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Assessment of two fetal movement counting methods: compliance, sensitivity, specificity and predictive value

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Objective : *To compare modified count-to-ten and modified Sadovsky fetal movement counting (FMC) methods in accuracy, understandability, feasibility and compliance of pregnant women.*

Setting : *Maternal and Child Hospital, Health Promotion Center 8, Nakornsawan*

Design : *Comparative controlled trial*

Method : *Pregnant women were classified into two group at 32 - 36 weeks of gestation.*

Conventional group : *Modified from Sadovsky study : the women were asked to count her baby movements in three 1 - hour periods each day after each meal. If counting was less than 12 times per day they have to contact the doctor.*

Treatment group : *Modified count-to-ten method: the women were asked to count for only 10 fetal movements at a convenient time especially after dinner and while lying on her side. If less than 10 movements were detected during two hours, she should contact her physician that day or the latest on next morning.*

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Performance was evaluate 2 weeks after teaching and postpartum. Women from both groups who complained of decreased fetal movements were further managed by fetal well being monitoring techniques. The accuracy and compliance of both tests was analyzed.

Results : *Six hundred and four pregnant women were recruited postpartum, and 302 in each group. Age, parity, educational level, socio - economic status and complications of pregnancy were not different statistically. In the modified count-to-ten group, 88.4 % of the women felt it was not difficult to accomplish. They performed the counting on 73 % of the days asked do. In the conventional group, 62.9 % felt it easy but performed it only 56 % of the time. 92.4 % of women in the treatment group correctly counted the movements and 90.4 % could relate the criteria when they should see the doctor. These same aspects in the conventional group were only 78.8 % and 76.5 %, respectively. Sensitivity, specificity and predictive value of both methods were similar.*

Conclusions : *The single period FMC method is more appropriate to the life style of pregnant Thai women than is the divided period method.*

Key words : *FMC, Count-to-ten, Sadovsky.*

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วัตถุประสงค์ : *เพื่อศึกษาเปรียบเทียบความไว ความจำเพาะ ความสามารถของการทำนาย ตลอดจนความง่ายต่อความเข้าใจ และการปฏิบัติได้ของวิธีการนับลูกดิ้น แบบ Modified count-to-ten และ Modified Sadovsky*

สถานที่ศึกษา : *โรงพยาบาลแม่และเด็ก ศูนย์ส่งเสริมสุขภาพเขต 8 นครสวรรค์*

รูปแบบการวิจัย : *Comparative controlled trial*

วิธีการศึกษา : *สตรีตั้งครรภ์อายุครรภ์ 32 – 36 สัปดาห์ จะถูกแบ่งออกเป็น 2 กลุ่ม โดยเลือกสลับวันที่แผนกฝากครรภ์ให้จำนวนตัวอย่างเท่ากัน โดยใช้กลุ่มศึกษาเป็นเกณฑ์*

***กลุ่มเปรียบเทียบ** (Conventional group) ถูกสอนให้นับทารกดิ้นหลังอาหาร 3 เวลา ครั้งละ 1 ชั่วโมง ซึ่งประยุกต์จากวิธีของ Sadovsky โดยใช้การนับน้อยกว่า 12 ครั้งต่อวันเป็นเกณฑ์ผิดปกติ*

***กลุ่มศึกษา** (Treatment group) ถูกสอนให้นับทารกดิ้น เวลาที่สะดวกหรือหลังอาหารเย็น โดยการนอนตะแคง ให้นับจนทารกดิ้นครบ 10 ครั้ง โดยใช้เกณฑ์ผิดปกติ คือ เมื่อใช้เวลาครบ 2 ชั่วโมง แต่ทารกยังดิ้นไม่ถึง 10 ครั้ง*

สตรีตั้งครรภ์ทั้งหมดจะได้รับการประเมินความรู้ ความเข้าใจและการปฏิบัติเมื่อ 2 สัปดาห์ หลังการสอน และเมื่อคลอด

สตรีตั้งครรภ์ที่นับทารกดิ้นผิดปกติ จะได้รับการประเมินสุขภาพทารกต่อโดยตรวจคลื่นหัวใจทารก และอัลตร้าซาวนด์

การทดสอบมาตรฐานที่ใช้เปรียบเทียบ คือ ผลการตรวจคลื่นหัวใจทารกขณะเจ็บครรภ์ผิดปกติ (Positive contraction stress test)

ผลการศึกษา : *ผลของการศึกษา พบว่าตัวแปรทางอายุ ระดับการศึกษา ภาวะเศรษฐกิจของครอบครัว ความรู้เกี่ยวกับการนับทารกดิ้นในครรภ์ จำนวนครั้งของการตั้งครรภ์ ภาวะแทรกซ้อนระหว่างการตั้งครรภ์ในอดีต และปัจจุบัน ไม่มีความแตกต่างอย่างมีนัยสำคัญทางสถิติ พบว่ามีความแตกต่างอย่างมีนัยสำคัญระหว่างกลุ่มศึกษา และกลุ่มเปรียบเทียบ คือ การปฏิบัตินับทารกดิ้น (73 % และ 62.9 %), ความง่ายในการปฏิบัติ (88.4 % และ 56 %) การปฏิบัติได้ถูกต้อง (92.4 % และ 78.8 %) และตอบว่าทารกดิ้นผิดปกติอย่างไร ต้องมาพบแพทย์ (90.4 % และ 76.5 %)*

ผลการศึกษาคุณสมบัติของการทดสอบ พบว่าวิธีการนับทารกดิ้นในครรภ์แบบ Modified count - to - ten และ Modified Sadovsky . มีค่า Sensitivity 33.33 % และ 30.0 %, Specificity 95.9 % และ 95.5 %, Predictive value 97.9 % และ 97.6 % ตามลำดับ

สรุป : คุณสมบัติของการทดสอบเพื่อการคัดกรอง (Screening accuracy) ของการนับทารกดิ้นในครรภ์ทั้ง 2 วิธีมีค่าใกล้เคียงกัน แต่พบว่าวิธีการนับแบบเวลาเดียวคือ Modified count - to - ten เข้าใจได้ง่าย และเหมาะสมต่อการนำไปใช้ในชีวิตการทำงานปกติดีกว่าการนับแบบ Modified Sadovsky

One of the ultimate goals of antenatal care (ANC) is healthy intrauterine growth and healthy extrauterine life. [1]

During 1997, two - thirds of perinatal mortalities at the Maternal and Child Hospital, Nakornsawan occurred during intrauterine life (Dead Fetus in Utero : DFU = 3,78/1,000 livebirth). Data from developed countries [2] indicates that about half of all fetal deaths occurred in low risk pregnancies which no indication for antepartum fetal testing. To achieve the ANC goal, fetal movement counting (FMC) is one technique which can strengthen high - tech antepartum fetal testing.[3]

FMC is a clinical method which every pregnant women can perform conveniently, without cost and without expensive high-tech medical equipment.

Fetal movement is an important clinical indicator of fetal health. Decreased or cessation of fetal movement usually precede fetal death and should urge the mother and clinician to intervene before death occurs.

Pregnant women at the Maternal and Child Hospital in Nakornsawan were taught to count their fetal movements by Sadovsky's method [4] introduced in 1986. This method is not universally used because it is difficult for pregnant woman to understand and not practical for daily life. Moore et al [2] introduced the more practical FMC method "Modified count-to-ten" and compliance is as high as 97 %.

This study compared the accuracy and compliance of the modified count-to-ten and Sadovsky FMC methods in expectation of selecting the better method for routine use in low-risk pregnancies.

Material and Method

This comparative control trial was designed to compare the accuracy and compliance of the modified count-to-ten and Sadovsky FMC methods in pregnant women of 32-36 weeks of gestation at the Maternal and Child Hospital of Nakornsawan.

Simple randomization on an alternate day basis was used to allocate pregnant women to each method.

Exclusion Criteria

1. Pregnant women who knew any method of FMC
2. No expectation to deliver at the Maternal and Child Hospital
3. Not wishing to be in the study

Sadovsky FMC (Conventional Group): The pregnant women were asked to count the baby movements in three 1-hour periods a day after each meal. If fetal movement was less than 4 times an hour she was to continue counting for a total of 6 hours for that day. If the movements were still less than 4 times, or if total movement count was less than 12 times a day, she was to see her doctor for further management.

Modified count-to-ten method (Treatment group) : The pregnant women were asked to count up to only 10 fetal movements at a convenient time, but especially after her dinner, and while lying on her side. If this required more than two hours she should contact her doctor that day or no later than the next morning. Performance was reevaluated at 2 weeks after teaching and postpartum.

The women from both groups who show decrease in fetal movement will be further investigated by advance fetal well being monitoring technique as described below:

1. NST show reactivity, pregnant woman could

continue her FMC at home.

2. NST show non-reactivity, pregnant women will be admitted to further investigate by ultrasound and oxytocin challenge testing.

- if OCT and ultrasonography are normal pregnant women will be discharged

- if OCT is positive, the pregnancy will be terminated.

We didn't use low Apgar score, intrapartum fetal distress or perinatal mortality like in many studies.[5-7] as poor outcome to calculate the accuracy of the test because there are many variation during labor which is very difficult to control.

This study used OCT as a comparative standard to analyzed sensitivity, specificity and predictive value of the test using the definition of outcome on the day of admission and delivery below:

- True Positive = ↓ FMC, NST = Non – reactive, CST = Positive

- False Positive = ↓ FMC, NST = Reactive or non - reactive , CST = Negative

- False Negative = Normal FMC,NST = Non - reactive or reactive but CST = Positive

- True Negative = Normal FMC, NST = Reactive, CST = Negative

Compliance was analyzed by counting the number of days each pregnant woman did the FMC from assignment until the delivery. Compliance was classified into three group ; non-practicing, practicing between 1-75 % of the day, and practicing more than 75 %. The compliance rate was the sum of practicing FMC days as compared to the sum of days from assignment of a method to the day of delivery for every pregnant women.

Results

Six hundred and four pregnant women were recruited postpartum between September 1,1997 and July 1,1998, and 302 in each group.

There were no significant differences between the two groups in terms of age, educational status, occupation, family income and knowledge about benefits of FMC.

There were also no differences in gravidity, previous intrapartum and postpartum complications and adequacy of ANC sessions attended.

These factors show no significant relation to the practice of both FMC methods (Table 1,2)

Table 1. Relation of socioeconomic and education status to the practice of both FMC methods.

Variable	Treatment group (n = 302), n (%)	Conventional group (n = 302), n (%)	P - value
Age (Year)			
≤ 16	3 (1.0)	3 (1.0)	
17 – 30	216 (71.8)	220 (72.8)	NS
> 30	83 (27.2)	79 (26.2)	
Education			
Non education	12 (4.0)	12 (4.0)	
Pre - university	247 (81.7)	240 (79.5)	NS
University	43 (14.3)	50 (16.5)	

Table 1. Continuous.

Variable	Treatment group (n = 302), n (%)	Conventional group (n = 302), n (%)	P - value
Occupation			
Employee	194 (64.2)	189 (62.6)	
House workers	108 (35.8)	113 (37.4)	NS
Family Income (bath/month)			
≤ 5,000	153 (34.1)	150 (35.4)	
5,001 –10,000	96 (48.4)	91 (44.4)	NS
>10,000	53 (17.5)	61 (20.2)	
Recognized the significance of FMC			
No	197 (65.2)	193 (63.9)	
Yes	105 (34.8)	109 (36.1)	NS

Table 2. Relation of obstetrics and gynecological history to the practice of both FMC methods.

Variable	Treatment group (n = 302), n (%)	Conventional group (n = 302), n (%)	P - value
Gravida			
Primigravida	154 (51.0)	144 (47.7)	
Multigravida	148 (49.0)	158 (52.3)	NS
Postpartum complications			
Yes	78 (25.8)	71 (23.5)	
No	224 (74.2)	231 (76.5)	NS
Intrapartum complications			
Yes	54 (17.9)	55 (18.2)	
No	248 (82.1)	247 (81.8)	NS
Number of antenatal care			
Non adequate (less than 4 standard visit)	50 (16.6)	56 (18.5)	
Adequate	252 (83.4)	246 (81.5)	NS

Results of FMC, CST, sensitivity, specificity and predictive value of both methods are shown in table 3,4.

The accuracy of both tests were similar.

Perinatal outcome in term of Apgar score and perinatal death are shown in table 5. There were no perinatal death in both groups.

Pregnant women in treatment group do FMC more than 75% and compliance rates were significantly better than in the conventional group (Tables 6,7).

Table 3. Results of screening.

	Treatment group			Conventional group		
CST / FMC	Positive	Negative	Total	Positive	Negative	Total
Decreased FMC	3 (TP)	12 (FP)	15	3 (TP)	13 (FP)	16
Normal FMC	6 (FN)	281(TN)	287	7 (FN)	279 (TN)	286
Total	9	293	302	10	292	302

Table 4. Accuracy of fetal movement counting (FMC) method.

Efficiency of Test	Modified Count to ten	Modified Sadovsky
Sensitivity	33.3	30.0
Specificity	95.9	95.5
Positive predictive value	20.0	18.8
Negative predictive value	97.9	97.6

Table 5. Outcome of pregnancy.

	Normal FMC		Decreased FMC	
	Treatment (n = 287)	Conventional (n = 286)	Treatment (n = 15)	Conventional (n = 16)
Apgar 1' ≤ 6	12	8	0	0
5' ≤ 6	3	2	0	0
Perinatal Mortality	0	0	0	0
Fetal distess	13	16	1	2

Table 6. Compliance rate.

Compliance	Treatment group n = 302		Conventional group n = 302	
	n	%	n	%
Fetal movement count				
Do not count (0 %)	17	6.3	31	12.4
Counting (1-75 %)	93	34.6	127	51.1
Counting (76-100 %)	159	59.1	91	36.5
Compliance rate	73 %		56 %	

Table 7. Number and percentage of compliance.

Variable	Treatment group (n = 302), n (%)	Conventional group (n = 302), n (%)	P - value
Performance 2 weeks after assignment			
Practice Counting			
Do not count	17 (5.6)	31 (10.3)	
Incomplete counting	93 (30.8)	127 (42.1)	0.001*
Complete counting	192 (63.6)	144 (47.6)	
Explain FMC method			
Incorrect	23 (7.6)	238 (78.8)	
Correct	279 (92.4)	64 (21.2)	0.001*
Explain abnormal criteria for further management			
Incorrect	29 (9.6)	71 (23.5)	
Correct	273 (90.4)	231 (76.5)	0.001*
Feasibility and Convenience for practice			
Difficult	4 (1.3)	19 (6.3)	
Some difficult	31 (10.3)	93 (30.8)	0.001*
Convenience	267 (88.4)	190 (62.9)	
Performance of FMC from assignment until delivery			
Do not count (0 %)	17 (6.3)	31 (12.4)	
Counting (1 – 75 %)	93 (34.6)	127 (51.1)	0.001*
Counting (76 – 100 %)	159 (59.1)	91 (36.5)	

Significant difference between Treatment group and Conventional group ($P < 0.05$)*

Discussion

There were no significant differences between the treatment and conventional groups in terms of age, occupation, education, income and parity. These factors also had no significant relation to acceptance and accuracy in fetal movement counting practice, which is similar to the studies of Gettinger [8] and Leader et al.[5] This study also found that complications in past and present pregnancies were not related to the practice of FMC in both groups. Leader [5] found that the practice of FMC was more dependent on maternal attention and psychosocial aspects rather than other personal characteristics. These findings should encourage health providers to educate FMC not only to the well educated women but also to all pregnant women.

In the past, only high risk pregnancies at the Maternal and Child Hospital in Region 8, and perhaps at many hospitals in Thailand, were taught Sadovsky FMC method. That might not be adequate in clinical care to prevent and decrease the morbidity and mortality of the babies. FMC should be introduced into the routine antenatal cared for all pregnancies in order to reduce antepartum fetal deaths, of which

about 50 % occur in low risk pregnancies.[2] Pregnant women in Modified Count-10-ten method did counting more than women in modified Sadovsky (73 % vs 56 %). And showed better performance in many other aspects, such as re-statement of the method (92.47 % vs 21.2 %), recognized the abnormal criteria which it was necessary to see the doctor (90.4 % vs 76.5 %) and feasibility and convenience for practice (88.4 % vs 62.9 %). In short, single period counting method is more appropriate to use as a self-screening method in ANC. However, because of its rather high specificity and predictive values but low sensitivity, which was similar to the studies of Pearson, [6] Rayburn [7] and Leader, [5] if it was implemented as a screening program in routine ANC, back - up or confirmation methods such as NST, CST and ultrasonography should be available [3,9] especially for community hospitals. Otherwise, the referring system should be effective if pregnant women show a low FMC.

Conclusions

Single, period FMC each day shows more compliance for pregnant women and less difficulty in teaching for health care provider than three period method.

On the basis of high – touch technique, the single - period FMC method should be promoted extensively for all pregnant women in our country in order to reduce the high perinatal morbidity and mortality rate.

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