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Original article

Birth Asphyxia Prevalence and Related Factors in Live Births at University Hospital, Tripoli, Libya

Sabria Slaam[1], Noura Elawam[2]*

[1]*Department of Obstetrics and Gynecology, Faculty of Medicine, University of Tripoli, Tripoli, Libya*
[2]*Department of Community and Family Medicine, Faculty of Medicine, University of Tripoli, Tripoli, Libya*

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Corresponding Email. *elawamnoura@gmail.com*

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ABSTRACT

Birth asphyxia is the cause of about one-third of newborn deaths at University Hospital's Neonatal Intensive Care Unit (NICU). On the other hand, the precise burden of birth asphyxia has not been supported by modern scientific research. The purpose of this study was to assess the prevalence of birth asphyxia and its associated variables in the NICU of University Hospital in Tripoli, Libya. A descriptive cross-sectional study including 182 mother-newborn pairs delivered at a maternity ward was carried out on the sample. From January 1, 2020, until December 30, 2022, every other mother's newborn was included. Data were gathered using a checklist and a pre-tested structured questionnaire. 28.5% of cases had asphyxia [95% CI: 26.51, 35.24%]. The final model showed that birth asphyxia was positively associated at 95% CI with fetal malpresentation (AOR = 6.96: 3.16, 15.30), rupture of fetal membranes preterm (AOR = 6.30, 95% CI: 2.45, 16.22), meconium-stained amniotic fluid (AOR = 7.15: 3.07, 16.66), and vacuum delivery (AOR = 6.21: 2.62, 14.73). The occurrence of birth asphyxia continues to be a significant public health concern. Consequently, to avoid birth asphyxia due to difficulties such as fetal mal-presentation, premature fetal membrane rupture, meconium-stained amniotic fluid, and vacuum delivery, the current emergency obstetric and newborn care efforts should be reinforced.

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INTRODUCTION

The definition of birth asphyxia is a progressive decrease in oxygen levels, a rise in carbon dioxide levels, and the emergence of metabolic acidosis, which eventually leads to the failure of multiple organs [1]. According to definitions found in the literature, birth asphyxia is the inability of the baby to start breathing on their own and continue doing so after delivery [2]. The American College of Obstetricians and Gynecologists and the American Academy of Paediatrics state that, a newborn is considered asphyxiated if it satisfies any of the following criteria: (a) An arterial pH in the umbilical cord less than 7; (b) An Apgar score of 0–3 that lasts longer than five minutes; (c) The existence of neonatal neurological manifestations such as seizures, coma, or hypotonia; and (d) occurrence of multisystem organ dysfunction affecting the cardiovascular, gastrointestinal, haematological, pulmonary, or renal systems [3].

Babies' oxygen deficiency can be detected by the acidity of their umbilical cord blood. When birth asphyxia occurs, tissue perfusion is reduced, which in turn results in hypoxemia (low oxygen levels) and hypercarbia (high carbon dioxide levels). This condition is brought on by the newborn's inability to breathe regularly, which reduces the quantity of oxygen that gets to different organs. Preterm birth and severe diseases are two of the main causes of infant mortality

worldwide, along with perinatal asphyxia, also known as birth asphyxia [1, 4]. Perinatal asphyxia occurs owing to the loss of blood supply or the impairment of gas exchange to or from the foetus, either before, during, or after delivery [5]. Birth asphyxia can result in significant metabolic acidosis, hypercarbia, hypoxemia, newborn encephalopathy, multi-system organ failure, and eventually, mortality. There have also been concerns expressed about the hospital's delayed intrapartum judgments on emergency obstetrics care. Furthermore, previous research has not addressed the significance of delivery time and professional mix of labor attendants for public health.

The prevalence of birth asphyxia among term newborns varies between 2 and 10 per 1000 births worldwide [4]. The World Health Organization (WHO) has conducted research which indicates that birth asphyxia is responsible for an estimated four million neonatal deaths each year. A number reference was supplied by the user [5]. In the majority of wealthy countries, birth asphyxia leads to a mortality rate of under 0.1% in newborns. Nonetheless, it should be highlighted that infant mortality rates in developing countries ranged from 4.6 to 7-26 per 1000 live births, according to reference [6]. The purpose of this study was to assess the prevalence of birth asphyxia and its associated variables in the NICU of University Hospital in Tripoli, Libya.

METHODS

Study setting

The study was conducted at University Hospital, Tripoli, Libya. It is a referral and tertiary medical center. It delivers clinical services for the population in Tripoli and areas nearby.

Study design and period

A hospital-based cross-sectional study design was used, and data collected to include neonates were seen from January 1, 2020, to December 30, 2022.

Study population

The study included all newborns who met the inclusion criteria and were admitted to the NICU ward at University Hospital during the study period. Inclusion criteria includes all newborns admitted to University Hospital with gestational age ≥ 28 weeks or birth weight ≥ 1000. Neonates were excluded if they suffer from significant congenital anomalies or syndromes, e.g., NTD (neural tube defect), have incomplete documentation, and are kept for observation.

Sample size determination and sampling method

G power software were determined the sample size. The required sample size (n), p is the proportion, and d is the precision or acceptable error level. 95% confidence interval with a 5% level of precision and 21.1% prevalence of birth asphyxia were used in a previous study [15]. The total sample size was calculated to be 256. With an attrition rate of 10%, the final sample was determined to be 182. Finally, variables with a P value < 0.05 were expressed as associated factors of birth asphyxia. The study subjects were selected by a systematic sampling method, and relevant information was collected using a checklist.

Data collection procedures

A restructured data collection format was used to collect the information. Data were collected by the researcher. Relevant information was obtained, this comprises maternal information (age, parity of mothers, residence, place of delivery, mode of delivery, and problems during pregnancy or labor) and neonatal information (gender, gestational age, birth weight, APGAR score, and length of hospital stay).

Data analysis

Data were entered into SPSS (Statistical Package for the Social Sciences) version 28, cleaned, coded, and checked for normality and completeness before analysis. To ascertain the prevalence of birth asphyxia as well as sociodemographic and obstetrical history, descriptive statistics were employed. To find the PNA-associated factors, bivariate and multiple binary logistic regression analysis were performed. The multivariable logistic regression model was included variables with a P value < 0.25 during the bivariate analysis. Finally, variables with a P value < 0.05 were expressed as associated factors for birth asphyxia.

RESULTS

In this study, all 182 mothers approached agreed to participate, thus a response rate of 100%. More than half of the respondents, 116(63.7%) were Tripoli residents. While 36.2% were from outside Tripoli city. The majority of

respondents, (92.3%) were married and Thirty-five percent of them (33.5%) had no formal education. but can read and write. The mean maternal age was 25.7 (SD = ± 5.86) years of whom 68.6% were between 20 and 34 years. (Table 1).

Table 1. Demographic distribution of mothers who gave live birth at University Hospital, Tripoli, Libya, 2020--2022 (n = 182)

Factor	Response	Frequency	%
Residence	Tripoli City	116	63.7
	Outside Tripoli city	66	36.2
Age (years)	16–19	20	9.5
	20–34	125	68.6
	> 34	37	29.4
Marital status	Married	168	92.3
	Widowed	4	2.1
	Separated	10	5.4
Occupation	House wife	181	31.1
	Employee	172	29.6
Educational Status	No formal education but can read and write	61	33.5
	Primary education (1–8)	44	18.4
	Secondary education (9–12)	43	12.2
	College or University	34	16.2

More than two third of patients had more than 3 children (62.8%). as well as 54.9% they were multiparous. Table 2 shows that 35.0% of the 77 moms (42.3%) who had a history of unfavorable pregnancy outcomes were preterm mothers. Prenatal care was received by 465 mothers [165(90.6%)] at private health centers and public hospitals. But of the 144 moms, more than half (87.2%) had four or more prenatal care visits. Approximately 136,135 mothers (74.1%) had obstetric complications during the prenatal period.

Table 2. Demographic distribution of mothers who gave live birth at University Hospital, Tripoli, Libya, 2020--2022 (n = 182)

Factor	Response	Frequency	%
Gravidity	< 3	69	37.9
	≥3	113	62.8
Parity	Primiparous	82	45.0
	Multiparous	100	54.9
History of adverse pregnancy outcome	Yes	77	42.3
	No	105	57.6
If yes, which one? (*n* = 77)	Abortion	21	27.2
	Intrauterine fetal death	8	1.03
	Still birth	12	15.5
	Preterm	27	35.0
	Neonatal death	9	11.6

Anemia accounted for the largest percentage of these complications, 61 (45.2%) (Table 3). Of the total respondent mothers, 112 (61.5%) had spontaneous labor onset. Majority of the mothers 114(62.6%) had intrapartum rupture of fetal membranes whereas premature rupture of membrane was reported among 68 (37.3%) mothers.

Table 3. Antepartum related factors of mothers who gave live birth at University Hospital, Tripoli, Libya, 2020--2022 (n = 182)

Factor	Response	Frequency	%
ANC (*n* = 182)	Yes	165	90.6
	No	17	9.3
Number of ANC visits (*n* = 165)	< 4	21	12.7
	≥4	144	87.2
Obstetric complication during pregnancy (*n* = 182)	Yes	135	74.1
	No	47	25.8
Type of complication (*n* = 135)	Preeclampsia/eclampsia	24	17.7

	Antepartum hemorrhage	16	11.8
	Anemia	61	45.2
	Infections	24	17.7
	Gestational diabetes	10	7.4

Following membrane rupture, meconium-stained amniotic fluid was observed among 100 (54.6%) mothers. At labor, about one fifth of the fetuses 111 (19.1%) were mal-presented (Table 4). Among the mal-presentations, there were 65 (58.6%) breech presentations of which 111(60.5%) were delivered vaginally whereas the rest 64(35.7%) were delivered by cesarean section (Table 4).

Table 4. Factors related to the intra-partum period among mothers who gave live birth at university Hospital, Tripoli, Libya, 2020--2022 (n = 182)

Factor	Response	Frequency	%
Fetal presentation	Vertex	471	80.9
	Malpresentation	111	19.1
Labor type	Spontaneous	112	61.5
	Induced	70	38.4
Labor duration	Normal	362	62.2
	Prolonged	137	23.5
	Precipitated	83	14.3
Time of membrane rupture	*PROM	68	37.3
	Intrapartum	114	62.6
Color of amniotic fluid	Meconium stained	100	54.6
	Clear	82	45.0
Mode of delivery	**SVD	111	60.5
	Vacuum	7	3.8
	***C/S	64	35.1

**PROM= Prelabour Rupture of membrane **SVD= Spontaneous vaginal delivery ***CS= Cesarean Section*

More than half of the newborns, 103 (56.5%) were females. At birth, the average gestational age was 38.5 (±2.4) weeks, and 68.8% of the 125 newborns were born at term. Furthermore, 2687.3 (±1481.3) grams was the average birth weight, and 24.7% of the newborns were underweight. 105 (or 18.0%) of the newborns had health issues at birth. Neonatal sepsis accounted for about two thirds 69 (65.7%) of these issues, with birth injuries accounting for the remaining 57 (54.3%) (Table 5).

Table 5 Newborn related characteristics at University Hospital, Tripoli, Libya, 2020--2022 (n = 182)

Factor	Response	frequency	%
Sex	Male	79	47.9
	Female	103	52.1
Birth outcome	Singleton	179	84.9
	Twin	3	15.1
Birth weight	< 2500	44	24.7
	≥2500	138	75.3
Gestational age at birth	Preterm	81	29.4
	Term	105	55.8
	Post term	60	14.8

Seven factors were found to be loosely associated with birth asphyxia, according to the bivariable logistic regression analysis. These factors included antenatal obstetric complications, fetal presentation, premature rupture of fetal membranes, meconium-stained amniotic fluid, mode of delivery, delivery time, and birth outcome. However, the length of labor, the outcome of the birth, and prenatal obstetric complications were not significant after statistical adjustments in the final model. Compared to babies born with vertex presentations, those born with fetal mal-presentation had a seven-fold (AOR = 7.0, 95% CI: 3.2, 15.3) higher chance of asphyxiating at birth Seven factors were found to be loosely associated with birth asphyxia, according to the bivariable logistic regression analysis. These factors included antenatal obstetric complications, fetal presentation, premature rupture of fetal membranes, meconium-stained amniotic fluid,

mode of delivery, delivery time, and birth outcome. However, the length of labor, the outcome of the birth, and prenatal obstetric complications were not significant after statistical adjustments in the final model. Compared to babies born with vertex presentations, those born with fetal mal-presentation had a seven-fold (AOR = 7.0, 95% CI: 3.2, 15.3) higher chance of asphyxiating at birth.

Table 6. Bivariable and multivariable logistic regression analysis of factors associated with birth asphyxia among live births at university Hospital, 2020

Factor	Birth asphyxia		95% CI		*P* value
	Asphyxiated (*n* = 52)	Not asphyxiated (*n* = 130)	COR AOR (95%CI)	AOR	
Antenatal obstetric complications					
Yes	42	85	16.8 (10.5, 26.8)	6.5 (0.6, 1.6)	.08
No	10	45	1.0	1.0	
Fetal presentation					
Vertex	19	100	1.0	1.0	
Malpresentation	33	30	15.0 (9.1, 24.6)	7.0 (3.2, 15.3)	.000
Membrane rupture					
***PROM**	29	27	3.2 (1.7, 6.1)	6.3 (2.5, 16.2)	.000
Intra-partum	23	103	1.0	1.0	
Amniotic fluid					
Meconium stained	34	47	12.8 (8.2, 19.7)	7.2 (3.1, 16.7)	.000
Not stained	18	83	1.0	1.0	
Labor duration					
Normal	20	112	1.0	1.0	
Prolonged	17	10	6.5 (4.2, 10.2)	5.5 (0.4, 1.6)	.21
Precipitated	15	8	7.4 (4.4, 12.5)	2.8 (0.1, 7.2)	.098
Mode of delivery					
****SVD**	28	123	1.0	1.0	
Vacuum	13	1	3.9 (2.4, 6.4)	6.2 (2.6, 14.7)	.001
*****CS**	11	6	9.5 (5.9, 15.3)	6.5 (0.7, 2.0)	.065
Birth outcome					
Singleton	49	129	1.0	1.0	
Twin	3	1	1.1 (0.7, 1.8)	1.2 (0.4, 3.3)	.717

**PROM= Prelabour Rupture of membrane **SVD= Spontaneous vaginal delivery ***CS= Cesarean Section*

DISCUSSION

The frequency and risk factors for birth asphyxia in live births at University Hospital are shown in this study. Fetal malpresentation, early rupture of the fetal membranes, meconium-stained amniotic fluid, vacuum-assisted delivery, nighttime delivery, and medical interns' observation of the labor process were all significant predictors of birth asphyxia. The study's 28.4% birth asphyxia frequency is consistent with a different study (32.8%) carried out at Dilla Referral Hospital in Southern Ethiopia [7]. Nevertheless, the occurrence in our research was less than the occurrence in Jimma zone public hospitals in South West Ethiopia (47.5%) [8], possibly due to the fact that our study was carried out at a sole general hospital that caters to less complex referral deliveries compared to the specialized hospitals in Jimma zone where more complicated referral deliveries, such as birth asphyxia, are expected. Moreover, the occurrence of birth asphyxia in our environment was less than research conducted in Iran (58.8%) [9], potentially because of variations in sample size and study location. Importantly, the discrepancy in case definition may have influenced the discrepancy; for instance, our research focused on fifth minute APGAR scores under 7, while the Iranian study had a broader definition of birth asphyxia including various criteria such as umbilical cord pH < 7- or 5-minute APGAR score < 6- or 20-minute, APGAR score under 7 or multiple organ failure in the first 72 hours or seizures in the first 24 hours of life. During the evaluation of related factors, newborns delivered with fetal mal-presentation had a 4.5 times higher risk of experiencing asphyxia compared to those with vertex presentations. This result aligned with previous research indicating that mal-presented fetuses had 7 times and 4.5 times higher odds of birth asphyxia compared to vertex presented fetuses, as shown in other studies [10].

A study from Cameroon (reference 20) presented a comparable discovery. This similarity may stem from the frequent connection between mal-presentation and premature rupture of membrane, which is a significant factor in this research. After the early rupture of membranes, serious events in newborns, such as umbilical cord accidents (such as cord prolapse and cord compression), can lead to birth asphyxia. Furthermore, prolonged labor is frequently the result of malpresentation, which is a known obstetric emergency endangering the life of the fetus, even though this study found no statistical significance in this regard [12,13].

In order to detect any fetal derangement early and take appropriate action, such as surgical deliveries, mothers should be aware of their fetal presentation in the late gestation and those who exhibit fetal malpresentation during labor should receive strict parto- graphic monitoring of their fetal heartbeat [14]. Compared to mothers who experienced intrapartum rupture, newborns whose mothers had premature rupture of fetal membranes (PROM) were 6.3 times more likely to asphyxiate at birth. Research conducted at the Al-Diwaniya Teaching Hospital [17], produced consistent results in Cameroon [15] and Uganda [16].

To lower the risk of ascending genital infections, digital vaginal exams should also be performed as little as possible [18,19]. When it came to delivery mode, spontaneous vaginal deliveries had a 6.2-fold lower association with birth asphyxia than vacuum deliveries. This might be because of the possibility that vacuum delivery could cause hemorrhagic cranial injuries, such as sub-galeal hemorrhage and cephal-hematoma, which could then be associated with birth asphyxia from hemorrhagic anemia [20]. Furthermore, it is asserted that the painful nature of the vacuum procedure depresses the brain stem's neonatal respiratory center [21]. A different study may need to address other unmeasured factors that may be connected to the increased risk of birth asphyxia during the night.

CONCLUSION

The prevalence of birth asphyxia has continued to be a significant public health concern in the study area. Within the particular study setting, there was a significant correlation found between the odds of birth asphyxia and fetal mal-presentation, premature rupture of the fetal membranes, meconium-stained amniotic fluid, and vacuum delivery. Even with our limited resources, we can prevent the majority of these factors.

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انتشار الاختناق أثناء الولادة والعوامل ذات الصلة في المواليد الأحياء في مستشفى جامعة طرابلس، ليبيا

صبرية سلام[1]، نورا العوام[2]

[1]قسم أمراض النساء والتوليد، كلية الطب، جامعة طرابلس، طرابلس، ليبيا
[2]قسم طب الأسرة والمجتمع، كلية الطب، جامعة طرابلس، طرابلس، ليبيا

المستخلص

الاختناق عند الولادة هو سبب حوالي ثلث وفيات الأطفال حديثي الولادة في وحدة العناية المركزة لحديثي الولادة بالمستشفى الجامعي. من ناحية أخرى، فإن العبء الدقيق لاختناق الولادة لم يتم دعمه من خلال البحث العلمي الحديث. كان الغرض من هذه الدراسة هو تقييم مدى انتشار الاختناق عند الولادة والمتغيرات المرتبطة به في وحدة العناية المركزة لحديثي الولادة في المستشفى الجامعي في طرابلس، ليبيا. تم إجراء دراسة وصفية مقطعية شملت 182 زوجًا من الأمهات والأطفال حديثي الولادة في جناح الولادة على العينة. من 1 يناير 2020 حتى 30 ديسمبر 2022، تم إدراج كل مولود جديد للأم الأخرى. تم جمع البيانات باستخدام قائمة مرجعية واستبيان منظم تم اختباره مسبقًا. 28.5% من الحالات كانت تعاني من الاختناق [95% فاصل الثقة: 26.51، 35.24%]. أظهر النموذج النهائي أن الاختناق عند الولادة كان مرتبطًا بشكل إيجابي عند فترة ثقة 95% مع سوء تمثيل الجنين (AOR = 6.96: 3.16، 15.30)، وتمزق أغشية الجنين قبل الأوان (AOR = 6.30، 95% CI: 2.45، 16.22)، وتمزق السلى الملطخ بالعقي. السائل (AOR = 7.15: 3.07، 16.66)، وتسليم الفراغ (AOR = 6.21: 2.62، 14.73). لا يزال حدوث الاختناق عند الولادة يشكل مصدر قلق كبير على الصحة العامة. وبالتالي، لتجنب الاختناق عند الولادة بسبب صعوبات مثل سوء ظهور الجنين، وتمزق غشاء الجنين المبكر، والسائل السلوي المصطبغ بالعقي، والولادة بالشفط، ينبغي تعزيز الجهود الحالية في مجال التوليد ورعاية الأطفال حديثي الولادة في حالات الطوارئ.

الكلمات المفتاحية. انتشار الاختناق أثناء الولادة، المواليد الأحياء.