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Original research article

Role of cardiotocography in improving maternal and fetal outcomes in high-risk pregnancy

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Abstract

Background: Given the demanding nature of labour, alterations in the cardiotocography (CTG) trace may be an indication of how the foetus is responding to continuous hypoxic or mechanical stressors, such as compression of the umbilical cord or a decrease in placental blood flow. Any foetus deemed to be at a "high risk" of experiencing intrapartum hypoxic damage requires constant foetal monitoring.

Objective: The aim of our study was to evaluate CTG in high-risk pregnancy and its correlation with maternal and fetal outcomes.

Methodology: Two hundred antenatal patients with ≥ 37 weeks period of gestation with high-risk pregnancies were included in the study. As per the RCOG guidelines, the CTG analysis of recruited patients was performed. Maternal and fetal outcomes were then correlated with the CTG.

Results: The mean age of the patients was 27.84 ± 4.58 years. Patients with non-reactive CTG found to have significantly high risk of premature rupture of membranes. Prolonged labour was also encountered significantly high in patients with non-reactive CTG. No significant difference in the mode of delivery was observed between patients with reactive or non-reactive CTG. APGAR score was significantly low in patients with non-reactive CTG. NICU admissions was also significantly high in patients non-reactive CTG.

Conclusion: A non-reactive CTG indicate a lack of fetal well-being, which may be due to various causes such as fetal distress, umbilical cord compression, or low fetal oxygenation. In present study, we found that patients with non-reactive CTG tends to have poor maternal and foetal outcomes compared to the patients with reactive CTG which indicate potential role of CTG in predicting outcomes in high-risk pregnancy.

Keywords: Cardiotocography, fetus, pregnancy, NICU, APGAR.

Introduction

Cardiotocography (CTG) is a commonly used technique for monitoring fetal well-being during pregnancy, particularly in high-risk pregnancies. The CTG records the fetal heart rate (FHR) and uterine contractions in real-time, providing important information about the health of the fetus. In high-risk pregnancies, CTG can play a crucial role in improving maternal and fetal outcomes by detecting any signs of fetal distress early, allowing for timely intervention and improving the chances of a successful outcome. In several ways CTG can improve maternal and fetal outcomes in high-risk pregnancies [1].

A non-reactive CTG trace can indicate fetal distress and allow for early intervention, such as delivery, which can improve the chances of a successful outcome. CTG can be also used to monitor the growth of the fetus, which can be a concern in high-risk pregnancies. A non-reactive CTG can indicate that the fetus is not growing properly, and the healthcare provider can take necessary steps to address this issue. CTG can be used to monitor uterine contractions during labor, which can be a concern in high-risk pregnancies. An abnormal pattern of contractions can indicate that the fetus is not in the best position for delivery, and the healthcare provider can take necessary steps to address this issue [2, 3].

CTG provides important information about the health of the fetus, which can guide clinical decisions regarding the management of high-risk pregnancies, such as the timing and mode of delivery. It is important to note that CTG is not a perfect test and false positive or false negative results can occur. It should be interpreted in conjunction with other clinical and obstetrical data and not used as a sole tool for decision making. Overall, CTG can play a significant role in improving maternal and fetal outcomes in

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high-risk pregnancies by providing important information about fetal well-being, guiding clinical decisions and enabling early intervention when necessary [4, 5].
Nowadays, CTG is a common way to check on the health of the foetus and it helps the obstetrician choose the best delivery approach to optimise the perinatal outcome. The aim of our study was to evaluate CTG in high-risk pregnancy and its correlation with maternal and fetal outcomes in our institute. Very few studies have been done on this subject in Himachal Pradesh therefore present study can be of helpful in improving the maternal and fetal outcomes in high-risk pregnancy on the basis of CTG. Based on this study after the admission CTG the plan of care of the patient can be modified well in time thereby improving outcomes.

Methodology

Study design: Total two hundred antenatal patients with ≥ 37 weeks period of gestation with high-risk pregnancies admitted in the department of obstetrics and gynaecology at the host institute were included in the study. Women with fatal congenital anomalies, fetal hypoxia like placental abruption, placenta previa with antepartum hemorrhage, cord prolapsed, uterine scar rupture, and abnormal lie at presentation were excluded from the study.

Data collection: Data regarding the demographic profile, socio-economic status, clinical complaints, menstrual history, obstetric history, medical history and family history was captured on predesigned semi-structured performa. CTG analysis was preformmed at the time of admission and maternal and fetal outcomes were analyzed at the time of birth of fetus.

Cardiotocography (CTG): The patient on being placed in dorsal supine position on admission CTG was done for 20 minutes and according to Royal college of Obstetrics and Gynaecology (RCOG) criteria of CTG the following parameters were assessed: baseline variability, acceleration and deceleration and for suspicious cases CTG tracing of >40 min was seen and decision was taken on this basis whether CTG reactive or nonreactive. If CTG trace is nonreactive then temporary corrective measures like intravenous fluids, left lateral position given to patients and a CTG trace of 40 minutes is taken. If repeat CTG remain nonreactive early intervention in form of operative or instrumental intervention taken as soon as possible. National Institute of Child health and Human Development proposed scaling factors of 30 beats per minutes (bpm) and 3cm/min chart recorder paper speed.

Statistical Analysis: The statistical analysis was carried out using SPSS 27.0. For quantitative variables, mean and standard deviation was used as measures of central tendency and variability respectively. For qualitative variable, fraction of total and percentages was calculated. Chi-square test was used to compare two qualitative groups and unpaired t-test was used to compare two quantitative groups. A p value <0.05 was considered as significant.

Results

The mean age of the patients was 27.84 ± 4.58 years. Among total 200 cases, 178 (89%) patients were homemaker and rest of 22 (11%) were working women. Socioeconomic status revealed that 4 (2%) patients belong to the lower class, 79 (39.5%) patients belong to the lower middle class, 48 (24%) patients belong to the upper lower class and 69 (34.5%) patients belongs to the upper middle class. Obstetric history revealed nullipara in 106 (53%) patients, ≤2 in 93 (46.5%) patients and >2 in 1 (0.5%) patient. Out of the patients who had conceived for the second or third time, 50 (47.5%) had previous normal vaginal deliveries, 1(.9%) had previous instrumental delivery, 43 (40.5%) women had prior delivery by caesarean section, 11 (10.3%) patients had abortions and 1 had a previous ectopic pregnancy. At the time of admission CTG trace was non-reactive in 60 (30%) patients and was reactive in 140 (70%) patients (Table 1).

Table 1: Demographic and clinical profile of the patients

Variable	Subdomain	Mean or N
Mean age		27.84 ± 4.58 years
Occupation	Homemaker	178 (89%)
	Working	22 (11%)
Socioeconomic status	Lower	4 (2%)
	Lower middle	79 (39.5%)
	Upper lower	48 (24%)
	Upper middle	69 (34.5%)
Obstetric history	Nullipara	106 (53%)
	≤2	93 (46.5%)
	>2	1 (0.5%)
Previous pregnancy	NVD	50 (47.5%)
	Instrumental delivery	1 (0.9%)

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	LSCS	43 (40.5%)
	Abortion	11 (10.3%)
	Ectopic	1 (0.9%)
Admission CTG	Non-reactive	60 (30%)
	Reactive	140 (70%)

Premature rupture of membrane (PROM) was observed in 32 (53.33%) patients with non-reactive CTG which was significantly high compared to the patients with reactive CTG i.e., 26 (18.57%). Prolonged labour was observed in 42 (70%) cases of non-reactive CTG which was significantly high compared to the patients with reactive CTG i.e., (17.2%). Operative mode of delivery was observed in 25 (41.7%) cases of non-reactive CTG and 63 (45%) cases of reactive CTG but the difference between the two group is not statistically significant (Table 2).

Table 2: Maternal outcomes in non-reactive and reactive CTG

Variable	Non-reactive CTG	Reactive CTG	P value
Premature rupture of Membrane	32 (53.33%)	26 (18.57%)	0.000*
Prolonged labour	42 (70%)	24 (17.2%)	0.001*
Operative mode of delivery	25 (41.7%)	63 (45%)	0.660

Fetal outcome indicate that the APGAR score was ≤ in 2 (3.28%) cases of non-reactive CTG which is significantly different from the reactive CTG cases where no fetus has the APGAR score ≤5. Also, NICU admission was observed in 40 (66.7%) cases of non-reactive CTG which is significantly higher compared to the reactive CTG cases i.e., 43 (30.7%) (Table 3).

Table 3: Fetal outcomes in non-reactive and reactive CTG

Variable	Non-reactive CTG	Reactive CTG	P value
APGAR ≤5	2 (3.28%)	0	0.029*
NICU admission	40 (66.7%)	43 (30.7%)	

Discussion

CTG is an important predictor of fetal hypoxia and can predict whether the fetus can bear the stress of labour or not. As the labour puts physiological burden on the fetus by compromising the blood supply with uterine contractions [6]. Hence we included high risk pregnancies in our study where the fetuses were at increased risk of hypoxic damage, so that we could plan timely intervention in these and improve the outcome of pregnancy [7]. We observed that 30% of the patients had non-reactive CTG trace as compared to 70% who had a Reactive CTG trace amongst all the high risk pregnancies we included in our study. Study done by Singh S *et al*. in 2020 included 100 cases amongst which 60% had reactive NST as compared to 40% who had non-reactive NST [8]. Study done by Gupta et al 63.2% patients had reactive CTG and 36.8% has non-reactive CTG [9].

In our study, 32(53.33%) women with PROM had non-reactive CTG trace and this was found to be statistically significant when compared to ones with reactive CTG trace. (p value <0.01). Study done by Rahman et al observed that 33.3% patients with PROM had non-reactive CTG trace [10]. similar study done by Lohana *et al*. observed 8.33% with reactive CTG and 2.78% patients with non-reactive CTG underwent LSCS in view of PROM [11].

Prolonged labour is also known as dystocia is a regular complication which we see in labour rooms. It is a frequent indication for instrumental delivery or caesarean section in emergency. We observed that amongst the 200 participants, labour was prolonged in 42 patients with a non-reactive CTG trace compared to only 24 with a reactive trace. Thereby showing a statistically significant correlation between the two (p value <0.01). Similar results were obtained in study done by Laughon *et al*. which said that there were 1.35 to 1.85 times more NICU admissions in the fetuses who were born after prolonged labour [12].

In present study, 58.3% participants had a vaginal delivery and 41.7% cases underwent operative delivery among 60 cases of non-reactive CTG. In 140 cases of reactive CTG, 55% cases underwent vaginal delivery and 45% patients underwent operative delivery. In the study by Thapa *et al*., among the reactive AT group of 95 cases, 37.9% underwent intervention in form of operative as well as instrumental deliveries [13]. The present study also exhibit similarity with the findings with Rahman *et al*., where in reactive AT group of 123 cases, 52.8% had normal vaginal delivery, 35.8% had LSCS and 11.4% had instrumental delivery [14]. According to Rahman *et al*. another research, only 5.5% of women in the reactive group, 27.8% of those in the equivocal group and 84.6% of those in the ominous group needed to have an operation to deliver a fetus in distress [10].

Our study observed that 3.28% babies who were born to mothers with a non-reactive CTG trace had a low APGAR score at 1 min and 5 mins which was found to be statistically significant. Hence showing us the importance of CTG a good indicator of fetal status and predictor of low APGAR scores. In the study

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by Thapa *et al*., out of 130 deliveries, 19.2% of babies had Apgar score <7 at 5 minutes after birth and the rest 80.8% had Apgar score ≥7 [13]. In a study by Rahman *et al*., 6.5% of the cases from reactive AT (admission test) group had babies with Apgar score <7 [14]. In a study done by Sandhu *et al*. in reactive AT group of 101 cases, 4% of babies had Apgar score <7 at five minutes after birth [15].

Out of the total 60 newborns of the mothers with non-reactive CTG trace 66.7% required NICU admissions with only 33.3% not requiring any NICU admissions. This was found to be statistically significant with a p value <0.01. In the Thapa *et al*., study out of 130 babies, 16.9% required resuscitation and 10.8% required NICU admission [13]. The results were consistent with the research conducted by Rahman *et al*., which found that the occurrences of NICU admission were considerably higher in infants born to mothers in the ominous test group (62%) than in the equivocal test group (28%) and reactive test group (3.45%) [14]. Neonatal admission to the NICU was necessary in 1 percent of cases with a reactive AT, 12 percent of cases with an equivocal AT, and 33 percent of cases with an ominous AT, according to research by Sandhu *et al*. [15]. In a research conducted in Lahore, Noreen et al. discovered that the majority of women who decelerated had the majority of abnormal outcomes, with 10% of newborns being referred to the neonatal intensive care unit [16].

In light of all the factors and findings, CTG is therefore a crucial tool for foetal monitoring during pregnancy. Even if surgical intervention is definitely on the rise, the relative decline in perinatal mortality rates allows us to save many infant lives in a timely manner, which is something every mother and obstetrician hope for. Based on the results of our study, we advise high-risk patients to employ CTG monitoring as a trustworthy method for predicting a positive perinatal outcome.

Conclusion

A non-reactive CTG indicates a lack of fetal well-being, which may be due to various causes such as fetal distress, umbilical cord compression, or low fetal oxygenation. In the present study, we found that patients with non-reactive CTG tends to have poor maternal and foetal outcomes compared to the patients with reactive CTG which indicate a potential role of CTG in predicting outcomes in high-risk pregnancy. Following CTG testing, an obstetrician should be able to determine whether the foetus is healthy and determine what steps need to be done. As a result, it has been determined that the admission test is a useful tool for identifying and predicting foetal distress before it manifests, and that it is linked to a higher likelihood of caesarean delivery.

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