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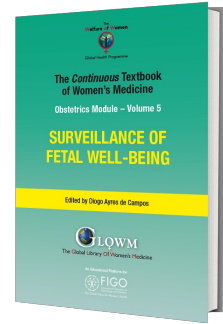
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SURVEILLANCE OF FETAL WELL-BEING

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Chapter

Fetal Movement Counting

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INTRODUCTION

Maternal perception of fetal movements is the oldest method of evaluating fetal well-being, a concept that is nowadays more objectively defined as adequate fetal oxygenation and nutrition. Of course, the occurrence of fetal movements is not only dependent on adequate oxygenation and nutrition, but also requires appropriate osseous, neurological, and muscular development.

Women usually become aware of fetal movements from 18 to 20 weeks of pregnancy, although some multiparous women may perceive them from 16 weeks onwards, and some primiparous women may only note them later.^{1,2} As pregnancy proceeds, fetal movements usually increase until they peak around the 32nd week of gestation.³ The gradual decline observed thereafter is likely to be due to central nervous system maturation, resulting in the appearance of clear “fetal behavioral states”, with periods of deep sleep alternating with active sleep and active wakefulness. Fetal movements are scarce or nonexistent during deep sleep, which usually lasts 20–50 minutes and rarely exceeds 90 minutes in normal healthy fetuses.^{4,5} Alternation between fetal behavioral states occurs regularly during the day and night in the third trimester, but a circadian rhythm usually emerges, with movements becoming more frequent in the evening and early night. Increased fetal size and reduced amounts of amniotic fluid may also play a role in the decreased perception of fetal movements observed in late pregnancy, as well as contributing to the changing characteristics of fetal movements. The proportion of kicks decreases and these are replaced by slow squirming movements.¹

Isolated movements of the extremities are perceived by around 50% of women, while those involving the trunk and limbs are perceived by around 80%. Maternal perception of fetal movements is influenced by a wide variety of other factors. It is well known that fetal movements are poorly perceived when women are involved in normal daily activities. On the other hand, when resting and focused on fetal activity, women have a much higher capacity to detect them.⁶ The presence of an anterior placenta is also known to reduce maternal perception of movements, but this ceases to be relevant in the third trimester.⁷ Other conditions that have been associated with diminished perception of fetal movements are obesity, smoking, use of sedative drugs, and primiparity.^{8,9} Presence of fetal movements has long been used by pregnant women as reassurance that the fetus is alive, but their frequency is also important, as it is known to be decreased in fetal growth restriction.¹⁰ Several studies report that 30–55% of women with stillbirth report reduced movements in the preceding week.¹¹ Reduced fetal movements have thus been associated with an increased risk of stillbirth, with reported odds ratios (OR) varying between 2.37 and 14.1.^{12,13} Fetal movement counting was introduced into routine prenatal care in the 1970s and 1980s, as a screening method for complications associated with abnormal fetal oxygenation and nutrition. Conceptually it has the advantages of being free of charge, non-invasive, and easy to implement. Difficulties arise when one takes into account the subjectivity involved in quantification of fetal movements, the anxiety it may cause to pregnant women, and the additional visits and tests that may be required when reduced movements are reported. Some studies demonstrate that more than 40% of women report decreased fetal movements at least once during pregnancy, and unplanned third-trimester appointments for this reason have been reported in up to 10% of cases.^{14,15}

METHODS OF FETAL MOVEMENT COUNTING

Several methods of formal fetal movement counting have been proposed, varying in the number of movements counted and the duration of monitoring. They can be divided into two main strategies. The first involves the counting of fetal movements for a fixed period of time, as proposed by Sadovsky in 1973,¹⁶ usually reflecting a day's activity. For practical reasons, it was subsequently modified to include lesser periods of time, varying from 30 minutes to 2 hours, and usually after meals.^{6,17,18} The second strategy is registering the time it takes to perceive a fixed number of movements, with the most well-known method being the “count-to-ten” or “Cardiff method”, introduced by Pearson in 1977.¹⁹ The time taken to count 10 movements varies according to the activities a woman is undertaking. Average times are about 20 minutes, when relaxed and focused on counting,²⁰ and 162 minutes during normal daily routines.²¹ There is no consensus on what constitutes abnormal values in the count-to-ten method.²² Some authors propose 2 hours in relaxed settings, others 12 hours in everyday activities.^{16,20} Variations to this method include counting of four movements in 1 hour when the woman is resting and focused on detection of movements.

Since their original description, all of these methods have been associated with a variety of matching “alarm signs”, signifying insufficient fetal activity. Unfortunately, as in many other aspects of obstetrics, no standardization of practice was achieved, and no consensus was reached on the best methods and best alarms used for fetal movement counting. Consequently, different methodologies continue to be used, in both clinical and research settings, leading to insecurity in interpretation and in generalizability of results.²²

Two randomized controlled trials carried out in low-risk populations compared the count-to-ten method with two modified Sadovsky methods (in one trial, counting for 1 hour, three times a day after meals; in another, counting four times per day for 30 minutes, after each meal and at bedtime).²³ With the count-to-ten method compliance was higher, and other tests of fetal well-being were used less often. There was no difference in other outcomes, and perinatal mortality was either not reported or nonexistent.

There is strong evidence of large interpersonal variability and some intrapersonal variability in the applicability of formal fetal movement counting.^{24,25} Another approach is to ask women to evaluate fetal movements subjectively on a daily basis, but without counting, and to report (or to start counting them) when there is a decrease in the usual pattern.^{24,25}

USEFULNESS OF FORMAL FETAL MOVEMENT COUNTING

Interest on maternal fetal movement counting as a screening method for abnormal fetal oxygenation or nutrition has had varying popularity over the past five decades. In the 1970s and 1980s, following several observational studies suggesting that the quantification of fetal movements could predict impending stillbirth, there was a wide dissemination of the method.^{6,16,17,18,19,25} A systematic review published by Frøen *et al.* in 2004¹⁴ evaluated 24 studies published between 1976 and 1997, including a total of 175,277 pregnancies. Nine of the studies involved high-risk pregnancies and used the count-to-ten method ($n = 163,757$), eight involved low-risk pregnancies and used the count-to-ten method ($n = 5283$), and seven involved low-risk pregnancies and used subjective evaluation of fetal movements ($n = 6237$). In high-risk pregnancies, reduced fetal movements were associated with a significantly increased risk of stillbirth (OR = 44; 95% CI 22.3–86.8), fetal growth restriction (OR = 6.34; 95% CI 4.19–9.58), need for urgent/emergent delivery (OR = 9.40; 95% CI 5.04–17.5), and low 5-min Apgar scores (OR = 10.2; 95% CI 5.99–17.3). In these observational studies, use of fetal movement counting significantly reduced stillbirth rates in the high-risk population (OR = 0.56; 95% CI 0.40–0.78), but not in the low-risk group (OR = 0.74; 95% CI 0.51–1.07).

In 1989, a large cluster multicenter randomized clinical trial evaluating formal fetal movement counting was published.²¹ This trial enrolled 68,654 women from 66 paired clusters. In the experimental arm, women were instructed to count fetal movements daily using a modified count-to-ten method. Alarm was defined as no movements on a single day or less than ten movements during 10 hours on two successive days (in one country it was less than ten movements on a single day). Women allocated to the control group were not instructed to monitor movements routinely, but they could be asked about fetal movements in antenatal visits, and obstetricians could give charts to selected women when indicated. There was no fixed management policy (e.g. cardiotocography, ultrasound, hospital admission, etc.) in either group. No significant difference was found in the incidence of antepartum late stillbirths, antenatal admissions to hospital, or use of cardiotocography. The authors concluded that a policy of routinely recommending formal fetal movement counting does not reduce antepartum late fetal deaths when compared to a policy of selective use in high-risk cases or informal noting by women.

In fact, 10.4% of women in the experimental arm did not receive fetal movement counting charts, while 8.9% in the control arm received charts. Compliance in the experimental arm was 58.9%. In a subgroup analysis of the trial, including UK, Irish and Swedish hospitals, 9.4% of women with late antepartum stillbirths reported reduced fetal movements leading to hospital admission with the fetus still alive, but clinical management failed to avoid adverse outcomes. This finding raises the issue that, as with all other diagnostic tests, performing tests alone does not reduce adverse outcomes, but reacting adequately to positive tests may result in this. Lack of guidelines on how women reporting reduced fetal movements should be managed may have been the main cause for the disappointing results.^{14,22,26} Lack of consensus on how tests should be performed, what are abnormal results, and how these should be managed is a major hindrance to the demonstration of benefit in any diagnostic method.

Despite the authors' careful recommendation that the study did not indicate that reduction in fetal movements is clinically unimportant, and that better compliance with counting, reporting, and acting on reduced movements might improve performance to make formal counting useful, the trial is generally regarded as strong evidence against the routine use of formal fetal movement counting.

A second smaller randomized controlled trial,²⁷ enrolling 1076 women, also compared formal fetal movement counting with "standard care". Fetal growth restriction prior to birth was more frequently identified in the fetal movement counting group (87.0% versus 60.0%). Also in this group, maternal anxiety was significantly lower and antenatal hospital admission significantly higher. No cases of perinatal death were reported.

A Cochrane review of 2015²³ evaluated these two randomized controlled trials, and concluded that they do not provide sufficient evidence to influence practice. To date, there are no trials comparing fetal movement counting with no counting, and trials comparing routine fetal movement counting with selective fetal movement counting are required.

RECOMMENDATIONS BY INTERNATIONAL SCIENTIFIC SOCIETIES

The National Institute for Clinical Excellence (NICE) guidelines on antenatal care, published in 2003 and revised in

2008,^{28,31} state that routine formal fetal movement counting should not be offered.

The American College of Obstetricians and Gynecologists (ACOG), in a practice bulletin on antenatal fetal surveillance published in 2014 and reaffirmed in 2016,²⁹ states that the effectiveness of fetal movement counting in preventing stillbirth is uncertain, and whether it adds benefit to an established program of regular fetal surveillance has not been evaluated. Formal fetal movement assessment may slightly increase the number of antepartum visits and fetal evaluations, but this does not appear to result in higher rates of intervention. Not all women need to perform formal daily fetal movement assessment, but if a woman notices a decrease in fetal activity, she should be encouraged to contact her healthcare provider, and further assessment should be performed.

World Health Organization (WHO) recommendations published in 2016,³⁰ state that daily fetal movement counting, such as with count-to-ten kick charts, is only recommended in the context of rigorous research. Nevertheless, it advocates that healthy pregnant women should be made aware of the importance of fetal movements in the third trimester and of reporting reduced fetal movements. Moreover, healthcare providers should enquire about maternal perception of fetal movements at each antenatal visit, and women who perceive reduced fetal movements require further monitoring (i.e. with daily fetal movement counting) and further investigation, if indicated.

PRACTICE RECOMMENDATIONS

There is no general consensus on the use of formal fetal movement counting in prenatal care, so the practice recommendations listed below translate the authors' interpretation of the available scientific evidence. There is an urgent need for further research and for a worldwide consensus on aspects related to the methodology of fetal movement counting, as well as to the definition of abnormal results and recommended management.

In the meanwhile, women will not stop to notice fetal movements, and reduced fetal movements have been strongly associated with fetal growth restriction and stillbirth. Therefore, some form of guidance is needed for women to understand the significance of fetal movements.

- **Women should be advised that fetal movements usually become recognizable after the 20th week of gestation, sometimes a little later, and that they may not be easily perceived during routine daily activities.**
- **Women with low-risk pregnancies should be advised that, if a subjective reduction in fetal movement frequency is detected, formal daily fetal movement counting should be started.**
- **Women with pregnancies at higher risk of abnormal fetal oxygenation and nutrition should be advised to perform formal daily fetal movement counting and registration in the 3rd trimester.**
- **The count-to-ten method appears to be associated with better patient compliance than fixed time-interval methods.**
- **There is no consensus on what constitutes abnormal results with any of the methods, but each hospital should have a written protocol to define this.**
- **Women with reduced fetal movements, as defined by a formal method of fetal movement counting, should seek advice from a healthcare provider.**
- **Hospitals should have written protocols on how to manage women reporting with reduced fetal movements, preferably including cardiotocography and ultrasound evaluation.**

CONFLICTS OF INTEREST

The authors of this chapter declare that they have no interests that conflict with the contents of the chapter.

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