

CORRELATION BETWEEN NON REASSURING FETAL HEART RATE PATTERN WITH CORD BLOOD PH AND PERINATAL OUTCOME

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Abstract

Background: Electronic fetal heart rate monitoring involves cardiotocography (CTG) to record fetal heart rate patterns to determine the fetal well-being in order to detect the sign of intrapartum Fetal hypoxia. Acute hypoxia is one of the most serious pathological conditions in the intrapartum period and is a major risk factor for significant neonatal mortality and morbidity. This study aimed to correlate non reassuring CTG using a scoring system with umbilical cord pH and to find out the perinatal outcome. **Materials and Methods:** This hospital based prospective Observational study was conducted on 100 patients in the Department of Obstetrics and Gynaecology of our institute in a period of 18 months from January 2021 to March 2022. In patients with non-reassuring CTG, Umbilical cord arterial blood sample was collected from the umbilical vein, immediately after delivery. The correlation between non-reassuring fetal heart rate using kreb scoring with cord blood pH and the neonatal outcome was analyzed by using statistical software SPSS Version 23. **Result:** There was a significant correlation between low CTG score, acidosis, and NICU admission of babies. Rapid deterioration of CTG scores was found to require immediate intervention to prevent acidosis. **Conclusion:** Neonatal outcome is worsened when there is a low Kreb score as well as acidotic pH. CTG with a very low score correlates strongly with NICU admissions and hence immediate LSCS is needed whereas an intermediate score requires close observation before a decision towards operative intervention.

INTRODUCTION

Identification of fetal asphyxia and subsequent intervention to treat it are the objectives of the intrapartum fetal evaluation.^[1] A significant risk factor for neonatal morbidity and mortality is intrapartum fetal asphyxia. Reducing the occurrence of intrapartum fetal asphyxia and avoiding moderate and severe fetal asphyxia are the two objectives of intrapartum fetal surveillance.^[2] Fetal distress during intrapartum has been measured using a variety of techniques. Intermittent auscultation and electronic fetal heart rate monitoring (EFM) using a cardiotocograph (CTG) are the two currently utilized standard procedures. Fetal hypoxia is evaluated after birth both subjectively by the Apgar score and quantitatively by the pH of the cord blood.^[1,3-5]

High false positive rates and poor inter- and intra-observer reliability were found in studies on EFM.^[3,6] Although EFM has good sensitivity, it has a low specificity. 50% of fetal acidity was linked to abnormal FHR patterns for which caesarean or instrumental births were performed. Therefore, to increase specificity, RCOG advises using a fetal blood sample (FBS) in addition to EFM. Additional techniques such as fetal pulse oximetry, scalp blood analysis, waveform or analysis of fetal ECG, and lactate estimation are advocated in order to increase the efficacy of EFM. Therefore, in a single tertiary care obstetric facility, this study was conducted to investigate CTG, fetal blood gas, and acid-base evaluation for the prediction and prevention of intrapartum fetal hypoxia. Additionally, the newborn outcome was observed.^[7-10]

MATERIALS AND METHODS

This hospital based prospective Observational study was conducted on 100 patients in the Department of Obstetrics and Gynaecology of our institute in a period of 18 months from January 2021 to March 2022. The sample size calculated was 100.

Using $n = Z^2 \times p \times q / d^2$ where n is required sample size $z = 1.96$ at 95% Confidence limit, 5% alpha and 80% power (1-beta) $p = 0.70$ (assumed probability), $q = 1-p = 0.30$ $d =$ Precision (marginal error allowable up to 20%) which was considered 13% relative to the probability i.e., $0.105 \quad 0.806736 / 0.008281 = 97.42$

To reduce statistical errors and to allow for calculations, the total sample size was taken as 100.

Inclusion criteria

- Gestational age >34 weeks
- Singleton
- Cephalic presentation
- Non reassuring CTG
- Patient with repeat suspicious CTG

Exclusion criteria

- Elective LSCS
- Breech
- Anomalous babies
- Multifetal Gestation

- All patients with reactive CTG
- Patient having only first suspicious CTG
- Gestational age < 34 weeks

All patients were subjected to CTG and assessed objectively using the Krebs scoring system

Five parameters were used in the scoring system

- Baseline Heart rate
- Baseline variability
- Amplitude (Frequency)
- Acceleration
- Deceleration

Patient with non-reassuring CTG and patient with repeated suspicious CTG. (After the first suspicious CTG, repeat CTG was taken after fluids and left lateral position). Immediately after delivery, umbilical cord arterial blood sample was collected from the umbilical vein. Maternal profile, neonatal outcomes in terms of APGAR score, cord pH, immediate ventilation, and NICU admissions were recorded. The correlation between non-reassuring fetal heart rate was analyzed. The data was recorded in the predesigned proforma and then it was entered in MS Excel and eventually, it was analyzed by using statistical software SPSS Version 23. Statistical analysis was done after entering the data in Excel sheets with the appropriate software.

KREBS SCORING SYSTEM

Score	Baseline FHR	Amplitude (variability BPM)	Variability OSC. Points/minutes	Accelerations	Decelerations
0	<100 >180	<5	<3	0	Late or severe variable deceleration
1	100-119 161-180	5-10	3-6	1-3	Mild or moderate variable deceleration
2	120-160	>10	>6	>3	Early or no deceleration

RESULTS

Table 1: Comparison of Liquor colour and Krebs score

Liquor colour	0-4		5-7		8-10	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Clear	5	26.3	29	58.0	23	74.2
Meconium stained	14	73.7	21	42.0	8	25.8
Total	19	100.0	50	100.0	31	100.0
Chi sq	11.058		P value		0.004*	

Table 2: Comparison of Mode of delivery and Krebs score

Mode of Delivery	0-4		5-7		8-10	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Vaginal Delivery	3	15.8	23	46.0	18	58.1
Vacuum	1	5.3	0	0	0	0
LSCS	15	78.9	27	54.0	13	41.9
Total	19	100.0	50	100.0	31	100.0
Chi sq	12.019		P value		0.017*	

Table 3: Comparison of Krebs score and Umbilical cord pH

Mode of Delivery	0-4		5-7		8-10	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
≤7.15	16	84.2	20	40.0	3	9.7
>7.15	3	15.8	30	60.0	28	90.3
Total	19	100.0	50	100.0	31	100.0
Chi sq	27.549		P value		<0.001**	

Table 4: Comparison of Krebs score and fetal outcome

Fetal Outcome	0-4		5-7		8-10	
	Frequency	0-4	Frequency	5-7	Frequency	8-10
Received routine care	5	26.3	16	32.0	19	61.3
NICU Admission without ventilator support	8	42.1	24	48.0	9	29.0
NICU Admission with Ventilator support	6	31.6	10	20.0	3	9.7
Total	19	100.0	50	100.0	31	100.0
Chi sq	9.915			P value	0.042*	

Table 5: Comparison of umbilical cord pH and fetal outcome

Fetal Outcome	Umbilical Cord PH				Total
	<=7.15		>7.15		
	N	%	N	%	
Received routine care	6	15.38	34	55.74	40
NICU admission without ventilator support	19	48.72	22	36.07	41
NICU admission with ventilator support	14	35.9	5	8.2	19
Total	39	39	61	61	100

Table 6: Fetal outcome using multinomial logistic regression

Model Coefficients - Fetal Outcome						
Fetal Outcome	Predictor	SE	p	Odds ratio	95% Confidence Interval	
					Lower	Upper
NICU Admission without ventilator	Intercept	1.70	0.98	0.96	0.03	26.98
	LIQUOR COLOUR	0.55	0.02	3.64	1.25	10.63
	KREB SCORE	0.41	0.64	1.21	0.54	2.71
	UMBILICAL CORD PH	0.62	0.06	0.31	0.09	1.05
NICU admission with ventilator support	Intercept	2.24	0.77	0.52	0.01	41.76
	LIQUOR COLOUR	0.75	0.00	10.94	2.52	47.54
	KREB SCORE	0.56	0.97	0.98	0.32	2.93
	UMBILICAL CORD PH	0.82	0.01	0.10	0.02	0.52

There were 57% of patients had clear liquor, and 43% of patients had meconium-stained liquor. In them, the kreb score was very low (0-4) in a majority of patients (73.6%) with meconium-stained liquor, which was found to be statistically significant (p = 0.004) [Table 1]

As per the mode of delivery 55% were delivered by LSCS, 44% delivered vaginally, and 1% by vacuum application. In patients with a very low kreb score (0-4), 78.9% LSCS was done. LSCS rate was reduced to 54% in patients with intermediate scores (5-7) and 41.9% in patients with kreb scores (8-10). Statistical significance (p = 0.017) was found between kreb scoring and mode of delivery. [Table 2]

In our study umbilical cord pH, was found to be <7.15 in 84.2% of patients with a very low kreb score (0-4) .40% in patients with an intermediate score (5-7), and 9.6% in patients with a kreb score (8-10). Acidosis is statistically significantly correlated (p<0.0001) with Krebs's score. [Table 3]

As per fetal outcome, 40 babies received routine care only. 41 babies needed NICU admission but no ventilatory support and 19 babies were on ventilatory support. Ventilatory support was needed for 31.6% of babies with the patient having a very low kreb score (0-4), 20% with, an intermediate score, and 9.7% with a kreb score (8-10). Out of 19 babies on ventilator support 4 babies died and 15 babies survived. There was a statistically significant

correlation (p=0.042) between the Fetal Outcome and Krebs. [Table 4]

In babies having umbilical cord pH<7.15, 35.9% needed ventilator support, 48.7% needed NICU admission but were not on ventilators, and only 15.3% received routine care. While in babies having >7.15 majority (55.74%) received routine care and only 8.2% needed ventilator support. There was a statistically significant correlation (p<0.0001) between the fetal outcome and Umbilical cord pH. [Table 5].

Using multinomial regression, it is found that the odds ratio is >1 for kreb scoring and liquor colour concerning fetal outcome in terms of NICU admission. But for ventilatory support odds ratio is >1 (OR-10.94) for liquor colour only. Indicates that babies who required ventilatory support correlated with meconium stained liquor. [Table 6]

DISCUSSION

Our study included 69 primigravidae and 31 multigravidas. Out of these, kreb score was 0-4 in 16 primigravidae and 3 multigravidas. It was 5-7 in 30 primigravidae and 40 multigravidas. It was 8-10 in 23 primigravida and 8 multigravidas.

Liquor Colour

There were 57 (57%) patients who had clear liquor, and 43(43%) patients had meconium-stained liquor. In them, the kreb score was 0-4 in 19 patients, out of whom 5 (26.3%) patients had clear liquor and 14 (73.7%) patients had meconium-stained liquor. kreb

score was 5-7 in 50 patients, out of whom 29(58%) patients had clear liquor and 21(42%) patients had meconium-stained liquor. Krebs score was 8-10 in 31 patients, 23(74.2%) patients had clear liquor and 8(25.8%) patients had meconium-stained liquor.

Umbilical cord pH<7.15 was seen in 39 patients, out of them 33.33% (13) of patients had clear liquor and 66.67% (26) of patients had meconium stained liquor. Umbilical cord pH>7.15 was seen in 61 patients, 72.13%(44) of patients with clear liquor and 27.87%(17) of patients with meconium stained liquor. Fouzia P et al⁷ found that the grading of MSL did not correlate well with pH levels. Since 85.7% of grade I, 68.9% of grade II, and 59.4% of grade III meconium-stained liquid (MSL) had pH levels of more than 7.25.

Mode Of Delivery

Looking at the mode of delivery of the patients 55% (55) were delivered by LSCS, 44%(44) delivered vaginally, and 1%(1) by vacuum application. In patients with a very low kreb score (0-4), 15 (78.9%) caesarean section was done. Caesarean rate fell 27(54%) in patients with intermediate scores (5-7) and 13(41.9%) in patients with kreb scores (8-10). Jamal A. et al.⁸ found that women with borderline AFI had a significantly higher caesarean section rate for non reassuring fetal heart rate. NRFHR (non reassuring fetal heart rate), which requires an emergency caesarean birth, may result from many underlying causes, according to Weiner E et al,⁹ The injury is probably acute and detectable intraoperatively in around half of the cases. Reactive CST patterns were found to have a lower caesarean section rate, according to Thacker et al research from 1979.¹⁰

Umbilical Cord pH

In our study umbilical cord pH, was found to be <7.15 in 39 babies, out of whom 16(84.2%) patients had very low kreb score (0-4), 20(40%) patients had intermediate score (5-7), and 3(9.7%) patients had their kreb score (8-10). According to Ray C et al,¹¹ findings, 52.5% of the participants with aberrant intrapartum CTG, 7.3% of the subjects with normal intrapartum CTG traces, and 22.7% of the 110 subjects with uncertain intrapartum CTG had acidosis.

Fetal Outcome

As per fetal outcome, 40 babies received routine care. 41 babies needed NICU admission but no ventilatory support and 19 babies were on ventilatory support. In patients with Krebs scores, 0-4 total 19 babies were there, out of whom 5 babies received routine care, 8 babies needed Nicu admission but no ventilatory support, and 6 babies needed Ventilatory support. In patients with Krebs scores between 5-7(50 patients), 16 babies received routine care, 24 babies needed Nicu admission but no ventilatory support, and 10 babies required Ventilatory support. In patients with Krebs scores between 8-10(31 patients), 19 babies received routine care, 9 babies needed Nicu admission but no ventilatory support, and 3 babies required

Ventilatory support. There were 19 babies which were on ventilator support just after delivery out of which 4 babies died and 15 babies survived. Predictive FHR patterns can be an effective screening tool for fetal asphyxia, according to Low JA et al analysis.¹² According to the planning workshop report from the National Institute of Health and Human Development Research, published in 1999.¹³ Neonatal admission in their study ranged from 6% in the normal CST group to 38% in the aberrant CST group.

Umbilical cord pH<7.15 was seen in 6 babies who received routine care, 19 babies needed Nicu admission but no ventilatory support, and 14 babies required Ventilatory support. Umbilical cord pH>7.15 was seen in 34 babies who received routine care, 22 babies needed Nicu admission but no ventilatory support, and 5 babies required Ventilatory support. Meconium stained liquor, mothers with low kreb score and umbilical cord pH < 7.15 required NICU admission.

According to Paris A et al,¹⁴ the Apgar score at 5 minutes were considerably lower when there was umbilical acidosis (pH 7.15 or lactate 5 mmol/L) (4.66 3.59 compared 8.35 2.73 for pH; 6.6 3.77 versus 8.45 2.58 for lactate). According to Vintzileos AM et al,¹⁵ acidemic infants had a significantly higher frequency of neonatal complications than non-acidemic infants, including a higher rate of neonatal mortality (17% vs. 8%), intraventricular hemorrhage/seizures (33% vs. 8%), severe respiratory distress syndrome (46% vs. 11%), ventilatory support over 1 week (29% vs. 12%). Yeh P. et al,¹⁶ concluded that the "optimal" cord pH ranges from 7.26-7.30 and that 7.10 is the threshold pH for negative neurological effects. However, neonatal acidemia is only marginally linked to poor outcomes above 7.0. The pH levels of the cord are often normal in infants with neurological morbidity. According to Goyel S. et al,¹⁷ there is a correlation between the pH level of the umbilical cord blood and other variables that can be used to assess perinatal outcomes like Apgar score, low birth weight, and NICU admission; the length of the labour was also found to be statistically significant concerning the method of delivery.

CONCLUSION

To conclude, the pH levels of the umbilical cord blood at the time of delivery were connected to FHR patterns rated using the Krebs scoring method. Low CTG scores were significantly correlated with acidosis. CTG is a simple test that is easy to do, allowing for early intervention in cases of abnormal tracings to reduce infant morbidity. Babies with an abnormal CTG need to be treated in the right way to avoid acidosis and other long-term problems. When the CTG tracings are not clear, the obstetrician should be more careful and watch the labour closely. CTG with a very low score correlates strongly with

NICU admissions and hence prompt LSCS is needed whereas an intermediate score requires close observation before a decision towards operative intervention.

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