AMERICAN JOURNAL OF BIOLOGY AND NATURAL SCIENCES
https://biojournals.us/index.php/AJBNS
ISSN: 2997-7185

Article

Effect of Birth Asphyxia on Newborn Infant at Al Zahraa Teaching Hospital (2024-2025)

Ali Ayad Abd Alsaheb[1], Aida H.H. Al-Obaidi[2], Hawraa S. Yacob[3], Zainab I. Zgher[4], Asmaa A. Muzail[5]

1. Neonatal Intensive Care Unit, Department of Pediatrics, Al-Zahra Teaching Hospital, Wasit, Iraq
2. Department of Anatomy and Biology, College of Medicine, University of Wasit, Wasit, Iraq
3,4,5. Researcher, College of Medicine, University of Wasit, Wasit, Iraq
Correspondence: shathawyallawy@gmail.com[1], aidah@uowasit.edu.iq[2]

Citation: Alsaheb A. A. A, Al-Obaidi A. H. H., Yacob H. S., Zgher Z. I., Muzail A. A. Effect of Birth Asphyxia on Newborn Infant at Al Zahraa Teaching Hospital (2024-2025). American Journal of Biology and Natural Sciences 2026, 3(2), 12-23.

Received: 25th Dec 2025
Revised: 05th Jan 2026
Accepted: 20th Jan 2026
Published: 04th Feb 2026

Abstract: Birth asphyxia is a major cause of neonatal morbidity and mortality on a global scale especially in low and middle income countries. It is due to the inability to begin and maintain proper breathing during birth and cause hypoxic-ischemic damage and possible neurological disability in the long-term. Intrauterine asphyxia means the insufficient supply of oxygen to the fetus in the womb before or at the birth and results in hypoxia and acidosis. The purpose of this study was to test the impact of birth asphyxia among the newborns admitted to Al-Zahraa Teaching Hospital, in terms of clinical presentation, complications, lab results, and short-term outcomes during the period from January (2024) to June (2025) and compromised 31 newborn infants with full maternal and neonatal data. Birth asphyxia was used as a definition of Apgar score of less than 7 at 5 minutes. Motherly features, medical history, neonatal clinical records (Sarnat stage, seizures), laboratory study including random blood sugar (RBS), urea, creatinine and calcium, period of stay and outcome were documented. The findings revealed that 41.9% of study individuals were asphyxiated; in which, maternal age shown insignificant variation with non-asphyxiated ones but a significant difference in parity and gravidity. Among the past maternal medical history, diabetes and hypertension were elevated significantly in asphyxiated individuals compared to non-asphyxiated ones; while among mothers of asphyxiated neonates, diabetes was more frequently. In Sarnat stage, asphyxiated individuals reported a reduction in none and mild but an elevation elevation in moderate and severe cases when compared to non-asphyxiated data. Subsequently, data observed a higher rate of moderate cases compared to severe mild and none. Iincidence of seizures was increased significantly in asphyxiated individuals compared to non-asphyxias. Length of NICU and hospital stay identified no marked differences between the asphyxiated and non-asphyxiated group. Data of serum markers detected that asphyxiated cases having a significant lowering in RBS and calcium with higher creatinine but no marked alteration in urea compared to non-asphyxiated group. The findings of short term outcome reported a significant increase in died neonates compared to alive which in contrast to non-asphyxiated cases that shown the lack of mortalities.

Keywords: Neonatal Outcomes, Sarnat Staging, Hypoglycemia, Creatinine, Iraq

Introduction

Birth asphyxia is characterized by the inability to start and maintain sufficient breathing at birth leading to inadequate gas exchange and insufficient oxygen to the body leading to hypoxemia, hypercapnia, and metabolic acidosis [1], [2]. It is viewed as a significant health issue in the world and one of the primary causes of neonatal morbidity and mortality, especially in low- and middle-income nations [3]. The World Health Organization (WHO) estimates that every year about 4 million neonates are dying in the first four weeks of life, and nearly a quarter of them dies with birth asphyxia [4], [5]. Besides mortality, most of the survivors experience permanent neurological impairment, including cerebral palsy, epilepsy, developmental delay, and cognitive impairments [6], [7].

The mechanism of pathophysiology of birth asphyxia is the experience of a halt in the placental blood flow or insufficient respiratory transition following delivery, which results in hypoxic-ischemic injury. This is especially susceptible to the central nervous system, and the degree of damage is also determined by the duration and severity of oxygen deprivation [8]–[10].

The spectrum of mild respiratory illness to hypoxic-ischemic encephalopathy (HIE), seizures, and dysfunction of multiple organs have different clinical manifestations [11], [12]. Neonatal encephalopathy outcomes and interventions highly depend on early diagnosis and treatment of the condition [13], [14]. The global burden of the condition is more skewed to resource-limited environments, being critically low access to skilled birth attendants, substandard intrapartum monitoring, and insufficient facilities of the neonatal intensive care [15], [16]. Although more sophisticated interventions, like therapeutic hypothermia, were proven to be beneficial to the outcomes in developed nations [17], [18]. they are not accessible in resource-poor settings, contributing to further imbalance in the survival of newborn babies and their health outcomes [19], [20].

Birth asphyxia is still one of the most important aspects of public health in Iraq and other developing countries, and it is one of the leading reasons of neonatal hospitalization and mortality regardless of the advancement of maternal and child health services, perinatal asphyxia [5], [21]–[23]. That is why it is essential to comprehend its impact on neonatal outcomes to influence clinical practice and inform resource distribution and enhance preventive and therapeutic efforts. This research paper seeks to examine the impact of birth asphyxia on infants admitted in Al- Zahraa Teaching Hospital, in terms of clinical presentation, complications, and short-term outcomes. Through such parameters, the research objectives will help to add to the current body of evidence and point to the necessity of the effective interventions depending on the local situation in healthcare.

Materials and Methods

Study design and setting

This study was an observational retrospective study that was carried out at the Al-Zahraa Teaching Hospital between January 2024 and June 2025. The research was designed to assess birth asphyxia maternal and neonatal predictors in hospitalized newborns.

Study population

The population of the study was babies born in Al-Zahraa Teaching Hospital off the course of the study. Review of medical records was done, with inclusion of cases that had full maternal and newborn data pertaining to study variables.

- Inclusion criteria:
  - Infants whose Apgar score at 1 and 5 minutes is documented..
  - Availability of maternal demographic, obstetric, and medical history data.
  - Availability of laboratory and clinical outcomes.
- Exclusion criteria:
  - Records with missing Apgar scores or incomplete essential data.
  - Newborns with major congenital malformations or chromosomal abnormalities.

Definition of birth asphyxia

Birth asphyxia was defined according to the pre-specified criterion of Apgar score < 7 at 5 minutes.

- Asphyxia group: Apgar score < 7.
- Non-asphyxia group: Apgar score ≥ 7.

Samples and data

A total of 31 newborn records met the inclusion criteria. Data were extracted from maternal and neonatal records using a structured checklist with collection the following variables:

- Maternal characteristics:
  - Age, gravidity, parity.
  - Past medical history (diabetes, hypertension, other conditions).
- Neonatal clinical data:
  - Apgar scores at 1 and 5 minutes.
  - Sarnat staging of hypoxic-ischemic encephalopathy.
  - Occurrence of seizures within the first 24 hours.
  - Length of NICU and hospital stay.
  - Short-term outcome at discharge (alive or died).
- Laboratory investigations:
  - Random blood sugar (RBS).
  - Serum creatinine.
  - Blood urea.
  - Serum calcium.

Outcome measures

The primary outcome was birth asphyxia based on Apgar score. Secondary outcomes included Sarnat stage, seizures, length of stay, laboratory findings, and survival at discharge.

Statistical analysis

Data were entered and analyzed using Microsoft Office Excel Software and the GraphPad Prism Software. Continuous variables were expressed as mean ± standard deviation (SD), and differences between groups were assessed using the independent samples t-test. Normality distribution test was done and it was following normal distribution p value more than 0.05. Categorical variables were expressed as frequencies and percentages, and associations were tested at a $p< 0.05$ [24].

Ethical considerations

Ethical approval for this study was obtained from the Ethical Committee of Al-Zahraa Teaching Hospital. Since the study was retrospective and based on anonymized patient records, informed consent was waived. Confidentiality of patient data was maintained throughout the research process.

Results

A total of 31 newborn records met inclusion in the dataset from Al-Zahraa Teaching Hospital (2024–2025). Using our pre-specified definition (Apgar score at 5 minutes < 7), 13 (41.9%) were classified as having birth asphyxia and 18 (58.1%) as non-asphyxiated (Figure 1).

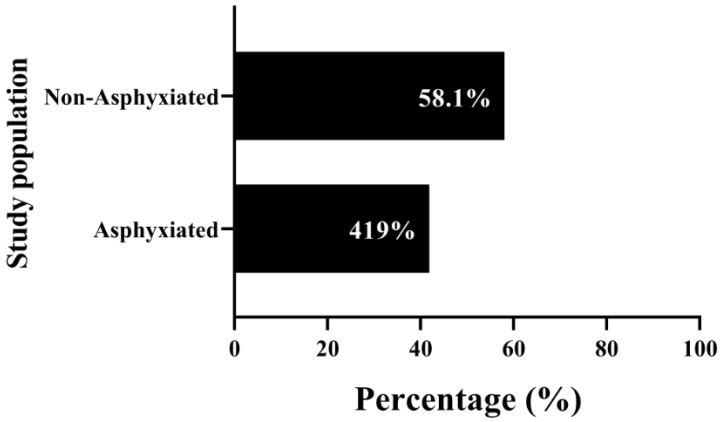

Figure 1. Percentage of birth asphyxia among study population.

Maternal and obstetric characteristics

The results showed the maternal and obstetric characteristics of the study participants according to asphyxia status. The mean maternal age was similar between groups (29.2±6.3 years in asphyxiated group vs. 30.0±6.7 years in non-asphyxiated group), with no statistically significant difference (p<0.637), (Figure 2). Parity and gravidity were lower in the asphyxia group (2.15±1.3 and 2.62 ±1.5, respectively) compared to the non-asphyxia group (3.22±2.2 and 3.72±2.5, respectively) with similar p value of <0.005 (Figures 3, 4).

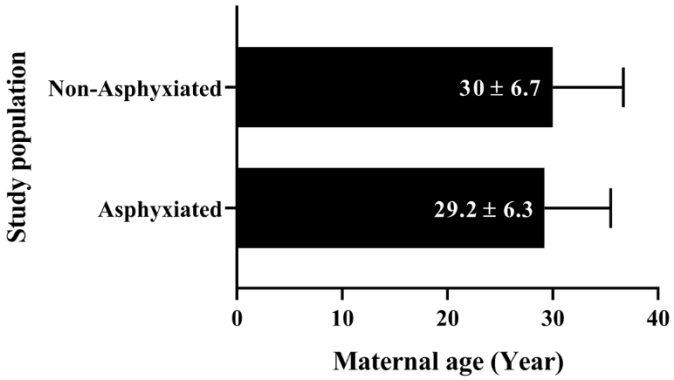

Figure 2. Distribution of birth asphyxia according to maternal and obstetric characteristics (maternal age); values (M±SD).

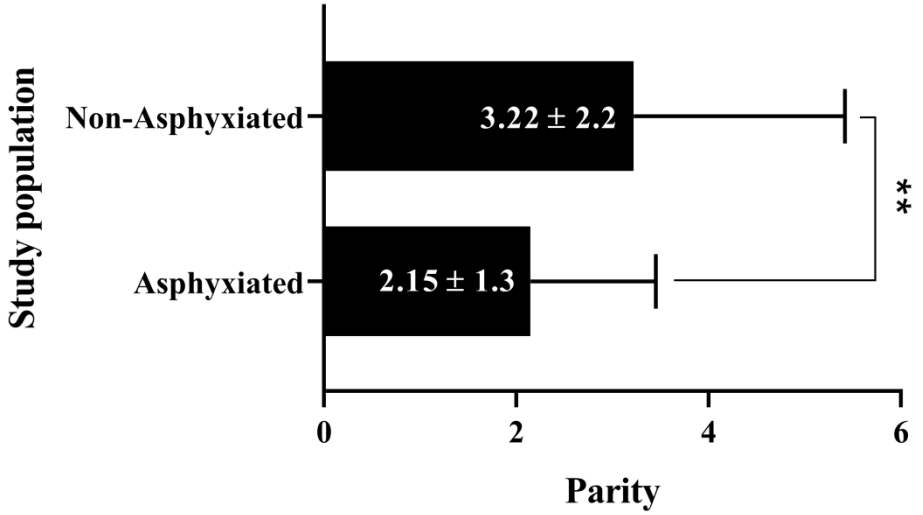

Figure 3. Distribution of birth asphyxia according to maternal and obstetric characteristics (parity); values (M±SD); ** (p<0.001).

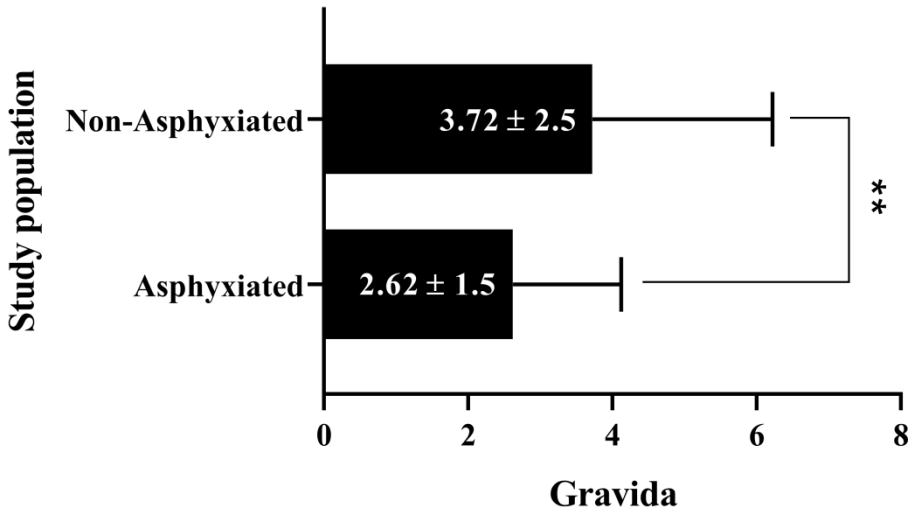

Figure 4. Distribution of birth asphyxia according to maternal and obstetric characteristics (gravida); values (M±SD); ** (p<0.001).

Past maternal medical history

In comparison to non-asphyxiated individuals, the findings of diabetes (38.46%) and hypertension (30.77%) were elevated significantly in asphyxiated individuals while negative (30.77%) and other (0%) data were reduced significantly. Among mothers of asphyxiated neonates, diabetes (38.46%) was more significantly frequent (p<0.019; 95%CI: 2.140 to 52.14); whereas in non-asphyxia group, negative data (55.56%) was shown a significant higher elevation (p<0.0181; 95%CI: 7.681 to 57.69), (Table 1; Figures 5, 6).

Table 1. Past maternal medical history by asphyxia status.

PMH	Asphyxiated (n=13); No. (%)	Non-Asphyxiated (n=18); No. (%)	*p-value*	*95%CI*
Diabetes	5 (38.46%)	3 (16.67%)	0.0381	110.9 to 166.0
Hypertension	4 (30.77%)	3 (16.67%)	0.0392	65.86 to 113.3
Negative	4 (30.77%)	10 (55.56%)	0.0272	114.3 to 200.7
Others	0 (0%)	2 (11.11%)	0.0395	65.03 to 76.14
p-value	0.019	0.0181	-	-
95%CI	2.140 to 52.14	7.681 to 57.69	-	-

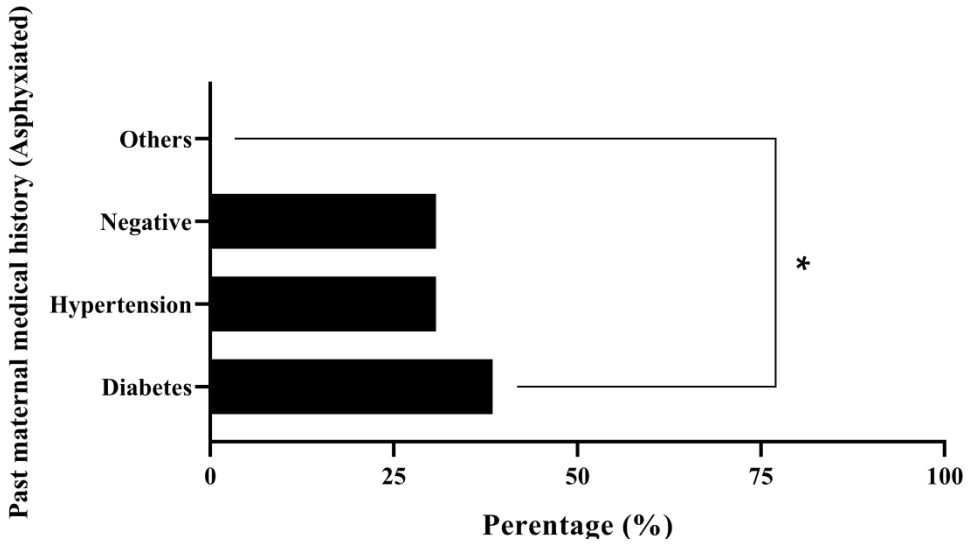

Figure 5. Past maternal medical history in asphyxiated cases.

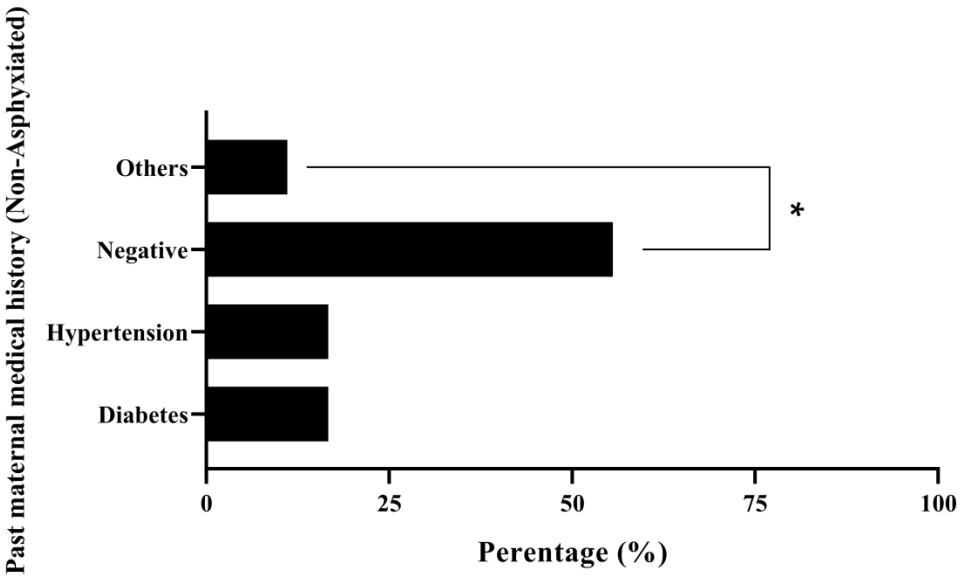

Figure 6. Past maternal medical history in non-asphyxiated cases.

Sarnat staging and seizures within the first 24 hours

The findings of Sarnat staging and seizures were differed significantly between groups (Table 2). In Sarnat stage, the findings of none (0%) and mild (7.69%) were reduced significantly in asphyxiated individuals while significant elevation was identified in moderate (61.54%) and severe (30.77%) cases when compared to non-asphyxiated data. Subsequently, data of Sarnat stage showed that the prevalence rate of moderate cases was markedly increased compared to severe mild and none (Figure 7). Additionally, incidence of seizures (38.46%) was increased significantly in asphyxiated individuals compared to non-asphyxias (5.56%). However, the number of non-seizures individuals was significantly more than the seizures ones (Figure 8).

Table 2. Sarnat staging and seizures within first 24 hours by asphyxia status.

Variable	Category	Asphyxiated (n=13); No. (%)	Non-Asphyxiated (n=18); No. (%)	*p-value*	*95%CI*
Sarnat stage	None	0 (0%)	2 (11.11%)	0.0395	65.03 to 76.14
	Mild	1 (7.69%)	10 (55.56%)	0.0124	272.5 to 335.7
	Moderate	8 (61.54%)	5 (27.78%)	0.0231	169.8 to 259.1
	Severe	4 (30.77%)	1 (5.56%)	0.0386	142.0 to 178.3
	p-value	0.0168	0.0123	-	-
	95%CI	18.99 to 68.99	10.73 to 60.73	-	-
Seizures (24h)	Yes	5 (38.46%)	1 (5.56%)	0.0408	187.0 to 231.0
	No	8 (61.54%)	17 (94.44%)	0.0323	131.0 to 287.0
	p-value	0.0344	0.0062	-	-
	95%CI	96.63 to 196.6	514.7 to 614.7	-	-

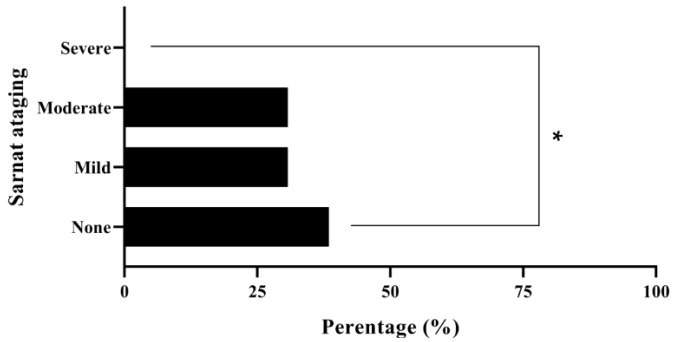

Figure 7. Sarnat staging within first 24 hours in asphyxiated cases.

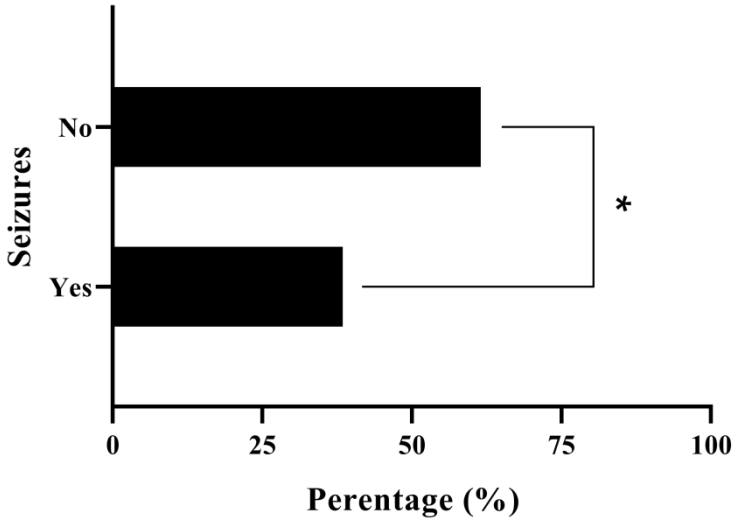

Figure 8. Seizures within first 24 hours in asphyxiated cases.

Length of stay

The mean length of NICU stay was varied insignificantly between asphyxiated (4.58±3.26 days) and non-asphyxiated (3.83±2.31 days) groups. Similarly, no statistically significant the total hospital stay was nearly identical between groups (5.85±4.34 vs. 5.78±2.84 days), (Table 3, Figure 9)

Table 3. Length of stay by asphyxia status.

Variable	Asphyxiated (M±SE)	Non-Asphyxiated (M±SE)	*p-value*	*95%CI*
NICU stay (days)	4.58±3.26	3.83±2.31	0.566	-0.5598 to 8.970
Hospital stay (days)	5.85±4.34	5.78±2.84	0.38	-5.370 to 6.260

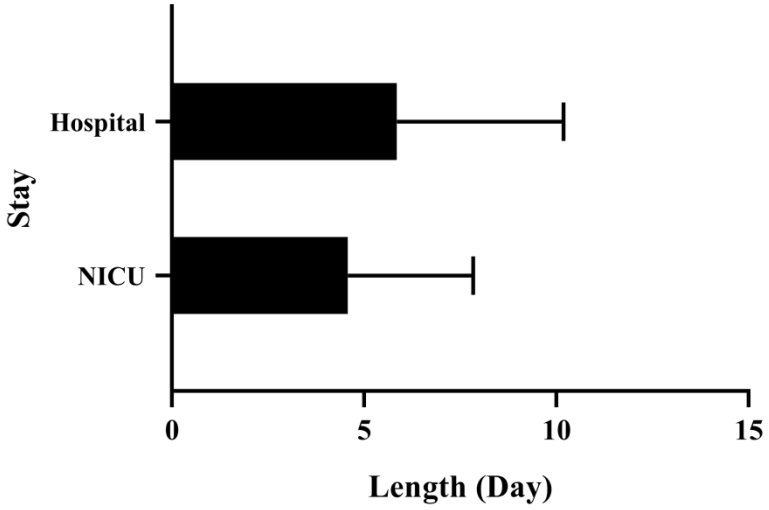

Figure 9. Length of stay (day) in asphyxiated cases.

Laboratory findings

The results of asphyxiated neonates showed a significant lowering in random blood sugar (RBS) levels (49.2±11.3mg/dL) as well as in serum calcium (5.51±1.18 mg/dL) when compared to non-asphyxiated ones (64.5±7.1mg/dL and 6.43±0.65mg/dL, respectively). Although, higher serum creatinine was recorded in asphyxiated cases (1.29±0.66mg/dL) compared to non-asphyxiated neonates

(0.56±0.031mg/dL), serum urea showed no significant difference (26.0±8.2mg/dL vs. 22.7±9.9mg/dL), (Table 4, Figure 10).

Table 4. Laboratory findings by asphyxia status.

Variable	Asphyxiated (M±SE)	Non-Asphyxiated (M±SE)	*p-value*	*95%CI*
Random blood sugar (mg/dL)	49.2±11.3	64.5±7.1	0.001	40.35 to 154.1
Urea (mg/dL)	26.0±28.2	22.7±9.9	0.0737	-3.385 to 45.32
Creatinine (mg/dL)	1.29±0.66	0.56±0.31	0.01	3.713 to 5.563
Calcium (mg/dL)	5.51±1.18	6.43±0.65	0.024	0.1251 to 11.81

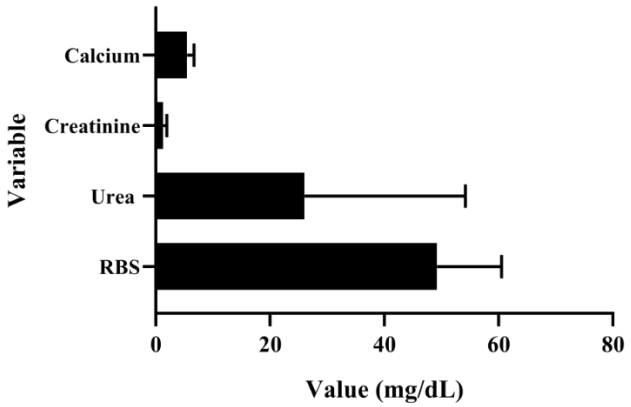

Figure 10. Laboratory findings in asphyxiated cases.

Short term outcome

All neonates in the non-asphyxia group survived to discharge (100%), whereas only 3 out of 13 (23.08%) in the asphyxia group survived, with 10 (76.92%) deaths. This difference in short-term outcomes was highly significant, indicating a strong association between birth asphyxia and increased neonatal mortality (Table 5, Figure 11).

Table 5. Short-term outcome at discharge.

Outcome	Asphyxia (n=13) No. (%)	Non-Asphyxia (n=18) No. (%)	*p-value*	*95%CI*
Alive	3 (23.08%)	18 (100%)	0.0075	427.1 to 550.2
Died	10 (76.92%)	0 (0%)	0.001	450.2 to 527.1
p-value	0.0096	0.001	-	-
95%CI	292.1 to 392.1	585.3 to 685.3	-	-

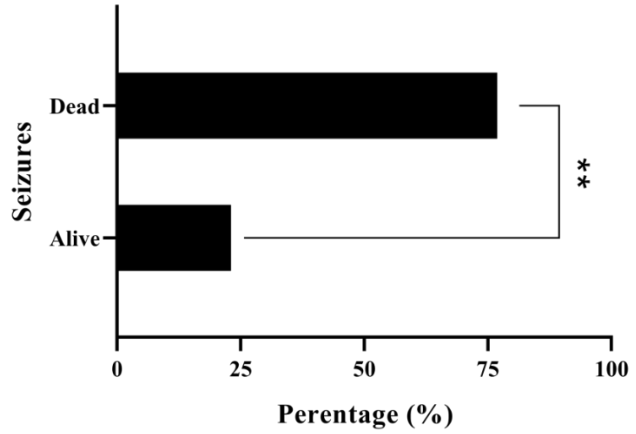

Figure 11. Short-term outcome in asphyxiated cases.

Discussion

This paper compared maternal, obstetric, clinical, and laboratory features of neonates who developed birth asphyxia and no birth asphyxia at Al-Zahraa Teaching Hospital in 2024-2025. The number of patients (n=31) was used to select 31 neonates, including 13 or 41.9 per cent of those that met the criteria of birth asphyxia (APGAR at 5 minutes <7). The results show that there is a substantial disparity in the maternal reproductive history, the neonatal Sarnat staging, the laboratory parameters, and the short-term outcomes in the two groups. Asphyxia among this group is significantly found (41.9) compared to the estimates of low- and middle-income countries, where the data ranges 1030% [25], [26]. A meta-analysis conducted in sub-Saharan Africa showed a total prevalence of 17.3% (Techane et al., 2022). Equally, Ethiopian and South-Asian studies report values of prevalence ranging between 15% and 25% [27], [28]. The increased percentage in our study could be due to the selection bias where only the NICU admissions were considered, or could be an indication of the systemic issues in obstetric and neonatal services in the study environment. Maternal age is not different between groups. It is in line with numerous researches, e.g., in Illu Ababor zone (Ethiopia) the average age of mothers of asphyxiated and non-asphyxiated newborns was not significantly different [29]. Yet, younger or very advanced maternal age has been identified as a risk factor of asphyxia in some studies, but in most cases they turn to be insignificant after other obstetric and intrapartum variables have been factored out [15], [30], [31].

Mothers of the asphyxiated babies had a large number of fewer past pregnancy and had a large number of previous births. In various reports, lower parity (nearer to primiparity) has been found to be a risk factor. As a typical example, in Ethiopia and Pakistan, primiparous mothers are at a greater risk of adverse outcomes such as birth asphyxia [5], [32]–[34]. It can be reduced maternal physiology (uterine contractility, and labour progress), or reduced stress tolerance to intrapartum, possibly due to unequal access to care, or maybe, once again, different maternal access to care.

In the current study, diabetes (38.5%) and hypertension (30.8) were also more common among mothers of the asphyxiated infants than controls but were not significant. In line with this finding, Cnattingius et al found that maternal diabetes, especially type 1 was linked to the elevated risk of asphyxia-related neonatal complications, such as low Apgar score, hypoxic ischemic encephalopathy, and neonatal seizures, with adjusted odds ratios of 2.54 to 3.41. Although our results indicate the potential contribution of maternal comorbidities, the statistical insignificance can be explained by the fact that the sample size is lower than the large-scale population-based Swedish cohort.

Among asphyxiated neonates, most were in moderate or severe stages per Sarnat (61.5% moderate, 30.8% severe), while non-asphyxia infants were mostly mild. Also, seizures within 24 hours were much more common in the asphyxia group (38.5% vs 5.6%), though $p<0.068$ (borderline). This would be consistent with the predicted relationship between the degree of hypoxic damage (measured in Sarnat staging) and neurodevelopmental complications such as seizures. Other HIE research findings indicate that severe HIE usually results in more frequent seizures and adverse short-term outcome. As an example, severe HIE was linked to poor laboratory and clinical outcome in the research of renal dysfunction in term neonates with HIE [6], [35].

One of the most vivid outcomes is that asphyxiated infants random blood sugar (mean= 49mg/dL) was considerably lower when compared with non-asphyxiated (mean= 64mg/dL), and serum creatinine (~1.29mg/dL) was considerably higher when compared to non-asphyxiated (~0.56mg/dL). These results are consistent with the existing literature: hypoxia / asphyxia results in a state of metabolic derangements, such as hypoglycaemia, and may lead to the development of acute kidney injury (AKI) or at least the renal dysfunction. One of the studies has revealed that approximately 62 percent of them developed AKI, and there was an increase in serum creatinine levels with the increasing severity of HIE [36]. These results, therefore, are in line with the pathophysiology of asphyxia that can lead to multi-organ outcomes (such as renal failure and metabolic deterioration).

There is a dramatic change in the short-term outcome at discharge: in the asphyxia group 3/13 survived as compared to all 18 in the non-asphyxia group (10/13 of the asphyxiated neonates died). This high rate of deaths in the asphyxia group is illustrative of the seriousness of asphyxia in the environment. Similar results were documented in several other studies as well; high mortality due to

moderate / severe HIE and asphyxiated infants [37]–[39]. Birth asphyxia was a major cause of death among newborn infants admitted to the NICU in the Ethiopian Amhara study [25].

Conclusion

This study identifies the birth asphyxia was identified in 41.9% of newborns, and it was significantly associated with lower parity/gravidity and adverse laboratory findings, including hypoglycemia and elevated serum creatinine. Also, the Sarnat staging revealed that most asphyxiated neonates were in moderate or severe stages, with a higher incidence of seizures within the first 24 hours. Also, the sort-term outcomes were markedly worse in the asphyxia group, with a significantly higher mortality rate. However, this study recommended the strengthen antenatal care and maternal risk factor screening (e.g., diabetes and hypertension) to reduce the risk of neonatal asphyxia, implement early recognition and management protocols for at-risk neonates, including monitoring for hypoglycemia, seizures, hypocalcemia, hypothermia, and renal dysfunction, establish specialized neonatal resuscitation and intensive care training programs to improve survival and neurological outcomes among asphyxiated infants, hypothermia treatment, and Ph probe sclap of the baby.

REFERENCES

[1] R. Moshiro, P. Mdoe, and J. M. Perlman, "A global view of neonatal asphyxia and resuscitation," *Frontiers in Pediatrics*, vol. 7, p. 489, 2019.

[2] M. Z. Jovandaric, "Perinatal Asphyxia, Hypoxia, Ischemia, and the Newborn," in *Asphyxia in Neonates*, CRC Press, 2024, pp. 1–16.

[3] M. D. Kawakami *et al.*, "Neonatal mortality associated with perinatal asphyxia: a population-based study in a middle-income country," *BMC Pregnancy and Childbirth*, vol. 21, no. 1, p. 169, 2021.

[4] J. E. Lawn, "4 million neonatal deaths: An analysis of available cause-of-death data and systematic country estimates with a focus on birth asphyxia," University College London, 2019.

[5] R. Ahmed *et al.*, "Prevalence and risk factors associated with birth asphyxia among neonates delivered in Ethiopia: a systematic review and meta-analysis," *PLoS One*, vol. 16, no. 8, p. e0255488, 2021.

[6] L. Seikku *et al.*, "Asphyxia, neurologic morbidity, and perinatal mortality in early-term and postterm birth," *Pediatrics*, vol. 137, no. 6, 2016.

[7] F. Soleimani, F. Zaheri, and F. Abdi, "Long-term neurodevelopmental outcomes after preterm birth," *Iranian Red Crescent Medical Journal*, vol. 16, no. 6, p. e17965, 2024.

[8] M. A. Rainaldi and J. M. Perlman, "Pathophysiology of birth asphyxia," *Clinics in Perinatology*, vol. 43, no. 3, pp. 409–422, 2016.

[9] S. Zhang, B. Li, X. Zhang, C. Zhu, and X. Wang, *Birth Asphyxia*. Springer, 2021.

[10] S. Dugalic, "Pathophysiology of Asphyxia in Pregnancy," in *Asphyxia in Neonates*, CRC Press, 2024, pp. 17–38.

[11] M. Masood, "Birth asphyxia-hypoxic ischemic encephalopathy." 2020.

[12] B. T. T. Nguyen, H. T. D. Vu, and T. B. Tran, "Multiorgan dysfunction in birth asphyxia," *MedPharmRes*, vol. 8, no. 2, pp. 114–121, 2024.

[13] K. Martinello, A. R. Hart, S. Yap, S. Mitra, and N. J. Robertson, "Management and investigation of neonatal encephalopathy: 2017 update," *Archives of Disease in Childhood - Fetal and Neonatal Edition*, vol. 102, no. 4, pp. F346--F358, 2017.

[14] J. F. Langeslag *et al.*, "Clinical prediction models and predictors for death or adverse neurodevelopmental outcome in term newborns with hypoxic-ischemic encephalopathy: a systematic review of the literature," *Neonatology*, vol. 120, no. 6, pp. 776–788, 2023.

[15] S. Igboanugo, A. Chen, and J. G. Mielke, "Maternal risk factors for birth asphyxia in low-resource communities: A systematic review of the literature," *Journal of Obstetrics and Gynaecology*, vol. 40, no. 8, pp. 1039–1055, 2020.

[16] N. N. Ngongo *et al.*, "Prevalence and risk factors of birth asphyxia at Livingstone University Teaching Hospital," *PLOS Global Public Health*, vol. 5, no. 12, p. e0004757, 2025.

[17] V. A. Ayeni *et al.*, "Pharmacologic neuroprotective agents for the treatment of perinatal asphyxia in low-income and lower-middle-income countries: A systematic review and meta-analysis of randomised controlled trials," *PLoS One*, vol. 20, no. 12, p. e0337798, 2025.

[18] C. C. Hawkins, E. Spiegel, D. D. Allen, and K. Nesbit, "The impact of therapeutic hypothermia on developmental outcomes in lower-middle income countries: A systematic review and meta-analysis with a health equity lens," *Pediatrics and Neonatology*, 2025.

[19] R. P. Dhiloo, "Maternal Risk Factors for Birth Asphyxia in Low-Resource Communities," *Journal of the Society of Obstetricians and Gynaecologists of Pakistan*, vol. 14, no. 1, pp. 6–10, 2024.

[20] V. J. Kain, R. Dhungana, and A. Dhungana, "Reducing Neonatal Mortality in Nepal's Remote Regions: A Narrative Review of Challenges, Disparities, and the Role of Helping Babies Breathe (HBB)," *Pediatric Reports*, vol. 17, no. 2, p. 48, 2025.

[21] H. F. Aljawadi and E. A. Ali, "Neonatal Mortality in Misan Hospital for Child and Maternity in Iraq in 2018 and 2019," *Journal of Babol University of Medical Sciences*, vol. 25, no. 1, 2023.

[22] S. M. Ali and R. F. Shitran, "Morbidity and Mortality of Premature Birth at Ramadi Teaching Hospital for Maternity and Children/West of Iraq," *Acta Medica Iranica*, pp. 136–143, 2024.

[23] A. Alsharif, A. M. Almatary, F. Ahmed, M. Badheeb, and A. M. S. Almatary, "Perinatal birth asphyxia among newborns at Jiblah public health hospital in Ibb city, Yemen, during six years of conflict and its predictive factors: a retrospective cross-sectional study," *Cureus*, vol. 16, no. 2, 2024.

[24] S. J. Al-Shaeli, A. M. Ethaeb, and H. A. Gharban, "Determine the glucose regulatory role of decaffeinated Green Tea extract in reduces the metastasis and cell viability of MCF7 cell line," in *AIP Conference Proceedings*, Nov. 2022, vol. 2394, no. 1, p. 20003.

[25] A. D. Meshesha, M. Azage, E. Worku, and G. G. Bogale, "Determinants of birth asphyxia among newborns in referral hospitals of Amhara National Regional State, Ethiopia," *Pediatric Health, Medicine and Therapeutics*, pp. 1–12, 2020.

[26] N. S. Tibebu *et al.*, "Magnitude of birth asphyxia and its associated factors among live birth in north Central Ethiopia 2021: an institutional-based cross-sectional study," *BMC Pediatrics*, vol. 22, no. 1, p. 425, 2022.

[27] G. T. Gebregziabher, F. B. Hadgu, and H. T. Abebe, "Prevalence and associated factors of perinatal asphyxia in neonates admitted to Ayder Comprehensive Specialized Hospital, Northern Ethiopia: a cross-sectional study," *International Journal of Pediatrics*, vol. 2020, no. 1, p. 4367248, 2020.

[28] A. K. Sunny *et al.*, "A multicenter study of incidence, risk factors and outcomes of babies with birth asphyxia in Nepal," *BMC Pediatrics*, vol. 21, no. 1, p. 394, 2021.

[29] T. Fekede and A. Fufa, "Determinants of birth asphyxia at public hospitals in Ilu Aba Bor zone southwest, Ethiopia: a case control study," *Scientific Reports*, vol. 12, no. 1, p. 10705, 2022.

[30] H. M. Aslam *et al.*, "Risk factors of birth asphyxia," *Italian Journal of Pediatrics*, vol. 40, no. 1, p. 94, 2014.

[31] N. Yadav and S. Damke, "Study of risk factors in children with birth asphyxia," *International Journal of Contemporary Pediatrics*, vol. 4, no. 2, pp. 518–526, 2017.

[32] A. Woday, A. Muluneh, and C. St Denis, "Birth asphyxia and its associated factors among newborns in public hospital, northeast Amhara, Ethiopia," *PLoS One*, vol. 14, no. 12, p. e0226891, 2019.

[33] W. A. Bayih *et al.*, "The state of birth asphyxia in Ethiopia: An umbrella review of systematic review and meta-analysis reports, 2020," *Heliyon*, vol. 7, no. 10, 2021.

[34] A. Manzoor, F. Sabir, S. T. Batool, N. Chaudary, S. H. Tarar, and Y. Kafait, "Birth asphyxia and its associated risk factors among newborns in tertiary care hospital of Mirpur Azad Kashmir," *Journal of Pakistan Medical Association*, vol. 50, no. 2, p. 400, 2025.

[35] C. E. Ahearne, G. B. Boylan, and D. M. Murray, "Short and long term prognosis in perinatal asphyxia: An update," *World Journal of Clinical Pediatrics*, vol. 5, no. 1, p. 67, 2016.

[36] A. Sood, A. Bhardwaj, S. Singh, and J. S. Chahal, "Evaluation of renal function among term neonates with perinatal asphyxia," *International Journal of Contemporary Pediatrics*, vol. 9, no. 7, p. 653, 2022.

[37] V. S. Kapadia, L. F. Chalak, T. L. DuPont, N. K. Rollins, L. P. Brion, and M. H. Wyckoff, "Perinatal asphyxia with hyperoxemia within the first hour of life is associated with moderate to severe hypoxic-ischemic encephalopathy," *The Journal of Pediatrics*, vol. 163, no. 4, pp. 949–954, 2013.

[38] K. Mainuddin, "Correlation of Severity and Outcome in Perinatal Asphyxia of Intramural Term Babies with Cord Blood Biochemical Markers and Possible Interventions: A Hospital Based Descriptive Study," Rajiv Gandhi University of Health Sciences, 2017.

[39] J. F. Mwatonoka, "Prevalence of Hypoxic Ischemic Encephalopathy and Predictors of Poor Outcome Among Term Newborns with Birth Asphyxia Admitted at Dodoma Regional Referral Hospital," University of Dodoma, 2021.