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Abnormal Cardiotocography and Perinatal Outcome

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Abstract:

Background: *Cardiotocography is the graphic presentation of the fetal heart rate activity and the fetal hypoxia. It is the most commonly used test for antepartum and intrapartum fetal surveillance in the majority hospitals of developed countries.*

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Methods: *In this prospective observational study total 384 tracings, 192 consecutive normal & 192 abnormal were collected from admitted pregnant patients during July 2008 to December 2008 in the department of obstetrics in BSMMU.*

Results: *Out of all patients of case group 92.7% had C/S & 7.3% had NVD & in control group 77.1% had C/S & 22.9% had NVD. Here abnormal CTG needed higher rate of C/S. Apgar score at 1st& 5th min was significantly less in case group. Immediate resuscitation needed in 82.3% newborns in case group & 22.4% of control group. On the other hand 67.7% newborns of case group needed NICU support where it is only 6.3% in control group. Death of newborn is 9.4% in case group & no death in control group.*

Conclusions: *In current study, the group comprising abnormal CTG finding showed significantly higher incidence of lower birth weight, immediate resuscitation, NICU support, longer stay in NICU and neonatal death. So we conclude that abnormal CTG is a good predictor of poor perinatal outcome.*

Key words: Cardiotocography *(CTG), Neonatal Intensive Care Unit (NICU), Caesarian Section (C/S), Normal Vaginal Delivery (NVD).*

INTRODUCTION

Cardiotocography is the graphic presentation of the fetal heart rate activity and the fetal hypoxia. It is the most commonly used test for antepartum and intrapartum fetal surveillance in the majority hospitals of developed countries.[1] This technology was first developed in 1950 and become commercially available in 1960. Clinicians originally anticipated the fetal heart rate (FHR) monitoring would solve two problems. First, it would serve as a screening test for severe asphyxia (i.e. asphyxia severe enough to cause neurological damage or fetal death). Second, FHR monitoring would allow recognition of early asphyxia, so timely obstetrics intervention could avoid asphyxia induced brain damage or death in the newborn.

The goal of antepartum surveillance for fetal asphyxia is the prediction, diagnosis and termination of pregnancies that are complicated with fetal asphyxia leading to fetal and newborn morbidity and death.[2]

Continuous electronic FHR monitoring during labor is superior to intermittent auscultation in terms of sensitivity and positive and negative predictive values.3 The higher sensitivity by electronic FHR (97% vs. 34%) in all fetuses with acidemia are expected to exhibit one or more heart rate pattern abnormalities. Because some of this abnormalities may be difficult to appreciate by auscultation (i.e. late deceleration or, decreased variability) 3 False negative rate of reactive CTG is low, 3 per 1000 similar to that of BPP.3 The negative predictive value is similar to that of BPP (99.5% for NST, 98.5% for BPP) but positive predictive value of an abnormal NST (37.0%) is better than other screening tests. Sensitivity of NST (70% vs. 34% is higher and significantly better. In addition, electronic FHR monitoring is significantly better in detecting all types of acidemia, metabolic (5.5%), mixed (95%) and respiratory (100%).[3] Great efforts have been made to increase the reliability of the antepartum non stress test (NST) in order to detect the fetal deterioration early. Yet visual interpretation of FHR records is associated with a high inter and intra observer variability that greatly reduces its accuracy.[4]

Contraction stress test (CST) is one of the forms of fetal surveillance; it is still the only form that tries to use the principle of induced stress to reveal marginal placental insufficiency. Clearly the CST should not be the only form of testing to follow high risk pregnancies.[5]With nipple stimulation it is an easy and quick method for evaluating the fetus4. However it's proved efficacy and close correlation with intrapartum monitoring make it an essential tool. In post term pregnancies, the bio-physical profile (BPP) appears to have higher intervention rates than the CST. Classification system

for electronic FHR monitoring tracing is capable of discriminating both healthy fetuses and those at risk for umbilical artery acidemia at birth and subsequent neonatal complication.[6]

From 70 to 90 percent fetal death occur before the onset of labour.7 NST is now a standard method of antepartum fetal surveillance while CST is used only in selected cases.[7] A large number of antepartum fetal testing by identifying the uteroplacental insufficiency and timely intervention has prevented many fetal death.[8] Similarly intrapartum fetal monitoring by detecting fetal distress in early stages has saved many fetuses from demise.[9] The criteria for the NST are base line between 120-160 bpm, the presence of periodic accelerations i.e. two accelerations in 20 minutes of fetal heart rate of 15 bpm over base line for 15 seconds, the absence of deceleration of the fetal heart rate, and subjective assessment of variability of fetal heart rate from 5-25 bpm.[10] NST is less expensive noninvasive and has a higher false positive and possibly false negative rate than BPP or CST.[7-10] Except in postdates pregnancy, the NST may be supportable based on outcomes. Technically more simple and less time consuming is now routinely used as a screening test while the CST is used as an additional test for definitive decisions.[7-10] It has surpassed oxytocin tress test due to its safety, convenience to the patient and the physician, noninvasiveness, easy interpretation, can be repeated without risk.[7-10]

METHODS

A prospective observational type of study was conducted on 384 pregnant women who were admitted at department of Obstatrics, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka during July, 2008 to December, 2008. Respondents who were advised for CTG were the study

population. Respondents who were given informed written consent and fulfilled the following inclusion and exclusion criteria were enrolled for this study. Inclusion criteria was: i) Pregnancy between 32-43 weeks of gestation ii) Singleton Gestation iii) One of the following indicated for FHR tracing present (a) History of prior stillbirth (b) Maternal medical indications e.g. DM, HTN, Renal disease, Collagen disease, Cardiac disease (c) Complications during pregnancy e.g Premature rupture of membrane, Pre-eclampsia, Abruptio placenta, Undiagnosed third trimester bleeding, IUGR, Oligohydramnios, Postdated pregnancy, Less fetal movement, Less fetal movement, Rh isoimmunization (d) Complications during labour e.g Prolonged labour, Meconium stained of amiotic fluid, Abnormal FHR by auscultation. And with following exclusion criteria: i) Multifetal pregnancy ii) Gestational age<32 weeks iii) Inability to obtain a satisfactory FHR tracing. Cardiotopography of all respondents was done and result was recorded on data collection sheet. Assessment of early neonatal outcome of all live births was done and recorded accordingly as outcome measures. After collection, data were checked for inadequacy, irrelevancy, and inconsistency. Data were analyzed by computer with the help of SPSS 13 software package. Statistical analyses were done by using appropriate procedure and tools like chi square test, student t test where applicable. Statistical significance was set at 0.05 level and confidence interval at 95% level.

RESULTS

Table 1: Distribution of the patients' age by group

Age (in years)	Group		p value*
	Case	Control	
<25	53 (27.6)#	47 (24.5)	
25-30	83 (43.2)	84 (43.8)	

>30	56 (29.2)	61 (31.8)	
Total	192 (100.0)	192 (100.0)	
Mean ± SD	28.03 ± 4.15	28.43 ± 4.28	0.358

*t test was done to measure the level of significant.
#Figure within parenthesis indicated in column percentage.

Out of all patients maximum 43.2% patients were within 25 to 30 years age group followed by 29.2% above 30 years and 27.6% up to 30 years age group. No statistical significance difference was observed in term of age between groups.

Table 2: Distribution of the patients' duration of pregnancy by group

Duration of pregnancy (in weeks)	Group		p value*
	Case	Control	
<37	64 (33.3)#	44 (22.9)	
37-40	98 (51.0)	119 (62.0)	
>40	30 (15.6)	29 (15.1)	
Total	192 (100.0)	192 (100.0)	
Mean ± SD	37.43 ± 2.45	38.40 ± 1.89	0.001

*t test was done to measure the level of significant.
#Figure within parenthesis indicated in column percentage.

Maximum patients of both groups were within 37 to 40 weeks range that was 51.0% and 62.0% respectively for both case and control group. Mean duration of pregnancy for case and control group was 37.43 and 38.4 weeks respectively. Duration of pregnancy in significantly lower in case group.

Table 3: Mode of delivery

Mode of delivery	Group		p value*
	Case	Control	
NVD	14 (7.3)#	44 (22.9)	0.001
C/S	178 (92.7)	148 (77.1)	
Total	192 (100.0)	192 (100.0)	

*Chi-square test was done to measure the level of significant.
#Figure within parenthesis indicated in column percentage.

Out of all patients of case group 92.7% had C/S and 7.3% had normal vaginal delivery and in control group 77.1% had C/S and 22.9% had NVD. Significantly higher C/S was observed in the abnormal CTG group.

Table 4: Birth weight of the babies

Birth weight	Group		p value*
	Case	Control	
<2.5	102 (53.1)#	28 (14.6)	
>2.5	90 (46.9)	164 (85.4)	
Total	**192 (100.0)**	**192 (100.0)**	
Mean ± SD	2.44 ± 0.67	2.78 ± 0.37	0.001

*t test was done to measure the level of significant.
#Figure within parenthesis indicated in column percentage.

Here 53.1 % of case group and 14.6% of control group had babies with a birth weight <2.5Kg and 46.9% of case and 85.4% had birth weight >2.5. Mean birth weight was 2.44 ± 0.67 and 2.78 ± 0.37 respectively for both case and control, which indicate that case group had a significant lower birth weight.

Table 5: Distribution of the patients' APGER score at 1 minute by group

Apger score at 1st minute	Group		p value*
	Case	Control	
Abnormal (<7)	146 (76.0)#	16 (8.3)	
Normal (>7)	46 (24.0)	176 (91.7)	
Total	192 (100.0)	192 (100.0)	
Mean ± SD	6.28 ± 0.78	7.61 ± 0.64	0.001

*t test was done to measure the level of significant.
#Figure within parenthesis indicated in column percentage.
Apger score at one minute was significantly lower in abnormal CTG group.

Table 6: Distribution of the patients' APGER score at 5 minute by group

APGER score at 5th minute	Group		p value*
	Case	Control	
Abnormal (<7)	11 (5.7)#	0 (.0)	

Normal (>7)	181 (94.3)	192 (100.0)	
Total	**192 (100.0)**	**192 (100.0)**	
Mean ± SD	7.72 ± 0.83	9.09 ± 0.60	0.001

*t test was done to measure the level of significant

#Figure within parenthesis indicated in column percentage

Abnormal Apger score at five minutes was present only in abnormal CTG group.

Table 7: Immediate resuscitation needed

Immediate resuscitation	Group		p value*
	Case	Control	
Needed	158 (82.3)#	43 (22.4)	0.001
Not needed	34 (17.7)	149 (77.6)	
Total	192 (100.0)	192 (100.0)	

*Chi-square test was done to measure the level of significant.

#Figure within parenthesis indicated in column percentage. Immediate resuscitation was needed in 82.3% newborns of case group and only 22.4% of control. The difference is significant in between case and control group.

Table 8: Distribution of the patients' clinical condition by group

Variables	Group		p value*
	Case	Control	
Diabetes mellitus	42 (21.9)	42 (21.8)	0.999
Hypertension	35 (18.2)	12 (6.3)	0.001
Collagen disease	0 (.0)	4 (2.1)	0.123**
Cardiac disease	12 (6.3)	4 (2.1)	0.041
Premature rupture of membrane	0 (.0)	15 (7.8)	0.001**
Pre-eclampsia	40 (20.8)	0 (.0)	0.001
Placenta previa	0 (.0)	14 (7.3)	0.001**
History of IUGR	47 (24.5)	0 (.0)	0.001**
Oligohydramnios	40 (20.8)	4 (2.1)	0.001
Polyhydramnios	11 (5.7)	0 (.0)	0.001**
Postdated pregnancy	35 (18.2)	44 (22.9)	0.256
Less foetal movement	105 (54.7)	40 (20.8)	0.001
Rh isoimmunization	14 (7.3)	7 (3.6)	0.116
History of prior still birth	0 (.0)	8 (4.2)	0.007**

*Chi-square test was done to measure the level of significant

**Fisher's exact test was done to measure the level of significant

#Figure within parenthesis indicated in column percentage.

Abnormal CTG was more found in patient with hypertension, IUGR, cardiac disease, pre-eclampsia PET, oligohydramnios, polyhydramnios, less foetal movement.

Table 9: Admission in neonatal intensive care unit needed.

Admission in neonatal intensive care unit	Group		p value*
	Case	Control	
Yes	130 (67.7)#	12 (6.3)	0.001
No	62 (32.3)	180 (93.8)	
Total	**192 (100.0)**	**192 (100.0)**	

*Chi-square test was done to measure the level of significant.
#Figure within parenthesis indicated in column percentage.
Admission in neonatal intensive care unit was significantly higher in abnormal CTG group.

Table 10: Duration of stay in NICU in case group.

Duration of stay in NICU	Abnormal	Normal	p value*
<7	54 (100.0)#	0 (.0)	0.112
>7	84 (95.5)	4 (4.5)	

Table 11: Distribution of the patients' condition of the baby during discharge by group

Out come at discharge	Group		p value*
	Case	Control	
Good	174 (90.6)#	192 (100.0)	0.001
Neonatal death	18 (9.4)	0 (.0)	
Total	**192 (100.0)**	**192 (100.0)**	

Out of all baby in case group 9.4% and in control group no death was recorded. The difference is highly significant.

Table 12: Different type of abnormal CTG in case group.

Types of abnormal CTG	Frequency	Percent
Tachycardia	68	35.4
Bradycardia	7	3.6
Absent beat to beat variability	108	56.3
Non-reactive	83	43.2
Deceleration	19	9.9

After CTG exploration in case group 35.4% had tachycardia, 3.6% had bradycardia, 56.3% had absent beat to beat variability, 43.25% had non-reactive CTG and 9.9% had deceleration.

DISCUSSION

The aim of the present study was to evaluate the neonatal outcome in the fetus with abnormal RCT, with a focus on the complicated/adverse perinatal outcome. Here perinatal outcome of fetus with abnormal CTG were compared with control of normal CTG.

Out of all patients maximum 43.2% patients were within 25 to 30 years age group followed by 29.2% above 30 years and 27.6% up to 30 years age group. In control group 43.8%, 31.8% and 24.5% respondents were within 25 to 30 years, above 30 years and up to 25 years respectively. No statistical significance difference was observed in term of age between groups.

Maximum patients of both groups were within 37 to 40 weeks duration of pregnancy range that was 51.0% and 62.0% respectively for case and control group. Mean duration of pregnancy for case and control group was 37.43 and 38.4 weeks respectively. No statistical significance difference was observed in term of duration of pregnancy between groups ($p<0.05$).

Out of all patients of case group 92.7% had cessarean section (C/S) and 7.3% had normal vaginal delivery (NVD) and in control group 77.1% had C/S and 22.9% had NVD. Statistically significant difference was observed between groups in term of mode of delivery, that is pregnancy with abnormal CTG needed higher rate of operative delivery.

146 (76.0%) of pregnant ladies of case group and 16 (8.3 %) of control had the Apgar score <7 at 1st minute, mean Apgar score at 1st minute was 6.28 ± 0.78 and 7.61 ± 0.64 in case and control respectively. 11 (5.7%) of patients of case group and

none of control had Apgar score <7 at 5th minute. Apgar score at both 1st and 5th minute was significantly less in case group.

In present series 53.1 % of case group and 14.6% of control group had babies with a birth weight <2.5Kg and 46.9% of case and 85.4% had Birth weight >2.5. Mean birth weight was 2.44 ± 0.67 and 2.78 ± 0.37, which indicate that case group had a significant poor outcome in terms of birth weight.

Immediate resuscitation was needed in 82.3% newborns of case group and only 22.4% of control, which shows a significant level of poor outcome in the group of abnormal CTG. 130 (67.7%) newborns of the cases with abnormal CTG needed the support of neonatal intensive care unit (NICU),whereas it is only 12 (6.3%) of the control.

At the time delivery we reported death of 18 (9.4%) newborn of the cases group and there no demise in the control group.

Here it is evident that abnormal CTG significantly indicate that there would be delivery of critically ill newborns, which require immediate resuscitation and care.

Hypertension, cardiac disease, IUGR, oligohydramnios, polyhydramnios and less foetal movement was present in a significantly higher rate in the case group mothers than that in controls.

In case group the major CTG abnormalities was present, tachycardia in 68 cases, bradycardia 7, absent beat to beat variability 108, non-reactive 83 and deceleration in 19 cases.

Comparing outcome CTG finding with baseline CTG, there is no significant difference in the group of abnormal CTG. Here it proves that abnormal CTG successfully predicts the poor perinatal outcome.

Curzen et al. (1984) in a prospective study of 6825 labors, documented the sensitivity of an abnormal CTG tracing where 35.2% for babies who needed intermittent positive pressure ventilation. They also suggested that cardiotocography

is more reliable in the first stage than in the second stage of labour. [11]

Noren et al. (2003) commented that cardiotocography plus ST analysis provides accurate information about intrapartum hypoxia and may prevent intrapartum asphyxia and neonatal encephalopathy by giving a clear alert to the staff members who are in charge.[12]

Although Pattison and McCowan summarized in their review article that, there is not enough evidence to evaluate the use of antenatal cardiotocography for fetal assessment. All of the trials included in this review date from the introduction of antenatal cardiotocography and may be difficult to relate to current practice (Pattison &McCowan, 2000).[13]Vetr et al. found that, the value of ante-partum CTG and Doppler flowmetry in the prognosis of neonatal hypoxia is low.[14]

Despite opposing comments of different authors towards and against the sensitivity of CTG findings, in the light of our findings we conclude that abnormal CTG is a successful predictor of poor perinatal outcome.

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