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Original Article

Paediatrics Section

Study of Latency Interval of Moro Reflex in Full-term Newborns with Hypoxic Ischaemic Encephalopathy

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ABSTRACT

Introduction: Neurological morbidities are the earliest presentation of hypoxic insult in newborns. Parents seek medical advice when they notice abnormal posture or abnormal movements or persistent cry or delayed milestones. By that time pathophysiology would have set in and would have led to irreversible changes in brain which subsequently manifests in developing period of brain or later. Early recognition of asphyxiated newborns and their timely referral has better neurological outcome.

Aim: To describe Moro's response in newborns with Hypoxic Ischaemic Encephalopathy (HIE) by using Ordinal scale.

Materials and Methods: This was a prospective cross-sectional study conducted in a tertiary care hospital. Inclusion criteria were full term newborns with HIE. Recruited newborns were classified in different grades of HIE after initial stabilisation, two investigators were present in examination room, one investigator examined the Moro's response while the baby was alert, active and moving the limbs by using head drop method. Whole event was recorded by second investigator and third investigator was calculating the latency interval of Moro's response by using stopwatch with accuracy of 1/100 of a second from video recording separately. Moro's response was assessed by ordinal scale.

Results: Final analysis was done on 104 newborns, out of which 18 had absent reflex, 17 had long latency interval, 19 had normal latency interval and 50 newborns had short latency interval. Long latency of Moro response had sensitivity of 45.95%, with 50.8% of accuracy to screen deviant Moro's response in HIE.

Conclusion: Long latency interval of Moro response could be a valuable clinical sign to screen for neurological impairment in HIE.

Keywords: Asphyxia, Deviant moro response, Long latency, Ordinal scale

INTRODUCTION

Neurological morbidities are the earliest presentation of hypoxic insult in newborns. Parents seek medical advice when they notice abnormal posture or abnormal movements or persistent cry or delayed milestones. By that time, pathogenesis would have started and would have led to irreversible changes in brain, which subsequently manifests later in life. Early recognition of asphyxiated newborns and their timely referral has better neurological outcome. Absent Moro's response during neonatal period is diagnostic of compromised conditions like birth injury, severe birth asphyxia and intracranial haemorrhage [1,2]. However, variations from normal responses like vigorous (hyperactive) and weak (hypoactive) have been found in neurologically impaired newborns and subtle variation in primitive reflex response during neonatal period that would help to know current neurological status of newborns [3]. Latency of a reflex is the time period before onset of first sign of reflex and it is found that assessment of latency interval of Moro's reflex by health care providers helps in early identification of asphyxiated newborns [4] which would help in early intervention [5-7]. The present work was undertaken to study Moro response and latency interval of Moro response in newborns with HIE by ordinal scale.

MATERIALS AND METHODS

This was a prospective cross-sectional study conducted on asphyxiated newborns recruited from September 2012 to August 2013, over one year period at NICU of Shyam Shah Medical College, Rewa, Madhya Pradesh located in central India. The inclusion criteria were full term newborns with HIE. Different stages of HIE in the same infant were not studied, each case was studied only once and categorised in relevant group at admission. Exclusion criteria were children born preterm, with congenital malformation, genetic or skeletal disorders, and encephalopathy other than hypoxia (e.g., hypoglycaemia, hypocalcaemia, infection). The study was approved by the Ethics committee of the college (No.IEC001/2012:06/11/12) and informed consent was obtained from the parents of all patients before the study. Detailed antenatal, natal and postnatal history of the mothers was obtained in predesigned format.

Diagnosis of HIE was based on clinical signs and symptoms. Sarnat and Sarnat criteria was used for classification of HIE after 12 hours of birth [8]. Relevant investigations were done to rule out metabolic causes of encephalopathy and meningitis. The assessment of Moro reflex was performed within 48 hours after birth, either in post natal wards of Obstetrics and Gynaecology or examination room of neonatal intensive care unit, when newborns were haemodynamically stable except in newborns with HIE-III. Moro's reflex in newborns with HIE-III was assessed at time of discharge. Out of 54 newborns with HIE-I, nine were kept in NICU for 24 hours and 45 were shifted to post natal ward within six hours after stabilisation. Two investigators were present in examination room, one investigator examined the Moro response while the baby was alert, active and moving the limbs by using head drop method and conventionally it was interpreted as initiation, optimisation and completion of response [9]. Whole event was recorded by second investigator and third investigator was calculating latency interval of Moro responses by using stopwatch with accuracy of 1/100 of a second from video recording separately. Moro reflex is simple to perform and interpreted by using Ordinal scales (Absent reflex-0, Long latency-1 (>0.49s), Normal range-2 (0.41-0.49s) and Short latency-3 (<0.41s) [4]. Mean values were calculated for latency interval, optimisation, and total time taken to complete the response. Latency interval was defined as the time taken

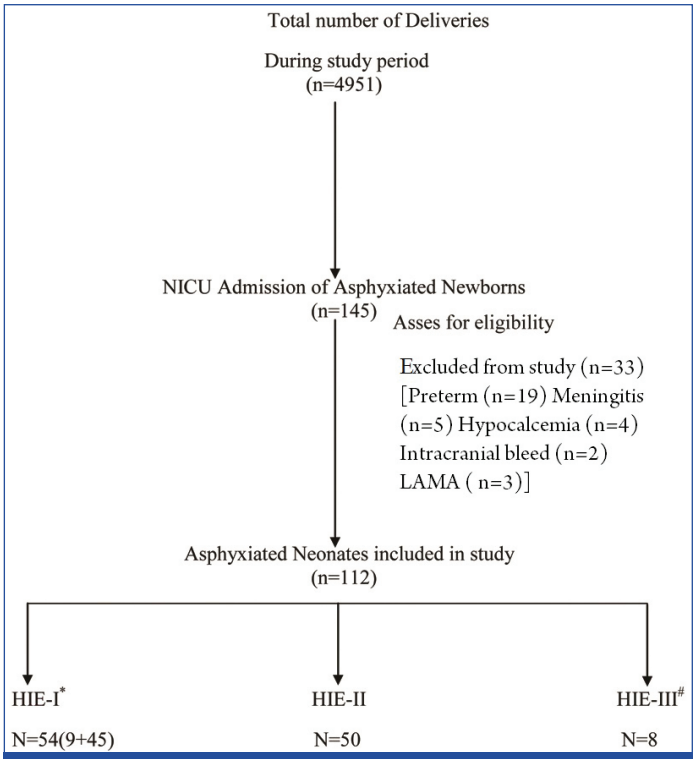
for onset of first sign of reflex response i.e., abduction of arms following the stimulus. Optimisation was defined as the arc like embracing the movement of arms following initial abduction of arms and the total time taken for complete response was labelled as completion [4].

STATISTICAL ANALYSIS

The clinical and demographic characteristics of study population were filled in case record. The SPSS version 18 was used for data analysis. The demographic characteristics, clinical information was presented as frequencies with percentages. Latency interval, optimal response, and completion of response were presented as mean with ranges. Fischer's exact probability test was used to compare the data and sensitivity, specificity, positive predictive value, and negative predictive value.

RESULTS

Out of total 145 asphyxiated newborns, 112 newborns were included in the study, 33 were excluded and final analysis was done in 104 newborns because newborns with HIE-III received two or more antiepileptic including phenobarbitone within 24 hours and examined at discharge were excluded from final analysis. Out of total 112 newborns, 54 (33.33%) newborns were in HIE-I, 50 (30.86%) newborns were in HIE-II, and eight (4.93%) newborns were in HIE-III respectively [Table/Fig-1]. Normal Moro response was elicited in newborns with HIE-I, whereas 13 (26%) newborns had normal response, 19 (38%) newborns had incomplete response and 18 (36%) newborns had absent response in newborns with HIE-II [Table/Fig-2]. On ordinal scale analysis 18 (17.30%) newborns had absent response, 17 (16.34%) newborns had long latency (0.72s), 19 (18.26%) newborns had normal latency (0.44s) and 50 (48.07%) newborns had short latency (0.21s) respectively [Table/Fig-3]. We analysed the effect of different stages of HIE on latency interval of Moro response and it was found that newborns with HIE-I had normal (n-16) or short latency (n-38), whereas newborns with HIE-II had either absent (18), long latency (17), normal (3) or short latency (12) [Table/Fig-3]. On analysing the Moro response by two different methods i.e., Ordinal Scale and Conventional in terms of normal and abnormal responses, it was found that all newborns with HIE-I had normal response by conventional scale, whereas on ordinal scale out of 54 newborns, 16 had normal response and 38 newborns had short latency and the difference was statistically significant ($p<0.001$). It means though all newborns with HIE-I are able to complete the response, ordinal scale identified 38 newborns who have hyperactive response (short latency). Out of 50, 13 newborns with HIE-II had normal response by conventional, whereas on ordinal scale 3 newborns had normal response, 12 newborns had short latency and 17 newborns had long latency and the difference was statistically significant ($p<0.001$, [Table/Fig-4]). It means only 13 newborns with HIE-II were able to complete the response out of which 12 newborns had hyperactive response (short latency) and newborns who have incomplete responses, 17 had hypoactive response (long latency). Therefore, ordinal scale has significant ability to identify hypo-hyper active responses in Moro reflex. There is significant difference between latency interval of Moro response among survived and expired newborns with HIE-II ($p=0.009$) [Table/Fig-5]. We consider Moro response by conventional method as standard and analyse the ability of latency interval of Moro to screen the deviant Moro response in HIE-II and we found that short latency interval had sensitivity (5.4%), specificity (23%), positive predictive value (16.67%), and negative predictive value (7.89%). Long latency interval had sensitivity (45.95%), specificity (29.24%), positive predictive value (100%), and negative predictive value (13.4%) with accuracy of 50.8%.



[Table/Fig-1]: Study flow chart.
*Out of 54 newborns with HIE-I, 9 were examined in NICU and 45 were examined in Post natal ward #HIE-III newborns were excluded from the final analysis

Grade of HIE	Absent response	Initiation		Optimisation		Completion	
		No	Mean (sec)	No	Mean (sec)	No	Mean (sec)
I n=54	Nil	54	0.265	54	0.683	54	2.002
II n=50	18	32	0.623	19	1.275	13	3.094

[Table/Fig-2]: Moro response in asphyxiated newborns.

Ordinal scale score (n=104)	Number (%)	Mean (sec) with range	Grade I (n=54)	Grade II (n=50)	Conventional Moro response (HIE-II) (n=54)
Absent (Zero)	18 (17.30%)	Nil	Nil	18	Absent n=18
Long latency (One)	17 (16.34%)	0.720 (0.524 to 1.01)	0	17	Incomplete n=19
Normal (Two)	19 (18.26%)	0.44 (0.42 to 0.48)	16	03	Complete n=13
Short latency (Three)	50 (48.07%)	0.207 (0.045 to 0.408)	38	12	

[Table/Fig-3]: Moro response on ordinal scale and conventional.
*HIE-III excluded from the final analysis because newborns with HIE-III received 2 or more antiepileptic including phenobarbitone within 24 hours and they were examined at discharge

Hypoxic Ischaemic Encephalopathy (HIE)	Moro reflex				p-value*
	Ordinal scale		Conventional		
	Normal	Abnormal$	Normal	Abnormal#	
HIE-I (n=54)	16	38	54	0	χ=7.657<0.001
HIE-II (n=50)	3	47	13	37	χ=7.44<0.006

[Table/Fig-4]: Comparison of Moro response.
*Fisher's-exact probability test was use to compare the data
$Abnormal includes, absent response, short and long latency interval
#Abnormal includes, absent response and incomplete response

Latency interval of Moro response	Survived (n=38)#	Expired (n=12)	p-value*
	No	No	
Short latency n=12	11	1	p=0.009
Long latency n=17	15	2	
Absent response n=18	9	9	

[Table/Fig-5]: Comparison of latency interval in newborns with HIE-II who survived and expired.
*Chi-Square test for independence was use to calculate the p-value.
#3 newborns have normal latency.

DISCUSSION

In this present work, we assessed Moro's response by an ordinal scale and we found that out of 104 newborns, 18 had absent response, 17 long latency interval, 19 in normal range, and 50 were short latency interval. Among different grade of HIE, normal and short latency interval were seen in HIE-I, whereas absent, long, normal and short latencies interval were seen in HIE-II. Assessment of Moro reflex by ordinal scale would significantly differentiate variation in Moro responses in stage-I HIE ($p<0.001$), though newborn would have complete Moro response. This ability was also shown in stage-II HIE [Table/Fig-3]. Newborn state of consciousness would affect motor and reflex activity, and in present study we found that Moro reflex was influenced by different stages of HIE [10-12]. A study by Rundjan L et al., showed that reflex was influenced by asphyxia insult {3.96(1.32), $p<0.001$} [13]. A study by Sohn-M on assessment of primitive reflexes in high risk newborns conclude that reflex would be analysed by standardised assessment protocol in high risk infants and standardisation would be like absence, hypoactive, normal and hypoactive [3]. Author tries to explore the clinical importance of main observations of present study. First, short latency interval found in stage-I and II encephalopathy, could be subtle change in Moro response because all these newborns would able to complete the Moro reflex. Short latency interval could be transient phenomenon during the evolution of symptoms of HIE, therefore short latency warrants close observation till recovery or deterioration of neurological status of newborn. Persistent short latency interval after recovery may have clinical significance; this could be evident in further long term follow-up study. HIE-I newborns have complete Moro response and take less time to complete the response when compared with HIE-II newborns [Table/Fig-2]. It means response is hyperactive, and easily identified by short latency. Long latency was seen in newborns with HIE-II, however as none of these newborns were able to complete the Moro reflex, so the response was hypoactive. Long latency interval was not a transient phenomenon during evolution of symptoms of hypoxic encephalopathy, so we might use long latency as clinical sign of hypoxia. Long latency interval had 45% sensitivity with 50% accuracy to screen the deviant Moro response in HIE-II. Applicability of latency interval in clinical setting for day to day use is very simple; the time taken to pronounce the word "thousand and one" is approximately 0.4-0.5 sec. As soon as assessor says "thousand and one" simultaneously drop the head and see the response. Onset of response before and after the completion of word "thousand and one" shall be considered abnormal. Those newborns who had short latency need close monitoring and those who had long latency seek medical advice. The strengths of our study are sampling of all consecutive full term asphyxiated newborns admitted to NICU, exclusion of causes of neonatal encephalopathy other than hypoxia and assessment of Moro response on ordinal scale. This is the first attempt of assessment of Moro reflex by using ordinal scale and Moro response was assessed at the time of admission after initial stabilisation. Hence, we suggest Moro response in, newborns with HIE would be assessed by ordinal scale and those who have abnormal latency interval were closely followed during hospitalisation and if it persists at discharge, then were followed in high risk neonatal follow-up clinics.

LIMITATION

The limitation of our study was that we have not calculated the sample size and onetime assessment of Moro reflex, as newborns would have been in transition phase of HIE, lack of bed side EEG and no follow-up was done. Large sample size study with follow-up would be needed to reproduce the finding of current study.

CONCLUSION

Standardised assessment protocol of Moro reflex in newborns with HIE has better clinical yield, and long latency interval of Moro response could be valuable clinical sign of hypoxia.

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