

# Study of Relationship between Postpartum Umbilical Cord Blood Ph and Neonatal Outcome in Patients Undergoing Emergency Caesarean Section for Fetal Distress

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**Abstract:** Background: In recent years, Caesarean section rates are increased and most common indication being fetal distress. Fetal distress basically occurs due to fetal hypoxemia because of various reasons either maternal or fetal. Thus, to know the immediate outcome of baby delivered through caesarean section, umbilical cord blood pH has emerged out to be the best indicator of fetal hypoxemia and to give the prognosis of baby delivered. Method: In our study, we included low risk 103 singleton term pregnant patients who Underwent Emergency Caesarean Section for Fetal Distress diagnosed clinically. Blood collection was performed following delivery by caesarean section, from immediately isolated segment (10 to 20 cm) of cord and sent for pH analysis. Result: A total of 72 (69.9%) neonates had a normal Umbilical cord blood pH (>7.2), while 31 (30.1%) neonates had acidosis (ph <7.2) of which 3 (2.9%) had severe acidosis (pH<7). Out of 103 neonates, 34 (33%) neonates required NICU admission and 4 (3.88%) neonates succumbed. Conclusion: Low umbilical cord blood pH values of babies born by caesarean section (for fetal distress) strongly correlated with low APGAR score at birth and higher rates of NICU admission.

**Keywords:** Fetal Distress, Hypoxemia, Acidosis, Umbilical cord blood pH, NICU admission

## 1. Introduction

The most common indication of caesarean section is fetal distress for the past few decades.<sup>1, 2</sup> There are many reasons for fetal distress, such as labour, reactions to medications or issues with the umbilical cord or placenta. Fetal distress stimulates concern in the obstetrician about the fetal condition and necessitates immediate intervention like caesarean section or instrumental vaginal delivery in order to prevent fetal death.

Intra - partum assessment of fetal condition is based on intermittent auscultation of the fetal heart rate (FHR) and checking for the presence of meconium - stained liquor with the assumption that an abnormal FHR pattern, especially in the presence of meconium - stained liquor, signifies fetal hypoxia and acidosis. The clinical diagnosis of fetal distress should be accurate so that unnecessary caesarean section is avoided in the parturient.

Umbilical cord blood gas analysis is a really important tool, and it is believed to be the most excellent predictor of birth asphyxia soon after birth.<sup>3</sup> The direction of blood flow of fetal umbilical artery is from the fetus to the placenta, so it reflects the situation of the fetus. The direction of blood flow of umbilical vein is from placenta to fetus, so it reflects the placental function and acid - base balance of pregnant women. Thus umbilical arterial blood is collected for cord blood analysis.

An important association exist between umbilical cord pH, low APGAR score and incidence of selective neonatal

outcomes such as neonatal intensive care unit admission and the need for advance resuscitation.<sup>4</sup> Apgar score for neonatal assessment at birth is a universal practice while cord blood gas analysis is reserved for high - risk situations or where there is low APGAR score at birth.

Cord blood pH is the most sensitive parameter for diagnosis of birth asphyxia and should be performed in all high - risk births, as this may help in providing appropriate care to the newborn at birth and in preventing as well as decreasing neonatal morbidity and mortality.<sup>5</sup>

The aims and objectives of this study are as follows:

- 1) To study the relationship between umbilical cord blood pH and fetal distress in patients undergoing emergency caesarean section for fetal distress.
- 2) To assess the neonatal outcome of caesarean section for fetal distress.

## 2. Methods

This was a prospective study conducted over 103 pregnant patients in the department of Obstetrics and Gynecology of tertiary care centre of Central India for a duration of 18 months between June 2021 to November 2022 after approval by the Institutional research ethics committee. Diagnosis of non - reassuring fetal status during Labour was clinical, by detection of fetal heart rate abnormality by intermittent auscultation with stethoscope or fetal doptone (with or without associated MSL). Type of fetal heart rate abnormality was noted.

Volume 12 Issue 4, April 2023

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**Inclusion criteria:**

- 1) Pregnant patients who attained at least 37 weeks of gestation from last menstrual period
- 2) Singleton pregnancy with cephalic presentation and longitudinal lie 3. Patients who are willing for the study/ who give consent.

**Exclusion Criteria:**

- 1) Multifetal pregnancy
- 2) Caesarean section for indication other than fetal distress / elective caesarean section
- 3) Mal - presentations
- 4) All high risks pregnancy (anemia, hypertension, thyroid disorders, diabetes, epilepsy, asthma)
- 5) Refusal of consent

Blood samples were taken from umbilical vessels following delivery by caesarean section from immediately isolated umbilical cord segment (10 - 20 cm), with 2 clamps near the neonate and two clamps near the placenta. The cord was then cut between the two proximal and two distal clamps. Cord blood was drawn from the isolated segments of the cord into a prepared 2 cc syringe containing lyophilized heparin. The needle was capped and the sample was taken to the laboratory while being kept on ice for further analysis. After that samples were tested for pH analysis. Acidemia was defined as cord blood pH less than 7.2. Severe acidemia was defined as cord blood pH less than 7.0.

Apgar score of all the neonates was assessed at one and five minutes. All neonates were prospectively followed until discharge from the hospital or otherwise till death. Adverse neonatal outcomes in terms of need for resuscitation, neonatal intensive care unit (NICU) admission, ventilator requirement, neonatal morbidity (hepatic encephalopathy, myocardial dysfunction, acute renal failure, sepsis, hypotension/shock, necrotising enterocolitis) and neonatal mortality were noted from the neonate’s case sheet as recorded by the pediatrician.

**3. Results**

In this study, the age of patients ranged from 24 to 32 years. About 88 (85.4%) were in the age group of 24 - 28 years. When booking status was studied, 82 (79.6%) patients had booked status and 21 (20.4%) had unbooked status. Most of the women were primigravida 53 (51.5%), while 50 (48.5%) of women were multigravida. When gestational age was studied, most of the women 43 (41.7%) were in the gestational age range of 40w0d to 40w6d.

62 (60.2%) of women were induced while 41 (39.8%) had spontaneous labour. Of all 103 patients, 72 (69.9%) had bradycardia and tachycardia was seen in 31 (30.1%) women. The mean fetal heart rate was 114.3+43.3 beats per minute.

Of all, 55 (53.4%) women had clear liquor, meconium - stained liquor in 46 (44.7%) and blood stained in 2 (1.9%) women. The cord was normal in 52 (50.5%), short in 12 (11.7%), cord meconium stained in 6 (5.8%), 1 loop of cord around neck in 9 (8.7%), 2 loops of cord around neck in 19 (18.4%), 3 loops of cord around neck in 4 (3.8%), and 4 loops of cord around neck in 1 (1%) of women.

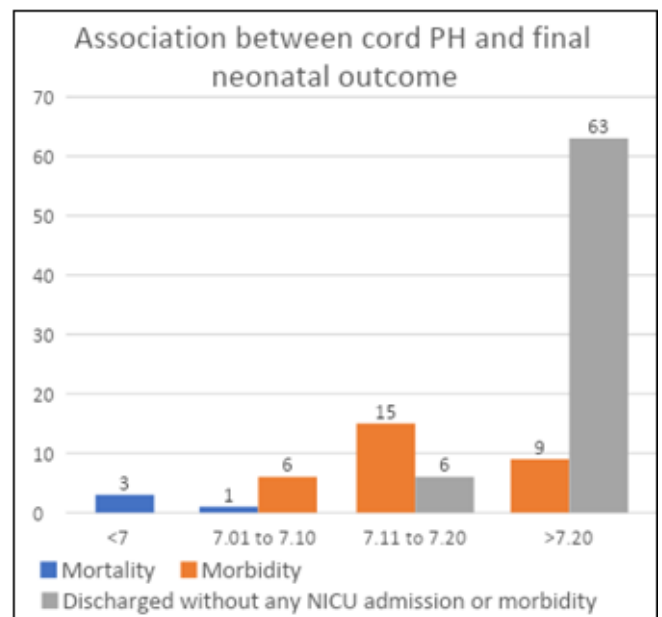
When APGAR score at 1 minute was studied, 60 (58.2%) neonates had Apgar score of 7 and below, while 32 (31.1%) had a Apgar score 8/10, Apgar score 9/10 in 11 (10.7%) of neonates. When Apgar Score at 5 mins was studied, we found that a total of 25 (24.3%) neonates had Apgar score of 7 and below, while 25 (24.3%) had a Apgar score 8, Apgar score 9 in 53 (51.6%) of neonates.

When Umbilical cord blood pH was studied, we found a total of 72 (69.9%) neonates had a normal cord blood pH >7.2, while 21 (20.4%) had mild acidosis pH 7.11 - 7.2, 7 (6.8%) had moderate acidosis pH 7.01 - 7.10, and 3 (2.9%) had severe acidosis pH<7.

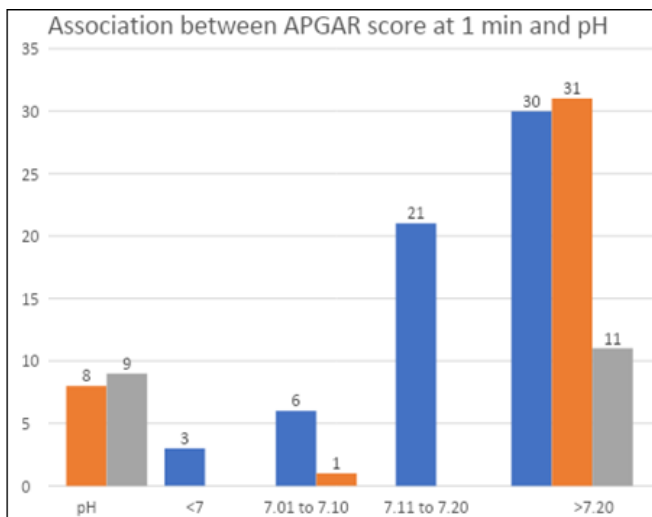
Out of 103 neonates, a total of 65 (63.1%) neonates required resuscitation of which, 34 (33%) neonates required NICU admission and 31 neonates revived on suctioning itself and were kept with mother under observation of neonatologist. Of the 34 neonates who were admitted in NICU, 16 (47.05%) of the neonates required ventilator support. Of these, 4 (3.88%) neonates succumbed and 12 neonates were shifted down on CPAP.

**Table 1:** Association between cord PH and final neonatal outcome

pH	Interpretation	Mortality	Morbidity	Discharged without any NICU admission or morbidity	Total
<7	Severe	3	0	0	3
7.01 to 7.10	Moderate	1	6	0	7
7.11 to 7.20	Mild	0	15	6	21
>7.20	Normal	0	9	63	72
Total		4	30	69	103



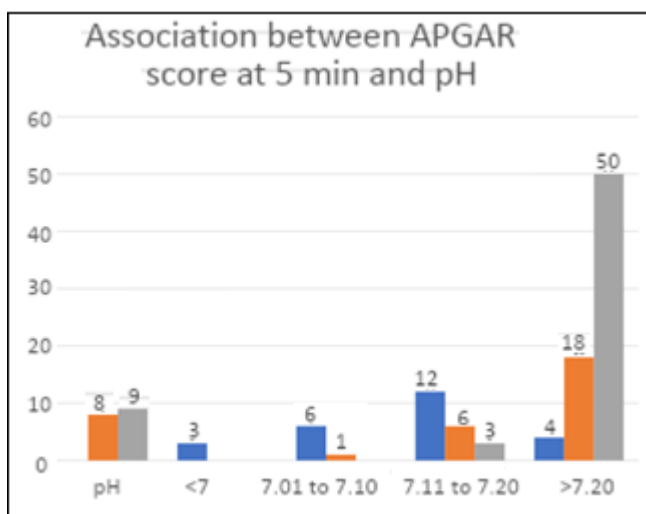
**Figure 1:** Association between cord PH and final neonatal outcome



**Figure 2:** Association between APGAR score at 1 min and pH

**Table 2:** Distribution of neonates according to their Cord blood pH

pH	Interpretation	No of neonates	Percentage
<7	Severe	3	2.9
7.01 to 7.10	Moderate	7	6.8
7.11 to 7.20	Mild	21	20.4
>7.20	Normal	72	69.9
Total		103	100



**Figure 3:** Association between APGAR score at 5 min and pH

#### 4. Discussion

This study aimed to determine the relationship between immediate postpartum umbilical cord pH, fetal distress and neonatal outcome at a tertiary care center in the Department of Obstetrics and Gynecology. The study revealed that umbilical cord blood pH is the best indicator of fetal hypoxemia during labour. When APGAR score at 1 min was studied, we found that a total of 60 (58.2%) neonates had Apgar score of 7 and below, while 32 (31.1%) had a score of 8/10 and score of 9/10 in 11 (10.7%) of neonates. When APGAR score at 5 mins was studied, we found that a total of 25 (24.3%) neonates had Apgar score of 7 and below, while 25 (24.3%) had a Apgar score of 8/10 and Apgar score 9/10 in 53 (51.6%) of neonates.

Of all 103, a total of 72 (69.9%) neonates had a normal Umbilical cord blood pH (>7.2), while 21 (20.4%) had mild acidosis (pH 7.11 - 7.2), 7 (6.8%) had moderate acidosis, and 3 (2.9%) had severe acidosis (pH<7). Sabol and colleagues found that fetal acidosis with pH less than 7.0 was associated with increased risk of respiratory distress syndrome, NICU admissions.<sup>6</sup> In the study by Syed et al,<sup>7</sup> acidemia at birth was present in 20 (74.07%) cases. Out of these 20 babies having acidosis at birth, 18 got admitted to NICU due to birth asphyxia. It was noted that there was a statistically significant association between low APGAR and neonatal acidemia, indicating that these two variables of neonatal outcomes complement each other in the assessment of neonatal morbidity. Also, there was a noteworthy association between 1st and 5th minute APGAR score, the umbilical cord artery pH and NICU admissions, as 20 babies admitted to NICU had APGAR score less than 7 at 0 minutes.

In this study, out of the 103 neonates, a total of 65 (63.1%) neonates required resuscitation, while 38 (36.9%) did not require it. Of the 65 neonates (63.1%) neonates, 34 neonates required NICU admission and 31 neonates revived on suctioning itself and were kept with mother under observation of neonatologist. During hospital stay they did not have any complications and were discharged as per neonatologist advice. Out of 65 neonates who required resuscitation, Suctioning was required in 31 (47.7%) neonates, AMBU in 18 (27.7%) and Intubation in 16 (24.6%) neonates. In the study by Singh et al, out of 108 studied neonates, 78 (72.2%) needed resuscitation whereas 30 (27.78%) didn't need any form of resuscitation, 77 (71.30%) babies were admitted in NICU for care & management as per protocols, whereas 31 (28.70%) neonates were shifted to mother side & followed up till discharge.<sup>8</sup>

Out of 103 neonates, 34 (33%) needed neonatal intensive care unit admission, while it was not required in 69 (67%) of neonates. Of the 34 neonates who were admitted in NICU, 16 (47.05%) of the neonates required ventilator support. Of these, 4 neonates succumbed and 12 neonates were shifted down on CPAP. The neonatal morbidities observed in neonates admitted in NICU were acute renal failure in 2 (5.9%), HIE stage I in 8 (23.5%), HIE stage II in 4 (11.8%), HIE stage III in 3 (8.8%), Hypotension/shock in 1 (2.9%), meconium aspiration syndrome in 4 (11.8%), myocardial dysfunction in 2 (5.9%), necrotizing enterocolitis in 2 (5.9%), sepsis 6 (17.6%) and shock in 2 (5.9%). Singh et al showed that 52 (48.15%) were neurologically normal without encephalopathy, 20 (18.52%) were in HIE stage 1, 11 (10.19%) were in stage 2 & 25 (23.15%) were in stage 3 of hypoxic ischemic encephalopathy. There was a significant difference in the association between cord blood pH and final neonatal outcome (p<0.001). There was a significant relation between umbilical cord pH and low Apgar score with the incidence of selective neonatal outcomes like neonatal intensive care unit admission and need for advanced resuscitation. According to Younas and colleagues, severity of metabolic acidosis with pH less than 7.01 is strongly associated with serious neonatal neurological morbidity and neonatal mortality.<sup>9</sup> Locatelli et

all10 found that acidemia is present in 38% of term babies with low APGAR score.

## 5. Conclusion

In present study it was found that majority of cesarean sections which were done for fetal distress, did not had fetal distress in real sense, as majority of babies after delivery had cord blood pH within normal range ( $7.40\pm 0.20$ ). All babies who had pH  $<7.2$  showed signs of birth asphyxia and were admitted in NICU. As the severity of HIE increases, the values of mean APGAR score and cord blood pH decreases which is inversely proportional to duration and severity of intrauterine or intrapartum hypoxia. There is a clear association between umbilical cord blood pH and neonatal outcome. Hence, it was found that cord blood pH is the most sensitive parameter for diagnosis fetal asphyxia and should be performed in all high risk births, as this may help in providing appropriate care to the newborn at birth and in preventing as well as decreasing neonatal morbidity and mortality.

## 6. Future Scope

Electronic fetal monitoring for every patient in labour room is not possible because of high delivery rate. More intensive intrapartum fetal monitoring, maternal interventions to improve FHR and to assess response to those interventions are needed. Availability of standardized tests in Govt hospitals or Teaching Institutions all over India are very essential for more studies about neonatal acidosis and measures to be taken to prevent neonatal complications due to that.

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