



“Birth asphyxia – Incidence and immediate outcome in relation to risk factors and complications”

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Abstract:

Background: Birth asphyxia is a major cause of neonatal morbidity and mortality. **Objective:** Study is intended to determine the incidence of birth asphyxia and its immediate outcome in relation to risk factors and complications.

Materials and Methods: Cross sectional study. Setting: Tertiary care teaching hospital. Patients and methods: 364 term neonates delivered and admitted in neonatal intensive care unit of our institution with APGAR score of <7 at one minute were enrolled in this study. The maternal and neonatal data was recorded according to predesigned proforma. All these neonates were resuscitated as per the need according to the guidelines of neonatal resuscitation program by American Heart Association (AHA) and were followed up till death/discharge and the data was analyzed. Statistical analysis: Chi-square test. **Results:** The incidence of birth asphyxia was 6.6 percent and the mortality was 17.8% percent. Male to female ratio was 1.4: 1. Statistically significant maternal risk factors were primiparity (54.9% in cases vs. 35% in controls) hypertension (18.1% vs. 4%), toxemias of pregnancy (25.3% vs. 15%), antepartum hemorrhage (6.9% vs. 0%), prolonged rupture of membranes (PROM) (35.2% vs. 5%), prolonged second stage of labour (37.4% vs. 4%) and Oxytocin use during labour (18.7% vs. 0%). Serious neonatal complications observed were hypoxic ischemic encephalopathy (HIE) (45.1% vs. 0%), convulsions (32.9% vs. 3%), apnea (14.3% vs. 2%) and necrotizing enterocolitis (NEC) (7.7% vs. 0%). **Conclusions:** Maternal risk factors and neonatal complications were significantly higher in asphyxia cases.

Key words: Birth asphyxia; Outcome; Risk factors.

Key message:

- Causes of neonatal deaths globally have remained unchanged over the past decade and include infections (30%), prematurity (30%), and asphyxia (25%).
- The observational findings indicate that asphyxia accounts for a much higher percentage (60%) of early deaths. Prematurity (18%), low birth weight (8%), and overt infection are much less common
- Training of birth attendants in antenatal, intranatal and neonatal complications can produce remarkable reduction in neonatal mortality.

Introduction

The 'State of India's newborn's published by Save the Children and the National Neonatology Forum (2004), says 1.2 million out of the 26 million newborn children a year die within four weeks of birth. This is the highest share of any single country, i.e., 30 per cent of 3.9 million neonatal deaths worldwide [1,2]. Birth Asphyxia is found to be responsible for 28.7% deaths in hospital settings and 20% deaths in rural/tribal areas. Estimated deaths due to this substantially preventable and treatable cause is 3, 00,000/year and ranks as the second most important cause of neonatal deaths after infections [3,4]. Approximately the same number develops serious sequelae which cripples these children both physically and mentally [2,5]. Since ours is among the institutions with limited resources, especially in the labour ward and NICU and the paucity of studies on birth asphyxia in this region of the country, there is 'crying need' to assess the incidence, obstetric risk factors, complications and immediate outcome of birth asphyxia.

Materials and Methods:

This prospective, observational, cross sectional cohort study was carried out in the Neonatal intensive care unit (NICU) of the department of Pediatrics from August 2013 to July 2014, in collaboration with the Obstetric department in a tertiary care hospital of South India with limited resources yet overburdened with deliveries. The study was approved by the institutional review board.

All the 364 babies with birth asphyxia who were delivered during the study period with gestational age of 37 weeks or more and APGAR score of less than 7 at one minute formed the study group. Another 100 babies who were matching with study group in birth weight and gestational age and admitted in NICU with other problems other than

birth asphyxia were taken as control group. Preterm low birth weight babies and babies with congenital abnormalities, sepsis and Rh incompatibility were excluded from the study.

The purpose and the mode of handling the babies were explained to the duty pediatricians, interns and nurses. After informed consent from the parents cases were enrolled within 12 hours of admission. Detailed history regarding maternal age, level of education, socio economic status, parity, antenatal care, mode of delivery, gestational age, gender of the baby, meconium stained liquor and duration of resuscitation was taken. History of present pregnancy included fever, hypertension, toxemias of pregnancy, antepartum hemorrhage, prolonged rupture of membranes (PROM), prolonged 2nd stage of labour and multiple pregnancies. Babies were examined for their weight, length, occipitofrontal circumference, fontanels, vital signs, systemic examination particularly nervous system in terms of muscle tone and primitive reflexes. Any evidence of birth injury or anomaly was noted.

Where ever resuscitation was needed it was carried out as per the neonatal resuscitation program by American Heart Association (AHA) and further management was given as per the national neonatology forum protocol. Note was kept on complications like hypoxic ischemic encephalopathy (HIE), convulsions, jaundice, apnea, septicemia, respiratory distress, necrotizing enterocolitis (NEC), feeding intolerance, and cardiac arrest and were appropriately addressed. Data was analyzed by using Chi-square test.

Results:

During the study period there were 6958 live births and 5845 (84%) full term live births in this institution. Of these 456 were born with APGAR score of <7 at 1 minute. The incidence of birth asphyxia was 6.6 percent. Among these 364 were full term birth asphyxia (FTBA) babies, of these 65 died. The mortality rate was 17.8 percent of FTBA babies. HIE was observed in 164 (45.1%) of FTBA babies. (Table-1)

The male to female ratio was 1.4: 1 and 1.5: 1 among cases and controls. Most of the neonates were term and percentage of caesarian section deliveries was also higher in both the groups. Meconium stained liquor was found more often among cases and the duration of resuscitation was more in these babies compared to control. Stratified age distribution of mothers of cases and controls

were similar. Also similar was the distribution of their educational levels and socioeconomic status. More of the asphyxiated babies (54.9%) were born to primi mothers than control group babies (35%). It was serious concern that that good antenatal care was lacking in 72% of cases and 66% of controls. From this it is obvious that the incidence of BA was most commonly associated with maternal age between 20-35 years, illiteracy of mother, primi parity and poor antenatal care. It was also more common after emergency caesarian sections, meconium stained liquor and when duration of resuscitation is 30 sec. or more. (Table-2)

Among the antepartum and intrapartum risk factors hypertension, toxemias of pregnancy, antepartum hemorrhage, PROM, prolonged 2nd stage of labour, Oxytocin use during labour and multiple pregnancies were significantly higher (p-value <0.05) in the BA group. (Table-3) Observed neonatal complications were HIE 45.1% (mortality 11.6%), convulsions 32.9% (mortality 3.3%), jaundice 22.5% (mortality 1.2%), apnea 14.3% (mortality 5.8%), septicemia 13.7% (mortality 2%), respiratory distress 11.8% (mortality 9.3%) necrotizing enterocolitis (NEC) 7.7% (mortality 10.7%) feeding intolerance 7.1% (mortality 3.8%) and cardiac arrest 3.6% (mortality 7.7%). Compared to control group HIE, convulsions, apnea, NEC, were significantly (p-value <0.05) more common among birth asphyxia cases. (Table-4 & Figure-1)

Average hospital stay was similar in both the groups. 26.2% of asphyxiated babies developed sequelae and mortality was 17.8%. Comparatively there were no neurological sequelae or mortality in the control group. (Table-5)

When classified according to Sarnat and Sarnat staging of HIE, majority of neonates with HIE Stage I of (91.8%) were discharged to their mothers while majority of those with Stage-III (50%) died or not responded (28.7%) within 7 days. (P= <0.0001)

Discussion

Birth asphyxia refers to the impairment of normal exchange of respiratory gases during the birth process and the ensuing adverse effects on fetus. Studies have emphasized that the outcome is not only death but also impairment. Dr. Costello's group studied the outcome of those diagnosed as "HIE Stage-I, II and III" and found that almost all with Stage-III was dead by one year: 25% of Stage-II were dead, but 45% were impaired. Of the Stage-I cases, 18% were dead and only 5% were impaired. 6

Thus there exist a condition which is much more serious and crippling than polio before the nation is declared as polio free and there is no marked change in its incidence, risk factors, morbidity and mortality over the past decade [6].

In this study the overall incidence of BA was 6.6%. Our findings are in correlation with those of Ekta AD [7]. Some other studies from the developing world reported varied incidence [8, 9] because they have included all live births while we have included only live term/post term babies. Varied incidence observed in other studies could also be due to various definitions of birth asphyxia, which makes comparison between different studies difficult [8-11]. Incidence of HIE was 2.8%, higher than that of Ekta AD [7]. Higher incidence of HIE in our study could be explained by the fact that this study was conducted in a tertiary hospital where many of the high risk pregnancies are referred and bound to be managed

In this study, male to female ratio was 1.4: 1. This was almost similar to other studies [11]. Several maternal and neonatal risk factors were studied and analyzed by comparing with control group. Babies delivered by caesarian section, meconium stained babies and babies with resuscitation lasting for more than 30 sec. developed BA/HIE more often. Incidence was higher in mothers of 20-35 years and increase or decrease in maternal age was not associated with any risk of BA. Parity and antenatal checkups were found to be important factors. 54.9% were primi compared to 35% in the control group. 71.9% and 66% of cases and controls respectively had no regular antenatal checkups. This reflects the low awareness for antenatal checkups in our society, irrespective of social class or education background. No association was found among the literacy level or socioeconomic status of mothers and incidence of BA. Etuk et al reported similar findings in their studies [12].

Statistically significant maternal risk factors associated with BA were hypertension (18.1% in cases vs. 4% in controls), toxemias of pregnancy (25.3% vs. 15%), antepartum hemorrhage (6.9% vs. 0%), PROM (35.2% vs. 5%), prolonged second stage of labour (37.4% vs. 4%) and Oxytocin use during labour (18.7% vs. 0%). Serious neonatal complications observed were hypoxic ischemic encephalopathy (HIE) (45.1% vs. 0%), convulsions (32.9% vs. 3%), apnea (14.3% vs. 2%) and necrotizing enterocolitis (NEC) (7.7% vs. 0%).

Similar association was observed by Dongol et al and Bashir et al [11,13].

In our study the overall mortality rate was 17.8%. Mortality as per the grade of HIE was significantly higher in Stage-III (50%) compared to Stage-I (4.1%) and Stage-II (21.7%). Average hospital stay was same in cases and controls. Overall 42% cases were recovered without apparent sequelae and 26% had neurological sequelae. As reported by other authors recovery rate was higher in Stage-I (91.8%) and Stage-II (60.9%) compared to Stage-III (22.2%) [11,12,14].

Conclusions

Evidently, birth asphyxia is associated with significant morbidity and mortality. Its mortality and the morbidity and associated risk factors were not changed much over a decade. Most of the maternal and neonatal risk factors were significantly related to BA. HIE was the serious and most common complication. It is possible to reduce the occurrence of BA and its complications within our limited resources by training health workers and village health guides who can create awareness among prospective mothers about the importance of regular antenatal checkups and provide timely antenatal, intranatal and neonatal care.

Suggestions For Further Study

There is urgent need to conduct studies on larger number of neonates and followed up over a longer period to explore permanent residua in survivors of HIE associated with birth asphyxia.

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Table 1: Birth asphyxia - Incidence and mortality

Variables	Frequency
Number of deliveries during study period	7248
Number of live births	6958
Full term live births	5845 (84%)
Preterm live birth	1113 (16%)
Neonates with APGAR < 7 at 1 minute	456 (6.6%)
Full term neonates with APGAR < 7 at 1 minute (study population)	364 (79.8%)
Preterm neonates with APGAR < 7 at 1 minute	92 (20.2%)
HIE in full term neonates with birth asphyxia	164 (45.1%)
Deaths in full term neonates with birth asphyxia	65 (17.8%)

Table 2: Demographic data of cases and controls

Variables	Cases (n = 364)	Controls (n = 100)	P - value
Mothers			
Age (yrs.)			0.713
• < 20	54 (14.8)	18 (18.0)	
• 20-35	262 (72.0)	70 (70.0)	
• >35	48 (13.2)	12 (12.0)	
Level of education			0.862
• Illiterate	142 (39.1)	40 (40.0)	
• Literate	222 (60.9)	60 (60.0)	
Socio Economic Status			0.0732
• Lower class	175 (48.1)	38 (38.0)	
• Middle class	189 (51.9)	62 (62%)	
Parity			0.0004
• Primi	200 (54.9)	35 (35.0)	
• Multi	164 (45.1)	65 (65.0)	
Antenatal care			0.4839
• Regular (≥ 3 visits)	102 (28.1)	34 (34.0)	
• Irregular (<3 visits)	262 (71.9)	66 (66.0)	
Neonates			

Mode of delivery			0.2133
• Normal vaginal	168 (46.2)	42 (42.0)	
• Caesarian section	188 (51.6)	58 (58.0)	
• Assisted vaginal	8 (2.2)	0 (0)	
Gestational age			0.0843
• Term	330 (90.7)	96 (96.0)	
• Post term	34 (9.3)	4 (4.0)	
Gender			0.729
• Male	215 (59.1)	60 (60.0)	
• Female	149 (40.9)	40 (40.0)	
•			
Meconium stained liquor			
Present	153 (42.0)	26 (26.0)	< 0.0001
Absent	216 (58.0)	74 (74.0)	
Duration of resuscitation			
<30 sec.	76 (20.9)	78 (78.0)	< 0,0001
30 sec. – 2 min.	178 (48.9)	21 (21.0)	
>.2 min.	110 (30.2)	1 (1.0)	

Table 3: Antepartum and intrapartum risk factors among cases & controls

Risk factors	Cases (n = 364)	Controls (n = 100)	P - value
Fever	38 (10.4)	12 (12.0)	0.654
Hypertension	66 (18.1)	4 (4.0)	0.0005
Toxemias of pregnancy	92 (25.3)	15 (15.0)	0.0307
Antepartum hemorrhage	25 (6.9)	0 (0.0)	< 0.0001
Prolonged rupture of membranes	128 (35.2)	5 (5.0)	< 0.0001
Prolonged 2 nd stage of labour	136 (37.4)	4 (4.0)	< 0.0001
Malpresentation	44 (12.1)	18 (18.0)	0.1237
Oxytocin use during labour	68 (18.7)	0 (0.0)	< 0.0001
Multiple pregnancy	12 (3.3)	9 (9.0)	0.0151

Table 4: Complications among birth asphyxia babies compared to controls

Complications	Cases (n = 364)	Controls (n = 100)	P - value
Hypoxic ischemic encephalopathy	164 (45.1)	0 (0.0)	< 0.0001
• HIE – I	46 (28.0)	--	
• HIE – II	62 (37.8)	--	
• HIE – III	56 (34.2)	--	
Convulsions	120 (32.9)	3 (3.0)	< 0.0001
Hyperbilirubinemia	82 (22.5)	18 (18.0)	0.4028
Apnea	52 (14.3)	2 (2.0)	0.0007
Septicemia	50 (13.7)	8 (8.0)	0.1245
Respiratory distress	43 (11.8)	10 (10.0)	0.6171
Necrotizing enterocolitis	28 (7.7)	0 (0.0)	0.0042
Feeding intolerance	26 (7.1)	4 (4.0)	0.2253
Cardiac arrest	13 (3.6)	0 (0.0)	0.1153

Table 5: Immediate outcome of cases vs. controls

Immediate outcome	Cases (n = 364)	Controls (n = 100)
Average hospital stay	4.73 days (1- 16 days)	4.8 days (2-10 days)
Discharge without apparent sequelae	182 (42.0)	72(72.0)
Discharge with neurological sequelae	95(26.2)	0 (0.0)
Discharge against medical advise	22(17.0)	28 (2.0)
Death	65(17.8)	0 (0.0)

Table 6: grade of HIE vs. Immediate outcome

Grade	Immediate outcome			Total
	Discharge	Death	No resp. in 7 days	
HIE-I	113 (91.8)	5 (4.1)	5 (4.1)	123 (100.0)
HIE-II	14 (60.9)	5 (21.7)	4 (17.4)	23 (100.0)
HIE-III	4 (22.2)	9 (50.0)	5 (27.8)	18 (100.0)
Total	131 (79.9)	19 (11.6)	14 (8.5)	164 (100.0)

P-value=<0.0001

Figure 1: Complications among birth asphyxia babies and fatality of each

