

## Cord blood gas analysis in predicting the short term outcome in High-risk deliveries

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**Abstract:** *OBJECTIVE: To find the association between Cord blood Gas analysis and outcome in the immediate neonatal period. STUDY DESIGN: Prospective observational study. A total of 104 term newborns are included, and their Cord Blood gas values are analyzed. Forty-six had an acidic pH (<7.25). Outcomes looked at are NICU admission, need for resuscitation, convulsions, encephalopathy. RESULTS: Statistical significance was found among variables like NICU admission, need for resuscitation, delay in attaining full feeds. CONCLUSION: Most of the babies had pH in the normal range and had a healthy outcome. Adverse outcomes like NICU admission, need for resuscitation were observed in babies belonging to a group having acidic pH (< 7.25). So cord blood analysis had a prognostic significance in predicting outcomes in the immediate newborn period.*

Date of Submission: 10-01-2020

Date of Acceptance: 27-01-2020

### I. Introduction

Perinatal hypoxia, ischemia, asphyxia refers to a relative lack of oxygen, blood flow, gas exchange to fetus or newborns. Perinatal or neonatal depression refers to a condition of the infant on physical examination in the immediate postnatal period (first hour of life). The infant may show muscle hypotonia, depressed mental status, disturbed respiratory & cardiovascular function (1).

Perinatal asphyxia refers to a condition during the first and second stages of labor in which impaired gas exchange leads to fetal hypoxia & hypercarbia. It is identified by fetal acidosis, which can be measured in umbilical arterial blood. The umbilical artery pH that defines asphyxia is not the primary determinant of brain injury.

The most widely accepted definitions of fetal acidosis are pH less than 7.0, & even at that degree of acidosis, the chance of brain injury is low. But many babies with cord pH less than 7.00 are clinically well without any evidence of short term morbidity. So many institutions do unnecessary NICU admission & expensive, irrelevant diagnostic tests for just low cord arterial pH. As per many studies, pH less than 7.00, base deficit more than 16mmol/ marks the duration & severity of hypoxic insults. Fetal acidemia is defined as umbilical artery pH less than 7.20, significant acidemia if pH less than 7.00. Some authors set significant acidemia as 2SD (standard deviation) below the mean for a given population. It is well documented that neonates with cord arterial pH >7.00 will be born vigorous & without significant neurological sequelae, and would be discharged usually (2).

This study is to find any association between umbilical cord arterial blood gas values and neonatal outcomes in the immediate newborn period. The justice for the study is that low pH values are associated with poor neurodevelopmental outcome.

### II. Material And Methods

#### Aims & Objectives

##### Primary Objective:

To find an association between umbilical cord blood gas analysis and outcome in the immediate newborn period.

##### Secondary Objective:

To find any association between low umbilical blood pH with a need for resuscitation, need for NICU admission, delay in attaining full feeds, convulsions or encephalopathy

**Study Design:** Prospective open-label observational study

**STUDY DESIGN:** Prospective observational study

Study Place: Narayana Medical College Hospital Nellore  
Study Period: From January 2019 – June 2019  
Study Population: Term Neonates Delivered In Nmch With Inclusion Criterion  
Sample Size: 104

**Inclusion criteria:**

**Term newborns born to mothers with**

1. The prolonged second stage of labor
2. Fetal heart rate deceleration or acceleration
3. Emergency cesarean section for fetal or maternal problems
4. Placental insufficiency

**Term Newborns who had**

1. Meconium stained liquor (vigorous & non-vigorous)
2. A need for some form of resuscitation.

**Exclusion criteria:**

- Babies with significant congenital anomalies

**Procedure methodology**

- 1ml of the umbilical cord blood sample was collected using three clamp technique, under aseptic precautions, and was immediately transported to the biochemistry lab.
- The attending pediatrician analyzed the APGAR scoring and treated the baby as per protocol. The treating pediatrician decided further management of the baby as per need.
- Informed consent was taken from parents.
- All babies were followed up until discharge, and the data collected as per proforma. The variables measured were
- **Need for resuscitation:** Any form of intervention at birth include positive pressure ventilation, endotracheal intubation, chest compressions, intravenous medications (adrenaline).
- **Need for NICU admission:** Babies requiring NICU admission as deemed necessary by the attending pediatrician for any reason.
- **Delay in attaining full feeds:** feed intolerance or could not satisfactorily breastfeed by day 3 of life.
- **Convulsions:** Babies with seizures – generalized or subtle, from any cause in the newborn period.
- **Encephalopathy:** classified as per modified Sarnat and Sarnat scoring

**III. Results**

- One hundred four babies were eligible and recruited for the study; among them, 46 babies had pH < 7.25 (group 1), and 58 babies had pH more than 7.25 (group 2).
- Out of the 104 babies, 103 babies are discharged.
- TOTAL NUMBER OF neonates: 104
- No of babies with pH less than 7.250 (Group-1): 46  
Number of babies with pH > 7.250 (Group – 2] 58

**Need For Resuscitation**

**Table 1:** Shows babies in either group who needed resuscitation

Resuscitation	Yes	No	TOTAL
Group 1	11	35	46
Group 2	01	57	58
Total	12	92	104 ( p=0.008)

Out of 46 babies of group 1, 11 babies needed resuscitation – 5 with bag and mask ventilation (BMV) in room air, two with Oxygen by mask/ hood, two required BMV with Oxygen, one baby needed oxygen by mask and IV fluid bolus, and one baby intubated. Among the babies in group 2, one baby required resuscitation. This baby required intubation and mechanical ventilation. P-value 0.008

**NICU admission.**

**Table 2** showing NICU admissions in both groups

Nicu Admission	Present	Absent	
Group 1	7	39	46
Group 2	2	56	58
Total	9	95	104 (p=0.001)

Seven babies in group 1 required NICU admission, two babies in group 2 required NICU admission. P-value 0.001

**Table 3** showing delay in attaining full feeds in the two groups

Delay in achieving full feeds	Yes	No	
Group 1	6	40	46
Group 2	1	57	58
Total	7	97	104 (p=0.003)

Six babies out of 46 babies in group 1 required NICU admission & one baby out of 58 in group 2 required NICU admission. P-value 0.003

**Table 4** showing encephalopathy among the two groups

ENCEPHALOPATHY	YES	NO	
GROUP 1	4	42	46
GROUP 2	1	57	58
TOTAL	5	99	104 (p=0.28)

Five babies in the entire study population had encephalopathy during the hospital stay — four babies in group 1 who had encephalopathy. There was only one baby in group 2 who had encephalopathy. P-value 0.28

**Table 5** shows babies who had convulsions in both groups

Convulsions	Yes	No	
Group 1	3	43	46
Group 2	1	57	58
Total	4	100	104 (p=0.54)

Three babies in group 1 had convulsions and only one baby in the group had convulsions. P-value 0.54

	Number	Mean pH	P value
Need for resuscitation	12	7.13	
No need for resuscitation	92	7.26	0.008
The need for NICU admission	9	7.08	
No need of nicu admission	95	7.26	0.001
Convulsions	4	7.10	
No convulsions	100	7.25	0.54

Encephalopathy	5	7.10	
No encephalopathy	99	7.25	0.28
Delay in attaining full feeds	6	7.09	
No delay in attaining full feeds	98	7.24	0.003

#### IV. Discussion

This study attempted to find an association between umbilical cord pH in high-risk newborns with the early-neonatal outcome as measured by:

1. Need for resuscitation,
2. NICU admission,
3. Delay in attaining full feeds,
4. Convulsions,
5. Encephalopathy.

The study group is divided into two groups — Group 1 with babies having cord blood pH < 7.25 and consisting of 46 babies. Group 2 with pH >7.25, consisting of 58 babies.

In the study, 12 babies out of 104 babies required resuscitation, of which 11 were in group 1, and 1 in group 2. On applying Fischer exact test, a p-value of 0.000 was calculated which is statistically significant. In the study done by Mousa Ahmadpour (3), the outcome of 120 high-risk neonates were observed. 42

babies among 60 belonging to the group of neonates with pH less than 7.2 needed resuscitation against 13 in the other group with a pH of more than 7.2. They concluded that pH of 7.2 could be taken as a cut off for determining the prognosis of short term outcome in neonates

In our study, nine babies required NICU admission, of which 7 (15%) belonged to group1 and 2(3.4%) from group2. After applying Fischer exact test p-value of 0.038 was obtained, which is statistically significant. A similar observation was noted in the study by Ahmadpour Mousa et al. (3) which looked into factors determining the neonatal outcomes. Sixteen babies with pH less than 7.2 required NICU admission against three babies in the other group with a pH of more than 7.2. The difference was reported to be statistically significant. Victory et al. found that the risk for NICU admission progresses with the worsening of acidemia at birth in term neonates. In a study by Rogers et al. (4), it was found that among those with pH >7.02, only 50% needed resuscitation and 36.36% of babies required NICU admission, while all required resuscitation and NICU admission, when the pH was between 6.80 and 7.02.

In this study, seven babies had a delay in attaining full feeds. Among these, six babies (13%) belonged to group1. The one baby (1.7%) in group 2 who could not be fed. P-value of 0.042 was obtained after applying the Fischer exact test, which is statistically significant. In the study by Mousa Ahmedpour (3), they correlated pH with delay in starting feeds. While 16 babies out of 60 babies with pH<7.2 had a delay in beginning feeds, only 4 babies out of 60 babies with a pH>7.2 had a delay.

The overall findings of our study correlate well with the study by Victory et al. (14) who found that neonatal outcomes like IVH, demise were found in groups of neonates with pH less than two standard deviations below the mean

In the study by Lindsey et al., it was found that neonatal outcomes depend on both pH & base deficit. They found that the brain and RS are the first to get involved, followed by kidney and CVS depending on the degree of acidemia in cord blood gas.

In this study, there are four babies with convulsions and five babies with encephalopathy. Four babies (9.5%) with HIE and three babies (6.5%) with seizures were under group 1. Though there was a difference in the number of subjects in both the study groups, there was no statistical significance in applying the Fisher exact test. A meta-analysis by Gemma L Malin found that low cord arterial pH was significantly associated with adverse neonatal outcomes. HIE

was found to be associated with odds ratio 16.9, 95% confident interval 9.7 to 29.5 among babies with low arterial cord pH. The study by Yeh P1 et al. (5) found that convulsions within 24 hours of life were more among neonates with pH<7.1. But there is a study (8) which states that acidemia at birth increases the chance of developing severe intraventricular hemorrhage and convulsions in both term and preterm neonates. But there was no significant long term outcome

In our study on high-risk newborns, most babies had an uncomplicated neonatal period irrespective of the umbilical cord blood pH. This correlates with the research done by Goldhaber et al. and Goodwin et al. (7) which looked at whether fetal acidemia indicating low pH in cord blood analysis had an adverse outcome. They found that even with pH values lesser than 7.00, there had no long or short term morbidity. Another study by Low et al. also found that neonatal morbidity is uncommon with pH> 6.90. They found that chances for neonates requiring intubation were seen if pH< 6.83, cardiopulmonary support if pH< 6.83, seizures if pH<6.75, hypoxic-ischemic encephalopathy if pH<6.75

A study by Liv Knutzen (6) found that there are other factors that determine neonatal outcomes other than pH & base deficit. Those were H<sup>+</sup> ions, glutamate receptors, oxygen, reactive nitrogen species, genetic factors (some obstetrics insults too). These needed further research. This might be the rationale as to why babies with almost similar cord blood gas values have different outcomes.

In our study, we found that high-risk babies who required resuscitation, NICU admission, delay in reaching full feeds have a median cord blood pH which was significantly lesser than the other babies (p-value < 0.05) implying that babies with a low cord blood pH should be carefully monitored during the entire neonatal period. This is similar to that in the study done by Mousa Ahmedpour (3). Thus the analysis of cord blood pH in high-risk newborns is a reliable parameter in predicting some morbidities and outcomes in the early neonatal period.

## V. Conclusion

High-risk term babies with cord pH less than 7.25 have an increased need for resuscitation, NICU admission, and delay in achieving full feeds, when compared to those with pH more than 7.25.

2. There is no statistical correlation between cord blood pH and incidence of convulsions and encephalopathy in term high-risk newborns in this study.

3. In high-risk newborns, the median cord blood pH is significantly lower in those who required resuscitation, NICU admission or had a delay in achieving full feeds compared to the other babies.

4. Measurement of cord blood pH is advised for all high-risk newborns.

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Dr Uma Mahesh, et al. " Cord blood gas analysis in predicting the short term outcome in High-risk deliveries". *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 19(1), 2020, pp. 50-54.