A novel daily fetal movement monitoring chart to detect the fetus at risk for IUD- A case–control study

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ABSTRACT

Background: Fetal movement (FM) monitoring by the expectant mother is a noninvasive and inexpensive method to detect a fetus at risk. In spite of using available methods, stillbirths continue to occur; hence, there is a need for newer methods.

Methods: In this prospective case–control study, 500 booked uncomplicated singleton antenatal mothers were introduced to a specially designed daily FM count (DFMC) chart at 24 weeks of gestation. The ultrasonography (USG) evaluation for all the women was conducted before the beginning of the study. Women were advised to record FMs for an hour after breakfast, after lunch, and after dinner. If the FMs felt were less than five in the first hour, they were advised to continue recording the movements in the subsequent hours. Women were advised to consider “FM diminished” and report to the doctor when they persistently perceived less than five movements/hour for 6 h. Five hundred similarly booked antenatal mothers, who were not given DFMC charts, formed the control group. The number of mothers who reported diminished FM, number of intrauterine fetal deaths (IUFDs), and the number of meconium-stained liquor at delivery in the subgroups of women with abnormal cardiotocography (CTG) and biophysical profile (BPP) were recorded in both groups and compared.

Results: The number of mothers who reported diminished FM in cases was 39 (7.8%) and in controls was 15 (3%). The number of IUFDs in cases were 2 (0.4%) and in controls were 9 (1.8%). The number of fetuses with abnormal CTG and BPP in cases was 15 (3%) and in controls was 3 (0.6%). The number of fetuses with meconium-stained liquor in subgroup of women with abnormal CTG and BPP in cases was 11 (73%) and in controls was 3 (100%). Statistically significant differences were observed between cases and controls with \( P < 0.005 \), favoring the use of new DFMC charts.

Conclusion: Fetal monitoring with the new DFMC charts by every mother from 24 weeks onward improves maternal awareness about FMs and helps detect fetuses at risk for IUD, leading to reduction in stillbirths.

Key words: Case-control study; daily fetal movements count chart; intrauterine death.

Introduction

To face an unexpected and inexplicable fetal death is an “embarrassing” situation for any obstetrician. When we declare that “the baby is fine” after the antenatal check-up or ultrasonography (USG), that statement holds good only for that moment. It is not possible to predict the events that occur after the mother leaves the hospital. Perceivable fetal movement (FM) monitoring by mothers is a noninvasive and inexpensive method to detect a fetus at risk.\[1\] Different authors have reported the perception of decreased FMs in...
5 to 15% of mothers during the third trimester.[2,3] Normally, there is a wide variation in range and number of FMs per hour.[2] Although several FM counting protocols have been used, neither the optimal number of movements per hour nor the ideal duration of counting has been defined.[3] Fetuses have cyclic sleep patterns and the duration of sleep varies between 20 to 90 min. During sleep, FMs are less.[2] Movements come down when the liquor volume reduces.[4] Movements are better felt around maternal mealtimes.[5]

There is no evidence that “any absolute definition for reduced FMs” is of greater value than the “subjective maternal perception of reduced FMs” in the detection of fetal compromise or fetal death.[6] Around 50% of the mothers perceive a gradual reduction in FMs days before intrauterine fetal death (IUID).[2] A reduction in FMs is associated with fetal hypoxia, fetal growth restriction (FGR), and increased incidence of stillbirth.[6] In spite of using available FM monitoring methods, stillbirths are continuing to occur; hence, there is a need for newer methods. All these issues were taken into consideration while designing our daily FM count (DFMC) chart.

**Methods**

In this prospective case–control study, 1000 booked antenatal mothers having a normal USG study at 24 weeks gestation formed the study population. The case group consisted 500 consecutively booked mothers who were given specially designed DFMC charts for FM recording at home. Similarly, the control group was comprised of 500 consecutively booked mothers who were not given the DFMC charts but were advised orally to report the diminution of FMs.

**DFMC card and recording of FM**

Women were advised to record FMs for 1 h after breakfast, lunch, and dinner. They were advised to lie down in the left lateral position and record every FM by marking a vertical mark in the concerned area of the chart [Figure 1]. At every antenatal visit, the women showed the DFMC chart and got it signed by the doctor.

**FM were considered diminished**

The women were advised to record all movements in 1 h and consider the baby as “fine” when they perceived more than 5 counts of FM. They had to stop the procedure after recording for 1 h if the movements felt were more than 5 counts. If the perceived movement count was less than 5 in the first hour, they were advised to continue recording in the subsequent hours. Women considered FM “diminished” and reported to the doctor when they persistently perceived less than 5 FMs per hour for 6 h. Clear written instructions (in local language) to record DFMC were given to mothers in the DFMC card [Figure 2].

**Interpretation and follow-up**

When mothers reported with diminished FM, USG and cardiotocography (CTG) were done to assess the biophysical profile (BPP). If the BPP profile was low, a Doppler evaluation was done and the cases were managed accordingly.

On the other hand, if the BPP was found normal and good FMs were observed under USG, it was considered that the woman was not recording FM properly. In such a case, the CTG machine was connected to the woman and she was advised to record FM for 1 h. The women were advised to observe the sounds made by the machine when the fetal kick occurred. This facilitated them to appreciate the FM better and helped record the movements properly. These women were discharged after 6 h of observation.

**Outcome measures**

The number of women who reported diminished FM and the number of IUIDs that occurred were recorded in both cases and controls and compared. In the subgroups of women with abnormal CTG and BPP, the presence of meconium-stained liquor at delivery was recorded and analyzed [Table 1].

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*Figure 1: (Original): DFMC chart showing different patterns of fetal movements, (a) Movements <10 in 1 h; (b) Movements in between 11–20 in 1 h; (c) Movements >20 in 1 h*
In the case group, observations and outcomes of women who were not compliant to record DFMC were also reported. In addition, in this group, the pattern of recorded FMs was analyzed from the DFMC charts. Informed and written consent was obtained from all the subjects who participated in this study. This study confined to the standards of declarations of Helsinki.

**Results**

In the cases group, 39 women (7.8%) reported diminished FM, whereas, in the controls group, 15 women reported diminished FM (3%). The number of IUFDs that occurred in the cases group was 2 (0.4%), and in the control group, they were 9 (1.8%). The number of women (fetuses) with abnormal CTG and BPP in the cases group was 15, and in control group, they were 3. The differences in these variables between cases and controls were statistically significant with $P < 0.005$ [Table 1].

In the cases group, among 39 women—who reported diminished FM—24 were found to be normal after BPP and Doppler evaluation, and they were discharged after 6 h observation. Among the remaining 15 women, 11 had an amniotic fluid index (AFI) $<5$ cm and their gestational age (GA) ranged from 27+ to 37+ weeks. Four women had AFI between 5 and 9 cm. All 11 women, who had AFI $<5$ cm, underwent elective caesarean section (c-section), and 8 of them had meconium-stained liquor. Among the 4 women with AFI between 5 and 9 cm, 3 of them developed fetal distress with meconium-stained liquor on trial of labor and underwent c-section. One woman had normal vaginal delivery without any complications. Among these 15 women, 11 (73%) had meconium-stained liquor.

In the control group, among 15 women—who reported diminished FM—9 women had IUFDs. In the remaining 6 women, 3 were normal after evaluation and discharged after 6 h observation. Three women had AFI $<5$ cm and their GA were 31+ weeks, 33+ weeks, and 35+ weeks, respectively. All these women underwent elective c-section and all (100%) of them had meconium-stained liquor.

As the DFMC charts can be used as a screening tool for identifying the fetuses at risk, the sensitivity and specificity for using it were evaluated. It had a sensitivity of 88.24% and specificity of 95.03% and negative predictive value of 99.57% [Table 2].

**Pattern of FMs**

The pattern of FMs in cases group from DFMC charts was analyzed [Figure 1]. We observed that 216 (43.25%) women recorded less than 10 movements in 1 h, 193 (38.6%) women recorded between 11–20 movements in 1 h, and 91 (18.13%) women recorded more than 20 movements in 1 h [Table 3]. Instead of mothers considering FM recording procedure as cumbersome, they expressed their happiness in recording the movements of their unborn babies. The compliance of working mothers for this chart was reasonably good.

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**Table 1: (Original): Outcomes of women with diminished FMs in cases and control groups**

| Variables                                         | Cases (DFMC chart) Group (n=500) | Control Group (n=500) | Chi-square | Significance P |
|---------------------------------------------------|----------------------------------|-----------------------|------------|---------------|
| No. of women reported with diminished FM           | 39 (7.8%)                        | 15 (3%)               | 11.27      | 0.0007        |
| IUFDs                                             | 2 (0.4%)                         | 9 (1.8%)              | 4.50       | 0.0338        |
| Number of women (fetuses) with abnormal CTG and BPP| 15                               | 3                     | 8.1466     | 0.0043        |

FM=Fetal movement, DFMC=Daily fetal movement count, IUFD=Intrauterine fetal deaths, CTG=Cardiotocography, BPP=Biophysical profile

**Table 2 (Original): The sensitivity, specificity, and predictive values for using the new DFMC chart**

| Parameter                          | Value   | 95% CI            |
|------------------------------------|---------|-------------------|
| Sensitivity                        | 88.24%  | 63.56%‑98.54%     |
| Specificity                        | 95.03%  | 92.70%‑96.79%     |
| Positive Predictive Value          | 38.46%  | 28.97%‑48.92%     |
| Negative Predictive Value          | 99.57%  | 98.42%‑99.88%     |

DFMC=Daily fetal movement count, CI=Confidence interval

**Table 3: (Original): Patterns of FMs in cases group (n=500) from the DFMC charts**

| No. of Movements/h | Number (n=500) | Percentage |
|--------------------|----------------|------------|
| <10/h              | 216            | 43.25%     |
| Between 11-20/h    | 193            | 38.6%      |
| >20/h              | 91             | 18.13%     |

FM=Fetal movement, DFMC=Daily fetal movement count
Observations of women, who were not compliant for DFMC recording in the cases group
Two women, one at 35 weeks and the other at 36 weeks reported normal FMs at a regular antenatal check-up. They attended the clinic in the morning session. When we examined their DFMC cards, they had recorded movements for that day’s afternoon and night also. When USG was done, IUFD was observed in both women. In both cases, the fetal maceration was observed after expulsion, indicating fetal deaths had taken place more than 12 h earlier.

Discussion
Monitoring FMs serve as an indirect method of assessing the functional integrity of the central nervous system (CNS) of the fetus. Short-term observations of the fetus are best performed using real-time USG imaging or Doppler USG.[1] Subjective perception of reduced fetal movements by the mother is of greater value in the detection of intrauterine fetal compromise or fetal death.[6] In the current technique, by recording all movements in 1 h and marking every movement with a vertical line in the concerned area of the chart gave a better presentation of quantum of perceived FMs when compared with the numerical presentation.[3] This helped for better comparison and recognition of diminished movements by the mother and doctor [Figure 1].

In our charts, mothers started recording FM from 24 weeks onward, and the recording was done three times a day. This helped for early awareness of FMs by the mother. As the mother monitored the movements for a longer period, i.e. for 3 h at different phases of the day, it helped her discover the compromised fetus better when compared with other available methods like Cardiff’s count to 10.

In our method, all mothers recorded FM from 24 weeks onward as a part of the antenatal program. Unlike only high risk mothers, all mothers monitored fetal movements in our method. This avoided ‘anxiety of something wrong’ in the minds of mothers. We observed that the mothers enjoyed recording the movements of their unborn babies instead of considering the procedure ascumbersome.

Our DFMC recording made the mother a major partner in fetal monitoring. As the mother monitored her fetus for a longer period, the onus of responsibility of monitoring is more on the mother than the doctor. This helps the doctor fight the litigation better in the event of a fetal death.

In the cases group, in the subgroup of 15 women with abnormal CTG and BPP, 11 (73%) women had meconium-stained liquor. Whereas in the controls group, in the subgroup of three women with abnormal CTG and BPP, all 3 (100%) women had meconium-stained liquor.

These results show that it is possible to pick-up women who are at risk of developing fetal hypoxia and fetal death by using the new DFMC charts. The Society of Obstetricians and Gynaecologists of Canada (SOGC) had recommended using DFMC (charts) to identify the fetuses at risk for developing asphyxia.[7] Further studies are needed to confirm our results with a larger sample size.

Conclusion
The DFMC monitoring with new DFMC charts, from 24 weeks of gestation onward, for 3 h at different phases of the day, significantly helps identify the babies at risk for stillbirth. As the mother monitors her fetus for a longer period, the onus of responsibility of monitoring is more on the mother than the doctor. This helps the doctor fight the litigation better in the event of a fetal death.

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Conflicts of interest
There are no conflicts of interest.
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