Exploring the factors associated with birth asphyxia among the new-born infants at a rural hospital in Bangladesh

Running Title: Birth asphyxia among the new-born infants

Abstract:

Background: Birth asphyxia is a critical problem to address within the context of public health. There are many reasons a baby may not be able to take in enough oxygen before, during, or just after birth. **Objective:** The objective of this research is to determine the risk factors that are associated with birth asphyxia in the Matlab, Hospital Bangladesh. **Methods:** This is a case-control study. Cases were selected from the hospital records. A group of 94 mothers who gave live births resulting in asphyxiated new-borns during 24th October 2006 to 20th August 2008 at the labour ward of Matlab hospital, Bangladesh. **Results:** Result indicates the largest group of mothers with Asphyxiated new-born between <25 years old, was 61 (35.5%) while in the control group it was 111 (64.5%). Foetal presentation was associated with birth asphyxia in new-born (OR= 15.21; 95% CI: 1.841-125.67; p= 0.001). The study shows that infant with birth weight <2500g had 3.49 times greater risk of developing birth asphyxia compared to the infant with birth weight >2500g (CI: 1.79-6.78, p value = 0.00). **Conclusions:** A future community based study with larger sample size is necessary to find the temporal relationship between Birth asphyxia and cord around the neck, Gestational age at birth less than 37 weeks and prolong first stage of labour.

Keywords: *Birth asphyxia, newborns, Bangladesh, pregnant*

Background

Birth asphyxia is a critical problem to address within the context of public health. According to The World Health Organization (WHO) Birth asphyxia is defined as "failure to initiate and sustain breathing at birth" and based on Apgar score as an Apgar score of <7 at one minute of life[1]. Each year, globally, it results in many neonatal deaths and neurological disability especially in low and middle-income countries. After infections and preterm births. It is the

third major cause of neonatal death. Globally, birth asphyxia is estimated to account for 23% of the 4 million neonatal deaths[2] and 26% of the 3.2 million stillbirths each year[3,4]. According to WHO (World Health Organization) about 3% from 120 million infants born every year in developing countries suffers from birth asphyxia and estimated 900,000 die each year[5].

One of the present challenges is the lack of a gold standard for accurately defining birth asphyxia. Because of same reason the incidence of birth asphyxia is difficult to quantify. Definitions of birth asphyxia designed for use in hospital-based settings require evaluation of neonatal umbilical cord pH, Apgar scores, neurological clinical status, and markers of multisystem organ function,[6] and are not feasible for community settings[7]. In our study we have used Apgar score to determine the condition of Birth asphyxia. Risk factor of birth asphyxia in Hospital-based and home-based may be similar. Birth asphyxia is a major neonatal health problem in Bangladesh and it is more common in rural areas. Because in rural areas most of births are attended by untrained birth attended and antenatal risk factors are not identified. This is because the pregnant mothers are not empowered to seek healthcare services[8]. Therefore risk factors are not diagnosed in time. When these deliveries are conducted at home by untrained personnel- results into perinatal asphyxia in most of the situations. Birth asphyxia is the main causes of neonatal mortality especially in low income countries and there is dearth of publications on the incidence and risk factors of severe birth asphyxia in Bangladesh. On this backdrop, the purpose of this research is to explore the factors responsible for birth asphyxia in the Matlab Hospital, Bangladesh.

Methods and Data

This is a retrospective case -control. The study populations were the mothers who gave live birth at Matlab hospital. In a series of 282 mothers were selected, 94 mothers were gave live births resulting in asphyxiated new-born and other 188 mother gave birth to healthy new-born. Apgar score was used to diagnose birth asphyxia in the present study. Apgar score of less than < 7 at 1 minute of birth were included. Apgar scores less than 7 were considered as cases and Apgar scores 7 or more at 1 minutes of birth were in control arm.

Selection of Cases: Cases were selected from the hospital records. A group of 94 mothers who gave live births resulting in asphyxiated new-borns during 24th October 2006 to 20th August 2008 at the labour ward of Matlab hospital, Bangladesh.

Selection of Control: Control are the group of 188 mothers who gave live birth resulting in non-asphyxiated new-borns at same hospital at the same period of time of cases and whose Apgar score more than 7 at 1 minute of birth. To avoid misclassification bias, controls were selected from the groups of new-born who's Apgar score more than 7 at one minute of birth. Two cases of control group compared to one case of study group by selecting the sample case which is prior and after to a sample case in the study group.

Sample Size determination: The sample size was determined by using Epi-info version 6. Probability that if the two samples differ this reflects a true difference in the two populations (confidence level or **1-**α) = 0.05 Probability that if the two populations differ, the two samples will show a 'significant' difference (power or 1-β) = 75

Proportion of controls with exposure = 0.5; Odd Ratio= 2; Control: Case= 2:1

By using Epi-info version, I have found my cases that was 94;

So the control was 94 x 2 = 188;

And total sample size was 188+92= 282

Inclusion criteria- (i) The mother who gave live birth having Apgar score was less than < 7 at 1 minute of birth (ii) The mothers with 28 weeks gestation or more (iii) Mother who deliver at Matlab hospital.

Exclusion criteria- (i) Children with congenital anomalies and genetic disorders were excluded from the study.

Data were collected by reviewing the Hospital records of all the cases and the selected controls by a nurse who works in the Matlab Hospital. Additionally, the delivery records of expectant mothers resulting in the live births have been also included to this study. The nurse was trained properly before data collection and was blinded about the objectives. The data was recorded to the specific data collection form, systematically designed for computer coding and analysis. Information obtained from the cases and controls were coded and entered twice in to the microcomputer to avoid mistake. Data was analysed using Statistical Package for Social Sciences (SPSS) ver. 16. Quality and reliability of collected data were re-checked. Following the WHO and Bangladesh Medical Research Council (BMRC) guidelines of ethical consideration, the informed consent was taken before the interview.

Results

Table 1 presents the Apgar score among new-born at 1 and 5 minute of births. The mean Apgar score of the new born at 1 and 5 minute was 7.45±2.55 and 8.88±2.09 respectively. Median, Lowest and highest Apgar score was 9,1,10 and 10,0,10 at 1 and 5 minute of birth respectively.

[Table 1 is here]

Table 2 shows the general characteristics of the subjects of case and control groups including the OR, with the association of Birth asphyxia. This result indicates the largest group of mother with Asphyxiated new-born between <25 years old, was 61 (35.5%) while in the control group it was 111 (64.5%).On the other hand, the second largest group age between 26-35 years old were in case group of 21(33.3%) and control group were 42 (66.7%). The third largest group below 20 years old or lower being in case group were 11 (26.8%) and control group were 30 (73.2%). The smallest group found in oldest mother with ages 36 years old or higher at 1(20%) in case group and control group were 4(80%). However maternal age below 25 years (OR= 1.49; 95% CI: 0.70-3.19; p= 0.29) and age between 26-35 years (OR= 1.27; 95% CI: 0.54-3; p= 0.57) was not statistically significant association between maternal age and asphyxia in new-born. Having one to three children in the family had OR of 0.80 and more than three children had OR of 0.59 which were not statistically significant (95% CI: 0.48-1.32; p= 0.39) for one to three children and (95% CI: 0.11-3.03; p= 0.52) for more than three children. From the statistical significance test result, it suggests that maternal Height less than 145 cm had 2.22 times more risk of getting birth asphyxia on her neonates compared with mother more than 145cm height which was statistically significant (OR= 2.22 ; 95% CI: 1.14-4.31; p= 0.01).

[Table 2 is here]

Table 3 shows, 41.5% and 18.1% of new born both cases and controls had birth weight less than 2500 gm while 58.5% and 82% of new born both cases and controls had birth weight more than 2500 gm. The statistical significant analysis result suggests that low birth weight

was associated with birth asphyxia in new-born compared with new born more than 2500gm (OR= 3.21; 95% CI: 1.84-5.58; p= 0.00). It is it is found that gestational age 37-41 weeks (OR= 0.45; 95% CI: 0.20-1; p= 0.057) and >42 weeks (OR= 0.897; 95% CI: 0.32-2.48; p= 0.83) are not statistically significant in compared with gestational age <37 weeks at births. The head presentation of foetal are common in both mothers with asphyxiated new-born and non- asphyxiated new-born which consist of 92% and 99.4% of the sample. Whereas the breech/ malpresentation of foetal are not common and only consist of 8 % and 0.6% of the sample respectively. The logistic test result shows that foetal presentation was associated with birth asphyxia in new-born (OR= 15.21; 95% CI: 1.841-125.67; p= 0.001).

[Table 3 is here]

Table 4 shows that about 28.4% of mother with asphyxiated new-born had Bad obstetric history during delivery while 71.6% mother with asphyxiated new-born had no Bad obstetric history. About 11.4% of mother with asphyxiated new-born had the history of Premature Labour while 88.6% mother with asphyxiated new-born had not such history. In contrast to mothers with non-asphyxiated new-born, 3.9% had the history of Premature Labour while 96.1% had not such history. The test result suggests that history of Premature Labour was significantly associated with Birth Asphyxia in new born (OR = 0.319; 95% CI: 1.149-8.533; P = 0.020). Also the results that the time taken in the Prolong second stage of delivery was associated with birth asphyxia in new-born (OR = 4.943; 95% CI= 1.661-14.71; P= 0.002) and , it suggests that history of Meconium Stained Liquor were significantly associated with Birth Asphyxia in new born (OR = 5.372; 95% CI: 2.479-11.64; p = 0.00)**.**

[Table 4 is here]

Table 5 shows there are about 46.8% of mothers with asphyxiated new-born who complete the minimum of four visits in antenatal care program and 34% of mothers who complete the three visits of antenatal care program and 19.1% of mother complete 0-2 visit of antenatal care program. Similar result found in mother with non-asphyxiated new-born, about 54.3%

complete the program, 26.6% mothers complete the three visits of antenatal care program and 19.1% of mother who complete 0-2 visit of antenatal care program. No statistical significant association was found between 0-2 visits of antenatal care and Birth Asphyxia compared to mother who visits total 4 antenatal visits of antenatal care program (OR= 1.15, 95% CI: .60-2.25, p= 0.66). However, Birth Asphyxia was not significantly associated with mothers who have completed the 3 visits of antenatal care program (OR= 1.48, 95% CI: .84-2.61, p=.17). The result also indicates that cytromis induction is not associated with birth asphyxia in new-born (OR = 1.11, 95% CI: 0.32-3.82, p = 0.863).

[Table 5 is here]

Table 6 shows that the case and control status was fitted as dependent variable in to an Unconditional multiple logistic regression model with new born weight (<2500gm,>2500gm), malpresentation, Meconium stained liquor, Prolong second stage of delivery and Height of the mother (<145cm ,>145 cm). The OR corrected for confounding factors were significantly associated with new born weight, malpresentation, Meconium stained liquor, Prolong second stage of delivery and Height of the mother. The infant with birth weight <2500g had 3.49 times greater risk of developing birth asphyxia compared to the infant with birth weight >2500g (CI: 1.79-6.78, p value = 0.00). The malpresentation had 14.5 times greater risk of developing Birth asphyxia compared to the infant who's position was normal during delivery (CI: 1.59-132.62 p value = 0.018). Mother with history of Meconium stained liquor had 6.8 times greater risk of developing birth asphyxia of the infants compared to the mother who had not such type of history (CI: 2.82-16.40, p value = 0.00).The result in time study in prolong second stage of delivery shows that Prolong 2nd Stage had 4.9 times greater risk of developing birth asphyxia of the infants compared to the mother who had not such type of history (CI: 1.45-16.92, p value = 0.010).The study showed that mothers height <145cm had 2.1 times greater risk of developing birth asphyxia compared to the mothers height >145cm (CI: 1.13-3.89, p value = 0.018).

[Table 6 is here]

Discussion:

In this Hospital based case-control study revealed that about 60% of male new-born had Birth asphyxia in both the cases and controls. Only 3% of both cases and controls had more than three children and rest had no children or up to three children that reflects well accepted family planning in the society. Several studies showed association between parity and birth asphyxia[1-3]. This research revealed that there are no association between birth asphyxia and parity and similar to the another study that obtained in India[4]. This study could not find any significant relationship between birth asphyxia and gestational age. And this study is similar to the another study conducted at Jordan[5]. Again this study could not find any association with mother age, mother weight and mother BMI but maternal weight was about to be associated. However, wide OR (95% CI: 0.99-2.75) indicated that with larger sample size significant association could have been ascertained. A Retrospective study conducted at Nepal have seen that maternal age between 18-35years was associated with Birth asphyxia[9]. This study could not find any significant relationship between birth asphyxia and gestational age. And this study is similar to the another study conducted at Jordan[5].Moreover, there is no significant association found with mother age, mother weight and mother BMI but maternal weight was found to be associated. However, wide OR (95% CI: 0.99-2.75) indicated that with larger sample size significant association could have been ascertained. A Retrospective study conducted at Nepal have seen that maternal age between 18-35years was associated with Birth asphyxia[9].

Infant with birth weight <2500g had 3.48 times greater risk of developing birth asphyxia compared to the infant with birth weight >2500gm.This finding is consistent with the findings of another study conducted at Nigeria and done over three years period, showed that infants with low birth weight play a significant role in occurrence of asphyxia[10]. A Retrospective case-control study conducted at Phramongkutklao Hospital, Thailand have seen that fetal birth weight less than 2,500 grams had 2.5 times greater risk of developing birth asphyxia compared to the fetal birth weight more than 2500 grams[11]. But different from another Hospital based study which was carried out in Jordan[5]. The study showed that mothers height <145cm had 2.1 times greater risk of developing birth asphyxia compared to the mothers' height >145cm. This is similar to a study conducted in Nepal[12].

Antenatal care from a trained provider is important to monitor the status of a pregnancy and to reduce the risk that is associated with the pregnancy and at delivery for the mother and child. The study findings show that majority of the mother had received four visits of

antenatal care and only 19% of both cases and controls had received 0-2 visits of antenatal care and it showed that there was no significant relationship between birth asphyxia and antenatal care and the findings are contrast to the findings in the Jordan study[5]. Around 29% of both cases and controls had bad obstetric history and this study also shows that, it is not associated with birth asphyxia in new-born but this result is different from multiple hospital based studies [4,13,14]. In this study malpresentation is associated with birth asphyxia in new-born and this study is similar to another Hospital based study which was conducted at Mulago Hospital, Kampala, Uganda have seen that malpresentation had 6.32 times greater risk of developing Birth asphyxia compare to the normal presentation[15].There was no significant difference in the premature rupture of membrane of both the case and control group and it is not statistically significant but this study is different from other authors[1,13-16]. Prolonged rupture of membrane may be associated with intrauterine infection resulting in birth asphyxia[1.]

Meconium should always be considered a marker for foetal distress therefore there was a significant effect on the Apgar score of neonates[17]. Meconium-staining of the amniotic fluid is present in 9-14 per cent of all deliveries at the time of delivery[18]. In this study, Meconium was strongly associated with Birth asphyxia in new-born and this study is similar to the other study[19-21].A population based retrospective case-control study conducted at Sweden have seen that Meconium release had 4.1 times greater risk of developing birth asphyxia compared to the mother who did not have the history of Meconium release during delivery[22]. Coiling of the umbilical cord around the fetal neck is a common complication of labour, said to occur about once in every five deliveries[23]. In this study the association was borderline (p=0.05). Study conducted at London have found association between birth asphyxia and Cord around the neck[24.] Prolong second stage of labour is associated with birth asphyxia in new-born and this study is similar to another Hospital based cohort study which was conducted at Maulana Azad Medical College in New Delhi [10]. A retrospective study over a 3-year period from 1989 to 1991 was performed at a tertiary level, referral hospital have found association between Birth asphyxia and prolonged second stage of labour[9.] Potential limitation of the study could not be ignored. Firstly, the research relied on the Hospital records where history was taken from the attendant. The nurse who collected data was blinded of the objectives so; bias is unlikely in this regard. Secondly there was small sample size and as it is hospital based study. A future community based study with larger sample size is necessary to find the

temporal relationship between Birth asphyxia and cord around the neck, Gestational age at birth less than 37 weeks and prolong first stage of labour.

Conflicting Interest: The authors declared that they are no conflicting interests.

Funding: There was no financial support recieved to conduct the research.

Highlights

1. Foetal presentation was associated with birth asphyxia in new-born babies.
2. Meconium was strongly associated with birth asphyxia
3. Infant with birth weight <2500g had 3.48 times greater risk of developing birth asphyxia compared to the infant with birth weight >2500gm
4. There is no any significant relationship between birth asphyxia and gestational age

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Table 1. Apgar score at 1 and 5 minutes among the new-born

Statistic	Apgar Score at 1 minute	Apgar Score at 5 minutes
Mean±SD	7.45±2.55	8.88±2.09
Median	9	10
Lowest	1	0
Highest	10	10

Table-2. Frequency distribution of Socio demographic and maternal factor by case and control including OR and p-value

Categories	Cases (n= 94) No (%)	Controls (n= 188) No (%)	OR (95% CI)	p-value
Maternal age (Years)				
<25	45(48%)	92(49%)	1	
26-35	42(45%)	79(42%)	1.1(0.65-1.8)	0.75
>35	7(7.4%)	17(9%)	0.84(0.32-2.18)	0.72
Parity				
No parity	47(50%)	83(44.1%)	1	
1-3	45(47.9%)	99(52.7%)	0.80(0.48-1.32)	0.39
>3	2(2.1%)	6(3.2%)	0.59(0.11-3.03)	0.52
BMI				
<25	73(83%)	155(87%)	1	
>25	15(17%)	23(13%)	1.38(0.68-2.8)	0.36
Mother Height				
<145cm	21(24%)	22(12.4%)	2.22(1.14-4.31)	0.018
>145cm	67(76.1%)	156(87.6%)	1	
Mother weight				
<50kg	55(59.8%)	86(47.3%)	1.65(0.99-2.75)	0.051
>50kg	37(40.2%)	96(52.7%)	1	

Education				
No education	21(22.3%)	29(15.4%)	1	
Primary	25(26.6%)	58(31%)	0.59(0.28-1.23)	0.21
Secondary	48(51%)	101(53.7%)	0.65(0.34-1.26)	0.16
Asset index				
1(Poorest)	13(14.1%)	21(11.2%)	1	
2	20(21.7%)	35(18.6%)	0.92(0.38-2.23)	0.85
3	18(19.6%)	38(20.2%)	0.76(0.31-1.86)	0.55
4	16(17.4%)	40(21.3%)	0.64(0.26-1.59)	0.34
5(Richest)	25(27.2%)	54(28.7%)	0.74(0.32-1.73)	0.49

Table 3. Frequency distribution of Foetal factors by case and control including OR and p-value

Categories	**Cases (n= 94) No (%)**	**Controls (n= 188) No (%)**	**OR (95% CI)**	**p-value**
Birth weight of infants (g)				
<2500gm	39(41.5%)	34(18.1%)	3.21(1.84-5.58)	0.00
>2500gm	55(58.5%)	154(81.9%)	1	
Gestational age at birth (weeks)				
<37 weeks	13(13.8%)	14(7.4%)	1	
37-42 weeks	66(70%)	156(83%)	0.45(0.20-1)	0.057
>42weeks	15(16%)	18(9.6%)	0.89(0.32-2.48)	0.83
Sex of infants				
Male	55(58.5%)	110(58.5%)	1	
Female	39(41.5%)	78941.5%)	1(0.6-1.6)	1
Mal-presentation				
Present	7(8%)	1(0.6%)	15.21(1.84-	0.001
Absent	81(92%)	176(99.4%)	125.67)	1
Cord around the neck				
Present	20(22.7%)	24(13.5%)	1.89(0.97-3.64)	0.056
Absent	68(77.3%)	154(86.5%)		1

Table 4. Frequency distribution of deliveries related factor by case and control including OR and p-value

Categories	Cases (n= 94) No (%)	Controls (n=188) No (%)	OR (95% CI)	p value
Bad obstetric history:				
- Present	25 (28.4)	25 (28.4)	0.96	0.89
- Absent	63 (71.6)	63 (71.6)	(0.547-1.69)	1
Leaking Membrane:				
- Present	4 (4.5)	18 (10.1)	0.42	0.12
- Absent	84 (95.5)	160 (89.9)	(0.13-1.29)	1
Premature rupture of membrane:				
- Present	9 (10.2)	13(7.3)	1.44	0.41
- Absent	79 (89.8)	165(92.7)	(0.59-3.52)	1
Premature labor				
- Present	10 (11.4)	7 (3.9)	0.31	0.02
- Absent	78(88.6)	171(96.1)	(1.14-8.53)	1
Prolong 1st stage				
-Present	15 (17.0)	25(14.0)	1.25	0.51
-Absent	73 (83.0)	153(86 .0)	(0.62-2.59)	1
Prolong 2nd Stage				
-Present	11 (12.5)	5(2.8)	4.94	0.00
-Absent	77 (87.5)	173(97.2)	(1.66-14.71)	1
APH*				
-Present	1 (1.1)	1 (.6)	2.03	0.55
-Absent	87 (98.9)	177 (99.4)	(0.12-32.9)	
Meconium Stained Liquor				
-Present	23(26.1%)	65(73.9%)	5.37	0.00
-Absent	11(6.2%)	167(93.8%)	(2.47-11.64)	1
Prolong labour				
-Present	15(17%)	7(3.9%)	5.02	0.00
-Absent	73(83%)	171(96.1%)	(1.96-12.82)	1

Table 5. Distribution of maternal care received factor by case and control including OR and p-value

Categories	Case(n= 94) No (%)	Control (n= 188) No (%)	OR (95% CI)	p value
Antenatal care visits				
0-2nd visits	18(19.1%)	36(19.1%)	1.15(0.59-2.25)	0.66
3rd visits	32(34%)	50(26.6%)	1.48(0.84-2.61) 1	0.17
4th visits	44(46.8%)	102(54.3%)		
Cytromis induction				
Yes	4(5.40%)	8(4.9%)	1	
No	70(94.6%)	156(95.1%)	1.11(0.32-3.82)	0.86

Table 6. Risk factor for Birth asphyxia in new-born

Factors	OR adjusted 95% CI	p Value	OR unadjusted 95% CI	p Value
Birth weight of newborn <2500gm	3.49 (1.79-6.78)	0.00	3.21 (1.84-5.58)	0.00
Malpresentation	14.52 (1.59-132.62)	0.01	15.21 (1.84-125.67)	0.00
Meconium stained liquor	6.80 (2.82-16.40)	0.00	5.37 (2.47-11.64)	0.00
Prolong 2nd Stage	4.96 (1.45-16.92)	0.01	4.94 (1.66-14.71)	0.00
Premature labour	4.55 (1.62-12.74)	0.00	0.31 (1.15-8.53)	0.02
Height of the mother	2.10 (1.13-3.89)	0.01	2.22 (1.14-4.31)	0.01