

## Original Research Article

# A prospective study of analysis of Cord blood gas to predict the short term outcome in high-risk deliveries

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### ABSTRACT

**Background:** Neonatal acidaemia at birth will increase the neonatal morbidity and mortality. It is a predictive marker of neonatal asphyxia. The current study aimed to investigate the relationship between cord blood gas analysis and neonatal outcome.

**Methods:** A prospective hospital based observational study conducted in 150 term newborns. Cord Blood gas levels were examined, pH of 7.25 was observed in 70 samples. The primary outcomes measured were the percentage of NICU admission, need for resuscitation, convulsions, and encephalopathy.

**Results:** Primary outcome of NICU admission, need for resuscitation, and delay in attaining full feeds were observed to have statistical significance. The majority of the babies had pH levels that were within the normal range and had a healthy outcome. NICU admission and the need for resuscitation were observed in babies from group with acidic pH (<7.25).

**Conclusions:** Cord blood analysis had prognostic significance in predicting outcomes in the new-born period.

**Keywords:** Cord blood gas pH, Resuscitation, Convulsions, Encephalopathy

### INTRODUCTION

At birth, each newborn is assigned a score based on the Apgar scale. This system is a quick way to assess the newborn's clinical status at 1 minute and 5 minutes after birth.<sup>1</sup> Low Apgar scores are associated with birth weight and gestational age, but only a low score cannot predict morbidity or mortality for each individual newborn.<sup>2</sup> As a result, the score is a useful tool for decisions made in the delivery room during newborn care, but it is not a good idea for assessing short and long term health status. Blood Gas Analysis is a tool that can aid in determining the patient's health status (BGA). The BGA allows for the assessment of the patient's respiratory exchanges, metabolism, and electrolytic state.<sup>3</sup> pH is determined by the balance of lactates, which tend to decrease pH.<sup>4</sup> Neonatal acidaemia is associated with an increased risk of NICU admission, hypoxic ischemic encephalopathy, respiratory distress syndrome (RDS), multi-organ

dysfunction, and neonatal exitus.<sup>5,6</sup> Umbilical cord blood gas analysis is critical for determining neonatal acidaemia during delivery. There is no clear pH threshold value today. It is unclear whether newborns with moderate acidaemia should be monitored for the development of a negative outcome.<sup>7</sup> Hermansen et al described the "acidosis paradox," which states that newborns who do not have acidaemia at birth can still develop a hypoxic condition. Indeed, adverse outcomes in newborns with normal pH are possible.<sup>8,9</sup> The purpose of our research is to investigate the relationship between cord blood gas and neonatal outcome.

### METHODS

From January 2019 to December 2019, a prospective hospital-based observational study was conducted at the Department of Pediatrics, Narayanamedical College and Hospital, Nellore.

A total of 150 term neonates were delivered at our hospital to mothers who experienced a prolonged second stage of labour, foetal heart rate deceleration or acceleration, an emergency caesarean section for foetal or maternal problems, and placental insufficiency were all included. Term newborns with Meconium stained liquor (vigorous and non-vigorous) who required resuscitation were included. Babies with significant congenital anomalies were barred from participating in this study.

### Procedure

Parents provided informed consent, and 1ml of umbilical cord blood was collected using a three clamp technique under aseptic conditions and immediately transported to the biochemistry lab. The attending paediatrician reviewed the APGAR score and treated the baby according to protocol. The treating paediatrician decided on the baby's further management based on his or her needs. All of the babies were monitored.

Requirement of any form of intervention at birth, including positive pressure ventilation, endotracheal intubation, chest compressions, and intravenous medications (adrenaline). Need for NICU admission for Babies who require NICU admission for any reason as determined by the attending paediatrician. Delay in achieving full feeds such as feed intolerance or inability to breastfeed satisfactorily by day 3 of life was measured. Babies in the newborn period who have seizures, whether generalised or subtle were analysed. Encephalopathy is classified using the modified SARNAT scoring systems.

### Statistics

Frequencies of the variables were expressed as percentages. Chi-square test has been used to find the association between outcome variables and socio demographic variables. Student's t test was used for comparison of means.  $P < 0.05$  was considered to be statistically significant. The statistical software, Statistical package for social sciences (SPSS) version 22 was used for the analysis of the data: Microsoft word and excel have been used to generate graphs and table.

## RESULTS

150 babies were included in the study; among them, 70 babies had  $pH < 7.25$ , and 80 babies had  $pH > 7.25$ . Out of the 150 babies, 147 were discharged.

Out of 70 babies of group 1, 22 babies needed resuscitation; 8 with bag and mask ventilation (BMV) in room air, 6 babies with Oxygen by mask/ hood, two babies required BMV with Oxygen, 3 babies needed oxygen by mask and IV fluid bolus, and 3 babies intubated. Among the babies in group 2, 9 babies required resuscitation. These babies required intubation and mechanical ventilation.  $P$  value 0.006.

**Table 1: Clinical characteristics of neonates.**

	Frequency
Gender, %	Male 89 (64.4)
	Female 61 (35.6)
Gestational age, wks (Mean± SD)	38.7±1.1
Body weight, gr (Mean± SD)	2884.7±421
Emergency or urgency caesarean section	12%
Elective caesarean section	4%
Instrumental labor	24%
Vaginal delivery	60%
Apgar score 1 min, median (25 <sup>o</sup> -75 <sup>o</sup> percentile)	5% (8-9)
Apgar score 5 min	7% (9-10)

**Table 2: Clinical variables measurements.**

Variables	Yes	No	Total	P value
<b>Resuscitation</b>				
$pH < 7.25$ –group 1	22	48	70	0.007*
$pH > 7.25$ –group 2	9	71	80	
<b>Delay in achieving full feeds</b>				
$pH < 7.25$	12	58	70	0.006*
$pH > 7.25$	3	77	80	
<b>Encephalopathy</b>				
$pH < 7.25$	8	62	70	0.009*
$pH > 7.25$	1	57	80	
<b>Convulsions</b>				
$pH < 7.25$	6	64	70	0.045*
$pH > 7.25$	2	78	80	
<b>NICU admission</b>				
$pH < 7.25$	12	58	70	0.015*
$pH > 7.25$	4	76	80	

\* Chi-square test,  $p < 0.05$  was considered to be statistically significant

**Table 3: Association between requirements of variables with mean pH levels.**

Variables	No	Mean pH	P value
Need for resuscitation	31	7.14	0.007*
No need for resuscitation	119	7.26	
The need for NICU admission	16	7.09	0.001*
No need of NICU admission	134	7.26	
Convulsions	8	7.11	0.6
No convulsions	142	7.24	
Encephalopathy	9	7.11	0.3
No encephalopathy	141	7.24	
Delay in attaining full feeds	15	7.08	0.004*
No delay in attaining full feeds	135	7.23	

\*Student's t test,  $p < 0.05$  was considered to be statistically significant

Mousa et al examined the outcomes of 120 high-risk neonates in a study. 42 babies out of 60 in the neonatal group with a pH less than 7.2 required resuscitation, compared to 13 in the other group with a pH greater than 7.2. They concluded that a pH of 7.2 could be used as a cut-off point for determining the prognosis of neonatal outcome (Table 1).<sup>10</sup>

In the current study, 16 babies required NICU admission, with 12 babies falling into the pH <7.25 group and 4 falling into the pH >7.25 group having a statistically significant difference. A similar observation was made in Mousa et al study which looked into factors influencing neonatal outcomes. Sixteen babies with pH less than 7.2 required NICU admission, compared to three babies with pH greater than 7.2 in the other group. The difference was declared statistically significant. Victory et al discovered that the risk of NICU admission increases as acidemia at birth worsens in term neonates. In a study conducted by Rogers et al, it was discovered that among those with pH levels greater than 7.02.<sup>11</sup>

In the current study, 15 babies were delayed in receiving full feeds. With a statistically significant difference, 12 babies belong to the pH <7.25 group and 3 babies belong to the pH >7.25 group. Mousa et al research found a link between pH and feed start-up time. While 16 babies out of 60 with pH 7.2 experienced a delay in starting feeds, only 4 babies out of 60 with pH >7.2 experienced a delay (Table 2).

There are 8 babies with convulsions and 9 babies with encephalopathy in this study. The pH <7.25 group included 8 babies with HIE and 6 babies with seizures. Despite the fact that there was a difference in the number of subjects in both study groups, there was no statistical significance when the Fisher exact test was used. Malin et al discovered that low cord arterial pH was significantly associated with poor neonatal outcomes.<sup>12</sup> In babies with low arterial cord pH, HIE was associated with an odds ratio of 16.9, with a 95 percent confidence interval of 9.7 to 29.5.

Regardless of the umbilical cord blood pH, most babies in the current study of high-risk newborns had an uncomplicated neonatal period. This is consistent with the findings of Goldhaber et al. and Goodwin et al who investigated whether foetal acidemia, as indicated by low pH in cord blood analysis, had a negative outcome.<sup>13</sup> They discovered that there was no long or short term morbidity even with pH values less than 7.00. Another study, by Low et al discovered that neonatal morbidity is uncommon when the pH is greater than 6.90. They discovered that neonates requiring intubation were more likely if the pH was 6.83, cardiopulmonary support was more likely if the pH was 6.83, seizures were more likely if the pH was 6.75, and hypoxic-ischemic encephalopathy was more likely if the pH <6.75.

Other than pH and base deficit, Liv et al discovered that other factors influence neonatal outcomes.<sup>14</sup> H<sup>+</sup> ions,

glutamate receptors, oxygen, reactive nitrogen species, and genetic factors were among them (some obstetrics insults too). These required additional investigation. This could explain why babies with nearly identical cord blood gas levels have different outcomes.

In our study, we discovered that high-risk babies who needed resuscitation, NICU admission, or a delay in reaching full feeds had a significantly lower median cord blood pH than the other babies (p<0.05), implying that babies with low cord blood pH should be closely monitored throughout the neonatal period. This is similar to the findings of Mousa's study. Thus, in high-risk newborns, cord blood pH analysis is a reliable parameter for predicting some morbidities and outcomes in the early neonatal period.

### **Limitations of the study**

It is a hospital based study and findings cannot be generalised to community. As the study was conducted at tertiary hospital, information regarding antenatal could not be obtained with accuracy and it was based on the memory of mother.

### **CONCLUSION**

When compared to those with pH >7.25, high-risk term babies with cord pH <7.25 have an increased need for resuscitation, NICU admission, and delay in achieving full feeds. In this study, there is no statistical correlation between cord blood pH and the incidence of convulsions and encephalopathy in term high-risk newborns. When comparing high-risk newborns to other babies, the median cord blood pH is significantly lower in those who required resuscitation, NICU admission, or had a delay in achieving full feeds. All high-risk newborns should have their cord blood pH measured.

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