Original Research Article

Relationship between Abnormal CTG Findings and Perinatal Outcome

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Abstract

Background: Continuous monitoring of fetal well-being through cardiotocography (CTG) is a standard practice in antenatal care, aiming to detect and manage potential complications. However, interpreting CTG patterns requires expertise and understanding, especially in diverse clinical settings such as those in Bangladesh. *Objective*: To assess normal and abnormal CTG patterns and their implications for perinatal outcomes in a tertiary level hospital in Bangladesh. *Methods*: A cross sectional study was conducted on CTG recordings of pregnant women admitted to the antenatal unit of a tertiary level hospital in Bangladesh from January 2024 to June 2024. CTG pattern was abnormal based on established criteria. Perinatal outcomes including fetal distress, neonatal outcomes, and obstetric interventions were recorded and analyzed in relation to CTG findings. The aims of the study were to evaluate the abnormal cardiotocography (CTG) patterns during the antenatal period and their impact on perinatal outcomes at a tertiary level hospital in Bangladesh. *Results*: The incidence of fetal distress was significantly higher in cases with abnormal CTG patterns compared to normal patterns ($p<0.05$). Furthermore, neonatal outcomes such as Apgar scores <7 at 1 minute and 5 minutes were more prevalent in pregnancies with abnormal CTG patterns. Among the abnormal CTGs groups, who had more risk factors abnormal outcomes were more. Most of the patients in both the normal and abnormal CTGs groups were associated with DM. In abnormal CTGs groups pre-eclampsia, PROM Many pregnant women had other risk factors associated with DM. *Conclusion*: This study highlights the importance of accurately assessing CTG patterns in the antenatal period for predicting perinatal outcomes. The identification of abnormal CTG patterns can aid in timely interventions to prevent adverse outcomes for both the mother and the newborn.
Keywords: CTG Patterns, NICU, Cardiotocography.

INTRODUCTION

Cardiotocography (CTG), a noninvasive method, is used to determine the fetal oxygenation level upon admission to the labor ward [1]. Elaborate Cardiotocography (CTG) is the most commonly used test for antepartum and intrapartum fetal surveillance because it gives information via the cerebro-cardiac response of fetal cerebral activity, which is modified by the hypoxia [2]. Cardiotocography (CTG) records changes in fetal heart rate and their temporal relation with uterine contractions [3]. It utilizes Doppler ultrasound transducer to detect changes in fetal heart rate pressure transducer to detect uterine contractions. Alteration in fetal heart rate commonly denotes

shortage of oxygen to fetus (fetal hypoxia). Advantages of CTG are that it gives a written record of fetal heart activity in relation to uterine contractions and also it can be used continuously unlike Pinard or handheld Doppler device. Thus, it is useful in labor where uterine contractions can affect placental circulation to blood supply to the fetus. Therefore, fetuses that may be compromised or potentially compromised, by shortage of oxygen can be detected prior to the delivery by use of cardiotocography hence clinicians can implement necessary interventions at an early stage of labour [4]. Prenatal asphyxia continues to be a major issue that contributes significantly to prenatal morbidity and mortality, even with the advances in perinatal care over the previous few decades. Thus, it is crucial to monitor

the fetus during the intrapartum phase. Cardiotocography is a type of electronic foetal monitoring that records both uterine contractions and the heart rate of the developing foetus simultaneously [5].

Therefore, foetal monitoring during the intrapartum period is of paramount importance. Antepartum and intrapartum fetal surveillance is the best way to reduce perinatal morbidity and mortality. Foetal monitoring can be done by various methods like intermittent auscultation of foetal heart rate, electronic foetal monitoring in form of cardiotocography (CTG), biophysical profile, modified biophysical profile, contraction stress test, doppler velocimetry foetal scalp blood PH, and serum lactate level [6, 7].

This recording is done by placing foetal and toco transducers on the mother's abdomen for 20 minutes [8]. However, the subsequent researches showed mixed results. Continuous CTG during labour was associated with a reduction in neonatal seizures but no significant difference in cerebral palsy, infant mortality, or other standard measures of neonatal wellbeing was found [9]. Studies have shown that asphyxia and hypoxic-ischemic encephalopathy (HIE) in 79% of cases were associated with an abnormal CTG [10]. This study will be evaluating the role of CTG within 12 hours of delivery in predicting the adverse neonatal outcome.

METHODOLOGY

This was a prospective descriptive study conducted form January 2024 to June 2024, focused on foetal outcome and abnormal cardiotocography (CTG) patterns among antenatal patients admitted to the obstetrics department at Bangladesh Medical College & Hospital in Dhaka. We systematically collected 50 consecutive normal and 50 consecutive abnormal CTG tracings from antenatal patients admitted to the obstetrics department were included in this study. The aims of the study were to evaluate the abnormal cardiotocography (CTG) patterns during the antenatal period and their impact on perinatal outcomes and to comprehensively assess abnormal CTG patterns in the antenatal period among pregnant women aiming to understand their implications for perinatal outcomes. A predetermined data collection sheet was utilized to systematically gather all essential clinical information and data pertaining to the study. By adhering to this predetermined format, we ensured consistency and accuracy in recording the necessary clinical variables and parameters relevant to the assessment of cardiotocography (CTG) patterns among antenatal patients.

RESULTS

In terms of age in year, the abnormal CTG was 25.39+4.21 years, while the normal CTG was 26.74+5.28 years (p>0.05). The abnormal CTG group had parity 1.35+0.75, while the normal CTG group had parity 1.26+1.05 (p>0.05). There was no statistically significant difference in gravida or gestational age between the abnormal and normal CTG groups (p>0.05) (Table-I). Figure 1 shows common abnormality tachycardia (14%), absent beat to beat variability (32%), non-reactive 28% and decelerations 26%. In abnormal CTG, there were significantly more APGAR scores <7 in 1min and 5min compared to normal CTG (p < 0.001). Small for gestation age: 05 (10%) in normal CTG and 15 (30%) in abnormal CTG (p<0.05). NICU admission rates were greater in the abnormal CTG group than in the normal CTG group, at 8 (16%) and 20(40%), respectively. There was no significant relationship between duration of NICU admission and perinatal morality, but the percentile was greater in the abnormal CTG group (p>0.05) (Table-II). Among the abnormal CTGs groups, who had more risk factors abnormal outcomes were more. Most of the patients in both the normal and abnormal CTGs groups were associated with DM. In abnormal CTGs groups pre-eclampsia, PROM Many pregnant women had other risk factors associated with DM (Figure -2).

Table I: Maternal age, gestational age and obstetric characteristics of the study group

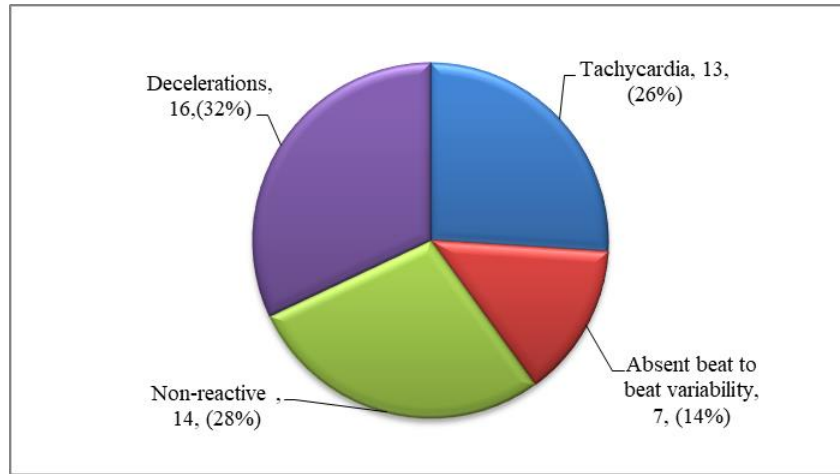| Variables	Study group		p value
	Abnormal CTG Mean ±SD	Normal CTG Mean ±SD	
Age (Year)	25.39+4.21	26.74+5.28	0.16
Parity	1.35+0.75	1.26+1.05	0.62
Gravidity	1.92+1.27	1.79+1.15	0.59
Gestational Age	37.53+2.69	36.58+2.39	0.06

Figure 1: Major abnormality in CTG (n=50)

Table II: Normal and abnormal fetal heart rate outcomes

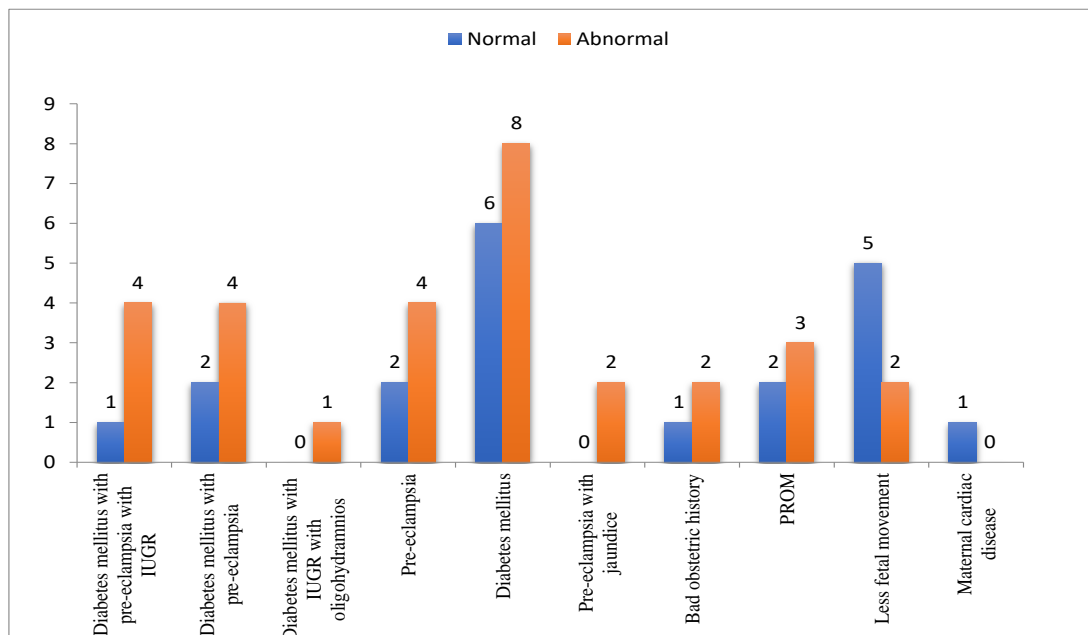| Outcomes	Normal CTG n=50 (%)	Abnormal CTG n=50(%)	Total	p value
1 min APGAR score<7	2 (4)	17 (34)	19	0.001
5 min APGER Score<7	1 (2)	8 (16)	9	0.01
Small for gestational age	5 (10)	15 (30)	20	0.02
Admission in NICU	8 (16)	20 (40)	28	0.008
Duration of stay in NICU				
≤5 days	7 (14)	14 (28)	21	0.63
>5 days	01 (02)	06 (12)	7	
Perinatal Mortality	01 (02)	03 (06)	4	0.61

Figure 2: Influence of risk factors on outcomes with abnormal study group

DISCUSSION

The presented cross-sectional research delves into abnormal cardiotocography (CTG) patterns and their implications on pregnancy and newborn outcomes.

The study scrutinized various variables, including maternal age, parity, gravidity, gestational age, glycemic control, and obstetric characteristics, to discern any discernible patterns.

In this study observed that age in year, the abnormal CTG was 25.39+4.21 years, while the normal CTG was 26.74+5.28 years (p>0.05). The abnormal CTG group had parity 1.35+0.75, while the normal CTG group had parity 1.26+1.05 (p>0.05). There was no statistically significant difference in gravida or gestational age between the abnormal and normal CTG groups (p>0.05). Sarmin *et al.,* [2] study, it was observed that the majority of 19(38.0%) of the patients belonged to 21-25 years, and their mean age was 26.60±6.9 years with a range from 18-42 years. Similarly, Khatun *et al.,* [11] and Kaban *et al.,* [12] found that the mean age of the patients was 26.7±4.9 years and 27.82 ± 5.29 years, respectively, which closely resembled the current study. Sarmin *et al.,* [2] Regarding parity, it was observed that the majority (42.0%) of patients had para 1, followed by 24.0% para 2, 20.0% para 3, and 14.0% patients had para ≥4. Rahman also made similar observations regarding parity [13]; Westerhuis *et al.,* and Kaban *et al.,* found that the majority of abnormal cardiotocography (CTG) was found in primigravida [12, 14]. The frequently observed gestational age was lower than the normal CTG group because early intervention was taken by observing the abnormal fetal heart rate pattern obtained by Khatun *et al.,* [11].

Common abnormalities in this study include tachycardia (14%), non-reactive 28%, decelerations 26%, and no beat-to-beat variability (32%). Sen M *et al.,* [15] according to types of abnormal CTG more than one third (34.0%) patients had decelerations abnormal CTG, 10(20.0%) had non-reactive (absent of accelerations), 11(22.0%) had tachycardia. According to abnormal fetal heart rate pattern and early neonatal outcome it was observed in this present study that tachycardia was found 11 cases out of which 90.0% in normal outcome and 9.1% abnormal outcome.

In abnormal CTG, there were significantly more APGAR scores <7 in 1min and 5min compared to normal CTG (p < 0.001). Small for gestation age: 05 (10%) in normal CTG and 15 (30%) in abnormal CTG (p<0.05). NICU admission rates were greater in the abnormal CTG group than in the normal CTG group, at 8 (16%) and 20(40%), respectively. There was no significant relationship between duration of NICU admission and perinatal morality, but the percentile was greater in the abnormal CTG group (p>0.05). In Indiramani study NICU admission were 55.9% in patient with abnormal CTG pattern as compared to 1.7% in normal CTG patterns [16]. The results of present study were comparable to the studies by Rahman *et al.,* [13] and Dvid *et al.,* [17] Incidence of NICU admission were high in the patients with suspicious and abnormal CTG groups compared to normal CTG groups in both low risk and high risk group. There were no perinatal deaths in women with normal CTG tracing. The abnormal CTG pattern in the present study had 3.38% perinatal mortality which can be comparable to the study by Sandh *et al.,* where the incidence was 5.6%. Both the babies belonged to high risk group [18]. In Banu study 6.3% neonates with abnormal CTG had Apgar score <5 at 5 minutes while 18.86% neonates had Apgar score <7 at 5 minutes [19].

Present study, it was observed that the abnormal CTGs groups, who had more risk factors abnormal outcomes were more. Most of the patients in both the normal and abnormal CTGs groups were associated with DM. In abnormal CTGs groups pre-eclampsia, PROM Many pregnant women had other risk factors associated with DM. Similar observation was found Sarmin *et al.,* [2] regarding the influence of risk factors on outcomes with abnormal CTG pre-eclampsia /chronic hypertension was found in 9 cases out of which 33.3% and 66.7% had normal and abnormal pregnancy outcome respectively. About the indications of CTG, most 9(18.0%) of the patients had pre-eclampsia/chronic hypertension followed by 14.0% had PROM.

Overall, this research highlight on the intricate interplay between CTG patterns, maternal characteristics, obstetric outcomes, and neonatal health, emphasizing the significance of proactive monitoring and intervention to optimize perinatal outcomes and mitigate adverse events.

CONCLUSION

The clinical impact of cardiotocography on neonatal outcomes remains controversial, CTG is the most commonly used test for antepartum and intrapartum fetal surveillance in the major hospitals of developed countries. This study was undertaken to determine the fetal outcomes of abnormal cardiotocography (CTG). CTG provides direct information on the fetal condition in contrast to other techniques. So, CTG can be continued as a good screening test of fetal surveillance but is not the sole criterion to influence the management of high-risk pregnancies. Enhanced training and resources for healthcare professionals in interpreting CTG findings may contribute to improved perinatal care in tertiary level hospitals in Bangladesh and similar settings.

REFERENCES

1. Oluwasomidoyin, O. B., Emmanuel, A. U., & Folasade, A. B. (2024). Admission Cardiotocography and Neonatal Outcomes at a Tertiary Health Facility in Southwestern Nigeria. *Annals of African Medicine, 23*(2), 154-9.
2. Sarmin, F., Swarna, S. S., Dhar, D., Doly, F. A., Sikder, M., Bari, R., & Begum, A. (2023). Study on Abnormal Cardiotocography (CTG) and Correlation with Fetal Outcomes in BSMMU. *Obstetrics and Gynecology Research, 6*, 342-348.
3. Mahjabeen, N., & Nasreen, S. Z. (2022). Analysis of Normal and Abnormal Admission

Cardiotocography (CTG) and Its Association with Perinatal Outcomes. *Sch Int J Obstet Gynec, 5*(2), 32-6.

4. Tharindu, E. A. (2023). Admission Cardiotocography: Its Role in Predicting Perinatal Outcome in Term, Uncomplicated (Low Risk) Pregnant Women in Spontaneous Labour. *Open Journal of Obstetrics and Gynecology, 13*(3), 528-49.

5. Singh, S. K., Kumar, R., Agarwal, A., Tyagi, A., & Bisht, S. S. (2022). Intrapartum cardiotocographic monitoring and its correlation with neonatal outcome. *Journal of Family Medicine and Primary Care, 11*(11), 7398-405.

6. Walton, J. R., & Peaceman, A. M. (2012). Identification, assessment and management of fetal compromise. *Clin Perinatol, 39*, 753 68.

7. Patil, S. S., Sukanya, Rath, S., & George, C. E. (2018). Study on umbilical cord arterial blood gas analysis and cord blood lactate levels as predictors for adverse neonatal outcome: An observational study. *Int J Reprod Contracept Obstet Gynecol, 7*, 1494 500.

8. Kansal, R., Goel, G., Mangala, D., Garg, P., Verma, K., & Geetika. (2014). Correlation of admission test with neonatal outcome. *People's J Sci Res, 7*, 27-31.

9. Alfirevic, Z., Devane, D., Gyte, G. M., & Cuthbert, A. (2017). Continuous cardiotocography (CTG) as a form of electronic fetal monitoring (EFM) for fetal assessment during labour. *Cochrane Database Syst Rev, 2*, CD006066. doi: 10.1002/14651858.CD006066.

10. Palsdottir, K., Dagbjartsson, A., Thorkelsson, T., & Hardardottir, H. (2007). Birth asphyxia and hypoxic ischemic encephalopathy, incidence and obstetric risk factors. *Laeknabladid, 93*, 595 601.

11. Khatun, A., Khanam, N. N., & Nazir, F. (2009). Role of Elaborate Cardiotocography (CTG) in Pregnancy Management. *Bangabandhu Sheikh Mujib Medical University Journal, 2*(1), 18-24.

12. Kaban, A., Cengiz, H., Kaban, I., Özcan, A., & Karakaş, S. (2012). The success of cardiotocography in predicting perinatal outcome. *Journal of clinical and experimental investigations, 3*(2), 168-71.

13. Rahman, H., Renjhen, P., Dutta, S., & Kar, S. (2012). Admission cardiotocography: Its role in predicting foetal outcome in high-risk obstetric patients. *The Australasian medical journal, 5*(10), 522.

14. Westerhuis, M. E., Moons, K. G., Van Beek, E., Bijvoet, S. M., Drogtrop, A. P., Van Geijn, H. P., ... & Kwee, A. (2007). A randomised clinical trial on cardiotocography plus fetal blood sampling versus cardiotocography plus ST-analysis of the fetal electrocardiogram (STAN®) for intrapartum monitoring. *BMC pregnancy and childbirth, 7*, 1-8.

15. Sen, M., Samal, S., Datta, S., & George, M. (2019). Abnormal cardiotocographic findings and perinatal outcome: a prospective study. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology, 8*(11), 4261-4271.

16. Indiramani, Y., Spoorthy, S., & Aruna Kumari, K. (2018). Comparative study of normal and abnormal CTG in term pregnant women in labour and its perinatal outcomes. *J Evid Based Med Healthc, 5*(44), 3084-3087.

17. David, B., & Saraswathi, K. (2014). Role of admission CTG as a screening test to predict fetal outcome and mode of delivery. *Res J Pharm Biol Chem Sci, 5*, 295-9.

18. Sandhu, G. S., Raju, R., & Bhattacharyya, T. K. (2008). Admission cardiotocography screening of high risk obstetric patients. *Medical Journal Armed Forces India, 64*(1), 43-45.

19. Banu, S. (2015). Relationship between Abnormal Cardiotocography and Fetal Outcome. *Nepal Journal of Obstetrics & Gynaecology, 10*(2).