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Research Article

Prevalence and risk factors Associated with Meconium Aspiration Syndrome among neonates admitted to Neonatal Intensive Care Unit in Southern Ethiopia

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Abstract

Background: Meconium Aspiration Syndrome is one of the most frequent causes of respiratory distress in newborn babies. Meconium Aspiration Syndrome (MAS) is a global health concern and a major contributing factor to morbidity and mortality among neonates, particularly in low and middle-income countries. Data on the magnitude and risk factors of Meconium Aspiration Syndrome among neonates admitted into NICU were scarce, especially in resource-limited countries, like Ethiopia. This study sought to assess the prevalence clinical proportion of Meconium Aspiration Syndrome and associated factors in the study area.

Methods: An institutional-based cross-sectional study was conducted from March to July 2022 on neonates who were admitted into the Neonatal Intensive Care Unit of Wachemo University Nigist Eleni, Comprehensive Specialized Hospital, Southern Ethiopia. A total of 255 neonates with their indexed mothers were included in the study. A pretested and structured questionnaire was used to collect the data from study participants, using a systematic random sampling technique. A combination of interviews and chart reviews were used to collect the data. Data was entered into Epi-Data Manager version 3.1 and exported to SPSS version 25 for analysis. Frequency, percentage, and summary statistics were used to describe the study subjects. A multivariate regression model was used to identify factors associated with MAS. Finally, statistical significance was declared at a p-value of <0.05, and an adjusted odds ratio with a 95% confidence level was used to report the strength of the association.

Result: Two hundred fifty-five neonates with their mothers were included with a response rate of 100%. The prevalence of Meconium Aspiration Syndrome (MAS) in this study was found to be 30.6%. 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), APH (AOR=3.5; 95% CI: 1.08-11.96), obstructed labor (AOR=26.5; 95% CI: 5.0-140.0), and PROM (AOR=14.3; 95% CI: 3.7-55.5) were found to have a significant association with Meconium Aspiration Syndrome among neonates.

Conclusion: Meconium Aspiration Syndrome was highly prevalent among neonates admitted to NICU. Neonates born to mothers with prime para, pregnancy-induced hypertension, antepartum hemorrhage, obstructed labor, and pre-matured rupture of the membrane were found to have significantly associated with the development of Meconium Aspiration Syndrome. Conversely, neonates having low Apgar scores were associated with decreased risk of developing Meconium Aspiration Syndrome.

Keywords: Meconium Aspiration Syndrome; Risk factors; Neonatal intensive care unit; Neonates; Ethiopia

Abbreviations

AORs: Adjusted Odds Ratios; APH: Antepartum Hemorrhage; CIs: Confidence Intervals; GDM: Gestational Diabetes Mellitus; MAS: Meconium Aspiration Syndrome; NEMMCSH: Nigist Eleni Mohammed Memorial comprehensive specialized hospital; NICU: Neonatal Intensive Care Unit; PROM: Premature Rupture of Membrane

Introduction

Meconium is an odorless, thick, germ-free, and black-green material that is first noticeable in the fetal intestine around the third month of pregnancy [1,2]. Meconium Aspiration Syndrome is referring to anew born babies' respiratory distress secondary to aspiration of meconium-stained amniotic fluid into the tracheobronchial airways during the antepartum or intrapartum period [3]. Meconium Aspiration Syndrome is a major problem a clinician observes while conducting newborn care in the health care facility [4]. Meconium Aspiration Syndrome (MAS) in newborns is a significant cause of respiratory distress [5]. It is a major cause of morbidity and mortality among neonates and a common reason for requiring admission to the neonatal intensive care unit, particularly in developing countries [6,7]. Meconium passage likelihood increases progressively with age and it is less common before 37 weeks of gestational age [8]. Newborns with Meconium Aspiration Syndrome often show the classical signs of respiratory distress with marked tachypnea, retractions, grunting, nasal flaring, and cyanosis that ensue instantly the following birth [2].

Meconium Aspiration Syndrome is a global health problem and a major factor in neonatal morbidity and mortality and it is the most common etiology of respiratory distress [9]. Newborn morbidity and mortality are concerning health problems, particularly in low and middle-income countries contributing the majority of the burden [10]. Previous studies indicated that the contribution of Meconium

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Aspiration Syndrome to neonatal mortality accounted for 3%-5% [11,12]. Previous studies showed that about 8% to 15% of newborns are born with meconium-stained amniotic fluid and 5% of them develop MAS [13]. The literature revealed that MAS was found in 34% of infants in Australia and New Zealand who were born after 40 weeks [11]. Among the MAS cohort study, 2.5%) died as a result of MAS [14].

The exact etiology of Meconium Aspiration Syndrome is still not clear. However, many previous studies revealed that Maternal, neonatal, and intrapartum socio-demographic characteristics were major risk factors for MAS. Among maternal risk factors that were positively associated with the development of Meconium Aspiration Syndrome were null parity, anemia during pregnancy [15], pregnancy-induced hypertension and preeclampsia [16], maternal age [17], mother HIV positive [18] and medical disease of mothers [8]. Additionally, several studies have shown that prolonged labor [19-21], premature rupture of the membrane [21, 22], induction of labor [16], cesarean delivery [14,23], advanced gestation [14,23-25], low Apgar score at the first minute and abnormal fetal heartbeat [23,25-27] were significantly associated with the development of MAS.

In Ethiopia, reports indicated that increasing neonatal mortality from 23 to 33 deaths per 1000 live births, and 60% of infants were at higher odds of dying from avoidable risk factors [28]. A study conducted in Jimma revealed that high prevalence of MAS among meconium-stained amniotic fluid which accounted for 71.4% [14]. However, there have only been a few studies conducted in Ethiopia that have focused only on the causes of MSAF and its outcome. Nevertheless, while studies were conducted in the developed world, records on the magnitude and risk factors of Meconium Aspiration Syndrome were scarce, especially in resource-limited countries, like Ethiopia. Therefore, this study aimed to assess the prevalence and risk factors of Meconium Aspiration Syndrome among neonates attending the NICU of Wachemo University Comprehensive Specialized Hospital in southern Ethiopia.

Methods and Materials

Study area and period

Wachemo University Nigist Eleni Mohammed Memorial Comprehensive Specialized Hospital is located in Hosanna Town, the capital city of the Hadiya Zone in southern Ethiopia. It is about 230 kilometers from Addis Ababa, which is the capital city of Ethiopia. The hospital is one of the largest hospitals in Ethiopia and serves more than 4 million people as a referral hospital in the southern part of Ethiopia. The hospital has 20 NICU beds, 10 ventilators, 3 incubators, 2 radiant warmers, a CT scan, MRI, and 2 phototherapy units for newborn infants. It was one of the largest NICUs in the southern region of the state, with a very high patient admission rate. It also has a very high patient flow of 150 neonates per month on average. The study was conducted from January to April 2022.

Study design

An institution-based cross-sectional study was conducted among neonates admitted into the Neonatal Intensive Care Unit of Wachemo University Nigist Eleni Mohammed Memorial Comprehensive Specialized Hospital.

The source and study population

All neonates admitted to the neonatal intensive care unit of Wachemo University Nigist Eleni Mohammed Memorial Comprehensive Specialized Hospital were the source of the population, and all selected neonates during the study period were the study population. Those mothers who presented to the neonatal intensive care unit with their babies who refused to participate in the study were excluded.

Sample size determination

The required sample size was determined using the single population proportion formula by taking the following assumptions: prevalence of Meconium Aspiration Syndrome was18.5% from the previous study [15], 95 % confidence level (Z=1.96), and 5% margin of error (d), which yields 232. After adding 10% of the sample size for the non-response rate, the required sample size was 255. Then, the samples were selected using a systematic random sampling technique by selecting every other term neonate. The first case was selected by using the lottery method.

Data Collection procedures

Pre-tested interviewer-administered questionnaires and checklists were used to collect the data. The tools were developed by reviewing different works of previous literature [14,17,19,29]. The tool was prepared in English and translated into the local language 'Amharic' to ensure the clarity of questions to respondents. A pretest was conducted in Worabe Comprehensive Specialized Hospital by taking 15% of the sample size that was not included in the actual study population. Correction on the instrument was done accordingly. Data were collected by four trained well experienced BSc nurses and the data collection process was supervised by the principal investigators. Before the date of actual data collection, training was given to data collectors and supervisors for two days duration about the data collection and how to handle the data, and the content of the tools. The data was collected during the admission of the neonate to the NICU and by reviewing the registration book records in the NICU of Wachemo University Nigist Eleni Mohammed Memorial comprehensive specialized hospital.

Operational definition

MAS: Meconium Aspiration Syndrome is defined as newborn respiratory distress secondary to the presence of meconium in the tracheobronchial airways and diagnosed based on clinical parameters by a pediatrician (tachypnea, grunting, nasal flaring, and chest retraction) and the presence of classic radiographic findings that are overexpansion of the lungs with widespread coarse, patchy infiltrates [16].

Data processing and analysis

The data were entered into the EPI-data manager Version 4.6 software. The data that was entered into Epi Data was checked and cleaned. Then, it was transferred to SPSS version 25 for analysis. Then, an exploratory analysis was conducted to determine the level of missing values, influential outliers, and data distribution. The data were summarized using frequency tables, percentages, graphs, and means with standard deviations or medians with values, and to determine the number of expected events per cell. Binary logistic regression was used for the analysis of the data. Model fitness was checked using Hosmer and Lemeshow test (p=0.83). To determine associated factors multivariate logistic regression analyses were used. To determine the relationship between the two variables, the odds ratio and p-value were calculated. To adjust for probable confounders, variables with a p-value of less than 0.2 were entered into a multivariable logistic regression model. Finally, variables with a p-value less than 0.05 with

a 95% confidence interval were considered as significantly associated with the development of Meconium Aspiration Syndrome.

Ethical consideration

Ethical clearance was approved by Wachemo University Institutional Review Board (IRB). A formal cooperation letter was written by Wachemo University and submitted to Wachemo University Nigist Eleni Mohammed Memorial Comprehensive Specialized Hospital administrative to obtain their cooperation. We obtained the permission letter to collect the data. The purpose of the study and confidentiality were explained. The study was conducted per the declaration of Helsinki. At the time of data collection, verbal consent was taken from the participants' mothers to confirm whether they were willing to participate. Those not willing to participate were given the right to do so. Confidentiality of responses was also ensured throughout the research process.

Result

Two hundred fifty-five neonates with their mothers from January to April 2022 were included in the study with a 100% response rate.

Socio-demographic characteristics of the neonates' mothers

Nearly one-third, 92 (36.1%) of mothers were found in the age group of 25 to 29 years. The study finding showed that 135 (52.9%) study participants were from urban areas. Regarding educational status, 96 (37.6%) of the participants had no formal education. On the other hand, the majority of the mothers 233 (91.4%) were married. About nearly half 120 (47.1%) of the mothers were housewives (Table 1).

Obstetrics related factors

Of the total participants majority 159 (62.4%) of the mother were multiparas and the remaining 96 (37.6%) of the mother were para I.

Table 1: Socio-demographic characteristics of mothers of newborns at Wachemo University Nigist Eleni Mohammed Memorial Comprehensive Specialized Hospital, South Ethiopia (n=255).

Variables	Category	Frequency (%) (n=255)
Age	≤ 19 yr	4 (1.6%)
	20 yr-24 yr	52 (20.4%)
	25 yr-29 yr	92 (36.1%)
	30 yr-34 yr	76 (29.8%)
	≥ 35	31 (12.2%)
Educational status	No formal education	96 (37.6%)
	Primary	43 (16.9%)
	Secondary	57 (22.4%)
	Higher education	59 (23.1%)
Residence	Rural	135 (52.9%)
	Urban	120 (47.1%)
Religion	Muslim	34 (13.3%)
	Orthodox	66 (25.9%)
	Protestant	121 (47.5%)
	Catholic	24 (9.4%)
	Other	10 (3.9%)
Occupation status	Housewife	120 (47.1%)
	Private	15 (5.9%)
	Government	48 (18.8%)
	Merchant	26 (10.2%)
	Student	46 (18%)
Marital status	Married	233 (91.4%)
	Single	12 (4.7%)
	Widowed	7 (2.7%)
	Divorced	3 (1.2%)

Regarding, gestational age most of the participants 199 (78%) were between 37 wk-42 wk and the remaining 22.0% were post-term. About 179 (70.2%) of the mothers had regular ANC follow-ups for the current neonates. Nearly One-third of the mother 87 (34.1%) had pregnancy-related anemia and regarding the mode of delivery for the current neonates, almost two-thirds 189 (74.1%) of the mothers were delivered by spontaneous vaginal delivery. Only 8(3.1%) of the mother conducted instrumental delivery for the current neonates. Seventy-eight (18.8%) of the neonates was born from mothers with obstructed labor. On the other hand, this study revealed that 60 (23.5%) of the neonates were born from mothers with PROM, 55(21.6%) of the neonates was born from mothers with antepartum hemorrhage, 29 (11.4%) of the neonates born from mothers with gestational diabetics mellitus and 28 (11%) of the neonates born from mothers who had an infection (Table 2).

Table 2: Obstetrics characteristics of mothers of Term neonates at NICU Nigist Eleni Mohammed Memorial Comprehensive Specialized Hospital, South Ethiopia (n=255).

Variable	Category	Frequency (percentage) n=255
Parity	Primipara	96 (37.6%)
	Multipara	159 (62.4%)
Gestational age	37 week-42 week	199 (78%)
	>42 weeks	56 (22.0%)
ANC follow up	Yes	179 (70.2%)
	No	76 (29.8%)
Anemia	Yes	87 (34.1%)
	No	168 (65.9%)
Pregnancy-induced hypertension	Yes	31 (12.2%)
	No	224 (87.8%)
APH	Yes	55 (21.6%)
	No	200 (78.4%)
Oligohydramnios	Yes	23 (9%)
	No	232 (91%)
Induction of labor	Yes	36 (14.1%)
	No	219 (85.9%)
Gestational DM	Yes	29 (11.4%)
	No	226 (88.6%)
Infection	Yes	28 (11%)
	No	227 (89%)
Mode of delivery	SVD	189 (74.1%)
	C/S	58 (22.7%)
	Instrumental	8 (3.1%)
Duration of labor	>12 hr (prolong)	76 (29.8%)
	<12 hr	179 (70.2%)
PROM	Yes	60 (23.5%)
	No	195 (76.5%)
Obstructed labor	Yes	78 (18.8%)
	No	207 (81.2%)

Neonatal related factors

The study findings showed that more than half 148 (58%) of the term neonates were female. Nearly two-thirds of the term neonates were delivered in the hospital 188 (73.7%), and only 17 (6.7%) of the neonates were delivered at home. Regarding the presentation of the fetus during the delivery, only 12 (4.7%) of the term neonates had an abnormal presentation. The majority of the term neonates 175(68.6%) were delivered from mothers who had meconium-stained amniotic fluids. additionally, about 100 (39.2%) of the neonates experienced fetal distress. On the other hand, the majority of the neonates 144 (56.5%) recorded Apgar scores of less than 7 in the first minute of newborn and only 17 (6.6%) of the term neonates' Apgar scores were unknown since home delivery (Table 3).

Table 3: Characteristics of term neonates who were admitted to the NICU of Nigist Eleni Mohammed Memorial Comprehensive Specialized Hospital, South Ethiopia (n=255).

Characteristics	Category	Frequency (%) (n=255)
Presentation	Vertex	243 (95.3%)
	Non-vertex	12 (4.7%)
Place of delivery	Home	17 (6.7%)
	Health center	42 (16.5%)
	Private clinic	8 (3.1%)
	Hospital	188 (73.7%)
Gender	Male	107 (42%)
	Female	148 (58%)
Birth weight	<2.5 kg	45 (17.6%)
	2.5 kg-4 kg	183 (71.8%)
	>4 kg	27 (10.6%)
Intrauterine meconium release	Yes	80 (31.4%)
	No	175 (68.6%)
Fetal distress	Yes	100 (39.2%)
	No	155 (60.8%)
Meconium aspiration syndrome	Yes	78 (30.6%)
	No	177 (69.4%)
APGAR score at-1 minute	≤ 3	13 (5.1%)
	04-Jun	131 (51.4%)
	07-Oct	94 (36.9%)
APGAR score at-5 minute	≤ 3	0
	04-Jun	99 (38.8%)
	07-Oct	139 (54.5%)

Prevalence of meconium aspiration

The prevalence of Meconium Aspiration Syndrome (MAS) among neonates who were admitted to the NICU of Wachemo University Nemmcsh was found to be 78 (30.6%) with (95% CI: 25.1-36.5) (Table 4).

Table 4: Bi-variable and Multivariable Analysis of Factors Associated with Meconium Aspiration Syndrome among term neonates admitted to the NICU of Wachemo University Nigist Eleni Mohammed Memorial Comprehensive Specialized Hospital, Southern Ethiopia 2022.

Variables	MAS		COR 95%CI	AOR 95%CI	p-value
	Yes	No			
Parity of the mother					
Primipara	41	55	2.45 (1.4, 4.2)	1.7 (1.01, 10.1)	0.047
Multipara	37	122	1	1	
pregnancy-induced hypertension					
Yes	20	11	5.75 (2.35, 11.51)	6.2 (1.19,33.2)	0.03
No	58	166	1	1	
Antepartum hemorrhage					
Yes	28	27	3.11 (1.67, 5.77)	3.5 (1.08, 11.96)	0.037
No	50	150	1	1	
Oligohydramnios					
Yes	12	11	2.74 (1.15,6.52)	0.61 (0.11,3.33)	0.574
No	66	166	1	1	
Place of delivery					
Home	2	15	4.15 (0.922,18.71)	0.34 (0.012,9.7)	0.53
Health center	6	36	3.32 (1.33,8.29)	.42 (0.109,1.62)	0.912
Privet clinic	3	5	.923 (.214,3.98)	.46 (.037,5.88)	0.55
Hospital	67	121	1	1	
Premature rupture of membrane					
Yes	53	7	51.5 (21.07,125.7)	14.3 (3.7,55.5)	0
No	25	170	1	1	
Obstructed labor					
Yes	39	9	18.6 (8.3,41.7)	26.5 (5.0,140.0)	0
No	39	168	1	1	
APGAR score at five minute					
<7	71	36	0.025 (0.011,0.059)	0.016 (0.004,0.068)	0
7-10	7	141	**1**		

Factors associated with meconium aspiration syndrome

In multivariate analysis primipara, premature rupture of membrane, preeclampsia, obstructed labor, and antepartum hemorrhage was significantly associated with Meconium Aspiration Syndrome. Whereas, term neonates born from primipara mothers (AOR=1.7; 95% CI: 1.01-10.1) were nearly 2 times more likely to develop Meconium Aspiration Syndrome compared to those who were born from multiparous mothers. Maternal preeclampsia was significantly associated with Meconium Aspiration Syndrome. Neonates born from mothers who had pregnancy-induced hypertension (AOR=6.2; 95% CI: 1.19-33.2) were 6 times more likely to develop Meconium Aspiration Syndrome. On the other hand, the odds of term neonates who were born from mothers with Antepartum Hemorrhage (APH) (AOR=3.5; 95% CI: 1.08-11.96) showed that increased the development of MAS compared to those born from mothers who had no APH. In addition, term neonates who were born from obstructed mothers (AOR=26.5; 95% CI: 5.0-140.0) were 26 times more likely to develop MAS compared to those who were born from none obstructed mothers. Finally, term neonates born from mothers who had pre-matured rupture of the membrane were 14 times more likely to develop MAS compared to those born from mothers without PROM (AOR=14.3; 95% CI: 3.7-55.5).

Discussion

Meconium Aspiration Syndrome (MAS) is a challenging problem and one of the most common causes of respiratory distress among neonates, which is the main reason for NICU admission. In this study, the prevalence of MAS was 30.6% among the term neonates. This study's findings are higher than others study reported in Bahir-Dar at 17.8% [17], Saudi Arabia at 4.2% [30], India at 26%, Harding medical college in India at 16% [31], Nepal at 6.6% [32], and USA 4.6%. The discrepancy might be due to poor quality maternal care services in the current study due to the overcrowded patient flow. The crowding might have various systematic consequences on the quality-of-care services by undermining the ability of clinicians and the whole maternal care services in the healthcare setting. Therefore, our study area is the only referral comprehensive hospital to the catchment area, which services about four million people. Another justification for this discrepancy may be due to the difference in sources of population socio-cultural variation. However, another study conducted in Jimma reported that 71.4% [14] of neonates had MAS, which was relatively higher than that in our study. The difference might be the difference in the study population; this study included only neonates born from mothers with MSAF, but in our study, all neonates who were admitted to NICU were included.

This study revealed that neonates born from primipara mothers were nearly 2 times more likely to develop Meconium Aspiration Syndrome compared to those neonates born from multiparous mothers. This study was supported by the study conducted in Klaipeda University of Lithuania [15], India [33], Auckland, and New Zealand [29]. The possible justification might be explained that more fetal complication during labor is common among the primipara mothers due to prolonged and obstructed labor. Hence, it results increasing of the intrauterine meconium release during the 2nd stage of labor, which increased the aspiration of meconium.

This study found the odds of Meconium Aspiration Syndrome increased about 6 times more comparing neonates born from mothers who had pregnancy-induced hypertension to those neonates whose mothers did not have pregnancy-induced hypertension. This study

was supported by the study conducted in Bahir Dar [17], Taiwan [34], and India [35]. This might be the reason since pregnancy induces hypertension and can cause placental dysfunction which may lead to fetal hypoxia there for a decrease in oxygen supply can lead to the fetus in distress. This can cause weakness of the anal sphincter of the fetus that increases intrauterine meconium release.

This study revealed that neonates born from mothers who had antepartum hemorrhage were about 4 times more likely to develop Meconium Aspiration Syndrome compared to those born from mothers who did not have an antepartum hemorrhage. We couldn't find any previously reported study regarding the association between antepartum hemorrhage and MAS. The possible justification might be due to uteroplacental ischemia that results from fetal distress, which is highly associated with intrauterine meconium release. In addition, the mothers who had APH might be an increased rate of cesarean section than spontaneous vaginal delivery, as a mode of delivery incidence of cesarean section increased, which is seen and associated with meconium release [29].

This study also found the odds of MAS increased about 14 times more compared to neonates whose mothers had premature rupture of the membrane to those mothers who did not have premature rupture of the membrane. This finding is in line with a study conducted in India by Keziah Joseph [22]. The possible justification might be due to mothers with premature rupture of membrane had probably increased the chance of deliveries by induction of labor, which increased fetal distress since tetanic uterine contraction after oxytocin administration. When the fetus suffered from fetal distress, increased para-sympathetic stimulation by the vagal nerve results in the passage of meconium from the fetal gastrointestinal. Hence, fetal distress might have been increasing the meconium-stained amniotic fluid that leads to meconium aspiration. This is supported by a previous study by Linas Rovas [15], which showed induction of labor was significantly associated with the development of MAS. However, we couldn't find previous reports on the direct association between PROM and the development of Meconium Aspiration Syndrome. Hence, we recommend researchers for further studies to identify the association between PROM and the development of MAS.

Another finding from our study is that the odds of Meconium Aspiration Syndrome were twenty-six times more likely observed among term neonates born from mothers who had obstructed labor compared to those term neonates born from mothers who did not have obstructed labor. This study is supported by a study conducted in East North Ethiopia that revealed obstructed labor was significantly associated with the development of Meconium-stained amniotic fluid among neonates. The possible explanation might be due to obstructed labor could increase the prolonged fetal stressfulness during labor, which might increase the peristalsis of the fetal gastro intestine and relaxation of anal sphincters of the fetus that leads to passage of meconium.

Conversely, this study found that neonates having low Apgar scores at five minutes were associated with decreased risk of developing Meconium Aspiration Syndrome. However, a study in Nepal [21] reported that low Apgar scores at five minutes were strongly associated with increasing Meconium Aspiration Syndrome among neonates. Furthermore, this is against the finding of studies on risk factors of Meconium Aspiration Syndrome in different countries [1,8,15,27]. This discrepancy may result from different study populations and study settings where quality obstetric care services are provided. In addition, the sample size and methodological difference may impact this difference.

This study shares the limitations of cross-sectional studies. Therefore, might not be possible to establish a time-based relationship between Meconium Aspiration Syndrome and independent variables. Moreover, as the study was applied in a single teaching hospital, the results may not be representative of the whole community.

Conclusion

The prevalence of Meconium Aspiration Syndrome was higher compared to those reported previously worldwide. Multidimensional factors such as premature rupture of the membrane, pregnancy-induced hypertension, obstructed labor, primipara mothers, and Antepartum Hemorrhage were independently associated with an increased Meconium Aspiration Syndrome among the neonates who were admitted to NICU. Therefore, we would like to recommend to the clinicians early identification of the risk factors during the intrapartum period of the pregnancy and close monitoring using standard protocols to reduce the occurrence of MAS among the term neonates. We also recommend to researchers conduct a high-quality observational study design to detect the predictors of Meconium Aspiration Syndrome among neonates and confirm controversial results.

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Authors' Contributions

All authors had been involved in every stage of this work, whether that is in the conception, study design, execution, data acquisition, analysis, and interpretation, or all these areas; took part in drafting, revising, or critically reviewing the article. Moreover, all authors approved the final version of the manuscript, agreed to submit it to the selected journal, as well willing to be accountable for all aspects of the work.

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