The Fetal Biophysical Profile and its Predictive Value in Antenatal Fetal Assessment

FETAL BİOFİZİK PROFİL VE ANTENATAL FETAL DEĞERLENDİRMEDEKİ ÖNEMİ

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SUMMARY

Fetal biophysical profile (FBP) scoring was used as a method for antenatal fetal risk assessment in 104 high-risk pregnancies. Firstly a nonstress test was done in these patients and then after the other four fetal parameters were observed with real-time ultrasonography: Fetal breathing movements, fetal movements, fetal tone, and amniotic fluid volume. Fetal biophysical profile score was found to be normal (18) in 84 patients (80.7%), equivocal (-6) in 17 patients (16.4%) and abnormal (<4) in 3 patients (2.9%). In 84 patients in whom FBP score was normal, no fetal death occurred (Perinatal mortality=666 per 1000). A statistically significant relationship was determined between FBP score and perinatal mortality, intra-uterine fetal distress and Apgar score (p<0.01). It is concluded that fetal biophysical profile scoring is an accurate method for identification of the fetus at risk for perinatal death.

ÖZET

104 yüksek riskli gebede, antenatal fetal riskin değerlendirilmesi amacıyla Fetal Biofizik Profil (FBP) skorlama yapılmıştır. Bu hastalarda önce nonstress test yapılmış, ardından real-time ultrasonografi aracılığıyla fetal solunum hareketleri, fetal hareketler, fetal tonus ve amnion sıvı miktarı araştırılmıştır. FBP skor 84 gebede (%80.7) > 8 (normal), 17 gebede (%16.4) - 6 (şüpheli), 3 gebede (%2.9) ise < 4 (anormal) bulunmuştur. FBP skorun normal olduğu 84 olguda fetal ölüm saptanmamış (périnatal mortalité: 0), buna karşın skorun anormal bulunduğu 3 olgunun 2'sinde fétus ex olmuştur (périnatal mortalité: binde 666). FBP skoru ile périnatal mortalité, intra-uterin asfiksi ve Apgar skoru arasında istatistiksel anlamlı ilişki bulunmuştur (p<0.01). Sonuç olarak, fetal biofizik profil skorlamanın, périnatal ölüm açısından yüksek riskli fetusların saptanmasında oldukça doğru bir yöntem olduğu kanısına varılmıştır.

Antepartum idendification of the fetus at risk for death or damage in utero remains a major challenge in modern obstetric practice. Until recently, monitoring and recording of the fetal heart rate was the only accurate fetal biophysical variable in the antepartum period, accelerations of the fetal heart rate to fetal movements (nonstress test) and to contractions (Contraction stres test) were accepted as the standart method of assessing fetal health in advanced gestation. These tests predict normal outcome fairly well, but are much less accurate for poor outcome (1). Moreover, the use of contraction stress testing presents practical difficulties as it is lengthy and cumbersome (2).

With the use of real-time ultrasound in obstetrics in the past 10 years, monitoring of fetal biophysical activities has become widely applied as a method for antepartum evaluation of fetal well-being. Manning et al (3) described a fetal biophysical profile scoring in 1980 by using fetal tone, fetal body movements, fetal breathing movements, amniotic fluid volume and nonstress test. Subsequent studies showed that FBP sco ring had significantly low false negative and false positive rates and this combination of five biophysical observations led to improved fetal assessment (4,5).

In this study, our aim was to investigate the vaule of fetal biophysical profile in the evaluation of fetal weill-being in antepartum period.

MATERIAL AND METHODS

Between August 1990 and February 1991, 104 "high-risk" pregnancies of longer than 34 weeks gestation were referred for antepartum testing to department of obstetrics and gynecology of Ege University Medical Faculty. The indications for initial referrals were listed in Table 1. Twin pregnancies, pregnancies with premature rupture of membranes were excluded from this study. All patients were delivered within seven days of the last test. Studies were repeated weekly in most patients and twice a week in others (D. Mellitus, post-term pregnancies and preeclampsia etc.).

Fetal evaluation was initiated with nonstress testing. The nonstress test was done by means of Doppler ultrasound to record fetal heart rate and tocodynamometer to record fetal movements (Hewlett-packard 8021 A cardiotocograph). The ultrasound evaluation was done by means of a linear array real-time ultrasound method (Shimadzu-SDL-100 A2) equipped with a 3.5 Mhz transducer. During the ultrasound evaluation, fetal movements and fetal breathing movements were counted and fetal tone, amniotic fluid volume were estimated. Each biophsical variable was scored as 2 if it is positive and O if it's negative according to biophysical profile scoring described by Manning et al (3). The criteria used in this study are listed in Table 2. Recommended clinical management based on the fetal biophysical score was shown in Table 3 (4).

The ability of the fetal biophysical profile score to predict an abnormal perina'al outcome was tested. An abnormal perinatal outcome was defined as one or more of the following: 1-Fetal distress in labor, characterized by repeated late decelerations or repeated profound variable decelerations or persistent bradycardia or amniotic fluid with meconium. 2-Five minute Apgar score is less than 7. 3-Perinatal death of an infant who weighed 500gr. or more up to the twenty-eight day of age.

The statistical evaluation was done by the x^2 test in Ege University, the center of computer sciences.

RESULTS

The mean age of 104 patients was 27.6*0.6 years (The youngest 17, the eldest 42). The mean gestational age was 38.6+0.3 weeks (29-42 weeks). The birth weight ranged from 1550 to 4200gm. with the mean of 3227±57gm.

The biophysical profile score of 104 patients and perinatal mortality, patients with fetal distress in labor and five minute Apgar score is less than 7 were listed in Table 4. Of 104 patients, 84 (80.7%) had normal FBP score (>8); 17 had an equivocal FBP score (-6). whereas 3 patients (2.9%) had an abnormal score (<4).

Of 3 patients with abnormal FBP score, the first patient was admitted with the diagnosis of "Preeclampsia". During the initial evaluation, a FBP score of 4 was found (Fetal movements and fetal tone were present). During oxytocin induction, fetus died and patient delivered same day.

Table 1.   Study population by primary indication for referral

Indication for Referral	No. of Patients
1. Diabetes mellitus	
Gestational	7
Insuline-dependent	3
2. Hypertension	
Chr: Hypertension	8
Preeclampsia	11
3. Hypertension + D.mellitus	1
4. Post-term pregnancy	12
5. Suspect infra-uterine growth retardation	10
6. Antepartum hemorrhage	4
7. Rh isoimmunization	22
8. Pregnancy complicated by heart disease	3
9. Pregnancy complicated by lung disease	1
10. Others (Pr. infertility, elderly primigrávida etc.)	22

Table 2.   Technique and interpretation of biophysical scoring (From Manning et al (4))

Biophysical variable	Normal (Score:2)	Abnormal (Score:o)
1.Fetal breathing movements	One or more episodes of >30 sec in 30 min	Absent or no episode of <30 sec in 30 min
2 Gross body movements	Three or more discrete body/limb movements in 30 min	Two or less episodes of body/limb movements in 30 min
3. Fetal tone	One or more episodes of active extension with return to flexion of fetal limbs or trunk, opening and closing of hand considered normal tone	Either slow extension with return to partial flexion or movement of limb in full extension or absent fetal movement.
4. Reactive fetal heart rate	Two or more episodes of acceleration of> 15 bpm and of >15 sec associated with fetal movement in 20 min	Less than 2 episodes of accleration of fetal heart rate or acceleration of 15 bpm in 40 min
5.Qualitative amniotic fluid	One or more pockets of fluid measuring^ 1 cm in two perpendicular planes	Either no pockets or a pocket 1cm in two perpendicular planes

Table 3. Management scheme based on biophysical scoring (From Manning et al (4))

Score	Recommended management
8-10	Repeat in 1 week. In diabetic and postdates pregnancies, repeat twice weekly. No indication for active intervention.
4-6	If fetal pulmonary maturity assured and cervix favorable, deliver, otherwise repeat in 24h. It persistent score of 4 to 6, deliver if fetal pulmonary maturity certain Otherwise that with steroid and deliver in 48 h.
0-2	Evaluate for immediate delivery. In cases of certain pulmonary Immaturity, give steroids and deliver In 24 h.

The diagnosis of the second patient was "Chronic Hypertension and small for gestational age baby" In this patient, there was only fetal tone and FBP score was found to be 2.A dead fetus (2400gm.) was delivered the same day.

The third patient had had a "Post-term pergnancy" diagnosis. FBP scoring was done and a total score of 4 was determined (Fetal movements and fetal tone). The same day, patient delivered a live baby with vacuum extraction. (Birth weight: 3200gm. and five minute Apgar score was 6).

Taken together, there were 2 fetal death In 104 high-risk patients and perinatal mortality in this study was found to be 10.8 per 1000.

The results of the Individual biophysical variables and the two categories (normal and abnormal) of the biophysical profile, along with their relationships to perinatal complications, were shown in Table 5.

DISCUSSION

Fetal biophysical profile scoring is a method of fetal asssessment based on dynamic ultrasound monitoring of five fetal variables, and interpretation of these variables as normal or abnormal according to fixed criteria (Table 2). The variables may be considered as two groups: those that reflect immediate fetal condition (Fetal movement, tone, breathing, heart rate activity) and that reflect fetal condition in the longer term (Amniotic fluid volume). The variables are judged as normal or abnormal and then are assigned an arbitrary score of two if normal or zero if abnormal (6).

After developing biophysicol profile scoring system, Manning et al (4) reported the results of a prospective clinical management based on a fetal biophysical profile scoring method in 1.184 high-risk patients. The false negative rate, defined as a death within a week of a normal last test, was 0.8 per 1000. Overall perinatal mortality in this study patients was reported to reduce to 11.7 per 1000 as compared with an expected rate in a similar high-risk but non-tested population (68 per 1000). In our study, there was no fetal death following a normal FBP score (The false negative rate: O) and overall perinatal mortality was determined as 10.8 per 1000. Baskett et al (7) reported a similar prospective study using this method in 2400 high-risk pregnancies. In this study, perinatal mortality was 3 per 100 when FBP score was normal (8-10), whereas It was found to be 292 per 1000 when FBP was abnormal (0-4). Overall perinatal mortality reported in this study was 9 2 per 1000. During the same period, perinatal mortality was determined as 14.2 per 1000 in non-tested population. When compared to our study, perinatal mortality rates of both studies were very similar to ours.

In another study reported by Piatt et al (5) FBP scoring and its relationship with perinatal mortality, intra-uterine fetal distress and five minute Apgar score were Investigated. Perinatal mortality in this study was found as 14 per 1000. Three of the five fetal biophysical parameters succesfully predicted lower perinatal mortality rates when the test result was normal (Fetal movements, fetal tone and nonstress test). Absence of fetal distress was succesfully predicted statistically by

Table 4. The biophysical score of 104 patients and its relationship with perinatal mortality, fetal distress in labor and five minute Apgar score

Biophysical Profile Score	No. of cases	Perinatal mortality	5' Apgar Score<7	intra-uterine fetal distress
8-10	84 (80.7%)	0	1* (1.2%)	0
6	17 (16.4%)	0 0	13* (76%)	13* (76%)
4-0	3 (2.9%)	2 (66.6%)	3* (100%)	3* (100%)
Total	104	2 (1.9%)	17 (16.3%)	16 (15.3%)

*P<0.01 (Statistically significant)

Table 5. **The results of the individual biophpsical variables, along with their relationships to perinatal complications**

Variable	Score Normal (2)	Abnormal (0)	Perinatal Mortality	I.uterine Fetal Distress	5 minute Apgar Score <7
LNonstress test	88 (84.6%)		0*	4* (4.4%)	5* (5.6%)
		16 (15.4%)	2* (12.5%)	12* (75%)	12* (75%)
2. Fetal breathing movements	89 (85.6%)		0*	8* (8.9%)	8* (8.9%%)
		15 (14.4%)	2* (13.3%)	8* (53.3%)	9* (60%)
3. Fetal body movements	102 (98%)		1* (0.9%)	15* (14.7%)	16* (15.7%)
		2 (1.9%)	1* (50%)	1* (50%)	1* (50%)
4. Fetal tone	103 (99%)		2 (1.9%)	16 (15.5%)	16 (15.5%)
		1 (0.9%)			(0.9%)
5.Amniotic fluid volume	75 (72.2%)		0*	1* (1.3%)	3* (4%)
		29 (27.8%)	2* (6.9%)	15* (51.7%)	14* (48.2%)

*P<0.05 (Statistically significant)

normal results for three fetal biophysical parameters: nonstress test, amniotic fluid volume and fetal tone. None of these variables succesfully predicted a low five minute Apgar score. In our study, a statistically significant relationship was found between perinatal mortality all variables except fetal tone. While fetal tone was reported to predict perinatal mortality most accurately, we were unable to find a significant relationship between them. In our opinion, it was a result of having only one fetus whose fetal tone was abnormal in our study. Also, three of five biophysical variables succesfully predicted that if intra-uterine fetal distress would occur in labor (Nonstress test, fetal breathing movements and amniotic fluid volem). A low five minute Apgar score was succesfully predicted by abnormal test result of all variables except fetal tone In our study.

FBP scoring was found to have 100% sensitivity and 98% specifity In high-risk pregnancies In our study. The positive predictive value of this test was 66% and the negative predictive value was found to be 100%. The conclusion from this study is that FBP scoring Is a reliable and accurate method In antepartum fetal assessment.

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