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Prevalence and Outcome of Neonates presenting with Hypoxic Ischemic Encephalopathy

Shafa[1], Aisha Tuz Zohrah[2], Wajeeha Riaz[3], Farrah Eemaan[4], Salma Shaikh[5]

[1-5]Department of Pediatrics, Bilawal Medical College for Boys, LUMHS, Jamshoro, Sindh, Pakistan.

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Correspondence to: Shafa, Postgraduate Resident, Pediatrics, Bilawal Medical College for Boys, LUMHS, Jamshoro, Sindh, Pakistan.
Email: shafachanna@gmail.com

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ABSTRACT

Objective: To determine the prevalence and outcome of neonates presenting with hypoxic ischemic encephalopathy. **Study Design:** Observational descriptive study **Setting:** Department of Pediatrics, Neonatal care unit, Bilawal Medical College for Boys, LUMHS, Jamshoro. **Duration:** April 15, 2025 to July 15, 2025. **Methodology:** A total of 65 term newborns (delivered at ≥37completed weeks of gestation) with Hypoxic Ischemic Encephalopathy of either gender, birth weight > 2000 g were included. Newborn with Hypoxic ischemic encephalopathy was labelled as positive if she/he had low APGAR scores (< 7 at 5 min), intrapartum asphyxia (PH < 7.0, or base deficit ≥ 12.0 mmol/l) and had at least 2 of the following clinical features like state of abnormal consciousness, impaired sucking, swallowing or feeding difficulty and Hypotonia. Further HIE was graded using the Modified Sarnat Encephalopathy Grading (MSEG) system. All the newborns with HIE were managed according to standard operating systems at the unit and were followed up by a daily clinical examination and outcomes of HIE i.e., mortality and discharge were assessed on 7th day. **Results:** A total of 65 newborns with asphyxia were included in this study. Mean age of the mothers was 28 ±2.5 years. Mean infant age was 2.73±1.31 days and mean gestational age was 38.68±1.24 weeks. 33 (50.7%) were male and 32 (49.2%) were female. 34 (52.3%) delivered vaginally and 31 (47.69%) through C-section. 7 (10.7%) newborn Neonates had Hypoxic Ischemic Encephalopathy. 3 (42.8%) of the babies suffered from hypoxic ischemic encephalopathy grade I & grade-II each, grade III was found to be 1 (14.2%). Mortality occurred in 2 cases (28.5%) of HIE, 1 was from grade-I and 1 was from grade-III. **Conclusion:** This study reveals high prevalence of Hypoxic Ischemic Encephalopathy in birth asphyxia newborns. The severity of HIE affects the outcome of newborns having birth asphyxia, with HIE grade III associated with maximum mortality.%.

INTRODUCTION

Hypoxic ischemic encephalopathy (HIE) is a neurological complication from the inability to establish and sustain respiration at birth in a newborn. It is the commonest cause of neonatal encephalopathy (HIE) remains one of the major causes of mortality and morbidity in neonates.[1] Its severity has been related to the degree of depression of the Apgar score[2]

Globally, neonatal mortality accounts for up to 44% of the Under Five Mortality, of which 99% occurs in low and middle income countries. Intrapartum asphyxia and consequential Hypoxic Ischemic Encephalopathy (HIE) are a common cause of potentially avoidable neonatal brain injury and mortality[3].

Predicting neurodevelopmental outcome with the advent of newer technologies such as cranial ultrasonography, Doppler ultrasound of the middle cerebral artery, computed tomography scanning and magnetic resonance imaging.[4] However, availability and accessibility of these modalities are limited or non-existent in developing countries. Clinicians in these settings still rely heavily on clinical parameters to help them determine prognosis.[5,6]

Sarnat and Sarnat proposed a staging system useful in classifying the encephalopathy associated with birth asphyxia. According to the classification stages 1, 2, and 3 correlates with the description of mild, moderate, and severe encephalopathy, respectively.[7] NE incidence is estimated as 3.0 per 1000 live births (95%CI 2.7 to 3.3) and for HIE is 1.5 (95%CI 1.3 to 1.7 min).[8]

Different measures are being taken to reduce neonatal mortality and morbidity. These include preventive measures such as; proper monitoring of labor with a partograph, timely and adequate resuscitation and therapeutic hypothermia of Newborns with HIE to improve out.[9,10]

The aim of this study was to determine the prevalence and outcome of neonates presenting with hypoxic

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ischemic encephalopathy. Results of this study may bring a light to the healthcare personnel so as to improve their services during antenatal period and delivery.

METHODOLOGY

This observational descriptive study was carried out over a period of three months from April 15, 2025 to July 15, 2025 in the department of Pediatrics, Neonatal care unit, Bilawal Medical College for Boys, LUMHS, Jamshoro. After taking the written informed consent from parents or guardian, a total of 65 term newborns (delivered at ≥37completed weeks of gestation) with asphyxia of either gender, birth weight > 2000 g were included via non-probability sampling technique. Newborns who delivered by caesarian section under general anesthesia were excluded. Newborns with congenital abnormalities and newborns with chromosomal abnormalities were also excluded. Sample size was calculated using OpenEpi calculator by taking the prevalence of outcome of HIE i.e., expiry rate in newborn with Hypoxic Ischemic Encephalopathy i.e., P = 16.39%[9], margin of error d = 9%, confidence interval = 95%, then calculated sample size was n = 65. Newborn with Hypoxic ischemic encephalopathy was labelled as positive if she/he had low APGAR scores (< 7 at 5 min), intrapartum asphyxia (PH < 7.0, or base deficit ≥ 12.0 mmol/l) and had at least 2 of the following clinical features like state of abnormal consciousness (hyper alert or lethargic), impaired sucking, swallowing or feeding difficulty and Hypotonia (low muscle tone). Further HIE was graded using the Modified Sarnat Encephalopathy Grading (MSEG) system.[8] Neonate was classified with Mild HIE, if scoring was between 1-10, Moderate HIE had scoring 11-14 and Severe HIE had scoring 15-22. All the newborns with HIE were managed according to standard operating systems at the unit. They were followed up by a daily clinical examination and outcomes of HIE i.e. mortality and discharge were assessed on 7th day. Data was entered and analyzed by using SPSS version 24. Mean and standard deviation was calculated for continuous data and frequencies and percentages were calculated for qualitative variables like gender of the baby, mode of delivery, booking status, residential status, grade of HIE and outcome variables i.e. HIE and its outcomes i.e. mortality and discharge. Effect modifiers like newborn age, maternal age, gestational age, birth weight, grade of HIE, APGAR score at 1 minute, APGAR score at 5 minutes, mode of delivery, booking status, residential status of mother was controlled through stratification. Post-stratification Chi square/Fisher exact test was applied by taking P-value ≤ 0.05 was considered as significant.

RESULTS

A total of 65 newborns with Hypoxic ischemic encephalopathy were included in this study. Mean age of the mothers was 28 ±2.5 years. Mean infant age was 2.73±1.31 days and mean gestational age was 38.681±1.24 weeks. 33 (50.7%) were male and 32 (49.2%) were female. 34 (52.3%) delivered vaginally and 31 (47.69%) through C-section. Out of 65 cases, 23 (35.3%) were booked cases and 42 (64.6%) were un-booked cases. 25 (38.4%) cases were urban resided and 40 (61.5%) were rural resided. 20 (30.7%) cases had LBW, 42 (64.6%) had normal birth weight and 3 (4.6%) were overweight. Regarding the APGAR score, 61 (94%) had between 4-6 and 4 (6%) had between 1-3, **as shown in table 1.**

7 (10.7%) Neonates had Hypoxic Ischemic Encephalopathy. 3 (42.8%) of the babies suffered from hypoxic ischemic encephalopathy grade I & grade-II each, grade III was found to be 1 (14.2%). Mortality occurred in 2 cases (28.5%) of HIE, 1 was from grade-I and 1 was from grade-III, **as shown in figure 1 & table 2.**

Table 1

Baseline data of the patients (n=65)

Baseline Data	(mean ± sd)/n(%)
Maternal age (Years)	28 ±2.5
Infant age (Days)	2.73±1.31
Gestational Age (Weeks)	38.68±1.24
Gender of baby:	
Male	33 (50.7%)
Female	32 (49.2%)
Mode of Delivery:	
Vaginal	34 (52.3%)
C-section	31 (47.69%)
Booking Status:	
Booked	23 (35.3%)
Un-booked	42 (64.6%)
Residential Status:	
Urban	25 (38.4%)
Rural	40 (61.5%)
Birth Weight:	
Low birth weight (< 2500 g)	20 (30.7%)
Normal (2500-4500 g)	42 (64.6%)
Overweight (> 4500 g)	03 (4.6%)
APGAR Score:	
4-6	61 (94%)
1-3	04 (6%)

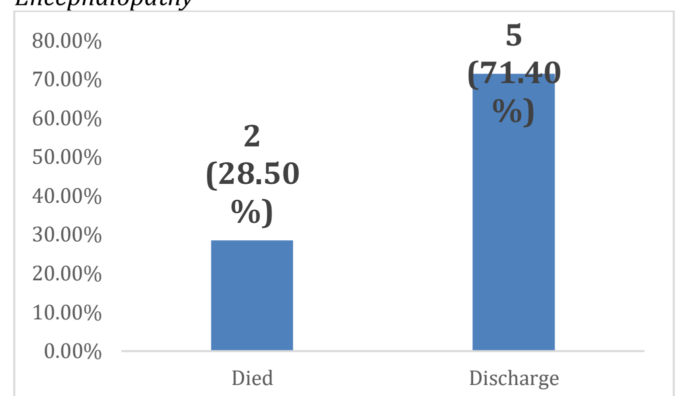
Table 2

Prevalence of Hypoxic Ischemic Encephalopathy in newborn neonates

Hypoxic Ischemic Encephalopathy	n (%)
Yes	7 (10.7%)
No	58 (89.2%)
Grades of HIE:	
Mild	03 (42.8%)
Moderate	03 (42.8%)
Severe	01 (14.2%)

Figure 1

Outcomes of the newborn neonates with Hypoxic Ischemic Encephalopathy



DISCUSSION

In this study 7 (10.7%) of the neonates had HIE. The prevalence of HIE observed is lower compared with the findings of a study done in Tanzania at Muhimbili National Hospital in 2007 where the prevalence was found to be

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30.9%.[11] It's however higher than among the studies done in high income countries. In Spain the prevalence of HIE was found to be 2.42 per 1000 infants between 2000 and 2008.[12] HIE is among the leading causes of death in the neonatal period and apart from mortality, neonates with HIE have a risk of serious long-term neuro-motor sequelae like cerebral palsy and epilepsy among the survivors. Hence improvement in monitoring of mothers in labor and of the newborns with HIE should be strengthened.

A study conducted by Namusoke H et al, reported the incidence of Hypoxic Ischemic Encephalopathy such as 30.6%. Revealed that mild HIE was 43.5%, moderate HIE 34.8% and severe HIE 21.7%. Outcome of Hypoxic Ischemic Encephalopathy were as follow, mortality 26% and discharged 65.2%.[5]

Another Pakistani study conducted by Hafsa N et al, observed the frequency of grades of HIE in newborns i.e. HIE grade 1 (50%), HIE grade 2 (34.43%), HIE grade 3 (15.57%) and reported the prevalence of outcomes HIE such as discharge (83.61%) and expired (16.39%).[8]

42.8% of the babies suffered from hypoxic ischemic encephalopathy grade I & grade-II each, grade III was found to be 14.2%. In one Pakistani study majority of babies suffered from grade-I HIE whereas other studies from Pakistan document the predominance of HIE -II.[13] Regional studies also document the predominance of HIE-I. The severity of HIE affects the outcome. HIE grade III is associated with 100% death or disability and the survivors usually die by 5 years of age due to various causes.[14] Mortality occurred in two cases (28.5%), one was from grade-I one was from grade-III.

Overall mortality observed among newborns with HIE was 28.5%. This finding is above from the statistics as reported in previous studies at Mulago Hospital in Uganda 12.9%,[15] in Cameroon 10%,[16] at tertiary hospital in Johannesburg South Africa 14.3%,[17] at Liaquat teaching hospital in Pakistan 15%[18] and at Ayub Teaching hospital in Pakistan 16%.[19]

Our local data is very limited as regards to the incidence of HIE and its outcomes, hence we need to conduct various multicenter studies in different areas of Pakistan so that interventions can be done to educate and guide the masses regarding this very important issue and implement appropriate management strategies. Our study opens the door of large proportion of research which needs on this topic to define more accurately the true burden of HIE in developing countries.

CONCLUSION

This study reveals high prevalence of Hypoxic Ischemic Encephalopathy in birth asphyxia newborns. The severity of HIE affects the outcome of newborns having birth asphyxia, with HIE grade III associated with maximum mortality. Early identification of pregnancies at risk for asphyxia, with appropriate intervention in selected cases is the key to prevent birth asphyxia and its ensuing neonatal complications.

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