

Original Article

CORRELATION OF UMBILICAL CORD BLOOD PH IMMEDIATELY AFTER BIRTH IN PATIENTS WITH PRESUMED FETAL DISTRESS TO APGAR SCORE.

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ABSTRACT

Background: The best parameter to diagnose neonatal distress is an academic assessment of cord blood pH immediately after birth. The detection of pH in the immediate postpartum period can predict neonatal outcomes and will be helpful in the planning of further plans of care. The study aimed to establish co-relation between umbilical cord blood pH immediately after delivery with APGAR score.

Material and Methods: This cross-sectional study was conducted in the Department of Obstetrics & Gynecology, Mumtaz Bakhtawer Hospital, Lahore. This study randomly included 68 full-term pregnant women who presented to the labor room with labor pains. After delivery cord blood was taken in a pre heparinized insulin syringe within one minute of delivery. Maternal demographic features along with gestational age and fetal pH, base deficit, and HCO₃⁻ levels were noted. The correlation coefficient of pH and APGAR score was also calculated, p-value ≤0.05 was considered statistically significant.

Results: Eighty patients were enrolled in the study, but 70 were confirmed and became part of the research. Later on, 2 patients withdrew their consent for the study. Among 68 patient, 48(70.5%) patient had non-reactive CTG (pathological CTG) and 20(29.4%) patients had meconium-stained liquor with normal CTG. LSCS was done in 56(82.35%) mothers while 12(17.6%) underwent spontaneous vaginal delivery (SVD). Among these 56 females 14 (25%) have grade 2 meconium and 42(75%) have non-reactive CTG. Among 12 patients 6(50%) had non-reactive CTG and 6(50%) had Grade 2 meconium. Four 4(5.8%), neonates had acidosis along with an APGAR score < 7. The mean cord blood pH was 7.24±0.15. Only two needed neonatal intensive care unit (NICU) admission. Among Sixty-four (94.11%) with APGAR >7 two neonates with meconium needed observation for 24 hours and the remaining babies after 6 hrs of observation were handed over to the mother and cared for by the mother. There was a positively weak relationship observed between cord blood pH and APGAR score (r=0.645), however, it was statistically non-significant P > 0.05.

Conclusion: Acidic pH leads to poor APGAR score and birth asphyxia. Early assessment and diagnosis can improve fetal outcomes. Meconium-stained liquor and non-reactive pathological CTG had no significant correlation with neonatal outcomes. These two parameters result in unnecessary cesarean section.

Key Words: Fetal Distress, Hypoxia, APGAR score

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INTRODUCTION

The most common indication for cesarean section, routinely, is meconium-stained liquor and non-reactive CTG (pathological) for many decades. Fetal distress may be defined as fetal tachycardia followed by fetal bradycardia manifested by non-reactive

CTG and passage of meconium. With the invention of CTG in 1970, it was thought that this will decrease the risk of cerebral palsy and mental retardation by 50%. CTG is used for the past few decades as a monitoring tool, however, unfortunately, randomized controlled trial results are not encouraging in terms of long-term neonatal outcomes and a fourfold increase in cesarean section rate.¹ There is inconsistency in the interpretation of CTG, sometimes due to inaccurate interpretation doctor is unable to predict neonatal morbidity. Nowadays it is a matter of medico-legal concern.^{2,3} Meconium-stained liquor is a subject of discussion as a sign of impending fetal compromise, however, some researchers believe that passage of meconium is not an absolute sign of fetal compromise.⁴ Many babies delivered with the passage of meconium-stained liquor have normal umbilical artery pH. Clear liquor is a healthy sign of fetal outcome.^{4,5} The assessment of cord pH at the time of birth results inappropriate decision of care after birth.⁶ To differentiate between hypoxia and normal infant lactate and pH value are definitive indicators. Arterial and venous blood gases are indicators of placental and fetal oxygenation.⁶⁻⁸

To assess fetal pH, a cord blood sample venous should be taken within one minute of delivery after applying a double clamp. When we disrupt the umbilical cord continuity to the placenta and environment, the acid-base status of the cord will remain the relatively same as before birth for an hour. Subtle changes in acid-base status can occur within one minute.⁹ This possibility can be ruled out by double clamping the cord. Placental metabolism and gas exchange processes may lead to changes in pH if the umbilical cord remains in continuity with the placenta.¹⁰⁻¹² According to SOGC (society of obstetrician and Gynaecology Canada) Attendance at Labor and Delivery Guideline, there is a recommendation for routine arterial and venous blood gases of all delivered babies which leads to immediate care and plan

further management.¹³ The pH and APGAR score has an important correlation in terms of neonatal outcomes like the need for a neonatal intensive care unit(NICU), and advanced resuscitation. The normal neonatal umbilical cord pH is 7.40 ± 0.20 . There is an increased incidence of morbidity in terms of fits, advanced resuscitation, and NICU admission and mortality. Metabolic acidosis is defined as if pH is less than <7 and base deficit >12 mmol/L. There is an increasing trend in neonatal cord blood gases analysis among all deliveries to assess the status of the fetus in an intrauterine hypoxic environment.^{3,14-17} The main aim of obstetrics is to reduce fetal morbidity and mortality. To keep this aim in mind, we have conducted the study to evaluate all the deliveries and emergency cesarean sections performed for pathological CTG and meconium-stained liquor and its relationship with neonatal outcome using cord blood pH to APGAR score. The main aim of this research was to find the pH value of umbilical cord blood immediately after birth to detect true fetal distress in patients undergoing delivery for meconium and non-reactive CTG. This will help us to design interventions/protocols for patients in labor such as fetal scalp blood sampling and neonatal cord blood sampling to detect acidemia of fetus or neonate rather than relying only on meconium and non-reactive CTG.

MATERIAL AND METHODS

This descriptive observational cross-sectional study was conducted in Obstetrics and Gynaecology department, Mumtaz Bakhtawer Hospital, Lahore, from January to June 2020. The sampling technique was nonprobability consecutive sampling. It included 68 full-term pregnant women who presented to the labor room of the department of Obstetrics and Gynaecology with labor pains. All women included in the study were having signs of fetal distress (non-reactive CTG (pathological) and passage of meconium-stained liquor on

artificial and spontaneous rupture of membrane) inactive or latent phase of labor. All full-term pregnant mothers having signs of fetal distress with pathological CTG and grade 2 meconium-stained liquor included in the study

The following exclusion criteria was used

- Grade 3 meconium-stained liquor
- Women with preterm labor <37weeks
- Women with anomalous baby
- Women with intrauterine fetal demise

Maternal history, demographic and examination findings were recorded. Monitoring of these term pregnancies was done by the maintenance of a Partogram. After delivery of fetus and cord is clamped and a blood sample (arterial and venous) was taken in pre-heparinized insulin syringes within one minute of delivery. In the blood gas analyzer pH, base excess, carbon dioxide pressure (PCO₂) and HCO₃⁻ were measured within 30 minutes after sample collection. All this information along with gestational age, parity, mode of delivery, gender of baby, APGAR score and NICU admission were recorded in a computer database. APGAR score was calculated by a pediatrician at 1 and 5 minutes intervals. The baby who was resuscitated was shifted to NICU. pH < 7.20 was labeled as fetal distress.

All data were collected and analysis was done by SPSS 22. Mean and standard deviation was calculated for quantitative variables. For qualitative variables, percentages and frequencies were calculated. The correlation coefficient and Chi-square test were used to assess the significance of the findings. p-value <.05 was considered significant.

RESULTS

A total of 80 patients were enrolled for the study, 70 were confirmed and included in the study and 2 patients withdraw their consent for the study later hence several pregnant women at term who completed the analysis were 68. The mean age of women was 26.00±2.39 years. The mean duration of pregnancy of women was 38.20±2weeks.

Thirty-two 32(47.1%) were Multigravida and 36 (52.9%) females were primigravida. Out of a total of 68 patients, 48(70.5%) patients had non-reactive CTG (pathological CTG) and 20(29.4%) patients had meconium-stained liquor. Lower segment caesarean section (LSCS) was done in 56(82.35%) mothers while 12(17.6%) underwent SVD. Among 68 babies 48(70.6%) were male and 20 (29.4%) were female. Among these 56 females 14 (25%) had grade 2 meconium and 42(75%) had non-reactive CTG. Among 12 patients 6(50%) had non-reactive CTG and 6(50%) had Grade 2 meconium. Among 48 newborns with non-reactive CTG 2(4.1%) had severe bradycardia. Out of these 68 patients, 4(5.8%) had acidosis. Only two needed NICU admission (1 with severe bradycardia and one with thick meconium). Among Sixty four (94.11%) with APGAR >7 two neonates with meconium need observation for 24 hours and the remaining babies after 6 hrs of observation are handed over to the mother and cared for by the mother. The mean cord blood pH was 7.24±0.15. Four (4) babies had severe hypoxemia with pH 6.85 -7.00 and the remaining 64 babies had pH 7.40±0.20. with no sign of acidosis. During the period of stay in the NICU, one baby with a pH of 6.8 was shifted to a ventilator after 6hrs and survived. The correlation coefficient was r=0.645

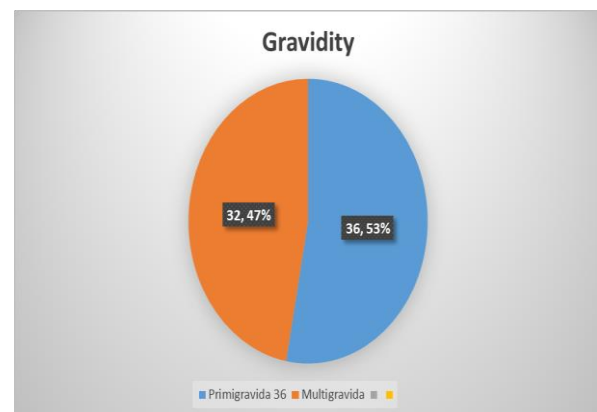


Figure-1: Primigravida/Multigravida

The pH values of all neonate's cord blood are given in figure 2.

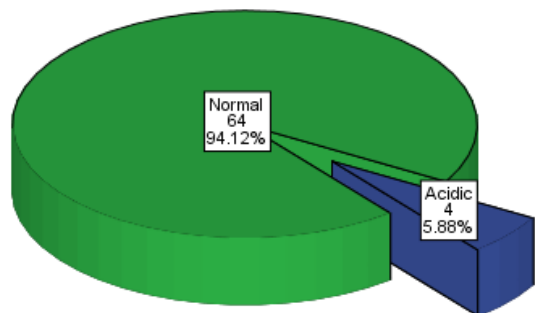


Figure-2: The pH of neonatal cord blood

Table-1: Comparison of Mode of delivery with indications

		Indication	
		Grade 2 Meconium	Non-reactive CTG
Mode	LSCS	14(25%)	42(75%)
	SVD	6(50%)	6(50%)
Total		20(29.4%)	48(70.5%)

Later the outcome was compared in acidic and normal pH of fetal cord blood. A summary of this can be seen in table 2.

Table-2: Comparison of outcomes in both pH group

	Acidic	Normal	p-value
Mode of delivery			
LSCS	2	54	0.080
SVD	2	10	
Stage of labor			
1 st	2	38	0.712
2 nd	2	26	
Grade 2 meconium	2	20	0.183
Non-reactive CTG	2	44	
Apgar score at 1min	6.50±0.58	7.88±0.55	0.191
Apgar score at 5min	7.00±0.58	7.94±0.50	0.097
Apgar score			
<7	4	0	<0.05
≥7	0	64	

A significant correlation was found between pH and APGAR score at one and 5 minutes.

DISCUSSION

Umbilical cord pH is the gold standard to detect fetal distress. According to the literature review, pH and lactate levels in cord blood are considered definitive diagnostic parameters.^{6,7} The results of this study also revealed that cord blood pH is the most reliable parameter of fetal distress (hypoxemia). In this study, among 68 babies, 4 babies had fetal distress based on cord blood pH and 2 needed NICU admissions. During the period of stay in the NICU, one baby with a pH of 6.8 was shifted to a ventilator after 6hrs and survived. Similar results were reported by William et al that cord pH <7.00 is an independent predictor of fits than another parameter¹⁸ Goldhaber et al has studied the correlation between umbilical arterial acidosis and adverse neurological outcome in term single fetus among 3506 patients with pH<7.20. According to their results, there was a more likely chance of neonatal death at pH<7.0, fits<7.¹⁹ In literature search another study concluded that pH <6.7, <6.8, <6.9, and pH<7.00 can lead to 80%,60%,33% and 12% hypoxic-ischemic encephalopathy (HIE).

In this study, it is also found that at pH <6.6 fetus is unable to survive.^{18,19} Intensive search of the literature showed a decreasing trend of pH leads to fetal morbidity and fetal mortality. In comparison cord blood pH than fetal scalp pH is a better predictor of fetal hypoxia.²⁰ According to the present study, clear liquor is a predictor of healthy neonatal outcomes however thick meconium-stained liquor can result in fetal morbidity and mortality. Fetuses having thick meconium at the time of birth had a high probability of academia, which is 5.8 times more than fetuses having clear liquor.^{20,21} Concentration of meconium in amniotic fluid had a direct relation to poor outcome. Another study showed the risk of academia is 12.5 times higher with thick meconium-stained liquor.²² Another study found a weak relationship between academia due to meconium-stained liquor and cord blood pH.²² A study concluded that mean neonatal

cord blood pH and acidemia were the same in clear and meconium-stained liquor.²³

In obstetrics practice, fetal distress is the most common indication for instrumental delivery and cesarean section, 40% and 30% respectively.^{20,21} The same trend was found in the present study which revealed non-reactive CTG had no significant association with neonatal distress and also resulted in high cesarean delivery. Out of 48 patients, who had non-reactive CTG, 42 had emergency cesarean section and 6 were delivered vaginally. Among these 48 only 2 babies had acidosis and were admitted to NICU. According to a Cochrane review, the fatal outcome had no significant association with antenatal CTG. Continuous and intermittent fetal heart rate monitoring had no difference in terms of perinatal outcome but rather an increase in cesarean section rate. Electronic Fetal Monitoring (EFM) has high sensitivity and low specificity and positive predictive value.^{23,24} Many studies regarding EFM revealed that there is no reduction in long-term complications like cerebral palsy, infant morbidity, and mortality but has a significant effect in reducing the incidence of seizures but at cost of instrumental delivery, cesarean section, and anesthesia.^{24,25}

Despite all these large clinical trials and research, surveillance tools had no significant role in the reduction of fetal morbidity and mortality.²³ Similar results were found in another study that CTG is an important monitoring tool for labor management however had no definitive impact on perinatal outcome.²⁵

The present study signifies that diagnosis of true fetal distress depending upon pH and lactate level is very important as this will help obstetricians to select the patient who requires prompt delivery. This reveals the need for another intrapartum monitoring tool for the early detection of fetal acidemia. Umbilical cord blood analysis for early diagnosis of fetal distress and time management should be done.

CONCLUSION

This study conclude that non-reactive CTG and grade II meconium has no significant association with fetal distress and 46(95%) cesarean sections done due to fetal distress were not having true fetal distress. This unnecessary intervention results in a burden on resources and increases maternal morbidity and mortality.

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AUTHOR'S CONTRIBUTION

SK: Manuscript writing & data collection

MR: Discussion & data analysis

KKM: Review & statistics

HS: Data collection & analysis

RS: Supervised the research

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