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Original Article

Antepartal & Intrapartal CTG and Correlation with Feto-Maternal Outcome

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ABSTRACT

Introduction: *Cardiotocography (CTG) is a method of graphically (or "graph") recording fetal cardiac activity (also known as "cardio") and uterine contractions (also known as "toco"), both of which are constantly and at the same time scale captured during uterine quiescence and contraction. The scope of the method has now been greatly expanded to include the antenatal period as well, where uterine contraction is not a factor except when it is artificially generated just for the test as in contraction stress test. Although originally designed to monitor the fetus during labor to see how it performs in the face of the circulatory stress brought on by uterine contraction (CST).* ***Aim of the study:*** *The aim of the study was to observe the antepartal and intrapartal CTG findings, and their correlation with fetal and maternal outcomes.* ***Methods:*** *This prospective observational study was undertaken during the period July 2015 to July 2016 at the department of Obstetrics & Gynecology in Azimpur Maternity and Child Health Training Institute. A total of 100 patients were selected for the study and were divided in two equal groups, 50 patients with normal tracing and 50 patients abnormal tracing.* ***Result:*** *Regarding mother age, obstetric traits such gravidity, parity, and gestational age, there was no discernible difference between the normal and abnormal CTG groups. 100% of outcomes were abnormal when a CTG showed bradycardia and no beat-to-beat variability, whereas 72.22% of outcomes were bad when a CTG showed decelerations. While aberrant CTG is not very predictive of abnormal outcomes, normal CTG was more predictive of outcomes that were normal. CTG's sensitivity was greater than its specificity.* ***Conclusion:*** *The most prevalent test for antepartum and intrapartum foetal monitoring is CTG. The clinical influence of cardiotocography on neonatal outcome is still debatable. Further randomized trials with larger sample size are needed to confirm results of the present study.*

Keywords: *Cardiotocography, Pregnancy, Antepartal, Intrapartal, Fetal*

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INTRODUCTION

Cardiotocography (CTG) is a graphical ('graph') recording of fetal heart activity ('cardio') and uterine contraction ('toco'), both at the same time scale and continuously during uterine quiescence and contraction[1]. Though originally intended to monitor the fetus during labor to see how it performs in the face of the circulatory stress caused by uterine contraction, the scope of the method has now been widely expanded to include the antenatal period as well, where uterine contraction is not a factor unless it is artificially generated just for the test, as in the contraction stress test (CST)[2]. Cardiotocography, a groundbreaking method of prenatal monitoring, was invented in the late 1950s[3]. The main credit goes to the following two obstetricians - Professor G. S. Dawes and Professor R. Caldeyro Barcia of Uruguay. CTG became commercially available in 1960s[4]. While electronic monitoring was in progress for intrapartum and contraction stress test, investigators observed that when fetal heart rate increased with fetal movement , fetal outcome was invariably good. This reactivity of fetal heart rate to its movement was later recognized as good sign of fetal wellbeing just as absence of decelerations in oxytocin stress test and this laid foundation of the Non-Stress Test (NST) for antepartum fetal surveillance. In 1969 Kubli, Kaesar, Kinselman and Hammacher in Europe studied fetal heart rate fluctuations and oscillation in pregnancy without stress[5.] They observed that lack of fetal heart rate acceleration was associated with poor fetal outcome. Clinicians first expected FHR monitoring to remedy two difficulties. For starters, it would function as a screening test for severe hypoxia (i.e., asphyxia severe enough to cause neurological damage or fetal death). Second, FHR monitoring would allow recognition of early asphyxia so that timely obstetric intervention could avoid asphyxia-induced brain damage or fetal demise.

METHODS

This is a prospective observational study which was undertaken during the period July 2015 to July 2016 at the department of Obstetrics & Gynecology in Azimpur Maternity and Child Health Training Institute. Only patients >32 weeks pregnancy with or without labor pain who were admitted for delivery for different reason were included in the study. 50 patients with normal and 50 patients with abnormal tracings are selected. Their consent for enrolment were taken. Twin Pregnancy, congenital Malformation detected on USG, period of gestation <36 weeks were excluded. CTG was done with the use of cardiotocography instrument. The monitoring was done for 20 min. If the first report is nonreactive the tracing was repeated after change of maternal position, and maintaining adequate maternal hydration. Interpretation of CTG was based on FIGO recommendation (1987). In this study, 'normal CTG' was as like as normal CTG described by FIGO and 'abnormal CTG' included both suspicious and abnormal CTG as defined by FIGO. In a simple way, CTG was considered normal when the baseline heart rate was 110-160 bpm, beat to beat variability was 5-25 bpm and at least two accelerations of the fetal heart rate were present during a 20-minute period, each at least 15 beats above the baseline rate and lasting at least 15 seconds. Abnormal CTG included fetal tachycardia (>160 bpm), fetal bradycardia (FHR <110 bpm), reduced or absent beat to beat variability, late decelerations, and extreme variable decelerations. Deliveries were conducted either by vaginal route or by caesarean section depending upon the fetal heart rate tracings and their interpretations. At the time of delivery umbilical cord blood was taken for the pH analysis. All new born babies were seen by the pediatricians immediately after delivery. 1 and 5 minute APGAR scores as well as birth weights were recorded for each baby.

RESULTS

In this prospective study, fifty normal and fifty abnormal CTG were interpreted and correlated with pregnancy outcomes and early neonatal outcomes.

I would like to introduce the following tables

Table 1: Maternal age, Obstetrics & gestational age of study subjects

Variables	Normal CTG N=50 (Mean ±SD)	Abnormal CTG N=50 (Mean±SD)	t value	P value
Age (yrs)	26.25±6.65	27.35±3.15	1.06	>0.05
Parity	0.94±1.12	0.88±1.26	0.45	>0.05
Gravidity	2.56±1.68	2.47±1.61	0.29	>0.05
Gestational age(weeks)	38.02±1.54	37.62±2.66	0.88	>0.05

There was no significant difference between the normal and abnormal CTG groups regarding maternal age, obstetric characteristics like gravidity, parity and gestational age (Table-I)

Table 2: Abnormal fetal heart rate pattern & early neonatal outcomes

Types of abnormality in CTG	Number	Normal Outcome no (%)	Abnormal Outcome no (%)
Tachycardia	14	12 (85.72%)	2 (14.28%)
Bradycardia	2	0 (0%)	2 (100%)
Absent beat to beat variability	4	0 (0%)	4 (100%)
Nonreactive	12	6 (50%)	6 (50%)
Decelerations	18	5 (27.78%)	13 (72.22%)
Total	50	23 (46%)	27 (54%)

CTGs showing bradycardia and absent beat-to-beat variability were associated with 100% abnormal outcomes and CTGs showing decelerations were associated with 72.22% abnormal outcomes. (Table-3).

Table 3: Effect of glycaemia on CTG

Groups	Association with Diabetes mellitus (N)	Controlled blood sugar (F<6.0mmol/l, ABF<7.8mmol/1)	Uncontrolled blood sugar (F>6.0 mmol/l, ABF>7.8mmol/1)
Normal CTG (N)	34	30 (88.23%)	4 (11.76%)
Abnormal CTG (N)	32	21 (65.62%)	11 (34.37%)
Z/P values		2.26/<0.01	2.26/<0.01

Table 4: Overall Outcomes of normal and abnormal CTG

Group	Normal Outcomes Of neonates	Abnormal Outcomes Of neonates
Normal CTG (N=50)	46	4
Abnormal CTG (N=50)	23	27

Sensitivity 87%, Specificity 66%, Positive predictive value 54%, Negative predictive value 92%. Normal CTG was more predictive of normal outcomes but abnormal CTG is not much predictive of abnormal outcomes. Sensitivity of CTG was more than its specificity (table 4).

Table 5: Mode of delivery across the two electronic fetal monitoring groups

Variables	**Delivery by LUCS**	**Vaginal delivery**
Normal CTG (N)	26 (52%)	24 (48%)
Abnormal CTG(N)	39 (78%)	11 (22%)
Z/P values	2.82/<0.01	2.82/<0.01

There was significant difference between the two electronic fetal monitoring groups regarding mode of delivery. Caesarean section was more in abnormal CTG groups (Table-5).

Table 6: Comparison of pregnancy finding and outcome between normal & abnormal CTG

Variables	Normal CTG N=50 No (%)	Abnormal CTG N=50 No (%)	Z value	P value
Caesarean delivery	26 (52%)	39 (78%)	2.83	<0.01
Less fetal movement	4/26 (15%)	20/39 (51.2%)	3.41	<0.01
Oligohydra-mnios	3 (6%)	16 (32%)	3.51	<0.01
Meconium stained liquor	2 (4%)	11 (22%)	2.64	<0.01

Table 6 shows comparison of pregnancy outcomes between normal and abnormal CTG groups. 26(52%) VS 39(78%) had caesarean delivery, 4/26(15%) VS 20/39(51.2%) had caesarean delivery for fetal distress, 3(6%) VS 16(32%) was associated with oligohydramnios, 2(4%) VS 11(22%) had meconium stained liquor. There was significant difference in above mentioned criteria between the two groups.

Table 7: Distribution of early neonatal outcomes of the two electronic fetal monitoring groups

Outcomes		Normal CTG		Abnormal CTG		Chi square value	P value
		Yes	No	Yes	No		
1 min Apgar Score (< 7)		2	48	16	34	11.44	<.001
5 min Apgar Score (< 7)		1	49	8	42	4.25	<0.05
Small for gestational age		4	46	16	34	7.54	<0.01
Admission into NICU		4	46	15	35	6.48	<0.05
Duration of stay in NICU	≤ 7 days	4		10			
	> 7 days	0		5			
Perinatal mortality		0	50	3	47	1.36	>

The distribution of early neonatal outcomes of the two electronic fetal monitoring groups has been shown in Table - 8. Low 1 minute Apgar score was found on 2 occasions during 50 normal CTG. Of the 50 abnormal CTG, 16 neonates were observed to have depressed evaluations. A statistically significant difference was observed when normal and abnormal CTG were compared. Low 5 minutes Apgar score was observed in 1 neonate out of 50 normal CTG results and in 8 neonates out of 50 abnormal CTG. Statistically significant differences was observed when normal and abnormal CTG results were compared. 4 small for gestational age in neonates were identified out of 50 normal CTG and 16 neonates out of 50 abnormal CTG results. Statistically significant (P< 0.01) difference between the normal and abnormal CTG results were observed in predicting IUGR (Table- 8). No neonate was admitted more than seven days in normal CTG groups and five neonates in abnormal CTG groups were admitted more than seven days in NICU. Out of 50 normal CTG, there was no perinatal death. In case of 50 abnormal CTG results there were 3 perinatal deaths. There was no statistically significant (P>0.05) difference between normal and abnormal CTG results. 4 out of 50 normal CTG neonates and 15 out of 50 abnormal CTG were admitted into NICU. A statistically significant (P<0.05) difference was observed when normal and abnormal CTG results compared.

DISCUSSION

In spite of lack of specificity cardiotocography is a useful procedure for antepartum and intra partum fetal assessment[13]. The purpose of this study was to test the ability of a CTG to predict pregnancy outcomes and early neonatal outcomes. There Was No Significant difference between the two CTG groups regarding the mean maternal age, parity, gravidity and gestational age which were similar to many published studies such as

by Dellinger el al[19]. Both the groups included patients who were relatively elderly and of low parity. Though the mean gestational age of the two CTG groups showed no significant difference, but in abnormal CTG group the frequently observing gestational age was lower than the normal CTG groups because of early intervention was taken by observing the abnormal fetal heart rate pattern. CTG showing only tachycardia, 14.28% showed abnormal outcomes. It is the early sign of foetal distress[2]. As interventions were taken early outcomes were good. Significant bradycardia was seen in 2 (4%) cases. Hurban et al[20] and Seidenari et al[21] in their study showed that significant bradycardias were observed in 1-2 percent of all CTGs. In these studies both the CTGs showing bradycardia were associated with abnormal outcomes. Gee et al[18] in his study showed that, bradycardia was associated with increased morbidity and mortality. Bradycardia has the higher positive predictive value for fetal compromise than nonreactive CTGs [2]. In this study, all the tracings showing absent beat to beat variability showed abnormal outcomes. Studies. done by Shields et al[22] demonstrated that the fundamental component of ominous fetal heart rate pattern is absent or markedly decreased fetal heart rate variability. In this study showed that nonreactive CTG were associated with 50% abnormal outcomes which is similar to the studies done by Chakrabarty et al[10]. Ansari et al[11], Housseine et al[12]. CTGs showing decelerations were associated with 72.22% abnormal outcomes. In this study deceleration included variables decelerations and late decelerations. When the risk factors are more the overall abnormal outcomes are more among the abnormal CTG group[14]. In this study it was seen that when diabetic patients developed preeclampsia and intra uterine growth retardation abnormal outcomes were more, and the risk factors are interrelated, one predispose to others. In this study, it was observed that normal CTG was extremely predictive of normal outcomes, and negative predictive value was 92% which is similar to many published studies like Dellinger et al[19]. Thacker[24] observed the negative predictive value was 99.7%. In this study positive predictive value was 54% and in Thacker[24] it was 50%.The present study showed that among the fifty normal tracings, abnormal outcomes were four and normal outcomes were forty six and out of fifty abnormal tracings number of abnormal outcomes were twenty seven and normal outcomes were twenty three. The sensitivity of CTG was 87%, specificity was 66%. This proves CTG was highly sensitive but the specificity was relatively poor which is similar to numerous works done by others. CTG is good for detecting the fetus at risk for asphyxia but the vast majority of new born with abnormal fetal heart rate patterns are not asphyxiated at birth[1]. 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, severe preeclampsia and severe intra uterine growth retardation. This study showed that there was significant difference between the normal and abnormal CTG groups regarding the mode of delivery and caesarean delivery for fetal distress, which was similar to the observation of Dellinger et al[19]. The association of oligohydramnios, meconium stained liquor and small placenta were more in abnormal CTG group than normal CTG which was similar to study done by Platt et al but differ with Dellinger et al[19]. Reduced liquor volume before labor is considered an indication of placental insufficiency and during labor it is associated with an increased incidence of FHR decelerations. In the past, the presence of meconium in the amniotic fluid was considered to be a sign of fetal hypoxia. However, most of the recent literature tends to disregard the

importance of intrapartum meconium as a sign of fetal hypoxia. Divia et al.[15] in his study showed that about 50% of the intrapartum meconium cases is an insignificant finding in contrast thick meconium is suggestive of fetal hypoxia. Though thick meconium is regarded as normal in breech presentation. Apgar score at <7 at 1 minute was 4% among normal CTG group which was 5.1% showed by the Dellinger et al[19] and 3.5% showed in the study done by Rana[5]. Among the abnormal CTG group, Apgar score at 1 minute was 32%, 31 % and 20% showed in this study, study done by Rana5 and Dellinger et al[19] respectively. Apgar score <7 at 5 minute among the normal CTG group was 2%, 2%, 1% respectively and Apgar score <7 at 5 minute among the abnormal CTG was 16%, 17.1% and 5% in this study, study by Rana[5] and Dellinger et al[19]respectively. It is seen that low Apgar score at 1 and 5 minute is more or less same in this study and study done by Rana[5] slightly differ with Dellinger et al[19] because they studied CTG from all types of patients not only the high risk cases. The PNM rate in the present study was significantly lower than the PNM in other teaching center of Bangladesh. Timely intervention according to CTG and in most of the cases Biophysical profile results may be the reasons for such variation. This 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 attempts to show the pregnancy outcome and early neonatal outcomes in case of normal CTG and abnormal CTG cases.

Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

Cardiotocography machines are certainly required in the labor room. Equally important is the proper interpretation of the CTG tracings so that unjustified caesarean sections can be minimized. Although the clinical impact of cardiotocography on neonatal outcome remain controversial, CTG is the most commonly used test for antepartum and intrapartum foetal surveillance. The rational behind this test is that it gives an indication via the cerebro-cardiac response of foetal cerebral activity which is modified in the presence of hypoxia. However, it is not only the result of foetal hypoxia and acidosis, it can be due to foetal sleep, foetal anomalies, sedative and narcotics to mother which explain healthy outcome of nonreactive CTG. As the present study included small sample size and early neonatal outcomes were evaluated on the clinical basis, further randomized study with larger sample size and early neonatal outcomes also on biochemical basis like umbilical cord blood gas analysis, fetal scalp pH may further confirm the results of the present study and will be more informative.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. *Parer JT, King T. Foetal heart rate monitoring: Is it salvageable? Am J Obstet Gynecol 2000; 182:982-7*
2. *Gabbe SG, Niebyl JR, Simpson JL, Landon MB, Galan HL, Jauniaux ER, Driscoll DA, Berghella V, Grobman WA. Obstetrics: normal and problem pregnancies e-book. Elsevier Health Sciences; 2016 Mar 18.*
3. *Krupa N, MA MA, Zahedi E, Ahmed S, Hassan FM. Antepartum fetal heart rate feature extraction and classification using empirical mode decomposition and support vector machine. Biomedical engineering online. 2011 Dec;10(1):1-5.*
4. *Resnik R. Electronic fetal monitoring: the debate goes on... and on... and on.*

Obstetrics & Gynecology. 2013 May 1;121(5):917-8.

5. *Rana S. Obstetrics and perinatal care for developing countries. SAF Publications; 1998.*
6. *Freeman RK, Garite TJ, Nageotte MP, Miller LA. Fetal heart rate monitoring. Lippincott Williams & Wilkins; 2012 Sep 26.*
7. *O'Brien K, Robson K, Bracht M, Cruz M, Lui K, Alvaro R, da Silva O, Monterrosa L, Narvey M, Ng E, Soraisham A. Effectiveness of family integrated care in neonatal intensive care units on infant and parent outcomes: a multicentre, multinational, cluster-randomised controlled trial. The Lancet Child & Adolescent Health. 2018 Apr 1;2(4):245-54.*
8. *Belfort MA, Saade GR, Thom E, Blackwell SC, Reddy UM, Thorp Jr JM, Tita AT, Miller RS, Peaceman AM, McKenna DS, Chien EK. A randomized trial of intrapartum fetal ECG ST-segment analysis. New England Journal of Medicine. 2015 Aug 13;373(7):632-41.*
9. *Kamala BA, Kidanto HL, Wangwe PJ, Dalen I, Mduma ER, Perlman JM, Ersdal HL. Intrapartum fetal heart rate monitoring using a handheld Doppler versus Pinard stethoscope: a randomized controlled study in Dar es Salaam. International journal of women's health. 2018;10:341.*
10. *Chakraborty B, Mondal TK, Barman SC, Rudra BP, Sahana RA, Mondal PC. Evaluation of Perinatal Outcome by Antenatal CTG and Umbilical Artery Doppler in Preeclamptic Mothers. Indian Journal of Clinical Practice. 2013 Nov;24(6):559-65.*
11. *Ansari RS, Kosar S. The Neonatal Outcomes in Women with Non-Reactive Cardiotocography. Journal of The Society of Obstetricians and Gynaecologists of Pakistan. 2019 Dec 12;9(3):158-63.*
12. *Housseine N, Punt MC, Browne JL, Meguid T, Klipstein-Grobusch K, Kwast BE, Franx A, Grobbee DE, Rijken MJ. Strategies for intrapartum foetal surveillance in low-and middle-income countries: A systematic review. PloS one. 2018 Oct 26;13(10):e0206295.*
13. *Krishna UR, Tank DK, Daftary S, Shah D. Pregnancy at risk: Current concepts. New Delhi: Jaypee Bros.; 2004.*
14. *DeCherney AH, Pernoll ML. Current Obstetric & Gynecologic Diagnosis & Treatment 1994. East Norwalk, CT: Appleton & Lange; 1994.*
15. *Divia A. Study on risk factors and perinatal outcome in meconium stained liquor in IOG (Doctoral dissertation, Madras Medical College, Chennai).*
16. *Bishop F : Foetal acceleration test. Am J Obstet Gynecol 141: 905,1981.*
17. *Lavin J Miodovnik M, Barden T. Relationship of non stress test reactivity and gestational age. Obstet Gynecol : 63: 338,1984*
18. *Gee AH, Barbieri R, Paydarfar D, Indic P. Predicting bradycardia in preterm infants using point process analysis of heart rate. IEEE Transactions on Biomedical Engineering. 2016 Nov 24;64(9):2300-8.*
19. *Dellinger EH, Boehm FH, Crane MM. Electronic fetal heart rate monitoring. Early neonatal outcomes associated with normal rate, fetal stress, and fetal distress. Am J Obstet Gynecol 2000 ;I82,214-20.*
20. *Hruban L, Janků P, Jordanova K, Huptych M, Jouzova A, Gerychova R, Ventruba P. The effect of transient fetal bradycardia and other heart rate changes during and after external cephalic version on perinatal outcomes. European Journal of Obstetrics & Gynecology and Reproductive Biology. 2020 Feb 1;245:39-44.*
21. *Seidenari A, Cavoretto PI, Carbone IF, Germano C, Iurlaro E, Gaeta G, Cetera GE, Amodeo S, Morano D, Masturzo B, Di Martino DD. The cumulative incidence of neonatal metabolic acidemia after terminal bradycardia in the 2nd stage of labor: a survival-based model. Archives of Gynecology and Obstetrics. 2022 May 30:1-8.*
22. *Shields JR. , SchiFrin BS : Perinatal antecedents of cerebral palsy . Obstet Gynecoll 988: 71:899-905 ,*
23. *Langer O, Vega-Rich M, Cohess W : Terminal pattern : characteristics and management Am J Pennatol 1985:2:300-304.*
24. *Thacker SB Efficiency of intrapartum monitoring. Am J Obstet and Gynecoll 56: 24-30, 1987.*