

Magnitude and Determinants of Birth Asphyxia: Unmatched Case Control Study Assela Referral Teaching Hospital, Arsi Zone, Ethiopia



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Abstract

Backgrounds: Birth asphyxia is a common and serious neonatal cause morbidity and mortality globally. In developing countries majority of the cases suffer from the consequences of birth asphyxia, while no information in the study area that the current study aimed to provide.

Methods: A cross sectional case control study design done on 346 neonates, 115 cases and 231 controls making 1:2 ratio. All neonates delivered with Apgar score ≤ 7 at first minute taken as cases and two consecutive babies delivered with Apgar score > 7 at first minute following the case taken as control. Interviewer administered structured questionnaire for mother and check list to extract information from patient record was used. The data entered using EPI info 7 statistical software and SPSS version 22 for checking consistency, accuracy and further analysis.

Result: The mean maternal age in the study group and control group was 27.0 ± 5.5 years and 26 ± 4.4 years, respectively. Independent risk factors of birth asphyxia include preterm [AOR= 4.97; 95% CI(1.37,18.05)], instrumental delivery [AOR=4.68; 95% CI (2.12,9.95)], Wt < 2500gm [AOR=3.64; 95% CI (1.50,8.87)], caesarean section [AOR = 3.23; 95% CI(1.70,6.12)], PROM [AOR=2.98; 95% CI (1.44,6.18)], rural residence [AOR= 2.726; CI(2.51,4.38)], breech presentation [AOR=2.41; 95% CI (101,5.74)].

Conclusion and Recommendation: rural residence, breech presentation, instrumental deliveries, caesarean section delivery, PROM, preterm delivery and low birth weight were risk factors of birth asphyxia. There is an immediate need to develop strategies for early identification and management of birth asphyxia by involving beneficiaries, health professionals and policy makers. Health workers should be trained for emergency obstetric care, basic newborn care and encourage early recognition and referral.

Keywords: Case control study; Birth asphyxia; Arsi

Abbreviations: ANC: Antenatal Care; APGAR: Appearance Pulse Grimace Activity Respiration; BPR: Business Process Re-engineering; BW: Birth Weight; CI: Confidence Interval; CNS: Central Nervous System; CPD: Cephalo-Pelvic Disproportion; DHS: Demographic and Health Survey; DM: Diabetes Mellitus; HC: Health Center; HIV/AIDS: Human Immune Virus/Acquired Immune Deficiency Syndrome; HP: Health Post; HSDP: Health Sector Development Plan; IUGR: Intra Uterine Growth Retardation; IRB: Institutional Review Board; NICU: Neonatal Intensive Care Unit; OR: Odds Ratio; PIH: Pregnancy Induced Hypertension; PROM: Premature Rupture of Membrane; WHO: World Health Organization

Introduction

Ethiopia is the tenth largest country in the world and second populous in Africa of whom 44.5% in the reproductive age [1]. There has been considerable health facility rehabilitation program and furnishing during the Health Service Development Program I (HSDP-I): HSDP-II and HSDP-III including improvements in support facilities. As a result: the potential health service coverage increased from 45% in 1996/97 to more than 95% by 2008/09 [2]. The term "asphyxia" is derived from the Greek and means "stopping of the pulse". Perinatal asphyxia is a condition characterized by an impairment of exchange of the respiratory gases (oxygen and carbon dioxide) resulting in hypoxemia and hypercapnia: accompanied by metabolic acidosis [3]. World

Health Organization (WHO) has defined birth asphyxia as "failure to initiate and sustain breathing at birth" [4]. Perinatal asphyxia is a common and serious neonatal problem globally and significantly contributes to both neonatal morbidity and mortality [5]. According to the (WHO) report: 130 million infants born globally each year: approximately 4 million babies die before they reach the age of 1-month. It has been shown that 99% of these neonatal deaths take place in the developing countries where perinatal asphyxia contributes to almost 23% of these deaths [4]. The incidence of asphyxia is 1 - 6 per 1000 births in developed countries and 5 - 10 per 1000 births in developing countries [6]. Globally perinatal asphyxia is estimated to be the fifth largest

cause of under-five child deaths (8.5%). Indeed: newborn deaths constitute over 40% of all deaths in children aged under five [7].

The WHO's classification of diseases according to ICD 10 (The International Classification of Disease 10) defines birth asphyxia when the Apgar score at 1 minute is less than or equal to 7 by the two levels. Severe birth asphyxia is defined where the Apgar score at 1 minute is 0-3 and mild or moderate birth asphyxia is defined where the Apgar score at 1 minute is 4-6 [8]. In Ethiopia: despite the progress in child health over the past decades: neonatal mortality rate is high and has remained stagnant [9]. Birth can occur as result of problems during labor and delivery or after delivery due to neonatal factors. The ante-partum risk factors are severe preeclampsia/eclampsia: multiple gestation: breech presentation: trauma: increasing or decreasing maternal age: lack of antenatal care: anemia and ante-partum hemorrhage. Numerous intra-partum risk factors for asphyxia are including prolonged rupture of membrane (PROM): abnormal fetal heart rate during labor: chorioamnionitis: thick meconium: assisted vaginal delivery: general anesthesia: emergency cesarean delivery: induction/augmentation of labor with oxytocin: placental abruption: umbilical cord prolapse and uterine rupture. Neonatal risk factors including congenital malformation: twin pregnancy: intrauterine growth restriction (IUGR): preterm delivery: fetal distress and birth weight less than 2:500 grams. It should be noted that: in many cases: the timing of asphyxia cannot be established with certainty [10]. Although the majority are transient: the long-term consequences of asphyxia affect the central nervous system (CNS): which can ultimately lead to cerebral palsy: epilepsy: and learning disabilities [5,11]. Ethiopia is suffering from high rate of neonatal morbidity and mortality. Neonatal asphyxia is one of the major causes. Having gone through literature: there is no sufficient documented report on magnitude and determinants of perinatal asphyxia in our country. The result of this study is intended to benefit health professionals: policy makers and NGOs that are working on neonatology. It can also benefit neonates by preventing them from losing their life and prevent them from suffering by the complications of birth asphyxia. Finally, families and society are also benefitted. Moreover: it is the most likely practical intervention point to reduce the mortality and morbidity associated with birth asphyxia. Therefore: this study was designed to measure magnitude of birth asphyxia and its determinants in the study area.

Methods

Study area

The study conducted at Assela Referral Teaching Hospital which in Arsi Zone: South-Eastern part of Ethiopia. Assela is the capital Town of Arsi Zone located at 175 km from Addis Ababa: Capital of Ethiopia. According to the 2007 national census report projection: Assela Town total population is estimated about 94:500 and Arsi Zone has 3.5 million as of CSA projection [12]. So: the hospital assumed serves more than 3.6 million population together with some of neighboring zones. The town has one public university:

one public referral hospital: two private general hospitals: two health centers and ten private clinics. Assela Hospital is one of the teaching hospitals in Ethiopia and it has different departments: gynecology and obstetrics: surgery: internal medicine: pediatrics and neonatal intensive care unit and ophthalmology. The hospital is the largest health facility in Arsi Zone, and it serves as a referral center from different facilities in the zone including six district hospitals. More than 5:000 deliveries conducted in the hospital annually. The current study conducted on newborn in Assela referral hospital during the study period.

Study design and period

A cross sectional case-control study design relating one case with two controls.

Source population is all neonates born in Arsi Zone during the study period.

Study population

All live newborns with gestational age of 36 or more weeks during the study period were screened for eligibility of the study. Birth asphyxia (cases): Newborn babies with apgar score <7 at first minute were defined as cases while newborns with apgar score of ≥ 7 at first minute were considered as controls. Though these cases were not found: the authors proposed to exclude newborn with one or more malformations and incapability with life: like cyanotic congenital heart defects and hydrops.

Inclusion

Neonates who born either by spontaneous vaginal delivery or by caesarian section in the hospital during the study period.

Exclusion criteria

Newborns whose mothers refused informed consent: Neonates with major congenital malformations such as cyanotic congenital heart disease: severe meningomyelocele: and anencephaly excluded from the study. Neonates who delivered on the way to hospital. Patients with neurologic defects explained by a condition other than perinatal asphyxia like electrolytic alteration: inborn error of metabolism: patients with syndromes (Down and hypotonic child). Neonates/mothers with incomplete study records excluded.

Sample size determination

Sample size of the study determined by using Epi-Info V. 7 based on the following parameters. The variable low birth weight (birth weight <2500gms) used and based on this: the proportion of controls with exposure =12.2% and odds ratio= 2.50 [13]: level of confidence = 95% and 80% power =80%. A ratio of 1:2 used between cases and controls. Finally: 10% added for non-response rate. The final sample size 115 cases and 231 controls while overall was 346.

Sampling procedure

Subjects divided into cases and controls. All neonates who were delivered with an APGAR score of <7 at first minute taken as

a case until the required sample size fulfilled and risk set sampling employed to select the controls. For each asphyxiated neonate two non-asphyxiated neonates who born after the case taken as a control i.e.: 115 neonates and 231 neonates required in the case and control group: respectively.

Operational Definition

APGAR score

It is an excellent tool for assessing the overall status of the newborn soon after birth (one minute) and after a brief period of observation (five minute). A normal apgar score is 7 and above at one minute. It consists of five signs: heart rate: respiratory effort: muscle tone: reflex irritability and color each evaluated out of two.

Premature rupture of membrane (PROM)

is defined as amniorrhexis prior to the onset of labor at any stage of gestation. It has been suggested that the term “preterm premature rupture of the membrane (PPRM) should be used to define those patients who are preterm with ruptured membranes whether or not they have contraction and is said prolonged if it was lasting >18hrs without starting of labor.

Chorioamnionitis

is an intra uterine infection involving mononuclear and polymorph nuclear leucocytic infiltration of the fetal membranes and amniotic fluid.

Oligo hydramnios

when volume of amniotic fluid is deficient: less than 100ml.

Poly hydramnios

it refers an excessive amount of amniotic fluid usually exceeding 2liters.

Data Collection Procedure

Data collected using interviewer administered: structured and pre-tested questionnaire for the mother and information extracting check list for baby document that developed by reviewing literatures in order to address the objective of the study. It had three parts: sociodemographic of the mother: intrapartum variable and neonatal variable. Data collection conducted by data collectors. Data collectors were revised the patient chart:

examine the newborn and interview the mother to fill the questionnaire and check list. A Medical doctor was a supervisor from gynecology department and 5 mid-wives were participated in the data collection process. Training given for data collectors and the supervisor for one day before starting data collection by the investigator. The questionnaire and check list pre-tested to identify potential problem of the questionnaires: unanticipated interpretation and cultural objections to any of the questions in 5% of the respondents having similar characteristics with the study subjects. Based on the pre-test results the questioner then adjusted contextually and terminologically: and distributed to data collectors. Counter checking of daily filled questionnaire and check list and regular supervision made by the supervisor.

Data Quality Assurance

The questionnaires and information extracting check list whose internal consistencies checked by previous researchers used after carefully adapted them into the current context and without changing the original meaning. The adapted questionnaire and check list pre-tested to identify potential problem: unanticipated interpretations and cultural doubts to any question in respondents having similar characteristics on five percent two weeks back of the main study. Originally the questionnaires and check list prepared in English and translated into Amharic and back to English by language experts to keep the consistency of the meanings. Questionnaire and check list checked thoroughly for completeness before distributing. The collected data checked daily by supervisor for its completeness. Finally: data checked for consistency and completeness before entry to computer software for analysis.

Data Processing and Analysis

The collected data checked for its completeness: consistency and accuracy using EPI info version 7 statistical software and then exported to SPSS version 22 for further analysis. The data presented by using descriptive and analytic statistics. All independent variables processed individually with the dependent variable using binary logistic regression model. Variables which had significant association during binary analysis entered in to multi variable logistic model and finally the variables which have significance of association declared on the basis of adjusted odds ratio at 95% confidence level and 0.05 % p-value.

Result

Table 1: Socio-Demographic Characteristics in Neonates' Mothers among the Study Population.

Socio-Demographic Characteristic		Cases		Controls	
		Frequency	Percent	Frequency	Percent
Maternal age (in years)	<19	7	6.1	4	1.7
	19 -35	91	79.1	209	90.5
	>35	17	14.8	18	7.8
Marital status	Single	10	8.7	24	10.4
	Married	105	91.3	207	89.6

Ethnicity	Oromo	92	80	137	59.3
	Amhara	18	15.7	60	26
	Other	5	4.3	34	14.7
Residence	Rural	74	64.3	100	43.3
	Urban	41	35.7	131	56.7
Maternal education	Can't read and write	20	17.4	34	14.7
	Primary education	17	14.4	25	10.8
	Secondary education	38	33	77	33.3
	High school	19	16.5	39	16.9
	Diploma and above	21	18.2	56	24.2
Paternal education	Can't read and write	7	6.1	18	7.8
	Primary education	12	10.4	17	7.4
	Secondary education	31	27	50	21.6
	High school	33	28.7	61	26.4
	Diploma	19	16.5	47	20.3
	Degree and above	13	11.3	38	16.5
Occupation	Housewife	82	71.3	125	54.1
	Health professional	4	3.5	15	6.5
	Merchant	9	7.8	43	18.6
	Teacher	14	12.2	29	12.6
	Other	6	5.2	19	8.2
Family income (in birr)	<500	62	53.9	93	40.3
	500 - 1500	14	12.2	34	14.7
	1501 - 3000	18	15.7	46	19.9
	3001 -4500	11	9.6	26	11.3
	>4501	10	8.7	32	13.9

During the study period: there were 115 newborns with neonatal apgar score <7 at first minute from 687 total live births during the study period and matched with 231 newborns with apgar score ≥7 at first minute as controls. The incidence rate of birth asphyxia obtained was 167/1000 live birth. Socio-demographic features in neonates' mothers among the study population: Majority of mothers of the case and control groups were in the age range of 19 to 35 years: 91(79.1%) and 209(90.5%) respectively. Age group <19 years and >35years comprises 7(6.1%) and 17(14.8%) for cases and 4(1.7%) and 18(7.8%) for controls. The mean maternal age in the case group and control group was 27.0±5.5 years and 26±4.4 years: respectively (Table 1).

Antenatal characteristics among the study population

Seven (6.1%) mothers of the case group and 3(1.3%) mothers of the control group were short stature. Ninety-seven (84.3%) mothers of the case group and 212(91.8%) mothers of the control group had ANC follow up: at least one visit. Fifty-eight (50.4%) mothers of the case group and 102(44.2%) mothers of the control group were nulliparous while 57(49.6%) mothers of the case group and 129(55.8%) mothers of the control group were multiparous. In the case group 95(82.6%) were singleton pregnancy and 20(17.4%) were multiple pregnancy while in the control group 217(93.9%) were single and 14(6.1%) were multiple pregnancy (Table 2).

Table 2: Antepartum Characteristics in the Study of Birth Asphyxia among the Study Population.

Antepartum Factors		Cases		Controls	
		Frequency	Percent	Frequency	Percent
Short maternal stature	Yes	7	6.1	3	1.3
	No	108	93.9	228	98.7
Taking Infertility treatment	Yes	8	7	11	4.8
	No	107	93	220	96.2
Have ANC follow up	Yes	97	84.3	212	91.8
	No	18	15.7	19	8.2

Number of visits	1visit	10	10.3	41	19.3
	2visits	26	26.8	58	27.4
	3visits	44	45.4	87	41
	4/above	17	17.5	26	12.3
Parity	One.	58	50.4	102	44.2
	>2	57	49.6	129	55.8
Birth space for multiparous	<2years	18	31.6	41	31.8
	≥2 years	39	68.4	88	68.2
Type of pregnancy	Single	95	82.6	217	93.9
	Multiple	20	17.4	14	6.1
Gestational DM	Yes	5	4.35	2	0.9
	No	110	95.65	229	99.1
Chronic HPN	Yes	4	3.5	2	0.9
	No	111	96.5	229	99.1
Preeclampsia	Yes	22	19.1	23	10
	No	93	80.9	208	90
Eclampsia	Yes	3	2.6	2	0.9
	No	112	97.4	229	99.1
Anemia	Yes	9	7.8	29	12.6
	No	106	92.2	202	87.4
APH	Yes	17	14.8	13	5.6
	No	98	85.2	219	94.4
Oligohydramnios	Yes	2	1.7	10	4.3
	No	113	98.3	221	95.7
Polyhydramnios	Yes	4	3.5	9	3.9
	No	111	96.6	222	96.1
Chorioamnionitis	Yes	16	13.9	13	5.6
	No	99	86.1	218	94.4

Intrapartum characteristics among study population

Onset of labor was spontaneous in majority of case and controls group 97(84.3%) and 188(81.4%) respectively. Majority of mothers of the case group 99(86.1%) had moderate to thick meconium stained amniotic fluid as compared to mothers of the

control group 3(1.3%) whereas majority of mothers of the control group had clear amniotic fluid color as compared to mothers of the study group: 193(83.5%) and 3(2.6%) respectively. Thirteen (11.3%) mothers in case group and 35(15.2%) mothers in control group had mild meconium stained amniotic fluid color (Table 3). Gp- general practitioner

Table 3: Intrapartum Characteristics in The Study of Birth Asphyxia among the Participants.

Intrapartum Factors		Cases		Controls	
		Frequency	Percent	Frequency	Percent
On set of labor induced/augmented labor not started	Spontaneous	97	84.3	188	81.4
	14	12.2	29	12.6	
	4	3.5	14	6.1	
Amniotic fluid color mild meconium stained moderate to thick meconium	Clear	3	2.6	193	83.5
	13	11.3	35	15.2	
	99	86.1	3	1.3	
Fetal presentation Breech	Cephalic	97	84.3	216	93.5
	18	15.7	15	6.5	

Did the mother suffer from the condition during labor?	CPD	Yes	6	5.2	3	1.3
		No	109	94.8	228	98.7
	PROM	Yes	22	19.1	21	9.1
		No	93	80.9	210	90.9
	Cord prolapsed	Yes	7	6.1	3	1.3
		No	108	93.9	228	98.7
Mode of delivery Assisted vaginal del. C/S delivery	SVD	58	50.4	182	78.8	
	22	19.1	19	8.2		
	35	30.4	30	13		
Type of anesthesia for c/s general anesthesia	spinal anesthesia	33	94.3	24	80	
	2	5.7	6	20		
Duration of labor not prolonged	Prolonged	96	83.5	15	6.5	
	19	16.5	216	93.5		
Mother sedation No	Yes	27	23.5	30	13	
	88	76.5	201	87		
Type of drug given for sedation MgSo4	Pethidine	8	29.6	8	26.7	
	19	70.4	22	73.3		
Delivery conducted by: Gp Gynecologist	Mid wife	52	45.2	173	74.9	
	33	28.7	32	13.9		
	30	26.1	26	11.3		

Neonatal risk factors

Table 4: Neonatal Risk Factors of Birth Asphyxia Among the Study Population.

Neonatal Factors		Cases		Controls	
		Percent	Frequency	Percent	Frequency
Gender of the newborn	Male	62	53.9	137	59.3
	Female	53	46.1	94	40.7
	Total	115	100	231	100
Gestational age	<37 weeks	16	13.9	5	2.2
	37 – 42 weeks	94	81.7	222	96.1
	>42weeks	5	4.3	4	1.7
	Total	115	100	231	100
IUGR	Yes	6	5.2	6	2.6
	No	109	94.8	225	97.4
	Total	115	100	231	100
Birth weight	<2500grs	30	26.1	17	7.4
	2500 -4000grs	81	70.4	210	90.9
	>4000grs	4	3.5	4	1.7
	Total	115	100	231	100
Baby cry at birth	Yes	5	4.3	208	90
	No	110	95.7	23	10
	Total	115	100	231	100
Need of assisted ventilation	Yes	110	95.7	3	1.3
	No	5	4.3	228	98.7
	Total	115	100	231	100

Mode of ventilation	Nasal catheter	17	15.5	2	66.4
	Bag and mask IPPV	93	84.5	1	33.3
	Total	115	100	3	100

Sixty-two (53.9%) neonates in the case and 137(59.3%) in control group were male and remaining were female. Majority of neonates of both case and control groups were within gestational age of 37 to 42 weeks: 94(81.7%) and 222(96.1%). The mean birth weight of the case group was 2977.39±609.15grams (range 1700 -5500grams) whereas the mean birth weight of the control group was 3216±455.68grams (range2100-5200 grams) (Table 4).

Multivariable analysis of perinatal risk factors of birth asphyxia

Multivariable analysis yielded neonates with rural residence: PROM: breech presentation: instrumental delivery: caesarean section: preterm: birth weight of < 2500 gram found more likely experience birth asphyxia (Table 5).

Table 5: Perinatal Determinants of Birth Asphyxia Multivariable Model with Selected Variables.

Variable	Cases (n=115)	Controls (n=231)	COR (95%CI)	AOR (95%CI)
	No (%)	No (%)		
Maternal Age (In Years)				
<19	7(6.1)	4(1.7)	4.02(1.15,14.07)	3.63(0.85,15.41)
19-35	91(79.1)	209(90.5)	1	1
>35	17(14.8)	18(7.8)	2.17(1.07,4.40)	2.14(0.92,4.99)
Residence: Rural	74(64.3)	100(43.3)	2.36(1.49,3.75)	2.57(1.51,4.38)
Urban	41(35.7)	131(56.7)	1	1
PROM: yes	22(19.1)	21(9.1)	2.37(1.24,4.51)	2.98(1.44,6.18)
No	93(80.9)	210(90.9)	1	1
Fetal Presentation:				
Cephalic	97(84.3)	216(93.5)	1	1
Breech	18(15.7)	15 (6.5)	2.67(1.29,5.52)	2.41(1.01,5.74)
Mode of delivery:				
SVD	58(50.4)	182(78.8)	1	1
I.D	22 (19.1)	19 (8.2)	3.63(1.84,7.18)	4.68(2.12,9.95)
C/S	35 (30.4)	30 (13.0)	3.66(2.07,6.48)	3.23(1.70,6.12)
Gestational Age:				
Preterm	16(13.9)	5(2.2)	7.56(2.69,21.23)	4.97(1.37,18.05)
Term	94(81.7)	222(96.10)	1	1
Postdate	5(4.30)	4(1.7)	2.95(0.78,11.24)	2.18(0.52,9.12)
Birth weight: <2500grs	30(26.1)	17(7.4)	4.58(2.39,8.74)	3.64(1.50,8.87)
2500-4000	81(74.3)	209(90.9)	1	1
>4000grs	4(3.5)	4(1.7)	2.59(0.63,10.61)	1.21(0.23,6.38)

Discussion

Perinatal asphyxia is a common and serious neonatal problem globally and significantly contributes to both neonatal morbidity and mortality [5] and incidence is very high in developing countries. In this study: a total of 687 newborns were involved. One hundred fifteen newborns (62 males and 53 females) with birth asphyxia matched with 231 (137 males and 94 females) newborns without the events as controls. From the current study: the incidence rate of birth asphyxia obtained was 167/1000 live births. Different studies revealed a range of prevalence for birth asphyxia in different areas. In Dilchora Hospital in Ethiopia

25/1000 live births [14]; Nigeria 301/1000 live births [15]; Nepal 26.9/1000 live births [16] and Zambia 230/1000 live births [17]. The current finding is more than that of Dilchora and Nepal while by far less than the findings from Nigeria and Zambia. This difference may occur due to differences in study measurements: study settings and study populations evidenced a need for further study to stabilize the cause. The current study report showed that the risk of newborns developing birth asphyxia was 2.57 times higher with confidence interval of (1.51:4.38) among neonates of rural mothers as compared to those came from urban mothers (Table 5). This could be explained: among others: by late arrival of the mother to hospital where cesarean section and instrumental

deliveries are conducted. Living in rural area in third world like Ethiopia is obviously exposing to poor antenatal care and referral services that might define the current finding. This study identified breech presentation as a significant risk of birth asphyxia (Table 5) with adjusted odds ratio (AOR) of 2.40 and confidence interval of (1.01: 5.74) when it is compared to neonates delivered by cephalic presentation. This was a complimentary result with previous studies in different study areas of Pakistan: Thai and India (13: 18: 19: 20). The assumption is that breech presentation has a high rate of umbilical cord prolapse head entrapment: birth trauma: prolonged labor and also increased perinatal mortality. Newborns from mothers who were suffering from Premature Rupture of Membrane (PROM) during the current delivery exhibit a 2.98 times higher risk of developing birth asphyxia with confidence interval of: (1.44:6.18): compared to the contrary (Table 5). PROM has also been severally reported previously as a significant risk factor for birth asphyxia [18-22]. This could be that prolonged rupture of membrane may be associated with intrauterine infection resulting in birth asphyxia. Mode of delivery in our study was found to be a risk factor for birth asphyxia as most of the mothers of the asphyxiated neonates came with complications requiring immediate intervention.

The occurrence of birth asphyxia was 3.23 times more likely among cesarean delivery when compared to SVD. This finding was in line with a similar study conducted in Turkey [23]. This could be explained by the fact that indications for the caesarean sections were mostly due to prolonged obstructed labor and non-reassuring fetal heartbeat. Instrumental delivery was major risk factor in our study. Neonates who were delivered by vacuum/forceps exhibit 4.68 times higher risk of developing birth asphyxia. Other hospital-based studies on risk factors of birth asphyxia also had reported similar finding [24]. The current study revealed that the risk of developing birth asphyxia was higher among preterm newborns as compared to term neonates: with AOR of 4.97. This was a complementary result with what was reported by other literatures which were conducted in Pakistan: Thailand and Nepal: [13,18,22]: respectively. Preterm babies have a variety of morbidities: largely due to organ system immaturity: especially lung maturation causing respiratory distress syndrome (RDS) in infants after birth. In the case of preterm labor: it is important to make a diagnosis and find the cause to provide appropriate management to prevent preterm delivery. Nevers less: in our study: no association has been detected between birth asphyxia and IUGR. This was supported by a study conducted in Thailand [18]. This study found birth asphyxia was 3.64 times higher among fetal birth weight less than 2:500 grams as compared to normal fetal birth weight (2500-4000grs). This result was similar to other studies which were conducted in Tigray of Ethiopia [25] Thailand and Pakistan [18-21]. It is beneficial here to note that low birth weight (LBW) infants are often related to maternal complications such as anemia: hypertension: and under nutrition that present preconception or antepartum. To decrease the risk of LBW: in the case of previously described maternal conditions: these pregnant

women should be advised to optimize their nutritional status and get treatment for anemia and hypertension during ANC follow up.

Conclusion

This study identified that significant perinatal risk factors include rural residence: breech presentation: PROM: instrumental delivery: C/S delivery: preterm delivery and low birth weight.

Recommendations

- a) Early identification of high-risk pregnancies is a top priority.
- b) Incapacitating professionals: establishing neonatal centers and equipping the facilities will decrease the incidence: morbidity and mortality associated with birth asphyxia of rural residents: preterm babies and of C/s and instrumental deliveries by providing optimum timely care.
- c) Further investigation needed under this topic to develop preventive strategies.
- d) Strengths of the study:
- e) The strength of our study lies in its design and extracted primary data. In this study: Apgar score and clinical signs used to diagnose birth asphyxia. Our Apgar score assigned correctly by the maternity staff: general practitioners and obstetricians present at deliveries.
- f) Limitations of the study:
- g) Biases might result because of case and control selection. Another limitation of this study was that the study conducted in one referral hospital of Assela where mostly patients belong to the low and low middle-class economy and data couldn't predict the overall situation in the country. The third limitation was Lack of national data and literatures on the topic area for comparison. The fourth limitation was short sample size of the study which may have limited our ability to detect small differences.

Declaration

Ethical approval and consent to participate

The Ethical Review Committee of Arsi University: College of Health Sciences approved the study protocol and the verbal consent for participants. Project approved on 26th of January 2017: Project protocol number A/CHS/RC-1/17 and protocol number of letter of recommendation to the institution A/U/H/S/C/120/61-1/17 Informed verbal consent was obtained from each participating woman after explaining to them all the purpose of the study. The right of the participants to withdraw from the interview at any step was assured. Any personal identifiers were differed during coding: identifiers of the study subjects were replaced with identification numbers.

Contribution of the Authors

BNA developed the study conception: design: proposal

development: data collection: analysis and manuscript writing. WLT and MST involved in designing: data analysis and manuscript writing. All the authors read and approved the final manuscript for publication.

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