluded if they had a history of febrile seizures, were born preterm with gestational age below 36 weeks or birth weight under 1500 grams, or had conditions such as intracranial bleeding, major congenital anomalies of vital systems, severe hyperbilirubinemia suggestive of kernicterus, hypoglycemia, or meningitis as contributing factors to encephalopathy. Infants whose parents declined to provide consent were also excluded.

Once parental consent secured, eligible neonates were systematically enrolled. Demographic details such as name, gender, age, and gestational age at birth were recorded from medical charts. Each neonate was evaluated for neurological abnormalities during the hospital stay based on predefined clinical indicators, including seizures, abnormal muscle tone, difficulties with swallowing or sucking, and abnormal neonatal reflexes observed at discharge. Clinical care followed the standard treatment protocol.

Data were recorded in a pre-designed proforma and analyzed using SPSS version 25. Data distribution was initially tested for normality using the Shapiro-Wilk test. Quantitative variables such as age, gestational age, and duration of hospital stay were summarized as mean and standard deviation for normally distributed data, or as median and interquartile range when non-normally distributed, as determined by the Kolmogorov–Smirnov test. Categorical variables, including gender, residence, mode of delivery, family income, maternal education, occupation, and presence of neurological complications, were expressed as frequencies and percentages. Stratification was performed based on demographic and clinical factors to assess their influence on neurological outcomes. Following stratification, the chi-square test was used to determine statistical significance, with a p-value of 0.05 or less considered indicative of a significant association.

RESULTS

This study included 195 neonates diagnosed with birth asphyxia. Of these, 136 (69.7%) were older than 38 weeks of gestation, while 59 (30.3%) were ≤ 38 weeks. Female neonates comprised a slightly higher proportion (53.8%) than males (46.2%). Most participants (84.1%) resided in urban areas, and the remaining 15.9% were from rural settings.

A majority of neonates (71.3%) remained admitted for more than 7 days, while 28.7% were discharged within one week. Among the parents, 59.5% were unemployed, and 40.5% were employed. More than half (55.9%) of the families reported a monthly income exceeding PKR 50,000, whereas 44.1% earned PKR 50,000 or less. Regarding maternal education, 49.2% had completed secondary education, 20% were illiterate, and 15.4% each had attained primary or higher education.

Neurological complications were evaluated using key clinical indicators. Seizures were present in 20% of neonates, while 16.4% exhibited changes in muscle tone. Difficulties in swallowing and sucking during feeding were reported in 15.4% of cases. At the time of discharge, 19.5% of neonates displayed either reduced or exaggerated neonatal reflexes.

When analyzing the association between seizures and baseline characteristics, neonates aged ≤ 38 weeks exhibited a higher rate of seizures (27.1%) compared to

those >38 weeks (16.9%), though the difference did not reach statistical significance (p = 0.10). Similarly, female neonates demonstrated a higher seizure frequency (23.8%) than males (15.6%), but this was not statistically significant (p = 0.15). No significant association emerged between seizure occurrence and residence status (p = 0.69).

Changes in tone occurred more frequently in neonates >38 weeks (17.6%) than in those ≤38 weeks (13.6%) (p = 0.47). Female neonates showed a slightly higher rate (18.1%) compared to males (14.4%) (p = 0.49). However, a statistically significant difference was observed with respect to residence: all cases with tone changes were from urban areas, while none were reported among rural residents (p = 0.01).

Swallowing and sucking difficulties were slightly more common among neonates >38 weeks (16.2%) than those ≤38 weeks (13.6%) (p = 0.64), and more frequent in males (18.9%) compared to females (12.4%) (p = 0.20). These differences were not statistically significant. Urban neonates experienced these issues more often (15.9%) than rural neonates (12.9%), with no significant association (p = 0.67).

At discharge, 19.5% of neonates had altered neonatal reflexes. This complication occurred more often in neonates ≤38 weeks (22%) than in those >38 weeks (18.4%) (p = 0.55). Male neonates had a significantly higher rate of abnormal reflexes (26.7%) compared to females (13.3%) (p = 0.01). However, no statistically significant association was observed between reflex abnormalities and residence status (p = 0.31).

Table 1

Distribution of baseline characteristics among the study participants.

Variables	n (%)
Age	
≤ 38 weeks	59 (30.3)
> 38 weeks	136 (69.7)
Gender	
Male	90 (46.2)
Female	105 (53.8)
Residence status	
Urban	164 (84.1)
Rural	31 (15.9)
Duration of hospital stay	
≤ 7 days	56 (28.7)
> 7 days	139 (71.)
Occupational status	
Employed	79 (40.5)
Unemployed	116 (59.5)
Family monthly income	
≤ 50000 per month	86 (44.1)
> 50000 per month	109 (55.9)
Maternal educational status	
Illiterate	39 (20)
Primary	30 (15.4)
Secondary	96 (49.2)
Higher	30 (15.4)
Seizure	
Yes	39 (20)
No	156 (80)
Change in tone	
Yes	32 (16.4)
No	163 (83.6)
Change in swallowing and sucking difficulty observed during feeding	
Yes	30 (15.4)
No	165 (84.6)
Reduced/ exaggerated neonatal reflexes observed at the time of discharge	
Yes	38 (19.5)
No	157 (80.5)
Total	195 (100)

Table 2

Distribution of patient characteristics according to the Seizure.

Variables	Seizure Yes n (%)	Seizure No n (%)	P value
Age			
≤ 38 weeks	16 (27.1)	43 (72.9)	
> 38 weeks	23 (16.9)	113 (83.1)	0.10
Gender			
Male	14 (15.6)	76 (84.4)	
Female	25 (23.8)	80 (76.2)	0.15
Residence status			
Urban	32 (19.5)	132 (80.5)	
Rural	07 (22.6)	24 (77.4)	0.69

Table 3

Distribution of patient characteristics according to the Change in tone.

Variables	Change in tone Yes n (%)	Change in tone No n (%)	P value
Age			
≤ 38 weeks	08 (13.6)	51 (86.4)	
> 38 weeks	24 (17.6)	112 (82.4)	0.47
Gender			
Male	13 (14.4)	77 (85.6)	
Female	19 (18.1)	86 (81.9)	0.49
Residence status			
Urban	32 (19.5)	132 (80.5)	
Rural	00 (00)	31 (100)	0.01

Table 4

Distribution of patient characteristics according to the Change in swallowing and sucking difficulty observed during feeding.

Variables	Change in swallowing and sucking difficulty observed during feeding Yes n (%)	Change in swallowing and sucking difficulty observed during feeding No n (%)	P value
Age			
≤ 38 weeks	08 (13.6)	51 (86.4)	
> 38 weeks	22 (16.2)	114 (83.8)	0.64
Gender			
Male	17 (18.9)	73 (81.1)	
Female	13 (12.4)	92 (87.6)	0.20
Residence status			
Urban	23 (15.9)	138 (84.1)	
Rural	04 (12.9)	27 (87.1)	0.67

Table 5

Distribution of patient characteristics according to the Reduced/ exaggerated neonatal reflexes observed at the time of discharge.

Variables	Reduced/ exaggerated neonatal reflexes observed at the time of discharge Yes n (%)	Reduced/ exaggerated neonatal reflexes observed at the time of discharge No n (%)	P value
Age			
≤ 38 weeks	13 (22)	46 (78)	
> 38 weeks	25 (18.4)	111 (81.6)	0.55
Gender			
Male	24 (26.7)	66 (73.3)	
Female	14 (13.3)	91 (86.7)	0.01
Residence status	34 (20.7)	130 (79.3)	0.31

Urban	04 (12.9)	27 (87.1)
Rural		

DISCUSSION

In this study, we investigated the frequency and characteristics of neurological complications in neonates with birth asphyxia admitted to a tertiary care hospital in Hyderabad. Our findings revealed that seizures occurred in 20% of the patients. There were changes in tone in 16.4% participants, feeding difficulties in 15.4%, and abnormal neonatal reflexes in 19.5%. These results highlight the significant burden of neurological impairment following birth asphyxia. These results support earlier research emphasizing its long-term impact on neonatal health.[11-13]

We observed that seizures were the most common neurological complication, consistent with other studies reporting neonatal seizures as a frequent outcome of perinatal hypoxia. [11, 14] Seizures often represent the earliest clinical sign of hypoxic-ischemic encephalopathy (HIE) and are associated with poor neurodevelopmental outcomes when not promptly recognized and treated. [15-16] Electrographic seizures may occur without clinical manifestations. Thus their true frequency may be underestimated in settings lacking continuous EEG monitoring. [17]

Feeding and swallowing difficulties, present in 15.4% of neonates, are also recognized consequences of HIE. These issues likely result from impaired coordination of sucking and swallowing due to brainstem or cortical injury. [12, 18] Researchers found similar dysfunctions persisting beyond the neonatal period. This can hinder growth and development if not addressed early. [12] The high prevalence in our data underlines the importance of early oromotor assessment and feeding support for at-risk infants.

Abnormal neonatal reflexes were noted in nearly one-fifth of patients. This may serve as early indicators of more severe neurological injury, including the risk of cerebral palsy. [13, 19] Patterns of reflex abnormalities often correlate with the type and severity of brain injury observed in imaging studies. This particularly shows damage to the basal ganglia and thalamus. These are the regions which are commonly affected in moderate-to-severe HIE. [20-21]

Notably, we identified a significant association between male gender and the presence of abnormal reflexes at discharge. This aligns with prior studies indicating that male neonates have heightened vulnerability to perinatal brain injury. This happens potentially due to differential neuroprotective hormonal influences and inflammatory responses. [14, 22] Researchers similarly reported higher rates of morbidity and mortality in male neonates across a range of birth complications. [23]

While our results showed a higher rate of neurological complications among urban residents, this finding may reflect referral bias or variations in healthcare access rather than a true difference in incidence. Nonetheless, the observation warrants further exploration, particularly in multicenter studies that include both urban and rural populations.

LIMITATIONS

This study was conducted at a single center, which may limit the generalizability of the findings. Additionally, the cross-sectional design restricted our ability to assess long-term neurological outcomes. A prospective cohort design with long-term neurodevelopmental follow-up would provide a more comprehensive understanding of the true burden of neurological impairment following birth asphyxia.

CONCLUSION

This study demonstrates that neurological complications, particularly seizures and abnormal neonatal reflexes. These frequently occur in neonates with birth asphyxia. Male infants showed a greater tendency to develop reflex abnormalities, and tone changes appeared more often in those from urban areas. These patterns suggest that both biological vulnerability and environmental factors may contribute to early neurological outcomes. By identifying these complications during the initial hospital stay, clinicians can initiate timely assessments and interventions. Strengthening early screening and follow-up protocols could help reduce the risk of long-term neurodevelopmental impairments.

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