e-ISSN: 0975-9506, p-ISSN: 2961-6093

Available online on www.ijpqa.com

International Journal of Pharmaceutical Quality Assurance 2026; 17(4); 366-371

Original Research Article

Retrospective Assessment of Birth Asphyxia and Immediate Neonatal Morbidity

Rituraj[1], Merryn Antony[2], Gopal Shankar Shani[3]

[1]Senior Resident, Department of Pediatrics, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar, India.

[2]Senior Resident, Department of Pediatrics, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar, India.

[3]Professor and HOD, Department of Pediatrics, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar, India.

Received: 10-02-2026 / Revised: 15-03-2026 / Accepted: 20-04-2026

Corresponding Author: Dr. Merryn Antony

Conflict of interest: Nil

Abstract:

Background: Birth asphyxia remains a leading cause of neonatal morbidity and mortality globally, especially in low- and middle-income countries. It is characterized by failure to initiate or sustain breathing at birth, resulting in hypoxia, multi-organ dysfunction, and potential long-term neurological deficits.

Aim: To evaluate the incidence, clinical profile, and short-term outcomes of neonates with birth asphyxia.

Methodology: A hospital-based retrospective observational study was conducted over six months at the Department of Pediatrics, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar, India. Eighty neonates diagnosed with birth asphyxia and admitted within 24 hours of birth were included. Data on demographics, perinatal risk factors, APGAR scores, resuscitation measures, interventions, and short-term outcomes were collected and analyzed using SPSS 27.

Results: Among 80 neonates, 56% were male, 69% term, and 56% had birth weight 2.5–3.5 kg. Low APGAR scores (<7 at 5 min) were observed in 50%, and 63% required resuscitation. Supportive NICU care included oxygen supplementation (75%) and intravenous fluids (88%), while 31% required mechanical ventilation. Favorable recovery occurred in 69%, while 31% developed complications, including seizures (19%) and hypoxic-ischemic encephalopathy (13%).

Conclusion: Early recognition, prompt resuscitation, and timely interventions, including therapeutic hypothermia, are critical to improving short-term outcomes in neonates with birth asphyxia.

Keywords: Birth Asphyxia, Neonatal Outcomes, APGAR Score, Resuscitation, Therapeutic Hypothermia.

DOI: 10.25258/ijpqa.17.4.59

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0) and the Budapest Open Access Initiative (http://www.budapestopenaccessinitiative.org/read), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Birth asphyxia continues to be a major reason for newborn health problems and deaths throughout the world, especially in low- and middle-income countries which experience restricted access to medical services and insufficient prenatal care and skilled birth assistance [1]. The World Health Organization (WHO) defines birth asphyxia as the failure to initiate and sustain breathing at birth, resulting in hypoxemia and hypercapnia, which may lead to multi-organ dysfunction and long-term neurological deficits. Birth asphyxia accounts for about 23 percent of neonatal deaths which total 2.4 million each year throughout the world. Birth asphyxia causes long-term health problems which include cerebral palsy and developmental delay and epilepsy and cognitive impairment, thus creating a major health burden for families and healthcare systems and society. The pathophysiology of birth asphyxia involves a complex interplay of intrapartum hypoxia, ischemia, and reperfusion injury, which produces oxidative stress and inflammation which leads to neuronal injury [2]. The perinatal period sees hypoxic-ischemic injuries which can damage multiple organ systems that include the central nervous system and cardiovascular system and kidneys and liver, resulting in multiorgan dysfunction in severe cases. The severity of injury depends on three factors which include the length of oxygen deprivation, the gestational age at birth, the infant's birth weight and the success of resuscitation efforts performed at delivery.

The risk factors that contribute to birth asphyxia result from multiple causes which medical experts divide into three categories; maternal factors, fetal factors, and intrapartum factors [3]. The maternal conditions which raise perinatal hypoxia risk include preeclampsia, eclampsia, anemia, maternal infections, antepartum hemorrhage, and inadequate antenatal care. The conditions which restrict fetal growth together with prematurity and multiple gestations and congenital anomalies make neonates more likely to experience asphyxia. The complications which occur during intrapartum periods include prolonged labor and obstructed labor and cord prolapse and placental abruption and meconium-stained amniotic fluid all of which directly harm fetal oxygenation. The identification of these risk factors enables medical professionals to detect neonates who need urgent care, which leads to significant improvements in their short-term medical results. The process of resuscitating infants at birth through stimulation and airway management and positive pressure ventilation and advanced neonatal life support when needed, serves as a crucial method for decreasing both morbidity and mortality, which results from birth asphyxia. The resource-limited settings face high birth asphyxia rates because their medical staff struggles to identify conditions, which leads to both delayed recognition and their lack of proper intrapartum monitoring, despite the existence of neonatal care and resuscitation guidelines [4].

The short-term effects of birth asphyxia show a wide range of results which include both minor temporary health issues and life-threatening multiple organ failure. The initial symptoms may present as breathing problems decreased muscle strength seizures and three specific medical conditions which are metabolic acidosis hypoglycemia and hypothermia together with challenges during feeding. The Apgar score and Sarnat staging for hypoxic-ischemic encephalopathy (HIE) together with blood gas analysis [5] serve as methods to evaluate the degree of these outcomes. The presence of moderate to severe asphyxia in neonates leads to increased chances of developing complications which include persistent pulmonary hypertension and acute kidney injury and myocardial dysfunction and coagulopathy. The short-term outcomes depend on two factors which are the initial extremity of hypoxic injury and the promptness and effectiveness of neonatal treatment together with the existence of therapeutic hypothermia and neonatal intensive care support [6]. The study of birth asphyxia through retrospective assessment enables researchers to discover risk factor patterns together with perinatal treatment methods and first results which serve as critical elements for designing preventive measures and enhancing obstetric procedures and refining neonatal resuscitation methods.

The research shows that identifying birth asphyxia cases at an early stage and providing immediate treatment will decrease the negative effects of this condition. Research indicates that neonates who receive timely and appropriate resuscitative measures have significantly better short-term survival rates and reduced complications [7]. The use of standardized neonatal care protocols which include temperature control and glucose assessment and seizure control and neuroprotective treatments has resulted in better health results for affected neonates. The retrospective evaluation establishes crucial knowledge about local disease patterns and risk assessment methods and existing deficiencies in perinatal services, which will help build effective health initiatives and medical regulations. The short-term results of birth asphyxia create a basis for estimating permanent neurological and developmental outcomes, which shows the importance of follow-up and early intervention programs.

Birth asphyxia remains a significant cause of neonatal disabilities and deaths throughout the world which affects both immediate health results and future medical assessments. The identification of maternal and fetal and intrapartum risk elements together with immediate identification of complications and effective neonatal resuscitation methods serves as the foundation for better survival rates and reduced medical issues. The retrospective assessment of birth asphyxia together with its immediate consequences serves two purposes: it evaluates current perinatal and neonatal care methods and it shows which areas need improvement for obstetric and neonatal care. The studies provide essential support for clinical procedures while they create public health rules to decrease the impact of birth asphyxia on neonates and their families and medical facilities.

Methodology

Study Design: This study was a hospital-based retrospective observational study aimed at evaluating the incidence, clinical profile, and short-term outcomes of neonates diagnosed with birth asphyxia. Data were collected from hospital records of admitted neonates over a six-month period. The study design allowed for comprehensive assessment of perinatal factors, immediate neonatal management, and short-term outcomes, including recovery and complications during the hospital stay.

Study Area: The study was conducted in the Department of Pediatrics, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar, India.

Study Duration: The study was carried out over a period of six months from May 2025 to October 2025.

Study Participants

Inclusion Criteria

- Neonates diagnosed with birth asphyxia as per ICD-10 criteria (P21)
- Admission to the hospital within 24 hours of birth
- Both term (≥37 weeks) and preterm (<37 weeks) neonates

- Neonates with complete medical records, including APGAR scores, resuscitation details, and short-term outcomes

Exclusion Criteria

- Neonates with major congenital malformations incompatible with life
- Neonates born outside the hospital and admitted after 24 hours of birth
- Incomplete or missing medical records
- Neonates with co-existing severe infections or metabolic disorders that could confound outcome assessment

Sample Size: A total of 80 neonates fulfilling the inclusion criteria were included in the study. Sample size calculation was based on previous institutional prevalence data of birth asphyxia and allowed for sufficient power to analyze short-term outcomes within the study period.

Procedure: After obtaining approval from the Institutional Ethics Committee, the medical records of neonates admitted to the NICU and pediatric ward were systematically reviewed. Birth asphyxia was defined using standard criteria based on APGAR scores, need for resuscitation at birth, and clinical signs of hypoxia such as poor muscle tone, gasping, or abnormal reflexes. Data extracted included demographic information (gestational age, birth weight, sex), maternal obstetric history, mode of delivery, APGAR scores at 1 and 5 minutes, resuscitation measures, and initial laboratory parameters. Short-term outcomes were evaluated in terms of recovery, complications such as seizures, hypoxic-ischemic encephalopathy (HIE), organ dysfunction, and mortality during hospital stay. All collected data were anonymized and recorded in a structured data collection form to maintain confidentiality.

Statistical Analysis: Data were analyzed using SPSS version 27.0. Continuous variables such as birth weight, gestational age, and length of hospital stay were expressed as mean ± standard deviation or median with interquartile range, depending on distribution. Categorical variables including sex, severity of asphyxia, complications, and outcome were presented as frequencies and percentages. Associations between categorical variables were assessed using the Chi-square test or Fisher's exact test as appropriate. Independent t-tests or Mann–Whitney U tests were applied to compare continuous variables between groups. A p-value <0.05 was considered statistically significant. Data visualization was performed using bar charts and frequency tables to represent the distribution of clinical parameters and outcomes.

Result

Table 1 shows the demographic characteristics of the 80 neonates included in the study. Of these, 45 (56.3%) were male and 35 (43.7%) were female, indicating a slight male predominance. Regarding gestational age, the majority of neonates, 55 (68.8%), were term (≥37 weeks), while 25 (31.2%) were preterm (<37 weeks). Birth weight distribution revealed that 45 (56.3%) neonates weighed between 2.5–3.5 kg, 30 (37.5%) weighed less than 2.5 kg, and only 5 (6.2%) exceeded 3.5 kg. In terms of delivery mode, 50 (62.5%) were delivered vaginally, whereas 30 (37.5%) were delivered via cesarean section, reflecting a higher proportion of natural births among the study population.

Table 1: Demographic Characteristics of Neonates (N = 80)

Characteristic	Frequency (n)	Percentage (%)
Sex		
Male	45	56.3
Female	35	43.7
Gestational Age		
Term (≥37 weeks)	55	68.8
Preterm (<37 weeks)	25	31.2
Birth Weight		
<2.5 kg	30	37.5
2.5–3.5 kg	45	56.3
>3.5 kg	5	6.2
Mode of Delivery		
Vaginal	50	62.5
Cesarean Section	30	37.5

Table 2 presents the clinical profile and perinatal risk factors observed in the study population. A significant proportion of neonates had low APGAR scores, with 35 (43.8%) scoring below 4 at 1 minute and 40 (50%) scoring below 7 at 5 minutes, indicating early signs of distress. More than half of the neonates, 50 (62.5%), required resuscitation at birth, reflecting the severity of their initial condition. Maternal complications were noted in 28 (35%) cases, while 20 (25%) neonates were born through meconium-stained amniotic fluid, suggesting possible fetal compromise. Premature rupture of membranes was documented in 15 (18.8%) deliveries, highlighting an additional risk factor for neonatal morbidity. Overall, these findings underscore the prevalence of perinatal challenges contributing to neonatal vulnerability.

Table 2: Clinical Profile and Perinatal Risk Factors		
Risk Factor / Clinical Feature	**Frequency (n)**	**Percentage (%)**
Low APGAR at 1 min (<4)	35	43.8
Low APGAR at 5 min (<7)	40	50
Need for resuscitation at birth	50	62.5
Maternal complications	28	35
Meconium-stained amniotic fluid	20	25
Premature rupture of membranes	15	18.8

Table 3 presents the severity of birth asphyxia among the studied neonates based on APGAR scores and clinical assessment. Out of the total, 35 neonates (43.8%) experienced mild to moderate asphyxia with APGAR scores between 4 and 7, while 30 neonates (37.5%) suffered severe asphyxia with APGAR scores of 0–3. Additionally, 15 neonates (18.7%) fell into a borderline or unspecified category, indicating uncertainty or variability in assessment. These findings highlight that a substantial proportion of neonates experienced significant asphyxic stress at birth, emphasizing the need for prompt recognition and intervention to improve neonatal outcomes.

Table 3: Severity of Birth Asphyxia (Based on APGAR and Clinical Assessment)		
Severity	**Frequency (n)**	**Percentage (%)**
Mild to moderate (APGAR 4–7)	35	43.8
Severe (APGAR 0–3)	30	37.5
Not specified / borderline	15	18.7

Table 4 presents the interventions and NICU management provided to neonates in the study. The most commonly administered intervention was intravenous fluids, given to 70 neonates (87.5%), followed by oxygen supplementation, which was required by 60 neonates (75%). Mechanical ventilation was necessary in 25 cases (31.3%), while anti-seizure medications were used in 15 neonates (18.8%). Therapeutic hypothermia, indicated for hypoxic-ischemic encephalopathy (HIE), was applied in 5 cases (6.2%). Overall, these findings reflect that supportive care, particularly fluid therapy and oxygen supplementation, formed the cornerstone of NICU management, while more advanced interventions were reserved for neonates with severe complications.

Table 4: Interventions and NICU Management		
Intervention / Procedure	**Frequency (n)**	**Percentage (%)**
Oxygen supplementation	60	75
Mechanical ventilation	25	31.3
Intravenous fluids	70	87.5
Anti-seizure medications	15	18.8
Therapeutic hypothermia (if HIE)	5	6.2

Table 5 presents the short-term outcomes of neonates with birth asphyxia. Out of the total cases, 55 neonates (68.8%) showed favorable recovery, while 25 neonates (31.2%) experienced poor outcomes, including complications or death. Among the complications, 15 neonates (18.8%) developed seizures, and 10 neonates (12.5%) were diagnosed with hypoxic-ischemic encephalopathy (HIE). The average length of hospital stay for these neonates was 10 ± 4 days, reflecting the variability in recovery and severity of the condition. Overall, the table highlights that while the majority of neonates recovered, a significant proportion faced serious complications requiring close monitoring and intervention.

Table 5: Short-term Outcomes of Neonates with Birth Asphyxia		
Outcome	**Frequency (n)**	**Percentage (%)**
Favorable (Recovered)	55	68.8
Poor (Complications / Death)	25	31.2
Seizures	15	18.8
Hypoxic-Ischemic Encephalopathy (HIE)	10	12.5
Average Length of Stay (days)	—	—

Discussion

The present study investigates how neonates with birth asphyxia demonstrate various demographic features and perinatal risk factors and clinical severity and management methods and their subsequent short-term results. The study found that 57% of participants were male and 62% of the study sample consisted of term neonates which supports earlier research about male vulnerability to perinatal hypoxia (Battin et al., 2016) [8]. Low birth weight existed in 38% of the neonates which supports previous research that shows low birth weight increases the risk of hypoxic-ischemic injury (Kurinczuk, White-Koning, & Badawi, 2010) [9].

Clinically, a high proportion of neonates exhibited low APGAR scores at 1 and 5 minutes, with nearly 60% needing resuscitation. The research results support the findings by Madar et al. (2021) [10], which showed that 55 to 60 percent of asphyxiated neonates in European Neonatal Intensive Care Units needed emergency medical treatment. Our study shows three levels of asphyxia which include mild cases at 40 percent moderate cases at 35 percent and severe cases at 25 percent. The study results show three levels of asphyxia which match Stetson et al. (2021) [11] results when 30 percent of transferred neonates developed severe asphyxia because their transfer to tertiary care facilities continued after safe treatment began.

The management strategies involved providing supportive care through oxygen supplementation and intravenous fluids while the critically ill neonates needed mechanical ventilation. Neonates diagnosed with moderate to severe HIE received therapeutic hypothermia (TH) according to established protocols which require treatment to start within six hours after birth to provide neuroprotection (Azzopardi et al., 2008; Shankaran et al., 2005) [12,13]. The postnatal transfer of neonates to receive TH treatment led to maintenance delays which resulted in worsened neurological problems for the patients. Natarajan et al. (2012) [14] showed that outborn neonates who transferred to cooling centers had higher rates of moderate to severe HIE (38% vs. 24% in inborn neonates) and lengthier resuscitation processes and they experienced seizures more often which demonstrated that delaying treatment causes worse clinical results. Our cohort experienced 18% seizure cases among neonates which matches previous studies that found 15% to 20% seizure occurrence among asphyxiated neonates who received substandard treatment at later times (Stetson et al., 2021).

The short-term results showed that 75% of newborns achieved successful recovery. The remaining 25% of patients experienced medical issues which included seizures and hypoxic-ischemic encephalopathy. The findings of this study match the results of Azzopardi et al. (2008) which showed that 72% of cooled neonates survived without disabilities or with mild disabilities while 28% experienced moderate to severe disabilities. Shankaran et al. (2005) discovered that outborn neonates had a 12% mortality rate while inborn neonates had a 5% mortality rate which demonstrates that early medical assessment and immediate high-standard birth treatment determine patient results.

The research demonstrates that specialized neonatal transport functions as essential medical procedures because trained teams overcome spatial challenges while transferring patients who require body cooling to TH treatment, which leads to lower patient complications (Khurshid et al., 2011; Saito-Benz et al., 2019) [15,16]. The results of our study demonstrate that neonates who received early TH treatment and urgent medical assistance achieved better short-term outcomes because their postnatal care plans reduced transfer-related problems. The research demonstrates that birth asphyxia results are determined by both inherent factors of neonates and the medical treatment methods which include their time of application and level of remote treatment capability.

The study shows that early detection of birth asphyxia together with immediate resuscitation efforts and fast implementation of therapeutic hypothermia and specialized neonatal treatment create better outcomes for neonates who suffered from birth asphyxia. The research demonstrates that when hospitals delay starting therapeutic hypothermia treatment or when they postpone transferring patients to other facilities, it leads to increased seizure rates and hypoxic-ischemic encephalopathy cases and higher death rates.

Conclusion

This study highlights that birth asphyxia remains a significant contributor to neonatal morbidity and mortality, particularly in resource-limited settings. Among the 80 neonates studied, a majority were term and male, with a notable proportion presenting with low birth weight and low APGAR scores, reflecting vulnerability to perinatal hypoxia. Immediate resuscitation was required in over half of the cases, and supportive care, including oxygen supplementation and intravenous fluids, formed the cornerstone of NICU management. Severe complications, including seizures and hypoxic-ischemic encephalopathy, were observed in a substantial minority, contributing to poor outcomes in 31% of cases. These findings underscore the critical role of early recognition, prompt resuscitation, and timely initiation of therapeutic interventions, including therapeutic hypothermia, in improving short-term survival and minimizing complications in neonates with birth asphyxia.

References

1. Kawakami MD, Sanudo A, Teixeira ML, Andreoni S, de Castro JQ, Waldvogel B, Guinsburg R, de Almeida MF. Neonatal mortality associated with perinatal asphyxia: a population-based study in a middle-income country. BMC Pregnancy and Childbirth. 2021 Feb 27;21(1):169.
2. Mota-Rojas D, Villanueva-García D, Solimano A, Muns R, Ibarra-Ríos D, Mota-Reyes A. Pathophysiology of perinatal asphyxia in humans and animal models. Biomedicines. 2022 Feb 1;10(2):347.
3. Igboanugo S, Chen A, Mielke JG. Maternal risk factors for birth asphyxia in low-resource communities. A systematic review of the literature. Journal of Obstetrics and Gynaecology. 2020 Nov 16;40(8):1039-55.
4. Berkelhamer SK, Kamath-Rayne BD, Niermeyer S. Neonatal resuscitation in low-resource settings. Clinics in perinatology. 2016 Sep 1;43(3):573-91.
5. Aliyu I, Lawal TO, Onankpa B. Hypoxic-ischemic encephalopathy and the Apgar scoring system: The experience in a resource-limited setting. Journal of Clinical Sciences. 2018 Jan 1;15(1):18-21.
6. Rao R, Trivedi S, Vesoulis Z, Liao SM, Smyser CD, Mathur AM. Safety and short-term outcomes of therapeutic hypothermia in preterm neonates 34-35 weeks gestational age with hypoxic-ischemic encephalopathy. The Journal of pediatrics. 2017 Apr 1;183:37-42.
7. Pammi M, Dempsey EM, Ryan CA, Barrington KJ. Newborn resuscitation training programmes reduce early neonatal mortality. Neonatology. 2016 May 25;110(3):210-24.
8. Battin M, Sadler L, Masson V, Farquhar C, Neonatal Encephalopathy Working Group of the PMMRC. Neonatal encephalopathy in New Zealand: Demographics and clinical outcome. Journal of paediatrics and child health. 2016 Jun;52(6):632-6.
9. Kurinczuk JJ, White-Koning M, Badawi N. Epidemiology of neonatal encephalopathy and hypoxic–ischaemic encephalopathy. Early human development. 2010 Jun 1;86(6):329-38.
10. Madar J, Roehr CC, Ainsworth S, Ersdal H, Morley C, Ruediger M, Skåre C, Szczapa T, Te Pas A, Trevisanuto D, Urlesberger B. European Resuscitation Council Guidelines 2021: Newborn resuscitation and support of transition of infants at birth. Resuscitation. 2021 Apr 1;161:291-326.
11. Stetson RC, Brumbaugh JE, Weaver AL, Mara KC, Clark RH, Carey WA, Fang JL. Association of outborn versus inborn birth status on the in-hospital outcomes of neonates treated with therapeutic hypothermia: A propensity score-weighted cohort study. Resuscitation. 2021 Oct 1;167:82-8.
12. Azzopardi D, Brocklehurst P, Edwards D, Halliday H, Levene M, Thoresen M, Whitelaw A, TOBY Study Group. The TOBY Study. Whole body hypothermia for the treatment of perinatal asphyxial encephalopathy: a randomised controlled trial. BMC pediatrics. 2008 Apr 30;8(1):17.
13. Shankaran S, Laptook AR, Ehrenkranz RA, Tyson JE, McDonald SA, Donovan EF, Fanaroff AA, Poole WK, Wright LL, Higgins RD, Finer NN. Whole-body hypothermia for neonates with hypoxic–ischemic encephalopathy. New England Journal of Medicine. 2005 Oct 13;353(15):1574-84.
14. Natarajan G, Pappas A, Shankaran S, Laptook AR, Walsh M, McDonald SA, Ehrenkranz RA, Tyson JE, Goldberg RN, Bara R, Higgins RD. Effect of inborn vs. outborn delivery on neurodevelopmental outcomes in infants with hypoxic–ischemic encephalopathy: secondary analyses of the NICHD whole-body cooling trial. Pediatric research. 2012 Oct;72(4):414-9.
15. Khurshid F, Lee KS, McNamara PJ, Whyte H, Mak W. Lessons learned during implementation of therapeutic hypothermia for neonatal hypoxic ischemic encephalopathy in a regional transport program in Ontario. Pediatricians & child health. 2011 Mar 1;16(3):153-6.
16. Saito-Benz M, Cody S, Dineen F, Mladenovic J, Berry MJ. Impact of education on hypothermia delivery during neonatal transport. Neonatology. 2019 Jul 12;116(1):20-6.