TO CORRELATE APGAR SCORE AND CORD BLOOD PH WITH SEVERITY OF BIRTH ASPHYXIA AND SHORT-TERM OUTCOME

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KEYWORDS

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ABSTRACT

Introduction: Research is focusing on identifying predictive measures for adverse neonatal outcomes in high-risk infants, particularly in relation to birth asphyxia, a condition causing inadequate gas exchange during labor. Birth asphyxia is a major contributor to perinatal morbidity and mortality, with an annual incidence of 4-9 million cases. Addressing this is crucial for improving maternal and neonatal health outcomes. Perinatal asphyxia accounts for around 20% of infant mortality in India, with a significant subset succumbing within the first three days. **Aims:** The study investigates the relationship between APGAR score and cord blood pH in neonates with birth asphyxia, its severity, and immediate outcomes like death or discharge. **Methodology:** This study investigates the correlation between APGAR score, cord blood pH, and birth asphyxia severity in inborn neonates at Krishna Hospital Karad. It includes term AGA newborns with a score below 7, normal respiration, or requiring active resuscitation measures.
RESULTS: The study involved 60 cases, with 54% male and 46% female. The mean maternal age was 23.76 years, newborns were 38.68 weeks, and birth weight was 2.92 kg. The mean APGAR scores were 3.33 and 5.51, with a significant percentage of participants having some degree of HIE. The study found a significant correlation between APGAR scores and mortality rates. **Discussion:** Perinatal asphyxia is a common neonatal issue in low- and middle-income countries like India. The Apgar score, a rapid tool for assessing newborn clinical status, is used to report resuscitation response. Umbilical cord blood pH (UC-pH) is a reliable indicator of fetal acidosis at birth, correlated with adverse outcomes like resuscitation and NICU admission. Combining UC-pH with the Apgar score is cost-effective in resource-limited settings. **Conclusion:** Prolonged hypoxia can decrease cord blood pH, which can predict neonate birth asphyxia severity and result, alongside the APGAR score.

INTRODUCTION

Recent research has focused on identifying predictive measures for adverse neonatal outcomes in high-risk infants, with umbilical cord blood pH analysis being a notable approach. [1]
Birth asphyxia, a condition causing inadequate gas exchange during labor, results in hypoxia and hypercarbia in the fetus. This condition is a major contributor to perinatal morbidity and mortality globally, with an annual incidence of 4 to 9 million cases. It leads to 1.1 million stillbirths and one million neonatal deaths shortly after delivery. Addressing the challenges posed by birth asphyxia is crucial to improve maternal and neonatal health outcomes. Perinatal or neonatal depression, observed during the first hour of life, can include muscle hypotonia, diminished mental status, neurological impairment, and disturbances in respiratory and cardiovascular functions in the infant. [2]
Perinatal asphyxia is estimated to account for around 20% of infant mortality in India, with a significant subset of 300,000 to 350,000 infants succumbing to this condition, predominantly within the first three days of their fragile existence, according to data from the National Neonatology Forum NNPD Network. This issue is particularly concerning given the 1.2 million neonatal deaths annually in the country.
The gold standard for birth asphyxia remains elusive, so perinatal asphyxia is more appropriate. Asphyxiation can occur in utero, during labor, at birth, or postnatally. The World Health Organization, the National Neonatal-Perinatal Database, the American Academy of Pediatrics, and the American College of Obstetricians and Gynecologists have provided various definitions and criteria for birth asphyxia. The WHO and the National Neonatology Forum Network of India have broad recognition in delineating birth asphyxia.

AIM AND OBJECTIVES

The study aims to investigate the correlation between APGAR score and cord blood pH in neonates with birth asphyxia, its severity, and the immediate outcome of birth asphyxiated neonates, such as death or discharge.

Methodology:

Study Setting: NICU of Krishna hospital Karad
Study design: Hospital based prospective observational cross-sectional study
Study duration: June 2022 to November 2023
Inclusion criteria: The study includes all term AGA newborns at Krishna hospital, Karad, with an APGAR score below 7 at birth, normal respiration not established within one minute, or requiring active resuscitation measures.
Exclusion criteria: The study excluded term-asphyxiated newborns with severe congenital malformations and parents who refused to give consent.
This study aimed to investigate the correlation between APGAR score, cord blood pH, and the severity of birth asphyxia and short-term outcomes in inborn neonates born at Krishna Hospital, Karad. The study was approved by an institutional ethics committee and conducted in accordance with clinical practice guidelines. Data was collected at the time of birth, admission to the neonatal intensive care unit (NICU), and days of hospitalization. Arterial blood gas analysis (ABG) was performed for pH analysis, and APGAR scoring was done at 1 minute and 5 minutes after birth. All asphyxiated newborns were shifted to the NICU for further monitoring, screening,

and staging of Hypoxic Ischemic Encephalopathy (HIE). The correlation between APGAR score, cord blood pH, HIE staging, and short-term outcomes was evaluated and analyzed statistically.

RESULTS:

Table 1: Clinical variables in all the cases

Clinical variables	**Cases (n=60)**
Male	32 (54%)
Female	28 (46%)
Mean maternal age(years)	23.76±2.75
Mean gestational age (weeks)	38.68±0.99
Mean birth weight (kg)	2.92±0.33
Mode of delivery	
NVD	32 (54%)
LSCS	28 (46%)
Type of amniotic fluid	
Clear	31 (51%)
Meconium stained	29 (49%)
APGAR	
At 1 minute	3.33±0.79
At 5 minutes	5.51±1.081

The study involved 60 cases, with 54% male and 46% female. The mean maternal age was 23.76 years, newborns were 38.68 weeks, and birth weight was 2.92 kg. 54% were normal vaginal delivery, 46% were lower segment cesarean section. Amniotic fluid was clear in 51% of cases and meconium-stained in 49%. The APGAR scores were 3.33 at 1 minute and 5.51 at 5 minutes.

Table 2: Gender distribution of study participants

Gender	**Cases (n=60)**
Male	32 (54%)
Female	28 (46%)

Table 2 displays the gender distribution of study participants, with 54% being male and 46% being female.

- **Table 3: Mode of delivery**

Mode of delivery	**Cases (n=60)**
NVD	32 (54%)
LSCS	28 (48%)

The table displays the distribution of study participants based on their mode of delivery, with the maximum number of participants being delivered through normal vaginal delivery.

Table 4: Table shows the colour of amniotic fluid

Type of amniotic fluid	**Cases (n=60)**
Clear	31 (51%)
Meconium stained	29 (49%)

The study revealed that 51% of patients had clear liquor, while 49% had meconium stained liquor.

Table 5: Mean APGAR score at 1 minute and 5 minutes for the study participants.

APGAR	Mean	SD
At 1 minute	3.33	0.79
At 5 minute	5.51	1.08

The study participants' mean APGAR score at 1 minute and 5 minutes was 3.33 with a standard deviation of 0.79 and 5.51 with a standard deviation of 1.08.

- **Table 6: Birth asphyxia and HIE staging**

Birth asphyxia	HIE Staging
Without HIE	18 (30%)
With HIE 1	10 (16.6%)
With HIE 2	13 (21.6%)
With HIE 3	19 (31.6%)

The study revealed that a significant percentage of participants with birth asphyxia had some degree of HIE, with 16.6% showing no HIE and 21.6% showing HIE stage 2.

- **Table 7: Birth asphyxia and mean APGAR at 1 min**

Birth asphyxia	Mean APGAR at 1 min	SD	P Value	R
Without HIE	3.75	0.68	<0.0001	-0.913
With HIE 1	3.6	0.69		
With HIE 2	3.42	0.69		
With Hie 3	2.6	0.63		

The table shows the mean APGAR score for study participants, with the maximum number having no HIE. The p value is <0.0001, indicating significant results. The mean score ranges from 3.75 to 2.6.

Table 8: Birth asphyxia and mean APGAR At 5 minutes

Birth asphyxia	Mean APGAR At 5 minutes	SD	P Value	r
Without HIE	6.625	1.5	<0.0001	-0.859
With HIE 1	6.9	1.28		
With HIE 2	6.2	1.4		
With HIE 3	5.06	0.25		

The study found that participants without HIE had a mean APGAR score of 6.625, while those with HIE 1, 6.2, and 3. HIE 3 babies had the least mean APGAR score, indicating a significant difference in the results.

Table 9: Birth asphyxia and mean cord blood pH

Birth asphyxia	Mean cord blood ph.	SD	P Value	r
Without HIE	7.19	0.17	<0.05	-0.785
With HIE 1	7.15	0.19		
With HIE 2	7.192	0.11		

With HIE 3	6.98	0.17		

The table reveals birth asphyxia and mean cord blood ph, with higher hypoxia levels resulting in lower cord blood ph. The data is significant, with a p value of <0.05.

Table 10: Outcome

Immediate outcome	**Cases**
Discharge	39 (65%)
Death	21 (33.3%)

The table displays the immediate outcomes of study participants, with 65% achieving discharge and 33.3% dying.

Table 11: Immediate outcome and APGAR Score at 1 min

Immediate outcome	**APGAR at 1 min**	**SD**	**P Value**	**r**
Discharge	3.53	0.10	<0.0001	-1.0
Death	2.89	0.87		

The table reveals a statistically significant correlation between the mean APGAR score of participants who discharged and those who died, with a p value of <0.0001.

Table 12: Immediate outcome and APGAR At 5 minutes

Immediate outcome	**APGAR At 5 minutes**	**SD**	**P Value**	**R**
Discharge	5.87	1.2	<0.0001	-1.0
Death	5.42	0.87		

The table reveals a statistically significant correlation between the mean APGAR score of participants who discharged and those who died, with a p value of <0.0001.

Table 13: Immediate outcome and mean cord blood pH

Immediate outcome	**Mean cord blood pH**	**SD**	**P Value**	**R**
Discharge	7.24	0.08	<0.012	-0.67
Death	6.92	0.11		

The study participants' mean cord blood pH was significantly higher in those who discharged (7.24±0.08) and those who died (6.92±0.11), indicating a significant outcome.

DISCUSSION

Perinatal asphyxia is a prevalent neonatal issue, particularly in low- and middle-income countries like India. The Apgar score, a rapid tool for assessing newborn clinical status, is used to report resuscitation response. Umbilical cord blood pH (UC-pH) is a reliable indicator of fetal acidosis at birth, correlated with adverse outcomes like resuscitation and NICU admission. Combining UC-pH with the Apgar score is cost-effective in resource-limited settings.[1]

The study analyzed 60 term newborns, with 54% males and 46% females, and found no statistically significant association between the two groups.

The study compared delivery modes among term newborns with birth asphyxia and normal newborns. Most (54%) were normal, while 46% were caesarean. LSCS was indicated by PROM, previous LSCS, preeclampsia, abruption, breech presentation, and foetal distress. [3]
The study found that 49% of neonates had meconium-stained liquor, while 51% had clear liquor.
The study evaluated the APGAR score in term newborns at 1 and 5 minutes of life, with the mean score at 1 minute being 3.33±0.79.
The study revealed that 31.6% of neonates developed HIE, 21.6% developed HIE 2, 16.6% developed HIE 1, and 30% did not show symptoms.
The study found that a higher mean APGAR score at 1 minute indicates better prognosis and no hypoxic ischemic encephalopathy in neonates without encephalopathy. However, neonates with lesser APGAR scores had different severity of hypoxic ischemic encephalopathy. Fetal asphyxia was directly associated with neonatal acidosis. [6]
A study found that a higher mean APGAR score at 5 minutes was linked to better prognosis and no hypoxic ischemic encephalopathy in neonates. However, neonates with lesser APGAR scores had different severity of hypoxic ischemic encephalopathy. Linda Hogan et al. found that most AS5-minute scores were below 4.
A study found that lower cord blood pH is linked to worse outcomes and increased severity of hypoxic ischaemic encephalopathy (HIE). The mean cord blood pH was 7.25 for patients without HIE, 7.22 for HIE 1, 7.20 for HIE 2, and 7.11 for HIE 3. [5]
The study revealed that the mean APGAR at 1 minute for patients discharged was 3.53, while the mean APGAR at 1 minute for patients who died was 2.89.
The study found that the mean APGAR at 5 minute for patients discharged and dying was 5.87 and 5.42, respectively, and that the severity of HIE inversely proportionately affects these values. [4]
The study found that lower mean cord blood pH in patients discharged had unfavorable immediate neurological abnormalities and poor final outcome in terms of death at discharge, according to Meena et al. [4]

CONCLUSION

Prolonged and intensified hypoxia will progressively diminish the pH of cord blood.
The pH of cord blood can predict the severity and result of birth asphyxia in neonates, alongside the APGAR score.

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