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Timing of delivery in high risk pregnancy by monitoring of fetal movements*

E. Sadovsky, D. Weinstein and W. Z. Polishuk

Department of Obstetrics and Gynecology, Hadassah University Hospital, Herusalem, Israel

1 Introduction

Several tests are available to evaluate placental function. Urinary estriol, serum human placental lactogen and heat stable alkaline phosphatase, and leukocyte alkaline phosphatase are some of the tests used. These tests may indicate placental insufficiency but not the time when the fetus should be delivered to avoid intrauterine death.

Fetal movements are an expression of fetal well-being and have been found to be reduced in cases of placental insufficiency [2, 3, 4, 6]. We have shown [8] that in high risk pregnancies, as with pre-eclampsia or diabetes mellitus, a pronounced decrease leading up to cessation of fetal movements occurred while fetal heart sounds were still audible before intrauterine death. Such reduction, followed by a cessation for at least 12 hours, was referred to as a "movements alarm signal" (M.A.S.). This signal points to a severely distressed fetus and indicates impending intrauterine fetal death. It is an indication for immediate delivery of the fetus, provided the fetus is viable. In this way daily fetal movements recording may be used to monitor fetal well-being.

The purpose of the present study was to evaluate our experience in antenatal monitoring of fetal movements in 127 normal and high risk cases. We have previously reported on our first 80 cases [8] that have thus been monitored.

Curriculum vitae

Dr. E. SADOVSKY graduated at the Hebrew University and Hadassah Medical School, Jerusalem, in 1956 and has since then worked in the Department of Obstetrics and Gynecology Hadassah Hospital. In 1971 he was appointed Associate Professor in Obstetrics and Gynecology, Hebrew University Jerusalem and in 1975 head of the High Risk Pregnancy Unit there.

Main research interests: Ante-natal monitoring by daily fetal movements recording.

2 Material and methods

Daily fetal movements were studied in 127 cases of normal and pathologic pregnancies (Tab. I).

Of the normal cases recording fetal movements while under care of ante-natal centers, five came to the maternity department because they had failed to notice movements for 24 hours. In none of these was any pathology found on examination. All pathological cases were hospitalized and were chosen for this study because of severe maternal pathology and the likelihood of fetal distress and of intrauterine fetal death.

Tab. I. Diagnosis of cases studied by daily fetal movement recording

Diagnosis	No. of Cases	Weeks of Pregnancy
Normal	41	18-40
Pre-eclampsia	11	30-40
Pre-eclampsia with SGA* infants	24	27-40
SGA* infants with no apparent disease	12	23-40
Diabetes	6	32-38
Latent Diabetes	8	23-40
Premature rupture of membranes	5	23-37
Heart disease	3	35-40
Post maturity	5	42-43
Bleeding	4	31-35
Rh incompatibility	3	21-36
Polyhydramnion	3	32-40
Cord around neck	1	40
Scleroderma	1	25
Total	127	

*SGA = small for gestational age

All these women were instructed to assess and record all fetal movements during periods of 30-60 min., three times/day. If the number of movements was less than three/hr., the recording was continued for 6-12 hr/day. The sum of movements recorded was calculated for 12 hr. and called the daily fetal movement record (D.F.M.R.).

Fetal heart beats were recorded daily with the aid of a stethoscope or doptone.

Estriol in 24 hr. urine was determined by a modification of the method of BROWN et al. [1] 2-3 times each week. Estriol results were evaluated according to criteria used by us previously [7].

Growth retardation suspected clinically was confirmed by birth weight to be below the fifth percentile for gestational age, according to the table of THOMSON, et al. [10].

These cases in which M.A.S. was manifested were divided into 2 groups:

a) A group in whom an expectant approach was taken because the fetus was considered too immature to be viable or when estriol determination did not show clear fetal jeopardy. This group served as control.

b) The second group in whom delivery was promptly induced as soon as the M.A.S. occurred.

3 Results

3.1 M.A.S. and fetal outcome

Tab. II gives the outcome of pregnancy in the 36 cases with M.A.S.

In the control group of 19 cases, Group A, in whom an expectant approach was taken following M.A.S., all fetuses died in utero 1 to 12 days after disappearance of fetal movements as mentioned further below. In this group 11 weighing above 1500 gm might have been saved by prompt delivery. The other 8 fetuses were too immature to be viable. The duration of the M.A.S. in this group was 1-3 days except for one case in which it lasted 12 days. In Group B, 17 cases in which prompt delivery followed the M.A.S., all fetuses were delivered alive, vaginally or abdominally. One newborn died a few hours post-partum, during exchange transfusion.

Tab. II. Outcome of pregnancy in cases with movement alarm signal

	No. of cases	Still-births	Neonatal deaths	Stillbirths > 1500 g
a) Control group	19			11
b) Study group	17	0	1	0
Total	36	19	1	11

3.2 Normal movements

The number of fetal movements per day in 91 women who did not show the M.A.S., and in all of whom the outcome of pregnancy was a live child, varied between 4 and 1440. Some showed fluctuations of about 30 to 100 fetal movements/day. Others showed a high or low D.F.M.R., and as little as 4 to 10/day, that was fairly constant. In spite of low D.F.M.R. patients delivered live and normal fetuses. Thus there was no significance to the absolute number of the movements recorded, provided that they did not cease for 12 hours.

4 Discussion

These results indicate that in cases of high risk pregnancy daily recording of fetal movements may be useful in monitoring fetal well-being. Pronounced reduction in fetal movements from

high, constant or fluctuating levels, to less than 4/day or the complete cessation of movement with heart sounds still audible, may point to a severely distressed fetus and impending death. Attention should be drawn to the fact that in some cases where "few" movements are reported, we may be dealing with passively provoked fetal motion by the mother's activity. We have observed cases of constantly low fetal daily movements, lasting several weeks but above 4 per day, with satisfactory outcome. Only a definite decrease of the D.F.M.R. followed by cessation for at least one day is an indication for prompt delivery, provided the fetus is of viable gestational age and its heart is still audible.

Each fetus has its own rhythm and rate of movements and the assessment of these movements depends on subjective perception, which is influenced by the mother's character, occupation and readiness to cooperate, as well as the week of pregnancy and the underlying maternal pathology. We have shown [5] by simultaneous electromagnetic recording and maternal assessment of fetal movements that the patients subjective sensation registered about 87% of the motions recorded by the electromagnetic device. Some patients with pre-eclampsia were able to remain ambulatory while recording fetal movements, and reported to their obstetrician as soon as the D.F.M.R. decreased sharply or disappeared.

It appears that the D.F.M.R. could be a satisfactory means of monitoring cases of high risk pregnancy, with or without placental insufficiency, leading to chronic fetal distress with gradual reduction in fetal well-being, by providing a sensitive index of impending fetal death. The D.F.M.R. is of no use in acute fetal distress, as in cases of sudden placental abruption or umbilical cord compression, which are manifested by sudden vigorous movements followed quickly by cessation of fetal movements and fetal death. In some cases a slight, reversible decrease of fetal movement was noted in patients receiving diazepam or barbiturates.

Summary

Fetal movements are thought to express fetal well-being and have been shown to be reduced in cases of placental insufficiency. The reduction in fetal movements, up to

The clinical data, with the aid of biochemical placental function tests (hormonal and enzymatic), ultrasonic cephalometry, amniocentesis, F.H.R. (Fetal Heart Rate) monitoring [SIMMONS, 9] and D.F.M.R. enable us to classify high risk pregnancies into three groups:

a) Those with maternal or obstetric disorders in which however, the fetus is not growth retarded, and the hormonal assays, like estriol and HPL, the enzymatic tests and ultrasonic cephalometry are normal.

b) Cases with clinical I.U.G.R. which may be confirmed by measurement of fetal biparietal diameter and usually associated with abnormal values for estriol, HPL, leukocyte alkaline phosphatase and serum heat stable alkaline phosphatase. These tests indicate chronic fetal distress. The normal D.F.M.R. and F.H.R. indicate that the fetus is not in immediate danger and should be watched. There is no need for immediate delivery. The fetoplacental impairment as indicated by the biochemical tests may rarely be improved or may persist up to spontaneous delivery without gross danger to the fetus. However if in cases of pre-eclampsia, for example, the uteroplacental blood flow is further reduced, the fetus may become hypoxic and so be classified in the third group (c).

c) In this group, in addition to clinical I.U.G.R. and abnormal hormone and enzyme values, the D.F.M.R. shows M.A.S. Furthermore the F.H.R. may show a pathological pattern, and amniocentesis may show meconium. This situation indicates a severely distressed fetus and impending death requiring prompt delivery provided that the fetus is of viable maturity.

Pregnant women in group b), with biochemical evidence of fetoplacental impairment, should be hospitalized and monitored daily by D.F.M.R. and F.H.R. to determine whether there is immediate danger to fetal life. Group c): This classification may lead to a more rational management of the high risk pregnancy.

their cessation for at least 12 hours, while fetal heart beats are still audible, was referred to as a "movements alarm signal" (M.A.S.). This signal points to a severely distressed

fetus and indicates impending intrauterine fetal death. Such development is an indication for immediate delivery of the fetus, provided it is viable. As a result, daily fetal movements recording (D.F.M.R.) may be used to monitor fetal well-being.

The purpose of the present study was to evaluate our experience in antenatal monitoring of fetal movements in 127 normal and high risk cases in the second half of pregnancy (Tab. I). The patients recorded fetal movements for 1 to 12 hr/day. In 36 patients there occurred a decrease followed by cessation of fetal movements for at least 12 hours ("movements alarm signal" M.A.S.) while fetal heart beats were still audible. Fetal death in utero occurred in 19 of these cases when an expectant attitude was taken because the fetus was considered too immature to be viable or when other tests did not indicate fetal jeopardy. In the other 17 cases in which prompt delivery was undertaken,

all fetuses were delivered alive (Tab. II). When fetal movements were not decreased pregnancy was allowed to progress in spite of appearing clinically small for gestational age or having low estriols levels, and all fetuses were born alive.

These results indicate that in high risk pregnancy, daily recording of fetal movements may serve as means of monitoring fetal well-being and aid in the timing of delivery, because the M.A.S. provided a reliable index of impending fetal death.

It is suggested that the clinical data, hormonal and enzymatic placental function tests, ultrasound cephalometry, amniocentesis, F.H.R. monitoring and daily fetal movement recording (D.F.M.R.) could be used to classify high risk pregnancies into three distinct groups for purposes of clinical management.

Keywords: Fetal death, fetal movement, timing of delivery

Zusammenfassung

Bestimmung des Geburtszeitpunktes bei Risikoschwangerschaften durch Registrierung fetaler Bewegungen.

Intrauterine Kindsbewegungen sind Ausdruck fetalen Wohlbefindens; es konnte beobachtet werden, daß bei Fällen mit Placentarinsuffizienz die fetalen Bewegungen verringert sind.

Rückgang der Fetalbewegungen bis zum völligen Sistieren für mindestens 12 Stunden bei noch hörbaren Herztönen wurde als „Bewegungsalarm signal“ B.A.S. bezeichnet. Dieses Symptom weist auf eine schwere Depression des Feten hin und kündigt den drohenden intrauterinen Fruchttod an. Diese Beobachtung ist eine Indikation für eine sofortige Entbindung, vorausgesetzt, der Fet ist noch am Leben. Folglich kann die tägliche Registrierung von Fetalbewegungen dazu benutzt werden, das kindliche Wohlergehen zu überprüfen.

Ziel der vorliegenden Studie war es, eigene Erfahrungen mit der Registrierung antenataler Fetalbewegungen bei 127 normalen und Risikoschwangerschaften darzustellen (Tab. I). Diese Frauen bestimmten in ihrer zweiten Schwangerschaftshälfte die fetalen Bewegungen über einen Zeitraum von 1–12 Stunden pro Tag.

Bei 36 Patientinnen trat eine Abnahme bis zum völligen Fehlen von Fetalbewegungen für mindestens 1 Tag auf, während die Herztöne hörbar blieben. In 19 dieser Fälle trat ein intrauteriner Fruchttod ein, weil man sich abwartend verhielt mit der Begründung, daß der Fet noch klein und nicht lebensfähig sei oder weil andere Überwachungsmethoden die fetale Gefahr nicht angezeigt hatten. Bei den anderen 17 Frauen, die sofort entbunden wurden, waren alle Kinder am Leben (Tab. II).

Wenn die fetalen Bewegungen nicht abgenommen hatten, wurde die Schwangerschaft trotz eines klinisch hypotrophen Kindes und trotz tiefer Östriolwerte weitergeführt. Die Ergebnisse zeigen, daß das tägliche Bestimmen von Kindsbewegungen bei Risikoschwangerschaften eine Methode ist, das fetale Wohlergehen zu erfassen und den Zeitpunkt der Geburt zu bestimmen. Auf der Basis klinischer Daten unter Zuhilfenahme hormoneller und enzymatischer Placentafunktionstests, der Ultraschallcephalometrie, der Amniocentese, der fetalen Herzfrequenzregistrierung und der Bestimmung der fetalen Bewegungsaktivität ist es möglich, Risikoschwangerschaften in 3 Gruppen einzuteilen.

Schlüsselwörter: Bestimmung des Zeitpunktes der Geburt, fetale Bewegungen, intrauteriner Tod.

Résumé

Détermination de la date d'accouchement dans les grossesses à haut risque par l'enregistrement des mouvements du fœtus

Les mouvements du fœtus dans l'utérus sont l'expression du bien-être foetal et on a observé qu'ils sont réduits dans les cas d'insuffisance placentaire.

La réduction de ces mouvements du fœtus, jusqu'à leur interruption d'au moins 12 heures tandis que les battements du cœur foetal sont encore audibles, est définie comme un « signal d'alarme des mouvements »: M.A.S. Ce signal témoigne d'un distress grave pour le fœtus et d'un risque imminent de mort foetale intrautérine avec, pour indication,

l'accouchement immédiat à condition que le fœtus soit viable. En conséquence, on peut utiliser l'enregistrement quotidien des mouvements du fœtus (D'F'M'R') pour déterminer le bien-être foetal.

La présente étude se propose d'évaluer notre expérience de l'enregistrement prénatal des mouvements foetaux dans 127 cas normaux et à haut risque (Tab. I). Ces femmes arrivées à la seconde moitié de la grossesse ont enregistré les mouvements foetaux pendant 1 à 12 h/jour.

Chez 36 parturientes, on a observé une diminution jusqu'à interruption complète des mouvements du fœtus pendant

un jour au moins tandis que les battements du coeur étaient audibles. La mort foetale intrautérine est survenue dans 19 de ces cas où on était resté en situation d'attente après avoir estimé le fœtus trop petit et non viable ou les autres tests n'indiquant aucun risque. Dans les 17 autres cas où on avait procédé à un accouchement immédiat, tous les fœtus ont été accouchés vivants (Tab. II).

En cas d'absence d'une diminution des mouvements foetaux, on a laissé la grossesse se poursuivre malgré l'immaturité clinique des fœtus ou les taux bas d'oestriol.

Ces résultats indiquent que pour les grossesses à haut risque, l'enregistrement quotidien des mouvements du fœtus peut servir à déterminer le bien-être foetal et aider à fixer la date de l'accouchement.

Il est possible de classer les grossesses à haut risque en trois groupes en s'appuyant sur les données cliniques avec l'aide des tests de fonction hormonale et placentaire enzymatique, de la céphalométrie ultrasonore, de l'amniocentèse, de l'enregistrement F.H.R. (rythme cardiaque foetal) et du D.F.M.R.

Mots-clés: Mouvements du fœtus, mort foetale, détermination de la date d'accouchement.

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E. Sadovsky
Dept. Obstet. & Gynec.
Hadassah University Hospital
P.O.B. 499
Jerusalem/Israel