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Original Research Article

Modified biophysical profile in antepartum fetal surveillance of high risk pregnancies

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ABSTRACT

Background: Fetal biophysical profile is a well-established method of antepartum surveillance in high risk pregnancy. Classical biophysical profile with all parameters (fetal breathing movements, fetal tone, fetal gross body movements, amniotic fluid volume and non-stress test) needs two phase testing by ultrasound and external Doppler monitor to record fetal heart rate, is more cumbersome, time consuming and expensive.

Methods: This study was a prospective clinical study which consisted of 70 patients having pregnancy with high risk factors. The patients were evaluated with the modified biophysical profile consisting of NST recording for 20mins, followed ultrasound assessment of amniotic fluid volume, using four quadrant technique.

Results: When the Modified biophysical profile is normal, it gives reassurance that the fetal status is good with good perinatal outcome. When the MBPP is abnormal there is increased incidence of perinatal morbidity as well as mortality.

Conclusions: Modified biophysical profile is an effective primary antepartum fetal surveillance test in high risk pregnancies in predicting perinatal outcome.

Keywords: Amniotic fluid index, Amniotic fluid volume, Biophysical profile, Fetal heart rate, Modified biophysical profile, Non-stress test

INTRODUCTION

It has been a known fact that no health problem can be of greater consequence to a nation, than maternal health and perinatal mortality. From hospital records it is observed that the average perinatal mortality in a year is about 45 per 1000 live births. Various maternal complications such as preeclampsia, eclampsia, anemia, oligohydramnios etc. are the major causes for perinatal loss. Such high-risk pregnancies need to be identified so that appropriate surveillance and timely interventions can be employed and thus bring down the rate of perinatal morbidity and mortality.¹

Antenatal fetal surveillance is directed at identifying fetuses of the high-risk pregnancy group which are at risk of suffering intrauterine hypoxia with resultant damage including death.

Since the 19th century, fetal assessment consisted of auscultation of fetal heart sounds and subjective recording of fetal movements. In the 20th century, these techniques have been augmented by electronic fetal heart rate monitoring and sonographic evaluation of fetal activity and amniotic fluid volume.²

The fetal biophysical profile is one of the most widely accepted test for the evaluation of fetal well-being in such high-risk cases. The original biophysical profile was

described by Manning et al, which includes study of five variables i.e. breathing movement, fetal tone, fetal body movement, amniotic fluid index and non-stress test. It needs two phase testing by ultrasound and external Doppler monitor to record fetal heart rate. The complete biophysical is more cumbersome, time consuming and is more expensive.

The modified biophysical profile (MBPP) suggested by Nageotte et al combines non-stress test (NST) as a short-term marker of fetal status and the amniotic fluid index (AFI) as marker of long term placental function is easier to perform and less time Consuming than complete biophysical profile or contraction stress test. Also, MBPP is considered to be as effective as complete biophysical profile.³

Hence in this study, modified biophysical profile is used as primary surveillance test in high risk pregnancy to study its effectiveness in predicting perinatal outcome.

METHODS

A detailed history of the pregnant women included in the study was taken and thorough clinical examination including recording of vital parameters, Systemic and obstetric examination was carried out at booking or admission All preliminary investigations including ultrasound were done. The risk factor for which the patient was included in the study was noted.

The patients were evaluated with the modified biophysical profile consisting of NST recording for 20mins, followed by amniotic fluid index measurement using four quadrant technique. The test was initiated at 30 wks of gestation or at the gestational age at which risk factors was identified.

The test was repeated weekly or bi-weekly depending on the findings of the previous tests and the risk factors.

The NST was performed with cardiotocogram (FM model-Viridia 50A, Hawlett Packard) in Semi-Fowlers position. Recording of FHR, fetal movements, uterine contractions were done. The trace was considered as reactive, if more than 2 fetal movements with acceleration of more than or equal to 15 beats/minute lasting for more than or equal to 15 seconds, with good beat-to-beat variability and no decelerations. If the reactive pattern was not recorded within 20 minutes period, the fetus was stimulated with VAST (fetal acoustic stimulator), or administration of a glucose containing beverage and the test continued for another 20 minutes period. If there is no reactivity in this extended period, the trace was deemed non-reactive.

Real-time ultrasound scanning was performed using a 3.5 MHz sector probe (Logic α 200) and general survey of fetus was done and presentation noted. The volume of amniotic fluid was measured according to the four-quadrant technique described by Phelan et al. With the patient in supine position, uterus was divided into four

equal quadrants by two imaginary lines. The vertical line corresponding to linea alba and a transverse line equidistant from pubic symphysis to the top of the fundus. The transducer was held vertically along the maternal longitudinal axis. An AFI was obtained by summing up the depths of largest vertical pockets, which is cord free in all the four quadrants. An AFI of >5 was considered normal and less than or equal to five or >18 was considered as abnormal. Patient's management was decided on gestational age, other risk factors and MBPP results. The last observation of MBPP before 1week of delivery was compared with outcome of pregnancy.

End points to assess outcome of pregnancy

- Thick meconium staining of liquor
- 5 minute Apgar score <7 was considered as abnormal.
- Admission to NICU
- Perinatal morbidity
- Perinatal mortality

Interpretation of MBPP and action

- If both tests were normal-weekly fetal surveillance with MBPP.
- If both tests were abnormal-management depends on gestational age. If gestational age >36 weeks-delivery
- If gestational age <36 weeks-Management is individualized.
- If NST is reactive, but AFI is decreased-evaluate for chronic fetal conditions particularly congenital abnormalities and perform MBPP twice weekly.
- If AFI is normal and NST is non-reactive, further testing with a full BPP is indicated.

RESULTS

Out of 70 patients 39 of them had vaginal delivery and 31 of them had caesarean section .out of the 39 patients who had vaginal delivery 29 of them (41.23%) had full term vaginal delivery and 10 of them (14.29%) had preterm vaginal delivery. Out of the 31 patients who had caesarean section 29 of them (41.42%) had emergency LSCS and 2 of them (2.86%) had elective LSCS.

Table 1: Mode of delivery.

Test Delivery interval	Number	Percent
FTVD	29	41.23
PTVD	10	14.29
LSCS-emergency	29	41.42
LSCS-elective	2	2.86

Out of the 31 cases who underwent caesarean section majority of them (75%) had fetal distress as the indication for LSCS. Other indications were cephalo pelvic disproportion (19.35%), scar tenderness in 9.6%, and breech presentation in 12.9% of the cases.

Table 2: Indications for LSCS.

Indications	Number	Percent
Fetal distress	18	75
CPD	6	19.35
Scar Tenderness	3	9.6
Breech	4	12.9

Majority of the babies had birth weight between 2.5-3.5 kgs (65.71%), followed by 30% of the babies whose birth weight was between 1.5-2.4 kgs. Those with <1.5 kg birth weight constituted 2.86% and those with >3.5 kgs constituted only 1.43%.

Table 3: Weight of baby.

Birth weight in kg	Number	Percent
<1.5	2	2.86
1.5-2.4	21	30
2.5-3.5	46	65.71
>3.5	1	1.43

Among the modified biophysical profiles done in 70 patients both parameters (NST and AFI) were normal in 44 patients (62.85%), both parameters were abnormal in 5 patients (7.14%), NST was normal and AFI was abnormal in 4 patients (5.71%), AFI was normal and NST was abnormal in 17 patients (24.29%).

Table 4: MBPP profile.

	Number	Percent
Both parameters normal	44	62.85
Both parameters abnormal	5	7.14
NST normal AFI abnormal	4	5.71
NST abnormal AFI normal	17	24.29

70% of the patients in the study group had one MBPP test performed, 20% had two MBPP tests performed, 4.29% of them had three MBPP tests performed and 2.86% of them had four MBPP tests performed. Five and six MBPPs were performed in 1.43% of the patients each.

Table 5: Number of MBPP's performed.

No. of tests performed	Number	Percent
1	49	70
2	14	20
3	3	4.29
4	2	2.86
5	1	1.43
6	1	1.43

Among the modified biophysical profiles done in 70 patients when both parameters (NST and AFI) were normal (44 patients) 13 (29.5%) patients underwent LSCS and 31 (70.45%) patients had vaginal delivery, when both parameters were abnormal (5 patients) 3 (60%) patients underwent LSCS and 2 (40%) patients had vaginal

delivery, when NST was normal and only AFI was abnormal (4 patients) 3 (75%) patients had vaginal delivery and 1 (25%) of them underwent LSCS, when AFI was normal and NST was abnormal (17 patients) 15 patients (88.23%) underwent LSCS and 2 (11.7%) patients had vaginal delivery.

This suggests that the rate of caesarean section is high when either both parameters are abnormal or when NST is abnormal.

Table 6: Last test results vs mode of delivery.

Last MBPP results (no. of cases)	LSCS	Vaginal delivery	P- value
Both parameters normal (44)	13	31	0.06 NS
Both parameters abnormal (5)	3	2	0.026 S
NST normal AFI abnormal (4)	1	3	0.999 NS
NST abnormal AFI normal (17)	15	2	0.000 S

Out of 70 patients thick meconium staining of liquor was observed among 19 cases. When both parameters (NST and AFI) were normal out of 44 patients 2 patients had thick meconium stained liquor, when both parameters were abnormal all 5 out of 5 patients had thick meconium stained liquor, when NST was normal and AFI was abnormal 2 patients of 4 out had thick meconium stained liquor and when AFI was normal and NST was abnormal 10 patients had thick meconium stained liquor.

Table 7: Meconium staining of liquor.

Test results	Thick meconium stained liquor	p-value
Both parameters normal (44)	2	0.009 S
Both parameters abnormal (5)	5	HS
NST normal AFI abnormal (4)	2	0.4 NS
NST abnormal AFI normal (17)	10	0.001 S

Among the 70 cases included in the study, APGAR score of <7 was observed among 13 cases. when both parameters (NST and AFI) were normal 1 patient had APGAR score of <7, when both parameters were abnormal 3 patients had APGAR score of <7, when NST was normal and AFI was abnormal 1 of the patients had APGAR score of <7 and when AFI was normal and NST was abnormal 6 patients had APGAR score of <7.

When both parameters (NST and AFI) were normal perinatal morbidity was present in 13 cases (30%), when

both parameters were abnormal 4 (80%) of them had perinatal morbidity. when NST was normal and AFI was, abnormal perinatal morbidity was present in 2 (50%) cases and when AFI was normal and NST was abnormal 11 (64.7%) of them had perinatal morbidity.

Table 8: Last test result Vs APGAR score.

Test results	APGAR	APGAR	P- value
	<7	>7	
Both parameters normal (44)	1	43	0.009 S
Both parameters abnormal (5)	3	2	0.054 Near S
NST normal AFI abnormal (4)	3	1	0.739 NS
NST abnormal AFI normal (17)	6	11	0.001 S

This suggests that whenever both parameters were abnormal or even one of the parameters were abnormal there was increased incidence of perinatal morbidity.

Table 9: Perinatal morbidity associated with test results.

Test results	No. of patients	Percent	P-value
Both parameters normal (44)	13	30	0.078 NS
Both parameters abnormal (5)	4	80	0.053 Near S
NST normal AFI abnormal (4)	2	50	0.1 NS
NST abnormal AFI normal (17)	11	64.7	0.000 S

S-Significant; NS-Non significant; Near S-Near significant

Table 9: Perinatal morbidity associated with test results.

Test results	No. of patients	Percent	P-value
Both parameters normal	0	-	-
Both parameters abnormal	2	40	0.003 S
NST normal AFI abnormal	0	-	-
NST abnormal AFI normal	3	60	0.000 S

S-Significant; NS-Non significant; Near S-Near significant

When both parameters (NST and AFI) were, normal perinatal mortality was not present in any of the cases, when both parameters were abnormal 2 (40%) of them had perinatal mortality. when NST was normal and AFI was abnormal perinatal mortality was present in any of the cases and when AFI was normal and NST was abnormal 3 (60%) of them had perinatal mortality.

This suggests that abnormal MBPP and abnormal NST increased incidence of perinatal mortality.

DISCUSSION

There were 105 MBPP tests performed on 70 patients with an average test per patient being 1.5. The number of patients undergoing one test constituted 49%. The highest number of tests performed was 6 in one patient. The last test done showed that 64.29% of the MBPP test results as normal, 7.14% as abnormal, NST was abnormal in 24.29% and AFI was abnormal (<5cms and >18cms) in 4.29% cases.

Of the 70 NST's in the last MBPP, 68.57% were reactive and 31.43% were non-reactive. The AFI values were >5 in 91.43% of the cases. Earlier works by Miller et al and Eden et al also showed similar results, evident from the following table.^{4,5}

Table 11: Comparison of last MBPP results with other study groups.

Test results	Miller et al	Eden et al	Present study
Reactive NST	90.8%	96.0%	68.57%
AFI >5	86.1%	88.4%	91.43%

The mode of delivery in the study group with respect to last MBPP result showed that when MBPP was normal with respect to both parameters, the incidence of LSCS and vaginal delivery among these were 18.8% and 44.28% respectively. When the MBPP was abnormal with respect to both parameters 60% of the cases had LSCS and 40% of them had vaginal delivery.

This shows that the mode of delivery in cases where MBPP was normal was vaginal in most of the cases and the incidence of LSCS in cases where MBPP was abnormal was increased.

The incidence for LSCS for fetal distress in various studies were as follows.^{4,6}

Table 12: Comparison of incidence of LSCS for fetal distress with other study groups.

Studies	No. of patients (%)	P-value
Miller et al	15 (8.8)	<0.0001 S
Eden et al	23 (6.8)	<0.05 S
Nageotte et al	155 (5.6)	<0.0001 S
Present study	18 (25.7)	0.000 HS

In the study by Miller et al, caesarean section rate when test results were abnormal was high compared to those when MBPP was normal (36% v/s 13.2%, p <0.0001). Similar results were seen in the study by Eden et al, who has 15.8% caesarean section rate when test results were abnormal, compared to 4.1% when the results were normal.

In our study, the incidence of caesarean section for fetal distress was very high (30.1%) compared to other studies. Booked cases were more and majority of the cases were referred as our hospital is a tertiary referral centre. Thick meconium staining of liquor is compared with other studies in the following table.^{5,7}

Table 13: Comparison of thick meconium staining of liquor with other study groups.

Studies	No. of patients (%)	P-value
Eden et al	52 (15.4)	<0.05 S
Patil SK et al	71 (11.5)	<0.05 S
Present study	19 (27.14%)	0.000 HS

When studied with respect to the last MBPP, showed that whenever the test results were abnormal, we had 100% (all 5 out of 5 cases) showing thick meconium. When the test results were abnormal with respect NST only 52.6% (10 out of 19) had thick meconium. When the test results were abnormal with respect only AFI 10.5% (2 out of 19) had thick meconium.

Hence from the above results, it is seen that the incidence of perinatal morbidity with respect to meconium is increased when both MBPP parameters were abnormal, and more so when NST abnormal compared to AFI abnormal when individual parameters were considered.

Comparison of 5minute APGAR score of <7 with other study groups.^{5,6}

Table 14: Comparison of 5 minute APGAR score of <7 with other study groups.

Studies	No. of patients (%)	p-value
Eden et al	5(1.5%)	<0.001, significant
Nageotte et al	13(0.8%)	Not significant
Present study	13(18.57%)	0.000 HS

An APGAR score of <7 was seen in 18.57% of the cases in our study group. When both the parameters were abnormal 60% of the cases had APGAR <7 whereas when NST was normal and AFI was abnormal 3 (4.28%) the cases had APGAR <7. When AFI was normal and NST was abnormal 8.57% of the cases had APGAR <7. In the present study 22 babies (31.42%) were admitted to NICU. This is comparable to earlier study by Compitak K et al on 185 patients with high risk pregnancies, which had 33.3% of the babies admitted to NICU in his study. In our study, there were 5 (7.14%) perinatal mortalities wherein 4 cases were those with pre-eclampsia, one in a patient who came with decreased fetal movements. A study by Patil SK et al showed a perinatal mortality of 8 out of 650 patients

(1.2%) and Eden et al had 5.94% of perinatal mortalities in their study.

From the above discussion, we can conclude that MBPP can be used as a primary antepartum fetal surveillance test to predict the perinatal outcome in high risk cases which is similar to other studies.⁸⁻¹⁰

CONCLUSION

When the Modified biophysical profile is normal, it gives reassurance that the fetal status is good with good perinatal outcome. At the same time, when MBPP is abnormal, it indicates that the fetus may be compromised. MBPP can be used as a primary antepartum fetal surveillance test to predict perinatal outcome and provide timely intervention in high risk pregnancies.

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