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Risk Factors of Birth Asphyxia among Neonates Born in Dessie Referral Hospital, North East, Ethiopia: Unmatched Case- Control Study

Moges Workneh Ayele* and Birhanu Demeke Workneh
College of Medicine and Health Sciences, Wollo University, Dessie, Ethiopia

ABSTRACT

In Ethiopia, approximately one third of the neonatal deaths are caused by birth asphyxia. Identifying risk factors for birth asphyxia is, thus, crucial for program and policy maker. The current study was conducted from November 1, 2016 and June 30, 2017 and aimed to identify risk factors of birth asphyxia among neonates born in Dessie Referral Hospital, Northeast Ethiopia. Unmatched case control study was employed among 143 cases and 286 controls of neonates and their index mothers. Structured questionnaire and document review were used to collect the data. Data were entered to Epi-data 3.1 and exported to SPSS for analysis. Among factors identified, age of mothers greater than 36 years (AOR=7.8 ; 95% CI (1.80,34.41), history of ante-partum hemorrhage (AOR= 3.84 ; 95% CI(1.70,8.71), maternal infection (AOR= 13.51; 95% CI(4.64-39.34), maternal anemia (AOR= 5.51; 95% CI (2.27, 13.33), premature rapture of membrane (AOR=3.10; 95%CI (1.04 -9.10), meconium amniotic fluid (AOR=15.23;95% CI(5.88-39.56), male neonatal sex (AOR=2.73;95% CI (1.23-5.93), birth weight less than 1500gram (AOR=22.16; 95% CI(2.34-210.30), birth weight between 1500-2500gram (AOR=10.87;95% CI(1.16-101.60) and gestational age less than 34 weeks (AOR=3.20;95% (1.16-8.83) were independently associated with birth asphyxia. This concludes that advanced maternal age, maternal infection and anemia, meconium amniotic fluid, being male, birth weight and gestational age were found to be associated factors for birth asphyxia. Health mangers and policy makers should focus on these priorities and identified factors to reduce neonatal deaths related with birth asphyxia.

Keywords: Birth Asphyxia, Neonates, Risk factors, Ethiopia.

INTRODUCTION

World Health Organization (WHO) defines birth asphyxia as failure to initiate and sustain breathing at birth (Ersdal & Singhal, 2013). About 2.7 million neonatal deaths occur worldwide accounting for more than 45 percent of the deaths of children under age 5 years (Liu et al., 2016). The Ethiopian neonatal mortality accounts for 63% of all infant deaths and 45 % of all under-five deaths (EDHS, 2016).

WHO estimates that 4 million neonatal deaths occur annually due to birth asphyxia accounting for 38% of deaths of children under-5 years of age (Aslam et al., 2014). Birth asphyxia, the third leading cause of neonatal killer, accounts quarter (24 %) of all of neonatal death (Afolabi et al., 2017). Birth asphyxia is among the three-leading cause of neonatal mortality in Sub-Sahara Africa, which accounts 24% of all neonatal deaths (Kerber et al., 2017). In Ethiopia birth asphyxiais, the first leading cause of neonatal mortality, accounted one third (31.6 %) neonatal mortality (CSA, 2016).

*Corresponding author: moges0846@gmail.com

Most of the risk factors of perinatal asphyxia are preventable includes increase or decrease maternal age, prolonged rupture of membranes, meconium stained fluid, multiple births, antenatal care, low birth weight, mal-presentation, ante-artum hemorrhage, eclampsia, pre-eclampsia, ante partum hemorrhage and anemia (FMOH, 2014).

Birth asphyxia is oxygen deficit lead to severe hypoxic organ damage (heart, lungs, liver, gut, kidneys), but with damage to the brain manifested as either mental, such as developmental delay or intellectual disability, or physical, such as spasticity (Dickson et al., 2014; Aslam et al., 2014).

Ethiopia has developed a health sector strategic plan to direct its health intervention through 2035, in this plan; the country will avert unnecessary neonatal mortality (Tadesse & Ardalan, 2014). Progress in reducing deaths will depend on systematically addressing implementation and targeted innovation where most of the deaths occur. Thus, this study was conducted to identify

of risk factors for birth asphyxia, which is significantly important for evidence-based intervention to reduce neonatal mortality.

MATERIALS AND METHODS

Study area and period:

This study was conducted in Dessie Referral Hospital, North Central Ethiopia from November 1, 2016 and June 30, 2017. Dessie is the capital town of South Wollo zone, in the Amhara regional states, which is located at 401 Km North East of Addis Ababa. According to the 2016 Population Census of the Central Statistic Authority, the projected population of South Wollo zone is estimated to be 2,518,862. Of these, 47.4% are male and 52.6% female.

Study design:

Hospital based unmatched case-control study design was employed.

Source and study population:

All babies that were born in Dessie Referral Hospital with their mothers were considered as source population. All cases and controls that were available during the study period were the study population. For cases: all asphyxiated babies that were born in DRH with Apgar scores < 7 at the 5th minute of delivery and their mothers were included in the study from 1st January 2017 to 30th of April 2017; and for controls non-asphyxiated babies that were born in DRH with Apgar scores ≥7 at 5th minute of deliver and their mothers were included in the study from 1st January 2017 to 30th of April 2017 (FMOH, 2014).

Sample size determination:

The sample size for this study was calculated by considering risk factors of birth asphyxia using EPI–INFO version 3.5.1 by considering two sample proportions based on the following assumptions. Proportions used to determine the sample size obtained from case-control study conducted in Thailand (Rachatapantanakorn et al., 2005). Among all the risk factors of birth asphyxia, birth weight of newborn babies as predictors of birth asphyxia was found to give the largest sample size. Based on this, the proportion of birth asphyxia among the case neonate with birth weight (<2500gm) is estimated to be 23.48% (P= 0.2349) and among the control the proportion of birth asphyxia with birth weight (<2500gm) was estimated to be 11.33% (P= 0.1133) with Odds Ratio (OR) of 4.46 for birth asphyxia neonates compared to not birth asphyxiated neonates. In addition, 95 % level of confidence and 80% power are considered. A one to two allocation ratio of cases to controls (1:2) and a 10% non-response was assumed. Accordingly, the final sample size was consisted of 143 cases and 286 controls.

Sampling procedure:

All consecutive neonates that fulfill the criteria of being a case was included in the study until the calculated sample size was obtained where as for the controls, the first control was selected before the inclusion of a given case and the second control was selected following the case.

Data collection process:

The data was collected from cases (asphyxiated neonates) and controls (non- asphyxiated neonates) in the specified period using structured questionnaire and data abstraction form (chart) as indicated below.

Structured interview:

Mothers of the newborn babies were interviewed using structured questionnaire to capture socio-demographic variables and related issues.

Document review:

The various ante-partum, intra-partum and post-partum risk factors were extracted from the medical charts/ cards using the data abstraction form/ checklists. Two BSc nurses who worked in the delivery wards of DRH were trained for data collection procedure and ethical issue prior to data collection.

Data quality control:

The questionnaire was prepared in English and translated into the local language, Amharic for the interview and then back to English to maintain consistency. Pretest was conducted in Akesta Hospital on 10% of sample size one week before the commencement of the main study in order to identify potential problems in the data collection tools and procedure.

Data entry, clean up and analysis:

Data was entered and analyzed using statistical package for social science (SPSS) version 25. Odds ratio with 95% confidence interval (CI) was calculated using logistic regression analysis to assess to statistically significant association between birth asphyxia and independent variables. P < 0.25 on binary logistic regression inter into multiple logistic regression analysis and those variables that had a p-value < 0.05 on multiple logistic regression analysis were declared as independent risk factors for birth asphyxia. Model fitness was tested using the Hosmer and Lemeshow's test and it was insignificant. Multi-collinearity was checked using variance inflation factor (VIF).

RESULTS

Socio-demographic characteristics of respondents:

A total of 143 birth asphyxia neonates (cases) with their index mothers and a total of 286 controls neonates who had no birth asphyxia with their index mothers were participated which making a response rate of 100%. The mean age of the mothers was 26.57 years. Almost all 412(96%) mothers were married, majority of the respondents were farmer, 253(59%) and more than half of asphyxiated neonate's mothers were house wife 51(35.7%) (Table 1).

Table 1: Socio-demographic characteristic of cases and controls attending in Dessie Referral Hospital Ethiopia.

Variables	Category	Cases, n(%) n=143	Controls, n (%) n= 286	Total (n= 429)
Age of mothers	21- 35 years	63 (44.1)	222(77.6)	285(66.4)
	Greater than 36 years	61(42.6)	55(19.2)	116(27.1)
	Less than 20years	19 (13.3)	9 (3.1)	28(6.5)
Marital status	Married	134(94.0)	278 (97.2)	412(96.0)
	Divorced	5(3.0)	5(1.7)	10(2.3)
	Windowed	4(2.7)	3(1.1)	7(1.6)
Occupation	Farmers	52(36.3)	201(70.3)	253(59.0)
	Housewives	51(35.7)	49(17.1)	100(23.3)
	Civil servants	15(10.5)	16(5.6)	31(7.2)
	Others	25(17.5)	20(7.0)	45(10.5)
Educational level	1-8 Grade	40(28.0)	95(33.2)	135(31.5)
	9-12 Grade	59(41.2)	132(46.2)	191(44.5)
	Certificate and above	44(30.8)	59(20.6)	103(24.0)
Neonatal sex	Male	66(46.2)	111(38.8)	177(41.3)
	Female	77(53.8)	175(61.2)	252(58.7)

Risk factors for birth asphyxia:

After analysis of bivariate and multivariate logistic regression, ten variables had showed significant association with birth asphyxia. Age of mothers greater than 36 years were 7.8 times higher risk of developing birth asphyxia as compared to younger age mothers (21-35 years) [AOR=7.8; 95% CI (1.80,34.41)]. The study showed that neonates born to mothers who had history of antepartum hemorrhage had 3.8 times higher odd of developing birth asphyxia compared to those neonates born to mothers who did not have history of antepartum hemorrhage [AOR= 3.84; 95% CI (1.70,8.71)]. Those neonates born to mothers who had history of infection had 13.5 times higher developing birth asphyxia compared to neonates born to mothers who did not have infection [AOR= 13.51; 95% CI (4.64-39.34)]. Anemia was significantly associated with increased risk of birth asphyxia [AOR= 5.51; 95% CI (2.27, 13.33)]. Babies born from a mother with history premature rapture of membrane had 3 times increase the risk of birth asphyxia (AOR=3.10; 95%CI (1.04 -9.10). Babies born with meconium amniotic fluid were more likely to develop birth asphyxia (AOR=15.23; 95% CI (5.88-39.56), being male (AOR=2.73; (95% CI (1.23- 5.93), birth weight <1500gram (AOR=22.16; 95% CI(2.34- 210.30), birth weight between 1500-2500gram (AOR=10.87; 95% CI (1.16-101.60) and gestational age < 34 weeks (AOR=3.20;95% (1.16-8.83) were more likely increased the risk of birth asphyxia (Table 2).

DISCUSSION

The present study was designed to study risk factors of birth asphyxia among new born babies born in DRH. This study showed that advanced maternal age (>36 years) was found to be the risk factor for birth asphyxia with the likelihood of birth asphyxia was 7.8 times higher among new born babies born to mother's age > 36 years compared to those new born babies born from mother's age < 36 years of age. But other studies showed that maternal age less than 20 years of age were found to be risk for birth asphyxia (Bahubali et al., 2013). This inconsistency could be due to the demographic difference in the study population. In this study, antepartum hemorrhage was found to be risk for birth asphyxia. This finding is supported by other studies (Babu et al., 2013; Majeed et al., 2007). The study also revealed that a significant association was found between maternal infection and birth asphyxia which is comparable with the finding of studies conducted previously in Nepal (Lee et al., 2008). This would be justified that antepartum hemorrhage causes drop in maternal blood pressure that substantially interfere with blood flow to the infant's brain during delivery.

Prolonged rupture of membrane (PROM) had shown a significant effect on risk of birth asphyxia with the likelihood of birth asphyxia was 3.1 times higher among neonates born to mothers who had PROM compared to those neonates born before 18 hours of rupture of membrane. Similar findings were also observed in earlier studies conducted in different parts of the world (Chiabi et al., 2013; Torres-Muñoz et al., 2017; Üzel et al., 2012). Prolonged rapture of membrane increases the chance of ascending microorganisms from the birth canal in to the amniotic sac which results fetal compromise and frequently leads to birth asphyxia (Nayeri et al., 2012).

Babies who were born from mothers who had anemia during labor had 9.4 times higher odds of developing birth asphyxia compared to babies born to mothers who did not have anemia during labor.

Table 2: Bivariate and multivariate logistic regression of risk factors for birth asphyxia among neonates born in DRH, Ethiopia.

Variables	Category	Case n=143 (%)	Control n= 286 (%)	COR (95% CI)	AOR(95%CI)
Maternal age	21- 35 years	63 (44.1)	222(77.6)	1.00	1.00
	>36 years	61(42.6)	55 (19.2)	1.9 (0.79, 4.56)	7.86 (1.80 34.41)
	< 20 years	19 (13.3)	9 (3.1)	7.44 (3.21 ,17.25)	
Marital status	Married	134(94.0)	278(97.2)	1.00	
	Divorced	5(3.0)	5(1.7)	0.36 (0.08-1.64)	
	Windowed	4(2.7)	3(1.1)	0.48 (0.14- 1.70)	
Educational level	1-8	40(28.0)	95(33.2)	0.56 (33- 1.00)	
	9-12	59(41.2)	132(46.2)	0.94 (0.58-1.52)	
	Certificate and above	44(30.8)	59(20.6)	1.0	
ANC follow up	Yes	122(85.3)	227(79.4)	1	
	No	21(14.7)	59(20.6)	1.51 (0.88- 2.60)	
Parity	< 1	33(23.1)	36(12.6)	2.81 (1.61- 4.92)	
	2-3	57(39.9)	175(61.2)	1	
	>3	53937.1)	75(26.2)	1.30 (0.72- 2.33)	
Multiple gestation	Yes	12(8.4)	6(2.1)	4.23 (1.57- 11.64)	
	No	131(94.6)	280(97.9)	1.00	
Chronic hypertension	Yes	37(25.9)	39(13.6)	2.21 (1.33- 3.66)	
	No	106(74.1)	247(86.4)	1.00	
Antepartum hemorrhage	Yes	62(42.6)	33(11.5)	5.87 (3.60- 9.59)	3.84 (1.70-8.71)
	No	81(56.4)	253(88.5)	1.00	
Maternal infection	Yes	63(44.1)	13(4.5)	16.54 (8.66- 31.58)	13.51 (4.64-39.34)
	No	80(55.9)	273(95.5)	1.00	1.00
Anemia	Yes	61(42.7)	21(7.3)	9.39 (5.39- 16.34)	5.51 (2.27- 13.33)
	No	82(57.3)	265(92.7)	1.00	1.00
Prolonged labor	Yes	24(16.8)	26(9.1)	2.02 (1.11- 3.66)	
	No	119(86.2)	260(90.9)	1.00	
Prolonged rapture of membrane	Yes	19(13.3)	30(10.5)	1.31 (0.71- 2.41)	3.10 (1.04 -9.10)
	No	124(86.7)	256(89.5)	1.00	
Birth trauma	Yes	11(7.7)	10(3.5)	2.30 (0.95- 5.55)	
	No	132(92.3)	276(96.5)	1.00	
Meconium amniotic fluid	Yes	65(45.5)	18(6.3)	12.41 (6.95-22.15)	15.23 (5.88-39.56)
	No	78(54.5)	268(93.7)	1.00	1.00
Neonatal sex	Male	66(46.2)	111(38.8)	1.35 (1.00- 2.01)	2.73 (1.23- 5.93)
	Female	77(53.8)	175(61.2)	1.00	1.00
Birth weight in grams	<1500	18(12.6)	8(2.8)	25.07 (7.71-81.50)	22.16 (2.34- 210.30)
	1500-2500	66(46.2)	49(17.1)	13.74 (4.38- 43.11)	10.87 (1.16-101.60)
	2500- 3500	38(26.6)	116(40.6)	3.34 (1.06 -10.50)	
	>3500	21 (14.7)	117(40.9)	1.00	1.00
Gestational age in weeks	<34	55(38.5)	17(6.0)	21.81 (11.07- 42.94)	3.20 (1.16-8.83)
	34-36	61(42.7)	87(30.4)	4.61 (2.45-8.71)	
	>36	27(18.9)	182(63.6)		1.00

ANC= Antenatal Care

Similar observation was also shown in the study conducted in India (Tabassum et al., 2014; Ahmad, 2015; Kiyani et al., 2014; Sangeetha & Pushpalatha, 2014; Siva et al., 2015). This could be due to the fact that the concentration of hemoglobin determines the oxygen caring capacity of blood; this deficiency may lead to hypoxia of the fetus inside the womb resulting in neonatal asphyxia.

The present study demonstrated that meconium staining of amniotic fluid was found to be risk factors of birth asphyxia. This result is consistent with other similar studies (Pitsawong & Panichkul, 2011; Dalal & Bodar, 2013; Ibrahim & Asmaa, 2016; Bari et al., 2008). The present study also showed that neonatal sex was found to be risk factors of birth asphyxia. This is in line with others previous studies (Bari et al., 2008; Seikku et al., 2016). In this study birth weight was observed as risk factor for birth asphyxia. This result is consistent with the findings of other studies (De Almeida et al., 2015). The other finding of this study also revealed that babies born at age less than 34 weeks of gestational age were developed the risk of birth asphyxia (Pitsawong & Panichkul, 2011).

In conclusion, this study demonstrated that advanced maternal age, maternal anemia, prolonged labor, prolonged rapture of membrane, meconium amniotic fluid, antepartum hemorrhage, low birth weight and preterm births were found to be risk factors for birth asphyxia and majority of them were preventable. Health mangers and policy makers should focus on these priorities and identified factors to reduce neonatal deaths related with birth asphyxia.

ETHICAL CONSIDERATIONS

Ethical clearance was obtained from the Research and Ethical Review Committee of College of Medicine and Health Science, Wollo University. Written consent was sought from Dessie Referral Hospital. Moreover, study participants involved in the study were fully informed about the nature and objectives of the study and the confidentiality of the data. Then, their consent to participate in the study was requested. Participation in the interview was also voluntarily and the participants have the right to escape a question. Codes instead of personal identifiers were used in the survey data collection tools and main report. Privacy and confidentiality are ensured by placing the data in a locked cabinet so that others except the researcher cannot access the data.

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