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CLINICAL PROFILE AND MANAGEMENT OUTCOME OF BIRTH ASPHYXIA AMONG NEONATES ADMITTED TO NEONATAL INTENSIVE CARE UNIT OF SELECTED PUBLIC HOSPITALS IN ADDIS ABABA, ETHIOPIA,2023.

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THESIS TO BE SUBMITTED TO ADDIS ABABA UNIVERSITY COLLEGE OF HEALTH SCIENCE DEPARTMENT OF EMERGENCY MEDICINE FOR A PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR MASTER'S DEGREE OF SCIENCE IN EMERGENCY MEDICINE AND CRITICAL CARE NURSING

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Declaration of the thesis

I, the undersigned, confirmed that this thesis was my original work and had never been presented or published in this or any other university or institution. It is presenting partial fulfillment for the degree of Master in Emergency Medicine and critical care nursing, therefore all source information applied for the study has been completely acknowledged.

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Date Signature

Approval of Advisors

This original thesis has been decided to submit with our initial approval as university Advisors for examination.

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List of Acronyms and Abbreviations

AAU----------Addis Ababa University

ANC----------Ante Natal Care

APGAR----------Appearance, Pulse, Grimace, Activity, Respiration

APH----------Antepartum Hemorrhage

CNS –----------Central Nervous System

DM----------Diabetes Mellitus

DORB----------Discharged on Risk Bond

EDHS----------Ethiopian Demographic and Health Survey

ETB----------Ethiopian Birr

HIE----------Hypoxic Ischemic Encephalopathy

LAMA----------Left Against Medical Advice

LBW----------Low Birth Weight

NGMC----------Nepalgunj Medical College

NICU----------Neonatal Intensive Care Unit

PROM----------Premature Rupture of Membrane

SVD----------Spontaneous Vaginal Delivery

TASH ----------Tikur Anbessa Specialized Hospital

UNICEF----------United Nations Children's Fund

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Abstract

Background: Birth asphyxia is one of the leading causes of neonatal morbidity and mortality in developing countries. It is a condition that continues to concern physicians, patients, and attorneys. It accounts for more than 80% of neonatal deaths, along with prematurity and neonatal sepsis. It is defined as a lack of oxygen around the time of birth that can be caused by several perinatal events. This medical condition affects approximately four million neonates worldwide each year, killing one million of them. Most infants recover successfully from hypoxia episodes; however, some patients may develop Hypoxic Ischemic Encephalopathy, resulting in permanent neurological impairment of various organs and systems.

Objective: To assess the clinical profile and outcome of birth asphyxia among neonates admitted to the neonatal intensive care unit at a selected governmental hospital in Addis Ababa, Ethiopia. 2023.

Method: A facility-based retrospective study was conducted. The data was collected by using a structured checklist from delivery records of selected governmental hospitals and then checked, coded, and entered into Epi Data Software version 4.6 before being exported and analyzed by SPSS version 26 software. Categorical data were summarized using frequency and percentages. A continuous variable was explained by using the mean, and standard deviation. Binary and multivariate logistic regression was used. The results were presented using tables, figures.

Result: A total of 256 documents were reviewed. 7 (0.3%) documents were incomplete. The majority of maternal age was between the age groups of 15–25 accounting for 1166 (45.3%) and the residency of 180 (70.3%) were in Addis Ababa. The majority of neonates, 194 (75.8%), have normal birth weight (2500–3999 g); 103 (40.2%) of neonates developed stage I HIE; 105 (41.0%) developed stage II HIE; and the rest developed stage III HIE. The mortality rate of the neonate admitted to the neonatal intensive care unit with birth asphyxia was 23%. Associated factors related to neonatal mortality at $p < 0.05$ were HIE stage II AOR 4.09 (95% CI, 1.49, 14.61), HIE stage III 22.05 (95% CI, 5.35, 90.82), neonates with low birth weight (500–2499 g) 4.58 (95% CI = 1.83–11.50), and neonates who need CPAP 4.63 (95% CI = 2.02, 10.60).

Conclusion: This study showed higher mortality of birth asphyxia. The mortality of the newborn admitted to the neonatal intensive care unit a has significant association with HIE II, HIE grade III, low birth weight, and the neonate required CPAP.

Keywords: birth asphyxia, clinical profile, neonatal intensive care unit, outcome

1. Introduction

1.1. Background

Perinatal asphyxia is a major cause of infant morbidity and mortality throughout the world. The inability of the newborn to establish and sustain adequate respiration after delivery is known as perinatal asphyxia. The newborn cannot initiate and sustain adequate respiration following complete separation from the mother at delivery (1).

Perinatal asphyxia occurs during the first and second stages of labor and is characterized by poor gas exchange, which results in fetal hypoxemia and hypercarbia. To diagnose the condition, the level of acidity in umbilical arterial blood was measured (2). Although some conditions such as fetal distress and preterm childbirth, can predict birth asphyxia, the vast majority of cases cannot. So that every newborn should be considered at risk of asphyxia. Any infant can develop neonatal asphyxia without any warning signs during labor (3).

The classification of birth asphyxia is based on the APGAR grading performed by the professionals in the delivery room, initially at one minute and then at five minutes following delivery. It is classified as mild if the APGAR score at one minute is greater than 7, moderate if it is between 4 and 6, and severe if it is between 3 and 4 (4). It can cause major systemic and cerebral problems. When the placental or pulmonary gas exchange is impaired, the muscles, liver heart, and ultimately the brain are deprived of oxygen, and as a result, the tissues are injured (5).

Worldwide, neonatal mortality accounts for 44%of all under-five fatalities (6). A World Health Organization (WHO) report showed that there is a higher mortality rate of the neonate (42% in developing countries like Africa when compared to developed nations for under-5 fatalities), and among those, perinatal asphyxia is the third most common cause of under-five child mortality (11%), after preterm delivery (17%) and pneumonia15% (7).

However, in 2015, birth asphyxia (31.6%), prematurity (21.8%), and infection were the main causes of mortality in Ethiopia (18.5%) (8). Its long-term effects have raised the chance of neurological damage, the onset of severe mental or physical retardation in preschoolers, and the development of cardiovascular diseases in adults (6).

The hospital's neonatal intensive care unit (NICU) is anticipated to offer a range of services, such as the resuscitation of suffocating infants, treatment of unwell newborns, treatment of

hypothermia and hypoglycemia, post-natal care, follow-up of high-risk babies, referral, and immunization services. These NICUs have highly trained NICU staff and life-saving equipment such as radiant heaters, phototherapy devices, oxygen concentrators, pulse oximeters, and IV infusion pumps. These sophisticated neonatal intensive care units may alleviate neonatal deaths from birth asphyxia (7,9).

1.2. Statement of the Problem

Currently, an estimated 2.6 million newborns die each year worldwide (19 per 1000 live births), with large global disparities: from 3 per 1000 live births in Northern America and Europe to the highest rates in Central and Southern Asia (27 per 1000 live births) and Sub-Saharan Africa (28 per 1000 live births) (10). From the causes of neonatal mortality, birth asphyxia is one of the leading ones, alongside prematurity and severe infections. The number of deaths from birth asphyxia is much higher in low-and middle-income countries than in high-income countries (25 percent vs.7 percent). With 50.2 million disability-adjusted life years, birth asphyxia has a large global disease burden. In low- and middle-income countries, an estimated 50% of birth asphyxia survivors have neurodevelopmental impairments, resulting in lower school learning potential and economic productivity (9).

It is a severe clinical issue around the world and a neonatal emergency. Because full recovery may not be possible and many children are left with life-long neurological impairment, the ensuing encephalopathy is linked to a high risk of neurodevelopmental impairments in survivors, including cerebral palsy, functional disability, and cognitive impairment later in childhood (10). These conditions place a heavy emotional, psychological, and financial burden on the tient's family, the community, and the economy.

Neonatal mortality in Ethiopia has only decreased by 39% from 68 per 1,000 live births in 1990 to 29 per 1,000 live births in 2012 (11); however, in 2015, it was the leading cause of neonatal death at 31.6%, followed by prematurity at 21.8% and sepsis at 18.5 % (12). According to the Ethiopian Demographic and Health Survey (EDHS), 37/1000 live births result in death, with the leading reasons being prematurity (17%), asphyxia (25%), infection (37%), tetanus (7%), diarrhea (3%), congenital abnormalities (4%), and others (7%) (13).

One of the main causes of neonatal death in the Jimma Zone is birth asphyxia (47.5%), which is followed by neonatal infections (34.3%) and preterm birth (11%). These were the three leading causes of neonatal death, accounting for 93% of the total (14).

The commonly known clinical profile of birth asphyxia is different across regions. Early recognition of the clinical profile of birth asphyxia is important for the positive outcome and improvement of neonatal quality of life. Although several government initiatives have been made to avoid birth asphyxia by offering every woman in the community high-quality perinatal, intranasal, and postnatal care, birth asphyxia remains a significant issue in Ethiopia, with limited information on the clinical profile and outcome. It is necessary to determine the factor that is associated with the outcome of birth asphyxia. There are limited studies regarding the problems in the country, including in the study area. Therefore, this study is aimed at coming up with solutions for a better clinical profile and management outcomes of birth asphyxia for neonates admitted to the NICU of selected public hospitals in AA, Ethiopia.

1.3. Significance of Study

There are data regarding the negative impact of birth asphyxia. Because of the different factors that affect the normal labor process and maternal complications during pregnancy. The prevalence of birth asphyxia is high. There is adequate data on the clinical profile and birth outcome of birth asphyxia in the study area and country in general. As a result, the findings of this study may have some significance for

For policymakers and managers of health institutions, it will provide information that can help them understand the depth of the problem and give emphasis to an appropriate plan and focus to increase the survival rate of the neonate. For healthcare providers, this study will help them broaden the evidence regarding the biophysical profile and outcomes of the neonate and expedite necessary interventions. The results of this study will help decision-makers develop hospital guidelines for identifying and treating newborns who have suffered from birth asphyxia. The study's findings will also serve as the starting point for subsequent studies that are related to it and will provide baseline data on the clinical profile and outcome of patients today. This will have an impact on improving the survival rate of neonates.

2. Literature review

2.1. Clinical Profile of Neonates

Different studies were conducted across the world and in some parts of Africa about birth asphyxia. The clinical profile of a neonate includes sex, gestational age, mode of delivery, birth weight, and others. Regarding sex, studies showed different proportions of males and females. The study conducted about the clinical profile and outcome of neonates from a tertiary care hospital in western India showed an equal ratio of male and female neonates (15). Similarly, a study conducted in general hospitals in Tigray shows (50.4%) males and (49.6%) females (16).

Gestational age was one of the determinants of the clinical profile for neonates. The study conducted in a public hospital in the Gamo and Gofa zones, south Ethiopia, showed that there were 89 neonates admitted to the NICU with birth asphyxia, of whom 21 (23.6%) were preterm, 62 (69.66%) were term, and the remaining 6 (6.74%) were post-term neonates (17). A similar study conducted in Enugu, south-east Nigeria, showed that the majority were (58%) term and (34.7%) preterm and developed birth asphyxia (18).

About mode of the delivery, there were a variety of findings in different studies. The study, conducted at the Lumbini Medical College Teaching Hospital, found that 82 (19.3%) neonates admitted to the NICU had perinatal asphyxia, with 65.85%, 23.17%, and 10.97% delivered via normal vaginal delivery, cesarean section, and instrumental delivery, respectively (19). Similarly, in a tertiary care hospital in central Nepal, 64.8% of newborns were delivered by spontaneous vaginal delivery (SVD), 22.4% underwent a cesarean section, and 12.8% were assisted in delivery (20); another study from Nepal found that 9.3% of perinatally asphyxiated neonates from all NICU admissions, were SDV, 39.4% received CS, and 4.7% received instruments (21). Similarly, the study conducted in Dhulikhal Hospital shows that spontaneous vaginal deliveries (51.96%), cesarean sections (39.21%), and instrumental deliveries (8.82%) were among those asphyxiated neonates (22).

According to a study done at a tertiary academic hospital in Enugu, south-eastern Nigeria, 30.66% of low birth weight (LBW) babies were under 2500g, 64.66% of babies were normal weight, weighing between 2500 and 4000g, and 4.66% were macrocosmic, weighing more than 4000g (23). A cross-sectional study in a public hospital in the north Gondar zone of north-west

Ethiopia showed that 27.1% of neonates developed perinatal asphyxia (PNA), of which 43.56% were babies with low birth weight (LBW), 73.83% were normal-weight babies, and 12.61% were macrosomic babies (24).

Meconium aspiration was one of the major risk factors for the development of birth asphyxia. According to the study, in Tigray, Ethiopia, meconium aspiration found a 55% significant association (16); Similarly, the study done at the University of Gondar Referral Hospital in north Ethiopia and southern Kerala shows that meconium-stained amniotic fluid contributes 35–44% to the development of asphyxia (25,26).

2.2. Maternal factors associated with birth asphyxia

Maternal factors are a common reason for birth asphyxia. According to a study conducted in Dhulikhal Hospital (22), Rawalpindi Hospital (27), and Debre Markos comprehensive specialized hospital in Ethiopia (28), the largest number of babies affected by birth asphyxia belonged to mothers of 18–35 years (78.43%), 51.9%, and 71.8%, respectively. On the other hand, a study was done on the risk factor and short-term outcome of birth asphyxiated babies in the Dhaka Medical College Hospital and the magnitude of birth asphyxia and its associated factors at the Wolayita Sodo University Referral Hospital revealed that age did not show any association with birth asphyxia (16,21).

Parity also affects the outcome of birth asphyxia. The study conducted at Risk Factors Short-Term Outcome of Birth asphyxiated Babies in Dhaka College Hospital Parity shows that 57% of the asphyxiated babies were born to primiparous mothers and 43% were multiparous (29). The other study that was done in the University of Gondar referral hospital, northwest Ethiopia, shows that 45.6%, 22.2%, and 32.2% of the asphyxiated neonates were born to primate, multipara, and grand multipara mothers, respectively (25).

Regarding maternal educational status, there were different results in a variety of studies. According to a study in Enugu, Nigeria, 51.3% of the mothers of these babies had secondary school education, 37.3% had tertiary education, and 11.3 percent had no formal education. Those asphyxiated babies whose mothers had no formal or primary education had about a 20% chance of survival, while those whose mothers had secondary education had about an 80% chance of survival compared to those whose mothers had tertiary education (23). In a case-control study in

Gondar, northwest Ethiopia, the percentages of women with no formal education, primary education, and secondary education are 38.9%, 26.7%, and 34.4%, respectively (25). The prevalence of recurrent pregnancies, subsequent malnutrition, and care-seeking during the antepartum period are all linked to maternal illiteracy, which is a fairly broad indicator of poor socioeconomic situations (30).

Maternal antenatal care follow-up was one of the factors associated with birth asphyxia. According to a study at Dhulikhal Hospital, out of all admissions neonates that developed asphyxia account for 14% for f cases, among them 15.68% of mothers received no antenatal care, 60.70% received regular antenatal care (ANC) at Dhulikhal Hospital, and 23.52 percent received antenatal care (ANC) at a health post (22).

Regarding prolonged labor as a risk factor for birth asphyxia, there were different findings. According to the study of Jimma, Ethiopia, a mother who had prolonged labor has a significant contribution of 18.8% for the development of birth asphyxia (31). Similarly, the clinical profile and short-term outcome of perinatally asphyxiated term neonates in a tertiary hospital in southern Kerala Prolonged, difficult labor was seen in 23.3% (26). The study in Wolayita Sodo, Southern Ethiopia, found that there was a significant association between prolonged rupture and birth asphyxia development (85.5%) (32).

Maternal medical and obstetric conditions also had their contributions to the development of birth asphyxia. A Study done on the risk factor for birth asphyxia showed that among 123 PNA neonates, their mother suffered from those medical conditions: maternal hypertension (11.4%), gestational diabetes (6.5%), anemia (48%), antepartum hemorrhage (APH) (3.3%), pre-eclampsia (5.7%), diabetes mellitus (4.1%), and placenta previa (4.9%) (33).

similarly, a study on the prevalence of birth asphyxia and associated factors among neonates delivered in a Dilchora referral hospital in Dire Dawa showed that out of 246 PNA neonates, 24 (9.8%) were associated with maternal hypertension,6 (2.4%) were associated with diabetes mellitus (DM),206 (83.7%) had no medical illness and other were (4.1%) (34).

2.3. The Outcome of asphyxiated neonates

Different findings were observed as an outcome of birth asphyxia in different studies. The study conducted in Nepal showed that 57.3% developed hypoxic ischemic encephalopathy (HIE), of

which 24.4% developed HIE I, 23.17% developed HIE II, and the remaining 9.75% developed HIE III (20). Another study done at a tertiary hospital in southern Kerala revealed that 78.3% of babies developed HIE. Of these, 31.6% developed hypoxic ischemic HIE 3, HIE 2, 27.5%, and HIE 1, 19.3% (26)

Regarding the outcome of neonates treated for birth asphyxia, a variety of findings were seen in different studies. According to a study conducted in Enugu, Nigeria, 72.7% of neonates with moderate and severe asphyxia survived, while 27.3% of neonates with moderate and 50.7% of severe asphyxia died (23). Similarly, in a study conducted at Dhaka Medical College Hospital on the Risk Factors and Short-Term Outcome of Birth Asphyxiated Babies, the death rate in asphyxiated babies is 16%. Forty percent of patients were discharged with no visible sequelae. 28% were discharged with neurological sequelae, and the death rate for those discharged on risk bond (DORB) was 16% (29). According to a study on the clinical profile and outcome of neonates admitted to the Neonatal Intensive Care Unit of Nepalgunj Medical College (NGMC), 76% of neonates improved after treatment, 7.4% died, 7wereing discharged on request, 6.8% left against medical advice (LAMA), and 2.8% were referred to a higher center (35).

2.4. Conceptual Framework

This conceptual framework was developed after reviewing different related literature (23,26). The dependent variable (outcome of birth asphyxia) and the independent variables (maternal sociodemographic factors, neonatal factors, and obstetric factors) were directly related (correlated).

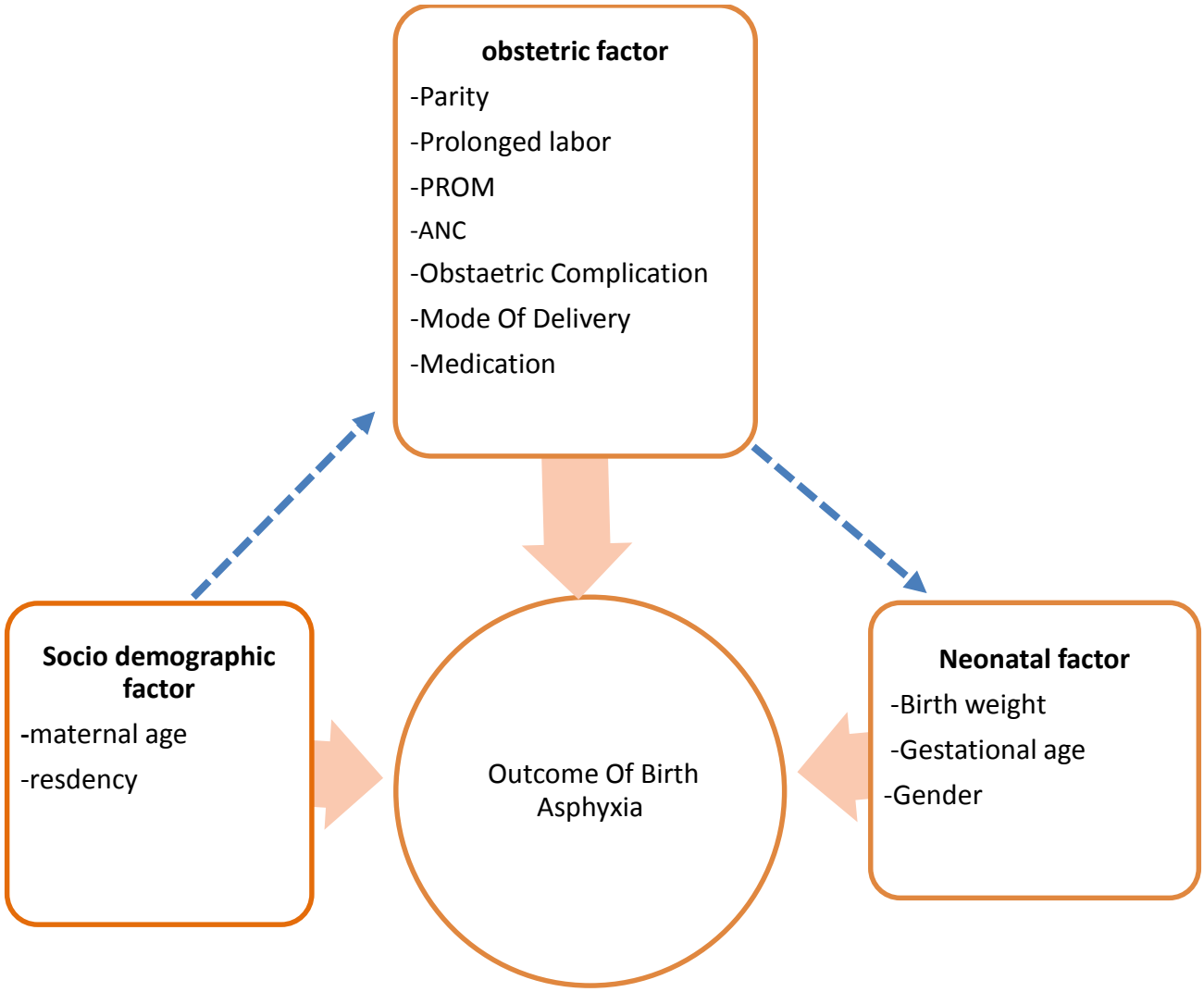


Figure 1. Conceptual Framework depicting the association between outcomes the birth asphyxia and associated factors in selected public hospitals of Addis Ababa Town

3. Objective

3.1. General Objective

- To assess the clinical profile and outcome of birth asphyxia among the neonates admitted to the NICU at a selected governmental hospital in Addis Ababa, Ethiopia,2023.

3.2. Specific Objectives

- ❖ To assess the clinical profile of birth asphyxia among neonates admitted to the NICU of selected public hospitals in AA, Ethiopia, 2023.
- ❖ To assess the management outcome of neonates admitted to the NICU with birth asphyxia at a selected governmental hospital in Addis Ababa, Ethiopia, in 2023.
- ❖ To determine the association with the outcome of birth asphyxia at selected governmental hospitals in Addis Ababa, Ethiopia, in 2023

4. Methodology

4.1. Study area and study period

The study was carried out in Addis Ababa's selected public hospitals. Addis Ababa is the capital city of Ethiopia. The city is situated in the geographic middle of the nation and contains eleven sub-cities. According to the national census, Addis Ababa's yearly population growth rate was 2.1% between 1994 and 2007, with a total estimated population size of 4,005,597, of which 52% were women. There are 947,855 women in the reproductive age group in the entire population(36).

Addis Ababa city has 13 public hospitals distributed throughout 11 sub-cities. Of those, 11 have a neonatal intensive care unit. From there, Tikur Anbessa Specialized Hospital (TASH), Gandhi Hospital, Tirunesh Beijing general hospital, and Alert Hospital were selected by lottery method. On the selected, the study was carried out from March 15 to April 15, 2023.

4.2. Study Design

- A facility-based retrospective study design was conducted for neonates admitted from January 1, 2022- December 30, 2022.

4.3. Source population

- All neonates who were diagnosed and treated for perinatal asphyxia in selected public hospitals from January 1, 2022, to December 30, 2022.

4.4. Study population

- Sampled neonates who were diagnosed and treated for perinatal asphyxia.

4.5. Inclusion and exclusion criteria

4.5.1. Inclusion Criteria

- Neonates who were admitted to NICU with an APGAR score less than 7 in the 5^{th} min.

4.5.2. Exclusion Criteria

- Data with incomplete documentation
- Missed charts
- Neonates referred out

4.6. Sample size determination and Sampling Procedure

4.6.1. Sample Size Determination

The sample size was calculated by using the following single population proportion formula:

$$n = \frac{\left(Z\frac{\alpha}{2}\right)^2 P(1-P)}{d^2}$$

Where, $Z\frac{\alpha}{2}$ =1.96, the confidence limit of the study (95%), p is the proportion of the study population (19.3%) (37) d is the margin of error or desired precision (5% or 0.05), and n is the total sample size.

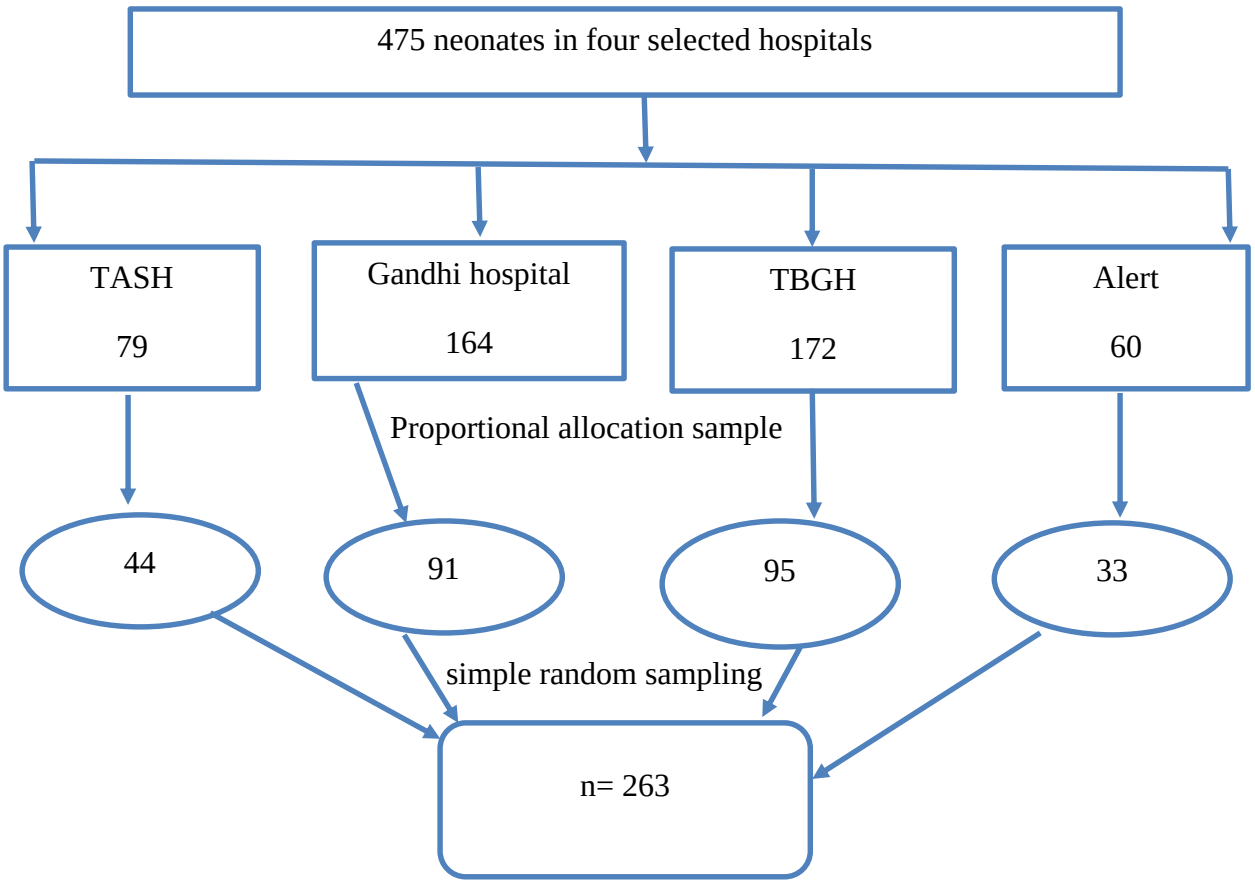
Let us take p = 19.3% which is the Magnitude of Birth Asphyxia and Associated Factors among Newborns Admitted in Neonatal Intensive Care Units at Government Hospitals in Addis Ababa

$$n = \frac{(1.96)^2 0.193(1-0.193)}{0.05^2} = 239.33 \approx 239$$

Hence, the final sample size will be 263 after adding 10% incomplete documentation.

4.6.2. Sampling Procedure

There are 13 public hospitals in Addis Ababa; from those, four were selected by lottery method. After checking the total patient from the neonatal intensive care unit (NICU) log book from each hospital, the proportional allocation was calculated. Finally, study participants from each hospital will be picked by using systematic random sampling. For each hospital, the proportionate number of study subjects was determined by using **n=nf/N*ni** where, **nf**= total sample size **N**= total number of asphyxiated neonates in selected hospitals, **ni**=number of asphyxiated neonates in each hospital.



Note: *TASH: Tikur Anbessa Specialized Hospital; TBGH: Tirunesh Beijing General Hospital*

Figure 2: the proportional allocation of study participants from selected hospitals in Addis Ababa City

4.7. Study Variables

4.7.1. Dependent Variables

- Survival
- Death

4.7.2. Independent Variables

Maternal socio-demographic factors (age, residence,)

Fetal factors (Gender, gestational age, birth weight,)

Obstetrics factors (mode of delivery, obstetrics complications, ANC follow-up,)

4.8. Operational Definition

Birth asphyxia: A newborn with poor breathing (less than 30 breaths per minute). Gasping or failing to breathe at all (38).

APGAR scoring: consists of five physical signs: color, heart rate, reflex irritability, muscle tone, And respiratory effort. In our study Birth asphyxia is defined as when babies are unable to breathe at 5th min after birth and APGAR score at 5th min (6,38)

Classification of asphyxia: is defined as the categorization of asphyxia based on the APGAR scoring performed by the clinician in the delivery room, initially at one minute and subsequently at five minutes after birth(7).

Mild birth asphyxia: was defined as an APGAR score greater than 7 at one minute(7).

Moderate birth asphyxia: was defined as an APGAR score of 4-6 indicates moderate asphyxia (7).

Severe birth asphyxia: was defined as an APGAR score of 3 or lower indicating severe birth asphyxia (7).

Hypoxic ischemic encephalopathy (HIE): was defined as an aberrant neurological condition caused by severe central nervous system (CNS) damage, which happens in a series of events, suffocation being one of them in a newborn(39,40).

It was classified based on the involvement of multiple organs as

Stage I HIE: was defined as neuromuscular control (muscle tone normal, posture mild distal flexion, stretch overactive) complex reflex (suck weak, Moro strong, oculovestibular normal, tonic neck slight)(39,40)

Stage II HIE: was defined as neuromuscular control (muscle tone mild hypotonia, posture strong distal flexion, stretch overactive) complex reflex (suck weak, Moro Weak, oculovestibular overactive, tonic neck strong)(39,40)

Stage III HIE: was defined as neuromuscular control (muscle tone flaccid, posture stretch Intermittent decerebration) complex reflex (suck absent Moro absent, oculovestibular weak tonic neck absent)(39,40)

4.9. Data Collections Tool

The data was collected using a structured checklist from record reviews. It was developed by the principal investigator after a thorough review of different literature (23, 26). It is prepared in English, and data was collected from each selected hospital. The tool consists of three parts: the first part is socio-demographic characteristics of the mother (like age, residence, etc.); the second section of the checklist contains obstetric factors (like mode of delivery, obstetric complications, ANC follow-up, PROM); and the third part is neonatal factors that affect the outcome of birth asphyxia (like gender, gestational age, weight).

4.10. Data Collection Procedure

Data collection was carried out by three BSc in Midwifery graduates who are not working in those selected hospitals. The document was retrieved from the card rooms of the hospitals, and then the identity and other information were checked before starting to fill out the checklist. The selected documents were then taken to a private room, where the information was kept. Finally, data collection was carried out after reviewing the documents.

4.11. Data quality

To maintain the quality of the data, data collectors were trained for two days on methodology, the aim of the research, and data collection procedures. Data quality was ensured by applying a pre-test to 5% of the sample outside of the study area before the two-week data collection period. Every day, the collected data were checked for completeness and validity. Overnight, issues were discussed with data collectors. Uncompleted checklist items were omitted before data entry. The data were cleaned daily and supervised by the supervisor and principal investigator.

4.12. Data Analysis

The data were checked, coded, and entered into Epi Data Software version 4.6 before being exported and analyzed by SPSS version 26 software. Categorical data were summarized using frequency and percentage. Continuous variables were explained using the mean, standard deviation, and interquartile range. To explain the strength of the association between dependent and independent variables, a binary regression was used. The variables with a p-value less than 0.25 in bivariate analysis were taken to multivariate analysis to control confounding factors. In multivariate analysis, a p-value less than 0.05 was declared a significant association with

adjusted odds and a 95% confidence interval. Finally, the results were presented using tables, figures, graphs, and narration.

4.13. Ethical consideration

Permission to carry out the study was obtained from the AAU College of Health Science, Department of Emergency Medicine. After receiving the letter, permission was sought from the medical directors of those selected hospitals. The confidentiality of the information was maintained by not exposing it to anyone except the data collectors.

4.14. Dissemination of the result

The findings of this study will be presented to AAU, the College of Health Sciences, and the Department of Emergency Medicine. The document will be shared with the Federal Minister of Health, Tikur Anbessa Specialized Hospital (TASH), Gandhi Memorial Hospital, and Alert Hospital. The manuscript will also be presented at workshops and other seminars before being submitted for publication in a relevant scientific journal.

5. Result

5.1. Sociodemographic characteristics

Of a total of 263 sampled neonates admitted with a problem of birth asphyxia in the NICU of the selected hospital, 256 were studied, with a chart retrieval rate of 97%. The majority of maternal age was between the age groups of 15–25, 116 (45.3%), with a mean age of 26.12 (SD±4.3). The majority of maternal residency 180 (70.3%) were in Addis Ababa. Mothers who developed medical complications during pregnancy were 25 (9.8%) of the total. (Table 1)

Table 1: socio-demographic characteristics of the neonate admitted with a diagnosis of birth asphyxia study participants Addis Ababa Public Hospitals, 2023

Variables	Response	Frequency	Percent
Age group	16-25	116	45.3%
	26-30	1 13	44.1%
	≥31	27	10.5%
Residence	Addis Ababa	180	70.3%
	Outside Addis Ababa	76	29.7%
A maternal medical condition during pregnancy	Yes	231	90.2%
	No	25	9.8%

5.2.Obstetrics Factors

Two hundred eleven (82.4%) of mothers had ANC follow-up; and 124 (48.4%), were null Para. Regarding the duration of ROM, the majority of 226 (88.3%) ruptured less than eighteen hours; 76 (29.7%) mothers were in prolonged labor. In terms of mode of delivery, 138 (53.9%) were delivered through SVD, while 97 (37.3%) were delivered via C/S, and the rest were delivered instrumentally. (Table 2)

Table 2: Obstetric characteristics of women who deliver birth asphyxiated babies in selected hospitals of Addis Ababa City, 2023.

	Response	Frequency	Percent
ANC	No	45	17.6%
	Yes	211	82.4%
Parity	Nullipara	124	48.4%
	Primipara	88	34.4%
	Multipara	44	17.2%
ROM	<18 hours	226	88.3%
	≥ 18 hours	30	11.7%
Prolonged labor	No	179	69.9%
	Yes	76	29.7%
Mode of delivery	C/S	97	37.9%
	Instrumental	21	8.2%
	SVD	138	53.9%

5.3. Neonatal Factors

The majority of neonates were female139 (54.3%) and 149 (58.2%) were term. The majority of neonates, 194 (75.8%), have normal birth weight (2500-3999g). The mean neonatal birth weight was 2897.70g (SD ± 609.670), one hundred twenty-four (48.4%) had meconium-stained liquor, and 197 (77.0%) had an APGAR score of 3-6.99 at the 1st minute. The mean hospital stay of asphyxiated neonates was 6.85 with (SD ± 5.87). Regarding HIE, 103 (40.2%) of neonates developed stage 1 HIE, 105 (41.0%) developed stage 2 HIE, and the rest developed stage 3 HIE. In terms of classification of asphyxia, 78 (30.5%) neonates were classified as mild, more than half, 142 (55.5%), were moderate, and 36 (14.1%) were classified as severe asphyxia. (Table 3)

Table 3: The clinical profile of asphyxiated neonates admitted to selected hospitals in Addis Ababa City, 2023

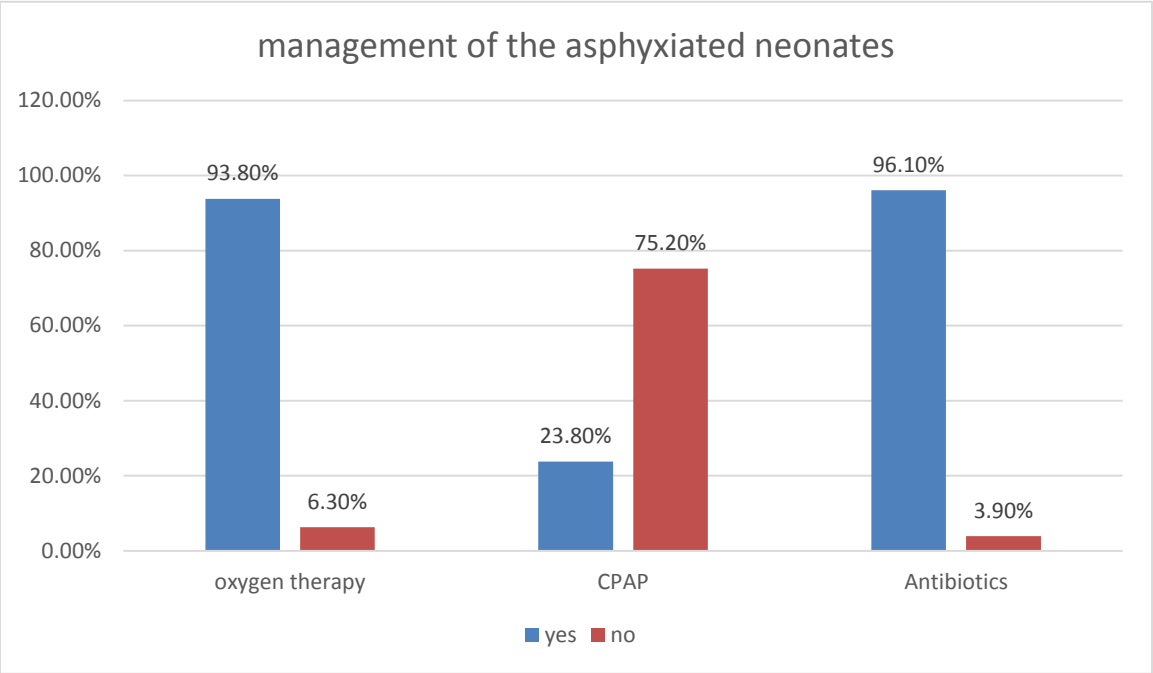
Variable	**Response**	**Frequency**	**Percent**
Gender	Male	117	45.7%
	Female	139	54.3%
Gestational age	28-36	32	12.5%
	37-40	149	58.2%
	≥41	75	29.3%
Birth weight	500-2499	54	21.1%
	2500-3999	194	75.8%
	≥4000	8	3.1%
Meconium stained liquor	No	132	51.6%
	Yes	124	48.4%
1st minute	0 - <3	26	10.2%
APGAR score	≥3 - <7	197	77.0%
	≥ 7	33	12.9%
5th minute APGAR score	0 - <3	3	1.2%
	≥3 - <7	126	49.2%
	≥ 7	127	49.6%
HIE staging	Stage 1	103	40.2%
	Stage 2	105	41.0%
	Stage 3	48	18.8%
Severity of asphyxia	Mild	78	30.5%
	Moderate	142	55.5%
	Severe	36	14.1%

Note HIE; Hypoxic-ischemic encephalopathy

5.4. Management of birth asphyxia

In our study, almost all neonates, 240 (93.8%), were given oxygen therapy; those treated with CPAP were 61 (23.8%); and 246 (96.1%) were treated with antibiotics. From those treated with

antibiotics, 30 (11.7%) were treated with different other management strategies like calcium gluconate, Lasix phenobarbital, salbutamol puff, and vitamin K. (figure3)



Note: CPAP-continuous positive air pressure

Figure 3 Management of the asphyxiated neonates at selected hospitals, Addis Ababa, Ethiopia from January 1 2022 to December 2022.

5.5.Neonatal Outcomes

Of most neonates 197 (77.0ere survived and 59 (23,0%) died. (Figure 4)

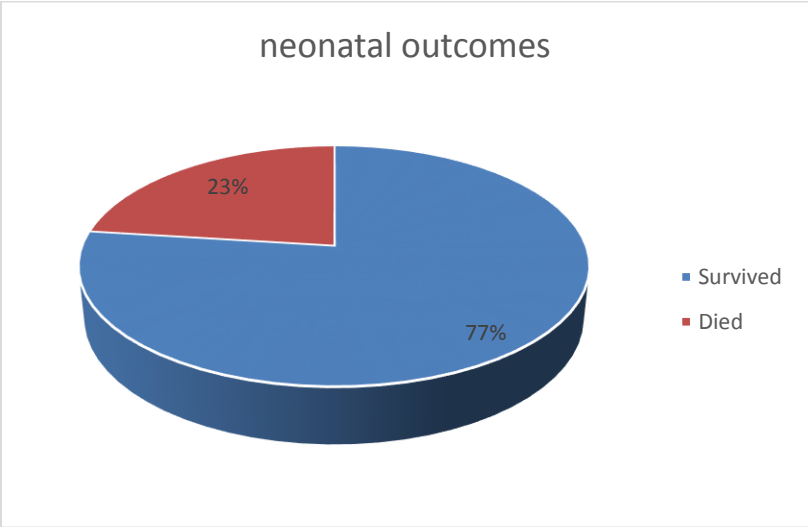


Figure 4: The outcome of asphyxiated neonates admitted to neonatal intensive care units at selected public hospitals in Addis Ababa, 2023.

5.6. Factors associated with the outcome of birth asphyxia

Bivariate analysis was performed to check the significance of each variable for the outcome of birth asphyxia, and the variables with a p-value < 0.25 were entered into multivariate analysis to check the confounding variables. Bivariate logistic regression analysis showed the crude odds ratio (COR) at 95% CI for the outcome of birth asphyxia as follows: HIE 2: 3.80 (1.46, 9.91); HIE 3: 35.56 (12.75, 99.21); neonates whose birth weight was 500–2499 g: 2.58 (1.33, 4.99); and 4000 g: 2.63 (0.60, 11.52). classification of asphyxia: moderate; 2.83 (1.18, 6.77), and severe; 14.2 (5.11, 39.40) 1st minute APGAR score 0–3; 4.10 (1.20, 14.03) and 3–7; 1.56 (0), oxygen therapy 4.78 (0), CPAP 8.56 (4.44, 16.51), and antibiotics 5.46 (1.48, 20.06) were associated with the outcome of birth asphyxia (table 5).

A multivariate logistic regression analysis was performed to sort out the confounding variables. A backward regression elimination process was used to assess those confounding variables. Finally, multivariable logistic regression results showed that HIE, birth weight, and CPAP at

P<0.05 at 95% CI after adjustment for the possible effect of confounding variables were significantly associated with outcomes of birth asphyxia. Neonates who developed HIE 2 (AOR=4.09, 95% CI [1.49, 14.16]) have 4 times mortality rate compared with neonates who developed HIE 1, whereas neonates who developed HIE 3 (AOR=22.06, 95% CI [5.35, 90.82]) have 22 times mortality rate compared with neonates who developed HIE 1. Neonates with low birth weight (500–2499 g) (AOR = 4.58, 95% CI = 1.83–11.50) had five times mortality compared with normal birth weight. whereas neonates with birth weight > 4000g (AOR = 8.51, 95% CI [1.49, 48.63]) were 8 times the mortality compared with normal birth weight neonates. Neonates who need CPAP (AOR = 4.63, 95% CI = 2.02, 10.60) were at five times the risk of mortality rate compared with those who do need not CPAP (table 4)

Table 4: Bivariate and multivariate analysis of the factors associated with the outcome of birth asphyxia

Variable	**Response**	**Neonatal outcome**		**Crude odds ratio (95%CI)**	**Adjusted odds ratio (95%CI)**	**p-value**
		Survived	**Death**			
Maternal age	26-30	87(34.0%)	26(10.2%)	1	1	
	16-25	93(36.3%)	23(9.0%)	0.82(044,1.55)	1.32(0.56,3.07)	.565
	>30	17(6.6%)	10(3.9%)	1.96(0.80,4.82)	1.21(0.33,4.37)	.782
HIE	Stage 1	97(37.9%)	6(2.3%)	1	1	
	Stage 2	85(33.2%)	20(7.8%)	3.80(1.46,9.91)	4.09(1.49,14.61)	**.030***
	Stage 3	15(5.9%)	33(12.9%)	35.56(12.75,99.21)	22.06(5.35,90.82)	**.0001***
Birthweight	2500-3999	158(61.7%)	36(14.1%)	1	1	
	500-2499	34(13.3%)	20(7.8%)	2.58(1.33, 4.99)	4.58(1.83,11.50)	**.010***
	≥4000	5(2.0%)	3(1.2%)	2.63(0.60,11.52)	8.51(1.49,48.63)	**.016***
Classification of birth asphyxia	Mild	71(27.7%)	7(2.7%)	1	1	
	Moderate	111(43.4%)	31(12.1%)	2.83(1.18,6.77)	0.85(0.21,3.47)	.878
	Severe	15(5.9%)	21(8.2%)	14.2(5.11, 39.40)	2.31(0.38,13.97)	.333
1st minuet	0 - <3	15(5.9%)	11(4.3%)	4.10(1.20, 14.03)	0.83(0.12,5.63)	.692

Apgar score	≥3 - <7	154(60.2%)	43(16.8%)	1.56(0.57,4.29)	0.78(0.19,3.20)	.822
	≥ 7	28(10.9%)	5(2.0%)	1	1	
Oxygen	No	15(5.9%)	1(0.4%)	1	1	
therapy	Yes	182(71.1%)	58(22.7%)	4.78(0.61,36.97)	2.25(.17, 29.49)	.516
CPAP	No	170(66.4%)	25(9.8%)	1	1	
	Yes	27(10.5%)	34(13.3%)	8.56(4.44, 16.51)	4.63(2.02,10.60)	**.0001***
Antibiotics	No	4(1.6%)	6(2.3%)	1	1	
	Yes	193(75.4%)	53(20.7%)	5.46(1.48,20.06)	.16(0.02, 1.03)	.066

Note; * AOR associated variable

6. Discussion

The prevalence of birth asphyxia was common in Ethiopia at 24.06% (41). It affects the health and positive outcome of the pregnancy. In a middle-income country, the neonatal mortality rate from birth asphyxia was 9% (42). So, this study was intended to assess the clinical profile, management outcome, and factors associated with birth asphyxia.

According to the current study, the mortality rate from birth asphyxia was 23%. This is in line with the previous study in the Lancet neonatal survival steering team of 23% (43) and Kenya of 25% (44). However, this study was lower than other studies conducted in Enugu (31%) (45) and Liberia (32%) (46). The potential explanation for this difference is due to study design, study time, and our sample characteristics, which were drawn from a large referral center providing care for the sickest neonates.

Similarly, this study showed the prevalence of birth asphyxia was higher among female neonates (139, 54.3%) than male neonates (117, 45.7%). This finding was supported by a study conducted at Dilla University Referral Hospital, south Ethiopia (47). In contrast, studies showed a higher proportion of birth asphyxia among males than females in Ayder Comprehensive Specialised Hospital, Northern Ethiopia 58.3% (48) and Dow University of Health Sciences, Karachi (33). The present study showed that severe asphyxia was 36 (14.1%), a lower proportion than the study conducted at Debre Tabor General Hospital in Ethiopia 21.2%,(49).

Regarding the factors associated with the management outcome of the asphyxia, neonates with normal birth weight had a better prognosis of birth asphyxia outcomes than those with low birth weight and macrosomic babies. Neonates with lower birth weight were five times (AOR of 4.58, 95% CI 1.83–11.50) more likely to die when compared with normal birth weight neonates, and macrosomic babies were 8.5 times more likely to survive than those with LBW. This finding was supported by studies from Enugu, southeast Nigeria (18), and Ethiopia (47). This is possible because LBW neonates have vital organ immaturity, and this proneness to hypoxia leads to a poor prognosis of birth asphyxia outcome (50).

Almost an equal number of asphyxiated neonates developed HIE 1 (103 (40.2%)) and HIE 2 (105 (41.0%), respectively. This result is in line with a previous study (20). Whereas the study conducted in the Pakistan Emirates Military Hospital, Rawalpindi, showed HIE1's fifty percent

predominance (27). In our study, 23% of the babies died due to birth asphyxia. The highest mortality was documented in babies who suffered from HIE grades III as compared to HIE grades II and I. From total neonates whose developed stage HIE III was 48 (18.8%), the highest mortality was registered at 33 (12%) as compared to HIE 2 105 (41%), which expired only 20 (7.8%), and from HIE 1 neonate 103 (40.2%), which expired a very small number of 6 (2.3%). This finding is in line with the previous study (22)

This study found a link between CPAP use and neonatal asphyxia mortality, despite no prior research to support this. This may be explained by the fact that preterm and low-birth-weight infants who need CPAP often have obstructions in their upper airways. As a result, this may cause the alveoli to collapse and ultimately result in respiratory failure and newborn mortality (51).

7. Conclusion

Neonates who experience birth asphyxia are affected by HIE severity (HIE grade III) and low birth weight, and those neonates' who need CPAP as a treatment are associated with the highest fatality rate. Therefore, identifying and managing these associated factors may consistently improve outcomes.

8. Recommendation

To clinician

The clinician should give supportive measures for babies with asphyxia, focusing on adequate oxygenation, ventilation, perfusion, and careful fluid management, as these interventions aim to avoid any further brain injury in these neonates.

To hospitals

The hospitals emphasize health education during ANC follow-up, as this promotes the health of mothers and their babies by maintaining healthy weight gain and good nutrition.

To researchers

Because this study was retrospective in nature and only included certain hospitals, its findings might merely be the tip of the iceberg. Therefore, it is crucial to construct a wide range of form prospective studies across the country on the clinical profile and consequences of birth asphyxia to develop new, more potent, and focused methods to enhance prognosis. This might give future researchers something to think about and get inspired by as they consider and investigate it.

9. Strengths and limitations of the study

9.1. Strength of the study

As it is a retrospective it is cost effective and the data analysis process is fast.

Our study is more representative as the sample size was addressed by a systematic random sampling technique.

9.2. Limitations of the study

- It was challenging to find precise information from each patient's medical record since the data was collected retrospectively.
- maternal demographic and socioeconomic characteristics were not adequately documented, which may have had a significant impact on the outcomes of the study.
- The present research could not disclose the results of the individuals who were transferred to another hospital because of the limited period (study period) that the complete process had.

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Annex I: Information sheet

Dear Mr. / Mrs.---------- I am Asamnewu Feyissa, currently pursuing an Honours MSC Degree in Emergency Medicine and Critical Care Nursing at Addis Ababa University College of Health Sciences. This research topic aims to assess the clinical profile and management outcome of birth asphyxia among neonates admitted to the neonatal intensive care unit of selected public hospitals in Addis Ababa, Ethiopia, in 2023. Since there is limited research done on this topic in the study area, the provision of such data on this very important subject may alert researchers, health workers, the community, and individuals to better health outcomes for newborns. It will serve as a resource for anyone who wants to conduct a study on the same subject. The study will involve completing the checklist that is enclosed with this letter. The privacy and anonymity of the data are completely guaranteed, and only the research team will have access to the results.

Person to Contact: For more information and to check about this project you can contact the following people.

Principal Investigator Name and Address:

Name: Asamnewu Feyissa Phone number: +251916443384 Email: asamnewfaya84@gmail.com

Annex II: Checklist

Q-NO	QUESTION	CODING	
100	**Part I: Socio-demographic characteristics of mothers whose neonates were admitted to NICU for birth asphyxia in selected government hospitals**		
101	Age of the mother	----------	
102	Residency	1 rural 2 urban	
103	Maternal educational status	1 not read and write 2 Primary 3 Secondary 4 college/university	
200	**Part II: Obstetrics and newborn factors that affect the outcome of birth asphyxia among mothers with newborns in selected government hospitals**		
201	parity	----------	
202	Gestational age	---------in weeks	
203	ANC follow up	1 no 2 yes	
203	Mode of delivery	1 SVD 2 C/S 3 Instrumental	
203	Duration of ROM	1 < 18 hrs.	

		2 > 18 hrs.	
204	Prolonged labor	1 yes 2 No	
205	Meconium stained liquor	1 yes 2 No	
206	Birth weight (g)	----------in gram	
207	Classification of asphyxia	1 mild 2 moderates 3 sever	
208	HIE	1 stage1 2 stage2 3 stage3	
209	1 min APGAR	1 1 <3 2 >3	
210	5 min APGAR	1 1<3 2 >3	
211	Presence of maternal medical complications during pregnancy	1 yes 2 No	
212	Type of complication		
	1) Chronic HTN	1 yes 2 No	
	2) DM	1 yes 2 No	
	3) Cardiac disease	1 yes 2 No	
	4) Anemia	1 yes 2 No	

	5) Seizure disorder	1 yes 2 No	
	6) Asthma	1 yes 2 No	
	7) Other Specify	----------	
213	Oxygen provided for neonate	1 yes 2 No	
214	On CPAP?	1 yes 2 No	
215	Antibiotics (Specify) -----	1 yes 2 No	
216	Other management for neonate	----------	
300	**Part III: Outcome variable**		
301	Duration of stay at NICU	----------in days	
302	Outcome of neonate	1 survived 2 death	
303	If Q302 survived, where is its disposition?	1) In Hospital 2) Home Discharged 3) Referred	
304	Is the family left against medical advice?	1 yes 2 No	
305	Is neonate referred?	1 yes 2 No	
306	Is the neonate expired?	1 yes 2 No	