RESEARCH ARTICLE

CLINICAL PROFILE AND RISK FACTORS OF NEONATAL HYPOGLYCEMIA IN NEONATES ADMITTED TO NICU

Dr. Subodh Shetty [1], Dr. Shemina Puthukudiyil[2*], Dr.Jayashree Purkayastha [3], Dr. Pankaj Gupta[4], Dr. Leslie Edward Lewis[5]

[1] Associate Professor, Department of Neonatology, E mail: subodh.shetty@manipal.edu, Orcid Id: 0000-0002-0695-1822

[2*]Senior Resident, Department of Paediatrics, E mail: shemina.puthukudiyil@manipal.edu, Orcid ID: 0009-0000-2664-9615

[3] Professor, Department of Paediatrics, E mail: jaya.p@manipal.edu, Orcid ID: 0000-0002-9754-1756

[4]Junior Resident, Department of Paediatrics, E mail: pankaj.gupta@learner.manipal.edu, Orcid ID: 0009-0002-0624-5853

[5]Professor, Department of Paediatrics, E mail: leslie.lewis@manipal.edu, Orcid id: 0000-0002-3467-6821

[1,2,3,4,5] Department of Pediatrics and Neonatology ,Kasturba Medical College, Manipal Academy of Higher Education, Manipal, India ,576104

ABSTRACT

Introduction- Neonatal hypoglycemia is a common metabolic condition in newborns that can lead to long-term neurodevelopmental complications if not promptly diagnosed and treated. It is influenced by various maternal and neonatal factors. Numerous questions remain unanswered regarding how these variables impact clinical outcomes.

Objective- To study the incidence, clinical features and risk factors associated with development of hypoglycaemia in newborns admitted to NICU of tertiary care hospital.

Methods: This retrospective observational study included 238 neonates diagnosed with hypoglycemia over the period of 5 years (January 2018 to December 2022). Detailed history, neonatal risk factor, maternal risk factors and laboratory investigations were noted from medical records. Descriptive statistics and cross-tabulation analyses were employed to assess the distribution and outcomes.

Results: Out of 17,020 neonatal admissions, 6643 (39%) were admitted to the NICU. Out of 6643 NICU admissions 238 newborns developed hypoglycemia with a hypoglycemia incidence of 3.5% out of which 83.6% were symptomatic and 16.4% were asymptomatic. The incidence of hypoglycaemia was 3.5% among NICU admissions, in that preterm- 37.4%, Term-62.6%, SGA- 39.5%, LGA- 8.8%. Male to female ratio was 1.6:1. 31% cases had onset of hypoglycaemia on day 1 of life. Maternal risk factors for development of hypoglycaemia were GDM (16.4%), PIH (16%), hypothyroidism (4%). Neonatal risk factors like Low birth weight, sepsis and polycythaemia were observed in 54.6%, 28.9% of 6.7% of the cases respectively. Lethargy, Seizure and poor feeding were seen in 40.3% ,35.7% and 30.6% cases respectively.

Conclusion: Neonatal hypoglycemia is influenced by both maternal and neonatal risk factors, with low birth weight, prematurity, and maternal conditions such as GDM being significant contributors. Early identification and management are crucial to prevent long-term complications.

Keywords: Neonatal hypoglycemia, Gestational diabetes mellitus, low birth weight, maternal risk factors, neonatal outcomes.

How to cite this article: Shetty S, Puthukudiyil S, Purkayastha J, Gupta P, Lewis L E., Clinical Profile and Risk Factors of Neonatal Hypoglycemia in Neonates Admitted to Nicu. Int J Drug Deliv Technol. 2026;16(43s): 922-927; Doi: 10.25258/Ijddt.16.43s.99

Source of support: Nil., **Conflict of interest:** None

Introduction

Neonatal hypoglycemia, remains one of the most common metabolic emergencies in neonatal intensive care units (NICUs) worldwide.1 It presents a serious threat to neonatal health, with potential consequences including irreversible neurological damage, developmental delays, epilepsy, and other long term sequalae. This condition's impact is profound due to its often-subtle clinical presentation, which can delay diagnosis and treatment, leading to significant long-term morbidity. Early identification and timely management are crucial to mitigating these risks.2,3

The incidence of neonatal hypoglycemia varies widely, ranging from 5% to nearly 15% in neonates, depending on their risk profile. In high-risk groups, such as those born prematurely, with low birth weight (LBW), or to mothers with gestational diabetes mellitus (GDM), the prevalence is significantly higher. In India, where GDM affects 10-15% of pregnancies, neonatal hypoglycemia is particularly prevalent, with studies reporting incidences between 13% and 15% in NICU

admissions.4,5 This is further compounded by high rates of preterm births, which account for 15-20% of neonatal admissions, compared to global averages of 6-10%. Prematurity and LBW, often linked to intrauterine growth restriction (IUGR), increase the susceptibility of neonates to hypoglycemia due to inadequate glycogen stores and immature metabolic regulation.6,7

Despite advancements in neonatal care, hypoglycemia remains a critical issue, particularly in low-resource settings where early screening and intervention protocols may be inconsistent. Symptoms such as lethargy, poor feeding, seizures, and respiratory distress are often nonspecific, necessitating routine blood glucose monitoring for at-risk neonates.8,9 Current management guidelines emphasize the importance of screening neonates within the first 48 to 72 hours of life, especially those born to mothers with GDM or other risk factors.10 However, significant gaps remain in understanding the long-term outcomes of these infants and optimizing treatment protocols to prevent hypoglycemia-related complications. This study aims to explore the clinical profile and associated risk factors of neonatal hypoglycemia in NICU settings, providing insights for improving diagnostic and therapeutic strategies.

Material and Methods:

This study design was a retrospective, single center, observational study, conducted in the NICU of tertiary care hospital from January 2018 to December 2022. A total of 238 Newborns admitted in NICU with hypoglycemia or those who developed hypoglycemia during NICU stay over 5 years were included in this study. The study was conducted following ethical guidelines, with approval obtained from the hospital's ethics committee, IEC Number -424/2022. Data confidentiality and anonymity were strictly maintained.

Data collection: The diagnosis of neonatal hypoglycemia was made on the basis of Glucose readings based on serum blood glucose <50 mg/dl within 48 hrs. of life and <60 mg/dl after 48 hrs. of life (as per Pediatric Endocrine Society). Detailed clinical history, neonatal risk factor, maternal risk factors and laboratory investigations were noted from medical records. Detailed antenatal, natal and postnatal history was noted. Neonatal risk factors like birth weight, gestational age, IUGR, sepsis, respiratory distress and polycythemia were also noted. Presence of maternal risk factors such as GDM, PIH, obesity, hypothyroidism was noted. History of refusal of feed, lethargy and history of abnormal movements were noted. Number of babies who had symptomatic hypoglycemia and number of babies who had asymptomatic hypoglycemia was noted from the records. EEG, MRI when done was noted. Day of life when hypoglycemia occurred was taken from the medical records. Maximum percentage of IV dextrose infusion given were noted. Drugs like Diazoxide, Hydrocortisone and Octreotide was taken from the records. Number of babies who received antiepileptics and those who were discharged on antiepileptics were noted.

Statistical analysis: The data of the neonates admitted at the tertiary care hospital was collected retrospectively, the collected data was entered in Microsoft Excel version 13 and analysed using descriptive analysis and cross tabulation technique. Frequencies and percentage were used for categorical variables.

RESULTS:

Demographic characteristics: A total of 17020 neonates were admitted to a tertiary care hospital during the study period. Out of them 6643 neonates (39%) were admitted to NICU. Present study noted 238 cases of hypoglycemia, 1.4% of total admission to the hospital however, incidence of hypoglycemia in neonates admitted to NICU over 5 years was 3.5%.

This study found that hypoglycemia occurred in 3.5% of neonates admitted to NICU over a five-year period. Male neonates constituted 61.7% of cases, while females represented 38.3%.

A large proportion of these neonates were delivered via Caesarean section (76.4%), with the majority being out born (65.9%) compared to inborn (34.1%).

In this study 147 were male and 91 were female neonates. Male to female ratio was 1.6:1. Gestational age analysis showed that 62.6% of the cases were term neonates, while preterm neonates accounted for 37.4%. The majority of cases in the study 62.6% (149 neonates) were full-term infants. Term AGA neonates were most common, 92(38.6%) while next most common was Term SGA, 42(17.6%).

Among preterm neonates, late preterm (16.4%) and moderate preterm (12.6%) were the most common categories. Additionally, 0.8% of preterm neonates were born extremely premature, and 7.6% were early preterm. Preterm LBW neonates accounted for 31.5% of cases, and among preterm neonates, 6.3 % were small-for-gestational-age (SGA), who are particularly susceptible to hypoglycemia due to intrauterine growth restriction. These findings highlight the significant role of birth weight and gestational age as key risk factors for neonatal hypoglycemia in NICU settings. Birth weight analysis indicated that 40 % of neonates had a normal birth weight, while 54.6 % were classified as low birth weight (LBW), which is a known risk factor for hypoglycemia. Furthermore, 12.6% of neonates were classified as very low birth weight (VLBW), and 5.0% had extreme low birth weight (ELBW). Macrosomia, or birth weight over 4 kg, was observed in 5.4% of the cases. Comparison between normal and low birth weight neonates revealed that 40 % had a normal birth weight, while the majority (54.6 %) were LBW (Table 1).

Table 1 Demographic characteristics of study population (N=238)

	Demographic data	Number of Cases	Percentage (%)
Sex	Male	147	61.8
	Female	91	38.2
Mode of Delivery	NVD	56	23.6
	LSCS	182	76.4
Place of Delivery	Out born	157	65.9
	Inborn	81	34.1
Gestational age	Preterm	89	37.4
	AGA	31	13
	SGA	15	6.3
	LGA	6	2.5
	Term	149	62.6
	AGA	92	38.6
	SGA	42	17.6
	LGA	15	6.3
	Post term	0	0
Preterm categories	Extreme Preterm	2	0.8
	Early Preterm	18	7.6
	Moderate Preterm	30	12.6
	Late Preterm	39	16.4
Birth weight categories	Low birth weight	130	54.6
	Normal birth weight	95	40
	Macrosomia	13	5.4

Table 2. Clinical features at presentation in neonates with hypoglycemia (N= 238)

Clinical features	**Number of cases**	**Percentages**
Symptomatic	199	83.6
Asymptomatic	39	16.4
Lethargy	96	40.3 %
Seizures	85	35.7%
Poor feeding	76	31.9 %
Respiratory distress	73	30.6%
Jitteriness	65	27.3%
Irritability	46	19.3%

Lethargy, seizures, and poor feeding were seen in 40.3% ,35.7% and 31.9% cases respectively. Respiratory distress was seen in 30.6%. Jitteriness and irritability were seen in 27.3% and 19.3% respectively.

In our study among neonates with hypoglycaemia, 85 neonates (35.7%) had seizures. Maximum number of cases had multifocal clinic seizures (89%). Among neonates with seizures 76 (89.4 %) were out born and presented with seizures or came with history of seizure while 25(29.4%) neonates were inborn. EEG was done in 62 neonates and 28 neonates had EEGs that showed normal results. MRI was done in 47 neonates out of which 40 neonates had MRI scans with abnormal findings. Majority of the cases required only one AED, and 32 cases (76.2%) required a single antiepileptic medication. A

smaller proportion of neonates required more aggressive treatment, including two AEDs in 7 cases (16.7%) and three AEDs in 3 cases (7.1%). Of the specific AEDs used, phenobarbitone was the most common, administered in 40 cases (95.2%). This was followed by phenytoin in 8 cases (19%) and levera (levetiracetam) in 3 cases (7.1%).

Sepsis was observed in 28.9% of the neonates. Sepsis was classified based on time of onset, with 35% of cases classified as early onset neonatal sepsis (EONS), occurring within the first 72 hours of life, and 65% was late onset neonatal sepsis (LONS), after 72 hours. Blood culture results indicate that 46% of sepsis cases were culture- positive, whereas 54% were culture-negative among the neonates with hypoglycaemia. The majority (91%) of culture-related cases were due to bacterial infections, reflecting the prevalence of bacterial infections in neonatal sepsis A small proportion was attributed to fungal (6%); and viral (3%) infections .

Table-3: Maternal and neonatal risk factors in neonates with hypoglycemia (N=238)

Risk factors	Number of cases	Percentage
Maternal Risk factor		
GDM	39	16.4
PIH/GHTN	38	16
PROM	21	9
Hypothyroidism	10	4
NO Maternal Risk factor	130	54.6
Neonatal Risk factor		
LBW	130	54.6
Preterm	88	36.9
IUGR	82	34.4
Sepsis	69	28.9
Birth asphyxia	17	7.1
Polycythaemia	16	6.7
Twin gestation	3	1.2
Syndromic	2	0.8

We noted 39 cases of Gestational Diabetes Mellitus (GDM), accounting for 16.4% of the total neonates with hypoglycaemia. PIH/GHTN was present in 38 cases, accounting for 16% of the total cases. PROM was observed in 21 cases, representing 9% of the total cases. Hypothyroidism was present in 10 cases, accounting for 4% of the total. No maternal risk factors were seen in 130 cases, accounting for 54.6% of the total (Table 3). In our study Low birth weight (LBW) was the most prevalent risk factor, affecting 54.6% of the cases. Preterm birth was identified in 36.9% of the cases, underscoring the vulnerability of neonates born before 37 weeks of gestation. Intrauterine growth restriction (IUGR) was another significant factor, present in 34.4% of the cases (Table 3).

The onset of neonatal hypoglycemia varied considerably. The majority of cases (31.1%) were noted to have hypoglycemia on the first day of life, emphasizing the importance of early care and intervention immediately after birth and decreased slightly to 21.4% on the second day of life and 16.8% on the third day.

The most common dextrose concentration used was 10% dextrose, administered to 121 neonates, representing 52.2% of the cases. Higher doses, such as 12.5% and 15%, were used in 28.5% and 9.9% of cases. Maximum dextrose concentration used was 25%. 18 cases had refractory hypoglycaemia. Hydrocortisone was the most frequently used drug in refractory hypoglycaemia cases used in 9 neonates. Diazoxide was used in 8 neonates making it the second most commonly administered therapy in refractory hypoglycemia. Octreotide was used in 1 case.

Discussion:

Neonatal hypoglycemia continues to be a significant clinical challenge due to its multifactorial aetiology and potential for severe, long-term complications.11

Standardized screening protocols and timely interventions, including glucose monitoring for high-risk neonates, are essential for early detection and prevention of adverse outcomes.12 In the Indian context, where conditions such as gestational diabetes mellitus (GDM) and preeclampsia are prevalent, the incidence of neonatal hypoglycemia in NICU settings mirrors global trends, with rates as high as 14.9% among NICU admissions. This emphasizes the need for vigilant monitoring in both high-risk and general neonatal populations to mitigate the serious neurological sequelae associated with delayed diagnosis and management.13,14

In the present study incidence of hypoglycemia was found to be high in male newborn (61.8%) than in females (38.2%). This was similar to the studies conducted by Dhananjay et al , Somanathan et al . 17,20 Male to Female ratio in present study was 1.6:1 which is similar to studies by Singh et al(1.15:1), Dhananjaya et al (1.37:1), Manjunatha et al (1.35:1) . 2,17,18

The high prevalence of hypoglycemia observed within the first 24 hours of life (31% on day 1) in our study is consistent with other studies like Somanathan et al (29%)20 . In Dhananjaya et al majority of the newborns (55.26%) were found to be hypoglycaemic in day 2 of life. 17

The clinical manifestations of hypoglycemia in our study, such as lethargy (40.3%), seizures (35.7%), and poor feeding (31.9%), are consistent with previous literature. Studies like Puchalski et al (2018) and Sweet et al. (2013) have similarly identified prenatal risk factors, including IUGR and neonatal sepsis, as major contributors to neonatal hypoglycemia.15, 16 Our findings further underscore the heightened vulnerability of preterm neonates, who accounted for 37.4% of hypoglycemic cases significantly higher than rates reported in studies by Dhananjaya et al.(11.4%) and Somanathan et al. (28.2%). 17,20

SGA contributed 31.5 % of hypoglycaemic babies in the present study which is high compared to other studies like Dhananjaya et al (11.9%) Somanathan et al (29.5%). 17,20 LGA contributed 8.8 % of hypoglycaemic babies in the present study. This is similar to other studies conducted by Singh et al (4.5%), Somanathan et al (5.9%). 2,20

Maternal conditions such as GDM, preeclampsia, and delivery complications emerged as significant risk factors, with 16.4 % of neonates in our study affected by GDM, which is comparable to global data. Interestingly, 54.6% of hypoglycemic neonates had no identifiable maternal risk factors, indicating that neonatal factors, such as low birth weight (LBW), prematurity, and intrauterine growth restriction (IUGR), play a critical role. LBW was present in 54.6% of the cases, aligning with Dhananjaya et al and Manjunatha et al findings that LBW and prematurity are the most common neonatal risk factors.17, 18

Sepsis contributed to 28.9% of hypoglycemic cases in our study, a rate significantly higher than the 15.2% reported by Dhananjaya et al 17. This highlights the importance of early and aggressive treatment of infections in neonates to prevent hypoglycemia-related complications. The high incidence of hypoglycemia within the first 24 hours of life (31%) is consistent with studies by Dani et al. (2023) and Somanath et al. (2021), further emphasizing the critical need for early glucose monitoring, particularly in the first 48 hours of life.19, 20Limitations of our study include the nature of the study population and its retrospective design. All data of the neonates studied were not available the study being retrospective in nature and retrieved from medical records.

Conclusion

Incidence of hypoglycemia was 3.5% among NICU admissions in our study. Male to Female ratio among the study neonates was 1.6:1. The most common maternal risk factor was GDM (16.4%). The most common neonatal risk factor was LBW (54.6%). Most of the neonates in our study were symptomatic 83.6% because ours is a tertiary care NICU. Most of the neonates in the study had onset of hypoglycemia on day 1 of life (31%). Most of the neonates who presented with seizures were out born (89.4%). Antiepileptics were used in 42 cases (49.4%) of the neonates with seizures.

In conclusion, neonatal hypoglycemia remains a most common neonatal metabolic disturbance, which is a critical concern requiring a multifaceted approach.21,22 Our study reinforces the importance of regular blood glucose monitoring in managing hypoglycemia, especially in neonates with known risk factors. The identification of both maternal and neonatal risk factors underscores the necessity for tailored interventions to reduce the incidence and improve neonatal outcomes. Further research is needed, particularly in larger, more diverse populations, to refine current screening protocols and optimize preventive strategies for neonatal hypoglycemia, thus improving long-term neurological outcomes.

REFERENCES

1. Thompson-Branch A, Havranek T. Neonatal hypoglycemia. Pediatrics in review. 2017 Apr 1;38(4):147-57.

2. Singh K, Kher AM. Clinico-biochemical profile of hypoglycemia in neonates admitted in NICU. Int J Contemp Pediatr. 2019;6(1):1.

3. Ansari A, Savaskar SV, Moin Tamboli PS. Study of incidence, risk factors and immediate outcome of hypoglycemia in neonates admitted in NICU. International Journal of Contemporary Paediatrics. 2023 Aug;10(8):1303.

4. Somanathan S, Pothapregada S, Varadhan A, Mathew R. Clinical profile of hypoglycemia in neonates admitted in neonatal intensive care unit of a tertiary care hospital. Int J Contemp Pediatr. 2021;8:341.
5. Prasad PL, Malik R, Chandra S. Clinical Profile and Risk Factors of Neonatal Hypoglycemia in Tertiary Care Teaching Hospital. SRMS JOURNAL OF MEDICAL SCIENCE. 2023 Jun 30;8(01):43-6.
6. Nava C, Modiano Hedenmalm A, Borys F, et al. Accuracy of continuous glucose monitoring in preterm infants: a systematic review and meta-analysis. BMJ Open. 2020;10:e045335.
7. Angelika D, Etika R, Utomo MT, Ladydi L, Sampurna MT, Handayani KD, Ugrasena ID, Sauer PJ. The incidence of and risk factors for hyperglycemia and hypoglycemia in preterm infants receiving early-aggressive parenteral nutrition. Heliyon. 2023 Aug 1;9
8. Tas E, Garibaldi L, Muzumdar R. Glucose homeostasis in newborns: an endocrinology perspective. Neoreviews. 2020;21(1):e14–e29.
9. Rattanasakol T, Kitsommart R. Factors associated with neonatal hyperinsulinemic hypoglycemia: a case-control study. J Pediatr Endocrinol Metab. 2024;37(3):243-9.
10. Giouleka S, Gkiouleka M, Tsakiridis I, Daniilidou A, Mamopoulos A, Athanasiadis A, Dagklis T. Diagnosis and management of neonatal hypoglycemia: a comprehensive review of guidelines. Children. 2023 Jul 14;10(7):1220.
11. Sharma A, Davis A, Shekhawat PS. Hypoglycemia in the preterm neonate: etiopathogenesis, diagnosis, management and long-term outcomes. Transl Pediatr. 2017 Oct;6(4):335-348.
12. Anderson JM, Milner RD, Strich SJ. Effects of neonatal hypoglycemia on the nervous system: a pathological study. J Neurol Neurosurg Psychiatry. 1967 Aug;30(4):295-310.
13. Infant With Suspected Hypoglycemia - Pediatric Endocrine Society [Internet]. Pediatric Endocrine Society; 2022 [cited 2022 May 16]. Available from: https://pedsendo.org/clinical-resource/infant-with-suspected-hypoglycemia.
14. Adamkin DH, Committee on Fetus and Newborn. Clinical report - postnatal glucose homeostasis in late-term and preterm infants. Pediatrics. 2011;127:175.
15. Puchalski ML, Russell TL, Karlsen KA. Neonatal hypoglycemia: Is there a sweet spot? Crit Care Nurs Clin North Am. 2018;30(4):467-80.
16. Sweet CB, Grayson S, Polak M. Management strategies for neonatal hypoglycemia. J Pediatr Pharmacol Ther. 2013 Jul;18(3):199-208. doi: 10.5863/1551-6776-18.3.199. PMID: 24052783; PMCID: PMC3775554.
17. Dhananjaya CD, Kiran. B. Clinical profile of Hypoglycemia in newborn babies in rural hospital setting. International journal of biological and medical research. 2011; 2:1110-1114.
18. Babu Manjunath R, D'SouzaJLP, Susheela C. Study of incidence, clinical profile and risk factors of neonatal hypoglycemia in a tertiary care hospital. Int J Pediatr Res. 2016;3(10):753-7.
19. Dani C, Corsini I. Guidelines for Management of Neonatal Hypoglycemia: Are They ActuallyApplicable?JAMAPediatr.2020;174(7):638–639. doi:10.1001/jamapaediatrics.2020.0632.
20. Somanathan, Sayooj & Pothapregada, Sriram & Varadhan, Anuradha & Mathew, Ruth. (2021). Clinical profile of hypoglycemia in neonates admitted in neonatal intensive care unit of a tertiary care hospital. International Journal of Contemporary Paediatrics. 8. 341. 10.18203/2349-3291.ijcp20210126.
21. Abramowski A., Ward R., Hamdan A.H. Neonatal Hypoglycemia. StatPearls; Treasure Island, FL, USA: 2022.
22. Deshpande S., Upton M., Hawdon J. Admissions of Term Newborn Infants for Hypoglycaemia: Their Characteristics and Preventability. The Neonatal Society; Edinburgh, UK: 2016.