

CLINICAL STUDY OF ETIOLOGICAL FACTORS AND ITS OUTCOME IN BIRTH ASPHYXIA

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ABSTRACT: A prospective and descriptive clinical study was done to study etiological factors of birth asphyxia and its outcome. Total 150 newborn babies were included in this study and 1190 normal babies were taken as control to study etiological factors for birth asphyxia. Data analysis was done by Z test, chi square test, univariate and multivariate logistic regression analysis of risk factors. In this study statistically significant association between severity of perinatal asphyxia and severity of HIE was seen. In this study, significant proportion of neonates develop HIE following asphyxia insult. The identification of HIE following perinatal hypoxic insult is important because of the predictive significance for future motor and cognitive deficits.

KEYWORDS: Birth asphyxia, HIE, predictive significance.

INTRODUCTION: Perinatal asphyxia, neonatal asphyxia or birth asphyxia is a medical condition resulting from deprivation of oxygen to a newborn infant that lasts long enough during the process to cause physical harm, usually to the brain. Hypoxic damage can occur to most of the infants organs (Heart, lungs, liver, gut, kidney), but brain damage is of most concern and perhaps the least likely to completely heal.⁽¹⁾

Birth asphyxia is one of the major causes of early neonatal mortality in India. Among the institutional births, incidence is 5% and accounts for 24.3% of neonatal deaths.⁽²⁾ The greatest risk of adverse outcome is seen in newborn infants with fetal acidosis (pH <5), a five minute apgar score of 0-3, hypoxic ischemic encephalopathy (HIE) or multi organ malfunctions.⁽³⁾ Sarnat and Sarnat described their HIE grading in 21 infants in 1976⁽⁴⁾ in a study relating electroencephalographic findings to the clinical conditions of infants. Later on this classification was modified by Levene based on clinical observation. HIE was classified as mild HIE (Stage I) in which the infant was hyper alert with normal muscle tone, reflexes were normal and seizures were absent. Moderate HIE (Grade II) presented with an infant being lethargic, decreased muscle tone, weak or absent reflexes and seizures were present. In severe HIE (Grade III) the level of consciousness was very much depressed (Stuporose) with flaccid muscle tone, absent reflexes and seizures were either too frequent or difficult to control.

The common worry of health professional and parents is the permanent brain damage that birth asphyxia can cause and the common aim is to reduce the number of newborns affected. Improving women's' health and health care will reduce the risk factors and decrease the number of newborns needing resuscitation.

Nevertheless, there is one single intervention for dealing with asphyxia when it occurs – Resuscitation. Therefore, every birth attendant must be both skilled and equipped to resuscitate newborns that don't start breathing spontaneously.

So, appropriate and effective resuscitation at birth is a cornerstone of optimal neonatal care. The new guidelines provide for a uniform, systematic and action oriented approach to the neonatal resuscitation. With the introduction of newer guidelines the clinical profit and course of birth asphyxia

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is expected to change. So, we proposed to do present study to identify maternal and fetal risk factors of birth asphyxia and to study the methods of resuscitation of infants with birth asphyxia.

MATERIALS AND METHODS: SOURCE OF DATA–150 newborn babies including those born in MGM Medical College & LSK Hospital, Kishanganj and out-born babies referred within 1hour after delivery to MGM Medical College and LSK Hospital. 1190 normal babies (Control) were also included in the study to find out etiological factors of HIE.

Study Design: Prospective and descriptive clinical study.

STATISTICAL METHODS: The data were analyzed by standard statistical test, namely Z Test, chi square test and univariate and multivariate logistic regression analysis of risk factors. Chi square test and 2 * 2, 2 * 3 and 3 * 3 Fisher Exact test has been used to find the significant association of HIE staging (Modified Sarnat and Sarnat classification by Levene) and outcome and other study characteristics. Similarly, similar tests have been used to find the significant association of Neonatal and Perinatal factors with the presence of HIE and outcome of HIE. Analysis of variance/Kruskal Wallis test has been used to find the significance of Apgar score with HIE stages.

- Significant figures.
- Suggestive significance $0.05 < p < 0.10$.
- Moderately significant $0.01 < p < 0.05$.
- Strongly significant $p < 0.01$.

RESULTS AND ANALYSIS: Table 1 and 2 shows that mother with complications like eclampsia, antepartum hemorrhage, PROM, cord accidents, failed progress of labour, obstructed labour and prolonged 2nd stage of labour were more likely to deliver asphyxiated baby.

Of the various fetal risk factors, those found to be significantly associated with birth asphyxia were preterm delivery, low birth weight, intrauterine growth retardation and twin pregnancy.

Of the 150 asphyxiated newborns 31% required bag & mask resuscitation and only 3% required bag & mask, bag tube and chest compressions.

Of the 96 newborns who developed HIE, 54 had stage I encephalopathy, 29 had stage II and 13 had stage III encephalopathy. Of the 96 HIE newborns, 75 were normal, 11 of them had persisting neurological abnormality and 10 of them died.

Among HIE stage I, all the babies i. e. 54(100%) were normal, in HIE stage II 21(72.41%) were normal. 6(20.68%) of them had persisting neurological abnormality and 2(6.89%) newborns died. In stage III 5(38.46%) had persisting neurological abnormality and 8(61.53%) newborns died.

Out of the 150 asphyxiated newborns, CNS was the most frequently involved organ accounting for 64%, followed by kidney accounting for 46.66%.

DISCUSSION: Exact incidence of birth asphyxia is not known, as there is no consensus on the definition of the birth asphyxia. The incidence rate of birth asphyxia in total births, which included all live births and late fetal deaths of malformed fetuses was also calculated. This gave an incidence rate of 14.6% amongst total births. Chandra et al (1997)⁽⁵⁾ found an asphyxia rate of 3.63% in total births. The lower asphyxia rate in their study could be due to the fact that these authors employed more stringent criteria (Fetal distress + ventilation >1min, Apgar score < 7, altered sensorium and tone) to define asphyxia.

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The most important pregnancy related complications which significantly increase the risk of birth asphyxia were eclampsia (Relative risk RR=6.6), APH (RR=30), preeclampsia (RR=2.5), oligohydramnios (RR=3.2) as significant risk factors for birth asphyxia. Other studies have also documented eclampsia as a risk factor for birth asphyxia (Batra et al, 1998 ; Chaturvedi & Shah, 1989).^(6,7)

In the present study the important intrapartum risk factors which increased the risk of birth asphyxia include obstructed labour (RR=6.4), prolonged 2nd stage of labour (RR=6.0), cord accidents (RR=4.2), precipitate labour (RR=3). Chandra et al (1997) reported prolonged 2nd stage of labour (RR=9.2), abruption placenta (RR=4.9), cord prolapse (RR=3.1) and breech vaginal delivery (RR=6.3) as significant intrapartum risk factors.

The data of present study indicate that the risk of birth asphyxia increases significantly in maternal illnesses such as severe anemia (RR=4.8), Hepatitis (RR=4.1). Batra et al (1988)⁽⁶⁾ found severe anemia as a cause of birth asphyxia in 5.5% of cases. Lack of antenatal care (RR=1.9) and rural residence (RR=1.9) were found to be significantly associated with birth asphyxia. This is consistent with earlier observation (Kumari et al, 1993).⁽⁸⁾ In the present study birth asphyxia was significantly associated with prematurity (RR=2.5), post maturity (RR=3.0) and multiple gestation (RR=2.0). Chandra et al (1997)⁽⁵⁾ found multiple births (RR=2.4), IUGR (RR=2.5) and low birth weight (RR=2.5) as significant risk factors for asphyxia. We could not determine the cause of birth asphyxia in 4.93% of cases. Chaturvedi and Shah (1989)⁽⁷⁾ were not able to find causes of asphyxia in 9.9% of cases.

In the present study we found that bag and mask ventilation was successful in 47(31%) out of 150 asphyxiated infants. PPV with bag tube was successful in 56(38%) infants. Drugs were needed in 9 infants and chest compression in 17 babies. Daga et al (1990)⁽⁹⁾ reported that among 56 infants with birth asphyxia, 33(58.9%) could be resuscitated with bag and mask. 17 infants needed endotracheal intubation and PPV (Positive pressure ventilation).

In present study the proportion of HIE neonates in different stages was HIE stage I (56.25%), stage II (30.20%) and stage III (13.54%). Martin Ancel et al⁽¹⁰⁾ reported proportion of neonates in stage I as 57.7%, stage II 28.8% and stage III as 13.5%.

In present study outcome of HIE neonates were: out of 96 HIE neonates 75(78.12%) were normal, 11(11.45 %) of them had persisting neurological abnormality and 10(10.41%) newborns died. Peliowski and Finer⁽¹¹⁾ reported overall risk of death in HIE neonates was 12.5% and 14.3% for neurological sequelae.

In the present study, involvement of other organs was studied. Renal involvement occurred in 70(46.66%) of total asphyxiated neonates. Pulmonary involvement occurred in 33(22%), cardiac in 35(23.3%) and GIT in 38(25.33%). Martin Ancel et al reported renal involvement in 42%, pulmonary involvement in 26%, cardiac and GIT both 29%.

CONCLUSION: Multiple logistic regression analysis of risk factors revealed that only certain risk factors had strong independent association with birth asphyxia. This included eclampsia, cord accidents, obstructed labour, prolonged 2nd stage of labour, cesarean operation, assisted breech delivery, thick meconium stained amniotic fluid, preterm delivery, low birth weight and rural residence of mother. The result in the present study indicate that perinatal asphyxia is frequently followed by dysfunction of one or more organs during neonatal period.

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Table 1:Incidence of birth asphyxia in relation to antepartum and intrapartum factors.

RISK FACTORS ANTEPARTUM FACTORS	ASPHYXIA (n=150) NO.	PERCENTAGE	CONTROLS (n=1190) NO.	PERCENTAGE
Eclampsia	21	14	11	0.92
Pre eclamptic toxemia	10	6.66	26	2.18
Antepartum hemorrhage	13	8.66	27	2.26
Cephalopelvic Disproportion	1	0.66	3	0.25
Oligo hydramnios	21	14	11	0.92

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RISK FACTORS INTRAPARTUM FACTORS	ASPHYXIA (n= 150)		CONTROLS (n = 1190)	
	No.	%	No.	%
OBSTRUCTED LABOUR	5	3.33	2	0.16
PROLONGED 2 nd STAGE OF LABOUR	2	1.33	1	0.08
CORD ACCIDENTS	8	5.33	10	0.84
CHORIOAMNIONITIS	2	1.33	3	0.25
PRECIPITATE LABOUR	1	0.66	2	0.16
MULTIPLE GESTATION	5	3.33	19	1.59
PREMATURE RUPTURE OF MEMBRANE	10	6.66	47	3.94
FAILED PROGRESS OF LABOUR	7	4.66	42	3.52

Table 2: Analysis of maternal risk factors for birth asphyxia.

Risk factors	Asphyxia n=150		Controls n=1190		RR (95%CI)	Z TEST
	No.	%	No.	%		
<u>Eclampsia</u>	21	14	11	0.92	6.6	5.3 p < 0.001
<u>Pre-eclamptic toxemia</u>	10	6.66	26	2.18	2.5	1.3
<u>Cephalopelvic Disproportion</u>	3	2	62	5.21	0.3	2.9 p < 0.01
<u>Oligo hydramnios</u>	1	0.66	3	0.25	3.0	3.1 p < 0.01

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INTRAPARTUM FACTORS	ASPHYXIA No. %	CONTROLS No. %	RR (95%CI)	Z TEST
OBSTRUCTED LABOUR	5 3.33	2 0.16	6.4	2.5 p <0.05
PROLONGED 2 nd STAGE LABR	1 0.66	1 0.08	6.0	1.3
CORD ACCIDENTS	8 5.33	10 0.84	4.2	2.9 p < 0.01
ANTEPARTUM HEMORRHAGE	13 8.66	27 2.26	3.0	3.1 p < 0.01
CHORIO AMNIONITIS	1 0.66	3 0.25	3.0	1.0
PRECIPITATE LABOUR	1 0.66	2 0.12	3.0	0.7
MULTIPLE GESTATION	5 3.33	19 1.60	2.0	1.4
PROM	10 6.66	47 3.97	1.6	1.6
FAILED PROGRESS OF LABOUR	7 4.66	42 3.52	1.2	0.9

PRESENTATION	ASPHYXIA (n = 150)		CONTROLS (n = 1190)		RR(95%CI)	Z Test
	No.	%	No.	%		
VERTEX	126	84	1138	95.63	0.3	X2 = 36.89
BREECH	19	12.66	46	3.86	2.8	p < 0.001
OTHERS	5	3.33	6	0.50	3.9	
FETAL DISTRESS	34	22.66	97	8.15	2.7	Z = 4.8 p <0.001

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NATURE OF DELIVERY	ASPHYXIA (n = 150)		CONTROLS (n = 1190)		RR (95%CI)	Z TEST
	No.	%	No.	%		
SPONTANEOUS VAGINAL	44	29.33	724	60.84	0.3	X ² = 75.43 p < 0.01
CESAREAN SECTION	92	61.33	427	35.88	3.0	
OUTLET FORCEPS	8	5.33	34	2.85	1.6	
ASSISTED BREECH	6	4	5	0.42	4.9	

RISK FACTORS	ASPHYXIA (n = 150)		CONTROLS (n= 1190)		RR (95% CI)	Z TEST
	No.	%	No.	%		
THICK MECONIUM STAINED	4	2.66	65	5.46	0.5	X ² =14.1 p < 0.001
THIN MECONIUM STAINED	49	32.66	98	8.23	3.9	
SEVERE ANEMIA Hb< 5 g/dl	5	3.35	5	0.42	4.8	Z = 2.2 p < 0.05
DIABETES	0	0	2	0.08	--	
HEPATITIS	4	2.66	5	0.42	4.1	Z = 1.9

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RISK FACTORS	ASPHYXIA (n = 150)		CONTROLS (n = 1190)		RR (95% CI)	Z TEST
	No.	%	No.	%		
ANTENATAL CARE BOOKED	87	58	471	39.56	0.5	19.43
UNBOOKED	63	42	719	60.42	1.9	p < 0.01
RESIDENCE RURAL	87	58	471	39.57	1.9	19.43 p < 0.001
URBAN	63	42	719	60.42	0.5	
MISCELLANEOUS	7	4.66	11	0.92	3.5	2.4 p < 0.05
UNKNOWN	7	4.66	--	--	--	

Table 3:Analysis of fetal risk factors for asphyxia.

RISK FACTORS	ASPHYXIA (n=150)		CONTROLS (n = 1190)		RR (95%CI)	
	No.	%	No.	%		
SEX MALE	81	54	629	52.85	0.9	X2 = 0.21
FEMALE	69	46	561	47.14	0.9	
GESTATION PRETERM	48	32	167	14.03	2.5	X2 = 31.76
TERM	97	64.66	986	82.85	0.4	p < 0.001
POST TERM	5	3.33	37	3.10	1.1	

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RISK FACTORS	ASPHYXIA (n = 150)		CONTROLS (n = 1190)		RR (95% CI)	
	No.	%	No.	%		
BIRTH WEIGHT < 2500gm	89	59.33	355	29.83	3.0	X2 = 53.26 p < 0.001
>/2500gm	61	40.66	835	70.16	0.3	
INTRAUTERINE GROWTH AGA	125	83.33	1047	87.98	0.7	X2 = 7.53 p < 0.01
IUGR	18	12	75	6.30	1.9	
LGA	7	4.66	68	5.71	0.8	
MULTIPLE GESTATION TWIN	5	3.33	20	1.68	2.0	Z = 1.5

Table 4: Types of Resuscitation in infants with birth asphyxia (n =150).

TYPES OF RESUSCITATION	NUMBER OF INFANTS	
	No.	%
BAG AND MASK (BM)	47	31
THROAT SUCTION AND PLANTAR STIMULATION	38	25
BM + BT (BAG TUBE)	39	26
BT + CC	4	3
BM + CC + BT	4	3
CC + BT + DRUGS (adrenaline, NaHCO ₃ etc.)	9	6
BM + FREE FLOW OXYGEN	9	6

Fig 1: Pie diagram showing proportion of asphyxiated newborns with HIE.

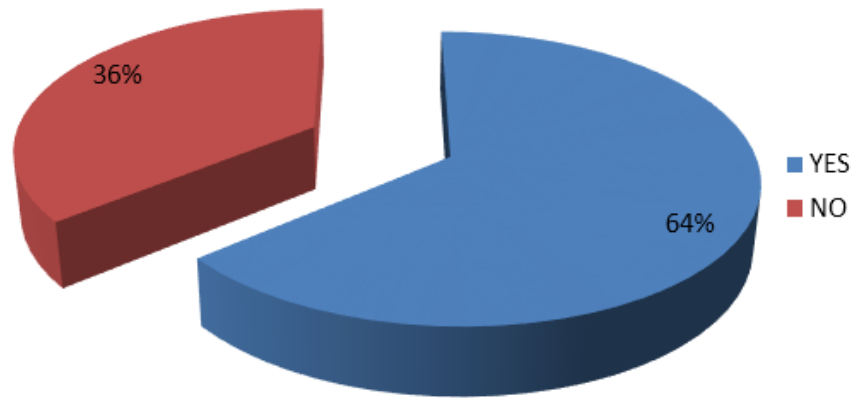


Table 5: Distribution of HIE newborns according to Sarnat & Sarnat clinical staging of HIE.

HIE STAGING	NUMBER (n = 96)	PERCENTAGE
STAGE I	54	56.25
STAGE II	29	30.20
STAGE III	13	13.54

Table 7: Outcome in HIE stages.

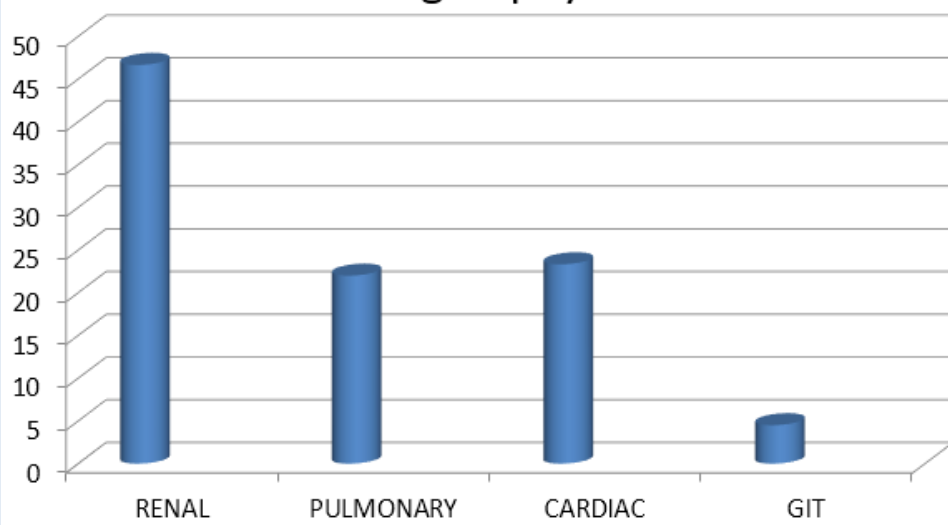
HIE STAGING	OUTCOME			TOTAL
	NORMAL	PERSISTING NEUROLOGICAL ABNORMALITY	DEATH	
STAGE I	54	---	---	54
STAGE II	21	6	2	29
STAGE III	---	5	8	13
TOTAL	75	11	10	96

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Table 8: Frequency of organ involvement among the asphyxiated newborns.

ORGAN INVOLVEMENT	NUMBER	PERCENTAGE
RENAL	70	46.66
PULMONARY	33	22
CARDIAC	35	23.33
GASTROINTESTINAL TRACT (GIT)	38	25.33

Fig 2 :Bar diagram showing frequency of organ involvement among asphyxiated newborns.



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