A Study of Antepartum Cardiotocography in Mothers with Reduced Fetal Movement at Term and Its Correlation with Fetal Outcome

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ABSTRACT

Maternal perception of fetal movement is one of the first signs of fetal life and is regarded as a manifestation of fetal well-being. Reduced or absent fetal movements may be a warning sign of impending fetal death. According to the various tracings obtained on cardiotocography (CTG), categorization can be done into normal, suspicious or abnormal/pathological and thereby fetal jeopardy can be reliably predicted. This study was designed to evaluate the CTG findings in mothers with complaint of reduced fetal movement and their fetal outcome at term. It was seen that abnormal and suspicious CTG were more commonly associated with meconium-stained liquor at delivery; also they were associated with a higher rate of cesarean section with fetal distress being the most common indication among these two groups.

Keywords: Cardiotocography, reduced fetal movement, fetal distress, meconium-stained liquor

Maternal perception of fetal movement is among the first signs of fetal life and is considered a manifestation of fetal well-being. Movements are first perceived by the mother around 18-20 weeks of gestation and rapidly acquire a regular pattern. Fetal movements have been defined as any discrete kick, flutter, swish or roll. A marked reduction or sudden alteration in fetal movement is a potentially important clinical sign. Reduced or absent fetal movements may be a warning sign of impending fetal death. Studies of fetal physiology using ultrasound have pointed to an association between reduced fetal movement (RFM) and poor perinatal outcome. The majority of women (55%) experiencing a stillbirth perceived a reduction in fetal movements prior to diagnosis. Maternal perception of fetal movement is reassuring to pregnant women and doctors, whereas RFM is a common reason for concern. In our hospital, many mothers come with the complaint of RFM. Also, there is a high rate of perinatal complications. RFM can be a sign of ongoing central nervous system (CNS) hypoxia and injury. A cardiotocograph or electronic fetal monitoring is nowadays more commonly used for monitoring fetal heart rate (FHR) along with RFM. There is an observed association of FHR acceleration with fetal movements, which when present, indicates a healthy fetus. It can reliably be used as a screening test. According to the various tracings obtained on cardiotocography (CTG), categorization can be done into normal, suspicious or abnormal/pathological and thereby fetal jeopardy can be reliably predicted. So by doing a CTG in mothers with complaint of RFM (as per the Royal College of Obstetricians and Gynecologists [RCOG] guidelines), we can find out whether actual fetal distress is present or not and plan for management accordingly.

Fetal movement commences as early as 7 weeks and becomes coordinated by the end of pregnancy. Between 20 and 30 weeks gestational age, general body movement becomes organized and fetus starts showing rest-activity cycles. Perception of fetal movements typically begins in the second trimester and occurs earlier in parous women than nulliparous women. In 1973, Sadovsky and Yaffe described seven case reports of pregnancies with reduced fetal activity that preceded fetal death. Since then, various methods have been

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described to quantify fetal movement as a prognostic factor of fetal well-being. There are several methods of counting fetal movement, like daily 'kick count chart', Cardiff 'count to 10' formula, daily fetal movement count (DFMC), etc. Currently, fetal movement is thought to be reassuring if mother perceives 10 fetal movements in up to 2 hours. Incidence rate of mothers presenting with RFM is variable. A study reported that 7% of 6,793 women delivered at a London Hospital presented with a complaint of RFM. It is clear that complaints of RFM are significant and warrant further evaluation.

Monitoring the fetal well-being in the uterus during pregnancy is often undertaken using a CTG. A CTG assesses the pattern of FHR alongside the size of uterine contractions; however, it is not very accurate, so monitoring of fetal movements is a useful addition to predict babies in difficulty. It is seen that a normal nonstress CTG is a reliable indicator of fetal well-being in mothers with complaint of RFM. In third trimester pregnant women with complaint of RFM, abnormal pregnancy outcomes are more common where the initial CTG was abnormal.

This study was designed to evaluate the CTG findings in mothers with complaint of RFM and their fetal outcome at term. The aim of this study was to find out the sensitivity and specificity of CTG in relation to fetal outcome in such cases.

MATERIAL AND METHODS

The prospective observational study was carried out in the Dept. of Obstetrics and Gynecology, Eden Hospital, Medical College, Kolkata from June 2012 to May 2013. The study was conducted after obtaining clearance from the Ethics Committee. An informed consent was taken and signed by the patients before recruitment. One hundred cases of antepartum women at or more than 37 weeks to 42 completed weeks of gestation with singleton fetus complaining of RFM were selected randomly for our study. Pregnant women with multiple pregnancy, diagnosed intrauterine fetal death (IUFD), thickly meconium-stained liquor at admission, high-risk factors like antepartum hemorrhage, congenitally malformed fetus, active labor and doubtful fetal maturity were excluded from our study. Clinical examination was done after taking proper history. Antenatal investigations such as complete hemogram, blood sugar estimation, blood grouping, Rh typing, human immunodeficiency virus (HIV) I and II, Venereal Disease Research Laboratory (VDRL), hepatitis B surface antigen, urine and stool examinations were done as usual. CTG, umbilical cord blood pH estimation (2 mL blood was drawn in a heparinized syringe and cord blood pH was determined) and estimation of Apgar score at 1 and 5 minutes after birth were done in all cases. All relevant data was collected for statistical analysis. In this study, test for means were conducted using the data analysis add-in functionality of Chi-square analyses of contingency tables and test. Calculation of proportions reported in the study was derived.

RESULT AND ANALYSIS

A total of 100 women who had complained of RFM were selected according to inclusion criteria. Table 1 shows the baseline characteristics of the selected population. Majority of our study population belonged to younger age group (74% <25 years of age), primigravida (61%) and most of the study population had a period of gestation between 39 and 40 weeks. Cardiotocographical monitoring was done for the selected pregnant women with RFM and they were grouped under normal CTG (Group A), suspicious CTG (Group B) and abnormal CTG (Group C). It was seen that normal, suspicious and abnormal CTG were 70%, 16% and 14%, respectively (Table 2). Distribution of different CTG interpretation groups with the different outcome measures such as incidence of fetal distress, meconium-stained liquor, mode of delivery, cord blood pH, Apgar score at 1 minute/5 minutes and stillbirth rate are shown in Tables 3 and 4.

Table 1. Baseline Characteristics

Parameters	Distribution (n = 100)		Percentage (%)
Age (years)	≤20	30	30
	21-25	44	44
	26-30	22	22
	30-35	3	3
	≥35	1	1
Gravida			
Primi	-	61	61
Multi	-	39	39
Gestational age (weeks)	37-38	10	10
	>38-39	18	18
	>39-40	66	66
	>40-41	1	1
	>41-42	5	5

Table 2. Interpretation of CTG

CTG	Number	Percentage (%)
Normal (Group A)	70	70
Suspicious (Group B)	16	16
Abnormal (Group C)	14	14

Table 3. Different CTG Interpretation Groups with the Different Outcome Measures

Parameters	Group A (n = 70)	Group B (n = 16)	Group C (n = 14)	Total (n = 100)
Incidence of fetal distress	1	11	10	22
Incidence of meconium-stained liquor	5	13	14	32
Mode of delivery				
Vaginal delivery	40	4	4	48
LSCS	30	12	10	52
Incidence of stillbirth	2	0	4	6

Table 4. Cord Blood pH and Apgar Score at 1 Minute and 5 Minutes

Parameters	Group A (n = 70)	Group B (n = 16)	Group C (n = 14)	Total (n = 100)
Cord blood pH <7.2	2	2	13	17
Apgar score at 1 minute				
No depression	66	6	0	72
Mild depression	2	10	3	15
Severe depression	0	0	7	7
Apgar score at 5 minutes				
No depression	68	14	4	86
Mild depression	0	2	5	7
Severe depression	0	0	1	1

DISCUSSION

Reduced fetal movement (RFM) is a common reason for concern for mothers as well as doctors, whereas maternal perception of fetal movement is reassuring to both. There is a possibility of intrauterine fetal death and other perinatal complications in such cases. Fetal movement count by Cardiff 'count to 10' formula or by DFMC is one of the biophysical tests used to assess fetal well-being in late pregnancy. In the present study, a total of 100 cases were taken. All of them presented with RFM. The 100 cases were divided into three groups. Group A included those who had a normal CTG. Those with suspicious CTG belonged to Group B and patients with abnormal CTG were allotted Group C. Majority of the cases belonged to the young age group, that is 74% were <25 years old and primigravida (61%). Study conducted by Miller, Eden et al, Usher et al and Steer et al showed that fetal distress and meconium-stained liquor are more common in postdated cases. But in our study, majority of patients with suspicious and abnormal CTG had period of gestation between 39 and 40 weeks. In Table 2, it is seen that among patients with RFM, 70% had a normal CTG, 16% had a suspicious CTG and 14% had an abnormal CTG. Accordingly, we have divided our study population into three groups A, B and C, respectively. It was seen that in all three groups, the majority of the women belonged to younger age group, mostly 21-25 years and ≤20 years. The p value is 0.279, which is >0.05, therefore not significant. This means that there was no correlation between age and patients presenting with RFM, which is true. It was seen that mothers of all ages can equally present with RFM. In our country, there is a trend towards early marriage and early childbearing; so most of our study population belonged to younger age groups.

Sixty-one percent mothers were primigravida. The p value is 0.482, which is not significant. All mothers can

present with the complaint of RFM irrespective of their parity. A similar study conducted by Fitzgerald and Miller demonstrated that the incidence of suspicious and abnormal CTG in primigravida was more than multipara, whereas Rosario found no significant difference. Table 3 shows the incidence of fetal distress in different groups. Approximately 71.4% of babies in Group C had fetal distress, whereas only 1.4% of Group A had fetal distress. One hundred percent of Group C had meconium-stained liquor at delivery, whereas 7.1% of Group A had meconium-stained liquor at delivery. In Group A, 57.1% of patients had a vaginal delivery. In Group B and C, 75% and 71.4% underwent lower-segment cesarean section (LSCS), respectively. The p value is 0.02, which is significant. It was seen that the incidence of LSCS was more in the suspicious and abnormal CTG groups.

In the suspicious and abnormal CTG group, it was seen that 91.7% and 100%, respectively underwent LSCS for fetal distress. The p value is 0.0001, which is highly significant. The incidence of fetal distress was much higher in suspicious and abnormal CTG group and therefore the incidence of LSCS due to fetal distress in these two groups was also higher. Chitra and Neeru demonstrated operative delivery for fetal distress was 1.16% in the normal CTG group, 32% in the equivocal group and 70% in the abnormal CTG group. Kulkarni and Shrotri showed progressive rise of operative delivery for fetal distress from 5.17% in reactive group to 28.5% in ominous group. Elimian et al were also in favor that women with nonreactive admission test (CTG) were more likely to be delivered by cesarean section, to have fetal distress resulting in LSCS and to have longer neonatal hospital stay.

In Group A, 92.9% had clear liquor at delivery; in Group B, 81.3% had meconium-stained liquor; in Group C, 100% had meconium-stained liquor at delivery. The p value is 0.0001, which is highly significant. So, in the suspicious and abnormal CTG group, the incidence of meconium-stained liquor was much higher. In a retrospective study, "Study of meconium-stained liquor and its fetal outcome" conducted by M Priyadarshini and S Panicker, it was seen that meconium-stained liquor with abnormal CTG was associated with poor outcome, increased cesarean section rates and increased neonatal complication.

Tables 3 and 4 show the distribution according to the fetal outcome in different groups. In Group A, 97.1% babies were live; in Group B, 100% babies were live and in Group C, 71.4% babies were live and 28.6% were stillborn. The p value is 0.001, which is significant. So, we can say that abnormal CTG is a good predictor of adverse fetal outcome. The stillborn rate in the present study was 6%, which is comparable to similar studies conducted by Hellman, Gaud and Krishna and Narang. Whereas a study by Fujikura and Klionsky showed a neonatal mortality rate of 3%.

In Groups A and B, 97.1% and 87.5% had cord blood pH >7.2, respectively. In Group C, 92.9% had a cord blood pH <7.2 and 7.1% had cord blood pH >7.2. The p value is 0.0001, which is highly significant. Metabolic acidosis was more common among the abnormal CTG group. Smith et al analyzed the umbilical cord arterial blood gas in 21 patients undergoing cesarean section because of abnormal CTG. They found minor degrees of respiratory acidemia and concluded that abnormal CTG traces may be associated with hypoxia, but were unrelated to asphyxia. The small number of the study population was a limitation of the study.

The distribution of Apgar score at 1 minute in different groups was seen. In Group A, 97.1% babies had no depression and 2.9% had mild depression. In Group B, 62.5% babies had mild depression and 37.5% had no depression. The p value is 0.0001, which is significant. So, 1 minute low Apgar score was more in the abnormal CTG group and in cases of meconium-stained liquor. This is in accordance with observations made by Walkar, 1954; Desmond, 1954; Miller, 1975 and Mies, 1978.

The distribution of Apgar score at 5 minutes in different groups was seen. In Group A, 100% of babies had no depression. In Group B, 12.5% babies had mild depression and 87.5% had no depression. The p value is 0.0001, which is significant. So, there was a significant improvement in babies with severe depression (Apgar score 0-3) at 1 minute compared to 5 minute, Apgar score. In a study by Hogan et al, it was shown that a 5 minutes Apgar score <4 is a good proxy for asphyxia. The sensitivity of CTG was 72.34% and the specificity was 66.7%. In a similar study conducted by Prof. Dilsath, Meena "Admission test and its correlation with fetal outcome" the sensitivity of CTG was found to be 78%, and specificity as 87%.

CONCLUSION

We can conclude that RFM can be a complaint of any mother irrespective of her age and parity. It was seen that abnormal and suspicious CTG were more commonly associated with meconium-stained liquor at delivery; also they were associated with a higher rate of cesarean section with fetal distress being the

most common indication among these two groups. The incidence of stillbirth was 28.6% among the abnormal CTG group, which is quite high. The incidence of cord blood pH <7.2, low Apgar scores at 1 minute and 5 minutes were higher among the abnormal CTG group. The necessity for early intervention could be reduced in those patients with normal CTG. Also mothers with normal CTG were assured to some extent. In our study, we have found the sensitivity of CTG to be 72.3%.

Hence, we can say that RFM, if detected early and with the help of antepartum CTG, we can reduce the rate of perinatal mortality and IUFD. This can be done simply and CTG is more acceptable as it is a noninvasive procedure. So, in a country like India, mothers should be more adequately counseled about the importance of RFM and CTG so that pregnancy outcome can be optimized with adequate antenatal care and supervision. RFM is an important cause of adverse perinatal outcome and it may be a sign of CNS hypoxia and injury. By doing a CTG in mothers with complaint of RFM, we can find out whether actual fetal distress is present or not.

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Fractional Flow Reserve

- Fractional flow reserve (FFR) compares the intracoronary pressure distal to the stented site (measured with a specially designed angioplasty guidewire) to the aortic root pressure measured through the guiding catheter during maximal hyperemic flow produced by bolus intracoronary adenosine injection or a continuous IV infusion.
- FFR cut-off value = 0.8.
- Percutaneous coronary intervention (PCI) of intermediate lesions can be safely deferred if the FFR is above the nonischemic value >0.8.

Coronary Stenosis of Intermediate Severity

Less than 40% to more than 80% diameter narrowing as assessed by visual inspection of the radiocontrast luminogram during coronary angiography, is seen in almost 40% of patients undergoing coronary arteriography.