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Original Research Article

A study on clinical correlation of EEG in neonates with perinatal asphyxia

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ABSTRACT

Background: Perinatal asphyxia is the most common and important cause of preventable cerebral injury occurring in the neonatal period. The WHO has estimated that 4 million babies die during the neonatal period every year. According to WHO, perinatal asphyxia is defined as the failure to initiate and sustain breathing at birth. The objective is to study the electroencephalographic changes and correlation between severity of Perinatal asphyxia with EEG changes.
Methods: It is prospective observational study, which includes 40 term neonates admitted in NICU with perinatal asphyxia in GMCH Aurangabad. EEG analysis focused on background activity and classified into four categories.
Results: The EEG was normal in 45%, mild abnormal in 25%, intermediate in 15%, and severely abnormal in 15%. Outcome at discharge was normal in 19(47.5%) and abnormal in 21(52.5%) including 1 death. Abnormal outcome was seen in 27% of newborns with normal EEG and 72% of abnormal EEG.
Conclusions: Severity of perinatal asphyxia correlated well with abnormality of EEG. EEG changes and severity showed good correlation with immediate outcome of newborn in terms of duration of hospitalization and normal neurological examination.

Keywords: EEG, Neonates, Outcome, Perinatal asphyxia

INTRODUCTION

Perinatal asphyxia is the most common and important cause of preventable cerebral injury occurring in the neonatal period. Perinatal asphyxia (PA) is an insult to the fetus or newborn due to a lack of oxygen(hypoxia) and/or a lack of perfusion (ischemia) to various organs.[1] The WHO has estimated that 4 million babies die during the neonatal period every year and 99% of these deaths occur in low-income and middle income countries. Three major causes account for over three quarters of these deaths, serious infection (28%) complication of preterm birth (26%) and Perinatal asphyxia (23%). These estimations imply that birth asphyxia is the cause of around one million neonatal deaths each year. One of the present challenges is the lack of a gold standard for accurately defining perinatal asphyxia. Because of same reason the incidence of Perinatal asphyxia is difficult to quantify.[2]

Damage to the brain tissue is a serious complication of low oxygen that can cause seizures and other

neurological problems.[3] It is better to use term perinatal asphyxia since asphyxia may occur in utero, at birth or in postnatal period.[4]

To initiate neuroprotective intervention, early and accurate identification of those at risk of developing hypoxic-ischemic injury (HIE) and subsequent poor neurodevelopment outcome is crucial. An accurate prediction of the prognosis of individual infants is important for clinicians and parents. In some cases, the prediction of an adverse outcome may lead to withdrawal of intensive care, in other cases the prediction of an adverse outcome will lead to early supportive care, such as physiotherapy and speech therapy.

EEG can detect subclinical seizures. Electroencephalographic (EEG) abnormalities can be used to aid outcome prediction for infants with HIE.[5]

Many characteristics of EEG recordings have been examined for their ability to predict outcomes, and several different grading systems exist. EEG abnormalities, particularly background abnormalities correlate more with the adverse neurodevelopment outcome. Most studies agree that mild abnormalities predict a normal neurologic outcome in 90%. studies of Neonatal EEG in term infants with perinatal asphyxia shown that background activity is an important prognostic indicator.[6,7]

METHODS

A hospital based prospective study was done in government medical college and hospital, Aurangabad from May 2009 to April 2012 for a period of 3 years. A total of 40 term neonates with perinatal asphyxia which were admitted in the NICU ward of the hospital were included in the study.

Inclusion criteria

- Term neonates with perinatal asphyxia admitted in NICU.

Exclusion criteria

- Preterm neonates
- Neonates with congenital anomalies
- CNS infections.

WHO definition of perinatal asphyxia like failure to initiate and sustain breathing at birth was considered for study.[6]

Details of obstetric history recorded, including parity, antenatal registration, antenatal complication. Postpartum details like, resuscitation details. APGAR score at 1min and 5min recorded. Perinatal asphyxia severity graded based on Apgar score at 1min.

EEG

EEG performed after cardio respiratory stabilization of neonates. Infant preparation. No sedation is used for procedure.

As cry activity, excessive movements interfere with recording and interpretation of EEG, the procedure was performed after half an hour of feeding so that baby will be sleeping.

EEG Of neonates recorded in medicine neurostation. RMS digital EEG machine is used.

Electrode placement

The international 10-20 system of electrode placement (Jasper, 1958) has been modified for recording neonates (Kellaway and Crawley,1964).[1] This is to accommodate the neonate's immature frontal lobes that do not extend as anteriorly relatively skull compared to older children and adult. typically nine scalp positions are used (F1, F2, C3.C4.Cz, T3, T4, O1, O2)In addition electrodes placed at A1 and A2 , ground electrode placed either at mid fore head or on a mastoid region and reference electrode in non cephalic region

After head measurements the scalp electrodes are placed using conductive gel and ball of cotton is applied to secure the electrodes. Each electrode site is labelled with a letter and a number. The letter refers to the area of brain underlying the electrode e.g. F-frontal lobe and T-temporal lobe. Even numbers denote the right side of the head and odd numbers the left side of the head.

EEG analysis focused on the background activity and was classified into four categories:

1. Normal:continuous activity with physiological EEG patterns for behavioral state
2. Mildly abnormal: isolated temporal spikes, mild asynergy
3. Intermediate: predominant or transient discontinuous activity;
4. Severely abnormal: inactive (background activity <5μV) or permanent discontinuous activity ("suppression-burst" or "permanent discontinuous activity plus theta activity").

Statistical analysis

Statistical analysis was performed using chi square test (χ^2) test. The results are considered significant if P value of <0.05.

RESULTS

A total of 40 term neonates with perinatal asphyxia were included and analyzed in the study.

In present study nearly 60% of the study subjects were delivered to primi parous women with nearly 90% of them were delivered by normal labor Majority of them were males (80%). Nearly 37.5% of them had meconium stained liquor with average gestational age of 38 weeks (Table 1).

Table 1: Clinical details of the study subjects.

		Frequency
Parity	Primi	24 (60%)
	Multi	16 (40%)
Mode of delivery	FTND	36 (90%)
	LSCS	4 (10%)
Gender	Male	32 (80%)
	Female	8 (20%)
Liquor amnion	Meconium stained liquor	15 (37.5%)
	Unstained liquor	25 (62.5%)
Average gestational age		38 weeks
Average birth weight		2.85kg

Risk for perinatal asphyxia was present in 50% of patients amongst which PIH present in 7.5%, PROM present in 5% and meconium stained liquor present in 37.5%. In present study 30% patients had mild PA ,65% moderate and 5%severe PA (Table 2).

Table 2: Clinical profile of perinatal asphyxia.

Clinical profile		Frequency	Percentage
Risk factors	No risk factors	20	50
	PIH	3	7.5
	PROM	2	5
	Meconium stained liquor	15	37.5
Severity of perinatal asphyxia	Mild PA	12	30
	Moderate PA	26	65
	Severe PA	2	5

EEG was normal in 45%, abnormal in remaining 55%. showed mild abnormality in 25%, intermediate abnormality in 15%, severe in 15% of patients. On an Average of 4.4 day after the delivery the EEG was recorded, and average duration of EEG was 40 minutes (Table 3).

Table 3: EEG Characteristics in perinatal asphyxia.

		Frequency
EEG changes	Normal	18 (45%)
	Mildly abnormal	10 (25%)
	Intermediate	6 (15%)
	Severe	6 (15%)
Average day on which EEG recorded		4.4 day
Average duration of EEG recorded		40 min

The association between the EEG and perinatal asphyxia was found to be statistically significant (Table 4).

Table 4: Association of EEG changes with perinatal asphyxia severity.

EEG changes	Asphyxia types			Total
	Mild	Moderate	Severe	
Normal	11	7	0	18
Mild	0	10	0	10
Intermediate	1	4	1	6
Severe	0	5	1	6
Total	12	26	2	40

Chi square=19.76 p=0.0031*

The association between the EEG changes and outcome was also found to be statistically significant. Outcome at discharge was normal in 19 (47.5%), abnormal in 21 (52.5%) which include death in one of the study subjects (Table 5).

Table 5: Association of EEG changes with outcome.

EEG changes	Outcome		
	Normal	Abnormal	Total
Normal	13	5	18
Mild	2	8	10
Intermediate	4	2	6
Severe	0	6	6
Total	19	21	40

Chi square=13.76 p=0.0032*

DISCUSSION

Perinatal asphyxia is an important cause of neonatal mortality and long term morbidity. various parameters are postulated as useful in early prediction of long term outcome. In present study the incidence of perinatal asphyxia in primipara is 60% as compared to multipara (40%), similar finding was described in the study done by Ong LC et al.[9] In present study mean maternal age is 23 years. Very young mother tends to be less educated and probably higher risk of prolonged or obstructed labor in younger mother is responsible for high incidence of perinatal asphyxia in primi.[10]

In present study sex ratio for male: female was 4:1. The High incidence of perinatal asphyxia was found among male in present study. Similar findings were also reported reported by the study done El-Auoty M et al and other studies.[11-13] In present study the average gestational age is 40 weeks which is similar to studies reported by El-Auoty M et al and various other studies.[11,12,14] In study reported Allemand F et al the average gestational age is 35 weeks the difference is because they also included preterm neonates in their study.[15] In present study the incidence of meconium stained liquor in perinatal asphyxia was 37.5% which is comparable to Leijser LM et al study where the incidence of meconium stained liquor is 34%.[12]

In present study authors could do EEG on average 4.4 day of life. In studies reported by El Auoty M et al the

EEG was performed in less than 72 hours.[11,13,14] The difference is because of unavailability of portable EEG machine; we could do EEG after cardiopulmonary stabilization of neonates. In studies reported by, El Auoty M et al the percentage of normal EEG is less when compared to present study findings which is due to difference in study inclusion criteria as in their study most of patients had severe perinatal asphyxia.[11,13,14]

In present study the classification of perinatal asphyxia is based on APGAR score. 30% mild,65% moderate and 5% had severe perinatal asphyxia. The clinical profile of perinatal asphyxia in the study done by Haidary MH et al 35(18.3%) were mild PA, 40 moderate (20.94%), and severe 116 (60%).[16] The recovery rate in mild asphyxia 100%.in moderate 32 (92%) and in severe cases 86 (74.13%). In present study outcome at discharge was normal in 45% and abnormal in 55% patients including a single death. In studies reported by Leijser LM et al the percentage of abnormal outcome is more, this is due to difference in time of follow up period for examination and inclusion criteria.[12] In present study authors could do follow up examination at discharge. The abnormal EEG predicted poor outcome at short term, neurological examination. similar finding was reported by El-Auoty M et al.[11]

CONCLUSION

Severity of perinatal asphyxia correlated well with abnormality of EEG. EEG changes and severity showed good correlation with immediate outcome of newborn in terms of duration of hospitalization and normal neurological examination.

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