Scholars Journal of Applied Medical Sciences
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: https://saspublisher.com/sjams/

OPEN ACCESS

Medical Science

Incidence and Risk Factors for Severe HIE in A Semi- Urban Referral Hospital in India

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| **Received:** 12.04.2019 | **Accepted:** 22.04.2019 | **Published:** 30.04.2019
DOI: 10.21276/sjams.2019.7.4.59

Abstract **Original Research Article**

Objectives: To find the incidence and maternal and neonatal risk factors associated with severity of hypoxic ischemic encephalopathy (HIE) in a referral hospital located in semi urbarn area of East India. ***Methods:*** We conducted an observational study of HIE in Burdwan Medical College Hospital, over a one-year-period, from April 2013 to March 2014. All the inborn term babies without major congenital anomaly that developed HIE were included in the study. A total of 40 cases were included in the study taken serially. Babies were categorised in three groups according to the Sarnat and Sarnat staging of HIE. Data was collected for possible risk factors. The incidence of risk factors in the 3 groups was analyzed and compared statistically. ***Results:*** The total number of live births in the study year was 21142. Out of this 361 newborns suffered from HIE. About 16.67% of these newborns expired during the study period. An overall incidence of hypoxic ischaemic encephalopathy (HIE) in Burdwan medical college and hospital was found to be 17.1 per 1000 live birth in the year of study. Among the various maternal factors studied amongst the selected 40 babies included in the study, low socioeconomic status according to Kuppuswamy scale seemed to influence the severity of HIE (P=0.033). Similarly antenatal monitoring of foetus by Ultrasonography was also inversely related to severity of HIE (p=0.031). ***Conclusion:*** The incidence of HIE and birth asphyxia reported in different studies varies widely. The incidence in our hospital is slightly higher than reported in many studies from developing countries. The important associated risk factors includes being in a low socioeconomic family, and lack of antenatal care specially antenatal ultrasound monitoring. Improvement in antenatal care and socioeconomic status can decrease the incidence of HIE.

Keywords: Incidence, severe HIE, urbarn, risk factors.

INTRODUCTION

The World Health Organisation (WHO) estimates that globally, between four and nine million newborns suffer birth asphyxia each year. Of those, an estimated 1.2 million die and almost the same number develop severe consequences. The WHO also estimates that globally, 29% of neonatal deaths are caused by birth asphyxia [1, 2]. In the developing world, the reported incidence of perinatal asphyxia and HIE is high, and it continues to be a major cause for neonatal morbidity and mortality [3].

Ellis and Manandhar[4], based on a literature search of published studies from 20 developing countries in the previous 15 years, estimate that 24 to 61% of perinatal mortality was attributable to asphyxia. The cause-specific perinatal mortality rate associated asphyxia was generally between 10 and 20 per 1000 births.

Indian data, in NNPD report[5], among disorders of the central nervous system, Hypoxic ischemic encephalopathy accounted for 1.4%; seizures 1.0% and Intra-ventricular haemorrhage 0.3 %. Perinatal hypoxic ischemic cerebral injury is an extremely important medico-legal problem as well in the current era [6].

But the question remains why baby suffers from HIE. Are there any risk factors that put some babies in a disadvantage position and as a result they suffer. This prompted us to look for various factors in a semi - rural set up, that might lead to increased incidence of HIE.

MATERIALS AND METHODS

This observational study was carried out to find out the relationship between the degrees of birth

asphyxia (HIE) and various maternal and feral factors involved. This was a hospital based study with a cross-sectional design among newborns suffering from birth asphyxia (HIE) and admitted in Department of Paediatrics of Burdwan medical college and hospital, which is the main referral centre for the city of Bardhaman and surrounding rural belt. The study was conducted from April 2013 to March 2014.

Study population: All Intramural newborns suffering from birth asphyxia and admitted in Department of Pediatrics of Burdwan medical college and hospital were taken serially. A total of 40 newborns suffering from birth asphyxia subsequently developing hypoxic-ischaemic encephalopathy were analysed after considering inclusion and exclusion criteria.

INCLUSION CRITERIA

- Newborns suffering from birth asphyxia and subsequently developing hypoxic ischaemic encephalopathy.
- Gestational age 37 weeks and above
- Birth weight > 2 kg

EXCLUSION CRITERIA

- Newborns with sepsis, major congenital malformations, haemolytic disease, birth trauma.
- Newborns born to mother having major disease like malaria, diabetes mellitus, severe anaemia.
- Maternal intake of any drugs causing, sedation in newborn

Data were collected after ethical committee approval, with direct interview with the parents, and also records obtained from the maternal and neonatal case notes. All babies were subjected to Sarnat and Sarnat[7] staging for the categorisation of degree of HIE. Newborns were provided with medical care according to standard protocol and followed till discharge or death. A single observer, following the standard procedure, recorded all the measurements.

Data thus obtained were analysed with SPSS software version 20, with the help of medical statistician. To calculate the means and SD of all indices in respective stage of HIE were obtained by Microsoft Office Excel 2007 software and then put into formula. Comparison between three quantitative variables were done by one way ANOVA test and two variables by t test. Qualitative data was analysed by Chi square test. Socioeconomic status was determined by the Kuppuswamy scale.

RESULTS AND ANALYSIS

Age and anthropometric parameters of mothers

Most of the mothers had age between 20 to 25 years with mean age around 21 years. The trend was not significantly different among 3 stages of HIE (P=0.997). Most of the mothers were having BMI in normal range in all three groups (83.33%, 81.25% and 77.5% respectively). This study also excludes relation between body weight and height of mother as predisposing factor for severity of HIE. (P=0.095 and P=0.920 respectively).

Antenatal factors

The antenatal clinic visits ranged from 0 to 5 in different groups. Antenatal monitoring of foetus by Ultrasonography was also significantly inversely related to severity of HIE (p=0.031).

The study showed that the mean±SD level of maternal haemoglobin in the three groups were 9.16±1.48, 8.71±1.28 and 9.43±1.96 gm% respectively with p value of 0.526. Maternal intake of iron and folic acid was also not associated with severity of HIE (p<0.668).

Intrapartum factors

Factors related to labour and delivery, like mode of delivery (P=0.085), meconium staining of liquor (P=0.915), and also whether mother was referred from peripheral centre to our institute due to complications related to pregnancy (P=0.801) were not associated with any increased risk with the severity of HIE.

Past obstetric history

History of birth asphyxia was present in previous pregnancy in about 44.44% of cases in HIE stage I group and in about 0% in HIE-III group. The history birth asphyxia was present in about 23.85% of cases overall. The relation was found to be statistically insignificant (p=0.181) among groups.

Socio economic and other factors

Socioeconomic status according to Kuppuswamy scale seemed to influence the severity of HIE (P=0.033), although in all groups the most of study population (62.5%) belonged to lower socioeconomic class. We looked at all the details of socioeconomic details like religion, occupation and residence and did not find any risk associated with severity of HIE.

Factors related to Newborns

Three groups were comparable in terms of the Gestation, Birth weight, Gender distribution and Apgar at 5 mins. Amongst all the babies included in the study 2 babies in HIE 2 groups (16.6 %) and 6 in the HIE 3 group (37.5 %), unfortunately died.

Table-1: Maternal Demographic variables

Variable		HIE 1	HIE 2	HIE 3	Total	P-Value
Religion	Hindu	4(33.33)	10(83.33)	11(68.75)	25(6.25)	
	Muslim	5(41.67)	2(16.67)	4(25)	11(27.5)	
	Christian	3(25)	0(0)	1(6.25)	4(10)	
	Other					
		12(30)	12(30)	16(40)	40(100)	P- 0.087
Occupation	Housewife	8(66.67)	9(75)	9(56.25)	26(65)	
	Daily wage labour	4(33.33)	3(25)	5(31.25)	12(30)	
	Teacher	0(0)	0(0)	2(12.5)	2(5)	
		12(30)	12(30)	16(40)	40(100)	P - 0.473
Residence	Rural	8(66.67)	7(58.33)	12(75)	27(67.5)	
	Urban	4(33.33)	5(41.67)	4(25)	13(32.5)	
		12(30)	12(30)	16(40)	40(100)	P - 0.646
Socioeconomic status	Lowe middle	0(0)	4(33.33)	3(18.75)	7(17.5)	
	Upper Lower	2(16.67)	0(0)	6(37.5)	8(20)	
	Lower	10(83.33)	8(66.67)	7(43.75)	25(62.0)	
		12(30)	12(30)	16(40)	40(100)	P - 0.033
BMI	<18.5	2(16.67)	4(33.33)	3(18.75)	9(22.5)	
	18.5 -24.9	10(83.33)	8(66.67)	13(81.25)	31(77.5)	
		12(30)	12(30)	16(40)	40(100)	P- 0.577
Age	17-19	4(33.33)	4(33.33)	6(37.5)	14(35)	
	19-22	4(33.33)	4(33.33)	5(31.25)	13(32.5)	
	22-25	3(25)	3(25)	3(18.75)	9(22.5)	
	>25	1(8.4)	1(8.34)	2(12.5)	4(10)	
		12(30)	12(30)	16(40)	40(100)	P -0.997

Table-2: Antepartum Maternal Variables

Variables		HIE1	HIE2	HIE3	Total	P Value
No. Of Antenatal visit	0	2(16.67)	4(33.33)	1(6.25)	7(17.5)	
	1	5(41.67)	4(33.33)	8(50)	17(42.5)	
	>2	5(41.67)	4(33.33)	7(43.75)	16(40)	
		12(30)	12(30)	16(40)	40(100)	P-0.283
No of Antenatal USG	0	2(16.67)	5 (41.67)	11(68.75)	18 (45)	
	1	4(33.33)	7(58.33)	5 (31.25)	16(40)	
	2 or more	6 (50)	0(0)	0(0)	6 (15)	
		12(30)	12(30)	16(40)	40(100)	P-0.031
Hb	>11	2(16.67)	2(16.67)	3(18.75)	7(17.5)	
	10-10.9	0(0)	1(8.34)	3(18.75)	4(10)	
	7-9.9	10(87.33)	9(75)	10(62.5)	29(72.5)	
		12(30)	12(30)	16(40)	40(100)	
Mother referred	Yes	8(66.67)	8(66.67)	9(56.25)	25(62.5)	
	No	4(33.33)	4(33.33)	7(43.75)	15(43.75)	
		12(30)	12(30)	16(40)	40(100)	P - 0.801
Past Obstetric History	Gravida 1	3(25)	7(58.33)	11(68.75)	21(52.5)	
	Gravida 2	5(41.67)	4(33.33)	3(18.71)	12(30)	
	Gravida 3	4(33.33)	1(8.34)	2(12.5)	7(17.5)	
		12(30)	12(30)	16(40)	40(100)	P- 0.171
HIE in Previous Pregnancy	Present	4(44.4)	1(20)	0(0)	5(23.8)	
	Absent	5(55.56)	4(80)	7(100)	16(76.19)	
		9(42.80)	5(23.81)	7(33.33)	21(100)	P- 0.181

Table-3: Intrapartum maternal variables

Variables		HIE 1	HIE 2	HIE 3	Total	P-Value
APH	Present	4(33.33)	2(16.67)	2(12.5)	8(20)	
	Absent	8(66.67)	10(83.33)	14(87.5)	32(80)	
		12(30)	12(30)	16(40)	40(100)	
Meconium stained liquor	Yes	4(33.33)	5(41.67)	6(37.5)	15(37.5)	
	No	8(66.67)	7(58.33)	10(62.5)	28(62.5)	
		12(30)	12(30)	16(40)	40(100)	P-0.915
Mode of Delivery	Normal	8(66.67)	5(41.67)	4(25)	17(42.5)	
	Instrumental	0(0)	2(16.67)	0(6)	2(5)	
	Breech	0(0)	1(8.35)	3(18.75)	4(10)	
	LUCS	4(33.33)	4(33.33)	9(56.25)	17(42.5)	
		12(30)	12(30)	16(40)	40(100)	P-0.085

Table-4: Baby Variables

Variables		HIE 1	HIE 2	HIE 3	Total	P -Value
Gestation		39 ±1.4	38.5 ±1.3	38.3 ± 1		P - 0.345
Birth weight		2.38 ± 0.34	2.75±0.29	2.85±0.48		P 0.786
Sex	M	4(33.33)	7(58.33)	9(56.25)	20 (50)	
	F	8(66.67)	5(41.67)	7 (43.8)	20 (50)	
		12(30)	12(30)	16(40)	40(100)	P - 0.38
Fate	Survived	12 (100)	10(83.33)	10(62.5)	32(80)	
	Expired	0(0)	2(16.67)	6(37.5)	8(20)	
	Total	12(30)	12(30)	16(40)	40(100)	P - 0.08
APGAR at 5 min	0	1 (8.4)	1(8.35)	2(12.5)	4(10)	
	1	2 (8.4)	4(33.33)	10(62.5)	16 (40)	
	2	4(33.33)	6 (50)	3(18.75)	13 (32.5)	
	3	5 (41.7)	1 (8.4)	1 (6.25)	7 (17.5)	
	Total	12(30)	12(30)	16(40)	40(100)	P 0.068

DISCUSSION

Despite the advancement in the antenatal monitoring and better infrastructure facility to facilitate safer delivery, the incidence of Hypoxaemic ischaemic encephalopathy continues to be high especially in the developing countries. Incidence of hypoxic ischaemic encephalopathy (HIE) in Burdwan medical college and hospital was found to be 17.1 per 1000 live birth during the study period of one year. The total number of live births were 21142. Out of this 361 newborns suffered from HIE. About 16.67% of these newborns expired during the study period. Many studies have reported incidence of HIE from various part of world. Most of the study reported incidence to be about 14 to 18 per 1000 live births. The studies from developing countries show more incidence of HIE in compare to developed nations. The mortality rate is reported to be about 11 to 15%[7,8]. Although cooling is now the management of choice in HIE, many parts of India still using traditional method to treat HIE. This is mostly due to inadequate infrastructure, lack of trained personnel, and huge number of deliveries. At the same time higher number of babies with HIE eventually increase the health care expenditure by manifold.

Maternal demographic profile

Most of the mothers had age between 20 to 25 years with mean age around 21 years. The trend was not significantly different among 3 stages of HIE (P=0.997). In previous studies teen age pregnancy was considered as a factor for birth asphyxia with may lead to HIE, but in recent years a similar study by Itoo *et al.* [8] and other showed that the average maternal age of newborns suffering from HIE to be 26.05 years and it did not differ significantly from the control group which constituted normal newborns. This finding suggests that advancing age or young age both have no relation to aggravate HIE. Likewise this study also excludes relation between body weight and height of mother as predisposing factor for severity of HIE. (P=0.095 and P=0.920 respectively). Most of the mothers were having BMI in normal range in all three groups (83.33%,81.25% and 77.5% respectively).BMI of mothers was also comparable between the stages of HIE. (P=0.577). Chronic or acute malnutrition may indirectly affect the extent of damage to newborns but there was no direct evidence of it as a predisposing factor for severe grade of HIE.

Antenatal factors

The antenatal clinic visits ranged from 0 to 5 in different groups. Most of the subjects (42.5%) visited antenatal clinic (ANC) only once; moreover 17.5% of mothers never attended ANC. The number of ANC visits among mothers of 3 stages of HIE was statistically insignificant (P=0.283).

Although the number is small, antenatal monitoring of foetus by Ultrasonography was also significantly inversely related to severity of HIE (p=0.031). The mean no. Of USG performed in Mothers

of HIE-I was 1 whereas in HIE-III group it was one third of it.

The study showed that the mean±SD level of maternal hemoglobin in the three groups were 9.16±1.48, 8.71±1.28 and 9.43±1.96 gm% respectively with p value of 0.526 which shows no significant association. Similarly maternal intake of iron and folic acid was not associated with severity of HIE (p<0.668). History of antepartum hemorrhage was not associated with severity of HIE (P= 0.413).

Intrapartum Factors

Among factors related to labour and delivery; mode of delivery (P=0.085), colour of liquor (P=0.915) and whether mother was referred from peripheral centre to our institute due to complication related to pregnancy (P=0.801) may be related to birth asphyxia but were not found to influence the severity of HIE significantly in this study.

Past obstetric history

There were higher numbers of primigravida mothers (52.5%) in the study group in comparison to gravid 2 or 3, since the first delivery is more difficult than the subsequent one. Although it was not statistically significant among the 3 groups (P=0.171). Gravida 2-3 were less in our study population. This indicates the relatively less risk of asphyxia in this group. Decreasing risk of birth asphyxia with increasing parity was noticed by Alfy [9] and Badawi *et al*. [10] which was statistically significant. This points to the importance of intrapartum factors in the causation of HIE but it is not a deciding factor for severity HIE. The past Obstetric history was found insignificant in deciding severity in present newborn (p=0.181)

Socio economic factors

The factors like socioeconomic status of family, occupation of mother, area of residence (rural/urban) and religion to promote better facilities to mother and child were studied. The most of study group belonged to Hindu community (62.5%) followed by Muslims, (27.5%). Most mothers were housewives (65%). About 67.5% of mothers belonged to rural area. Among these factors only socioeconomic status according to Kuppuswamy scale seemed to influence the severity of HIE (P=0.033), although in all groups the most of study population (62.5%) belonged to lower socioeconomic class. This finding again emphasizes on the collective status of education, occupation and income affects rather than individual factor.

Sex of newborn

Out of the 40 study subjects 50 % were males and 50% were females, the sex ratio being 1:1 in i.e., the chances of male newborn suffering from HIE was equal to females (P=0.384).The male: female ratio was found 1:2 in HIE-I,1.4:1 in HIE-II,1.29:1 in HIE-III and was not found to be significantly different among three groups. This finding suggests that it is not a factor for severity.

CONCLUSION

Birth asphyxia is an important clinical problem, especially in rural India, with high overall case fatality. The causes of newborn hypoxic ischemic encephalopathy are heterogeneous and many causal pathways start in the antepartum period. Hence, proper antenatal monitoring with ultrasound surveillance is much needed to minimise the incidence. Moreover, socioeconomic status continues to be related to increasing severity of HIE, though other factors like religion, occupation and residence were not that significant.

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