Risk Factors Associated with Birth Asphyxia among Neonates in Maternity Teaching Hospital/Erbil City: A Case-Control Study

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ABSTRACT

Background and Objectives: Birth asphyxia is a critical condition characterized by the inability to begin and sustain breathing at birth. It is a leading cause of neonatal morbidity and mortality worldwide. This study aims to investigate the common risk factors for birth asphyxia in Erbil City.

Method: Matched case-control study was conducted from 1st October 2024 to 15th of Jan 2025 at Maternity Teaching Hospital in Erbil city, Iraqi Kurdistan Region, Data were collected through a questionnaire format and direct interview with the mothers of neonates diagnosed with birth asphyxia. The study recruited 276 neonates (92 neonates with birth asphyxia as a case group and 184 neonates without birth asphyxia as a control group). Newborns with congenital anomalies, congenital heart disease, premature babies (<35weeks), and epilepsy family history were excluded from both groups. The study utilized SPSS Version 27 for data analysis, employing chi-square to identify associations between case and control groups and univariate and multivariate logistic regression to identify risk factors independently associated with asphyxia, with a P-value of ≤ 0.05 considered significant.

Result: Risk factors were identified by the study and divided into antepartum and intrapartum maternal periods. Asphyxia was significantly linked to poor socioeconomic position, maternal illiteracy, number of gravidas with P- value of (0.022, 0.011, 0.006) and emergency caesarean section %35.9 with a very high significant P-value (<0.001). After adjusted factors like hypertension, infection, and polyhydramnios, they are associated with increased risks of asphyxia during pregnancy with odds ratios of 3.109, 2.168, and 3.024. And preterm premature rupture of membrane, difficult labour, prolonged second stage of labour, and fetal distress are associated with increased risks of asphyxia during labor with odds ratios of (4.906, 5.116, 6.739, and 8.685, respectively) at a significant level of <0.05.

Conclusion: The study concluded that factors such as socioeconomic status, level of education, hypertension, polyhydramnios, infection, prolonged and difficult birth, preterm premature rupture of membrane, fetal distress and emergency cesarean section were the main risk factors for induced birth asphyxia.

Keywords: Newborn; Risk factors; Asphyxia; Case-control study; Morbidity.

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INTRODUCTION

Birth asphyxia, also known as hypoxic-ischemic encephalopathy (HIE) is a clinical syndrome characterized by impaired neurological function in infants born at or beyond 35 weeks of gestation [1]. This condition occurs when the fetus lacks enough blood or gas exchange before, during, or after delivery, leading to hypoxemia and hypercapnia. Hypoxia and ischemia cause metabolic processes that result in neuronal cell death and brain damage [2]. Up to 26 neonates per 1,000 live births have a poor long-term result, including cerebral palsy, epilepsy, cognitive impairment, and learning problems. In addition, BA accounts for 25% of newborn mortality worldwide in poor and middle-income countries; perinatal asphyxia and other preventable causes of infant death accounted for 52% of all under-5 child mortality in South Asia, 53% in Latin America and the Caribbean, and 34% in Sub-Saharan Africa [3]. In Iraq the incidence of BA is as follows in Tikrit 22.2%, in Al-Diwaniya Province 16.5% of neonatal deaths, and in Basra among full-term newborns 0.74%, contributing to 4.9% of neonatal hospitalizations [4-6]. Severe birth asphyxia was observed in 1–8 per 1,000 live births at Babylon [7]. Perinatal asphyxia is linked to sociodemographic characteristics. Advanced maternal age ≥35 years increases placental abnormalities, and maternal illiteracy, poor prenatal care, and poverty contribute to higher BA rates and are significantly associated with adolescent pregnancy [8, 9]. Hypertensive disorder is strongly linked to BA, as they impair placental perfusion and fetal oxygenation and lead to prolonged second-stage labor, increasing the risk of severe HIE due to extended resuscitation needs [10, 11]. Prolonged or obstructed labor, non-cephalic fetal presentation and malpresentation, emergency C/S and meconium-stained amniotic fluid are also significant intrapartum factors [12, 13]. Healthcare disparities in low- and middle-income countries contribute to the risk of preterm birth, low birth weight, and protracted labor. Weak healthcare infrastructure and delays in medical intervention exacerbate these risks [14, 15]. Complications like uterine rupture and shoulder dystocia still exist in high-income countries like Norway and Sweden. [16, 17]. Neonatal resuscitation can prevent about 30% of intrapartum-related deaths on its own, and it is believed that 75% of all occurrences of perinatal asphyxia are preventable [8]. Reducing the occurrence of asphyxia is a critical responsibility of healthcare practitioners, especially midwives and nurses specialized resuscitation skills [18]. According to the official census, which has been recorded in the maternity teaching hospital in Erbil, there were 19062 neonates delivered in the hospital, 7115 cases admitted to NICU and 6019 cases were ≥ 35 weeks, 202 of them diagnosed with BA and 17 neonates died because of the severity of HIE, and all 19062 deliveries during the year reported by maternity teaching hospitals. A total of 202 asphyxiated instances were observed, accounting for 10.59 per 1000 live-born neonates. Neonates who had BA documented in their medical records were considered cases of birth asphyxia. The case fatality rate was estimated by dividing the total number of deaths in the year by the total number of confirmed cases and multiplying by 100. The fatality rate was 8.41 percent from January 1 to December 31, 2023.

METHOD

A matched case-control study was conducted from the 1st of Oct. 2024 to the 15th of Jan. 2025 at Maternity Teaching Hospital in Erbil city, Iraqi Kurdistan region. Non-probability convenience sampling of

276 (92 as case, and 184 control) was asked, respectively, to participate in the study. The mothers who gave birth to babies and were diagnosed by neonatologists at the NICU department with BA were included as a case group, as well as the mothers who delivered babies diagnosed with other conditions and did not have signs of birth asphyxia as a control group. The sample size was estimated with EPI INFO version 7.1.1 Stat Calculation statistical software using the double population proportion formula for a matched case-control study with the following parameters: confidence level=95%; power=80%; odds ratio=2.53; case-to-control ratio=1:2; proportion of controls with exposure 17.7%; proportion of cases with exposure=35.2% [14, 19]. Mothers of newborns who were willing to participate and available at the NICU were included. Newborns who have congenital anomalies, congenital heart disease, or are premature babies less than 35 weeks or who have a family history of epilepsy were excluded from the study. The ethical approval was obtained from the scientific and ethical committee at the College of Nursing / Hawler Medical University, Number 2449 on 24/8/2024 with permission from the Directorate General of Health -Erbil, Ministry of Health and Maternity Teaching Hospital. To commence the study verbal consent was obtained from the mothers before starting the interview, and the purpose of the study was explained. The researchers promised to keep the data for confidentiality and anonymity. A special questionnaire format was built, and it included two parts. The first part consisted of two sections; the first section included the biographical characteristics of the neonates, and the second section was to assess the sociodemographic and reproductive characteristics of the mothers. The second part was to find out the factors associated with birth asphyxia, and it consisted of 19 questions related to antepartum (during pregnancy) and 13 questions related to intrapartum (during birth) factors. Two dichotomous question styles were used; the answer was 0 for no (haven't) and 1 for yes (have). The researcher distributed it through a direct interview technique; the same questions were posed for both groups, and the dependent variable was birth asphyxia. In contrast, the independent variables were socio-demographic characteristics and antepartum and intrapartum factors. Before the data collection, the validity of the questionnaire was obtained through related experts. Internal consistency reliability was determined and measured by applying Pearson correlation (r), which was 0.97. The pilot study was conducted with 10 participants excluded from the study. Data was analyzed through the Statistical Package of Social Science (SPSS-27). Data were shown in descriptive statistics of frequency, percentage, mean, standard deviation, and range (minimum and maximum values); chi-square was used to find out the association between case and control groups and inferential statistics such as univariate and multivariate logistic regression analysis were used to identify the risk factors independently associated with asphyxia. Statistical significance was associated when the P-value was equal to or less than 0.05.

RESULTS

From the total number of the mother's newborns, 276 (92 cases, 184 controls). The study reveals that 81.5% and 83.2% of neonates with the case and control groups have normal weight at birth, respectively. More than half (56%,53%) of both groups were male; almost all (100%) of participants were singleton births in every condition. The majority (95.7%,99.5%) of deliveries in both groups (case and control)

were inside hospital, respectively, and the majority (92.4%) had cephalic fetal presentation. A non-statistically significant association exists between case and controls regarding child characteristics, P ≥ 0.05 (Table 1).

Table 1: The distribution of child characteristics according to case and control group

Child characteristics		Case (92)		Control (184)		Chi-square P-value
		No.	(%)	No.	(%)	
Weight at birth	Low birth weight (<2500 gm)	5	(5.4)	5	(2.7)	0.516
	Normal birth weight (2500- <4000 gm)	75	(81.5)	153	(83.2)	
	High birth weight (>4000 gm)	12	(13.0)	26	(14.1)	
	Mean± SD (Range)	3238.04±591.672 (2000-4900)		3329.08±507.603 (1500-5000)		
Gender	Male	52	(56.5)	98	(53.3)	0.608
	Female	40	(43.5)	86	(46.7)	
Fatal Outcome	Single	92	(100)	184	(100)	-
	Twin	-	-	-		
Place of Childbirth	Home	2	(2.2)	1	(0.5)	0.061
	Private Hospital	2	(2.2)	-	-	
	Public Hospital	88	(95.7)	183	(99.5)	
Presentation of the Fetus	Cephalic	85	(92.4)	170	(92.4)	0.734
	Breech	5	(5.4)	12	(6.5)	
	Other Presentation	2	(2.2)	2	(1.1)	

Around one-third (33.7%) of mothers with asphyxia were aged between 21-25 years, while 25.5% of the control group were aged between 26-30. Most of the mothers (30.4%) of the case group were illiterate, while 27.2% of the control group had intermediate education. The majority of mothers (94.6%, 89.1%) in both groups were unskilled workers (housewives). Also, the majority (84.4%) of the case group, compared to 65.2% in the control group, live in low socio-economic status. There is a statistically significant association between the case and control groups according to the percentage of reproductive characteristics such as number of gravida, number of abortions, and mode of delivery at a P-value of <0.05.More than half (59.8 %) of the participants in the case group had a gravida number of 1-2 times which was higher (41.3%) compared to the participants in the control group, which reveals that 27.7% of the participants in the control group had several abortions 1-2 times, respectively, which was higher (14.1%) significantly associated with the participants in the case group at P-value of 0.027. In addition, (35.9%) of the case group compared with (17.9%) of the control groups had emergency C/S, majority (87% vs. 83.7%) had regular antenatal care visits (Table 2).

Table 2: The distribution of socio-demographic and reproductive characteristics of mothers according to case and control group

		Case (92)		Control (184)		Chi-square P-value
		No.	(%)	No.	(%)	
Age of mother	16-20	17	(18.5)	29	(15.8)	0.397
	21-25	31	(33.7)	44	(23.9)	
	26-30	22	(23.9)	47	(25.5)	
	31-35	13	(14.1)	33	(17.9)	
	>36	9	(9.8)	31	(16.9)	
	Mean± SD (Range)	26.30±6.130 (17-42)		28.04±6.579 (16-44)		
The educational level of the mother	Illiterate	28	(30.4)	33	(17.9)	0.011
	Can read and write	11	(12.0)	10	(5.4)	
	Primary	10	(10.9)	43	(23.4)	
	Intermediate	18	(19.6)	33	(17.9)	
	Secondary	11	(12.0)	22	(12.0)	
	College and above	14	(15.2)	43	(23.4)	

Table 2: The distribution of socio-demographic and reproductive characteristics of mothers according to case and control group

		Case (92)		Control (184)		Chi-square
		No.	(%)	No.	(%)	P-value
Occupation of Mother	Lower Professional	5	(5.4)	19	(10.3)	0.303
	Higher Professional	0	(0)	1	(5)	
	Un-skill workers	87	(94.6)	164	(89.1)	
Socio-economic status	Low (≤79 score)	74	(80.4)	120	(65.2)	0.022
	Middle (80-100 scores)	12	(13.0)	34	(18.5)	
	High (101-150 scores)	6	(6.5)	30	(16.3)	
	Mean± SD (Range)	66.82±20.188 (30.0-125.0)		74.59±22.822 (30.0-140.0)		
Gestational age	Preterm (<= 37 weeks)	34	(37.0)	57	(31.0)	0.593
	Normal term (38-40 weeks)	54	(58.7)	117	(63.6)	
	late and post term (>40 weeks)	4	(4.3)	10	(5.4)	
No. of gravida	1-2 times	55	(59.8)	76	(41.3)	0.006
	3-4 times	28	(30.4)	60	(32.6)	
	5-6 times	6	(6.5)	35	(19.0)	
	>6 times	3	(3.3)	13	(7.1)	
Para	1-2 Children	59	(64.1)	100	(54.3)	0.208
	3-4 Children	27	(29.3)	59	(32.1)	
	5-6 Children	4	(4.3)	21	(11.4)	
	>6 Children	2	(2.2)	4	(2.2)	
No. of abortions	Non	77	(83.7)	124	(67.4)	0.027
	1-2 times	13	(14.1)	51	(27.7)	
	3-4 times	2	(2.2)	5	(2.7)	
	≥5 times	0	(0)	4	(2.2)	
Mode of Delivery	Normal Vaginal Delivery	49	(53.3)	102	(55.4)	<0.001
	Emergency C/S	33	(35.9)	33	(17.9)	
	Elective C/S	10	(10.9)	49	(26.6)	
Antenatal care visits	Irregular (<4 visits)	12	(13.0)	30	(16.3)	0.477
	Regular (>=4 visits)	80	(87.0)	154	(83.7)	

The results found that there is a non-statistically significant association between case and control groups regarding the frequency of risk factors associated with antepartum (P-value >0.05), except for hypertension (P-value = 0.012), anaemia (P-value=0.037),infection(P-value=0.004), polyhydramnios (P-value= 0.019) and weakly significant maternal cardiovascular disease P-value = 0.045, respectively. (Table 3).

There is a non-statistically significant association between case and control groups concerning the frequency of risk factors associated with intrapartum (P-value >0.05),except for PROM (P-value= 0.033) PPROM (P-value = 0.004), induction of labour (P-value=0.005) , difficult labour, prolonged second stage of labour and Fetal distress (very high significant P-value <0.001), Cord prolapse and chorioamnionitis (P-value = 0.045) are weakly significantly associated with asphyxia (P-value<0.05 (Table 4). Univariate Logistic Regression analysis shows that illiterates are at more risk of developing asphyxia than those with high education (P = 0.017, OR = 2.606;95% C.I “1.188-5.718”). Also, those who have low socio-economic status are more at risk of developing asphyxia compared to those who have high socio-economic status (P = 0.017, OR = 3.083;95% C.I. “1.225-7.761”). (Table 5).

Table 3: Association between case and control groups according to risk Factors associated with antepartum (during pregnancy)

Variable		Case (92)		Control (184)		Chi-square
		No.	(%)	No.	(%)	P-value
Hypertension	No	78	(84.8)	173	(94.0)	0.012
	Yes	14	(15.2)	11	(6.0)	
Diabetes Mellitus	No	88	(95.7)	179	(97.3)	0.472
	Yes	4	(4.3)	5	(2.7)	
Anaemia	No	66	(71.7)	152	(82.6)	0.037
	Yes	26	(28.3)	32	(17.4)	
Infection (systemic, amniotic, extra-amniotic, cervical)	No	28	(30.4)	89	(48.6)	0.004
	Yes	64	(69.6)	94	(51.4)	
Thyroid Disease	No	90	(97.8)	181	(98.4)	0.750
	Yes	2	(2.2)	3	(1.6)	
Hepatitis	No	92	(100)	182	(98.9)	0.316
	Yes	0	(0)	2	(1.1)	
Antepartum vaginal bleeding	No	84	(91.3)	170	(92.4)	0.753
	Yes	8	(8.7)	14	(7.6)	
placenta previa	No	88	(95.7)	175	(95.1)	0.841
	Yes	4	(4.3)	9	(4.9)	
Polyhydramnios	No	81	(88.0)	176	(95.7)	0.019
	Yes	11	(12.0)	8	(4.3)	
Oligohydramnios	No	85	(92.4)	174	(94.6)	0.479
	Yes	7	(7.6)	10	(5.4)	
Intrauterine growth retardation	No	89	(96.7)	183	(99.5)	0.075
	Yes	3	(3.3)	1	(5)	
Maternal cardiovascular disease	No	90	(97.8)	184	(100)	0.045
	Yes	2	(2.2)	0	(0)	
Asthma	No	90	(97.8)	183	(99.5)	0.218
	Yes	2	(2.2)	1	(5)	
Loss of appetite	No	77	(83.7)	162	(88.0)	0.318
	Yes	15	(16.3)	22	(12.0)	
Antepartum depression	No	83	(90.2)	167	(90.8)	0.884
	Yes	9	(9.8)	17	(9.2)	
Using Chemical cleaning products	No	52	(56.5)	92	(50.0)	0.307
	Yes	40	(43.5)	92	(50.0)	
Exposure to Radiation	No	83	(90.2)	162	(88.0)	0.590
	Yes	9	(9.8)	22	(12.0)	
Using electronic devices more than usual	No	90	(97.8)	179	(97.3)	0.787
	Yes	2	(2.2)	5	(2.7)	

Table 4: Association between case and control groups according to Risk Factors associated with intrapartum (during labour)

Variable		Case (92)		Control (184)		Chi square P-value
		No.	%	No.	%	
Prolonged Rupture of Membrane	No	86	(93.5)	178	(96.7)	0.210
	Yes	6	(6.5)	6	(3.3)	
Premature Rupture of Membrane	No	81	(88.0)	175	(95.1)	0.033
	Yes	11	(12.0)	9	(4.9)	
preterm premature rupture of membrane	No	80	(87.0)	177	(96.2)	0.004
	Yes	12	(13.0)	7	(3.8)	
difficult labour	No	37	(40.2)	168	(91.3)	<0.001
	Yes	55	(59.8)	16	(8.7)	
prolong second stage of labour	No	54	(58.7)	180	(97.8)	<0.001
	Yes	38	(41.3)	4	(2.2)	
Meconium-Stained Amniotic Fluid	No	72	(78.3)	148	(80.4)	0.672
	Yes	20	(21.7)	36	(19.6)	
Chorioamnionitis	No	90	(97.8)	184	(100)	0.045
	Yes	2	(2.2)	0	(0)	
Induction Labour	No	76	(82.6)	172	(93.5)	0.005
	Yes	16	(17.4)	12	(6.5)	
Cord Prolapse	No	90	(97.8)	184	(100)	0.045
	Yes	2	(2.2)	0	(0)	
Labor dystocia	No	91	(98.9)	184	(100)	0.157
	Yes	1	(1.1)	0	(0)	
Abraptio Placenta	No	91	(98.9)	184	(100)	0.157
	Yes	1	(1.1)	0	(0)	
Nuchal Cord	No	89	(96.7)	182	(98.9)	0.202
	Yes	3	(3.3)	2	(1.1)	
Fetal distress	No	42	(45.7)	166	(90.2)	<0.001
	Yes	50	(54.3)	18	(9.8)	

Table 5: Univariate Logistic Regression analysis to identify variables dependently associated with asphyxia

		P-value	OR	95% C.I. for OR	
				Lower	Upper
The educational level of mother	Illiterate	0.017	2.606	1.188	5.718
	Can read and write	0.023	3.379	1.185	9.630
	Primary	0.471	0.714	0.286	1.783
	Intermediate	0.225	1.675	0.728	3.853
	Secondary	0.372	1.536	0.599	3.940
	College and above	R			
Socio-economic status	Low	0.017	3.083	1.225	7.761
	Middle	0.310	1.765	0.590	5.281
	High	R			

R; reference

Unadjusted logistic regression analysis discovers that hypertension, anemia, infection, and polyhydramnios are associated with increased risks of asphyxia during pregnancy with OR= 2.823 [1.226- 6.498], 1.871[1.034-3.385], 2.164[1.273-3.678], and 2.988[1.158-7.710] at a significant level <0.05, respectively. And PROM, PPROM, difficult labour, prolonged second stage of labour, and induction of labour, as well as fetal distress are associated with increased risks of asphyxia during labor with OR= 2.641[95% CI =1.053-6.623], 3.793 [95% CI=1.439-9.994], 15.608 [95% CI= 8.061-30.222], 31.667[95% CI=10.816-92.710], 3.018 [95% CI=1.362-6.687], 10.979 [95% CI=5.811-20.744].

After adjusting factors like hypertension with AOR= 3.109 [95% CI =1.313-7.363], infection AOR= 2.168 [95% CI = 1.252-3.753] and polyhydramnios AOR= 3.024 [95% CI= 1.144-7.990] the main risk factors during pregnancy, factors like PPROM AOR=4.906 [95% CI=1.458- 16.513] , difficult labour AOR= 5.116 [95% CI= 1.997-13.103], prolonged second stage of labour AOR= 6.739 [95% CI= 1.713- 26.519], and fetal distress AOR= 8.685 [95% CI= 4.086-18.458] are the main factors of during labour at a significant level <0.05, respectively (Table 7).

Table 6: Univariate and Multivariate Logistic Regression analysis to identify factors of antepartum and intrapartum associated with asphyxia

Variable	P-value	Unadjusted COR [95% CI]	P-value	Adjusted AOR [95% CI]
Hypertension	0.012	2.823[1.226- 6.498]	0.010	3.109 [1.313-7.363]
Anaemia	0.037	1.871[1.034-3.385]	0.074	1.752 [0.946- 3.244]
Infection (systemic, amniotic, extra-amniotic, cervical)	0.004	2.164[1.273-3.678]	0.006	2.168 [1.252- 3.753]
Polyhydramnios	0.019	2.988[1.158-7.710]	0.026	3.024 [1.144-7.990]
Premature Rupture of Membrane	0.033	2.641 [1.053-6.623]	0.332	1.918 [0.515- 7.150]
preterm premature rupture of membrane	0.004	3.793 [1.439-9.994]	0.010	4.906 [1.458-16.513]

Table 7: Univariate and Multivariate Logistic Regression analysis to identify factors of antepartum and intrapartum associated with asphyxia

Variable	P-value	Unadjusted OR [95% CI]	P-value	Adjusted AOR [95% CI]
prolong second stage of labour	<0.001	31.667[10.816-92.710]	0.006	6.739 [1.713, 26.519]
Induction Labour	0.005	3.018 [1.362-6.687]	0.891	1.087 [0.327, 3.616]
Fetal distress	<0.001	10.979[5.811-20.744]	<0.001	8.685 [4.086, 18.458]

DISCUSSION

This study aimed to identify the major risk factors associated with birth asphyxia among newborns available in the maternity teaching hospital in Erbil city. From the total number of newborns, 276 (92 cases, 184 controls). Most of the mothers with asphyxia babies were aged between 21-25 years. This result is consistent with another study [20]. Babies with asphyxia were more than half were male; this result aligned with a study done in Nepal that reported a higher range of asphyxia among male babies [2]. The majority had cephalic at fetal presentation; this result contrasts a study that found non-cephalic presentation is a risk [21]. Poor socioeconomic status; maternal illiteracy associated with BA. This finding comes in line with a study done in Yemen that shows that a large percentage do not have any advanced degrees at all. This might have an impact on their knowledge of health concerns and their ability to get the care they need. Important factors in reducing the risk of problems during pregnancy and delivery include maternal health, nutrition, and access to healthcare, all of which can be impacted by socioeconomic position [9]. Same findings with studies in Ethiopia [8], Nigeria [22] and India [23]. The Current study also demonstrated a significant relationship between maternal reproductive characteristics and asphyxia risk factors such as gravidity, history of abortion, and emergency C/S were associated with neonatal asphyxia as found by other studies [12, 24]. The risk of suffocation in neonates delivered via C/S was eight times higher than in babies born vaginally [19]. One possible explanation is that most cases of emergency C/S were caused by factors that prevent the fetus from getting enough oxygen, such as acute fetal distress, cephalopelvic disproportions, and prolonged labour. However, these findings contradict a study in Najaf, Iraq, which found vaginal delivery is associated with a higher risk of HIE [25]. Tasew and colleagues discovered that infants whose mothers had abortions were more likely to be born prematurely. Neonatal asphyxia is largely caused by protracted second-stage labour, which is in turn caused by primigravida, according to reports [14]. The same result was found by other studies [8, 26]. Our results demonstrate that the risk of hypertension is three times greater in mothers who do not have the disease similar to studies from China [10], Thailand [21] United Kingdom [27]. A study in eastern Ethiopia found that compared to mothers without chronic hypertension, the likelihood of their babies' experiencing hypoxia was approximately five times higher [11]. Also, asphyxia was three times more likely to occur in mothers who were anemic [28]. The process of giving birth might be complicated by anemia. The danger of asphyxia during delivery is already high, and anemia increases it since it can cause intrapartum hypoxia, or a shortage of oxygen [13]. However, in our result anemia after adjusting using multiple regression was not the strongest factor, but conditions like polyhydramnios, infection and hypertension were stronger during pregnancy and led to birth asphyxia. According to previous research, polyhydramnios is associated with 30% of all neonates that need resuscitation and frequently occurs alongside other maternal health problems such as pregnancy-induced hypertension (PIH) [29]. A different study found that in polyhydramnios there are a number of issues that can arise during pregnancy and after giving birth, including hypoxia, PROM, and postpartum haemorrhage [30]. A study conducted in Iran found that polyhydramnios might cause problems, including fetal discomfort, a sign that BA is imminent [31]. Another study found urinary

tract infection during pregnancy to be a risk for asphyxia, because urinary tract infection activates the host monocyte-macrophage system and releases cytokines that stimulate prostaglandin biosynthesis, which in turn causes contractions that decrease oxygen levels and cause asphyxia. It increases the risk of having an asphyxiated neonate during a pregnancy fifteen times [19]. Women who experienced chorioamnionitis throughout their pregnancies were three times more likely to have babies born with asphyxia [11]. On the other hand, according to a study conducted in the United Kingdom, infant outcome was likely better in the group that included women who experienced pyrexia during labour, who were closely observed, and who likely had a lower threshold for intervention delivery by C/S [27]. PROM and PPROM have a highly significant factor for the incidence of BA found in the current study, but PPROM was a stronger factor than PROM after adjusting and using multiple regression analysis. Research conducted in Indonesia found that PROM had a twofold impact on the risk of asphyxia neonatorum [32]. Other studies from eastern Ethiopia [11] Ghana also support this finding [33]. Woday and the colleagues found that the risk of BA was 3.85 times higher in mothers whose PROM was compared to those whose membranes broke normally [24]. We found a significant association of difficult labour and prolonged second stage with the occurrence of asphyxia, which is consistent with other studies from Ethiopia [24, 33], Pakistan [15] USA [34], Tanzania [13], and Cameron [19]. Prolonged labour is usually caused by factors such as sluggish cervix dilation, big infants, pelvic disproportion, and an incorrect foetal presentation. These factors can all influence the placenta's ability to transport oxygen from the mother to the foetus [13]. Induction of labour and fetal distress were found in the current study to be high significant risks for asphyxia before adjusting. Also, after using multiple regression, fetal factor was a stronger factor than induction of labour as a main factor that led to birth asphyxia. This finding is the same with studies in Al-Diwaniya Iraq [35], India [36], Pakistan [15, 26], Nepal [37], Ethiopia [14]. This might be described as “Oxytocin and misoprostol are commonly used to treat insufficient contractions”. The placenta is unable to provide the fetus with enough oxygen since these medications might induce excessive contractions. Because of this, fetal oxygenation will be impaired, which increases the risk of asphyxia after delivery due to difficulties in starting and maintaining breathing [19].

CONCLUSION

This study highlights several significant factors associated with the risk of birth asphyxia, factors such as socioeconomic status, level of education, and antepartum factors like polyhydramnios, infection, anemia, and hypertension, as well as intrapartum factors such as prolonged and difficult birth, PROM, PPROM, induction of labour, fetal distress, and emergency C/S were the main risk factors associated with birth asphyxia.

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ETHICAL CONSIDERATION

The study was approved by Hawler Medical University’s ethics committee at the College of Nursing

CONFLICT OF INTEREST

The authors disclose no conflicts of interest.

ABBREVIATIONS

HIE: Hypoxic ischemic encephalopathy
BA: Birth asphyxia
C/S: caesarian section
AOR=Adjusted odds ratio
COR=Crude odds ratio
CI=Confidence interval
PROM: Premature rupture of membrane
PPROM: Preterm premature rupture of membrane

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