Original Article

Neonatal Outcomes in Women with Non-Reactive Cardiotocography

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Abstract

Objective: To determine the neonatal outcomes in women with non-reactive cardiotocography (CTG).

Methodology: This prospective observational study was conducted at Department of Gynecology & Obstetrics in Chiniot General Hospital, Karachi. Consecutive women of age between 20 to 35 years presented to labour room with non-reactive CTG were included in this study. Non-reactive CTG was defined as per the FIGO criteria of fetal tachycardia> 150bpm, fetal Bradycardia < 110, Reduce or absent beat to beat variability, late deceleration & extreme variable deceleration. During the hospitalization neonatal Apgar score, color of liquor, neonatal death, and need for admission in a neonatal intensive care unit (NICU) were recorded. Data was analyzed using SPSS version 21. Mann-Whitney test and Chi-Square test were applied and p-value ≤ 0.05 was taken as criteria for statistical significance.

Results: A total of 122 women were enrolled, mean ± standard deviation of age was 25.8±3.75 years with average gestational age of 38.24± 1.41 weeks. Satisfactory Apgar score was found in 109(89.3%) patients, meconium stained liquor was found in 43(35.2%) babies, need of NICU admission was observed in 38(31.1%) babies and five neonates died i.e.4.1%.

Conclusion: CTG was found to be helpful in monitoring and evaluating the state of a fetus that is in danger. With the satisfactory Apgar score in majority of patients, it is important to build up a consistent and clear-cut description of FHR tracing to decrease the occurrence of bogus positive results that may produce an elevated percentage of needless intervention principally caesarean section.

Key words: Cardiotocography, Non-reactive CTG, Neonatal death, Apgar score, Meconium stained Liquor.

Cite this article as Ansari RS, Kosar S. Neonatal Outcomes in Women with Non-Reactive Cardiotocography. J Soc Obstet Gynaecol Pak. 2019; Vol 9(3):158-163.

Introduction

Cardiotocography (CTG) provides important information about the interaction between fetal cerebral and cardiac activities which are both modified by hypoxia. The duration and severity of hypoxia and associated biochemical abnormalities all influence the manifestations of fetal heart rate abnormalities. Antenatal fetal heart rate monitored with CTG has potential in preventing intrauterine fetal death.

Monitoring and evaluation of fetus health is one of the greater concerns of the present-day obstetricians which involves detection and

Authorship Contribution: [1] Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work, Final approval of the version to be published [2]Drafting the work or revising it critically for important intellectual content

Funding Source: none
Conflict of Interest: none

Received: July 28, 2019
Accepted: Nov 21, 2019

management of the disease in utero.[1] Fetal heart rate and fetal circulation are the important determinants of fetal supply. Placental insufficiency may lead to the development of acute or sub-acute hypoxia.[2] Intrapartum asphyxia is directly responsible for more number of prenatal deaths and long term sequlae.[3]

Different published studies have been provided the important role of CTG monitoring.[1, 2] Admission CTG is a commonly used screening test which aims at identifying admission to the delivery unit, the fetus at increased risk of intrapartum hypoxia.

However, one of the major challenges among the perinatologists is the development of a specific and accurate modality for the identification of high risk fetus.[5] Despite the lack of specificity, one of the most widely adopted modalities for the antepartum and intrapartum surveillance is cardiotocography (CTG) and has become a standard in obstetrics nowadays.[6-8]

CTG is a graphic presentation of the fetal heart and uterine contraction to detect the fetal hypoxia.[9] It is a continuous electronic record of the fetal heart rate & uterine activity obtained by keeping ultrasound transducer and the mother's abdomen.[10] Continuous electronic fetal monitoring reduces many neonatal complications such as fetal distress, seizure, cerebral palsy.[11,12] However, lack of accuracy of most of the modalities increase the rate of unnecessary interventions which results in the increase of risk for both the newborn and mother.[6,13]

To optimize the use of continuous monitoring modalities and reduce the high false positive rate, a number of interventions adjunctive modalities have been proposed over the last decade. Some of the currently available modalities are fetal blood sampling (FBS) for pH and lactate measurements, fetal scalp stimulation (FSS), combined cardiotocographic–electrocardiographic monitoring and computer analysis of fetal monitoring signals.[14] There are several signal processing & computer programming based techniques for interpreting typical cardiotocography data. The evaluation of these signals can be made using the criteria recommended by the International Federation of Gynecology and Obstetrics (FIGO). [8]

A suspicious or pathological record of CTG does not always require an immediate decision to end delivery.[3] In such cases, they find justification for simple procedures, such as hydration, changing the birth position, reduction of oxytocin infusion or, much less frequently, intrauterine resuscitation (tololysis), which may help in restoring the correct CTG recording.[4]

In developing countries, like Pakistan, mortality and morbidity increase due to a lack of proper antenatal checkup and timely interventions. With the adoption of profound management and monitoring strategies, we can improve outcomes for babies as well as reduce the heartache for mothers and families when babies die or suffer long term disability.

Our aim of study was to find out the magnitude of neonatal outcome in women with non-reactive CTG, if found to be satisfactory then the decision for management can be taken with added confidently on the basis of CTG findings.

Methodology

This prospective observational study was conducted at the Department of Gynecology & Obstetrics in Chiniot General Hospital, Karachi between 28th April 2015 to 17th May 2017. Approval of the institutional ethical review committee was taken before the commencement of the study. A sample size of 120 was calculated using WHO sample size calculator version. 2.0 taking prevalence guess of 27.7% for meconium stained liquor based on past study[15], 95% confidence interval, and 8% of absolute precision. Before enrollment, informed consent was taken from women for inclusion in the study. The required number of consecutive women aged between 20 to 35 years presented to labour room with non-reactive CTG, more than or equal to 37 weeks of gestation assessed on last menstrual period (LMP), Cephalic presentation, and singleton pregnancy were included in this study. Mothers with multiple pregnancies, anomalous fetuses and severe ante

partum hemorrhage were excluded from the study. Based on FIGO criteria [8], CTG was defined non-reactive when fetal tachycardia > 150bpm, fetal Bradycardia < 110, reduce or absent beat to beat variability, late deceleration & extreme variable deceleration. Women with persistent non-reactive CTG were confirmed by a consultant supervisor having more than five years of experience. All the enrolled women were observed and followed until delivery. Demographic characteristics and outcome such as the age of mother, parity, gestational age, mode of delivery, neonatal Apgar score at one and five minutes, weight of the baby, color of liquor, neonatal death and need for admission in a neonatal intensive care unit (NICU) were recorded using a structured questionnaire. The parity distribution classified as zero to one as primipara, two to four as multipara, and more than or equal to five as grand multipara. Apgar score more than or equal to seven at one and five minutes was considered satisfactory and meconium-stained liquor was defined as the presence of light to dark green liquor on speculum examination. Data was entered and analyzed using IBM SPSS Statistics for Windows, Version 21.0. (IBM Corp., Armonk, NY, US). Mean ± standard deviation (SD) for quantitative variables and frequency and percentage were calculated for the qualitative variable. Stratification was done with regard to age, gestational age, parity and mode of delivery. To see the effect of these on outcomes, Chi-Square test was applied; p-value ≤ 0.05 was taken as criteria for statistical significance.

Results

A total of 122 women with a gestational age of more than or equal to 37 weeks, confirmed on LMP, were included in this study. The mean ± standard deviation of age of patient was 25.8±3.75 years and gestational age was 38.24± 1.41 weeks. The average birth weight of the baby was 3.02±0.46 kg and Apgar score at one and five minutes were 7.09±1.18 and 8.26±0.968 respectively. Most of the women belonged to >25 years age group. The parity distribution was primipara in 56 (45.9%), multipara in 53 (43.4%) and grand multipara in 13 (10.7%). The 76 (62.3%) pregnant woman delivered cesarean mode of delivery while the rest of 46 (37.7%) delivered as normal vaginal delivery. The 71 (58.2%) pregnant women delivered babies in between 37-39 weeks of gestational age were as 51 (41.8%), pregnant women delivered in >39 weeks. Baseline demographic variables of the study subjects are presented in Table I.

Table I: Demographics variables of the study subjects

Demographics variables	Frequency (%)
Age Groups	
≤25 Years	54 (44.3%)
>25 Years	68 (55.7%)
Birth Weight	
≤3 Kg	67 (54.9%)
>3 Kg	55 (45.1%)
Mode Delivery	
Vaginal Delivery	46 (37.7%)
Cesarean Section	76 (62.3%)
Gestational Age	
≤ 39 Weeks	71 (58.2%)
>39 Weeks	51 (41.8%)
Parity Distribution	
Primipara	56 (45.9%)
Multi Para	53 (43.4%)
Grand Multi Para	13 (10.7%)

Based on this study, the satisfactory Apgar score was found in 109 (89.3%) patients. Meconium stained liquor was found in 43 (35.2%) babies. Only five (4.1%) neonates died out of 122 births and 38 (31.1%) babies admitted to NICU (Figure 1). The neonatal birth weight was less than or equals to three kg in 67 (54.9%) and more than three kg in 55(45.1%).

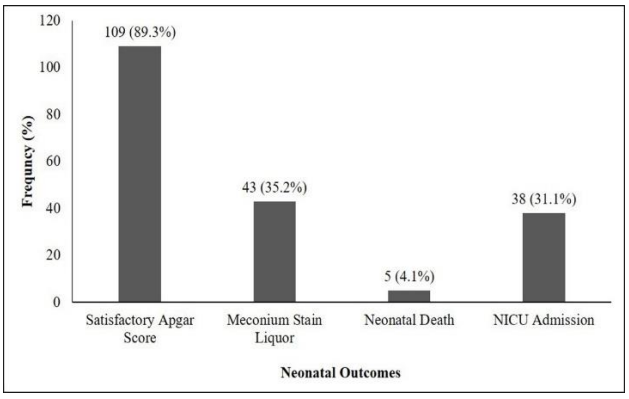

Figure 1: Neonatal outcomes of the women with non-reactive cardiotocography (CTG)

Table II: Neonatal outcomes by demographic variables

Demographics variables	N	Satisfactory Apgar Score	Meconium Stain Liquor	NICU Admission	Neonatal Death
Age Groups					
≤25 Years	54	43 (79.6%)	38 (70.4%)	18 (33.3%)	1 (1.9%)
>25 Years	68	66 (97.1%)	5 (7.4%)	20 (29.4%)	4 (5.9%)
P-value	-	0.002*	<0.001*	0.642	0.265
Birth Weight					
≤3 Kg	67	56 (83.6%)	32 (47.8%)	15 (22.4%)	3 (4.5%)
>3 Kg	55	53 (96.4%)	11 (20%)	23 (41.8%)	2 (3.6%)
P-value	-	0.023*	0.001*	0.021*	0.816
Mode Delivery					
Vaginal Delivery	46	43 (93.5%)	9 (19.6%)	13 (28.3%)	1 (2.2%)
Cesarean Section	76	66 (86.8%)	34 (44.7%)	25 (32.9%)	4 (5.3%)
P-value	-	0.25	0.005*	0.592	0.404
Gestational Age					
≤ 39 Weeks	71	63 (88.7%)	34 (47.9%)	19 (26.8%)	3 (4.2%)
>39 Weeks	51	46 (90.2%)	9 (17.6%)	19 (37.3%)	2 (3.9%)
P-value	-	0.796	0.001*	0.217	0.933

** Statistically significant at 5% level of significance*

Neonatal outcomes of the women with non-reactive cardiotocography (CTG) by demographic variables are presented in Table II. Satisfactory Apgar score was significantly higher among women above 25 years of age (66 (97.1%) vs. 43 (79.6%); p=0.002), similarly, it was significantly higher in a neonate with birth weight more than three kilograms (53 (96.4%) vs. 56 (83.6%); p=0.023). The meconium stain liquor was significantly associated with women ≤ 25 years of age, neonate with birth weight less than or equal to three kilograms, cesarean section delivery, and gestational age ≤ 39 weeks with p-values of <0.001, 0.001, 0.005, and 0.001 respectively. Admission in the neonatal intensive care unit (NICU) was significantly higher among the neonate with birth weight less than or equal to three kilograms (23 (41.8%) vs. 15 (22.4%); p=0.021), however, neonatal death did not show a significant

Discussion

In this study, out of 122 nonreactive cases at intervals of 1 and 5 minutes, around 14(almost 11%) of the total cases has the Apgar score between the range of 0 to 4. The Apgar score was found to be more than 7 after a time period of five minutes in around 89% of the total cases. Hence, it can be concluded that CTG is essential for the prediction of the low Apgar score. Out of the total of cases that were nonreactive, around 43(35.2%) had meconium stained liquor, while only around 10% had stained liquor which was fresh blood. Around 25% of the total cases had a case of clear liquor. Based on the results of this study, it was found that almost 3 quarters of the babies with nonreactive CTG and around 38(31.1%) of the babies with reactive CTG were admitted in a nursery. Therefore, it can be concluded that there is a direct correlation with a p-value of less than 0.0001 between the admission at NICU and the reactivity of CTG. In terms of Perinatal mortality, it was found that out of 120 cases which were non-reactive, five (n=5) of the babies died accounting for almost 4.5% of the total cases and the remainder survived thereby giving a Perinatal mortality rate of around 5% with a p-value of less than 0.0001. These results were compared by Gupta, M., et al.[5]

In order to discover fetuses that had the highest risk of intrapartum hypoxia, cardiotocography or CTG was used. This also formed the bases of identifying those fetuses which might take advantage of monitoring that was more intensive in nature by incessant monitoring of electronic fetal and analysis of fetal scalp blood gas or from the intervention of the immediate nature, i.e. accelerated birth.[6, 7] In terms of maternal age for this study, the range is from 18 to 37 years old women. The average age was 26 years with a standard deviation of 3.5 years. On the other hand, the study conducted by Birgitta Essen[8] stated that the maternal age for almost 95% of the patients to

be between the ages of 19 and 40. In the study performed by us, the age of gestation was found to be greater than 37 weeks, with a range of minimum of 37 weeks to a maximum of 42 weeks. Around 53% of the patients were observed between 37 to 38 weeks, 33% of the patients were between the weeks of 39 and 40 and around 16% of the patients ranged from 41 to 42 weeks. When CTG develops an abnormal pattern, it is common for the delivery to be perceived by the Cesarean Section. The evaluation was made by Oladrian et al[9] in a study that showed 72% Cesarean Section rate. Results from other studies have also shown a direct correlation between an abnormal CTG and Cesarean procedure.[10, 11] From the results of our study, it was found that in 66 cases or around 54.1% of the patients, the Apgar score was greater than 7, it was less than 7 in 14 cases out of a total of 122 cases which accounts for around 76(62.3%) of the women who underwent cesarean section due to CTG which was non-reassuring and the results were found to be statistically significant. Nevertheless, in the study performed by Leung TY, it was observed that around 10% of the patients needed emergency intra-partum delivery of the cesarean nature for fetal status that was non-reassuring and around 10% for progress that was poor.[12]

In case of high risk, meconium stained liquor is of immense concern. It was observed at a larger percentage (around 31.1%) in the age group of <=25 years compared to the percentage (around 4.1%) for age group >25 years of patients (P-value=0.001*) respectively.

Based on the results of massive studies that were random in nature for the population in the high risk segment, it was observed that there was a reduction of around 60% in Perinatal mortality rates due to distress in the fetal when EFM was used as a regular procedure for that high risk group.[13]

From our study, it was found that 83 of pregnant women who delivered babies using the cesarean method accounted for almost 70% of the total cases while the rest had normal delivery through vagina (Figure 1). Therefore, the findings from our study are similar to those from other studies.[14] Department of Obstetrics and Gynecology and Pakistan Institute of Medical Sciences, Islamabad who had cesarean section due to abnormal CTG, around 50 or almost 90% had doubtful trace while 6 of the patients or around 10% had trace of the pathological type (Aboulghar WM et.al.[15] Apart from this, we observed the findings of admittance at NICU both in pathological and doubtful, the results were: From a total of 100 patients with a CTD that was non-reactive, 52% were found to be suspicious while the rest were pathological in nature. Our study signifies the requirement for admittance at NICU is 33(around 25%) in cases where CTG was found to be non-reactive in nature.

Gluhovschi A et.al[16] established the consequences of the age of gestation (GA) of the ensuing newborn babies as 38 to 42 weeks (pregnancies which were full-term) for 75% of the total patients; less than 38 weeks (births which were pre-term) for 20% of the total pregnant women and 1 women (3%) with GA greater than 42 weeks (pregnancies which were post mature). This study also indicates that around 63.9% pregnant women deliver babies between 37-39 weeks of Gestational Age.

This study has shown that there is a role of CTG in monitoring pregnancies with reduced fetal movements. Patients with non-reassuring CTG tracing had poor Apgar score at 5 minutes and therefore were resuscitated and admitted to NBU. This tool identifies fetus at risk thus allowing early interventional delivery as the fetus is no longer safe in the uterus. According to the ACOG bulletin, reassuring CTG is predictive of normal fetal acid base balance. Similarly, ultrasonography has a role in the management of these mothers. Patients with good BPP score had a good Apgar score and unlikely to be resuscitated. In other studies, non-stress test and ultrasound examinations were found to be the most useful tools for fetal surveillance in decreased fetal movement, while an umbilical artery 33 Doppler examination failed to add significant information.

Evaluation of intrapartum fetal condition remains a cardinal challenge of modern obstetrics. None of

the tests designed for this purpose meets with the necessary requirements: diagnostic performance and clinical utility, such as to be considered a good golden standard in usual clinical practice.[4, 17] There is also a lack of standardization in the definitions of the different MFE patterns. The International Federation of Gynecology and Obstetrics (FIGO) and the American College of Obstetricians and Gynecologists (ACOG) have presented paths pattern definitions and recommendations regarding clinical management corresponding, but there are no uniform criteria in this regard.[17, 18]

Use of CTG and ultrasonography as tools for antenatal fetal surveillance can identify the fetus at risk and therefore allow opportune time of delivery. These tools should be used routinely in all women with reduced fetal movements and they are best delivered by caesarian section if a risk is identified. Pregnant women with pregnancy induced hypertension and reduced fetal movements require close fetal surveillance because in such cases, the risk to poor fetal outcome significantly increases.

Conclusion

It can be concluded that satisfactory Apgar score was greater than 7 in 89 % of the total cases and less than 7 was found in 11% of the total cases which is significant statistically speaking. To monitor and evaluate the state of a fetus that is in danger, CTG was found to be helpful and irreplaceable in nature. Nevertheless, there is a requirement to build up a consistent and clear-cut description of FHR tracing to decrease the occurrence of false positive results that may produce an elevated percentage of needless intervention principally caesarean section. CTG cannot be used as the only test to take judgment for caesarean section and liquor's color but also the findings of the clinical nature and scalp ph. calculations should be carried out for better results.

Acknowledgement: We are very thankful to Mr Ahmed Raheem for his hard work as bio statistician in bringing out this article

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