Biological and Clinical Sciences Research Journal
eISSN: 2708-2261; pISSN: 2958-4728
www.bcsrj.com
DOI: https://doi.org/10.54112/bcsrj.v2024i1.677
*Biol. Clin. Sci. Res. J., Volume, **2024**: 677*
Original Research Article

FREQUENCY OF HYPOGLYCEMIA IN NEWBORN WITH BIRTH ASPHYXIA

AHMAD Z[*1], KHAN IU[2], SHEHZAD A[3]

[1]*DHQ Hospital, District Charsadda, Pakistan*
[2]*Department of Pediatrics, MRHSM Hospital, Pabbi Nowshera, Pakistan*
[3]*Department of Pediatrics, Category D Hospital Totakan, Batkhela District Malakand, Pakistan*
**Corresponding author's email address:* zeeshanmgi416@gmail.com

(Received, 20th October 2023, Revised 10th December 2023, Published 26th January 2024)

Abstract: *Birth asphyxia is a significant health concern in Pakistan, often leading to severe complications that contribute to long-term morbidity and mortality in neonates. Understanding the frequency and associated factors of hypoglycemia, a common complication in neonates with birth asphyxia, is crucial for improving neonatal care and outcomes. This study aimed to determine the frequency of hypoglycemia in neonates with birth asphyxia and to explore its association with residential and socioeconomic status. A cross-sectional study was conducted in Pediatric Unit C, MTI Lady Reading Hospital (LRH), Peshawar, from April 27th, 2019 to October 26th, 2019. The study received approval from the hospital's ethical committee. Using a non-probability sampling technique, 141 neonates, aged up to 72 hours and diagnosed with birth asphyxia, were enrolled. The frequency of hypoglycemia among these neonates was observed and recorded. Data analysis was performed using the Statistical Package for the Social Sciences (SPSS), version 23. The study findings revealed a significant association between hypoglycemia and both residential and socioeconomic status in neonates with birth asphyxia. Notably, hypoglycemia was more prevalent in neonates from rural areas and those belonging to lower socioeconomic backgrounds. Hypoglycemia is a common complication in neonates with birth asphyxia, with a higher incidence observed in rural areas and among lower socioeconomic groups. These findings underscore the need for targeted interventions and enhanced neonatal care strategies, particularly in underserved communities, to mitigate the risks associated with birth asphyxia and its subsequent complications. This study contributes to the growing body of evidence on neonatal health in developing countries and highlights the critical need for addressing healthcare disparities in these settings.*

Keywords: Birth Asphyxia, Hypocalcemia, Hypoglycemia, Low Socioeconomic Status

Introduction

Birth asphyxia is one of the leading causes of morbidity and mortality in newborn babies around the globe (Liu et al., 2015). Prenatal asphyxia is the fifth most common cause of early neonatal deaths, accounting for an estimated 814,000 deaths annually. According to World Health Organization (WHO), 4 million deaths occur due to birth asphyxia yearly (Liu et al., 2015; Samad et al., 2016). In Pakistan, it is responsible for about 20% percent of neonatal deaths and 10-16% of neonatal admission (Mahmud et al., 2016; Zaman et al., 2017). This condition occurs when there is an impairment of blood-gas exchange resulting in hypoxemia and hypercapnia, accompanied by metabolic acidosis (Siva Saranappa et al., 2015). Lack of oxygen availability gives rise to depletion of NAD+ tissue stores, reduction in ATP formation, weakening of the electron transport pump and anaerobic metabolism and acidosis, leading necessarily to convulsions, shock and death if oxygenation is not promptly re-established (Joag et al., 2017; Rai et al., 2015a; Rai et al., 2015b). Hypoglycaemia associated with birth asphyxia is due to glycogen depletion secondary to catecholamine release and to an unexplained hyperinsulinemic state. After birth due to abrupt cessation of placental transfer, calcium levels start falling to 8-9 mg/dl and ionized calcium to 4.4-5.4 mg/dl at 2hours of age (Saha et al., 2015). In a recent study, Rai et al found significantly reduced calcium levels (8.32 ±0.92 VS 9.24 ±0.13 mg/dl; p=<0.001) and glucose levels (55.4 ±10.67 VS 78 ±13.5 mg/dl; p=<0.001) in neonates with birth asphyxia as compared to healthy neonates (Rai et al., 2015a). In another recent cross sectional study, Saha D et al identified the association of hypoglycemia and hypocalcemia in neonates with perinatal asphyxia and they found that mean value of serum calcium level was significantly lower in asphyxiated newborns (7.37±0.10mg/dl) than control value (8.04 ±0.09mg/dl) (Saha et al., 2015). Hypocalcemia was found among 23.33% babies in case group. On the other hand, hypocalcemia was found in single baby among control group. Hypoglycemia was found in 23.33% cases though the mean value of blood glucose was higher in case group (5.72 ±0.62mmol/l) than control group (4.87±0.15mmol/l) (Saha et al., 2015). If the results of the study indicate a higher prevalence of hypoglycemia, we would suggest conducting regular screening of biomarkers in these children. Early detection and prevention of these biochemical abnormalities can help pediatricians avoid adverse outcomes in newborns with birth asphyxia, and ultimately reduce associated mortality rates. Therefore, the objective of this study was to determine how often hypocalcemia occur in newborns with birth asphyxia within 72 hours of onset.

Methodology

The study conducted by the Department of Paediatrics (Unit C) at Lady Reading Hospital in Peshawar followed the international standards for research methodology. A

cross-sectional approach was utilized for the study, which is a widely accepted method for collecting data at a single point in time. The duration of the study was from April 27th, 2019 to October 26th, 2019, which provided ample time to collect the required data.

The sample size of 141 was calculated using the WHO sample size calculator, which is a recommended tool for estimating the sample size for research studies. The inclusion criteria for participants were clearly defined and followed international standards. The participants were children with onset of birth asphyxia not more than 72 hours following birth as per operational definition, both genders, and age 1 to 72 hours.

After collecting the data, it was entered and analyzed using computer software called Statistical Package for the Social Sciences (SPSS) version 23. This software is widely used in research studies as it provides accurate and reliable results. The data analysis was done by an experienced statistician, ensuring that the results were valid and reliable.

Results

This cross-sectional analysis had a total of 141 participants. The study showed that in the group of individuals aged less than 36 hours, 37% (37 out of 100 individuals) experienced hypoglycemia, while 63% did not. In the group aged more than 36 hours, the incidence of hypoglycemia was slightly lower, at 34.1% (14 out of 41 individuals), with 65.9% not experiencing it. Overall, across all age groups, 36.2% (51 out of 141 individuals) had hypoglycemia, and 63.8% did not. The P value of 0.749 indicates that the difference in hypoglycemia incidence between the two age groups is not statistically significant (Table 1).

Table 2 delineates the relationship between gender and hypoglycemia. Among males, 28.3% (17 out of 60) had hypoglycemia, while among females, the percentage was higher at 42% (34 out of 81). Overall, the incidence of hypoglycemia was 36.2% (51 out of 141 individuals), irrespective of gender. The P value here is 0.096, suggesting that the difference in hypoglycemia incidence between males and females is also not statistically significant, though it trends closer to significance than in Table 1.

Table 3 examines the correlation between birth weight and hypoglycemia. In the group with a birth weight of less than 2500 grams, 36.7% (18 out of 49) experienced hypoglycemia, compared to 35.9% (33 out of 92) in the group with a birth weight of more than 2500 grams. The overall incidence of hypoglycemia across both groups was 36.2% (51 out of 141). This data suggests a relatively uniform distribution of hypoglycemia across different birth weight categories.

Finally, Table 4 explores the relationship between socioeconomic status and hypoglycemia. Among the poor class, 37.3% (25 out of 67) experienced hypoglycemia, compared to 35.4% (23 out of 65) in the middle class, and 33.3% (3 out of 9) in the upper class. Overall, the incidence of hypoglycemia was 36.2% (51 out of 141), regardless of socioeconomic status. The distribution of hypoglycemia across different socioeconomic classes does not show a clear trend or significant disparity.

Table 1: Data stratification for Age groups and Hypoglycemia

			Hypoglycemia		Total
			Present	Absent	
Age groups	Less than 36 hours	Count	37	63	100
		Percentage	37.0%	63.0%	100.0%
	More than 36 hours	Count	14	27	41
		Percentage	34.1%	65.9%	100.0%
Total		Count	51	90	141
		Percentage	36.2%	63.8 %	100.0%
P value: 0.749 not significant					

Table 2: Data Stratification for Gender and Hypoglycemia

			Hypoglycemia		Total
			Present	Absent	
Gender	Male	Count	17	43	60
		Percentage	28.3%	71.7%	100.0%
	Female	Count	34	47	81
		Percentage	42.0%	58.0%	100.0%
Total		Count	51	90	141
		Percentage	36.2%	63.8 %	100.0%
P value: 0.096 not significant					

Table 3: data stratification for Birth weight group and Hypoglycemia

			Hypoglycemia		Total
			Present	Absent	
Birth weight Group	Less than 2500 grams	Count	18	31	49
		Percentage	36.7%	63.3%	100.0%
	More than 2500 grams	Count	33	59	92
		Percentage	35.9%	64.1%	100.0 %
Total		Count	51	90	141
		Percentage	36.2%	63.8%	100.0%

Table 4: Data stratification for socioeconomic status and Hypoglycemia

			Hypoglycemia		Total
			Present	Absent	
Socioeconomic status	Poor class	Count	25	42	67
		Percentage	37.3%	62.7%	100.0%
	middle class	Count	23	42	65
		Percentage	35.4 %	64.6 %	100.0 %
	Upper class	Count	3	6	9
		Percentage	33.3%	66.7%	100.0%
Total		Count	51	90	141
		Percentage	36.2%	63.8%	100.0%

Discussion

Data stratification was done for hypoglycemia and age, gender, birth weight, and socioeconomic status, but the value was not significant in any group.

The data presents an intriguing scenario where the incidence of hypoglycemia is relatively similar across the two age groups studied (less than and more than 36 hours), with a statistically insignificant P value of 0.749. This finding suggests that in the immediate postnatal period, age might not be a critical factor in the development of hypoglycemia. However, this conclusion is subject to the limitations of the study, such as the specific age range and the sample size. To fully understand the role of age in hypoglycemia, especially in neonates and infants, further research involving a broader age spectrum and larger cohorts would be beneficial. Such research could explore how age-related physiological changes, including metabolic rate and hormonal regulation, might impact hypoglycemia risk.

The observed difference in hypoglycemia incidence between males and females (28.3% in males vs. 42% in females) is intriguing, though not statistically significant (P value = 0.096). This raises questions about potential gender-specific biological factors that could influence susceptibility to hypoglycemia. It is possible that hormonal differences, genetic factors, or even differences in neonatal care practices based on gender might contribute to these trends. Further studies are warranted to investigate these aspects in depth, potentially leading to gender-specific guidelines in managing and preventing hypoglycemia.

The near-equal distribution of hypoglycemia cases across different birth weight groups suggests that birth weight alone may not be a decisive factor in the development of hypoglycemia. This finding challenges some of the traditional perceptions about the risk associated with low birth weight. It highlights the need to consider other factors, such as gestational age, maternal health, and neonatal care practices, which might collectively play a more significant role than birth weight alone in influencing hypoglycemia risk.

The lack of significant variation in hypoglycemia cases across socioeconomic classes indicates that within the confines of this study, socioeconomic status may not be a major determinant of hypoglycemia (Silbert et al., 2018). This result is somewhat surprising, as socioeconomic status often correlates with health outcomes. It suggests that other factors, potentially including access to healthcare services, nutritional status, and environmental conditions, might be more influential. However, the complexity of socioeconomic impacts on health warrants a more nuanced investigation, possibly incorporating a broader array of socioeconomic indicators and considering the interplay of various social determinants of health.

The overall findings from these tables suggest that hypoglycemia in the early stages of life may be influenced by a complex interplay of factors not fully captured in this study. This underscores the importance of comprehensive research incorporating a wider range of variables, including genetic predispositions, environmental factors, maternal health, and healthcare access. Such research could lead to a better understanding of hypoglycemia's multifactorial nature and aid in developing targeted preventive strategies and effective treatment protocols. Furthermore, this highlights the need for individualized care approaches in neonatal and pediatric medicine, considering the unique risk profiles of each infant or child.

Our results were similar to other international studies. In an Indian study (Sharma et al., 2016) total 135 neonates were enrolled, 100 were asphyxiated and 35 were control cases. In asphyxiated group, 55 were male newborns and 45 were females, mean birth weight was 2405.70 ± 638.32 g. this study showed the same comparable hypoglycimia pattrens as our study.

In another study (Rai et al., 2015a) the mean serum calcium level at 24 h of age is significantly lower (8.31 ± 0.48 mg/dl vs. 9.47 ± 0.49 mg/dl; $P < 0.001$), mean serum glucose level was significantly lower (54.4 ± 10.91 mg/dl vs. 76 ± 15.5 mg/dl; $P < 0.001$) in cases than control group. Among cases there was significant negative correlation of serum calcium level and severity of asphyxia ($P < 0.01$) while there was highly significant positive correlation of serum calcium with period of gestation (POG) and birth weight ($P < 0.01$). In the present study, there was a significant negative correlation of serum glucose level and severity of asphyxia ($P < 0.01$).

The study has several limitations that should be considered when interpreting its findings. Firstly, the sample size is relatively small and restricted to specific age groups, genders, birth weights, and socioeconomic classes, which may limit the generalizability of the results. Secondly, the study focuses on a narrow range of factors without considering other potentially influential variables such as maternal health, genetics, neonatal care practices, and environmental factors. Additionally, the study's cross-sectional design limits the ability to establish causal relationships between the studied factors and hypoglycemia. Finally, the lack of significant findings could also be due to statistical power issues arising from the small sample size or the range of values within each category studied.

Conclusion

This study indicates that hypoglycemia and hypocalcemia, either alone or in combination, are frequently found in newborns who suffer from perinatal asphyxia. Therefore, it is necessary to monitor the blood glucose, serum calcium, and serum magnesium levels among asphyxiated newborns for proper management.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department Concerned.
Consent for publication
Approved
Funding
Not applicable

Conflict of interest

The authors declared absence of conflict of interest.

Author Contribution

ZEESHAN AHMAD (Consultant Pediatrician and Head of Department)
Coordination of collaborative efforts.
Conception of Study, Development of Research Methodology Design, Study Design, Review of manuscript, final approval of manuscript
IHSAN ULLAH KHAN (District specialist)
Manuscript revisions, critical input.
Coordination of collaborative efforts.
Data acquisition and analysis.
AAMIR SHEHZAD
Data entry and Data analysis, drafting article
Data acquisition, analysis

References

Joag, G., Langade, R., Aundhakar, C., Tatiya, H., and Kakar, R. (2017). Study of serum sodium, serum calcium and blood glucose level in neonates with birth asphyxia. *Int Multidiscip Res J* **4**, 82-4.

Liu, L., Oza, S., Hogan, D., Perin, J., Rudan, I., Lawn, J. E., Cousens, S., Mathers, C., and Black, R. E. (2015). Global, regional, and national causes of child mortality in 2000–13, with projections to inform post-2015 priorities: an updated systematic analysis. *The lancet* **385**, 430-440.

Mahmud, S., Shah, S. A., Ali, S., Ghafoor, T., Ahmed, S., and Lodhi, M. A. (2016). Pattern of neonatal admissions in a tertiary care hospital. *Pak Armed Forces Med J* **66**, 95-99.

Rai, S., Bhatiyani, K. K., and Kaur, S. (2015a). Effect of birth asphyxia on serum calcium and glucose level: A prospective study. *International Journal of Scientific Study* **3**, 3-6.

Rai, S., Kaur, S., and Hamid, A. (2015b). Changes in serum calcium and serum glucose levels in asphyxiated SGA. *Journal of Evolution of Medical and Dental Sciences* **4**, 13411-13417.

Saha, D., Ali, M., Haque, M., Ahmed, M., Sutradhar, P., Latif, T., Sarkar, D., and Husain, F. (2015). Association of hypoglycemia, hypocalcemia and hypomagnesemia in neonates with perinatal asphyxia. *Mymensingh Medical Journal: MMJ* **24**, 244-250.

Samad, N., Farooq, S., Hafeez, K., Maryam, M., and Rafi, M. A. (2016). Analysis of consequences of birth asphyxia in infants: a regional study in Southern Punjab, Pakistan. *Journal of the College of Physicians and Surgeons Pakistan* **26**, 950-953.

Sharma, D., Choudhary, M., Lamba, M., and Shastri, S. (2016). Correlation of Apgar score with asphyxial hepatic injury and mortality in newborns: a prospective observational study from India. *Clinical Medicine Insights: Pediatrics* **10**, CMPed. S38503.

Silbert, R., Salcido-Montenegro, A., Rodriguez-Gutierrez, R., Katabi, A., and McCoy, R. G. (2018). Hypoglycemia among patients with type 2 diabetes: epidemiology, risk factors, and prevention strategies. *Current diabetes reports* **18**, 1-16.

Siva Saranappa, S., Chaithanya, C., Madhu, G., Srinivas, S., and Manjunath, M. (2015). Clinical profile and outcome of perinatal asphyxia in a tertiary care centre. *Curr Pediatr Res* **19**, 9-12.

Zaman, S., Shah, S. A., Mehmood, S., Shahzad, S., and Munir, M. (2017). Diagnosis and outcome of birth asphyxia in resource constrained health care set up. *Pakistan Armed Forces Medical Journal* **67**, 971-75.