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BAHIR DAR UNIVERSITY COLLEGE OF MEDICINE AND HEALTH SCIENCES DEPARTMENT OF PEDIATRICS AND CHILD HEALTH

Proportion And Associated Factors Of Meconium Aspiration Syndrome In Neonates Admitted To Nicu Tibebe Gion Specillized Hospital Bahir Dar Amhara Reginal State North West Ethioapia.

BY: DR. Minwuyelet Amera TIZAZU (PEDIATRICS RESIDENT)

A THESIS SUBMITTED TO BAHIR DAR UNIVERSITY COLLEGE OF MEDICINE AND HEALTH SCIENCE DEPARTEMENT OF PEDIATRICS AND CHILD HEALTH IN PARTIAL FULFILMENT OF CERTIFICATE OF SPECIALITY IN PEDIATRICS AND CHILD HEALTH.

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BAHIR DAR, ETHIOPIA

BAHIR DAR UNIVERSITY COLLEGE OF MEDICINE AND HEALTH SCIENCES DEPARTMENT OF PEDIATRICS AND CHILD HEALTH

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Abstract

Back ground: Meconium aspiration syndrome is defined as respiratory distress in newborn infant born through MSAF whose symptoms can't be otherwise explained. It is one of the common neonatal problems especially in developing countries which results in significant death. Knowing the burden of MAS will help to give attention and decrease the risk factor.

Objectives: The aim of this study is to determine the proportion and associated factors of meconium aspiration syndrome in neonates admitted to NICU, TGSH BDU, North West Ethiopia 2024.

Methods: Institutional based cross sectional Retrospective study was conducted among in neonates at NICU, TGSH from November 2023 to November 2024. Data were collected with carful chart reviewing by using systematic random sampling technique. The data were collected using Kobo tool collect. After checking completeness and coding, data were export to SPSS version 27 for analysis. Descriptive statics like frequency and percentages were presented with texts and tables. First bivariate analysis was made and all the variables with p-value less than 0.2 in bi-variable analysis were entered into the final multivariable logistic regression analysis. Statistically significant association was declared at P-value less than 0.05 with 95% confidence interval.

Results: In this study, the chart attrition rate (chart completeness) was 96.9%. The study found that 8.5% (CI: 6.0-7.11) of neonates developed Meconium Aspiration Syndrome. Gestation age with AOR 5.179 (CI: 2.104-12.751), onset of labor with AOR 4.484 (CI: 1.259-15.962), and First minute APGAR with AOR 7.463(CI: 2.783-20.016) were significantly associated with Meconium Aspiration Syndrome.

Conclusion and Recommendations: The proportion of neonates developed Meconium Aspiration Syndrome was high compared to other countries. The findings indicate that post-term/date gestation and low first-minute APGAR scores and labor induction are significant risk factors for MAS. Enhanced Fetal Monitoring for Postdate and Post-Term Pregnancies: Close surveillance of pregnancies beyond 40 weeks to identify fetal distress early and prevent MAS development and Continuous fetal monitoring during labor is crucial.

Keywords: Meconium, Aspiration, Syndrome, Tibebe Ghion, north west Ethiopia

Abbreviations/acronyms

AOR	Adjusted Odds Ratio
APH	Antepartum Hemorrhage
BDU	Bahir Dar University
CI	Confidence Interval
ECMO	Extra Corporal Membrane Oxygenation
ETA	Emergency Assessment and treatment
TGSH	Tibebe Gion Specialized Hospital
PROM	Premature Rupture Of Membrane
IUGR	Intrauterine Growth Restriction
KMC	Kangaroo Mother Care
NICU	Neonatal Intensive Care Unit
MAS	Miconium Aspiration Syndrome
MSAF	Miconium Stained Amniotic Fluid
PNA	Perinatal Asphyxia
PHN	Pulmonary Hypertension
RF	Respiratory Failure
SGA	Small for Gestational Age
U/S	Ultrasonography
USA	United States Of America

Table of contents

Contents

Acknowledgment II

Abstract III

Abbreviations/acronyms IV

Table of contents V

List of tables VII

List of figures VII

List of Appendixes VIII

1. Introduction 1

1.1 Back ground 1

1.2 Statement of the problem 2

1.3 Significance of the study 2

1.4 Literature Review 3

2. Objectives 8

2.1 General objectives 8

2.2 Specific objectives 8

3. Methods and materials 9

3.1 Study area 9

3.2 Study design and period 9

3.3 Source population and Study population 9

3.3.1 Source population 9

3.3.2 Study population 10

3.4 inclusion and exclusion criteria 10

3.4.1 Inclusion criteria 10

3.4.2 Exclusion criteria 10

3.5 Sampling technique and sample size determination 10

3.5.1 Sample size determination 10

3.5.2 Sampling technique 10

3.6 Study variables: 10

3.6.1 Dependent variable 10

3.6.2 Independent variables: 10

3.7 operational definition: 11
3.8 data collection tools and procedures 11
3.9 Data quality control 11
3.10 Data processing and analysis 11
3.11 Ethical clearance 12
3.12 Dissemination of the result ..... **Error! Bookmark not defined.**
4. Results 12
5. Discussion 20
6. Conclusion and Recommendation 21
6. Reference 23
7. Annexes 25
7.1 Information 25
7.2 Questionnaire 25
7.3 Declaration 26

List of tables

Table 1: study participant characteristics (term and post term neonates) admitted to NICU at Tibebe Gion specialized hospital (TGSH) North West Ethiopia, 2025. 13
Table 2: other comorbid conditions among term and post term neonates admitted to NICU at Tibebe Gion specialized hospital (TGSH) North West Ethiopia, 2025. 14
Table 3: Maternal factors among term and post-term neonates admitted in NICU, at Tibebe Gion specialized hospital (TGSH) North West Ethiopia, 2025. 16
Table 4: Bivariable and multivariable logistic regression of Meconium aspiration syndrome (MAS) and its associated factors, among term and post-term neonates admitted in NICU, at Tibebe Gion specialized hospital (TGSH) North West Ethiopia, 2025. 19

List of figures

Figure 1: conceptual frame work of MAS and its associated factors (2,5,13,14,16)**.** 8
Figure 2:Shows the proportion of Meconium Aspiration Syndrome among neonates admitted at Tibebe Ghion Specilized Hospital, 2025. 17

List of Appendixes

7. Annexes ..... **Error! Bookmark not defined.**
7.1 Information ..... **Error! Bookmark not defined.**
7.2 Questionnaire ..... **Error! Bookmark not defined.**
7.3 Declaration ..... **Error! Bookmark not defined.**

1. Introduction

1.1 Back ground

Meconium aspiration syndrome (MAS is defined as respiratory distress in newborn infants born through meconium stained amniotic fluid (MSAF) whose symptoms cannot be otherwise explained(1). Meconium is a thick, black-green, odorless material which is first recognized in the fetal intestine around 12 weeks of gestation and stores in the fetal colon throughout gestation(2).

Passage of meconium in the newborn infant is developmentally programed. It normally occurs at 24 to 48 hours of birth. However, the fetus may pass meconium into amniotic fluid before birth due to different stressing events. This usually occurs after 37 weeks of gestation and it is not common in preterm(3).

When a neonate aspirates meconium during intrauterine gasping or during initial breaths at birth, MAS ensues(3). Fetal hypoxic stress or vagal stimulation due to cord compression stimulates peristalsis in the colon. The evidence is mounting for a chronic in-utero insult that may be more important for meconium passage as opposed to an acute peripartum event(4). Hypoxia also causes fetal gasping that results in meconium aspiration. Term and post-term fetuses are more likely to pass meconium in response to such a stress than preterm(5). Gastrointestinal maturation may be inadequate in preterm to be able to pass meconium; although, both the presence of meconium and active intestinal peristalsis have been reported as early as 8 week of gestational age(6).

Meconium aspiration syndrome (MAS), which occurs in 2 to 10% of infants born through meconium-stained amniotic fluid (MSAF, is the respiratory distress of the newborn due to the presence of meconium in the tracheobronchial airway. This causes airway obstruction, atelectasis, epithelial injury, surfactant inhibition, pneumothorax, pulmonary hypertension and respiratory failure(7). The diagnosis of MAS is not well defined though term and post term neonates with MSAF and respiratory distress soon after birth not otherwise explained have to be diagnosed MAS(8). Diagnosis of MAS is based on the presence of respiratory distress in an infant born through MSAF, with no alternate cause for respiratory distress. Chest radiograph and blood gas analysis should be performed if necessary. Because of diverse mechanisms causing this disease, radiographic findings are different. The classic radiographic findings in MAS are

overexpansion of the lungs with widespread coarse, patchy infiltrates(9). Ultrasonography(U/S can be used routinely to diagnose MAS in an accurate, reliable, convenient, and non-invasive manner(10). In severe cases it can cause MAS requiring neonatal intensive care unit(NICU) with respiratory, hemodynamic and metabolic support(6).

1.2 Statement of the problem

Meconium aspiration syndrome is one of the common causes of neonatal admission. It accounts for 10 % of all causes of respiratory failure in neonates with mortality of 20 % in the developing countries(11) .Despite the progress made in medicine, meconium aspiration syndrome is still one of the causes of newborn infants' mortality. It has a mortality rate of 10-40%(12).

Population studies of meconium aspiration syndrome (MAS) are rare and report incidences between 0.43/1000 and 3.8/1000 in high income countries depending on data sources, population studied and diagnostic criteria. Incidence in lower income countries may be considerably higher, but estimates are based on institutional or NICU level data rather than population data(13).

There are encouraging trends of a progressive decline in the incidence of MAS. In the united states of America(USA), Yoder et al documented a fourfold decline in the incidence of MAS from 5.8% to 1.5% during 1990–1997, attributable to 33% reduction in the incidence of births at >41 weeks of gestation(14). Similar decrease in incidence has been reported from multicenter trial in Australia(14). New Zealand (0.43–0.37 per 1000 live births between 1995 and 2002).This reduction in MAS incidence has been attributed to better obstetric practices, in particular, avoidance of post maturity, and expeditious delivery where fetal distress has been noted(15).

In contrast, developing countries like India and Africa, with limited resources for fetal monitoring and delivery room care, still share a major burden of morbidity due to MAS(13). There are only few studies so far in Ethiopia. It is also one of the fields which is not extensively investigated in the world.

1.3 Significance of the study

MAS is one of the common cause of neonatal admission and death in neonates. It mainly occurs in term and post term neonates. In developing countries like Ethiopia the burden is estimated to be high and we are admitting many newborns with MAS yearly. But the proportion is not well known.

Knowing the burden MAS is important to set goals on improving obstetric care to decrease MAS and to establish better NICU set up for the management of MAS. It could also be used as baseline for future researches and encourage to generate new knowledge and understanding in the field.

1.4 Literature Review

1.4.1 Magnitude of the problem

Meconium-stained amniotic fluid (MSAF) is a major global public health problem. Meconium staining is common in labor with the prevalence of 12-16%. Many studies have been conducted worldwide especially in Asia to determine the fetal outcome and risk factors in patients with MSAF(3). A cross-sectional study was conducted through non-probability consecutive sampling technique at Liquate University Hospital, Hyderabad from August 2016 to February 2017. All neonates at ≥37 weeks of gestation with meconium-stained amniotic fluid (MSAF) detected during delivery were included in this study after obtaining informed consent from their parents (16).

Overall, 136 neonates were included in the study. The mean gestational age was 38 ± 1.43 weeks.

An observational study was conducted in 12 public hospitals in Nepal from 1 July 2017 to 29 August 2018. All babies born within the study period were included in the study. The overall incidence of MAS was 2.0 per 1000 live births(13).

There was population-based cohort study in Australia and was associated with a statistically significant decline in risk factors: maternal smoking (from 20 to 12%), gestational age (from 57 to 47% >= 40 weeks of gestation), delivery at small hospitals (from 15 to 9%) and infants with birthweight below the third percentile (from 3.3 to 2.4%). There were simultaneous statistically significant increases in practices that reduce the risk of MAS: labor inductions (from 22 to 27%) and birth by caesarean section, both elective, prior to 40 weeks of gestation (from 7.3 to 13.8%), and emergency (from 3.0 to 5.3% prior to 40 weeks of gestation, and from 5.1 to 6.7% at 40 weeks of gestation or later)(13).

Detrimental complications of meconium aspiration syndrome and their impact on outcome was done in Pakistan. This cross-sectional descriptive study was conducted in a tertiary care Neonatology unit. Seventy-two babies were included in the study. Mean gestation was 37±0.56 weeks and birth weight was 2.87±0.49 kg. Male to female ratio was 1.57:1 and mean age of admission was 9.59±5.27 hours. There was a study in west part of secondary hospital in china and there was a total of 294 neonates were included and the mean age at admission (0.55 ± 0.9 h)

was lower and the proportion of cesarean deliveries (90.00%, 27/30) was higher in the preterm group than in the other three groups. There was no statistically significant difference among the four groups regarding 1- and 5-min Apgar scores and the need for delivery room resuscitation. In terms of complications, early-term infants had the highest incidence of neurological injury (52.9%, 27/51), and late-term infants had the highest incidence of pneumothorax (37.8%, 17/45). The overall mortality rate of children with MAS was 7.80% (23/294), and the difference in mortality rates among the four groups was not significant.

There also another study in South Korea which includes a total of 671 neonates and it was found MAS developed in 10.6% (71/671) of neonates with meconium staining at birth. Among the neonates with MAS, 81.7% had mild MAS, 5.6% had moderate MAS, and 12.7% had severe MAS. The presence of minimal variability was significantly increased in both the mild/moderate and the severe MAS groups. The frequencies of null parity, fetal tachycardia, and intrapartum fever were significantly increased in the mild/moderate MAS group, but not in the severe MAS group. While a longer duration of the second stage of labor was significantly associated with mild/ moderate MAS, severe MAS was associated with a shorter duration of the second stage. Notably, low mean cord pH (7.165 was significantly associated with mild/moderate MAS, but not with severe MAS compared with the absence of MAS(17).

Retrospective review on an administrative identified data set. A total of 415,772 neonates formed the starting data set and 162,075 (39%) were >or=37 weeks. Of the 162,075 term neonates, 7518 (1.8% of all neonates and 4.6% of term NICU admissions) had an admission diagnosis of MAS. In the 7518 neonates, the following outcomes were observed: 6124 (81.5%) were discharged home; 679 (9%) were acutely transferred to a higher level of intensive care; 416 (5.5%) were transferred to another clinical service within the hospital; 178 (2.4%) were transferred to another NICU for convalescent care and 88 (1.2%) died. There were 33 (0.4%) who did not have data on outcome at discharge. During the period between 2002 and 2005, acute transfer rates decreased (12.4 to 9%) and the reported rate for death remained relatively constant between 0.9 and 1.5%. There were 107 (1.4%) neonates who were treated (n=61) with, or transferred, for extracorporeal membrane oxygenation (ECMO (n=46). Three of the sixty-one neonates (4.9%) who were treated with ECMO died(3).

There was a seven-fold increase in the use of inotropes in neonates with MAS when compared to the control group (22/304, 7.2% vs. 2/304, 0.7%; p=0.001). There were significantly more neonates with MAS who required ventilation when compared to the control group (109/304,

35.9% vs. 17/304, 5.6%; p=0.001). The use of surfactant was similar in both groups (54/288, 18.8% vs. 53/289, 18.3%; p=0.750)(18).

There was another study in Nigeria and a total of 45 (0.57%) out of 7845 admissions were diagnosed with MAS. The median age on admission was one hour, with a male preponderance (54.1%). Forty-four (97.8%) of our patients had a gestational age above 37 weeks. Thirty (66.6%) mothers and 32 (71.4%) of the fathers had at least secondary level of education. Forty-two (93.3%) children with MAS, were born through thick meconium (93.3%), 20 (44.4%) neonates had mild Oxygen requirement, 43 (95.6%) neonates developed respiratory distress at <24 hours of life, and 36(80%) of the neonates were born to booked mothers. Forty-two (93.3%) of children with MAS received oxygen and antibiotics respectively. Delivery via caesarean section had a positive correlation with fetal hypoxia in MAS. Forty-one (91.1%) of children with MAS were discharged. The case fatality rate of MAS in our series was 6.7%(19).

A facility based unmatched case control study used to identify meconium aspiration syndrome with a total sample size of 249 at Nigist Eleni Mohammed Memorial Comprehensive Specialized Hospital, South Ethiopia, from January to April 2022.Two hundred forty-nine (83 cases and 166 controls) mothers with their respective neonates were included in this study and that made the overall response rate 100%.

A study in Ethiopia on mothers with MSAF and their neonates it was found that nonreassuring fetal heart rate pattern (29.7% versus 2.1%), meconium aspiration syndrome (7.58% versus 0.68%), neonatal sepsis (9% versus 4.1%), perinatal asphyxia (PNA)(13.8% versus 7.6%), admission to the neonatal intensive care unit (23.4% versus 3.2%), and early neonatal deaths (4.8% versus 1.4%) among meconium stained groups as compared to the clear amniotic fluid groups(2).

A study done in welkite university southern Ethiopia which is An institution-based cross-sectional study prospectively through meticulous chart review and interviews with 275 mothers with meconium-stained amniotic fluid who gave birth with an emergency cesarean section.it was found that the prevalence of the meconium-aspiration syndrome is 28.7%. The neonatal death rate associated with meconium aspiration syndrome is 1.8%, and thick meconium contributed to 65% of admissions to the neonatal intensive care unit and all deaths(20). There also another in southern Ethiopia (Wachamo University) which is institution based cross sectional study which includes 255 neonates and it was found that prevalence of Meconium Aspiration Syndrome (MAS) in this study was found to be 30.6%.

1.4.2 Risk factors

A cross-sectional study was conducted through non-probability consecutive sampling technique at Liquate University Hospital, Hyderabad from August 2016 to February 2017. The major factors for MAS in this study were detected as fetal distress (67.0%,n = 91),non-reassuring fetal heart rate (54.0%, n = 73), cesarean birth (48.0%, n = 65), intrauterine growth restriction (IUGR; 17.0%, n = 23), and post maturity (12.0%, n = 16)(16). An observational study was conducted in 12 public hospitals in Nepal from 1 July 2017 to 29 August 2018. In this study Babies born at post-term gestation (adjusted odds ratio (AOR = 2.41; 95% confidence interval (CI): 1.05-5.55), null parity (AOR = 2.26; 95% CI: 1.20-4.28), instrumental delivery (AOR = 4.79; 95% CI: 2.52-9.10) and caesarean delivery (AOR = 3.67; 95% CI: 2.29-5.89) were significantly associated with MAS. Babies with MAS had a 10-fold risk for pre-discharge mortality (odds ratio = 9.87; 95% CI: 5.81-16.76)(13). There was case control study in south Africa, Johannesburg and it was found that More neonates born with MAS were born small for gestational age (SGA) when compared to the control group (74/301, 24.6% vs. 57/300, 19%; p=0.001). Substantially more neonates with MAS required resuscitation at birth when compared to the control population (107/304, 35.2% vs. 66/303, 21.8%; p=0.001). There were more MAS neonates with poor Apgar scores when compared with the control population (75/292, 25.7% vs. 43/288, 14.9%; p=0.001)(18). A facility based unmatched case control study used to identify meconium aspiration syndrome with a total sample size of 249 at Nigist Eleni Mohammed Memorial Comprehensive Specialized Hospital, South Ethiopia, from January to April 2022.Two hundred forty-nine (83 cases and 166 controls) mothers with their respective neonates were included in this study. In this study Preeclampsia (adjusted odds ratio: 3.35, 95% confidence interval: 1.02, 10.97), antepartum hemorrhage (adjusted odds ratio: 3.63, 95% confidence interval: 1.50, 8.78), duration of labor (adjusted odds ratio: 4.34, 95% confidence interval: 1.83, 10.30), premature rupture of membrane (adjusted odds ratio: 16.02, 95% confidence interval: 5.66, 45.29), and obstructed labor (adjusted odds ratio: 4.57, 95% confidence interval: 1.42, 14.70) were determinants of meconium aspiration syndrome (4). A study done in welkite university southern Ethiopia which is An institution-based cross-sectional study prospectively through meticulous chart review and interviews with 275 mothers and it was found that factors associated are: latent phase (AOR: 2.580; 95% CI: 1.126, 5.913), low 1st minute APGAR score (AOR: 2.43; 95% CI: 0.892, 6.625), and thick meconium (AOR: 31.018; 95% CI: 9.982, 96.390).

Neonates born to mothers from prim para (AOR=1.7; 95% CI: 1.01-10.1), pregnancy-induced hypertension (AOR=6.2; 95% CI: 1.19-33.2), antepartum hemorrhage(APH (AOR=3.5; 95% CI:

1.08-11.96), obstructed labor (AOR=26.5; 95% CI: 5.0-140.0), and premature rupture of membrane (PROM) (AOR=14.3; 95% CI: 3.7-55.5) were found to have a significant association with Meconium Aspiration Syndrome among neonates(21).

1.4.3 Effect of the problem

There was a cross-sectional descriptive study was conducted in a tertiary care Neonatology unit. Seventy-two babies were included in the study. In this study Chemical pneumonitis, pulmonary hypertension (PHN) and chemical pneumonitis with PHN were observed in 23.6%, 20.8% and 26.4% neonates respectively. Mortality rate was 19.44%. The mortality was highest in babies having chemical pneumonitis with PHN (p-value=0.013) followed by chemical pneumonitis group (p-value=0.02) and PHN group (p-value=0.032)(16). Another study done in china The overall mortality rate of children with MAS was 7.80% and Low 1-min Apgar score and gestational age, metabolic acidosis, and respiratory failure were independent risk factors for neurological injury; metabolic acidosis, respiratory failure(RF), and sepsis were independent risk factors for death in neonates with MAS(17).

1.5 conceptual frame work

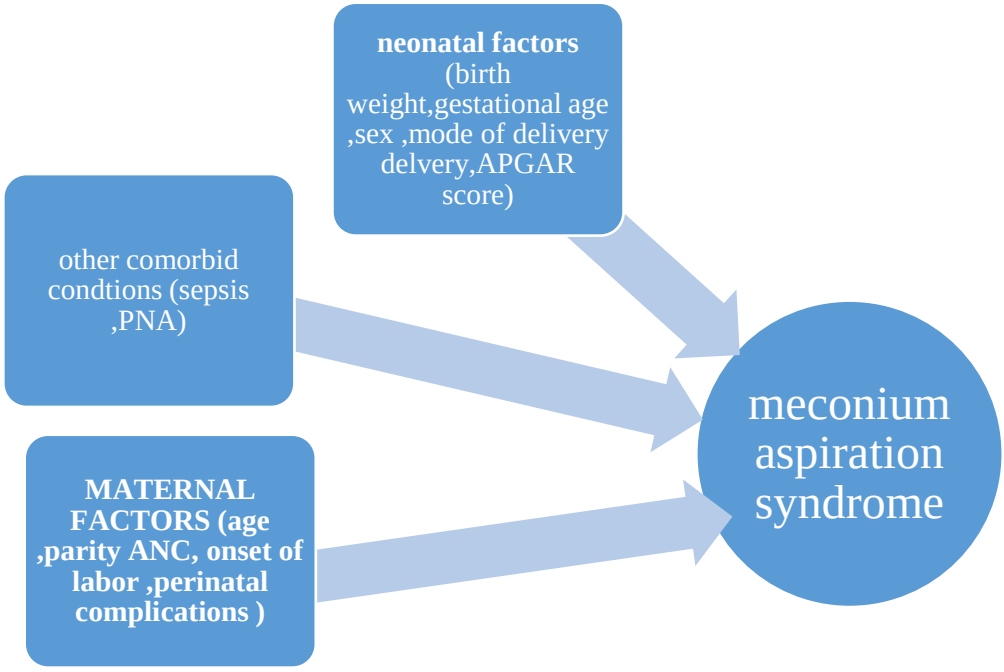

Figure 1: conceptual frame work of MAS and its associated factors (2,5,13,14,16,22)**.**

2. Objectives

2.1 General objectives

- ✓ To determine proportion of meconium aspiration syndrome and associated factors neonates admitted to NICU at Tibebe Gion specialized hospital (TGSH) North West Ethiopia, from November 2023-November 2024G.C.

2.2 Specific objectives

- ✓ To determine the Proportion of meconium aspiration syndrome and associated factors among neonates admitted to NICU, TGSH from November 2023-November 2024 G.C
- ✓ To identify associated factors of meconium aspiration syndrome among neonates admitted to NICU, TGSH from November 2023-November 2024 G.C.

3. Methods and materials

3.1 Study area

The study was conducted at Tibebe Gion Specialized Hospital, Bahir Dar,North West Ethiopia starting from November 2023 to November 2024. Bahir Dar, the capital of Amhara regional state is located Northern-west of Ethiopia, 565 Km far from Addis Ababa, capital city of Ethiopia.

Tibebe Ghion specialized hospital is a newly established Tertiary care Teaching hospital in Bahir Dar City founded in January, 2019GC. It is located about 10km south from the city center and about 7 km from the new bus station. it serves a total of around 5 million people. It gives 12 specialty programs (pediatrics and child health, internal medicine, general surgery, obstetrics and gynecology, ear nose and throat (ENT), anesthesia , psychiatry, ophthalmology , orthopedics , radiology, dermato-venerology and emergency medicine) and 3 sub-specialty programs (pulmonology and critical care, gynecology oncology and feto-maternal , urology fellow ship)

It has more than 450 bed capacity and gives for more than 94,000 clients (around 20,000 in patient and 74,000 outpatient) services per year.

The pediatric and child health unit has about 112 beds divided into Emergency Triage Assessment and treatment (ETAT), Critical and stable Wards, Neonatal Intensive care unit (NICU), Pediatric Intensive care Unit (PICU) and follow up clinic and outpatient department (OPD).

Neonatal Intensive care unit (NICU) is one of the unite in pediatrics and child health department which has an average monthly admission rate of around 168 neonates and it has around 32 beds dividing in to term, preterm and kangaroo mother care (KMC). The service there is delivered by pediatricians, residents, interns and nurses.

3.2 Study design and period

Institution based cross-sectional study was conducted from November 2023 to November 2024 among neonates admitted at NICU ward TGSH, North West Ethiopia.

3.3 Source population and Study population

3.3.1 Source population

All neonates admitted to NICU at TGSH.

3.3.2 Study population

All term and post-term neonates admitted to NICU at TGSH during study period

3.4 inclusion and exclusion criteria

3.4.1 Inclusion criteria

All term and post term neonates admitted to NICU during study period

3.4.2 Exclusion criteria

Neonates with congenital heart disease, Preterm neonates and Neonates suspected to have chromosomal abnormality (Down syndrome, Edward, Patau...) were excluded from this study.

3.5 Sampling technique and sample size determination

3.5.1 Sample size determination: The sample size was calculated using single population proportion formula assuming P; the overall prevalence of MAS. Since there is no study which shows over all prevalence of MAS among term and post term neonates, 50% was taken as proportion of MAS with marginal error (d) of 5% and confidence interval of 95%.

n=Z^2*P(1-P)d^2

n=1.96*1.96 *0.5 (1-0.5)/0.05*0.05 =384

(Where n= sample size, p= prevalence, d= margin of error).

By adding 10% non –response (chart incompleteness) rate total sample size was 423.

3.5.2 Sampling technique: A systematic simple random sampling technique was used to select 423 charts from neonatal ICU registration book. The first chart was selected randomly and the subsequent chart was selected based on K^{th} value which was 3.

3.6 Study variables:

3.6.1 Dependent variable

- Meconium aspiration syndrome (Yes/No)

3.6.2 Independent variables:

- Sociodemographic of the mother
- Mode of delivery
- Gestational age
- ANC
- Sex of neonate
- Birth weight
- APGAR score
- Onset of labor
- duration of labor
- perinatal complications

- duration of rupture of membrane
- Other co-morbidities (sepsis, PNA, NHB)(2)

3.7 operational definition and definition of terms

Neonate: an infant whose age is from birth up to 28 days of age

Meconium: a thick, black-green, odorless material which is first recognized in the fetal intestine around 12 weeks of gestation and stores in the fetal colon throughout gestation.

Meconium aspiration syndrome: is a clinical diagnosis of neonates with meconium stained amniotic fluid evidenced by meconium stained finger nail, umbilical stump and inter-nipple to chest circumference ratio ≥ 27%and respiratory distress not explained by other diseases entity(4**).**

Term neonate: a baby born at 37-41+6 weeks.

Post term neonate: a baby born after 42 weeks.

Postdate neonate: baby born between 40-42 weeks.

Preterm neonate: neonates born before 37 completed weeks.

APGAR: a score out of 10 given to new born during 1st and 5th minute based on 5 parameters (appearance, heart rate, respiratory rate, grimce and reflex) each having 2(2).

Good APGAR: >= 7(2).

Low APGAR :< 7(2).

3.8 data collection tools and procedures

Data were collected from the patients' medical records by using an English structured questionnaire (check list). Data were collected by 5 trained residents who are working at TGSH NICU ward. The questionnaire was prepared reviewing the previous literatures(2,5,13,14,16,22).

3.9 Data quality control

Data collectors and supervisor were trained for one day on objective of the study, content of questionnaire, and data collection procedure. During the data collection period the collected data were checked daily for completeness by the principal investigator and supervisor.

3.10 Data processing and analysis

The collected data by kobo collect tool were exported to SPSS version 27 for analysis. Descriptive summary was be presented using frequencies, proportions, means, figures and tables. The association between independent variables and MAS was made using binary logistic regression model. First bivariable analysis was made and all the variables with p-value less than 0.2 in bi-variable analysis were entered into the final multivariable logistic regression analysis. Statistical significance was determined using adjusted odds ratio (AOR), with 95% confidence intervals and P-value less than 0.05 in the final model.

3.11 Ethical clearance

Ethical clearance was obtained from Bahir Dar University College of Medicine and Health science institutional review board. Then, permission letter was written to have an access of charts and help from the record and data center about the selected patients. Names of study participant were not mentioned in the questionnaire or other place so that confidentiality assured.

4. Results

Study participant characteristics (Neonatal factors)

In this study, the chart completeness rate was 96.9%. Seven (1.7%) had post-term pregnancies, which delivered after 42 weeks, and 37 (9.0%) had postdate pregnancies, which delivered between 41 and 42 weeks, the remaining 366 (89.3) had term pregnancy .A total of 102 (24.9%) neonates were less than or equal to 72 hours old at admission, whereas 308 (75.1%) were older than 72 hours.

There were 197 (48.0%) female neonates and 213 (52.0%) male neonates. Of the 402 neonates, 322 (80.1%) weighed between 2500 and 3999 grams at birth, 5 (1.2%) weighed 4000 grams and above, and 75 (18.7%) weighed less than 2500 grams. In the first minute, 360 neonates (89.6%) had an APGAR score of 7 or higher, whereas 42 neonates (10.4%) had a score of less than 7.

Spontaneous vaginal delivery (SVD) was the most common mode of delivery, occurring in 327 (79.8%) cases. Cesarean section (C/S) was performed in 78 (19.0%) cases, while 5 (1.2%) were instrumental assisted deliveries.

Among the 78 cesarean deliveries, 28 (35.9%) were due to maternal indications, while 50 (64.1%) were performed due to fetal reasons, specifically non-reassuring fetal heart rate (NRFHR).

Among the 28 cases where cesarean section was indicated for maternal reasons, 7 (25.0%) were due to eclampsia, 10 (35.7%) were due to poor maternal effort, 7 (25.0%) were due to placenta Previa, and 4 (14.3%) were attributed to other unspecified reasons (see Table 1)

Table 1: Study participant characteristics (term and post term neonates) admitted to NICU at Tibebe Gion specialized hospital (TGSH) North West Ethiopia, 2025.

Variables	Category	Frequency(n)	Percentage (%)
Gestational age (in weeks)	Term (37-40)	366	89.3
	Postdate (41-42)	37	9.0
	Post-term (>42)	7	1.7
Age of neonate during admission	≤72 hours	102	24.9
	>72 hours	308	75.1
Sex of neonate	Male	213	52.0
	Female	197	48.0
Birth weight (n=402)	<2500gm	75	18.7
	2500-3999gm	322	80.1
	≥4000gm	5	1.2
First Minute APGAR(n=402)	<7 score	42	10.4
	≥7 score	360	89.6
Fifth minute APGAR(n=402)	<7 score	125	30.1
	≥7 score	277	68.9
Mode of delivery	SVD	327	79.8
	C/S	78	19.0
	Instrumental assisted	5	1.2
If 'C/S' indication(n=78)	Maternal	28	35.9
	Fetal (NRFHR)	50	64.1
Maternal indication for C/S (n=28)	Eclampsia	7	25
	Poor effort	10	35.7
	Placenta Previa	7	25.0
	Others	4	14.3

Other comorbid conditions

Perinatal complications were reported in 26 (6.3%) mothers, whereas 384 (93.7%) did not experience any complications. Among the 26 mothers who experienced perinatal complications, 5 (19.2%) had antepartum hemorrhage (APH), 4 (15.4%) had premature rupture of membranes (PROM), 13 (50.0%) developed preeclampsia or eclampsia, and 4 (15.4%) had diabetes mellitus (DM).

Among the neonates, 309 (75.4%) were diagnosed with sepsis, 38 (9.3%) had perinatal asphyxia (PNA), 55 (13.4%) had neonatal hyperbilirubinemia (NHB), and 60 (14.6%) were classified under surgical cases. Additionally, 16 (3.9%) had other diagnoses (see Table 2).

Table 2: Other comorbid conditions among term and post term neonates admitted to NICU at Tibebe Gion specialized hospital (TGSH) North West Ethiopia, 2025.

Variables	**Category**	**Frequency(n)**	**Percentage (%)**
Perinatal complications	Yes	26	6.3
	No	384	93.7
If ‘yes’ which complication (n=26)	APH	5	19.2
	PROM	4	15.4
	Pre/eclampsia	13	50.0
	DM	4	15.4
Was MSAF detected	Yes	37	9.0
	No	373	91.0
If ‘yes’ grade of Meconium (n=37)	Grade 1	7	18.9
	Grade 2	11	29.7
	Grade 3	19	51.4
Was there a diagnosis of MAS	Yes	35	8.5
	No	375	91.5
Other diagnosis	Sepsis	309	75.4
	PNA	38	9.3
	NHB	55	13.4
	Surgical cases	60	14.
	Others	16	3.9

Maternal factors

Among mothers, 50 (12.2%) were younger than 25 years old, while the majority, 252 (61.5%), were between 25 and 34 years old. Additionally, 108 (26.3%) of the mothers were older than 34 years. A total of 199 (48.5%) mothers resided in rural areas, whereas 211 (51.5%) lived in urban areas.

Among the participants, 174 (42.4%) were primiparous, meaning they were experiencing childbirth for the first time. In contrast, 236 (57.6%) were multiparous, having given birth multiple times. Most of the mothers, 397 (96.8%), received antenatal care during pregnancy, whereas 13 (3.2%) did not receive any antenatal care.

Spontaneous labor occurred in 392 (95.6%) of the mothers, while labor induction was required for 18 (4.4%) of them. A total of 210 (51.2%) of the mothers experienced labor lasting less than 12 hours, whereas 200 (48.8%) had labor lasting 12 hours or longer

Among the mothers, 8 (2.0%) experienced rupture of membranes before the onset of labor, while the majority, 402 (98.0%), did not. A total of 208 (50.7%) mothers gave birth in a government hospital, while 194 (47.3%) delivered at a health center. Additionally, 8 (2.0%) mothers gave birth at home (see Table 3).

Table 3: Maternal factors among term and post-term neonates admitted in NICU, at Tibebe Gion specialized hospital (TGSH) North West Ethiopia, 2025.

Variables	**Category**	**Frequency(n)**	**Percentage (%)**
Age of the mother	<25	50	12.2
	25-34	252	61.5
	>34	108	26.3
Place of residency	Rural	199	48.5
	Urban	211	51.5
Parity	Primipara	174	42.4
	Multipara	236	57.6
Antenatal care	Yes	397	96.8
	No	13	3.2
Onset of labor	Spontaneous	392	95.6
	Induction	18	4.4
Duration of labor (in hours)	<12 hours	210	51.2
	≥12 hours	200	48.8
Rupture of membrane before onset of labor	Yes	8	2.0
	No	402	98.0
Place of delivery	Gov't hospital	208	50.7
	Health center	194	47.3
	Home	8	2.0

Proportion of Meconium aspiration syndrome

The proportion of Meconium aspiration syndrome (MAS) was 8.5% (CI: 6.0-11.7) in this study (See Figure 2).

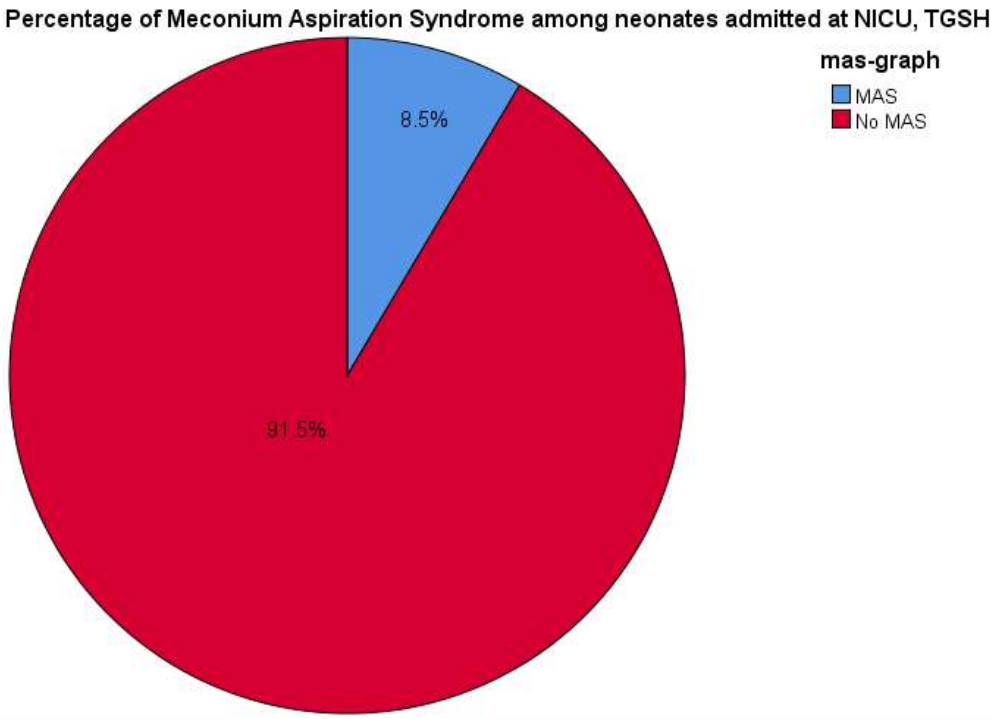

Figure 2:Shows the proportion of Meconium Aspiration Syndrome among neonates admitted at Tibebe Ghion Specilized Hospital, 2025.

Meconium-Stained Amniotic Fluid (MSAF) Detection was detected in 37 (9.0%) of the cases, while 373 (91.0%) had clear amniotic fluid. Among the 37 cases with MSAF, 7 (18.9%) were classified as Grade 1, 11 (29.7%) as Grade 2, and 19 (51.4%) as Grade 3. Meconium aspiration syndrome was diagnosed in 35 (8.5%) neonates, while 375 (91.5%) did not have the condition.

Meconium aspiration syndrome and its associated factors

The result of this study shows that gestational age, onset of labor, and first minute APGAR were significantly associated with meconium aspiration syndrome.

Newborns born post-date (>40 weeks) had five times higher odds of developing MAS compared to those born at term (37-40 weeks) (AOR: 5.179, 95% CI: 2.104-12.751). This indicates a statistically significant association between post-date/term gestation and MAS.

Neonate born after labor induction had more than four times higher odds of MAS compared to those with spontaneous onset of labor (AOR: 4.484, 95% CI: 1.259-15.962). This suggests that labor induction is a significant risk factor for MAS.

Neonates with an APGAR score of less than 7 at the first minute had more than Seven times higher odds of MAS compared to those with a score of 7 or more (AOR: 7.463, 95% CI: 2.783-20.016). This suggests that fetal distress significantly increases the risk of MAS (see Table 4).

Table 4: Bivariable and multivariable logistic regression of Meconium aspiration syndrome (MAS) and its associated factors, among term and post-term neonates admitted in NICU, at Tibebe Gion specialized hospital (TGSH) North West Ethiopia, 2025.

Variables category	Meconium Aspiration Syndrome (MAS)		COR (95% CI)	AOR (95%CI)
	Yes	No		
Gestational age				
Term (37-40)	21	345	1	1
Post-date/term (>40)	14	30	7.667(3.541-16.597)	5.179(2.104-12.751) **
Onset of labor				
Induction	7	11	8.273(2.975-23.002)	4.484(1.259-15.962) *
Spontaneous	28	364	1	
First minute APGAR				
<7 score	14	28	8.072(3.706-17.579)	7.463(2.783-20.016) **
≥7 score	21	339	1	1
Fifth minute APGAR				
<7 score	19	106	2.924 (1.449-5.924)	1.415(0.571-3.507)
≥7 score	16	261	1	1
Mode of delivery				
C/S and Instrumental	12	71	2.234(1.061-4.702)	1.741(0.707- 4.284)
SVD	23	304	1	

Note: *p-value<0.05, **p-value<0.01

5. Discussion

. In this study we found that the proportion of meconium aspiration syndrome is 8.5% among term and post term neonates in TGSH. A study done in southern Ethiopia at Nigist Elleni Mohammed memorial hospital ,it was found that the prevalence of MAS was 30.6% among term and post term neonates which higher than the current study .The possible explanation for the difference may be small sample size for that study and high risk mothers like PROM ,APH were taken are (21).

In a study done in south Gonder at Debretabor compressive specialized hospital the overall proportion of MAS was 7.8% among neonates born with MSAF which is difficult to compare with the current study because the study in south Gonder was on mother with MSAF which is the strong risk factor for the development of MAS(2). Another study done in Nigeria the proportion of MAS among neonates admitted to NICU was 0.57 %(19) which is significantly lower than the current study and the possible explanation for this significant discrepancy is due to the study includes all neonates including preterm who are at very low risk for MAS .Another study in Italy shows the proportion of MAS among term and post term neonates found to be 2% (15)which is lower than the current study. This may be due to set up and good follow up during labor and delivery. In Pakistan a study was done among term and post –tem neonates and it was found that the prevalence of MAS was 4.9% which is lower than the current study(23).with possible explanation may be better perinatal care at Pakistan .

A study in South Africa Johannesburg proportion of MAS among MSAF mothers during labor was found to be 4 %(18) which lower than the current study probably good set up for feto-maternal follow up during labor and delivery .Another study done in Australia the proportion of MAS among term and post-term neonates was 2%(14) which lower than the current study probably due good set for perinatal follow up during labor and delivery .

Post-term pregnancies are associated with an increased odds of MAS (AOR 5.179, 95% CI: 2.104-12.751) found in the current study. This study goes in line with the study done at Nepal (13), and in Nigeria(19). The likelihood of meconium-stained amniotic fluid (MSAF) rises with gestational age, leading to a higher incidence of MAS in post-term infants(14).

Neonate born after labor induction had more than Four times higher odds of MAS compared to those with spontaneous labor (AOR: 4.484, 95% CI: 1.259-15.962). This suggests that labor induction is a significant risk factor for MAS. This finding is supported by other studies done in Ethiopia which is found to be neonates born after labor induction had 2.6 times more likely to

develop MAS as compared to the spontaneous onset of labor(6). Similar finding was observed in southern Ethiopia study(AOR: 4.34, 95% CI: 1.83, 10.30)(4), and South Gonder which shows labor induction has 3.3 higher odds of MAS(2). In contrast a study done in Australia induction of labor was associated with a reduced risk of MAS compared with women who were not induced, <40 weeks of gestation(14). The possible explanation for this may be the set up for follow up after starting induction and the gestational age cut of for induction indication which is usually greater than 42 weeks.

A low first-minute APGAR score (<7) is a significant risk factor for MAS (AOR 7.463, 95% CI: 2.783-20.016). This is supported by a study done in South Africa, Johannesburg in neonates with poor Apgar score (<7) are more likely to have MAS(18).the current study also supported by a study done in Nepal which was found to be low first minute APGAR(<7) had higher odds for MAS(13).

Limitation of the study

This study has some limitation which should be considered while interpreting this result. Using secondary source of data, and study done at tertiary care center should be under consideration.

6. Conclusion and Recommendation

Conclusion

The current study found that, the proportion of neonates developed Meconium Aspiration Syndrome (MAS), was high compared with other studies (Nigeria, Pakistan, South Africa and Italy). The current findings also indicate that post-term gestation and low first-minute APGAR scores and labor induction are significant risk factors for MAS. These insights emphasize the need for careful perinatal management and close follow up of mothers who are on induction is crucial to reduce the incidence of MAS.

Recommendations

- ✓ Enhanced Fetal Monitoring for Postdate and Post-Term Pregnancies: Close surveillance of pregnancies beyond 40 weeks to identify fetal distress early and prevent MAS development.
- ✓ Improved Intrapartum Care and Neonatal Resuscitation: Continuous fetal monitoring during labor, particularly in cases with rapid progression, to detect distress and intervene promptly.
- ✓ Routine APGAR-Based Risk Assessment: Early intervention for neonates with low first-minute APGAR scores to reduce complications and Prompt NICU admission and respiratory support for newborns at risk of MAS.
- ✓ Public Health and Clinical Awareness: Training healthcare providers on MAS risk factors, including prolonged gestation and birth asphyxia, to enhance decision-making during labor and delivery. Educating pregnant women on the risks of post-term pregnancies and encouraging timely antenatal visits to optimize outcomes.

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7. Annexes

7.1 Information

My name is Dr. Minwuyelet Amera a 3rd year pediatrics and child health resident .I am going to conduct a study on proportion and associated factor of meconium aspiration syndrome among term and post term neonates admitted TGSH .

Here is the questionnaire prepared to collect data from the retrieved patient chart .for any unclear questions please communicate with the principal investigator.

Thank you

7.2 Questionnaire

Date of data collection ……..

MRN ……..

Code ……..

Data collector ……

Part I. Sociodemographic status

1. Age of the mother …….

2 .Residency

A .Urban B. Rural

PART 2: OBSTETRIC factors

1. Parity

A. primipara B .multipara

2. Gestational age (in weeks)……..

3. Antenatal care

A .yes B. no

4. Duration of labor (HRS)……..

5 .Onset of labor …… A. Spontaneous B. Induction

6 .Rupture of membrane

A. before onset of labor B .after labor started

7. Place of delivery

A. Hospital B .heath Center C .home

8. Perinatal complications

A. yes B. no

8.1 If yes which complications

A. Preeclampsia /eclampsia B .APH C. PROM D. If other specify

Part 3: neonatal factors

1. Age at admission (hrs.)……
2. Sex of neonate A. male B. female
3. Birth weight (gm)……
4. APGAR at 1st Minute …….
5. 5th minute APGAR. …….
6. Mode of delivery ……..A, C/S B, SVD C, Instrumental assisted

6.1 If C/S what was the indication … A, maternal B, fetal

7. Was MSAF detected … (Yes/No?)

7.1 If YES grade of meconium ….A.grade1 B. grade2 C. grade3

8 Is the neonate has clinical diagnosis of MAS?

9. Other diagnosis A) sepsis B) NHB C) PNA D) birth trauma If other specify ……..

7.3 Declaration

I would like to declare that the best of my knowledge this research proposal is my own work.

It has not been presented to any institution either partially or totally for any academic award or for publication.

The work here is original where the work of others are appropriately referenced.

This research thesis is for partial fulfilment of my specialty in the department of pediatrics and child heath BDU

Investigator: Dr Minwuyelet amera (3rd year pediatrics and child heath resident)

Signature.....date...02/02/17.....

This research thesis is submitted with the approval of the following advisor.

Advisors

1. Dr Achenef Mothainot (PhD)

Signature .....date ...02/02/17 E.C.

2. Dr Yalemwork Antench (MD, pediatrician)

Signature .....date 02/02/17 E.C

