

# Correlation of clinical variables with hypoxic ischemic encephalopathy stages

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## Abstract

**Background:** The fetus with significant hypoxia episode is at risk of developing HIE and it may result in neonatal death or permanent motor and mental disability. Various epidemiologic studies have identified adverse sociodemographic factors, maternal conditions, and antenatal complications in association with HIE. **Aim:** To correlate clinical variables with hypoxic ischemic encephalopathy stages. **Material and Methods:** The study was conducted on 150 asphyxiated babies admitted to NICU with Apgar score of 6 or less at 5 minutes of birth. Intrapartum signs of fetal distress, as indicated by non-reassuring non-stress test on continuous electronic fetal monitoring and by thick meconium stained amniotic fluid. HIE was classified into mild, moderate, or severe HIE, as defined by Sarnat and Sarnat staging. **Results:** The maternal history, gestational age and mode of delivery were found to be not significant and do not correlate with the severity of HIE. A non-reactive non-stress test (NST) and thick meconium staining of the liquor found to be statistically significant. **Conclusion:** Consideration of the clinical variables during diagnosis and treatment of cases with HIE can improve the objectivity of the assessment and monitoring of newborns and the early start of treatment.

**Key Words:** Hypoxic ischemic encephalopathy, Apgar score, meconium staining, Sarnat and Sarnat staging.

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## INTRODUCTION

Birth asphyxia is a common neonatal problem and contributes significantly to neonatal morbidity and mortality. In India, most of the deliveries occur at home and many asphyxiated babies are brought late to hospitals.<sup>1</sup> Failure to initiate and sustain breathing immediately after delivery has been associated with severe fetal hypoxia or ischemia which can manifest in newborn as encephalopathy, termed as Hypoxic Ischemic

Encephalopathy (HIE).<sup>2</sup> The fetus with significant hypoxia episode is at risk of developing HIE and it may result in neonatal death or permanent motor and mental disability. In India, 8.4% of inborn babies have a one-minute Apgar score less than 7 and 1.4% suffer from HIE.<sup>3</sup> Various epidemiologic studies have identified adverse sociodemographic factors, maternal conditions, and antenatal complications in association with HIE.<sup>4,5</sup> The present study was carried out to correlate clinical variables with hypoxic ischemic encephalopathy stages.

## MATERIAL AND METHODS

The study was conducted on 150 asphyxiated babies admitted to neonatal intensive care unit at Tertiary Teaching and General hospital.

### Inclusion Criteria

- Term Babies admitted to NICU with Apgar score of 6 or less at 5 minutes of birth.
- Intrapartum signs of fetal distress, as indicated by non-reassuring non-stress test on continuous

electronic fetal monitoring and by thick meconium stained amniotic fluid

- Requirement of > 1 min of positive pressure ventilation
- Mild, moderate, or severe HIE, as defined by Sarnat and Sarnat staging.<sup>6</sup>

**Exclusion Criteria**

- Babies with congenital malformations.
- Suspected metabolic disease on treatment with diuretics, suffering from anuria.
- Those born to mothers having hypertension, diabetes mellitus, toxemia of pregnancy, receiving general anaesthesia, pethidine, phenobarbitone and other drugs likely to cause depression in babies and mother.
- Febrile attack within 2 months before delivery.

The included cases were studied for demographic details, such as gestational age, birth weight, maternal history and mode of delivery. Gestational age was assessed from last menstrual period and New Ballard score. Arterial blood gas (ABG) analysis was done from the umbilical arterial blood. Blood samples were taken from all the patients in these three groups within 15 min following their admission, then at 48 h and at 72 h of admission to the NICU. Blood samples were analyzed for ABG, base deficit levels, complete blood count (CBC), renal parameters, liver parameters, etc. The patients were divided into three groups (Stage 1: Mild, Stage 2: Moderate, and Stage 3: Severe) according to the Sarnat and Sarnat staging system within 48-72 h following their admission to the NICU.

**Statistical Analysis:** Descriptive statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean±SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5% level of significance. Chi-square/ Fisher Exact test has

been used to find the significance of study parameters on categorical scale between two or more groups.

**RESULTS**

Among the 150 neonates in case group, 87 (58%) neonates were delivered normally, 24 (16%) were delivered by cesarean section and 39 (26%) had instrumental delivery. Out of the 150 neonates, 32 (23%) cases were IUGR, among them (3%) neonates weighed <2 kgs and 27 (18%) weighed between 2.0-2.5 kg. About 89 (59%) neonates weighed between 2.5-3.0 kg, 27 (18%) weighed between 3.0- 3.5 kg and 3 (2%) weighed > 3.5 kg. The mean weight was 2.733±0.346 kg. Out of these 150 cases, 61 (41%) had no seizures. 89 (59%) had seizures as an abnormal neurological examination finding.

**Table 1: Incidence of HIE stages among neonates studied (n=150)**

HIE stages	No. of patients	%
Stage I	62	41%
Stage II	62	41%
Stage III	26	18%
<b>Total</b>	<b>100</b>	<b>100%</b>

The primi mothers (61%) were having asphyxiated neonates compared to multipara (39%). All the 3 stages of HIE were more in primi mothers and it was found to be statistically not significant with a P>0.05. 88% were term neonates and remaining 12% were post term and the correlation whether gestational age affects HIE stage among the cases and it was found to be statistically not significant with a P value of >0.05. The correlation of mode of delivery affects HIE stages among the cases and it was found to be statistically insignificant with a P value of >0.05 and normal deliveries were more in all three HIE stages as normal deliveries were thought to be safest because of people’s illiteracy and socially backward in this part of the state

**Table 2: Correlation of clinical variables with HIE stages in cases studied**

Variables	Total No. of cases (n=150)	HIE stage			χ <sup>2</sup> - Value	P Value
		Stage I (n=62)	Stage II (n=62)	Stage III (n=26)		
<b>Maternal History</b>						
Primi	92 (61%)	42 (68%)	34 (55%)	16 (62%)	2.177	P>0.05 (NS)
Multi	58 (39%)	20 (32%)	28 (45%)	10 (38%)		
<b>Gestational age</b>						
Term	132 (88%)	56 (90%)	55 (89%)	21 (81%)	5.954	P>0.05 (NS)
Post term	18 (12%)	6 (10%)	07 (11%)	05 (19%)		
<b>Mode of delivery</b>						
Normal	87 (58%)	39 (63%)	36 (58%)	12 (46%)	2.443	P>0.05 (NS)
Instrumental	24 (16%)	08 (13%)	11 (18%)	05 (19%)		
LSCS	39 (26%)	15 (24%)	15 (24%)	09 (35%)		
<b>NST (Non stress test)</b>						
Reactive	24 (16%)	19 (31%)	05 (08%)	00 (0.0%)	22.122	P<0.001 (S)
Non-reactive	89 (59%)	34 (55%)	35 (56%)	20 (77%)		

Not done	37 (27%)	09 (14%)	22 (36%)	06 (23%)		
<b>TMSAF (Thick meconium stained amniotic fluid)</b>						
No staining	57 (38%)	27 (44%)	20 (32%)	10 (38%)	1.524	P<0.05 (S)
Meconium stained	93 (62%)	35 (56%)	42 (68%)	16 (62%)		
<b>Outcome</b>						
Discharge	131(87%)	62 (100%)	62 (100%)	07(27%)		
DAMA	07 (05%)	0 (0%)	00 (0%)	07(27%)	103.76	P<0.001 (S)
Death	12 (08%)	0 (0%)	00 (0%)	12(46%)		

The correlation of non-stress test (NST) whether reactive or non-reactive which is an indicator of fetal distress affects HIE stages among the cases and it was found to be statistically significant with a P value of <0.001 with 59% showing non-reactive NST. Meconium staining was more in all the three HIE stages and statistically significant with a P value of <0.05. The correlation of outcome with HIE stages among the cases and it was found that 8% death and all were with HIE stage 3 and was statistically significant with a P value of < 0.001.

## DISCUSSION

Birth asphyxia is a common neonatal problem and contributes significantly to neonatal morbidity and mortality. Perinatal asphyxia is a devastating clinical condition because of its potential for causing permanent damage, even death of the fetus or newborn infant. In the absence of perinatal records, it is difficult to retrospectively diagnose perinatal asphyxia. In present study, maternal history, gestational age and mode of delivery were found to be not significant and do not correlate with the severity of HIE. A non-reactive non-stress test (NST) and thick meconium staining of the liquor found to be statistically significant. Milsom *et al*, in a population-based case-control study of 227 term infants who had low Apgar scores not attributable to maternal anesthesia, congenital malformations, or chromosomal disorders, identified only 1 antepartum factor (marital status), but 6 intrapartum factors independently associated with low Apgar scores. In the subset of 75 infants who subsequently developed encephalopathy, the presence of meconium, and a caesarean delivery were related to HIE.<sup>7</sup> A number of investigators have associated low Apgar scores with meconium stained amniotic fluids.<sup>8,9</sup> In these studies, the incidence of low 1 and 5 minute Apgar score was approximately two times greater when meconium was present. Ash AK have suggested that meconium stained

amniotic fluids might signify underlying acute or chronic fetal hypoxia with adverse perinatal outcome.<sup>10</sup> To conclude, consideration of the clinical variables during diagnosis and treatment of cases with HIE can improve the objectivity of the assessment and monitoring of newborns and the early start of treatment.

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