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Original Research Article

Study on Correlation of Umbilical Cord Arterial Blood pH with Perinatal Asphyxia and Early Neonatal Outcome

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Abstract

Background: Perinatal asphyxia is a leading cause of neonatal morbidity and mortality. Umbilical cord arterial blood pH is a key marker for assessing asphyxia severity and its impact on neonatal outcomes, particularly hypoxic ischemic encephalopathy (HIE).

Objectives: To investigate the correlation between umbilical cord arterial blood pH and perinatal asphyxia, focusing on its relationship with early neonatal outcomes, including HIE and the need for resuscitation.

Methods: This cross-sectional study at GMC Kota included 131 neonates with suspected perinatal asphyxia. Umbilical cord pH and neonatal outcomes, including HIE, were analyzed. Statistical analysis was performed using SPSS 24.0, with $p<0.05$ considered significant.

Results: Among 131 neonates, 67.2% were born at 37-39 weeks. Pregnancy-induced hypertension was the most common risk factor. APGAR scores improved significantly over time. The mean umbilical cord pH was 6.9, indicating acidosis, and 39.7% of neonates had grade 3 HIE. No significant correlation was found between meconium-stained liquor and perinatal asphyxia ($p=0.745$).

Conclusion: Umbilical cord pH is a critical marker for perinatal asphyxia and its associated outcomes, including severe HIE. The lack of correlation between meconium-stained liquor and asphyxia warrants further investigation.

Keywords: Perinatal Asphyxia, Umbilical Cord pH, Hypoxic Ischemic Encephalopathy, Neonatal Outcomes, Acidosis, Meconium-Stained Liquor.

Introduction

Perinatal asphyxia is a significant clinical condition that impacts neonates, causing severe morbidity and mortality. It refers to a lack of oxygen and blood flow to the fetus or newborn, which can result in permanent neurological damage and other long-term health complications. The umbilical cord blood pH, a marker of metabolic acidosis, is a critical determinant in assessing perinatal asphyxia. Studies have demonstrated that lower umbilical cord blood pH levels are closely linked with poor neonatal outcomes, including increased risk of neonatal morbidity and mortality [1].

Recent research highlights that umbilical cord pH is an effective marker for fetal distress, with abnormal pH levels correlating with an increased risk of adverse perinatal outcomes such as hypoxic ischemic encephalopathy [2]. The relationship between umbilical cord pH, base deficit, and lactate levels has been explored, with findings indicating that these biomarkers serve as valuable predictors for poor neonatal outcomes in cases of perinatal asphyxia [3]. Intrapartum monitoring of these parameters aids in timely interventions that could prevent or mitigate adverse outcomes [4]. The burden of perinatal asphyxia is significant in many regions, particularly in developing countries where prenatal care access is limited. Neonatal mortality remains high due to perinatal asphyxia, with studies indicating that immediate intervention following abnormal umbilical cord pH can improve neonatal survival and reduce the incidence of long-term disabilities [5]. Despite advances in monitoring and care, challenges persist in the early identification of at-risk neonates, particularly in resource-constrained settings [6].

Existing diagnostic approaches, including umbilical cord blood gas analysis, have shown promise in identifying at-risk infants, but gaps remain in optimizing these tools for better predictive accuracy [7]. Additionally, the need for further

research into the exact thresholds of umbilical cord pH that correlate with severe neonatal outcomes is evident [8].

Material and Methods

Type of Study: Cross-sectional analytical study.

Period of Study: 1 Year

Place of Study: Department of Paediatrics, GMC Kota.

Sample Size:131 cases were studied.

Inclusion Criteria

- Singleton, live born neonates of gestational age > 34 weeks with suspected perinatal asphyxia
- Signs of intrapartum fetal hypoxia, as indicated by Non-stress test and color Doppler showing change in uterine artery and uteroplacental artery blood flow and middle cerebral artery blood flow
- Apgar score of <7 at 1 min of life
- Need for resuscitation for > 1 minute
- Mothers with PIH/Eclampsia/APH/Gestational Diabetes Mellitus etc.

Exclusion Criteria

- Gestational age completed <34 weeks
- Multifetal gestation
- HIV/Hepatitis B
- Gross congenital malformations [by USG and color Doppler]

Statistical Analysis: Statistical analysis will be performed using SPSS 24.0. Student's t-test, Yates continuity correction, Chi-square, Fisher's exact, and Fisher-Freeman-Halton tests will compare quantitative and qualitative data. Results with $p<0.05$ will be considered statistically significant.

Results

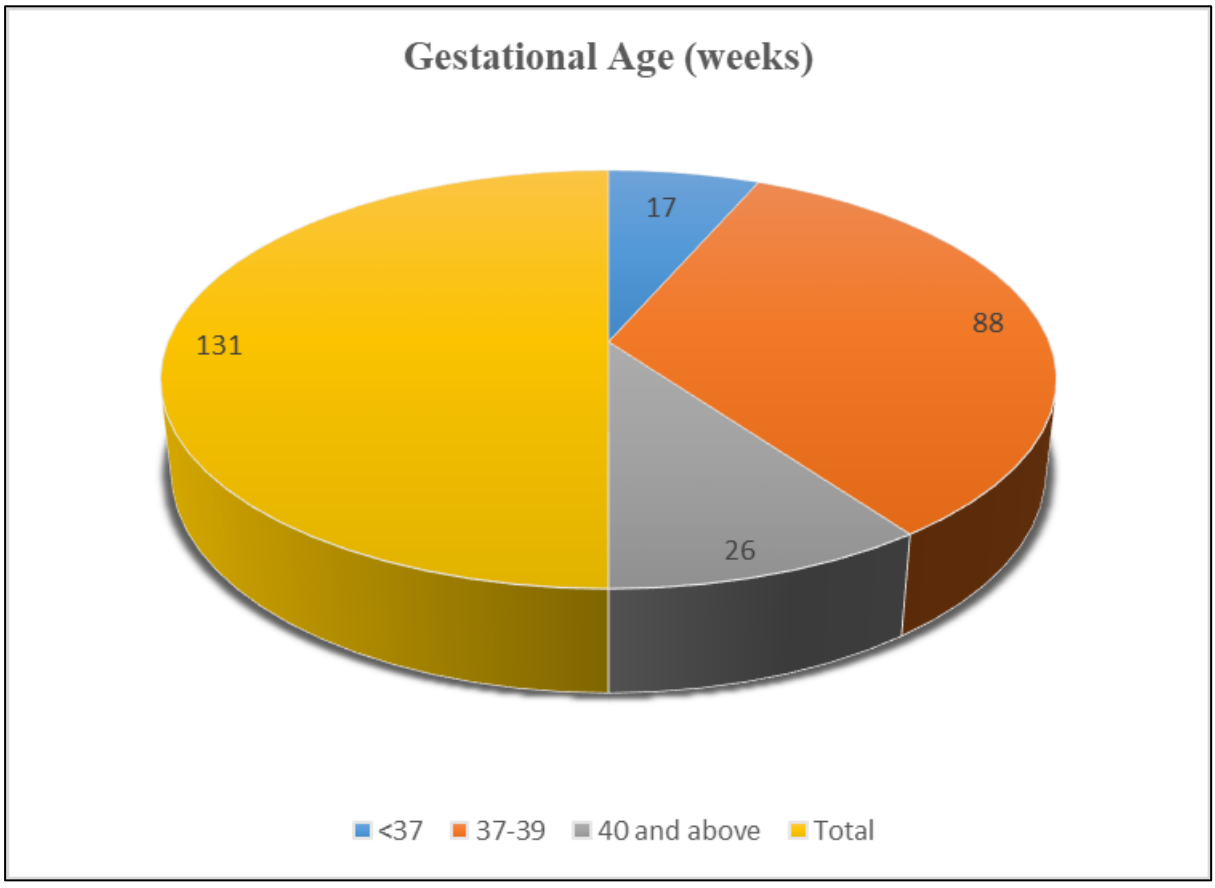

Figure 1: Distribution According to Gestational Age (Weeks) of Mothers (n=131)

In Figure 1 among the 131 mothers, the majority (67.2%) were within the gestational age range of 37-39 weeks. Those with gestational ages below 37 weeks accounted for 13%, while 19.8% had gestational ages of 40 weeks or more. This distribution indicates that a significant proportion of the pregnancies were full-term.

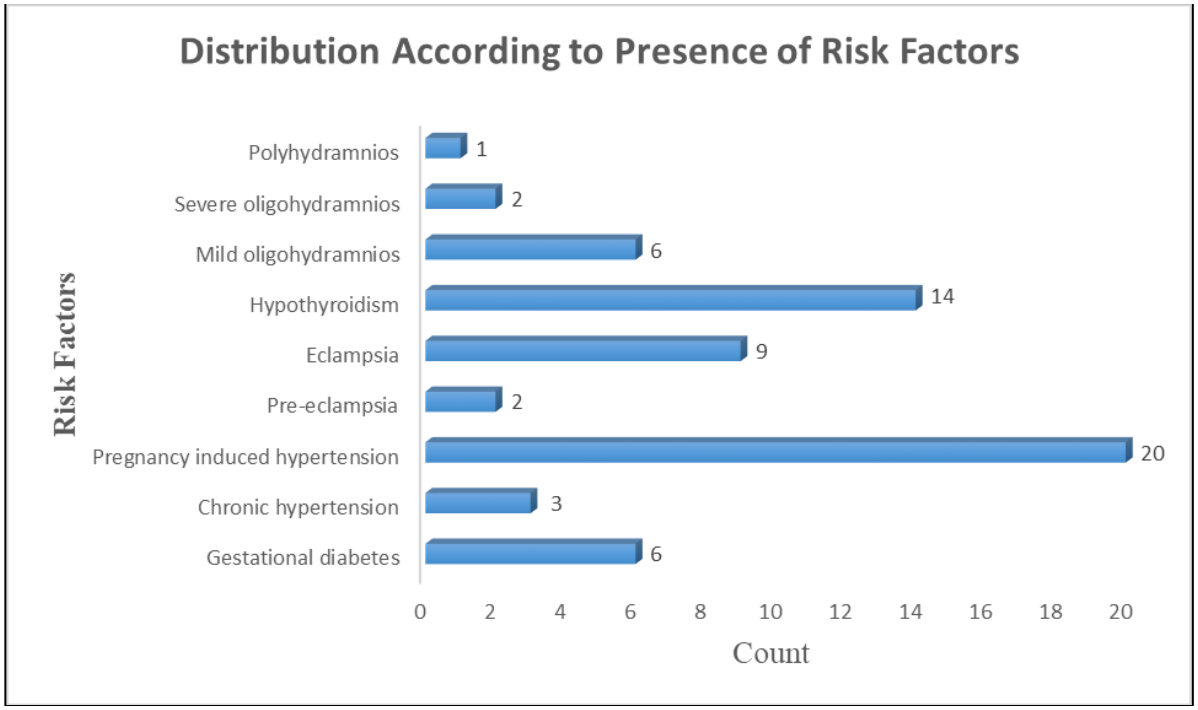

Figure 2: Distribution According to Presence of Risk Factors in the Mothers (n=131)

Figure 2 shows that the most common risk factor was pregnancy-induced hypertension, affecting 15.3% of mothers. Other significant conditions included hypothyroidism (10.7%), eclampsia (6.8%), and gestational diabetes (4.6%). This highlights the diversity of risk factors present in the population.

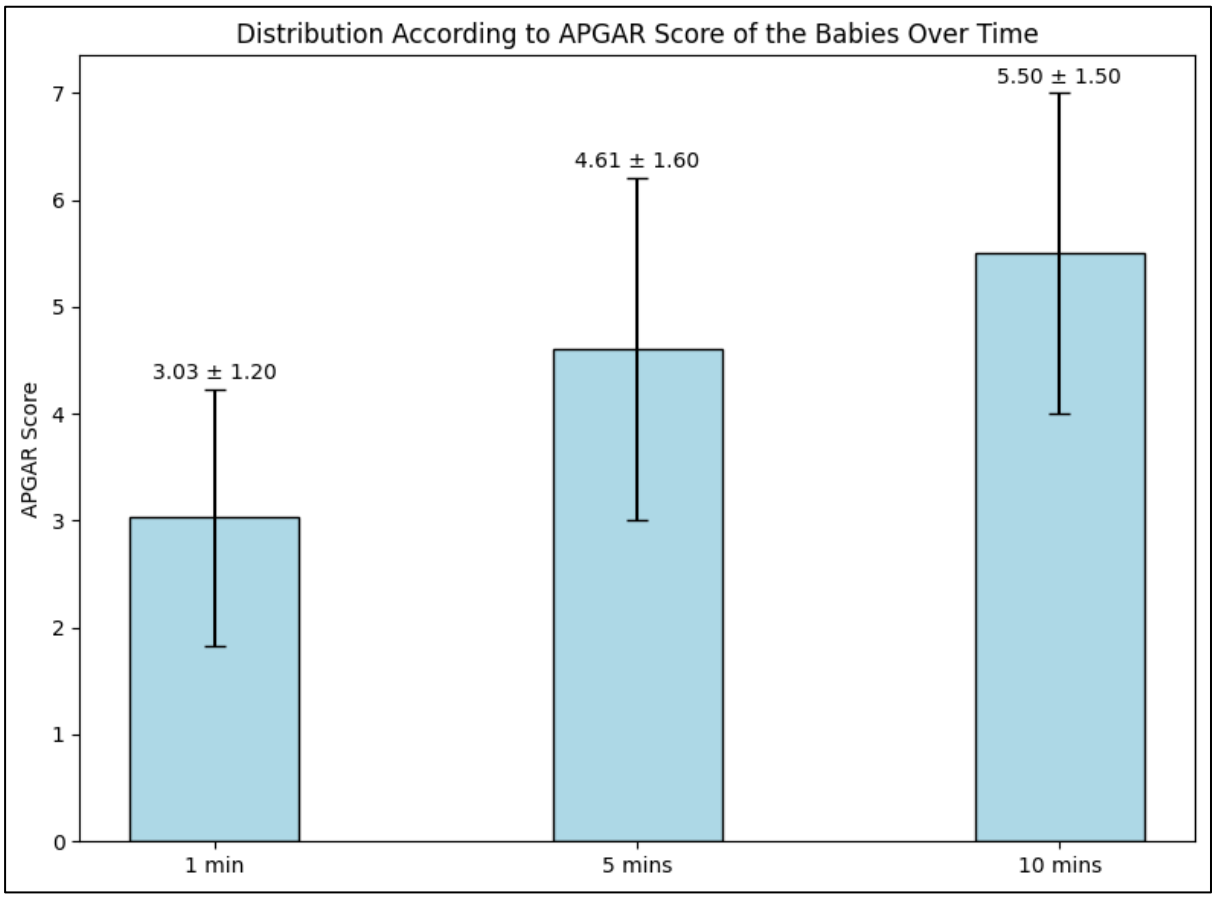

Figure 3: Distribution According to APGAR Score of the Babies Over Time (n=131)

In Figure 3, the mean APGAR scores of the babies were 3.03 at 1 minute, 4.61 at 5 minutes, and 5.5 at 10 minutes. The significant increase in scores over time ($p<0.001$) reflects improving newborn conditions post-delivery.

Table 1: Distribution According to Mean Umbilical Cord Artery pH (n=131)

Umbilical Cord Artery pH	Mean ±SD
	6.9±0.1

Table 1 represents the mean umbilical cord artery pH was 6.9 with a standard deviation of 0.1. This low pH indicates acidosis, which is a critical factor in evaluating perinatal asphyxia.

Table 2: Distribution According to Incidence of Hypoxic Ischemic Encephalopathy in the Patients (Levine Classification) (n=131)

HIE	Mean ± SD
None	19 ± 14.5
1	28 ± 21.4
2	32 ± 24.4
3	52 ± 39.7
Total	131

Table 2 shows that Hypoxic ischemic encephalopathy (HIE) was observed in varying degrees: 14.5% had no HIE, 21.4% had grade 1, 24.4% had grade 2, and 39.7% had grade 3. This indicates a high incidence of severe HIE (grade 3) among the neonates.

Table 3: Correlation between Meconium Stained Liquor and Perinatal Asphyxia (n=131)

Perinatal Asphyxia	MSL No	MSL Yes	p-value
None	18 (64.3%)	10 (35.7%)	0.745
HIE grade 1	19 (59.4%)	13 (40.6%)	
HIE grade 2	27 (51.9%)	25 (48.1%)	
HIE grade 3	11 (57.9%)	8 (42.1%)	

Table 3 shows that there was no statistically significant association observed between meconium-stained liquor and perinatal asphyxia.

Discussion

The distribution of gestational ages in this study shows that the majority of the pregnancies were full-term, with 67.2% of mothers in the 37-39 weeks range, aligning with findings from other studies where full-term pregnancies are the most common in cases of perinatal asphyxia Einikyte R et al. (2017). [8] The presence of diverse risk factors such as pregnancy-induced hypertension (15.3%), hypothyroidism (10.7%), and eclampsia (6.8%) reflects the complexity of maternal conditions in this cohort, similar to the findings by Ghimire A et al. (2017) [9] where maternal health complications like hypertension significantly impacted neonatal outcomes. The mean APGAR scores observed in this study show a significant improvement post-delivery, from 3.03 at 1 minute to 5.5 at 10 minutes, which is consistent with the general pattern of improving neonatal conditions over time, as also noted in the study by Perveen F et al. (2015) [10] where a similar upward trend was observed. The mean umbilical cord pH of 6.9 observed here suggests acidosis, indicative of perinatal asphyxia, which is in line with previous studies that show lower pH levels in asphyxiated neonates Einikyte R et al. (2017). [8] Furthermore, the high incidence of severe HIE (grade 3: 39.7%) in this study highlights the severe neurological damage associated with low pH levels, which is similar to findings from Ghimire A et al. (2017) [9] where HIE was also observed at varying degrees in asphyxiated neonates. In contrast, the correlation between meconium-stained liquor (MSL) and perinatal asphyxia in this study showed no significant relationship ($p=0.745$), which contrasts with other studies such as Perveen F et al. (2015) [10] where MSL was strongly associated with poorer neonatal outcomes. This difference could be attributed to variations in the patient population or the specific perinatal conditions observed. The overall findings emphasize the role of umbilical cord pH and maternal risk factors in predicting neonatal outcomes and underline the importance of close monitoring for neonates with signs of asphyxia.

Conclusion

The study on the correlation of umbilical cord arterial blood pH with perinatal asphyxia and early neonatal outcomes revealed significant findings. The distribution of gestational ages and maternal risk factors like pregnancy-induced hypertension and hypothyroidism underscore the complexity of neonatal conditions in cases of perinatal asphyxia. The analysis of APGAR scores over time demonstrated significant improvements, highlighting the potential for recovery following initial asphyxia. A mean umbilical cord pH of 6.9

further corroborated the presence of acidosis, which is critical for diagnosing perinatal asphyxia.

A high incidence of severe hypoxic ischemic encephalopathy (HIE) points to the serious neurological consequences associated with low pH levels. Interestingly, no significant correlation was found between meconium-stained liquor and perinatal asphyxia, contrasting with some studies that report a stronger association.

Overall, the study emphasizes the importance of early detection and careful monitoring of neonates with suspected asphyxia, with umbilical cord pH serving as a key indicator.

References

1. Bajgain A, Yadav BK, Khan SA, Bhattarai CD, Basnet K, Adhikari K, Budhathoki A, Bhattarai N, Chauhan S, Dhungana A. Correlation between umbilical cord blood pH with perinatal asphyxia and early neonatal outcome. Medicine. 2025 Jul 25;104(30):e43624.
2. Andersson CB, Klingenberg C, Thellesen L, Johnsen SP, Kesmodel US, Petersen JP. Umbilical Cord pH Levels and Neonatal Morbidity and Mortality. Obstetrical & Gynecological Survey. 2025 Feb 1;80(2):79-81.
3. Qamar S, Ansari MA, Mohapatra JN, Khan SS. Correlation of umbilical cord blood pH, base deficit, and lactate levels with outcomes of hypoxic newborns: A prospective study. Journal of Acute Disease. 2023 Jun 1;12(3):114-20.
4. Kanagal DV, Praveen BK. Intrapartum fetal monitoring and its correlation with umbilical cord blood ph and early neonatal outcome: A prospective cohort study. Journal of South Asian Federation of Obstetrics and Gynaecology. 2022 Apr 5;14(1):63-7.
5. Syed W, Liaqat N, Qazi Q, Yasmeen S. Relationship between immediate postpartum umbilical cord pH, fetal distress and neonatal outcome. Pakistan journal of medical sciences. 2020 Nov;36(7):1529.
6. Mannan MA, Dey S, Karim SR, Iqbal S, Yasmin S, Ferdous N. Neonatal arterial blood gases & immediate outcome following perinatal asphyxia. Bangladesh Journal of medical science. 2019 Mar 25;18(2):238-43.
7. Patil SS, Sukanya RS, George CE. Study on umbilical cord arterial blood gas analysis and cord blood lactate levels as predictors for adverse neonatal outcome: an observational study. Int J Reprod Contracept Obstet Gynecol. 2018 Apr 1;7(4):1494-500.
8. Einikyte R, Snieckuviene V, Ramasauskaite D, Panaviene J, Paliulyte V, Opolskiene G, Kazenaite E. The comparison of umbilical cord arterial blood lactate and pH values for predicting short-term neonatal outcomes. Taiwanese Journal of Obstetrics and Gynecology. 2017 Dec 1;56(6):745-9.
9. Ghimire A, Shrestha L, Shrestha M. Analysis of umbilical cord blood gas in term and near term asphyxiated newborn babies. Journal of Patan Academy of Health Sciences. 2017 Nov 15;4(2):3-8.
10. Perveen F, Khan A, Ali T, Rabia S. Umbilical cord blood pH in intrapartum hypoxia. J Coll Physicians Surg Pak. 2015 Sep 1;25(9):667-70.