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# Antepartum Cardiotocography (CTG) in High Risk Pregnancy and Fetal Outcome at SZMCH, Bogura, Bangladesh

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**Abstract**
**Background:** Cardiotocography (CTG) is worldwide the method for fetal surveillance during labor. However, CTG alone shows many false positive test results and without fetal blood sampling (FBS), it results in an increase in operative deliveries without improvement of fetal outcome. FBS requires additional expertise, is invasive and has often to be repeated during labor. Two clinical trails have shown that a combination of CTG and ST –analysis of the fetal electrocardiogram (ECG) reduces the rates of metabolic acidosis and instrumental delivery.
**Objectives:** To observe the antepartum cardiotocography and fetal outcome in high risk pregnancy.
**Place of study:** Department of Obstetrics and Gynaecology, Shaheed Ziaur Rahman Medical College Hospital, Bogura, Bangladesh.
**Period of study: October** 2019 to March 2020.
**Study design:** Prospective cross sectional study.
**Methods:** It was a prospective cross sectional study carried out in the department of Obstetrics and Gynaecology, Shaheed Ziaur Rahman Medical College Hospital, Bogura, Bangladesh. Thereafter, they were scrutinized according to eligibility criteria and 60 patients were finalized. Sixty consecutive CTG tracings were collected from patients who were advised to perform CTG after admission. Statistical analysis was carried out by chi-square test. Level of significance was set at p value <0.05.
**Results**: This study shows highest percentage 20 (33.3%) of age group 21-25 years. The mean ±SD was 23.25±4.18. CTG shows 44(73.3%) had normal CTG and 16(26.7%) had abnormal CTG. Regarding birth weight 22 (36.7%) were <2.5 kg and 38(63.3%) were >2.5 kg. 15(25%) had apgar score <7 and 45 (75%) had Apgar score >7. There was significantly higher caesarean delivery, lower Apgar score, higher admission at neonatal unit among the abnormal CTG group.
**Conclusion:** This study shows lower APGAR score and low birth weight were associated with abnormal CTG. CTG can be continued as a good screening test of fetal surveillance but it is not the sole criteria to influence the management of high risk pregnancies. Abnormal CTG should be supplemented with other test before intervention.

**Keywords:** Antepartum Cardiotocography (CTG), High Risk, Pregnancy, Fetal outcome

## Introduction
Cardiotocography (CTG) is a graphical representation of fetal heart rate (FHR) and uterine activity (UA), also termed as electronic fetal monitoring, has been an indispensable part of antepartum and intrapartum fetal surveillance for four decades [1]. Cardiotocography (CTG) is a technical means of recording (-graphy) the fetal heart beat (cardio-) and the uterine contractions (-toco) during pregnancy, typically in the third trimester. The machine used to perform the monitoring is called a cardiotocography, more commonly known as an Electronic Fetal Monitor or External Fetal Monitor (EFM). CTG can be used to identify signs of fetal distress [2]. Cardiotocography (CTG) is worldwide method for fetal surveillance during labor. However, CTG alone shows many false positive test results and without fetal blood sampling (FBS), it results in an increase in operative deliveries without improvement of fetal outcome. FBS requires additional expertise, is invasive and has often to be repeated during labor. The current clinical practice of visual interpretation of CTG shows a high degree of inter-observer and intra-observer variability due to its large dependency on the expertise and experience of the clinician

(s) involved [1]. Antepartum cardiotocography (CTG) is the most frequently used method for fetal surveillance during labor. In high risk pregnancies antepartum fetal heart rate assessment can be used to predict fetal compromise. However, the false-positive rate can be as high as 60% for various reasons. Higher sensitivity might be achieved either by longer recording (fetal deep sleep phase) or by adding ultrasound Doppler [3]. Antepartum cardiotocographs (CTGs) were obtained at weekly intervals from 34 weeks onwards and twice weekly from 40 weeks onwards in normal pregnancies." A Hewlett-Packard cardiotocograph with narrow ultrasound beam was used for simultaneous recording of fetal heart rate and uterine activity. In the past few years the recording of antepartum cardiotocographs (CTGs) has emerged as one of the prime methods of evaluating fetal wellbeing is a great deal of attention has been devoted to its use in the surveillance of high risk pregnancy [4]. Intrauterine growth retardation (lUGR) is associated with fetal adverse conditions. The most important cause of growth restriction and poor perinatal outcome is chronic fetal hypoxemia (CFH). Adaptation to CFH can be studied by Doppler velocity waveform on umbilical and middle cerebral arteries and cardiotocography (CTG) [5]. Antenatal cardiotocography (CTG) in the management of high risk pregnancy was assessed. The use of antenatal cardiotocography (CTG) is now widely accepted as a method of monitoring fetal health and is regarded by some as the primary means of assessing fetal wellbeing. Many studies have shown an association between an abnormal antenatal CTG trace and poor fetal outcome. Progression from a normal trace to the appearance of repeated decelerations and finally intrauterine death has been recorded frequently. This has led to recommendations that antenatal CTG should be used on a routine basis, repeated at weekly or more frequent intervals in high risk pregnancy and even in low risk pregnancy. Normal pregnancies has a suspicious CTG trace on at least one occasion [6]. The use of routine antenatal CTG on a regular basis makes heavy demands on patients, staff and equipment. The technique may be of value if applied to a more highly selected group of patients for whom other methods of assessment are less appropriate, particularly those who are at high risk, who report a reduction in fetal activity. CTG is the most commonly used test for antepartum and intrapartum fetal surveillance in the majority hospitals of developed countries. But in our country it is used only in selected centres. There are very few studies on fetal outcome of antepartum CTG in high risk pregnancies in Bangladesh. So, this study has been designed antepartum cardiotocograph and fetal outcome in high risk pregnancy.

## Materials and Methods
**Study design:** Cross sectional observational study.
**Types of study:** It was a prospective cross sectional study.

**Place of study:** Department of Obstetrics and Gynaecology, Shaheed Ziaur Rahman Medical College Hospital, Bogura, Bangladesh.

**Period of study:** From October 2019 to March 2020.
**Study population:** This study was conducted among high risk pregnant women attending Department of Obstetrics & Gynecology in Shaheed Ziaur Rahman Medical College Hospital had been selected for this study after fulfill inclusion criteria.

**Sample size:** The sample size was determined to measure a given proportion with a given degree of accuracy at a given level of statistical significance by using the following formula. To determine the sample size, the formula is used;

$$n = \frac{z^2 pq}{d^2} = 59.53 \text{ (Estimated sample size)}$$

The duration of study is 6 months and collection of 59.53 case. For the examination purpose I was taken 60 cases as my sample size.

## Inclusion criteria
- Patients with high risk pregnancy (PIH, eclampsia, diabetes, IUGR, Thyroid disorder, heart disease, anaemia, BOH, Oligohyramnios, Postdated pregnancy, Diminished fetal movements, Premature rupture of membrane >6 hrs.).
- Gestational age (33 to 42 weeks).

## Exclusion criteria
- Patients with normal pregnancy.
- Multi fetal pregnancy.
- Gestational age <32 weeks.
- High risk pregnancy who went to labor.
- Pregnancy with congenital fetal anomalies.

## Operational definition
**Cardiotocography:** Cardiotocography (CTG) is a continuous recording of the fetal heart rate obtained via an ultrasound transducer placed on the mother's abdomen.

**High risk pregnancy:** High risk pregnancy is defined as one where pregnancy is complicated by factor or factors that adversely affects the outcome- maternal or perinatal or both.

## Procedures of collecting data
Data were collected by interview, brief history, general physical examination and sonographic finding using a structured questionnaire containing all the variables of interest.

## Procedures of data analysis
All the collected data were compiled and analyzed by statistical package for social science (SPSS-16) software. Test of significance was done by P value/ Chi square test.'P' values <0.05 was considered as statistically significant.

## Results

**Table 1:** Baseline characteristics of study subjects (N=60)

| Variables | Frequency | Percentage (%) |
|---|---|---|
| Age group (years) | | |
| ≤20 | 5 | 8.3 |
| 21-25 | 20 | 33.3 |
| 26-30 | 26 | 43.4 |
| 31-35 | 9 | 15.0 |
| Total | 60 | 100.0 |

| Occupational status | | |
|---|---|---|
| House wife | 47 | 78.3 |
| Service holder | 7 | 11.7 |
| Student | 6 | 10.0 |
| Total | 60 | 100.0 |
| Educational status | | |
| Illiterate | 3 | 5.0 |
| Class I-V | 13 | 21.7 |
| Class VI-SSC | 26 | 43.3 |
| Higher secondary | 17 | 28.3 |
| Graduate | 1 | 1.7 |
| Total | 60 | 100.0 |
| Method of delivery | | |
| Spontaneous | 20 | 33.3 |
| Caesarean section | 40 | 66.7 |
| Total | 60 | 100.0 |

Above table shows that highest percentage 26 (43.4%) of age group 26-30 years. Shows that majority patients 47(78.3%) were housewife. That educational status, 3(5.0%)) had illiterate, 13(21.7%) had primary level of education, 26(43.3%) had secondary, 17(28.3%) had higher secondary and 1(1.7%) had graduate level. Method of delivery, 20 (33.3%) were spontaneous and 40 (66.7%) were caesarean section.

**Table 2:** Distribution of fetal heart condition in study subjects (N=60)

| CTG | Frequency | Percentage (%) | p value |
|---|---|---|---|
| Normal CTG | 44 | 73.3 | 0.001 |
| Abnormal CTG | 16 | 26.7 | |
| Total | 60 | 100.0 | |

Above tables shows that fetal heart condition 44 (73.3%) had normal CTG and 16 (26.7%) had abnormal CTG. The differentiation was statistically significant (p<0.05).

**Table 3:** Distribution of liquor colour in the study subjects (N=60)

| Liquor | Frequency | Percentage (5%) |
|---|---|---|
| Normal colour | 37 | 61.7 |
| Light meconium | 16 | 26.7 |
| Deep meconium | 7 | 11.6 |
| Total | 60 | 100.0 |

Above table shows that liquor 37(61.7%) were normal colour, 16(26.7%) were light meconium and 7(11.6%) were deep meconium stained.

**Table 4:** Pregnancy status of the study subjects (N=60)

| Pregnancy status | Frequency | Percentage (%) |
|---|---|---|
| Chronic hypertension | 3 | 5.0 |
| Gestational HTN | 2 | 3.3 |
| Preeclampsia | 20 | 33.3 |
| Eclampsia | 10 | 16.6 |
| Diabetes | 9 | 15.0 |
| Heart disease | 1 | 1.7 |
| Anaemia | 7 | 11.7 |
| BOH | 3 | 5.0 |
| IUGR | 4 | 6.7 |
| Others | 1 | 1.7 |
| Total | 60 | 100.0 |

Above table shows that pregnancy status of the study subjects 3(5.0%) had chronic hypertension 2 (3.3%) had gestational HTN, 20 (33.3%) had preeclampsia, 10 (16.6%) had eclampsia, 9(15.0%) had diabetes, 1 (1.7%) had heart disease, 7 (11.7%) had anaemia 3 (5.0%) had BOH, 4 (6.7%) had IUGR and 1

(1.7%) had other disease.

**Table 5:** Distribution of fetal birth weight (N=60)

| Birth weight | Frequency | Percentage (%) | Mean ± SD |
|---|---|---|---|
| <2.5 kg | 22 | 36.7 | 2.54±0.46 |
| >2.5 kg | 38 | 63.3 | |
| Total | 60 | 100.0 | |

Above table shows that birth weight 22(36.7%) were <2.5 kg and 38(63.3%) were >2.5 kg.

**Table 6:** APGAR score at one minute (N=60)

| APGAR score | Frequency | Percentage (%) |
|---|---|---|
| ≤7 | 15 | 25.0 |
| ≥7 | 45 | 75.0 |
| Total | 60 | 100.0 |

Above table shows that APGAR score 15(25.0%) had <7 and 45(75%) had >7 at one minute.

**Table 7:** Relationship of CTG according to method of delivery (N=60)

| Mode of delivery | CTG | | | | Total | | p value |
|---|---|---|---|---|---|---|---|
| | Normal | | Abnormal | | No. | (%) | |
| | No. | (%) | No. | (%) | | | |
| Spontaneous | 19 | 43.1 | 1 | 6.2 | 20 | 33.3 | 0.007283 |
| Caesarean section | 25 | 56.9 | 15 | 93.8 | 40 | 66.7 | |
| Total | 44 | 100.0 | 16 | 100.0 | 60 | 100 | |

About table shows that 19 (43.1%) were spontaneous delivery and 25(56.9%) were caesarean section in normal CTG. On the other hand 15 (93.8%) were caesarean section and 1 (6.2%) had spontaneous delivery in abnormal CTG. The difference was statistically significant between normal CTG and abnormal CTG.

**Table 8:** Relationship of CTG according to birth weight (N=60)

| Birth weight | CTG | | | | Total | | p value |
|---|---|---|---|---|---|---|---|
| | Normal | | Abnormal | | No. | (%) | |
| | No. | (%) | No. | (%) | | | |
| <2.5 kg | 12 | 27.2 | 10 | 62.5 | 22 | 36.7 | 0.012279 |
| >2.5 kg | 32 | 72.8 | 6 | 37.5 | 38 | 63.3 | |
| | 44 | 100.0 | 16 | 100.0 | 60 | 100.0 | |

About table shows that cardiotocograph, 12 (27.2%) were normal CTG and 10 (62.5%) were abnormal CTG in birth weight <2.5 kg. On the other hand 32 (72.8%) were normal CTG and only 6 (37.5%) were abnormal CTG in birth weight >2.5 kg.

The differentiation was statistically significant between normal CTG and abnormal CTG. (p<0.05)

**Table 9:** Relationship of CTG according to APGAR score at one minute (N=60)

| APGAR score | CTG | | | | Total | | p value |
|---|---|---|---|---|---|---|---|
| | Normal | | Abnormal | | No. | (%) | |
| | No. | (%) | No. | (%) | | | |
| ≤7 | 2 | 4.6 | 13 | 81.2 | 15 | 25.0 | 0.0037 |
| ≥7 | 42 | 95.4 | 3 | 18.8 | 45 | 75.0 | |
| Total | 44 | 100.0 | 16 | 100.0 | 60 | 100.0 | |

About table shows that 2 (4.6%) had APGAR score ≤7 and 42 (95.4%) had APGAR score ≥7 in normal CTG. On the other hand 13 (81.2%) had APGAR score ≤7 only 3 (18.8%) had ≥7 in abnormal CTG. The differentiation was statistically significant between normal CTG and abnormal CTG. (p<0.05).

## Discussion

The goal of the obstetrician and neonatologist is not only to prevent fetal death by taking care of pregnant women but also to detect fetal compromise and to monitor timely delivery of such infant. Seventy to ninety percent of fetal deaths occurred before the onset of labor [7]. Although technology has made great advance in the field of antepartum fetal surveillance and intrapartum monitoring [8]. The diagnosis of fetal distress during labor cannot be assessed by any single clinical or laboratory measurement. CTG is the commonly used test for antepartum and intrapartum fetal surveillance in majority hospitals of developed countries although the clinical impact of cardiotocography on neonatal outcome remains controversial [9]. CTG provides direct information of fetal condition in contrast to other technique. The rationale behind this test is that it gives an indication via the cerebro-cardiac response of fetal cerebral activity that is modified in the presence of hypoxia. Acceleration of FHR is due to intact response CNS mechanism. The loss of FHR variability or decelerations reflects depression of this CNS mechanism. It is not only the result of fetal hypoxia and acidosis; it can be due to fetal sleep, fetal anomalies, sedative and narcotics to mother, which explain healthy outcome of non-reactive CTG. In spite of lack of specificity cardiotocography is a useful procedure for antepartum fetal surveillance and it remains the mainstay of intrapartum fetal assessment [8]. The purpose of this study was to observe the antepartum cardiotocography and fetal outcome in high risk pregnancy. Among the study population 8.3% was in age group ≤20 years, 33.3% in age group 21-25 years, 43.3% in age group 26-30 years and 15% in age group 31-35 years. The mean ±SD was 23.25±4.18. In this study, 73.3% had normal CTG and 26.7% had abnormal CTG. Khatun et al. study found abnormal CTG in 37.7% [10] and Bina I et al. found abnormal CTG in 20.7%. When the risk factors are more the over-all outcomes are more among the abnormal CTGgroup [11]. In this study it was seen that chronic hypertension, PIH, pre-eclampsia, eclampsia, BOH, diabetes, anaemia, IUGR abnormal outcomes were more and risk factors are interrelated, one predispose to others [12]. In the study APGAR score was <7 at 1 min among the babies of abnormal CTG group than normal CTG that was similar to the study done by Dellinger et al. [13] The difference in number of the babies with APGAR score <7 at 1 min was very significant in abnormal CTG group than normal CTG group which was similar to many other studies. Piazze et al. [14, 10, 12] suggest that FHR tracing may be correlated to a low APGAR score at 5 min in postdated pregnancy. APGAR scoring has been the

conventional means of evaluating the status of the infant at birth. It is usually assumed that this score reflects the degree of perinatal asphyxia. However recent studies [11] using cord blood analysis and fetal scalp blood pH have cast serious doubts on the reliability of APGAR scoring for asphyxia. An analysis of several published works on the subject gives the following approximate indexes of accuracy for the APGAR score in the prediction of hypoexemia: sensitivity 47% specificity 89%, positive predictive value 56% negative predictive values 86% [15]. This study found 12(27.2%) had normal CTG and 10(62.5%) had abnormal CTG in birth weight <2.5kg. On the other hand 32(72.8%) were normal CTG and 6(37.5%) were abnormal CTG in birth weight >2.5kg. Divon et al. study showed 53 in <4000g birth weight and 10 in >4000 g birth of abnormal CTG [16]. Many studies have shown an association between an abnormal antenatal CTG tracing and poor fetal outcome [14, 17-20]. In respect to mode of delivery, there was a high incidence of caesarean section in this study. The reason for high incidence of caesarean section in this study in spite of normal test result was due to obstetrical indications, like history of previous caesarean section, cephalopelvic disproportion, failed induction, severe preeclampsia and severe intrauterine growth retardation. Here caesarean delivery for fetal distress was significantly higher in abnormal CTG group, this finding is similar to the observation of Dellinger et al. study [13]. In the present study no perinatal death was observed in normal CTG and abnormal CTG group. The study did not attempt to demonstrate an ability to decrease caesarean delivery rates nor did it attempt to link electronic fetal monitoring with long term neurologic function and cerebral palsy. It only attempted to show the pregnancy outcome and early neonatal outcomes in case of normal and abnormal CTG cases.

## Conclusion

The present study showed that the APGAR score and birth weight was low among the babies with mothers having abnormal CTG. The proportion of immediate resuscitation and admission of the babies at neonatal care unit was higher among this group. Cardiotocograph provides direct information of fetal condition in contrast to other techniques. Cardiotocograph can be continued as a good screening test of fetal surveillance. If CTG shows abnormal pattern then antepartum CTG should be supplemented with biophysical profile and intrapartum CTG should be supplemented with fetal scalp blood sampling for acid base status before intervention. So it is needed to be careful in dealing with abnormal CTG, as these babies need further evaluation before final decision about their mode of delivery.

## Recommendation

This was a small study and further studies involving larger population group should be done. Fetal outcome were evaluated on the clinical and biochemical basis.

▪ CTG should be supplemented with other test like biophysical profile and fetal scalp pH before intervention.
▪ Another approach would be to quantify single parameters to determine a score. Extensive knowledge of the physiology and pathophysiology of the fetal cardiovascular regulation is essential for correct interpretation of fetal heart rate patterns. The preliminary warning by CTG for fetal decompensation is with 0-3 days, very short. Therefore, additive methods (Doppler ultrasound, amniotic fluid volume, kineto-CTG) for better preliminary warning should be used for high risk pregnancies. Continuous electronic fetal heart rate monitoring during labor leads to a significant

reduction in perinatal mortality due to fetal hypoxia and neonatal morbidity (neonatal seizures).

**Conflict of Interest**
Not available

**Financial Support**
Not available

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