

Prognostic value of biophysical profile score in post-date pregnancy

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Summary: Objectives: This study was undertaken to assess the ability of each individual biophysical profile score variable and combination of variables, to predict fetal distress or imminent labor in the post date pregnancy.

Materials and methods: From June 1992 to August 1993, Biophysical Profile Scoring (BPS) was performed on 182 pregnant women. Thirty one patients delivered between 42 and 43 weeks of gestation, while the other 151 pregnant women delivered between 38 and 41+6 days. Monitoring procedures were based on the evaluation of fetal heart rates by Non Stress Test and four ultrasound parameters:

- Fetal Tone;
- Gross Body Movements;
- Fetal breathing movements;
- Evaluation of amniotic fluid volume.

Results: In this analysis the BPS showed a high specificity (82.7%) with a negative predictive value of 100%. The mean value of the last BPS among the 151 term patients was significantly higher if compared with the 31 post term pregnant women (6.73 and 6.12 respectively with $p < 0.05$). The predictive value of Fetal Breathing Movements (FBM) for the onset of imminent labor was confirmed.

Conclusion: BPS, as measured in this study, has proved to be a very accurate method of determination of fetal well-being. Although these results will be further verified by other studies, BPS should come into general use to help reach the correct diagnosis and treatment of post date pregnancy.

Key words: Post date pregnancy; Fetal biophysical profile scoring; Antepartum fetal evaluation; Fetal distress.

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INTRODUCTION

The actual incidence of pregnancies extending beyond 42 weeks has been reported as 3.5% to 10%.

Macrosomia, fetal distress in labor, oligohydramnios, post-maturity syndrome, congenital anomalies and subsequent development of behavioural disturbances are associated with an increase in perinatal

morbidity and mortality of post term fetuses (1, 2, 3, 4).

Many investigators have attempted to identify specific biochemical or biophysical parameters to find out the fetus at risk in post date pregnancy. The fetal Biophysical Profile Score (BPS), described by Manning in 1980 and recently referred on a wide high risk pregnancy population, holds promise as an improved method of fetal risk detection.

In fact the negative predictive value was 92% with a low false negative rates (0.6-0.7%) (5). The BPS was used to measure five fetal parameters during a single observation period:

- Fetal Breathing Movements;
- Fetal Movements;
- Fetal Tone;
- Non Stress Test;
- Amniotic Fluid Volume.

This study was undertaken to assess the ability of each individual biophysical profile score variable and combination of variables, to predict fetal distress or imminent labor in the post date pregnancy.

MATERIALS AND METHODS

From June 1992 to August 1993, Biophysical Profile Scoring described by Manning *et al.*, was performed on 182 pregnant women. Thirty one (17%) pregnant women delivered between 42 and 43 weeks of gestation, while 151 (83%) patients delivered between 38 and 41 weeks+6 days. Gestational date were derived from menstrual dates and confirmed by early real-time ultrasonography examination of CRL (Crown-Rump Length and BPD (Biparietal Diameter) within 16 weeks of gestation. Ultrasonographic images were obtained by ecography Ansaldo AU 940 with a 3.5 MHz linear transducer. The BPS was performed by two operators. Monitoring procedures were based on the evaluation of fetal heart rates by Non Stress Test and four ultrasound parameters:

1) Fetal Tone: at least 1 episode of active extension with return to flexion of fetal limb(s) or trunk in 30 min. Opening and closing of hand considered normal tone.

2) Gross body movements: considered normal at least 3 discrete body/limb movements in

30 min. (episode of active continuous movement considered as single movement).

3) Fetal breathing movements: at least 1 episode of fetal breathing movements or at least 30 seconds duration in 30 minutes of observation.

4) Evaluation of Amniotic Fluid Volume by:
- measurement of maximal vertical pocket in mm of amniotic fluid (normal value > 10 mm);
- measurement of Amniotic Fluid Index (AFI) by 4 quadrants technique described by Phelan (6). An AFI < 5 cm is equivalent to oligohydramnios, an AFI > 20 cm is equivalent to polyhydramnios.

To each variable a value of 2 or 0 was assigned according to presence of absence respectively. If all four ultrasound parameters (fetal movements, fetal tone, fetal breathing movements and amniotic fluid volume) were presented, the BPS was considered normal. A score of 6 was equivocal, while a score ≤ 4 was abnormal with a high risk of intrapartum fetal distress. The BPS was performed every 3 days until 41 weeks+6 days and each day from 42 weeks forwards. For score ≤ 6 the BPS was repeated within 24 hours. The results obtained from 31 post-term pregnant women were compared to term pregnancies and to neonatal outcome which include:

- birthweight;
- Apgar at first and fifth minute and sum of these values;
- presence of macrosomia, fetal distress in labor (defined by presence of periodic fetal heart rates decelerations), oligohydramnios, post-maturity syndrome, meconium;
- admission to a neonatal intensive care unit for not less than 24 hours.

For each individual biophysical profile score variable and combination of variables, sensitivity, specificity and positive and negative predictive values were determined.

Fisher test was applied for pair values with different variance. A value of $p < 0.05$ was considered significant.

All variances were expressed \pm SD.

RESULTS

Of the 31 post-term pregnant women observed from the 38th week, 64.3% were nulliparous and 35.7% were pluriparous. Among the 151 at term-pregnant women, 40.8% were nulliparous and 59.2% were pluriparous. Of the 31 post-term patients, 64.5% delivered spontaneously, 6.5% had induced labor and 29% required caesarean section.

Table 1. – *Characteristics of 22 post term pregnant women and 101 term patients with vaginal delivery.*

Characteristics	Term (n=101)		Post term (n=22)		p
	Mean	SD	Mean	SD	
Age	28.7	1.46	28.2	1.62	NS
Last BPS	6.80	1.19	6.45	1.59	NS
Apgar *	16.4	0.96	16.2	1.12	NS
Meconium	2	(1.98%)	3	(13.6%)	
Placental weight	588.3	48.3	608.8	50.2	NS
Birth weight (gm)	3402.9	371.8	3423.7	350.4	NS

(*) Sum of 1 and 5-minute Apgar score.

Of the 151 term-pregnant women, 66.89% delivered spontaneously and 33.11% had a caesarean section.

Tables 1-2 show the average of some quantitative clinical data of the two groups of pregnant women studied, according to mode of delivery.

We observed that the mean value of the last BPS among the 151 term patients was significantly higher if compared with the 31 post-term pregnant women (6.73 and 6.19 respectively with $p < 0.05$). The last BPS of term patients undergoing caesarean section (which included repeated caesarean section and breech presentation) was significantly higher if compared with the BPS of post-term caesarean section

(7.06 and 5.78 respectively). The mean value of the sum of 1 and 5-minute Apgar score was higher among neonates delivered vaginally if compared to neonates delivered by caesarean section ($p < 0.05$ for post-term group and $p < 0.01$ for the term group).

There were no characteristic neonatal complications of post date fetuses (macrosomy, dismaturity, etc.) and no admissions to the neonatal intensive care unit in our population. There were no statistical differences in the AFI between the two groups. The AFI showed a progressive reduction during the last period of pregnancy with a marked decrease from 41st to 42nd week in the post-term group with

Table 2. – *Characteristics of 9 post term and 50 at term patients submitted to caesarean section.*

	Term caesarean section				Post term caesarean section		
	For pathology		**other		Mean	SD	p
	Mean	SD	Mean	SD			
N.	16		34		9		
Age	30	1.83	28.4	1.73	29.3	1.66	NS
Last BPS	5.75	1.56	7.06	1.11	*5.78	1.47	* $p < 0.01$
Apgar sum	*14.4	1.73	*15.9	1.70	14.7	2.16	* $p < 0.01$
Meconium	4	(8%)	–	–	6	(66.7%)	
Placental weight	583.1	55.6	590.9	49.7	582.2	48.9	NS
Birth weight	3357.5	378.7	3369.7	392.0	3350.0	344.2	NS

(**) Includes repeated caesarean section and breech presentation.

Table 3. – Amniotic fluid index (AFI) in post and term patients.

Weeks	38		40		41		42		p
	No.	AFI	No.	AFI	No.	AFI	No.	AFI	
At term vaginal delivery	53	12.2	52	12.3	34	11.1			NS
Post term vaginal delivery	2	13.7	5	12	13	*12.7	18	*10.7	*p<0.05
At term pathological caesarean section	8	**8.8	7	11.1	6	9.6			**p<0.01
At term other caesarean sections	21	**12.9	15	11.7	4	13.4			NS
Post term caesarean section	2	15.7	2	10.2	4	12.8	7	10.0	NS

vaginal delivery (12.7 and 10.7 respectively with $p<0.05$) (Table 3). Figs. 1, 1a, 2, 2a, 3, 3a show the BPS assessment at 38th, 40th, 41st, 42nd week in the two groups tested, according to mode of delivery. The fetal breathing movements were found in 72% of term pregnant women with spontaneous delivery at 38th week, in 64% at the 40th week and in 62% at the 41st week. In the post term pregnant women with spontaneous delivery, the fetal breathing movements were represented in 50% of cases at the 38th week, in 80% at the 40th week, in 77% at the 41st week and in 50% at the 42nd week. The fetal breathing movements of term pregnant women who underwent caesarean section were represented in 76% of cases at the 38th week, in 86% of cases at the 40th week and in 80% of cases at the 41st week. In the post term pregnant women who delivered with caesarean section the fetal breathing movements appeared at the 38th, 40th and 41st week in 100% of cases, while it disappeared in 29% of patients at the 42nd week. Furthermore Fig. 1 illustrates a correlation between decreased fetal breathing activity with progression of pregnancy. The gross body movements were found in 98% of term pregnant women with spontaneous delivery at the 38th, 40th and 41st week, while body movement were represented in 100% of post term patients at the 38th week, in 80% of cases at the 40th week and in 90% of pregnant wo-

men after the 41st week. In term pregnant women who underwent caesarean section the gross body movements were found in 95% of cases at the 38th week, in 86% of patients at the 40th week. In the post term patients gross body movements were represented in 100% of cases until the 41st week with a progressive reduction near the 42nd week. The fetal tone was found in 90% of term pregnant women with spontaneous delivery at the 38th week, in 93% of cases at the 40th week, in 88% of cases at the 41st week with a progressive reduction near term, while in post term pregnant women fetal tone was found in 100% of cases until the 40th week, in 92% of patients at the 41st week and in 83% of cases at the 42nd week. The fetal tone was absent in 28% of term pregnant women with caesarean section at the 38th week, in 23% of cases at the 40th week and in 40% of cases at the 41st week. In post term patients with caesarean section fetal tone was represented in 100% of cases at the 38th and 40th weeks, disappearing in 50% of cases at the 41st week and in the 29% at the 42nd week. The fetal tone appeared to be in good correlation with fetal well-being, in fact it was associated with a physiological labor and delivery. Once again there was a correlation between the absence of fetal tone and caesarean section and between the presence of fetal breathing movements and prolongation of pregnancy.

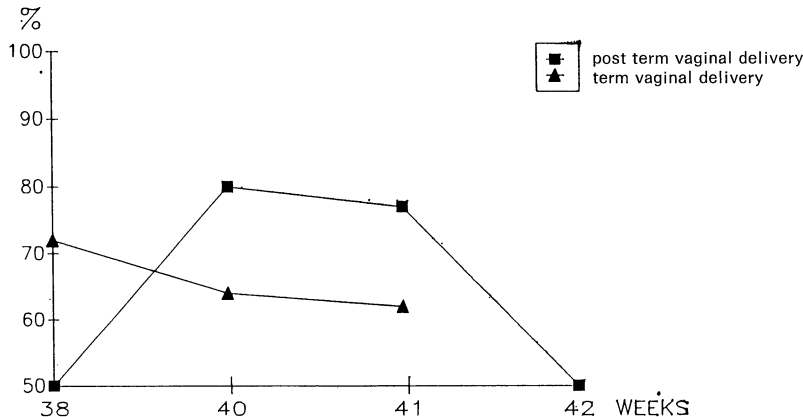


Fig. 1. — Incidence of fetal breathing movements in post-term and term vaginal delivery.

DISCUSSION

The significance and appropriate management of post-term pregnancy has been and remains a highly controversial issue in obstetrics. Gauging the fetal condition based on biophysical parameters, has been possible since the advent of real time ultrasound. The possible approaches to an intrauterine embryo-fetal movements visualization are:

- the assessment of physiological and behavioural variables which, for many functions, are under CNS control. A

progressive complexity of dynamic biophysical activities in the fetus suggests the presence of several stages of neurologic organization;

- the possibility of a differentiation between a normal and a compromised fetus by a decrease, cessation or change in fetal motor behaviour, which may be an indication of a change in the fetus CNS development;
- the analysis of the fetal psychic development which is a direct reflection of fetal motor behaviour.

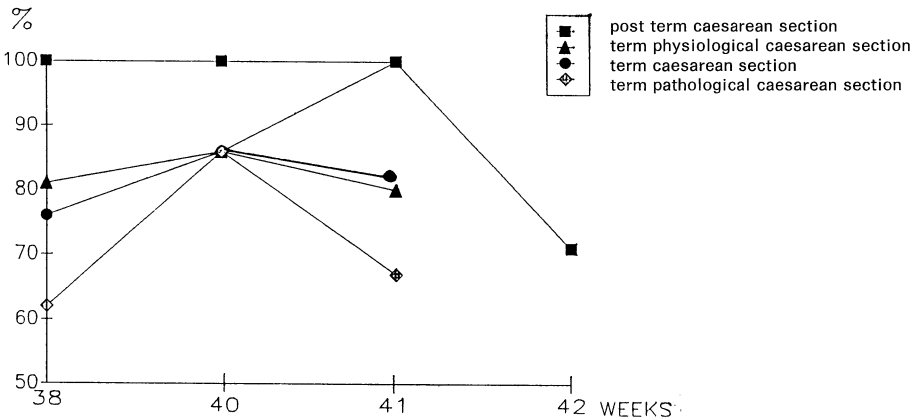


Fig. 1a. — Incidence of fetal breathing movements in post-term and term caesarean section.

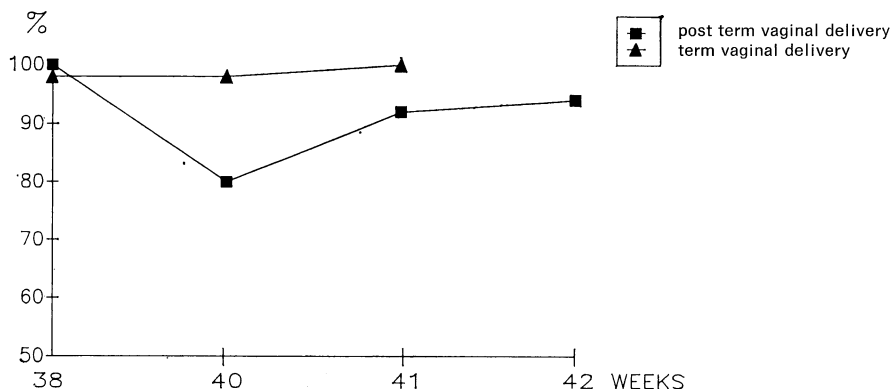


Fig. 2. — Incidence of fetal movements in post-term and term vaginal delivery.

Fetal biophysical activities are initiated by nervous impulses that arise from different anatomic sites in the brain. It has been hypothesized that fetal tone is regulated by the cortex, fetal movements by the cortex nuclei, breathing movements by the ventral surface of the fourth ventricle, and the fetal heart rates by the posterior hypothalamus and medulla (7). Recent reports (5, 8, 9) have shown a high correlation between the presence of fetal breathing movements, fetal body movements, fetal tone and normal amniotic fluid volume with normal neonatal out-

come. A decrease in fetal breathing activity during the 72 hours period before spontaneous labor at term was reported by Boddy and Dawes (10). They also found a decrease in fetal breathing activity during labor. The reduction of fetal breathing movements in labor was confirmed by Lewis and Boylan (11). Carmichael *et al.* (12) also reported a significant decrease in the incidence of fetal breathing movements during the last 3 days before at term spontaneous delivery.

In 70 patients who were between 32 and 36 weeks of gestation and who com-

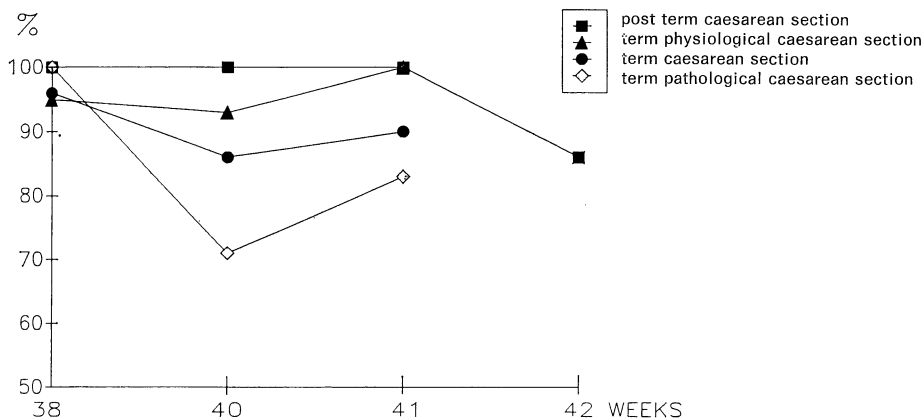


Fig. 2a. — Incidence of fetal movements in post-term and term caesarean section.

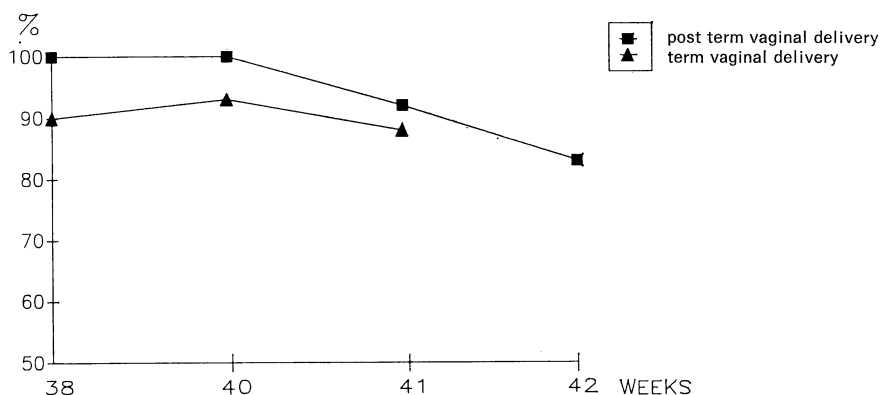


Fig. 3. — Incidence of fetal tone in post-term and term vaginal delivery.

plained of painful uterine contractions real time ultrasonography was performed by Schreyer *et al.* ⁽¹³⁾ to establish the presence or absence of fetal breathing movements. Ten of the 14 women in whom no fetal breathing movements could be detected were delivered of their babies within 48 hours, whereas the pregnancies continued for a week or longer in 52 of the 56 patients in whom fetal breathing movements were presented. Schreyer interpreted the presence of fetal breathing movements

as a marker of imminent labor with a false positive rate of 14.3% and a false negative rate of 3.5%, whereas the predictability of imminent labor on this basis was >80%. In our study the predictive value of fetal breathing movements for the onset of imminent labor was confirmed. In fact the negative predictive value of the fetal breathing movements in post-term patients with vaginal delivery and caesarean section was 81.2% and 100% respectively if compared to term patients

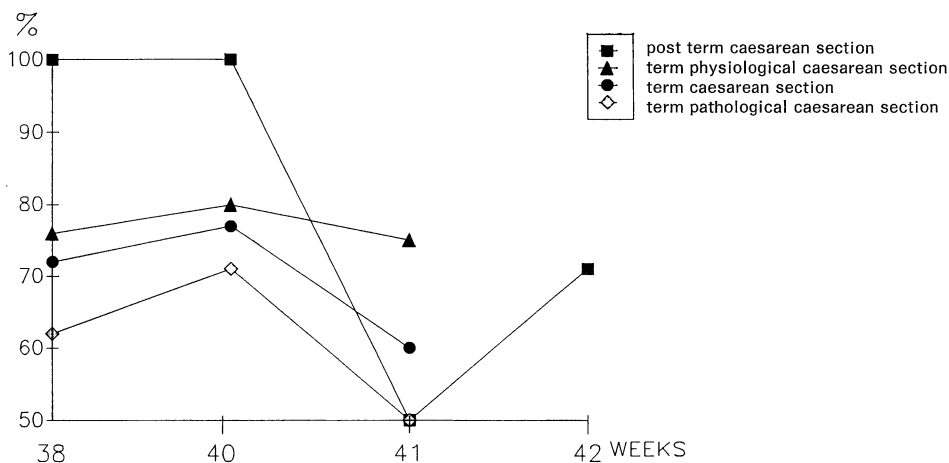


Fig. 3a. — Incidence of fetal tone in post-term and term caesarean section.

Table 4. – Correlation between sum of 1 and 5 minute Apgar score and BPS within 72 hours before delivery in 31 post term pregnancies.

Apgar	<14	>14
BPS <4	–	6
BPS >6	–	25
Sensitivity	–	
Specificity	82.7%	
PV +	–	
PV –	100%	

at the 41st week. As suggested by Castle and Turnbull⁽¹⁴⁾ the link between labor and fetal breathing may be the prostaglandins, with regard to both their oxytocic and fetal apnoeic effects. We have also confirmed the association between decreased amniotic fluid volume and post term pregnancy. In fact amniotic fluid volume decreases beyond 38 weeks, averaging 300 ml at 42 weeks and decreasing further in more prolonged gestations, thus increasing umbilical vulnerability. Consequently, it has been suggested that umbilical cord compression rather than placental dysfunction may account for most perinatal morbidity in post term gestation⁽¹⁵⁾. Many different techniques of measurements and ultrasonographic definition for oligohydramnios are available. The most commonly used technique in our institute is the amniotic fluid index. This technique offers significant advantage over other techniques by providing an indirect estimate of the total intrauterine volume^(16, 17). In this study we found a marked reduction of AFI in the post term group from the 41st and 42nd week. The results of this prospective clinical analysis of a selective management strategy for the postdate pregnancies are very encouraging. The appropriate management of the obstetric patients whose gestation has exceeded the 42nd week remains one of the most difficult problems in modern perinatal medicine. The perinatal risk of the postdate syndrome are well established, perinatal

mortality doubles for each additional week after the 42nd⁽¹⁸⁾.

One simple solution to this problem would be to deliver all patients by the end of 42nd week. However, such a nonselective approach, while being undertaken to prevent perinatal morbidity and mortality, may create iatrogenic morbidity for the mother. A more logical approach may be to consider both fetal and maternal prognostic factors in selecting the most appropriate management strategy. Fetal biophysical profile scoring, as measured in this study, has proved to be a very accurate method of determination of fetal well-being. In this analysis the correlation between fetal biophysical profile score and sum of 1 and 5-minute Apgar score in post term pregnant women, showed a high specificity (82.7%) with a negative predictive value of 100% (Table 4). The BPS specificity was higher in the 22 post term vaginal deliveries if compared to the 9 post term caesarean sections (90.5% and

Table 5. – Correlation between sum of 1 and 5 minute Apgar score and BPS within 72 hours before delivery in 9 post term caesarean section.

Apgar	<14	>14
BPS <4	–	3
BPS >6	–	6
Sensitivity	–	
Specificity	62.5%	
PV +	–	
PV –	100%	

Table 6. – Correlation between sum of 1 and 5 minute Apgar score and BPS within 72 hours before delivery in 22 post term vaginal delivery.

Apgar	<14	>14
BPS <4	–	3
BPS >6	–	19
Sensitivity	–	
Specificity	90.5%	
PV +	–	
PV –	100%	

62.5% respectively) (Tables 5, 6). The clinical application of this data could construct a new scoring system in which variables receive different relative weight, according to gestational age. Although these results will be further verified by other studies, BPS should come into general use to help reach the correct diagnosis and treatment of post date pregnancies.

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