

Neonatal Outcome-Comparison of Non-Reactive Cardiotocography versus Non-Reactive Cardiotocography with Fetal Blood Sampling

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ABSTRACT

Background: Fetal assessment and monitoring during pregnancy and labor is now a norm for the last fifty years. The purpose is to recognize any abnormality in the monitoring tests and act accordingly. Cardiotocography (CTG) and fetal blood sampling (FBS) used together have been seen to improve the neonatal outcome rather than using either of the modality alone. The present study was conducted to compare immediate neonatal outcome with use of Cardiotocography alone versus use of Cardiotocography and fetal scalp blood sampling both. **Methods:** This secondary analysis from a cross sectional analytical study was carried out at Department of Obstetrics & Gynecology Unit 3, Lady Willingdon Hospital, Lahore from October 2019 to April 2020. A total of hundred patients, fulfilling the inclusion criteria were included in the study. Non-probability, purposive sampling was done. The selected patients were placed randomly into two groups, according to method of fetal assessment i.e. Group A (continuous Cardiotocography) and Group B (continuous Cardiotocography and Fetal Blood Sampling). The patients in group A with non-reactive CTG were taken for Cesarean Section. In Group B hypoxia was assessed by fetal blood pH and delivery was planned accordingly. All this data was recorded on a proforma. The data was analyzed using SPSS version 21. Sensitivity, specificity, Positive predictive value (PPV), Negative predictive value (NPV) and fetal scalp pH were calculated. **Results:** The mean age of women in group A was 27.64±4.38 years. The mean gestational age in group A was 39.3±1.05 weeks. Mean parity in group A was 2.34 ±1.51 while in group B was 2.46±1.39. In group A 28 (56%) cases had Apgar score less than 7 at 5 minutes, whereas in group B 18 (36%) cases had Apgar score less than 7 at 5 minutes. There was significant difference in all the parameters between the two groups. Neonatal mortality was observed in 8% of cases in group A as compared to no mortality in Group B. The NICU admission was observed in 20% in group A and in 12% of cases in Group B. **Conclusion:** It was concluded that Cardiotocography plus fetal blood sampling versus Cardiotocography alone is an accurate method of assessment of fetal condition in labor to predict neonatal outcome after birth.

Keywords: Neonatal outcome, Non-reactive Cardiotocography, Fetal Blood sampling.

INTRODUCTION

Screening for fetal distress has been always been a challenge to those responsible for monitoring the laboring patients. Graphic recording of fetal heart rate at the time of admission helps to differentiate between the women who require continuous electric monitoring and the ones who could be left to intermittent auscultation.^[1] Present progress in the assessment of fetal condition during pregnancy and labor was made by use of Cardiotocography, assessment of fetal heart beat and monitoring of uterine contractions simultaneously. Hon was the first one to demonstrate typical drop in heart rate during labour.^[2]

Disruption of gas exchange at the placental level leads to decreased oxygen levels and raised carbon

dioxide levels which culminate in low fetal pH. The affected baby can expire, recover or show features of brain damage and neurodevelopmental problems later on.^[3] CTG testing at the time of admission should be used to predict sub optimal fetal outcome and help in tailoring appropriate management.^[4] Finding an association between abnormal CTG findings during labor and long term neurodevelopment of children can be made possible with realistic obstetric intervention, avoiding episodes of low fetal pH and proper protocol for care of newborns.^[5]

Fetal blood sampling is an ancillary tool in addition to CTG in assessment of fetal wellbeing. The blood sampling is essential and helps to decide the future course of action based on fetal pH according to a study done by Tsikorous.^[6]

In vaginal deliveries with abnormal graphic recording of fetal heart rate, sampling of fetal blood is a method of fetal monitoring which is associated with less surgical intervention and management can be

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enhanced by the use of FBS which is used to measure capillary pH, base excess or lactate. The combination of the two could be of great aid to reduce the rising trend of cesarean section.^[8]

FBS was introduced by Saling in 1960 to indicate low levels of Fetal scalp pH.^[9] It is often labelled as the “gold standard” with which the other indicators of fetal distress might be compared. In general low pH means that the fetus is not coping with labor well.^[10] The analysis of fetal pH needs small amount of blood and leads to 20% sampling failure rate. This procedure needs expertise and may need to be done again when CTG problems persist and can be problematic.^[11] Holzmann et al did a large scale study and carried out pH analyses or lactate analyses on fetal blood. They observed that there was no significant difference between the two groups in terms of low fetal pH during labor, low Apgar score and brain damage.^[12] CTG, although results in more surgical intervention but is more reproducible in cases of medico legal litigation in contrast to FBS, so its importance cannot be undermined.^[13]

Rationale of this study is to find the difference in the neonatal outcome when CTG is used alone versus use of CTG and fetal blood sampling both for fetal monitoring so that effective and reliable methods could be devised for the patient monitoring during labor. This would go a long way in ensuring a better neonatal outcome as well as reduced C section rate in low resource setting like ours.

MATERIALS AND METHODS

Study Design: It was a secondary analysis from a cross sectional analytical study

Study Setting: The study was conducted at Department of Obstetrics & Gynecology, Lady Willingdon Hospital Lahore.

Study Duration: It was conducted over a period of six months from October 2019 to April 2020.

Sample size: The calculated sample size was 97 (approximately 100 cases), by taking 95% confidence interval, 80% power of study, taking expected percentage of decreased scalp pH that is 6.8% (11) in laboring patients with non-reactive CTG.

Sampling Technique: Non-probability, consecutive sampling was used.

Study population

Inclusion Criteria:

All booked, 18-35 years old patients in labor, having singleton fetus with vertex presentation, 37-42 weeks of gestation as per last menstrual periods with ruptured membranes and clear liquor and cervical

dilatation >3 cm with non-reactive CTG were included in the study.

Exclusion Criteria:

Those with abnormal findings on external cardiac monitoring, normal tracings, in advanced labour, cases of severe anemia, intrauterine growth retardation, diabetes mellitus, hypertension with proteinuria, previous sections and maternal infections were excluded from the study.

Data Collection Procedure:

After approval from local ethical committee, 100 booked patients admitted in the labor room were enrolled. Patients were informed and consent was taken. In the Group A, 50 patients having non-reactive CTG were taken and according to assessment based on CTG underwent C section. While in Group B patients, in 50 patients having non-reactive CTG fetal assessment was done by continuous Cardiotocography as well as fetal scalp sampling. Fetal blood samples were assessed for pH value and subsequent action was taken.

In case of normal pH >7.2, sample was repeated after one hour if fetal heart rate abnormality persisted as before or sooner if required. If the second sample indicated normal results, normal vaginal delivery was considered. If the pH was borderline (7.21 -7.24) sample was repeated 30 minutes after maternal resuscitation. In case of no improvement, cesarean section was planned. If the pH was < 7.2, emergency cesarean section was planned. While analyzing the blood samples, other fetomaternal factors like color of liquor, fetal heart rate and maternal fever were taken note of. If FBS was not possible emergency C section was done within 30 minutes. Once delivered Apgar score at 1 and 5 minutes was noted. Admission to NICU was also recorded.

For fetal blood sampling, the patient was placed in the appropriate position. After ensuring asepsis, Bishop Scoring was done. The amnioscope was used to see the fetal scalp, which was then cleaned and ethyl chloride was sprayed to develop capillary action. Optic light source was applied to FBS device and a small cut was given to the fetal scalp. Two samples were collected in a syringe containing heparin and the blood sample was subjected to analysis with blood gas analyzer (Nova Biomedical) for pH and base excess at clinical laboratory of the hospital.

Data Analysis Procedure:

All this data was recorded on a predesigned proforma. All the data was entered and analyzed by using SPSS version 21.0. Quantitative variables like age, gestational age and scalp blood pH, Apgar score at 1 min and 5 min were presented as mean and standard deviation. Qualitative variables like gravidity and Apgar score were calculated as Frequency and percentage. Both groups were compared by chi-square for any difference and p-value ≤ 0.05 was considered as statistically significant.

RESULTS

In this study a total of 100 patients were enrolled. The mean age was 27.64 + 4.38 years with a range of 19 - 37 years. In this study the distribution of parity is shown in [Table 1]. In group A total no of patients were 50 and all had non-reactive cardiotocography [Table 2]. In group B, among 50 cases, at first attempt of fetal scalp blood sampling, 14 cases had normal pH (7.25-7.35), 34 cases had borderline pH (7.21-7.24) and 2 cases had abnormal pH (≤ 7.20).

In group B, among 50 cases, 14 cases with normal pH, scalp sample was repeated after 1 hour. All cases remained normal. 34 cases with borderline pH, scalp sample was repeated after 30min, 24 cases remained borderline, 6 cases converted to normal and 4 cases converted to abnormal, and finally 20 cases had normal pH (7.25-7.35), 24 cases had borderline pH (7.21-7.24) and 6 cases had abnormal pH (≤ 7.20). In group A, all cases 50/50 (100%) underwent LSCS. In group B, 30 (60%) cases underwent LSCS while 20 (40%) cases underwent Spontaneous Vaginal Delivery. In group B, among 50 cases with abnormal pH sampling, all six cases underwent LSCS while among cases with borderline pH sampling, all twenty four cases underwent LSCS. And in cases with normal pH sampling all twenty cases were delivered vaginally (SVD). In this study, the distribution of Apgar score is shown in [Table 3].

In group B among 50 cases, neonates with abnormal pH value, 100 % neonates had poor Apgar score. Among cases of borderline pH value, 50% neonates had poor Apgar score and the other fifty percent neonates had good Apgar score. Similarly, in cases with normal pH value, no neonate had poor Apgar score. There was significant difference observed among sub-groups. (P=0.0001). The distribution of Apgar score for admission in NICU is shown in [Table 4]. In group A, among 50 cases, 10 (20%) cases had NICU admission while in group B, among 50 cases, only 6 (12%) cases had NICU admission as shown in [Table 5]. In group B among 50 cases, neonates with abnormal pH value, 4 out of 6 neonates required NICU admission. Among cases of borderline pH value, 2 out of 24 neonates required NICU admission. Similarly, in cases with normal pH value, no neonate required NICU admission. There was significant difference observed among sub-groups (P<0.0001). In group A among 50 cases, 4 (8%) cases expired while in group B no mortality was observed. There was significant difference observed between two groups, (p=0.041) as shown in [Table 6].

DISCUSSION

Cardiotocography is a common method used for fetal monitoring during pregnancy and labor as the abnormal findings are a harbinger for low fetal oxygen saturation. Unluckily CTG correlates poorly with neonatal outcome. Presently the frequent aid

used for fetal monitoring is CTG which has shown to result in more cesarean sections.^[5] Admission CTG has less benefit in women with no or few risk factors, and has to be supplemented with other methods like fetal blood sampling for increasing its accuracy in those presenting with abnormal traces.^[1]

Table 1: Distribution about Parity of the patients

		Frequency	Percent
Parity	One	12	12.0
	Two	26	26.0
	Three	28	28.0
	Four	20	20.0
	Five	4	4.0
	Six	8	8.0
	Seven	2	2.0
	Total	100	100.0

Table 2: Patients with reactive and non-reactive CTG in group A

		No. of pt.	Percent
CTG	Reactive	12	12.0
	Non-Reactive	26	26.0
	Total	50	100

Table 3: Comparison of Apgar score between both study groups

		Study Group		P-value
		Group A N=50	Group B N=50	
Apgar score	<7	28/50 (56%)	18/50 (36%)	0.045
	\geq	22/50 (44%)	32/50 (64%)	
Total		50/50 (100%)	50/50 (100%)	

Table 4: Comparison of Apgar score in both groups for NICU admission

		Study group		p-value
Apgar score	NICU admission	5.00±0.94	5.38±0.74	0.372
	No NICU admission	6.80±2.63	7.40±1.43	0.197
	p-value	0.40 (Significant)	0.0001 (Significant)	

Table 5: Comparison of NICU admission between both study groups

		Study group (n=100)		p-value
		Group A (n=50)	Group B (n=50)	
NICU Admission	Yes	10 (20%)	6 (12%)	0.275
	No	40 (80%)	44 (88%)	
Total		50 (100%)	50 (100%)	

Table 6: Comparison of neonatal death between both study groups

		Study group (n=100)		P-value
		Group A (n=50)	Group B (n=50)	
Death	Yes	4 (8%)	0 (0%)	0.041
	No	46 (92%)	50 (100%)	
Total		50 (100%)	50 (100%)	

In our study there was significant difference in the Apgar score between the neonates of both groups at 5

minutes (56%) vs. (36 %). Neonatal mortality was observed in 8% in group A while none in Group B. The NICU admission was observed in 20% in group A and 12% of cases in Group B. There was significant difference observed in subgroups and the cases with abnormal and borderline pH had more chances of developing poor Apgar score as compared to those with normal pH. There was significant difference observed among groups regarding NICU admissions. Neonates having normal pH had less chance of NICU admissions as compared those with to abnormal and borderline pH.

In a study done by Stein and colleagues, the use of fetal blood sampling as an additional tool for fetal surveillance has shown improved short term neonatal outcome .This finding is comparable to ours.^[7] Another study found that there was a positive association between the results of fetal scalp sampling and the Apgar score of the neonate at 7 minutes.^[14] In a study on human subjects, a meaningful association has been observed between the scalp pH in blood samples taken a little time before delivery and the umbilical cord samples obtained shortly after birth. This finding is again in agreement with our study.^[15] In a study done by Kundu and colleagues in 2017, it was concluded that the estimation of pH value and the neonatal outcome based on current CTG shows varying results. These findings are different from our results where the abnormal tracings were related with abnormal scalp pH and low Apgar score at 5 minutes.^[16] In this study, in group B, among 50 cases severe acidemia (pH < 7.2) was found in 12 % of cases. Holzmann et al in 2011, performed a secondary analysis of more than two thousand patients, who experienced lactate or pH analyses by FBS. Very low scalp blood PH (pH <7.17) was present in 6.8% of cases. This finding also matched with our results.^[12] Chetandas and Colleagues in their study showed that CTG is associated with more intervention due to its false positive rate and no improvement in the neonatal outcome. By this study it was inferred that ancillary methods are required to improve the sensitivity and specificity of fetal monitoring if unnecessary intervention is to be avoided.^[17]

A study done by Henderson, it was observed that assessment of fetal scalp pH can provide an accurate idea of acid base balance. But it has raised questions about its association with short and long term advantages in the neonates. This finding is in conflict with our study.^[18]

In a study done by Holzmann et al there was no appreciable difference between the two groups in terms of low scalp pH, Apgar score and neonatal brain damage.^[12]

Kavitha et al reported that in patients with non-reactive CTG there were 5.6% neonatal deaths and the NICU admission was 44.4%, whereas the corresponding figures in our study were 8% and 20% respectively. In a study by Gupta M et al the

comparative figures were 12% and 75%. These results indicate a lower rate of complications in our study.^[19,20]

In a local study done in Islamabad, it was observed that CTG alone is of less value in predicting fetal acidemia and needs to be supplemented with pH analyses. This observation also matches our findings.^[21]

In a study done in 2012 to assess the success of CTG in predicting perinatal outcome, it was observed that CTG was insufficient in predicting perinatal outcome. This could be due to the fact that the pH analyses were done on the umbilical cord blood. This study again strengthens the results of our study.^[22]

The limitation of this study was its small sample size and the strength was the nature of the study which is very much applicable in our set up.

CONCLUSION

It was concluded that fetal blood scalp sampling is an appropriate and accurate method for assessment of fetal condition during labor and neonatal outcome after birth. CTG combined with fetal scalp blood sampling can increase the ability of Obstetricians to identify hypoxia and intervene appropriately resulting in improved fetal outcome.

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