Effect of immediate postpartum umbilical cord pH on fetal discomfort and neonatal outcome

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ABSTRACT

Objective: This study aimed to assess the effect of immediate postpartum umbilical cord pH on fetal discomfort and neonatal outcomes.

Methods: A descriptive cross-sectional study was conducted in the Department of Gynecology at King Saud Medical City from March 2022 to July 2023. Around 47 full-term expected women who experienced abnormal cardiotocography during the active or latent stages of labor were included in this study.

Results: Around 29 women (61.7%) of the total participants were primigravida, while others were gravida 2 (14.8%), gravida 4 (8.5%), and gravida 7 (2.1%), with significant fetal bradycardia. Cesarean delivery was necessary in 17% of instances, with late decelerations occurring in 37 (78.7%) and persistent varied decelerations with loss of baseline variability occurring in 2 (4.2%) cases. The correlation between the umbilical cord pH and the appearance, pulse, grimace, activity, and respiration (APGAR) score at 0 minutes was highly significant (r = 0.821, p = 0.001), and the correlation between the umbilical cord pH and the APGAR score at 5 minutes was also highly significant (r = 0.783, p = 0.001).

Conclusion: The most accurate way to diagnose birth asphyxia is by measuring the pH of the cord blood, which should be done in all high-risk deliveries. Doing so might assist in the prevention or lessening of neonatal morbidity and mortality by ensuring that the newborn receives proper care upon delivery.

Keywords: Birth asphyxia, umbilical cord blood gas analysis, neonatal morbidity, APGAR score, high-risk deliveries.

Introduction

One of the top three causes of newborn morbidity and mortality in terms of structurally normal neonates is birth asphyxia. Neonatal sepsis and respiratory distress syndrome are the other two reasons [1]. Hypoxic-ischemic encephalopathy, cerebral palsy, seizure disorder, and developmentally delayed children can all be caused by perinatal asphyxia [2]. Appearance, pulse, grimace, activity, and respiration (APGAR) scoring practices were often developed to swiftly describe a newborn’s health in relation to infant mortality [3]. The APGAR score is calculated at 1 and 5 minutes of age shortly after birth to assess the newborn’s condition. This method is popular and widely accepted, but it is not appropriate for evaluating birth asphyxia because it might be influenced by other factors like prematurity, maternal analgesia or sedation, muscle disease, cerebral malformations, and...
Subject and Methods

This descriptive cross-sectional study was carried out in the Obstetrics and Gynecology Department of the King Saud Medical City in Riyadh, Saudi Arabia from March 2022 to July 2023.

All the women who had cesarean birth as the mode of delivery, and who had symptoms of fetal distress, such as fetal bradycardia, tachycardia, decelerations, and meconium-stained fluid on the artificial or spontaneous rupture of membranes were included in this study. Women suffering intrauterine fetal death, newborns with anomalies, and women carrying multiple pregnancies were not included in the study.

A segment of the umbilical cord was doubly clamped after a baby was born via cesarean section, and 1 ml of blood was collected from the umbilical artery and immediately sent to a lab for analyzing the pH of the umbilical cord arterial blood. Within 20 minutes after the cord blood sample, a pH study was completed. A senior resident of the hospital’s neonatology unit cared for each baby delivered via the cesarean section. All newborns had their APGAR scores assessed 1 and 5 minutes after birth. Low APGAR scores were defined as those under 7. Senior neonatologists referred infants with acidemia, a low APGAR score, or both to the NICU for additional evaluation. A pH of less than 7.2 in cord blood indicated acidemia.

The sample size was determined using a confidence range of 95%, an error margin of 10%, and a cesarean section rate of 1.4% for fetal distress. The total sample size calculated is 47.

The IBM Statistical Package for the Social Sciences Statistics for Windows, version 24 was used to evaluate the data. Mean and standard deviation were used to report continuous values, and number was used to report categorical variables (percentages). The chi-square test and Pearson’s correlation test were used for the analysis of associations. The significance threshold is set at a p value less than and equal to 0.05.

Results

Out of all patients, 48.9% were between the ages of 20 and 25 years (Table 1).

A Cesarean delivery was necessary in 17% of instances, with late decelerations occurring in 37 (78.7%) and persistent varied decelerations with a loss of baseline variability occurring in 2 (4.2%) cases. Almost 78% of all delivered babies were under 3.5 kg at delivery, and 21% were over 3.5 kg. One newborn, representing 75%...
Table 4. Neonate outcomes in correlation to weight at birth.

<table>
<thead>
<tr>
<th>Birth weight</th>
<th>Mean APGAR at 0 minutes</th>
<th>Mean APGAR at 5 minutes</th>
<th>Mean pH</th>
<th>NICU admission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 3.5 kg</td>
<td>6.46 ± 1.2</td>
<td>8.97 ± 1.35</td>
<td>7.16 ± 0.94</td>
<td>22 (46.8%)</td>
</tr>
<tr>
<td>More than or equal 3.5 kg</td>
<td>6.28 ± 2.5</td>
<td>8.1 ± 2.29</td>
<td>7.13 ± 0.13</td>
<td>14 (29.7%)</td>
</tr>
</tbody>
</table>

Table 5. Correlation of nursery ICU admission with umbilical cord pH.

<table>
<thead>
<tr>
<th>pH</th>
<th>Yes</th>
<th>No</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;7.2</td>
<td>31 (65.9%)</td>
<td>4 (8.5%)</td>
<td>0.004</td>
</tr>
<tr>
<td>&gt;7.2</td>
<td>4 (8.5%)</td>
<td>8 (17%)</td>
<td></td>
</tr>
</tbody>
</table>

of all neonates that suffered acidosis at birth, had severe hypoxemia and acidosis with a pH of 6.85 (Table 3).

The correlation between the umbilical cord pH and the APGAR score at 0 minutes was highly significant \( (r = 0.821, p = 0.001) \), and the correlation between the umbilical cord pH and the APGAR score at 5 minutes was also highly significant \( (r = 783, p = 0.001) \) (Table 4).

Almost 35 babies were admitted to the nursery ICU, their mean APGAR score at 0 minutes was 5.86 ± 1.47, while APGAR at 5 minutes was 8 ± 1.74. Only four babies with pH levels above 7.2 were admitted, while infants with pH less than 7.2 made up the majority 31 (65.9%) of NICU admissions \( (p-value = 0.004) \) (Table 5).

Discussion

More than 70% of the cases in this study had neonatal acidemia at birth. Birth asphyxia was the cause of acidosis in 31 of the 35 newborns who needed NICU hospitalization. Newborn acidemia and low APGAR score were found to be statistically strongly associated, indicating that these two markers of newborn outcomes act together to quantify neonatal morbidity.

The umbilical cord artery pH, first- and fifth-minute APGAR scores, and NICU admissions were also significantly correlated, with 36 newborns admitted to the NICU having an APGAR score of less than 7 at 0 minutes.

This study also demonstrated a relationship between abnormal CTG patterns and neonatal acidemia. In a different Pakistani experiment, a correlation between a cord pH lower than 7.25 and a newborn result was found [11]. However, Kumar et al.’s [12] study found no connection between meconium stained liquor or an unsettling fetal heart rate and poor neonatal outcomes.

Younas et al. [13] study discovered a strong link between metabolic acidosis with pH less than 7.01 and severe baby neurological morbidity, neonatal death, and neonatal fatality.

Around 38% of term babies with low APGAR scores have acidemia, which is primarily linked to intrauterine vascular diseases like pre-eclampsia, placental abruption, low birth weight, and placental vascular pathologies, according to Locatelli et al.’s [14] estimation of the umbilical artery acidemia predictive value in term infants. Lower umbilical cord blood pH is associated with adverse immediate outcomes, such as neurological abnormalities, and adverse long-term outcomes, such as mortality at discharge.

The APGAR score and the pH of the cord blood have been linked, according to other authors [15]. In infants admitted to the NICU, Durrani et al. [16] found a connection between neonatal hypoglycemia, cord acidemia, and intrapartum fetal discomfort.

The use of the APGAR score for newborn assessment at birth is a ubiquitous practice, but cord blood gas analysis is only performed in high-risk situations or when there is a low APGAR score. Sabol and Caughey [17] found greater rates of infant acidemia in connection with obstetric events such as the presence of meconium, placental abruption, and cesarean deliveries, despite the fact that these newborns had normal 5-minute APGAR scores. Fetal acidemia with a pH less than 7.0 is also associated with an increased risk of respiratory distress syndrome and NICU admissions.

Conclusion

The most accurate way to diagnose birth asphyxia is by measuring the pH of the cord blood, which should be done in all high-risk pregnancies. By doing this, gynecologists might be able to give the baby the care they need at delivery and prevent or reduce neonatal morbidity and mortality.

List of Abbreviations

<table>
<thead>
<tr>
<th>APGAR</th>
<th>Appearance, pulse, grimace, activity, and respiration</th>
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<tbody>
<tr>
<td>CTG</td>
<td>Cardiotocography</td>
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<tr>
<td>ICU</td>
<td>Intensive care unit</td>
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<tr>
<td>NICU</td>
<td>Neonatal intensive care unit</td>
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Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this article.

Funding

None.

Consent to participate

Written informed consent was obtained from all the participants.
Umbilical cord pH effect on fetus

Ethical approval

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