

Prevalence of Birth Asphyxia and Associated Factors among Neonates Delivered in Dilchora Referral Hospital, in Dire Dawa, Eastern Ethiopia

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Abstract

Introduction: The greatest gap in new-born care is often during the critical first week of life when most neonatal and maternal deaths often occur at home and without any contact with the formal health sector. Some unacceptable practices such as unskilled attendants during delivery, unhygienic delivery practices, taboos and superstitions associated with caring for the new-born greatly affect new-born survival in Ethiopia.

The aim of this study is to identify the prevalence and associated factors of birth asphyxia among babies born in Dilchora referral hospital.

Methods and materials: Hospital based retrospective study design was used among babies born in Dilchora referral hospital of three years of study period from 1st July 2014 to 30th June 2017 and admitted to NICU with APGAR score <7 at 5th min. Data was collected by two data collectors by reviewing NICU registration book.

Result: Of 9738 babies born in the study period, 302 (3.1%) had birth asphyxia from our records; but only 246 (81.5%) case files with complete documentations were retrieved, giving a prevalence of 2.5% or 25/1000 live birth. Age ranges between 15 to 25 (AOR, 0.04; CI 0.03-0.07) and (AOR, 0.02; CI 0.050-0.091) Who were illiterate (AOR, 0.08; CI 0.035-0.049) and who were primary educational level (AOR, 0.04; CI 0.023-0.043) Born with vacuum delivery AOR, 0.042; CI 0.082-0.043) and Forceps delivery (AOR, 0.05; CI 0.06-0.09) duration of labour <18 h (AOR, 0.017; CI 0.012-0.9) were important determinant factors for birth asphyxia.

Conclusion and recommendation: Prevalence of birth asphyxia was almost close to the national prevalence 29/1000 live births. APGAR score at 5th min were 204 (82.9%) 4-6 and 42 (17.1%) 0-3 scores. Two hundred nineteen (89%) of babies were discharged; while 27 (11%) died. So higher official of regional health bureau and hospital administrators as well NGOs should have to act collaboratively in order to improve poor birth outcome.

Keywords: Birth; Neonatal asphyxia

Abbreviations AAP: American Academy of Paediatrics; ACOG: American College of Obstetricians and Gynaecologists; ANC: Ante Natal Care; APGAR: Appearance, Pulse Rate, Grimace, Activity, Respiration Rate; BA: Birth Asphyxia; DRH: Dilchora Referral Hospital; EDHS: Ethiopian Demographic Health Survey; FMOH: Federal Ministry Of Health; GA: Gestational Age; NICU: Neonatal Intensive Care Unit; WHO: World Health Organization; NMR: Neonatal Mortality Rate; IMR: Infant Mortality Rate; CMR: Child Mortality Rate

Introduction

World Health Organization defined birth asphyxia as “the failure to initiate and sustain breathing at birth [1-3]. The exact definition of birth asphyxia is given by the ACOG, AAP includes existence of 3 factors: Metabolic or mixed acidemia (pH<7) which is determined by umbilical cord arterial blood samples; APGAR score of <3 for longer than 5 min; neurological manifestations; and multisystem organ

dysfunction [4-6] this definition is designed for use in hospital-based settings which requires evaluation.

Worldwide Midwives uses APGAR score for describing the wellbeing of new-borns at birth [7]. Because it is a clinical indicator commonly used to describe the new-born's physical condition at birth. In many cases, the timing of asphyxia cannot be established with certainty [8] that is why the severity of asphyxia is widely assessed by the Apgar score, at 1 and 5 min after birth [9]. Commonly the first 1 min after birth which is the “golden minute” the baby should be breathing well [10]. The ACOG stated that a low APGAR score beyond 5 min is a suggestive criterion for an estimate of the severity of asphyxia [9,11].

The birth of a healthy new-born is one of the finest gifts of nature. The birth process takes only few hours but it is the most hazardous period of life since it is associated with the largest number of deaths as compared to any other phase of life [12]. If new-born is unable to breathe spontaneously at birth it results birth asphyxia [10] and causes a damaging condition of impaired blood gas exchange and if it persists leading to progressive hypoxemia, hypercapnia with significant

metabolic acidosis and tissue oxygen debt, which can cause serious multi organ failure and poor prognosis and high mortality stillbirth or lifelong disability in the surviving infant [13-19] commonly with a very high incidence of 25% irreversible neurologic damage [8,20-25] and 1.15 million develop clinical encephalopathy [26-28] such as cerebral palsy, mental retardation and epilepsy leading to detrimental long term consequences for both child and family [29,30]. Cognitive and behavioural difficulties [18,19] which leads to memory and attention deficit hyperactivity disorder (ADHD), autism and schizophrenia [31,32].

Globally birth asphyxia continues to present a major clinical problem [25,33,34] and one of the common and leading causes of perinatal and neonatal mortality and morbidity especially in developing countries [8,10,25,33,35-37]. Four million babies are born with asphyxia each year. According to statistics by WHO, in developing countries 3% of infants (3.6 million babies) suffer from moderate to severe asphyxia, of whom 23% (840,000) die which equates to nearly 1 million neonatal deaths per year [1,38] and in a countries with high neonatal mortality rates the death rate is 8 times that of countries with low NMRs and almost the same number suffer from the associated consequences [39,25].

The prevalence of birth asphyxia is increasing; in 1990s the incidence of asphyxia was reported as 5.4/1000 live births [40] while in the 2006 the ACOG reported 25-73/1000 live births [14] in developed countries an incidence of 1-6/1,000 live births, and birth asphyxia (23%) represents the third most common cause of neonatal death [41] and 5-10/1000 live births in developing countries with 24-29% of neonatal deaths [42,43] upto 99% of these deaths occurred in LMIC [22].

Africa accounts for 11% of the world's population but more than 25% of the world's new-born deaths. Of every 4 children who die in Africa, one is a newborn [44]. Due to this neonatal deaths have remained stagnant globally [25,45,46] In Ethiopia NMR accounts 29/1000 live birth. A large proportion of this death occurs during the first 48 h after delivery and still declined little [47].

Babies born in sub-Saharan Africa have a very high risk of birth asphyxia because 280,000 deaths occur due to birth asphyxia during first day of life [25,44,48,49]. Usually hospital data shows a very high percentage of deaths due to asphyxia since complicated births are more likely to come to hospital. Birth asphyxia is one among top three causes of new-born deaths next to infections and complications of preterm birth which together account for 88% of newborn deaths in Africa of which birth asphyxia accounts 24% [44] and 22% developed complication of asphyxia [50] and it is still the fifth largest cause of under-five mortality [51]. In Ethiopia BA accounting 23% of 29/1000 live birth neonates mortality [38].

A series of various maternal, obstetrical, and foetal factors cause hypoxia in the foetus and asphyxia in the new-born. Therefore, the risk factors are associated with decreased blood flow and oxygenation to the tissues [52,53]. So birth asphyxia can be caused by events that have their roots in 50% of cases primarily antepartum in origin, 40% cases intra-partum and remaining 10% of cases are postpartum periods or combinations thereof [3,33,41,54]. Lack of referrals and inadequate and inappropriate resuscitation measures and lack of modern obstetric care, and lack of therapeutic hypothermia lack of PICU nurses; lack of intensive care technologists; lack of basic paediatric critical care training for nurses to provide effective paediatric advanced life support; inadequate resuscitation efforts; paediatric nurses' inability

to recognize critically ill neonates; lack of modern or advanced equipment; and lack of transport services to facilitate movement of babies from peripheral hospitals to neonatal units will contribute to increased risks of neonatal asphyxia [33,55,56].

In most African countries including Ethiopia and in the study area there is lack of availability of prevalence of birth asphyxia and related study literatures. So the aim of this study is to fulfil this gap by assessing the prevalence of neonatal asphyxia and its associated factors among babies born in DRH.

Methods and Materials

The study was conducted in DRF which was established in 1952 in Dire-dawa city, 515 km east of capital city of Addis Ababa. It is the only referral hospital in the city administration that provided service approximately 11,229 inpatient and 118,886 outpatient attendees in 2016/2017 coming from catchment population of 500,000. The hospital has different departments those renders comprehensive health services by care providers from different department and professional levels. The maternity unit provides service for more than 3000 clients a year with a total of 28 beds, three labour couch, 18 midwives, 1 general practitioner, 3 obstetrics and gynaecologist. Two caesarean section tables with 7 nurses, 1 scrub nurse, 2 anaesthetists. Neonatal ICU has 12 beds, 3 incubators, 2 radiant warmers and staffs of 10 BSc nurses, 3 interns, and 2 senior paediatricians. The NICU offers diagnostic and treatment for approximately 1000 babies per year.

Study design and period

Facility based retrospective study design was conducted from July1/2014-June 30/2017 (N=9738).

Source population

All delivery records (babies delivered) used at Dilchora referral hospital from July1/2014-June.

Study population

All 246 delivery records with birth asphyxia.

Sampling technique and sample size

All 246 cases files with birth asphyxia were taken purposively since our source population and study population is the same.

Study subjects

Babies who were admitted into NICU with APGAR score <7 at 5th min.

APGAR score was one of the criteria used to define birth asphyxia in this study, due to unavailability of blood gas analysis in babies delivered in the hospital. It is moderate asphyxia if the 5 min APGAR score is 4-6, or required stimulation and oxygen administration before a cry. Severe asphyxia is when the score is 0-3.

Diagnostic criteria of birth asphyxia:

Gestational age greater than equal to 28 weeks.

Birth weight >1000 g.

Birth asphyxia: when babies are unable to breathe at birth or after birth by its own effort with APGAR score at 5th min <7.

Exclusion criteria: Data with incomplete documentation (which has no maternal or foetal measurement parameters properly).

Born in other health facility and admitted to NICU.

Presence of major congenital malformation (hydrops, NTD).

Maternal analgesia, prematurity and infection, (may cause depression of the Apgar score).

Metabolic disorders.

The records for patients with birth asphyxia were perused using a checklist which was adopted after reviewing different literatures which addresses the following aspects: socio-demographic data, maternal information (ANC visits, mode of delivery); neonatal information (gender birth weight and APGAR score).

Study protocol

APGAR scoring consists of five physical sign: colour, heart rate, reflex irritability, muscle tone, respiratory effort. In our study Birth asphyxia is define when babies are unable to breathe at 5th min after birth and APGAR score <7 at 5th min.

ANC follow up at least once in her last pregnancy, GA is based on LMP and fundal height measurement, Educational status which contains Illiterate (unable to read and write). Primary education, secondary education, higher education (college/university), previous delivery history like no abnormal labour and delivery history (normal labour).

Data collection method

The data was collected through record review using pre-tested structured check lists. Prior to analysis, data was cleaned, coded, checked for normality, completeness, and entered into SPSS version 16.0. Frequency, descriptive statistics was computed to determine the prevalence of birth asphyxia and socio-demographic as well obstetrics history. Bivariate and multiple logistic regression analysis were carried out to see significance of the associated factors at p value <0.05 at 95% CI.

Result

During the study period, a total of 9738 babies born and of which 302 (3.1%) babies were admitted to NICU with birth asphyxia as documented in our record book with APGAR score of <7 at 5th min. However, we were able to retrieve case files of 246 (81.5%) babies records had complete data, which gave us a prevalence of 2.5%.

Socio-demographic characteristics of the study participants

Of 246 (81.6%) babies the prevalence of birth asphyxia accounts 25/1000 live birth. The majority of mothers of asphyxiated babies 92 (37%) were age 21-25 years old (mean 2.54, SD 1.09). Maternal education statuses were 136 (55.3%) illiterate. Regarding the residence of mothers 135 (56.1%) were living in rural and 117 (47.6%) Muslim by religion and 164 (66.7%) were house wife (Table 1).

Obstetrics history of mothers

One hundred seventy seven (72%) had spontaneous vaginal delivered and 8 (3.9%) were delivered by C/S. 206 (83.6%) mothers gave birth between 6 to 18 h from the onset of labour and the remaining 40 (16%) delivered after 18 h.

Regarding membrane about 129 (52.4%) had rupture of member intra partum while the remaining 117 (47.6%) developed premature rapture of membrane. Regarding maternal antenatal follow-up 209 (85%) had follow-up at least once prior to delivery and about 24 (9.8%) of had hypertension history. Based on the previous obstetric history of mothers 12 (4.9%) had premature birth, 12 (4.9%) neonatal death, 11 (4.5%) intra uterine death, 20 (8.1%) abortion and 191 (77.6%) had normal labour and delivery history (Table 2).

Characteristics	n=246	%
Age		
15-20 years	40	16.3
21-25 years	92	37.4
26-30 years	69	28
31-35 years	39	12.2
36-40 years	15	6.1
Educational status		
Illiterate	136	55.3
Primary	64	26
Secondary	30	12.2
Higher educ.	16	6.5
Residence		
Rural	138	56.1
Urban	108	43.9
Religion		
Muslim	117	47.6
Orthodox	91	36.9
Protestant	21	8.5
Catholic	13	5.3
Others	4	1.7
Occupation status		
House wife	164	66.7
Private	40	16.3
Government	18	7.3
Other	24	9.8

Table 1: Socio-demographic characteristics of mother at Diredawa, Ethiopia 2017 (n=246).

Clinical picture of asphyxiated baby

APGAR score of the babies was 204 (82.9%) 4-6 had mild birth asphyxia while the remaining 42 (17.1%) 0-3 had severe birth asphyxia at fifth minutes. Two hundred nineteen (89%) of new-borns were resuscitated and discharged; while 27 new-borns died, giving a case fatality rate of 11%. Majority of them 200 (81.3%) were weighed between 2.5 to 3.9 kg. 153 (62.2%) of babies born were male (Table 3).

Characteristics	n=246	Present
Mode of delivery		
SVD	177	72
Vacuum delivery	19	7.7
Forceps delivery	8	3.9
C/S	42	17.1
Labour time		
<18 h	206	83.7
≥ 18 h	40	16.3
Rupture of membrane		
Premature rapture	117	47.6
Intra-partum rupture	129	52.4
Maternal illness		
Hypertension	24	9.8
Diabetes mellitus	6	2.4
No medical illness	206	83.7
Other	10	4.1
Previous delivery history		
Premature birth	12	4.9
Neonatal death	12	4.9
Intra uterine death	11	4.5
Abortion	20	8.1
No bad labour history	191	77.6
ANC follow up		
No	37	15
Yes	209	85
Gestational age		
37 weeks above	210	85.4
32-37 weeks	33	13.4
28-32 weeks	3	1.2

Table 2: Obstetrics history of mothers at Dilchora referral hospital Diredawa, Ethiopia 2017.

Discussion

In our study, the prevalence of birth asphyxia was 2.5 live births in past 3 years at DRH. This finding is lower than study done in Gusau Nigeria (21.1%) [51]. In Dar es Salaam Tanzania (21.1%) [33] Malawi (6.1%) [57]. In Cameroon (8.1%) but higher than study done in Iran (1%) [58]. This fluctuating incidence could be explained by the difference in the methodology used in different studies.

In our study 27 (11%) Neonates were died due to birth asphyxia after resuscitation which is similar with study done in six sub-Saharan Africa [59] but lower than study done in Tigray 31% [60] and in Jimma 23.2% [61] of Ethiopia and in Tanzania dar es salaam 62.5% [33] And in Nagaur, India (39%) [62] and 26% in Iran [57]. But higher than study done in IRAN (3.1%) [63]. In Gusau Nigeria (5.4%) in Cameroon 6.7% [63,64].

Characteristics	(n=246)	%
APGAR score		
0-3 scores	42	17.1
4-6 scores	204	82.9
Baby cried after resuscitation		
No	27	11
Yes	219	89
Birth weight of the newborn		
1000 to 1499 g	10	4.1
1500 to 2499 g	34	13.8
2500 to 3999 g	200	81.3
≥ 4000 g	2	8
Sex of the baby		
Male	153	62.2
Female	93	37.8

Table 3: Clinical picture of asphyxiated baby born in Dilchora referral hospital, Dire-dawa, Ethiopia 2017.

The possible explanations for this difference might be due to variation in study setup, health care providers believes, awareness of health, guideline on child birth and delivery, training, availability of modern tools [65,66].

In our study there was statistically significance association found between birth asphyxia and age of mother. Maternal age group 15-20 years were four times [AOR=0.04, 95% CI (0.03-0.07)] and age between 21-25 years old were two times AOR=0.02, 95% CI (0.050-0.091) to develop birth asphyxia when compared to age 26-30 years old.

This finding is consistent with study done in at a national hospital in Dar es Salaam, Tanzania. 27.5% of the birth asphyxiated babies' mother's age were younger than 24 years [33] and Montreal [3] Karachi, Pakistan [67] but inconsistent with studies done in Rural in Dhaka Medical College Hospital [42] and District Pakistan [68-71] Kenya in maternity ward kakamega county referral hospital [72].

The possible explanations for this possibly due to the pelvic disproportions of these young women make deliveries more difficult and prolonged.

Characteristics	n=246	COR at 95% CI	P	AOR at 95% CI	P
Age of mother					
15-20	40 (16.3%)	0.03 (0.01-0.09)*	0.01	0.04 (0.03-0.07)**	0.04*
21-25	92 (37.4%)	0.01 (0.040-0.071)*	0.03	0.02 (0.050-0.091)*	0.03*
26-30	69 (28.0%)	1.173 (0.223-6.177)	0.851	2.283 (0.323-5.265)	0.851
31-35	30 (12.2%)	0.359 (0.067-1.928)	0.232	0.448 (0.089-3.737)	0.232
≥ 36	15 (6.1%)	1		1	
Maternal educational status					
Illiterate	136 (55.3)	0.05 (0.024-0.037)*	0.09	0.08 (0.035-0.049)*	0.07
Primary	64 (26.0)	0.03 (0.063-0.24)*	0.043	0.04 (0.023-0.043)*	0.033
Secondary	30 (12.2)	0.068 (0.905-16.798)	3.9	0.077 (0.105-13.79)	3.9
Higher education	16 (6.5)	1		1	
Mode of deliver					
SVB	177 (72.0%)	1.236 (0.539-2.836)	0.617	2.325 (0.347-3.747)	0.017
Vacuum delivery	19 (7.7%)	0.023 (0.071-0.054)*	0.04	0.042 (0.082-0.043)*	0.03
Forceps delivery	8 (3.3%)	0.03 (0.04-0.09)*	0.02	0.05 (0.06-0.09)**	0.04
C/S	42 (17.1%)	1		1	
Duration of labour					
<18 h	206 (83.7%)	0.05 (0.212- 0.9)*	0.027	0.017 (0.012- 0.9)*	0.007
≥ 18 h	40 (16.3%)	1		1	
NB: These variables are from the total variables statistical significant while cross tabulation done (p<0.05) (Age of mother, Maternal educational status, Mode of deliver, Gestational age, Duration of labour)					

Table 4: Bivariate and multivariate logistic regression model showing predictors of birth asphyxia among babies born from June 1/2014-July 30/2017 at Dilchora referral hospital, Aug 1-Sep 30/2017.

In our study maternal education was one of the factors associated with birth asphyxia. Similar finding were observed in other studies

conducted in Tanzania, Mexico City, Southern Nepal and rural district Matiari, Pakistan [33,64-66]. But inconsistent with finding conducted in hospital based study in Bangladesh [42].

So being illiterate was significantly associated with increased risk of birth asphyxia. This finding is consistent with studies conducted in Tanzania, in rural Gana, Rural District Matiari, Pakistan, Sweden, Kenya in maternity ward kakamega county referral hospital [33,66-68,72].

This is may be due to women without formal education might find it difficult to benefit from reproductive health education. Maternal illiteracy is a very broad indicator of poor socio-economic conditions associated with consequent malnutrition, frequent pregnancies and also influences care seeking during antepartum period.

In our study mode of delivery is one of the factor that has significant association with birth asphyxia. Neonate who were delivered by vacuum four times AOR=0.042, 95% CI (0.082-0.043) and forceps delivery were five times develops birth asphyxia AOR=0.05, 95% CI (0.06-0.09) compared to caesarean section and spontaneous vaginal delivery. In our study 177 (72%) had spontaneous vaginal delivery (SVD) is higher than study done in Karachi Pakistan [69] and Yaoundé Cameroon [70]. Kenya in maternity ward Kakamega county referral hospital [72] (Table 4).

Duration of labour was statistically significant factors in our study. There was significant statistical association observed between mothers who spent less than 18 h in labour were 98% less likely to develop birth asphyxia than those spent longer than 18 h in labour [AOR (95% CI=0.017 (0.012-0.9))].

This result is similar with what has been observed in studies done in Cameroon urban health facility in Yaounde and centre of hospital universities of Yaoundé and Kenya in maternity ward kakamega county referral hospital [70-72].

Regarding mode of delivery it showed that babies born with vacuum delivery [AOR=0.042 (0.082-0.043)] four times and forceps delivery [AOR=0.05 (0.06-0.09)] five times more likely develops birth asphyxia than those born with C/S. This is different from study done in Karachi Pakistan [69].

In neonates lives maternal health is often believed as a vital aspect and influences health of neonate, this has positive effect on the prevalence of neonatal asphyxia. The finding of this study showed that 15% of mothers didn't have follow-up. This is quite less than with the finding obtained in Gusau, Nigeria (66.0%) [51] had no ANC follow up.

Conclusion

Based on the finding of the study we have made concluded that significant predictors birth asphyxia was age of mother, educational level, duration of labour, mode of delivery, and duration of labour. There was significant association (p<0.05) between birth asphyxia and associated factors.

Recommendations

Proper emphasis should be given for neonatal mortality by addressing and providing adequate information because prevalence of birth asphyxia was 25% in study area. This may increase mortality and morbidity rate of neonates. Indirectly also has effect on quality of care. So that the following recommendation will be forwarded to:

Health care providers to monitor mothers during labour closely with Partograph to minimize the effects of delayed labour.

Ministry of health and regional health bureau should have to focus on report but also to look the gaps of the health professionals in order to strengthen their knowledge and skill and attitude towards labouring mothers.

A quasi experimental study can be done to assess the knowledge of mothers regarding birth asphyxia.

This study can be elaborated by assessing knowledge, attitude and practice of clinicians about birth asphyxia.

Competing Interests

We declare that there are no conflicts of interest to disclose.

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