Diagnostic Value of Fetal Movement Counting by Mother and the Optimal Recording Duration

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ABSTRACT

Fetal movement counting is a method used by mother to quantify her baby’s movements. However, the optimal number of movements and the ideal duration of counting them have not been recognized. The aim of this study was to determine the diagnostic value of the two common fetal movements counting methods by mother including "ten fetal movements counting in two hours" and "three fetal movements counting in one hour" and the required mean time for counting fetal movements in the two methods.

Methods: 300 subjects were selected by random sampling among clients with complains of decreased fetal movements referring to AL-Zahra teaching hospital in Tabriz, Iran. Full training about how to perform the two methods of counting and how to record was instructed by researcher. Immediately after counting movements, biophysical profile test was performed.

Results: Among 291 mothers in the two groups, 99.7% had active fetuses based on both methods of fetal movement counting. 96.9% of these active fetuses obtained score of 10 in biophysical profile. There was a statistically significant relation between the results of both two methods of counting and the biophysical profile as the gold standard. Sensitivity, specificity, positive and negative predictive values of both methods were equally 100%, 96%, 10% and 100%, respectively. Mean time (SD) for ten movement counting was 22.1(4.6) and for three movement counting was 8.0(2.8) minutes.

Conclusion: The findings of this study showed that fetal movement counting test can be used as an initial screening method in predicting fetal health.

Introduction

The aim of care in pregnancy is birth of a healthy baby and to satisfy mother.1 Since the maternal mortality rate has significantly decreased in developing countries, emphasis has shifted towards assessing fetal health.2 According to the American College of Obstetricians and Gynecologists and American Academy of Pediatrics, the goals of monitoring fetal health before delivery include preventing fetal death and avoiding the unnecessary interventions.3

There are many methods for assessing the fetal health during pregnancy,1 among which fetal movement counting is the oldest, most common, simplest, and most economical compared to all fetal assessment techniques and it is applicable to large number of women.1, 4-7 The mother's report of decreased fetal movements is a frequent reason for unplanned health consultations during the third trimester8,9 with a range between 4-16%
in various populations. On the other hand, diminishing or cessation of fetal movements is associated with a range of pathological pregnancies and poor fetal and pregnancy outcomes. Therefore, various guidelines for assessing mother’s perception of fetal movement or fetal-kick counts have been created with different alarm limits and different time frames.

In a review study, it was concluded that the strongest definition of normal fetal movement activity comes from definition of Moore and Piacquadio who recommended less than 10 fetal movements within two hours as the alarm limit. On the other hand, the method of three fetal movements counting in one hour could be the simplest way for mother to assess the fetal condition because most mothers are able to feel the three fetal movements in few minutes, therefore, very little time is needed. As much the counting period gets longer, the accuracy of method becomes less instead of reduction in false positive rates and so, it will not allow early detection of fetal complications. The inclusion criteria were: gestational age of 32-40 weeks according to the last menstrual period and first trimester ultrasound, ability to read and write, age range of 18 to 35 years, singleton pregnancy, not addicted to drugs, not smoking or consuming alcohol, not taking sedatives or tranquilizers (barbiturates, narcotics and benzodiazepine), not given prescription of corticosteroids (dexamethasone and betamethasone), no rupture of membrane, no spotting or bleeding, no ultrasound evidence of fetal abnormalities, not having mental disorders, not having oligohydramnios or polyhydramnios and no bilateral hip dislocation.

Sample size was determined as 289 subjects considering α = 0.05, power=0.8, sensitivity of 84.6%, and accuracy of 0.02. To increase the validity and taking into account the possibility of sample loss, 300 subjects were selected. In order to avoid bias, subjects were randomly divided into two groups with six blocks; that in the first group, the mother should firstly carry out the method of ten fetal movements counting within two hours and then the method of three fetal movements in one hour and in the second group this process was vice versa. Counting fetal movements was performed in a room in the hospital. The full training about how to perform the two methods of fetal movements...

**Materials and methods**

This was a descriptive study that was carried out from June to October 2011, in Al-Zahra educational curative center, affiliated with Tabriz University of Medical Sciences. Data gathering tools were personal and social demographic questionnaire and obstetric checklist, tables for recording of fetal movements and forms for recording of biophysical profile.

After the approval of the ethics committee, sufficient explanation about the study was given to the eligible participants with complaint of decreased fetal movements. After providing written consent, subjects were randomly selected using numbers generated from a web site (www.randomizer.org). The inclusion criteria were: gestational age of 32-40 weeks according to the last menstrual period and first trimester ultrasound, ability to read and write, age range of 18 to 35 years, singleton pregnancy, not addicted to drugs, not smoking or consuming alcohol, not taking sedatives or tranquilizers (barbiturates, narcotics and benzodiazepine), not given prescription of corticosteroids (dexamethasone and betamethasone), no rupture of membrane, no spotting or bleeding, no ultrasound evidence of fetal abnormalities, not having mental disorders, not having oligohydramnios or polyhydramnios and no bilateral hip dislocation.

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counting and how to record information in related tables was done individually for each mother by the researcher in a face to face manner.

The tables which were given to mothers for recording the fetal movements included starting time, fetal movements, finishing time, total time and the total number of fetal movements. The mother was instructed to empty her bladder, drink a glass of juice and immediately lie on her left side, put her hand on her abdomen and without any stress concentrate on fetal movements and start counting them. The mother should have recorded the exact time of starting fetal movement counting using a clock that was given to them in the right place of the table and should have marked the table by crosses for the clear fetal movement that she felt. In the counting method of ‘ten fetal movements in two hours’ the mother had to mark each clear fetal movement in the table. At the time the tenth movement was noticed the counting was ended and its time was recorded. If after two hours the ten fetal movements were not noticed then the counting was stopped and was considered as decreased fetal movement. This was also the same for the counting method of ‘three fetal movements in one hour’; if there was less than three fetal movements in one hour it was considered as decreased fetal movement. During the counting methods, mother’s blood pressure and fetal heart rate was assessed every 15 minutes.

The items for total time and total fetal movements of recorded fetal movements were completed by researcher. The total time was calculated by subtracting the finishing time from the starting time, and the total fetal movement was calculated by counting the number of crosses in the fetal movement cell that recorded by the mother. Immediately after finishing the methods of fetal movement counting, the biophysical profile test was performed. This test includes five biophysical variables: Non-stress test, fetal breathing, fetal movement, fetal tone and amniotic fluid. Score of 2 was considered for each normal item and 0 for each abnormal item. Therefore, maximum score of five items was 10 and the minimum score was zero.

The time required for the non-stress test was minimum 20 minutes and maximum 40 minutes (to calculate the fetal sleep cycles). The maximum time needed for calculating fetal breathing, movement and tone was 30 minutes. The radiologist who performed the biophysical profile test was not aware of the research process. After finishing this test the results were given to an obstetrician and gynecologist for interpretation and her recommendations were applied.

The only limitation of the study was the accuracy of mothers in counting the fetal movements that could not be fully controlled. In order to control this, the mothers were trained accurately and were encouraged to be accurate. These methods were valid based on medical literature in various studies. To check the reliability, two radiologists were used to perform the pilot observation on the first 30 subjects simultaneously, and the Kappa agreement was obtained (0.98). Data were analyzed by SPSS version 13, using chi-square test or Fisher’s exact test and Spearman’s correlation coefficient. P-value less than 0.05 was considered statistically significant.

**Results**

From 300 mothers, 9 cases (4 in the first group and 5 in the second group) were excluded from the study because of high blood pressure. The findings of this study showed that 50.9% of mothers were nulliparous and 49.1% were multiparous. 84.5% had normal pregnancy and 15.5% had high risk pregnancy (medical or obstetric problems). Mean age (standard deviation) of mothers was 25.5 (4.9) years. The mean gestational age according to last menstrual period was 38 (1.7) weeks. Based on ultrasound of the first trimester, it was 37.7 (1.8) weeks that the correlation between them was statistically significant (p < 0.001, r_s = 0.76).
On the basis of results of this study from a total of 291 mothers in both groups, 99.7% had active fetus (0.3% inactive). According to the two counting methods of ten fetal movements in two hours and three fetal movements in one hour, from 146 subjects in the first group, only one fetus was inactive, and from 145 subjects in the second group no fetus was inactive (Table 1).

Biophysical profile test showed that 96.9% of fetuses had score of ten or normal (3.2% less than ten or abnormal (Table 2). In the first group, 4 cases had score of 8 with nonreactive nonstress test; one case had score of 6 without movement and reduction in respiratory activity. In the second group, 5 cases had score of 8 with nonreactive nonstress test. One fetus that was inactive according to the results of both fetal movement counting tests had score of 8 in biophysical profile, with nonreactive nonstress test.

In all the cases except one, while fetus was counting tests, it was also active during biophysical profile test. The one case that was inactive according to both fetal movement counting tests was active during biophysical profile test (Table 3). Sensitivity, specificity, positive and negative predictive values of both fetal movement counting tests were equal considering biophysical profile as the gold standard and were 100, 96, 10 and 100 percent, respectively.

The average time required for the method of ten fetal movements counting in two hours was 22.1 (4.6) minutes and for the method of three fetal movements counting in one hour was 8.0 (2.8) minutes. From 290 mothers that had active fetus; 74.9% felt ten movements during first 30 minutes, 20.1% felt it during the second 30 minutes, 4.7% felt it during the third 30 minutes and 0.3% felt it during the fourth 30 minutes. Moreover, 97.3% felt the

Table 1. Frequency distribution of fetal movements of two fetal movement counting tests

<table>
<thead>
<tr>
<th>Fetal movements</th>
<th>Level</th>
<th>Group 1 N (%)</th>
<th>Group 2 N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ten movements in two hours test</td>
<td>&lt; 10</td>
<td>1 (0.7)</td>
<td>0 (0)</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>145 (99.3)</td>
<td>145 (100)</td>
</tr>
<tr>
<td>Three movement in one hour test</td>
<td>&lt; 3</td>
<td>1 (0.7)</td>
<td>0 (0)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>145 (99.3)</td>
<td>145 (100)</td>
</tr>
</tbody>
</table>

Table 2. Frequency distribution of biophysical profile score based on the two fetal movement counting tests

<table>
<thead>
<tr>
<th>Fetal movement counting test</th>
<th>Level</th>
<th>Biophysical profile score</th>
<th>Total N (%)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ten movements in two hours count test</td>
<td>Active</td>
<td>10 (N)</td>
<td>281 (96.9)</td>
<td>8 (N)</td>
</tr>
<tr>
<td></td>
<td>Inactive</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>9 (3.1)</td>
</tr>
<tr>
<td>Total</td>
<td>281 (96.9)</td>
<td>8 (2.9)</td>
<td>1 (0.3)</td>
<td>290 (100)</td>
</tr>
<tr>
<td>Three movements in one hour count test</td>
<td>Active</td>
<td>10 (N)</td>
<td>281 (96.9)</td>
<td>8 (N)</td>
</tr>
<tr>
<td></td>
<td>Inactive</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>9 (3.1)</td>
</tr>
<tr>
<td>Total</td>
<td>281 (96.9)</td>
<td>8 (2.9)</td>
<td>1 (0.3)</td>
<td>290 (100)</td>
</tr>
</tbody>
</table>

Table 3. Frequency distribution of fetal movement in biophysical profile test based on the results of the two fetal movement counts

<table>
<thead>
<tr>
<th>Fetal movement counting test</th>
<th>Level</th>
<th>Fetal movement during biophysical profile test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ten movements in two hours count test</td>
<td>Active</td>
<td>280 (99.7)</td>
</tr>
<tr>
<td></td>
<td>Inactive</td>
<td>1 (100)</td>
</tr>
<tr>
<td>Total</td>
<td>290 (99.7)</td>
<td>1 (0.3)</td>
</tr>
<tr>
<td>Three movements in one hour count test</td>
<td>Active</td>
<td>289 (99.7)</td>
</tr>
<tr>
<td></td>
<td>Inactive</td>
<td>1 (100)</td>
</tr>
<tr>
<td>Total</td>
<td>290 (99.7)</td>
<td>1 (0.3)</td>
</tr>
</tbody>
</table>
three movements during the first 30 minutes and 2.7% felt it during the second 30 minutes. 2.4% of the mothers felt the three movements in less than 1 minute.

**Discussion**

In this study, the results of two methods of "ten fetal movements counting in two hours" and "three fetal movements counting in one hour" were compared to biophysical profile that is a reliable predictor of fetal health and an accurate indicator of impending fetal death.

Several studies have been conducted to determine the diagnostic value of fetal movements counting. In a study by Wilailak et al. that performed on 200 high risk pregnant women with gestational age of more than 32 weeks, they concluded that the best correlation was between fetal movements counting by mother and non-stress test as the gold standard when counting of ten movements were completed within two hours. It had 85.7% sensitivity, 76.8% specificity, 42.1% positive predictive value and 96.5% negative predictive value. It appears that the difference in the diagnostic value of this research with the present study was due to the high rate of false positive results of the non-stress test.

Khooshideh et al. carried out a study on 250 postdate singleton pregnant women. They concluded the positive predictive value of fetal movement counting by mother for prediction of meconium-stained amniotic fluid as the gold standard was very low (10%) but negative predictive value was 91%. In the present study (which did not include the post-term pregnancy), the positive and negative predictive value of fetal movement counting by mother compared to biophysical profile as the gold standard was 10 and 100 percent, respectively. The findings of these two studies showed that fetal movement counting is a good predictor of healthy fetus with high negative predictive value.

Leader et al. in their study on 264 pregnant women admitted to the ward of high risk pregnancy found that the sensitivity, specificity and positive predictive value of evaluation of fetal movements in assessing good and poor fetal outcomes was 86, 91 and 46 percent, respectively. These results showed the urgent need for further evaluation in patients with abnormal fetal movements. De Muylder studied on 200 high risk pregnancies and showed the diagnostic value of kick chart in prediction of the risk of intrauterine fetal death yielded 87.5% sensitivity, 94.1% specificity, 43.7% positive predictive value and 99.3% negative predictive value. It was concluded that this test predicts the risk of intrauterine fetal death with acceptable sensitivity and specificity.

In a study by Berbey et al. on 752 pregnancies (550 normal pregnancies and 202 high risk pregnancies) with gestational age of more than 35 weeks, they found that decreased fetal movements reported by the mother were significantly predictive for the abnormal results of fetal tests and pregnancy outcomes. They concluded decreased fetal movements predicted the abnormal results of fetal tests in normal and high risk pregnancy with sensitivity of 57.7% and 56.5% and specificity of 96.2% and 88%, respectively. In the present study, there was a significant relation between fetal movements counting by the mother and the results of biophysical profile (p < 0.001) in the way that the kick chart predicted the results of biophysical profile with sensitivity of 100% and 96.5% and specificity of 96.2% and 88%, respectively. In the present study, there was a significant relation between fetal movements counting by the mother and the results of biophysical profile (p < 0.001) in the way that the kick chart predicted the results of biophysical profile with sensitivity of 100% and specificity of 96.5%.

Jones et al. showed in their review study that evidence from the meta-analysis of randomized controlled trials did not show improvement in outcomes with formal instruction on monitoring of fetal movements. It probably reflects the low positive predictive value (2 to 5 percent) of fetal movement counting protocols due to the subjective nature of this test.

In the present study, besides determining the diagnostic value, the average time spent for specified number of fetal movements in each of these two methods was also computed. In the method of "ten fetal..."
movements counting within two hours” the mean time required to appreciate ten movements by the mother was 22.1 (4.6) minutes. In a study by Moore and Piacquadio study, this time was 20.9 (18.1) minutes and 99.5% of mothers counted ten movements within 90 minutes. In Smith et al. study, the mean time for recording ten fetal movements by the mother was 19.7 (22.9) minutes, which were in agreement with the present study findings. In other studies on women with normal and non-complicated pregnancies, 99% of them were able to feel ten fetal movements within 60 minutes. In the present study, 95% of women felt ten movements in 60 minutes.

In a study on 1200 fetal movement charts, the mean time for counting ten fetal movements was less than 10 minutes. The differences with this study’s findings might be due to different approaches. In the method of “three fetal movements counting in one hour” the mean time for counting three movements was 8.0 (2.8) minutes, which are in common with the results of a study that showed the most women feel three fetal movements in just a few minutes and so very little time is required. Furthermore, in this study, four mothers were able to feel the three fetal movements in less than a minute.

Conclusion
The findings of this study showed that there was a significant relationship between both methods of fetal movement counting by the mother and biophysical profile. Both fetal movement counting tests with 100% sensitivity and 96% specificity predicted the results of biophysical profile test. It is clear that the use of fetal movement counting test can be useful in predicting fetal health. Noting that using ultrasound to assess the fetal health is not available in all countries especially in the developing countries, therefore, fetal movement counting and controlling can be used as a primary screening method to assess fetal health.

Ethical issues
None to be declared.

Conflict of interest
The authors declare no conflict of interest in this study.

Acknowledgments
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References
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