ORIGINAL   PROF-1030

BIOPHYSICAL SCORE;
HIGH RISK   PREGNANCY

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ABSTRACT... dayshashahid@yahoo.co.uk A pregnancy is defined as high risk when there is a likelihood of an adverse outcome to the woman and or her baby that is greater than the incidence of that outcome in the general pregnant population. **Objectives:** To determine the efficacy and predictive value of biophysical profile in detecting perinatal outcome. **Design:** Observational study. **Setting**: Obstetrics and Gynaecology department, PNS SHIFA Karachi **Period:** From February 2003 to October 2003. **Patients and Methods**: The study was carried on 100 randomly selected high risk pregnant patients who reported to gynae OPD or were referred from different armed forces hospitals from all over sindh . Manning's biophysical profile excluding nonstress test and including only ultrasound based parameters were employed for fetal screening (BPS 8/8). These parameters include four variables i.e fetal breathing movement, fetal tone, fetal movements, and amniotic fluid volume. Nonstress test and Doppler studies were used as backup tests where biophysical profile was abnormal. All cases selected were admitted in the hospital and each had an admission biophysical profile followed by subsequent monitoring. Parameters for abnormal perinatal outcome include fetal distress in labour, five minute apgar score less than 7/10, admission of newborn to intensive care unit and stillbirth or neonatal death. The result of last biophysical profile is compared with perinatal outcome. For statistical analysis the predictive value, specificity and sensitivity are used to determine the ability of biophysical profile to predict an abnormal perinatal outcome. **Results**: Out of 100 cases 92 had a normal biophysical profile in the last scan of 8/8. 90 cases had a normal perinatal outcome with A/S > 7/10. In two cases A/S at 1 and 5 minute is < 7/10 with one baby shifted to nursery for delayed cry. 08 cases had an abnormal biophysical profile with scores of 4/8 and 2/8. There was one false positive who showed abnormal biophysical profile but baby was born with an A/S of 8/10 at 05 minutes. There was no neonatal death in this study group. The sensitivity of biophysical profile was 77.7%, specificity 98.90%. predictive value for a positive test was 87.5%, predictive value for a negative test was 97.8%. **Conclusion:** Biophysical profile is highly accurate and reliable test of diagnosing fetal status.

Key words: Bio physical profile, high risk pregnancy, and perinatal outcome.

INTRODUCTION
Great majority of pregnancies have favorable results, but unfortunately it can not be anticipated with a high-risk pregnancy. Out come in a high risk pregnancy can be improved by employing a system that identifies risk factors and mitigates problems in pregnancy and childbirth.

Real time ultrasound offers the clinician the advantage of having a direct view of the fetus. We can monitor a cluster of biophysical variables with real time ultrasound both dynamic and static collectively termed as bio-physical profile[2].

The maternal appreciation of fetal life has been, since ancient times, a traditional indication that the pregnancy is proceeding normally. Ultrasound has broadened the scope of fetal assessment as a means of determining fetal well-being.

It became evident from animal and human fetal studies that biophysical activities are cyclical, this inherent variability being the result of intrinsic CNS generated rhythms that varied in duration from 30 to 60 minutes and over a 24 hour cycle. The presence of any normal biophysical activity regardless of its duration is a powerful indicator of fetal health.

* Fetal breathing movements
* Gross body movements
* Tone
* Heart rate accelerations with fetal movements
* Qualitative assessment of amniotic fluid volume,

The final idea, that of combining all above variables; emerged as a result of a prospective study designed to determine which of these variables used alone would be the most accurate predictor of perinatal outcome. Best accuracy was achieved if all five variables were considered in combination[3].

The nonstress test and the contraction stress test through electronic fetal heart rate monitoring have been the most frequently used methods for antepartum detection of fetal asphyxia. However major disadvantage of these two tests, is that fetal heart rate was the only information on which fetal health was judged. Both tests are associated with low false-negative rates (<1% to 2.7%) and very high false- positive rates (50%to75%)[4-5].

The fetal biophysical profile score (BPP or BPS) refers to the sonographic assessment of four discrete biophysical variables plus results of non stress test.

Each biophysical activity or component is scored as 0 when abnormal and given a score of 2 when normal. (Table-I). Manning and colleagues[9] were the first to report on the use of these five biophysical variables to predict perinatal outcome.

Table-I. Fetal biophysical profile scoring		
Variable	Score 2	Score 0
Fetal breathing movement	The present of at least 30 seconds of sustained fetal breathing movements in 30 minutes of observations.	Less then 30 seconds of fetal breathing movements in 30 minutes.
Fetal movement	Three or more gross body movements in 30 minutes of observation. Simultaneous limb and trunk movement are counted as a single movement.	Two or less gross body movements in 30 minutes of observation.
Fetal tone	At least one episode of motion of a limb from a position of flexion to extension and a rapid return to flexion.	Fetus in a position of semi-or full-limb extension with no return to flexion with movement. Absence of fetal movements is counted as absent tone.
Fetal reactivity	The presence of two or more fetal heart rate accelerations of at least 15 beats per minute and lasting at least 15 seconds and associated with fetal movement in 20 minutes.	No accelerations or less then two accelerations of the fetal heart rate in 20 minutes of observation.
Qualitative amniotic fluid volume	A pocket of amniotic fluid that measures at least 2 *2 cm in two perpendicular planes.	Largest pocket of amniotic fluid measures < 2 cm in two perpendicular planes.
Maximal score	10	-
Minimal score	-	0

The fetal biophysical profile is a combination of acute and chronic markers. The fetal heart rate reactivity, fetal breathing movements, fetal movements and fetal tone are the acute markers. Amniotic fluid volume and placental grading have been considered chronic markers. The acute markers are biophysical activities that are initiated and controlled by different fetal central nervous system centers[10].

These CNS centers are developed at different times during fetal life. There is convincing data that during hypoxia and acidosis the earliest biophysical activities to become compromised are fetal heart rate reactivity and fetal breathing movements[11,12,23].

In advanced fetal hypoxia and acidosis, fetal body movements and fetal tone are also absent[11,13]. The presence of a given biophysical activity during real time observation suggests that the fetal CNS center that controls the activity is functioning properly and CNS hypoxia is ruled out[14].

The chronic markers of the fetal condition (amniotic fluid volume and placental grading) are not altered by acute hypoxia changes. The presence of oligohydramnios is considered to be the result of chronic fetal distress and reflects the presence of fetal hypoxia of long duration, which is associated with redistribution of the fetal cardiac output away from non vital organs such as kidney.

The purpose of this study is to determine the efficacy and predictive value of biophysical profile to detect perinatal outcome. A modified scheme for biophysical profile scoring based on real-time ultrasonographic examination is employed in high risk pregnancies for predicting perinatal outcome . CTG and Doppler studies are used as back up tests where modified biophysical profile is abnormal and decision to be taken for time and mode of delivery. Sensitivity, specificity, positive and negative predictive values of BPP is calculated.

PATIENTS AND METHODS
The study was conducted at the department of obstetrics and gynaecology PNS Shifa Karachi, the only tertiary care hospital of armed forces in the province of Sindh.

PNS Shifa receives referral cases of high risk pregnancies not only from armed forces hospitals in Karachi but also from all over Sindh which includes Combined military hospitals in Badin, Chor, Hyderabad, and Panoaqil. The study lasted for a period of nine months starting from February 2003 and ending in October 2003. A total of 100 randomly selected patients with high risk pregnancy were included in the study.

An informal verbal consent was taken from the patients for inclusion in the study. Inclusion criteria was all high risk pregnancies such as pregnancy induced hypertension, postdate, IUGR, pregnancy with diabetes, pregnancy with cardiac disease and other such as pregnancy with thrombocytopenia, BOH, and patients reporting with less fetal movements. All were booked, singleton pregnancies, patients with multiple pregnancies, anomalous fetus and with any obstetric complication which needed early intervention with Cesarian section such as ante partum hacomoarrhage and pre-term labour were excluded from the study.

Manning biophysical profile excluding non stress test (BPS 8/8) including only real time ultrasound based parameters were employed for fetal screening.(Table-II). These parameters include four variables. i.e. Fetal breathing movement, fetal movements, fetal tone and amniotic fluid volume. Biophysical profile was evaluated by means of a real time mode ultrasound scan.

Each component of the profile was scored 0 if abnormal and 2 if normal. All cases selected for study were admitted in hospital and each had an admission biophysical profile followed by repeated BPP based on individual case to case indication. Biophysical profile in each case was done for 30 min period[15]. Non-stress test was done in those cases with abnormal biophysical profile or in labouring patients in the labour ward which is part of intrapartum management at our hospital. Doppler studies were also carried out in cases of IUGR as a back up test when profile was abnormal.

Routine antepartum monitorings were continued with daily vital sign recording of mother and intermittent fetal heart rate recording with fetoscope. Biophysical profile

was specifically repeated and recorded when ever decision was taken regarding mode and timing of delivery. In case of any abnormal biophysical scoring (<6/8) conventional intrauterine resuscitation is done followed by CTG and repeat biophysical profile. Emergency cesarean section is performed for the presence of fetal distress if score remains low (4/8,2/8), or persists at 6/8 with oligohydramnios and/or abnormal

CTG patterns persists;

1.   Repetitive late decelerations.
2.   Repetitive profound variable decelerations or prolong early decelerations with reduced variability.
3.   Persistent bradycardia (<70 beats per minute for >60 seconds).

Table-II. Modified biophysical score		
Variable	**Score 2**	**Score 0**
Fetal breathing movement	The presence of at least 30 seconds of sustained fetal breathing movements in 30 minutes of observation.	Less then 30 seconds of fetal breathing movements in 3o minutes.
Fetal movement	Three or more gross body movements in 30 minutes of observation. Simultaneous limb and trunk movements are counted as single movement.	Two or less gross body movements in 30 minutes of observation.
Fetal tone	At least one episode of motion of a limb from a position of flexion to extension and a rapid return to flexion.	Fetus in a position of semi-or full-limb extension with no return flexion with movement. Absence of fetal movements is counted as absent tone.
Qualitative amniotic fluid volume	A pocket of amniotic fluid that measures at least 2 *2 cm in two perpendicular planes.	Largest pocket of amniotic fluid measures < 2 cm in two perpendicular planes.
Maximal score	8	-
Minimal score	-	0

Parameters for abnormal perinatal outcome or endpoints of morbidity include fetal distress in labour as characterized by above mentioned fetal heart rate changes, five minute Apgar score less 7, admission of the neonate to intensive care unit and stillbirth or neonatal death. The results of last biophysical profile were compared with perinatal outcome and the ability of the profile score to predict an abnormal perinatal outcome was tested.

DATA ANALYSIS
For statistical analysis the predictive value, specificity and sensitivity were used. In this context the predictive value of a normal biophysical profile is the proportion of women with normal BPP when the infant had a normal condition; predictive value of abnormal BPP is the proportion of women with abnormal test results when the

infant had an abnormal condition; specificity is the proportion of normal infants with normal BPP; and sensitivity the proportion of infants with an abnormal condition with abnormal profiles[15].

RESULTS
Out of 100 patients forty were primigravidas and sixty patients were multigravidas.

Mean age was 33.5 years, mean gestational age was 36.5 weeks with average of 32 to 41 weeks. Last BPP to delivery interval was within 07 days, with a minimal interval of 02 hours to four days. Mean neonatal birth weight was 3300 grams with a range of 2200 to 4500. The obstetric indications for antepartum evaluation are documented in table-IV . Each patient underwent minimum of two to five scans with a total of approximately 422 BPP done in this study.

Table-III. Demographic data of study population.	
Maternal age (mean)	33.5 years (range 25 to 42)
Parity	-
Primigravida	40
Multiravida	60
Booked (n)	all
Estimated gestational age at admission	36.5 (32 to 41 weeks)
BPP to delivery interval	Mean: 1 hour to 2 days
Neonatal birth weight	3500 grams (2500 to 4500)

Table-IV. Obstetric indication for biophysical profile scoring.		
Risk factors	No of pts	%age
Pregnancy induced hypertension	38	38%
Postdate	20	20%
Suspected IUGR	18	18%
Pregnancy with diabetes mellitus	6	6%
Pregnancy with cardiac disease	3	3%
Other complications (other medical diseases, BOH, elderly grand multigravida), anaemia	15	15%

Mode of delivery was vaginal in 79 cases out of which 77 delivered by spontaneous vaginal delivery and 02 had a forceps extraction both due to failed maternal effort. 21 patients delivered by cesarean section.

Out of 100 cases 92 had a normal biophysical profile in the last scan of 8/8. 90 cases had a normal perinatal outcome with A/S >7/10 and no element of intrapartum fetal distress in those cases delivered vaginally. In two cases A/S at 1 and 5 minute was <7/10 with one baby shifted to nursery for delayed cry after emergency cesarian section done for persistent bradycardia in labour.

08cases had abnormal BPP with scores of 4/8 and 2/8. Backup tests including CTG also showed non reactivity in four cases, bradycardia in one variable decelerations in one patient and borderline CTG in one case. In two cases with abnormal BPP and suspected IUGR, doppler studies were done which showed reverse flow in both cases. There was one false positive who had an abnormal BPP with reduced liquor and less than three gross body movements but baby had an A/S of 8/10 at five minute. This patient had come with a post term pregnancy and under went emergency cesarian section due to abnormal biophysical score.

Table-V shows the distribution of neonatal morbidity among biophysical profile scores. There was no neonatal death or stillbirth in this study group.

Table-V. Distribution of neonatal morbidity among biophysical profile scores					
BPP Score	N	5 min A/S<7/10	LSCS for fetal distress	NICU transfer	Morbidity
Normal (8/8)	92	2	1	1	2.17%
Abnormal	-	-	-	-	-
6/8 not oligohydramnios	1	1	-	1	12.5%
6/8 with oligohydramnios	1	1	1	1	12.5%
4/8 only 2 parameter normal	5	4	4	4	5.0%
2/8 only 1 parameter normal111112.5%	-	-	-	-	-

The sensitivity of BPP score in this study is 77.7%, specificity 98.90%.

Predictive value for a positive test is 87.5%. predictive value for a negative test is 97.8 %.(table-VI).

Table-VI. Clinical efficacy of biophysical profile	
Characteristics	**Biophysical profile %age**
Sensitivity	77.7%
Specificity	98.90%
Positive predictive value	87.5%
Negative predictive value	97.8%
Accuracy	97%

DISCUSSION

With improved obstetric care, the perinatal mortality has reduced in developed countries.(07/1000)[16]. However the figure is still high in developing countries, even in tertiary care hospitals. There are no reliable perinatal mortality (PMR) for Pakistan and most of the data is hospital-based. A multicenter survey from hospital-based facilities indicated an overall PMR of 92 per thousand births with a majority of deaths(72%) due to stillbirths [17]. Thus whereas in developed countries the end point of improved obstetric services is reduction in perinatal morbidity[18]. we still aim at both aspect of perinatal outcome.

Large studies of BPP do conclude that it could usefully predict perinatal outcome[19]. In this study we have used a modified version of BPP employing only real time ultrasound based variables and using CTG as a back up test.
It has been documented that if four ultrasound variables are normal, the accuracy of BPP was not found to be significantly improved by adding NST (Non Stress test). As a result, in 1987 the BPP was modified to incorporate the NST only when one of the ultrasound variables was abnormal (Manning)[20].

This study has shown a specificity of 98.8%, thus the predictive value of normal BPP can be ranked excellent

regarding the absence of ominous, intrapartum fetal heart rate pattern, normal 05 minute apgar score and baby,s cry within one minute after birth. Nevertheless, it should be emphasized that many intrapartum events can lead to low A/S or delayed cry. The best predictive values of normal test result were found when all BPP through out pregnancy were considered. The predictive value of BPP [22] in high risk insulin dependant diabetic patients has shown a specificity of 80 to 90 %, but the predictive value of abnormal test and sensitivity was poor, 58.4%. We had a sensitivity of 77.7%, and out of 08 abnormal BPP cases one was false positive where the BPP was <6/8 and baby born with A/S >8/10 with good cry within first minute. This may be because of very immediate intervention i.e patient was delivered within one hour of abnormal BPP.

The negative predictive value was excellent i.e 97.8% and the positive predictive value is more than 80%(87.5%). The results are comparable to another study done at a tertiary care hospital New Delhi India[23] where full BPP including CTG was utilized in high risk term or near term pregnancies for predicting fetal outcome. 154 high risk pregnant patients were consecutively included in the study. At a cut off score of <8/10 sensitivity was 70.83%.and specificity 91.53% as compared to each individual variable, the positive predictive value for abnormal perinatal outcome improved considerably after combining all the variables. The negative predictive value for normal perinatal outcome did not improve.

In another study at Nashville, TN[24] modified USG based BPP is used which included expanded scores of fetal movements, fetal breathing, and qualitative assessment of accelerated placental maturity, and this method was compared with method of Vintzileos et el and applied to 180 high risk pregnancies to determine correlation with perinatal outcome. Relationship of results of last total score and perinatal outcome shows good predictive values with specifity of 98.8% and sensitivity of 82.4%. Results of this preliminary study suggested that real time ultrasound evaluation based scoring of acute fetal events namely movement and breathing alone has an important role in perinatal management.

In Mother and Child Health Center PIMS Islamabad another study was carried out[25] which concluded that admission intrapartum biophysical profile is better predictor of perinatal outcome than electronic fetal heart rate monitoring alone. They evaluated 620 low risk laboring women and sensitivity, specificity, positive and negative predictive value of BPP was 87%, 98%, 75%,and 99.5% respectively.

The role of Biophysical profile in intrapartum surveillance is established in high risk pregnancies and it has been found to be associated with significant reduction in incidence of cerebral palsy compared with an untested population (1.33 per 1000 versus 3.68 per 1000)[26]. It is evident from the data presented that results of our study are comparable to the different studies carried out on predictive accuracy of biophysical profile.

Major criticism to use of BPP as a routine screening test is the expertise required by the operator, long duration of time required and cost effectiveness. Modified BPP which is combination of amniotic fluid index and nonstress test and has been shown to be an excellent means of primary surveillance, due to its low false- positive rate and less time consuming method[27].

CONCLUSION
Biophysical profile is a time tested noninvasive method of antepartum surveillance .In our study it has an excellent specificity, satisfactory sensitivity and good positive and negative predictive values. Biophysical profile is a better test in anticipating fetal condition than the conventional NST alone, because a combination of tests produces improved predictive accuracy for both normal and abnormal test results. It is clearly evident that there is direct linkage between the fetal compensatory adaptive responses and its biophysical activities as expressed over a short (acute) and prolong (chronic) interval. A normal palette of biophysical activities is an almost certain assurance of fetal well-being, where as the complete absence of these activities virtually assures perinatal asphyxia and a high risk of death in the immediate future.

From this study it is concluded that BPP is highly accurate and reliable test of diagnosing fetal conditions.

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